Voluntary Behavior by Electric Utilities: Levels of Adoption and Contribution of the Climate Challenge Program to the Reduction of Carbon Dioxide

Eric W. Welch
Allan Mazur
Stuart Bretschneider

Abstract

This paper analyzes the effect of participation in the Department of Energy's Climate Challenge Program on CO_2 emission reduction activity of the largest 50 electric utilities east of the Rocky Mountains from 1995 to 1997. Based primarily on regulatory influence theory of voluntary behavior developed by Lyon & Maxwell (1999), a two-stage model was developed and tested in which the first stage predicts voluntarism and the second stage uses the predicted values to test how voluntarism contributes to pollution reduction. Findings show a moderate level of support for regulatory influence theory with firms more likely to volunteer if they were located in states characterized by higher levels of environmentalism and if they were subject to higher levels of direct federal and state regulation. Findings also support previous empirical evidence that larger firms are more likely to adopt voluntarism, while larger, high-polluting utilities voluntarily committed to reduce greater quantities of CO_2. Nevertheless, adoption of the program seems to have no effect on reduction levels and those firms predicted to volunteer higher reduction levels were found to reduce CO_2 emissions less. It is hypothesized that the ineffectiveness of the Climate Challenge Program, compared with other voluntary programs, such as the 33/50 Program, may be due to the general weakness of the CO_2 regulatory regime in the United States. © 2000 by the Association for Public Policy Analysis and Management.

INTRODUCTION

In recent years, government and the private sector have promoted voluntary emission reduction programs as flexible and cost-effective mechanisms for decreasing pollution (Harrison, 1999). While some of these voluntary programs are targeted toward end users—such as the U.S. Environmental Protection Agency's (USEPA) Green Lights program—others have been developed to address specific industries and specific pollutants—such as the EPA's 33/50 Program (USEPA, 1996) and the Department of Energy's Climate Challenge Program (USDOE, 1998a).[1] Government considers voluntary programs to be effective and to fit well into simultaneous public demands for environmental vigilance and low cost (United States EPA, 1997a). Business

[1] The EPA 33/50 program targets 17 toxic chemicals and the DOE's Climate Challenge Program targets carbon dioxide (CO_2).

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approves of voluntary programs because of their flexibility and potential cost-related benefits (Cushman, 1997). While debate over the pluses and minuses of voluntary environmental programs have been significant (Cooper, 1998; Newton & Harte, 1997), theoretical and empirical academic literature on the topic is only just beginning. As a result, compared to the extent to which voluntary programs are used in United States environmental policy, understanding of why, how, and under what conditions they work is minimal.

The research reported here further addresses this gap in understanding in two ways: first, by investigating why utilities adopt voluntary programs and what drives higher or lower voluntary reduction commitments; and second, by exploring the extent to which voluntarism contributes to pollution reduction. Results provide some indication of the benefits of and limitations to voluntary policies. The questions were investigated by analyzing voluntary carbon dioxide (CO_2) reduction commitments of the electric utility companies under DOE's Climate Challenge Program. Because the electric utility industry is experiencing significant change as a result of deregulation, conclusions include an interpretation of the results in light of deregulation and a discussion of the potential future effects of deregulation on voluntary CO_2 reduction.[2]

VOLUNTARY SEMANTICS AND THE CLIMATE CHALLENGE PROGRAM

The relatively new generation of voluntary mechanisms designed to reduce pollution and increase conservation has led to some semantic confusion. As a first task in this paper, we place the DOE's Climate Challenge Program into two existing typologies of voluntary programs. The European Union Research Network (EURN) on Market-based Instruments for Sustainable Development identifies three types of voluntary programs: "unilateral commitment" in which industry leads,[3] "public voluntary schemes" in which government leads,[4] and "negotiated agreements" in which significant discussion leads to legally binding contracts between business and government (European Environment Agency, 1998; Lyon & Maxwell, 1999). Harrison (1999) offers a more traditional policy perspective in which voluntary mechanisms are generally characterized as one type of cooperative regulation (as opposed to command and control regulation) in which government attempts to "exhort" or persuade organizations to alter their behavior.[5] This typology groups voluntary policies into three types: "voluntary agreements" in which government preserves a significant threat of punishment in the case of voluntary failure, "voluntary challenges" in which government provides opportunities for organizations to change their behavior but prefers promises of future benefits to threats of punishment, and education and information dissemination programs which imply negligible levels of coercion. Others have coined the terms "voluntary environmental regulation" (Arora & Cason, 1996), "voluntary approaches to pollution control" (Khanna & Damon, 1999) and "self-regulation" (Lyon & Maxwell, 1999).

The DOE's Climate Challenge Program is a "public voluntary scheme" according to the EURN typology, and a "voluntary challenge" according to Harrison's typology. The Climate Challenge Program is regulatory in the sense that it is administered by a government agency, but DOE does not use or threaten sanctions in case of non-compliance with written agreements. While a written agreement is signed by the

[2] Deregulation of the electricity industry was officially begun in 1996 with Federal Energy Regulatory Commission (FERC) orders 888 and 889.
[3] Such as the Chemical Industry Association's Responsible Care program.
[4] Such as EPA's 33/50 or Green Lights programs.
[5] See the Netherlands and France case examples (Lyon & Maxwell, 1999).

USDOE energy secretary and the company representative, the company is free to determine the level of detail and extent of commitment contained within the agreement. The agreement is self-administered, which means that companies are responsible for implementing the agreement and reporting of emissions. No government agency formally oversees or monitors outcomes for regulatory purposes. In addition, the voluntary program concerns a pollutant, CO_2, which is not otherwise regulated in the United States.[6]

WHY VOLUNTEER?

Voluntarism inevitably incurs costs by the actor. To fulfill voluntary commitments companies may require technological or skill improvements as well as nontechnical enhancements, including public affairs specialists, legal experts, or lobbyists. Because the potential costs are well recognized, most, if not all, voluntary programs specify a range of benefits that will result from adoption (and presumably implementation) of the program. DOE's Climate Challenge identifies five benefits including the potential negation of future regulation, potential future credit for reduction, improved bottom line, public recognition and environmental improvement (see Box).

Stated reasons why firms should volunteer under the Climate Challenge Program

1. <u>National and international officials are watching this program closely.</u> *Therefore, an effective voluntary effort may negate the need for legislation or regulations.*
2. <u>Your involvement may yield possible future "credits" for your emission reductions.</u> *A companion voluntary reporting system implemented by the Energy Information Administration registers your emission reduction results for credit against any possible future mandatory requirements.*
3. <u>Your efforts are likely to improve your utility's and your customer's operations and bottom line.</u> *Most of the options taken by Climate Challenge utilities have reduced costs and/or improved operations, saving money and/or producing new revenue. This is especially useful at a time of increasing competition.*
4. <u>Your community will support your efforts.</u> *Public opinion polls demonstrate that the public wants a healthy environment and will judge community institutions by their environmental commitment. You can secure favorable local publicity for your actions.*
5. <u>Your efforts count.</u> *Only through a concerted effort on the part of all electric utilities, as well as other industries, will the nation be able to stabilize greenhouse gas emissions. Over 60% of the electric utility industry is represented by signed agreements pledging voluntary reduction efforts. Your neighboring utility is likely one of those utilities with an agreement already signed.*

Source: United States DOE (1998a)

[6] This was not the case for the 33/50 program in which a significant amount of prior legislation was already in place and in which the TRI was already established as a significant information tool.

Recent academic research has identified four almost parallel theoretical reasons why companies may adopt voluntary programs. Most of these theories have emerged in the economics literature during the past five years. The first set of theories, and those of primary interest in this study, can be grouped into the category of "regulatory influence." While there are numerous variations on this theme, these theories generally consider voluntarism to represent an announcement of an intended investment in or a commitment to environmental improvement with the expressed objective of influencing or manipulating the regulatory system. Much of this work is based on more fundamental political economic theories of interest group pressure (Becker, 1983; Peltzman, 1976; Stigler, 1971). However, Maxwell, Lyon, and Hackett (1998) have applied this work to the public environmental regulatory process in which "self-regulation" by firms acts to weaken the lobbying effectiveness of consumer and environmental groups. According to the theory, political action by individuals incurs information and organizing costs (called consumer costs) which in turn form a barrier between consumer benefits of voluntary abatement and the benefits of mandatory abatement. When consumer costs are high, self-regulation (voluntarism) is not viable because consumers are effectively removed from the process. However, as consumer costs fall, self-regulation increases in an effort to drive a "wedge" between consumers and the regulatory process (Lyon and Maxwell, 1999; Maxwell, Lyon, and Hackett, 1998). The ultimate result of voluntarism is to preempt more stringent environmental regulation. According to this perspective, company agreements to voluntarily reduce CO_2 emissions are driven by the company's intention to influence future CO_2 regulation.

Additionally, researchers have suggested that firms may agree to voluntary reductions in one policy area to obtain reductions in monitoring intensity or enforcement severity in other policy areas, or to convince regulatory agents to transfer scrutiny to other firms (Decker, 1998; Maxwell and Decker, 1998). In the case of CO_2 volunteers, companies would be announcing an investment in CO_2 reduction to gain regulatory ease in other environmental areas (SO_2 or NO_x for example). Finally, work by Lutz, Lyon, and Maxwell (1998) also shows that a company adopting self-regulation programs may be seeking a means of weakening rather than preempting forthcoming regulations. However, because CO_2 is not yet regulated in the United States, nor is any regulation forthcoming, companies are most likely seeking regulatory preemption or some kind of transfer of existing regulatory pressure.

Segersen and Miceli (1998) offer another model that can be placed under the rubric of regulatory influence. They show that under certain circumstances it is in the best interests of welfare-maximizing regulators to offer a voluntary agreement and for firms to accept such agreements. Because the regulator is assumed to be a welfare maximizer, voluntary agreements are always assumed to require increased reductions (beyond regulated levels). Moreover, a firm will fulfill the terms of a voluntary reduction agreement if it believes that nonfulfillment will trigger regulatory or legislative action that would be more costly. The authors posit that the level of reduction agreed to depends upon the allocation of bargaining power between regulator and company, and the magnitude of the background threat of sanctions. Stronger threats and greater regulator bargaining power imply agreement to higher levels of reduction (Segersen and Miceli, 1998). Accordingly, voluntary reduction programs that are established within an existing regulatory framework (in which background threat is established and political contention is limited) may result in more substantial agreements. In the case of CO_2, a lack of existing or forthcoming regulation implies that firms perceive limited threat and hold much of the bargaining power. It is likely, therefore, that agreed upon reduction levels are relatively low, compared with other voluntary programs that are nestled within established regulatory contexts.

A second set of theoretical reasons why firms volunteer is to take advantage of "simultaneous environmental and economic efficiency gains." Here, firms either volunteer as a means of reducing direct economic costs of production (through innovation or management) or free ride on investments that simultaneously enhance economic and environmental efficiency. In the first case, firms voluntarily adopt environmental management schemes because they hope to identify new processes or techniques that reduce production costs (Lyon and Maxwell, 1999). Economic benefits expected to accrue from techniques such as life cycle assessment and pollution prevention may influence corporate decisions to consider new self-regulation environmental schemes (Buchholz, 1993; Groenenwegen et al., 1996; Smart, 1992). Maxwell and Lyon (1999) are careful to point out, however, that some of these savings may occur quickly, while longer term savings are more difficult to realize. Economic benefits may also accrue to many of the newer environmental management systems, such as ISO 14000, that attempt to satisfy multiple regulatory efforts simultaneously, thereby reducing risk exposure, compliance costs, and other environmentally associated business costs (Fredericks and McCallum, 1995). Secondly, regulatory "over-compliance" may be driven by a lumpy investment phenomenon in which one-time investments may result in significant simultaneous environmental and economic efficiency gains (Arora and Cason, 1996).[7] Companies may volunteer because prior or planned investments in new technology carry with them expected environmental efficiency improvements. In such cases, cost of voluntarism may be perceived to be low while regulatory or competitiveness benefits may be high. In a somewhat similar vein, previous research has hypothesized that firms are more likely to volunteer when they already have acquired some kind of reduction success. This has been termed free riding on prior clean-up success. However, recent empirical evidence finds no support for this (Arora and Cason, 1996; Khanna and Damon, 1999).

A third set of theories considers company voluntary action to be an expression of "market response" strategy. The two primary drivers of voluntary activity under this category include a response to green consumers and a response to investors. A recently growing body of literature shows that companies are increasingly recognizing and responding to consumers who are willing to spend more for environmentally benign products (Arora & Cason, 1996; Arora & Gangopadhyay, 1995; Williams, Medhurst, and Drew, 1993). In the case of utilities, deregulation of the energy market in the United States will offer consumers choices about their energy supplier, and some customers may be willing to pay more for alternative "green" energy.[8] Voluntary agreements that promise to reduce CO_2 emissions may seek to tap into such green energy markets. Investors, too, may be more willing to back green companies. Investors may favor green firms for ethical reasons (Baron, 1996), because future profit scenarios include expanding green markets (Hamilton, 1995; Khanna and Damon, 1999; Khanna, Quimio, and Bojilova, 1998), or because companies are perceived to be proactively addressing environmental problems and thereby gaining some strategic advantage (Khanna & Damon, 1999; Williams, Medhurst, and Drew, 1993). Therefore, companies that volunteer to improve environmentally may be trying to attract or hold investor interest.

A fourth area of theoretical work concerns new literature on cooperation in public goods. Economic theory predicts that privately provided public goods should receive few contributions (cooperation) and that free riding should dominate. However, empirical evidence indicates that cooperation (investment in public goods) is much higher than expected. Results of public goods experiments consistently show that

[7] Over-compliance is sometimes equated with voluntarism in the literature.
[8] Examples include wind- and solar- generated electricity.

cooperation is the result of "kindness" (Andreoni, 1995; Palfrey and Prisbrey, 1997) which is defined as "appeal to notions of benevolence or social custom (Andreoni, 1995)."[9] Experiments typically entail a public goods game in which participants are given a series of investment tasks in which public goods returns are typically lower than private goods returns. Typically, investment in public goods is higher than economic theory would predict. More recently, researchers have tried to separate "kindness" from participant investment "confusion." Results show that "on average about 75 percent of the subjects are cooperative, and about half of these are confused about incentives, while about half understand free-riding but choose to cooperate out of some form of kindness (Andreoni, 1995, p. 900)." Although researchers have not yet generalized the results from public goods experiments to the firm level, future work that seeks to link kindness theories to beyond compliance activity of firms would be interesting.

Of these four sets of theories, this paper pays particular attention to the first: regulatory influence. To restate the primary research questions in terms of the theoretical approach used:

- First, to what extent does regulatory influence theory predict voluntarism of firms?
- Second, to what extent does voluntarism predict emission changes?

MODEL AND HYPOTHESES

Voluntarism represents a commitment of resources to reduce pollution of some form. Because firms are assumed to be rational, it follows that participation in a voluntary program must be based on some form of expected net benefit. In addition, if the net benefits to the firm are positive, it is possible that voluntary participation results in additional pollution reduction. This relationship can be modeled using the following equation:[10]

$$Y_{it} = \beta_1 X_{it} + \partial D_{1it} + \varepsilon_{1it} \qquad i = 1,......I;\ t= 1,....T \tag{1}$$

where Y_{it} represents the pollution level of firm i at time t, X_{it} represents a vector of exogenous firm-specific variables (such as technology use and input and output levels or prices), and D represents the voluntarism variable. The vector β_1 and scalar ∂ are the coefficients for the vector of variables (X) and voluntarism (D) respectively, and ε_1 is a random error term with mean zero and variance $\sigma_{1\varepsilon}^2$.

The effect of a discrete or "point in time" decision on changes in Y (pollution) over time can also be examined. The resulting equation represents a simple adaptation of equation 1.

$$\Delta Y_{it} = \beta_1 \Delta X_{1it} + \partial \Delta D_{1it} + \varepsilon_{1it} \qquad i=1,......I;\ t=1,....T \tag{2}$$

where variable descriptions are taken from equation 1 and Δ represents the change in the variables between t and t −1.

Although D represents the firm's decision to volunteer, it is not exogenous to pollution level because firm voluntarism is likely to be influenced by some other unobserved

[9] The term "kindness" is also interchangeable with the term "warm glow" in the literature.
[10] The model used here is adapted from Khanna and Damon, 1998.

factors. Moreover, from the perspective of the organization, D does not represent the decision per se, but rather the expected net benefit of the decision. Because the benefit cannot be observed, the observed decision serves as a proxy.

$$D_{it} = \beta_2 X_{2it} + \varepsilon_{2it} \tag{3}$$

The equation indicates that the decision of firm i at time t, D, is predicted by some vector of exogenous factors, X_{2it} with coefficients β_2. The error term ε_2 is also assumed to the random with mean zero and variance $\sigma_{2\varepsilon}{}^2$. The error terms ε_1 and ε_2 may be correlated.

To avoid bias problems associated with equations 1 and 2, a two-stage model is proposed in which the first stage predicts voluntarism (equation 3) and the second stage analyzes the environmental effects of voluntarism over time (equation 2). The technique is similar to the one used in Khanna and Damon (1999). The first stage uses a probabilistic choice method to determine estimates for β_2. The second stage uses predicted values obtained from the first stage as the independent variable representing voluntarism. Ordinary least squares regression is used to estimate equation 2.

The data contain two decision variables. The first is a discrete variable that indicates adoption or non-adoption of the voluntary program. The second variable indicates the level of reductions agreed to between the firm and the agency. In the first case logit analysis is used to determine estimates for β_2; in the second, due to the truncated nature of the data, tobit analysis is used to obtain estimates.

Stage One

In the first stage of the model, the approach highlights the general "regulatory influence" model, while also representing aspects of other theories. In addition, based on prior findings in the literature, the first-stage model includes company size and past environmental record as important factors contributing to voluntarism.

Level of external pressure represents public and external non-governmental forces that lobby for new or stronger regulation. Membership in environmental organizations or public demonstrations, media coverage, or citizens' legal challenges serve to measure different aspects of this construct. According to the regulatory influence literature, external pressures from stakeholders (community, environmental and industry groups) and perceived level of future regulation, will lead to an increased likelihood of voluntarism. Empirical research also tends to support this expectation (Khanna and Damon, 1999; Maxwell, Lyon and Hackett, 1998;). The first hypothesis seeks to verify these findings:

H1: Firms will be more likely to volunteer in regions exhibiting higher levels of pressure from external stakeholder groups.

Regulatory action refers to the explicit and direct use of government regulation or oversight of the firm. Regulatory action may include such measures as level and frequency of fines, number and frequency of violation notices, extent of on-site monitoring, or reporting requirements. Higher levels of direct regulatory action may be indicative of a generally greater background threat and higher bargaining power for regulators. Segersen and Miceli (1998) would predict that higher levels of direct regulation could lead to higher levels of voluntarism. Moreover, Decker (1998) would expect that firms volunteer to reduce existing regulatory pressure. Therefore, the second hypothesis reflects this expectation.

H2: Firms experiencing higher levels of direct pressure by regulatory agencies will be more likely to adopt volunteer programs (and volunteer to reduce higher levels).

Environmental effort refers to the extent to which firms address environmental problems through managerial or financial commitments. Managerial commitment could be measured by assessing the extent to which business planning incorporates environmental considerations. Financial commitment can be measured using environmental investment or environmental budgetary figures. Environmental effort is not considered to include the extent to which companies have cleaned up in the past.[11] Market response theory indicates that firms volunteer to reduce emissions to appeal to green consumers willing to purchase higher priced environmental products (e.g., energy from wind or solar sources), or to investors interested in competitiveness and risk reduction strategies. Firms responding to market constituencies would also be recognized as maintaining high levels of environmental effort (managerial or financial). Simultaneous efficiency theory would also imply that firms with higher environmental investment would also be more likely to volunteer because of the simultaneous environmental and economic efficiency benefits that are realized from new investment. The next hypothesis formally represents this expectation.

H3: Firms with higher levels of environmental effort will be more likely to adopt a voluntary program.

Corporate environmental values are founded on the values of individual employees and the culture of the organization. In plain terms, this construct captures the environmental attitude of the firm. However, while research on environmental attitudes is well advanced at the individual level (Dunlap and Van Liere, 1978; Guagnano, Stern, and Dietz, 1995), it is not well developed at the organization level. A relationship may exist between organization environmental values and findings from public goods research on kindness. A relationship may also exist between the organization environmental values and environmental action. Unfortunately, sufficient effort has not been made to define what is meant by the environmental attitude (or values) of organizations or to establish its relationship with the kindness hypothesis. Therefore, specific values-based hypotheses are not developed for testing.

Previous empirical work finds that larger firms are more likely to volunteer (Arora and Cason, 1996; Khanna and Damon, 1999). Researchers have offered two main explanations. First, regulatory compliance costs are considered to be high and fixed such that larger companies may be more able to take advantage of economies of scale. Second, large companies are publicly more visible and may more often be a target of stakeholder groups and regulatory agents (Lyon and Maxwell, 1999). It is also possible that larger companies have greater organizational capacity in the form of specialized environmental divisions, environmental expertise and environmental training. Therefore, the fourth hypothesis seeks to verify previous findings on size.

H4: Larger companies will be more likely to adopt a voluntary reduction program.

Previous work also indicates that firms that pollute more (dirtier firms) are more likely to volunteer (Arora and Cason, 1996; Khanna and Damon, 1999). Measures of dirtiness most often include some form of emissions divided by economic output. However, other measures such as type or quantity of raw material consumption or

[11] Previous work shows that companies do not free-ride on their own clean-up efforts (Lyon & Maxwell, 1999). Two recent studies confirm that firms with better prior emission reduction records were not more likely to volunteer (Arora & Cason, 1996; and Khanna & Damon, 1999).

recycled content of product may also be appropriate. Several reasons why dirtiness predicts voluntarism have been offered in the literature. As with larger firms, dirtier firms may be more visible and pose more obvious targets for external stakeholders and regulators. Lyon and Maxwell (1999) also indicate that because environmental improvement is often measured in "percentage-reduction terms" it may be possible for a previously poor performer to become a much improved performer for relatively low cost. As a result, voluntary action may result in proportionately greater improvement and hence increased recognition for previously poor performers. Similarly, dirty firms may also be technology laggards. By upgrading standard process technology, such firms may expect to realize simultaneous environmental and economic efficiency gains. In such cases, voluntarism would be considered a low cost, low risk endeavor. Finally, it is conceivable that dirty firms volunteer, but do not intend to act. In essence they may be free riding on the willingness of other firms to make substantial actual reductions that lead to an overall success of the voluntary program.[12] Success of the program and reduced likelihood of future regulation would accrue to the "symbolic volunteer" at the expense of the "substantive volunteer." This thinking is formalized as follows.

H5: Dirtier firms will be more likely to adopt a voluntary reduction program.

Two dependent constructs are used: program adoption and level of reduction commitments. Program adoption and level of reductions agreed to are considered to be different types of decisions made by the company. Program adoption is one type of decision that may or may not carry with it any effort to quantify emission reduction targets. Development of reduction targets represents a qualitatively different decision in which specific commitments are identified and reduction levels are calculated. Although these two decisions seem to be distinct, it cannot a priori be determined how the independent constructs would affect program adoption or commitment level differently. Therefore, identical hypotheses (H1–H5) for both dependent constructs are proposed.

Stage Two

To explain emission changes explanatory variables in the second-stage model include voluntarism (as predicted by the first-stage model), fuel use changes, energy generation changes and environmental technology. Relationships in the second-stage model are more straightforward than in the first stage. Changes in pollution output of the firm over time are primarily influenced by changes in technology and in quantities, qualities, and mixtures of inputs and outputs. In addition, voluntarism is added as a predictor of pollution output changes. Therefore, the contributing constructs in the second-stage model include: the utility's use of environmental technology, input fuel mixtures, the change in its total generation of electricity, and voluntarism.[13] Predicted values from the primary models are used as indicators of voluntarism. The dependent construct is simply the change over time of pollution emissions. This paper tests two specific hypotheses that result from the secondary model:

H6A: Firms that adopt voluntary agreements will reduce emissions more than firms that do not.

[12] This may be especially true for national programs in regions of low stakeholder and regulatory pressure.
[13] (This leads to an overall positive relationship with CO_2 output despite a negative association that may result from efficiency improvements at higher levels of production),

H6B: Higher levels of commitment to voluntary reduction will lead to greater reduction of emissions.

In addition, companies that move away from high-polluting fuels and use more environmentally sound technology can be expected to reduce emissions more. Changes in output of electricity will also be positively associated with changes in emissions.

DATA AND METHODS

Electricity generation is one of the primary sources of sulfur dioxide (SO_2), carbon dioxide (CO_2) and oxides of nitrogen (NO_x). Moreover, the structure of the electric utility industry is such that the largest 50 utilities emit large percentages of the industry's total (73 percent of NO_x emissions, 78 percent of SO_2, emissions, and 64 percent of CO_2 emissions) (NRDC, 1997). As a result of their high contributions to atmospheric pollution, the public, Congress, and the Executive Office of the President have, over the last two decades, tried to persuade the utility industry to "clean up their collective act." This pressure has taken multiple forms including increased regulation and alternative policy instruments, including voluntary programs.[14] One such effort is the Climate Challenge Program. Administered by the DOE, this program provides a mechanism for utilities to voluntarily sign a contract agreeing to reduce CO_2 outputs. Utilities are allowed to set their own goals (including general goals that do not state specific reduction targets) developed from a flexible set of pollution reduction options. All pollution reduction mechanisms, projects, and promises within the contract are converted to equivalent tons of CO_2 emission reductions by the year 2000. The research reported here focuses on voluntarism of the top 50 utilities (based on electricity generation) in the United States east of the Rocky Mountains, and the effect their participation in Climate Challenge Program has had on CO_2 reductions between 1995 and 1997. Of the top 50, 35 participated in the program and 15 did not.[15]

To test the hypotheses explained above, five independent constructs in the primary model: size, environmental effort, external environmental pressure, direct regulatory action, and environmental condition of the firm. The variable *SIZE* is measured by total net energy generated in 1995, which was reported in the Department of Energy's Federal Energy Regulation Commission (FERC 1) survey data (USDOE, 1995). Environmental effort (denoted *EFFORT*), also obtained from 1995 FERC 1 data, is operationalized by the ratio of environmental expenditures relative to total expenditures. Because measures of state-level environmentalism are typically highly correlated, a set of these variables has been combined to denote level of external environmental pressure. The variable, denoted *PRESSURE*, combines environmental membership levels (Wilke, 1995), aggregated public environmental survey data from the General Social Survey (GSS) (Mazur and Welch, 1999), environmental voting records of House and Senate members (League of Conservation Voters, 1998), and the total of the 50 possible environmental policy initiatives at the state level (Hall and Kerr, 1991, p. 145). The Chronbach's alpha correlation for these four measures was 0.80. Direct regulatory action on the utility (*REGULATION*) was measured as the total sum of federal and state environmental regulatory expenses paid by the utility in 1995 (USDOE, 1995). Correlation coefficients among regulation, size, and dirtiness are low and not significant.[16] The dirtiness of the firm is represented as the combination

[14] One example is the recent addition of electricity generating facilities that combust oil or coal to the list of industries required to report toxic releases under an expanded SARA III.
[15] As of May 1995 (UDSOE, 1998b).
[16] $R_{\text{regulation \& size}} = .19$; $R_{\text{size \& dirtiness}} = -.13$; $R_{\text{regulation \& dirtiness}} = 0.03$

of two variables: CO_2 emission rate and percentage of total electricity generated from combustible fuels—oil, coal and natural gas—relative to total generation in 1995 (both from NRDC, 1997). The Chronbach's alpha correlation coefficient is 0.95. This measure simultaneously provides a means of identifying those firms that have the worst CO_2 efficiency and use the greatest percentage of fossil fuels. This variable is called *DIRTINESS*.

As mentioned, the model was tested on two different dependent decision variables: adoption of the voluntary program and extent of reductions pledged. Program adoption is measured using a discrete variable in which 1 was assigned if the utility volunteered to participate in the Climate Challenge Program and 0 if it did not (USDOE, 1998b). Pledged reduction level is represented by the total pledged reductions of CO_2 in the year 2000 which utilities had agreed to in 1995. Reduction pledges are stated in the Climate Challenge contracts agreed to by the volunteering utility and the Department of Energy. Although utilities are free to use their own calculation methods to determine their pledge levels, the Climate Challenge Program has separately calculated metric ton equivalent reductions in the year 2000 for all pledging utilities (USDOE, 1998b).[17] The final equation for the primary model is:

$$D = f(X_0, X_1, X_2, X_3, X_4, X_5, \varepsilon_1) \tag{4}$$

where X_1 = SIZE, X_2 = EFFORT, X_3 = PRESSURE, X_4 = REGULATION, X_5 = DIRTINESS and Y represents either a 1/0, adopt/non-adopt variable or the level of voluntary commitment.

As a final issue, the structure of the industry is of significance when attempting to show how external pressure affects utility environmental behavior. For example, companies can be alternatively associated with a political and administrative region and with a customer base. Regulatory influence theory would predict that firms with headquarters in states with higher regulatory and stakeholder pressure would be more likely to volunteer because stakeholders are connected to a legislative and regulatory system that can serve legal controls over the polluter. Market response theory would predict that firms volunteer to provide evidence of commitment to a growing market of customers willing to purchase green products. Because interest here focuses on whether regulatory influence is associated with voluntarism, the policy and utility databases have been matched in two ways to test effects of regulatory environment. In the first case, utilities are matched with the state in which the company headquarters is located. In the second case, utilities are matched with the state in which the utility had a majority of electricity sales in 1995. Results were expected to support hypothesis 1 (external environmental pressure predicts voluntarism).

The secondary stage model utilizes the predicted values obtained from the first-stage model to observe effects on actual CO_2, SO_2, and NO_x (Nitrogen Oxide) emission changes from 1995 to 1997 (1997 emissions minus 1995 emissions). Actual emission changes (in tons) were calculated from EPA's Acid Rain database (USEPA, 1995; 1997b). This variable is called PREDICTED. Three additional variables were used to explain the emission changes: change in percentage of fossil fuel usage (FUEL SHIFT), change in total generation (GENERATION CHANGE), and use of technology (TECHNOLOGY). FUEL SHIFT was measured using the following constructed variable:

[17] All utilities used in this data set volunteered in 1994 and 1995.

FUEL SHIFT = (fossil generated electricity 1995 / total generation 1995) –

(fossil generated electricity 1997 / total generation 1997) (5)

where all values were obtained from FERC 1 survey data (USDOE, 1995; 1997b). GENERATION CHANGE is simply the total electricity generated in 1997 minus that generated in 1995. TECHNOLOGY is measured by the depreciation of environmental capital in 1995 divided by total 1995 depreciation (USDOE, 1995). This variable provides a comparable measure of the capital use for environmental objectives. Generation change and technology values are also taken from FERC 1 survey data (USDOE, 1995; 1997). The final equation for the secondary model is:

$$Z = f(V_0, V_1, V_2, V_3, D_4, D_5, \varepsilon_2) \tag{6}$$

where D = PREDICTED, V_1 = FUEL SHIFT, V_2 = GENERATION CHANGE, and V_3 = TECHNOLOGY.

Logit analysis was used in the first stage (equation 4) to regress a discrete adopt/nonadopt dependent variable, while to accomodate the truncated nature of the data, tobit analysis was employed to analyze data on the level of voluntarism: some utilities specify reduction targets while others do not. Ordinary least squares (OLS) regression analysis was used in the second stage to estimate effects on CO_2 emission changes (equation 6). An additional analysis substitutes actual levels of voluntarism (ACTUAL) for the predicted values (PREDICTED) for comparison. Second-stage OLS regressions were also run using tobit-predicted voluntarism on SO_2 and NO_x emission changes for 1995 to 1997. Descriptive statistics for all variables used can be found in Table 1.

Table 1. Descriptive statistics.

Variable	N	Mean	Standard Deviation	Sum	Minimum	Maximum
Primary Model						
ACTUAL volunteered reductions in year 2000 (tons)	45	3,031,222	5,452,080	136,405,000	0.00	23,945,000
SIZE	45	40,834,120	33,952,187	1,837,535,403	14,031,798	150,864,223
EFFORT	41	5.16	0.12	211.70	4.73	5.52
PRESSURE	45	0.44	0.16	19.59	0.23	0.73
REGULATION	45	46,083	140,820	2,073,716	0.00	653,166
DIRTINESS	45	0.04	0.17	2.00	0.01	0.72
Secondary Model						
FUEL SHIFT	44	-1,703.39	588.55	-75,521.34	-2,958.37	-657.61
GENERATION CHANGE	44	-4,004,049	11,655,948	-176,178,173	-52,295,968	11,939,357
TECHNOLOGY	41	0.01	6.54 E-03	0.47	3.14 E-03	2.68 E-02
PREDICTED (LOGIT)	41	0.29	0.25	12.00	3.01 E-03	0.83
PREDICTED (TOBIT)	41	0.49	0.24	19.97	0.05	0.91
NOx REDUCTION (97-95)	45	-6,690	37,115	-301,036	-172,712	63,686
SO_2 REDUCTION (97-95)	45	-38,426	102,432	-1,729,198	-515,117	93,236
CO_2 REDUCTION (97-95)	45	-6,330,942	14,381,070	-284,892,410	-65,282,176	6,448,301

FINDINGS

Results of the primary model are given in Table 2. The first column reports results from the logit analysis in which utilities are matched with the state in which their headquarters is located. The second column reports results from the logit analysis in which utilities are matched with the state of greatest residential electricity sales in 1995. The final column reports results from the tobit analysis (state also defined according to utility headquarters). Missing values reduced the number of utilities from 50 to 41. Logit results indicate that of the utilities studied, larger organizations tended to adopt voluntarism. In addition, where state is defined as state of utility headquarters, firms located in states exhibiting greater general environmental pressure were more likely to volunteer. However, where state is defined as the place of greatest residential consumption, environmental pressure does not affect the decision to volunteer. Other variables of dirtiness, effort, and regulatory action are not significant in the logit model. Overall these findings tend to provide mixed support for hypotheses, set out above and previous research. Larger firms (hypothesis H4) and those located in situations of higher external environmental pressure (H1) are more likely to volunteer. No evidence indicates that prior direct regulatory action or environmental effort are associated with the decision to volunteer (H2 and H3 respectively). Nor is there any evidence that dirtier firms are more likely to adopt the voluntary program (H5). Firms that adopt the CO_2 voluntary reduction program tend to be larger and headquartered in states that have higher levels of environmentalism.

Tobit results show that a somewhat different mixture of factors affects the level of reductions agreed to. As with the decision to volunteer, larger organizations also set higher reduction targets than smaller organizations. However, contrary to the logit results, the tobit results reveal that there is no apparent association between level of targeted reductions and the environmentalism of the state. Instead, voluntary reduction levels of CO_2 are positively associated with the level of direct regulation experienced by the firm. In addition, utilities that are dirtier and consume more fossil fuels are more likely to specify higher reductions. Dirtier firms may be more visible, but it is also possible that they may have more potential to reduce emissions than other firms already using better technology and lower emitting fuels. The final variable, environmental effort, shows no significant association with voluntarily agreed-to reduction levels. Again, the evidence suggests some support for prior research and hypotheses with larger (H4) and dirtier (H5) firms agreeing to higher reduction levels. However, tobit results indicate that levels of voluntarism are associated with direct regulatory pressure (H2) rather than with a more general environmental context (H1). As with the decision to volunteer, there is no evidence that environmental effort by the firm is associated with agreed-to reduction levels (H3).

In general, the findings somewhat support the general regulatory influence hypothesis. Firms may be adopting voluntarism in environmentalist states as a means of influencing the existing regulatory system or preempting future CO_2 regulation. By volunteering, firms may be seeking to gain some leverage in the policy-making or implementation process. While it is also possible that firms are simply responding to a significant environmental regulatory threat and carry no regulatory influence intentions, knowledge about the fundamental nature of policymaking as a bargaining and negotiation process, and about the strategic planning function of firms, allows this to be discounted. It is more likely that firms are seeking to be politically proactive rather than reactive. Finally, the theoretical explanation that firms volunteer in order to influence regulation is reinforced by the lack of significance of state environmentalism when state is defined as majority residential sales.

Table 2. Decision to volunteer and extent of voluntarism: logit and tobit models.

	PRIMARY MODEL		
	Adoption decision HQ-defined state	Adoption decision Customer-defined state	Extent of voluntarism
	Decision to Volunteer (logit results, N=41)*	Decision to Volunteer (logit results, N=41)*	(tobit results N=41)**
SIZE	+0.88 (0.06)	+0.79 (0.08)	+ (0.08)
EFFORT	+0.02	+0.02	+
PRESSURE	+0.49 (0.09)	+0.36	+
DIRTINESS	–0.23	–0.02	+ (< 0.10)
REGULATION	+0.03	+0.08	+ (0.03)

Notes: *Standardized coefficients are reported with P-values in parentheses.
**No standardized coefficients are available for tobit models, P-values in parentheses.

Results of the secondary model are shown in Table 3. Change in CO_2 emissions is the dependent variable in the first three columns, while change in SO_2 and NO_x emissions are the dependent variables in columns four and five, respectively. The first three columns differ based on alternate representations of voluntarism. The first column uses predicted values from the logit analysis as the measure of voluntarism; the second column uses predicted values from the tobit analysis as the measure of voluntarism; and the third column uses actual reduction pledges rather than the predicted values.[18]

Results indicate that across almost all models, changes in electricity generation (GENERATION CHANGE) and use of environmental technology (TECHNOLOGY) are positively associated with changes in CO_2 emissions.[19] The most important factor in all models is change in electricity generation (based on standardized beta values). This finding is not surprising as changes in electricity generation and CO_2 emissions are highly correlated (R=0.83). This high correlation also helps explain why the adjusted R -square values are high (0.55-0.78 across all models). Change in fuel inputs is not a significant factor in any of the trials.

Findings on voluntarism are especially interesting. First, predicted values of voluntarism from the logit model are not significantly associated with change in CO_2 emissions (column one). Yet, predicted values from the tobit analysis are significantly and negatively related to changes in CO_2, SO_2 and NO_x emissions. This suggests that, contrary to the hypothesized expectation (H6A and H6B), utilities that agree to higher levels of voluntary reductions also tend to reduce CO_2, SO_2 and NO_x. These results

[18] Trials using predicted values from both primary logit models (Table 2) resulted in similar findings. Results reported here represent the trial using predicted values from data in which utility was matched with the state in which their headquarters is located.
[19] Technology is not significant in the case of NO_x emissions.

Table 3. Effect of voluntarism on pollutant reduction of utilities (N=40).

	SECONDARY MODEL (p-values and standardized beta coefficients) †				
	CO_2 Reduction (tons)* 1	CO_2 Reduction (tons)** 2	CO_2 Reduction (tons)*** 3	SO_2 Reduction (tons)** 4	NO_x Reduction (tons)** 5
FUEL SHIFT	0.15	0.01	0.02	0.07	0.04
PREDICTED	0.17	–0.15 (0.07)	NA	–0.28 (0.02)	–0.22 (0.05)
ACTUAL	NA	NA	–0.09	NA	NA
TECHNOLOGY	0.17 (0.04)	0.20 (0.02)	0.17 (0.07)	0.23 (0.05)	0.18
GEN CHANGE	0.83 (0.01)	0.83 (0.01)	0.83 (0.01)	0.65 (0.01)	0.74 (0.01)
Adjusted R-Square	0.78	0.78	0.70	0.55	0.62

Notes: *Using logit model predicted values.
**Using tobit model predicted values.
***Using direct measures of voluntarism.
†All models significant at less than 0.0001.

show that by itself, the decision to adopt the Climate Challenge Program did not affect the utilities CO_2 emission levels from 1995 to 1997, however, decisions about level are inversely related to levels of reduction during the same years.[20] Other results show that use of technology is significantly and positively associated with CO_2 and SO_2 reduction. Importantly, the beta weights of PREDICTED and TECHNOLOGY are comparable but the signs are reversed, indicating that much of the gain acquired from the use of new technology is offset by other factors associated with voluntarism. Collinearity in all of the models was negligible with variance inflation factors never rising above 1.4 and the collinearity condition index remaining below 19 for all models.

In summary, Climate Challenge voluntarism seems to either have no effect (in the case of program adoption) or to contribute negatively to emission reductions (in the case of specified levels). In terms of the theory presented above, a number of clarifying explanations can be offered. First, according to regulatory influence model, consumer costs may still be very high. Information costs related to the effects of CO_2 and organizing costs against a pollutant whose effects are difficult to quantify for purposes of local political action are probably significant. As a result, companies do not need to drive a "wedge" between consumers and regulators (Lyon and Maxwell, 1999; Maxwell, Lyon and Hackett, 1998) and the voluntary agreements do not represent plans of action that significantly affect environmental behavior. Second, firms may be volunteering as a means of manipulating existing regulation of other pollutants.

[20] It is important to emphasize that the agreed to reduction levels are reductions in the year 2000. As a result, these findings show only trends, not definitive results of the Climate Challenge Program.

This may be especially true where reduction commitment levels are concerned because results indicate that voluntary levels are associated with direct environmental regulation. Therefore, by volunteering more, companies under pressure may be attempting to present a convincing portrait of environmental commitment that may influence regulators to treat them with less rigor in other areas (Maxwell and Decker, 1998). Third, CO_2 reduction is not backed up by a significant regulatory threat and DOE certainly does not hold the bargaining power (Segersen and Miceli, 1998) with respect to Climate Challenge agreements. Therefore, while convincing agreements have been established, they may hold little practical sway over company policy. CO_2 regulation may be perceived to be such a long way off (by both regulators and companies) in the United States that companies consider agreements to represent a low cost, low risk means of enhancing their environmental image without the fear of accountability for real reductions. Therefore, in general, the findings of this study are not inconsistent with the precepts of the regulatory influence theoretical perspective or with prior research findings.

CONCLUSIONS

This paper examines the mechanisms that lead to voluntarism and determines the extent to which voluntarism affects pollutant reduction under the DOE's Climate Challenge Program to voluntarily reduce CO_2 emissions. Analysis was limited to the top 50 utilities in the United States east of the Rocky Mountains between the years 1995 and 1997. While this sample size certainly limits generalizability (especially to smaller utilities), results are generally supportive of other work done on voluntarism to date. Findings indicate that larger, dirtier firms, under higher direct regulatory pressure are more likely to pledge higher specific reductions in the year 2000, if they are to pledge anything. Firms predicted to pledge higher reduction levels were also found to typically exhibit lower actual reductions of CO_2, SO_2 and NO_x emissions (while environmental technology use and energy generation change were positively associated with emission reductions). Actual levels of pledged reductions and predicted levels from the adopt / nonadopt logit model were not significant contributors to changes in CO_2 emissions from 1995 to 1997.

It may be too early to pass final judgment on the ultimate effect of the Climate Challenge Program on CO_2 reduction by electric utilities. Nevertheless, from a broader perspective, the program seems to face two significant foes. First, in terms of regulatory influence theory, the background threat of regulation is low and companies hold most of the bargaining power when establishing reduction agreements. In addition, apart from small pockets, public scrutiny of CO_2 emissions and understanding of their potential consequences are nascent at best in the United States. Therefore, utilities are in little danger of being held tightly accountable by a public that is much more concerned about pollutants that have been more directly linked (by tradition or by science) to human health and ecological problems (such as toxins, nuclear waste and SO_2). Under conditions of weak regulation and weak public concern, firms probably feel little external pressure to deliver on promised reductions. In such cases, voluntarism may be used as a strategy to preempt future CO_2 regulation, as a means of reducing regulatory pressure in other areas, or transferring attention of regulators to other firms.

Deregulation is the second fundamental force creating barriers for the success of any voluntary CO_2 reduction program in the utility industry. Deregulation of the energy industry started in 1996 when the Federal Energy Regulatory Commission (FERC) filed orders 888 and 889 effectively removing the barriers to competition in the energy sale and transmission markets (USDOE/EIA, 1999; Dahl and Ko, 1998). While on the one hand numerous utilities are probably negotiating in good faith with DOE to reduce CO_2 emissions, many of those same companies are also buying up large quantities of low cost coal under conditions of growing price competition in the energy market (USDOE/EIA, 1999). Cheaper input fuels will fundamentally conflict with CO_2 reduction goals. The ultimate effect of deregulation on CO_2 reduction is not certain. However, it is probable that significant increases in technology investment will be required to offset CO_2 increases from the increased use of cheap fuels. Such investment would negate at least some of the savings from low-cost material inputs in the short run. It is also possible that deregulation will help develop a "green" energy market that will cater to customers willing to pay for electricity generated by low polluting firms or methods (USDOE/EIA, 1999). However, it is safe to say that demand for low-cost energy will outweigh demand for "green" energy, at least in the next decade or so.

This analysis shows that the adoption and effectiveness of voluntary policies varies depending upon regulatory context. In a weak regulatory context, a utility's decisions to volunteer seem generally to be ineffective and probably aimed at either preemption of future regulation of the target pollutant, or at reduction of existing pressure not associated with the target pollutant. Moreover, although reduction commitment levels probably indicate serious and conscientious intentions of some companies, forces linked to market deregulation may tend to counter even the best intentions. These findings seem to suggest that, at a minimum, policymakers need to keep both market and regulatory contexts in mind when developing voluntary programs.

Based on findings in this paper and in prior research, two thoughts emerge. First, voluntary environmental policy, like economic environmental policy, represents a class of regulatory instruments. Distinction among different types of voluntary policies by researchers, policymakers, and the public is critical to understanding the mechanisms of corporate response. Failure to make these distinctions will result in unforeseen consequences and invalid expectations. Second, corporate adoption of and compliance with voluntary policy initiatives is complex, much more complex than current models acknowledge. The effects of voluntarism are known to depend on the type of agreement constructed, regulatory context, market factors, and social environment. Internal managerial and technological factors may also significantly affect corporate voluntarism. Limited understanding about when, why, and how these agreements work implies caution against undisciplined use and overuse during times of fiscal stress or unpopularity of traditional regulatory instruments.

ERIC W. WELCH is an Assistant Professor in the Graduate Program in Public Administration at the University of Illinois at Chicago.

ALLAN MAZUR is a Professor in the Public Affairs Program at Syracuse University.

STUART BRETSCHNEIDER is a Professor in the Public Administration Department at Syracuse University.

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