

Regulatory Pluralism: Designing Policy Mixes for Environmental Protection*

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One of the most important strategies for protecting the environment is regulation, yet our present regulatory system is often not up to the task. An excessive reliance on "single instrument" approaches is misguided, because all instruments have strengths and weaknesses, and because none are sufficiently flexible and resilient to be able to successfully address all environmental problems in all contexts. Accordingly, a better strategy will seek to harness the strengths of individual mechanisms while compensating for their weaknesses by the use of additional instruments. That is, in the large majority of circumstances, a mix of regulatory instruments is required, tailored to specific policy goals. We cannot assume, however, that all combinations of instruments will be better than a single instrument approach. On the contrary, different combinations of instruments, or the introduction of a new instrument to an existing policy mix, could have a variety of effects, not all of which are positive. This article examines the interactions of different categories of regulatory instruments to determine which combinations are productive, counterproductive, or context specific. The aim is to develop a prescriptive categorization of instrument mixes that will aid policy-makers in policy design.

I. INTRODUCTION

As the failings and limitations of both the main government and market approaches to regulation have become increasingly apparent,¹ so have policymakers begun to explore a much wider range of policy mechanisms. These include economic instruments, self-regulation, information-based strategies, and voluntarism. Yet while these instruments open up a suite of policy options far broader than traditional regulation, they have rarely been used to their full potential. Rather, most have been driven by pragmatic policy considerations and the desire to rectify specific problems, often with

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little systematic enquiry concerning how such instruments might interact with each other and other forms of regulation.

Overall, there remains a tendency to treat the various policy instruments as alternatives to one another rather than as potentially complementary mechanisms capable of being best used in combination (Swanson 1995). As a result, policy analysts have tended to embrace one or another of these regulatory approaches without regard to the virtue of others. Perhaps predictably, economists have focused on economic instruments, lawyers and government regulators on direct regulation, industry on self-regulation, and scientists on research (see, e.g., Dovers 1995: 149).

In our view, such "single instrument" or "single strategy" approaches are misguided, because all instruments have strengths and weaknesses, and because none are sufficiently flexible and resilient to be able to successfully address all environmental problems in all contexts. For example, command and control regulation has the virtues of high dependability and predictability (if adequately enforced), but commonly proves to be inflexible and inefficient (see, e.g., Gunningham & Grabosky 1998: chap. 2). In contrast, economic instruments tend to be efficient, but, in many cases, not dependable (*ibid.*). Information-based strategies, voluntarism, and self-regulation have the virtues of being noncoercive, unintrusive, and (in most instances) cost-effective, but also have low reliability when used in isolation. Their success also depends heavily on the extent of the gap between the public and private interest (see Gunningham & Young 1997). Accordingly, a better strategy will seek to harness the strengths of individual mechanisms while compensating for their weaknesses through the use of additional and complementary instruments. That is, in the large majority of circumstances (though certainly not all), a mix of instruments is required, tailored to specific policy goals.

It cannot be assumed, however, that any combinations of instruments will be better than a single instrument approach.² On the contrary, different combinations of instruments, or the introduction of a new instrument to an existing policy mix, could have a variety of effects, not all of which are positive. These range from complementarity (where two instruments enhance each other's effects) to counterproductivity (where one instrument negates or dilutes the effects of another). In the case of the former, an example is targeted information campaigns, which necessarily supplement self-regulatory initiatives. In the case of the latter, an example is uniform pollution standards across industry, which undermine the efficiency of a pollution tax.

We are not alone in advocating the need to design optimal (or at least better) instrument mixes. In recent years, there has been a growing recognition that this is a vitally important issue of environmental policy. Dissatisfaction with the regulatory *status quo* and the deregulatory alternatives has spawned a number of suggestions, at international, regional and national levels, in favor of such an approach.³ Yet despite these expressions of support for a new approach to regulation involving a broader range of

instruments and parties, little attempt has been made to operationalize it. As the Organisation for Economic Co-operation and Development (OECD) put it in 1997: “instruments, while pervasive, are the least analyzed [public management tool]. When they are analyzed, they tend to be studied individually rather than comparatively” (OECD, PUMA 1997).⁴

There has not been any substantial advance in thinking about regulatory mixes at the theoretical level either. Certainly, the OECD, long a leader in both monitoring and developing the environmental regulatory agenda internationally, now explicitly acknowledges that combinations may be more valuable than using instruments in isolation. However, it has yet to engage in the crucial task of theorizing how this might be brought about (see, e.g., OECD 1994; see also Opschoor & Turner 1994). That is, while the thrust of the OECD approach is to be applauded, it has still not taken the next crucial step of identifying *which* combinations of instruments are likely to be complementary rather than counterproductive. It is equally true of sustainability policies more generally that, as Dovers points out, “rarely have criteria for choosing between different instruments been made explicit and applied rigorously” (1995: 149). Even less attention has been paid to identifying criteria for choosing between different *combinations* of instruments and institutions.⁵

In summary, despite a recent and growing recognition of the importance of “regulatory mix” as a research and policy issue, very little work has been done to put the concept into practice, to show what it would mean in specific circumstances. The task of this article is to fill that gap by identifying, albeit as a first step, complementary and counterproductive instrument combinations. While our principal focus is upon the environment, the lessons we draw have much broader application to other areas of social regulation. As such, the article will be of interest, not only to those with particular environment concerns, but also to regulators and policy-makers in other fields, and to regulatory theorists generally.

II. METHODOLOGICAL CONSTRAINTS

There are practical limits as to how one approaches the task of assessing instrument mixes. Specifically, there are so many possible permutations of instrument and institutional interactions as to make the task of producing a general causal model of relationships between the multiple variables impractical, even if problems of context specificity were overcome.⁶ As Elinor Ostrom has pointed out:

the framework for analyzing problems of institutional choice [or, we might add, instrument choice] illustrates the complex configurations of variables that must be addressed.... The reason for presenting this complex array of variables as a framework rather than as a model is precisely because one cannot encompass (at least with current methods) this degree of complexity within a single model. (1990: 214)

A further difficulty in arriving at global policy conclusions is the impact of localized political and cultural traits. For example, it may be argued that in the United States, where a culture of regulatory adversarialism predominates, that self-regulation or co-regulation are less likely to be successful than in Western Europe, where cooperation between regulatory authorities and industry is more common. Orts, in particular, has highlighted the limitations of a narrow, adversarial approach in providing incentives for firms to voluntarily improve their environmental performance beyond that required by minimum regulatory standards (1995: 1227). Such political and cultural specificities may in turn influence the interactions of different instrument combinations.

Does this mean that nothing of value can be said at a general and abstract level, and that the most we can ever do is focus on solutions to particular environmental problems, in particular jurisdictions, with little hope of learning any broader lessons or of extrapolating from one policy area to another? We believe that such an outlook is too bleak, and that there is a middle path. This path enables us to learn and extrapolate from sector-specific problems and solutions and to describe instrument combinations, without falling into the trap of overambitious predictive modelling. As such, it will entail drawing lessons from both the theoretical literature on regulation and from our recent field research into the chemical industry (Gunningham & Grabosky 1998: chap. 4) and agriculture (*ibid.*: chap. 5). Although we recognize the importance of political and cultural factors in influencing the operation of policy instruments in different jurisdictions, and have no wish to downplay this issue, our primary purpose is to transcend such considerations by categorizing instrument interaction at a more abstract level. In this way, policymakers in a variety of jurisdictions will be in position to derive a benefit from our conclusions.

However, the practical task of teasing out the relationships between different regulatory instruments is an especially daunting one. Not only is there an extremely large number of potential instrument combinations, but the answers to the question "Which ones are complementary or otherwise, and why?" are themselves both complex and qualified. To engage in the encyclopaedic task of exploring the full implications of all instrument combinations would not only be impractical, but would not, we suspect, make for riveting reading. Instead, we have chosen to provide a much shorter (and we hope more digestible) account of instrument interactions, which analyzes the most important combinations and their implications without attempting an exhaustive categorization.

III. INSTRUMENT MIXES

For the purposes of analysis, we divide the plethora of potential instrument combinations into the following categories: (1) mixes that are inherently

complementary; (2) mixes that are inherently incompatible; (3) mixes that are complementary if sequenced; and (4) mixes whose complementarity or otherwise is essentially context specific. In completing this analysis, we have tried to bring the conclusions to life by drawing on pertinent, illustrative examples from field research, and, where appropriate, from the wider regulatory literature.

In examining instrument combinations, a preliminary question to resolve is the level of generality with which to approach this issue. If we engage at too abstract a level, then we risk making broad generalizations that lack utility because they are incapable of addressing more subtle distinctions within instrument categories. For example, if we seek to treat economic instruments as a single category, then we may miss or seriously misunderstand the important differences between, for example, taxes and liability rules. On the other hand, if we address the issue of instrument categories at a high level of specificity, then we must deal with so many categories of combinations as to make the entire enterprise unworkable. We have sought to steer between these two extremes, breaking up the most important and complex categories of instruments, command and control regulation and economic instruments, into a number of parts, while treating self-regulation, voluntarism, and informational strategies largely as single entities.

To assist the understanding of the following discussion of instrument interactions, summarized below are the main categories of instruments that will be referred to in this analysis.

1. *Command and Control Regulation*

The various types of command and control standards have fundamentally different *modus operandi*. For example, *design or specification standards* prescribe an approved technology for a particular industrial process or environmental problem.⁷ Such a standard emphasizes the design and construction of safeguards to suite specific situations (MacAvoy 1977). In contrast, *performance standards* define a firm's duty in terms of the problems it must solve or the goals it must achieve. That is, performance standards are outcome-focused and avoid overt prescriptions. *Process standards* address procedures and parameters for achieving a desired result, in particular, the processes to be followed in managing nominated hazards (see, e.g., Potter 1993). They are most used in respect of hazards that do not lend themselves to easy measurement, such as safe working practices or environmental management systems (Industry Commission 1995: 38; Gunningham 1996).

2. *Economic Instruments*

For present purposes, we distinguish between three types of economic instruments. First, we refer to *broad-based economic instruments* as tradeable

emission/resource permits and pollution/resource taxes that apply to industry as a whole, that do not distinguish between sectors and/or preferred technological solutions, and do not impose performance limits on individual firms. That is, apart from government setting the overall level of the tax or number and value of permits, the market is left to operate freely. Second, we refer to *supply side incentives*, which, in essence, are subsidies provided by government for particular types of technology and/or specific types of industrial activity. These are distinguished from broad-based instruments in that there is a much higher level of government prescription. The third and final category is that of *legal liability*, whereby firms can be held financially responsible for previous cases of environmental harm.

3. *Self-Regulation*

This is not a precise concept, but for present purposes self-regulation may be defined as a process whereby an organized group regulates the behavior of its members (OECD 1997: 7). Most commonly it involves an industry-level organization (as opposed to the government or individual firms) setting rules and standards (codes of practice) relating to the conduct of firms in the industry. One can further categorize industry self-regulation in terms of the degree of government involvement (for “pure” self-regulation, without any form of external intervention, is uncommon).⁸

4. *Voluntarism*

In contrast to self-regulation, which entails social control by an industry association, voluntarism is based on the individual firm undertaking to do the right thing unilaterally, without any basis in coercion. Commonly, voluntarism is initiated by government and may involve government playing the role of coordinator and facilitator. At a general level this category embraces voluntary agreements between governments and individual businesses that are a means of achieving improvements in behavior which go beyond the regulated requirements. Under such arrangements, “parties enter into an informal understanding . . . but where the parties set their own targets” or the “parties enter into a form of contract . . . and negotiate targets” (OECD 1997: 29). However, the variety of such agreements makes precise classification difficult.⁹

5. *Information Strategies*

The range of educational and information-based instruments is broad, and in many cases, these instruments may overlap. For present purposes information strategies may be taken to include education and training,¹⁰ corporate environmental reporting,¹¹ community right to know and pollution inventories,¹² and product certification.¹³

A. INHERENTLY COMPLEMENTARY COMBINATIONS

Certain combinations of instruments are inherently complementary. That is, their effectiveness and efficiency will be significantly enhanced by using them in combination, irrespective of the specifics of the relevant environmental issue or the prevailing political and cultural background. As such, policymakers can be confident in employing these combinations in a wide variety of circumstances.

1. *Information and All Other Instruments*

Information is an important instrument of environmental protection, not least because of serious asymmetries of information that exist in the absence of intervention (for example, between regulator and regulatee, between large and small firms, between the community and business, and between buyers and suppliers). Information strategies can be designed to rectify or compensate for these asymmetries. The provision of information will also assist firms in achieving continuous improvement in environmental performance, for only with adequate information can decision makers at all levels of management arrive at decisions that maximize returns and do not lead to unintended consequences.

A potential shortcoming of information-based instruments is, however, a lack of dependability.¹⁴ Specifically, there is no guarantee that information alone will lead to the achievement of predetermined or quantifiable environmental outcomes. For example, community right to know provisions, although they can be a potent instrument, provide no assurance that individual firms will actually improve their environmental performance. For this reason, information will realize the greatest benefit when used in combination with other instrument categories to increase its dependability. Indeed, as we will see immediately below, the provision of information is a crucially important complement to virtually all other policy instruments.

Information is essential to the effectiveness of command and control regulation, both flowing from the regulatee to regulator and vice versa. For example, monitoring and disclosure requirements are crucial to ensure adequate compliance and are therefore often built into the legislation itself.¹⁵ Information instruments designed primarily for other purposes may also be of value to regulators, for example, enabling them to target more effectively toxic "hot spots" or worst performers. Conversely, information provided by a regulator to industry may reduce the prospects of regulatory resistance and facilitate best practice.

Information is equally important to successful self-regulation. Because of the distrust that industry self-regulation almost inevitably generates among local communities and national environmental groups, the legitimacy and credibility of such schemes is likely to depend heavily upon their accountability and transparency and, underpinning both, the availability of

independent performance information.¹⁶ For example, under the European Union's Eco-Management and Audit Scheme, participating firms are required to provide a regular environmental statement detailing their activities and independent third-party verification (*ENDS Report* 1995: 19). Information will similarly serve to complement voluntarism, which itself relies largely upon harnessing enlightened self-interest or altruism.¹⁷ In either event, the provision of information is usually necessary to draw the attention of communities or individuals either to their own self-interest or to the wider environmental merits of a particular course of action.¹⁸ For example, the European Commission administers the high profile European Better Environment Awards for Industry, which recognize voluntary improvements in environmental performance (Elkington, Knight & Hailes 1992). Information flow from participants in voluntary agreements to regulators will be equally important.

Market mechanisms, including economic incentives, also depend heavily for their success upon the availability of sufficient information to enable economic actors to make rational decisions in their self-interest. Indeed, one of the most common failings of pure free-market approaches, such as the creation of property rights, is the lack of access to information of the main parties and their consequent inability to make rational decisions in the absence of such information. In the case of economic instruments, information is of such fundamental importance that, in almost every case, its provision will enhance the functioning of individual instruments.¹⁹ For example, recent commentators on regulation in developing countries have pointed out that:

it would be pointless, and ultimately counterproductive, to advocate large-scale implementation of pollution charges or tradeable permits under conditions [of very limited information] which practically guarantee their failure. (Afsah, Lapante & Wheeler 1996: 5)

Indeed, information instruments such as full-cost accounting may be fundamental in ensuring that firms do respond rationally to economic incentives.²⁰

Our conclusion is that (except in a very small number of cases where the provision of information would be demonstrably counterproductive²¹), information should be seen as a potentially important complement to all other instrument categories. However, this is not to say that it should be invoked in all circumstances. On the contrary, information instruments cost time and money to implement (to government, to business, or to others) and should only be invoked where the benefits outweigh the costs. Compare, for example, the considerable costs incurred in establishing an environmental labelling strategy and the very modest benefits such a strategy has commonly delivered (Dawson & Gunningham 1996) with the modest costs of and very considerable dividends provided by a Toxic Release Inventory or similar instrument (Gunningham & Cornwall 1994).

2. *Voluntarism and Command and Control Regulation*

As with the case of information, voluntarism lacks dependability, and therefore is most effective when used in combination with other instruments to overcome this potential weakness. In this regard, voluntarism will be complemented by most forms of command and control regulation, particularly where levels of environmental performance “beyond compliance” are desired. In the case of performance-based command and control regulation, a minimum performance benchmark is established, with voluntary based measures encouraging firms to achieve additional improvements. The United States Environmental Protection Agency’s 33/50 program is a good example of this approach (Aora & Cason 1995). Under the 33/50 program, firms are encouraged to reduce the levels of their toxic chemicals releases, often at substantial cost, on a purely voluntary basis. Existing command and control regulations that apply to toxic chemical releases remain in force, with the 33/50 program delivering additional benefits.

The combination of the two instruments means that participating firms go beyond the command and control baseline, but that nonparticipating firms must still comply with this baseline. If voluntarism were introduced alone, then there would be no guarantee that nonparticipating firms would not increase their levels of toxic chemical releases, thus free-riding on those committed to higher standards. The combination of voluntarism and performance-based command and control in this instance has produced environmental improvements additional to that which could have been achieved if either were employed in isolation. It is important to note that, in contrast to beyond-compliance activities, if voluntarism and performance based standards were targeting the *same* level of behavior then, at best, they would be a duplicative combination, and, at worst, counterproductive.

Voluntarism may also work well with process-based command and control regulation, for example, where the adoption of environmental management systems such as ISO 14001 or the European Union’s Eco-Management and Audit Scheme have been mandated (Thomas 1997). Because process-based prescriptions tend to be qualitative in nature, and therefore more difficult to measure quantitatively than performance- or technology-based standards, their full potential is difficult to enforce externally unless the regulated firm is committed to the concept. Voluntary-based measures that seek to change the attitude of managers and the corporate culture may serve to reinforce a commitment to process-based standards.

In contrast, technology-based command and control regulation is unlikely to produce complementary outcomes when used in combination with voluntary measures. This is because technology based standards are highly prescriptive – firms can either comply or not, resulting in little room for beyond-compliance achievements. In effect, technology-based standards restrict the way in which firms respond to an environmental imperative, in

terms of the method of environmental improvement, whereas voluntary measures are in principle designed to provide additional regulatory flexibility.

3. *Self-Regulation and Command and Control*

As with voluntary measures, self-regulation that targets environmental performance that is beyond mandatory minimum standards will also be inherently complementary with performance-based command and control regulation. The complementarity arises because the two instruments are targeting different levels of environmental performance, and because the command and control standard is not prescribing how the standard must be achieved (see also voluntarism and command and control for a similar conclusion). In these circumstances, regulation will be the rising floor that follows the vanguard of self-regulatory responses to environmental challenges, rather than the ceiling that gets imposed ahead of, and which limits, the voluntary responses.²²

If, on the other hand, self-regulation and performance-based (or indeed technology or process-based) command and control regulation were targeted at the same level of environmental performance, then, as we indicate below, the self-regulatory component would be redundant. However, later we also demonstrate how the sequencing of command and control with self-regulatory instruments can be used to avoid such redundancy and build on their mutual strengths.

A number of innovative programs have been introduced that attempt to exploit the advantages of both self-regulation and command and control. For example, in the United States, the Environmental Leadership Program provides regulatory relief for participating firms that adopt "beyond compliance" levels of environmental performance, including a transparent system to monitor and track their performance. In the European Union, there is consideration of compliance and inspection exemptions for firms participating in eco-management and eco-audit schemes in effect, a form of self-regulation. In both examples, a backdrop of regulation remains to address nonparticipating firms.

4. *Command and Control Regulation (or Self-Regulation) and Supply-Side Incentives*

Economic instruments in the form of supply-side incentives, such as tax concessions or soft loans for environmental preferred technologies, will complement command and control regulation or self-regulation that target environmental performance directly related to those technologies. For example, performance-based regulation that requires firms to reduce their contribution to greenhouse gas emissions will obviously be assisted by incentives for firms to purchase more energy efficient industrial motors and drives or cogeneration facilities. In the case of biodiversity conservation, the

European Union has had particular success using a combination of grants and subsidies with regulation.²³ For example, the United Kingdom's Environmentally Sensitive Areas Scheme provides payment to private parties on a per hectare basis.

Similarly, technology-based standards, which could be mandated by government or take the form of self-regulatory codes of practice, are more likely to be complied with if there is an additional financial incentive associated with the purchase of the relevant technologies. However, the latter combination of instruments is probably a case of "policy overkill," and is such a clear violation of the polluter pays principle that it could probably only be justified as a transitional arrangement where industry faces onerous competitive pressures. The complementary link between process-based standards and supply-side incentives is less obvious than that for the other forms of regulation. This is because process-based standards do not necessarily entail a change in technology, particularly end-of-pipe technology. Rather, the emphasis is on developing systems that manage environmental issues better and ideally avoid problems before they arise, for example, through pollution prevention initiatives.

5. *Command and Control (or Self-Regulation) and Broad-Based Economic Instruments (which target different aspects of a common problem)*

Although the underlying rationale of regulation, in the form of command and control or self-regulation, is fundamentally different to that of broad-based economic instruments, their joint application may be complementary if they are used to target different aspects of a common environmental issue. The phasing out of leaded fuel provides a good example. In Australia, all vehicles post-1985 were required to be fitted with catalytic converters that necessarily entailed the use of engines that only operated on unleaded fuel (a conventional technology-based command and control measure). At the same time, the federal government introduced a (phased) price differential on the price of fuel such that leaded fuel became more expensive than unleaded fuel (a broad-based economic instrument, in the form of a pollution tax). The reason these two radically different policy approaches complement each other is that by addressing different contributory aspects of the same problem, they provide the market with mutually supportive signals – the technology-based standard is directed at the vehicle manufacturer, while the pollution tax is directed at the consumer (contrast the situation described below, when they are used to address the same contributory activities).

6. *Liability Rules and Command and Control (or Self-Regulation)*

In some circumstances at least, liability rules will complement command and control regulation (or self-regulation). Specifically, where the standard

imposed under tort law is higher than that imposed by regulation, then the latter will act as a baseline, leaving the possibility that the courts will provide for higher standards in particular circumstances. However, one potentially undesirable side-effect will be that an individual court decision may destroy the uniformity provided by the regulation (Rose-Ackerman 1996: 315).

Complementarity is also possible at the level of enforcement, provided that the negligence rule in torts is equal to or less stringent than the statutory standard (*ibid.*). Concern about civil liability can result in increased self-regulation or voluntarism “and stimulate innovative activity at the level of the firm” (*ibid.*).²⁴ However, if the tort system imposes standards that are higher than those under regulation then “it undermines the notion that the regulatory system sets standards where benefits are balanced against costs. Under such conditions the two systems would work at cross-purposes” (*ibid.*).

7. Broad-Based Economic Instruments and Compulsory Reporting and Monitoring Provisions

Much of the early literature on economic incentives and on regulation assumes that these mechanisms should be treated as alternatives. Some economists, for example, begin by listing the shortcomings of command and control regulation before going on to argue that it should be replaced, in all except extreme cases, by economic instruments and other market-based mechanisms (Stewart 1992). However, this mutually exclusive treatment of economic instruments and regulation hides far more than it reveals. In practice, many economic instruments rely on a substantial underpinning of government regulation for their effective implementation.²⁵

Most, if not all, broad-based economic instruments (such as pollution taxes and tradeable emission permits) require a certain level of command and control in order to function effectively and equitably. Of particular importance, in this regard, are compulsory reporting and monitoring provisions. For example, a tax on the level of effluent being discharged into a stream will only be a viable instrument if government (or conceivably a third party) can accurately measure the amount of discharge. Therefore, the economic instrument in this instance will need to be employed in conjunction with compulsory requirements for measuring and reporting the level of discharge, thus forming a complementary instrument combination (Huppes, van der Voet & Maxon 1992).

Similarly, tradeable permit schemes require that firms actually adhere to the requirements of the permit they have purchased (or have been granted), which necessarily entails the application of the command and control performance standard inherent in the value of the permit (Tietenberg 1990). In addition, each time a trade takes place, the government (or conceivably a third party) must be kept informed in order to maintain accurate record keeping of the location and monetary value of permits, thus necessitating compulsory reporting requirements. There is a crucial distinction to be made

between the application of command and control instruments in this instance, which are essentially ancillary to broad-based economic instruments, and those which are designed to address the same activities as economic instruments (see below).

B. INHERENTLY COUNTERPRODUCTIVE INSTRUMENT COMBINATIONS

Certain combinations of instruments are either inherently counterproductive or, at the very least, suboptimal. That is, their efficiency and effectiveness may be significantly diminished when they are employed in combination. As with complementary combinations, we consider that the counterproductive or suboptimal nature of these interactions is not context specific. This is not to suggest that such combinations should never be considered, but there would need to be some other overriding imperative (such as differences in regional assimilative capacities, discussed below, or overriding political and cultural imperatives) in order to justify the loss of regulatory efficiency. Some combinations, however, are so manifestly incompatible or antithetical (e.g., the free market environmentalism/property rights approach and command and control²⁶) that policymakers are unlikely to ever contemplate them, and these merit no further discussion. However, other combinations are more complex and their implications less clear. These we explore below.

1. *Command and Control Regulation and Broad-Based Economic Instruments (Which Target the Same Aspects of a Common Problem)*

Most command and control instruments, specifically performance-based standards and technology-based standards, seek to impose predetermined environmental outcomes on industry (Stewart 1992). That is, even if the standards are not uniform (in that different requirements apply to different sectors or indeed different firms) individuals firms are not free to make independent judgments as to their preferred method of environmental improvement (in the case of technology-based standards) or their overall level of environmental performance (in the case of performance-based standards). Economic instruments, in contrast, seek to maximize the flexibility of firms in making such decisions – government influences the overall level of environmental performance by providing a price signal relative to the level of pollution or resource consumption, or by creating a purchasable right to pollute or consume resources.²⁷

If a command and control instrument were to be superimposed on an economic instrument that targets the same behavior, or vice versa, then to the extent that the command and control instrument limits the choice of firms in making individual decisions, the economic instrument will be compromised. That is, there will be a suboptimal regulatory outcome. This is because economic instruments are designed to exploit differences in the marginal cost of abatement between firms.²⁸ It makes economic sense for

those firms that can reduce their levels of pollution most cheaply to carry a greater share of the abatement burden, and, for those where it is most expensive, to carry a lesser share of the same burden. The result is that the net cost of reducing the overall level of pollution (or resource consumption) will be lessened, or, for a given level of expenditure, a greater level of pollution reduction will be achieved (Panayotou 1994). By simultaneously applying a prescriptive command and control instrument, for example, a performance standard that mandates levels of energy efficiency for firms in tandem with a broad-based carbon tax, free market choices would be artificially restricted, thus undermining the basic rationale of the economic instrument.

Another example of where economic instruments and performance-based command and control have been uneasy bedfellows is the case of load-based licensing. Introduced in several jurisdictions internationally, load-based licences set a maximum level of pollution output that is determined by the regulatory authorities. Such licenses are often portrayed as another form of pollution tax. Firms are provided with an economic incentive for reducing pollution, via a reduction in license fees, which is often combined with a mandatory maximum level of permissible pollution. In effect, regulators are taxing higher levels of pollution at the same time as imposing a command and control minimum performance standard.

By adopting this approach, regulators, by imposing the minimum performance standard, are compromising the efficiency of the load-based license fees. In the interests of efficiency, they should remove the minimum performance standard and allow those firms with lower marginal cost of abatement to deliver the majority of the pollution reduction (and conversely, allow those with higher marginal costs to pay a higher tax, polluting at levels that may exceed the maximum contemplated under a licensing system). If the overall level of pollution remains too high, then the regulators should simply increase the size of the fee. If the fee is not set at a level sufficient to deliver the desired net outcome, and in many instances this will be the case, then, by implication, it is not acting as an effective economic instrument. Any further improvements in this instance would therefore be due to something other than an effective price signal.²⁹

There is, however, an extenuating circumstance that may justify the suboptimal outcome in regulatory efficiency resulting from the combination of broad-based economic instruments with prescriptive command and control. Where pollutants have highly localized impacts, through, for example, differences in assimilative capacities or proximity to local communities, effectiveness and equity issues may override the efficiency considerations. Localized impacts can be contrasted with global pollutants such as ozone depleting substances, greenhouse gas emissions, and to a lesser extent, sulphur dioxide emissions. In the case of highly localized pollutants, such as the runoff of agricultural chemicals into local river systems, it may be necessary to impose minimum levels of performance on firms/individuals in highly sensitive regions, or indeed a variety of different levels tailored to

local conditions, even if there was a more general economic instrument in place. Although this would reduce the overall efficiency of the economic instrument, through the restriction of free-market choice, this loss of efficiency may be justified on the grounds of effectiveness or equity.

Just as economic instruments are designed to maximize the choice of firms in determining their level of environmental performance, so too are they designed to maximize choice in the method of environmental improvement. In this sense, technology-based standards that dictate the method of environmental improvement will necessarily be in conflict with such economic instruments. That is, the capacity of economic instruments to drive innovative improvements in environmental performance will be undermined by the predetermination of preferred solutions by regulatory authorities. In contrast, process-based standards that seek to bring about a systems-based improvement to environmental management are unlikely to conflict with economic instruments as they neither seek to impose specific levels of environmental performance nor particular technologies for environmental improvement. On the other hand, if firm management responds rationally to the price signal provided by economic instruments, then it may be argued that process-based standards would be redundant. However, as we have pointed out elsewhere, for a variety of reasons, firms are unlikely to be purely rational actors.³⁰

3. *Self-Regulation and Broad-Based Economic Instruments*

To the extent that self-regulatory measures mimic the impact of command and control instruments cited in the previous example, then they too would be incompatible with broad-based economic instruments. If, for example, self-regulation required that firms meet uniform performance targets, then economic instruments designed to exploit differences in the marginal cost of abatement would be compromised. If self-regulation was used to impose industry-wide targets, thus leaving individual firms to determine the level of their contribution, then the effect of undermining broad-based economic instrument would be lessened. However, variations in the average marginal cost of abatement between sectors would still compromise the efficiency of the economic instrument to the extent that it was prevented from exploiting these cost differences.

For example, the sector-specific voluntary agreements that have been introduced in the Netherlands established different targets for different sectors (Gerits & Hinssen 1994: 323). Unless these agreements were established on the basis of perfect information, it is highly likely that they would not in fact accurately reflect the differences in the marginal cost of abatement between the sectors, let alone individual firms, nor would they be able to adapt to changes in those difference over time. As such it would be counterproductive to combine them with a broad-based economic instrument, because the latter do not discriminate between sectors.

A pertinent example of the incompatibility of self-regulation and broad-based economic instruments can be drawn from the policy mix used to phase out the use of ozone depleting substances, in particular CFCs, in Australia. Under the National Ozone Strategy, the federal government introduced a national cap on the production and importation of CFCs, with firms allowed to trade individual CFC quotas they had been allocated under the cap, in effect, a system of tradeable permits. Subsequently, however federal and state governments negotiated a number of sector-specific self-regulatory agreements with industry to phase out the use of CFCs. These agreements contained different timetables, both across different industrial sectors and across different types of ozone depleting gases.

The incompatibility of these two approaches being used in combination is obvious. If the tradeable permits were to realize their efficiency potential, those firms that faced the highest cost of abatement, irrespective of the particular industry they belonged to or the particular gas they used, should have been allowed to purchase the necessary CFC permits (albeit indirectly through the various importers and manufacturers of CFCs). This would have forced up the market price, thus encouraging those firms, again, irrespective of their industry sector, with lower abatement costs to reduce their consumption of CFCs. By imposing predetermined outcomes on the various industry sectors, the self-regulatory strategy effectively prevented such an outcome. Not surprisingly, the tradeable quota program failed, with only one recorded trade having taken place.³¹

4. Technology-Based Standards and Performance-Based Standards

In the United States, in particular, much command and control regulation has taken the form of technology based standards, that is Best Available Technology (BAT) standards (Alm 1992). And although technically these do not mandate particular technological solutions, the practical result is that firms are unwittingly coerced into choosing specific technologies. In addition, regulators may also employ technology specific regulations that mandate particular solutions. These are often used in relation to product standards. For example, in the case of vehicle safety in the United States, all new vehicles are required to be fitted with air bags for front passengers. In contrast, performance-based standards aim to avoid prescriptive technological solutions, leaving the method of compliance to individual firms (using the vehicle safety example, a performance-based standard would simply require vehicle manufacturers to meet predetermined benchmarks – this may or may not involve the use of air bags³²).

Although the differences between technology-based and performance-based standards may in some instances be an unintended outcome of regulatory practice, it is difficult not to conclude that they are fundamentally incompatible policy approaches. In the case of the former, regulators maintain a high degree of control over the direction and actuality of tech-

nological solutions. In the case of the latter, regulators are not concerned with the way in which firms run their industrial processes; rather, the focus is on the level of environmental performance. It is highly unlikely that these two approaches can operate successfully simultaneously, and indeed, it may be argued that some of the difficulties associated in particular with United States' style command and control regulation is the result of authorities failing to adequately recognize their mutual incompatibility, and the merits of applying them in different circumstances.

For example, the United States EPA's XL initiative (Clinton & Gore 1995: 36), which is designed to give firms much greater flexibility through the adoption of less prescriptive, performance-oriented regulation, has failed to attract a substantial number of participants due, at least in part, to the concern of firms that pre-existing BAT regulations may still apply. Thus even if firms participating in Project XL reach agreement with regulatory authorities to put into place a performance- and process-based environmental management strategy, they may still be subject to federal prosecution if they fail to comply with the Clean Air Act or the Clean Water Act (Carr & William 1997: 25).

The clash of regulatory styles between technology-based and performance-based standards is exacerbated by the advent of multimedia, facility wide permits and bubble licences. Not only do such instruments avoid prescriptive technological solutions, they also allow them to aggregate their environmental performance across more than one media and more than one site. Residual BAT standards may thus undermine the potential cost benefits to be derived from such approaches.

5. Incentive-Based Instruments and Liability Rules

The purpose of incentive-based instruments is to allocate regulatory costs to those who can bear them most efficiently, thereby providing a search by regulatees for innovative ways to minimize environmental damage. Pollution fees, tradeable pollution rights, offsets, and bubbles all fall into this category. If such incentives are in operation at the same time as liability rules, then this will be either redundant or counterproductive. As Rose-Ackerman points out:

tort judgments would undermine such a regulatory scheme, especially if courts applied a strict liability standard, the type of standard which some U.S. judges have found least "regulatory". Thus, incentive-based statutes should include a provision clearly pre-empting tort actions (1996:317).

C. SEQUENCING INSTRUMENT COMBINATIONS

One way of avoiding potentially dysfunctional results that can arise when applying incompatible instruments simultaneously (and of expanding the operational possibilities of compatible combinations) is to sequence their

introduction. That is, certain instruments would be held in reserve, only to be applied if and when other instruments demonstrably fail to meet pre-determined performance benchmarks. One type of sequencing is when an entirely new instrument category is introduced where previous categories have failed. Another version is when only the enforcement component of a pre-existing instrument is invoked to supplement the shortcomings of another. Logically, such sequencing would follow a progression of increasing levels of intervention. The benefit of this approach is that considerable utility can be derived from otherwise counterproductive instrument combinations, and in the process, the overall dependability of the policy mix can be improved.

1. Self-Regulation and Sequential Command and Control

One way of bolstering the credibility of self-regulation is to underpin its purported targets with a backdrop of command and control regulation (commonly referred to as “co-regulation”). That is, if and when it could be demonstrated that an individual firm or industry sector had failed to deliver the promised benefits, then the regulatory authorities could step in to impose mandatory requirements. Thus the two instruments are applied sequentially: it is only when the first fails that the latter kicks in. As an added incentive to effective self-regulation, those mandatory requirements could be more onerous than if the firm had never participated in the self-regulatory scheme in the first place. Such a complementary combination has the added benefit to participating firms of minimizing the incidence of firms “free-riding” on the efforts of others.

By sitting in reserve, to be imposed only when self-regulation fails, command and control, in the form of performance standards, can play an important complementary role in improving the operation of self-regulation. As we saw earlier, performance-based standards form a natural partnership with self-regulation, with the former specifying a minimal level of performance based compliance, and the latter delivering results over and above this minimum. Process-based standards may also be mutually reinforcing, or at worst, duplicative, to self-regulation (this is because process-based standards, by requiring firms to take greater responsibility for environmental performance through the adoption of management systems, already have several features in common with self-regulation). Technology-based standards, on the other hand, may be duplicative, or potentially even counterproductive, if used in simultaneous combination with self-regulation (for example, where a mandated technological solution is inconsistent with proposed self-regulatory solutions or where industry reacts defensively to external intervention).

2. Self-Regulation and Sequential Broad-Based Economic Instruments

A similar analysis to the above applies to the relationship between self-regulation and broad-based economic instruments, namely that they are

complementary when applied sequentially but not otherwise. However, in this case, the economic instruments are imposed when it is deemed that the entire self-regulatory regime has failed, rather than when an individual enterprise within that regime has failed to discharge its responsibilities under it. This provides an element of certainty and credibility to self-regulatory initiatives.

An example of this type of instrument sequencing can be drawn from a policy introduced in New Zealand to reduce the emissions of greenhouse gases by industry. Under this policy, industry agreed to self-regulate a 5 per cent reduction in greenhouse gas emissions. However, the government announced in advance that, if self-regulation failed, it would implement a broad-based carbon tax. Similarly, in Australia, industry agreed to voluntarily phase out the use of hydrochlorofluorocarbons (HCFCs) through a program of self-regulation, but on the clear understanding (included in legislation) that if it fails to meet prespecified phase-out targets, then a tradeable quota scheme would automatically be introduced.³³

D. COMBINATIONS WHERE THE OUTCOME WILL BE CONTEXT-SPECIFIC

While we have been able to identify a number of inherently compatible and inherently incompatible combinations, there will be other instrument combinations where it is not possible to state in the abstract whether the outcome will be positive or negative. Rather, much will depend on the particular context in which the two instruments are combined, including the prevailing political and cultural environment. For example, this is the case with combinations of voluntarism and self-regulation. These two instrument categories overlap to a substantial extent, and indeed, the borderline between them is significantly blurred. The main distinction for our purposes is that self-regulation entails social control by an industry association, whereas voluntarism is based on the individual firm undertaking to do the right thing unilaterally, without any basis in coercion. There is no inherent reason why these two instrument categories should be used in combination with each other, but equally no compelling reason why they should not.

Similarly, it is not easy to determine in advance the likely outcome of combinations using both the free market and self-regulation. In principle, self-regulation might appear to resonate with free market approaches, both (at least in their pure form) sharing an antipathy with government regulation. Yet in practice, self-regulation has often been used to achieve purposes quite antithetical to the ideals of the market as in the many documented examples when it has resulted in collusive conduct and as a vehicle for restrictive trade practices.

The relationship between voluntarism and economic instruments is also likely to be context specific – it is difficult to generate broad lessons in the absence of specific details. Although strict economic theory would appear to

make voluntarism redundant in the face of effective price signals, the relationship between the two in practice is less clear. To the extent that firms behave in less than fully rational ways, then voluntarism might be complementary to economic instruments by bringing to the attention of managers opportunities for environmental improvement that would not have occurred if relying on price signals alone. For example, energy taxes will make many energy efficiency improvements financially advantageous, but, as energy costs remain a minor component of many firms' overall costs structures, they may go unnoticed. Voluntary programs, such as the Green Lights program in the United States, may, however, encourage firms to actively seek out and exploit such opportunities (Miller 1994). On the other hand, to the extent that voluntary measures mimic the effects of command and control regulation or self-regulation in interfering with the free operation of the market, that is by allowing pollution from those firms with higher marginal costs of abatement to be compensated by reductions in pollution from those with the lower costs, then the combination will similarly be counterproductive.

In light of these conclusions, it is important for policymakers to distinguish between different instruments combinations that are inherently antagonistic, and those instruments combinations that are dysfunctional essentially as a result of the contextual features surrounding their application. In many cases, the *latter* will arise because of the existence of competing policy goals (rather than any inherent incompatibility of the instrument combinations themselves). For example, in the case of biodiversity conservation in Australia, the introduction of policies to preserve biodiversity have historically been undermined by incentives for clearing native vegetation on private land. Also in Australia, the introduction of a voluntary agreement with industry to reduce greenhouse gas emissions are compromised by the existence of generous tax subsidies for the use of diesel fuel. Where such conflicts exist, a priority for policymakers will be the removal of such perverse incentives.

E. MULTI-INSTRUMENT MIXES

So far we have confined our discussion to bipartite mixes. There is, of course, no reason why mixes should not be multipartite, and they commonly are. The benefit of our examination of bipartite mixes has been to identify complementary and counterproductive mixes, with the result that we know, in the case of multipartite mixes, what combinations to avoid, and which complementary combinations we might build upon. The possible permutations of multipartite mixes are very large indeed, and, having given a detailed examination of bipartite mixes, it is neither necessary nor practicable to examine all or even most such combinations here. Instead, we make two general points about such mixes, giving examples to illustrate our arguments.

First, there are often additional synergies to be derived from mixing larger numbers of complementary instruments, resulting in a return that is greater than with a simple bipartite mix. For example, in some cases environmental insurance could potentially act as a considerable incentive to improved environmental performance, but in practice is often either unavailable or available only at very high premiums. Commonly, such insurance is unavailable because insurance companies lack access to reliable, independent information upon which to base their premium structures. For example, in the case of the chemical industry's Responsible Care initiative, the mere existence of the self-regulatory scheme was insufficient to convince the insurance industry to give discounted premiums to Responsible Care companies (i.e., insurance and self-regulation were unable to function as complementary combinations). However, in Canada, with the gradual introduction of verification by independent third parties of the environmental performance of individual enterprises, the insurance industry changed its position and is now beginning to provide substantial discounts to best practice companies. This in turn has created a further incentive for companies to enter Responsible Care and subject themselves to such verification (see Gunningham & Grabosky 1998: chap. 4).

Second, the sequence in which the various components of multipartite combinations are introduced may be crucial to their success. For example, there may be substantial efficiencies in offering regulatory flexibility to better environmental performers, but the *quid pro quo* for this should include commitments by the enterprise to deliver environmental performance levels that go beyond compliance, independent indicators against which performance is measured, and can be verified by an independent third party, disclosure to and dialogue with the community, and a set of triggers that, if activated, result in government intervention (*ibid.*). However, what is crucial to the success of this arrangement is the ordering of these various instruments. In particular, it is essential that government regulation serves as a backstop, only being invoked where other instruments fail to achieve the desired effect. It is this that enables government to "regulate at a distance," providing industry (until it defects) with the autonomy and flexibility it demands, while saving scarce regulatory resources for other purposes.

IV. CONCLUSION

In this article we have built upon our previous field research, and that of others, to identify general lessons concerning the application of environmental policy mixes. In particular, we have sought to specify which particular combinations of instruments will facilitate successful policy outcomes. Given the very large number of possible permutations, this task can all too easily become encyclopaedic. To avoid both the impracticality of

this approach and the indigestion of the reader, we steered a more modest course, identifying the most important combinations and explaining in each case why they are variously complementary or counterproductive (or in some cases why the answer is context specific), and why it matters. We also explained how instrument combinations can be sequenced in order to avoid dysfunctional results and so as to expand the range of circumstances in which particular combinations will be complementary rather than counterproductive.

Our principal conclusion is that, as not all regulatory instrument combinations are equal, it is incumbent upon policymakers, in seeking to introduce a broader range of regulatory solutions, to carefully select the most productive instrument combinations. We recognize, however, that not all will necessarily agree with the precise conclusions we have arrived at. Nevertheless, by providing a prescriptive outline of potential instrument interactions, our intention is, in the first instance, to move the debate forward, and subsequently, to assist policymakers in achieving, in the words of Carol Browner, “cleaner, cheaper, smarter” regulation.³⁴

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NOTES

1. Specifically, the types of direct (or “command and control”) regulation that predominate in developed countries are now widely recognized to have serious shortcomings: they are often inflexible, and excessively costly for business to comply with. Centralized, bureaucratic standard-setting, the centerpiece of traditional forms of command and control, is now routinely castigated by its

critics for being an inherently inefficient and cumbersome way to control pollution and for failing to deliver many of the environmental benefits it promised. There is also considerable evidence that government regulation, at least in an archetypal form of command and control, has reached the limits of its technical capacity and cost-effectiveness. The low-hanging fruit has all been picked. The overall result is, at best, one of slow progress at excessive cost. See generally Alm (1992) and Fiorino (1996). Yet were the pendulum to swing to the opposite extreme, with free market and property rights approaches substantially replacing regulation, as proponents of deregulation have espoused, there is little reason to believe that environmental outcomes would be any better. The limitations of these approaches are also severe. See further Kuttner (1997). As a result, their capacity to deliver optimal environmental outcomes is, in most cases, even more limited than that of command and control regulation.

2. We do advocate a smorgasbord approach, assuming that the greater the number of different instruments and actors the better. On the contrary, there are limits to government and private sector resources that necessitate a careful selection of the most cost-effective regulatory combinations. There are also limits to the administrative burden that can reasonably be placed on regulatees in satisfying a multiplicity of policy instruments.
3. At the international level, references to the concept of regulatory mix (though not how to achieve it) are to be found as early as 1992 in *Agenda 21*, the main policy document to emerge from the Rio Earth Summit (UNCED 1992: § 1, chap. 8(B), 55) and more recently in the European Union's Fifth Environmental Action Program, which aspires to integrate different environmental regulations across a range of sectors (Hempfen 1993). Similar sentiments have also been expressed at a national level in a number of jurisdictions, and by organizations such as the Business Council for Sustainable Development and the United Nations Commission on Environment and Development (UNCED) (Schmidheiny 1992: 30–32).
4. In the United States, Europe and elsewhere, there are increasing calls to go "beyond command and control regulation," but without any clear sense of direction as to what this might mean. And while the United States EPA had by the late 1990s introduced a range of more flexible programs that sought continuous improvement and reflect collaboration with stakeholders, these remain marginal to its central mission and have so far produced only very limited results. Even a promising innovation, the Environmental Leadership Program, is beset by problems (not least the lack of credible incentives for firms to join) which makes the transition from the pilot phase to full program an extremely challenging one (see Ward 1997: 38).
5. Perhaps the closest approximation to the ideals expressed in this section is to be found in attempts by a few nations to design individual environmental strategies in ways that, without articulating the importance of mixes in regulatory design, nevertheless embody some important principles of such design. The Dutch approach to Internal Company Environmental Management and to environmental covenants (Van Dunné 1993), initiatives in the United States such as Project XL and the Environmental Leadership Program, and the efforts of some Australian States to reform the principles of their pollution legislation are good examples.
6. As Bressers and Klok put it "theories based on the joint influence of possible combinations of circumstances rather than the isolated influences of individual circumstances tend to become tremendously complex" (1988: 22).
7. In some versions the regulatee is notionally given considerable discretion to select the most appropriate technology to their circumstances, but, in practice, those who depart from the one approved technology run a considerable

“regulatory risk” that the regulatory authority will not deem their choice of technology as complying with the statutory requirement (Atcheson 1996: 17).

8. Rees (1988: 9) for example, suggests that industry self-regulation might take one of three forms. First, voluntary or total self-regulation involves an industry or profession establishing codes of practice, enforcement mechanisms, and other mechanisms for regulating itself, entirely independent of government. Second, mandated self-regulation involves direct involvement by the state whereby it requires business to establish controls over its own behavior but leaves the details and enforcement to business itself, subject to state approval and/or oversight. Finally, mandatory partial self-regulation involves business itself being responsible for *some* of the rules and their enforcement but with the over-riding regulatory specifications, though not the details, being mandated by the state.
9. The concept nonmandatory is fundamental for, to the extent that such agreements contain a coercive element (for example, there are strong pressures to enter into it), they might legitimately be regarded as an innovative form of command and control, or co-regulation.
10. Environmental information is commonly delivered through government sponsored education and training programs. Education and training can be tailored to meet the needs of industry, and in particular, to address information gaps that hamper the environmental performance of small- and medium-sized businesses. A key function of these instruments is to internalize environmental awareness and responsibility into corporate decision-making.
11. Corporate environmental reports are a way for firms to disseminate information about the environmental record, either as part of an annual report or as a stand-alone document. Corporate environmental reporting is still in its infancy, however developments include the use of “eco-balance sheets,” and full-cost accounting, which measure all business inputs and outputs, establish performance indicators, and calculate environmental efficiency per unit of production.
12. A number of countries around the world have introduced laws compelling disclosure of pollution and chemical hazard information. Commonly referred to as “community right to know” (CRTK), such legislation is intended to inform the community of the environmental impact of a firm’s activities and of a firm’s pollution abatement policies. The most prominent example is the Emergency Planning and Community Right to Know Act (EPCRA) introduced in the United States in 1986.
13. Surveys indicate that some consumers take environmental considerations into account when they purchase goods and services. There is evidence, however, that unassisted markets do not provide accurate information to consumers and in some cases may mislead them about the environmental performance of specific products. Product certification and eco-labelling schemes are intended to inform the public about the environmental “soundness” (or otherwise) of various consumer products.
14. Predictably, instruments within this category will also be more effective in some circumstances than others. CRTK, for example, relies heavily on the energies of local communities in using the information and pressuring enterprises to improve their environmental performance. Where an environmental hazard involves no immediate threat to human health, or where there is no identifiable local community, or where we are dealing with nonpoint source pollution, not readily measured and traced back to its origins, then this instrument has far less to offer. Similarly, corporate environmental reporting is dependent upon the willingness of public interest groups to follow through on its results and to both shame bad performers and praise good ones. Finally, eco-labelling relies upon the willingness of consumers to buy “green” products and upon their capacity to distinguish between these and other classes of product.

15. For example, enterprises may be required to self-monitor their emissions and disclose the results to the regulatory authority. In most instances, legislation will also compel the regulatee to give access to government inspectors in order for them to identify whether or not the regulatee is in compliance.
16. The use of independent verifiers (overcoming the limitations of industry self-reporting) under responsible care is one example. Such information is also essential to government, for independent evidence of the success of such schemes is part of the quid pro quo for government providing regulatory flexibility and autonomy to participating enterprises. Under effective self-regulatory schemes information is also likely to flow freely between member companies as to ways of more successfully delivering on their environmental goals. For example under Responsible Care, there are quite extensive provisions for technology sharing, for leadership groups, and for mentoring small suppliers to educate them as to how to achieve higher standards of environmental performance.
17. As, for example, the Australian Landcare program, which is designed to generate voluntary action from the rural community concerning issues such as soil erosion.
18. For example, only if farmers become aware of the longer-term consequences of destructive agricultural practices, such as the need for wildlife sanctuaries is clearly demonstrated, are they likely to modify them and voluntarily contribute to this goal.
19. For example, taxes, charges, or other price-based instruments may be imposed by government in order to give firms greater incentives for improved environmental performance, but unless an enterprise is aware of the extent of its environmental discharges and has an accounting system that identifies which area of the firm's operations is responsible (and which managers), then the economic instruments may not have their desired effect on behavior.
20. Similarly, most small- and medium-sized firms, in particular, barely know what questions to ask, or who to address them to, let alone what the possible solutions. Even in large firms, where information access is easier, such information may not be acquired. Bounded rationality, the lack of capacity to comprehend and address a wide variety of complex issues may result in a failure to access or act on information, even when it is rational (and profitable) to do so. Only to the extent that these problems can be overcome through information, education, and training will economic instruments be capable of achieving their desired impact on behavior.
21. For example, a duty to disclose the results of voluntary environmental audits (which might then be used against the enterprise, either by governments or by third parties such as environmental groups), would produce a disincentive to conducting audits in the first place. Such an outcome is highly undesirable, given the very considerable benefits such audits can produce in terms of improved environmental performance. A requirement for mandatory disclosure of commercial in confidence information would also be counterproductive, for similar reasons. Information disclosure by businesses can make them vulnerable to civil actions. This is a major reason why U.S. firms opposed transparency provisions in the ISO 14001 Environmental Management Systems standard. In relation to information, liability rules can also be counterproductive. For example, in the U.S.A. (where information disclosure can make firms vulnerable to civil action, and where litigation is frequent) companies are very resistant to providing information on their own performance for fear that this will subsequently be used against them in civil litigation.
22. We are indebted to Brian Wastle for this metaphor.
23. For example, in protected areas, regulations should be used to prevent site damage, while subsidies should encourage positive management of protected land.

24. The authors point out that liability rules do much more than just create a threat of financial penalty and thereby create incentives for improved environmental performance. In particular, they also create an added layer of horizontal control (e.g., transactional monitoring is extended to include environmental performance) reinforcing the effect of regulatory and market policy instruments.
25. More recent and sophisticated studies recognize the substantial extent to which many economic instruments depend upon pre-existing traditional regulation, and the extent to which they will as commonly complement other policy instruments rather than replace them.
26. The creation of property rights over the use of natural resources, such as water or wildlife, where access was previously available to all will be undermined by most forms of command and control regulation. This is because a central purpose of the property rights approach is to allow the unfettered operation of market forces, which the imposition of specific directives by government will necessarily inhibit.
27. Many economic instruments tend work with gradations and continuously defined variables that give no place for people to “dig in the heels” (Schelling 1960).
28. The “marginal cost of abatement” is the cost for each firm or industry to reduce emissions of a particular pollutant by a given unit from their current level of emissions.
29. For example, it may be that the load-based licence fee is in essence a revenue raising measure or principally symbolic in nature. One industry interviewee stated that the primary motivation for his firm’s preference of load-based licences was not financial, rather it, was to gain recognition for consistently exceeding minimum performance standards.
30. Contrary to the assumption of many neoclassical economists, industry is not composed of fully informed, flawlessly calculating individuals. In reality, people never have all the information they need, and yet they are unable to process all the information they have, rather they can only do one or a few things at a time, and can only attend to a small part of information recorded as memory or presented by the environment (most commonly, the situation is less than fully understood, not all options are recognised or fully assessed, and there is insufficient time to overcome these limitations).
31. In fairness, it should be pointed out that there were other contributory factors, in particular, the fact that the size of the overall quota was probably too large.
32. For example, the automobile company, Audi, devised a mechanical system based on cables that shifted the engine and other dangerous components away from a vehicle’s occupants in the event of a frontal collision, but was forced to resort to air bag technology in the face of, inter alia, United States safety legislation.
33. Interestingly, the performance benchmarks agreed to by industry to avoid the introduction of tradeable quotas were significantly tougher than those required for Australia to meet its international obligations under the Montreal Protocol.
34. Carol Browner is Administrator of the U.S. EPA.

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