ACEL FINAL REPORT:

BARRIERS AND MOTIVATORS TO THE ADOPTION OF CLEANER PRODUCTION PRACTICES

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Executive summary

This report was commissioned by Environment Australia to identify the barriers and motivators and drivers to the adoption of cleaner production by industry, and subsequently, to recommend a cleaner production policy strategy. In particular, the report makes specific references to the needs of small business, the potential for sector specific approaches and the role of regulation.

Cleaner production holds out the promise of improving the environmental performance of industry while at the same time improving a firm's bottom line. If this is true, then it would be expected that firms would be rushing to implement it. And yet, despite a shortage of concrete data, there is a general consensus that, in Australia at least, the widespread adoption of cleaner production remains a largely unfulfilled ambition.

In consulting with a wide range of industry representatives, it became clear that the majority of barriers to cleaner production confronted by firms could be placed into one of two categories: those that were internal to the firm and those that were external to the firm. Accordingly, the report identifies the major barriers to cleaner production as follows:

Internal barriers:

- A lack of information and expertise
- A low awareness of environmental issues
- Competing business priorities, in particular, the pressure for short term profits
- Bounded rationality in decision making processes
- Financial obstacles
- Lack of communication in firms
- Middle management inertia
- Labour force obstacles
- Difficulty in implementing cleaner technology

External barriers:

- The failure of existing regulatory approaches
- Difficulty in accessing cleaner technology
- Difficulty in accessing external finance
- Perverse economic incentives
- An absence of markets for recycled goods
- Economic cycles

The potential motivators and drivers for the adoption of cleaner production by industry are many and varied. They too can be categorised as either internal or external. Key motivators and drivers identified in the report are:
Internal motivators and drivers:

- Environmental management systems and continuous improvement
- Voluntary initiatives
- Environmental leadership
- Corporate environmental reports
- Environmental accounting
- Improvements in productivity

External motivators and drivers:

- Innovative regulation and pollution prevention
- Negotiated self-regulation
- Economic incentives
- Codes of practice
- Education and training
- Industry networking
- Buyer supplier relations
- Financial institutions
- Community perceptions and involvement
- Environmental auditors
- Green consumers
- International trade incentives

The report highlights, on the basis of industry consultations and literature reviews, the most important barriers, motivators and drivers of cleaner production common to all industry. Primary barriers identified were: a lack of information and expertise, particularly among smaller firms; a resistance to cultural change on the part of management; competing business priorities, especially the pressure for short term profits; and the high cost of new, cleaner technology.

Primary motivators and drivers identified were: government regulation; the ability to share information through networking and business partnerships, and access to external expertise, particularly for smaller firms; the desire to maintain good community relations, particularly for larger firms; the convergence of more efficient production processes with sophisticated cleaner production processes, such as environmental management systems; and access to financial incentives for investment in new, cleaner technology.

Recognising the substantial differences that exist between firms and sectors, the report also provides a more detailed analysis and informal ranking of barriers, motivators and drivers in six industry sectors. The six sectors are: pulp and paper; electrical and electronic engineering; chemicals; metal finishing; metal manufacturing; and automotive.

A substantive part of the report is devoted to providing a sophisticated and comprehensive set of policy recommendation to encourage the widespread adoption of cleaner production by industry. These recommendation are specifically designed to remove the barriers, and harness the motivators and drivers, identified in the earlier sections of the report.
In particular, the recommendations aim to cast government in the role of facilitator or catalyst, rather than relying on overtly interventionist policies. This can be achieved by the government developing strategic partnerships with industry, and by harnessing the power of commercial and non-commercial third parties. There remains, however, a role for government as environmental regulator, if only to step in when other measures fail. In this regard, the report makes a number of recommendations for the transformation of regulation from rigid and inflexible forms to those which are much more innovative and provide ongoing incentives for cleaner production.

The recommendations have been grouped under the following policy clusters: (i) the role of information strategies; (ii) changing corporate culture; (iii) the role of economic instruments; (iv) the role of third parties; (v) the role of industry; and (vi) the role of regulation.

Finally, the report identifies additional measures that might be used to address the particular requirements of smaller firms, and as requested, advances a sector-specific cleaner production strategy.
Introduction

As we approach the new millennium, the pressure of human growth and development on the integrity of ecological systems continues to grow. So does the pressure on industry, as a major contributor to environment degradation, to improve its environmental performance. Yet despite substantial improvements in minimising the impact of industrial processes on a per unit basis, most of these gains have been, or will be, undermined by: (i) increases in absolute levels of production; and (ii) the rapid growth of new markets in previously underdeveloped regions of the world.

At the same time, industry throughout the world is being exposed to the winds of international competition. Increasing globalisation has seen traditional trade barriers fall and the spectacular rise of newly industrialised economies. The imperative for firms to reduce costs and improve productivity merely to maintain their competitive position is therefore unlikely to ease in the foreseeable future.

These twin developments create an obvious potential for conflicting priorities. To the extent that further improvements in environmental performance are viewed as a cost imposition by firms, there will be a natural reluctance to engage in such activities beyond the minimum standard required by law - a firm's primary fiduciary duty is to maximise profits for its shareholders.

The essential challenge that industry faces is: how to reduce levels of pollution, waste generation and resource consumption to that required for long term environmental sustainability, while at the same time minimising reductions in competitiveness and profitability. Cleaner production aims to deliver just such an outcome by fundamentally changing the way in which firms address environmental performance. It asserts that there is significant opportunity for firms to benefit from environmental improvements, including benefits beyond a narrow financial focus, in such a way as to reconcile otherwise competing goals.

What is cleaner production?

By cleaner production we refer to "the continuous application of an integrated preventative environmental strategy applied to processes, products, and services to increase eco-efficiency and reduce risks for humans and the environment" (United Nations Environment Programme). The concept of cleaner production is closely related to that of "eco-efficiency", a phrase coined by the World Business Council for Sustainable Development, and defined as "the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity
throughout the life cycle, to a level at least in line with the earth's estimated carrying capacity”.

What is significant in both these concepts, is the priority they place on the coincidence between private profit and the public interest. Put another way, both assert that by adopting cleaner production processes, firms can and will be able to meet the twin objectives of environmental excellence and international competitiveness. It is this emphasis on beneficial outcomes for industry that distinguishes cleaner production from other approaches to environmental improvement.

In describing cleaner production, it is illustrative to compare it with conventional "end-of-pipe" environmental solutions. End-of-pipe refers to changes in the industrial process just before a pollutant would have entered the environment. For example, a filtration device on the end of a smoke stack may be added to remove polluting particulates. End-of-pipe also includes such activities as water treatment plants and waste facilities. Pollutants and wastes may thus simply be collected, stored or disposed of elsewhere. End-of-pipe is essentially a technological response to environmental pollution, requiring little change in management direction or the actual manufacturing process. To date, end-of-pipe has been the predominant industry response to environmental improvement.

In contrast, cleaner production refers to a management process that seeks out and eliminates the causes of pollution, waste generation and resource consumption at their source. As such it entails materials input reduction or substitution, pollution prevention, internal recycling and more efficient production technology and processes. In essence, cleaner production requires a profound shift in management culture, from the board room to the shop floor, away from ad-hoc reactive solutions towards an integrated approach where environmental considerations form a central component of the decision making process. Cleaner production emphasises a systems based approach to environmental management in addition to the purchase of new technologies. In summary, whereas end-of-pipe is curative, cleaner production is preventative.

Environmental benefits of cleaner production include:

- the avoidance or reduction of the amount of waste produced;
- a reduction in the use and production of toxic materials;
- a more efficient use of energy and resources;
- the prevention of pollution at its source; and
• the production of environmentally sound products and services.

**How can cleaner production improve competitiveness?**

According to a peak industry association in Europe\(^1\), competitiveness can be defined as follows: "the competitiveness of a firm is its ability on a sustainable basis to satisfy the needs of customers more effectively than its competitors by supplying goods and services more efficiently in terms of price and non-price factors". They go on to divide competitiveness into three sub-categories: (i) innovation - the ability of a firm to develop new products and services, and to exploit them effectively; (ii) operating efficiency - the ability produce goods and services at world class levels of cost, quality and flexibility simultaneously; and (iii) adaptability - the ability to adapt to and exploit major and unexpected changes in the competitive environment.

Cleaner production has substantial overlap with recent business management theories, such as total quality management (TQM) and continuous improvement, which are specifically designed to address these sub-categories of competitiveness. Common to both cleaner production and business management theories is a shift away from a management structure based on a bureaucratic division of labour with static goals, towards a management process where all levels of a firm participate in the pursuit of dynamic goals. As such, there is an emphasis on systematically assessing all aspects of a firm's activities to identify any opportunities for improvement in competitiveness or environmental performance.

It does not require a leap in logic to suggest that, as the consumption of resources and the production of waste are at the heart of manufacturing processes, any innovations, efficiencies and adaptations that can be generated through cleaner production may also benefit the firm's competitive position. In many advanced economies, therefore, cleaner production is gaining recognition as an essential component of modern industrial practice. Competitiveness benefits that may accrue to industry include:

• improvements in productivity

• savings on energy and raw materials;

• decreased storage requirements for waste and toxic materials;

• decreased liability;

• savings on pollution control expenditure;

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\(^1\) Union of Industrial and Employers' Confederation of Europe
• a more motivated workforce;

• a focus on continuous improvement;

• better health and safety provisions; and

• an improved public profile.

The limits of "win-win"

A number of prominent commentators, notably Vice President Al Gore and Michael Porter, of the Harvard Business School, have promoted the concept of "win-win" outcomes whereby environmental improvements occur in tandem with greater industrial productivity. However, this view is by no means uncontested. The counter argument is that such notions of win-win, while being highly seductive, are ultimately over-simplistic and misleading. It is suggested by critics of win-win that the extent to which firms are able to demonstrate savings through environmental improvement, that this is largely a reflection of previously neglected minor improvements - in essence, the "low hanging fruit" argument. The implication is that, in the longer term, continuing environmental improvement will cost, and cost a lot.

So where does this leave cleaner production? Without wishing to enter the debate in detail, this report recognises that the opportunities for short to medium term pay-offs from cleaner production investments will vary across firms, industrial sectors and environmental issues. However, what cleaner production can offer is a more cost-effective means of achieving environmental improvements, even though these may not automatically result in savings to firms, whatever their precise individual circumstances. It is also important to recognise that cleaner production can generate benefits beyond those characterised by a narrow, financial definition of win-win.

Barriers and motivators to cleaner production

Not surprisingly, given the substantial modification to management culture entailed, there may be significant internal barriers to the adoption of cleaner production processes and practices within firms. In addition, there may also be external barriers which are largely outside of the firm's capacity to change. This report seeks to identify the major internal and external barriers to the adoption of cleaner production, and their relative influence on firm behaviour.

Apart from the potential barriers to cleaner production, there are also considerable untapped opportunities for its use. A key task of the report is to identify the major motivators and drivers of cleaner production, and the ways in which these can be harnessed to overcome
barriers. An important consideration will be the extent to which sector specific approaches, and/or measures targeting small and medium sized enterprises, are necessary.

The ultimate goal of the report is a set of recommendations, which, if implemented, will provide considerable benefits both to individual firms and the economy at large in terms of increased profits and cost savings, while at the same time making an equally valuable contribution to reducing environmental pollution and attaining sustainable development.
Objective, scope and methodology

The objective of this report is set out in the Request for Tender document provided by Environment Australia on 28 April 1997.

The project objective is defined as:

"This project will identify both the barriers to the adoption of cleaner production by industry, and the motivators and drivers for the adoption of cleaner production by industry, including the role of regulatory systems, the market, industry guidelines, information and award schemes, and other incentive schemes."

Major tasks identified in the Request for Tender document are:

- review the available domestic and international literature;
- consult with industry and key government departments and agencies;
- assess the importance of barriers and motivators;
- examine the role of regulatory systems; and
- provide recommendations for overcoming barriers and maximising any untapped potential identified for the motivators.

The Request for Tender document explicitly excludes the examination of specific cleaner production programs, except to the extent that they impact on other motivators.

In preparing the report, the authors have comprehensively reviewed the domestic and international literature, and drawn on their in-house expertise. In addition, over 20 industry representatives, and other relevant stakeholders, have been consulted. These include:

- the West Australian Chamber of Commerce and Industry;
- the Australian Electrical and Electronic Manufacturers Association;
- the Environmental Management Industry Association of Australia;
- the Business Council of Australia;
- RTZ-CRA;
• the Australian Chamber of Manufactures;

• the Australian Paint Manufacturers' Federation;

• the Pulp and Paper Manufacturers Association;

• the Plastics and Chemicals Industries Association;

• the Metal Trades Industry Association;

• the National Farmers Federation;

• the Environment Industry Development Network; and

• the Monash Centre for Environmental Management.
Internal barriers

There are wide variety of potential internal barriers to the adoption of cleaner production. Key internal barriers include:

**A lack of information and expertise**

A major hurdle to the widespread adoption of cleaner production is the inaccessibility of appropriate information and expertise. In the economist's language, there are positive transaction costs associated with the attainment of information. Despite the considerable potential of cleaner production to improve a firm's competitiveness, in many instances they are incapable of exploiting such opportunities because of ignorance. Firms may lack information about specific clean technologies, thus contributing to risk and uncertainty regarding the adoption of the technology. Even to the extent that they are aware of these opportunities, a lack of appropriate skills and expertise prevents firms from acting upon them. This may be compounded by irregular decision making - firms may not review cleaner production issues on a regular enough basis to benefit from the available information.

Small and medium sized enterprises (SMEs), in particular, suffer from a lack of resources and expertise to devote to implementing best environmental practice. Commonly, SMEs also have difficulty in understanding the concept and terminology associated with the notion of cleaner production. Managing large volumes of information on environmental policy and business strategy is a major problem even for large firms, and many SMEs are likely to suffer from "information overload" and need good independence guidance services.

**A low awareness of environmental issues**

Related to the issue of difficulty in accessing information, some firms may also have conceptual obstacles to pollution prevention and cleaner production. Unfortunately, as one industry representative stated, "managing environmental affairs is [often] seen as insurance - insurance against an expensive and public disaster, and insurance against prosecution of officer and directors. Therefore these efforts have a negative reward feedback - they are successful if nothing happens. The challenge we face is turning the around to achieve a positive feedback for change."

Conceptual obstacles to cleaner production may include:

(i) underrating the environment in firm policy;

(ii) a narrow view of the relationship between firm policy and the environment, resulting in confusion about the definition of prevention;
(iii) the idea that protecting the environment costly;

(iv) having a high resistance to change;

(v) viewing legal established standards as the only goal and guideline; and

(vi) the view that the production process is a black box, that is, that inputs to the process can be altered in an attempt to control outputs without an attempt to understand the internal workings of the process - such firms are sceptical of the need to internalise environmental awareness in all parts of the organisation.

For example, a recent survey found significant conceptual difficulties with cleaner production among many SMEs (see Box 1).

**Box 1**

**Conceptual difficulties with cleaner production - the case of SMEs**

A recent industry survey noted that few SMEs were comfortable with the terms "cleaner production" and "cleaner technologies". There were objections to these terms on the basis that they were too vague, subjective and relative. A number of respondents suggested that explicit references to the environment or sustainability were likely to be off-putting to many firms, especially SMEs, that associated "environment" with technical complexity, burdens and costs, rather than with opportunities and savings. There is an argument, therefore, that cleaner production terminology should accentuate the benefits to core business activity, and resultant cost-savings and improvements in productivity.


**Accounting systems which fail to capture environmental costs and benefits**

Financial accounting drives many decisions, particular in the private and corporatised public sectors. Once measured, costs and liabilities are made transparent to decision makers, planners and controllers within an organisation. To achieve cleaner production it is essential that the polluter pays principle and the precautionary principle are integrated into all aspects of an organisation's activities. However, most financial accounting systems fail to factor in environmental costs and liabilities, and decision makers within the firm are consequently much less likely to integrate environmental considerations with wider business management issues.
In particular, mainstream accounting systems and project appraisal procedures fail to take adequate account of environmental impacts, risks, liabilities and associated costs, which are not easily quantifiable, and of the longer-term intangible benefits and avoided costs (e.g., costs of non-compliance) that flow from cleaner production. Similarly, payback calculations and discounting procedures can fail to take account of the full range of costs and benefits associated with a project proposal. Costs of inaction tend not to be built into assessment. Failure to build "soft" factors accurately into accounting and financial appraisal systems means that cleaner production strategies labour under the burden of "obscured profitability", and are slow to be adopted throughout industry.

In most firms, there is a large gap between the theory of economics and the practice of accounting. Many economic theories assume that firms behave in a purely rational manner according to, for example, net present values and discounted cash flows. According to these theories, if cleaner production makes good economic sense, firms will automatically adopt it. However, even assuming that firms had all the necessary information, the accounting practices used in decision making processes rarely correspond to economic theory. For most business accountants, a priority is to maintain a firm's liquidity in order for it to cope with unexpected pressures and avoid bankruptcy. Projected investment returns on cleaner technology mean little if a firm is unable to maintain its short-term cash flows.

**Competing business priorities, in particular, the pressure for short term profits**

A significant impediment to improved environmental performance through the adoption of cleaner production processes is the emphasis of firms on short-term profitability. This is the conclusion of both senior managers and environment managers themselves. A survey conducted in 1991 by Tufts University's Centre for Environmental Management revealed that 53 per cent of Chief Executive Officers cited an emphasis on short-term profitability as the most important factor preventing their firm from improving its environmental performance. Common indicators of business health, such as price earning ratios and dividend yields exacerbate short term pressures. Because corporations are judged by markets, investors and others principally on short-term performance, they have difficulty justifying investment in cleaner production processes and technologies, even when there are demonstrably attractive long term financial returns.

For instance, one industry representative commented that "many managers would be reluctant to spend money on improving environmental performance, unless such investment
also produced an immediate or early economic return. The emphasis on short term profits in Australia exacerbates this tendency”.

The tendency for firm and divisional management to sacrifice longer term economic wealth for an increase in reported short term profits is a fundamental flaw in many management practices which may inhibit the adoption of cleaner production. In particular, it encourages reducing tangible and intangible investments which may undermine future competitiveness. Management procedures which aim to quantify and take account of market prices for longer term investments such as research and development, employee training, flexible manufacturing processes, high quality suppliers, and customer loyalty, will greatly benefit the cause of cleaner production.

It is clear that those firms which are economically marginal often cannot afford the luxury of a long-term view to cleaner production. For them, the likelihood of ignoring potentially attractive cleaner production technologies in order to achieve short-term profit is very high indeed. Ironically, such firms may also be the most heavily reliant on old, inefficient plant and technology and management processes and, as a result, have the most to gain from cleaner production practices. Governments may inadvertently prolong the life of economically marginal firms by the use of inappropriate subsidies.

**Bounded rationality in decision making processes**

Even if we assume that all decision makers within a firm have access to perfect information, in reality, they may be unable to process all the information they have. This is referred to as bounded rationality. Managers are not "perfect mathematicians" with unlimited information processing capabilities. Inevitably, because of time and concentration constraints, they can only juggle a limited number of balls at any one time. In many cases, these "balls" will be issues other than cleaner production. As one industry representative stated "many companies are so busy doing business and focussing on down sizing that the infrastructure is lacking to investigate cleaner production".

Closely related to the concept of bounded rationality, are the management theories of "stakeholders" and "satisfying". In essence, these theories propose that management has to satisfy a number of key stakeholders, and only once this has been achieved can they engage in managerial discretion. For example, management must satisfy the needs of shareholders and employees before they can contemplate other discretionary issues such as cleaner production.

**Financial obstacles**
Despite the potential for cleaner production to generate substantial cost-savings, pollution prevention in firms may be inhibited by several real or perceived internal financial obstacles (see Box 2). Risk and uncertainty in the performance of certain technologies and management practices may result in a reluctance by firms to invest in cleaner production. This may be exacerbated by internal vested interests in maintaining the status quo, low government charges for the disposal of waste streams, incompatible internal investment policies, or an incomplete calculation and allocation of environmental costs.

Box 2

**Real or perceived internal financial constraints to cleaner production**

Potential financial constraints include:

1. non-comprehensive cost evaluations and cost-benefit analysis methods;

2. a lack of understanding and difficulty in predicting future liability costs (e.g., waste disposal);

3. short-term profit calculations resulting in low tolerance for longer payback periods of equipment investment;

4. alleged drawbacks in competitiveness due to the "free-riding" behaviour of other firms;

5. a lack of capital investment flexibility due to low profit margin;

6. economies of scale preventing smaller firms from investing in waste reduction options (e.g., in-plant recovery technologies);

7. possibilities that investment in process modification can be inefficient for old firms;

8. firm financially (and even technically) tied up due to other d-of-pipe investments; and

9. actual cost of current technologies masked in operating costs.

Lack of communication in firms

A lack of communication in firms, or as one industry represented referred to it, "the silo mentality", for example, between engineers and accountants, can be a significant handicap to decision making processes which aim to integrate cleaner production considerations. As one industry representative pointed out, the "issue that breaks the whole [cleaner production] program down is lack of a good communication strategy ... within companies". Management that is less than fully aware of the potential benefits available through cleaner production because of communication barriers is unlikely to be enthusiastic in its implementation. Beyond potential difficulties in communication, professional groups within a firm may form themselves into rival political factions, with significant activity being directed at maintaining and improving their respective power bases rather than being directed at a coherent cleaner production strategy.

Difficulties with communication relevant to cleaner production within firms may in part be overcome by:

- reducing the isolation of environmental affairs managers and their teams;
- balancing top-down communication of policy directives with bottom-up approaches;
- fostering a sense of responsibility for a cleaner environment and public health amongst the workforce; and
- removing organisational obstacles, such as bureaucratic and rigid structures, which make it difficult to introduce new ideas.

Middle management inertia

In larger firms, in particular, excessively bureaucratic layers of middle management may frustrate attempts to introduce a cleaner production culture, even when there is a strong commitment from upper management. Middle managers are in many cases resistant to change they perceive as a potential threat to their power and status within an organisation, or they may simply be reluctant to part with familiar work practices. Middle managers are also notoriously risk averse and tend to view developments in the context of their own job security. In this regard they are unlikely to be enthusiastic supporters of cleaner production if it is perceived as disruptive to the status quo. One industry representative suggested that it was important to "give specific performance indicators for middle management to meet environmental objectives".
Labour force obstacles

In addition to middle management inertia, the several aspects of a firm’s wider labour force may present obstacles to cleaner production. Problems may occur where there is:

- a lack of personnel in charge of management, control, and implementation waste reduction technology;
- a reluctance to employ trained engineers for the alleged time-consuming design of waste reduction technologies;
- an inability to manage an additional program within the firm;
- increased management requirements with the implementation of waste reduction technologies;
- a reluctance to engage in restructuring necessary for cleaner production which involves substantial job turnover, in senior management as well as in line functions; and
- a resistance on the part of engineers who have acquired the skills and professional techniques to manage and expand the existing systems to acquire the new knowledge and skills that new technology often demands.

Difficulty in implementing cleaner technology

The OECD (1995b) has identified structural factors, such as the need to amortise equipment already installed, as major impediments to the implementation of cleaner technology. Firms may have substantial investments in existing technologies, with associated investments in the staff whose skill and expertise is necessary to operate them. Firms may be reluctant to engage in activities that retire expensive equipment before the end of its useful life. Changes in systems and technology may also make certain employees obsolete, and therefore induce organisational structural protection of the existing system.

Opportunities for cleaner technologies also vary between industry sectors. In those sectors where technology does not change rapidly, for example mature industry sectors (see Box 3), and where it is hardest to justify investing the capital in new plant and equipment, there will be less opportunity for firms to modify their production processes to implement cleaner production. A number of industry representatives pointed to the vintage of much industrial technology in Australia. For example, in reference to one industry sector, it was stated that "a good proportion of the technology used in Australia is relatively old, and is therefore less
be technological limits to what can be achieved [with old technology] in comparison to state of the art equipment”.

It is also usually far more expensive to retrofit an out-of-date factory with advanced cleaner production technology than it is to incorporate state-of-the-art environmental technology into a new plant. In contrast, in circumstances where firms have substantially higher profit margins and a rapidly changing technology base, they will be in a far better position to adopt cleaner production.

Box 3

Mature industry sectors - the case of pulp and paper.

Technological innovation in the pulp and paper sector, which is an industry with mature product lines, is likely to be incremental. Consequently, the opportunities for large improvements in cleaner production will be diminished. In the absence of other external motivators, such as government regulation and community pressure, industry is less likely to adopt rapid advances in environmental performance. For example, in the United States, most pulp and paper firms have reduced dioxin releases by replacing chlorine bleaching with chlorine dioxide bleaching, which is an incremental innovation. However, a few firms have chosen to develop ozone bleaching technologies, which is a radical innovation. Interestingly, the former firms were responded to strict regulatory standards. In contrast, the latter firms were responding to clean water regulations in the 1980s, combined with water resource constraints, and perceived an opportunity to position themselves for future tighter regulations and "green" consumers. This suggests that, while standards are an important tool for environmental protection, they are most likely to be effective in promoting incremental innovation and diffusion. Additional approaches will be needed, particularly in mature industries, to move firms towards technological innovation that sets them on long term trajectories that are environmentally viable.

External barriers

In addition to the internal barriers identified, there are a number of external barriers to cleaner production over which firms have little or no direct control. Key external barriers include:

*The failure of existing regulatory approaches*

Conventional regulatory approaches have in many cases proved to be counterproductive to the uptake of cleaner production. Overly prescriptive regulatory standards may restrict flexibility and stifle innovation. By assuming that regulators are in the best position to determine appropriate action, regulation may engender an attitude of complacency on the part of firm management - there is no need for them to take responsibility for integrated environmental management planning whilst regulators remain as the standard setters. Conventional regulation also fails to accommodate the significant variation between different industrial sectors and firms sizes, both in the nature of their environmental problems, and their capacity to develop and implement solutions. New entrants, which may bring more sophisticated cleaner production processes and technologies, may be discouraged from entering the market by lengthy regulatory and legal approval proceedings.

Even performance based regulation, whilst allowing firms greater flexibility in how they achieve their regulatory commitments, may inadvertently restrict the adoption of cleaner production processes. By providing mandatory minimum performance standards, which necessarily must be applied to a wide range of business circumstances and capacities, there is little incentive for firms to substantially exceed these minimum requirements through, *inter alia*, innovative cleaner production solutions. In short, performance based regulation encourages a "lowest common denominator" approach to cleaner production.

Further drawbacks of conventional regulation include:

- uncertainty about regulatory framework in areas offering scope for cleaner production investment;
- uneven and inconsistent enforcement, which gives rise to an inequitable treatment of firms with the same environmental impacts;
- a complex and costly inspection system;
- regulators not promoting cleaner production;
- inducing a culture of "regulatory resistance" amongst industry;
• an unequal regulatory burden between firms which produce large volumes of emissions and can afford to pay for clean-up and firms with small volumes and limited resources; and

• little encouragement for innovation designed to prevent pollution at its source - at best, it forces the pace of innovation only in clean-up technology and at worst it may encourage minimal compliance with little or no innovative effort by firms.

An example of the counterproductive, and largely unintended, consequences of conventional regulation is *Industrial Chemicals (Notification and Assessment) Act (Cth) 1989* (see Box 4 below).

**Box 4**

**The National Industrial Chemicals Notification and Assessment Scheme (NICNAS)**

NICNAS began operation in July 1990 when the relevant Act came into effect, and is administered by Worksafe Australia. The general objective of the scheme is to help the protection of employees, the community and the environment from the harmful effects of industrial chemicals. The Act requires notification and assessment of new industrial chemicals before their introduction by import or local manufacture. Chemicals in use before July 1990 may be declared as priority existing chemicals and assessed.

Although NICNAS was designed to regulate the commercialisation of potentially hazardous materials, in doing so, according to chemical industry representatives, it inadvertently stifles innovation and unfairly prevents firms from introducing potentially useful new products that may result in cleaner production improvements. There is an inherent bias in the operation of NICNAS towards chemicals that have been in use by industry prior to its introduction. Regulatory officials originally did not want to unduly disrupt commerce by outlawing chemicals that industries and the workforce were dependent on. This has resulted in a very substantial anti-new-product bias in the system. For example, an existing chemical like asbestos is very difficult to regulate. Yet a new chemical can be restricted even though it poses no greater risk, and in many cases may pose a far lower risk, than existing chemicals in the same class or application. The impact of these restrictions is a major source of disagreement between regulatory officials and the chemical industry, and has potentially prevented the application of new chemicals far less damaging to the environment than existing chemicals.

Source: Industry consultations and Triplott, T (1996) "Does TSCA Stifle Innovation" in (1) *Industrial, Paint*
**Difficulty in accessing cleaner technology**

Investment in new, cleaner technology is a major decision for firms to undertake. In addition to the substantial costs of new technology, there are several potential external barriers which may discourage or prevent firms from updating their existing plant and equipment. SMEs, in particular, are susceptible to a range of complexities that serve to undermine their ability to access new technologies, even when they may benefit financially from them. These can be summarised as:

- the complexity of new technology;
- the level of technological specificity (industry case studies made by the OECD (1995b) show that new clean technologies may be hard to transfer from one user to another);
- the performance capability of technology under certain economic requirements and process design standards;
- the lack of (some) alternative substances to substitute for the hazardous components and proven cleaner technologies;
- unproven technologies;
- poor service from suppliers;
- a lack of integrated systems from suppliers (ie complete solutions for process or product changes as opposed to provision only of technology or of consultancy service);
- problems of obtaining realistically priced solutions for problems that could not be overcome through "low-tech" cleaner production measures;
- the high cost of cleaner production solutions compared to end-of pipe technologies; and
- cleaner technologies which have relatively higher prices and lower quality because of low-scale production and inferior materials (inferior from a non-ecological point of view).

In contrast, end-of-pipe technological equipment has attractions as it is tried and tested, and easily fitted and readily available from suppliers. The risks are fewer. If the device does not work the firm can continue to produce, installing add-on technology can be a neat public statement of the firm’s commitment to the environment, and may be easier for people to appreciate the adoption of new technology.
Discontinuities in technology may be another external barrier to cleaner production. This occurs when technology is "bundled" into complex systems - one component of a system cannot be replaced or upgraded without necessitating changes to the whole system. This bundling of technology makes it difficult for firms to upgrade discrete components of the manufacturing process to achieve cleaner production. This is because bundled technology requires excessively expensive "lumpy" investments, only some of which may be relevant to the desired environmental improvement. In contrast, unbundled technology spreads the cost of incorporating clean technology: firms are able to improve their operations in manageable steps.

**Difficulty in accessing external finance**

The implementation of cleaner production processes and technologies has been hindered by a lack of access to finance. SMEs in particular are frequently unable to make investments in cleaner technologies for a wide variety of financial reasons including a lack of available external capital and the absence of appropriate funding mechanisms.

**Perverse economic incentives**

Economic subsidies for business resource inputs may be a significant disincentive to cleaner production. For example, the price of energy has an important influence on energy conservation. Relatively high unit prices for energy stimulate efficiency for existing technologies as well as efforts to develop and use cleaner energy efficient technologies. To the extent that governments reduce the price of energy, or the prices of relatively polluting fuels, through subsidies, they will inhibit the financial benefits of cleaner production. Perverse economic incentives may apply to a range of business inputs and subsequently filter through the myriad of firm management decisions.

**An absence of markets for recycled goods**

Many firms are discouraged from recycling their waste products externally because of a lack of suitable markets. Ultimately, for recycling and re-use to be sustainable in the longer term, markets must be demand driven, not supply driven. Although, strictly speaking, cleaner production refers to the prevention of waste rather than its recycling or re-use, such activities can form an important component of an overall environmental management strategy. In this respect, the development of sophisticated recycling markets for waste material is an essential pre-requisite.

One industry representative referred to the need for government policy to move from "needs push" to "opportunitypull." For example, it was pointed out that the trade portfolio in
Washington State of the United States had established "diversified secondary manufacturing markets for recovered resources which made economic sense to the manufacturers and markets". It was claimed that this program was successful because it exploited market pull, rather than "the traditional environment portfolio driven supply push".

**Economic cycles**

Prevailing economic cycles will have a major impact on the capacity of firms to engage in cleaner production processes, and in particular, to purchase clean technologies. For example, during periods of recession, Australian firms tend to limit expenditure on new plant and equipment. Domestic economic cycles will be influenced by global trends, with the potential, for example, for a global recession to exacerbate a domestic recession.
Internal motivators and drivers

The potential motivators and drivers for the adoption of cleaner production by industry are many and varied, including, as the terms of reference correctly highlight, regulatory systems, market forces, industry guidelines, information and award schemes, and other incentive schemes. Key internal motivators and drivers of cleaner production include:

**Environmental management systems and continuous improvement**

Environmental management systems (such as ISO 14000 and BS 7750) have the potential to play a crucial role in the adoption of a "cleaner production mindset" within business management structures. Fundamentally, environmental management systems require a reorientation of firm priorities from a static model of discrete environmental solutions to a dynamic one where cleaner production is integrated into a firm's core continuous improvement activities. The benefits of this approach are twofold: first, firms are much more likely to identify cleaner production processes that deliver productivity improvements, thereby enhancing the firm's competitive position; and, second, environmental management systems entail a structured ongoing improvement in environmental performance through cleaner production processes that cannot be delivered through conventional outcome focussed or technology specific regulation.

One industry representative suggested that environmental management systems, such as ISO 14000, may not in fact be intrinsic drivers of cleaner production: "there are other environmental management structures that are just as effective therefore it is a structure and not necessarily a driver". As a result, environmental management systems may require another motivator or driver to pre-date them.

Firms need to be encouraged to not just think about the impact of individual pollutants, but also about the effects of the whole production process. An integrated approach to pollution prevention and control will be assisted by the manufacturing trend towards more flexible systems. The parallels between environmental management systems and other management approaches, in particular TQM, are identified in Box 5.

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<td>TQM and cleaner production</td>
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A number of industry representatives referred to the proliferation of management issues that are being directed at industry by government. For example, pollution prevention, just-in-time, quality systems, environmental managements systems, occupational health and safety management etc. A common view is the lack of any serious attempt to integrate these systems, resulting in firm resources be spread too thinly accross a number of issues. For instance, on industry representative stated that "irrespective of the benefits of the [cleaner production] programs, they get lost in the plethora of other competing programs/initiatives and relegated to the usual middle level managers to implement". The plethora of government iniatives can also generate cynicism with one industry representative lamenting the proliferation of "government "experts, usually running a specific agenda, telling them about the latest way to run a successful busines. Cleaner production is just one of these".

**Voluntary initiatives**

There is strong evidence that voluntary initiatives on the part of firms can engender substantial cleaner production improvements in both industrial and commercial enterprises. Benefits may flow to participating firms through financial savings, favourable public relations, and enhanced corporate morale. For example, the United States' Green Lights program (designed to exploit energy efficiency opportunities in the lighting requirements of commercial premises) has achieved sizeable reductions in energy consumption, and financial returns in the order of 20-40% have flowed to participating firms.

<table>
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<tr>
<th><strong>Formal system</strong></th>
<th>BS 5750 and ISO 9000</th>
<th>BS 7750 and ISO 14000</th>
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<tr>
<td><strong>Ideal goals</strong></td>
<td>Zero defects</td>
<td>Zero emissions</td>
</tr>
<tr>
<td><strong>Key principle</strong></td>
<td>Continuous improvement towards minimal defects.</td>
<td>Continuous improvement towards a closed loop</td>
</tr>
<tr>
<td><strong>Staff involved</strong></td>
<td>All levels and functions</td>
<td>All levels and functions</td>
</tr>
<tr>
<td><strong>External focus</strong></td>
<td>Supply chain</td>
<td>Value chain</td>
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Some programs have achieved even greater successes. The United States EPA’s 33/50 Program has successfully encouraged firms to voluntarily and substantially reduce their levels of toxic chemical releases even though this is estimated to have resulted in significant costs for participating firms. The United States, in particular, has policies which emphasise voluntary commitments, including the Environmental Leadership Program, Golden Carrots, and the Sustainable Industry Project. The Netherlands Government, through its PRISMA project, has also demonstrated the productivity rewards that business can derive through voluntary initiatives.

Apart from specific government programs, voluntary initiatives may be encouraged through industry peer pressure, for example, via the membership of industry associations, business networks, and through observation of competitors and benchmarking of performance against other firms. Claims of cleaner production performance by firms, particularly in high profile industries, may inspire greater efforts of environmentally orientated innovation among their competitors. Box 6 identifies the different types of voluntary cleaner production initiatives.

**Box 6**

**Key types of voluntary initiatives**

Voluntary schemes initiatives often work faster and with more flexibility than regulatory programs and so help to promote innovative technologies and cost-effective approaches to cutting pollution. Voluntary approaches also serve a very important function in building trust and credibility between the private sector, government and the public. The three broad categories of such program are:

- values, principles and practices emphasised through adherence to environmental principles (this includes industry initiatives such as the Business Charter for Sustainable Development and the Business Council of Australia's Principles of Environmental Management);

- goal setting and tracking for pollution reduction - for example the 33/50 Programme in the USA, the Rhine Research Project based in the Netherlands, and the Greenhouse Challenge in Australia; and

- self-initiated programs such as the Responsible Care program undertaken by the chemical industry.

*Environmental leadership*
Harnessing the power of environmental leadership can be a potent tool in the furtherance of cleaner production objectives. Environmental leadership refers to the management process within firms. Those firms in which senior management demonstrates a strong commitment to the principle and practice of cleaner production are likely to experience a "trickle down effect" whereby all layers of the firm experience a much greater corporate environmental commitment (see Box 7).

Box 7

**Implementing environmental leadership - organisational structure at IBM**

IBM provides a good example of how cleaner production may be integrated into core business activities and gain the support of senior management. At the world wide level, overall responsibility for environmental affairs within the IBM Corporation lies with the Corporate Environmental Advisory Council. This body is chaired by the IBM corporate vice president of environmental affairs. Within Europe, the Middle East and Africa, policy objectives and standards are set by the European Environmental Advisory Council, subject to consultation with corporate headquarters.

At the local level, for example IBM UK, executive responsibility has been assigned at Main Board level to the Director of Personnel at Corporate Affairs. To develop appropriate strategies to meet corporate environmental objectives, the "IBM UK Environment Council" has been established. It consists of representatives from all the major business functions including development, procurement, manufacturing, marketing, and property management. Senior management is therefore centrally involved in the implementation of environmental strategy.


Environmental leadership can have a positive impact on the employees, particularly where they can see improvements in the local environment which may results from their actions. A key element in environmental leadership, as a factor affecting decisions on environmental management and cleaner production, is the sense of accountability to local communities and also, increasingly important, to financial stakeholders (shareholders, banks and insurers). Good relations with local authorities are also seen as important, particularly given the need for planning permission for new plants or sites.

In an increasingly globalised market place, environmental leadership may be exerted over firms in a number of countries through a centralised head office cleaner production policy. Our industry representative referred to an Australian subsidiary of a multinational where it is
considered that "the best long term solution is simply to adopt a high international environmental standard and apply it to all its operations regardless of where they are located".

**Corporate environmental reports**

Corporate environmental reporting can be a useful way for firms to effectively disseminate information about their environmental performance activities, but more than that, it can be used as an internal diagnostic tool for cleaner production. The very act of compiling a corporate environmental report necessarily entails a degree of introspection that may reveal previously hidden opportunities for cleaner production. Corporate environmental reporting is still in its infancy, however, there are some potentially exciting developments which should have positive repercussions for cleaner production (see Box 8). These include the use of "eco-balance sheets", which measure all business inputs and all outputs, performance indicators, and the calculation of environmental efficiency per unit of production. If reports are to be a useful tool for assessing progress by firms towards cleaner production, they need to be based on comprehensive data quantifying actual environmental impacts of processes and products (and wider activities such as corporate transport use) and targets for reduction of impacts.

**Box 8**

**Corporate environmental reporting - the case of Western Mining**

In Australia, Western Mining has pioneered the use of corporate environmental reporting in the mining sector. Entitled a public Environmental Progress Report, key objectives included detailing its environmental performance in order to:

- ensure that employees at all sites and at all levels in the firm understood that top management recognised improvement in environmental performance as a key priority;

- ensure that all sites recognised that their own environmental performance reflected on the whole Western Mining group;

- establish a benchmark of Western Mining's existing environmental performance and to focus on some core improvement targets;

- make cost savings through the use of more efficient cleaner technology;

- demonstrate the firm's commitment to openness and to put on the public record its environmental challenges;
• enhance Western Mining’s reputation, and improve its relationship, with the investment community, governments (both national and international), environmental organisations, the community and its shareholders; and

• create a competitive advantage for Western Mining by showing a commitment to environmental performance and thus differentiating the firm from its competitors and enhancing its access to land for exploration and future development.

Key stages in the preparation of the report were:

1. A review of best practice in environmental performance throughout the world to establish a list of criteria for information which should be disclosed in the report.

2. The harmonisation and assessment of data from many sites over a five year period which was gathered under topics which would best describe the firm's impact on the environment: atmospheric emissions and losses from tailings retention systems; spillages and breaches of operating licences; use of energy and water; and land disturbance and rehabilitation. Advisers and environmental organisations were consulted to ensure that Western Mining covered the areas of their greatest interest.

3. A review of the results of the firm's internal audits and programmes of research and sponsorship in environmental areas.

4. Written and face-to-face feedback sessions with customers, environmental organisations, government officials and staff at all levels.


Environmental accounting

Various forms of environmental accounting\(^2\) (including full cost accounting) attempt to temper the dominance of narrow financial accounting systems. These recognise appropriate environmental valuations and balancing financial accounting systems with physical and other forms of information in management processes. There is considerable potential for

\(^2\) Environmental accounting in this context refers to accounting measures introduced at the level of the firm, not the calculation of national accounts.
environmental accounting to make a substantial contribution to both business success and sustainable development. For purposes of clarity, environmental accounting can been broken down into six domains (see Box 9).

### Box 9

**The six domains of environmental accounting**

1. Energy and material accounting: the tracking and analysis of all flows of energy and substances into, through and out of an organisation.

2. Environmental-related financial management: the generation, analysis and use of monetised information in order to improve corporate environmental and economic performance.

3. Lifecycle assessment: a holistic approach to identifying the environmental consequences of a product or service through its entire lifecycle and identifying opportunities for achieving environmental improvements.

4. Lifecycle cost assessment: a systematic process for evaluating the lifecycle costs of a product or service by identifying environmental consequences and assigning measures of monetary value to those consequences.

5. Environmental impact assessment: a systematic process for identifying all the environmental consequences of an organisation, site or project's activities.

6. Environmental externalities costing: the generation, analysis and use of monetised estimates of environmental damage (and benefits) created by an organisation, site or project's activities.


There is now substantial evidence (including an extensive series of case studies by the World Resources Institute) to demonstrate that a better accounting for environmental costs leads to better business decisions (Ditz et al 1995). For example, managers at Heakth Tecna, a composite materials manufacturer, found that by changing their production processes they made materials use more efficient, reduced hazardous waste generation, and reduced costs. At Cascade Cabinet, a decision to switch from hazardous nitrocellulose lacquer to a more benign varnish, cut manufacturing costs significantly. A better understanding of environmental costs can also affect pricing decisions. When Dow Chemical faced a stark
choice between shutting down a product line or investing in clean technology, its industrial customers accepted slightly higher prices in return for a guaranteed supply of the product.

Not all industry representatives have a positive view of internally generated environmentally accounting systems, however, with one describing "green accounting" as "an irrelevant term" and that "where costs are being externalised to the extent that damage is occurring to human health or the environment, it is up to the regulatory authorities to specify environmental standards which protect against that harm and transfer the costs of meeting those standards to those who are, or in future could be, causing the harm".

**Improvements in productivity**

A potentially powerful motivator for the adoption of cleaner production is improvements in productivity. Because of the substantial overlaps between good management generally and cleaner production in particular, firms have the opportunity to realise significant cost savings. As Michael Porter, at the Harvard Business School points out, cleaner production "is a processes that not only pollutes less but lower costs or improves quality" (1991).

Depending in part on length of time the technologies and associated management systems had been in use, firms may achieve cost savings: through better energy and waste management; decreased demand for raw materials; reduced storage requirements for waste and toxic materials; and less pollution control expenditure.

Productivity gains from cleaner production is not just a theory - there are numerous examples which demonstrate the financial benefits that can accrue to individual firms. For example, the United Nations Environment Programme has published a compilation of case studies in different countries and industrial sectors. The examples shown in this report demonstrate a rapid pay-back period, in the order of six months to two years. This compares favourably with other investments. In Australia, the Commonwealth’s Cleaner Production initiative has also produced a number of case studies where firms have improved their productivity and reduced costs (EPA 1996). Perhaps the most detailed evidence to date of the potential for cleaner production to improve productivity, however, comes from the Netherlands (see Box 10).

**Box 10**

**Cleaner production profits**

Evidence that prevention rather cure need not be more expensive came from the Netherlands where one of the most comprehensive investigations of cleaner production was carried out between 1988 and 1990 under the name "PRISMA". Key findings of the PRISMA project were:
• over 80% of the cleaner production measures identified were worthy of consideration;

• almost 50% were implemented immediately, or considered feasible; and

• almost 70% of the cleaner production measures implemented immediately had a pay-back of less than one year, 40% of them costing nothing at all.

External motivators and drivers

In addition to the potential internal motivators and drivers of cleaner production, there are a range of external measures that may be employed by governments and other interested third parties. Key external motivators and drivers include:

**Innovative regulation and pollution prevention**

Recognising the substantial failure of conventional command and control regulation to foster a culture of cleaner production within firms, a number of innovative approaches have been developed in recent years. A key turning-point in this regard was President Clinton's initiative "Reinventing Environmental Regulation" which emphasised the need for regulation to effectively harness the capacity of business to develop creative, innovative and cost-effective solutions to environmental problems (Clinton & Gore 1995).

A key feature of innovative government regulation is a shift from single pollutant and single media approaches to "integrated pollution control". This requires regulators and industry to take account of all the ways in which a facility generates pollution and waste, and avoids the transfer of pollution from one media to another. Central to this approach is the provision of facility-wide permits, which, in their ideal type incorporate two elements. First, cleaner production requirements are outlined in a facility’s pollution prevention plan, including an implementation schedule for the identified source reductions, implemented at the firm’s discretion. Second, permitted emission/discharge limits are set, which ensure compliance with existing single media regulations and eliminate cross media transfers. The virtue of facility-wide permitting is to enable a facility to focus its resources on achieving the pollution reduction goal rather than undergoing the cumbersome process of obtaining several different permits. Because the emphasis is on pollution prevention, facility-wide permit may create incentives for technology innovation.

An example of this type of innovative regulation is Project XL, a program designed to reward United States firms that "have developed creative, common sense ways of achieving superior environmental performance at their facilities" (Clinton & Gore 1995:36). Under this program, a firm can propose alternative environmental strategies where it can demonstrate that such strategies will achieve better environmental results than expected to be achieved under existing law. In Australia, accredited licensing implemented by the Victorian EPA is an example of innovative regulation (see Box 11 below).

**Box 11**

**Accredited licensing in Victoria**
Negotiated self-regulation

Negotiated self-regulation between industry and government is a viable alternative, or supplement, to conventional regulatory approaches designed to increase the adoption of cleaner production. Negotiated self-regulation involves target-setting by government and industry, without resorting to legal sanctions, allowing industry to decide the most appropriate ways to meet the targets and thereby encouraging innovative and flexible solutions. Consultation or dialogue on long-range policy goals between government and key "target groups" is a major element for arriving at voluntary agreements.

Negotiated self-regulation provides several advantages for industry and government, including greater long-term stability and increased flexibility in complying with environmental regulation. Firms are able to plan investments and environmental policies without the threat of short-term changes in environmental regulation. Industrial targets may apply to an industrial sector as a whole, minimising strategic competitive actions between individual firms within the sector. The negotiating process in the formulation of self-regulatory agreements allows industry to voice its concerns, increasing the chance for compliance and increases the level of trust between government and industry. Negotiated agreements also allow government to avoid the costs of preparing and passing new environmental legislation and take less time to construct than new regulations. The negotiation process necessarily requires the government to become more intimately involved with industry than it would through implementing environmental regulations. An example of negotiated self-regulation is at Box 12.

Box 12

Environmental covenants in the Netherlands
The Netherlands Government has introduced a series of sector specific environmental covenants under its National Environmental Policy Plan. The covenants are in effect negotiated voluntary agreements between the Government and industry. Covenants do not take precedence over existing law and do not replace existing environmental regulations, but provide a written agreement between government and the target group to meet the nation's overall environmental objectives.

Implementation of the covenants will depend on the nature of the industrial sector. Those sector which have a limited number of homogeneous production processes adopt a relatively straightforward approach to environmental management. A covenant is drawn up at branch level that functions as a detailed guide for environmental decision making and management and details measures to be taken to implement the overall environmental goals. Standard licensing regulations and checklists are used for enforcement purposes.

Those sectors which are heterogeneous and include large complex firms that employ various processes and cause a wide range of environmental problems undertake a different process. A Declaration of Intent is written by representatives of Government and industry which represents the sector's overall environmental goals. Individual firms who sign the document commit themselves to drawing up a Company Environmental Plan (CEP) in close cooperation with the licensing authority. Once approved, the CEP serves as the basis for the firm's permit.

The CEP must cover a period of at least four years, and provide a projection of activities to be taken over the following four years, indicating targets, timetables, and measures that the firm will adopt. The CEP will provide: an inventory of polluting emissions and energy consumption; a summary of emission reductions achieved and emissions that will be realised; an overview and timetable of additional reductions in pollution planned by the firm; and a statement of any areas that the firm regards as an obstacle to its contribution to the sector's overall environmental objectives.

Source: Atkeson, E (1996) Operationalizing Sustainability: The Netherlands' National Environmental Plan Technology, Business, and Environment Program, Massachusetts Institute of Technology, USA

**Economic incentives**

Economic incentives, through the use instruments such as taxes, subsidies, and load-based licences, may be employed to accelerate the adoption of cleaner production. Incentives may be positive, in the form of subsidies and tax deductions, or negative, in the form of taxes and charges. Either way, the incentives work by using a price signal to bring to the attention of management opportunities for cleaner production that would otherwise go unnoticed.
A key consideration in the use of economic incentives is the extent to which they can accurately target the desired environmental objective. In the case of cleaner production, this may entail focussing on specific environmentally preferable technologies and/or environmental management systems. Government may also provide subsidies in form of tax concessions for investment in capital-intensive changes to processes and industrial research and development that relate to cleaner production (see Box 13). Effectively targeted, economic incentives may be used to push back the point at which it is no longer financially viable for a firm to adopt cleaner production technology.

Box 13

Support for R&D - the Japanese Eco-Factory

The Japanese Government is encouraging the creation of so-called "eco-factories" through the provision of R&D support. The eco-factory is a closed loop operation employing technologies for recovering, disassembling and recycling factory waste efficiently and in a useable form. Specifically, the Japanese Government sponsors R&D on high speed intelligent robots for disassembly, materials, waste reduction, sorting technologies, rare metals recycling and other components necessary to make a closed loop factory practical and competitive. Interestingly, the Japanese Government has not picked specific technologies to sponsor, rather it has left that decision to the private sector.


The choice of cleaner technological solutions is often difficult, since a new technology's future costs and benefits are unknown to both policy makers and the suppliers of the new technology. In this situation economic instruments may be preferred than direct legislation since they interfere less with the choice of technology. Economic instruments may be favoured where the transition costs involved are likely to be high and when there is much uncertainty about the best alternative technology or trajectory. There is an increasing number of examples where economic incentives have been applied throughout the world. These include:

- taxes and other charges on environmentally damaging activities and materials;
- energy taxes and carbon taxes;
- tradeable pollution permits;
• tax concessions for investment in capital-intensive changes to processes;

• soft loans and patient venture capital for cleaner production investments by SMEs and for new technology development by smaller form suppliers of environmental technology;

• grants for purchase of cleaner production equipment and consultancy services; and

• funding incentives for firms to enter collaboration on cleaner production R&D and course design with educational institutions.

**Codes of practice**

Industry codes of practice are a potentially effective driver of cleaner production. In principle, codes of practice may have several advantages over more conventional forms of government regulation, including: (i) "industry ownership" which may result in a greater commitment to making the code work; (ii) more flexible and cost-effective solutions; (iii) greater sensitivity to market circumstances; and (iv) employing a language that is more readily understood by operators in a specific industry. Industry codes of practice can be a valuable vehicle for promoting appropriate cleaner production benchmarks within an industrial sector. In order to overcome concerns that codes of practice lack "bite", they may be introduced with a backdrop of regulation only to be employed if and when a code has demonstrably failed.

**Education and training**

Education and training will be a vital component of any cleaner production strategy, in particular, to overcome the limited resources of many SMEs. They are also critical to changing attitude and behaviour. With any education campaign, the critical issue is being able to effectively target and deliver the message to the intended audience. They work best when they exploit the self-interest of the target audience. In some cases, this may require lateral solutions.

Government can actively support the dissemination of best practice cleaner production information through readily accessible databases, information networks (such as EnviroNET) and subsidised training and environmental audits. Such activities should be tailored to meet the needs of SMEs (see Box 14). In order to maximise the benefits of
education and training, all levels of the firm's management structure should be engaged to ensure that cleaner production is integrated into other aspects of the firms operations

Box 14

Targeting SMEs - examples of information and education.

1. The Department of Trade and Industry in the United Kingdom operates a cleaner production telephone hotline which provides firms with an immediate and free initial consultation with an accredited expert. After an initial telephone consultation, firms may then arrange to meet with the expert on site, at a subsidised rate, to receive more detailed advice.

2. Cleaner production handbooks which provide a check-list of appropriate measures can also be of assistance to SMEs. For example, the Australian Chamber of Manufactures was commissioned by the then Commonwealth EPA to produce a series of Environmental Management Handbooks on best practice environmental management for all States and Territories. These handbooks provide guidance on self-assessment procedures for small industry and assist them in assessing their environmental performance and recognising the economic and environmental benefits of cleaner production.


One industry representative commented that cleaner production education and training should be extended beyond the current generation of business managers to encompass future generations. It was suggested that, as the success of cleaner production is rooted in cultural attitudes, it would be easier to inculcate a cleaner production ethos through our secondary and tertiary education systems for a future benefit than to change the "here and now". It was acknowledged, however, that such long lead times may not be politically attractive.

Demonstration sites and case studies, while potentially costly, can also be effective in overcoming information barriers (see Box 15). However, they must accurately target the specific circumstances of different industrial sectors for them to have widespread appeal. Industry associations can play a useful facilitative role in this regard by coordinating information sharing and networking within and between different industrial sectors.

Box 15

Demonstration programs - the case of EcoReDesign
The Royal Melbourne Institute of Technology has established a demonstration project called EcoReDesign which receives government support and is carried out in collaboration with industry. The goal is to promote life cycle analysis across industry, and the incorporation of environmental considerations already at the design stages of products. A number of leading Australian firms, which include Kambrook, Vulcan, Caroma, and Blackmores, have already participated in the project to provide various product lines which demonstrate the benefits of eco-redesign. It has hoped that the results of this project will translate into corporate shifts in philosophy from participating firms.

**Industry networking**

The sharing of information and expertise, particularly between SMEs, can greatly assist firms in implementing cleaner production. Information exchange can be facilitated by the creation of informal or formal industry networks. The majority of industry networks have been established on a sectoral or sub-sectoral basis, however, they can also organised along geographical lines (see Box 16 below). The primary function of networking is to provide firms with a forum to learn from each other experiences, however, it can also play a number of other roles, including: the distribution of government sponsored information; the commissioning of external advice and expertise; and acting as a clearing house for new technologies. One industry representative suggested the use networks between industry sectors to promote markets for the recycling and re-use of waste products.

**Box 16**

**The Aire Calder Project**

The Aire Calder Project was conducted in the early 1990s in the United Kingdom to demonstrate the benefits of cleaner production. The whole project was based on a river catchment in which participating firms were either discharging effluent, directly or indirectly, or extracting water. There was, therefore, a common interest in the health of the river. The project successfully identified cost-effective cleaner production solutions. A key factor in the success of the project was the cooperation between participating firms. This was due to:

- the local nature of the project being a powerful motivating force; and

- the geographical, rather than sectoral, nature of the project removing competition between participating firms and facilitating the free flow of information and experiences.

Buyer supplier relations

Larger firms, in particular, may be able to impose product and process preferences on other firms, using their market power to influence the behaviour of upstream suppliers and downstream buyers. For example, firms may require their suppliers to comply with certain cleaner production processing standards and may in fact subject them to an independent assessment of their environmental performance. The interchange between industrial buyers and suppliers generates incentives to innovate and to respond to market demands.

Given the difficulties government faces in regulating SMEs directly, supply chain pressure reinforced by government policy may prove to be an effective complementary strategy. However, supply chain pressure needs to be conducted in a spirit of partnership in order to avoid suppliers feeling persecuted by new and heavy demands for information. Established working relations with suppliers for achievement of quality management goals could go beyond any current unregulated practices which weed out poor performers, and put pressure on them, but were ineffective at raising standards, setting meaningful; goals and setting priorities for action.

Some larger firms have taken steps to influence the behaviour of SMEs through the practice of product stewardship or cradle-to-grave policies (see Box 17). This entails taking corporate responsibility for the life cycle of a product, from the extraction and consumption of raw materials, through its manufacture, use, and to its final disposal. For example, Dow Chemicals insists on conducting a cleaner production audit before it agrees to supply a new customer with hazardous material, and routinely audits its distributors. Government can play an indirect role in encouraging, facilitating and rewarding such practices, but, more importantly, can play a direct role by exerting its own supply chain pressure through its procurement policies.

Box 17

Supply chain pressure - British Telecom

British Telecom have identified specific factors which ensure the development and implementation of an effective environmental procurement policy. These include:

- a comprehensive life cycle assessment to ensure effective product stewardship;
- long term benefits to the organisation achieved through minimisation of environmental risk at the procurement stage; and
higher product quality from suppliers which operate environmental programs.

British Telecom assesses the environmental performance of its suppliers by requesting that these organisation supply copies of their environmental policy, if they have one. In addition, British Telecom has provided copies of its own generic purchasing policy to all its suppliers, demonstrating its commitment and indicating the increasing importance environmental performance must play if suppliers are to maintain it as a customer. The large scale of British Telecom’s procurement budget is used to influence the activities of its suppliers. This enables British Telecom to achieve a reduction in environmental impact considerable greater than which could be achieved solely within the firm itself.


Financial institutions

Financial institutions, including banks, insurers and investors may play an increasingly important role in encourage the adoption of cleaner production by firms. Environmental performance, as measured through the adoption of sophisticated cleaner production processes, is increasingly regarded as an indicator of business health. Good environmental management reflects good management in general. To the extent that this perception is shared by financial institutions, pressure on firms to adopt cleaner production processes will be that much greater. There is also the desire to avoid businesses that may face costs associated with environmental liability. Government could play a positive role in providing information such that good environmental performers may be recognised and rewarded in the market place.

Community perceptions and involvement

Research demonstrates that, apart from government regulation, community perceptions can play a critical role in determining the environmental performance of firms. For example, the chemical industry is sensitive to community criticism and has subsequently gone to great lengths through its Responsible Care initiative to address community concerns. As one industry representative said "companies generally recognise that it is better to get onto the front foot and actively demonstrate to the community that they are doing the right thing in terms of environmental practice, rather than continually having to react to community pressure in ways which appear negative and unresponsive".

Official award schemes may be one way for firms to demonstrate to the community that they have implemented cleaner production. The publicity which may accompany an award can serve an educative function, by raising public awareness about surrounding circumstances
and focussing attention on critical issues. Awards may be conferred in recognition of exemplary behaviour by third parties, as well as by industry.

**Environmental auditors**

The use of independent environmental auditors to assess and prescribe the environmental performance of firms has been a significant development in recent years. Auditors can provide firms with significant commercial incentives. Specifically, their professional services may reduce exposure to litigation and criminal penalties, improve risk management, operating performance and planning, reduce costs through recycling, waste minimisation and material substitutions (which might otherwise not be identified as viable) and achieve environmental goals more efficiently and with less application of government resources.

**Green consumers**

Growing public sensitivity to environmental issues is reflected in consumer behaviour. Collectively, such consumers have the economic muscle to demand that environmentally unsound products are either improved or replaced. Firms which are in a position to demonstrate their credibility as environmentally responsible corporate citizens through cleaner production processes and benefit from consumer preferences, will thus enjoy a competitive advantage. Indeed, consumer preferences may be more exacting than government regulatory requirements. Substantial public relations and marketing advantages can flow from a legitimately earned reputation as a cleaner production firm. It should be noted, however, that customer influence will be stronger in relation to products rather than processes. Green consumer pressure may be limited by information gaps on the consumer side, partly due to the fact that the environmental aspects are only one aspect of a product, and the "free rider" behaviour of other consumers. Consumers may also be susceptible to sophisticated marketing strategies which undermine genuine environmental concerns.

**International trade incentives**

In an increasingly globalised world economy, the power of our major trading partners to influence the production processes of our domestic firms will inevitably grow. This power can be exercised formally through, for example, specific importation requirements, or informally, through the consumer preferences of regional markets. For example, exports of Australian beef have to meet strict importation standards regarding the presence of chemical residues. Alternatively, many Australian primary producers promote their wares in the Asian market as being "clean and green". The ability of major international markets to dictate the environmental behaviour of Australian firms may be substantially greater than the enforcement capacity of domestic regulators.
There are several potential sources of international pressure for cleaner production. Accreditation with the environmental management system standard ISO 14001 may become a *de facto* legal requirement for trading with the European Union. International environmental treaties may address the trade of environmentally undesirable products and processes. For example the Montreal Protocol already restricts the trade of products which contain ozone depleting substances. It is possible that other international environmental treaties, for example that addressing climate change, will follow this lead. Trade agreements may also explicitly address cleaner production issues. For example, the North American Free Trade Agreement has provisions which address the environmental impact of industrial activities. There is also continuing political pressure for the World Trade Organisation to address "green" issues.
Ranking barriers, motivators and drivers

It is critically important that policy makers recognise the unique capacities and circumstances of different industrial sectors in relation to the adoption of cleaner production. The presence or absence of barriers and motivators will inevitably vary across different industrial sectors. A comprehensive cleaner production strategy will therefore need to accommodate these differences. In developing the report's recommendations, representatives from a broad range of industrial sectors were consulted in identifying the relative importance of the different barriers, motivators and drivers.

An industry-wide ranking

Despite the differences in circumstance between sectors, sub-sectors and individual firms, a substantial level of consensus emerged from the industry consultations and literature reviews as to which were the most important barriers, motivators and drivers of cleaner production common to all industry.

In terms of barriers, the most important issues were identified as:

- a lack of information and expertise, particularly among SMEs;
- a resistance to cultural change on the part of management;
- competing business priorities, especially the pressure for short term profits; and
- the high cost of new, cleaner technology.

In terms of motivators and drivers, the most important issues were identified as:

- government regulation (although many expressed the concern that such regulations must create a level playing field and not favour "free riders" or international competition);
- the ability to share information through networking and business partnerships, and access to external (subsidised) expertise, particularly for SMEs;
- the desire to maintain good community relations, particularly for larger firms;
- the convergence of more efficient production processes with sophisticated cleaner production processes, such as environmental management systems; and
- access to financial incentives for investment in new, cleaner technology.
Sector specific rankings

It is beyond the scope of this consultancy to provide a detailed and comprehensive ranking of barriers, motivator and drivers across a wide range of industry sectors. However, an indicative assessment of the issues confronting a representative sample of industry sectors provides some useful insights.

(i) The pulp and paper industry

This sector is characterised by lumpy investments in large pieces of capital equipment, and consequently has a slow technology turnover. Large new mills see significant advantages in reduced water and energy consumption, reduced emissions, higher yields and achieve significant benefits of scale. Internationally, tighter regulations favour investments in new, larger, more modern facilities which have impressive environmental performances. These plants will make it difficult for older facilities which will be confronted with increased expenditure on pollution abatement equipment.

In Australia, the pulp and paper sector is dominated by five large firms, which collectively make up the bulk of production. A substantial proportion of the technology used in Australia is relatively old, and is therefore less environmentally efficient than new state-of-the-art technology. Nevertheless, Australian firms have an impressive record of upgrading older equipment. Industry representatives have indicated that key drivers of cleaner production in Australia are: a desire to maintain good community relations; to comply with, and preferably exceed, mandatory regulations; and the influence of environmental management philosophies and best practice, including the use of environmental management systems, from corporate head quarters (in the case of firms which are Australian subsidiaries). One Australian firm is subject to regular external environmental audits from corporate headquarters which are viewed as far more stringent than those applied by domestic regulators. In this respect, cleaner production policy is often driven by corporate headquarters and their desire to harmonise environmental management systems across a number of international subsidiaries. Major barriers to greater adoption of cleaner production are highly volatile price cycles, pressure to maintain shareholders returns and a focus on short term profits.

(ii) The electrical and electronic engineering industry

The electrical and electronic engineering sector constitutes the manufacture of basic electrical equipment, batteries and accumulators through telecommunications equipment, electronic and electrical goods, and domestic appliances to active components and electronic sub-assemblies. This sector is not commonly associated with environmental issues, with the notable exception of the use of ozone depleting substances. However, there are in fact a number of industry activities with potentially negative environmental impacts. These include...
the release of highly toxic gases and chemical wastes from semi-conductor production; the use of PCBs in printed circuit boards; the use of heavy metals such as cadmium, mercury and lead in the battery industry; the use of polychlorinated biphenyls as insulators in power transformers; and the energy and water consumption of domestic white goods.

The cleaner production track-record of this sector is somewhat uneven. Many cleaner alternatives require large investments to change the manufacturing process, with little in the way of performance or economic benefits. Not surprisingly, major leaps forward in cleaner production have be relatively limited. On the other hand, firms are successfully phasing out the use of ozone depleting substances, and have made significant strides in advancing the energy efficiency and water conservation of their consumer products. For example, the sector has been at the forefront of the development of minimum energy performance standards. The industry is also collaborating with the Royal Melbourne Institute of Technology to apply the principles of eco-redesign to a range of products.

As this sector contains a large number of SMEs, many of the barriers to cleaner production are common to SMEs generally. These include a lack of resources, information and management expertise. Many firms in this sector are economically marginal, making it difficult to invest in new technology. They are also subject to fierce competition from cut-price foreign competitors. There is concern that further regulatory obligations would place domestic firms at an unsustainable competitive disadvantage to foreign imports (as most cleaner production regulations would inevitably be process prescriptive, not product prescriptive). Because of the highly competitive nature of the industry, it was considered that there were limited opportunities for cleaner production to generate significant cost savings.

Key motivators and drivers in this sector are the provision of adequate information and training, and financial incentives for the purchase of new, cleaner technology. It was suggested that subsidised cleaner production audits would be of assistance, provided they were delivered through industry departments or an industry association, and that "time-out" for management training would also be an attractive proposition. This should be supplemented by the development of a streamlined environmental management system that could be applied to a variety of facilities and firm sizes. A cleaner production code of practice was another potential policy tool, however, it was suggested that to be effective, it would need to be backed up by mandatory requirements in the event of failure, with perhaps a trial period of two to three years. Cross-industry cooperation in creating markets for recycled goods, for example coordinating the re-use of plastics with the automotive industry, was viewed as an important driver of waste reduction. To the extent that regulation is used as a driver of cleaner production, it should be linked to other incentives, be enforced evenly across the sector, be harmonised across state borders (and with New Zealand), encourage
the phase-out of old technologies, and not undermine the industry's international competitiveness.

(iii) The chemical industry

The chemical industry is a technologically advanced sector characterised by a comparatively large emphasis on innovation and research and development. However, for most firms, genuinely new process developments are very lengthy, typically taking longer than ten years to fully implement. In some areas, this delay is compounded by the need for regulatory approvals - such as the need for clinical trials. The expenses associated with the development of new, cleaner technologies can be a barrier to their widespread diffusion as firms seek to maintain a competitive edge.

The chemical industry is dominated by a small number of large multinational firms. Due to their high public profile, and continuing community concerns over the safety of their activities, such firms have been at the forefront of cleaner production innovations. This is evidenced by the chemical industry's Responsible Care initiative, which, whilst having significant room for improvement, represents the most sophisticated environmental self-regulatory program in the world. Government regulation, however, remains a significant driver of improved environmental performance for many firms.

Individual firms, such as Dow Chemical and Du Pont, have been world leaders in cleaner production management strategies, and have used their purchasing power to influence upstream suppliers. Such firms also view cleaner production as an opportunity to realise substantial cost savings through the introduction of more efficient production processes. Smaller chemical firms, in contrast, appear to be driven more by a desire to improve end product or to make gains in process economics, rather than in any ethical commitment to cleaner production. In this respect, supply chain pressure is a potentially powerful tool. Other barriers, motivators and drivers for small chemical firms are similar to those for SMEs in other sectors.

(iv) The metal finishing industry

The majority of firms in the metal finishing industry are SMEs and therefore confront the problems common to SMEs throughout the economy: a lack of information and expertise; limited capital; and a focus on short term survival. Managers in this sector are perceived as being resistant to the notion of cleaner production, and few firms have implemented environmental management systems. Therefore, management training is viewed as an essential to the widespread adoption of cleaner production. Assistance with the purchase and implementation of cleaner technology would also be of major benefit. Stable markets for recycled materials would also be a significant step forward. As with many SMEs, inadequate
enforcement of environmental regulations (and a lack of harmonised regulations between different States) means that firms with older, polluting practices and technologies are able to free ride on the efforts of others by undercutting their pricing.

(v) The metal manufacturing industry

The metal manufacturing industry includes the production of iron, steel, aluminium and other metals. Major environmental issues confronting this sector include: energy consumption; the production of slag and sludge; noxious effluents and wastes; and dust and fumes. The highly capital intensive nature of this sector means that plants have highly sunk investments, resulting in preference for incremental rather than dramatic improvements in cleaner production in relation to existing facilities. On the other hand, the firms in this sector tend be large and may have greater capital resources at their disposal to invest in cleaner production improvements. There may be substantial savings to be made in the area of energy efficiency. Such developments may be openly communicated and diffused throughout the sector. The world-wide oversupply of aluminium means that the opportunity for large investments in cleaner production is limited by financial constraints. Government regulation is a major driver of environmental performance in this sector.

(vi) The automotive industry

The automotive industry in Australia is characterised by a small number of subsidiaries of major multinational firms, and a large number of locally owned SMEs. Given the wide disparity of industrial activities, there is an equally wide variety of cleaner production issues: from energy conservation in large plants, to the safe disposal of toxic wastes generated in small smash repair firms. The barriers, motivators and drivers will therefore differ depending on the size and nature of the firm.

The four vehicle manufacturers are subsidiaries of foreign firms and are largely dependent on investment decisions made at corporate headquarters. However, with several recent and/or planned major investments in the industry, there are significant opportunities to replace older, more polluting plant and equipment. In terms of product performance, fuel efficiency has not been a priority in past years, however, there has been some progress on a voluntary code for improving vehicle fuel efficiency.

Since the decline of trade protection in the 1980s, the vehicle manufacturers have transformed their management processes to successfully adopt leading edge management systems such as TQM and "just-in-time". This has had positive flow-on effects for cleaner production. For example, the vehicle manufacturers are among the few firms in Australia to formally implement the ISO 14001 environmental management system. This is a process that has been driven by corporate headquarters, where environmental issues are playing an
increasingly important role in business management strategies. In this respect government regulation, for example vehicle fuel efficiency regulations in California, and community perceptions, are major drivers of cleaner production.

Further progress is hampered, however, by pressures to maintain short-term profitability and difficulties in training workers and management whilst maintaining the production line and shift work. The recycling of vehicle parts, in particular, plastic components, by the domestic industry substantially lags international best practice. For example, several European vehicle manufacturers are implementing sophisticated labelling and recovery programs for plastic and other components. Again, government regulation has been a key driver of recycling in Europe. Finally, the Commonwealth Government, with its decision to maintain tariffs at 15% between 2000 and 2005, has announced that a package of measures will be developed for the industry, including an environmental strategy.

The many SMEs that operate with the automotive sector can be divided into two broad categories: first, those which supply components to the larger vehicle manufacturers; and second, those which are mainly independent operators in the repair and aftermarket business. In terms of the former, there is already a high degree integration between suppliers and purchasers (ie the large vehicle manufacturers). This provides fertile ground for supply chain pressure and product stewardship to be drivers of cleaner production. In terms of the latter, it is generally conceded that many of these firms have minimal interest in cleaner production a operate with minimal influence by regulators. There may be role, therefore, for greater regulatory oversight of this sector, including a system of "on the spot" fines.

In general, the barriers, motivators and drivers of cleaner production for SMEs in the automotive sector are consistent with other sectors, with the provision of information, expertise, and simplified environmental management systems, and incentives for new technology, rating as high priorities.
Policy recommendations

In making our recommendations, we expected to be able to build upon the existing literature on cleaner production. Unfortunately, although there is significant volume of material, from both a domestic and international perspective, much of that literature lacks a coherent and sophisticated framework within which to address the core institutional and structural barriers to its application. We have sought to fill this gap, and to advance the cleaner production debate, by drawing directly upon our analysis of the various barriers and motivators and drivers identified in the report, and importantly, on the results of our consultations with key industry representatives and other stakeholders.

Based on this analysis and these consultations, we argue the case for a coordinated government strategy that effectively combines the key motivators and drivers of cleaner production to remove major obstacles, and which takes account of the different requirements and circumstances of different industrial sectors and firm sizes. This strategy also seeks to take advantage of the range of circumstances where cleaner production is both good for business and good for the environment - where there is a happy coincidence between private profit and the public interest. However, we must also emphasise the complexity of the task at hand, and the extent to which government is dependent on industry's cooperation to achieve its aims.

To be fully effective, cleaner production requires a major reorientation of firm behaviour and attitudes such that environmental considerations are integrated into core business decision making processes. In essence, cleaner production is preventative, and therefore must be addressed as a fundamental criterion of product design and industrial process operation. Apart from the cultural and logistical obstacles to such a profound transformation of firm attitudes and behaviour, many in industry are wary of edicts from government bodies which aim to tell them how to manage their businesses. Rightly or wrongly, government, and environmental regulators in particular, are often perceived as being removed from the commercial realities of managing a firm in an increasingly competitive global economy. As one industry representative put it: "those who espouse it [cleaner production] are fundamentally opposed to industry and the basis of its decision-making; they are therefore alienating themselves from their target market". It is crucial to the success of government cleaner production strategies that these issues are addressed and overcome.

In developing a set of policy recommendations we have therefore attempted to abide by the following guiding principles:

- to implement measures that target the key barriers and motivators across the different industry sectors:
• to suggest realistic and practicable measures that can be implemented with a minimum of anguish;

• to focus on measures that will lead to incremental and continuous improvements in environmental performance by industry;

• to maximise cooperation with industry and, where practicable, to utilise industry associations as a vehicle for delivering cleaner production measures;

• to concentrate on the benefits that can accrue to industry through the adoption of cleaner production; and

• to use a combination of measures that target as many entry points and decision making processes within the firm as possible.

The recommendations which follow have been grouped under policy clusters. These are: (i) the role of information strategies; (ii) changing corporate culture; (iii) the role of economic instruments; (iv) the role of third parties; (v) the role of industry; and (vi) the role of regulation. Our aim is to include recommendations under the first four of these clusters, most of which can be implemented without the necessity for legislative change. The objective is to minimise obstacles to their speedy introduction. However, given the critical role of environmental regulation in particular as a driver of cleaner production, and the critical need to design the correct type of regulation, some legislative change will be necessary if we are to "lock in" cleaner production in the longer term. What form this legislation should take is addressed in section (vi). Finally, we have also addressed separately, measures tailored to SMEs, and the need for, and a strategy to advance, a sector-specific approach.
The role of information based strategies

The lack of information and expertise were identified earlier as crucial barriers to the achievement of cleaner production. In many circumstances, inadequate information seriously inhibits private parties from reaching rational decisions in favour of cleaner production. SMEs, in particular, barely know what questions to ask, or who to address them to, let alone what the possible solutions are. As a result, many profitable opportunities for cleaner production are missed entirely. Even in large firms, where information access may be easier, such information may not be acquired, or if it is acquired, may not be acted upon. Bounded rationality, the lack of capacity to comprehend and address a wide variety of complex issues, may result in a failure to access or respond to information, even when it is rational (and profitable) to do so.

Accordingly, education and training are essential to improving the capacity of industry and the community to address cleaner production. They are critical to changing attitudes, behaviour and expertise to be consistent with environmental policy imperatives. Such education and training must be tailored to meet the needs of industry, and in particular, to address information gaps that hamper the environmental performance of SMEs. A key function of these instruments is to internalise environmental awareness and responsibility into corporate decision making.

Information, providing transparency, is also crucial in building trust between stakeholders. Voluntary initiatives, regulatory flexibility and other innovative means of facilitating and encouraging cleaner production may be looked upon with suspicion by environmental groups and communities unless they can be demonstrated to be delivering measurable improvements which take participants beyond compliance with existing laws. Once convinced however, then they are likely to reward the former group in terms of positive publicity. In some instances, constructive partnerships between industry and environmental groups have also resulted in these circumstances. In any event, decisions themselves are likely to be better if they are arrived at through constructive dialogue, to which information is an essential underpinning.

Government could make a substantial contribution in providing information in the many circumstances where the market cannot be relied upon to do so. As we shall see, government can also play a number of other important roles, facilitating the generation of information, thereby helping to overcome the problem of less than rational decision making processes within firms and facilitate constructive stakeholder engagement. The most important roles of government are:

(i) technical assistance and expertise
There is already a considerable history of government sponsored initiatives that provide some form of technical support to firms. In the case of cleaner production these might include mechanisms such as telephone hotlines, visits from government engineers, workshops and conferences, internet databases etc.

However, experience with the Commonwealth's Cleaner Production program suggests that, despite the development of a large suite of information transfer systems, technical assistance for implementing cleaner production has largely failed to penetrate mainstream industry. This indicates that innovative and more effective mechanisms are required through which information should be transmitted. In particular, there is a need to carefully consider the best ways of packaging and presenting such information, including the vehicle through which the information is presented. It is essential that governments provide information which addresses actual risks and uncertainty regarding the adoption of clean technology, and also corrects distorted images and false information.

Information will be most credible, and more likely to be acted upon when it is communicated by a source close to the recipient. The most appropriate source will vary from sector to sector. For example, a recent Australian survey suggested that cotton producers tend to rely most on agricultural consultants, cereals producers on farm supply dealers, and horticulturists on government departments. Again, some of the most effective use of information instruments is made by industry associations, whose legitimacy and credibility with their members is understandably greater than that of government institutions. For example, the National Farmers’ Federation has played a leading role in helping to train farmers on the appropriate use of chemicals since 1993, through its Farm Chemical User Training Program, which has had a significant impact on farmers' use of chemical inputs.

To the extent that such channels need to be supplemented by direct government measures, every effort should be made to present the information in a form which is readily digestible and accessible. In terms of government information programs, the United Kingdom's Department of Trade and Industry (DTI) provides a positive model of what can be achieved. DTI's Environmental Enquiry Point, a one-stop-shop for firms wishing to obtain technical information relevant to improving their environmental performance, has proven particularly successful.3

Because there are substantial limits to government resources, it is also important to develop innovative forms of assistance harnessing the capacities of the private sector with government in the role of facilitator rather than direct participant. We deal below, in the

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3 The service covers: technical matters; legal obligations; proposed new standards; and environmental conferences and seminars. If an enquiry is dealt with in less than four hours, no fee is charged.
sections on small business (the Minnesota experiment with third party auditors) and on product stewardship, how this might be achieved.

**Recommendation 1:**

(i) that government enhance the dissemination of best practice cleaner production information through databases, information networks, case studies, handbooks, subsidised environmental training and environmental audits; and

(ii) that government take greater advantage of the considerable benefits to be gained by:

- utilising industry and trade associations within individual sectors in circumstances where they are the most appropriate and effective vehicles through which to disseminate information;

- harnessing the power of the private sector (through supply-chain pressure and the promotion of product stewardship) to disseminate information; and

- harnessing the capacity of commercial third parties, and in particular environmental auditors, to perform this role.

**(ii) extension services**

The managerial ability of firms to improve their environmental performance and, in particular, to manage environmental risks, is often related to their size. Smaller firms often lack the in-house expertise to initiate improvements. Governments, often with the support of industry associations, may address this problem by offering extension services that aim to improve their environmental performance. For example, DTI in the United Kingdom subsidises the provision of independent cleaner production advice to small businesses. Importantly, this advice focuses on commercial opportunities, such as strategic approaches to environmental management, cost savings and green marketing.

In Australia, there are several business extension services that relate to cleaner production. These include Environment Australia's Cleaner Production Program, the Department of Primary Industry and Energy’s Energy Audit Program, and AusIndustry's Environmental Management: A Business Management Program. State Governments too have provided similar programs. Essentially, these programs subsidise an independent consultant to review the operation of SMEs and provide a forward plan of action.
Unfortunately, despite considerable promise, the penetration of the programs has been disappointing. This is due to a combination of factors: (i) a reluctance on the part of SMEs to accept external advice (particularly from environmental agencies) and/or an unwillingness to fund even the subsidised price; (ii) ignorance about the availability of the extension services; and (iii) the under resourcing and fragmentation of government programs. As one industry representative commented, "existing programs are a success for those who participate, but a failure for changing overall industry practice". Consequently, for cleaner production extension services to be more effective, a revamp of current arrangements is required.

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<td>(i) that the Commonwealth Government amalgamate current environmental management subsidy programs into one national cleaner production extension service, and provide additional funding;</td>
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<td>(ii) that State governments be encouraged to match Commonwealth funding on a dollar-for-dollar, state-by-state basis;</td>
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<td>(iii) that the central focus of the extension service be to deliver cost savings in tandem with environmental improvement for small business;</td>
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<td>(iv) that a national pool of accredited cleaner production consultants be created; and</td>
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<td>(v) that industry associations and/or the AusIndustry network become the primary delivery vehicle for cleaner production extension services.</td>
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**(iii) demonstration projects**

Cleaner production demonstration projects can be a valuable means of promoting new, cleaner technology. Many SMEs, in particular, find it difficult to obtain reliable, independent assessments of new technologies. However, demonstration projects can be limited by high start-up costs, and a perception among target audiences of limited applicability to their particular circumstances. In order to overcome these shortcomings, it is essential that any demonstration projects focus on technologies that are universally applicable to a specific sector, or indeed across sectors. It is equally vital that the demonstration projects be integrated, to the extent possible, into other cleaner production information programs.

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That government introduce a series of small-scale, widely applicable cleaner production demonstration projects designed to both assess and promote the application of new technologies, with specific links to other policies designed to disseminate information (for example, Recommendations 1, 2, 15, 23 and 28).

(iv) measuring success in cleaner production

Many of the strategies recommended below, such as regulatory flexibility, voluntary agreements, and corporate environmental reporting, rely heavily for their credibility and legitimacy upon a capacity to measure progress in cleaner production. For example, in the case of voluntary agreements and regulatory flexibility, high quality information concerning their success is essential, for without it, government and communities are unable to evaluate whether industry promises and commitments to cleaner production are achieving their objectives. More generally, monitoring performance is indispensable to effective policy-making.

The best means of distinguishing between success and failure, and between rhetoric and reality, is through identifying measurable goals, and measuring their attainment (for example, efforts to reduce volume and toxicity of waste and changes in volume and toxicity actually achieved). Put differently, evaluating actual performance requires the generation and collection of objective data that validates a firm’s activities against milestones that enable all firms to be compared against each other (often known as benchmarking). This in itself will create important incentives for improvement, at least if these figures are made public. It will be equally important that the relevant data is capable of demonstrating that each participating enterprise is going beyond compliance with outcome-based regulatory requirements. Ideally, the data should also be presented in such a way as to enable a firm’s performance to be understood by local communities.

Such data would also facilitate both financial institutions and financial intermediaries functioning as effective surrogate regulators, as described below - roles which at present are handicapped by a lack of adequate and independent information.

Performance indicators capable of meeting the criteria identified above have not yet been developed, though considerable effort is being addressed to this goal at the time of writing.  

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4 The World Resources Institute has a project on this issue. Steps towards such a system include the United States' toxic release inventory and the environmental index adopted by the French Chemical group Rhone Poulenc. This index can be applied in every plant, and reports combined to produce a measure of the environmental performance of each company. It has now been adopted by the Chemical Industries Association (UK) and France's Union des Industries Chimiques (Paris) as an environmental performance indicator.
including the role of Environmental Performance Evaluation, which is being addressed in ISO 14031. Whether it is possible to go further, and to develop a general measure of environmental performance applicable to different firms with different processes and products, remains to be seen.

**Recommendation 4:**

That government develop independent indicators of performance in cleaner production which firms can use to drive and evaluate their progress towards cleaner production and governments and communities can use to assess the performance of individual firms.

**(v) surrogate measures of cleaner production**

As an interim measure, it may be possible to devise surrogate measures of performance based on existing databases. For example, in the United States, the Chemical Manufacturers Association now claims to have external performance measures for 5 of its 6 codes of practice. These include the toxics release inventory (which measures pollution prevention), Occupational Health and Safety Administration figures (used to measure safety performance), and the Department of Transportation's hazardous materials transportation incident database (as the Distribution Code Performance Measure). In the short term, within Australia, the most potent surrogate measure likely to be developed is the estimates of emissions that will be required to be disclosed under the proposed National Pollutant Inventory, which embodies the principle of Community Right to Know, described more fully below.

**Recommendation 5:**

That, as an interim measure, government develop indicators of performance in cleaner production based on data required to be reported and measured under existing government programs.

**(vi) environmental performance reporting**

The advent of environmental management standards and pressure by industry associations, governments and community groups is making many firms consider producing corporate environmental reports. The practice entails firms producing a record of their environmental
performance and disclosing this information publicly as part of an annual report or as a stand-alone document\(^5\). Recent surveys indicate that the number of firms producing corporate environmental reports has risen significantly in the past few years, although this is off a low base.

Environmental reporting is still in its infancy, with very little consistency or coherence in the reporting format. There is a very wide range of reporting models, from short qualitative statements in annual reports to the integration of full-cost accounting and sustainability indicators. This variation, combined with the release of many less than forthright reports, highlights the need to inject some credibility into the practice. One way of achieving this is for industry associations to develop a code of practice for corporate environmental reporting. Government can play a direct role in certifying the veracity of such reports.

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<th>Recommendation 6:</th>
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<td>(i) that government assist and encourage major industry sectors to follow the lead of the Minerals Council of Australia in developing a code of practice for corporate environmental reporting; and</td>
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<td>(ii) that government enhance the credibility of corporate environmental reporting by devising criteria which would enable the veracity of such reports to be certified and enabling comparisons between different reports.</td>
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\(\textbf{vii) awards and prizes}\)

Award schemes have considerable publicity potential, and as such, can contribute to the education and information strategies of cleaner production. Recipients of awards may be presented as role models, with the exemplary act or pattern of conduct celebrated by the award held out as worthy of emulation by others.

For example, the European Commission administers the high profile European Better Environment Awards for Industry. A trophy and recognition is provided to the winning candidate. The Oregon Governor’s Awards for Toxics Use Reduction is another example of a program which celebrates environmental achievement. Awards can also be conferred by private institutions, such as public interest groups and by philanthropic organisations. The Goldman environmental prize, which recognises exceptional achievements by environmental activists is one example. Despite their obvious merits, award schemes are not without

\(^5\) Such disclosures may contain: an overall environmental policy statement; an overview of significant environmental impacts; targets for reducing emissions and wastes and quantitative performance against those targets; descriptions of environmental management systems in place; relevant research and development activities; breaches of environmental regulations; and the results of environmental audits. The reporting is predominantly non-financial in nature.
limitations. Most significant of these is their tendency to become debased through overuse. Excessive reliance on award schemes can make recognised achievements less noteworthy, and thus dilute their educative impact.

A sector specific approach to awards would be desirable, both because the opportunities for cleaner production (and the means by which leading firms may act as role models) will vary from sector to sector, and because this gives more scope for recognising achievement than a single award across all sectors.

**Recommendation 7:**

That government establish a sector-specific award scheme to recognise the achievements of those firms which contribute most to cleaner production.
Changing corporate culture

Amongst the most powerful barriers to cleaner production identified earlier, were a number which are characteristic of the structures of individual organisations and the management culture within them. These include inadequate business accounting systems, inappropriate incentive structures for management in conjunction with a pressure for short term profit, inappropriate internal divisions of responsibility/lack of communication and middle management inertia.

There is a number of measures which, if implemented, would directly address one or more of these barriers and which would enhance the prospects for a change in firm behaviour, particularly at the level of senior management and the decision making process. It is important to recognise however, that the cooperation and direct participation of industry in overcoming the barriers and achieving the desired outcomes is essential, and that government intervention most appropriately takes the form of facilitation rather than directive action.

(i) environmental accounting

Conventional accounting practices disguise many of the environmental costs of business decisions: either by burying them in "non-environmental" accounts or by failing to connect costs to the activities that generate them. In consequence, crucial business decisions concerning technologies, product lines, materials use, and much else, are taken in ignorance of crucial environmental implications. In turn, this results in a failure to exploit opportunities "to increase profits, use materials more efficiently, and protect the environment" (Ditz et al 1995: v): opportunities which are open to firms of all sizes and in all sectors.

In a detailed investigation of the role of environmental accounting, the World Resources Institute has emphasised the critical importance of:

• ensuring that information on environmental costs actually influences behaviour (which it can only do if it is communicated to appropriate decisionmakers); and

• integrating environmental accounting into business processes (this enables expertise and information essential to environmental accounting to be tapped or acquired at little additional cost, while helping to infuse environmental thinking into core decision-making) (Ditz et al 1995).

It is unlikely therefore that environmental accounting practices in isolation will transform firms into model cleaner production performers, because green accounting itself, has a number of limitations. First, accounting is essentially a retrospective activity: it describes the firm's development when it is using Cleaner production in practice in a
prospective activity: it requires firms to assess and plan their future operations. Second, external accounts in particular are merely responding to the demands of their client, and may have little influence on a firm's decision making process. Internal accounts in larger firms may have a more significant input in decisions relating to cleaner production. Third, it is the interface between financial planning, in the form of investment and budgeting decisions, and accounting practices that influence a firm's cleaner production strategy, not accounting alone.

Notwithstanding these limitations, environmental accounting is an integral component of a comprehensive strategy to change the way in which firms go about improving their environmental performance, away from ad-hoc end-of-pipe solutions, towards the introduction of a cleaner production ethos. But unfortunately, even though green accounting techniques are advancing rapidly, (and "how to" guides exist for introducing them) this does not in itself ensure that firms will use them. Tradition, inertia, lack of awareness, the short term costs and disruption involved in a transition to a new system, are among the factors which inhibit the use of green accounting. Accordingly, there remains an important role for government in promoting such techniques, facilitating and encouraging the private sector to adopt them.

Recommendation 8:

(i) that tertiary institutions be encouraged to accelerate the integration of environmental accounting methods into mainstream curricula;

(ii) that government and the Australian Society of Certified Practicing Accountants jointly develop a number of industry specific codes of practice for environmental accounting; and

(iii) that government and the Australian Society of Certified Practicing Accountants jointly develop "off-the-peg" environmental accounting systems that, in particular, can be readily applied to SMEs.

(ii) subsidising management systems

As we indicate earlier in the report, environmental management systems hold out the promise of achieving continuous improvement and cultural change in firms’ approach to cleaner production. They also have the capacity to deliver improved economic performance and to substantially increase profits. In theory, therefore, firms are likely to embrace such systems voluntarily, as a matter of enlightened self-interest.

Yet in practice, this is far from being the case. Many of the barriers to cleaner production identified earlier, contribute to a reluctance to adopt environmental management systems.
particularly by SMEs. These barriers are the pressure to maintain liquidity, the emphasis on short term profits, and the pressures resulting from economic marginality. Essentially the reason why these pressures militate against the adoption of environmental management systems, is that such systems are expensive in the short term to establish: most of the costs are "up front" but the benefits are less measurable and are mostly long term. How then, might firms be encouraged or facilitated to overcome the short term disincentives to adopting such systems?

The most obvious policy response, at least in the case of SMEs (for whom the barriers identified above are likely to be most severe), is that enterprises should be encouraged by means of government subsidies to implement such an approach. In theory, there are objections to using subsidies for such purposes. In economic terms, it is important to achieve "efficient" resource allocation by ensuring that firms "internalise externalities" thereby ensuring that the costs of environmental degradation are borne by the person or enterprise that causes them, rather than passed on to the taxpayer.

However, this is one area where pragmatic considerations might justifiably prevail. Because we know that the start up costs of developing a management systems approach are considerable, and that in the short term such systems are beyond both the financial and technical means of many SMEs, it may well be in the public interest to provide seed money to "kick-start" a systems-based approach in smaller firms. Environmental management systems for SMEs will necessarily be simplified "stripped-down" versions of more complex complete systems such as ISO 14000. There may also benefits in developing for SMEs a simplified and consolidated management system the incorporates environment, occupational health and safety, and quality (ISO 9000) systems. Finally, because of competing demands and limited resources, many managers in SMEs do not have the necessary time to fully master the intricacies of environmental management systems. Government may assist in such situations by "buying-out" the time of managers so that they can attend environmental management systems training workshops.

**Recommendation 9:**

(i) that government develop a simplified environmental management system for SMEs;

(ii) that consideration be given to the development of a consolidated management system incorporating environment, occupational health and safety, and quality systems;

(iii) that consideration be given to subsidising the introduction of environmental management systems in SMEs, at least for a trial period;
### (iv) that government trial the "buying-out" of SME managers’ time to attend environmental management system training workshops.

#### (iii) integrating cleaner production with business management practices

The last two decades have seen the rise of new management philosophies that have challenged basic assumptions about the way firms should conduct their business. Derived in large part from successful Japanese manufacturers, such philosophies include TQM, quality assurance, just-in-time, lean production and agile production. In essence, these management approaches emphasise: (i) the elimination of waste, for example wasted time repairing faulty products or wasted resources with unnecessarily large stock; (ii) utilising employees as quality assurors, whereby each individual is responsible for correcting mistakes when they occur; (iii) only producing things as they are needed; and (iv) a "value stream" philosophy that encompasses the firm's entire operations, for suppliers to customers, not just discrete products and processes.

Several commentators, notably Michael Porter (1991), have highlighted the potential synergy between cleaner production and the new management practices. These similarities exist because of a common focus on the elimination of waste. In the case of new management practices, waste is principally measured as wasted time, including such indicators as high inventories, defects, and customer complaints. In the case of cleaner production, waste is presented in the form of pollution, material waste generation, and resource consumption. In another example of the symmetry between these two approaches, TQM requires that products are designed in such a way as to be easy to put together, whilst cleaner production requires that they be easy to pull apart to promote reuse and recycling. In both cases, organisational barriers are viewed as a greater potential problem than technological barriers.

When applied to cleaner production, the new management practices hold out the promise of achieving higher profits and of boosting competitiveness. This is because the new management approach to cleaner production incorporates a systematic approach to pollution prevention and resource minimisation which results in win-win outcomes. Firms can use cleaner production to boost productivity by eliminating inefficiency, streamlining production and improving the workplace environment. Firms must pay for the energy and material they use. Therefore, the extent to which they are able to reduce this usage they are able to retain capital that would otherwise be expended.

Some firms are already adopting such techniques and making a business success out of cleaner production. For example, 3M committed itself to reduce air emission by 70-75 per cent of their 1987 levels by the end of 1993, and by 90 per cent by the end of the century. 3M estimated that this would cost SUS150 m by 1993 in state-of-the-art pollution control
equipment, with considerably larger further expenditures before the end of the century. How can the firm afford to do this and stay competitive? 3M’s answer is that "Pollution Prevention Pays", and that the firm has already "saved over half a billion dollars through" the implementation of more than 2,500 environmentally and economically sound manufacturing changes, altering the process to avoid the generation of wastes that would have been treated" (Reilly 1990:10 and Rosenberg 1990:35). Similarly, Dow Chemical company, creator of WRAP (Waste Reduction Always Pays), has achieved substantial cost savings through comprehensive environmental planning, not only from waste reduction, but also from improved energy efficiency, reduction of penalties associated with liability, and improved reputation and competitive posture (Roman 1992).

In their book, *In Search of Excellence*, Peters and Waterman (1982) provide empirical support for the importance of non-financial goals in achieving business success. What they found in their research was that the best performing firms invariably had a overriding set of guiding principles, which were essentially non-financial qualified statements of corporate purpose. In contrast, those firms which had highly detailed and specific financial measurements of success, such as earnings per share and growth measures, had done less well financially. Peters and Waterman conclude, perhaps provocatively, that business success is most likely achieved when profit is not pursued as an end in itself. Instead, it should be a "natural by-product of doing something well". This assessment has significant implications for cleaner production: those firms in which management articulates and implements a clear cleaner production strategy will not only improve their environmental performance, but may also generate financial benefits as well. Importantly, those benefits may be additional to any immediate return on cleaner technology and practices, deriving instead from more general gains in corporate morale and operating effectiveness.

These examples show how the business community can combine the objectives of cleaner production and economic growth. Firms going down this path not only greatly improve profitability, they also enhance their corporate image, position themselves to realise new environment-related market opportunities, generally improve efficiency and quality, foster a greater consumer acceptance of their firm and products, and reduce potential legal liability. These are powerful arguments for change. And yet the large majority of Australian firms have not yet engaged in such change. So why are not more firms investing in energy efficiency, pollution prevention and eco-design? Why has change been so slow? And why have the new management techniques, with an impressive track record in other areas, so rarely been translated and applied to cleaner production?

In answering these questions, a comparison with TQM provides a useful point of reference. Despite strong evidence for the benefits of quality products and services that focus on the needs of the customer over the last two decades, many firms have stubbornly refused to
adopt the principles of TQM. A 1991 survey on top American firms found that only 22 per cent used customer expectation in developing new products and services even though this is a basic component of TQM. Instead, the focus has been on fixing defects in quality after they have been made. Therefore the focus was not on preventing defects, rather it was on inspection and rework. Similarly, in terms of reducing pollution, most firms in the 1970s and 1980s focussed their efforts on reducing pollution after it had been created, ie landfills, treatment, incineration, rather than pollution prevention. It has been a common attitude amongst firm management to view environmental improvements essentially as a means of meeting regulatory obligations, and consequently implement end-of-pipe solution without giving full consideration to alternative pollution prevention strategies.

Another parallel can be drawn between Australian and American firms in comparison with their European and Japanese counterparts. Both Australia and the United States have built their economic prosperity in an environment where there is an abundance of natural resources. This is reflected in the profile of Australia's industry, with a larger emphasis on mining and resource processing industries than most other developed countries. Similarly, "the most distinctive characteristic of United States manufacturing exports was intensity in nonreproducible natural resources". As a result, "a heavy reliance on energy and resources - and the resulting pollution - is built into the basic paradigm of most American companies". It is not surprising therefore that Australian and American firms are far less efficient users of resources and energy than their European and Japanese counterparts, where natural resources tend to be far more scarce.

It may be concluded that resistance to change, the culture and resource-based nature of the economy, and indeed business ignorance of the benefits of cleaner production are all major impediments to change. As indicated above, bounded rationality, short-termism, managerial inertia and inappropriate managerial incentives also make a contribution. Accordingly, there remains a role for government in nudging firms at the margin towards cleaner production, heightening their awareness of the advantages of cleaner production, providing them with financial incentives (which at the margin may be crucial), and encouraging the reordering of corporate priorities in order to reap the benefits of cleaner production. Many of our recommendations elsewhere in this report address these issues directly. However, beyond these measures, government could also promote changes in organisational structure and behaviour by: (i) establishing a cleaner production training program for senior business managers; (ii) promoting the integration of cleaner production into business management schools; and (iii) establishing a cleaner production business roundtable.

(i) A cleaner production training program for senior business managers. Implementing cleaner production requires a fundamental shift in management attitudes and practices. Unless faced with a crisis situation, it is unlikely that most firms would be able to engineer
such change overnight: it will necessarily require incremental improvement. To assist in this process, 3M and the Australian Conservation Foundation have developed the Forsite Corporate Environmental Training Program which is specifically targeted at senior business managers. This program is designed to assist managers to understand the short and long term implications of sustainable development and to enhance the "in-house" capabilities of firms in exploiting the potential of cleaner production. The program is firmly grounded in business management principles, giving strong emphasis to strategy planning and opportunities for cost savings. Particular attention is paid to changing business culture and overcoming organisational constraints. Unfortunately, due to its infancy and limited resources, the scale of the program is limited. Government could provide funding assistance to the Forsite Program to expand its activities, including the number of training sessions, the number of participating firms and the number of sponsored positions.

(ii) The integration of cleaner production into business management schools. Business management is a rapidly expanding area of tertiary education. Many of Australia's future business executives will have an MBA from a domestic institution. It is imperative, therefore, that the principles of cleaner production and sustainable development be incorporated into mainstream business management curricula. There may be a role for government, with the support of peak industry associations, in encouraging relevant tertiary institutions to integrate cleaner production into their course material.

(iii) A Cleaner Production Roundtable. The World Business Council on Sustainable Development provides a positive example of the potential role of business. Within Australia, it may be possible to establish a "Cleaner Production Roundtable" made up of representatives from major firms which have demonstrably achieved excellence in cleaner production and other stakeholders. The roundtable could be coordinated through a peak industry association, for example the Business Council of Australia. Primary functions would be to promote and disseminate information about the benefits of cleaner production for firm competitiveness, and to provide ongoing policy advice to government. It could also act as a funnel for other policy recommendations, such as a cleaner production award scheme (Recommendation 7) and industry partnerships (Recommendation 23).

Recommendation 10:

(i) that government provide training for senior business managers through an expansion of the Forsite Corporate Environmental Training program;

(ii) that government, with the assistance of peak industry associations, encourage business management schools to incorporate the principles of cleaner production; and
(iii) that government consider the establishment of a Cleaner Production Roundtable, consisting of industry representatives from firms with a demonstrated record of excellence in cleaner production and other relevant stakeholders.
The role of economic instruments

Cleaner production would be encouraged and rewarded by the greater use of economic instruments. The World Business Council for Sustainable Development has concluded that economic instruments are "usually more cost-effective than direct regulation and give companies more flexibility as to how they achieve resource productivity and prevent pollution, and provide continuous incentive to producers to conserve resources, prevent pollution and step up technological and organisational innovation. They are also the most direct way of changing producer and consumer behaviour toward more efficient resource use ... companies will look for ways to cut the costs associated with their use, and design new systems, products and processes to reduce environmental impacts and add value for customers" (1995: 11). For all these reasons, economic instruments are an increasingly important policy tool and, as such, must be a component of any comprehensive cleaner production strategy.

(i) removing perverse incentives

Firms need to be given appropriate market signals in order to engage in cleaner production. Often they are not. For example, agricultural or energy subsidies may encourage the misuse of resources. Economic subsidies often hide the true price of goods and services so as not to reflect the environmental costs of their production, use, recycling and disposal. The World Watch Institute's 1997 report identified Australia as one of the largest subsidisers of unsustainable economic activity worldwide. From a strictly economic perspective, such subsidies distort the market by supporting particular industries at the expense of others, and are also a drain on public revenue. The removal of perverse incentives should therefore be a high policy priority.

Recommendation 13:
That government endeavour to remove perverse incentives to industry that distort the market place and hide the true environmental costs of production.

(ii) taxes, charges and market creation

There are a variety of ways of encouraging cleaner production goals utilising price signals. These include taxes, and other price based instruments which invoke the polluter pays principle, such as discharge fees and allowance trading. They also include subsidies, both
direct and indirect (discussed below). The principal advantage of economic instruments is that they allow firms to make individual choices about environmental performance and clean technologies free from outside interference. However, the use of economic instruments confronts problems as well as providing opportunities, which has restricted their widespread application.

For example, despite potential efficiency gains, tradeable permits are only likely to prove effective in circumstances where their use can be easily monitored and verified, and there are good trading prospects. Where these conditions are satisfied, then these instruments have worked well (as under the United States’ acid rain program). However, given Australia’s small size, the number of markets which are likely to enable active trading, may be very limited.

Taxes and charges confront other dangers. While they can provide some incentive for cleaner production they are usually not set high enough, for political reasons, to act as a strong incentive. They are also viewed with suspicion by industry which tends to regard them as more an income generating exercise for government than a genuine environmental tool. This problem could be overcome by hypothecation, where revenues raised are earmarked for environmental activities. However, this principle is generally opposed by Treasury (although notable exceptions include the Medicare levy and a one-off levy to fund the recent guns buy-back).

Four broader objections can be made to the use of taxes and charges. First, there is considerable difficulty in setting a tax or charge at the right level. This is because the costs and choices facing polluters may not be known to policy-makers (and in any case, may be subject to lobbying to minimise business costs). This problem might be overcome by trial and error (which may disrupt investment plans) or by establishing a progressive scale of charges, to be increased over time. Second, where prices are relatively inelastic due to limited input substitutability, costs may simply be transferred to final consumers with no consequential environmental benefit. Alternatively, the size of the tax or charge would need to be very large and thus undermine the cost-effectiveness of the instrument. Third, firms may not respond rationally to price signals. Where taxes or charges represent only a small proportion of outlays, costs might simply be ignored or not noticed. And fourth, taxes and charges may be perceived as legitimating or condoning environmentally harmful behaviour. The notion that the state will allow pollution at a price, strikes some members of the

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6 For example, the consumption of petrol for private motor vehicle use is very price inelastic: because of the unavailability of alternative fuels, the price of petrol would need to be very high before consumers would substantially change their driving behaviour
community as an inferior regulatory strategy to one which condemns environmentally deleterious activity outright.

For these reasons, it is important that there be a careful matching between the environmental context and the attributes of the particular environmental instrument to be invoked, and that they be targeted to circumstances where their strengths are likely to outweigh their weaknesses. Given the gap that sometimes exists between how such instruments work in theory and in practice, it would also be judicious to implement them on a trial basis in circumstances where the results can be carefully monitored.

**Recommendation 14:**

*That government trial the use of taxes, charges and tradeable permits, with any revenue gained hypothecated to support further cleaner production activities.*

**(iii) supply side incentives**

As one component of a broader strategy to promote investment in clean technologies and practices, supply side incentives can be an effective policy measure. Supply side incentives refer to direct or indirect payments, including tax concessions and subsidies, conditional upon desired conduct. For example, they include: tax concessions for the purchase of cleaner production technology; tax deductions for the expenses of environmentally responsible activity, such as mine site remediation; and lower tax rates on preferred products or materials, such as energy efficient cars or unleaded petrol. The OECD (1995b) Technology Environment Programme found that "natural technological evolution occurring in industry has not forced environmentally-protective technologies to be designed or employed. Governments will need to promote cleaner production and products."

Research data indicates a strong correlation between the level of supply side incentives and the uptake of clean technologies. In recent years, such approaches have become increasingly sophisticated. For example, the Netherlands has an accelerated depreciation program for specific clean technologies, and Costa Rica now runs a transferable reforestation tax credit scheme under which landholders receive a tax credit for keeping their land forested or for returning land to native species cover.

It terms of the potential shortcomings of supply side incentives, it may be argued that they contravene the polluter pays principle and are a drain on public revenue. Treasury often opposes such incentives because of the difficulties in classifying products and practices which might attract the subsidy, and because they have the potential to lock in current technologies at the expense of as yet unknown alternative solutions. Nevertheless...
international experience suggests that supply side incentives can be an effective spur to cleaner production investment.

**Recommendation 15:**

That the Commonwealth Government trial the introduction of accelerated depreciation arrangements for specific clean technologies.

**(iv) support for research and development**

Government research and development policies can compensate for the inability of the market to encourage the development of cleaner technology. For example, the Japanese New Sunshine Project supports research into cleaner technologies to reduce greenhouse gas emission, and in the United States, initiatives include the Waste Reduction Innovative Technology Assessment Program, a cooperative agreement with six states to study waste reduction technologies having industry wide application, and the Waste Reduction Assessments Program designed to promote industrial waste reduction assessments.

Government support for research and development should be designed to offset the costs and risks associated with the development phase of new technologies, where the chances of technical failure are high, and the market alone is unlikely to provide sufficient resources.

**Recommendation 16:**

That Commonwealth Government promote the use of innovative technology for cleaner production through a combination of tax incentives for research and development, and through itself directly sponsoring such research and development in circumstances where the market is unlikely to provide it.
The role of third parties

Third parties are of broadly two types: commercial and non-commercial. The role of commercial parties as *de facto* regulators and as instruments of informal social control capable of shaping future environmental outcomes has been largely neglected in the literature. In this section, the potential contribution of these interests in determining the cleaner production performance of industry is explored. The focus is on significant third-party non-governmental (in terms of direct government intervention) resources which can expand and strengthen the suite of measures designed to bring about the widespread adoption of cleaner production. We deal with this under four headings: (i) supply chain pressure; (ii) government procurement policies; (iii) financial institutions; and (iv) green consumers.

In contrast, non-commercial third parties can make very different, but equally important contributions to cleaner production. In most developed countries, community and environmental groups have become influential participants in the environmental arena. They have been instrumental in placing environmental issues high on the public agenda, and in keeping them there. A significant proportion of environmentally beneficial activity by government and industry only occurs because of the vigilance and the pressure exercised by community groups.

In relation to cleaner production, there are at least two opportunities for the community and community groups to encourage an improved industry performance. First, the community can be a powerful motivator for firms to enhance their public image. Second, community representatives may directly engage industry in a partnership role. Both of these functions are addressed below when we examine good neighbour agreements (section (v)) and community right to know (section (vi)).

(i) supply chain pressure

Firms, driven by their own internal priorities, or mindful of their customers' preferences and corporate image, commonly affect each others' behaviour. Purchasers often have leverage over suppliers which they may use to influence the latter's environmental performance. The interchange between industrial buyers and suppliers also generates incentives to innovate and to respond to market demands.

There are several ways in which government may enhance the quasi regulatory function of buyer-supplier commercial third parties. For example, government could require accredited environmental management systems to include provisions that explicitly address buyer-supplier relationships - only those firms that complied would be granted regulatory concessions and flexibility (see below, under the role of regulation). Government-sponsored
"green" award schemes could also recognise the contribution of upstream suppliers and downstream buyers. Corporate environmental reporting is another avenue where product stewardship could be encouraged through, for example, official government recognition of suitably comprehensive reporting systems. Economic instruments are also a potentially potent tool for sensitising buyer-supplier relationships to environmental factors. By taxing environmental undesirables, a price signal will filter through the entire downstream myriad of buyer-supplier relationships.

A central feature of any policy to encourage supply chain pressure should be the formation of cleaner production "partnerships" whereby larger firms assist their smaller vendors to achieve environmental goals. Such assistance could take the form of environmental management expertise, quality control, product design, advice on clean technologies or regulatory compliance audits. The objective of the partnerships would be to deliver mutually beneficial outcomes: smaller firms gain expertise to improve their environmentally performance in way that reduces compliance costs and improves productivity and larger firms gain a more reliable, cleaner and efficient supplier.

**Recommendation 17:**

(i) that government facilitate and reward creative supply-chain pressure and product stewardship by:

- including provisions requiring a commitment to these goals as a condition of regulatory flexibility (see below);
- by making this a condition in government procurement contracts;
- by including such activity in accredited corporate environmental reports;
- by recognising such activity in "green" award schemes; and

(ii) that government encourage larger firms to form cleaner production partnerships with smaller buyers and suppliers and provide public recognition to those who do so.

(ii) *government procurement policies*

Government can directly influence manufacturers through its purchasing power. In this way, government adopts the role of a commercial third party, as opposed to a regulator. In many markets, government is in fact the dominant purchaser. For example, government procurement of office equipment and motor vehicles far exceeds that of any other single...
purchaser. Government may therefore provide a leadership role in dictating market preferences for products by developing and implementing a green purchasing policy. For example, governments could support cleaner production by requiring government agencies to select the items "having the highest percentage of recovered materials practicable ... consistent with maintaining a satisfactory standard of competition" (RCRA 6002 (c) (I) USA). The Clinton Administration’s acquisition of energy efficient computers is an example of this approach.

In Australia, some initial steps were taken to implement a cleaner production purchasing policy through the development of environmental purchasing guidelines by the Commonwealth Department of Administrative Services in the early 1990s. However, the recommendations of its report have not been implemented. There remains significant opportunity for governments, both Federal and State, to utilise their considerable purchasing power as proposed above. As one industry representative stated: "If the governments are not committed to the philosophies they espouse, there is no way that they can insist on corporate leadership, corporate stewardship, corporate nurturing of linked suppliers ... there is little wonder that industry looks on the programs with scepticism. Government leadership in its purchasing policies would be a major step forward".

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<td>That Government promote cleaner production by giving preference to firms and products meeting cleaner production objectives, under government procurement policies.</td>
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(iii) financial institutions

As indicated earlier, financial intermediaries such as banks and insurance firms could potentially play an important role in supporting the introduction of cleaner production by firms. They may also fulfil monitoring functions reinforced by sanctions, in a manner which can often be more effective than government regulation. Financial markets too, can play an important role in rewarding those firms who demonstrate a commitment to cleaner production.

However, financial markets, and financial intermediaries can only play these roles if they have sufficient information (based on accurate indicators of environmental performance) to enable them to take environmental performance into account when determining a firm’s financial worth, or whether to grant it a loan, or a differential insurance premium. For example, in the United States, it was only once financial markets had access to reasonably accurate indicators of environmental performance (in the form of the government mandated
Toxic Release Inventory) that the environmental record of individual firms began to be reflected in their stock price.

**Recommendation 19:**

That government provide the necessary information to leverage financial institutions to support the introduction of cleaner production *(see also recommendations 4, 5 and 6 above on information)*.

**(iv) green consumers**

Undoubtedly, there is considerable untapped potential for green consumers to influence industry to provide environmentally sound products. However, opinion is divided as to whether consumers will pay a significant premium for greener products. Opinion is also divided as to whether government can play an effective role in encouraging consumers to exert green preferences. Experience with the Commonwealth Government’s abandoned eco-labelling scheme suggests that the complexities inherent in classifying the environmental performance of a particular product over a range of criteria, and across its entire life-cycle, can be overwhelming and very expensive. On the other hand, simplified labelling schemes such as the energy stars and water conservation labels for whitegoods have proved to be popular with consumers. In NSW, some electricity suppliers/distributors are providing consumers with the option of purchasing energy produced from renewable sources, for a premium.

An alternative to the labelling of product environmental performance, is to focus on the production process. For example, organically farmed produce has to meet specific production performance standards. It may be possible to extend this concept more broadly to cleaner production in industry. Government could sponsor a cleaner production label linked to performance indicators inherent in other policy measures (see, for example, two track regulation and voluntary agreements below).

**Recommendation 20:**

(i) that government extend the application of simplified product environmental performance labelling to a wider range of goods and services; and

(ii) that government trial the introduction of a cleaner production process label.

**(v) good neighbour agreements**
"Good neighbour agreements" between chemical firms and local residents are common in Europe and the United States. They feature means by which concerned citizens have access to information relating to regulatory compliance, and the right to inspect facilities and to review compliance and accident plans. For example, under the United States EPA's Project XL, community organisations and other local stakeholders have the opportunity to shape and vet a firm's environmental management strategy. With community support, the strategy becomes a legally enforceable contract.

In Australia, the Victorian EPA has pioneered the use of good neighbour agreements. Approximately 41 industry and community liaison committees have been established, resulting in approximately 20 completed Environment Improvement Plans (EIPs). EIPs are a public commitment by a firm to improve its environmental performance and have the signed endorsement of senior executives, local government, community representatives and the Victorian EPA. Where possible, EIPs contain details of planned improvements, specific timetables, and make provision for ongoing monitoring.

In Japan, citizen interaction with industry is facilitated by what are termed "pollution control agreements". These instruments contain detailed terms and conditions for management of the enterprise, including emission levels, and provisions for monitoring and reporting, and involve a type of contract between management of an enterprise on the one hand, and local government or citizens' group on the other.

Good neighbour agreements can provide firms with a strong incentive to engage in cleaner production activities. However, they are only likely to be appropriate for larger firms with a reasonably high community profile.

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<th>Recommendation 21:</th>
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<td>That government facilitate the formation of good neighbour agreements between larger firms and local communities through innovative regulation (see below) and industry partnerships.</td>
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**(vi) Community Right to Know**

Community Right to Know (CRTK) legislation is intended to inform the community of the environmental impact of a firm's activities and of a firm's pollution prevention activities. The benefits of this type of mandated disclosure of information are readily apparent from the
United States experience. These include: its capacity to stimulate pollution prevention by sensitising firms to community pressure; improving the quality of public policy debate; and lessening the need for environmental regulation via industry commitments to verifiable reduction targets. No executive likes to see their firm exposed publicly at the bottom of the performance rankings. Resulting managerial exhortation is likely to have greater impact than any fixed standard which regulatory authorities might be inclined to impose. When pollution performance information is published, this in turn can inform markets, including peers, regulators or NGOs which may be in a position to foster compliance. Overall, such legislation can and does provide substantial benefits to government, the community and responsible firms.

The most potent form of CRTK legislation is a pollutant inventory, whose basic function is to document the release or transfer of selected chemical pollutants to all media as a basis for developing and monitoring the effectiveness of pollution prevention measures or programs. In the United States, this strategy, as embodied in the Toxic Release Inventory, has been hailed by the former administrator of the EPA, William Reilly (1990), as "one of the most effective instruments available" for reducing toxic emissions. In Australia, the Commonwealth Government has indicated its intention to introduce a similar inventory and considerable work has already gone into its proposed design. However, cleaner production has not necessarily been a principal concern in that design.

**Recommendation 22:**

That specific attention be given, in the design of the proposed National Pollutant Inventory, to ensuring it has the capacity to reveal information relating specifically to firms' performance in achieving cleaner production.
The role of industry

Industry cooperation is essential to the widespread adoption of cleaner production. Apart from being the recipient of government regulation and other policy measures, industry can actively participate in the process. Several of the policy recommendations in this report depend on industry support, for example corporate environmental reporting and supply chain pressure (see above). In addition to such measures, industry may undertake voluntary cleaner production initiatives facilitated through formal, but not legally binding, partnerships with government. A further potential industry measure is the creation of codes of practice.

(i) cleaner production partnerships

At a general level, this category embraces voluntary agreements between governments and individual firms taking the form of "non-mandatory contracts between equal partners, one of which is government, in which incentives for action arise from mutual interests rather than from sanctions" (OECD 1994c). However, the variety of such agreements makes precise classification difficult.

Within the areas of energy efficiency and pollution control, two of the most notable partnership agreements between government and industry are the United States EPA’s 33/50 and Green Lights programs. Under 33/50, firms are encouraged to reduce the release of toxic chemicals through positive public recognition. Industry participation is completely voluntary and commitments are not enforceable by law. Instead, the program relies on cooperation between industry and the EPA, and subsequent positive public recognition of environmental achievements. Participating firms are required to develop detailed action plans, but can adapt them to target the least costly abatement measures.

An initial evaluation reveals that the 33/50 Program has significantly reduced toxic chemical releases from participating firms. The Green Lights Program (whereby firms agree in writing to install energy efficient lighting) has also claimed some success. The program signed up five per cent of all commercial office space in less than three years. Average investment returns are estimated at between 20 and 40 per cent. A new initiative in the United States, called the Pollution Prevention Pilot Project (4P), is also providing some encouraging results (see Box 18).

Box 18

Partnerships in action - the 4P program.

The pollution prevention pilot project is a unique partnership in the United States led by a core group of experts from the Natural Resources Defense Council, Amoco Petroleum, the
Dow Chemical Company, Monsanto, Rayonier, and the New Jersey Department of Environmental Protection. With a shared industry-environmentalist perspective, the group has begun to identify opportunities to cut production and environmental costs while reducing and preventing pollution at two chemical manufacturing facilities. Through site-specific work, the group is exploring what internal, external, or regulatory barriers may have kept the plants involved from already practising cost-saving pollution prevention.

Early evaluations reveal that significant environmental improvements could be achieved at the time as generating substantial cost savings by looking for creative ways to address environmental issues. The 4P initiative demonstrates that industry, government and the environmental community can work together for success - towards enhanced environmental improvements, policy reform and economic savings. It also highlights the value of collective as opposed to unilateral efforts.


The PRISMA project in the Netherlands, designed to promote environmental management, which is also a collaborative venture between government and industry, has demonstrated a high coincidence between environmental and productivity improvements. In Australia, the Commonwealth Government’s Greenhouse Challenge program, whilst still in the relatively early stages of its implementation, has formalised a series of agreements with firms to voluntarily reduce their greenhouse gas emissions. The Victorian EPA, in conjunction with the Australian Chamber of Manufactures, has introduced the Cleaner Production Partnership Program. This program makes available to SMEs funding and other forms of assistance to deliver rapid reductions in industrial waste and to encourage the implementation of cleaner production initiatives. The Australian Centre for Cleaner Production participates in the program by disseminating the results and experience.

Industry partnerships work better in some circumstances than others. Their greatest strength is where firms perceive their self-interest as being linked to cleaner production. Critics may point out that in such circumstances, the economic self-interest alone should be sufficient motivation. Yet in these circumstances firms may have difficulty in doing so voluntarily, particularly if the benefits of doing so cannot be demonstrated in the short term. For example, the benefits of introducing an environmental management system are almost always medium to long term, making it more difficult for firms to justify the introduction of such measures. Moreover, even when it might appear economically rational for a firm to invest in cleaner production it will not necessarily do so. There is considerable evidence that firms behave with far less rationality than mainstream economic theory would have us believe. In practice, some firms may simply not realise the benefits to be gained from improved environmental
performance, others may prove to be incompetent or irrational. Cleaner production partnerships can assist firms to take advantage of unexploited opportunities for cleaner production.

Unfortunately, in some circumstances, there is a considerable gap between the public interest in environmental protection and the private interests of individual businesses. This is not to suggest that industry partnerships have no role in these circumstances, but rather that they need to be underpinned by some form of government regulation. Examples of relatively tight controls over voluntary agreements are those in Denmark and the Netherlands where every participating firm is required to set out a detailed plan for reducing emissions, incorporating the likely effects of introducing best practice, improving technologies and speculative technologies as these are developed. Should voluntary undertakings not be honoured, there is a clear understanding that the alternative will be conventional regulation.

Industry partnerships often lack credibility with the community, and with environmental groups in particular, because of the suspicion that they will be cosmetic only, and used as an excuse by government for reducing levels of environmental protection. Such fears can be addressed by: (i) involving the community in the initial development process; (ii) clearly monitoring the results; and (iii) requiring firms that do not achieve results "beyond compliance" to meet the regulatory standards which are imposed upon non-participating firms. Most such partnerships are best negotiated on a sector-specific basis, given the context-specific nature of many environmental problems and their cleaner production solutions.

Suitably designed, and in combination with government intervention where necessary, industry partnerships have considerable attractions: "they avoid adversarial relations; involve businesses or other groups in political processes; improve compliance because rules rest on consensus rather than on coercion; and permit, through negotiation, the development of instruments better adapted to economic and competitive contexts" (OECD 1994c).

Recommendation 23:

That government pilot a series of negotiated sector-specific partnerships, designed to exploit cost-effective opportunities for cleaner production.

(ii) codes of practice

In recent years, a number of environment related codes of practice have been established. These include Responsible Care, ISO 14001, the Coalition for Environmentally Responsible Economies principles and the International Chamber of Commerce's Business Charter for Sustainable Development. All these codes "attempt to foster long-term changes in the ways
firms think about the environment and how they integrate environmental aims with other business objectives" (Nash & Ehrenfeld 1996: 16). They also have at their core a requirement to adopt environmental management systems and to audit their progress towards self-set environmental goals. Several codes include representatives of the community, government and peer firms to verify the results achieved. There is no reason in principle why other codes should not be developed, aimed more specifically at cleaner production.

In principle, industry-based codes of practice offer greater speed, flexibility, sensitivity to market circumstances, efficiency, and less government intervention than command and control regulation. Because standard setting and identification of breaches are the responsibility of practitioners, with detailed knowledge of the industry, this will arguably lead to more practicable standards, more effectively policed. There is also the potential for utilising peer pressure and for successfully internalising responsibility for compliance. Moreover, because such codes contemplate ethical standards of conduct which extend beyond the letter of the law, they may significantly raise standards of behaviour and lead to a greater integration of environmental issues into the management process.

Yet some forms of self-regulation, in isolation, such as voluntary codes have often failed to fulfil their theoretical promise, and are mistrusted by many community and environmental groups. As John Braithwaite (1993:91) has put it: "Self-regulation is frequently an attempt to deceive the public into believing in the responsibility of a irresponsible industry. Sometimes it is a strategy to give the government an excuse for not doing its job". According to the critics, self-regulatory standards are usually weak, enforcement is ineffective and punishment is secret and mild. Moreover, self-regulation commonly lacks many of the virtues of conventional state regulation, "in terms of visibility, credibility, accountability, compulsory application to all, greater likelihood of rigorous standards being developed, cost spreading, and availability of a range of sanctions" (Aalders 1993: 75).

Yet through careful design, it may be possible to take advantage of the considerable benefits which voluntary codes potentially offer, while compensating for, or overcoming their deficiencies by complementing them with other policy instruments. Voluntary codes may have their best chance of success when activated by external institutions. Government may directly engage in the self-regulatory process by jointly negotiating targets and strategies, and providing, if necessary, external verification and/or ratification. In such cases, self-regulation may be more properly termed co-regulation. Often, negotiations at this level will occur through industry associations on a sectoral basis. One benefit may be that firms participating in the design of such hybrid arrangements will be more committed to abiding by them. Experience in the Netherlands indicates that the very act of negotiating co-regulatory agreements provides industry with a greater insight into better environmental management.
Governments can also sustain self-regulatory systems by imposing sanctions on the recalcitrant few, who may lie beyond the reach of an industry association, or who may seek a free ride on the sacrifices others. There is considerable evidence, from a variety of jurisdictions, that it is largely fear of government regulation that drives the large majority of self-regulatory initiatives, and it seems unlikely that they will perform well in the absence of continuing government oversight and the threat of direct intervention in the event of self-regulatory failure. In addition, third parties are also able to contribute to the effective functioning of codes of practice, by providing a community perspective, by exercising vigilance and by voicing criticism as appropriate. This can move industry to open a dialogue with community groups with the aim of finding mutually beneficial ways to improve environmental performance.

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<th>Recommendation 24:</th>
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<td>That government, in conjunction with selected industry sectors, seek to develop sector-specific codes of practice for implementing cleaner production, and appropriate monitoring and verification mechanisms, and provide publicity and other incentives to firms and sectors which do so.</td>
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The role of regulation

There is considerable evidence that the single most important driver of improved environmental performance is regulation. As a recent British Government report concluded: "actual, planned or threatened environmental legislation ... was the most frequently cited driver of company action" (ENDS 1997). In circumstances where firms confront pressures to maintain liquidity, and there is a pressure for short term profits, regulation may be the most credible and persuasive instrument available to policymakers.

Yet traditional forms of regulation have rarely been geared towards the goal of cleaner production. Rather, they have commonly focused on end-of-pipe solutions and have been largely reactive. However, environmental regulation in Australia is in transition, with a number of statutory reforms in recent years demonstrating a greater awareness of the importance of pollution prevention and of the need for more innovative means of achieving it. We review below the main types of regulation available and the implications of regulatory reform for cleaner production.

The main types of standards used in Australian environmental regulation in the past have been specification standards (also known as technology standards) and performance standards (which set outcomes which must be achieved but not how they might be achieved). In terms of cleaner production, both have their limitations. They do not encourage firms to improve their environmental performance over and beyond the legal limits prescribed, through continuous improvement or industry best practice. Nor do they directly encourage firms to develop a cleaner production culture or to "build in" environmental considerations at every stage of the production process. Certainly for some firms, it may be unrealistic to expect performance much above the legal minima and, for these firms, specification and performance standards (particularly the latter) will continue to play an important role in ensuring that minimum standards are maintained.

However, there are many other firms which could achieve far more than the legal minima (particularly in terms of cleaner production). An important role of law is to encourage them to do so. For these firms, there is considerable potential for developing a new type of standard design: one which is predominantly concerned not with the detailed prescriptions for innumerable day-to-day circumstances, but with the scop to influence attitudes and create a framework for better environmental organisation by industry itself.

As we will see, such an approach (known as "process-based" regulation) not only has considerable flexibility and enables enterprises to devise their own least-cost solutions, but also gives them direct incentives to go "beyond compliance" with the minimum legal standards. Two particular types of process based regulation could contribute substantially to
cleaner production: (i) an environmental management systems approach; and (ii) a pollution prevention/toxic use reduction approach.

(i) integrating regulation and environmental management systems

There is considerable evidence that safety management systems can deliver substantially improved environmental outcomes, and that the best environmental outcomes are delivered by employers who have enterprise safety management systems which are based on the principles of TQM. Translated to environmental arena, TQM based management systems have been used as a means to improve environmental performance and save money by reducing resource use - by doing more with less over a life-cycle. As indicated earlier, they have an important contribution to make in delivering the goals of cleaner production.

However, there are two important constraints upon the use of systems-based approaches. First, they cannot be successfully forced upon those who have no interest in adopting them (conscripts as contrasted with volunteers). Second, they are difficult to adapt to the needs of SMEs. For these reasons (and because not all workplaces are alike and not all employers are similarly motivated) a "one fits all" approach to regulation would be both inefficient and ineffective. From this we conclude that two distinct types of regulation will be necessary: one for those firms which are willing voluntarily to adopt a systems-based approach, and another for those which are not.

This implies the creation of a two-track regulatory system under which firms are offered a choice between a continuation of traditional forms of regulation on the one hand (track one), and the adoption of an environmental management system on the other (track two). The latter will put primary responsibility on industry itself to find optimal means of achieving cleaner production, and will involve a partnership between the agency and the enterprise (and ideally the community too), from which all sides will benefit. Even the former, however, need not involve an adversarial relationship between regulator and regulated, and there is a case for developing a more co-operative and cost-effective approach, even under traditional regulation, for those who are motivated to comply voluntarily (see below).

Three components are essential to the functioning of track two regulation. These are:

(i) Those following this track should have environmental management systems that lead to the pursuit of cleaner production. Among the most important features of such systems are:

- incorporating pollution and waste prevention into core business practices;
- accounting for the total environmental impact of choices throughout the life cycle of products and services:
• improving efficiency;

• considering environmental costs to society in business decisions;

• employing planning processes to illuminate pollution prevention and product stewardship opportunities; and

• striving to improve continuously.

(ii) There should be independent verification both of the functioning of the system and of environmental performance under it, (eg by a third party environmental auditor), with a summary of the audit results (but not the detailed content) available both to the regulator and third parties such as community groups.

(iii) There should be community participation where practicable, enabling a dialogue with local communities concerning goals of cleaner production and means of achieving them. This ensures the credibility and legitimacy of the process and enables third party input.

In Victoria, the Accredited Licensing Scheme already substantially adopts these general principles (though the scheme is not directed to cleaner production as such) and Western Australia is developing a similar, but more comprehensive scheme. Other Australian jurisdictions have not advanced to this stage. For example, the draft New South Wales legislation, which aims to radically revise the environmental regulation of that State, does not take up this option in any form. Even the Victorian scheme has had a very slow start, with very few firms apparently willing to adopt it. The lesson from this is that close attention should be given to ensuring that firms have sufficient incentives (in terms of regulatory flexibility and improved environmental profile) as to be attracted to enlisting in track two regulation.

**Recommendation 25:**

(i) that State Governments be urged to provide regulatory flexibility designed to encourage the use of environmental management systems, based on, but going beyond ISO 14001 ("ISO Plus"); and

(ii) that a template of how a "Two-track" regulatory system might operate, be developed to facilitate this process.

(ii) pollution prevention planning regulation
Such regulation, now increasingly popular in the United States, require firms to prepare a plan that analyses production processes to identify opportunities for reducing the use of regulated pollutants. For example, it may require firms to chart the flow of a chemical through each production unit, assess the cost of existing pollution control method for each production unit and evaluate the technical feasibility and cost effectiveness of cleaner production solutions. It can require the firm to set quantitative reduction goals and to develop a program and goals for achieve them. Given the costs involved in this process, and the technological sophistication needed to deliver results, it is a strategy only suited to large enterprises.

In Australia, the Victorian EPA, under its Waste Minimisation Policy, has made the introduction of Waste Management Plans (WMPs) for industry a condition of various licence amendments and works approval provisions. They may also be required in trade-waste agreements with local water authorities. WMPs entail the completion of a waste assessment, the creation of a waste management team, and the implementation of waste minimisation goals across all waste streams that result in a reduction in production costs.

**Recommendation 26:**

That State Governments consider introducing pollution prevention planning legislation, applicable to firms over a given size, in selected industry sectors.

(iii) **harmonising regulatory systems**

Differences in regulatory systems across State and Territory borders are a constant source of frustration for many firms. Indeed, some industry representatives consider that the lack of harmonisation is a greater drain on firm resources than very high environmental standards. This is because firms gain improvements in efficiency and economies of scale by standardising processes across different facilities, irrespective of their location. Even firms not operating in different jurisdictions may be required to modify their products to meet different market specifications. The harmonisation of regulatory systems would assist firms in diverting limited internal resources towards the pursuit of cleaner production.

**Recommendation 27:**

(i) that State and Territory Governments be urged to harmonise their environmental regulatory systems, with the Commonwealth developing a model of best practice cleaner production regulation that can be adopted throughout Australia; and
(ii) that the Commonwealth Government open a dialogue with the New Zealand Government with the purpose of harmonising environmental regulations as they relate to cleaner production.
Additional measures to address SMEs

SMEs have a number of unique characteristics which may inhibit the adoption of cleaner production. For instance, they often lack the necessary technological sophistication and economies of scale, and have greater difficulty understanding the issues involved in cleaner production. SMEs may also be unaware of their current regulatory requirements. A disproportionate number of such firms are also economically marginal, further imposing pressures for short-term profit and rendering investment in cleaner production less likely. The costs of implementing cleaner production in most cases will be higher than for larger firms. Even where there is a demonstrated financial return from such investments, SMEs may lack the resources and expertise to exploit such opportunities. Accordingly, encouraging and facilitating cleaner production amongst such firms presents a substantial policy challenge.

Government initiatives have already made some progress in addressing the issues of SMEs. However, further strategies will also be necessary, given the serious environmental problems confronting SMEs, and their limited capacity to address these problems. It is important to recognise that the "pressure points" which impact on firm behaviour will substantially differ between small and large firms. For instance, SMEs will tend to have a much lower public profile than larger firms and will therefore be far less susceptible to measures which attempt to harness community pressure. A cleaner production strategy for SMEs will be far more successful if it is tailored to their special characteristics. In particular, the potential commercial benefits of adopting cleaner production should be emphasised: few SMEs can afford the luxury of engaging in practices, which while environmentally beneficial, result in non-recoverable costs.

Many of the recommendations in the previous sections of this report are designed to cater for the needs of SMEs. There are, however, several additional measures that may be employed by governments to specifically target SMEs.

(i) the creation of cleaner production networks

Experience in the United Kingdom indicates that formal industry networks, or cleaner production "clubs", allow information and expertise on the implementation of cleaner production management practices and specific clean technologies to be exchanged between SMEs in the same sector. Such networks could be organised and administered through the relevant industry associations, with the support of government. For example, in the related field of occupational health and safety, the Farmsafe strategy, which was developed by Worksafe Australia, the Department of Primary Industries and Energy and the agriculture industry, created regional farm safety action groups for this purpose. Such strategies may
stimulate awareness, and encourage innovation and a commitment to cleaner production. Specific activities of cleaner production networks should include:

- disseminating information and sharing experiences;
- identifying the primary environmental issues facing that sector and, in particular, their regulatory obligations;
- assessing the availability and applicability of new clean technologies, including an evaluation of upfront costs and potential investment returns (and presenting this information on a readily accessible database);
- identifying markets, and cooperating with other sectors, for the recycling and re-use of waste materials;
- developing sector specific cleaner production management strategies which aim to match world’s best practice, including the provision practical "how to" manuals; and
- engaging expert consultants to identify unexploited opportunities for reducing operating costs and improving environmental performance across the sector.

**Recommendation 28:**

That government trial the establishment of a number of cleaner production networks for SMEs with the support of relevant industry associations.

(ii) environmental inspectorates

There may be opportunities to assist SMEs through the use of environmental inspectorates. A broader "advice" role for environmental inspectorates may include: the provision of cleaner production information; assistance in finding professional help in respect of a particular problem; and technical assistance, for example by developing guidance material collectively where they confront a limited range of control measures. Here, specific strategies will vary greatly between industry sectors.

However, given that inspections are quite rare events, the opportunities for effective advice are limited. As an alternative, it might be valuable for the inspectorate to suggest the use of a consultant to assist the duty holder in resolving a problem, and agree to give them a period of grace in which to do so. Most valuable, may be those approaches which actively encourage duty holders to regulate themselves, and which give them a positive incentive to do so. Particular attention could be given to encouraging environmental self-audits, which, while
far less comprehensive than a full systems-based approach, are nevertheless very valuable in encouraging self-regulation, in alerting enterprises to environmental problems and opportunities, and in prompting corrective action. Some consideration should also be given to whether, and to what extent, systems-based approaches can be modified so as to be relevant to small and medium sized firms (see above).

A further problem concerns the nature of regulation itself. SMEs often struggle with performance-based (ie outcomes-based) regulation, and, lacking resources and expertise to design their own response, often require much more specific guidance on what is required of them than their larger counterparts. One means of providing such guidance, without compromising the flexibility inherent in performance-based standards, is by codes of practice, which might be invoked to provide practical guidance as to how to achieve compliance with general duties and performance standards.

Such codes are more flexible than regulations in that firms are not compelled to follow them, and non-compliance with the actions specified in a code is not in, and of itself, an offence. Rather, the onus is on the responsible party to prove, if challenged, that the action was "as good as" that in the approved code of practice. Thus firms who have the capacity to devise cost-effective and innovative means of achieving (or going beyond) the performance standard, are encouraged to do so while less advanced organisations have the benefit of specific indications as to how to meet the statutory standards.

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<td>That government equip environmental inspectors with a broader range of tools and options with which to provide assistance to SMEs in adopting cleaner production. Particular attention should be given to the roles of environmental audit, simplified management systems more suited to small enterprises, and the use of codes of practice.</td>
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(iii) incentives for environmental audit

A related incentives-based innovation directed specifically at SMEs which often lack the resources, expertise and economies of scale even to satisfy the statutory minima, has been introduced in the United States. It suggests some new ways to promote voluntary compliance in small firms. The scheme involves an agreement signed by the State of Minnesota and the Printing Industry of Minnesota, a state wide trade association, designed to significantly increase the use of environmental audits by printing firms, many of whom are
between firms that have adopted detailed firm environmental compliance and pollution prevention policies and those that take little or no positive initiatives in respect of environmental protection. It seeks "to better differentiate the good from the bad actors by increasing the incentives to voluntarily comply with environmental laws and to pursue pollution prevention initiatives" (Humphrey 1994: 2). By encouraging voluntary compliance, the scheme will enable regulatory resources to be redeployed and refocussed on those who are not responsive to voluntary initiatives.

Under the scheme, the Printing Industry of Minnesota Inc (PIM) established a separate corporation, PIM Environmental Services Corporation, to provide auditing services to PIM members. However, it was also necessary to provide some incentive to firms to engage in such audits. Government regulators were reluctant to provide a total amnesty from prosecution for breach of regulations, simply because a firm had engaged in such an audit, for fear of damaging the integrity of their enforcement program. However, an agreement was reached whereby an auditing firm, which discovers environmental violations and corrects them promptly, will have this fact taken into account when regulators decide whether to initiate any enforcement action, whether an enforcement action should be civil or criminal in nature, and what penalties to impose. Thus "a company which conducts an auditing program in good faith and makes appropriate efforts to achieve environmental compliance is likely to mitigate the consequences of any violations it discovers" (Humphrey 1994: 3).

The PIM audit agreement demonstrates how the use of audit programs might be expanded to thousands of SMEs in other industries that similarly do not have the resources or the motivation to conduct safety health or environmental audits, but who might be given incentives and encouragement to do so. Such a policy might result not only in voluntary initiatives that substantially improved environmental performance, but also in a far more flexible and cost-effective response on the part of participants than is likely to be achieved through traditional "command and control" government regulation.

Recommendation 30:

That government develop a pilot scheme for a program similar to the Printing Industry of Minnesota, to encourage, facilitate and provide incentives for SMEs to engage in environmental audits.

(iv) regulatory punishment and persuasion

Given the problems of short-termism and the lack of resources and incentives which SMEs face in coming into compliance, there will inevitably remain a role for enforcement of regulations as an underpinning and backstop to more creative and positive strategies.
Without such an underpinning there is commonly insufficient incentive for firms to take up more positive and creative strategies. Experience in the related area of occupational health and safety suggest that "a visit [by an inspector] is likely to be relatively effective since small employers are more impressed than are many larger employers by the authority wielded by government inspectors" (Hopkins 1994: 177).

Little attempt has been made in Australia to devise innovative enforcement strategies for dealing with small employees. Yet there is a rich overseas literature which suggests that much more could be done to give them an incentive to address cleaner production issues. For example, there is evidence to suggest that the very fact of an inspector's visit, coupled with some form of enforcement action (eg an "on the spot" fine) may have a significant impact on behaviour, even in circumstances where compliance costs will likely exceed the economic benefits to the employer of compliance. Essentially, this is because such action may serve to refocus employer attention on environmental problems they may previously have ignored or overlooked.

Amongst the main policy implications of the above analysis, is one that suggests that a regulatory agency can achieve a considerable impact by even a limited program of inspections. This is provided it is reinforced by some degree of formal enforcement action sufficient to bring the problem forcibly to the employer's attention even if the latter is not substantial, and even in the absence of full or "wall to wall" inspections. However, formal enforcement should be seen as a last resort. Firms should first be provided with assistance to improve the environmental performance and redeem themselves. Specifically, inspectors could link the provision of other government programs to encourage cleaner production (as above) with the execution of the spot fines, using the latter to underpin and to provide an incentive for firms to take advantage of the former.

**Recommendation 31:**

That regulators trial a system of on-the-spot fines (punishment), backed up by the provision of assistance and advice on opportunities for adopting cleaner production (persuasion), for SMEs.

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8 There is also some evidence that longer inspections have much greater deterrent effect than superficial inspections which check only the plant's injury record. However, it would be dangerous to generalise from this to conclude that shorter inspections generally, are less effective.
**Towards a sector-specific approach**

Some of the factors which both inhibit and drive clearer production are sector-specific. This is because "each industry presents a somewhat different combination of economic, environmental, technical and other factors that will affect the impact and effectiveness of different policies and programs" (US EPA 1994) (see Box 19 below for an example of sector specific factors). Accordingly, there are limits to what can be achieved by "across the board" strategies. Refinements in cleaner production strategies will need to be tailored to individual industry sectors or sub-sectors.

**BOX 19**

**Sector-specific characteristics of the metal finishing industry**

The metal finishing industry includes a variety of processes which are performed by independent "job shops" which tend to be small, with few available resources to address environmental concerns. The industry can be divided into distinct subgroups of firms, based on environmental performance and other characteristics:

1. **Firms which are consistently in compliance with regulatory requirements and are most proactive in making environmental improvements to move beyond baseline compliance.** These firms tend to be more motivated by the anticipated economic payoffs of strategic environmental investments, and maintain that increased flexibility in compliance requirements would promote innovative approaches and willingness to help other firms. Barriers to proactive environmental performance by these firms may include: the presence in the marketplace of firms in the other groups against whom they must compete and a belief that inconsistency among standards and regulatory enforcement requirements between firms and at all levels of government create competitive imbalances within industry and inhibit long-term planning, investment, and beneficial risk-taking.

2. **Firms whose primary environmental objective is to be in compliance with existing regulatory requirements.** These firms are driven by a strong desire to achieve and maintain compliance government environmental requirements although they often lack the motivation and/or resources to improve beyond that level of performance. They may often lack the technical in-house expertise to develop process innovations themselves and are dependent on suppliers for information on developments in plating technology.

3. **Old and outdated firms that are not sufficiently profitable to justify investments in new pollution controls and probably would like to shut down, but cannot do so because of fear of clean-up liability.** These firms may lack capital, information, and shop space to improve.
They do not fear enforcement because they are difficult to track down, and profit by undercutting firms in group 1 and 2.

4. "Renegade" shops that are out of compliance, make no attempt to improve, and escape enforcement attention. While not substantial competitors, these firms pull down the reputation of the industry and compete with the other firms by avoiding the costs of environmental investments.

Key policy options identified for the metal plating industry include:

- the establishment of criteria for defining the environmental performance (and the development of Best Management Practices) of firms in groups 1 and 2, with resulting eligibility for various forms of relief that would lower compliance costs.

- an "amnesty" programme to encourage group 3 firms to come forward by limiting their liability in return for responsible involvement in site cleanup;

- greater enforcement focus on group 4. Agencies could redirect resources by conducting less frequent inspections of responsible firms; and

- the reduction of regulatory and enforcement inconsistencies.


Developing and implementing sector-specific strategies is necessarily a very resource intensive task for government. However, a model (and a methodology) for how such work might proceed, is the Sustainable Industry Project, undertaken by the United States EPA. This project aims to: "develop, test and implement industry-specific policy recommendations that will remove barriers to innovation and promote strategic environmental protection in selected industries. The recommended policies and programs should promote a culture change throughout the industrial sector, among firms of all types and sizes, in the form of long-term corporate commitment to achieve cleaner, cheaper and smarter environmental performance".

Based on the experience of this project, a sector-specific approach will need to:

(i) Identify the relevant characteristics of the specified industry (eg "the economic, institutional, cultural, technical, life-cycle, and regulatory factors that may promote or hinder environmental improvements"). Relevant traits that can promote or hinder environmental
improvements include current economic and technological trends, demographics, and prevailing corporate culture.

(ii) Identify the driver factors and barriers that influence corporate decision-making and environmental performance: "the regulatory, informational, economic, or other factors that provide the greatest incentives (drivers) or impose the most significant obstacles (barriers) to improved environmental performance". These are the primary leverage points in each industry.

(iii) Prioritise these corporate decision-factors. By so doing it is possible to produce a menu of policy options and recommendations that have the greatest potential to promote cleaner production in the targeted industries. It is by linking the options to the key leverage factors in the targeted industry sector that the greatest gains are likely to be made.

(iv) Determine who are the key stakeholders for the targeted industry (e.g., trade associations, EPA, NGOs, local governments etc). This is important not only in terms of gaining input from all concerned, but also in terms of building consensus for industry specific policy options, and in developing workable plans for implementation. The experience is that open-ended dialogue among key stakeholders with different viewpoints has helped sharpen understanding of the true underlying causes of environmental outcomes.

Recommendation 32:
That government establish a small number of pilot studies in order to develop, test and implement cleaner production policies at a sector-specific level.
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