ACKNOWLEDGEMENT

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FOREWORD

In 1989, OECD Ministers called for development of a strengthened environmental programme for the Organisation to respond to new environmental challenges of the 1990s. Ministers singled out "technology and the environment" as a major theme for this effort, and the three-year OECD Technology and Environment Programme was created in 1990.

The focus of the Technology and Environment Programme has been on pollution reduction and prevention resulting from technological innovation in production and products. Four sectors key to economic development and employment were examined: agriculture, energy, transport and manufacturing industries. For each of these sectors, opportunities for transformation toward cleaner technologies were identified. A main focus of the work of the Programme was to consider and assess governmental policies and actions to overcome the barriers to implementation of these opportunities. A series of studies and workshops was carried out under the aegis of the Programme, which was guided by an expert group of Member government delegates. This report describes the results of one of these efforts. It is made available to the public under the responsibility of the Secretary-General of the OECD.

Financial assistance has been identified as an important policy tool by some governments for moving cleaner technology research, development and implementation forward at a faster and more directed pace. Many governments agree that the role of government in bringing about a transformation to cleaner technologies is pivotal for augmenting the supply and creating the demand for cleaner technologies. This report about supply side policies to augment government support for promoting cleaner technologies was prepared by Claudia Fénérol acting as consultant to the Technology and Environment Programme. The report: (1) examines financial assistance mechanisms for promoting the transformation of industry to cleaner technologies; (2) highlights important components for an effective and efficient financial assistance programme, and; (3) lists options and lessons learned for the application and design of programmes which could augment the development and introduction of cleaner technologies.

A list of Technology and Environment Programme documents available to the public can be found at the back of this document along with an order form.

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SUPPLY SIDE POLICIES TO AUGMENT GOVERNMENT SUPPORT FOR PROMOTING CLEANER TECHNOLOGIES

EXECUTIVE SUMMARY

Cleaner technologies enable society to produce goods and services with less energy, materials and wastes per unit of output. Many OECD governments have indicated that a transformation toward cleaner technologies will be important to attain sustainable development. Indeed, a number of OECD Member countries have put into place financial support mechanisms to hasten the development and implementation of cleaner technologies. In 1993, between US $1.5 billion and US $2 billion is likely to be invested by OECD governments for this purpose.

The objective of these investments is to develop and implement cleaner technologies which prevent pollution at the source and reduce the pollution burden while at the same time contributing to economic goals. A key question facing governments is how to attain this objective as efficiently as possible. Government financial support efforts thus seek to invest limited funds to obtain a good return on the investment, i.e., rapid deployment of cleaner technologies which do contribute to sustainable development and which would not have been implemented as quickly or effectively in the absence of government support.

Managers of government support programmes for cleaner technology are aware that technological development occurs in four phases: 1) formulation of the basic concept; 2) development and demonstration; 3) proof that full-scale implementation is feasible; and 4) diffusion and practical adaptation into economic endeavours. Each phase involves a different set of technical and financial risks; for example, technical risks are high in early phases, but financial risks can be very great in phases three and four. What financial support mechanisms to use, how to apply them and at which phase(s) of the technological development cycle to intervene, are key issues for government investors in cleaner technologies. Moreover, government investors are seeking more objective and consistent ways to evaluate the effectiveness of investments.

For this study, extensive interviews were conducted in several OECD Member countries with key representatives of government, industry, academia, research institutions and business and non-governmental associations, concerning the role of financial assistance instruments. After assessment of the results of these investigations, a workshop was held at OECD on 29 - 30 June 1993. Based on workshop outcomes, project interviews and supplementary written materials, this report: (1) examines financial assistance mechanisms for promoting the transformation of industry to cleaner technologies; (2) highlights important components for an effective and efficient financial assistance programme; and (3) lists options and lessons learned for the application and design of programmes which could augment the supply of cleaner technologies.

Information from eight Member countries shows that around US $350 million is being channelled directly into financial assistance programmes to promote cleaner technologies, and estimates for the OECD region exceed US $1.5 billion of investment. The majority of funds are used to offset costs and risks associated with the development/demonstration phase. This phase is where costs and risks are more significant and chances for technical failure much higher. Funds are also being used to support the practical implementation phase as well.
Study findings and results from the workshop indicate that financial assistance can play a positive role in promoting and stimulating the supply of cleaner technologies. Listed below is a summary of these findings.

- Financial supports should be viewed as one part of a larger approach to promote cleaner technologies and expand the role of pollution prevention within environmental policy.

- All Member countries visited, and those represented at the workshop, have some kind of financial incentive programme to promote cleaner technologies. Indeed, there has been a significant increase in funding and the number of available programmes over the past three years.

- Most countries are using the project grant mechanisms or favourable interest rate loans. Projects are selected for funding on a case-by-case basis. Awards, royalty option grants and loans, stock or equity option loans, or loans for specific purposes (for example, to facilitate obtaining of patents) are not typically used.

- Government programmes support research and development (R and D) and the demonstration of cleaner technology projects. There is a trend away from basic R and D toward support for the demonstration phase for cleaner technologies due to the increased financial and technical risk during this phase.

- Phases of the innovation process; conception, development/implementation, demonstration and diffusion of cleaner technologies, tend to require different types and amounts of financial support, depending on the risk of the technology (both technical and financial), and the number and type of parties involved in the innovation (e.g., firms, research institutes, universities, etc.).

- Projects which have relatively high risks associated with their development, demonstration, and implementation are likely to be rejected (especially in the demonstration and full scale pilot phase) for financing or capital by private investors such as banks, venture capital and private investment firms. The scarcity of risk capital is well known in the private sector. Therefore, governments may need to take a stronger role to support the development and deployment of cleaner technologies.

- The diffusion of technical information is an essential element for a technological transformation and can be viewed as an important means to complement and extend the effectiveness of government financial support efforts.

- Countries are attempting to evaluate the effectiveness and efficiency of financial support programmes. It is not clear at this stage exactly how effective or efficient these programmes are. However, it appears that programmes can probably be fine-tuned and adjusted so as to be more effective and efficient for promoting cleaner technologies.

- Cleaner production and cleaner products require differing amounts and types of stimuli to encourage motivation, innovation and diffusion activities. Creation of clear and strong demand for cleaner technologies by government actions is likely to lead to an accelerated pace for the development and diffusion of cleaner technologies.

Government financial assistance programmes should place strong emphasis on project selection methods and on the contents of an applicant’s business plan. These two principal features seem to help investors in judging the quality and potential of a candidate technology. The project selection criteria,
found in Box V of the paper, contain information which might help to guide government fund administrators in judging the merit of a project proposal.

The completeness and accuracy of a business plan is a crucial element for assessing project proposals. Annex III contains a business plan outline which applicants for government financial support might follow when preparing a project proposal. (Business plan evaluation guidelines have also been included in this document.) These guidelines can assist government administrators in making a determination on the project’s potential for success and the capability of the applicant to carry out the work. Once the plan is in place, both parties can review and evaluate it on a periodic basis to ensure that work is proceeding according to the agreement.

A major concern of government fund administrators was difficulty in measuring objectively the success of the financial assistance programme. Our investigations enable us to suggest an evaluation scheme (included in Box II) and a list of performance indicators. Both of these tools may be useful to build stronger capabilities for measuring programme success and effectiveness.

Findings also imply that wider use of alternative funding mechanisms could enhance the effectiveness of financial supports. Governments seem to select and continue to use only one or two types of instruments, usually the grant or favourable interest loan mechanisms. Perhaps the use of different mechanisms may be more efficient and effective for promoting cleaner technology innovation. Depending on the applicant, e.g., small- and medium-sized business, or phase of the innovation process, a wide variety of mechanisms and funding levels may improve the effectiveness of a programme.

Given the multiplicity of approaches already established by governments for promoting cleaner technologies, governments may wish to consider bringing their national support efforts together under one centralised "umbrella" organisation. Consolidating and centralising programmes to operate under one inter-active framework could enhance the positive effects of currently operating programmes. One central office could coordinate national government efforts to provide support aimed at increasing the development and implementation of cleaner technologies. Education, outreach, training, technology forecasting and planning activities could all be candidates for support from this central office. Industry, academia, research institutes and non-government organisations could be mobilised to cooperate and collaborate with the central office.

Supply-side policies need to be part of a larger, systematic, approach to promoting technological transformation to cleaner processes and products. Current efforts in promoting cleaner technologies show that government efforts focus almost exclusively on cleaner technology supply side policies and activities. Government managers consider the use of financial and technical support to have a positive effect in promoting the quantity of cleaner technologies being developed and deployed. However, without the market demanding these technologies, supplies of cleaner technologies can be produced, but their implementation and diffusion may be thwarted. Thus, the logical next step for governments interested in transforming to cleaner technologies and products would seem to be to develop complementary proposals and policy options for creating a strong demand for their implementation.
Part 1

INTRODUCTION

A. Background

In June 1989, OECD Ministers of Environment indicated that OECD would examine incentives and barriers to the innovation and diffusion of environmental technologies, and otherwise pursue measures to promote cost-effective "cleaner" (pollution-preventing) technologies designed to conserve raw materials and energy and reduce wastes and emissions in industrial operations. Accordingly, the OECD Council created a three-year Technology and Environment Programme. Objectives for this Programme were: (1) to raise awareness and increase emphasis about needs and opportunities for transforming to cleaner technologies as a basis for economic development; (2) to identify ways and means for national governments to promote and support this transformation; and (3) to understand the roles of those who collectively determine the types and rate of technology innovation and diffusion. Emphasis was placed upon "cleaner" technologies which are process or product changes leading to pollution reduction and/or prevention.

Work under the formal three-year Technology and Environment Programme has recently been completed. However, the role of financial assistance for promoting cleaner technologies was one area needing further exploration. Financial assistance has been identified as an important policy tool by some governments for moving cleaner technology research, development and implementation forward at a faster and more directed pace. Many governments agree that the role of government in bringing about a transformation to cleaner technologies is pivotal for augmenting the supply and creating the demand for cleaner technologies.

As part of the effort to stimulate a transformation to cleaner technologies, governments are creating and implementing programmes which not only enhance the supply of technologies, but also expand willingness and capacity for industry to do so. Furthering such efforts by providing strong and clear priorities and goals for cleaner technology can be a first step for attention and action. Complementing this with rewards and positive incentives can then accelerate the speed of transformation from current technology to that which is more environmentally "benign".

B. Scope

The Workshop on the "Role of Government Assistance for Promoting Cleaner Production and Cleaner Products", held on 29 - 30 June 1993, enabled representatives of Member countries to discuss issues and lessons learned concerning the role of financial assistance instruments for promoting cleaner technologies. This document describes current activities in Member countries, and emphasizes what types of programmes are in operation and how effective and efficient they are in increasing the supply of cleaner technologies.

Information for this report was based on published data, the background paper for the workshop, the workshop itself and supplementary information directly obtained from Member country visits\(^1\). Participants in this work included members of government, the private sector (mostly manufacturing and industry), academia, research institutions and business, trade and environmental associations. Descriptions of individual country programmes, types of financial instruments in use and budgets for each scheme can be found in Annex II.

\(^1\) Denmark, Finland, France, Germany, Japan, Netherlands, Norway, Sweden and the United Kingdom.
C. Summary of Workshop Outcomes

The workshop had two basic objectives: (1) to review the results of the study; and (2) to discuss topics for enhancing the effectiveness and efficiency of financial assistance programmes. In addition we sought guidance and recommendations on approaches for the contents of this document and the current status of government assistance programmes for promoting cleaner technologies. Boxes I and II contain a summary of workshop outcomes. A more detailed summary can be found in Annex I.

The workshop outcomes characterise the extent to which financial incentives are being used, and their practicality for promoting and stimulating cleaner production and products. Discussions centred on factors for governments to consider when setting up a financial assistance programme as well as ways to augment the efficiency and effectiveness of programmes currently in operation. These points are highlighted and discussed throughout this document.

---

**Box I**

**Summary of Workshop Outcomes**

Key discussions during the Workshop centred on: the status of current operating financial assistance programmes; the collective experiences of Member countries; how financial instruments fit into the transformation to cleaner technologies; and the chief issues governments are facing in promoting the supply of cleaner technology.

Three major issues were raised at the Workshop:

1. Financial assistance instruments play one part in a broader system to transform industry to cleaner technologies.

2. Uncertainty exists as to how to measure success of a financial assistance programme. *(Box II on the following page contains a programme evaluation guide which may be useful to governments for measuring success.)*

3. There is a need for a strong market demand for cleaner technologies. This needs to be woven into a long-term strategy that directs future development and deployment of cleaner technologies.
Box II

Workshop Outcomes - Financial Support Programme Evaluation

A. Objectives, strategy, policies and values

• Has activity been compatible with government’s current strategy and long-range plan?
• Has the programme been consistent with government’s attitude toward innovation and cleaner technology?
• Were technologies developed consistent with sustainable development goals?

B. Research and development criteria

• Have projects been consistent with government’s R and D directions?
• What has been the rate of technical success?
• What were the average development time and costs for projects?
• Were future product developments or future applications of the new technology generated?
• What has been the general effect upon the lot of projects funded?
• Has the R and D been compatible with the total operational system?
• Has diffusion of technologies occurred? To what extent? (local, branch, sector, national, international)

C. Marketing criteria

• Were markets clearly-defined?
• Percentage of technologies that were commercial successes?
• What was the compatibility with existing distribution channels?
• What were estimated launching costs?
• What was the vulnerability to competitive responses?
• What was the compatibility with the existing infrastructure?

D. Financial criteria

• What was the overall research and development cost?
• Demonstration costs?
• Issues or stumbling blocks incurred?
• Average administration costs? Government? Research institute, firm or innovator?
• What was the average manufacturing investment?
• What was the average marketing investment?
• What is the average funding percentage?

E. Miscellaneous

• What are the benefits achieved? (Indicators to measure performance could be useful here)
  - environmental
  - social
• What percentage of products were for cleaner production? Cleaner products?
• If the project failed: What were the reasons why the projects failed?
  - Can reasons be categorized across the project base (management, production, market, technical, etc.)?
• For those projects which failed, were causes evaluated? Any trends or patterns?
• What was the average project life for each phase of the innovation process?
I. Transformation to Cleaner Technologies: Role of Government

A. Definition of cleaner technologies

The definition of "cleaner technologies" means different things to different governments. Some Member countries did not have an explicit cleaner technology programme, but their activities and policy goals seem to implicitly promote and develop cleaner technologies. For the purpose of this paper, cleaner technologies, cleaner production, and cleaner products will refer to: redesign and/or reformulation of products; process modification; changes in plant equipment; raw material substitution; and simple operating changes and good house-keeping processes which contribute to meeting environmental quality objectives [1]. The definition does not include end-of-pipe (EoP) treatment and control technology, but focuses on technologies which prevent or eliminate pollution at the source.

B. Objectives of cleaner technology

The basic objectives of cleaner technology policies are: (1) to help effect a transformation to an environmentally sound, technology-based world; (2) to conserve and utilize raw materials and energy more effectively and efficiently; and (3) to encourage and stimulate efforts of both industry and government to integrate policies and initiatives for industrial development, consumer and worker safety, environmental quality and equity among citizens and firms [2].

C. Barriers to the transformation to cleaner technologies

An important step toward transformation to cleaner technologies is to identify and remove barriers. Several barriers were identified concerning development and introduction of cleaner production and cleaner products which must be removed for the changeover to take place. These barriers also affect the use of financial support for augmenting the supply of cleaner technology. Box III contains items mentioned by participants at the workshop and those who were interviewed as part of the study. There is no specific ranking to this list. Each barrier affected a Member country in a different way, thus priority ranking at this time was not possible. However, a list of antidotes to some of the barriers listed, provided at the workshop by the Dutch government, can be found in Annex VI.

D. System for transformation

In terms of overall policy to spur a technological transformation, there are both reactive and proactive policies and initiatives which governments might pursue, depending upon the nature of existing barriers, incentives or disincentives. Reactive policies concentrate on ensuring that environmentally unsound technologies are not actively deployed, transferred or diffused. Proactive policies are those which encourage and promote the supply of technologies which are environmentally sound or "cleaner" than their predecessors [2]. The latter might be pursued through the use of financial incentives that influence innovation and new technological "niches" as well as the diffusion of cleaner technologies.

Establishing concrete methods for promoting cleaner production and products requires analysis and clarification about how to combine environmental objectives, social and economic systems, and technical development to attain effective solutions. It is important to create and employ specific tools to encourage technological development and diffusion, as well as to align of government policies in such areas as environmental standards, pollution reduction requirements and government purchasing.
Still, attaining the goals for cleaner technologies places considerable demands on financial resources (this is especially true for the demonstration and installation stages). Therefore, cushioning this cost by providing financial assistance has been a course of action taken by governments throughout most of the OECD region for promoting research and development in a broad range of fields. The government role in many areas has been greatly extended over the past few years to promote cleaner technologies.

Economic theory suggests that the market, if left alone, will produce relatively little research and development because the technological spillover to other companies and society does not present direct profits to the inventor. Cleaner technology has two basic spin-offs from its development: (1) improved technology where firms and consumers can profit; and (2) an environment which has less pollution and/or lower consumption of energy and raw materials. Hence, economic theory implies that government
intervention to promote technology can be useful in stimulating technological change, especially in areas such as safety and the environment.

II. Financial Support Instruments to Promote Cleaner Technologies

For the purpose of this study, financial support instruments or **subsidies** are defined as the various types of financial mechanisms which act as an incentive for polluters to alter their behaviour or to accelerate the conception, development, deployment and diffusion of technologies which are relatively cleaner than their predecessors. Since the 1960s, governments around the world have acted to force environmental considerations into the business equation; coupling these activities with various environmental **subsidies** can help to ease the financial effects arising from environmental regulations and encourage the development and use of technologies which are "cleaner".

For industry, expenditures for the improvement of environmental performance are linked to the investment process of the firm. To achieve environmental goals, industry’s investment behaviour needs to be influenced by the use of measures that shift investments towards cleaner technologies. Using financial support to steer private sector investment towards national environmental goals is one way to speed up the development and implementation of cleaner technologies. Such assistance can be instrumental during the transition period to cleaner technologies to help a firm maintain its competitiveness.

Innovation is inherently risky both technically and financially. Governments are seeking to soften this risk by supporting research, development and demonstration efforts directed towards achieving national environmental goals. In the case of cleaner technologies, financial incentives act like catalysts, and they are economically justifiable if their costs are offset by the cumulative environmental and social gains obtained by speeding up developments in innovation and diffusion of environmental technologies[3].

A. Aim of financial support

The aim of financial support is to support projects that firms would not otherwise conduct, but which add value by promoting cleaner production and products to relieve the pollution burden and promote sustainable development. Use of financial incentives could be most effective when focused on stimulating the supply of technology where a cleaner substitute is not available. For those technologies where a cleaner substitute is available, efforts could concentrate more on diffusion. Several options are presented throughout this report which might allow governments to enrich and expand the quality of their programmes.

B. Financial support instruments for promoting the supply of cleaner technologies

The most commonly used financial assistance instruments can be found in Box IV. More detailed descriptions of each instrument are located in Annex V. As a reference, Table 1 (on the following page) summarizes the financial assistance instruments used in Member Countries for promoting cleaner production and products. (Summaries of Member country programmes can be found in Annex II.)
Box IV

List of Financial Support Instruments

General

• Tax deduction for R and D expenses.
• Tax deduction for the purchase of equipment or specified capital expenditure.

Selective - Non self-financing

• Project grants.
• Project loans at favourable or subsidised interest rates.
• Conditional project loans: Repaid if project is "successful".
• Loan guarantees.
• Awards and prizes.

Selective - Self-financing

• Fee based loan guarantees: Applicant pays a fee for the secured loan.
• Royalty grants: A specified royalty percentage is paid to the state based on sales of the product or process for which the grant was applied.
• Stock option grants: A stock option is given to the state by the firm - the state may exercise the option if stock value rises significantly. For larger firms a stock option refers to a separate venture company set up for the specific R and D or project.
• Convertible loans: The loan amount can be converted into stock if the project becomes a commercial success.
• Equity investments: The state invests in venture firms either directly or indirectly through private investment companies.

Source: Ref. 6
Table 1

Financial Support Instruments for Promoting Cleaner Technologies

<table>
<thead>
<tr>
<th>Country</th>
<th>Project Grants</th>
<th>Favourable Interest Loans</th>
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<td>Commission of the European Communities</td>
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*Source:* OECD, 1993
I. Formulating a Financial Support Programme

Governments which have operating financial support programmes or those who are considering instituting a support programme may wish to consider topics in this part to guide the development of, or assist in the fine tuning of a financial support programme.

A. Innovation, research development and demonstration of cleaner technologies

Many governments provide financial support aimed at the research, development and demonstration of cleaner process technologies. A small percentage of funding is directed towards basic or fundamental research, while the majority of available monies is used to support applied research and demonstration. Practical demonstration is the most expensive segment (about 20 to 50 per cent) of total R and D costs. It is also the most risky and perhaps difficult phase of the research, development and implementation of cleaner technology. Trends of newer assistance schemes being employed also seem to support this finding. Activity has also increased with regard to life cycle analysis and the public demand for products which are more environmentally "benign".

B. Diffusion of information about cleaner technologies

The existence of mechanisms by which technological information is disseminated is essential. It is not only necessary for technical information, but for innovations to circulate and penetrate different levels likely to use them (e.g. research institutes, universities, industry, etc.), but to also spread throughout the economy and industrial structure. This is particularly important for small- and medium-sized enterprises (SMEs) which are financially and technically limited in their access to pertinent information. Many governments have recently initiated special programmes aimed at the diffusion of information about cleaner technologies. Newsletters, technical and innovation centres, conferences and technology demonstration seminars are but a few examples. Dissemination of technical information needs to be facilitated at the local, regional, national and international level. Both private and public mechanisms and channels can be effectively used to this end. Networking and using established network systems to pass information on can be extremely beneficial to all parties involved. Diffusion is a critical phase for the transformation to cleaner technologies. This was especially emphasized by workshop participants where particular attention to SMEs was indicated. SMEs have special information and accessibility needs. Their size and lack of capital often hinders their access to cleaner technologies and breakthroughs in the environmental field. Getting the information out to those who need it most is a vital part of the system for transformation.

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2 Basic or fundamental research often receives funding through the Ministry of Education and Ministry of Economics, since a large proportion is carried out by universities.

3 In conventional cases, once one invests to the point of demonstration, R and D programmes are difficult to cancel due to the high costs and momentum. Most applicable cases include: food, textiles, pulp and paper, printing, petroleum and rubber products, ceramics, metals and motor cars. United States National Aeronautics and Space Administration, "Phased Project Planning Guidelines", Report NHB 7121.2 (1968).

4 Australia, Denmark, Finland, Germany, Italy, Norway, Sweden, the United Kingdom, and the United States.
C. Issues to consider

*Polluter Pays Principle*

Financial incentives to promote the development, demonstration and diffusion of cleaner technologies do not infringe upon the Polluter Pays Principle (PPP) as long as they are in accordance with the exceptions given in the 1974 OECD Council Recommendation on the implementation of the PPP. According to these exceptions, government assistance for pollution prevention and control might be given to ease transition periods for R and D on cleaner technologies and to reduce regional imbalances. Any financial assistance must be for a fixed time period in a clearly defined programme[5].

Cleaner technology assistance is compatible with the PPP when employed for stimulating and encouraging technologies which are environmentally directed under these conditions. Apart from the initial support, the polluter still bears the costs of the anti-pollution measure, and the financial assistance instrument or "subsidy" is used to realise governments' cleaner technology objectives. In fact, incentives can stimulate the polluter to go beyond regulatory standards (or in some cases help to shorten the time to reach them). They can also remove obstacles and allow investment for cleaner technologies or products and offset the risk and higher introductory costs of getting cleaner technologies demonstrated and implemented.

Financial support in this sense is viewed as spurring more environmentally-compatible behaviour. Assistance is short-term and limited, thereby shifting activities to be more in line with environmental standards and goals, while building the technological base.

*Competition*

Whether or not financial assistance aimed at cleaner technologies affects competition or trade is a critical question. A key consideration is to ensure that national and international trade and competition are not negatively affected by a financial assistance programme. Incentives which have a potential to create an "unlevel playing field" or trade barriers should be reviewed and avoided so that the transformation to cleaner technology does not cause undue harm to SMEs or create a disadvantage to other firms.

As long as financial assistance by governments is in accordance with the exceptions to the PPP and focused on the development of practical techniques to reduce pollution or the use of natural resources and energy in the production process or the product, it should not create significant distortions in trade and investment. The focus of support should be limited to seed money, "... just enough to oil the wheels a bit"5. Large or extended amounts of financial assistance to large firms, or to firms where the development of the product would give them a clear advantage, were looked upon with caution. As a multinational chemical company representative stated, "Prudent review and project selection should help in screening out projects that would create an unlevel playing field." In our interviews, the private sector was not generally concerned with the assistance itself as creating competitive advantages or disadvantages.

*Wrong incentives can distort policy*

Perverse incentives which hinder the deployment of cleaner technologies should be identified and addressed through programme reviews and evaluations. Perverse incentives identified at the workshop

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5 Representative from an Industry Association, the United Kingdom.
are those which: promote the purchase of end-of-pipe (EoP) treatment and control technology\(^6\) over a known cleaner technology; accelerated tax depreciation of technologies which have a known cleaner substitute; inadequate pricing; subsidies on certain energy uses; and the cost of pollution dispersal. No one issue was discussed in depth and perhaps this could be the subject of future work.

There are also "incentives" which distort policy and alter the effectiveness of a programme. Often funds are poured into a few "showcase" projects with too little concern about commercial viability, competition, or actual relief of the pollution burden. Frequently this is coupled with the fact that governments are unwilling to act against the vested interests of special interest groups. This bias can create not only an unlevel playing field, but distort the policy goals of sustainable development and the implementation of cleaner technologies. To ensure that this does not occur, governments could systematically re-evaluate programmes and policies, to re-align and adjust them so as not to distort competition or trade.

Established programmes are usually difficult to shut down, or even change. Inefficiency is not easily detected by government unless careful and regular evaluation and monitoring of tangible outputs of a financial assistance programme takes place. While it is not so difficult to verify that projects were implemented, showing that they were effective is a complex matter. (The complexity of defining and measuring effectiveness was raised as a major issue at the workshop and is addressed later in this report.) Change usually occurs in government when complaints reach a certain level. On the other hand, in the case of financial incentives, firms generally do not complain loudly about the hand that feeds them [6]. Plus, their complaints usually include that there are too many bureaucratic ties to the monies and that the application and monitoring process is too onerous. Taking steps to evaluate the efficiency and effectiveness of programmes will help in readjusting policies and aims to be sure a programme is not out of alignment with the goals of cleaner technology and sustainable development.

**Mixed funding options**

Considering options that combine government grants and/or loans, plus private sector financing, could be useful to enhance and foster additional support, hence stimulate more candidate technologies. A representative of the banking sector stated that a bank is more likely to approve a loan when the risk is shared by government and the applicant. What this means is that each party accepts a portion of the overall risk. This type of concept can be pursued through close co-ordination among financial institutions, local and regional governments and other entities such as environmental groups or associations which provide grants, loans and awards for environmentally-sound activities. Essentially, a mixed financing package, where a portion of the entire support package is provided by separate groups, could supply needed capital to an innovator and offset risks to each group involved [7].

**Best practical rate of return**

If the goal of government is to invest public funds to promote the common good, the aim would be to identify the best methods to ensure there is a positive rate of return. So, what would be a positive rate of return in the context of cleaner technologies? It could be argued that the rate of return is: the amount of pollution or waste reduced, especially over and above what would have normally been required in the regulatory programme (or substantially faster) and demonstrating a substantially more cost-effective approach that others can emulate; the reduction in the amount of energy or raw materials used; the increase in the amount of R and D; and the increase in the amount of cleaner technologies in place.

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\(^6\) Whether to end subsidies and tax incentives to purchase EoP pollution control equipment over a known cleaner technology was the most controversial aspect of the discussion. No conclusions were reached, however, and further investigation into the subject seems warranted.
Indicators

In the financial world, the rate of return on investment generally means capital for capital. But to synthesize this with the rate of return for cleaner technologies, it is necessary to bring social and environmental benefits into the equation. That is to say, where an investment by government is made to offset the risk of a cleaner technology, the measures could be economic and environmental. Indicators that provide a portrait of the status and pace of the technological transformation from the use of financial assistance incentives, could assist governments in evaluating their current situation. Implementation and programme design to incorporate these indicators would serve to provide information on the status and positive effects being achieved from cleaner technology development and deployment. In turn, these indicators can be used as a subset group to determine progress towards sustainable development.

Examples of indicators could include, *inter alia*:

**Macro indicators**

- Increase in the quantity of research and development;
- Increase in the amount of cleaner technologies (this can be broken down into product substitution, component substitution, process substitution or technology substitution); and
- Amount of diffusion of cleaner technology (by branch, by sector, regionally or nationally).

**Environmental indicators**

- Reduction in ambient pollution;
- Decrease in emissions;
- Decrease in wastes sent to final disposal;
- Reduction in energy consumption; and
- Reduction in the use of raw materials.

Note that this is a suggested list of indicators. No data have been collected, reviewed or analyzed to indicate if and how these indicators can be appropriately measured. One issue which could warrant future efforts would be to find out whether and how certain indicators can be used effectively to quantify the transformation to cleaner technologies.

**Open relationship with industry**

Working together with industry to set standards and goals can promote desired technological changes. Governments which tend to work *with* industry are setting standards which are more technology-flexible. “If government works with us to set standards, we can then develop the technology” 7. Firms were much more willing to work to meet the standards set forth by government in countries where an open relationship existed. In the Netherlands and Finland, industry representatives unanimously agreed that their open relationship helped both parties establish tangible and attainable goals and targets. An open relationship with industry plays a significant role within a financial support programme.

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7 *Representative of a Finnish Metal and Resource Corporation.*

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Private financing groups

In terms of private financing, the higher risks of cleaner technology projects and, paradoxically, the often low amounts of project funding requested, combine together to make a very unattractive proposal⁸. In 1992, only one out of sixty innovation proposals submitted to venture capital firms in the United Kingdom was accepted [8]. The risks involved with the "unknown" market for such technologies have created a situation where limited financing is available for the innovator. Additionally, venture capital firms are more inclined to require a very high percentage profit, within a very limited time-frame (for example, 20 percent over 2 years time). Generally, this is coupled with a desire for a very large share "buy-in" or "buy-out" of a firm’s management structure as one might expect only established firms to be able to meet this requirement. Both of these prerequisites for funding seem to steer venture capital firms away from financing cleaner technologies and support those projects which are less risky, with a clearer market. Once again, government financial support could help fill the gap where risk capital is scarce.

D. Selecting a financial support instrument for promoting the supply of cleaner technologies

An incentive programme for fostering the development, demonstration and diffusion of cleaner technologies should be an efficient investment for the public. Consequently, the key question is: How can an incentive programme be designed in a way that helps the administering agency select a practical financial support instrument? To assist governments in assessing and selecting an appropriate instrument, the following set of queries was devised from results of our interviews:

Setting objectives for a financial support programme:

- What are the overall environmental goals and policy aims for cleaner production and products?
- Who would fall under the scope of this programme (e.g. large industry, SMEs, all sectors, specific branches, etc.)?
- Which stages of research, development, implementation and diffusion are to be influenced?
- What training and qualifications for the government (and/or those engaged by government) decision-makers are required?

Finance

- How can projects be funded effectively and efficiently?
- What is the status of the budget (e.g. fixed, flexible, etc.)?
- Are there financial restraints such that a self-supporting/financing mechanism is preferred?
- What (human) resources are available for administering the programme?
- Is (and/or how much) industry support/financial sharing needed?
- Is a mixed financing programme possible?

Evaluation

- How can evaluation of programme success be accomplished? What measures can be used?
- How can the rate of return be measured (e.g. reduction of pollution, etc.)?
- Is the programme cost effective compared to potential benefits?
- How can environmental goals be achieved at least cost to society at large?

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⁸ In the United Kingdom, it was mentioned several times during government and private sector interviews that venture capitalists do not look to invest in any project less than 500,000 pounds sterling, (US $ 750,000). Moreover, venture capitalists are selective about the projects they fund and seek to invest not only in capital, but in the management and the firm’s infrastructure. This reflects the scarcity of risk capital in that many firms or innovators do not fit the minimum requirements of a venture capital firm to be considered as a candidate.
• How can this programme offset the high risks of new technology developments and accelerate change?

II. Administration and Operation of a Financial Support Programme: Options and Lessons Learned

To address the administrative and operational aspects of a financial support programme, this section contains options which could be considered for enhancing the efficiency and effectiveness of new or operating programmes.

A. Administrative elements

Investing public funds

The methods for selecting and funding projects to promote cleaner technologies can be compared to those used by private investors. A "good investment" usually means a strong positive rate of return for monies invested. Applying this concept to the investment of public funds could enhance the rate of return for monies expended. Accordingly, the assessment and evaluation of project proposals for selecting the "best candidate for the money" would be the potential or actual return received from reducing the pollution burden and/or decreasing the amount of raw materials or energy used. A worthwhile guide for increasing the effectiveness and efficiency of programmes could be likened to that used by investment bankers. With the goal of effectively investing monies to increase potential rate of return, an investment banker or venture capital firm will usually require the following information in project proposals:

• Project description and plan;
• Goal and objectives;
• Business plan (this is a principal element for the review and competence of a proposal and it includes information about the management experience and competence, technical expertise and staffing, accounting and marketing information);
• Estimated rate of return, e.g., environmental improvement, expected cost savings, relative risk to phase of innovation; and
• References, e.g., previous performance, products, etc.

Employee performance appraisals

Often employee performance appraisals used by financial support agencies are tied to the number of "winners" a government employee selects [6]. This provides a perverse incentive to select proposals which have a low risk and a high degree of market potential. Often, in such cases, projects which fall into the "winner" category could find funding elsewhere.

The rapidity and number of projects funded, whether appropriately or not, are two more common measures which drive inefficiency and reap negative results. Rewards and merit given for allocating all of a fund, or allocating funds to the largest number of projects in the shortest amount of time, can distort the efficiency and effectiveness of a programme. Refocusing measures for appraising employee performance can help to direct funding to the demonstration and introduction of cleaner technologies which fall into the higher risk category, yet complement government environmental goals.

Administration, education and training

It was repeatedly mentioned by interviewees and at the workshop that policy goals and objectives are not always clearly understood by government employees, or those who are distributing funds. Here, education, training and the proper tools can play a key role for improving a programme’s efficiency. This
is necessary to keep fund administrators up to date about new trends and markets, emerging technologies and R and D breakthroughs. Training and education in finance and investment, along with enhancing the understanding of the dynamics of business and market potential for project proposals, are important. It may also prove to be profitable to expand employee’s education to include fund or portfolio management for evaluating projects and the "best return on investment".

**Funding percentage**

Financial supports range from 10 to 100 per cent of the project costs depending on the country and specific programme. Recipients provide the remainder of funds. Most Member countries visited indicated that funding more than 50 per cent of a project was not necessary. "Assuring that industry is serious and willing to risk capital helps to ensure that the proposal had been well planned and thought about". 

Sometimes firms need just enough support to give them a push to offset some of the risk. "We will often provide 10 per cent funding so to buy into the rights to disseminate the information about the technology." 

Each government appears to favour a different funding method. The government of the Netherlands has set up a flexible funding margin scheme based on the risk associated with each phase of the innovation process. (Annex VII contains a chart submitted by the Dutch government concerning their view of the phases in the innovation process.) Other Member countries stated a preference for funding on a case-by-case basis with the percentage of support depending on the specific need, while some other governments favoured a specific funding percentage which is equal for all projects receiving support (e.g. 50 per cent).

The average funding percentage of projects, as obtained through interviews, is between 20 to 35 per cent of the project costs for direct grants, and 50 per cent for favourable interest loans. Funding of over 50 per cent of the project costs does not occur, except under special circumstances i.e. feasibility studies for SMEs, a specific branch or sector. This is partly due to lessons learned of other governments and the belief that the firm needs to have an vested interest to appropriately carry out the project. Ultimately, flexible funding margins might prove to be effective for setting the percentage of funding per project or phase of the innovation process. (Further analyses and study of concrete data would be warranted here to find what percentage of support is best for each phase of the innovation process or if an increased or varied percentage is necessary for SMEs or other special groups.) Funding percentages could then be granted on a sliding scale for a specific phase of the innovation process or for a particular group such as SMEs; or on a case-by-case basis based on each proposal submitted, demonstrated need. This could help direct funding to where it is needed and lower the chances of windfall profits. Low vested interest on the part of the recipient and high funding percentage from government combine into a greater potential for windfall profits [6].

**Phases of the innovation process**

The different phases associated with the innovation process may require different types and levels of support. Risks, costs and parties involved in each phase portray a different level of need, funding and assistance. For instance, the demonstration phase is one of the most risky and costly phases. This is because the concept is being expanded to full scale, and the degree of uncertainty is high -- as is the cost to create the technology. Also, this phase generally involves more groups; a manufacturer, innovator, or

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9 Interview with a representative of the Danish EPA.
10 ibid
11 The phases of the Innovation Process include: conception; development/demonstration; practical implementation; diffusion.
A research institute supported by a manufacturer, or innovator. In contrast, the basic research phase, which generally involves universities, tends to be less risky and less costly. At this stage a project could be cancelled without a great financial loss as compared to a technology which fails during the full scale demonstration phase. Risk and uncertainty, the participants, and percentage and need for funding, shift from one phase of the innovation process to the next. Therefore, a different mechanism and funding formula may be needed to ensure that financial assistance is effective and efficient. (Annex VII contains a chart provided by the Dutch government on the phases of the innovation process.)

**Channelled or targeted funding**

Some branches of industry are inherently more polluting than others. Directing or channelling funds to those industries which dominate, or to branches which are in the most need of support to develop and deploy cleaner technologies, could be warranted. Denmark has initiated such projects and feasibility studies, e.g., the furniture refinishing branch, the metal plating industry, textiles and fisheries. Widespread diffusion of the cleaner production process and product developed or demonstrated has been achieved through this approach. Several national business organisations also voiced their support for this type of focused funding whereby the diffusion of technologies can be extended more easily.

**B. Operational elements**

**Monitoring and evaluation**

Monitoring the progress of projects is crucial for ascertaining that the project is being carried out in a timely and cost-efficient manner. Some governments have opted to receive monthly and/or quarterly reports on the status of activity. A systematic scheme which involves one or two meetings per year, along with annual accounting and progress reports, seems to be a commonly used method. However, one private banking institution interviewed indicated that reviewing monthly and annual accounts and comparing them to the *business plan*, as well as confirming key milestones are being met, were the most important indicators. Here, factors such as the type of project, amount of funding, amount of administration necessary and so on, could be suitable monitoring and evaluation measures.

Frequently, evaluations are conducted by outside parties. Within the Department of Trade and Industry in the United Kingdom, a separate division is responsible for evaluating financial assistance programmes. Evaluations are periodically carried out concerning the effectiveness and efficiency of the scheme; reports are compiled with recommendations for adjustments and changes. These reports are then presented to a departmental committee where decisions on programme changes and adjustments are made and implemented accordingly. Perhaps adding financial and management experts to a review team may be useful to more fully assess and appraise individual projects and the programme as a whole. Using specialists from outside the government agency provides a more objective view as to how funds are being used both by the recipient and the government, with recommendations on what might be done to improve the operation.

Another method of monitoring and evaluation can be found in the Netherlands and Denmark. Here, steering committees are established at the beginning of projects for monitoring and evaluating activities. Meetings are usually held twice a year with the recipient and the steering committee to review reports, progress and results. At times, members of the private sector participate on such committees.

Several other Member countries have set up these systems for monitoring and evaluating their programmes. However, it is too early at this time to assess the results from any of these evaluation systems.
Application procedures and approval process

It is important to safeguard public funds, but overbearing and complex procedures are burdensome for the applicants as well as the administering agency. Potential applicants in Member countries remarked, "The subsidy structure and application procedure are so incoherent that you must be quite motivated to apply for a grant"; "We did not use government support because it took too long and had too much red tape before we could receive monies". Quotes such as these concerning the Netherlands and United Kingdom grant application procedures broadly reflect the sentiments of the private sector. While safeguards and information are imperative, onerous requirements can counter goals to accelerate the deployment of cleaner production and products.

For increasing efficiency, the establishment of procedures which optimise the amount of information and details required can limit delays in processing and approving applications. For financial support instruments, clear and simple application forms and instructions, which include a completed example, could prove useful in attaining more consistent and higher quality application forms. The time needed to request and contact the firm for further information and data can then be reduced.

Project selection

This activity is central to the programme. Ensuring that projects selected support national policy and objectives and expand the cleaner technology base is vital. Thus, procedures for assessing and selecting projects may be warranted.

Since the judgement of merit and adequacy need to be made for each project proposal, it is important that policy aims and goals are clearly understood by the reviewer or fund administrator responsible for selecting projects. Here, proper training, reinforcement and proper tools are vital to ensure efficiency. To effectively select projects, a criteria or checklist could be of use. Box V contains typical criteria based on private financing institution tests for deciding whether to finance technology innovation.

Business plans

A well thought out and designed business plan is an essential part of the project proposal. The plan should include all, or most of, the elements necessary to show that the potential of the technology, the management of the business and funding, time schedules, complete market analysis, potential rate of return, diffusion potential and environmental benefits. The business plan should explain all facets of the business, which in turn allows the fund administrator to judge the merit and potential impact of the candidate technology. As a general rule, a business plan for a project should cover: the background and management experience; the product/service/process description; the market; marketing and sales; management structure and operations; and the financial history and projections. To ensure that the plan is complete, the following support information may also need to be included: management curricula vitae; detailed forecasts and assumptions; market surveys; and if available, detailed product or process descriptions and benefits from its development and installation support.

Critical appraisal of a business plan is crucial, especially for identifying weaknesses and inconsistencies. Administrators reviewing plans for adequacy might find the following guidelines useful to ensure that the plan contains sufficient and appropriate information:

- Is there a complete project description? (e.g., technical design, application and use)
- Do the market assumptions, views, size and growth aspects as well as the shape and structure appear consistent with the overall market strategy? Is there a description of how the project and the firm will fit into the market? Has an independent market review been carried out?
Box V

General Project Selection Criteria Used in the Banking Industry

**People**

In any small or medium size enterprise, the role of individuals is a key factor in its success. This is doubly so in a technology company, since the knowledge that is the basis of the business is often limited to one or at most two, often irreplaceable, people. Confidence in the abilities of the major personnel involved in the venture is paramount.

- Have all the key personnel involved been identified/spoken to? Technical personnel?
- Are they fully qualified technically?
- Do any of the key people have experience of working in a similar commercial operation?
- Do any of the key people have sales/marketing expertise within the organisation?
- Have they been able to explain clearly their:
  - technology;
  - sales/marketing plans;
  - business plan;
  - reduction of pollution output; or
  - reduction of energy and raw material input?
- Can they describe how it meets environmental goals?

**Technology**

The technology/product the business is developing may be in any one of a number of stages of the innovation process. It is important that the business can clearly see its way forward through each of these stages. It is also important that the business sees, not just the technology or product as an end in itself, but as something that meets a market need.

- Is there a clear picture of the current stage of the company in developing the technology/product?
- Have they the requisite patents and/or licenses?
- Do they have sufficient R&D resources to continue development whilst marketing the product/technology?
- Do they have any verifiable trial data from recognized bodies in their industry?
- Do they have evidence of quality/approval ratings or standards accreditation?
- Are they willing for you speak to other experts in the field about their technology?
- Have they taken specialist design advice?
- Have they applied for other funding assistance?
- What kind of risk evaluation has been made?

*(continued)*
General Project Selection Criteria Used in the Banking Industry

Management and Planning
The management must have a clearly defined plan to which all are committed and which covers all aspects of the business.

- Does the business have a well-defined corporate strategy?
- Does the plan include an "innovative element"?
- Have plans for development been well thought through?
- Are financial plans well developed?
- Are plans focused on market needs?
- Has the plan been developed by the management themselves?

Market
The business must be able to demonstrate an understanding of the market - if it does not, its assumptions, projections and forecasts well probably not be valid. This understanding depends on their experience in the industry and their commercial market awareness.

- Has any market research been done, e.g., shape, structure, potential growth, etc.?
- Are target customers known?
- Have potential customers been approached?
- Have they spoken to people in the industry? If not, are they willing to do so?
- Have they approached potential distributors to ask opinions?
- Do they have a clear understanding as to how the market operates?
- Do they know how the market decides to buy these products/services?
- Have they considered other market factors which will influence demand (e.g. competitors, export);
- Do they know how the products reach the end user?
- Have they seriously investigated the competition?
- Do they know the likely sales volume?
- What is the probability of success?
- What is the estimated market size or market share?

Environmental

- Does the firm have a good environmental track record? Any outstanding violations?
- Does the proposal meet environmental and sustainable development objectives?
- Will production meet environmental laws, regulations or standards?
- Can the project be used in other branches or sectors of the economy?
- Does it fill research need or fall under a specific national research theme?
- Have potential hazards or pollution been eliminated?
- What is the recycling potential?
- What does the project improve and how will the public benefit?

(continued)
Box V

General Project Selection Criteria Used in the Banking Industry

Production

The business plan may call for in-house production, subcontract production or licensed manufacture. Production demands and costs must be well-defined and understood by the company.

- Do they have expertise in manufacturing?
- What is the availability of manufacture personnel (numbers/skills)?
- What is the cost of manufacturing?
- Are there any additional requirements or facilities?
- Has manufacturing safety been examined?
- What is the cost and availability of raw material waste/recycling?
- Have they investigated component materials sourcing?
- Are they reliant on other suppliers or subcontractors? Have they found alternative suppliers?
- Have they given evidence of production facilities?
- Have they considered quality standards?
- What is the duration of the project?
- What new processes are involved?

Marketing

The company’s ability to market its technology and services depends not only on its technical expertise but on its ability to understand the market, and supply something that is needed. This encompasses not just the piece of technology, but all the added value items that accompany it. The fact that a business has no in-built sales and marketing expertise is not an immediate reason for turning down a plan. However, acknowledgement by the company that such expertise is lacking is a pre-requisite.

- Have they a sales and marketing plan to complement their business plan?
- Do you know who has specific expertise/skills in (1) sales and (2) marketing?
- Have they demonstrated how they are going to sell and distribute their product to the customer?
- Have they developed a pricing policy that takes all the sales and distribution elements into account?
- Have they considered the levels of service and support?
- Have they built this into their marketing/business plan?
- Have they considered competitive reaction?
- Has a feasibility study been completed?
- Has a marketing budget been laid out?

Source: Ref. 7
• Is there a thorough description of the management team and capacity? Are the following items included: job descriptions; adequacy; competence; future requirements succession; quality of junior management, and; personal objectives of team members.

• Is financial and accounting information section complete? What is the basis of how accounts were prepared, and to what extent do accounts present a fair and true portrait of the company’s performance, principal assets, confirmation of liabilities as well as review of any hidden or contingent liabilities, historic performance compare against budgets. Review the quality of management accounting systems, completeness and accuracy of management information produced, extent and quality of budget process and current year data against budget. For financial forecasts, focus on whether the numbers compute and are properly recorded, has information been prepared based on business plan and look at whether there are any inconsistencies with historic performance.

• Are copies of all legal agreements and contracts which support the basic structure of the firm included? (e.g., other business concerns, partners, etc.).

Administrators should heed warning signs found in the business plan. Flaws in the management team, its composition or in data and information are danger signals. Other danger signs are if an independent market review reveals a completely different picture than that provided, or if a high proportion of references provide negative information about the business or management team; or if the financial projections are inconsistent. Sometimes plans may have been improperly prepared or prepared for the sake of the financing potential of the government.

The more consistent and standard the format of business plans submitted for financial assistance the easier and less time consuming it is for the administrator to analyze and evaluate them. There are several ways to spread this message to potential funding candidates. A special training course, distributing properly formatted samples, or perhaps a seminar for those who wish to apply for government funding, are just a few examples. Annex III contains a sample Business Plan Outline. This might be a useful guide for governments and could be used as a basis for the application for financial assistance.

III. Special Financial Support Programme Elements to Consider

Selecting the right instrument and improving the administrative efficiency of a programme is important. But for it to be effective and efficient the following components seem to form the foundation for a financial assistance programme. Workshop participants stressed the importance of addressing and adapting the following elements to fit Member country programmes. From innovation to diffusion, the effective combination of these components can accelerate the rate at which cleaner technologies are deployed and fuel the transformation of industry towards cleaner production and cleaner products.

A. Technology-flexible -- longer term goals

Changing regulatory targets create investment uncertainty for the regulated community. This can have a negative effect on compliance and capital investment by the private sector to meet targets. Clear signals and longer term goals were unanimously preferred by firms interviewed. "Sometimes we need to plan one to five years ahead of time for process, product or plant changes." This is where strong longer term environmental goals (e.g. the Netherlands NEPP Plus and Canada’s Green Plan) that are "technology flexible", can play a central role to driving development and implementation of cleaner technologies. The certainty of future demands and decreasing pollution levels provides industry with the opportunity to implement longer term remedies featuring cleaner technologies, since they can incorporate environmental aims more clearly and succinctly into business plans.

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12 French Multinational Chemical Company.
B. Inter-ministry co-ordination

Several interviewees suggested that some governments send confusing messages about their policy goals and objectives for cleaner production and cleaner products. Interviewees frequently referred to the different Ministries involved in promoting cleaner technologies as well as their differing programmes and goals. Conflicting goals, programmes and financial assistance schemes were categorized by the private sector as altogether confusing. In fact, sometimes one Ministry was not sure what another Ministry was doing, but knew some sort of programme existed. To avoid this type of situation, governments may wish to co-ordinate goals to create a cohesive and co-operative programme with clearly stated goals and objectives by consolidating programmes and pooling resources. At a minimum, representatives of various Ministries could meet on a regular basis to discuss activities and harmonize programmes.

C. Small- and medium-sized enterprises (SMEs)

It is rare for SMEs to have an R and D department, an environment staff, or even an employee dedicated to the subject. This makes them dependent on other firms, suppliers, private or governmental research institutes for information about, and for the purchase of, cleaner technologies. As a consequence, lack of capital and access to information often keeps SMEs in the dark. Yet their risks are real, as are the costs to modify, or interrupt production for the installation of new equipment or to change a process. In addition, the general lack of expertise or availability of "spare" personnel to make such changes creates a situation where SMEs are not easily able or motivated to make the transition to cleaner production and/or products.

Various countries have begun to address the special needs of SMEs by providing special funding for consultants and creating information access centres. Combining efforts to meet their special information, capital and technical needs may help to expedite the development and implementation of cleaner technologies. Plus, special efforts for diffusion and financial assistance and support would help them overcome the barriers they face to finding and implementing cleaner technology substitutes. Some activities intended to stimulate further action by SMEs could include, inter alia:

• Establishing special technical centres (as the Netherlands has done, for example), which expressly support branches of industry dominated by SMEs. Such centres, could be of great service if staffed by technical experts, and perhaps management and financial experts as well.

• Establishing special consulting services and support as has been done in Denmark, The Netherlands and Norway. Support involves assessing and advising SMEs on current environmental issues as well as identifying opportunities for cleaner production and products;

• Establishing a scheme or service for matching the innovator to a manufacturer or problem to solution. Sometimes innovators do not have the capital or knowledge to find another firm to collaborate and/or match a manufacturer to the inventor. Providing a means to enable this activity could be valuable to SMEs. Denmark, Finland, Sweden, and to an extent the United Kingdom, have focused on this type of activity.

• Elaborating information dissemination efforts to focus on information channels of small and medium-sized enterprises, similar to what is done in the Netherlands. Examples could include branch organisations, technical journals, local associations, trade fairs, suppliers, consultants, banks, accounting organisations, local community or business clubs, labour unions and business organisations.
D. Local or regional government support and education

Bringing local or regional government representatives and inspectors into the clean technology "family" can render valuable support. In Denmark, local community governments have taken the initiative to begin advising and assisting firms to look to cleaner technologies as a means for improving their local community environment. Over a year of retraining was needed to facilitate the change of personnel from being an "enforcement" officer to being a "service representative". As their role changes, so has their relationship with firms. Support for local government training and co-ordination by identifying needs and gaps in research and development, could also be rewarding for other countries. This transformation appears to be working well, helping to accelerate the information dissemination and deployment of cleaner technologies. Concrete data and evidence were not available at the early stage of this programme, but by providing alternatives and suggestions for change, this new programme in Denmark has been well received by local firms for whom education and information appears to be a vital asset.
I. Options to Enhance the Supply of Innovative Clean Technologies and Expand Diffusion

What might governments do to improve the efficiency and effectiveness of a financial assistance programme to accelerate the deployment of cleaner production and cleaner processes? Clearly, a first step is to articulate the demand for cleaner technologies and accelerate the transformation towards cleaner technologies for the 21st century [1]. Then, through the use of financial assistance and tools, strive to offset risks and uncertainty for the deployment of cleaner technologies, thereby filling gaps created if private investors and banks hesitate to act. This section addresses options that governments could set in place collectively, or individually, to enhance the supply of innovative cleaner technologies and expand the potential for diffusion.

A. Pinpointing cleaner technologies

The goal of assistance programmes is finding and supporting the development of technologies which are environmentally "benign" and putting forth efforts to ensure that those technologies which are contradictory to environmental policy are not developed. Governments which choose to take a proactive role in directing or channelling the development of technology in priority areas could: (1) use councils or teams to review and select technological development streams; (2) identify which branches or sectors to give priority to; (3) provide or support a co-ordination effort to ensure that duplicative research and development is limited and that the entities involved in development are complementary to each other; (4) promote teams of industry and government researchers to delve into new technological areas; (5) call for tender of a specific technology or area (e.g. production process recycling) and support full development of that technology; and (6) create a clear demand for specific technologies13, including the phase-out and banning of a specific substance or technology.

B. Diffusion Activities

Diffusion is an essential element in the technological change equation. To provoke a technological transformation, information needs to be widely available through a vast number of sources. Otherwise, the potential for change is limited, especially with regard to SMEs. Governments could incorporate any of the following concepts into their programmes to expand diffusion efforts, either individually or together as a system.

Technical Centres. Special Technical Centres composed of experts from industry, research and development, as well as the banking and management fields, could be established to assist and advise on the development, introduction and diffusion of cleaner technologies. The centre could act not only as an information resource centre but also: as a clearinghouse to match solutions to problems; to provide special training seminars and consultation to firms; to work with research teams in determining the technology inventory and future needs; and possibly co-ordinate or assist in the co-ordination of national research efforts. Such centres could also take the lead to develop, or facilitate the design of, general education materials, curricula and programmes for universities, technical institutes and industry. Experts 13 The Netherlands has attempted to create a specific market demand through their accelerated tax depreciation scheme. It is more fully explained in Annex II. To highlight their scheme, technologies of which they wish to stimulate use are placed on a special list. If a company purchases that cleaner technology during the year, the firm can receive a 100 per cent tax deduction for the price of that item. This scheme stimulates industry to buy those technologies which they have deemed more environmentally sound.
employed by the centres could provide special or directed training and seminars to help SMEs demonstrate or install cleaner technologies as well as act as a secretariat to technology research counsels and the like. (Japan has such a centre in operation - The Research Institute for the Technology of the Earth.) In sum, centres can be helpful for addressing the needs of industry as it undergoes a transformation to cleaner technologies.

Centres could also be tasked with evaluating proposals and administering financial support funds for government. The potential for increased effectiveness and efficiency by using a wide range of experts and an independent source for evaluating projects, may outweigh the effects of added bureaucracy. Centres could be responsible for administering a financial support programme, such as project grants, favourable interest loans or secured loans. This could help to ensure a prudent, independent review of projects and allocation of funds. Enlisting management and finance experts to evaluate financial capability and market potential of a given project could help to ensure prudent and independent reviews of projects and allocation of funds. Ultimately, the day-to-day administrative function could move from government to the centres.

**Cleaner Technology Assistance Network.** Information is a valuable asset; however, gaining timely, in depth, access to information is frequently difficult. Establishing a cleaner technology assistance network could increase the diffusion and exchange of information of cleaner production and products. When a firm tests or demonstrates a cleaner technology, results and information concerning its performance and savings can enter into an established network system to be widely distributed.

Developing an extensive network requires close co-ordination and strong programme integration, as well as interactive training seminars, to assist with the selection and evaluation of a proposal and project. This activity was especially stressed by the banking representative attending the workshop. Working with all those involved in innovation and diffusion of cleaner technologies is important. Co-ordination and interaction with the entities listed below may prove to be beneficial in the transformation to cleaner technologies. The following list suggests entities and is by no means comprehensive; it is meant to be viewed more as a basis for cultivating a cleaner technology assistance network. The list includes: local manufacturing branch associations; banks; insurance agencies; suppliers; technical institutes; local governments; local community organizations and chambers of commerce; utilities and power plants; environmental consultants; research and development institutes supported by government and/or industry; and private investment firms and venture capital firms.

**Education, training and outreach.** The training structures for researchers and technicians, universities public and private research institutes, etc., represent the essential bases for technical change. Education, information dissemination, training and retraining appear to be vital at all levels so as to integrate forward environmental thinking into the basic fabric of the educational infrastructure. Knowledge and understanding are crucial elements for increasing the speed at which cleaner technologies are employed. Education and retraining of the labour force, technicians and public and private research institutes are important to ensure a smooth transition to clean technologies. Development of a framework to promote cleaner technologies at all levels of formal education could have a positive effect on the supply side of know-how for cleaner technologies. Australia, The Netherlands and New Zealand have made special efforts in this area. Generally, technical training creates conditions favourable for the emergence of innovation and the readiness on the part of society to accept it. "Getting students to look forward so they can shape the future is the key."  

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14 Similar types of independent technical centres exist in Finland, Sweden and the Netherlands for selecting projects and administering financial assistance programme. All administrative activities are carried out by technical experts and administrative specialists.

15 Research Manager from a Private Research Firm in the Netherlands.
C. Technology forecasting and co-ordination

**Technology assessment council and teams.** Influencing R and D can affect the speed at which cleaner production and products are deployed and play a major part in those technologies which government chooses to support. Selecting or identifying opportunities, research themes and trajectories could mobilise research experts and teams to direct their creative skills toward cleaner technologies for the 21st Century. Conducting studies and holding strategic conferences with industry and research and development institutes (governmental and non-governmental), helps to identify topics where a supply push is needed. Forming "Technology Assessment Councils" whose goal is to identify trends, gaps and needs for the technological development of cleaner production and products, could serve this need and pave the way towards developing a national technology "portfolio".

Technology assessment councils could be comprised of research experts from industry, government, academia and private institutes. Efforts could involve the assessment of current and future technological needs; Japan and the Netherlands have special plans where technology forecasts are made for 50 to 100 years into the future. Once research themes and trajectories have been selected, a second tier, "Technology Assessment Team" could be brought in to discuss and evaluate the practicability of technologies and themes for the near future. The team could operate in conjunction with suppliers, manufacturers, bankers, private investors, insurance representatives, marketers and industry itself to gain a more pragmatic sense as to the possibilities of deployment, costs and barriers, as well as narrow down the list to those technologies which will be most prolific. In general, the council and/or team could be commissioned to:

- Assess innovation policy and technology development needs;
- Map out future environmentally cleaner technology priorities for the quality desired;
- Monitor, evaluate, and analyze new technology themes, trajectories, trends and needs; and
- Provide strategic plans for, say, the next 25, 50 to 100 years.

Once planning goals and technologies are identified, government could offer support and assistance in those areas.

**Collaboration of research and development.** Facilitating joint research and development arrangements could be highly beneficial in matching solutions to problems and developing the basis for the next generation of technology. Universities, industry, and government could participate together, or as an alliance to develop new techniques, processes, products and methods (such as for recycling and re-use of wastes). Government could support these types of ventures through a financial support scheme. Joint pre-competitive research would be used for improving a generic technology, leaving the finer details to firms to develop for competitive reasons. This concept has been very successful in the United States, Japan and other countries. Perhaps a wider use will stimulate a faster implementation of cleaner technologies and be used as a prerequisite for financial assistance.

**Research co-ordination.** Co-ordination of like research within a country is not a new concept, and it could be used to mobilise the development of cleaner production and cleaner products. Monitoring of research through a centralised co-ordination scheme has worked in the past to avoid duplication of efforts and strengthen overall research capability. Branch or multi-branch representatives, government, research institutes and universities can form teams of experts who work together to develop priorities for research and keep abreast of all like research to ensure that it is complimentary, not duplicative.
D. Cleaner technology umbrella organisation

Given the panoply of approaches established by governments for promoting cleaner technology, perhaps governments may wish to consider bringing national support efforts together under one centralised "umbrella" organisation. This approach may serve to improve the effectiveness and efficiency of the cleaner technology system by consolidating and centralising to operate under one interactive framework.

With one focal point, industry, the public, academia, research institutes, marketers, suppliers, financing institutions could be mobilised together. Education, training, outreach, selecting and forecasting technologies, promoting research coordination as well as research collaboration could all fall under the responsibility of this central organisation.

E. Fund administration options

**Use of private investment firms.** Private investment firms could be used or hired on a consulting basis to assist in administration of a financial assistance programme. When banks review projects for funding, they look to see how they can reduce risks. Private investment firms operate on the basis of finding projects and proposals which need capital in return for stock or equity in the firm. Thus, the expertise of private venture or investment firms could be enlisted to invest public funds and analyse and evaluate project candidates. This would be particularly useful if a special team of technical experts were employed, or called upon, to evaluate the technical viability of project proposals.

F. Wider use of alternative financial support instruments

Governments currently tend to use the grant and low interest loan instruments. However, depending on the nature of the project, desired outcome, phase of the innovation process or programme focus, the use of other financial assistance instruments could further the potential rate of return and benefits by being more focused and directed to the nature of the candidate technology. The following section describes instruments which could augment the effectiveness of a financial assistance programme and target specific needs and technology outcomes.

**Use of awards or incentive-based assistance.** An incentive-based system can motivate firms to demonstrate or develop a specific cleaner technology or product. This type of assistance would stimulate competition to develop a particular product or process. Governments could articulate a demand and prescribe specifications in the form of an award, contest or prize, leaving firms to develop the technology. Winning a competition or being selected by government can somewhat validate a potential market created by the contest or award. A recent example of an award contest is that of Sweden. Specifications were set out for a refrigerator which used less energy and no CFCs. The demand was created and filled, and refrigerators that use less energy and contain no CFCs are now available. A similar programme was also conducted in Switzerland. The Swiss government, and a non-governmental organisation, jointly funded the demonstration of a refrigerator which met their specifications of using 50% or less energy of operating refrigerators and have no CFCs or related forms (like HCFCs) in the system. The refrigerator has been successfully demonstrated and is now ready for market.

Similar incentive programmes have been initiated in the United States. US EPA is working with industry to create and implement cleaner alternatives. Partnerships are formed with industry to create market incentives and design an incentive programme to fit an environmental need. Recently, the "Golden Carat" programme was launched with the same refrigerator specifications as the Swiss and Swedish programmes. One interesting difference is that US EPA coordinated the pooling of several public utilities’ energy efficiency rebate funds to create an award for the "winner". The "Energy Star" is another example of a U.S. industry-government partnership. This initiative created not only a market incentive programme but it has promoted breakthroughs in the computer field for reducing energy use.
Selective self-financing assistance. Self-financing subsidies could be regarded as beneficial in terms of outlay for social value. Several instruments exist under this category, but stock option, royalty and equity share instruments appear to be effective assistance instruments. They give the "public purse" a share in the profits in return for financial assistance. These instruments more closely resemble investments which private investors conduct when they buy shares in a company. "To those who believe in the efficiency of free markets, it may come as no surprise that these subsidy instruments turn out to be efficient"16.

The royalty share loan and grant can be effectively used with large and small firms. The procedure for the return of the royalty is what differs most from current operating programmes 17. These instruments can be profitable if the project is successful. Broadly speaking, royalty grants and loans seem to screen out more successfully those applicants who would receive a windfall profit or could easily find private financing [6]. Therefore, perhaps that firms with innovative yet very risky ideas would represent the majority of applicants.

The equity and stock option instruments are more applicable to smaller sized firms since it is often difficult for large firms to split off a project from the firm to form a company in which stock or equity could be clearly available. Information furnished through our interviews showed that financial assistance was greatly needed by SMEs due to low capital reserves and access to technical information on cleaner technologies. Therefore, these two self-financing instruments could be used expressly for SMEs. Moreover, the provision of risk capital is relatively scarce from the private banking and investment sector, particularly in terms of the environment where there is, in addition to the uncertainty inherent in any innovation, a strong suspicion of "non-profitability" [4]. Thus, if governments provide risk capital such as equity and stock option loans, capital would then be available to firms for developing and introducing cleaner technologies as well as the potential of having funds being eventually returned to the assistance fund.

Wider use of selective self-financing assistance could be effective in deterring the funding of projects which have low risks, or risks which a firm is willing to accept itself in return for a potential profit. Essentially, if the loan or grant has a royalty or stock option payback provision, it could cut into the potential profit -- meaning their own pocketbook. As noted before, firms generally referred to this type of assistance instrument as one that more closely represents that which a private investment firm or venture capitalist would use. Therefore, monies would be repaid into the system when projects are successful, providing additional revenue to support additional projects, a technical centre, or for other specific uses (e.g. further technical research, demonstration, or feasibility studies).

II. Conclusion: Transformation Toward Cleaner Technologies

Cleaner technology is one fundamental basis for sustainable development. A recent study concludes that 70 to 90 per cent of current emissions can be reduced through the implementation of cleaner technology [9]. But the pace and degree of the transformation to cleaner technologies is limited; an overwhelming movement toward research, development and deployment of cleaner technologies has not yet occurred. Nevertheless, governments are expressing a clear desire for a transformation to cleaner processes and products and they are providing support financially and technically to enhance the supply.

Financial support instruments are but one part of a multi-faceted array of pollution prevention options. Their short-term incentive-based function helps to ease the risks associated with the development

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17 Referring to Member country programmes as described in Annex I.
and demonstration of cleaner technologies. Hence, their collective effect can be enhanced when used in tandem with other policy instruments.

The workshop held on 28-29 June 1993, made Member countries and the OECD Secretariat current with existing programmes and activities for promoting the supply of cleaner technologies. However, there is clearly a great deal of unfinished business. Further development of complementary policies that create and expand current market demand for cleaner technologies is needed as well as the in-depth exploration of other policy instruments. Moreover, supply-side programmes need to be part of the system for technological transformation -- a system in which government action will play an essential role.

The system to transform toward cleaner technologies requires establishment of appropriate policy instruments and a good underlying analysis of barriers and opportunities in a particular society and economy (e.g. infrastructure, institutional/individual capacity, and financing mechanisms). The types of policy instruments needed depend upon whether: (1) demand side intervention is needed to signal the market to move toward implementation of cleaner technologies which have already been developed; and/or (2) supply side intervention is needed due to the lack of cleaner, environmentally sound technologies; and (3) whether the focus is on product or production process changes, or both. The range of needs for technology development versus diffusion can (and, in practice, often will) differ from sector to sector -- thus arguing for both demand and supply side policies at the same time.

The key is to find and implement the "best mix" of strategic plans, goals, regulations, economic instruments, incentive and education programmes. The specific details of the policy mix in a given country are for that country to decide upon and implement. But clearly the development and implementation of systems of policies aimed at pollution prevention is central to environmental management now and in the 21st century.

Activities to promote development and deployment of cleaner technologies as one means toward pollution prevention and ultimately sustainability are being supported in the OECD area. About US $1.5 US $2 billion annually is being invested in increasing supplies of these technologies by OECD governments. This represents about one-percent of total government expenditures on environmental technologies and protection. But if 70 to 90 per cent of current emissions could, in fact, be cut by use of cleaner technologies, then clearly next steps are to determine the basic combination or policy mix which will achieve more pollution prevention at lowest practical cost.
REFERENCES AND BIBLIOGRAPHY


Annex I
SUMMARY OF WORKSHOP OUTCOMES

Key discussions from the workshop centred on: the status of current operating financial assistance programmes; the collective experiences of Member countries; how financial instruments fit into the transformation to cleaner technologies; and the chief issues governments are facing in promoting the supply of cleaner technology.

The outcomes of the workshop characterise the extent to which financial incentives are being used, and their practicality for promoting and stimulating cleaner production and products. Discussions centred on factors for governments to consider when setting up a financial assistance programme as well as ways to augment the efficiency and effectiveness of programmes currently in operation.

There were three key outcomes from the workshop. First, the transformation to cleaner technology is seen as a system for change; one which financial assistance plays a part. Secondly, there is an uncertainty as to how governments can measure the success of their financial assistance programmes. Thirdly, there needs to be strong demand to draw cleaner technologies onto the market.

A. System for Technological Transformation

Where a lack of market demand to stimulate technological change exists, government needs to institute a leadership role to instill a new philosophy on business and industry to take action. Workshop participants agreed that the actions involved in the transformation to cleaner technologies should be viewed as a "system". Governments can then implement those policy instruments effective in promoting a changeover to cleaner technologies. Clear goals and priorities are also important components for promoting and guiding the technological transformation of industry. Another important component in this system is the use of financial assistance for stimulating industry to develop, demonstrate and implement technologies.

Government needs to take a proactive role in formulating strategic technological changes. Workshop participants emphasized that both short-term actions and long-term strategies are necessary to culminate the desired change. This is extended to the relationship of government and industry. These parties need to work closely together to form short- and long-term policies and to identify future technology needs and "niches". This is so to guide the development of future technologies which are environmentally sound and complement national environmental goals and priorities. In fact, it is here that financial assistance plays the most effective role. The short-term incentive-based function of financial assistance helps to offset or "ease" the risks associated with the development and demonstration of cleaner technologies. Subsequently, promoting the supply of available substitutes.

Financial assistance instruments have different purposes and applications amongst themselves. Selecting the appropriate financial assistance instrument to meet specific goals and objectives within the "system" is extremely important. Characterising the sort of technology to be developed, the phase of the innovation process, the branch of industry, the parties involved in the development should be considered when putting into place a system for transformation. After the proper financial assistance instrument is installed, funding can be adjusted accordingly. Additionally, for an effective system, it is equally important to review policies and other financial incentives to ensure that activities do not hinder or obstruct forward motion of the transformation to cleaner technologies.

One other important point brought out during participant discussions was that clear priorities and long-term objectives give the private sector an assurance and certainty of future environmental goals. This assurance enhances the capacity of industry to make long-term financial and development decisions.
Knowing there will not be significant changes or major shifts in ideals every two to four years, (depending on the political climate), makes the transformation to cleaner technologies easier, with less friction or financial hardship.

Lastly, the importance of viewing the "system" as a continuously changing process of technological improvements will serve to perpetrate the cutting edge of cleaner technology. Policies and incentives should be reviewed on a regular basis to ensure activities are not hampering or stifling technological innovation. In the end, the public and the common good stands to gain from the changeover to cleaner technologies. And having a system for change in place is a principal step.

B. Measuring Success

Measuring and determining the success of a financial assistance programme emerged as a key issue. But first, it is relevant to point out that each county has a different definition of success directly related to its own environmental goals and objectives. Consequently, measurements are dependent upon a country’s own socio-political structure. For instance, one Member country felt enormously satisfied with a 50 per cent success rate and questioned whether a higher success rate actually reaped greater benefits (success meaning a technology that went to market). What is meant by this statement is that a success rate of 50 per cent could actually mean the programme is 100 per cent successful - especially if the government has learned why certain technologies did not go to market. In other words, an actual 100 per cent project success rate, where each technology goes to market, could indicate that the projects being supported are those with a low risk ratio and clearly defined market. This would signify that private financing could have been used in lieu of government funds. Governments need to ensure that financial assistance is used to underwrite risky projects. This naturally implies that there will be a lower success rate. Setting an acceptable range or rate of success is an important first step for evaluating the overall success rate.

Long-term management of a financial programme also surfaced as an important measurement feature. This is because technologies often take years to develop and perfect. Emphasizing short-term profits and looking to fund as many projects as possible can skew the success of a programme. Viewing a financial assistance programme over the long-term (4 to 6 years and longer), and accepting the "profit with the loss", (meaning the successes with the failures) is a principal factor to consider when measuring success. Programme’s could be managed more like a technology portfolio, allowing for success and failures as with private or business investment portfolios.

Once a decision is made on the acceptable range of success for projects funded, a more cognizant evaluation and assessment of the financial assistance programme can be completed. The simplest form of evaluation is to assemble a checklist of all the criteria that need to be taken into account for evaluating a project. This ensures that no one component is disregarded. But while checklists are commonly used for evaluation, it was surprising how few governments had actually compiled a comprehensive list for formal evaluations.

In terms of evaluation methods, there are some quantitative techniques (e.g. econometrics) which can be used, but are often quite time consuming and narrowly focused. Surveys and personal interviews appear to be more effective for collecting a broader set of performance data for a financial assistance programme.

General opinion from the workshop tends to support the use of performance indicators to evaluate variation and change incurred from the financial assistance programme. Each indicator or measure requires a different valuation method. An alternative would be a comprehensive survey containing simple evaluation factors and used in conjunction with personal interviews could be effective in providing a suitable portrait of programme results. Here again, actual techniques used to measure and determine programme success ratios would require a longer-term study and the collection and analyses of empirical
data needs to be weighted by importance, or valued by something as simple as very good to poor ratings. Determining a measurement for success and designing indicators could be a more effective method of evaluation. Measuring success rates could also be closely tied to the funding of a portfolio of projects compared to "profit". Profit in this instance means the social or environmental benefits.

These empirical techniques could be applied within a cost-benefit framework, carefully spelling out what the social/public costs and benefits (for example, pollution reduction, prevention, lower pollution levels, etc.) of the financial assistance provided. Even when it is not possible to quantify costs and benefits with any precision, the government needs to have a clear understanding of the benefits and gains accomplished by a specific project and programme.

C. Creating a Demand Strategy

In today’s world, technology is sought to meet demands perceived to yield commercial value quickly. There are many approaches governments can take to create a demand for cleaner technologies. The following is a list of approaches highlighted at the workshop. They can be used together or separately. Finding the best mix may be the basis for future work.

- Regulations (e.g. designed to be technology stimulating not stifling);
- Government procurement practices;
- Voluntary agreements;
- Clear priorities (e.g. lower energy consumption in Japan);
- Liability (e.g. United States Superfund Law);
- Public education;
- Product labelling (e.g. eco-labels);
- Standards and product specifications (e.g. a lower emission vehicle as was done in the State of California, USA);
- Elimination or phase out and ban of a toxic substance which signals the market for change (e.g. lead in Sweden and the Montreal Protocol for CFC’s);
- Ecotaxes (set at level high enough to spur technological change);
- Local building, plumbing and electrical codes; and
- Strong tax levied against those technologies contrary to the development and take-up of cleaner technology substitutes.

Once demand is created, it is important to team up efforts with the elimination of perverse incentives which support the purchase of replaced technologies.
Annex II

I. Current Applications of Financial Support Instruments for Cleaner Technologies

Based on the country visits\(^ {18}\), we found that the type of financial assistance or "subsidy" instruments used does not vary substantially. Overall, governments are using one or more of the following mechanisms: the project grant, favourable interest loans, secured loans, and tax relief by way of accelerated depreciation.

Given the fact that most countries were using similar instruments, it was observed that clear differences and variations exist within each programme. The differences identified can be attributed to, \textit{inter alia}:

- environmental policies;
- priorities for cleaner technologies and sustainable development;
- political structures;
- industrial and economic base;
- structures and organisation of research and development;
- international cooperation such as: The European Community the Nordic Council, etc.;
- relationship between government and industry;
- administering agency experience and age of the programme; and
- public concern for the environment.

The next section provides a brief description of some Member country financial assistance programmes for promoting cleaner technologies and the instruments in use. Nine countries were visited; however, in France, only the private sector was interviewed, therefore, a government programme description is not included. Thirteen Member countries\(^ {19}\) submitted papers describing their current financial incentive programmes for the workshop.

**Australia:**

At the beginning of 1993, the federal government began a programme to demonstrate best practice environmental management. As part of this programme, SME’s will be selected to undertake environmental audits to examine solid and liquid waste streams, toxic chemical use, raw material use, and packaging and identify where improvements can be made and cleaner technologies adopted. Grants are also available for the research and development of innovative environmental technologies. Recently, the federal government introduced a cleaner production education and outreach programme which places a strong emphasis on educating industry. This outreach initiative involves: information dissemination of demonstrated cleaner technologies; the development and distribution of an environmental management handbook; carrying out a series of workshops for SME’s on the costs-benefits of adopting cleaner production technologies; a national environment industries database to serve as a clearinghouse for cleaner production practices; and an EcoReDesign demonstration programme to develop an educational kit for use by industry for redesigning products to be more environmentally sound.

\(^ {18}\) Denmark, Finland, France, Germany, Japan, The Netherlands, Norway, Sweden and The United Kingdom.

\(^ {19}\) Australia, Austria, Canada, Denmark, Greece, Italy, Japan, The Netherlands, New Zealand, Norway, Switzerland, Turkey and The United Kingdom.
With regard to State and Territory governments, Victoria has introduced a cleaner production grants programme which will provide interest-free loans to assist businesses with waste reduction activities. Preference will be given to SME’s proposing the use of a production process that reduces waste from their waste stream. They are also in the process of formulating a cleaner production demonstration programme. The Victorian government has also established a National Centre for Cleaner Production. It is intended that the Centre serves to promote cleaner production to a range of audiences including the community, industry, consultants, educational institutions environmental groups and the media. New South Wales has implemented a variety of grant programmes to encourage R and D of innovative technologies. It is not specifically intended encourage cleaner technologies, but nonetheless supports it indirectly. The South Australian government has also initiated a financial assistance scheme to promote the reduction of waste through changes in production and product design.

**Austria**

Austria has several funds aimed at promoting cleaner production and products. The government supports basic and applied research for the demonstration phase through a series of dedicated funds. The Eco-Fund is a financial assistance mechanism for promoting industrial and municipal investments in pollution prevention techniques. Several cleaner technologies have been targeted for development under this scheme. The Science and Research Fund and the Research Promotion Fund are geared towards supporting research and development at universities and to a limited extent, research institutes. The primary objective of these two funds is technological innovation, economic efficiency and pollution prevention technology. An Innovation and Technology Fund supports the demonstration of highly innovative product and process development projects. Again, cleaner technology is not the chief goal, but one of several priorities.

The Austrian National Bank Fund and the TOP-Actions Fund are general technology development funds where cleaner technologies can be financed. Lastly, the Ministry for Science and Research and the Ministry of Environment each have separate financial assistance schemes to support the research and demonstration of environmental technologies and socio-economic environmental research.

**Canada**

Environment Canada’s first cleaner technology incentive programme was launched in 1973 to stimulate the development and demonstration of innovative pollution abatement technologies. Even at that time, focus was on improved production techniques rather than EoP solutions. Currently the government of Canada promotes the development and demonstration of innovative technologies through a few different programmes. The Environmental Technologies Commercialization programme, introduced in 1992, emphasizes the development and demonstration of innovative clean production processes. The Development and Demonstration of Resource Energy Conservation Technologies programme has been in operation since 1980 and supports the development of innovative waste recovery or recycling technologies. Several clean technologies have been developed and diffused under this programme since its inception.

Experience in Canada has been that incentive programmes need to be reviewed and evaluated systematically to ensure that they do not degenerate into subsidies for the implementation of standard technologies. In order to qualify for support from an incentive programme, the technology to be developed or demonstrated must have a significant technical risk. They also point out that the normal large profit margin with the development of a cleaner technology is frequently missing. This is where governments’ underwriting of part of this risk is particularly warranted. In summary, their experience shows that direct financial incentives can significantly accelerate the development of innovative clean technologies. Moreover, they have found that the use of tax relief in the form of accelerated tax depreciation, is best used for the diffusion and implementation of demonstrated cleaner technologies.
**Denmark:**

The Danish Environmental Protection Agency began its cleaner technology programme in 1986. The budget from 1990-1992 was DK 230 million (US $40 million) and recently received DK 380 million for 1993 to 1997 (US $70 million) to support cleaner production and cleaner product demonstration projects. Up to 100 per cent of the project costs can be funded, but 20 per cent to 30 per cent funding per project is the average rate. The percentage of support granted to each project is adjusted on a case by case basis depending on the economic need displayed by the firm and whether the project will "fundamentally change a production process or produce a product which will substantially reduce emissions". To receive funding, applicants must meet the precondition that two or more entities participate in the project (e.g. industry, universities, research institutes, etc.). In addition, funding is aimed at supporting SMEs, (that is unless a proposal from a large firm is presented which would have wide spread use and applicability). Funding also extends to support feasibility studies within a branch of industry are identified.

The initiative to provide consultancy services to SME’s has helped inform and provide cleaner alternatives for these enterprises. Consultants work with the enterprise, identifying areas of improvement and applications for cleaner technology. Results have been favourable and SME’s are taking the lead to adjust current processes and seeking to adopt cleaner technologies themselves.

Monitoring and evaluations of completed projects are carried out by a steering committee. The committee is established at the beginning of a project and monitors progress throughout the duration of the project. In addition, they take a proactive approach on information dissemination. Project results are widely distributed through their newly established outreach programme. Information meetings are held with industry, authorities and organisations on cleaner technology options within the country’s major industries. A newsletter has been created to communicate facts and information about cleaner technologies.

The application process has evolved from the start of their cleaner technology programmes in 1986. The current application is a booklet containing simple directions for filling out and submitting applications. This type of procedure seems to reap more consistent applications with necessary information which in turn saves administrative time when reviewing and evaluating applications.

In order to promote cleaner technology, the Danish government views a positive and constructive cooperation with industry, organisations and authorities extremely important. Programme managers find that funding cleaner technology projects promotes technological development in a preventive direction and financial assistance is seen as an effective instrument for achieving the main objectives of environmental policy.

**Finland:**

New regulations in Finland have changed what was a multiple permit system to a more streamlined permit. Objectives and standards appear to be longer-term and more harmonized for firms applying for permits under this new system. This change has afforded industry more flexibility to develop and test out cleaner technologies to meet the limits and standards set forth in the permits.

To support industry’s use and deployment of cleaner technologies a project grant scheme has been initiated. Funding of up to 50 per cent of the project costs is available for installing, building

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20 Interview with representative from the Danish EPA.
demonstrating or using new\textsuperscript{21} cleaner technologies. The budget for 1992 was Mk 30 million (US $5 million) where approximately 25 projects were funded. However, due to the current recession, the 1993 budget has been substantially reduced.

An independent centre, supported by the Ministry of Industry, administers a second funding programme which is exclusively for SMEs. The Technology Development Centre supports applied research and demonstration projects where a large percentage goes to fostering the deployment of cleaner technologies. The Centre is composed of technical experts who analyze proposals and award funding. These experts have all worked in a specific branch of industry giving them "hands-on" experience and knowledge with industry, technology and current trends.

Several funding schemes exist:

- Applied technical research grants for cleaner technologies. Up to 50 per cent funding. Budget for 1993, Mk 26 million (US $4.3 million);

- Project development grants for demonstration of cleaner products. Budget for 1993, Mk 26 million (US $4.3 million); and

- Project development loans for cleaner technologies. Budget for 1993, Mk 38 million (US $6.2 million). Loans are given at 4 to 5 per cent below the current market rate of interest. If the project is not commercially successful, the loan does not have to be repaid.

\textbf{Germany:}

Germany has several programmes which direct financial assistance to the research, development and demonstration of technologies. The German Environmental Protection Agency administers an investment programme to promote large scale technical demonstration projects. The projects should demonstrate how existing plants can be upgraded to advanced levels of pollution avoidance, how innovative processes can avoid and reduce pollution or how cleaner products and substitutes can be produced and applied. Up to 50 per cent of the investment costs can be reimbursed through programme grants. The Programme was budgeted at DM 115 million in 1991 (US $67.2 million). In practice, if the innovation or investments turn out to be practicable, they could serve as models for regulations of other similar industry. Once this is established all like industry and/or plants must observe these standards to receive grants.

Within the past two years an environmental foundation was established to provide assistance for the demonstration of environmental technology. Its funding is derived from the interest and capital from the profits of the privatization of state owned businesses in the New Länder. Grants for up to 50 per cent of the project costs are available for environmental technology aimed at reducing air or water pollution or waste. The Ministry of Environment provides a technical review of all project proposals for their technical viability, potential environmental benefits, and if it is a "realistic approach".

The European Recovery Plan (ERP) provides low interest loans to smaller businesses, i.e. annual sales of less than DM 500 million, (US $292 million). Loans are available for up to 50 per cent of the project cost at about 2 per cent below the market rate with a 10 year repayment term. Firms who make less than DM 50 million (US $29.2 million) are eligible under this scheme for loans up to 60 per cent of the project or investment value. This "revolving" fund has been prosperous. Loan amounts plus interest are repaid back to the fund to support additional projects. Therefore it has remained as a self-financing programme. The budget for all environmental projects is about DM 1 billion (US $650 million).

\textsuperscript{21} This means "new" to Finland. It could be a technology established or tested elsewhere or a new development.
An accelerated tax depreciation scheme is in operation in the New Länder. Eligible activities under this scheme are those directly related to environmental protection. A clear percentage applicable to cleaner technologies was no available. However, 70 per cent of the investment can be written off with up to 60 per cent of the asset value in the year of acquisition and up to 10 per cent of the asset value in the following years.

To increase information dissemination to SMEs (in particular), Germany has set up a programme for the promotion of consultancy services where grants up to 40 per cent of costs (up to DM 3 000) is for advising firms on all aspects of environmental protection and compliance. Firms in the New Länder with an annual turnover of less than DM 30 million (US $18.8 million) are eligible for this assistance. This programme has helped firms increase their awareness of legal provisions as well as identify opportunities to improve their operation and incorporate more environmentally sound procedures and technologies[1].

**Greece:**

Grants and loans are provided to industries which apply cleaner technologies to produce lower pollution levels. Industrial sectors which have participated in this programme have not shown a significant change in the country’s pollution burden. At this time the predominant effort in Greece is with the development of an environmental infrastructure.

**Italy:**

Italy has set forth a large scale effort for environmental protection where the promotion of cleaner technologies is one of the priorities. A three year programme with the funding support of over 11 000 billion lire (US $80 billion) was initiated in 1990 to improve all aspects of environmental protection. One hundred and fifty billion lire has been dedicated to cleaner technologies for zeroing in on the delocalisation and restructuring of industrial processes. At the end of 1990, another three year 230 billion lire (US $1.6 billion) research programme was established. This programme provides grants and favourable interest loans to firms under a series of research themes. Themes and funding referring to cleaner technology include: development of innovative technological solutions for reducing emissions of motor vehicles, 18 billion lire (US $13 million); basic research support, 1.2 billion lire (US $860 000); "clean" fuel development, 9.4 billion lire (US $67 million); and 1 billion lire for education and training activities. There is also a Technology Innovation Fund available which provides grants and loans to industry for the development of new products and processes. Again the fund is not specific to cleaner technology, but a portion of the projects approved are dedicated to research and development of cleaner production and cleaner products. For example, in 1990, 50 projects corresponding to around 450 billion lire (US $3.2 billion) of investment (35% was government funding) were conducted.

In 1991, a programme aimed at promoting development and innovation of small enterprises was initiated, having particular emphasis on the development and diffusion of new technologies. Grants and favourable interest loans are available to small enterprises. Two of the programmes main priorities focus on environmental protection. Qualifying candidate technologies must meet the following criteria: (1) no polluting substances can be substituted for another polluting substance; (2) technology is for the conversion or modification of a plant, and/or production process; and (3) the elimination of a polluting substance during a production process.

**Japan:**

Japan has an extensive support programme for innovative technology research and development. Research for cleaner technologies is an eligible activity under this programme. In general, businesses can claim an immediate 20 per cent tax deduction for all innovative technology R and D costs. SMEs may take an additional 6 per cent deduction. Lower interest construction loans may be granted for up to
50 per cent of such costs when associated with the development of new technologies. This means construction costs associated with R and D production lines demonstration plants and the commercialisation of new technologies can be granted favourable interest loans. In certain cases, interest free loans can be given for certain types of R and D activities.

The Japanese government has recently set forth the goal of the Ecofactory. This concerns the development and establishment of next-generation mechanical engineering contributing to the resolution of global pollution problem “The Ecofactory technology aims to strike a harmony between manufacturing activities and global ecology as well as coordinate industrial production and recycling processes with the global ecology circulation cycle...”. Research and Development schemes have been developed which will launch technology into the 21st century. Designing innovations for the design -- production -- disassembling and recycling processes for the: reduction in natural resource consumption; reduction in wastes; recycling wastes efficiently and to be of high quality; and reduction on the reliance of overseas natural resources[2].

In 1991, a direct budget items devoted exclusively to the promotion of research on global environment: 4.5 per cent of the total R and D budget.

The Netherlands

The Dutch government has 28 environmental subsidy schemes of which five are directed specifically to promote cleaner technologies. The first scheme has been set up to spur the development of environmental technology financing the demonstration of technologies which are "new" to the Netherlands. The Ministry of Environment administers, (in cooperation with the Ministry of Agriculture, the Ministry of Water Management and the Ministry of Public Works), this scheme where Gld 10 million (US $5 million), has been budgeted per year from 1990-1994. Financial assistance percentages differ with the placement of the candidate technology within the innovation process; for example, 50 per cent is provided for demonstration projects, and up to 90 per cent for feasibility studies. Projects results are publicised as diffusion is an important programme goal.

The Environmental Technology in Industry Scheme (PBTS) is supported by the Ministry of Economic Affairs. Financial support is directed towards research, development and demonstration of specific environmental technologies. Projects eligible under this scheme must fall under one of the following categories: prevention, re-use, processing of waste, soil clean up, and measurement and control technology. It aims to accelerate research from the basic or fundamental stage to the applied or know-how stage by providing 37.5 per cent of project costs. An independent technical centre administers the PBTS scheme. The board that judges the projects, consists of specialists and experts in the field of industry and technology science. Diffusion is quite limited with this programme due to the nature of property rights where much information must be left confidential.

The Innovation Oriented Environmental Technology Research scheme (IOP) aims to strengthen basic research on environmental technologies at universities and technology institutes. This matching project grant programme funds up to 50 percent of the project costs with an annual budget of Gld 10 million ($5.2 million). Innovative projects in the fields of environmental biotechnology, recycling and pollution prevention qualify for support under this scheme. It is viewed as a programme "to help steer future basic research towards cleaner technology needs"22.

The fourth scheme involves four different Ministries which have coordinated efforts to stimulate and support the development of environmental technology across sectors. Gld 10 million (US $5.2 million)

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22 Interview with a representative from the Netherlands Ministry of Housing, Physical Planning, and Environment.

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are dedicated to promote of the application innovations in the transport, agriculture and the public works field.

In 1991, the Netherlands launched an accelerated depreciation tax relief programme for environmental technologies. Tax relief, by way of accelerated depreciation of the investment cost of a specific cleaner technology, is available to all firms. Each year a special list is drawn up each year designating which capital goods are eligible for the tax deduction. For 1993, this list contains approximately 400 products. Gld 80 million (US $47 million) has been allocated, in terms of foregone revenue. Three tax deduction options are available to firms which make such investments: a one time 100 per cent write off the first year of purchase; a 33.3 per cent write off over a 3 year period; or a 4 year 10-10-10, 70 per cent write off plan. The investment cost is written off from the total profits. Therefore, if a firm does no make a profit one year, they may opt for one of the other options.

The list of capital goods is updated annually. Products are added and removed at this time. Goods placed on the list are generally products not commonly known and the deduction is aimed at promoting their diffusion and accelerating market introduction. Thereby providing firms with interest and liquidity advantages. The actual benefit to each firm for taking a tax deduction has been estimated at around 10 to 12 per cent23.

The selection and identification of technologies for the list is handled in several ways. A call for tender, where users and suppliers provide information, surveys of industry branches, national and international programme, seminars, and trade shows. Final selection is made according to environmental priorities and the character efficiency and market potential for a technology. This is accomplished through a weighted ranking scheme based on environmental priorities and such factors as viability and market potential.

The procedure for notification of a purchase is quite simple. Within 6 weeks after the investment, the firm must notify tax authorities using a 1 page, pre-printed form, accompanied by a certification statement by an accountant. The deduction then appears on taxes for the following year. As one might expect, there is a sharp increase of purchases during the month of December.

New Zealand:

New Zealand has recently initiated a cleaner production demonstration programme. Eight firms have been selected (out of 40 applicants) to participate in this programme. Selection criteria were based on the firms strength and commitment to cleaner production, type of business, size of firm and geographical spread. Workshops have been held with the participating firm to: introduce the concepts of cleaner production; set up a networking system; and help refine the guidelines that companies will use in implementing their own project. A manual will be developed from this project and subsequently made available to local authorities so they can take the lead in promoting cleaner technologies. Results of each demonstration project will be widely distributed throughout the country in hopes to promote the diffusion and take up of cleaner technologies.

Norway:

Three main subsidy schemes exist in Norway for promoting cleaner production and products. The first is administered by the State Pollution Control Authority where up to 50 per cent of project costs can be allocated to projects which qualify for funding. NKr 50 million (US $8 million) is allocated on an annual basis for demonstration and pilot projects. There are two categories for funding: (1) development projects, where the purpose is to adapt known technology or known products to new areas of applications,

23 Interview with a representative from the Netherlands Ministry of Housing, Physical Planning, and Environment.
or to test completely new technologies or products; (2) waste minimization assessments (priority is given to those branches with a large number of enterprises, or to branches where only a few enterprises are required to have a discharge permit. The aim of this scheme is the installation of cleaner technologies to achieve national environmental goals. Priority financing is given to specific branches of industry which create the greater pollution burden. Criteria which must be met before financial assistance is considered are: (1) the project should help to solve a high priority environmental problem; (2) the "owner of the problem" must also contribute financing; and (3) it should have diffusion potential to other enterprises with similar problems.

This programme demonstrates a transformation of an enforcement agency. Inspectors have been trained to assist and educate industry on how to meet pollution standards through the application of cleaner technologies. The Agency has shifted its strategy from enforcing standards strictly by penalty to helping industry in locating or directing them to the sources of cleaner technologies.

The second scheme in operation is the Technical Environment Analysis Programme. The State Pollution Control Authority in conjunction with a technical institute administers a technical assistance programme which evaluates the production process and operations of SMEs. Teams of experts comprised of inspectors, technical experts, industry and branch consultants serve to analyse operations and work together with a firm to find where environmental improvement can be made: jointly identifying where changes, adaptations and the installation of cleaner technologies can be made. Industry and government split the cost of the analysis per a sliding funding scale. A report with savings calculated per change, over a certain timeframe, is provided to the firm at the end of the project. This programme is led by the independent institute, thereby avoiding the "stigma" of government to the programme. The consultancy effort has been well received by SME's and helps mobilise activity by the firms to incorporate changes and adapt new cleaner technologies.

The third financial assistance instrument involves securing loans for enterprises embarking on the development of a prototype or the demonstration of a cleaner production process or product. The Ministry of Industry and Energy supports a State owned finance company (SND) which administers this programme for the Ministry of Environment. SND top-finances projects involving the reorganisation of processes, and cleaner technology projects. (In addition to the Ministry of Environment’s Programme, the institution also manages several industry and energy programmes with a total funding of Nkr 830 million - US $138 million.) The Ministry of Environment’s Research and Development programme amounts to Nkr 115 for 1993 (US $19.5 million.) These contracts are a means of supporting companies that wish to develop new profitable technologies for the public sector. Funding mainly applies to demonstration and development of full scale prototypes. So as projects are reviewed, the institution flags environmental technology projects and sends them to the State Pollution Control Authority (which operates under the Ministry of Environment) for technical review and approval while the financial institution evaluates the business and economic aspects of each proposal. At the time of the interview, loan estimates of Nkr 2 billion (US $330 million) for cleaner technology were outstanding. To date, approximately NKr 20 to 30 million (US $3 to 5 million) has been paid out for defaults. The conditions for loans include interest only payments for the first two years with a variable scale of repayment of 4 to 10 years.

Preliminary programme evaluations show that their approach has successfully funded risky projects for SMEs and has stepped up the speed at which cleaner production and processes have been deployed in Norway.

Sweden:

The Swedish Environmental Protection Agency project grant scheme aims at the demonstration of cleaner production and products. Established in 1990, SKr 25 million (US $3.8 million) is available each year to the "user" for testing and demonstrating new production processes or products. Total support, with industry’s contribution is estimated at SKr 75 to 80 million, (US $12 million) for each funding cycle.
Project priority areas include: waste minimization technology; use of cleaner substitute products; and the use of new products. Priority for funding is directed at small and medium enterprises (SMEs) where the technical and financial risks are more dramatic.

Due in part to past experience with subsidy programmes, the Environmental Protection Agency, has sought to keep the programme simple, avoiding excessively complex rules or controls. Hence, concentrating efforts on those firms having the capability and willing to demonstrate or put into place cleaner production and products. Experience has also proven that expectations for immediate start up and results can lead to poorly designed projects and windfall profits.

An independent technical institute, under the Ministry of Trade, administers the lion’s share of Sweden’s financial assistance for promoting cleaner technologies. Around SKr 190 (US $30 million), 20 per cent of the entire research budget, is directed at accelerating the implementation of cleaner production and products which are near market or in the demonstration phase. Project proposals are submitted to the Institute where technical experts evaluate the merit and technical viability of the proposal.

The overall aim of these funding schemes is to boost the demonstration and deployment of cleaner technologies throughout industry. Funds are distributed through a broad range of assistance schemes. These schemes include:

- Favourable interest loans for projects. Loans at 2 per cent below market rate for 25 per cent of the project cost. Repayment of loan is required only if the project is a commercial success. Terms of repayment is usually over a period of 10 years.

- Favourable interest loans for obtaining patents. Funding of 50 per cent of total costs.

- Conditional royalty loans. Loans are given on the condition that if the project is a commercial success, the firm will pay the institute a specified percentage from their profits as a royalty. Each loan has differing conditions. Some have a payment cap, others a timeframe limit, while some projects have no limits of amount or time. This scheme has proven quite beneficial with some projects. Royalties are returned to the Institute’s general budget.

- Awards. Special contests have been launched where the institute issues specifications for a cleaner products. The project which fits or exceeds criteria receives an award. The award also spurs marketing potential for the firm, almost guaranteeing future sales.

An interesting element to the priority funding scheme is the category of "regional". Priority is given to special regional areas that are: lower income; localities away from city centres; and areas where the economic base is changing (e.g. shipbuilding to auto manufacturing). Monitoring and project evaluations are based on reports submitted at each project mile stone and on an annual basis.

Switzerland:

Switzerland has launched an incentive programme for the development of cleaner products. There are several government-promoted lifecycle analysis applications and publications containing comparative product development methods for industry. The government has jointly supported with scientific and environmental protection organisations, the development of cleaner products. This project entailed the development of a refrigerator which was free of halogenated organic chemicals and consumed no more than half of the energy of refrigerators currently on the market. The aim is to stimulate innovation and demonstration of cleaner products and to provide product specifications in order to overcome the hesitance found with the market.
Turkey:

A technopark is being developed which will serve as a research and development centre for cleaner technologies which have national and global applications.

United Kingdom:

In 1988, the Department of Environment (DOE) launched a project grant scheme to promote cleaner technology in specific environmental priority areas. The Department of Trade and Industry (DTI) joined forces with DOE in 1990 broadening the scope and aims of the original programme. While DOE still supports technologies to achieve environmental priorities, DTI promotes the development and diffusion of innovative technologies for the whole range of environmental problems in hopes of developing a more dynamic environmental industry.

Since 1990, £12 million sterling (about US $19 million) has been allocated to 60 projects. There are two main schemes under this matching grant programme. The first is directed at promoting the demonstration and piloting environmental technologies. The second scheme supports projects in the applied research, yet nearing the demonstration phase, aiming to move projects to the next stage of the R and D process. About 75 per cent of all projects funded are specifically directed at cleaner technologies (monitoring methods and EoP account for the remaining 25 per cent).

The United Kingdom has employed some interesting features in this programme. First of all, a prerequisite for government support is the collaboration of two or more entities (e.g. industry, universities, R and D institutes, etc.). With regard to the review of applications and project proposals, consultants have been engaged to provide a technical review of each project.

Due to the overwhelming response of applicants (over a thousand), a two stage application process has been put into place. The first stage application contains general information for a preliminary screening. If the project is new and innovative with commercial potential, meets the "additionality" criteria (show need for funding) and clearly addresses an environmental problem, they are invited to submit a stage two application. The stage two application requires more detailed information (workplan, accounting data, etc.).

Projects are monitored on a quarterly basis. Funds are allocated to firms in quarterly instalments, after a quarterly progress report is received. Meetings are usually held with recipients every six months to review progress. Every few years the DTI evaluates the operation and effect of subsidy programmes. Results of evaluations are then used to adjust policy and programme, to arrive at a more efficient operation.

The Commission of European Communities:

The Commission of European Community’s Financial Instrument for the Environment (LIFE) came into force July 1992. The main objective of the LIFE programme is to contribute funding towards implementing EC environmental policies and legislation. The LIFE Regulation lists actions under five fields which define the scope of the programme:

- promotion of sustainable development and the quality of the environment;
- protection of habits and of nature;
- administration structures and environmental services;
- education, training and information; and
- actions outside Community territory.
For many years the Community has been financing research and development programmes, the results of which can be exploited by demonstration and pilot projects. Under LIFE, demonstration schemes, awareness campaigns and actions providing incentives or technical assistance will be eligible for assistance. Scientific and technical research is not included.

The first of the fields includes the promotion of new clean technologies i.e. those which create little or no pollution, and make fewer demands on resources. The Commission has targeted five industrial sectors in calling for demonstration projects. These are: surface treatments (e.g. metal plating, ceramics); textiles; tanneries; paper industry; and the agri-food industry (e.g. dairies).

Forty percent of the total funding is directed to cleaner technologies. Technological innovation is expected to play an important part in other priority actions within the LIFE programme, including: techniques to rehabilitate contaminated land; waste reduction and recycling; and modernising monitoring networks.

Annex II References


Annex III

Business Plan Components

A. Outline Summary:

• What is the business or project (description)?
• What is the market?
• What is the business or project potential?
• What is the listing of profit forecast figures?
• Indicate the amount of funding requested and why it is necessary.
• What are the prospects for the investor/lender?
• Characterise and forecast social and environmental benefits from the project itself.

B. Business Description and Performance (clues to future performance and accomplishments):

• When did the business begin?
• Provide a brief summary of past performance (key achievements).
• Indicate relevance of past performance.
• What is management’s experience?
• Identify any weaknesses and how they will be dealt with.

C. The Product, Process or Service:

• Provide a simple description and explanation as to why it is unique.
• Provide a brief survey of competition and imitation potential.
• How the product or process is developed? What it can accomplish (40 per cent reduction in CO₂ emissions, etc.)?
• Is this a new technology, process or product substitute?

D. Marketing Analysis:

• Indicate potential customer size and breakdown of market into sectors, likely customers and their needs. How do they buy? Why will they buy this item or service?
• Provide information on recent and anticipated trends, in terms of both size and shape of markets.
• What are the major influences on the market?
• What is the existing market share?
• A frank review of major competitors, summarising relative strengths and weaknesses.
• Summarise current customer base (if applicable).

E. Marketing and Sales (Crucial):

• Target customers: who and where are customers expected to be in two or five years time?
• What are the buying methods and procedures: decision-making and budget allocation processes, lead times and order slippage, size of orders, capability, tender processes, approved supplier rules ad requirements, etc.
• What are the selling methods: size of sales-force, type of sales-force (representatives, outside agents, commission only, etc.), geographical sales, historical and forecast effectiveness of sales-force. What are the market assumptions, views, basis of marketing strategy, size and growth aspects as well as shape and structure of market? (Special attention will need to be paid to explaining and reviewing how a project, firm or the innovator, will fit into the market.)
• Advertising and publicity: what are the budget, needs, timing, requirements, planned promotional activities?

(continued)
Annex III

Business Plan Components (continued)

F. Financial Analysis:

• Provide a summary of forecasts.
• Indicate monthly profit and loss forecast for at least two years.
• Provide cash flow forecasts for about three years and forecast balance sheets for two years.
• Provide copies of audited accounts for last three years (if available).
• Indicate assumptions behind the forecasts.

G. Prospects:

• Indicate objectives -- short and long term.
• Describe what financing is available and what is needed.

H. Management Structure and Operations:

• How is the management is structured (organisation, summary of roles and responsibilities, etc.)?
• Management description, i.e. strengths, weaknesses, existing or anticipated gaps in management and skill base and an explanation as to how this would be rectified.
• Summarise management team’s personal objectives.
• Provide a description of personnel and those responsible at each stage, general role and responsibilities, etc.).
• Describe the management information systems and automated (computer) processing.
• Describe production and delivery, capabilities and capacity.

I. Financial summaries:

• Indicate historic results.
• Provide recent management accounts and current budget.
• Indicate financial projections: rate and sources of revenue growth, structure and timing of funding and support, other major financial factors not mentioned before.

Ref. [18] and [19]
**Annex IV**

**FINANCIAL SUPPORT**

**BUDGET ESTIMATES**

Millions per country denominations, for 1992

<table>
<thead>
<tr>
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<th>Budget Estimates for the Research, Development and Demonstration of Cleaner Technologies</th>
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<tbody>
<tr>
<td>AUSTRALIA</td>
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<td>UNITED KINGDOM</td>
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* amounts are estimates assimilated from interviews, OECD 1993
Annex V

TYPES OF FINANCIAL SUPPORT INSTRUMENTS

General Financial Support

General financial support instruments are those available to all firms in accordance with specific and well-defined criteria. There is no case-by-case selection process. Most frequently used are tax reductions or credits. In practice, this scheme allows a firm to retain more of its gross earnings. This increment of capital helps pay for the specific items favoured by the tax system. Some countries use accelerated tax deduction schemes for certain items or equipment purchased, allowing a larger deduction for the increased expenditure from the profits of the firm. Government’s contribution to this fund is via foregone tax revenue. The advantage of this system is the low level of effort required by government to operate the system. Firms generally prefer this method due to its simplistic nature and their own familiarity with the tax system.

Selective Financial Support

Selective financial support is funding given on a case-by-case basis, depending on the judgement and criteria set up by the administering agency. In contrast to general financial incentives, the administering agency selects projects from a list of applicants.

The variation among selective financial support instruments is widespread. Project grants are the most commonly used instrument within the OECD region. The second most popular instrument is below market interest loans. Selective financing mechanisms are more narrowly focused than general financial assistance so that cleaner technology projects and activities can be clearly more targeted. The application procedure usually consists of firms preparing a proposal package which includes a project description and plan, personnel profile and accounting information.

Under selective financial support schemes, there is more control by the administering agency in selecting the project and technology to be supported. Disadvantages to this system include: pressure to select "winners"; ensuring that funds are distributed and used so as to avoid "windfall profits"; and confirming that the project has indeed a strong potential for decreasing the pollution burden, and/or reducing the use of raw materials, and/or energy [1].

Funding for Financial Support Programmes

Financial support programmes are usually financed in three ways: from the general budget; by self-financing or "revolving" funds; and through pollution charges and/or taxes. For the general budget case, funds are allocated to the Ministry or Agency as part of its budget, as a direct line item, or as a special "separate" budget for funding cleaner technologies. Self-financing programmes receive funds from the repayment of loans, royalties, etc. In essence, all or a portion of the original funds are returned to the fund. Those programmes supported via special pollution taxes, charges and fees derive monies either directly from the assessment and collection of the taxes, fees and charges; or directly from the Treasury where monies usually accumulate in a special fund for the programme [1].

Project Grant Instruments

Many countries providing financial incentives use some form of the project grant instrument. Support is given on a case-by-case basis by funding a percentage (in some cases, 100 percent) of the project. The administering agency sets forth criteria which reflect environmental goals and disseminates programme information for prospective applicants.
Applications from the private sector are critically evaluated to find the "best project for the money". Once a project is selected and funded, its progress is monitored so as to ensure that the recipient is meeting the pre-set objectives and time schedules. When the project is completed, a report is usually submitted to government concerning the technical procedure, product or effect. Frequently, publication of successful project results occurs in an effort to motivate other firms to purchase, demonstrate, take up the technology, or product themselves[1].

**Favourable Interest Loans**

Loans with favourable interest are conventional loans which are financed either by private banks, a government financial institution or by the government agency itself. The designated funding agency (e.g. Ministry of Environment) selects projects on a case-by-case basis for which it pays a portion of the interest. The lower rate of interest gives rise to smaller annual payments than a loan funded at the (higher) market rate of interest providing a benefit to firms through the difference in repayment [2]. Terms of repayment currently range anywhere from 2 to 15 years. With some schemes, the recipient pays only the interest for the first few years and then repays principal and (reduced) interest for the remaining term.

**Secured Loans**

Secured loans are given on a case-by-case basis and involve the government securing or guaranteeing repayment of a commercial loan. Applicants are usually required to meet a minimum criteria which could involve equity or perhaps a special fee. Loan guarantees are usually off-budget for the government in that there is no "actual" cost to the government unless a firm defaults.

**Tax Deduction: Accelerated Depreciation Schemes**

Tax incentives are considered as general financial assistance in that all who meet preset criteria are eligible to benefit. Accelerated depreciation is provided to a firm investing in a cleaner technology, i.e., a percentage of this investment cost can be deducted from profits. In other words, firms can depreciate certain investments at a higher rate over a shorter period of time as compared to the normal depreciation rate [2]. In contrast to direct grants, tax relief in the form of a depreciation allowance does not reduce real investment costs. Moreover, in instances where there are no profits, firms do not benefit from this scheme. This liquidity benefit does make it easier for companies to finance an investment due to a higher equity capital share available in the form of tax savings, thus reducing the need to borrow funds. In addition, grants and the interest rendered by favourable interest loans are often counted as "profit" in many tax systems which can make accelerated depreciation appear schemes more attractive.

**Annex V References**


Annex VI

HOW FINANCIAL ASSISTANCE SCHEMES HELP BREAK DOWN THE BARRIERS TOWARDS CLEANER PRODUCTION AND CLEANER PRODUCTS

The following chart, "How Financial Assistance Schemes Help Break Down the Barriers Towards Cleaner Production and Cleaner Products" was submitted by the Dutch government at the Workshop on "The Role of Government Assistant for Promoting Cleaner Production and Cleaner Products". This chart lays out several barriers and the response by the Dutch government as to how to overcome them.

<table>
<thead>
<tr>
<th>BARRIERS</th>
<th>FUNCTION OF FINANCIAL ASSISTANCE SCHEMES (FAS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. short term gains and immediate tangible results</td>
<td>1. subsidies on investments have a small favourable effect</td>
</tr>
</tbody>
</table>
| 2. slowing growth, increasing inflation and budget deficits | 2a. Theses (perceived) barriers may apply to EoP-techniques to some extent. Macro-economic analysis however suggest only minor effects. There may be important effects however on branch level.  
2b. FAS’s tend to apply overwhelmingly to new technologies, which are on average far more cost effective than EoP. New process-integrated technologies do add only slightly, if at all to a raise of capital-intensity of production.  
2c. Reducing environmental impacts has proven to be a very inspiring starting point for engineers to rethink and redevise processes and products to improve energy and materials efficiency as well as improving quality, reliability etc. FAS’s therefore improve overall efficiency and competitiveness. |
| 3. uncertainty and risk | 3a. FAS reduce the financial risks for the inventor (R&D stage), as well for the investors in the diffusion stage  
3b. By pinpointing new directions of R&D they also decrease the level of uncertainty for innovators in other fields of R&D.  
3c. Indicating emerging patterns of diffusion, they reduce the risks for investors in related fields. |
| 4. lack, or scarcity of risk capital by private bankers, innovators and investors | 4a. By reducing the financial risks involved in R&D and investment, FAS will increase the access for inventors and investors to risk capital.  
4b. By supplying information about the validity of new developments towards cleaner production and products to financing institutions (banks) they will reduce the risks as perceived by those institutions, thus making them more willing to supply financial support. |
| 5. limited information exchange and co-operation between supply industries and their buyers | 5a. In the overwhelming majority of cases, FAS require explicit design requirements for new technologies, giving clues where close collaboration of supplying industries and their buyers will be especially benevolent.  
5b. FAS’s mostly require appraisal of R&D - applications, offering referees opportunities to foster collaboration between universities, technological institutions and firms. (In fact the most successful applications of FAS in The Netherlands include projects, which were redesigned by (governmental) referees, to include more parties than originally envisaged by the applicant (anaerobic water purification, biofiltration)). |
<p>| | |</p>
<table>
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<tbody>
<tr>
<td>6.</td>
<td>uncertainty of government regulations and standards</td>
</tr>
<tr>
<td>6a.</td>
<td>It is counter productive to link government regulations and standards closely to attempts to foster cleaner technology by FAS, since business tends to be fearsome that their efforts will immediately be translated in stricter regulations and standards, shortening the depreciation time of capital goods.</td>
</tr>
<tr>
<td>6b.</td>
<td>An important proportion of FAS however has emerged from negotiations between government and industry. FAS’s helped to swallow the medicine. In those cases FAS’s were part and parcel of agreements, leaving the industry responsible for attaining future standards.</td>
</tr>
<tr>
<td>6c.</td>
<td>The overwhelming majority of FAS’s are based on some kind of explicit formulation of environmental policy goals into design requirements for new processes and products (called ‘programmes’). These design requirements give clues to future development of regulations and standards.</td>
</tr>
<tr>
<td>6d.</td>
<td>In order to be effective, those design requirements must be closely linked to targets of environmental policy and the technological state of the art (including emerging technologies). This can readily be achieved in the context of negotiations with target groups and voluntary agreements.</td>
</tr>
<tr>
<td>7.</td>
<td>lack of necessary infrastructure to bring about recycling, recovery and reuse of materials and products</td>
</tr>
<tr>
<td>7.</td>
<td>Because of FAS’s being based on technology programmes, they may provide government with some clues with respect to the magnitude of future recycling and reuse, thereby facilitating the planning of future needs for infra-structure.</td>
</tr>
<tr>
<td>8.</td>
<td>requirements for BAT stifles innovation and favour the employment of EoP-techniques</td>
</tr>
<tr>
<td>8a.</td>
<td>Reliance on BAT(NEEC)’s may mirror the wish of permit issuing authorities for certainty (on paper), and the felt urge to deliver permits in a short time. It is this wish to invest as little time as possible in issuing permits, as well as presenting unambiguous proof of their vigilance to the public (including environmental groups and municipal councils - and other representative bodies for that sake), that BATs seem to enjoy an ever increasing popularity with permit issuing authorities.</td>
</tr>
<tr>
<td>8b.</td>
<td>FAS’s at the other hand may provide information to the public at large about preferable options, giving more confidence in new technologies, not yet included in lists of BATs, especially when they are based on sound ‘programmes’.</td>
</tr>
<tr>
<td>9.</td>
<td>attitude of labour; fear of displacements because of new technologies</td>
</tr>
<tr>
<td>9.</td>
<td>If FAS’s are part and parcel of more comprehensive approaches towards environmental policies (which they should and in fact increasingly are), they may give more insight in those developments which well require more employment as well.</td>
</tr>
<tr>
<td>10.</td>
<td>lack of information and knowledge</td>
</tr>
<tr>
<td>10a.</td>
<td>The programmes on which the overwhelming proportion of FAS’s are based giver clues as to what is available.</td>
</tr>
<tr>
<td>10b.</td>
<td>Some FAS’s, notably the Dutch accelerated depreciation scheme provide precise and concrete information on some of the best capital goods money can buy. Especially small and medium sized companies get the opportunity to pick their best choices, without the necessity to invest considerable time and money to find out what those best options are.</td>
</tr>
<tr>
<td>10c.</td>
<td>There is an increasing interest of banks in obtaining more details of the investment goods eligible for accelerated depreciation and of appraisal techniques used to draw up the list of those items, to be used in their own appraisals of firms and applications for loans.</td>
</tr>
<tr>
<td>11.</td>
<td>lack of expertise within industry and research organisations, or lack of co-ordinated expertise.</td>
</tr>
<tr>
<td>11.</td>
<td>If FAS’s are based on well defined programmes, industry and research organisations are facilitated to start co-operation.</td>
</tr>
<tr>
<td>12.</td>
<td>poorly co-ordinated and/or unclear national environmental goals</td>
</tr>
<tr>
<td>12.</td>
<td>In devising FAS’s, government is forced to articulate future developments, thereby giving ‘a sense of direction’ to industry.</td>
</tr>
<tr>
<td>13.</td>
<td>limited consumer demand</td>
</tr>
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Source: Government of the Netherlands
ANNEX VII

THE PHASES OF THE INNOVATION PROCESS

The following chart, "The Phases of the Innovation Process" provided by the Dutch government at the Workshop on "The Role of Government Assistance Instruments for Promoting Cleaner Production and Products". The chart illustrates 4 phases of the innovation process and characteristics which are viewed to be different in each phase. This chart could be used as a base for other governments to review how their innovation operates and the characteristics for each phase.

<table>
<thead>
<tr>
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<th>RESEARCH AND DEVELOPMENT</th>
<th>INVESTMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FEASIBILITY STUDY (I)</td>
<td>DEMONSTRATION (II)</td>
</tr>
<tr>
<td>1. level of uncertainty about the outcome</td>
<td>XXXXXXXXX</td>
<td>XXXXXXX</td>
</tr>
<tr>
<td>2. amount of needed financial support relative to money spent</td>
<td>XXXXXXXXX</td>
<td>XXXXXXX</td>
</tr>
<tr>
<td>3. amount of needed financial support in absolute terms</td>
<td>XX</td>
<td>XXX</td>
</tr>
<tr>
<td>4. parties involved in the technical process</td>
<td>university technical institute firm</td>
<td>university technical institute firm</td>
</tr>
<tr>
<td>5. parties involved in funding</td>
<td>government firm</td>
<td>government firm</td>
</tr>
<tr>
<td>6. typical % of financial support</td>
<td>90 - 50</td>
<td>60 - 30</td>
</tr>
<tr>
<td>7. types of instruments</td>
<td>research and development subsidies</td>
<td>research and development grants</td>
</tr>
</tbody>
</table>

Source: Government of the Netherlands
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<td>Through Enhanced Managerial Accounting Systems</td>
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<td>Cleaner Technology for More Sustainable Agriculture (E/F)</td>
<td>___</td>
<td>OCDE 1994</td>
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<tr>
<td>(publication forthcoming)</td>
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<td>___</td>
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<td>Export Promotion and Environmental Technologies (E/F)</td>
<td>___</td>
<td>OCDE/GD(94)9</td>
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<td>(Environmental Monograph No. 87)</td>
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<td>Guide for Government Self-Assessment for Policies to Promote Technologies for Cleaner Production and Products</td>
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<td>(forthcoming)</td>
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