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**Cleaner Production  
Opportunities And Future Prospects**

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**First International Conference on Environment Research, Technology  
and Policy**

**July 16-19, 2007**

**Accra, Ghana**

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**Abstract**

Cleaner Production and Sustainability are very important for economic development in parallel with social advancement and environmental protection are now increasingly accepted, despite ongoing uncertainties about its practical implications for the technologies, products and practices of the future. The challenge ahead is to turn sustainability issues into a basic concept for innovation to deliver the sustainable technologies and products of the future, which reflect tomorrow's - rather than yesterday's - balance between economic, environmental and social imperatives.

In this paper the focus on how Cleaner Production and Sustainability can drive innovation in different industry sectors. In the context of food processing, textile, and Chemicals, all turned out to be effective to consider innovation at operational, design and technology platforms, each having their own timescales and improvement potentials. While more research is required, there is a clear indication that innovation should increasingly focus on the life cycle of materials and products, their environmental compatibility and resource intensity.

With regard to the practical implementation of Cleaner Production and sustainable technology development, a distinction is useful between sustainability considerations that enrich the existing innovation processes and sustainability considerations redefine the innovation processes. We should work on sustainability enhancement tools for process and product development and redefining sustainable futures for industry sectors and their technology bases

Environmental management has improved in many countries of the world through the adoption of a national environmental strategy (NES) and/or national environmental action plan (NEAP); efforts at integrated sustainable development have been very slow. This is because NES and NEAP preparation is oftentimes catalyzed by international donors and are often considered essential for national sustainable development strategies in the developing countries.

The challenge is thus how to achieve policy integration. This requires coordination and consultation between government institutions, as well as complementarily and coherence between policy instruments. Limited decentralization

of legislative and financial powers is also an obstacle to formulating and financing local Agenda 21.

Financing for sustainable development in the in developing countries remains limited, mostly because external indebtedness continues to deplete financial resources. Falling tariff revenues caused by trade liberalization and economic restructuring has also forced governments to finance national debt and public expenditures through alternative means, including taxation. Foreign direct investment, privatization, environmental and social funds and micro-financing programs are means for increasing financial support for sustainable development. However, most firms still lack sufficient access to resources from financial institutions and local financial markets to support environmentally friendly investments. Reducing the debt burden in view of tightening budgets would release funds for sustainable development.

The use of cleaner production strategies, basic technologies, research and transfer of appropriate, but not necessarily the most advanced technologies is needed. Regional technology centers should be developed. Regional policies towards WTO negotiations on technology transfer and trade-related aspects of intellectual property rights are needed, as is technology transfer and training.

## **1. Introduction**

UNIDO/UNEP NCPC Programme provides a unique set-up in terms of offering an opportunity for international co-operation, national capacity building and networking amongst the actors in cleaner production throughout the world.

The NCPC Programme is a joint initiative by UNIDO and the Division of Technology, Industry and Economics (DTIE) of UNEP, to help developing countries and countries with economies in transition promote the application of cleaner production in enterprises, and importantly, to incorporate cleaner production in the national environmental policy and regulatory framework.

In 1987, the concept of sustainable development was proposed to steer Our Common Future. In theory, sustainable development implied meeting the needs of the present generation, without compromising the needs of future generations. The true challenge of sustainable development was how to put the theory into practice. Cleaner Production (CP) provides a practical way to transform clues from the conceptual framework of sustainable development in practical actions.

Cleaner production is an overall approach to business management to reduce the use of energy, water and material resources and to minimize waste and pollution. It involves a shift in environmental protection from an 'end-of-pipe' approach where pollution is managed after it is created, to a 'front-of-process' approach where the creation of pollution is avoided or minimized at the source.

UNIDO has the lead role in establishing NCPCs. It is the executing agency for the NCPCs, being responsible to the funding or donor organizations and the NCPC counterparts; viz. the national governments. It is responsible for providing initial training to center personnel,

providing technical oversight for all activities undertaken by the centers, formulating the annual work plans with the Directors of the centers, assisting them in the management of their centers and monitoring their progress.

The UNIDO cleaner production (CP) programme aims at building national CP capacities, fostering dialogue between industry and government and enhancing investments for transfer and development of environmentally sound technologies. Through this programme, UNIDO is bridging the gap between competitive industrial production and environmental concerns. CP is more than just a technical solution. It has a widespread application at all decision-making level in industry, with the chief focus on adoption of cleaner technologies and techniques within the industrial sector. Costly end-of-pipe pollution control systems are gradually replaced with a strategy that reduces and avoids pollution and waste throughout the entire production cycle, from efficient use of raw materials, energy and water to the final product.

Cleaner Production describes a preventative approach to environmental management. It is neither a legal nor a scientific definition to be dissected, analyzed or subjected to theoretical disputes. It is a broad term that encompasses what some countries/institutions call Eco-efficiency, Waste Minimization, Pollution Prevention, or Green Productivity, but it also includes something extra.

Cleaner Production refers to a mentality of how goods and services are produced with the minimum environmental impact under present technological and economic limits. Cleaner Production does not deny growth; it merely insists that growth be ecologically sustainable. It should not be considered only as environmental strategy, because it also relates to economic considerations.

In this context, waste is considered as a 'product' with negative economic value. Each action to reduce consumption of raw materials and energy, and prevent or reduce generation of waste, can increase productivity and bring financial benefits to enterprise.

Cleaner Production is a 'win-win' strategy. It protects the environment, the consumer and the worker while improving industrial efficiency, profitability, and competitiveness.

The key difference between pollution control and Cleaner Production is one of timing. Pollution control is an after-the-event, 'react and treat' approach. Cleaner Production is a forward-looking, 'anticipate and prevent' philosophy.

## **2. Definition of Cleaner Production**

**The definition of Cleaner Production that has been adopted by UNEP is the following:** Cleaner Production is the continuous application of an integrated preventive environmental strategy to processes, products, and services to increase overall efficiency, and reduce risks to humans and the environment. Cleaner Production can be applied to the processes used in any industry, to products themselves and to various services provided in society.

**For production processes,** Cleaner Production conserving raw materials, water and energy; eliminating toxic and dangerous raw materials; and reducing the quantity and toxicity of all emissions and wastes at source during the production process.

**For products,** Cleaner Production aims to reduce the environmental, health and safety impacts of products over their entire life cycles, from raw materials extraction, through manufacturing and use, to the 'ultimate' disposal of the product.

**For services,** Cleaner Production implies incorporating environmental concerns into designing and delivering services

### **3. Cleaner Production - Related Concepts**

- Eco-Efficiency
- Pollution Prevention
- Waste Minimization
- Green Productivity
- Industrial Ecology

#### **Eco-Efficiency**

Eco-Efficiency defined as the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle, to a level at least in line with the earth's estimated carrying capacity.

However, the concepts of eco-efficiency and Cleaner Production are almost identical. The slight difference between them is that eco-efficiency starts from issues of economic efficiency, which have positive environmental benefits, while Cleaner Production starts from issues of environmental efficiency that have positive economic benefits.

#### **Pollution Prevention**

The terms Cleaner Production and pollution prevention are often used interchangeably. The distinction between the two tends to be geographic. The term pollution prevention tends to be used in North America, while Cleaner Production is used in other parts of the world. Both, Cleaner Production and pollution prevention (P2) focus on a strategy of continuously reducing pollution and environmental impact through source reduction -- that is eliminating waste within the process rather than at the end-of-pipe. Waste treatment does not fall under the definition of Cleaner Production or P2 because it does not prevent the creation of waste.

Pollution Prevention as the use of processes, practices, materials, products or energy that avoids or minimizes the creation of pollutants and waste, and reduce the overall risk to human health or the environment.

#### ***Waste Minimization***

In this concept, waste prevention approach and its techniques are defined as on-site reduction source reduction of waste by changes of input raw materials, technology changes, good operating practices and product changes. Off-site recycling by direct reuse after reclamation is also considered to be waste minimization techniques, but

have a distinctly lower priority compared to on-site prevention or minimization of waste. The waste minimization concept is used in the Pollution Prevention Directive (1992).

Currently, waste minimization and pollution prevention terms are often used interchangeably. Pollution prevention means not generating waste in the first place by reducing it at the source. Waste minimization is a broader term that also includes recycling and other means to reduce the amount of waste, which must be treated/disposed of.

### ***Green Productivity***

Green productivity is a term used by the other organization to address the challenge of achieving sustainable production. The Green Productivity program started in Asia in 1994. Just like Cleaner Production, green productivity is a strategy for enhancing productivity and environmental performance for overall socio-economic development.

### ***Industrial Ecology/Industrial Metabolism***

Industrial ecology and industrial metabolism are concepts for new patterns of industrial production and are closely related to the Cleaner Production concept. Industrial ecology and industrial metabolism are studies of industrial systems and economic activities, and their links to fundamental natural systems. Basically, they aim to imitate the material recycling aspect of an ecosystem - a material flow management is the crucial aspect of these approaches.

### **Six principal elements of industrial ecology/industrial metabolism:**

- The creation of industrial ecosystems: maximizing use of recycled materials in production, optimizing use of materials and embedded energy, minimizing waste generation, and re-evaluating "wastes" as raw material for other processes.
- Balancing industrial input and output to natural ecosystem capacity: understanding the ability of the larger natural system to deal with toxics and other industrial wastes in typical and catastrophic situations.
- Dematerialization of industrial output: reducing materials and energy intensity in industrial production.
- Improving the metabolic pathways of industrial processes and materials use: reducing or simplifying industrial processes to emulate natural, highly efficient ones.
- Systemic patterns of energy use: promote the development of an energy supply system that functions as a part of the industrial ecosystem, and is free of the negative environmental impacts associated with current patterns of energy use.
- Policy alignment with a long-term perspective of industrial system evolution: nations working together to integrate economic and environmental policies.

### **Governmental Strategies & Policies for Cleaner Production**

The role of enabling policy framework is of paramount importance to any new concept to get institutionalized and incorporated into routine business.

A Cleaner Production policy framework does not refer to simply making a few provisions (tax rebates, permitting provisions, etc.) in the existing system. Nor does it mean enacting a brand new, stand alone Cleaner Production Act. It requires interweaving the concept of preventive strategies in all facets of the governmental policy framework to make it uniformly supportive and favorable to the Cleaner Production concept.

It requires a change in thinking in how policies are formulated and implemented. In essence, it requires a paradigm shift -- from the current reactive 'cure' approach to a proactive 'preventive' approach. Pollution and environmental management in the preventive approach get internalized and integrated into the developmental process. Cleaner Production strategies would thereby be integrated in various policies such as:

- Environmental policies
- Industrial policies
- Resource pricing policies
- Trade policies
- Fiscal policies
- Educational policies
- Technology development policies

There is a wide range of available policy instruments that governments may use to stimulate the Cleaner Production adoption. It is important that policy-makers select the right mix of these instruments given the circumstances within each country.

### **Cleaner Production Policy Instruments**

A number of different typologies may be used to classify environmental policy instruments. One of the most commonly used distinctions divides instruments into three categories:

- Regulatory instruments that mandate specific behavior
- Market –based instruments that act as incentives for particular activities
- Information based instruments that seek to change behavior through the provision of information

It is possible to further categorize these policy instruments according to the nature of the interaction between government and industry, and the level of obligation of the policy instrument. Distinctions may be made between:

- Specified compliance: where government imposes obligatory standards on the regulated party ·
- Negotiated compliance: where the regulators and the regulated interact in setting the obligatory standards ·
- Co-regulation: where there is a high level of interaction between the parties, but the agreed standards are not mandatory ·

- Self-regulation: where industry acts unilaterally in setting standards that are not legally enforceable

In some instances a policy instrument may be characterized by more than one of the above categories. Furthermore, it is important to note that different policy instruments are sometimes best used in conjunction with others.

<b>Examples of Policy Instruments For Cleaner Production</b>
<b>Cleaner Production Strategies and Programs:</b> National and local governments may establish formal Cleaner Production strategies or programs to act as a framework for the coordinated implementation of subsequent, more specific policy instruments.
<b>Product Bans:</b> The imposition of a ban - or defined phase-out schedule - for a particular product or substance is an authoritarian means of promoting Cleaner Production. This may be implemented through application of the product-choice (or "substitution") principle.
<b>Extended Producer Responsibility:</b> EPR aims at making environmental improvements throughout the life cycle of products by making the manufacturer responsible for various aspects of the product's life cycle. In particular, this could include the take-back, recycling and final disposal of the product.
<b>Requiring Cleaner Production Audits:</b> As part of their permitting requirements, firms may be mandated to undertake Cleaner Production audits of their plants and to implement findings.
<b>Mandatory EMS &amp; Reporting:</b> In terms of integrated permit conditions, firms may be required to implement a structured environmental management system and to make public information on their environmental performance.
<b>Encouraging Waste Minimization Clubs:</b> An effective means of promoting Cleaner Production practices is by providing the right regulatory incentives, usually at local government level, for the establishment of waste minimization clubs.
<b>Financial and Technical Incentives:</b> Governments may stimulate Cleaner Production measures by providing grants, loans and favorable tax regimes, and/or by supplying targeted technical assistance to relevant industrial enterprises.

### *Regulatory Instruments*

The use of regulatory instruments, usually, a public authority sets standards, and then inspects, monitors and enforces compliance to these standards, punishing transgressions with formal legal sanction. These regulations may, for example, specify an environmental goal - such as the reduction of carbon dioxide emissions by a specified date - or they may mandate the use of a particular technology or process. Such an approach gives the regulator maximum authority to control where and how resources will be allocated to achieve environmental objectives, and it provides the regulator with a reasonable degree of predictability as to how much the pollution levels will be reduced.

There are certain specific situations where regulatory instruments may be seen as the most appropriate and effective means of achieving a desired environmental outcome, an important example being the control of hazardous materials through specified restrictions or banning.

### **Specified and Negotiated Compliance**



The negotiated compliance approach, by contrast, adopts a more co-operative approach between the regulators and the regulated in setting and enforcing standards. This "shared responsibility" between government and industry enhances the likelihood of a more open exchange of information between the parties, and allows greater flexibility regarding the means of meeting the standard. Moreover, a number of countries have started to develop regulations where attainment of certain targets (e.g. recycling targets) is required while concrete means of achieving such targets are left in the hands of industries (non-prescriptive regulations). This in turn may increase the economic efficiency of the regulation, and may be conducive to the adoption of innovative, preventative approaches.

With the growing appreciation of the limits of conventional policy instruments, many governments are encouraging the adoption of self-regulatory and co-regulatory policy instruments for promoting Cleaner Production.

### ***Market-Based Instruments***

There is a large body of empirical evidence to demonstrate that market-based instruments are inherently more economically efficient than regulatory standards in achieving a desired reduction in pollution. Reasons for this include the fact that they act as incentives for the development of more cost-effective pollution control and prevention technologies, they provide greater flexibility in the choice of technology or prevention strategy, thus being more cost-effective in achieving agreed levels of pollution, and they may provide government with a source of revenue which may be used to support environmental and/or social initiatives that may contribute to enhanced sustainable development. However there are often significant political constraints that act against the effective introduction of these market-based instruments.

Before introducing any new economic instruments, governments should identify and evaluate any economic incentives that may already be in operation, either explicitly or implicitly. These include for example the use of subsidies to make local industries more competitive. Many of these policies lead to artificially low prices for resources, such as energy and water, as a result of which these resources may be overused, creating both pollution and shortages. Government assessments of such policies are needed before other economic instruments are applied.

#### **Co-Regulatory And Self-Regulatory Instruments For Cleaner Production**

**Negotiated Agreements** between regulatory agencies and private sector enterprises or sectoral organizations.

**Reporting Requirements** such as the Pollution Release and Transfer Registers in the USA, Canada, Australia and the UK; mandatory environmental reporting in Denmark; and the PROPER initiative in Indonesia.

**Auditable Environmental Management Systems (EMS)** such as ISO 14001; government has a potential role in promoting EMS, by for example linking EMS adoption with permit requirements, introducing related flexible penalty systems, and ensuring that future updates of EMS standards have an increased emphasis on cleaner production and enhanced environmental performance.

**Public Voluntary Programs** (such as the waste management and Green Lights) in terms of which participating companies benefit through improved public

recognition, access to governmental technical assistance, and cost savings.

**Industry Codes of Practice**, such as the International Chamber of Commerce's Business Charter for Sustainable Development, the chemical industry's Responsible Care Program, and the Japanese business sector's Keidanren Global Environmental Charter. For these codes to be effective, mechanisms need to be in place to promote members' implementation of the code, to monitor and publicly report on adherence, and to have meaningful sanction in addition simply to peer pressure.

### **Taxes, Charges and Fees**

Taxes, fees and charges may be used to promote Cleaner Production practices by raising the costs of unwanted outputs, or by providing incentives to promote more efficient use of natural resources. In some instances it may be appropriate for the revenues from these instruments to be used to support Cleaner Production activities and thus to further stimulate preventative approaches. A significant constraint against the more widespread adoption of market-based instruments is that it is often not politically feasible to set taxes at a sufficiently high level to achieve desired environmental goals.

Government often faces resistance if taxation related to environment is taken merely as a means of increasing its revenues. It may be able to avoid some obstacles by earmarking the corrected charges or shifting tax sources. Furthermore, the successful implementation of such instruments requires a system of monitoring, revenue collection, and enforcement, as well as measures to combat possible corruption.

### **Liability rules**

Liability rules can exert a powerful direct economic incentive to move away from polluting technologies and unsafe products towards Cleaner Production. Several countries have found that enforcing strict liability - in terms of which firms are held responsible for all the environmental damage they cause, even if they have fulfilled their legal obligations and have exercised "due diligence" - often leads companies to try to minimize their risks and take preventive measures. The success of liability systems depends on the nature of the enforcement and legal system of the country.

### **Subsidies**

Financial subsidies, in the form for example of low-interest loans, direct grants, or preferential tax treatment, can be targeted to specific industries to stimulate technological development. It is important that governments carefully examine the way that subsidies work to ensure that they don't create perverse incentives for environmentally counter-productive behavior.

### ***Information-Based Strategies***

In addition to creating an appropriate regulatory and financial framework for Cleaner Production, government may further stimulate the adoption of Cleaner Production practices through the use of informational measures. These may be used to provide the right incentive - for example through the public disclosure of a firm's environmental performance - as well as to build capacity within industry, for example through the publication and dissemination of relevant case studies.

Examples of information-based strategies that may be introduced by government include: ·

- Promoting the adoption of targeted, high profile demonstration projects, to demonstrate the techniques and cost-saving opportunities associated with Cleaner Production.
- Encouraging educational institutions to incorporate preventative environmental management within their curricula, particularly within engineering and business courses.
- Requiring public disclosure of information on environmental performance by, for example, establishing a pollutant release and transfer register, stimulating greater voluntary corporate reporting, and requiring the provision of information on specific materials.
- Initiating and/or supporting measures that address consumption, such as eco-labeling schemes and environmental product declarations.
- Promoting the adoption of effective training initiatives.
- Issuing high profile awards for enterprises that have effectively implemented Cleaner Production.
- The potential value of these different information-based strategies is to be provided within their implementation in real politics.

### ***Benefits of cleaner production***

Cleaner Production can reduce operating costs, improve profitability, worker safety and reduce the environmental impact of your business. Companies are frequently surprised at the cost reductions achievable through the adoption of Cleaner Production techniques. Frequently, minimal or no capital expenditure is required to achieve worthwhile gains, with fast payback periods. Waste handling and charges, raw material usage and insurance premiums can often be cut, along with potential risks.

On a broader scale, Cleaner Production can help alleviate the serious and increasing problems of air and water pollution, ozone depletion, global warming, landscape degradation, solid and liquid wastes, resource depletion, and acidification of the natural and built environment, visual pollution and reduced bio-diversity.

One of the main drivers for improving environmental performance has been that organizations can no longer afford to simply treat and dispose of their waste; the focus has shifted to reducing waste at source. Cleaner production often focuses on raw materials, waste and energy but it is not just an environmental initiative - it's a combined environmental and business strategy. One of its basic premises is that it improves efficiency and productivity. Cleaner production does more than improve the environment by minimizing pollutants and waste. It:

- Reduces use of energy, water and other natural resources
- Improves operational efficiency and reduces production costs
- Reduces costs associated with managing wastes and material losses
- Reduces environmental liability and the risk of non-compliance
- Enhances community and employee health and safety
- Enhances corporate image and community relations
- Improves employee morale, teamwork and productivity.

Many businesses do not realize how much money they lose in wasted materials, energy and water, or through handling, storing and disposing of waste materials. Large and small businesses can save money by introducing cleaner production.

Cleaner production:

- Leads to improved products and processes
- Saves on raw materials and energy, reducing production costs
- Increases competitiveness through the use of new and improved technologies
- Reduces the need for more environmental regulation
- Reduces risk from on- and off-site treatment, storage and disposal of toxic wastes
- Improves the health and safety of employees
- Improves staff morale, leading to better productivity
- Improves a company's public image
- Reduces the cost of increasingly expensive end-of-pipe solutions

Case studies and feedback from industry indicate that cleaner production initiatives yield optimal outcomes when organizations appreciate the cost benefits and marketing advantage they can gain by adopting cleaner production approaches.

### **Why is Cleaner Production Important for Small-to-Medium Sized Enterprises (SMEs)?**

While Cleaner Production offers clear and quantifiable benefits to businesses economically and environmentally, it is still a relatively new concept to many SMEs. Cleaner Production can clearly illustrate that industry development; growth and prosperity can be consistent with preservation of the quality of life and the environment.

Small-to-medium enterprises are engines of economic growth and job creation in New South Wales. They are the largest source of new jobs, accounting for around 60% of all new jobs, and are at the forefront of innovation, product development, service delivery and exports.

Consumers, suppliers, governments and the market at large are increasingly demanding environmental responsibility by the business community. Businesses ignoring this trend and rejecting the opportunity to improve their environmental performance may find themselves left behind in the highly competitive global marketplace.

Cleaner Production is set to become an integral part of the business strategies of enlightened companies that want to embrace the ongoing challenges of industry leadership and continuous improvement.

### **Cleaner production and sustainable development**

We all know a clean, healthy environment is important for our future. Cleaner production can help protect our natural environment. By reducing our demand on

non-renewable resources, and recycling and re-using products and resources, we can reduce our impact on the natural environment.

### **Present production systems are linear.**

Cleaner production systems are cyclical. They try to imitate nature's processes. Wastes are used as secondary materials so that fewer new materials and less energy and water are required.

### **Taskforce to Promote Cleaner Production**

Developing countries that support cleaner production principles and techniques have to establish a Taskforce for promoting the concept of Cleaner Production. The Taskforce consists of government, industry and teaching institutions, working together to encourage the exchange of information on cleaner production and its implementation.

### **The following steps are a guide for Taskforce who would like to move from conventional production to cleaner production.**

- Develop and implement a comprehensive, corporate environment policy. This should be based on preventing pollution, minimizing waste and reducing environmental risk generated by all corporate activities.
- Develop regular pollution prevention and waste reduction audit procedures.
- Develop a plan containing specific environmental goals and timetables for achieving them.
- Educate and involve employees at all levels. Employees should be involved in identifying and solving environmental problems at their source. Often employees on the shop floor can develop better solutions to waste problems than executives not involved in day-to-day production.
- Allocate responsibility for achieving goals to specific employees. Management should allocate sufficient employee time and financial support to ensure that work can be accomplished. The Cleaner Production coordinator should be a senior management position.
- Gather the best management and technical information to help the business take advantage of waste reduction opportunities.
- Evaluate progress continually.
- Inform employees, shareholders and the public of the progress being made.
- Establish environmental award programs to foster and reward creative problem solving.
- Review and update goals and timetables regularly.

### **Cleaner Production and Implementation of Multi-lateral Environmental Agreement**

#### **The atmosphere conventions**

The Vienna Convention on the Protection of the Ozone Layer and its Montreal Protocol on Substances that Deplete the Ozone Layer and the United Nations Framework Convention on Climate Change and its Kyoto Protocol are closely associated in protecting the environment by eliminating or stabilizing anthropogenic emissions that threaten to interfere with the atmosphere. While the former focuses on the impacts that ozone depletion can have on human health, the latter addresses concerns that climate change may have on food production and economic development. The Montreal Protocol is well on its way to achieving its goal of gradually phasing out 96 listed ozone-depleting substances. Its overriding priority is to provide financial assistance through the Multilateral Fund to eligible developing countries to comply with the provisions of the Protocol and its amendments. The UNFCCC is in an earlier phase of implementation, with much of its future success depending on the operational of its Kyoto Protocol.

The overarching objective of the chemicals and hazardous wastes conventions is the protection of human health and the environment from pollution by specific chemicals and hazardous substances. In the case of the Rotterdam Convention, it specifically addresses certain banned or severely restricted chemicals, as well as severely hazardous pesticide formulations, subject to international trade. The Stockholm Convention has as its priorities the phasing out of an initial list of 9 chemicals; the restriction to certain acceptable purposes the production and use of DDT, and the reduction or elimination of unintentionally produced chemicals (dioxin and furans). The Convention also has provisions to add further POPs to the treaty, and will require parties with new chemical programs to prevent the introduction of new POPs onto the marketplace. The scope of the Basel Convention covers a broad range of hazardous wastes, including chemical wastes, subject to transboundary movements, aiming to reduce these movements to a minimum by minimizing the quantity and hazardousness of the wastes generated and by promoting the treatment and disposal of hazardous wastes and other wastes as close as possible to their source of generation.

Examples of roles being played by the Cleaner production Centers in the implementation of MEAs include:

- (a) Providing technical knowledge;
- (b) Awareness rising;
- (c) Assisting the secretariat in communicating with non-parties;
- (d) Promoting implementation in the field;
- (e) Gathering and transmitting information about possible non-compliance;
- (e) Implementation of relevant national policies;
- (f) Pressuring governments to implement the MEAs; and
- (g) Participating in the decision making process.

**Specific issues that are not being addressed effectively by MEAs include:**

- Control of new ozone-depleting substances
- Impact of climate change on migratory water-birds
- Commercial fishing from an environmental perspective
- The impact of high seas fisheries on marine species such as mammals and bird life
- Lack of sites on the World Heritage list nominated for their marine values
- Coastal zone management and information
- Impact of population, poverty and urbanization on coastal resources
- Forests
- Tropical timber trade
- Freshwater resources
- River ecosystems
- The role of poverty and corruption in relation to environmental management practices
- The failure to identify and make available alternatives to bad environmental practices
- The failure to quantify and publicize the economic benefits from good environmental practices
- Economic instruments and incentives
- Practical indicators for measuring performance of MEAs
- Compliance and enforcement

### **Transfer of Environmentally Sound Technologies (ESTs)**

Undoubtedly, environmentally sound technologies (ESTs) provide best cost-effective solutions for developing countries to pursue the way of sustainable industrial development. With increasing awareness on economic, environmental and technological multi-benefits of ESTs in recent years the research and development, transfer and application of ESTs are becoming hot topics in developed countries. However, the unexpected potentials of emerging ESTs needs and market disclose a lack of a holistic mechanism or strategic methodology to facilitate links among all stockholders of EST request and suppliers, financial requirement and available sources, and policy makers as well.

Donor's countries have to initiate strategic programme methods for financing on transfer and application of ESTs in developing countries.

#### **A. Support of and promotion of access to transfer of technology (Agenda 21 – Chapter 34)**

Governments and international organizations should promote, and encourage the private sector to promote, effective modalities for the access and transfer, in particular to developing countries, of environmentally sound technologies by means of activities, including the following:

- a. Formulation of policies and programmes for the effective transfer of environmentally sound technologies that are publicly owned or in the public domain;
- b. Creation of favorable conditions to encourage the private and public sectors to

innovate, market and use environmentally sound technologies;

c. Examination by Governments and, where appropriate, by relevant organizations of existing policies, including subsidies and tax policies, and regulations to determine whether they encourage or impede the access to, transfer of and introduction of environmentally sound technologies;

d. Addressing, in a framework which fully integrates environment and development, barriers to the transfer of privately owned environmentally sound technologies and adoption of appropriate general measures to reduce such barriers while creating specific incentives, fiscal or otherwise, for the transfer of such technologies;

e. In the case of privately owned technologies, the adoption of the following measures, in particular for developing countries:

i. Creation and enhancement by developed countries, as well as other countries which might be in a position to do so, of appropriate incentives, fiscal or otherwise, to stimulate the transfer of environmentally sound technology by companies, in particular to developing countries, as integral to sustainable development;

ii. Enhancement of the access to and transfer of patent protected environmentally sound technologies, in particular to developing countries;

iii. Purchase of patents and licenses on commercial terms for their transfer to developing countries on non-commercial terms as part of development cooperation for sustainable development, taking into account the need to protect intellectual property rights;

iv. In compliance with and under the specific circumstances recognized by the relevant international conventions adhered to by States, the undertaking of measures to prevent the abuse of intellectual property rights, including rules with respect to their acquisition through compulsory licensing, with the provision of equitable and adequate compensation;

v. Provision of financial resources to acquire environmentally sound technologies in order to enable in particular developing countries to implement measures to promote sustainable development that would entail a special or abnormal burden to them;

f. Development of mechanisms for the access to and transfer of environmentally sound technologies, in particular to developing countries, while taking into account development in the process of negotiating an international code of conduct on transfer of technology, as decided by UNCTAD at its eighth session, held at Cartagena de Indias, Colombia, in February 1992.

**(c) Improvement of the capacity to develop and manage environmentally sound technologies**



**Frameworks at sub -regional, regional and international levels should be established** and/or strengthened for the development, transfer and application of environmentally sound technologies and corresponding technical know-how with a special focus on developing countries' needs, by adding such functions to already existing bodies. Such frameworks would facilitate initiatives from both developing and developed countries to stimulate the research, development and transfer of environmentally sound technologies, often through partnerships within and among countries and between the scientific and technological community, industry and Governments.

B. National capacities to assess, develop, manage and apply new technologies should be developed. This will require strengthening existing institutions, training of personnel at all levels, and education of the end-user of the technology.

(d) Establishment of a collaborative network of research centers

C. A collaborative network of national, sub regional, regional and international research centers on environmentally sound technology should be established to enhance the access to and development, management and transfer of environmentally sound technologies, including transfer and cooperation among developing countries and between developed and developing countries, primarily based on existing sub regional or regional research, development and demonstration centers which are linked with the national institutions, in close cooperation with the private sector.

(e) Support for programmes of cooperation and assistance

D. Support should be provided for programmes of cooperation and assistance, including those provided by United Nations agencies, international organizations, and other appropriate public and private organizations, in particular to developing countries, in the areas of research and development, technological and human resources capacity-building in the fields of training, maintenance, national technology needs assessments, environmental impact assessments, and sustainable development planning.

E. Support should also be provided for national, subregional, regional, multilateral and bilateral programmes of scientific research, dissemination of information and technology development among developing countries, including through the involvement of both public and private enterprises and research facilities, as well as funding for technical cooperation among developing countries' programmes in this area. This should include developing links among these facilities to maximize their efficiency in understanding, disseminating and implementing technologies for sustainable development.

F. The development of global, regional and sub regional programmes should include identification and evaluation of regional, subregional and national need-based priorities. Plans and studies supporting these programmes should provide the basis for potential financing by multilateral development banks, bilateral organizations, private sector interests and non-governmental organizations.

G. Visits should be sponsored and, on a voluntary basis, the return of qualified

experts from developing countries in the field of environmentally sound technologies who are currently working in developed country institutions should be facilitated.

**H.** The international community, in particular United Nations agencies, international organizations, and other appropriate and private organizations should help exchange experiences and develop capacity for technology needs assessment, in particular in developing countries, to enable them to make choices based on environmentally sound technologies. They should:

a. Build up technology assessment capacity for the management of environmentally sound technology, including environmental impact and risk assessment, with due regard to appropriate safeguards on the transfer of technologies subject to prohibition on environmental or health grounds;

b. Strengthen the international network of regional, sub regional or national environmentally sound technology assessment centers, coupled with clearing-houses, to tap the technology assessment sources mentioned above for the benefit of all nations. These centers could, in principle, provide advice and training for specific national situations and promote the building up of national capacity in environmentally sound technology assessment. The possibility of assigning this activity to already existing regional organizations should be fully explored before creating entirely new institutions, and funding of this activity through public-private partnerships should also be explored, as appropriate.

**(g) Collaborative arrangements and partnerships**

**I.** Long-term collaborative arrangements should be promoted between enterprises of developed and developing countries for the development of environmentally sound technologies. Multinational companies, as repositories of scarce technical skills needed for the protection and enhancement of the environment, have a special role and interest in promoting cooperation in and related to technology transfer, as they are important channels for such transfer, and for building a trained human resource pool and infrastructure.

**II.** Joint ventures should be promoted between suppliers and recipients of technologies, taking into account developing countries' policy priorities and objectives. Together with direct foreign investment, these ventures could constitute important channels of transferring environmentally sound technologies. Through such joint ventures and direct investment, sound environmental management practices could be transferred and maintained.

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