

ANNEX

ANNEX-1

Industrial Pollution Prevention and Cleaner Production (CP) in Japan

1-A Background

The historical background of Activities related to industrial pollution prevention as well as Cleaner Production (CP) in Japan is briefly reviewed hereunder for reference.

Industries in Japan had made tremendous efforts after the Second World War to pull themselves through the distress they had faced and thereby achieved rapid economic growth thereafter, and thus the economic infrastructure of Japan became established to a certain extent. On the other hand, however, the rapid economic growth in the 1960's caused serious industrial pollution problems from which a number of people suffered as illustrated by cases of Minamata disease, Yokkaichi asthma and itai-itai disease.

In order to mitigate pollution issues, industries in Japan inevitably took countermeasures by adopting End-of-Pipe (EOP) technologies under Regulations related to Industrial Pollution Prevention.

A large investment in EOP technologies raised production costs in Japan to the extent that most enterprises had to make all-out efforts to reduce their production costs to maintain their competitive position in international markets. In addition, a substantial rise in labour costs and energy prices through a series of oil crises, as well as a demand for securing safety and high product quality, necessitated additional efforts to implement more thorough measures for production process improvement.

In-house efforts in production process improvement showed good results in combination with other activities such as QC circle activities, small group movements, TPM (Total Productive Maintenance), and so on. Consequently, industries in Japan achieved remarkable improvements in productivity and cost reduction based on production process improvement and thorough production management.

At present, CP is naturally considered as the starting point of enterprise activities in Japan, although most Japanese are not familiar with the term "Cleaner Production".

The following sections summarise activities related to industrial pollution prevention and Cleaner Production that were implemented in Japan.

1-B Industrial Pollution Prevention

(i) Environmental Legislation in Japan

(a) Major Laws and Regulations

Major laws and regulations related to environmental protection in Japan are listed below:

- Basic Law for Environmental Pollution Control (1967)
This law stipulated the responsibilities of parties concerned; i.e. enterprises and the government, environmental quality standards, and basic policies regarding measures for pollution control.
- Air Pollution Control Law (1968)
- Water Pollution Control Law (1970)
These laws stipulated emission standards and authorisation given to local government ordinance to establish more stringent standards.
- Law concerning the Improvement of Pollution Prevention Systems in Designated Factories (1971)
This law was enacted to obligate each factory to establish an organisation for pollution control.
- Environmental Basic Law (1993)
The conventional Basic Law for Environmental Pollution Control was rescinded and the new Environmental Basic Law was enacted and has been in operation as the basis for implementing environmental measures to cope with global environmental issues.

(b) Self-monitoring and Self-disclosure System

The enforcement of environment related laws including environmental monitoring is subject to local governments.

In addition, the Law concerning the Improvement of Pollution Prevention Systems in Designated Factories puts designated factories under obligation to:

- Establish appropriate organisations to prevent industrial pollution,
- Assign a Pollution Control General Manager, who is to supervise activities for preventing environmental pollution,
- Assign Pollution Control Managers who have expertise in pollution control to be in charge of technical tasks such as:
 - ✓ Inspection of raw materials to be used,
 - ✓ Inspection of facilities that discharge pollutants,
 - ✓ Operation, inspection and maintenance of facilities related to environmental pollution prevention,
 - ✓ Monitoring and Recording conditions of pollutants,

- ✓ Inspection and maintenance of measuring equipment, and
- ✓ Emergency measures on designated facilities.

Pollution Control Managers shall be certified by the government based on a national exam.

Thus, a self-monitoring and self-disclosure system is being put into practice.

(ii) Organisational Structuring for Environmental Protection

(a) Japan Environmental Management Association for Industry (JEMAI)

Japan Environmental Management Association for Industry (JEMAI: former Industrial Pollution Control Association of Japan (IPCAJ) was renamed in 1966) is a public corporation established in 1962 under the Ministry of International Trade and Industry (MITI), aiming at building up countermeasures for the prevention of industrial pollution. So far JEMAI has conducted activities related to management of the environment as follows:

- Develop a methodology for environmental impact assessment (EIA),
- R&D on environmental protection,
- Train upwards half a million of Pollution Control Managers (PCMs),
(Special training course started for applicants of national exams for PCM.)
- Training for trainees from overseas,
- Dispatch experts,
- R&D on measures for global warming prevention,
- Promote international “Environmental Management” standards (ISO14000 series)
- Register environmental management system (EMS) auditors,
(Centre of Environmental Auditors Registration (CEAR) was established in JEMAI in 1996, and certified as an Environmental Auditors Registered organisation by the Japan Accreditation Body for Conformity Assessment (JAB) in 1997.)
- Awareness campaign about environment-friendly industrial activities, life cycle assessment (LCA) and new Eco-labels.

JEMAI’s activities are supported by its members and the annual budget accounts for 1.3-1.5 billion yen based on membership fees.

(b) Japan Environment Corporation (JEC)

The semi-governmental “Environmental Pollution Control Service Corporation” was founded in 1965 to resolve air pollution, water pollution and other industrial pollution problems. The Corporation provided specialised support and assistance for anti-pollution policies implemented by industries. The Corporation was renamed the Japan

Environment Corporation (JEC) in 1992, reflecting organisational reform and ongoing changes in the major issues dealt with by the environmental administration. In addition to continuing operations aimed specifically at preventing environmental pollution, JEC started being involved in overall environmental protection, through establishing the Japan Fund for Global Environment in 1995, to support global environmental conservation activities carried out by private organisations. Incentives supported by JEC are summarised in (iii).

(iii) Incentives for Environmental Protection Measures

(a) Financial Support by JEC

JEC provides various incentives for environmental conservation activities as mentioned in 1-B (ii).

◆ Construction Leasing

Construction leasing involves performing all operations pertaining to the construction of any of the following facilities, on consignment from businesses attempting to install said facilities:

- Centralised groups of buildings (industrial parks),
- Community welfare facilities (green space to act as buffers between industrial and residential areas, park facilities),
- Green areas to prevent air pollution,
- Industrial waste treatment facilities, integrated green spaces,
- National park complexes, and
- Green spaces to combat global warming.

The completed facilities are then leased back to the original companies at the cost of construction, using long-term contracts with low interest rates.

◆ Waste Treatment Promotion

JEC supports the development of waste treatment technology, provides necessary financial support for technological development pertaining to the preparation of technology to use by waste treatment companies and local governments, and offers operational assistance for the promotion of activities related to waste treatment, such as information exchange related to waste recycling, and for the promotion of operations related to maintenance-management reserve funds for final disposal sites.

◆ Lending Environmental-cleanup Materials

JEC promotes environmental cleanup by allowing local governments and small businesses to utilise materials and equipment purchased by JEC, to help rid soil and groundwater of volatile organic compounds.

◆ Global Environmental Operations

To deal with global environmental issues, JEC:

- Supports environmental conservation activities undertaken by private organisations in Japan and overseas, utilising the “Japan Fund for Global Environment”, made possible by government capital and private donations;
- Provides information and technological know-how related to environmental conservation, which has been accumulated over the years through JEC operations, to JEC-affiliated parties in Japan and abroad; and
- Operates training programmes on behalf of JICA, to provide trainees from developing countries with technical knowledge related to JEC operations.

◆ Financing

JEC contributes to the promotion of environmental protection policies implemented by private companies and other businesses, by providing necessary financial support to companies and local governments that engage in the installation of industrial pollution control facilities, operations to prevent soil pollution, or the installation of waste treatment facilities. JEC provides this financial assistance under favorable terms, including long-term, fixed, low-interest rates and subsidised interest payments. JEC financial assistance operations have successfully supported a considerable number of organisations throughout the years, but the programme ceased operation in 1999.

(b) Financial Incentives for SMIs

◆ Funding System for the Modernisation of Small Businesses

The Funding System for the Modernisation of Small Businesses provides loans to individual small businesses, via corresponding prefectural governments, for the purpose of promoting the modernisation of their facilities, based on the “Small Business Modernisation Funding Support Act.” Financial assistance is offered to businesses engaged in the installation of pollution prevention facilities. JEC also lends equipment and facilities to small businesses, from leasing organisations located in each prefecture.

◆ Financing by Japan Small Business Corporation

The advanced financing system operated by the Japan Small Business Corporation provides funding for small businesses engaged in operations aimed at enhancing the structural efficiency of small businesses. Part of this financing is provided toward operations designed to alleviate overcrowded residential and industrial areas, by transferring factories and plants to industrial parks or other suitable locations; and for the installation of public waste treatment facilities operated by small businesses for the prevention of environmental pollution.

◆ Financial Assistance System by Local Governments

The Financial Assistance System for Environmental Improvement provides funds at low or partially-subsidised interest rates to small businesses for the installation and operation of anti-pollution facilities and other purposes.

Tokyo Metropolis established the Pollution Prevention Fund in 1965, which subsidised interest and a part of credit guarantee. The Fund was renamed the “Environmental Preservation Fund” in 1998, expanding the targeted activities to global environmental conservation and facilitating waste recycling societies as well as industrial pollution control activities.

(c) Financing via the Japan Development Bank

The Japan Development Bank provides financing for projects related to environmental pollution prevention facilities, waste treatment facilities, city-run environmental maintenance programmes, and the development of environmental technology, designed to maintain, achieve or improve environmental standards.

(d) Tax Incentives

Various tax incentives are available for parties engaged in introducing or installing anti-pollution equipment or facilities to improve the environment. Tax incentives include exemption from taxes, reduced taxation, and special amortisation.

Table A1-1 shows tax incentives related to environmental protection measures.

◆ National Tax Incentives

Special amortisation can be applied to the acquisition of anti-pollution equipment and facilities such as wastewater treatment facilities, as well as other kinds of equipment and facilities such as those to be used for the collection and separation of reusable resources. Special amortisation and tax deduction are also available for the purchase of resources related to the promotion of efficient energy use or the utilisation of reusable resources.

◆ Local Tax Incentives

Reduction of fixed asset taxes and plant taxes, as well as exemption from special land-holding taxes may be applied to facilities used for the treatment of pollutants, as stipulated in the Air Pollution Control Law and the Water Pollution Control Law.

Table A1-1 Tax Incentives for Environmental Protection Measures

	National Tax		Local Tax		
	Special Depreciation (*1)	Life Shortening (Accelerated Depreciation)	Fixed-asset Tax	Business Tax	Special Land-holding Tax
Noise Prevention Equipment	○		Tax Reduction to 1/2	Tax Exemption	Tax Exemption
Wastewater Treatment Facilities	○	○	Tax Exemption	Tax Exemption	Tax Exemption
NOx Reduction Facilities	○		Tax Exemption		
Smoke and Soot Treatment Facilities	○	○	Tax Exemption	Tax Exemption	Tax Exemption
Dust Collector				Tax Exemption	Tax Exemption
Asbestos Treatment Facilities	○		Tax Exemption	Tax Exemption	Tax Exemption
Facilities for Deodorization				Tax Exemption	Tax Exemption
High Chimney			Tax Reduction to 1/3		
CFCs Emission Control/Recovery Facilities	○		Tax Reduction by 2/5		
Desulfurization Facilities	○		Tax Reduction to 1/3 for initial 3 years		

*1: 18% depreciation of acquisition price only for the first year

(e) Award System

Every year, usually on 5 June, the Environment Day, the Minister of the Environment presents awards to those who have contributed to environmental preservation. These awards are:

- The Environmental Preservation Award
- The Regional Environmental Preservation Award
- The Regional Environmental Beautification Award
- The Environmental Preservation Award in the Global Warming Prevention Division
- The Regional Environmental Preservation Award in the Global Warming

1-C Energy Conservation

Figure A1-1 shows the basic policy scheme for energy conservation in Japan.

In the industrial sector, energy conservation has been implemented through the following:

- Appropriate management of energy,
- Improvement of energy related equipment and facilities, and
- Improvement of production processes.

(i) Legislative Measures for Energy Conservation

(a) Law Concerning Rational Use of Energy

The Law Concerning Rational Use of Energy (Energy Conservation Law) enacted in 1979 aimed at reducing the growth of energy demand through increasing energy efficiency without affecting economic growth.

This law set out guidelines for energy conservation measures for factories and buildings as well as as for machinery and equipment. The law also stipulates the designated energy management factory system.

The law was partially amended in 1995 and 1998 so as to establish a stable and adequate energy supply-demand structure capable of responding to changes in economic and social situations pertaining to energy issues and increasing concern over the impact of mass energy consumption on the environment.

(b) Energy Manager System

Factories, which consume a large amount of energy in the sectors of manufacturing, mining, electric power supply, gas supply and heat supply, are designated by the Minister of Economy, Trade and Industry as Designated Energy Management Factories when they meet the following criteria:

- (a) As to fuel consumption: Factories that consume more than 3,000 kl per annum (the total number accounts for 2,300 factories)
- (b) As to electric power consumption: Factories that consume more than 12,000 MWh per annum (the total number accounts for 2,900 factories)

The Energy Manager system under the Law Concerning Rational Use of Energy (1979) aims at promoting effective utilisation of energy in designated factories. Designated factories should assign a certain number of Energy Managers who possess the certificate of Energy Controller.

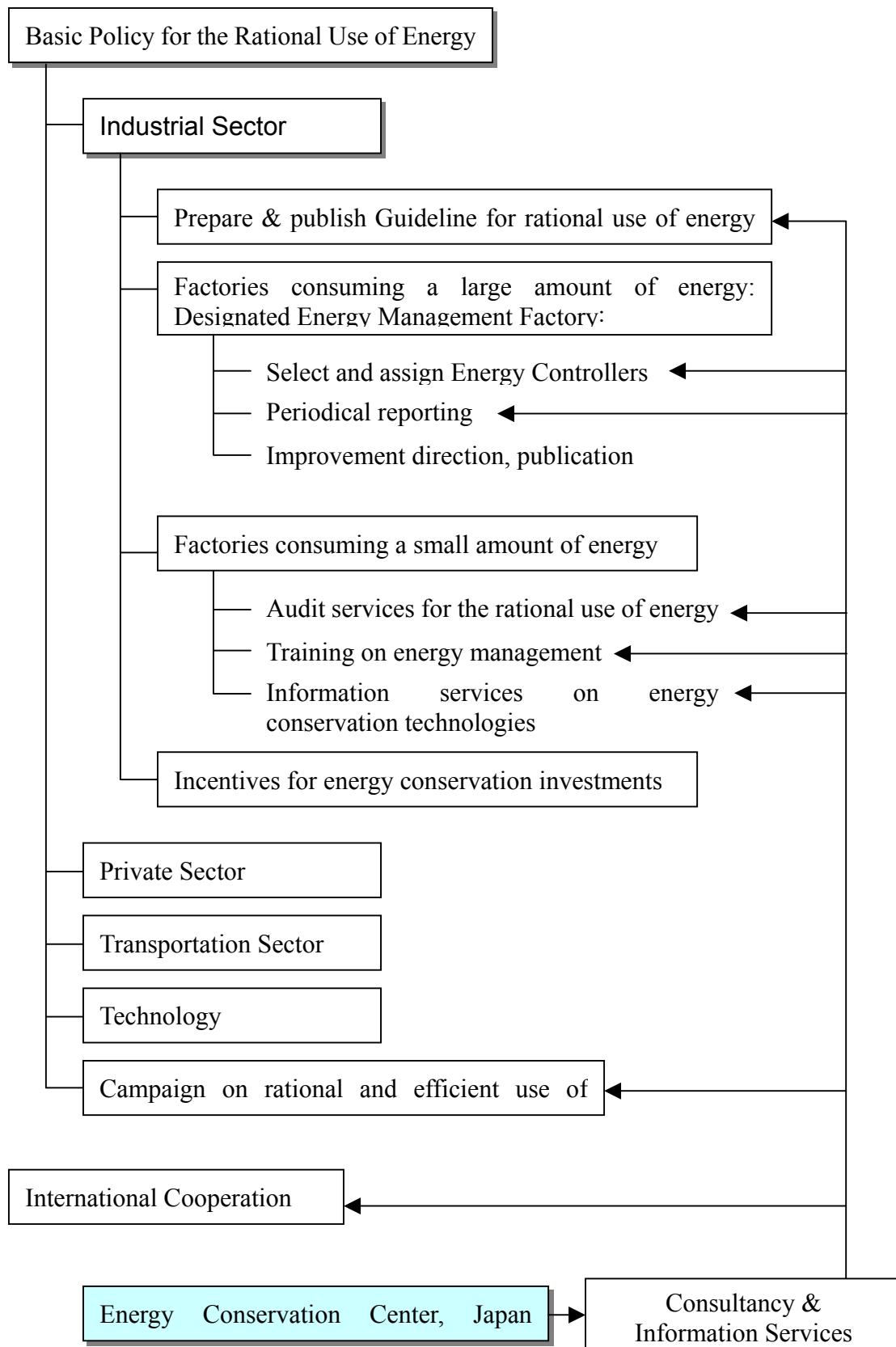


Figure A1-1 Policy Scheme for Energy Conservation in Japan

■ Certification of Energy Controller

The Minister of Economy, Trade and Industry issues the certification of Energy Controller, which includes two types; Heat Controller and Electricity Controller, to those who have successfully passed the examination for the certified Energy Controller.

■ Functions of Energy Manager

Energy Managers in the Designated Energy Management Factories shall perform the following:

- ✓ Manage maintenance of equipment and facilities which consume fuels and/or electricity,
- ✓ Improve and monitor utilisation method of fuels and/or electricity,

■ Periodical Reporting

Each Designated Energy Management Factory must annually report to the Ministry of Economy, Trade and Industry (METI) the following:

- ✓ Consumed volume of fuels and/or electricity,
- ✓ Status of fuel and/or electricity use including data concerning utilisation efficiency of energy,
- ✓ Status of equipment and facilities which consume energy, and
- ✓ Introductions and removals of equipment and facilities relevant to rational use of energy.

(ii) Organisational Structuring: Energy Conservation Center, Japan (ECCJ)

Corresponding to the enactment of the Heat-Management Regulations, the Heat-Management Association was established in the Kinki district in 1947 and in the Kanto-Shinetsu, Shikoku, Tokoku, Kyusyu, Tokai-Hokuriku, Chugoku and Hokkaido districts in 1948. These Heat-Management Associations were transformed into the Central Heat-Management Conference in 1951 and further to the Japan Heat Energy Technology Association in 1972. After the first oil crisis, The Energy Conservation Center Japan (ECCJ), was established in 1978 succeeding the Japan Heat Energy Technology Association. Aiming at realising the efficient use of energy, protecting the global environment and creating energy-saving communities, ECCJ is functioning as a centre for promoting energy conservation in Japan and conducting a wide range of activities as follows:

- Study on energy conservation,
- Publicity work, and publication of energy conservation related material,
- Education, training, and examinations on energy conservation,
(Examination Department and Training Course Department were established in 1984 and 1999 respectively), and

- R&D on energy conservation,
- Consultancy services on energy conservation
(Energy service company (ESCO) Project Promotion Office and Energy Diagnosis Guidance Department were established in 1997 and 1998 respectively), and
- Information services on energy conservation.

(iii) Incentives for Energy Conservation Measures

The incentive system for the promotion of energy efficiency in Japan is summarised as follows:

(a) Tax System for Promotion of Investment in Reformation of Energy Supply and Demand Structure

Since 1975, in the case where an enterprise acquires equipment that contribute to efficient use of energy, the enterprise can apply for either of the following within one year:

- Tax exemption equivalent to 7% of the equipment acquisition cost, which should not exceed 20% of the income tax or corporate tax payable),
- Special depreciation of 30% of the equipment acquisition cost in the year of acquisition, in addition to the ordinary depreciation.

Such energy efficiency equipment is subject to certification by MITI and MOF.

- Equipment for general industries: 97 units,
- Equipment for small and medium enterprises: 95 units

(b) Financial Incentives for Rational Use of Energy

Since 1975, in order to promote investments in energy conservation equipment, low-interest financing systems have been available through the Japan Development Bank, the Hokkaido-Tohoku Development Corporation, the Small Business Finance Corporation, and others. Targeted equipment is that such is found at manufacturing facilities of waste heat recovery equipment, and energy efficient production equipment such as the ion-exchange membrane system, co-generation systems and others.

(c) Incentive under Law on Temporary Measures to Promote Business Activities for the Rational Use of Energy and the Utilisation of Recycled Resources

In addition to the former measures, a new incentive was established under Law on Temporary Measures to Promote Business Activities for the Rational Use of Energy and the Utilisation of Recycled Resources. The system provides ultra low-interest loans, special tax incentives and debt guarantees through the Industrial Structure Improvement Fund (ISIF).

(d) Award for Energy Conservation

Awards are to be given by the Minister of Economy, Trade and Industry, the Director General of the Department of Resource and Energy, and the Chairman of EECJ to enterprises that satisfy the following criteria:

- Playing a leading role in the promotion of energy conservation in Japan based on the management policy,
- Actively making efforts for the promotion of energy conservation throughout the enterprise,
- Developing equipment or systems that are advanced and excellent in energy conservation performance, and have excellent marketability. In addition, such equipment or systems should be designed in view of resource conservation, recycling, and environmental protection and safety.
- Developing equipment or systems with excellent originality.

Figure A1-2 shows the trends of energy consumption in Japan respectively. Remarkable improvements can be seen after the first oil crisis.

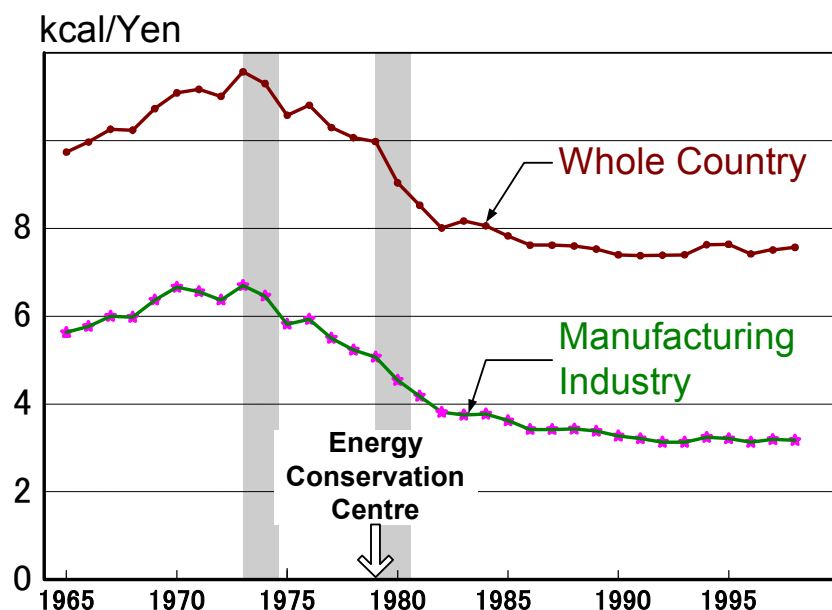


Figure A1-2 Energy Consumption per GDP in Japan

1-D Rational Utilisation of Water

(i) Policy Scheme Related to Industrial Water

The policy scheme related to industrial water in Japan consists of preparation of industrial water supply systems, measures for appropriate utilisation of underground water, rational utilisation of industrial water, and promotion of water reuse as shown in Figure A1-3.

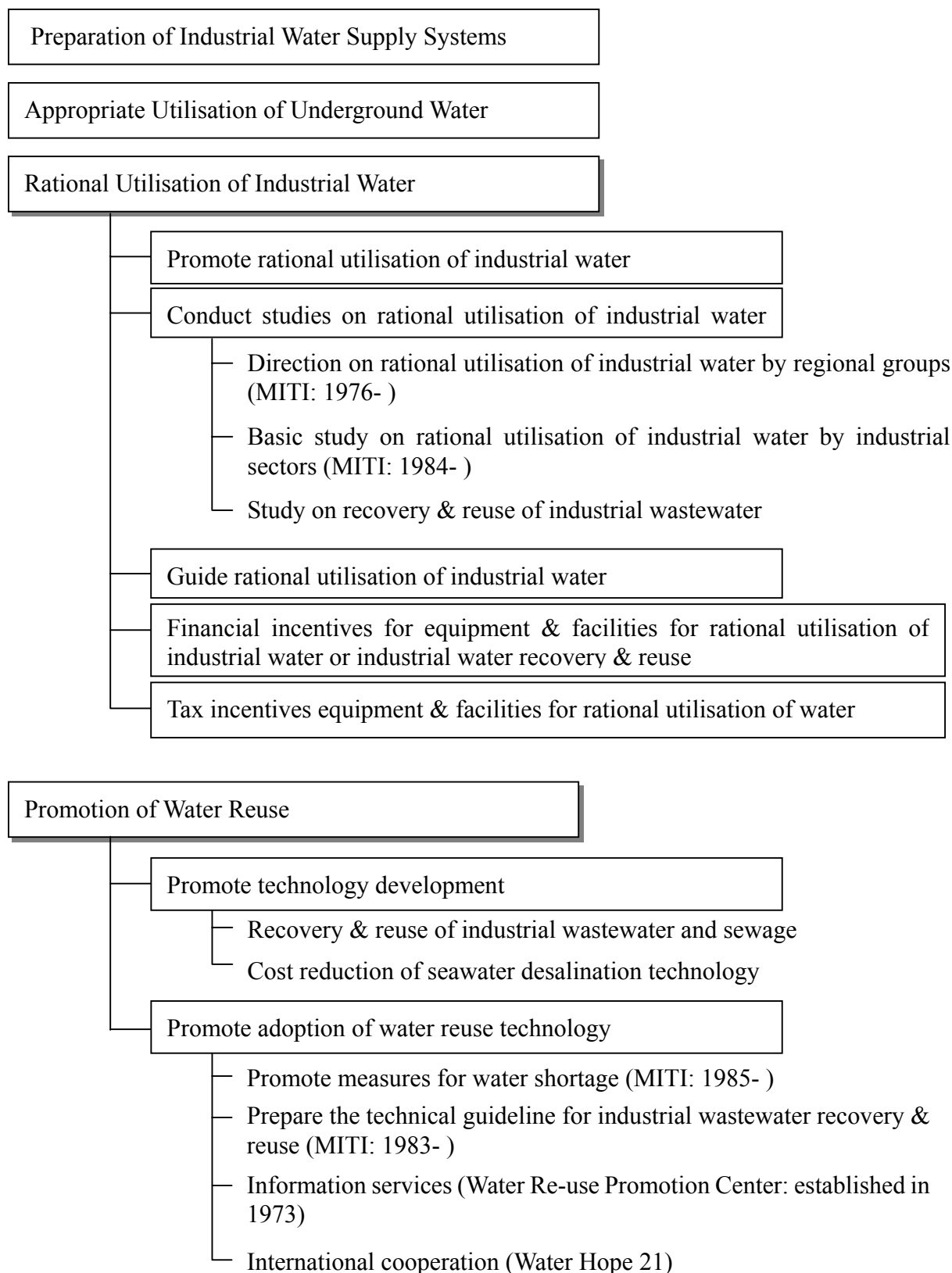


Figure A1-3 Policy Scheme for Rational Utilisation of Industrial Water in Japan

(a) Rational Utilisation of Industrial Water

Basic concepts of the Working Rule for Rational Utilisation of Industrial Water, which MITI started in 1976, were as follows:

- Decrease the amount of supply water by reducing unit consumption and improving the recovery rate of industrial water,
- Prevent land subsidence by reducing the amount of underground water drawing-up through promoting rational utilisation of industrial water, and
- Preserve the environment by reducing the amount of wastewater discharge through decreasing water consumption.

For implementation, the following were emphasised:

- Instead of nationwide uniform implementation, carryout measures based on regional conditions, such as water demand, problematic issues on ground water, and/or environmental problems,
- Implement in conformity with actual conditions, which differ by industrial sectors, scales and/or production processes,
- Apply measures that are acceptable to SMIs, and
- Enhance incentives for equipment installation.

Based on the above, MITI promoted the following:

- Direction on rational utilisation of industrial water by regional groups (1976-)
 - ✓ Investigate actual conditions of industrial water utilisation by region, business sector and industrial scale,
 - ✓ Prepare the Working Rules for water utilisation methods and equipment installation, and
 - ✓ Conduct guidance based on the above.
- Basic study on rational utilisation of industrial water by industrial sector (1984-)
 - ✓ Investigate the latest conditions of industrial water utilisation by industrial sector, incorporating situational changes such as changes in sector characteristics and new development of advanced technologies, and
 - ✓ Formulate basic measures for rational utilisation of industrial water.
- Industrial wastewater recovery and reuse
 - ✓ Promote recovery and reuse of industrial wastewater

(b) Promotion of Water Reuse

Since the extreme shortage of water in 1973, the importance of water reuse promotion has been recognised and various measures have been implemented in Japan. MITI conducted the following:

- Study on reusability of industrial wastewater

- ✓ Study aiming at establishing low-cost technologies for recovery and reuse of industrial wastewater, based on qualities of raw wastewater and allowable qualities of treated water.
- Study on measures for industrial water shortages
 - ✓ Study on development of new water resources aiming at supplying cheap and stable industrial water for the main regions of water shortage.
- Study on regional applicability of advanced technologies for water reuse
 - ✓ Promote effective utilisation of advanced technologies for recovery and reuse of industrial wastewater in model regions.
- Preparation of guidelines for environmental friendly water treatment technologies
- International cooperation for water environment preservation
(Water Hope 21)

(ii) Organisational Structuring: Water Re-use Promotion Center (WRPC)

Water Re-use Promotion Center (WRPC) was established in 1973 aiming at coping with the lack of water resources and contributing to environmental protection. WRPC is conducting the following:

- R&D of technologies related to rational utilisation of water such as:
 - ✓ Wastewater recovery, treatment and reuse, and
 - ✓ Seawater desalination,
- Studies related to rational utilisation of water:
 - ✓ Measures for industrial water shortages,
 - ✓ Basic study on guidelines for environment-friendly water treatment technology
 - ✓ Study on industrial water utilisation status,
 - ✓ Study on future conditions of water supply business
- Promotion of water re-use technology:
 - ✓ Water re-use symposium,
 - ✓ Publication of “Water Re-use” magazine,
 - ✓ Seminars and workshops on water re-use, and
 - ✓ Information services on water re-use.
- International cooperation:
 - ✓ Technical cooperation on environment-friendly technology for industrial water recycling and re-use, and
 - ✓ Training.

(iii) Incentives for Rational Utilisation of Water

(a) Tax System for Promotion of Investment in the Reformation of Energy Supply and Demand Structure

As a part of tax incentives under the Reformation of Energy Supply and Demand Structure mentioned in 1-C (iii), 7% tax exemption or 30% special depreciation of the equipment acquisition cost have been available since 1988 in order to promote the introduction of equipment for rational utilisation of water.

Figure A1-4 shows the trends of water consumption in Japan.

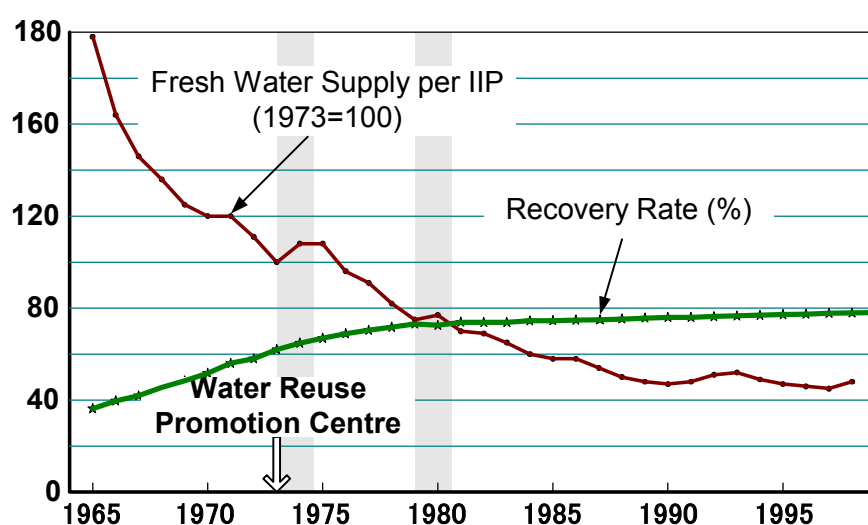


Figure A1-4 Industrial Water Consumption per IIP and Recovery Rate in Japan

1-E Industrial Waste Recycling

(i) Policy Scheme Related to Waste Recycling in Japan

In July 1999, the Industrial Structure Council of the MITI (present METI) submitted a report “Towards the Creation of a Recycling-Oriented Economic System”, which deemed that a recycling-oriented economic system needs to be established quickly, while waste and recycling-related measures need to be reassessed to realise it. Specifically, it emphasises that 3Rs, namely Recycling, Reducing and Reuse must be implemented more extensively. Before the submission of this report, measures had been carried out including legislation on waste and recycling-related laws, guidelines by the Industrial Structure Council, promotion of voluntary industry actions, and waste recycling.

Table A1-2 shows the history of legislation aimed at promoting recycling in Japan.

Table A1-2 Legislation for Waste Recycling in Japan

Year	Name	Content
1991	The Law for Promotion of Utilisation of Recyclable Resources	To promote recycling through a combination of industry's self efforts and the guidance of the political administration.
1991	Revised Waste Management and Public Cleaning Law	Introduction of regulations relating to waste reduction and recycling into legal system with the aim of promoting recycling
1993	Law on Temporary Measures to Promote Business Activities for the Rational Use of Energy and the Utilisation of Recycled Resources	Financial support and tax incentives, both for the rational usage of energy and certain specified materials and recycling
1995	Containers and Packaging Recycling Law	Targeting containers and packaging, which account for 60% by volume of municipal waste in Japan
1997	Revised Waste Management and Public Cleaning Law	Providing solutions for the shortage of landfill space and the problem of illegal dumping of waste
1998	Home Appliances Recycling Law	To promote the recycling of 4 types of home electric appliances. Took effect from April 2001
2000	Green Purchasing Law	Promotion of procurement of recycled products by national organisations
2001	The Basic Law for Promoting the Creation of a Recycling-Oriented Society	Basic framework law: - Clear presentation of "recycling-oriented society" - Disposal priority - Clarification of role-sharing
2001	The Law for Promotion of Effective Utilisation of Resources	Revision of the "Law for Promotion of Utilisation of Recyclable Resources" From 1R to 3R
2001	Revised Waste Management and Public Cleaning Law	Strengthening measures against improper disposal, and provision of facilities through participation of public sector

The latest legislative framework for recycling in Japan consists of the following as shown in Figure A1-5.

- Basic Law for Promoting the Creation of a Recycling-Oriented Society as the basic framework law,
- Waste Management Law, which aims at proper waste management,
- Law for Promotion of Effective Utilisation of Resources, which aims at promotion of recycling,
- Regulations in accordance with the characteristics of individual products such as:
 - ✓ Containers and Packaging Recycling Law,
 - ✓ Home Appliance Recycling Law,
 - ✓ Construction Materials Recycling Law,
 - ✓ Food Recycling Law, and
 - ✓ Green Purchasing Law.

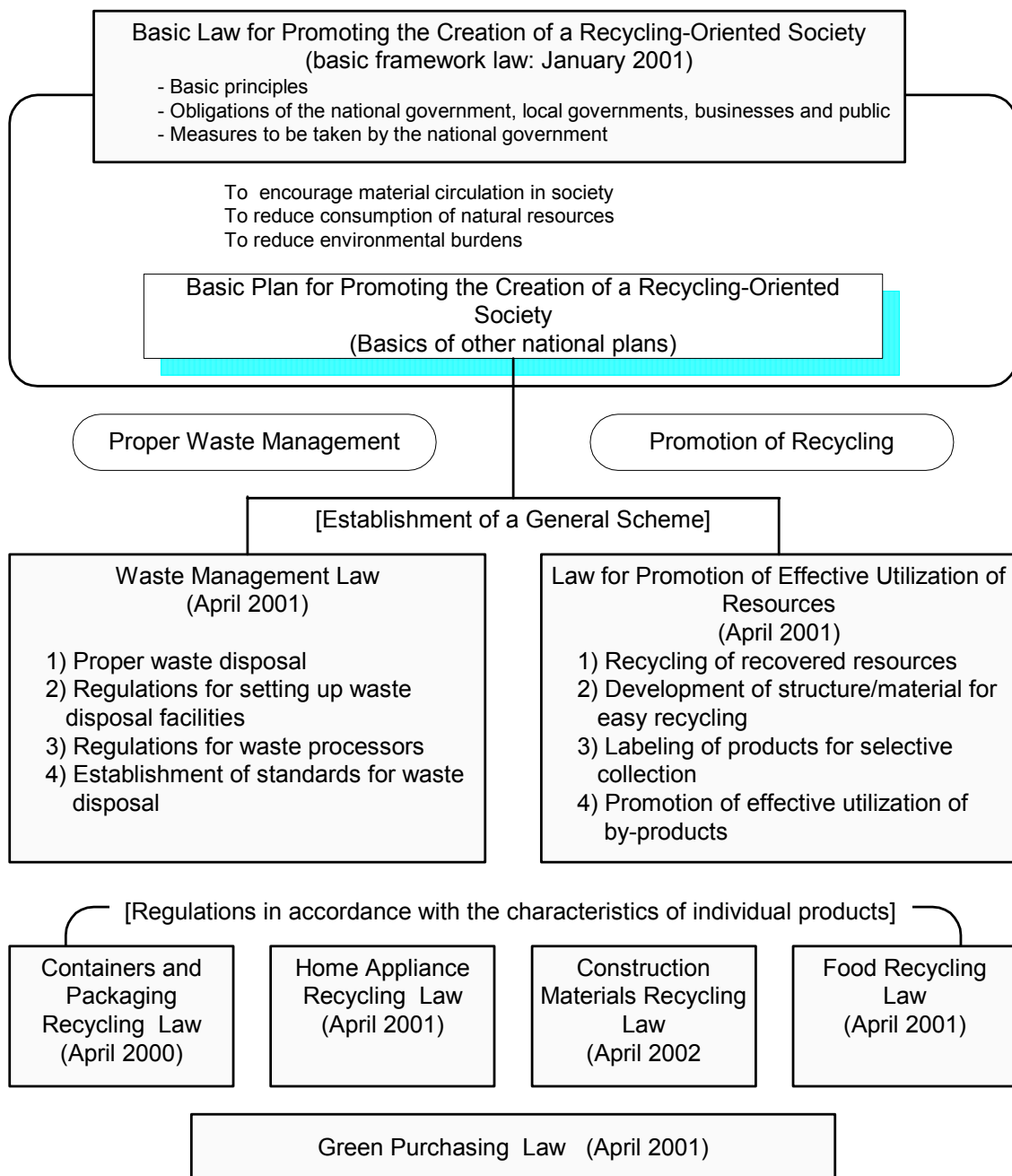


Figure A1-5 Legislative System for Promoting the Creation of a Recycling-Oriented Society

Source: data from the Industrial Structure Council

Figure A1-6 shows the roles of government, industries and consumers stipulated in the Recycling Law (Law for Promotion of Utilisation of Recyclable Resources) which became effective in October 1991 and was revised and took effective in 2001.

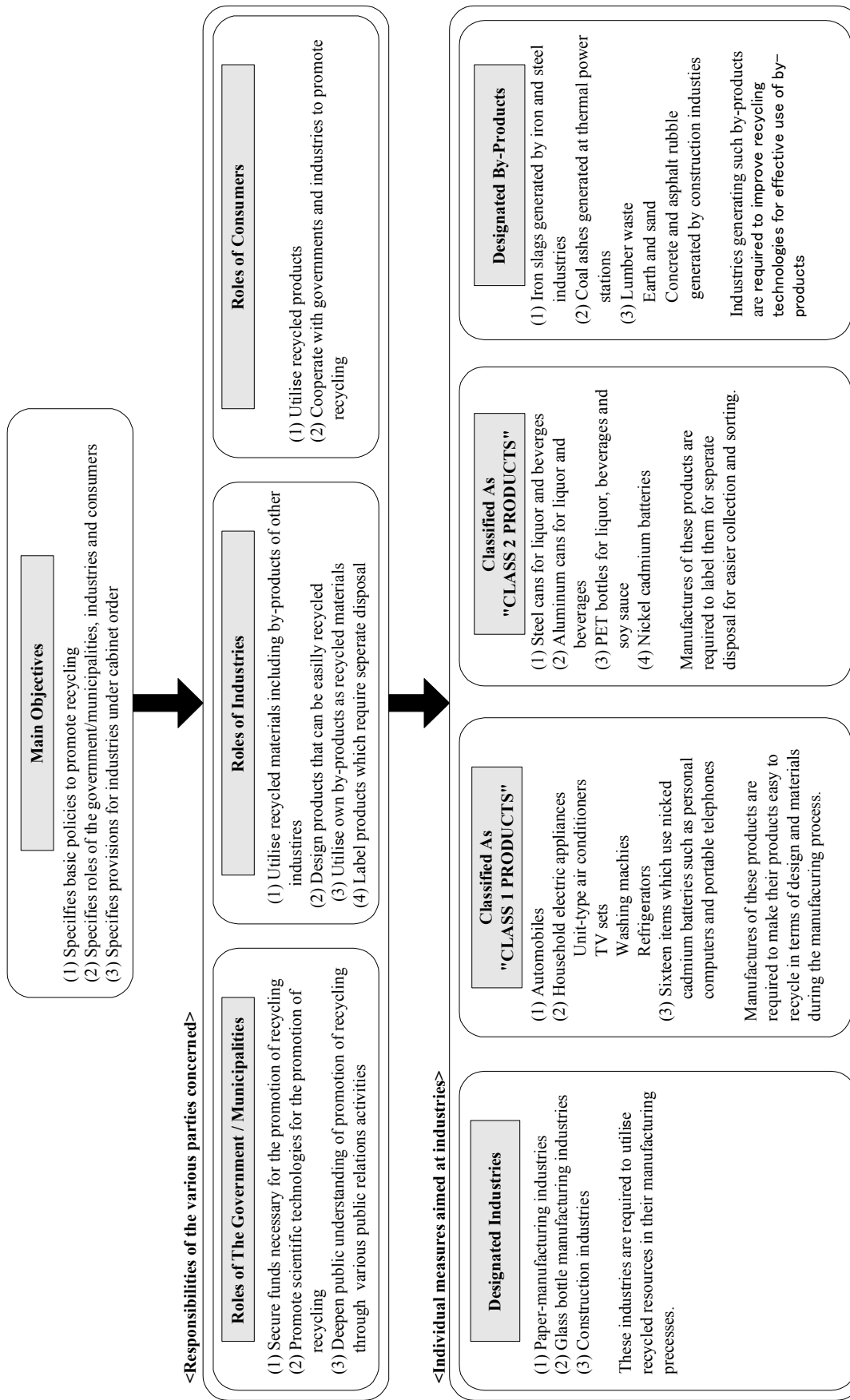


Figure A1-6 Role of the Government, Industries and Consumers Stipulated in the Recycling Law in Japan

In parallel with the legislative system, the government decided targets for reduction and recycling of industrial waste as shown in Table A1-3. A target was set to half the final disposal volumes actually recorded in fiscal 1996 for both municipal solid and industrial waste by fiscal 2010.

Table A1-3 Targets for Reduction of Industrial Waste in Japan

	Unit: million tons/year		
Fiscal year	1996	2005	2010
Waste Discharged	426	460	480
Recycled	181	219	232
Reduced by Intermediate Processing	185	202	216
Final Disposal	60	39	31
(Reference) Incinerated	18	14	14

Source: Cabinet Committee on Dioxin Countermeasures

(ii) Organisational Structuring Related to Waste Recycling

The Clean Japan Center (CJC) was established in 1975 as a semi-governmental organisation under MITI, aiming at searching for ways to make best possible use of waste materials in order to conserve resources and protect the environment. Activities of the CJC cover the following:

- R&D of technologies related to treatment, recovery and/or re-utilisation of waste,
- Demonstration projects for waste re-utilisation
- Information services on waste recycling, and
- Secretariat services for the Recycling Promotion Conference.

(iii) Incentives for Waste Recycling

(a) Incentive under Law on Temporary Measures to Promote Business Activities for the Rational Use of Energy and the Utilisation of Recycled Resources

Under the same law as mentioned in 1-C (iii) (c), ISIF provides debt guarantee and interest subsidiary for the following:

- Installation and/or improvement of facilities related to waste recycling,
- Development of waste recycling related technologies,
- Installation and/or improvement of facilities for manufacturing pulp mould.

(b) Award System for Waste Recycling

An award system is being operated by the Recycling Promotion Conference. Awards are presented by the Prime Minister, relevant Ministers and the chairman of the Recycling

Promotion Conference to those who have contributed to waste recycling through active and continuous efforts.

(iv) Status of Waste Recycling in Japan

Figure A1-7 shows the flow of industrial wastes in Japan in 1997.

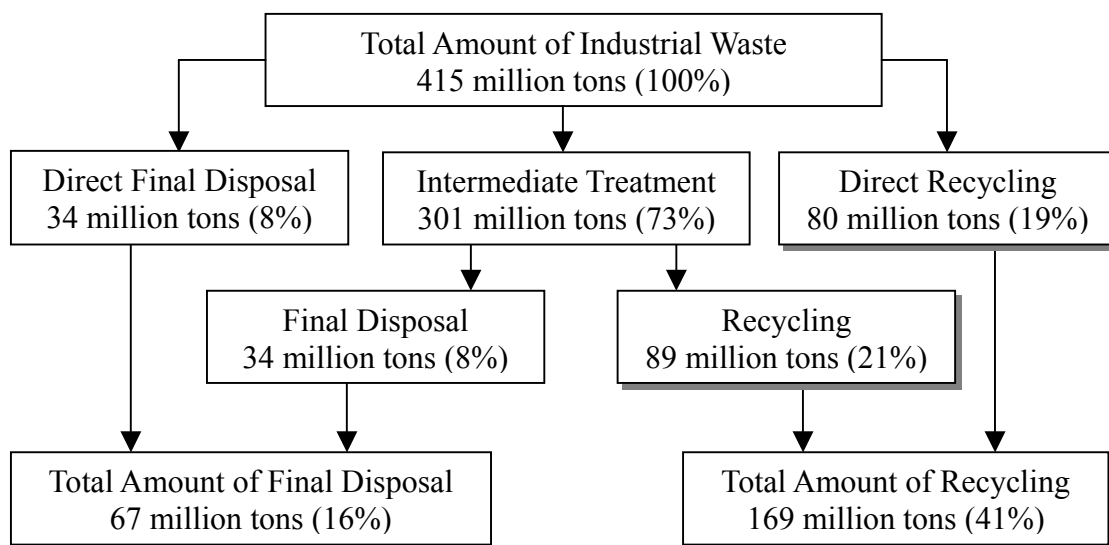


Figure A1-7 Simplified Flow of Industrial Wastes in Japan in 1997

The amount (301 million tons) reduced after intermediate treatment to 123 million tons (=34+89) through volume deduction by incineration etc. In total, 41 percent of industrial wastes were recycled. Figure A1-8 shows the trend of industrial waste recycling in Japan during five years since 1993. Recycling rates were maintained at approximately 40% during the period.

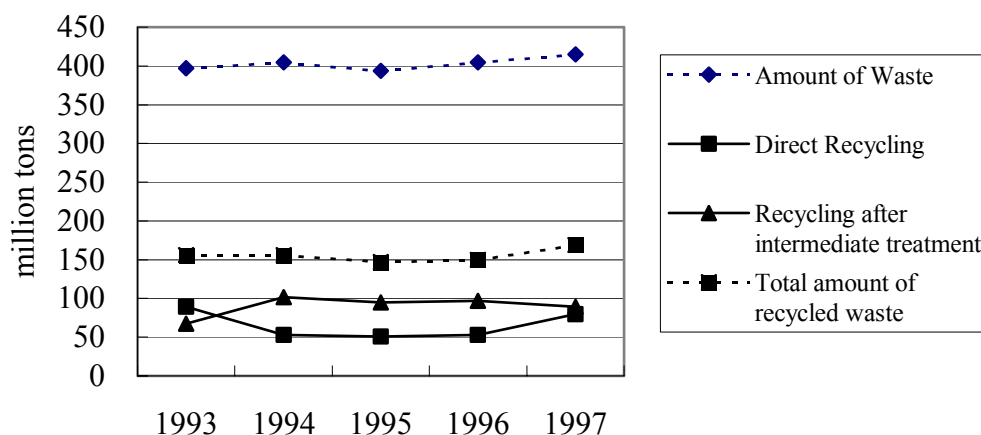


Figure A1-8 Trend of Industrial Waste Recycling in Japan

1-F Other Activities

(i) Industrial Statistics

The Yearbook of Industries Statistics is compiled and published every year by the Research and Statistics Department, Economic and Industrial Policy Bureau, METI based on industrial sector-based studies as per Ordinance No. 81 of MITI, which was enacted in 1951 and amended in 2000.

Sector-based studies are conducted by local governments for each business establishment on the following items:

- (a) Business establishment name and address,
- (b) Headquarter name and address,
- (c) Other business establishment,
- (d) Enterprise organisation and paid-up or authorised capital,
- (e) Number of employees and its breakdown,
- (f) Number of regular employees on monthly basis,
- (g) Total amount of cash wages,
- (h) Consumption amounts of raw materials, fuels and electric power,
- (i) Amount of commission production,
- (j) Fixed assets: present values, acquisition values, depreciation, and others,
- (k) Expenses for leasing contract,
- (l) Stock of products, half-finished goods, raw materials and fuels,
- (m) Amount of products delivered,
- (n) Income from processing and/or repairing work,
- (o) Amount of domestic consumer tax,
- (p) Names of major raw materials,
- (q) Summary of production processes,
- (r) Area of the site and buildings, and
- (s) Consumption of industrial water and its breakdown by the following:
 - Amount of industrial water by resources: piped water, surface water, underground water, other fresh water, and recovered water.
 - Amount of industrial water by utilisation purpose: for boiler, process, washing, cooling, temperature control, and others.

Detailed benchmarking studies are conducted on a non-regular basis by local industrial associations; e.g. prefecture-based electroplating associations.

(ii) Productivity Improvement Activities

(a) Small Group Movement

Productivity improvement activities in Japan are characterised by small group movements such as Total Quality Control (TQC) or Total Productive Maintenance (TPM). Both TQC and TPM aim at productivity improvement although targeted areas are different as follows:

- TQC, promoted since the late 60's, aims at product quality assurance through voluntary activities in production sites, and
- TPM, promoted since the 70's, aims at improvement in productivity, quality and cost through thorough reduction of losses.

Small group activities in Japan have the following features:

- Based on participation of all employees,
- Start from good house keeping such as “5S” movement,
- “KAIZEN” or improvement management system, which accompanies encouraging incentives,
- Training
Various training courses are prepared for each level of top-management, engineer and/or worker by various organisations as well as in-house training programmes.
- Nation-wide promotion

(b) Organisation related to Productivity Improvement

The Japan Management Association (JMA), a non-profit membership organisation, was established in 1942 under the accreditation of the Ministry of International Trade and Industry (MITI). Its mission is to pursue innovation in management that will result in improved quality and productivity.

The JMA together with other institutions such as the Union of Japanese Scientists and Engineers (JUSE) and the Japan Institute of Plant Maintenance (JIPM) played an important role in the promotion of TQC and TPM. The JMA is currently conducting the following activities:

- Education/Training services: conventions, symposium, seminars and forums,
- Management system audit for ISO series,
- Annual awards for companies excelling in productivity improvement,

ANNEX-2

Activities Related to Industrial Waste in Malaysia

2-A MAWAR (Malaysian Agenda for Waste Reduction)

Table A2-1 MAWAR (Malaysian Agenda for Waste Reduction)

Waste Minimisation (Cleaner Technology)	Reducing the generation and discharge of pollutants (gaseous, aqueous and solid) at the source to avoid subsequent handling, treatment and disposal. Benefiting the nation in terms of reduced waste treatment and disposal facilities and improved industrial productivities and the work environment
Categories of Waste Minimisation Techniques	Inventory management / Production process / Volume reduction Recovery / Recycling / Reuse (on-site / off-site)
Benefit from Waste Minimisation	Saving money through - Efficient use of valuable resources - Reduced treatment and disposal cost Reducing a generator's hazardous-waste-related financial liability
Industries Responsibility	Make waste minimisation a company policy (Top management support) Set specific goal Commit to implementing recommendations identified (Through assessments & evaluation) Designate a waste minimisation coordinator Publicise success stories Reward employees that identify cost-effective waste minimisation Train employees on aspects of waste minimisation Encourage technology transfer

During the MAWAR period, the Department of Environment (DOE) carried out a survey at various industries targeted on their activities with regard to industrial waste reduction.

Table A2-2 Examples of Expected Recycling Materials by Industry

No	Industry Name	Type of Waste	Method of Waste Reduction
1	Electronic & Semiconductor	Metal hydroxide	Upgrading of the system
2	Industrial gas plant	Waste oil	Recycling / reuse
3	Chemical plant	Nickel catalyst	Reduce in raw material
4	Electronic & Semiconductor	Wire saw oil Isopropyl alcohol	Recycle
5	Chemical	BACA by-product Carboxylic acid Bio-sludge	Reuse

2-B The Activities of the Federation of Malaysian Manufacturers (FMM)

(i) Outline of FMM

FMM was established on 2 July 1968 as a leading economic organisation representing over 2,000 manufacturing and industrial service companies.

FMM is open to all manufacturers and companies registered in Malaysia. Large, small and medium-size industries, whether foreign or locally owned or operated on a joint-venture basis, are eligible for membership.

Key roles of FMM are as follows:

- a. Work together with Government to ensure a sustainable and dynamic business environment.
- b. Assist Malaysian industries in increasing productivity, efficiency and improving their competitive edge.
- c. Mobilise efforts to moderate and expand the range and quality of supporting industries.
- d. Stimulate entrepreneurship and innovation in the Malaysian business community.

Profile of FMM membership is shown in Table A2-3.

Table A2-3 Profile of FMM

State (%)		Annual Sales (%)	
Malacca	5	RM 0 to 10 Million	44.5
Johor	14	RM 10 to 20	21.3
Pahang, Trengganu & Kelantan	2	More than 20	34.2
Sabah & Sarawak	2	Employment Size	
Penang, Kedah & Perlis	12	Below 50 employees	600
Perak	8	51 to 150	670
Selangor	41	151 to 500	530
Kuala Lumpur	13	501 to 1,000	150
Negeri Sembilan	3	1,001 to 2,000	100
		Above 2,000	60
Industry Sector (%)			
Electrical and Electronic App.	15.8	Basic Metal Products	5.2
Chemicals including petrochem.	11.5	Rubber Products	4.5
Food, Beverage and Tobacco	11.2	Non-Metallic Mineral Products	4.3
Fabricated Metal production	8.9	Motor Vehicles and Transport E.	4.0
Plastic Products	7.9	Textile, Wearing Apparel, Leather	3.9
Machinery and Equipments	7.6	Furniture	3.9
Paper, Printing and Publishing	5.8	Others	5.8

(ii) Data Analysis

Tables A2-4 and A2-5 show the numbers and volume categorised by material kind and DOE waste code respectively.

The FMM registry is a good reference as it shows actual implemented recycling activities in the form of waste exchange in Malaysia. There are 94 items for disposal and exchange and 15 for use as input materials. Thirty-seven (37) items are scheduled waste one (1) item is solid waste.

Metal, wood, acid, chemical, oil and food waste occupy a large volume in the list. Textile and paper waste do not contribute so much volume in the list, because main portions of these wastes belong to the category of solid waste and hence is out of the scope of the FMM registry.

Metal and hydroxy metal account for the majority of non-specified sources of waste under DOE's scheduled waste code (N-). Specified sources waste of DOE waste code (S-) include a variety of waste types.

Table A2-4 Numbers and Volume of FMM List by Material Category

Material Category	Number of Materials	Volume of Materials tons/y	Material Category	Number of Materials	Volume of Materials tons/y
Acid	4	6,018	Oil	8	4,002
Catalyst	1	190	Paint	5	874
Chemical	17	3,402	Paper	3	19
Cloth	2	54	Resin	9	398
Container	5	7	Rubber	5	150
Electric part	1	0	Sawdust	4	444
Food	5	3,298	Soap	1	250
Ink	5	145	Solvent	3	16
Lenses	1	12	Wood	2	26,880
Metal	19	74,697	Others	8	620

Table A2-5 Numbers and Volume of FMM List by DOE Code

DOE code	Description	Volume (t/y)
N011-N015	Oil	42
N031	Halogen waste	6
N041	Aromatic organic solvent	0
N051	Water soluble solvent	0
N091	Fusing mixture waste containing organic acid, solvent, chlorinated ammonium	6
N101	Alkaline solution	36
N131	Inorganic acid	6
N141	Photographic waste	18
N151	Hydroxy metal	1,476
N181-N184	Paint and ink	604
N191	Pigment and ink	72
N201-N204	Metal	3,252
N211-N212	Acid and alkali	13
N231	Contaminated soil, wastewater, waste	96
N261	Clinical wastes	1
N271	Container or bag contaminated with cyanide, arsenic, chromate, lead, salt	0
N281-N282	Mixture of schedule waste and non-scheduled	23
S032-S034	Paint and solvent	130
S041	Incinerator residue	450
S054-S056	Ink and others	529
S111-S113	Resin	26
S121	Rubber or latex sludge containing heavy metal	72
S152	Sludge	120
S181	Pressed cake of Glycerine	360
S211	Waste containing mercury	60
S231	Industrial catalyst	190
S251	Cloth, plastic, paper filter	24
S261	Used container and bas	6
S271	Battery	1
S281	Mixture of scheduled waste	2

2-C Waste Recovery and Utilisation Facilities

Table A2-6 Approved Waste Utilisation Facilities, 2001

No	Type of Waste	Number of Facilities
1	Calcium Sulphate Sludge	1
2	Panel Sludge (Silica)	1
3	Soap Sludge	1
4	Iron Slag	1
5	Calcium Sulphahte Sludge	
6	Aluminum Hydroxide Sludge	1
7	Copper Slag	
8	Phenolic Resin Paper	
Total		5

Source: Department of Environment

Table A2-7 List of Waste Recovered Off-Site Facilities in Malaysia, 2001

	Category	Type of Waste	Number
1	Metallic Hydroxides	Lead Hydroxide Aluminum Hydroxides Metallic Sludge	1 1 1
2	Waste Oils and Oil Sludge	Oil Sludge Slope Oil Waste Oil	1 1 3
3	Solvents, Acids and Alkaline	Waste Acid Lead Acid Batteries Spent Aqueous Acid Solution Copper Chloride Solution Spent Cupric Chloride Spent Ferric Chloride Spent Hydrochloric Acid Spent Ammonium Chloride Waste Solution Spent Copper Hydroxide Spent Etchant Spent Aqueous Alkaline Solution Spent Electroplating Solution	1 3 2 1 3 3 1 3 6 1 1 1 1
4	Dross, Ash and Slag	Solder Dross Brass Dross Aluminum Dross Zinc Ash / Dross Lead Dross Steel Slag	8 1 1 3 1 1
5	Others	Waste Paint Photographic Waste Contaminated Cloth Used Steel Drums / Containers	1 1 1 1

Source: Department of Environment, Malaysia

2-D Solid Waste Treatment in Malaysia

(i) Estimated Amount and Composition of Solid Waste in 1998

Table A2-8 Estimated Amount of Solid Waste in Peninsular Malaysia, 1998

State	Total Population served by the Local Authorities	Solid Waste Generation Rate (kg/person/day)	Estimated Total Solid Waste Generation (ton/day)
Peris	77,650	0.80	62
Kedah	1,581,483	0.80	1,265
Pulau Pinang	1,290,924	0.80	1,032
Perak	1,618,483	0.80	1,294
Selangor	1,583,572	1.25	1,979
Negeri Sembilan	578,035	0.80	462
Melaka	611,481	0.80	489
Johor	1,612,650	0.80	1,290
Pahang	634,660	0.80	507
Terengganu	583,907	0.80	467
Kelantan	1,041,311	0.80	833
Kuala Lumpur	1,446,803	1.56	2,257
Total	12,660,959		*11,940

*11,940 × 365 = 4.35 million tons

Table A2-9 Estimated Composition of Solid Waste in Malaysia

Domestic (residential)	49%	Construction	9%
Commercial and Institutional	16%	Municipal	2%
Industrial	24%		

(ii) Consortiums for Integrated Solid Waste Management System and These Roles

Table A2-10 Consortiums for Integrated Solid Waste Management System

Name of Company	Concession Area
Alam Flora Sdn Bhd	FT Kuala Lumpur, Selangor, Pahang, Terengganu and Kelantan
Northern Waste Industry Sdn Bhd	Perlis, Kedah, Pulau Pinang and Perak
Eastern Waste Management Sdn Bhd	Sabah, Sarawak and Labuan
Southern Waste Management Sdn Bhd	Melaka, Negeri Sembilan and Johor

Table A2-11 Function of Consortium

Task to manage and develop	New landfill equipments
Collection services	Sanitary landfills with double liners
Transfer stations	Leachate treatment facilities
Recycling depots	Gas control facilities
Sanitary landfills	Odor control devices
Waste incinerators	

(iii) Alam Flora

Table A2-12 Outline and Function of Alam Flora

Covered Area	Kuala Lumpur, Selangor, Pahang, Kelantan, Terengganu
Employees	Engineers, planners, Scientists: 85 Operators: 4,197
History	Establishment: December 1995 Area expansion (Kuala Lumpur): 1997 Area expansion (Pahang): 1998
Recycling Day	Education public on recycling activities and increasing the volume of recyclable items (2001 July)
Conference	Asia Solid & Hazardous Waste Management Trade Expo & Conference (2001 November)
Information & Recycling Centre	Various information including recycling activities provided

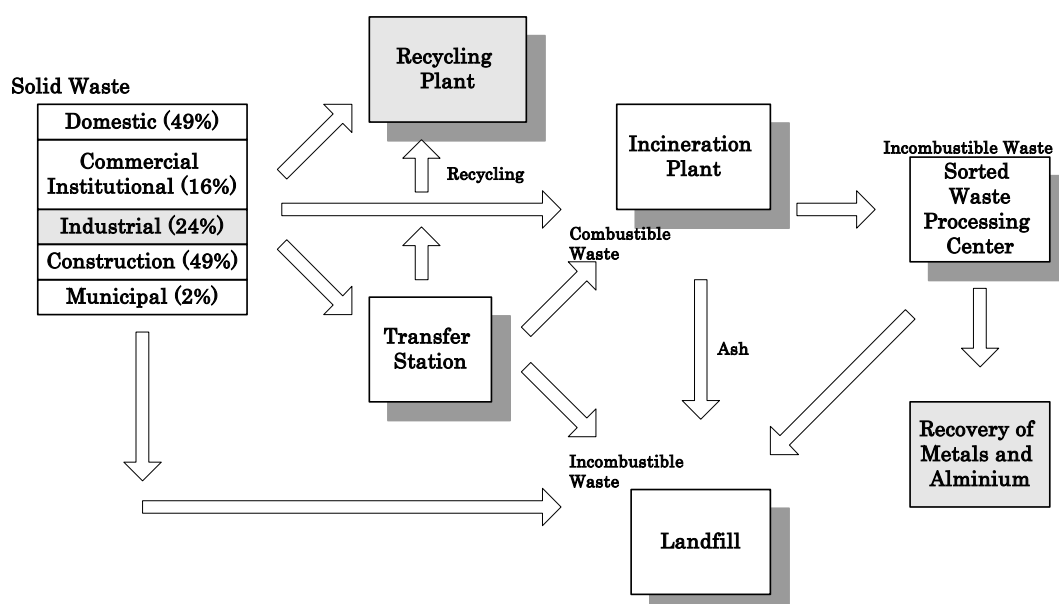


Figure A2-1 Waste Treatment System in Alam Flora

(iv) Incineration

Table A2-13 Distributions of Incinerators for Solid Waste Disposal

State	Estimated Population Served	Incinerator Capacity (ton/day/unit)	Number of Incinerator (unit)
Labuan	54,307	10	2
Trengganu	228,659	80	1
Pahang (Tioman Island)	2,654	3	2
Perak (Pangkor Island)	721	5	1
Kedah (Langkawi Island)	52,000	10	2

(v) Classification of dumping sites

Table A2-14 Classifications of Dumping Sites in Peninsular Malaysia, 1998

State	Open Dumping	Control Tipping	Sanitary Landfill	Total
Peris	0	1	0	1
kedah	7	5	1	13
Pulau Pinang	0	2	1	3
Perak	7	17	2	26
Selangor	7	9	2	18
Negeri	7	6	0	13
Sembilan	2	2	1	5
Melaka	15	15	0	30
Johor	22	8	2	32
Pahang	9	8	1	18
Terengganu	14	3	0	17
Kelantan	0	0	1	1
Kuala Lumpur				
Total	90	76	11	177

(vi) General Problems in Solid Waste Disposal

(a) Incineration

The aim of waste incineration is to redirect all combustible wastes, which present special problems with recycling. By incineration, the energy potential of waste is used for the last time, while material recycling is repeatedly used before the energy potential is deprived of. In incineration plants, there remain residual products from flue gas cleaning (5%) and incineration slag (20-25%) by weight of the incinerated wastes. Today land filling is the only method of residual products disposal from flue gas cleaning, which requires special care to prevent solving into water.

(b) Landfilling

Landfilling is ranking lowest on the list of treatment priorities. The location of sites must be selected taking into account the environment preservation. Furthermore, pollution problems entailed by greenhouse gases and leachate must be considered. Leaching from waste sites can be limited by setting up a number of special landfills for wastes. Leachate will also in the future present a threat to treatment plants and city waters, groundwater and surface water.

(c) Industrial Product Wastes

1) Paper / cardboard

The use of recycled paper as raw material in the manufacturing requires only $1/2 - 1/3$ of the energy required for manufacture of paper from wood. The energy savings are much larger than the energy used in CO_2 generating waste incineration, and reuse of paper / cardboard is a CO_2 reducing strategy which also cuts the need for incineration plants and landfill sites.

2) Glass

Recycling reduces waste quantities, primarily for land filling, and reduces the consumption of energy and resources. The benefits by reuse (i.e. refilling) are larger than by recovery (i.e. use of cullets in the production) and much larger compared to the manufacture of glass containers / one-way packaging

3) Plastics

The energy consumption for reprocessing of plastics waste is $1/3$ of the energy required for the manufacture of new plastic raw materials. Beside the energy content of the raw material itself, process energy is saved in connection with recycling. Incineration of plastics, being based on oil, contributes to atmospheric CO_2 emissions.

2-E Scheduled Waste Treatment in Malaysia

(i) Outlines of Environmental Quality (Scheduled Wastes) Regulations 1989

Table A2-15 Outlines of Environmental Quality (Scheduled Wastes) Regulations 1989

Definition	A total of 107 categories of waste is defined as scheduled waste; 28 kinds which are defined by components from non-specified generators and 30 kinds from specified generators. Organic solvents, PCB, heavy metals, cyanide, slug, incineration ash, sludge, and clinical waste are specified. The definition of scheduled waste does not include the concentration of components.
New Generators	New generators of scheduled wastes are required to notify the DOE within one month from the date of generation of wastes.
Required Licensing	Scheduled wastes can be stored, recovered and treated within the premises of waste generators. Such activities do not require licensing by the DOE. However, land farming, incineration, disposal and off-site facilities for recovery, storage and treatment can only be carried out at prescribed premises licensed by DOE.
Water Generators	Water generators shall also keep an up-to-date inventory of scheduled wastes generated, treated and disposed off. Proper labeling of containers and storage areas as well as prohibition of storage on incompatible waste are also required by the law.
Intermediate Treatment	Scheduled waste shall be given intermediate treatment through prescribed premises licensed by DOE or on-site facilities. The license of DOE is essential for the possession or use of the prescribed premises that include the following: <ul style="list-style-type: none"> • Off-site storage facility, • Off-site treatment facility • Off-site recycling facility • Incinerator, • Ground treatment facility, and • land-fill site.
Treatment	The final treatment of scheduled waste is allowed only for the prescribed premises with DOE license.
Reduction and Storage	The generation of scheduled waste shall be reduced at a maximum extent possible by the generator with best measures. For the storage of scheduled waste, durable containers shall be used with specified label at appropriate site; at the same time records on the generation, treatment, disposal and storage of
Transporting	In the case of transporting the waste from generator to the treatment and disposal facilities, the transporting of waste shall conform to the consignment note system whereby the movement of waste is monitored until it reaches the approved destination. It is the responsibility of a waste generator to monitor and ensure that the waste transported from his factory reaches the approved destination safely.
Nature of The waste	The waste generator is responsible for informing the transport contractor regarding the nature of the waste and what actions to be taken during accidents to minimise damage to human life and the environment. Scheduled wastes transporters should also be licensed by DOE.
Record	The regulation lists the procedure for license application, renewal and ownership transfer as well as requirements for record keeping and submission to the department of Environment. Every owner or occupier of prescribed premises is responsible to keep accurate and up-to-date records of waste handled and to submit these records within 14 days at the end of every period of three months to the DOE.

Offence	Offences under these Regulation can be compounded up to a maximum for RM500 or offenders can be prosecuted in court and the maximum is RM10,000 or imprisonment for a period not exceeding two years or both and to a further fine not exceeding RM1,000 per day the offence is committed.
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(ii) **Categorisation of Scheduled Waste**

Table A2-16 Generation of Scheduled Waste

Year	1994	1995	1996	1997	1998	1999	2000
Generation(t)	417,413	487,100	632,521	279,511	398,511	378,611	344,550
Generators	960	1,061	2,252	3,103	4,059	3,450	3,493

Source: DOE, Environmental Quality Report

Table A2-17 Categorised Scheduled Waste

Category	1998	1999	2000
Dross/Slag/Clinker	34.02	33.58	43.13
Mineral sludge	13.27	25.75	20.60
Heavy metal sludge	11.79	12.62	12.24
Oil and hydrocarbon	17.58	5.60	10.11
Paint/Ink/Dye solvent	1.15	1.98	2.40
Acid	0.39	1.08	1.83
Ink/Paint/Dye sludge	2.02	1.85	1.62
Rubber and latex	8.08	3.52	1.42
Phenol/Adhesive /Resin	0.23	3.30	1.21
Pharmaceutical	2.87	1.71	1.10
Catalyst	0.06	1.37	0.77
Halogenated solvent	0.49	1.40	0.37
Container	0.16	0.14	0.33
Non halogen solvent	0.61	0.58	0.30
Paper & plastic	0.10	0.11	0.07
Asbestos	0.01	0.00	0.02
Others	7.16	5.44	2.44
Total Generation (MT/year)	398,518	378,610.74	344,550.34

Source: DOE, Environmental Quality Report, 1998, 1999, 2000

Dross/slag/clinker, mineral sludge, heavy metal sludge and oil & hydrocarbon account for more than 75% of the total quantity of scheduled waste.

Table A2-18 shows sector-wise categorised scheduled waste in 1999.

Table A2-18 Sector-wise Categorised Scheduled Waste in 1999 (percent)

Metal	33.10	Pharmaceutical	1.53
Chemical	27.78	Workshop	1.46
Others	10.65	Printing & packing	1.15
Electronic	9.22	Oleo chemical	0.90
Rubber & plastic	7.19	Textile	0.77
Industrial gas	4.40	Resin & adhesive	0.11
Petroleum	1.73	Asbestos	0.00

Among the selected four sectors, metal finishing and electroplating industry discharge scheduled wastes at large quantity.

Table A2-19 Export and Import of Scheduled Waste (Approved amount)

Year	Export (t)	Import (t)
1993	496	
1994	1,285	
1995	3,605	150,000
1996	3,832	657,000
1997	2,694	1,232,000
1998	8,626	1,034,000
1999	5,186	166,729
2000	4,878	125,875

Note) Export in 1993-1997 shows a sum of export to major countries, not the grand total.

Source:: DOE, Environmental Quality Report, 1998, 1999, 2000

(iii) **Kualiti Alam**

The integrated facility operated by Kualiti Alam Sdn. Bhd. (KA) could accept all types of scheduled waste generated by the Malaysian industries. Only three groups of waste, namely explosives, radioactive and clinical wastes are not included in KA's scope of treatable and disposable waste.

(a) **The Solidification Plant**

The objective of the whole process is to fix all the heavy metals in the inorganic solid waste into concrete/silica matrix for long-term disposal in the secured landfill. As a result, hazardous heavy metals will not leach out to the environment.

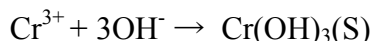
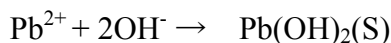
(b) **Physical/Chemical Treatment Plant**

The physical/Chemical Treatment Plant treats inorganic liquid waste such as acid, alkaline, chromate and cyanide. Generally, waste is detoxified through chemical

processes like neutralisation, oxidation and reduction.

(Chemical Treatment)

Acid and alkaline waste are neutralised by adding sulfuric acid and sodium hydroxide for pH adjustment. During the neutralisation process, all dissolved heavy metals will precipitate as metal hydroxides, e.g. lead and chromium will precipitate as lead hydroxide and chromium hydroxide respectively.



In the case of waste containing hexavalent chromate (CrO_4^{2-}), the chromate content will be reduced to trivalent form before it can be precipitated.

(Physical treatment)

The resulting residue from the various processes in the form of slurry is either used as a water source at the Solidification Plant or filtrated in the filter press.

The filter cake is further treated at the Solidification Plant before finally being disposed of in the Secured Landfill.

(c) The Incineration Plant

(Thermal Destruction Process)

The Rotary Kiln is probably the most prominent type of combustion system for incineration. These devices are popular because they can operate in a wide range of conditions and therefore can handle a wide range of waste. The Rotary Kiln has high entrainment of metals. Entrainment occurs when solids roll repeatedly inside the kiln, and are continually tumbled a reintroduced to the gas streams, providing multiple opportunities for them to become entrained. In addition, solids reside in the kiln for long time (30 min – 90 min).

The destruction of organic is determined by temperature, time, and turbulence factors (commonly referred to as the three Ts).

The current organic waste profile received at Kualiti Alam Sdn Bhd shows a very high concentration of solid and sludge waste. High solids content in wastes is of concern because of the potential of solids entrainment and carryover to downstream devices. About 10% - 25% of dust could be carried over into the SCC, quench, and boiler and then into flue gas treatment devices. The effect of such carryover can significantly reduce on-stream availability of the entire system, especially Boiler and Cooling Tower. Several interruptions have been encountered due to this phenomenon.

In view of this limitation, modifications have been carried-out during the Turn Around in December 1999. New mass and energy balance was calculated in order to enhance the capability to treat higher portions of solid waste. Two main areas were identified to further improve the system. The number of skip cycles or solid waste feeding rate to the incinerator has been increased from 6 to 12 cycles per hour, in an attempt to ensure more uniform feed and heat input rates. Secondly, the new combustion airline passing through the air pre-heater was erected and more pre-heated air is now diverted to Rotary Kiln. The modifications have greatly increased the throughput of the incinerator. Consumption of fuel (preheated air as a substitute for fresh air in the burner) has been reduced by 20% and the efficiency of the cooling tower (air to water ratio) as well as the boiler has been improved (measured in terms of overall heat coefficient).

(d) Certified ISO 14001 and ISO 9002

Kualiti Alam is the first company in Malaysia to achieve dual ISO 14001 and ISO 9002 Certification issued by SIRIM QAS Sdn Bhd.

The simplified flow of Kualiti Alam is shown in Figure A2-2.

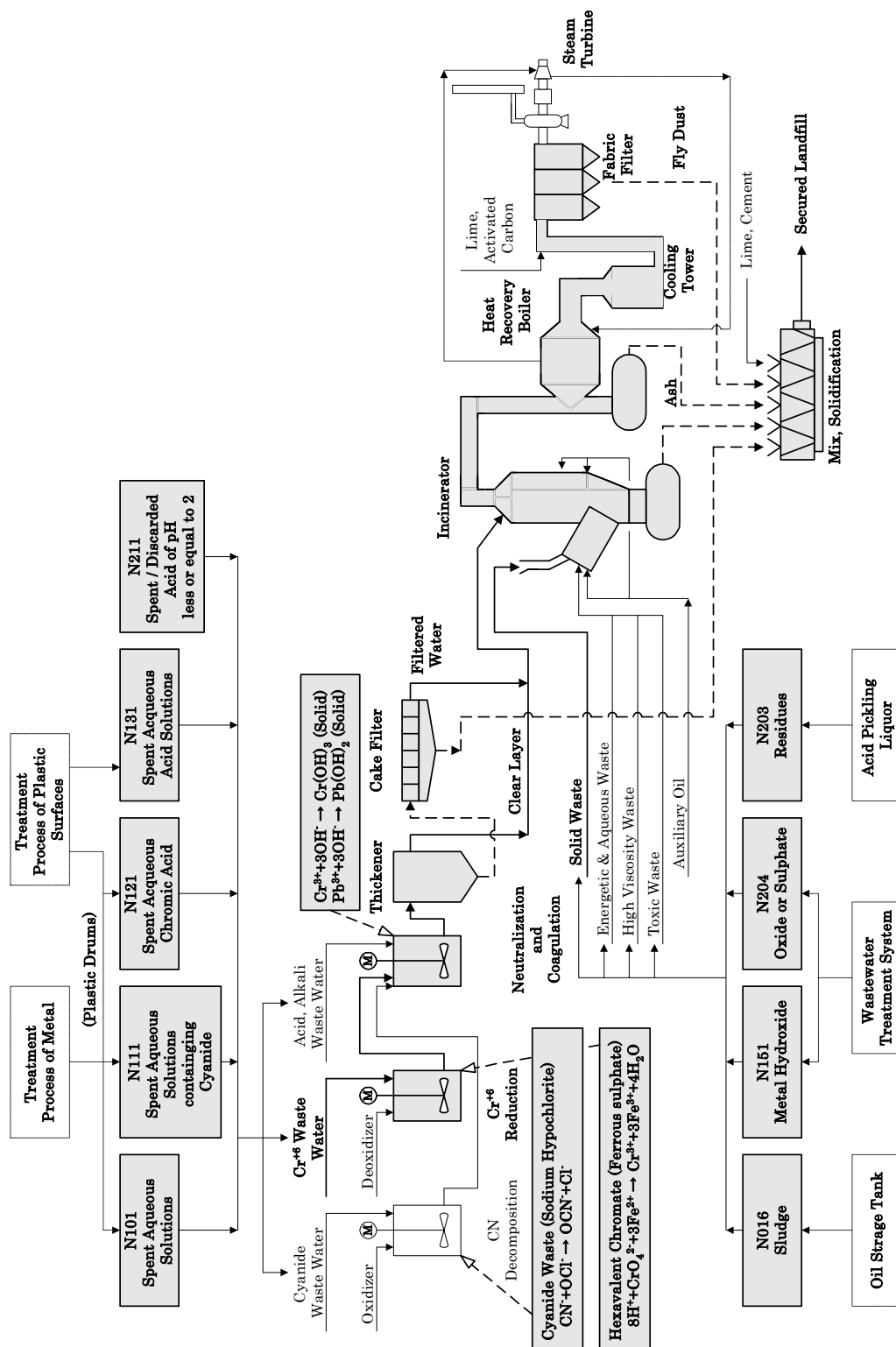


Figure A2-2 Waste Treatment System in Kuliti Alam Sdn. Bhd.

Table A2-20 Waste classification of Kualiti Alam

Group	Waste Type	Contents
A	Mineral Oil Waste	Lubricating oil Hydraulic oil Oil containing soil
B	Organic Chemical Waste Containing Halogen /Sulfur	Freon PVC waste Chloroform Solvent containing >1% Halogen, Transformer containing PCB
C	Waste Solvents without Halogen / Sulfur (<1%)	Acetone Alcohols (Ethanol, Methanol) Benzene Turpentine Xylene
H	Organic Chemical Waste without Halogen /Sulfur	Glue Latex Paint Phenol Printing ink Synthetic oils Soap Epoxy etc.
K	Waste containing Mercury	Mercury vapor lamps COD-fluids Mercury batteries
T	Pesticide waste	Insecticides Fungus Weed killers Rat poison
X	Inorganic Waste	Acids Alkaline Sodium hypochlorite Inorganic salts Metal hydroxide Sludge Chromate Cyanide
Z	Miscellaneous	Medicine waste Lab-packs Asbestos waste Mineral sludge Isocyanate (MDI, TDI) Batteries

Table A2-21 Transportation Rate of Kualiti Alam

State	Rate (RM per ton)	State	Rate (RM per ton)
Negeri Sembilan	48.60	Pahang	77.40
Kuala Lumpur	54.90	Pulau Pinang	104.40
Melaka	55.80	Terengganu	165.60
Selangor	60.30	Kedah	166.50
Perak	72.90	Kelantan	168.30
Johor	75.60	Parlis	169.20

Table A2-22 Treatment Fee (RM per ton) of Kualiti Alam

(Incineration Fee)

Waste Type		Packed Waste		Bulk Waste	
		Liquid	Solid	Liquid	Solid
A	Mineral Oil Waste	810	-	630	-
B	Organic Chemical Waste containing Halogen /Sulfur	3,150	3,600	-	-
C	Waste Solvents without Halogen / Sulfur (<1%)	1,350	-	-	-
H	Organic Chemical Waste without Halogen /Sulfur	1,890	2,790	1,800	2,700
T	Pesticide waste	3,150	3,600	-	-
Z	Miscellaneous	1,890	2,790	1,800	2,700

(Physical and Chemical Treatment Fee)

Waste Type		800 Liter Pallet	200 Liter Drum
K	Waste containing Mercury	3,600	3,780
X	Inorganic Waste		
	Acid Waste without Chromate	1,440	1,620
	Alkaline Waste without Cyanide	1,440	1,620
	Chromate Waste	1,800	1,980
	Cyanide Waste	1,800	1,980

(Solidification Fee)

Waste Type		Packaged Waste	Waste in Bulk
X	Inorganic Waste	810	765
Z	Miscellaneous		

(Direct Landfill Fee)

Waste Type		Packaged Waste	Waste in Bulk
X	Inorganic Waste	810	765
Z	Miscellaneous		

Table A2-23 Supporting Companies of Kualiti Alam

Off-Site Treatment	Kualiti Alam Sdn Bhd
Off-Site Incineration	Faber Medi-Serve Sdn Bhd Radicare (M) Sdn Bhd Tongkah Medivest Sdn Bhd
Transport For Domestic Off-Site Recovery	Pein Brothers Service Kundang Industri (M) Sdn Bhd S.A.S Enterprise Selayang Solder Sdn Bhd Sri Medan Trading UMMI Metal Orin Industries Sdn Bhd East Coast Freight Forwarders Sabaka Transport (M) Sdn Bhd
Transport For Disposal / Treatment at Kualiti Alam Sdn Bhd	Oma Shipping & Forwarding Sdn Bhd Sinar Meker Sdn Bhd Innatech Sdn Bhd Qarya W. P Labuah Shah Latiff Sdn Bhd

2-F Others

(i) Industrial Waste Recycling in Denmark

Table A2-22 shows the activity of recycling in 1985 and 2000 in Denmark described in their Action Plan. Their action plan started in 1980's and they could increase the recycling rate from 35 % in 1998 to 54 % in 2000.

Table A2-24 Waste Treatment in Demark

Million tons	Recycling		Incineration		Landfill		Total	
	1985	2000	1985	2000	1985	2000	1985	2000
Household waste	0.10	0.65	0.90	0.75	0.20	0	1.20	1.40
Bulky waste	0.05	0.10	0.03	0.15	0.22	0.15	0.30	0.40
Garden waste	0.16	0.30	0.04	0.05	0.20	0	0.40	0.35
Commercial and office	0.05	0.36	0.35	0.24	0.10	0	0.50	0.60
Industry	0.90	1.20	0.60	0.70	0.80	0.20	2.30	2.10
Demolition	0.20	1.10	0.10	0.20	1.40	0.60	1.70	1.90
Sludge	0.60	0.75	0.30	0.37	0.20	0.38	1.10	1.50
Energy generation	1.10	0.90	-	-	0.40	0.70	1.50	1.60
Residual Products from Incineration Plants	0.26	0.33	-	-	0.33	0.29	0.59	0.62
Total	3.42	5.69	2.32	2.46	3.85	2.32	9.59	10.47
Ratio (%)	35.7	54.4	24.2	23.5	40.2	22.1	100.0	100.0

(ii) Problematic Issues Faced by Small and Medium Scale Industries (SMIs)

Based on a 1993 survey of manufacturing industries, SMIs accounted for more than 84% of total manufacturing establishment in Malaysia. However, pollution from SMIs have not received due attention in the program of pollution control. There were 11,856 manufacturing industries. About 10,400 were small-scale industries and 1,708 medium scale industries. The majority of the SMIs are still concentrated in the traditional sectors of food & beverages, fabricated metal products, wood and wood products, basic metals, leather, textile and wearing apparel. SMIs are mainly located in the State of Johor, Selangor, Federal Territory, Perak and Pulau Pinag.

(a) Pollution by SMIs

Sixty six (66) % of the SMIs establishments reported producing solid waste, twelve (12) % reported producing liquid waste and seventeen (17) % reported producing toxic and semi-toxic waste.

The disposal methods were generally poor with food, textile and metal finishing. The major polluters among the SMIs tend to abuse the environment more than larger industries. Statistics shows about 70% of the environmental pollution complaints have been directed against SMIs.

(b) Public complaints, Enforcement and Prosecution

DOE relies mainly on public complaints for environmental monitoring and enforcement

of SMIs. Most public complaints are about air pollution (3,355: 80%) in 1997. There were 382 cases of complaints about water pollution, and among them 31 cases involved textiles and nine cases metal finishing and electroplating industries.

DOE's enforcement of environment regulations on SMIs has been weak, because DOE authorities at both federal and state level have limited enforcement officers and lack of uniform practices and training. Even though the electroplating factories pollution discharge exceeds the government regulation limits, DOE does not always come to bother them. Often, enforcement monitoring and auditing are carried out only when the public complains about observed pollution problem.

Once DOE determines that the pollution discharge limit has been exceeded and that action is to be taken, most likely it resorts to legal action, namely prosecution.

In 1997, 275 cases were prosecuted by DOE, and a total of RM2.4 million of fines were collected.

(c) Shutdown

In theory, polluting factories can be shut down if they fail to comply with environmental standards.

However, so far, very few factories have been shut down due to environmental non-compliance. One reason is that these factories have played an important role in the economy. Although small in size and backyards in technologies, SMIs' customers or their customers' customers are often large multinational companies, including automobile, motorcycle, electrical, electronic, chemical and construction industries, which have considerable economic and political influence. Such customers often come to defend these factories when they face the threat of being shut down.

Without these small vendors to supply the nuts and bolts, large industries would have to import them and pay higher prices. Besides, some large industries have made conscious decisions to divest heavy polluting operation to small vendors.

(d) Treating facilities

Existing integrated scheduled waste treatment and disposal facility at Bukit Nanas is not within the reach of SMIs, i.e., cost and location wise. Without an affordable treatment facility in each region, SMIs cannot cost-effectively comply with the regulatory requirements of scheduled waste management. The high cost associated with solid waste disposal cannot be met with SMIs. The environmental protection regulations are perceived to be unfair and hard to comply by SMIs electroplating sectors.

(e) Management Problems Facing SMIs

Followings are management problems of SMIs.

- Lack of strategic business development plan and knowledge
- Low capital investment / Low profit margins / Low budget operations
- Lack of awareness for government incentive development programs
- Lack of willingness and dynamism for modernisation
- Lack of accessible information technologies
- Disregard to worker health, safety, and environmental protection

(f) Technical Problems

Followings are technical problems of SMIs.

- Lack of technical knowledge and access to modern technologies
- Obtaining and applying appropriate technologies
- Manpower and training problems
- Capacity utilisation of plants
- High product rejection rates
- Inadequate infrastructure
- Lack of support services

(iii) Measures for Industrial Product Waste

Measures of each industrial products wastes are shown in Table A2-23.

Table A2-25 Measures of each industrial waste

(Already started recycling items)

Paper			Adoption of Recyclable paper Development of newspaper de-inking technology
Containers & Bottles	Cans	Steel Aluminum	Recycling of metal cans to manufacturers Non-refillable metal cans are not recommended
	Glass bottles		Recyclable and refillable containers and bottles Need for color separation
	PET bottles		Setting of standard returnable PET bottles for easy recycling
Batteries			Setting up collection systems of used batteries (Lead, mercury and cadmium) Focusing the production of manganese alkaline batteries Rechargeable NiCd batteries

(Recycling recommended items)

Coal ashes (Power plants)	Utilisation for building and construction.
Building & Construction	Construction by selected building materials Maximum separation of recyclable materials (Lumber / Earth and sand / Concrete / Asphalt / Tiles)
Cars and car parts	Minimising the waste fractions Increasing the recycling rate of the growing fractions of plastics and rubber materials
Used car tires	Rethreading or recycling of rubber powder New applications for processed rubber material. Technology development of Tire into rubber granulate
Household electric & electronics appliances	Mapping the quantities and material flows Promotion of voluntary taking back and recycling.
Packaging waste from industries	Taking back and recycling

ANNEX-3

Review of Industrial Pollution in Malaysia

3-A Environmental Related Laws and Regulations in Malaysia

The environment as a contemporary issue began to receive attention in Malaysia in the 1970s when the country embarked on its industrialisation programme. This was followed by the enactment of EQA1974. The EQA is considered the most comprehensive legislation on environmental matters in Malaysia. As many as 27 relevant laws pertaining to major resources and important sectors of the economy has been enacted related to the environment as shown in Table A3-1. These pieces of legislation, while not necessarily devoted entirely to environmental matters, contain provisions or references that are related to environmental pollution prevention.

3-B Governmental Institutions

The Environment Quality Council (EQC) launched in 1977, is a body to advice the Minister of MOSTE on matters pertaining to the Act, and provides policy guidance and strategic planning to DOE in a holistic approach. Because of the complexity of the two tiered Government structure, Federal and State, and the limitation of the Federal Government to have jurisdiction of matters over land, water and forests (as imbued in the Constitution) which rests entirely with State Governments, environmental problems concerning forest, water and land, can be quite complicated. The unique situation of Sarawak and Sabah which has its own set of legislation concerning land and forest provides them with even greater autonomy on these matters, as the related Federal Legislations do not apply there. In general, however, for the betterment of society and the environment, most states co-operate in implementing Government guidelines and policies, including adopting the relevant Federal Legislations.

At Federal level, the Ministry responsible for the environment is MOSTE, within which is DOE which oversees all environment activities and ensures their compliance with the law as provided for under EQA1974. It has established offices in almost every state, including Sabah and Sarawak. The state office is responsible for environmental monitoring, enforcement and approval of EIAs. It also sits in relevant State committees and provides advice on environmental matters. It is also the national focal point for coordinating, monitoring and implementing all Montreal Protocol activities.

Table A3-1 Environmental Related Laws and Regulations in Malaysia

Year	Sector	Strategy	Legislation
1920	Water	Resource use sustainability	Water enactment
1935	Forestry		Forest rules
1936	Fishers		Fisheries ordinance
1965	Land		National land code
1972	Wildlife		Protection of wildlife act
1980	Wildlife		National parks act
1984	Forestry		National forestry
1985	Fisheries		Fisheries act
1929	Mining	Human safety and welfare	Mining enhancement
1952	Merchant shipping		Merchant shipping ordinance
1958	Road transport		Road traffic ordinance
1967	Industry		Factories and machinery act
1969	Air transport		Civil activation act
1960	Population	Human settlement	Public health ordinance
1966	Housing	Human settlement	Housing developers (Licensing act)
1974	Housing		Street, drainage & building act
1974	Housing		Local government act
1976	Township		Town & country planning act
1960	Agriculture	Soil conservation	Land conservation act
1974		Human health	Pesticides act
1980		Pollution control	Piggy enhancements
1952	Drugs	Human health and safety	Poison ordinance
1984	Radioactivity		Atomic energy licensing act
1960	Maritime	Resource use and conflict	Continental shelf act
1972	matters		Petroleum mining act
1985			Economic exclusive zone act
1974	Environment	Pollution control	EQA

Its jurisdiction appears to be restricted to air pollution, scheduled wastes, wastes from oil palm and rubber factories, sewage and industrial effluent, vehicular noise, toxic wastes and approval of EIAs for prescribed activities.

For more environmental matters which it has no jurisdiction over, it has to refer to and work with the relevant departments, e.g.

- Forestry - Department of Forestry (e.g. licensing, forest inventory, reforestation, forest and water catchment management, recreation forest, enforcement, control of illegal logging – also involving police and army, mangroves, etc);
- Fisheries - Department of Fisheries (fish licensing, enforcement and management of marine and fresh water fisheries, research, management/enforcement of marine parks, breeding and supply of fish fries, aquaculture, etc);
- Solid Waste - Local Government (solid waste disposal, river, drains, building plans approval, town planning, sanitation, public health, etc.);
- Drains - Local Government, (as above);
- Pesticides - Pesticide Board, Dept. of Agriculture (control of importation and manufacture of pesticides by registration and permits, presence in food, death by pesticide injury, etc.);
- Wildlife/ - Perhilitan, MOSTE (research, enforcement, information National Parks system, ecotourism, education, protection of wildlife and management of Taman Negara – National Park);
- Mining/ - Dept. of Land and Mines, (licensing, enforcement)
- Quarry
- State Parks, - Johor State Park Corporation, (established under State
- Johor enactment to manage and control state parks and land matters within marine parks);
- Livestock Waste - Veterinary Department, dept. of Agriculture (technical services, regulation, livestock production, health of livestock, veterinary public health, etc.);
- Rivers - Drainage and Irrigation Department (flood mitigation, water quality at intake points, enforcement, etc.);
- Town/Country - Town and Country Planning Department, Ministry of
- Planing Housing and Local Government, (establishment and advice on town parks, guidelines on buildings, approval of plans/buildings, structure plans, strategic and action plans, etc.)

Decision on foreign investments and assistance programmes into the country will have to go through EPU.

In Sarawak, the newly established NREB, i.e. Natural Resource and Environment Board is responsible for all matters on natural resources and land, while the DOE oversees matters on scheduled wastes and prescribed activities. The other key player is the Department of Forestry.

In Sabah, scheduled projects are approved by the DOE. Other key players are The Environment Unit, Wildlife Department and Sabah Parks Dept., all of which come under the Ministry of Tourism and Environment Department.

3-C Governmental programmes for industrial pollution abatement

The government's programmes for environmental management are premised on a national policy on the environment, which was being drafted in 1996. The strategy is to incorporate environmental considerations in development planning, and that will take the form of environmental considerations in sectoral policies.

(i) Air Quality Management Programmes

In the area of air quality management, the government's programmes focussed on enforcement of clean air regulations for mobile sources, as it constituted 75% of the air pollution load. Given the high pollutant load from mobile sources, the other important programme was to reduce the lead content in petrol from 0.84 to 0.15 g/l through the regulation, and further promoted via a price differential in favour of unleaded fuel.

As for stationary sources, the DOE controls the emissions discharge through the Clean Air Regulations. For this, the state DOE's carry out regular monitoring and enforcement programmes, subject to the budgets and allocations provided by the federal government. Various government agencies cooperated to combat the open burning problem that caused or compounded the haze episodes during the dry months of the year. The 1997 haze episode was particularly instructive because of massive pollution from neighbouring countries that resulted in several places in the country being declared unsafe and Sarawak on the state of emergency. Since this episode, open burning programmes have been a particularly important enforcement effort.

The relocation of the federal administrative capital to Putrajaya was also to help reduce urban congestion and air pollution, although this is really a one-time effort.

(ii) Water Quality Management Programmes

As for river water quality, the deterioration in river water quality in the period 1985-94 prompted the government to take several measures. A privatisation exercise of the sewerage services was undertaken in 1993, attempting to readdress 65% of BOD in rivers.

In several states, the DOE has been tightening up on its enforcement programmes on mill discharge, and have issued licenses with considerably more stringent effluent standards. This has resulted in more cases being brought before the courts, when factories could not comply with the licensed standards. This is prompting the industry to take the matter up with the DOE. In addition, the government embarked on an awareness campaign (Love Our Rivers), as well as to inject environmental education into school curriculum, a long-term strategy that is intended to reduce overall pollution.

The DOE has also initiated four major river basin management studies with the aim of attempting to develop river quality standards that match the designated use of rivers. The outcome of these studies will be to make proposals for land uses to be matched to river quality standards. However, the studies are still at an early technical level, and will have to be adopted politically before they can be legislated.

(iii) Solid Waste Management Programmes

The solid waste situation was becoming critical as the existing disposal sites were rapidly being filled to capacity, and the search for new disposal sites was becoming more expensive. The government's approach was two prongs. First, it provided funds to upgrade and improve 27 sites and to develop 13 new sanitary sites. Second, it sought to privatise the collection, treatment and disposal system for solid waste to four consortia in 1993.

In addition to the above, the federal government is in the process of privatising the solid waste management system for the entire country. This privatisation of the solid waste management was to four consortia and was undertaken in 1996. The process of finalisation of the terms of privatisation is still under discussion. In the interim period, the consortia firms have made separate arrangements with the various local governments to provide interim services.

In the area of recycling, the Ministry of Housing and Local Government launched a national campaign in December 2000 to encourage people to carry out recycling efforts. This recycling campaign was targeted at the household level, started as part of the Local Agenda 21 programme that is being funded by the UNDP. Before this national campaign, various local governments have initiated their own campaigns; however, much of these have not had much success, in that many of these were, after a short period, not sustained.

(iv) Hazardous Waste Management Programme

For hazardous wastes, the government's programme is focused on four fronts, namely to intensify enforcement, prepare a code of practice, institute an environmentally sound management for toxic wastes, and enhancement of chemical safety. Additionally, it privatised the development of a toxic waste system in 1991 through an exclusive agreement with a private company. The exclusive arrangement is made for 15 years.

(v) Energy Programmes

In the energy sector, there are a number of policy areas that concern security (four-fuel strategy), diversification (renewable energy source), self-sufficiency, installed capacity, and rural electrification. However, in the area of industrial use, the government had initiated efforts towards promoting energy efficiency and renewable energy in order to minimise pollution effects and to encourage environment-friendly processes and technologies. For energy efficiency, the government intends to introduce the Energy Efficiency Regulations that will make it mandatory for large energy consumers to regulate themselves. As for renewable energy, the government has initiated studies to examine options, costs and strategies for its use.

(vi) Environmental Research and Development Programmes

The DOE has a programme to develop R&D activities to support the core components of managing the environment.

(vii) DOE Programme

As the main environmental agency in Malaysia, DOE has developed a number of programmes to control and prevent pollution from the industrial sectors. In its earlier inception, most of the environmental programmes undertaken by DOE were basically 'end-of-pipe' solutions. However in recent years, the DOE has taken a more complete and

integrated role, from the 'problem-solving approaches' to more systematic and holistic approaches encompassing enforcement, monitoring, development and planning. The environmental programmes already available in the country for pollution abatement are basically categorised into three (3) major activities which are shown in Table A3-2.

Table A3-2 Environmental Programmes Related To Pollution Abatement

Programme	Frequency
1. Enforcement	<ul style="list-style-type: none"> • Routine programme.
2. Monitoring	<ul style="list-style-type: none"> • Priority base on location of industries and compliance status. • Monitoring for air and water quality currently privatised to Alam Sekitar Malaysia Sdn. Bhd.
3. Environmental Awareness	<ul style="list-style-type: none"> • Yearly programmes under the Malaysian Environmental Week. • All other programmes based on allocation of funds and initiative of the DOE State Office and Education.

Enforcement programmes have always been given priority by the DOE recognising the fact that the Department is basically an enforcement agency.

Monitoring however is done at a regular basis in order to collect and compile environmental data that is required for the assessment of the state of the environment. The assessment is basically a prerequisite to enforcement action, and the highest priority of such action is given to the most critical area and thus, the major contributing sources of pollution.

(a) Enforcement Programme

Enforcement programmes are scheduled on a routine basis emphasis dependent on the major polluters and priority areas in each state. These programmes, reported yearly by DOE, are based on the following sectors:

-Agro Base Prescribed Premises

Raw natural rubber factories and crude palm oil mills are agro-based premises prescribed under Section 18 of EQA1974 that require license for occupation or use under the Act. In 1999, a total of 134 raw natural rubber (RNR) factories and 337 crude palm oil factories were licensed mills under EQA.

Table A3-3 provides a summary of the enforcement visits to the sector in 1999 and their status of compliance.

Table A3-3 Summary of Enforcement Visits For RNR and CPO, 1999

Section	No. of Mills	No. of Visits	No. Prosecuted	Compliance Status
RNR	134	161	8	90%
CPO	337	493	22	81%

Source: DOE, Annual Report, 1999

- Non Prescribed Premises

Non-prescribed premises are actually industrial premises or service utilities (power plant, sewage treatment plant etc.) that do not require an operating license from the DOE. Presently, only the crude palm oil industries, raw natural rubber industries and off site recovery / treatment / disposal scheduled wastes facilities are categorised as prescribed premises.

All other manufacturing industries or service utilities fall under the non-prescribed premises. The type of industries under this category range from small, medium, heavy to special industries of various industrial sectors and types that may discharge effluent, air impurities, generate noise or generate toxic and hazardous waste.

In 1999, DOE inspected 3,099 pollution sources discharging industrial effluents. Out of this number, as much as 2,707 sources (87%) were found to have complied with the Environmental Quality (Sewage and Industrial Effluents) Regulations, 1979.

In respect of industrial premises, a low compliance was recorded for the food and beverage industries (64%), metal finishing and electroplating (63%), fishmeal and animal feed industries (55%) respectively. The majority of these industries were the small and SMIs. The main reasons for the poor compliance were related to the following causes:

- Inefficient effluent treatment plants.
- Lack of skilled operators.
- Operating without an effluent treatment plant.
-

- Industrial Emissions

Base on the DOE's enforcement records in 1999, as much as 69% of 2,229 air pollution sources or premise visited were found to have complied with the Environmental Quality (Clean Air) Regulations, 1978.

Analysis of compliance by industry type showed that the textile industries achieved 93% compliance, the paper industry (87%), petroleum refinery (85%), rubber based industries (85%), non-metallic sector (57%) and plastic industries (51%).

The common offences for non-compliance include the following:

- Installation or erection of fuel burning equipment or chimneys without prior written approval from the Director General.
- Open burning of industrial wastes.
- Inefficient or absence of air pollution control equipment.
- Emission of black smoke exceeding the allowable limit.

- Legal Actions

As DOE intensifies its enforcement programmes, more and more polluters violating EQA were taken to court. In 1999, a total of 307 premises and companies were prosecuted in court and a total of RM 2,498,900.00 in fines were collected by DOE. Besides prosecution, DOE also issued 1,711 compounds for various offences under the EQA in 1999 that amounted to RM2,838,350.00.

(b) Monitoring Programmes

One of the mechanisms used by DOE to verify the effectiveness of its environmental programmes as well as to support future planning and directions of the Department's activities, is to monitor the environmental segments in terms of air, river, groundwater, and marine water quality and noise pollution. Table A3-4 provides a summary of the programmes related to monitoring undertaken by DOE on a yearly basis.

Table A3-4 Programmes Related to Environmental Monitoring

Segment	No. Of Stations	Target
Air Quality	50 continuous air quality monitoring stations	Various land use in Malaysia
Noise Monitoring	Ad hoc stations	Schools, hospitals in Kuala Lumpur
Water Quality	902 manual stations and 10 automatic continuous monitoring stations.	Tasik Biru, Tasik Kuning, Tasik Cermin in Selangor
Lake Water Quality	Ad hoc	
Marine Water Quality	237 stations	All states with coastline.
Island Marine Water Quality	85 stations	71 islands covering marine parks and protected islands.
Groundwater Quality	61 wells	Various land use in Malaysia

Source: DOE

The air and river water quality monitoring programme for the entire country is managed and monitored by Alam Sekitar Malaysia Sdn. Bhd. under a twenty (20) year privatisation concession agreement with the DOE.

The concession agreement relates to the installation, operations and maintenance of fifty (50) continuous air quality monitoring stations and ten (10) continuous water quality monitoring stations as well as managing the manual air, water and island monitoring operations for the DOE.

Alam Sekitar Malaysia Sdn. Bhd. (ASM) started as a joint venture company between Malaysia's Progressive Impact Corporation Sdn. Bhd. and Canadian based BOVAR Incorporated Ltd. However, in 1998 ASMA is fully owned by the Malaysian partnership.

(c) Environmental Awareness Programmes

The promotion of environmental awareness has been a continuous activity undertaken by DOE, the Ministry of Education as well as many other governmental and

non-governmental organisations. Since the Third Malaysia Plan, public environmental awareness and education programmes have been incorporated as a long-term strategy for sustainable development.

Nevertheless, most of the environmental awareness programmes were aimed at enhancing the environmental awareness of students or the school-going age by way of incubating the programme through extra curriculum school activities. Environmental awareness programmes for the industrial communities however are limited and confined to specific areas.

The only scheduled programme, which may involve participation from the industrial sector in the promotion of environmental awareness, is related to the following event:

- Malaysian Environmental Week

Normally held between 21 – 27 October of every year, the Malaysia Environmental Week (MASM) involves public / private participation in the promotion of environmental awareness. The objectives of the Malaysia Environmental Week are to:

- Increase the environmental awareness amongst the public.
- Tighten and enhance corporation between the Federal and State Governments in Environmental Management.
- Enhance the cooperation among non-governmental organisations, the private sector and individuals in environmental management.

ANNEX-4

Proposed National Strategy to Promote Cleaner Production (CP)

4-A Introduction to key issues in introducing CP

Within the government's own policy framework, industrial development initiatives have started much earlier in the late 1960s whereas environmental considerations in industrialisation came several years later.

In the mainstream, the industrial promotion agenda is the dominant one. The rationale has been to develop industrially as quickly as possible so that Malaysia can reach its development goals (Vision 2020). And within that focused approach, it has minimised the inclusion of environmental concerns into industrialisation.

However, the environmental agenda in industrial development is introduced into Malaysia in this context, under different programmes and under different names. It has not been implemented as a holistic package but as pilot or demonstration projects, and very often this has been done with the assistance of foreign donors. The environmental agenda does not have a central focus and concomitantly, it has not received comprehensive support in terms of its implementation as industrialisation initiative. Nevertheless, this area of work has attracted strong donor support, and accounts for the many projects that have been implemented by different organisations across the country.

Because of this situation, the SMIs and industrial firms have also been reluctant in terms of their reception of new ideas. This attitude is understandable because the introduction of new methods such as Cleaner Production (CP) is entirely voluntary. In general, SMIs are less than convinced of the full benefits, reluctant to fork out their expense for CP, and have more or less continued with the same way of doing business. That the SMIs lack the capacity for implementing CP has also been well documented. Even with the projects on CP and energy efficiency, adapting CP in SMIs had very little replication apart from the firms that participated in the demonstration projects.

It is observed that market access has been one of the key driving factors behind the adoption of environmental programmes in firms, such as the ISO 9000 and 14000 series. A small but increasing number of firms have taken on the process to comply with this requirement, in particular, firms which have main markets in developed countries, because the process have been required.

CP involves more than just environmental matters. Although the environment is at the target, the core of the strategy must be the sustainability of the firm and the industry. The idea of CP is an instrument that could help them achieve the profit or economic objective while taking care of environmental concerns. The main driving force for industries to adopt CP would be saving cost and strengthening competitiveness. In this regard, issues like energy efficiency, waste minimisation, good housekeeping, and sustainable development become to be the central CP concerns. Only when implementing CP is sustainable, will it be possible to disseminate it widely.

The national strategy should address several key areas, as follows:

- (1) The Policy Agenda
- (2) The Strategy at Institutional level
- (3) Strategy to assist implementation at the Firm Level
- (4) Mechanisms and Measures for implementing CP

Hence, these are the key issues for CP implementation in Malaysia. The rest of this section will present a methodology that aims to implement such issues.

4-B Proposed National Strategy

(1) The Policy Agenda

Currently there is no explicit policy statement in the Eighth Malaysia Plan (2001-2005) that promotes the concept of CP. However, industries, particularly SMIs, are encouraged to adopt Cleaner Technologies (CT) in their production processes. SIRIM will intensify efforts to collect and disseminate information on CT to increase general awareness in the industrial sectors.

As the Eighth Malaysia Plan provides the country's main development thrusts, a policy statement that reflects the government's commitment for the development of CP programmes will be very useful. With this policy, government agencies can organise programmes for implementation. It is therefore proposed that the government of Malaysia be urged to include a policy statement on CP implementation.

(i) Setting the Goal

Sector based benchmarks should be set up to provide industries with productivity improvement indices. Benchmarking is to be conducted based on industries' self-disclosure of basic data on the amount of input of raw materials and utilities, and output of products and waste.

(ii) Agenda and Perspective Term

The overall scheme of strategy/policy for CP promotion is shown in Figure A4-1.

Comprehensive methodologies should be worked out for the promotion of CP through:

- i) Regulatory policy framework including economic instruments on a long-term basis;
- ii) Incentive measures on a short- or mid-term basis; and
- iii) Measures for awareness raising, training, and information dissemination that call for activities on a short- term basis.

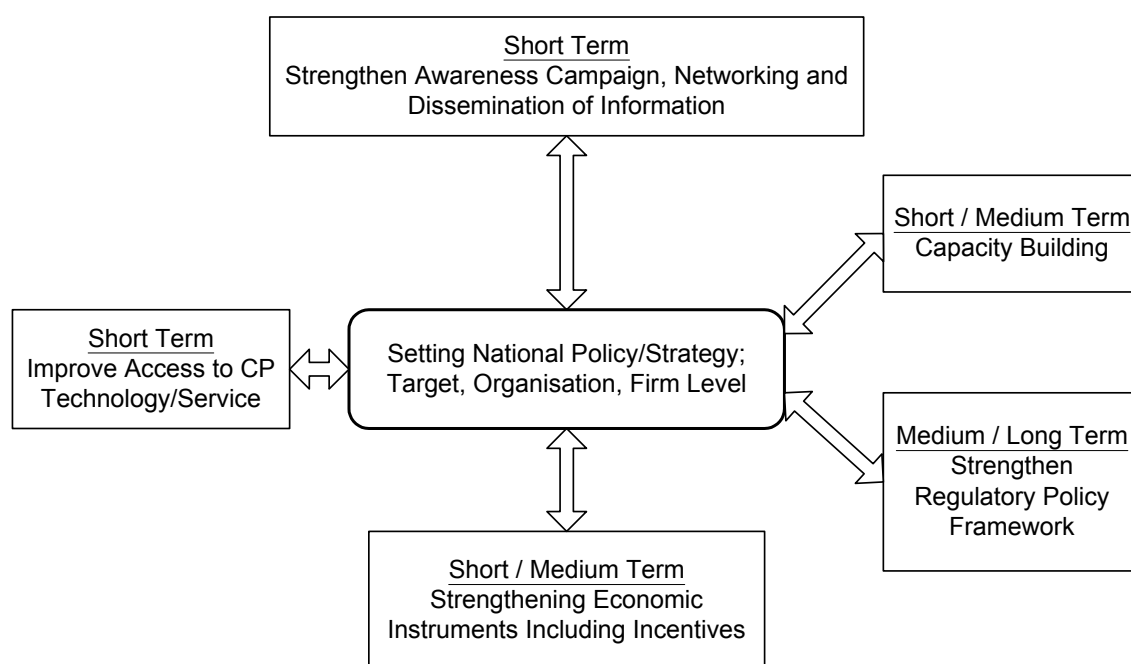


Figure A4-1 Concept of Strategy/ Policy for CP Promotion

(2) The Strategy at Institutional level

The institutional requirements for implementing CP should address two aspects; the national focal point, and the CP centre. Bearing in mind that the existing strategy for CP is voluntary in nature, which did not show expected results, it is proposed that a government organisation with legal enforcement powers be given the lead role serving as the national focal point, to drive the implementation of CP programmes. The reason for this proposal is to create the impression that CP implementation is not voluntary, but mandatory. The thrust of the responsibility in such an organisation is not that the legal instruments and machinery would be used to enforce non-compliance, but that enforcement and regulation could be used to achieve that purpose. That organisation should also have a key role in promoting sustainable development. Additionally, it should also be able to command the respect of relevant organisations as well as coordinate between them, so

that all the various elements of CP, such as energy efficiency, waste minimisation, tax incentives, could be implemented in an integrated manner.

In addition to the role of the national focal point, it is also important to set up a CP centre to spearhead the programmes. The role of the CP centre should include:

- (i) act as an interface between the industry, government, NGOs and the academics.
- (ii) act as a key advisory centre to provide direction ; for example by setting CP guidelines including CP sectoral guidelines
- (iii) act as an information clearing house for CP in providing information and technology transfer
- (iv) maintain close links with other CP centres
- (v) help set up demonstration projects in industry
- (vi) help identify opportunities for various stakeholders
- (vii) act as a catalyst between service providers (incl. suppliers) and industries

(a) Suggestion for National Focal Point and CP centre

There are a number of ways to approach setting up a national focal point. Perhaps this is best done in the form of options. Option 1 consists of taking a more conventional approach, and Option 2, a slightly different one.

Option 1:

It is proposed that EPU be the first national focal point and driver of CP for Malaysia. This task must be on a temporary basis, as EPU is the principal organisation with the overall view of development in Malaysia. It has the overall nation's vision and depth of experience and is in the position to command the respect of relevant organisations. EPU's task will be to organise the planning of CP programmes and policies. It is understood that once the planning is organised, EPU will appoint a suitable agency to take over the actual implementation. EPU is the best organisation to help prepare an action plan for implementation. This will require all the major organisations to be members of a committee. It may require a workshop session that provides a focus and concentration of time to work through the plan of implementation.

The organisation that is entrusted with these responsibilities is SIRIM. Hence, it is proposed that SIRIM be the organisation that takes the main responsibility during the EPU's tenure of leadership, and that it will take over as the key focal point when EPU's task of setting up the CP programme is completed.

Under this option, the CP centre would logically be at SIRIM, as it can then be the focus of all CP implementation activities. CP centres have been playing an important role in the experience of other countries in CP promotion. As CP centre, its role in research and promotion of CP and in the dissemination of information to SMIs will be enhanced.

In this respect, the other organisations that have enforcement powers would be coordinated through the focal point, which will have backing and support of EPU. And under this scenario, there is also no conflict of interest, as SIRIM will be the main promoter and developer of ideas for CP implementation. The regulatory aspects will reside with each of the organisations with their respective powers.

Option 2:

It is proposed that MOSTE be the national focal point and main driver with DOE serving as the secretariat. DOE has the legal powers and various instruments within its jurisdiction (e.g. contravention license), to ensure that CP could be implemented. In this way, the issue will be how the firms choose the best way to implement CP, not whether they would like to implement CP or not.

DOE has already carried out several awareness-raising programmes on CP to the industries. It has also started to train its officers on CP audits and developed CP training modules together with CETEC .

(b) Other Implementing Organisations

Elements of CP are distributed into several government organisations. As such, it is necessary that these key agencies are brought together by the national focal point so that policies and programmes can be coordinated, if not integrated to achieve the purpose of successful implementation. In this regard, several organisations have important roles in this effort to push for CP's implementation. They are:

- the Economic Planning Unit (development policy);
- the Ministry of Science, Technology and the Environment;
- the Ministry of Finance (tax incentives);
- the Ministry of Housing and Local Government (waste and local regulations);
- the Energy Commission and Energy Centre Malaysia (energy efficiency);
- the Department of Environment (CP and legal instruments);
- the Malaysian Industrial Development Authority (MIDA) (promotion of industrial

development);

- the Small and Medium Industries Development Corporation (SMIDEC) (SMI development programmes); and
- SIRIM (CP; certification body for quality programmes, such as ISO 9000 and 14000).

A CP network can then be set up with key implementing organisations to link the main players and stakeholders with those interested in CPs. Its first task would then be to establish a common vision and consensus among its network members on how to develop CP activities. This would mean assessing the existing system and its capacity in developing CP activities. A strategic analysis should be carried out to identify possible choices and options to facilitate the adoption of CP and to map out possible ways to introduce CP into industrial and environmental legislation.

(c) Professional Bodies

Apart from the government organisations, it is important that professional bodies, universities and NGOs be involved in CP activities. Such bodies like FMM, SMI Association, MAESCO or ENSEARCH can provide technical and training expertise to the industries. In fact, development of the services for CP is important, as it is the consultants who can help promote and bring the industry to a higher level of industrial efficiency, and in the process, help demonstrate the economic benefits of CP adoption.

(3) Strategy to assist implementation at the Firm Level

The CP strategy at the firm level shall focus on three key areas.

The first strategic area is to focus on manufacturing management. Several initiatives have begun in SIRIM; most of these are through donor agency support. Various programmes need to be developed in a manner that makes financial or economic sense such as energy efficiency, waste minimisation and waste separation, in order to avoid tax or to save cost, improve productivity. The focus shall be with the production managers as well as the top level management. By focusing on the efficient use of raw materials, waste and energy, cost savings are derived based on the premise of efficiency and productivity. CP does more than improving the environment. Its benefits extend beyond cost savings but can spread to advantage. Towards this end, government can help to promote CP from the perspective that it can increase productivity and enhance business as well as environmental improvement. The publication of CP's benefits towards productivity should also be highlighted. Other programmes that are necessary to support these include a constant and regular monitoring system that will make sure that enforcement is carried

out. This is an area where the government will need to make a firm commitment, in addition to the policy and institutional strategy mentioned earlier.

The second strategic area is to tackle issues of waste. SMIs are long established but without the ability nor capacity to handle end of the pipe pollution problems. The strategy should be to help create a market for waste, establish a waste recycling industry in various product categories beyond the few that exist today. Incentives and investments need to be coordinated (e.g. provision of land for such activities), while promotion and institutional support is necessary. One of the key roles that the government can play is to encourage investors to set up industrial ecology parks but such a proposal will be further down the road, and especially when an investor has developed a successful business model for it.

The third strategic area is to provide economic instruments to CP implementation. For example, the government provides subsidies and the cost of water and fuel is reduced. This leads to a considerable distortion to the cost of utilities. The proposal is to rectify the distortion of prices, so that the economic instruments will be able to function. A study should be carried out to examine the nature of subsidies.

(4) Mechanisms and Measures for implementing CP

As indicated above, the main thrust is an institutional approach, with a slight modification in the sense of placing the responsibility on DOE, the institution with legal powers. The other question that comes to mind is whether a new CP legislation is required (e.g. firms to adopt CP). The current policy on this matter, (i.e. leaving the markets to help drive CP adoption) should remain.

However, other mechanisms could provide further support for CP, such as economic instruments (e.g. financial incentives) and funding (e.g. principally soft loans). A combination of measures from existing regulations, economic instruments, funding, technical assistance, information dissemination, voluntary agreements and publication of environmental performance data may be necessary to bring about an intended effect.

(i) Legal Regulations

No new CP Act is proposed. Nevertheless, existing environmental regulations and instruments that are primarily designed to combat pollution control could support CP adoption. The CP approach is preventive rather than end-of-pipe control. However, if standards are tightened, and the cost of end-of-pipe technology is high, then industrial firms are faced with the choice of searching for solutions further up the production

process or paying for end-of-pipe technologies or paying the contravention license (if it's available). Where possible, the government could adopt a phase-in approach, as it did for the palm oil regulations. The government's philosophy is the Best Available Technology Not Entailing Excessive Cost (BATNEEC) has been demonstrated well in this regard. But the most important part of the palm oil strategy has been the constant development and negotiation of technological alternatives (with industry) that eventually provided the solutions for its implementation (see voluntary agreements later on). These useful lessons should be applied in the case of CP's introduction.

The amended EQA 1996 allows for Environmental Audit whereby the DG of the DOE can order firms to prepare and submit an audit report. This can be broadened to include a CP audit where not only waste and compliance issues are identified but also the improvement process towards productivity and environmental performance.

(ii) Economic Instruments

Economic instruments either impose financial burden on the targeted entities or afford financial incentives to the targeted entities to encourage favorable action or restrain unfavorable action, thereby minimising possible loads on the environment. To implement economic instruments, the institutional framework must be in place, and the social or cultural context must also be suitable, technical solutions must be reasonably priced. The market instrument is to correct market failures, and it then allows firms to choose between new options in an altered context.

The government has recognised the value of this approach, which is consistent with its policy of not imposing environmental requirements through legislative action. It is currently conducting pilot projects to see the extent of its applicability in Malaysia.

The range of economic instruments can include taxes, pollution charges, subsidies and tax incentives and can be designed in such a way to make CP implementation less costly and more attractive than the cost of polluting.

(iii) FUNDING

It is proposed that existing financing schemes should clarify that CP audit or investment is applicable. Utilising existing funding is effective for efficient CP implementation. Another source of fund would be the Environmental Fund that is provided under the amended EQA 1996 whereby the DOE collect fees from waste generated and the fees

would be channeled for research on pollution prevention and conservation measures.

(iv) Technical Assistance and Information Dissemination

Providing information on appropriate technology, environmental tools, CP solutions and making them accessible is an important feature for the success of CP implementation. Publications, newsletters, direct access to databases and the necessary expertise are essential features. This may be provided through the establishment of an information-clearing house at the CP centre.

(v) Capacity building

There is a need for professional bodies and government to work out the needs for capacity-building. Adequate training efforts need to be provided at all levels of the CP network (e.g. government, academics, NGOs) as well as the industry level. This is to ensure that appropriate training is given to develop CP systems as skills required for CP is different from pollution control. Moreover, training should also include skills to manage technological changes. Perhaps a study exchange between government personnel and industry may help to increase better understanding of each other's position and to facilitate a more effective partnership.

ANNEX-5

Factory Survey in Pulp and Paper Industrial Sector

5-A. Factory Survey Results (General)

During the first field survey, the following three representative companies were audited:

- (1) Telic Paper Sdn. Bhd.
- (2) Lekok Paper Mill (M) Sdn. Bhd.
- (3) Versatile Paper Boxes Sdn. Bhd.

The present condition and CP options for these factories are summarised as follows and the present status and CP options for each factory are described in section 3. “Surveyed Factories for Selection of Model Factory”.

(i) Present Condition

(a) Observation of pollution control condition

Through the survey of 3 pulp and paper factories, it was found that Malaysian regulations against water and air pollution was applicable only for the wastewater from pulp cleaning section and printing drum cleaning section and the exhaust gas from steam boilers. SIRIM and the Study Team took wastewater samples from 3 factories during the survey, and their analysis data show that COD and BOD values of one factory’s wastewater (Lekok Paper Mill (M) Sdn. Bhd.) satisfied perfectly the standard-B of Malaysian Wastewater Discharge, but COD and BOD values of one factory’s wastewater (Versatile Paper Boxes Sdn. Bhd.) both did not satisfy the standard-B of Malaysian Wastewater Discharge as shown in Table A5-1. The wastewater from this factory includes a small amount of kerosene which is used for the cleaning of printing drums and glue for lamination paper. However, the wastewater treatment plant cannot treat this wastewater perfectly because the appropriate coagulant is not used. Therefore, it was required that this factory select the most suitable coagulant and to decide the amount of it to inject. Another factory (Telic Paper Boxes Sdn. Bhd.) is producing paper cushion materials such as egg trays and all water which is used for making paper pulp is vaporized to the atmosphere by dryers. Therefore, there is no wastewater discharge from this factory. One factory (Lekok Paper Mill) is using fuel oil for a steam boiler. This steam boiler was been installed in 1998 and it is operated in to be good condition and was using lower sulfur and lower nitrogen content fuel oil. Therefore, it was concluded that SO₂ and NO_x content in the exhaust gas were

lower and there would be no problem with the Malaysian regulations for air pollution.

Table A5-1 Analysis Data of Wastewater in 3 Factories

Item	Unit	Effluent Standards B	Lelok Paper Mill (M) Sdn. Bhd.	Versatile Paper Boxes Sdn. Bhd.	Telic Paper Sdn. Bhd.
Temperature	°C	40	26.8	29.1	25
PH	-	5.5-9.0	4.09	6.42	6.26
Electrical Conductivity	μ S/cm	-	151	165	1,140
Turbidity	NTU	-	3.13	622	191
Oil and Grease	mg/l	10.0	<10	<10	<10
BOD	mg/l	50	7	220	610
COD	mg/l	100	24	580	1,590
DO	mg/l	-	3.9	1.1	0.9
SS	mg/l	100	12	87	34,800
Total Nitrogen	mg/l	-	2	14	5
Ammoniacal Nitrogen	mg/l	-	0.15	1.99	<0.01
Nitrate Nitrogen	mg/l	-	0.41	<0.01	<0.01
Residual Chlorine	mg/l	2.0	<0.1	<0.1	<0.1
Phosphate as P	mg/l	-	<0.01	2.83	<0.01

Note: The wastewater in Telic Paper Sdn. Bhd. is used for recycle water and is not discharged outside of the factory.

(b) Waste, disposal, treatment and recycling

One factory (Lekok Paper Mill (M) Sdn. Bhd.) is using waste paper and cartons as raw materials, and some plastic chips contained in the raw material is removed in the stock preparation process in the factory. The total amount of these removed plastic chips reached around 360 tones per year and this is treated as landfill through an industrial waste treatment company. All 3 factories are discharging some amount of sludge from their wastewater treatment plants and from sedimentation tanks in their paper pulp production processes. This sludge does not contain any harmful heavy metals, but they are sent to Kualiti Alam Sdn. Bhd. for final treatment because there is no other company in Malaysia except Kualiti Alam Sdn. Bhd. that can treat the industrial waste.

(c) Measures for productivity improvement

3 factories are producing different products using processes different from each other.

Therefore, the approach and effort for productivity improvement are also different for each factory. Telic Paper Sdn. Bhd. is producing paper cushion materials such as egg trays using several dryers that they have developed. However, it was found that unit capacity of dryers in this factory was lower when compared to those in Japan and in total around 8% off-specification products were produced. This rejection ratio is around 5% in Japan, and it was considered that there is still room for some improvement in this factory.

Lekok Paper Mill (M) Sdn. Bhd. is producing medium paper for cardboard production by operating a secondhand paper production machine that was manufactured 40 years ago. It was found that the dehydration capacity of the machine before drying process was lower and drying time of wet paper was longer. This wet paper drying time will be reduced if a roll press is installed just before the existing dryers.

Versatile Paper Boxes Sdn. Bhd. was producing many kinds of printed cardboard boxes. This factory had obtained ISO 9002 and ISO 14001 certificates, and it was judged that their production control was better than other factories. This factory is producing many kinds of products but the production amount for each product is not so much. This was causing lower productivity in this factory, and more minute and careful production plans should be studied and put into practice, considering the operating conditions of all machines.

(ii) CP Options

CP options for the 3 factories were categorised as follows.

- (1) Energy conservation
 - a. Total insulation of equipment and steam piping, and
 - b. Optimisation of drying temperature.
- (2) Productivity improvement
 - a. Reduction of off-specification production,
 - b. Installation of a roll press, and
 - c. Optimum layout of production equipment.
- (3) Others
 - a. Improvement of working area,
 - b. Placing of fire extinguishers, and
 - c. Training of engineers.

The improvement of wastewater treatment in Versatile Paper Boxes Sdn. Bhd. was also considered as a CP option at first, but it was finally excluded because it was related to

End-of-Pipe (EOP) matters.

5-B. Selection of Model Factory

Refer to Chapter 5, section 5.2 “Selection of Model Factories”.

No model factory in the pulp and paper sub-sector was selected.

5-C. Surveyed Factories for Selection of Model Factory

The outline of the surveyed factories are described here, and more detailed reports are attached as appendixes.

(i) Telic Paper Sdn. Bhd.

Refer to APPENDIX 3-1.

This factory is producing paper pulp cushioning materials that can protect fragile goods such as eggs, electric products and fruit from outside shock during their transportation. These cushioning materials are produced from waste paper such as magazines, carton boxes and newspapers by pulping, molding and drying of the paper pulp. These products are recently being replaced foam polystyrene and vinyl chloride products, but paper cushioning materials have been used abundantly as because they can be recycled without troublesome treatment after use, and this industry will prosper for ten years in the future. In the factory, water is used for dissolving raw waste paper and most of it is reused after being recovered at the molding process. Other water goes to oven dryers with molded half-finished products and vaporizes there; therefore there is no wastewater discharged from this factory. This factory is using fuel oil as a heat source for the drying of molded half-finished products and hot air is exhausted to the atmosphere at high temperature (around 140°C). This matter was considered as a CP option from the view point of energy saving. It seemed that management level of the factory was very good.

(a) Present Status

- **Observation of pollution control conditions**

Malaysian regulations against water and air pollution were both not applicable for this factory. As described before, all the water that is used in paper pulp making is vaporized to the atmosphere in the drying process of molded half-finished products such as egg trays. Therefore, there is no wastewater discharge from the factory. This factory is using fuel oil for oven dryers, and it was concluded that SO₂ and NO_x content in the exhaust gas was lower and there would be no problems with the Malaysian regulations

for air pollution.

- **Waste disposal, treatment and recycling**

Some amount of sludge is discharged from the paper pulp making process, and it is consigned to outside for final treatment. The amount of the sludge is around 15.2 m³ per year.

- **Measures for productivity improvement**

This factory is operating several oven dryers utilising their own technology, and they are also selling these dryers to other factories. However, it was found that the drying performance of them was lower than that in Japan and there would be some room for improvement. The total rejection ratio from molding, oven drying and pressing processes is reaching about 8% in the factory, while it is about 5% in Japan.

(b) CP Options

- **Improvement of heat insulation for oven dryers**

This factory is operating 6 oven dryers. SIRIM and the Study Team measured their surface temperature one by one, and it was found that the maximum temperature difference among them was 22°C. This was causing some of heat loss, estimated at 44,210 kcal/h, and it was equivalent to RM23,400 loss per year. Therefore, it is desirable to improve dryer heat insulation considering the cost of insulation and fuel oil. The oven dryers are also operated at different temperatures from each other, and it will be first necessary to control them at the same operating temperature.

- **Control of exhaust air temperature**

Hot air used for the drying of products is exhausted to the atmosphere. SIRIM and the Study Team measured the exhaust air temperature for all oven dryers, and it was found that the maximum temperature difference among them was 90°C. This was also causing heat loss estimated at 689,600 kcal/h, equivalent to RM360,000 loss per year. In order to reduce this temperature difference and heat loss, it is necessary to install thermometers inside oven dryers and dampers inside ducts for all oven dryers. During normal operation, operators will be able to control the recycle flow rate of hot air to blowers and control the drying temperature at the optimum level.

- **Reduction of rejection ratio**

All rejects are made in the molding, drying, high temperature pressing and printing

processes. In order to reduce the rejects at the molding process, it is desired to control the water content in molded half-finished products at 72 - 75%. This control can reduce the getting out of shape of half-finished products.

- **Automatisation for taking products out from dryers**

Operators are taking products from dryer conveyers by hand. The temperature in the working area is very high and it is unpleasant even though electric fans are prepared. It is also causing some heat loss from the openings of oven dryers. Therefore it is would be desirable to automate the process for taking products out of dryers.

- **Provision of fire extinguishers**

In the factory, there are quantities of combustibles including raw materials, but required fire extinguishers are not provided. The operating temperature of oven dryers is very high and there is the possibility of fire accidents. Therefore, it is recommended that fire extinguishers are placed near each oven dryer.

(ii) Lekok Pare Mill (M) Sdn. Bhd.

Refer to APPENDIX 3-2.

This factory is producing fluted medium paper for corrugated cardboard production. The product factory is limited to a few kinds of products such as 120g/m² weight cardboard, and there is a problem because there are many competitors in this market. This factory began operations in 1998. The factory is using a secondhand paper machine imported from Japan and remodeling using a Taiwanese technology, and is operating a wastewater treatment facility. Normally, some amount of white water (Shiromizu's Recycling) can be recycled from the paper machine section to the stock preparation section after the removal of fine fiber waste. Therefore, this recycling method was considered by SIRIM and the Study Team as a CP option. However, more detailed study is required because strict control of recycle water quality (suspended solid and conductivity) is needed for the proper operation of paper machines. In this factory, 5 kg/cm² steam is used for drying rollers in the paper machine section and the steam transfer piping is not insulated.

(a) Present Status

- **Observation of pollution control conditions**

Malaysian regulations against water and air pollution were both applicable for this factory. SIRIM and the Study Team took water samples during the survey and BOD and

COD values were 7 mg/l and 24 mg/l respectively as shown in Table A5-1. These values were satisfying the Malaysian regulation standard thoroughly even though the aeration tank for the activated sludge process was not operated at that time because of repair work. Therefore, it was judged that the capacity of the wastewater treatment plant was sufficient. This factory is using fuel oil for a steam boiler, and it was concluded that SO₂ and NO_x content in the exhaust gas was low and there would be no problems with Malaysian regulations for air pollution.

- **Waste disposal, treatment and recycling**

Some sludge is discharged from the wastewater treatment plant, and it is consigned to outside for final treatment. This factory is using waste paper and cartons as raw materials and some plastic chips are included. These plastic chips are separated in the preparation process and are also consigned to outside for landfill disposal. The removed plastic chips amount to 360 tones per year.

- **Measures for productivity improvement**

The factory is operating a secondhand paper machine that was manufactured 40 years ago, and a steam boiler newly installed in 1998. The wastewater plant has sufficient capacity. This factory is only using 50% of the area of the production building, and there is enough space for installation of a new production facility in the future.

(b) CP Options

- **Heat insulation of steam and condensate piping**

Steam and steam condensate piping are both not insulated. If steam piping is insulated, the surface temperature of the steam piping falls from 67.8 to 40°C and heat loss decreases from 12,400 to 4,000 kcal per hour. The surface temperature of the steam condensate piping also falls from 69.5 to 40°C and heat loss decreases from 8,200 to 3,800 kcal per hour, if steam condensate piping is insulated. In total, 12,800 kcal per hour of heat loss can be saved, equivalent to RM3,890 of fuel oil savings per year.

- **Installation of a press roller**

If a press roller is installed after the dehydration process in the paper machine line, water content in wet paper is decreased and it is possible to speed up the drying process, increasing productivity. However, without more detailed study it is uncertain how much the drying process can be accelerated. With regards to cost, the installation cost of a press roller is estimated around RM1,000,000 - RM1,330,000 if installed in Japan.

- **Rearrangement of product stock area and installation of a slitter**

The product stock area is located far from the finishing process, and this has caused damages to products and some energy loss during transportation by clamp lift. Therefore, it is recommended that when another production line is installed in the future, the product stock be located in an area near the finishing process. This factory is only producing 3,050 mm width products; however, clients will request 800 - 2,400 mm width products in the near future, and it is also recommended that a slitter be installed for this purpose.

- **Training of Engineers**

This factory considers quality and delivery control important. However, there are no standard specifications for products, no operation manuals or maintenance records. Quality control will be requested from clients in the near future, and maintenance procedure and records of the production facilities affect quality control. Therefore, it is urgent that engineers who can perform quality control and maintenance of production facilities be trained.

(iii) Versatile Paper Boxes Sdn. Bhd.

Refer to APPENDIX 3-3.

Operation of this factory was started in 1961, and it seemed to be a factory reliable for the production of printed carton boxes. The main products of the company are used for package containers of electrical goods. This company is producing three kinds of corrugated cardboard of AF, BF and EF, and operates offset printing machines. 90% of ink used for printing machines is oil-based and 10% is water ink, and wastewater from the production facilities includes these printing inks, causing COD values at high levels of 4,000 to 10,000 mg/litre. A wastewater treatment plant is operated batch-wise treating wastewater from the production facilities; however, it can not reduce the COD value because the wastewater quality changes when they change the printing ink. This matter will be considered a candidate for a CP option after more detailed study. In this factory, a small amount of LPG is used for the drying of glue in the corrugated single paper production section.

(a) Present Status

- **Observation of pollution control conditions**

Malaysian regulations against water were applicable for this factory. SIRIM and the

Study Team took water samples during the survey and the COD value was higher than the Malaysian regulation standard B as shown in Table A5-1. Through the survey, it was found that the operation method of the wastewater treatment plant should be studied in more detail in order to finalise the best flocculent and its optimum injection amount. For a view for energy consumption, this factory is using LPG for drying of glue in a single facer process, but no boiler is operated,

- **Waste disposal, treatment and recycling**

Some amount of sludge is discharged from the wastewater treatment plant, and it is consigned to outside for final treatment.

- **Measures for productivity improvement**

The factory had obtained ISO 9002 and 14001 certificates and it was judged that the production control was sufficient for this factory. This factory is producing many kinds of products in small lots, and this decreases productivity. In order to increase productivity, the company must prepare and practice a production plan that covers the operation load of all production facilities.

(b) CP Options

- **Widen the pass for clamp lifts**

It was found during the survey that the surface rolled raw paper had been damaged by a clamp lift. This trouble was due to the narrow path for clamp lifts. Therefore, it is first necessary to stock the raw materials at a proper and minimum level and to widen the pass for clamp lifts. Normally, the width for a clamp lift pass needs to be at least three times the width of a clamp lift.

- **Provision of fire extinguishers**

In this factory, there are quantities of combustibles such as raw materials, products and kerosene, but necessary fire extinguishers are not provided. If a fire occurs even once in a paper factory, all raw materials and products will be burnt extremely first. Therefore, it is recommended that fire extinguishers are supplied in accordance with applicable Malaysia fire regulations.