ERIA Research Project Report 2008

No. 6-1

3R Policies for Southeast and East Asia

Edited by

Michikazu Kojima and Enri Damanhuri

March 2009

Preface

This report is the first interim report of Working Group 3R Policies for Southeast and East Asia. The working group conducted the first workshop in Bangkok in February 2009, and the sub-working group meeting on Industrial Waste Information Exchange in Manila in March 2009.

Since working group members came from different backgrounds such as engineering, economics, management and policy studies, in the first workshop, we shared our experiences and concerns with each other. In addition, policies and current problems on 3R in each country were overviewed. In the sub-working group meeting, we compared the industrial waste information exchange programs in Thailand, Philippines and Japan. In addition, consulting services to waste generators in Indonesia, Thailand and Singapore were reviewed and compared to waste information exchange programs.

In the discussion of the working group, we realized that it is very useful for each other to share problems and policies in the region, because we face similar problems and challenges. We also recognized that we need to review the situation and analyze policies further. For example, we do not have much information on recycling infrastructure in the region. We also do not have information on industrial standards for recycled goods in the region.

We are planning to continue our discussion in the working group on responsibilities of stakeholders, industrial standards, recycling infrastructure and others. In addition we are planning to share the information with other experts, businessmen, policy makers and citizens. We hope this report will be a starting point to share the information and to discuss the policies to promote 3R.

March 31, 2009

Contents of the Report

Member of Working Group

Leader: Enri Damanhuri (Professor, Bandung Institute of Technology, Indonesia)

Coordinator: Michikazu Kojima (Director, Environment and Natural Resource Studies Group-Interdisciplinary Studies Center, IDE-JETRO, Japan)

Members: Lisa C. Antonio (Executive Director, Philippine Business for Environment, Philippines)

Thumrongrut Mungcharoen (Expert, National Metal and Materials Technology Center, and Professor, Kasetsart University, Thailand)

Ahmad Fariz Mohamed (Senior Research Fellow, Institute for Environment and Development (LESTARI), Universit Kebangsaan Malaysia, Malaysia)

Peck Thian Guan (Director, Office of Safety, Health and Environment, National University of Singapore)

Hai Trung Huynh (Associate Professor, Institute for Environmental Science and Technology, Vietnam)

Yasuhiko Hotta (Sub-manager, Institute for Global Environmental Studies)

Atsushi Terazono (Chief, International Material Cycles Section, National Institute for Environmental Studies)

Sub-Working Group on A Review of Waste Information Exchange Programs

Leader: Lisa C. Antonio (Executive Director, Philippine Business for Environment, Philippines)

Members: Michikazu Kojima (Director, Environment and Natural Resource Studies Group-Interdisciplinary Studies Center, IDE-JETRO, Japan)

Panrat Phechpakdee (Director of Industrial Environment Institute, Federation of Thai Industries, Thailand)

Executive Summary and Policy Recommendation

Background

The 3R (Reduce, Reuse and Recycling) policies have been formulated and applied in the context of waste management. All Asian countries have experienced pollution due to improper waste management, social conflict on the location of landfill sites, and heavy fiscal burden for implementing proper waste management. Resource scarcity is also another driving force in developing 3R policies, as it could increase resource efficiency and reduce the dependence on limited natural resources. 3R policies or circular economy policies are introduced in Japan, South Korea, Singapore and China in a holistic way. Other countries such as Thailand, Malaysia, Philippines, Indonesia and Vietnam are partially implementing or going to apply 3R policies.

3R approach is not only a question of how to segregate garbage at the source and to recover the potential material for sale, but also on how to develop understanding and mutual cooperation among stakeholders to minimize the consumption of natural resources. 3Rs approach should not merely be regarded as a way for waste handling. Successful implementation of 3R policies have also beneficial effect in other areas, such as in generating employment, and improving resource efficiency and productivity.

In Asian region, there are many efforts to implement 3Rs. In fiscal year 2008, the working group quickly overviewed the efforts in Indonesia, Japan, Malaysia, Philippines, Singapore, Thailand and Vietnam. The working group tried to extract lessons from past and ongoing efforts.

Summary of Papers in the Report

Chapter 1 provides an overview of the development of the policy concepts for eco-efficient industrial activities, such as 3Rs, zero emission, eco-industrial park and others. It is pointed out that the 3Rs is an environmental policy concept/slogan for waste reduction, reuse and recycling which exists for quite a long time. The 3R initiative of G8 has drawn attention of international community since 2004.

Chapters 2, 3 and 4 provide an overview of the situation of recycling in Indonesia, Malaysia, and Singapore respectively. Chapter 2 explains the legal framework of waste management and shows flows of waste plastics, used paper and e-waste for recycling in

Indonesia. Chapter 3, overviews the legislation and practices in managing hazardous waste and solid waste, focusing industrial waste in Malaysia. In Chapter 4, the waste profile and 3R efforts in Singapore are highlighted. It concludes that the critical success factors that contributed to the improvement of waste management include the partnership of public sectors, private sectors and the people, an integrated approach for dealing with waste management and long term planning and targets for policies. Chapter 5 explains the industrial policies for promoting development of recycling industries in Japan since 1970s. The efforts of the ministry in charge of industry complement to the efforts of ministry in charge of the environment, by stimulating the demand of recyclable waste.

Chapters 6 and 7 review waste reduction efforts under cleaner production programs in Thailand and Vietnam respectively, in which experts make suggestion to companies on measures to reduce cost of production and environmental burden. Cleaner production creates economic benefit to industries and environmental benefit to the society. One of the limitations of cleaner production is the fact that basic scope is limited to the production process in a factory. In order to reduce waste further in economical way, it may be better to work with other recycling factories. Waste information exchange program creates such opportunities.

Chapters 8, 9 and 10 provide an overview about the industrial waste information exchange programs and related activities in Philippines, Thailand and Japan. Industrial Waste Information Exchange Program is an effort to make matching of industrial waste generator and users by colleting the data of waste generation and demand of waste. Chapter 11 compares the industrial waste information exchange programs in the three countries. It is found that waste information exchange program is successful in the initial years after its launch. However, during its implementation it was also noticed that that there were certain types of wastes that could not attract any buyers or could not be recycled easily. Technical supports from experts are needed to develop appropriate technology to utilize these wastes and to advise companies on the commercial potential of these wastes. Such consulting services should be provided for further utilization of waste.

“Mapping document on 3R-related Regulation, Ministries and Programs” in the Appendix summarizes the legislation, ministries, and programs on 3R in the region.

Policy Recommendation

Based on these papers, the working group made the following policy

recommendations.

- The success of 3Rs policy is not only a task of one or two departmental sectors, such as Ministry of Environment, Ministry of Public Works or Construction. Others departmental sectors should also be integrated into the 3R policy, such as the Ministry of Industry, Ministry of Trade, Ministry of Small and Medium Enterprises, among others. This would be the initial step for introducing this new paradigm in 3Rs approach. For example, Ministry of Industry should formulate and/or implement policies such as developing recycling industrial park, giving tax incentive for investment in recycling industry.
- Some examples of 3R polices in the region include the following:
  - Industrial Waste Information Exchange Program
    - Japan, Philippines and Thailand implement industrial waste information exchange program which links waste generator and waste users. Third party collects the data of waste generation and demand of waste, and arranges matching of generator and users.
  - Disclosure of information on recycler
    - List of credited recyclers should be disclosed, because it becomes easier for waste generators to contact recyclers.
  - Providing guidelines for specific industries on recycling
    - Small and medium scale industries have limited information on how to reduce, reuse and recycle waste. Providing guidelines for these industries can promote 3Rs and give economic benefit to them. One of the models is Code of Practices provided in cleaner production program in Thailand.
  - Promoting technological development in recycling
    - Some research projects on recycling technologies have been implemented in various countries. Such research should be supported.
  - Providing information to small scale recycling industries
    - To upgrade small scale recycling industries in terms of prevention of pollution and quality control or products, some supporting program should be considered.
    - We believe, it is useful for Asian countries to share experiences in the region. We are facing similar problems and region-wide problems.
  - For a first attempt to compare similar programs, Industrial Waste Information Exchange Programs in Japan, Philippines and Thailand are reviewed. It is observed that the more companies are involved, the more waste are recycled through the programs. After several years of implementation, some difficult wastes, which are not easily recycled, are remained un-recycled. It is better to have experts group to find the technologies for recycling difficult wastes. To

find the way to deal with difficult waste, the consultation services from experts should be provided. This kind of program can be integrated into activities of cleaner production.

Some other policies such as putting responsibilities on various stakeholders, voluntary collection program, and industrial standard for recycled goods and developing recycling industrial park should be compared and reviewed.

Chapter 1. Development of the Policy Concepts for Eco-Efficient Industrial Activities: 3Rs, Zero Emissions, Eco-industrial Parks, and Others[1]

Yasuhiko HOTTA, Ph.D.
Integrated Waste Management and Resource Efficiency Project
Institute for Global Environmental Strategies, Japan

I. Introduction: Environmental Issues as Efficiency Issues from Industrial Perspective

Since the 1990s, environmental issues for businesses have shifted from "pollution prevention" to "global environmental issues" and "waste issues". This shift has increased the awareness on environmental issues as those of the restructuring of modern industrial society including its life-style. Environmental problems are appreciated not only as an issue for the industrial sector, but also as a concern for the industrial society as a whole. As stated by Socolow (1994) on the introduction of the concept of industrial ecology, '(t)he view of the firm changes from culprit to agent of change.' (1994: 4).

Along with the rise of global environmental problems as a central focus of the environment policy, businesses started to call themselves "global corporate citizens" and emphasize the importance of partnership with "the government, consumers, citizens and NGOs" (Keidanren Appeal on Environment, July 1996)[2]. In international policy circles on the environment, business has shifted from simply being the accused to a being a possible solution provider, as well as a cause of the problem[3].

Behind this, there is an intention of the business sector to promote the idea of increased efficiency, voluntary action, and partnership as measures to address environmental problems. To observe this process, Keidanren's (the Federation of Economic Organizations) response can be seen as a good example. Keidanren is the largest and most influential business organization in Japan. Most of the large businesses are members of this organization. Keidanren could be a synonym of the Japanese major business sector. Therefore, by observing Keidanren, we can catch the Japanese

[1] This working paper is based on the argument of Hotta, Y. 2004. *The transnational politics of ecological modernisation, An analysis of the formation of transnational authority in global environmental and industrial governance, with special reference to the Zero Emissions Initiative in Japan.* Sussex, UK: the University of Sussex.
[2] www.keidanren.or.jp/english/policy/pol046.html
[3] See Chapter 30 of Agenda 21 titled "Strengthening the Role of Business and Industry" for emphasis in the active role of business in sustainable development.

businesses' major understanding of environmental issues.

In July 1996, Keidanren announced "the Keidanren Appeal on Environment". In this appeal, the following four areas were selected as urgent environmental issues for business sector:

1. Measures to cope with global warming;
2. Structuring of recycle-based society;
3. Restructuring of Environmental Management System and Environmental Auditing; and
4. Environmental consideration in evolving overseas projects.

As Yamaguchi argues, this reflects a standard set of environmental issues after 1990s as understood by the business sectors (Yamaguchi 2000: 25). Interestingly, this does not contain specific reference to 'Pollution Prevention' or Kougai anymore.

It seems that resource and energy efficiency and voluntary action are the industrial sectors' interpretation of sustainability, and governance to cope with environmental issues as "global environmental issues" and "waste issues" from businesses. Environmental issues and sustainable development are interpreted along the logic of increasing efficiency. The effort to solve environmental problems is prompted by the drive for more efficient production and services. Voluntary action is considered as a better method both from the industrial sector and the government. Moreover, some businesses think that regulation is welcomed if it opens up new market opportunity and promotes innovation. Introduction of the idea of eco-efficiency (or energy and resource efficiency) and voluntary action into the central stage of environmental policies is supported by a story that energy saving in 1970s contributed to efficient production as well as less environmental load in Japan.

To achieve resource and energy efficiency through voluntary action, management and evaluation tools such as ISO 14001 and Life Cycle Analysis (LCA) have spread throughout businesses. The rise of green purchasing has also supported this trend. In 1990s in Japan, with the pressure of globalization and the atmosphere of blockade after end of bubble economy, the "environment" might appeal to Japanese society as an opportunity for restructuring the Japanese society, at least among businesses. However, it could not be explained only through the experience of energy and resource saving during energy crisis contributing to the idea of eco-efficiency and voluntary act. The interpretation of the environment into the activity of increasing efficiency and productivity is not only limited in Japan but covered at least in the highly industrialized society such as Germany, the Netherlands, Scandinavian countries, and the United States.

Now US government under Obama administration articulates Green New Deal to breakthrough economic crisis after US 'bubble economy' by increasing green public investment.

One of the possible explanations of this global trend of eco-efficiency and voluntary action is the needs of specific structural change pressured by ecological concerns of global environmental issues. Although the structural shift and success in overcoming energy crisis explain its influence to political and strategic response, centered around eco-efficiency and voluntary act to global environmental issues, this is not enough to explain the development of particular discourse to be influential over other discourse globally. At least, Japanese case shows that the realization of the environmental concern as a business opportunity in Japan have to wait until the realization of global environmental concerns (and economic globalization) among business and government after the cold war.

II. Ecological Modernization (EM)

In the 1980s to 1990s in industrialized countries, a trend of industrial and environmental policy and corporate strategy had been formed concurrently along with the rise of sustainable development. It was based on the claim that industrialization could be harmonized with environmental conservation without harming economic benefit. Furthermore, the intention of this trend should be understood not only as a re-engineering of industrial production process, but also as a restructuring of political and economic life (Dryzek 1997: 147), including the life style of citizens living in the advanced industrialized society.

In the area of social science, this trend was identified as a peculiar shift in emphasis of environmental policy: Ecological Modernization (EM), through studies of environmental policies of western European countries by sociologists and political scientists[4]. EM referred to changes of emphasis in policies, technological strategies and consciousness regarding environment and industry from the 1970s to the 1990s. For example, Japan's *Junkan-gata shakai* (a sound material cycle society) initiative since 1990s - promoted by Japanese government, business and local government based on *Junkan-gata shakai keisei suishin kihon hou* (Basic Law for the Promotion of the Creation of a Sound Material Cycle Society) - can be considered as a significant part of this trend.

[4] Those sociologists and political scientists include Joseph Huber, Martin Jänicke (and Weidner eds. 1995), Udo Simonis, Gert Spaargaren, Maarten Hajer (1995), Arthur P.J. Mol (1996 and 2001), Albert Weale (1992), Maurie Cohen (1997), John Dryzek (1997) and so on (Mol and Sonnenfeld 2000: 4).

As a discourse of environmental policy, ecological modernization provides the idea that economic growth and environmental protection are essentially complementary (Dryzek 1997: 15). As noted earlier, in ecological modernization discourse, environmental problems are considered as opportunities rather than troubles to "a restructuring of the capitalist political economy along more environmentally sound lines." (1997: 141) Or in more direct wording, Hajer (1995: 32) puts the positive relations of EM to modern political economy as follows: "the discourse of ecological modernization puts the meaning of the ecological crisis upside-down: what first appeared a threat to the system now becomes a vehicle for its very innovation."

The core components of a new trend in environmental policy explained by ecological modernization can be characterized in the following six ways:

1) Emphasis on compatibility between economic competitiveness and environmental protection;
2) Emphasis on technological and management innovation in industrial systems;
3) Emphasis on the role of market dynamics and economic agents;
4) A movement from the "react and cure" principle to the "anticipate and prevent" principle;
5) New forms of policy making process; and
6) A shift in the role of science in policy making.

One of the most important components, which make EM-type policy concepts appealing to industrial sector, is the idea that *pollution prevention pays* by emphasizing compatibility between economic competitiveness and environmental protection. As Dryzek (1997: 142) pointed out, "(f)or the key to ecological modernization is that there is money in it for business. Thus, business has every incentive to embrace rather than resist ecological modernization". The logic of EM–type concepts for business, he continues, is that "(l)ess pollution means more efficient production."

The concept of efficiency is a crucial and most significant notion for businesses and advocates of EM-type policy discourse. Robert Ayers, one of the earlier developers of the concept of eco-efficiency, defined eco-efficiency as "the objective of maximizing value added per unit resource input" (Ayers 1997: 6). The approaches on business and environment, such as LCA, environmental management systems such as ISO 14001 or environmental auditing are considered as tools to achieve this eco-efficiency. As Ayers (1997: 6) suggested "(t)his idea is essentially equivalent to maximizing resource productivity at the firm level, rather than simply minimizing wastes or pollution

associated with a given product." Most of the ecological modernization-type concepts, such as Industrial Ecology, Cleaner Production, Factor X, and Zero Emissions, argue that the increase of eco-efficiency should be a major target in order to achieve a sustainable society.

Echoing the idea of eco-efficiency, though with different emphasis, Allenby (1997: 40) defined the concept of Industrial Ecology as,

"the means by which humanity can deliberately and rationally approach and maintain a desirable carrying capacity, given continued economic, cultural, and technological evolution. The concept requires that an industrial system be viewed not in isolation from its surrounding systems, but in concert with them. *It is a systems view in which one seeks to optimize the total material cycle from virgin material, to finished material, to component, to product, to obsolete product, and to ultimate disposal. Factors to be optimized include resources, energy, and capital.*" (emphasis added)

Similarly, for Cleaner Production, the United Nations Environment Programme (UNEP) has defined it as "the continuous application of an *integrated preventive environmental strategy applied to processes, products, and services to increase overall efficiency* and reduce risks to humans and the environment" (emphasis added)[5]

Again, in a now recognizable vein, Factor X which is promoted by the Wuppertal Institute in Germany and the Club of Rome, is an idea that "if resource productivity were increased by a factor of four, the world could enjoy twice the wealth that is currently available, whilst simultaneously halving the stress placed on our natural environment" (Weizsäcker et al. 1997: XV).

And finally we can see how the United Nations University (UNU) has presented the Zero Emissions initiative to the business community as,

"(f)or business, Zero Emissions can mean greater competitiveness and represents a continuation of its inevitable drive forwards efficiency. First came productivity of labor and capital, and now comes the productivity of raw materials – producing more from less. Zero Emissions can therefore, be understood as a new standard of efficiency and integration" (UNU/ZERI and UNU/ZEF brochure, n.d., around 1997 and 1999).

All together, therefore, EM-type initiatives as the justification of the 'eco-efficiency' message targeted to *businesses* can be summarized, in the words of Desimone and Popoff of the World Business Council for Sustainable Development

[5] UNEP DTIE website: http://www.unep.fr/scp/cp/understanding/ (accessed date 11May 2009).

(WBCSD), as “increasing resource productivity so that more is obtained from less energy and raw material input” and “creating new goods and services that increase customer value while maintaining or reducing environmental impacts”(Desimone et. al, 1997: 21) Among the core components of EM, as identified by different scientists mentioned above include the following: 1) compatibility between economic competitiveness and environmental protection; 2) technological and management innovation in industrial system; 3) emphasis on role of market dynamics and economic agents; and 4) the shift from “react and cure” principle to “anticipate and prevent” principle, reflects the tendency of interpreting environmental issues and sustainable development in terms of increasing productivity and efficiency.

To include in this idea of eco-efficiency, Dryzek pointed out that there were four major identifiable story-lines typically utilized for the mobilization of business into environmental activities. First, pollution prevention pays, i.e. eco-efficiency. Second, the threatening prospect that problem solving in the future may be vastly more expensive for both business and government. Third, that a better environment is better both for workers and consumers. Fourth, that rising environmental awareness serves to expand the market for green goods and service (Dryzek 1997: 142).

The logic of eco-efficiency leads environmental policy and strategies to combine with other logics, including that of ‘self-regulation (or voluntary action)’. ‘Self regulation’ revolves around the idea that governmental regulation are often inefficient in implementing appropriate measures for environmental problems compared to self regulation by business and industries. Under the logic of ‘self regulation’, governmental regulation is interpreted as the method of encouraging the increase of eco-efficiency.

III. Policy Concepts for Eco-Efficient Industrial Activities

According to Robert Ayers, one of the leading scholars to develop the concept of eco-efficiency, the trend towards eco-efficiency can be divided into three stages:

(1) End of pipe waste treatment (to achieve maximum efficiency of treatment);
(2) Cleaner Production (to achieve maximum efficiency of goods production); and,
(3) Systems Modification (to achieve maximum efficiency of service delivery and minimum environmental impact).

Sakamoto (Sakamoto and Unoura 2001: 36) pointed out that there had been continuous and evolving efforts at waste reduction in terms of the improvement of productivity per unit in production processes among some industrialized countries since

the 1940s. Such activities had become major and were organized by the introduction of TQM (Total Quality Management)/TQC (Total Quality Control) in the industrial sector. This movement was integrated with pollution prevention policy around the time of serious industrial pollution in 1960s. By doing so, environmental strategy in industrial sector developed from end-of-pipe measures toward total integrated production and management system for waste and environmental load reduction. This idea that more efficient production would produce less waste had been conceptualized into the idea of Eco-efficiency (Ayers 1997). The movement of Eco-efficiency and trend of sustainable development gave birth successively to policy concept for eco-efficient industrial activities; Cleaner Production, Industrial Ecology and Zero Emissions initiatives, which are conceptually similar.

In this section, we overview the several policy concepts, emerged in the developed countries in the 1990s, which are relevant for resource efficient industrial activities.

III-1. Zero Emissions

The concept of Zero Emissions from UNU is based on a simple but powerful idea, namely, it "envisages all industrial inputs being used in final products or converted into value-added inputs for other industries or processes. In this way industries will reorganize into "clusters" such that each industry's wastes by-products are fully matched with others' input requirements, and the integrated whole produces no waste of any kind" (UNU/ Zero Emissions Research Initiative (ZERI) brochure: N.D. around 1997).

The intention of launching the Zero Emissions from UNU[6] was to influence the further development of industry based on the understanding that the industrial sector is a major pollutant and one of the important sources of environmental problems. To reduce waste, pollution and emissions, as well as changing and restructuring the processes and systems of industrial production is important. For example, while the Zero Emissions Research Initiative of the UNU declared that their mission was to achieve Agenda 21, they try to situate the concept of Zero Emissions along the line of industrial and technological concepts such as Zero Defects (TQC), Zero Inventory (Just-in-Time Systems), and Total Satisfaction (customer care) (UNU, Zero Emissions Forum Brochure, n.d.).

The concept of Zero Emissions stresses the following six points for the

[6] This understanding of UNU/ZERI is based on the presentation material of UNU/ZERI (1997-1999). Also, interview with Sakamoto, scientific advisor of UNU/ZERI (September 2000), and De Souza, former Rector of UNU (October 2000).

transformation of the conventional industrial system:

- A shift to a new integrated industrial system. Thus, a shift from a linear industrial model to a new integrated industrial system where all inputs are converted into final products;
- Clustering of Industries. An approach whereby industrial processes are organized into clusters with waste from one process becoming the resources for another;
- Total productivity of materials. Wastes from production processes will be reduced to minimum or ideally to *zero* and lead to the improvement of productivity of materials for total production system;
- Breakthrough technologies. The identification of breakthrough technologies to secure effective resource utilization; and
- Total Quality Management. A management approach which calls for networking and collaboration across organizational boundaries and maintenance of close links with other industries and consumers (Della Senta, Unoura, Sakamoto and Hotta 1999).

The concept of Zero Emissions has been accepted not only in industrial sector[7] but also in the community as a whole in Japan[8]. In other countries except Germany, the spread of Zero Emissions Initiative in link to UNU/ZERI seems not so remarkable except in the less developed countries (such as Colombia, Fiji, Namibia, or Nigeria). Hajer and Dryzek's separate discussions of Japan, as a highly industrialized society, conclude that it is a good example of where ecological modernization initiatives have taken place (Hajer 1996 and Dryzek 1997). This implies that the reason why the concept of Zero Emissions pervaded can be understood as one of the significant expressions of ecological modernization in Japan. In other words, Japanese society has perceived that Zero Emissions has provided the appropriate discourse and story line to contextualize their activity which has been implemented before the launch of UNU/ ZERI in relation to economic globalization and global environmental change.

In the mid 1990s until around 2000, announcing the creation of 'Zero Waste Factory' became a trend among major manufacturing industry led mainly by duplication manufacturers, electronic industries and four major breweries. The Zero Waste Factory is a part of environmental management and activities within one single factory to reduce

[7] The examples from major business entity which are claiming that they have achieved Zero Waste Factory or using the concept of Zero Emissions in their environmental charter are: NEC, Sony, NTT, Ebara, Taiheiyo Cement, Toyota, Honda, Sharp, Fuji Xerox, Fuji Film, Canon, Yokogawa Electronics, Asahi Breweries, Kirin Breweries.

[8] Based on my research in June 1999, the number of the local governments in prefectural level, which were using the concept of Zero Emissions in their environmental policy or planning in some ways, were 25 out of 46 prefectures. Also, Japanese Ministry of International Trade and Industry/MITI) (now Ministry of Economy, Trade and Industry/METI) and Japanese Environmental Agency (now Ministry of the Environment) made policies to support Zero Emissions Initiatives of industries as well as local governments which will be discussed later.

their landfill waste to ‘zero’ by promoting through waste and by-product separation for recycling. In this sense, it is different from Zero Emissions which advocates resource utilization and waste minimization through the clustering of various industries. Although the ‘Zero Waste Factory’ is not exactly Zero Emissions in the way UNU advocates, the manufacturers as well as UNU have presented the ‘Zero Waste Factory’ project along with the idea of Zero Emissions. Table 1 shows examples of companies which announced that they had established ‘Zero Waste Factory.’

Since Japanese society faced lack of capacity of landfills in the 1990s, increase in landfill expenses was the strongest motivation for these activities initially. However, this project has given several positive side effects for the companies pursuing Zero Waste Factories. To show this, Mitsuhashi (2000) introduced the following case of Fuji Xerox Takematsu Factory. Until 1991, the factory produced 2,000 tons of industrial waste annually which was disposed to its own landfill. In 1991, they decided to abandon landfill and to establish total recycling network of their wastes. Immediately in 1992, their landfill disposal was reduced to about a fifth, from 2000 tons to 400 tons. In 1997, they sent no industrial waste to landfill and announced the achievement of a ‘Zero Waste Factory’. Mitsuhashi noted three merits which Takematsu factory achieved as a Zero Waste Factory. The first merit was that they do not have to pay rising landfill fees. For Takematsu factory case, the landfill fee which was 7-8,000 yen per cubic meter in 1990 rose almost 5 times into 37,000 to 38,000 yen in 1997 (Mitsuhashi 2000 : 204-205). The second merit was that they could earn some profits by selling their separated waste for recycling. The third merit was that the factory workers’ environmental consciousness, working moral and confidence have grown by sharing the same goal of achieving Zero Waste Factory. Since ‘Zero Waste Factory’ activity was recognized to result in expenses reduction and improvement of company’s reputation in media and public in general, many companies has started to take the Zero Waste Factory as one of their major environmental activities. Even in United Kingdom (UK), Ricoh UK announced that they had achieved a Zero Waste Factory.[9] As one can see from Fuji Xerox case, most of environmental activities and management discussed in connection to Zero Emissions had already started as voluntary initiatives by Japanese industries in the early 1990s before the introduction of UNU/ZERI in 1994.

[9] BBC2 Working Lunch, September 10, 2003.

Table 1. Japanese Companies Establishing Zero Waste Factories (Mitsuhashi 2000)[10]

Company	Number of Zero Waste Factory
Sapporo Breweries	9
Asahi Breweries	9
Kirin Breweries	12
Oji Paper	4
Nippon Paper	1
Kyowa Hakkou	2
Lion	2
Taiheiyo Cement	10
INAX	2
NEC	12
Sanyo	1
Matsushita Tsushin Kogyo	2
Kyushu Matsushita Denki	1
Toyota	1
Honda	1
Canon	11
Ricoh	3
Kirin Beverage	2
Canon Kasei	2
Tabai Espec	1
Tostem	2
Fuji Xerox	3
Canon components	1
Suntory	3
Asahi Beverage	3
Coca Cola West Japan	2
Takei Kogyo	4

Other cases could be cited in the automobile industry[11] whose environmental activities as well as improving efficiency in production and management had a very good

[10] This is based on the environmental management research carried out by NIKKEI in 1999. Therefore, certainly, the number of companies and factories have achieved Zero Waste Factory has increased since then.

[11] Based on questionnaire to environmental department of a major Japanese automobile manufacturer through e-mail received on January 11, 2001. The name of the company cannot be revealed based on an agreement with interviewee.

reputation in Japan. This company announced in their environmental charters that Zero Emissions (ZE) was a challenge for their whole area of business activities. They interpreted Zero Emissions as the concept to eliminate inefficiency and loss in the original source of wastes as part of their 'corporate culture of targeting to eliminate unreasonable, inefficiency and inconsistency'. Their understanding of ZE was that of a concept that actually challenges the idea of *zero*. They did not think that perfect Zero Emissions was the absolute condition. For them, setting ZE as a target was simply to stimulate a breakthrough on the wall of conventional ideas of technology and management. Originally, they started to recognize ZE through media and communication with other industries. Zero Emissions Activity in Breweries and Electronic Industry gave a real impact to promote the activity in the company. My interview informant was able to confirm that for this auto-manufacturer, just like in other industries; once again their two major reasons to start thinking ZE seriously were shortage of land fill area in Japan and strengthening the activity towards *Junkan-gata shakai* (recycle-oriented society). From 1998, they started Zero Landfill waste activity. They believed that the launch of ZE by UNU at the end of 1990s was very good timing with the rise of the necessity to construct a *Junkan-gata shakai* system.

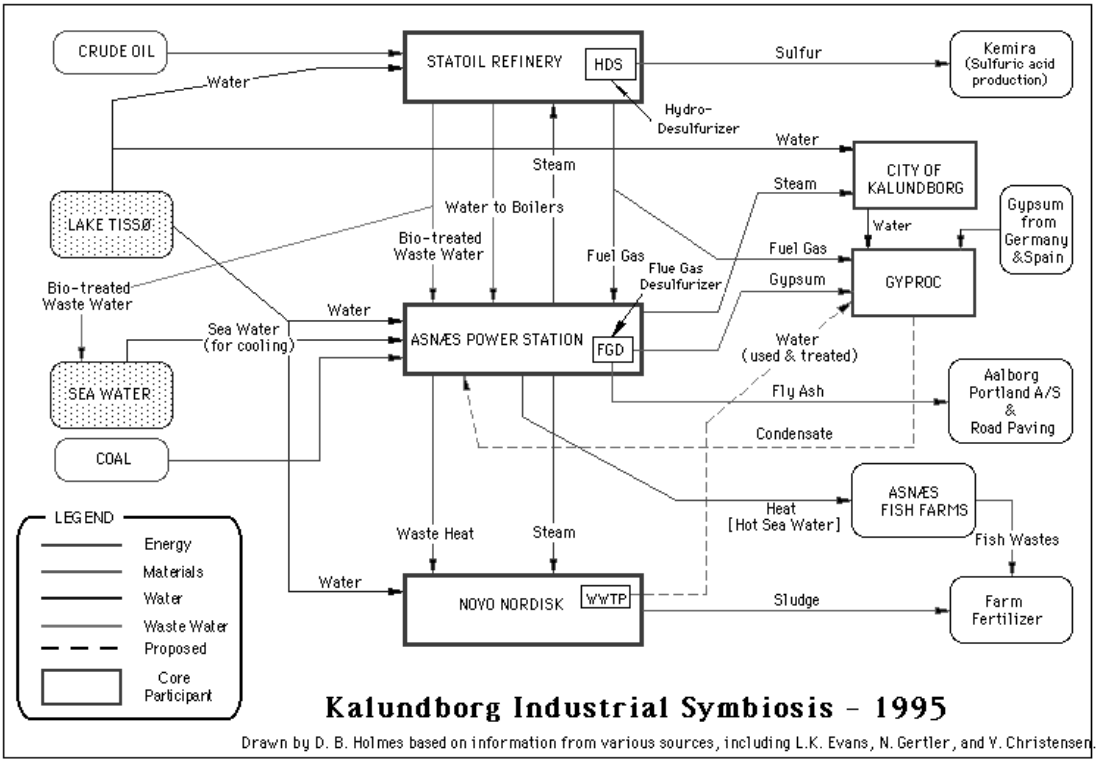
ZE has been recognized widely among the industrial sectors of Japan. Also, since the major so-called famous companies and local governments have started to launch their own ZE activities, it has been recognized more widely in Japanese society. The discourse of ZE allows central government, local government or industries to interpret environmental policies and activities in certain directions of environmental activities moving from a regulation-led passive position such as pollution prevention to a promotion-led active one, such as environmental management, marketing, reporting, or the 3Rs.

III-2. Eco-industrial Parks

The concept of eco-industrial parks is about regional and local industrial development plans informed by ecological consideration. It emphasizes the possibility of *synthesis* among various industries through connecting and closing the loop of material flows. It is inspired by a case of industrial symbiosis in Kalundborg in Sweden (see Chart 5.2). In this site, there is an inter-linkage among different plants to feed each other with their own by-products and waste. This inter-linkage includes an electric power plant, an oil refinery, a biotechnology plant, a plasterboard factory, a sulphuric acid plant, a cement manufacturer, horticulture and district heating (Ehrenfeld and Gertler 1997), out of which "[a]s a result wastes and loss of energy are reduced to an absolute minimum; and

interplant transport is scarcely needed" (Young 2000: 17). Therefore, from actual cases, this concept has been utilized more as a theoretical basis for regional and local industrial development plans informed by ecological consideration such as the construction of Eco-industrial Park.

Chart 1. Image of Material Flows in Kalundborg Industrial Symbiosis (http://www.indigodev.com/Kis95.gif)



It had been known for a long time that the idea of an industrial park for pollution prevention had become ineffective to cope with the rising environmental problems such as waste and global warming. For example, in Japan, the application of strict regulation was successful in preventing pollution and therefore the significance of industrial park (plant in non-habitat area) has diminished. Therefore, there arose the need for new models for reforming industrial park project. Against this background, the concept of eco-industrial parks inspired eco-town policy in Japan. In 1997, MITI launched the 'Eco Town project for promoting Zero Emissions Initiative (Eco Town Project)' based on the Zero Emissions concept and inspired by eco-industrial parks. Aiming at environmentally sustainable regional development, MITI (METI) claimed that this project promoted environmental industry, industrial and technological accumulation and environmentally harmonized social system. This project sought to open a competition of environmental management project from local governments. The accepted plan would be subsidized by MITI (METI). The Eco Town Project was to be subsidized for both 'hardware' such as

product recycling or renewable energy facilities, and 'software' such as feasibility studies and awareness building. Although the applicant should be local government, the proposals of the projects would not be approved without cooperation between business and local government. The total of 26 projects had been approved as eco-towns projects during 1997-2006.

Along with Kita-Kyushu city, Kawasaki[12] is one of the first local governments to officially utilize the concept of Zero Emissions (ZE) for their regional industrial development. To symbolize this shift in their industrial development policy, Kawasaki City launched its Zero Emissions Industrial Park Project with the support from the Eco-Town Policy of MITI and the Zero Emissions Industrial Park Project of Japan Environment Corporation (JEC: JEC was dissolved in 2004). It was one of the earliest industrial and regional development plans along the idea of ZE. Kawasaki City is planning to establish Zero Emissions Industrial Park in industrial area owned by Nihon Koukan (NKK: now JFE Steel) along coast. In this project, the City has invited about 20 small and medium private corporations which cooperate together to utilize and recycle many types of wastes in the park and do not generate waste outside.

The ZE industrial park project of Kawasaki was established to cope with: 1) the hollowing-out of industries in industrial bay area of the city; 2) new ways of utilizing urban space after the hollowing out; 3) solution of mixed zoning of industrial and residential area; and 4) making industrial bay area accessible for the citizens. Since the industrial coastal area does not contain residential areas, it can be utilized to plan a waste recycling function in this area within the framework of industrial policy. With the accumulation of environmental technology in Kawasaki (through the support from NKK, now JFE Steel), it can promote recycling policy by utilizing conventional manufacturing process (such as those requiring high temperature and energy usage). If heavy industries have retreated from the industrial bay area, the area can be re-branded with strong image of anti-pollution measures and making it more accessible for citizens. It was industrial policy based on the idea of zoning to symbolize the shift of Kawasaki's industrial development.

Kita-Kyushu City is another case of an industrial town pursuing the development of environmental industry development under the framework of Eco Town Project. Kita-Kyushu was the first industrial city, in which the Japan's first modern blast furnace was installed in 1901. Since then, Kita-Kyushu has become one of the centres of heavy

[12] On Kawasaki's ZE Industrial Park Project, it is based on interview with Mr. Mitsuaki Hayashi, Director, Industrial Promotion Section, Kawasaki city conducted on October 17, 2000; and Mr. Yasukuni Fukui, Manager, Planning Office, Industrial policy division, Department of Economy, Kawasaki conducted on November 6, 2000.

industrial development in Japan concentrating on the steel industries and heavy chemical industries. From 1960s to 1970s, Kita-Kyushu faced severe air and water pollution. In a very similar way to Kawasaki, Kita Kyushu has overcome pollution problems and accumulated environmental experience and technology. At the same time, the region faced the severe competition with Korea and China, the depressed condition of a steel industry - the major pillar of Kita Kyushu's industry - had become a major problem in Kita Kyushu as well. In response to this the Nippon Steel Company, the largest steel company in Japan which covers the largest industrial area in Kita Kyushu, started to shift their operation in Kita Kyushu from steel manufacturing towards the manufacturing of environmental technologies. Kita Kyushu was approved as one of the first group of Eco Town in 1997. Since then, it has become a well known pilot project and a showcase of Zero Emissions-type regional development and *Shigen Junkan-gata Shakai* (recycle oriented society) demonstrating cooperation between local government and business.

III-3. Industrial Ecology

The closely linked concept or theoretical basis for eco-industrial park development is Industrial Ecology. The notion of Industrial Ecology was developed from within academic circles of natural scientists[13] mainly based in US[14] in order to understand the impact of total human activities on natural ecology. B. Allenby defined the concept as,

'… the means by which humanity can deliberately and rationally approach and maintain a desirable carrying capacity, given continued economic, cultural, and technological evolution. The concept requires that an industrial system be viewed not in isolation from its surrounding systems, but in concert with them. *It is a systems view in which one seeks to optimize the total material cycle from virgin material, to finished material, to component, to product, to obsolete product, and to ultimate disposal. Factors to be optimized include resources, energy, and capital'* (my emphasis) (Allenby 1997, 40).

According to the Preface of *Industrial Ecology and Global Change* (Socolow et. al. 1994, xvii-xviii), the studies and concept of Industrial Ecology emphasizes the material flow analysis of the environmental impact of industrial activities emerging from two different traditions and motives. One tradition is that of "industrial metabolism[15]" which has the understanding of industrial systems as "a single entity" and seeks "a system

[13] The academic circle around industrial ecology is currently mainly based in US universities such as Yale, MIT and Cornell University. The School of Forestry and Environmental Studies at Yale University acts as secretariat of the network of Industrial Ecology: International Society of Industrial Ecology.
[14] See Socolow et. al. 1994, XV-XX.
[15] For more detailed discussion about industrial metabolism, see Ayers and Simonis (eds.) 1994.

wide transformations of materials". The focus of this tradition is rather macro material cycle (flow) analysis to understand the life cycle of resources and energy in "industrialized society as a whole". The other tradition is that of "industrial" ecology launched by Brad Allenby, Robert Frosch, Tom Graedel and Kumar Patel[16] (Socolow et. al. xviii, passim). This tradition has emphasized "industrial firm as agent of change, and has located its analysis at the level of specific industries". Their focus is more micro material flow analysis concentrating around and to seeking possibilities of connection between specific industrial activities. Therefore, "of special interest are the relationship among industries and the opportunities for the wastes of one industry to become useful inputs to a second."

In a broader sense, Socolow defined industrial ecology as a metaphor by which we enable to understand:

'The interrelationships among producers and consumers determine what becomes waste and what is usable, and how the "natural" is combined with the "synthetic." Industrial ecology explores reconfigurations of industrial activity in response to knowledge of environmental consequences. It intends to stimulate the imagination and enlarge the sense of the possible, with regard to industrial innovation and social organization. It offers a fresh view of environmental management' (Socolow 1994: 3).

From this statement, several essences of industrial ecology as an approach towards environmental issues can be extracted. First of all, their target of examination and change (or reconfiguration) is that of industrial activity. Secondly, as a driving force of change, they expect industrial innovation and social organization to play a central role. In other words, technological innovation and managerial approaches to environment are considered to give unquestionably favorable effects for achieving this change. Thirdly, as Socolow argues, industrial ecology is intended to "enlarge the sense of the possible" [1994: 3] and it is their intention, in this respect, to craft their argument through "optimistic" language.

To make it simple, Industrial Ecology is an argument that establishes a closed loop in industrial systems with total integrated technological and management which will prevent environmental degradation. Also, the concept targets to generate a change in the

[16] Brad Allenby, Tom Graedel and Kumar Patel had a research career at AT&T Bell Laboratories. Robert Frosch has published a famous article with N.E. Gallopulos on Industrial Ecology: Frosch, R.A. and N.E. Gallopulos. "Strategies for manufacturing." In *Scientific American*. 261(3): 144-153 September 1989. This article is considered as the starting point of the school of industrial ecology. At that time, Frosch was a head of research at the General Motors and Gallopulos was an engineer at the General Motors. They convinced AT&T to fund the emergence of school of industrial ecology (See, Reid Lifset, "Full Accounting" in *the Sciences*, May/June 2000, published by New York Academy of Sciences, which is available at http://www.nyas.org/scitech/harbor/materials/sci_0500_lifs.html#top). Also, Brad Allenby, who is one of the leaders in this area, is vice president of environment, health, and safety for AT&T.

relations of industrial process and environmental impact to ecologically sustainable one, through the analysis and redesign of industrial process, material cycle, product life cycle, design of product, way of regional and local industrial planning and waste management. Environmental protection and industrial activity is considered as a part of the whole process of society. This kind of system-oriented approach was inspired by a biological analogy, thus the analogy of "industrial metabolism" and "industrial ecology" represents just such a tendency. In this sense, Industrial Ecology can be "[understood to be] how the industrial system works, how it is regulated, and its interaction with the biosphere; then, on the basis of what we know about ecosystems, to determine how it could be restructured to make it compatible with the way natural ecosystems function"(Erkman 1997: 1). Industry and industrial activity are therefore considered to be part of the functioning of society as a whole. Therefore, although it started its focus on industrial activity, it has since tended to enlarge its scope to local waste management, green consumerism, and urban and regional development as a whole.

III-4. The 3R Initiative[17]

The 3Rs is an environmental policy concept/slogan for waste reduction, reuse and recycling which has existed for quite a long time. The concept of the 3Rs has started to be transformed recently along with the development of the 3R Initiative. The 3R Initiative, which was launched as a part of the G8 process in April 2005, identified the following five priorities for 3R promotion: (1) implementation of the 3Rs in an economically feasible manner within each country; (2) international flow of goods and materials; (3) multi-stakeholder cooperation; (4) promotion of science and technology; and (5) the need for greater cooperation between the developed and developing countries. Of these priorities, I would like to suggest that the increased interest among policy makers on (2) in relation to the 3Rs may be the key to understanding the background to the 3R Initiative.

From the viewpoint of both developed and developing countries, the very existence of the "global market of recyclables" itself should be sufficient in highlighting the need for 3R promotion. Since the 1990s, the transboundary movement of recyclables and second-hand goods, including paper, plastic waste, scrap metal, second-hand/ near end-of-life automobiles, electronic products and home appliances has seen a very sharp increase. This phenomenon—the increasing global flow of post-consumed materials and goods should be understood as an example of the structural change that is taking place in

[17] This section on the 3R Initiative is mainly from my following previous article:
Hotta, Y. (2006), "Comment on Makiya et. al.(2006): Cooperation between Developed and Developing Countries in Promotion of 3R" *Regional Development Dialogue*, 183-186.

the economic relations among developed and developing countries. The increasing transboundary movement of recyclables can be explained from the following three structural changes in the developed and developing economies: 1) a rapid increase in the recovery of recyclables due to successful implementation of recycling-related legislation in the developed countries; 2) the lowered demands of recyclables in developed countries due to shift in location of manufacturing industries from the developed countries into the Asian developing countries; and 3) the corresponding increase in demands regarding recyclables in developing countries in parallel with improvements in the related economies themselves.

Thus, from the viewpoint of developed countries, the recent interest in the 3R Initiative not only concerns domestic promotion of the 3Rs, but also concerns "a policy response to the possible hollowing out of the domestic recycling industry under globalization", and "how to establish an environmentally-sound and economically-efficient transnational flow of recyclables." For example, in Japan, after the introduction of a series of product-oriented recycling legislation acts, the 2003 figure for the amount of domestic solid waste for final disposal stood at half in 1989. The figure for industrial solid waste was reduced to 33% over the same period. Through the 1990s to the early 2000s, with several policy measures such as Eco-town to establish recycling industries and facilities, the Japanese government has successfully developed a nation-wide recycling capacity by focusing on a recycling system that covers several local administrations.

On the other hand, the export of recyclables has increased 7.0-fold for scrap iron, 8.3-fold for scrap copper, 8.3-fold for scrap aluminium, 38.7-fold for waste paper/cardboard, and 9.2 fold for waste plastic from 1990 to 2004 (Terazono, 2005). This rapid increase in the export of recyclables has started to influence Japan's domestic recycling businesses. For example, because of increasing foreign demand for PET waste as recyclables, PET recycling industries are facing increasing difficulty in securing sufficient PET waste to run their facilities at full capacity. Some are even on the brink of bankruptcy. When applied to the definition of economic globalization, i.e., expansion of markets, further international division of labour, increasing speed and amount of flow of goods and information, the aspect of "global supply chain of materials and products" also needs to encapsulate the meaning of "downstream material flow". Indeed, recyclables have been increasingly flowing out from the developed countries into the developing countries.

Therefore, for the developed countries, the establishment of an environmentally

sound downstream material flow is difficult to realize domestically without consideration of the international flow of recyclables. This is one of the reasons why developed countries, such as Japan, which already have the capacity for domestic recycling, need to promote the 3R Initiative in collaboration with the developing countries in Asia.

From the viewpoint of developing countries, 3R promotion is about capacity-building, including sanitary waste management. 3R promotion in the developing countries does not merely concern sanitary waste management, but it is also about raising resource efficiency by developing the 3R capacity in developing countries.

IV. Conclusion

The interpretation of "environmental" measure as an issue of increasing productivity and efficiency is dominant in arena of debate concerning "environment problematique at least among advanced industrialized societies. Ecological Modernization represents reconfiguration of relationship between environmental protection and economic competitiveness from "contradictory and conflicting" into "harmonized" and "compatible" (Hotta 2004: 124). But, at the same time, it is a process of industrial technologies and management system concerning productivity and efficiency, that extends into the environmental arena in order to interpret environmental concern from pollution control into a part of normal business operation. The global environmental concern and consciousness in facing economic globalization triggered the conscious effort to promote resource and energy efficiency as an environmental strategy. Here, "environment" is linked closely to issues of industrial and economic activities in terms of technological development and product development for prevention of global warming, waste and recycling, corporate social responsibility and accountability, or overseas operation and trade. Environmental issues have become significant strategic issues to reconfigure the role of actors including businesses, local governments, NGOs, academia, governmental agencies, and international organizations in the transnational political arena, expanding along economic globalization and global environmental change. The policy concepts introduced in this paper can be understood to provide an interpretation on the role of the different actors/ stakeholders in the context of environmental issues as strategic issues.

Thus, the case of Kawasaki and Kita-Kyushu city suggests that advocating environment has been understood as a major advantage in promoting local industrial governance to face economic globalization. The policy concepts for resource efficient industrial activities are not simply an environmental social movement or a glass-root

movement, but have become a strategic process as well as reflexive process to reconfigure, re-boost and regenerate political, social, economical, and industrial project of modernity at least in discursive level. Certainly, in this level, it is not intended to focus on environmental concern as a peripheral part of modern industrial society but in systems as a whole. They have emphasized to shift their focus from end-of pipe technologies into reform and change in "upstream" and to establish integrated industrial and management systems. However, at global scale, globalization expands from production and supply chain to downstream recycling chain. Thus, the new trend of EM expands to downstream economy as seen in the 3R Initiative.

References

Allenby, B. R., 1999. *Industrial Ecology: Policy Framework and Implementation*. Upper Saddle River: Prentice Hall.

Ayres, R. and Simonis, U.E., eds., 1994. *Industrial Metabolism: Restructuring for Sustainable Development*. Tokyo: United Nations University Press.

Ayers, R., 1997. "Toward zero emissions: Is there a feasible path? – Introduction to ZERI Phase II", presented as a working paper, UNU/IAS, Tokyo.

Cohen, M. J., 1997. "Risk society and ecological modernization – Alternative visions for post-industrial nations," in *Futures* 29 (2): 105-119.

DeSimone, L. D. and Popoff, F. with World Business Council for Sustainable Development, 1997. *Eco-efficiency: The Business Link to Sustainable Development*. Cambridge: The MIT Press.

Dryzek, J. S., 1997. *The Politics of the Earth – Environmental Discourses*. Oxford: Oxford University Press.

Ehrenfeld, J. R. and Gertler, N., 1997. "Industrial Ecology in Practice: The evolution of interdependence at Kalundborg," *Journal of Industrial Ecology,MIT*, 1 (1, Winter 1997):67-79.

Frosch, R.A. and Gallopulos, N.E., 1989. "Strategies for manufacturing," *Scientific American*, 261(3):144-153. September 1989.

Hajer, M., 1995. *The Politics of Environmental Discourse- Ecological Modernization and*

the Policy Process. Oxford: Oxford University Press.

Hotta, Y., 2004. *The transnational politics of ecological modernization, An analysis of the formation of transnational authority in global environmental and industrial governance, with special reference to the Zero Emissions Initiative in Japan.* Sussex, UK: the University of Sussex.

Mitsuhashi, T., 2000. *Nihon Keizai Green Kokufu-Ron (Japanese Economy and Green Wealth of Nations).* Tokyo: Toyo Keizai Simpo-sha.

Mol, A. P. J., 1996. "Ecological modernization and institutional reflexivity: Environmental reform in the late modern age," *Environmental Politics*, 5(2, Summer 1996): 302-323.

Mol, A. P. J., 2001. *Globalization and Environmental Reform – The Ecological Modernization of the Global Economy*. Cambridge: MIT Press.

Mol, A. P. J. and Sonnenfeld, D. A., eds., 2000. *Ecological Modernisation Around the World*. London: Cass.

Sakamoto, K. and Unoura, M., 2001. "Kokuren daigaku ni yoru Zero Emisson no teishou to junkangata shakai no keisei (Zero Emissions Initiative proposed by the United Nations University and its implication for the construction of recycle- oriented society)," *Kikan Kankyou Kenkyuu (Environmental Research Quarterly)*, 2001(121):33-39.

Socolow, R., Andrews, C. Berkhout, F. and Thomas, V., 1994. *Industrial Ecology and Global Change*. Cambridge: Cambridge University Press.

Socolow, R., 1994. "Six Perspectives from industrial ecology" in Socolow, R., Andrews, C. Berkhout, F. and Thomas, V.,*Industrial Ecology and Global Change*. pp. 3-15. Cambridge: Cambridge University Press.

Terazono, A., 2005. "Japanese recycling laws and international trade in recyclable resources," in Kojima, M., ed., *International Trade of Recyclable Resources in Asia*. pp. 17-32. Chiba: IDE-JETRO.

Weale, A., 1992. *The New Politics of Pollution*. Manchester: Manchester University Press. .

Yamaguchi, M., 2000. *Chikyu Kankyo Mondai to Kigyou* (*Global Environmental Issues and Business Actors),* Tokyo: Iwanami Shoten. .

Young, S. C. ed., 2000. *The Emergence of Ecological – Integrating the Environment and the Economy?* London: Routledge.

Chapter 2. Current Situation of Waste Recycling in Indonesia

Enri DAMANHURI and Tri PADMI
Institut Teknologi Bandung (ITB)

1. Introduction

The problem of waste management in developing countries, such as Indonesia, has a number of aspects associated with them, such as technical, institutional, financial, environmental and social aspects. To effectively and efficiently overcome this problem a holistic approach to develop solutions is required. The impact of these aspects varies markedly depending upon the income levels and socio-economic factors of individual countries or cities. Higher per capita income levels in developed countries allows for the financial means to maintain appropriate collection systems, treatment and disposal management. The generally higher education levels of the population in developed countries also provide the support for implementation of 3Rs of waste programs, public education and strict environmental regulations. Eventually it became clear that a sustainable improvement could be reached only by the integration of socio-economic and socio-cultural elements into the whole scheme. In Indonesia, proper waste management have been a major challenges in waste problem, but concern on gradually waste reduction through recycling have been raised in recent years. With the increasing growth of population and economic activities, the volumes of waste to be handled would increase accordingly. This paper reviews current situation of waste recycling in Indonesia. In the first section, the development of legislation on waste was explained. Section two overviews the flow of municipal solid waste management. Section three focus on hazardous waste management. In section four, recycling of waste electronics and electric equipment was reviewed.

2. Legal Aspect

2-1. Hazardous Waste Regulations: [1]

Interest regarding hazardous wastes in Indonesia had emerged since 1990s, especially after the intensified industrial activities. The hazardous wastes management in Indonesia refers to the principles and guidelines for sustainable development as stipulated in Law No. 4/1982 on Basic Provisions for Managing the Living Environment. The amendment of this Law has been issued by Law No. 23/1997 on Management of Living Environment.

The management of hazardous wastes was regulated in 1994, through the *Peraturan Pemerintah* (PP) or Government Regulation (GR) No. 19/1994, then revised through the PP No. 12/1995, an improvement and betterment of the PP No. 19/1994 by introducing reuse and recycling approach. Further, this regulation was improved in 1999 through the new PP (GR) No. 18/1999 amended by PP No. 85/1999. This regulation did not only prevent and minimize the generation of hazardous waste, but it also regulated their control, storage, transport, treatment and final disposal, including recycling and recovery. In addition, it also addressed issues for importing and exporting hazardous waste Decree of the Head of the *Badan Pengelola Dampak Lingkungan (BAPEDAL)* or

Environmental Protection Agency (EPA) 01/Bapedal/09/1995 to 05/Bapedal/09/1995 were further regulated those Government Regulations.

Before 1994, the handling of hazardous wastes was integrated with the other pollution control programs. After legislation of the PP No. 19/1994, the issue of hazardous wastes had been given special attention particularly those from industries. Based on the "cradle-to- grave" concept, these regulations control the handling of hazardous waste, starting from its place of generation, storage, transport, recycling, processing, to its final disposal, including the monitoring procedures at every step along the chain.

A waste may be considered hazardous for a number of reasons. Of that reasons, the potential for some wastes to cause a toxic reaction in humans is the most fearful anxiety among public concern. PP No. 18/1999 amended by PP No. 85/1999 defined a waste to be hazardous under legislation if it meets one or more of the following conditions:

- exhibits characteristics such as being explosive, ignitable, reactive, toxic by Toxicity Leaching Characteristics Procedure (TLCP), infectious, corrosive, and/or toxicity by Lethal Doses-50 (LD_{50}) tests;
- is a non specific source which includes generic wastes generated by a variety of general process, such as spent halogenated solvents tetrachloroethylene, trichloroethylene, etc;
- is a specific source which is generated from specific industrial process, such as bottom sediment sludge from the treatment of wastewaters from wood preserving industry process that use pentachlorophenol; and
- is a specific commercial chemical product or intermediate, discarded commercial chemical products, off-specification species, container residues, and spill residues thereof.

Other regulations that directly affect the quality and quantity of the generated hazardous wastes, are followings which control hazardous materials, namely:

- Government Regulation No. 7/1973 pertaining to the control, circulation, storage and use of pesticides
- Decree of the Ministry of Health No. 453/Menkes/Per/XI/1983 pertaining to hazardous materials
- Decree Letter of the Ministry of Industry No. 148/M/SK/4/1985 pertaining to the safeguarding of toxic and hazardous materials
- Decrees of the Ministry of Trade No. 155/Kp/VII/95 and No. 156/Kp/VII/95 pertaining on the trade of controlled imported goods
- Decree Letter of the Ministry of Agriculture No. 724/Kpts/TP.270/9/1984 pertaining to the prohibition of using the Ethylene Dibromide (EDB)
- Decree Letter of the Ministry of Agriculture No. 536/Kpts/TP.270/7/1985 pertaining to pesticide control

The first centralized hazardous waste treatment plant in Indonesia had been in operation since 1994. It was located in Cileungsi - Bogor (West of Java Province). This facility was meant initially to accept all wastes categorized as hazardous from industries in the surroundings of Jakarta, Bogor, Tangerang and Bekasi (JABOTABEK). It was presumed that from the planned operation area in 2001, there will be 67,000 tonnes of sludge deposits from industrial waste treatment processes per year, and 18,000 tonnes of liquid waste containing solvents, oil-spill or used oil per year.

2-2. Solid Waste Management (SWM) Regulations: [2]

Since May 7, 2008 Indonesia has introduced Law of Solid Waste Management (Law No. 18/2008), which has been drafted since 2003. The finalization of this law was delayed for such a long time until it was revived after the incidence of landslide of the Leuwigajah final disposal in February 2005. With full support from the government and parliament, it reached an agreement that a new paradigm in waste management in Indonesia was required. This SWM Bill was submitted to Parliament by the Government of Indonesia in August 2007.

The law of SWM defines solid waste as the residues of human daily activities and/or residues of natural processes in solid forms. Wastes specified under this law include the following: (a) domestic waste; (b) domestic waste equivalents; and (c) specific wastes:

- Domestic wastes, those generated by daily activities performed within households, but not include feces and specific wastes;
- Domestic waste equivalents, those generated from commercial zones, industrial estates, special zones, social facilities, public facilities and any other facility; and
- Specific wastes, those that require special management due to their properties, concentrations and/or volumes, in forms of:
  - hazardous materials contained wastes;
  - hazardous wastes contained;
  - wastes generated by disasters;
  - remnants of constructions ruins;
  - un-processable wastes due to availability of technology; and
  - non-periodical generated wastes

Waste management is performed under several principles: responsibility, continuity, benefits, equity, consciousness, commonness, safety, security and economic value. All of them aimed to improve the health of the community, and environmental quality, as well as convert wastes into resources.

The basis of waste management under this new Law is waste reductions as the first priority, and waste handling as the next priority. This Law also outlines directions on the tasks and authorities of governments, such as, but not limited to:

- conduct studies, develop programs on waste reduction and waste handling with the main emphasis on local-specific technology applications;
- promote and facilitate the development of efforts in reducing, handling and beneficially using wastes and yields of waste processing;
- perform coordination between governmental agencies, communities and business world so that there is an integration of efforts in waste management;
- establish national policies and strategies, norm development, standards, procedures, and criteria of waste management; and
- facilitate and develop co-operations between local areas, partnership and networking in waste management.

Some of the central issues of Law No. 18/2008 are as follows:

- extended producers responsibility (EPR), every producer should indicate a label on their product packaging and/or their final products about reducing and proper

handling of waste; and they should also manage the packaging of their products that are impossible or very difficult to be decomposed by natural processes;

- the application of waste reuse and recycling through the entire chains of waste transport, since their origin to their final disposals;
- selection of waste processing and dumping technologies that are safe and healthy, and conform with Indonesian situation. Open dumping and open burning are forbidden and during five years after the passing of the law, open dumping would be completely banned; and
- prohibition to import waste into Indonesia territories, and to mix waste with dangerous wastes.

3. Municipal Solid Waste (MSW) Recycling

3-1. MSW management in Indonesia [3]

The generation rate of MSW is generally calculated as 2.5 – 3.0 l/capita/day based on standard national of MSW generation (SNI S 04-1993-03) established in 1993. Based on a survey in Bandung area in 2005, the estimated MSW generated in this area was 0.59 kg/capita-day. Based on a survey in 2005-2006, the average of organic wastes in Bandung area was 52% (weight) and for inorganic wastes was 48% (weight).

There are not enough collection-transportation vehicles available. The transport vehicles are very often "old-timers" where the waste has to be filled in manually without any covers, which are above the heads of the workers. Open vehicles loose part of their load during their tour to the dumping area. There is generally too much time lost during transport due to traffic problems in the street. A transport vehicle sometimes needs hours to cover a few kilometres from city to landfill. Therefore most of the collection vehicles can do only 2-3 trips a day. In certain protocol areas and special zones, door-to-door collection is applicable using a better collection of MSW, such as compaction vehicles. This is carried out only in larger cities.

In so far, most of existing MSW management system in Indonesian municipalities relies on the existence of landfill. Most of wastes transported to final disposal sites are treated through open dumping, and it was estimated that only as much as 10% of it that were treated through better system such as controlled landfill. In many sites, these facilities are nothing more but uncontrolled open dumping sites. The main reason for this practice is due to the limitation of operational budget. Lack of serious attention over these final disposals tend to be a general practice on the part of city administrators in Indonesia, along with their presupposition that the waste handling over these landfills would run on them.

The common practiced for a landfill site is usually based on administrative borders. This is understandable, as the landfill manager is usually the city cleanliness division, working under the auspices of the local government. Differences regarding the administrative borders have sometimes brought unfavorable effects, such as the different perceptions between the respective local area governments: between Jakarta City and Bekasi City (landfill of Bantar Gebang), Bandung City and Bandung District/Cimahi City (landfill of Leuwigajah) and the like.

Rapid population growth in urban areas, socio-cultural classes heterogeneity and community participation that is generally not well directed and well organized have resulted the complexities of MSW problems to be handled in a municipality. On the other hand, fund situation and relatively low priority in waste handling among local governments are general trends, along with the limitations in proper human resources, adding to the low performance of municipality in handling the sanitation and waste in urban area in Indonesia. Many aspects involved in the cause of inadequate MSW management, some of these are lacks of supports of municipalities to address wastes problems systematically, integrated and comprehensively, lack of standard policies that are comprehensive and consistent in matters of waste handling, and lack of disciplines among waste managers in applying proper technical procedures. During the last years, because the problems of solid waste disposal became too obvious, the pressures of the public and the growing awareness concerning the environment also have caused a change in the policy concerning waste management. But still the progress in this field of environmental protection is slow and improvements are often rarely visible.

The MSW management in Indonesia has reached its relatively sound performance during 1990-1995, where many cities were being motivated to improve their cleanliness/sanitation due to, inter alia, the existence of Adipura Award program which would be granted to any city eligible to be called as successful city. Ever since, the multidimensional crises in Indonesia and the reforms entailing such crises in end of 1990s, turning point in MSW management in Indonesia begun. The era was significantly marked by fundamental changes in political and governmental aspects, such as decentralization and local autonomy era. In line with the implementation of local autonomy policy, municipal/district governments took over the full authority and responsibility of waste management from the central/province government. Many of these local governments adjusted the related policies, even drastically, especially in its institutional aspects. Another significant impact is the appearance of locality ego-centrism, which in turn poses difficulties to municipal governments to operate their respective landfills that generally situated in sites outside their own jurisdiction. The local autonomy era without well-supported local officials is one of the main factors responsible for the degradation of waste management sector in Indonesia. The main cause is lack of political will associated with the importance of MSW management within their own municipalities or districts to the extent that their views of funding priorities for waste management are at the lowest ranks.

The generally accepted practice of main sources of financing of MSW handling among most of Indonesian cities is originated from governmental development budget. The second main financial source comes from waste retribution charged to waste generators. It is indeed hard to raise the retribution, considering the still limited capacity of the people. The ideal condition is that the collected retribution would afford all of operating cost and expenses required, including all of maintenance expenses and even any depreciation expenses. Almost all of MSW management operators are experiencing fund deficit from their regular operation. There are some reasons they have been stated, including improper tariff structures, low appreciation of waste generators, including local governments themselves, to repay the service equivalent to the respective obligation.

One reason to the low-awareness on the part of the community to pay MSW tipping fee is that they are lacking knowledge of information associated with costs or expenses required to handle wastes. The currently prevalent circumstances is that there are two different services by two different service providers: the first involve cost of wastes

collection from households to be collected to transfer station, normally operated by their respective neighborhoods, and the second involve cost to transport the collected wastes from those transfer stations to final disposal, which were the responsibility of municipality's waste management. Most of community members, however, lack the knowledge of the complete stages to the extent that they feel they should pay multiple waste retributions.

3-2. MSW Recycling in General

One of the important mandates in the Law No. 18/2008 is the implementation of waste separation. Any recyclable waste is collected from its respective sources, such as residential areas, commercial zones, temporary collection facilities and the final processing facilities. Wastes are recycled to useful raw materials for production processes (i.e., reprocessing and remanufacturing activities). Every country recognizes the important of recycling. In most countries, plastics, glasses, papers, and metals are well collected by either the informal sector or municipalities, and these materials are recycled. In the case of MSW in Indonesia, there are two main recycling flows. In the first flow, collectors, including those in the informal sectors, collect recyclable materials at sources. In the second flow, these materials are separated and recycled by the municipality after MSW collection. Recycling activities in this context are all activities of reusing objects that previously been called as "waste", either by directly self-reusing or by selling to waste traders.

Most of Indonesian people in all economic levels have different terminology in perceiving the end-of-life of goods, including consumer goods. In other countries, especially in developed countries, some goods like used newspapers, old magazine/book, old clothes, old electronic-electrical etc. are considered to be waste and tend to generate any problems. In Indonesia, these wastes would be rather be perceived as used object that still have an economic value, to the extent that they rarely would be found in municipal waste management chains, for the very reason that these stuffs are actually saleable, or could be donated to the others who have lower income. Like in any other major city in developing countries, the informal sectors play an important role in any recovery effort over the usable materials of waste. The recycling activity engages this sector, to include housewives, waste workers (from the cleansing division), vendors of used articles, and waste pickers. Middle-men or intermediary traders are found in all corners of the Indonesian cities to buy used articles directly door-to-door. Dry waste (inorganic waste) is the most easily found object for waste recycling in large cities in Indonesia.

Another very active group in waste recycling activity is the waste pickers (scavengers). The existence of waste pickers in the waste management system brings about two different opinions. Some people consider that the activity will not only provide opportunities for the poor people to work in this sector, but will also help to reduce the amount of waste for disposal to the final dumping site. The other considers that this activity would bring a "bad" image to the country. So far, the role of informal sector in waste recovering activity has not been well organized.

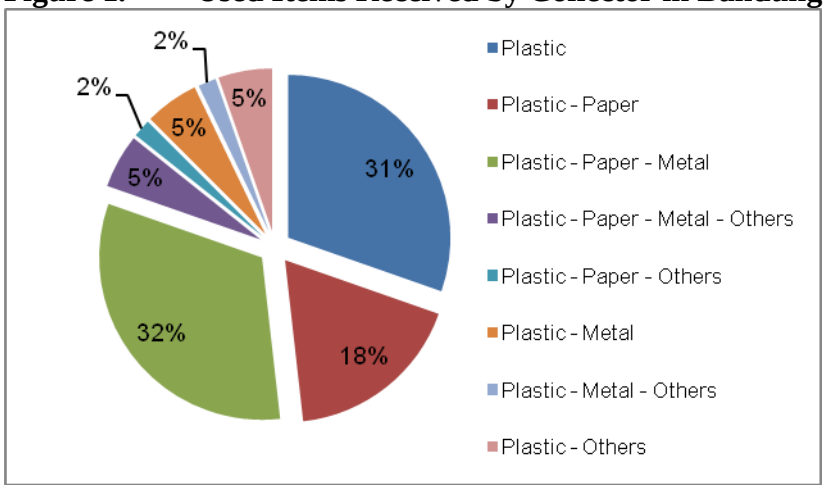
A positive impact derived from the current SWM systems in developing countries and economies in transition is the high level of recycling of the inorganic component of MSW. Although the methods employed for sorting and separation of MSW in these countries are considered inappropriate for solid waste management systems, as defined by

developed countries, these existing method not only provide an income stream to the hundreds of thousand people involved in this informal sector but also ensure a far greater amount of MSW generated is recycled.

Some of the recyclable wastes are collected by wastes scavengers who sell these wastes to the collectors. The latter separate and classify the wastes into several groups of items depending on the types, then sell them to the whole sellers. These sellers will then trade these wastes to recycling factories. Some parts of these wastes are recycled within the cities that produce them, but in general they sell these wastes to other cities, or even export them aboard.

Research results in 2007 [4] on waste of mineral water packaging in Bandung City showed that the most frequently traded used items were mineral water packaging plastics (bottles and cups), plastic sheets (leaves), newspapers, office supplies papers, ex packaging cardboard boxes, glass bottles, iron, metals (aluminum, copper) and used electronics debris (Figure 1).

Figure 1. Used Items Received by Collector in Bandung



[Source: Ref. 4]

This profile of used items trading is also similar to the results of a survey conducted in 2008 among recyclers in five cities, which include the Batam island, Bogor City, Magelang City, Makasar City and Pontianak City. Most of the respondents said that the most common used items recycled for local and export purposes comprised of plastics, papers, irons and metals [7].

3-3. Plastic Waste Recycling

The quality of wastes as used items that have potentials to be recycled determines their market selling prices. The recycling business-chains players in this activity are collectors (waste traders, and scavengers), intermediaries and recycler industries. They have their own criteria that should be met by their respective business partners. The discussion of some categories of plastic recycling players will be explained in the following sub-sections.

Based on the interviews with one of the plastic recycling players in Bandung City in March 2009, it could be concluded that most of the intermediaries or brokers in the recycling business channels serve as the main hubs between small collectors and large collectors, or between collectors and pellet making industries. These brokers work independently and individually using territorial bond or relatives based relationships, or listing by phone to get buyers or sellers. These brokers have authority in determining the quality of any item that would be released by the sellers, and to be offered later to the buyers or, alternatively, these brokers would find the items requested by the buyers. For example, these brokers would search the requested items from collectors in form of colored or transparent PET (*Polyethylene terephthalate*) plastic bottles in already pressed conditions for pellet making industries according to their consumers' requests. Brokers income from this very role is in the form of commission percentage of their pre-agreed amount upon selling or buying prices.

According to the interviews with one of the collectors of used plastic packaging, who is also the owner and manager of pellet making and recycled product factory, the power of a broker to survive and expand through the course of weak economic conditions lies in his or her wide networks (inter city, intra city, even international), the availability of supporting means such as press machines and/or cracking and pelletizing machineries to meet markets' needs, and the reliability of the products to be sold. Generally, these plastic packaging items collectors determine minimum standards for any item to be accepted from their counterparts e.g. scavengers. These standards are, but not limited to, as follows:

- Transparent PP (*Polypropylene*) from mineral water cups and transparent or colored PET from any drinking product bottles are usually been determined under two-tonnes/week minimum quantities requirement [5, 6].
- Other types of wastes that can be accepted by some plastic waste collectors such as papers, metals and glasses have no definite criteria [4].

Recycling industries or more widely known as pelletizing industries, in some cases serve dual roles, either as collectors or as end users of recycled products, depending on their business scales and the completeness of their own production means. Based on study in 2008 [4] and interviews with one of the collectors [6], it showed that plastic pellet manufacturing industries were generally requiring materials in the form of homogenous scrapped plastics in terms of their packaging uniformities, such as PP-only scraps or PET-only scraps. As long as these pellet industries gave grinding machines, however, they preferred to accept items in their pressed forms, because this would guarantee the scraps quality as export products or premium products for local usages. The impurity in the scrap of plastic mix of product from several different sub-collectors was frequently found such as the PVC (*Polyvinyl chloride*), PS *(Polystyrene*), iron rod, broken glasses, and aluminum rods.

Based on the interviews in February 2009 with one of big collector/recycler in Bekasi city [7], the grade of quality required to produce the end-product in forms of coconut root sweepers, would be met by green, red and blue pellets, depending on the color of the sweeper frames to be produced. For the end-products in form of plastic balls and kid coin holders, however, they required used grease bottles HDPE (*High-density polyethylene*) pellets. Thus, the most essential thing is the homogen quality based on packaging plastics they accepted from their trusted business partners. This will play an important role for their product to be successful and in maintaining good partnerships.

A producer of plastic zipper (2008) in Cimahi City (West of Java Province) expressed similar views [8]. His company produces zipper that requires transparent and colored PET as its raw materials. It has established criteria for any items that it would accept from its partner-collectors, in that these items should be already in their pressed forms. The main reason for setting these criteria is due to limited areas of its raw material warehouses and that the quality of the scrap products is generally better if they are produce in in-house basis. In this way, his industry will only sort these pressed materials based on their colors, cleansing, scrapping and washing through drying processes.

3-4. Plastic Waste Price Variations

Based on study in 2008 [4], the selling prices of plastic waste at the sources and collectors levels in Bandung City for June-November 2008 periods are presented in Tables 1 to 5 (1 US$ was equivalent to Rp 9,300 in June 2008 up to Rp 11,000 in November 2008).

Table 1. Plastic Waste Prices at the Sources Level [4]

Type	Sources Category (thousand Rp/kg)								
	HH	School	College	Stars Hotel	Budget Hotel	Restaurant	Office	Mall	Hospital
Cup (PP)	2 - 7	0.5 – 6	4 – 6	1.2	2.5 – 4	2 – 4	-	4 – 6	1.7 – 6
Bottle (Clear PET)	2 – 5.5	2 - 6	3 - 6	1.2 – 3.5	1.5 – 3	0.6 – 6	3	2 – 3	1.7 – 4.5
Color PET, (brand name)	2 - 3	0.8 - 6	-	-	4.5	1	-	0.5 -1	0.5 – 1

HH = household

Table 2. Plastic Waste Prices at the Collectors Level [4]

Type	Sources Category (thousand Rp/kg)		
	Mobile Scavenger / Junk Dealer	Temporary Station (TPS) Scavenger	Landfill Scavenger
Cup (PP)	4	4.5	4.5
Bottle (Clear PET)	3	3.5	3
Color PET	1.75	1.75	1.5

Table 3. Range of Plastic Waste Prices at Scavengers Level [4]

Type	Prices (thousand Rp/kg)	
	Buying-Prices	Selling-Prices
Cup(PP)	0.8 – 7	1.5 – 11.5
Bottle (Clear PET)	0.4 – 4.5	0.5 – 6.5
Color PET	0.2 - 3	0.4 – 3.5

Table 4. Range of Plastic Wastes Prices at Collectors Level [4]

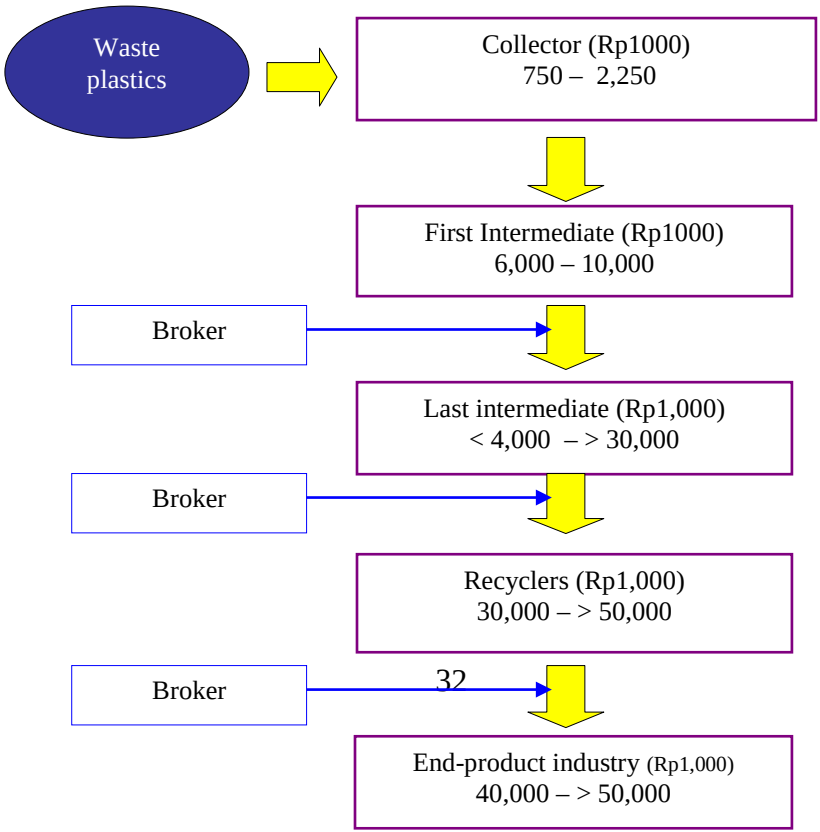
Plastics Waste	Prices (thousand Rp/kg)	
	Buying-Prices	Selling-Prices
Cup(PP)	1 - 11	2.5 -16
Bottle (Clear PET)	1 – 5.5	1.5 – 8
Color PET	0.5 – 4.5	1 - 7.5

Table 5. Prices at End-product Industries [6]

Raw Material	Buying-Prices (thousand Rp/kg)
Pellet virgin *(per November 2008)*	10
PET clear- *scraps*	4.5
PET clear - bottle	3 – 3.5
PET colour - bottle	2.5

Luck in engaging to recycling business, especially plastic recycling business is felt strongly especially by plastic grinding business players or large collectors with fix relations with industries that use their products as raw materials or end product industries. The range of gains or profit usually earned by large collectors is more than Rp. 10,000,000 per month. For large collectors with dual roles as raw material making industries and small end product manufacturing industries, this figure could reach as high as Rp. 30,000,000 per month. Monthly gross revenues or routine turnover of each plastic recycling business players based on previous research [4] and direct interviews with a large collector, pelletizing industry and end products manufacturing industry [6] are shown on Fig. 2.

Figure 2. Average Monthly Omzet of Recycling Business in 2008



[Source of data: Ref. 4 and 6]

The magnitude of monthly turnover, especially for large collectors and recycled product manufacturing industries, depends on the quantities of sales and purchases of its corresponding used items. Large collector with dual roles as raw materials making industries and recycled products manufacturing industries such as Mr. Baedowy [6], the owner of the Majestic Buana Group (MBG) in Bekasi City – West Java, expressed their strong interests with recycling business due to their incredible profits potentials. According to him, daily net profit from plastic bottle flake (PET) business could reach at least Rp. 500 a kilogram of plastic wastes and if it is supported by the capacity of milling machines of 1 tonne of plastic wastes a day, then the minimum Rp.500,000/day profit or Rp. 15,000,000/month net profits would be guaranteed.

3-5. Plastic Recycling Association [6]

Based on interviews with Mr. Baedowy, it is known that there is a Plastic Recycling Association of Indonesia, led by himself. Currently, this association has more than 40 member organizations all over Indonesia. This association serves as a network through partnership programs and businesses building programs with the Majestic Buana Group (MBG). The association members (hereinafter would be referred as "partners") are bonded through selling-buying written contracts, that they should use the MBG-owned machineries for the procurements and acquisitions of the end product of plastic waste milling.

The rights and obligations stipulated under the contracts between the MBG and its partners are as follows:

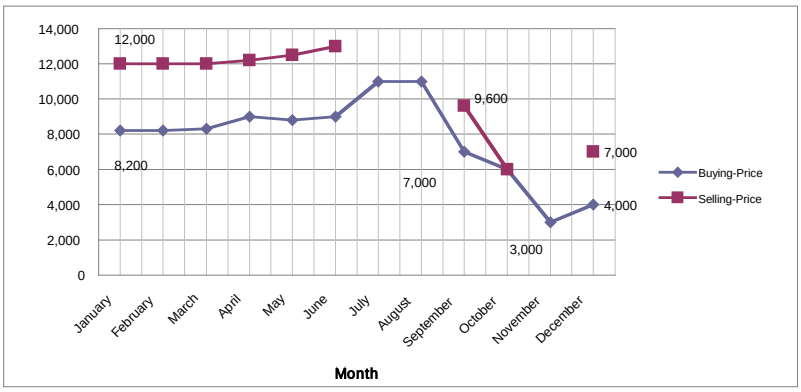
- The MBG as the center of the association is required to train and develop its partners so that the latter can ultimately have the abilities to produce their own plastic products independently;
- Th MBG is required to absorb the entire products of PET flake from its partners as long as these products meet the MBG predetermined standards. i.e, they should be in dry conditions and pass quality control tests procedure. This quality control procedure aimed to maintain the product homogeneity against any pollutant, such as rubber bracelet and ties;
- Every partner is allowed to sell its plastic flake products to third parties as long as it sent prior notice to the MBG;
- Every 20^{th} day of each month, partners are required to propose PET selling price listings based on the needs and conditions of market as observed by the partners to the MBG, so that the latter will be aware of the problems faced by its partners and take proper actions accordingly, and that nobody will be hurt;
- The acquisition price of the MBG from its partners should be determined every 25^{th} day of each month and should apply from the first day until the end day of the following month, and should be re-evaluated every 25^{th} day of each month;

- Payments from the MBG to its partner should be executed through the agreed upon inter bank transfer procedures, the maximum delay payment from the MBG is one working day from the date of the relevant items received; and
- Partners should deposit Rp.10,000,000 cash to the MBG as a guarantee against any possible breach of contracts, such as that partner sells their products to the third parties without prior notices. Should the signing of selling and buying contracts have lapsed until two-year periods with no breach of contracts, these money guarantee would be reimbursed by the MBG.

3-6. Plastic Prices Fluctuation

The study in 2008 [4] found that there was a flux in the buying and selling prices of PP from January until November 2008 as depicted in Figure 3. Based on the information gathered from several main collectors in Bandung City, it was seen that there were increases in PP plastic prices at the collectors level during the beginning through mid year of 2008 and reached their optimum level at July – August 2008 period. Entering September through November 2008 period, the purchase prices at collector level decreased significantly to more or less 50% of their beginning year's position. This decrease percentage was obtained by comparing the begriming year's price position relative to the lowest prices occurred during the period. It seemed that the main cause of this price decline was global economic condition. By January 2008 through June 2008, collector level price rose to Rp.13,000 per kg PP flake available. No collector level price data available for July – August 2008 period, because during that period the collectors were not selling PP flake available to industries. The similar conditions were observed once again in November, when the collectors preferred to build their inventory stocks, rather than to sell them with lower process, awaiting the prices to be rebounded.

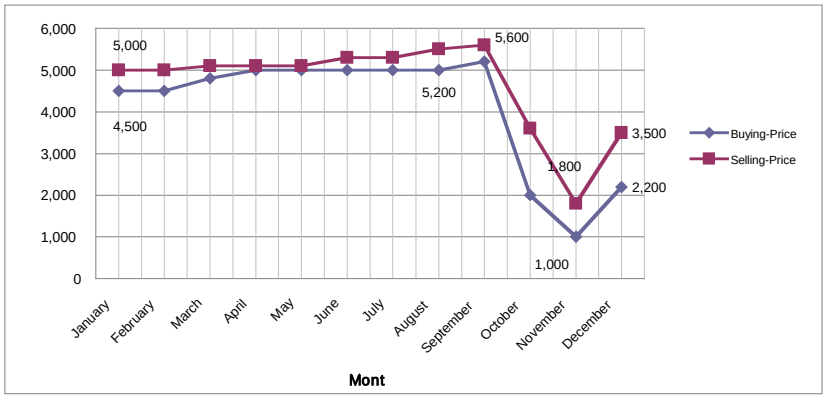
Figure 3. Fluctuation of Selling-buying Prices of PP in 2008



[Source: Ref. 4]

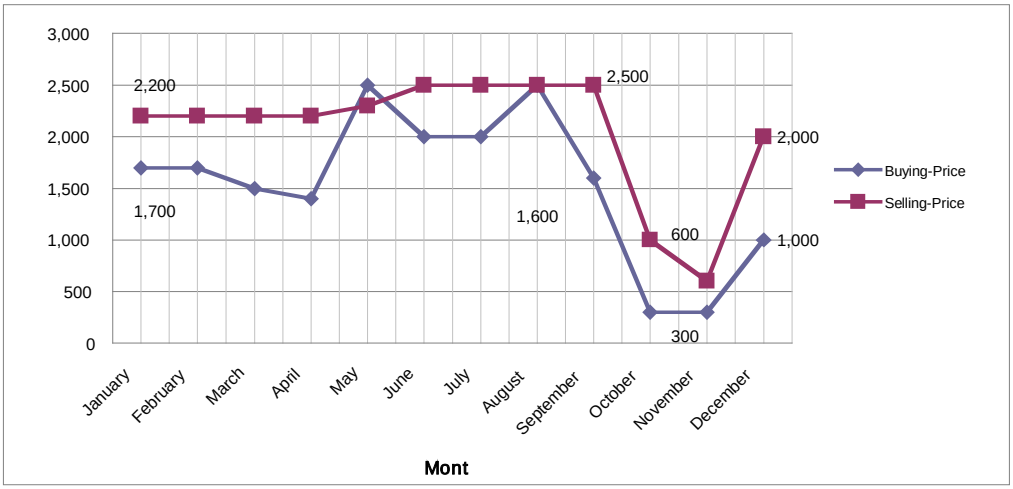
The similar conditions were also observed for packaged mineral waters, the source of transparent and colored PET wastes. Figure 4 depicts the fluctuation of transparent PET prices and Figure 5 depicts that of colored PET.

Figure 4. Fluctuation of Transparent PET Buying Prices in 2008



[Source: Ref. 4]

Figure 5. Fluctuation of Colored PET Buying Prices in 2008



[Source: Ref. 4]

The buying prices of transparent PET declined up to 78% from its beginning year position, while the selling price declined up to 64% in November 2008. The highest PT prices were achieved in September 2008 to Rp 5,600 level for selling prices and Rp. 5,200 for buying prices. A significant declines in selling and buying prices occurred from October to November 2008.

Colored PET experienced over 82% buying prices decline, and 73% selling price decline. The most significant decline in colored PET buying prices occurred in September 2008 to Rp. 2,500 level, and further declined to Rp. 300 level. The most significant decline in colored PET selling prices occurred in September 2008 to Rp. 2,500 level and further declined to Rp. 600 level.

Based on information from the same collector, price is normally fluctuated in a certain period. But 2008 price decline was the most significant one. The main factor causing this very significant price decline was the stress of global economic crisis. The prices changes have occurred especially for bottle PET during 2001-2009 periods (Table 6).

Table 6. Fluctuation of Used PET Plastic During the Last Nine Years [5]

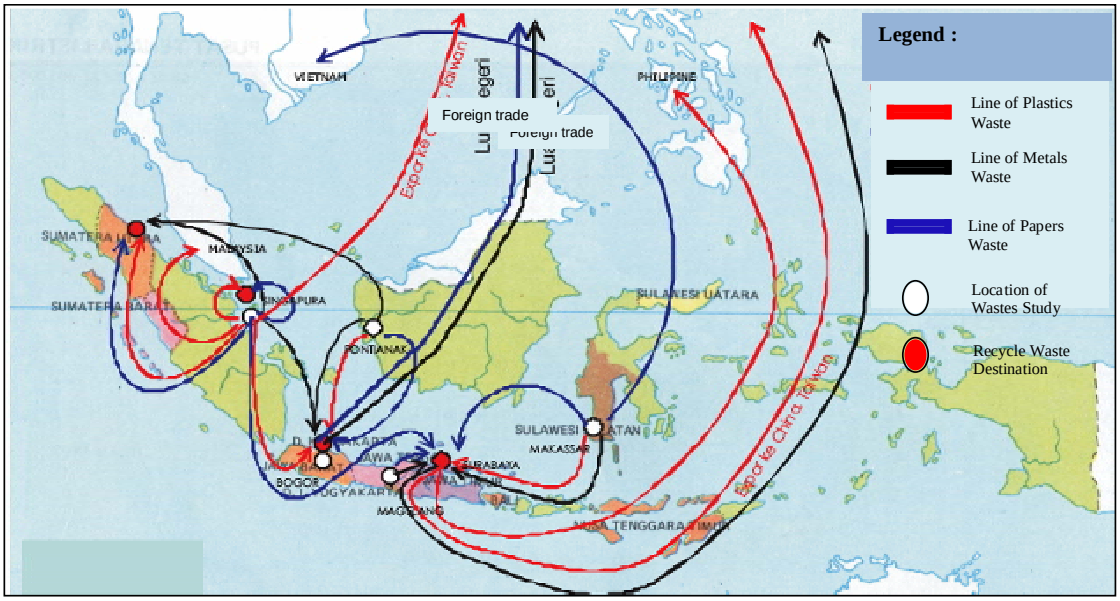
Year	Raw Material (Bottles) Rp/Kg	Scraps Product Rp/Kg
2001	1,500	3,100
2002	1,300	2,700
2003	1,000	2,300
2004	1,500	3,100
2005	2,500	5,000
2006	2,800	5,600
2007	3,000	5,000
2008	5,500	7,800
Januari 2009	2,000	4,000
Februari 2009	2,200	4,500

It was known that the decline for the used plastic price and scraps sales in 2008 were affected by the decline in the world's oil prices. This condition has made small scavengers and collectors, who have no strong network, bankrupt. Although, they have abundant stocks but they could not sell their stocks. The recycling products manufacturing industries have exploited these conditions by playing the price games. Any industries that offer lower prices would need to "surrender" if the collectors or raw materials manufacturing industries could maintain the prices at the level commensurate with the prices of the corresponding "virgin" products. It could be said that the most dominant players that determine the prices are large collectors, who have milling machines and pelletizing machines with good, homogenous products qualities. The recycling product manufacturing industries, however, have some role in determining the prices at collector level or pellet manufacturing industries level because these industries have tonne/day or tonne/week production targets. Nevertheless, changes in market selling and buying prices are greatly affected by global economic conditions, i.e., world's oil prices changes have their effects on production costs and transportation expenses.

3-7. Waste Recycling Routes

Based on data gathered from the Ministry of Environment of Indonesia (MEI) [7], the map of waste recycling in Indonesia is shown Figure 6. This map of recycling routes is constructed based on the findings of the survey among waste recycling business players that have been collected by the MEI's study from five cities which include Batam, Bogor, Magelang, Makassar and Pontianak.

Figure 6. Map of Used Material Route to Export

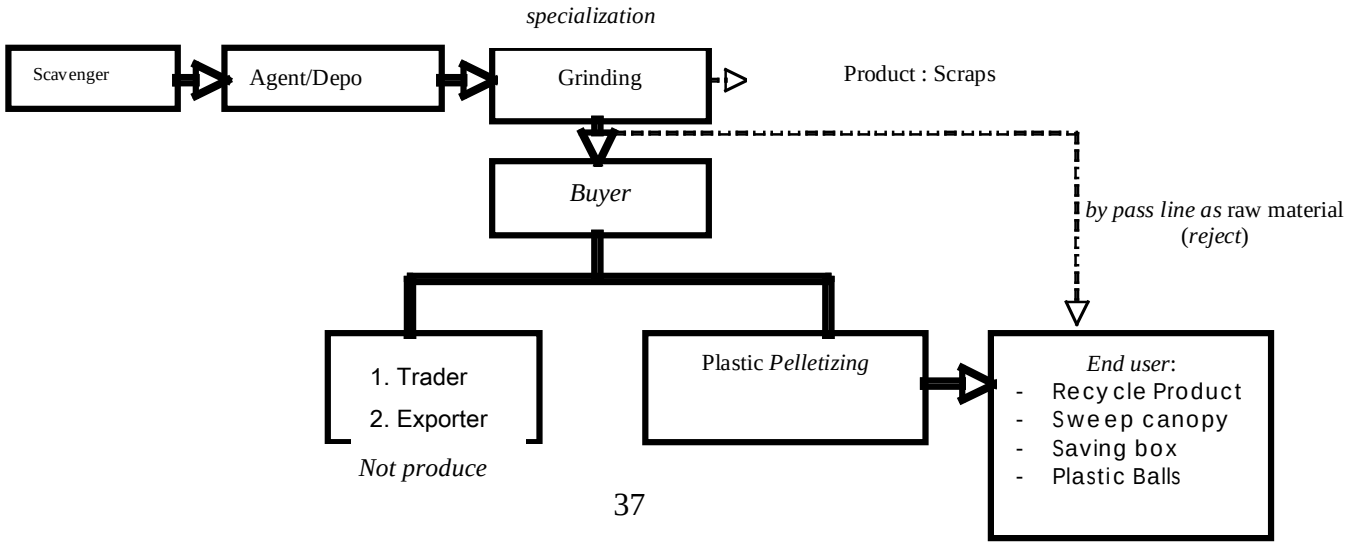


[Source: Ref. 7]

Waste recycling factories in Indonesia as the ultimate players in waste recycling business do not only manufacture finished goods, but also intermediate products (raw materials) such as papers, plastic flake or granules and scrapped irons. Bekasi City and its surrounding cities such as Cibitung and Cikarang are widely known as the area of finished goods, intermediate products and raw material exporters, although their top priority is domestic markets.

According to the MEI (2007), the PET bottles recycling factories and other factories manufacture pellet plastic products to be processed further into finished goods (plastic made appliances). Some part of these plastic flakes and pellets are exported to other countries like Singapore, Taiwan, China, Malaysia and Philippines, though most of their products are used for domestic industrial purposes. Figure 7 shows the traveling routes of domestic plastic wastes until they reach their final destinations, showing the routes that involve recycling business players [6].

Figure 7. Traveling Routes of Plastic Wastes Recycling

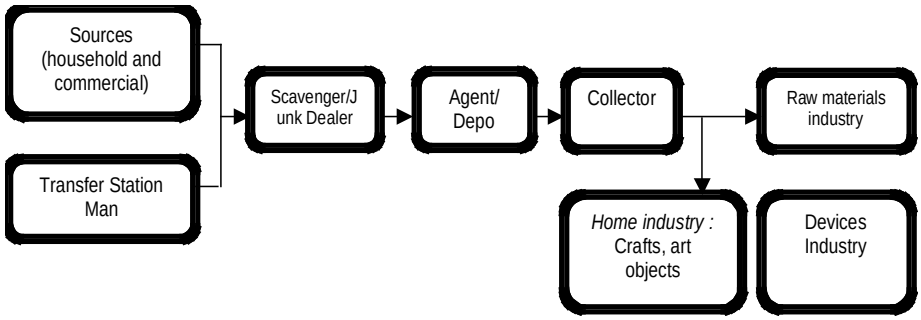


[Source: Ref. 6]

The capacity of plastic waste-based recycling business in Indonesia in managing their business is evidenced by the very existence of plastic recycling organizations like the MBG. They are able to maintain the quality of their products and good business relationships, thus their PET scraps products are able to enter into the international markets.

Generally speaking, other wastes that have their specific potentials to be recycled and enjoyed public popularities other than plastics are papers and metals. The paper- and metal-based waste traveling paths based on 2008's report [7] do not significantly differ from plastic-based waste. However, it seems, that these paper- and metal-based waste recycling businesses have not yet been accommodated in an association or partnership program such as the case of plastic-based waste recycling business. Figures 8 and 9 illustrate the paths of metal- and paper-based waste travels based on the data and results/findings of the previous researches [7, 9].

Figure 8. Paths of Metal-based Travels



Based on a study in 2007 [9] on metal based-waste recycling, it was found out that any waste containing metal element would be discarded by their consumers. Metal compositions on each player varied according to their respective statuses and the sources of the items received. In general, there are three metals most frequently found in recycling activities at Bandung City: irons, zincs and aluminums.

The difference between purchasing and selling prices is also affected by the exact status of its respective recycling players. The main cause behinds this relationship is that the final prices of any metal-based waste is affected by its own quality. Large scavengers receive most of this waste from small waste scavengers, thus the items they received in most cases are dirtier than those items sold by the used products sellers. This is because the latter purchased his or her used items from households and institutional sources.

These wastes would be then transported by the scavengers or be separated in the temporary accumulation sites. In general, these scavengers only pre sorted the recyclable wastes they found. This metal would be then sold to collectors and large collectors. The

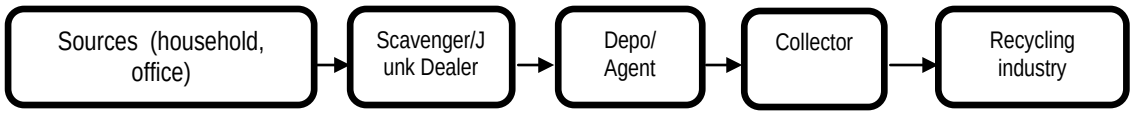
average purchase process for iron and zinc at scavengers through large collectors is Rp. 1,100/kg, while non-iron metal based waste is Rp. 15,425.

The consumers usage duration pertaining to materials required for recycling metal-based wastes will determine the quantities of copper-based waste available to be recycled. PT Copperindo Aneka Nusa is one of the producers of copper-based products such as; copper wires, copper bus bars, round copper and brass wares that made from waste cable and copper pipes provided by large collectors in Java, Sumatera and Bandung. The sales target of this company is the PLN (*Perusahaan Listrik Negara* - States own Electricity Utility Company) for the purposes of installations, cables, rounds, iron took-took, and home industry based artisans. The top prioritized sales targets are Surabaya and Jakarta cities.

The MEI's data reported [7] that iron- and metal-based scraps from Batam and Pontianak would be delivered to Medan and Jakarta, while the same scraps from Makassar and Magelang would be delivered to Surabaya. While there are exports of iron- and metal-based recycling products to countries like Taiwan and China, most of these products are absorbed by domestic steel factories. The Jabotabek Area (Jakarta, Bogor and Bekasi) areas and Surabaya play important roles in the network of recycling business because the majority of waste recycling activities occur in these areas.

The same data source also reported the facts that in exploiting paper-based recycling, these wastes are transported to Jakarta (From Batam, Pontianak and Bogor) and Surabaya (paper wastes from Batam, Magelang and Makassar). In addition to delivery to Surabaya, paper based-wastes from Magelang are delivered to Magelang's pulp- and papers-based factories. Though here are paper-based waste export, most of these paper-based wastes are absorbed domestically as raw materials of paper recycling. Figure 9 depicts the traveling paths of these wastes.

Figure 9. Paths of Paper Wastes



It should be known that the trading businesses of waste that has great potentials in recycling businesses are widely practiced through the internet, such as through *indonetwork.com* [10] or *Majalah Pengusaha* websites [11]. Companies or individuals that post their advertisements either as sellers or buyers are usually large collectors or recycling products manufacturing industries such as CV Megantara Utama in Bekasi City and U.D Sregep in Yogyakarta, that have been registered as large companies that search used papers in large quantities. The collectors offer the prices of the used newspapers at Rp. 1,200 – Rp. 1,300, and Rp. 1,500 for HVS paper. Its monthly sales for collected paper-based product could reach Rp. 20,000,000 as long as it has the ability to deliver 1,000 – 1,100 tonnes of paper based wastes.

3-8. Government-facilitated 3Rs Activities

The Government of Indonesia through the Ministry of Environment (MEI) and the Ministry of Public Work (PWI), facilitates 3Rs activities performed at several regions in

the country. The top priority in the implementation of these activities is the recycling of organic wastes into either individual or communal level composts.

The implementation of 3Rs activities by the MEI is administered in Singaparna (West Java Province), Jombang (East Java Province) and Magelang Cities (Central Java Province) from 2007 to 2009. This program separates the wastes, starting from its sources until the final processing on communal level composting sites [12]. The 3Rs activities implemented by the PWI was reported to be the best practice on addressing waste management issues in some regions of Indonesia in 2008. Similarly, the PWI administers the 3Rs implementation on waste separations at their sources and regions, and the composting of organic wastes. Some of the organic wastes management under composting strategy adopted by this institution is as follows [13]:

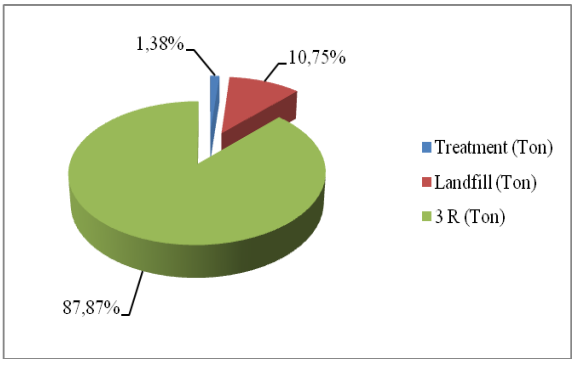
- integrated waste management at Sragen Regency (Central Java Province), Tangerang City (Banten), and a high school at SMUN 13 (North Jakarta);
- independent waste Management at Kampung Sukunan, Sleman (Yogyakarta Province);
- sub-neighborhood level waste management at Mampang Prapatan (Jakarta);
- compost production by CV Mitra Tani, Tasikmalaya (West Java Province);
- hotel waste management by PT Jimbaran Lestari (Bali Province);
- implementation of household waste management under Takakura method at Kampung Rungkut, Surabaya (East Java Province);
- paper wastes recycling by 'Bale Kertas', a handicraft group at Mataram (East Nusa Tenggara Province); and
- Household waste management at Monang Maning Residential Areas, Denpasar (Bali Province).

4. Hazardous Waste (HW) Recycling

4-1. HW Management in Indonesia

Most of HW waste in Indonesia as recorded by the MEI, originated from various industrial activities. For HW management activities, there are data on the quantities in terms of types and magnitudes of the hazardous waste that are managed, dumped, and processed under 3Rs principles during 2007 (Fig. 10). The most prevalent treatment for this type of waste was 3Rs-based management. The sector that produces the largest amounts of hazardous is mining industry sector.

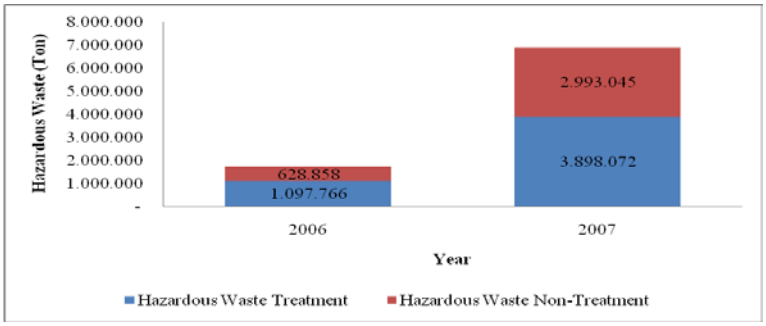
Figure 10. Hazardous Wastes Handling in 2007



[Source of data: Ref. 14]

In 2006-2007, the proportions of HW produced relative to the HW managed form linear trend. This means that any increase on HW produced entails an increase in the HW managed. The increasing generation of HW in 2007 compared to that in 2006 was mostly due to better coverage of statistical data in 2007. In 2006, the percentage of the managed hazardous was 64%, while in 2007 it was 57% [14]. Figure 11 shows the reports on managing HW during 2006-2007.

Figure 11. Hazardous Waste Handling in 2006 – 2007

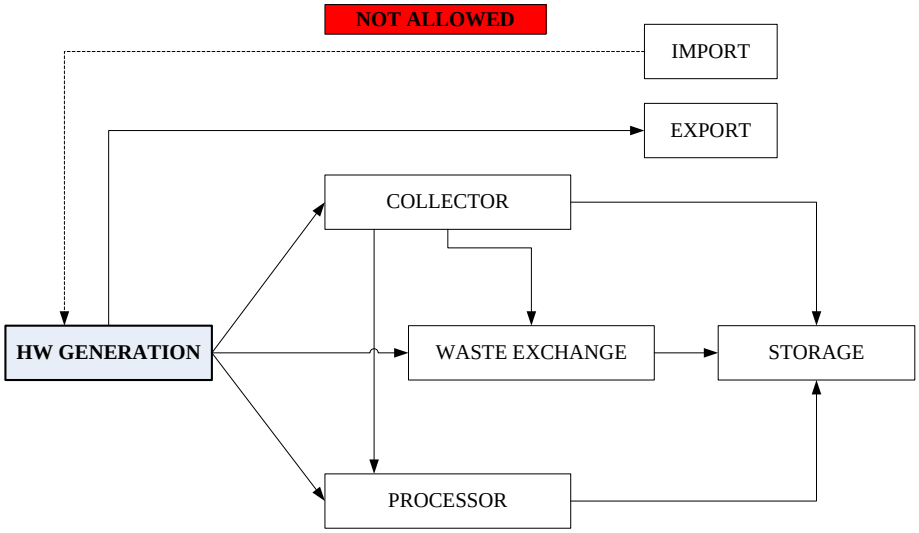


[Source of data: Ref. 14]

As explained in the beginning of this paper, the legal basis of the HW management in Indonesia is GR No. 18/1999 as amended by GR 85/1999, and its lower relevant regulations. At the very onset, these GRs on HW introduce the wastes minimization and recycling principles. These HW is one of the groups of wastes that has been specified in detailed through the law, GRs, and Ministry Regulations (MR). Other types of wastes that have been specified under Law No. 18/2008 are those waste originated from daily human activities. There is one type of waste in Indonesia that has not been yet specified by a regulation in Law order, i.e., any waste other than hazardous and not formally included as one of the municipal waste categories, such as sludge from biological waste water treatment plant from industrial activities.

HW management involves various players, from producers, collectors, transporters and processors. In addition, there are interrelationships among these hazardous wastes management players (Fig. 12). At the national level, HW management is based on “polluter pays principle” and “from cradle to grave” control system. Waste generators are required to handle the HW they generate, and the applicable regulations allow these generators to outsource these management activities from third-party. Every HW management activity is required to hold permit and recommendation from the MEI. For example, any activity that transports these wastes should be accompanied by a set of hazardous wastes documents (manifest). Through this permit mechanism, HW management activity is controlled and implemented well at the national level. Any hazardous waste that could not be processed domestically is allowed to be exported through a notification procedure. However, the importing of any hazardous waste is strictly prohibited.

Figure 12. Hazardous Wastes Management System in Indonesia



[Source: Ref. 14]

Measures that have been taken to promote corporate compliance in environmental management include the following: the implementation of PROPER (*Program Penilaian Peringkat Kerja Perusahaan dalam Lingkungan Hidup* – The Evaluation Program on Corporate Performance Rating on Living Environment). The regulation that serves as the legal basis for this PROPER activities is the Decree of the Minister of Environment No. 127/2002 [15]. Since 1995, Every year the Government of Indonesia evaluates the performances of companies/business activities in controlling pollution as specified by the Decree of the Minister of Environment 35A/7/1995 to control negative impacts over the environment. There are 5 ranks of business activity performance, i.e.:

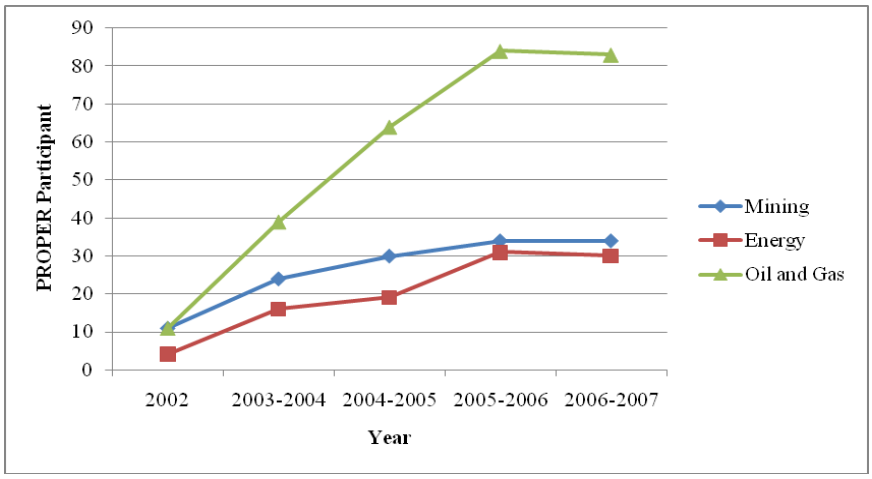
- Golden Rank: the business activity performs clean and/or zero emission production and very successful in its environmental management to the extent that it could serve as model for other businesses.
- Green Rank: the business activity performs successful environmental management efforts exceeding the requirements specified by the applicable law and regulations.
- Blue Rank: the business activity performs successful environmental management efforts in accordance with the requirements specified by applicable law and regulations.
- Red Rank: the business activity performs environmental management efforts but still has not achieved minimum requirements specified by applicable law and regulations.
- Black Rank: the business activity does not perform environmental or business management efforts o the extent that it generate negative impacts over the environment.

The business activity performance is assessed by the rate of its efforts in controlling negative environmental impacts, and the rate of its achievement in controlling these negative environmental impacts. That ranking designation will not formally impair the ongoing business activities. However, final rank obtained by a business activity will give image or impression to the general public about its environmental management efforts.

For mining, energy and oil-gas sectors, the indices of the PROPER program's success were observed through the increase of the numbers of the participating companies during 2002-2007 (Fig. 13). This manifested the improved awareness among hazardous wastes producers from these sectors of the environmental program. The participant of the PROPER program in 2006 from manufacturing and agro-industrial sectors was [14]:

- 38 participants from basic industries;
- 39 participant from chemical industries;
- 42 participant from multifarious specific industries;
- 79 participant from general industries
- 97 participants from agricultural industries; and
- 61 participant from forest products industries.

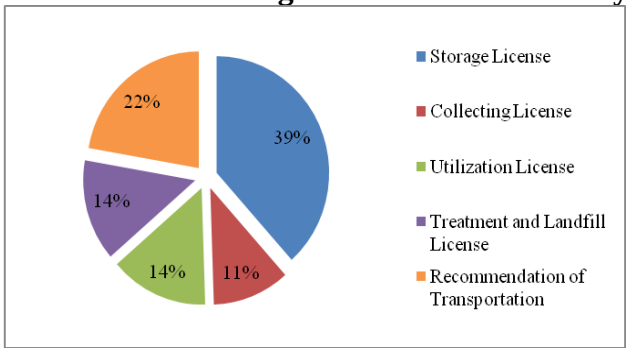
Figure 13. Increase of PROPER Program's Participants in 2002-2007 from Mining, Energy and Oil-Gas Sectors



[Source of data: Ref. 14]

Permits issued by the MEI for HW management purposes comprise of permits on storage, collection, usage, processing, landfill, and recommendations on hazardous wastes transports. The 2008 statistical data [16] shows the percentage of the different type of permits that have been issued by MEI for 1,200 HW management permits (Figure 14).

Figure 14. Hazardous Wastes Management Permits Issued by the MEI in 2008

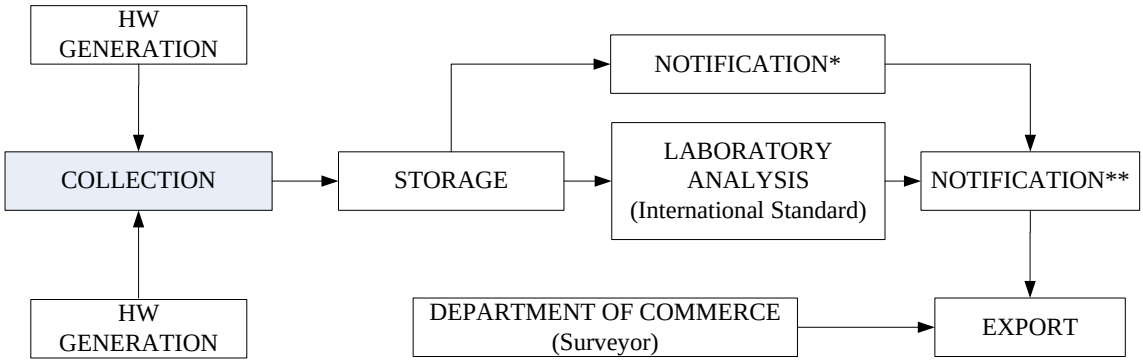


[Source data: Ref. 16]

Brief description of the MEI issued permits are as follows:

- Permit on storage by Local Government EPA, the authority to temporary store the hazardous wastes. It is issued to wastes generators before these wastes could be managed further. The maximum storage days are 90 calendar days;
- Permit on collection by Local Government EPA, the authority of a private institution to collect hazardous waste at various sources, that would be subsequently transported to any party that has actual ability to handle the related HW, and has the required permit to perform these activities.
- Permit on usage, a permit issued by the MEI to the recyclers. This permit covers notification permit to export the corresponding HW (Transboundary movement of hazardous wastes) in cooperation with the Department of Trade as surveyor. The procedures for HW export activities are illustrated on Figure 15, along with its detailed description.

Figure 15. Procedures of HW Export [17]



**Notification from ME from country of destination to MEI*
***Notification from MEI to the exporter*
Source: communication with an exporter

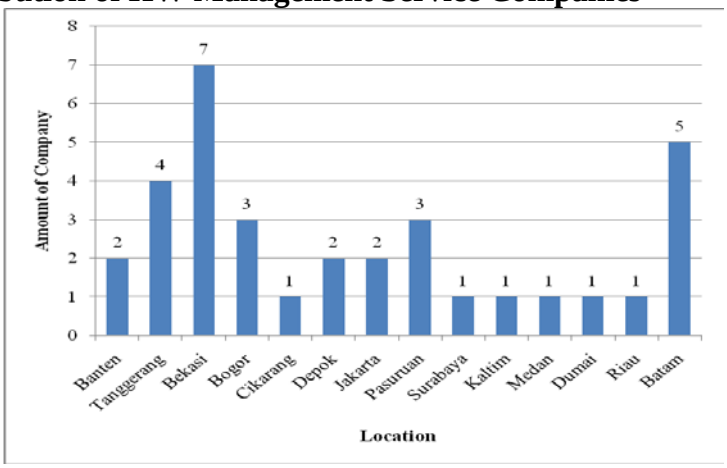
- The legally required limit of hazardous wastes storage is 90 calendar days; however, this time limit is frequently been exceeded;
- Contacts any purchaser listed in the Ministry of Environment from the country of destination as the party that would manage the hazardous wastes;
- Sends samples of hazardous wastes as required by the purchaser, especially for their compositions, usually accompanied by data on the results of internationally accredited laboratory checks; and
- Export notification by Ministry of Environment of Indonesia will be issued to the exporter after having received acceptance notification by Ministry of Environment of the country of destination that explicitly states its acceptance and ability to manage the incoming hazardous wastes.

- Permit on processing and landfill by the MEI, one of the processes done either individually or through outsourced party that allows to transform HW into fuels substitutes, or raw material substitutes. The recommendation stated that the relevant party shall have its independent laboratory to test the resulted products of these processes. For landfill, in addition to the outsourcing from Class 1 Landfill, there are some private companies that hold the required permit to perform on site landfill (Class II Landfill); and

- Transport recommendation, this cites that transportation activities should be planned and complied with any regulation issued by the Department of Transportation. The latter provides training facilities, especially for transport standard and procedures.

Generally, service companies that specialized in providing HW processing services as listed in the MEI are home based at Java islands, accounting for over 74% of the entire listed companies. Figure 16 shows the percentage distribution of these companies. Regulations on the procedures of HW permit for 2009 are being drafted.

Figure 16. Distribution of HW Management Service Companies



[Source of data: Ref. 16]

4-2. HW Management on the Implementation of 3R Principles

The use and recycling of hazardous wastes is regulated under Ministry Regulation No. 02/2008. These activities are allowed under special permit regulation but it should be accompanied with controlling and surveillance activities. Some of the indices of these surveillances activities are reductions of the environmental negative impacts over the corresponding hazardous wastes landfill areas and the natural resources savings directly associated with these uses as fuels and raw material substitutes. Table 7 shows the development of HW usage activities in Indonesia from 2001, and the types of HW uses that tend to be increasing from time to time.

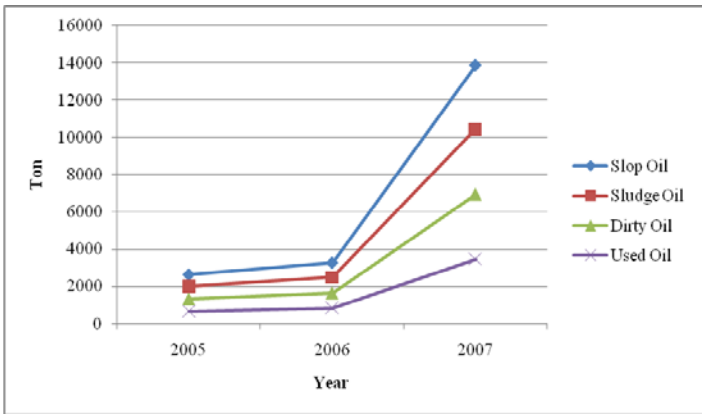
Table 7. Development of Hazardous Wastes Reuse in Indonesia *[15]*

2001/ 2002	Fly ash	Copper slag	MPB							
2003	Fly ash	Copper slag	MPB	$CuCl_2$ & $FeCl_2$	Solder dross	Used catalyst	Sludge Aluminum			
2004	Fly ash	Copper slag	MPB	$CuCl_2$ & $FeCl_2$	Solder dross	Used catalyst	Sludge Aluminum	Used Tire	RCC catalyst	Shoe factory waste

Figure 17 illustrates the increasing amount of HW used as fuels substitutes from greases and dirty oils wastes. For some types of hazardous wastes, such as fly ash, their

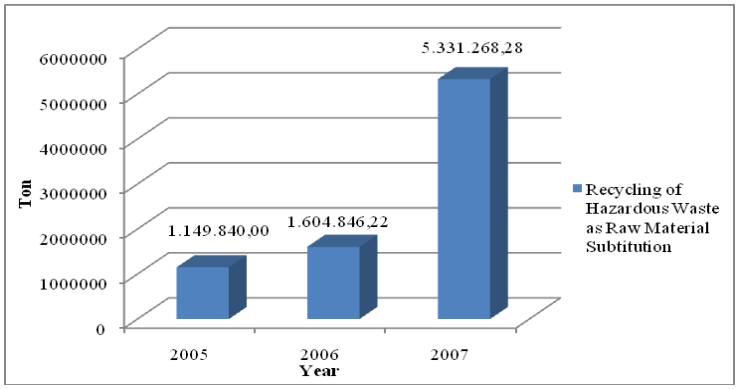
uses as raw material substitutes are predominantly significant. As shown in Figure 18, the usage values for 2005-2007 period were increasing.

Figure 17. Reuse of HW as Fuel Substitutes



[Source of data: Ref. 14]

Figure 18. Recycling of HW as Raw Material Substitutes



[Source of data: Ref. 14]

5. Used Electronic-Electrical Equipments (3Es) in Indonesia

5-1. General pattern of Used 3Es

During the last ten years, the quantities of electronic goods such as televisions, refrigerators, computers and mobile phones in Indonesia were drastically increasing that led to the increase in the amount of used electronic goods- and electronic based-wastes. It is estimated that the rate of this increase is between 3%-5% range of more than threefold than general wastes. UNEP data showed that the production of electronic wastes in the world in 2005 was over 20-50 millions tonnes a year. Some components of used electronic or electric devices or their related wastes (e-waste), require a management that should meet certain requirements, due to their hazardous nature [18].

The distribution of electronic industries in Indonesia includes the following [19]:

- Banten, Jakarta, and West Java Provinces;
- Batam, Riau Island Province;
- East Java Province;

- Kudus, Central Java Province;
- Yogyakarta Special Regions;
- North Sumatera Province; among others.

Until this time, there is no proper definition of e-waste. The entire applicable law and regulation in Indonesia have not specifically defined the e-waste. However, we could interpret an e-waste as any electronic or electric object that does not have any use or function or does not be needed anymore, and that can be disposed either as a whole or some part of it [19]. We should distinguish between e-waste and used electronic or electric objects because the latter still have sufficiently high economic values. Thus, not all of e-wastes should be treated as hazardous wastes. However, there are no clear criteria or definitions that distinguish between e-waste and used electronic and electric objects.

From the results of the survey of electronic equipments uses among households levels in Bandung Area in 2006 [20], it was found that some of the 3Es will extend their routes through relational ties, such as: being transferred to their families, their friends, or donated to the others or whoever in need them. These routes will flow almost without end and form chain-relations, from the higher income level parties to the lower income ones, and probably from higher income regions (such as urban regions) to the lower income communities (rural regions) and similar chain-relations. The role of refurbishment/repair is very important in extending the end-of-life of any electronic equipment, generally through replacements of out-of-order electronic components by the new ones or through cannibal system, i.e., through the uses that are still functioning electronic parts of the unusable electronic equipment. These mechanisms are the answer of the question: why the electronic equipments are rarely found within the urban waste chain. It is due to the fact that there will always the ways to recover them instantly by those who were at works in informal sectors.

The final chain of any object route is waste. As in another waste component in Indonesia, the role of the informal sectors is very important in maintaining e-waste as objects having high selling values. The value position of e-waste is considered higher than used plastic or papers. It's position is more less same with the position of iron/metal waste (scraps), with their higher selling values. There is some conviction that these practices were prevailing in other major cities in Indonesia. It is rarely found used nails or used electrical cables or similar object in the final disposals, except for several component such as used batteries. Most of these wastes have been recovered before they arrival at the landfill. A survey through interviewed of 105 scavengers working at Bandung final disposal at Sarimukti (receiving about 750 ton of municipal waste per day) shows these practices [20].

In Indonesia, there are at least 100 millions of cellular phones, and some of their contents are copper and other materials that belong to HW category. If the used or disposed electronic or electric appliances would be recycled, an environmental friendly recycling procedure is required. Should they have to be disposed into the environment, the disposal should be done in accordance with the applicable law and regulations to avoid environmental pollution and threats against health. A zero e-waste might be hard to achieve. But, the one thing that should be done is to have a better control over electronic wastes [21]

E-waste comprises hazardous components and non-hazardous ones. In Indonesia, all e-wastes have been included under hazardous waste category. Their origins are from household activities and office activities. Some of e-waste producing objects are: AC, refrigerators, TV, computers, notebooks, cell phones, washing machines, radio/tapes, VCD/DVD players, among others [21].

Under applicable regulations, there are three main sources of e-wastes in Indonesia: electronic industry, post-consumption and illegal import, including smuggling. The main cause of the many difficulties faced in gathering electronic-based data is due to collection through illegal trafficking and informal sector that varied widely in Indonesian' regions [22].

5-2. Waste Transboudary's Applicable Policies in Indonesia

Some regulations that have been implemented on hazardous wastes imports in Indonesia are as follows [21]:

- Importing of all types of hazardous wastes is prohibited. For accumulator wastes, this regulation is effectively applicable since September 2002;
- Since September 1997, a ban has been passed to avoid the granting of permit for all types of business activities that use imported hazardous wastes as their raw materials;
- Since January 1998, the importing of hazardous wastes, including accumulators, is strictly prohibited, including those from any country listed on Appendix VII of the Basel Convention;
- Accumulator imports are permitted only from any developing country as a member of the Basel Convention and other country through bilateral, multilateral and regional cooperation;
- The Decree of the Ministry of Industry and Trade No. 756/MPP/Kep/11/2002 on used machines and its accessories import. These items are defined as any machinery or equipment that could be reused or renovated and not in their scrap forms.
- Used machineries and its related equipments imports could be performed only by the user that has already has a license to perform production process or any other usage over the licensed facilities;
- This decree of the Ministry of Trade and Industry strictly prohibits import of used electronic and electric objects such as refrigerators, AC, electric fan, washing machines, TV and video projectors, telephone set (including its wireless versions) PCB and CRT monitors; and the following table [Table 8] lists the used electronic and electric objects that could not be imported based on the Regulation of the Ministry of Industry and Trade No. 39/M-DAG/PER/12/2005

Table 8. Prohibited Import of Used Electronics and Electric Good *[21]*

No.	HS Number	Description
1	8418	Refrigerator, freezer and its component, electrical and others, compressor exclude for AC in HS Number 84.15
2	8419	Machinery, plant or laboratory equipment, heated electrically or not (exclude burner, oven, and others in 85.14) to process material with temperature difference such as heating, cooking, grilling, destilation, rectification, sterilisation, pasteurisation, condensation, cooling, exclude machinery or installation for household appliances; instant water heater and with storage, non electric
3	8419.11	Instant water heater with gas
4	8422	Dish washer
5	8465	Machinery for processing of PCB
6	8471	Automatic data processing machine and its units, magnetic and optical reader, machinery for data writer on coded data media and its processor, not described or not include in other HS Number
7	8475	Machinery for assembling of electrical lamp, tube or valve or flash lamp, in glass envelope, machine for making glass or glass product by heating
8	8501	Electric motor and generator (exclude electric power plant)
9	8514	Burner and electric oven for industry or laboratory for heating material process by induction or dielectric loss
10	8517	Electric apparatus for telephone or telegraph
11	8525	Transmission, receiver, recorder and reproduction apparatus, television camera, recorder camera and video, camera digital
12	8525.20	Wireless LAN, internet mobile phone, internet video conference, other mobile phone
13	8539	Light bulb or tubular lamp, include sealed beam and ultra violet and infra red lamp

Until the present time, there are no data on the used electronic and electric objects or e-waste trans-boundary movements either to or from foreign countries. Recently, the increasingly prevalent practices of used electronic appliances illegal trafficking made the situations even worst. Several sources of used electronic and electric appliances and e-wastes circulation in Indonesia areas follows [21]:

- Import through false import documents or on behalf of other names;
- Illegal imports, by inserting used electronic and electric appliances to legally imported virgin objects.
- Donation activities on behalf of certain governmental institutions or privately owned enterprises.

Based on inspections by the Government of Indonesia, it showed that the practice of used electronic and electric appliances still prevailed in Indonesia. For examples, waste from electronic and electric appliances that contain or have been contaminated by hazardous materials (such as PCB) could be imported to Indonesia in illegal ways by declaring on the related import document that these items were mixed metal materials. Small islands usually served as the targeted markets of illegally imported e-wastes to Indonesia.

In 2005, there were 50 units of 40-feet long containers of waste entered to Indonesia. The import documents stated that the entire items in these containers was new office equipments and mixed metal scraps. The intention of this import was to process these mixed metal scraps to be subsequently re-exported. The governmental inspection officers found contaminated components, i.e., there were some items that contain PCBs, categorized as hazardous wastes. This case indicates that while we have had definite

regulations on hazardous wastes import, the possibility of breaching these regulations in Indonesia still exists.

The Department of Trade through its Ministerial Decree No. 229/MPP/Kep/07/07 on the General Rules on Import Affairs explicitly specifies that the only objects that would be allowed to be imported to Indonesia are new, virgin objects. The Department strictly prohibits imports of used electronic appliances, such as, televisions, refrigerators, computers, irons, and washing machines, among others. Used electronic appliances and electronic wastes entered in several regions of Indonesia either illegally or "legally." The latter refers to any import that uses illegal import permit documents. Batam island, as special or bonded areas in Indonesia, has some freedom in importing any kinds of items, except for any items that would be prohibited to be imported. Therefore, these virgin items would be lower in their prices, and its imported used counterparts even have lowest prices. The majority of these imported used items are imported from Singapore and Malaysia.

Batam is one of the final destinations of electronic wastes and used items. Most of used electronic goods currently traded in Batam are imported, especially from Singapore. Some of the types are PCB rejects, coils, cables, plastic scraps, solders, glass tubes, televisions frames and TV monitors. Its trading centers are located at several trading centers such as Batam Center, Aviari Market, Sengkuang Market, Batu Aji Street, and some malls. These used electronic goods are strongly needed in Batam due to its large market share, even they are generally have shorter lifespan, with more expensive services components than new ones.

For Eastern Indonesia regions, the distribution of electronic wastes from Singapore and Malaysia since 1980s has been centered at Pare-Pare (South Celebes) and Wakatobi Islands (Southeast Celebes). By their types, 10% of their total items come from Singapore (the main hub of used electronic items) and 5% from Malaysia.

These illegally imported used electronic items were generally reconditioned and sold as secondhand electronic and electric appliances. In 2006, Indonesian Police Officers successfully caught the efforts to illegally imported used PCs that have been reported on their import document as brand new PCs. They confiscated about 1,000 units of used PCs and hundreds of other PC components. These items came from Singapore and entered Indonesia through Pekanbaru to be subsequently traded inter insularly [20]. Generally, many advanced countries dispose their electronic and electric wastes to developing countries or the least developed countries under the masquerade of donation activities or human aids for natural disaster victims or educational purposes, despite the facts that the useful life of these items such as PCs are very short or even nil.

On a wider scales, the long routes of the 3Es as we have been discussed above, i.e. on their route to reach individuals or communities or regions having lower economic incomes, could rise a concern that resulted environmental impacts would be hidden problems or delayed problems and spreading problems to another regions with probably have more limited economic and educational capabilities than the original sources. These would be applied on regional and international scales as well, thorough uncontrollable transboundary 3Es and e-waste. Moreover, there is higher possibility that the components of a new-3E coming to Indonesia (formally or illegally) are assembled by e-waste inside. We should establish protection control and effort, including through regulations, and

more importantly through fair and responsible and serious rules of the games, due to the fact that the potential victims of their impacts are the part of the community having lower capacities. Any policy or considerations in economic growth should take these problems into account.

6. Conclusion

This paper reviews current situation of waste recycling in Indonesia from the legal aspect and the flows of municipal solid waste, hazardous waste and e-waste. It was noted that the role of informal sectors as waste collectors and recyclers are important. The dependence upon final disposal and the difficulties in finding disposal sites have made the 3Rs concept are interesting to be considered. Although related regulations have been established, additional efforts should be implemented for proper management of waste and further utilization of recyclable waste. The existence of Solid Waste Management Act 18/2008 and other related regulations is expected to bring major changes in solid waste management in Indonesia. However, all parties should realize that the existence of regulations and laws does not always mean that there exists a strict enforcement of such rules. We need a strong political will to respect these regulations.

Acknowledgement

The authors would like to express their appreciation to Mr. Lucy Lie Junpi, Ms Lina A. Sulistiowati and Ms Dessy Ristiana for their contribution to prepare this manuscript.

References

1. Damanhuri, Enri, 2001. “Hazardous Waste Management in Indonesia,” Keynote speech at the Pacific Basin Conference on Hazardous Waste, Okayama, Japan, December 5 - 7

2. Damanhuri, Enri, 2008. “International Network Development in SWM in Indonesia,” SWAPI-meeting, Yokohama, Japan, Nov 7 – 9.

3. Damanhuri, Enri, 2008. “A Future Prospect of Municipal Solid Waste Management in Indonesia”, Keynote Lecture in the 5th Asian-Pacific Landfill Symposium, Sapporo, Japan, October 22 – 24

4. Padmi, T. et al., 2008. *”Kajian Daur Ulang Limbah Pengemas Air di Bandung”* (Study on Mineral Water Packaging in Bandung), LAPI ITB, Bandung

5. Baedowy, M. 2007. *”Kaya Berkat Sampah Plastik”* (Become Rich with Plastic Waste), *Chic Magazine, Edition of 31st Januari*. Bekasi: Majestic Buana Group.

6. Baedowy, M. 2009. Personal communication.

7. Deputy of Domestic Waste Pollution, MEI - Japan Internasional Cooperation Agency (JICA). 2008. ”Panduan Praktis Pemilahan Sampah” (Practical Guidence in Waste Sorting). August, Jakarta.

8. Santosa, PT. Matahari Jaya,, 2009. Cimahi City (West Java Province). Personal communication.

9. Kusumadewi, N.,2007. *"Analisis Aliran Sampah Logam Di Kota Bandung dalam Kegiatan Daur Ulang,"* (Metal Waste Flow Analysis in Bandung City and Recycling Activity), Department of Environmental Engineering ITB

10. IndoNETWORK: http://www.indonetwork.co.id/limbah (accessed 23rd February 2009).

11. Pengusaha: http://www.majalahpengusaha.com/peluang (accessed 23rd February 2009).

12. Deputy of Domestic Waste Pollution Control - State Ministry of Environment. 2007. *"Rencana Pengelolaan Sampah Perkotaan Tahun 2007 – 2009"* (Municipal Solid Waste Management Planning Year 2007-2009). Jakarta.

13. Directorat of Sanitation Development - Directorat General of Human Settlment - Ministry of Public Work. 2008.*"Kisah Sukses Pengelolaan Persampahan di Berbagai Wilayah Indonesia"* (Success Story of Waste Management in Several Areas in Indonesia). Oktober, Jakarta.

14. Deputy of Hazardous Material and Waste Management - State Ministry of Environment. 2007. "Annual Report of 2007". Jakarta

15. State Ministry of Environment. 2005. "Pemanfaatan Limbah B3" (Reuse and Recycling of HW). Jakarta.

16. State Ministry of Environment and JICA. 2008. "Studi Pengumpulan Data Statistik Limbah B3" (Study of Statistical Data Collection of HW). September, Jakarta.

17. Anonymous – an exporter of hazardous waste. 2009. Personal communication.

18. Detik-i-Net: http://www.detikinet.com (accessed 28th December 2008)

19. Haruki, Agustina. 2007. "Identification of e-Waste and Second-hand e-Products In Indonesia". Regional Workshop on Prevention of Illegal Transboundary Movement for Hazardous Waste in Asia, BCRC, Beijing, China, March 28 - 29

20. Damanhuri, Enri and Sukandar. 2006. "Preliminary Identification of e-Waste Flows in Indonesia and its Hazard Characteristics, 3rd NIES Workshop on E-Waste, Tsukuba, Japan Nov 15 – 16

21. Haruki, Agustina, 2007. "Management of Transboundary Movement and Recycling of Wastes in Indonesia". Regional Workshop on Prevention of Illegal Transboundary Movement for Hazardous Waste in Asia, BCRC, Beijing, China, March 28 - 29

Chapter 3: Recycling Systems in Malaysia: Case studies on Industrial Waste

Ahmad Fariz MOHAMED
Institute for The Environment and Development (LESTARI)
Universiti Kebangsaan Malaysia

I. Introduction

Manufacturing industry has played an important role for Malaysia's economic growth for the past four decades. This sector's contribution to Malaysia's overall Gross Domestic Product (GDP) has grown from 13.9% in 1970 to 31.9% in 2000(Malaysia 2006). Malaysia continues to maintain the manufacturing industry as the main sector for the country's development process and economic growth. This sector also provides services and products that changed the way of life and the quality of life for Malaysia people and its ecosystem. However, the rapid change in industrialization generates huge amount of wastes and this signaled the need for a new way of looking at solid waste management. The existing management system in Malaysia for industrial wastes gives priority to end-of-pipe approach and promotes the use of treatment and disposal method, rather than recovery. But this approach has been found creating many environmental problems such as illegal dumping, the need for new land for the establishment of disposal facilities, among others. There are many cases of illegal dumping of industrial waste which have a significant impact to human and environment health. Table 1 listed important incidents of illegal dumping of industrial waste in Malaysia, creating social and environmental issues.

The current management method needs to be changed towards a more sustainable management regime, as there are now technology and demand to recover the waste for other uses. For example, Japan emphasizes recovery of waste and by-products through implementation of strategies to replace material resources with technology development (Erkman, 2002). Pongrácz and Pohjola (2004) also emphasize the importance of resource conservation towards achieving more sustainable waste practice. Wastes recovery allows industry to reduce manufacturing process costs, increases efficiency of resources utilization, promotes environmental friendly product design, and most importantly it reduces negative impacts on the environment and human health. Recovery of industrial waste creates alternative resources and promotes costs efficiency (Jo Dewulf and Langenhove 2005). Furthermore Ui (1984), Hirayama et.al., (1987) and Gotoh, (1987) have identified the importance of industrial waste recovery in Japan, that with proper recovery system implemented by the government and businesses, this mechanism has led towards a sustainable industrial waste management in the country.

Table 1: Reported Incidents of Hazardous Wastes Illegal Disposals in Malaysia

Year	Location	Amount and Type of Wastes	Company
1989	Pantai Remis, Perak	1,500 tonnes of toxic wastes	Unknown
1993	Bukit Merah, Perak	Radioactive wastes	Asian Rare Earth Plant, Mitsubishi Kasei.
1995	Pangkor Island, Perak	Forty-one drums of highly toxic potassium cyanide	Unknown

1995	Penang Island	28 drums of trichiorofluoromethane	unknown
2001	Ulu Tiram, Johor	1,000 tonnes of metal ashes	Foreign-based smelting company
2003	Ijok, Selangor	500 drums of paint sludge and glue.	Unknown

Source: Recycling Point Dot Com (2003), The Star, (2003)

The Malaysia government recognized the importance of industrial waste recovery. Through the Ministry of Natural Resources and the Environment and the Ministry of Housing and Local Government, waste recovery has been identified as an important environmental and economic activity. Awareness and education programs on waste recovery have been implemented with targeted audience of many levels of stakeholders, which include schools, businesses, industries and the community. Industrial waste recovery for the past decade has been identified as an emerging economic activity. Recovery of industrial solid wastes, such as plastic, steel, paper and glass has become an important support industry. This is in line with the increasing demand for limited natural resource, hence waste recovery provides alternative resources and reduces dependency on natural resource such as oil for plastic.

II. Manufacturing Industry Development in Malaysia

Industrialization in Malaysia could be traced since middle of the 19th century. Early industrial economy was of a special type based on the commercial production of industrial raw materials. The focus of Malaysian industry during that period until the independence was on producing rubber, tin, timber and palm oil. Rubber and tin industry gained an enormous boosts in value due to 1949 to 1953 Korean War (Brookfield 1994). Well planned and structured industrialization process in Malaysia started after the independence in 1957. This was stated in the First Malaya Plan1956 to 1960, which had driven the initial industrialization process in Malaysia. It also created more manufacturing industries which focused on tin, rubber and palm oil industry.

During Second Malaya Plan 1961 to 1965, industrial activity had been diversified to reduce dependency on agricultural and natural resources based industry. Manufacturing industry producing products such as textiles, food and building materials were established to enhance economic growth of Malaya. Modern manufacturing industry development in Malaysia which began during the early 1960s, started with industries processing primary commodity especially rubber, small-scale food processing and handicrafts.

However in mid-1960's, diversification of new industry was promoted and these include textiles, beverages, wood and furniture as well as printing and publication. These industries continued to dominate the 1970's industrial sector in Malaysia. As technology and human resource developed during 1980s, industrial sector expanded to include higher technology industry for food and beverages, furniture, textiles, plastic and petroleum based products. Since 1990s until now, more advance and high technology industries have been established and this includes electrical and electronics, engineering, information, communication and telecommunication. Four key factors driving manufacturing industrial development in Malaysia were identified, and these include the following:

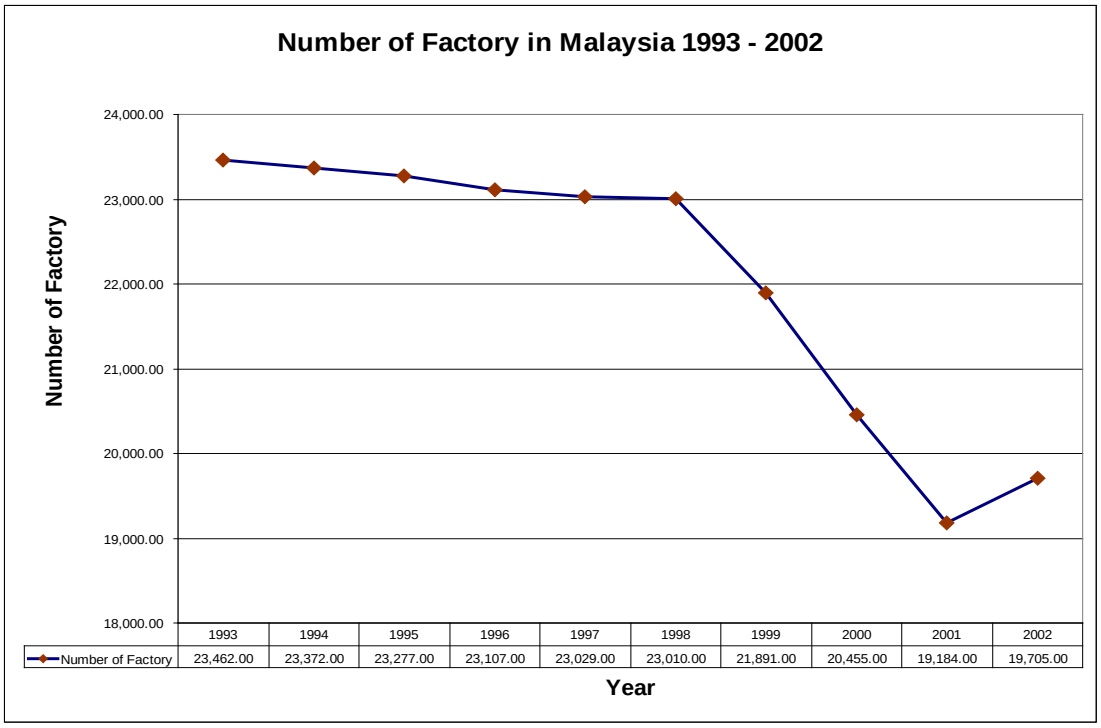
- policies and strategies – Industrial Master Plan (IMP) 1986 – 1995, Second Industrial Master Plan (IMP2) 1996 – 2005, Third Industrial Master Plan (IMP3) 2006 – 2020, First to Ninth Malaysia Plan (MP1 – MP9) 1966 - 2010, First Outline Perspective Plan (OPP1) 1971– 1990, Second Outline Perspective Plan (OPP2) 1991–2000 , Third Outline Perspective Plan (OPP3), 2001-2010;
- infrastructure – roads, ports, rail tracks, airports, energy, water, industrial parks;
- support services – financial agencies, transport services; and
- skilled labour – university, polytechnics, colleges, training institute.

Value added industry has been promoted through introduction of Pioneer Industries Ordinance 1958. As a result, manufacturing industry increased its GDP contribution from 8% in 1957 to 12% in 1969. The increase of GDP was also accelerated with the establishment of the Federal Industry Development Authority in 1966 and with the introduction of the Investment Incentives Acts 1968, which offered a variety of tax holidays for pioneer industry (Rasiah 2002; Samad 1994). In 1970, the manufacturing sector contributed 13.9% to GDP in Malaysia. With the introduction of Free Trade Zones in 1971, growth in the manufacturing sector accelerated. In 1990, it had doubled to 27.0%. The share of manufactured product in export by value was 11.1% in 1970 but by 1990, this had soared to 58.9% (Taylor and Ward 1994). This dramatic transformation which occurred over a period of two decades was the result of the policies and strategy implementation as outline above. Thus, industrial sector has fulfilled its responsibility to achieve the objectives of the New Economic Policy, which include an increased employment, increased income and restructured the society.

Malaysia envisages being an industrialized country by 2020. To achieve this vision, the government has identified industrial sector as the key sector. Therefore, manufacturing industry will play a vital role in enhancing Malaysian economic growth. The Industrial Master Plan (IMP) (1986 to 1995) and its revision, the Second Industrial Master Plan (IMP2) (1996 to 2005) commissioned in March 1995, guide the development of the manufacturing industry in Malaysia. According to The Ministry of International Trade and Industry, during the IMP period from 1985 to 1995, the manufacturing outputs expanded significantly, surpassing most of the targets set (Malaysia 1997). This sector performed very well, and in 1996, it contributed RM 45.2 billion (put the equivalent in US$) to the GDP, about 34.6% of the overall GDP, with 13.3% growth over the previous year value (Malaysia 1996).

However, during the economic recession from 1997 to 1998, the manufacturing growth reduced by 13.4%. The performance of manufacturing industry had been geared up and its growth increased 13.5% in year 1999 and 21% in year 2000. This had led to GDP contribution of 33.4% in year 2000 (Malaysia, 2001). As of 2002, there were more than 19,000 factories in all state (Figure 1).

Figure 1: Number of Factory in Malaysia from 1993 to 2002



Source: Department of Statistics, Malaysia 2005a, 2005b.

Manufacturing industry had continued as a key sector in economic growth for Malaysia. Its GDP contribution increased by 5.2% in 2005, and by 4.6% in 2007 (baseline year 2000) (EPU 2009). Future development of manufacturing sector will be guided by the Third Industrial Master Plan (IMP 3) (2006 – 2020), where it has a target to ensure growth of GDP at 5.6 % annually and to contribute 28.5% to GDP in 2020.

III. Industrial Waste Management in Malaysia

Industrial waste management in Malaysia has become an important activity that goes along with industrialization process. During 1950's after independence, environmental problems were ignored by industries in Malaysia and most of incidents were not taken care of. In 1960s, diluting and dispersing of pollutants were practiced by industries. However, when environmental problems became national issues, industries treated wastes by end-of-pipe solutions controlled by pollution standard established by Malaysian Government. In 1980s, waste minimization was emphasized using cleaner technology and production of cleaner products. The use of advanced technology, increased awareness campaigns among consumers and industries, and the application of approaches focusing on ecosystem sustainability were introduced and practiced in the country. These include application of eco-efficiency for resources, eco-design for cleaner products and use of life cycle assessment as a tool for eco-sustainability. Coming into 21st century, waste recovery for alternative resources was promoted to reduce dependency on natural resources and to ensure sustainability of industries.

This current practice in managing industrial wastes in Malaysia still maintains "end of pipe" approach, focusing on treatment and disposals. This system promotes

illegal dumping and increased incidents of environmental degradation. Therefore, legislative framework in managing industrial waste has been established to ensure that industrial waste will be managed better. However, there is no working industrial waste definition available in Malaysia. Hence, in managing industrial wastes, it is conducted based on sectoral legislative structure, which focuses on type and generator of wastes. Industrial wastes in Malaysia are categorized into two types as follows:

a) Solid waste, which includes wastes generated by manufacturing process, or activity or by product; and
b) Toxic and hazardous wastes, which include any matter prescribed to be scheduled waste, or any matter whether in a solid, semi-solid or liquid form, or in the form of gas or vapour which is emitted, discharged or deposited in the environment in such volume, composition or manner as to cause pollution.

The solid wastes generated by industries were non-hazardous waste. Its management falls under the jurisdiction of Local Government Act 1976, Street, Drainage and Building Act 1974, and Town and Country Planning Act. Specific definition of industrial solid waste is not available under the Local Government Act 1976. However, under the local government by laws, Rahmah (2001) stated that solid wastes were categorized as follows:

i. Waste materials, which include any valuable or non-valuable by products, reject or spoilt products produce in manufacturing process;
ii. Trade waste, which includes any waste materials generated by trade activity;
iii. Industrial waste, which includes any waste materials generated from industrial activity;
iv. Park waste, which includes leaves, grass, tree branches or soil from parks or from house or building compound or from land; and
v. Household waste, which includes all types of waste generated from household.

Solid wastes generated by industries fall under these categories, hence the Local Government Act 1976 and local governments by laws were able to manage industrial solid wastes. The key stakeholders in managing solid waste generated by industry were the Ministry of Housing and Local Governments, Department of Local Government, local governments, solid wastes contractors companies, industry and solid wastes recyclers. The government agencies lead by the Ministry of Housing and Local Government provide legislative and guideline in managing industrial waste. This includes how to recycle, treat and disposed the industrial solid wastes. The Local Government Act 1976 provide important legislative and technical requirements as a guide for the local government, waste generator, waste operator, waste recycler and disposal sites operator in conducting daily operation in managing industrial wastes.

However with increasing industrial waste generation and complexity in managing solid wastes, the Malaysian government established the Department of National Solid Waste Management (DNSWM) in 2007, to ensure effective and sustainability in managing solid waste which includes industrial solid waste. DNSWM role was to implement the National Strategic Plan for Solid Waste Management (Nazri,). The policy implementation was supported by legislative tool, the Solid Waste and Public Cleansing Management Act 2007. DNSWM will implement sustainable waste management based on waste management hierarchy which prioritize waste reduction through 3R,

intermediate treatment and final disposal as well as emphasis on environmental protection and public health (Abdul Nasir, 2007).

Industrial solid waste has different way of handling compare to household. The volume of these waste are bigger and its characteristics is different. In Klang Valley, collection of industrial solid wastes has been privatized. Companies such as Alam Flora Sdn Bhd have been awarded concession to manage the wastes. There was valued industrial waste which has been recovered and recycled, however those with no value were sent to landfill or dumpsite. Scrap iron, steel, aluminium, carton boxes, paper, plastics and glass were valuable solid wastes generated by industries. These wastes were recovered and there are factories in Malaysia that recycled these materials to produce other products. Meriahtek Sdn Bhd, for example is a recycling company recover electronic waste which includes ferrous and non-ferrous metal, plastic, glass and industrial oil. Paper, plastic and aluminium can recycling have been very successful in Malaysia. The recycling centre located in 148 local governments in Malaysia, shows that these three wastes were the most popular item recycled by public and industries. In supporting recovery activity in Malaysia, as of 2008, there are 119 licensed solid waste recyclers in Malaysia.

Other materials recycling scheme is in the process of research and development and hoping that it will start off soon. Solid waste recovery through recycling program has been the main agenda in Malaysia. Ministry of Housing and Local Government spearheaded this program and promote recycling by household, institutions, factories and people. Later this activity was taken over by the Department of National Solid Waste Management. Priority will be given for reduction and recovery of controlled solid waste. This includes prescribed recycling and separation of recyclables as well as implementing the take back system and deposit refund system. The recycling activity conducted with support from community associations, schools, institutions, private company, recycling associations, recyclers and non-government associations.

Similar to industrial solid waste management, managing industrial toxic and hazardous waste are also done through specific legislative structure. At present, the Environmental Quality Act (EQA) 1974, the Local Government Act 1976, and the Customs and Excise Act are the three laws playing a major role in managing industrial toxic and hazardous waste better. The EQA specifically addresses the toxic and hazardous wastes under its subsidiary legislations as follows:

- Environmental Quality (Prescribed Premises) (Crude Palm Oil), 1977.
- Environmental Quality (Prescribed Premises) (Raw Natural Rubber), 1978.
- Environment Quality (Sewage and Industrial Effluent), 1979.
- Environmental Quality (Scheduled Wastes), Regulation 1989.
- Environmental Quality (Prescribed Premises) (Scheduled Wastes Treatment and Disposals Facilities), Order 1989.

These regulations fall under the jurisdiction of the Department of Environment (DOE) Malaysia. Specifically, toxic and hazardous waste are directly managed under the Environmental Quality (Scheduled Wastes), Regulation 1989. Others have a significant role in managing toxic and hazardous waste through its activities and characteristics. The EQA defined toxic and hazardous wastes as scheduled waste rather than using the toxic and hazardous waste term. In the regulation, scheduled wastes refer to only 58 categories and 107 types of wastes listed in the First Schedule of the regulation. However, toxic and

hazardous wastes definition goes beyond of this waste. Therefore, scheduled wastes stated in the Environmental Quality (Scheduled Wastes) Regulation 1989 will be also referred to as toxic and hazardous wastes.

In addition to EQA 1974, there are other specific acts which have equal responsibility, these includes Poisons Ordinance, Dangerous Drugs Ordinance, Explosive Ordinance, Occupational Safety and Health Act, Radioactive Substances Ordinance and Pesticides Act (Jamaluddin 1993). These legislatives are under the responsibility of other agencies with different responsibilities. At least four different agencies and legislations that deal with aspects of toxic and hazardous wastes management (Table 2).

Table 2: Industrial Waste Management Stakeholders and Legislative Instruments in Malaysia

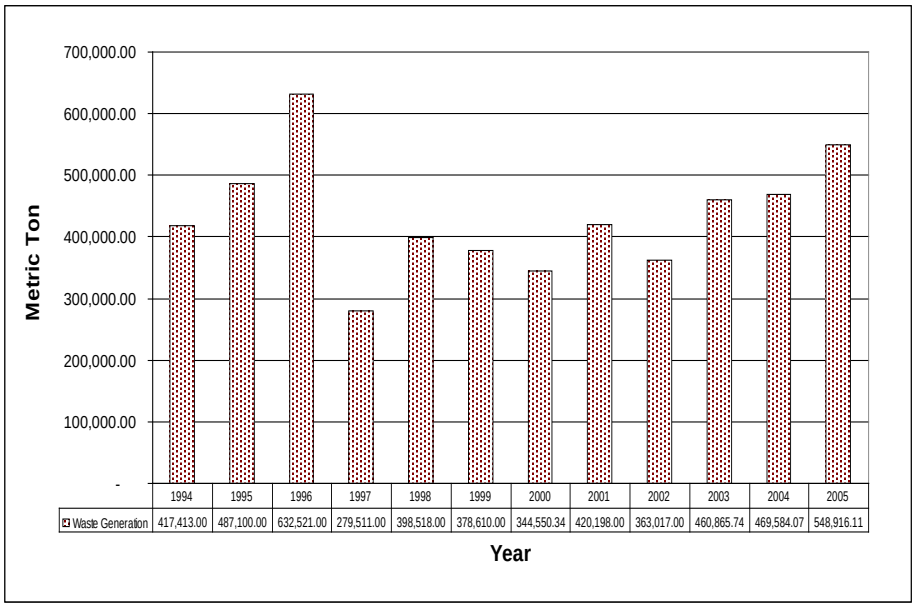
Agency	Legislations	Scope
Ministry of Natural Resources and Environment Department of Environment (DoE) Enforcement measures are shared with: Ministry of Trade and Industry Ministry of Agriculture with the support of Department of Agriculture Department of Fisheries	Environmental Quality Act 1974 (From this Act, there are at least five Regulations that can be linked directly and nine indirectly)	Prevention, abatement and control of pollution Regulation to recover wastes and resources under EQA 1974 Part IV Regulations provided for industrial activities such as: ● Crude Palm Oil ● Raw Natural Rubber ● Scheduled Wastes, Treatment and Disposal Facilities ● Marine Pollution Use of controlled substances in soap, synthetic and other cleaning agents
Ministry of Housing and Local Government Department of National Solid Waste Management Department of Local Government	Solid Waste Management and Public Cleansing Act 2007. Local Government Act 1976 and local governments' bylaws. Street, Drainage and Building Act, 1974 and Town and Country Planning Act.	The National Strategic Plan for Solid Waste Management emphasizes waste recovery.
Ministry of Agriculture	Pesticides Act 1974	Control of pesticides for use, sale and import of, and production
Ministry of Home Affairs Department of Royal Customs and Excise	Control of Supplies Act 1961 Environmental Quality Act 1974 Pesticides Act 1974	Control and rationing of controlled articles / items Control of import and export
Ministry of Human Resource Development	Occupational Safety and Health	Health, safety and welfare of workers

III-1. Industrial Waste Generation Trends

A high volume of industrial waste generated daily demands good management system and effective support of infrastructure. With a limited number of landfill to handle increasing volume of wastes, there is a need to recover wastes for other uses. Wastes such as plastic, steel, wood, glass and paper generated during manufacturing or packaging have been found having significant values. Industries now have developed a system and design to recover their products by recycling or reuse (ADEME 1999). Depletion of natural resources has created critical problems to manufacturing industry. For example, with increasing price of petroleum, the price of plastic pellet for manufacturing industry increases many folds. Hence, recovery of plastic waste help industry to obtain alternative resources and at the same time it would reduce their manufacturing cost. High volume of waste generated by Malaysian industries for the past three decades has provided enough supply of wastes for recovery purposes (Azni et.al. 2004). This will help to change the focus from end-of-pipe approach to sustainable use of wastes. Industrial wastes recovery also will minimize the vulnerability of ecosystems as it will reduce requirements for new landfills since most of the landfills in Malaysia have reached their maximum capacity.

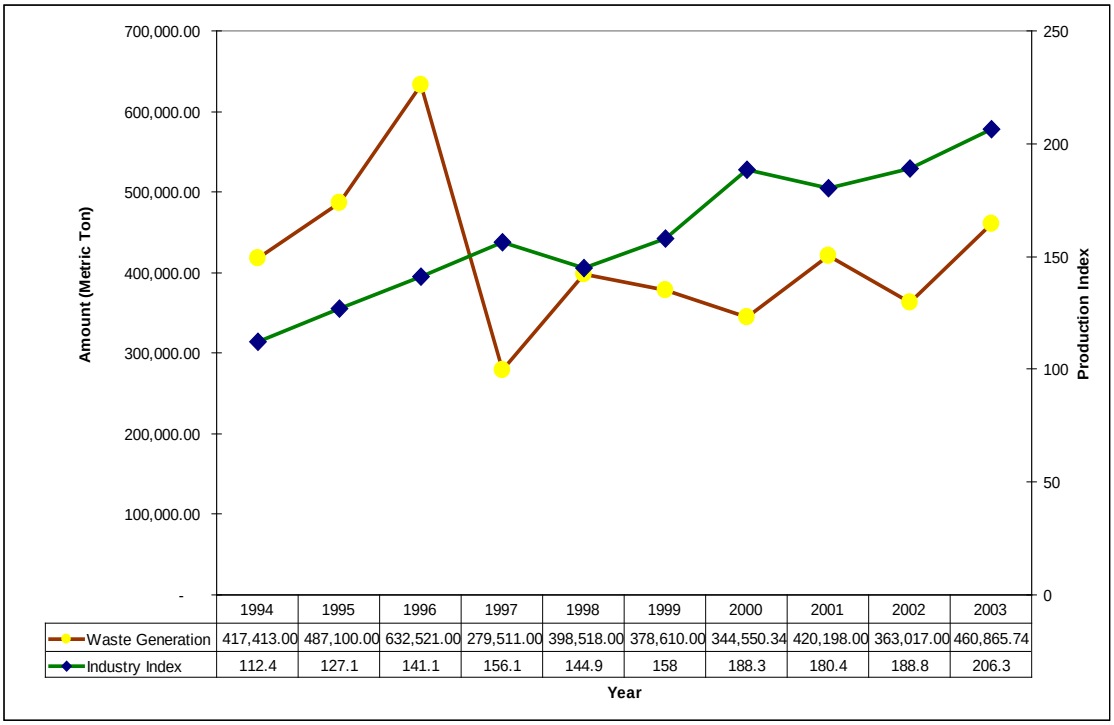
The amount of solid waste generated in Malaysia increased from 16,200 tonnes per day in 2001 to 19,100 tonnes in 2005 or an average of 0.8 kilogram per capita per day (Malaysia 2006). Nasir et. al. (1998) found that industries in Malaysia contributed 30% of solid wastes and that wastes generation increased at about 4% annually. It was estimated that the industrial solid wastes generation has increased from 7,721.58 ton/day in 1994 to 11,519.24 ton/day in 2005. Hazardous waste generation varied from 1994 to 2005, 417,413 metric tons of waste generated in 1994 and increased to 632,521 metric tons in 1996, later reduced to 548,916 metric tons in 2005 (DoE 1995, 2003, 2006). The trend of hazardous wastes generation is shown in Figure 2. There are significant relationship between industrial waste generation and industrial production. Figure 3 and 4 shows the significant relationship, where waste generation increased with increased of industry production index and manufacturing industry index.

Figure 2: Toxic and Hazardous Waste Generation Malaysia 1994 - 2005



Source: DoE 1995, 2003, 2006.

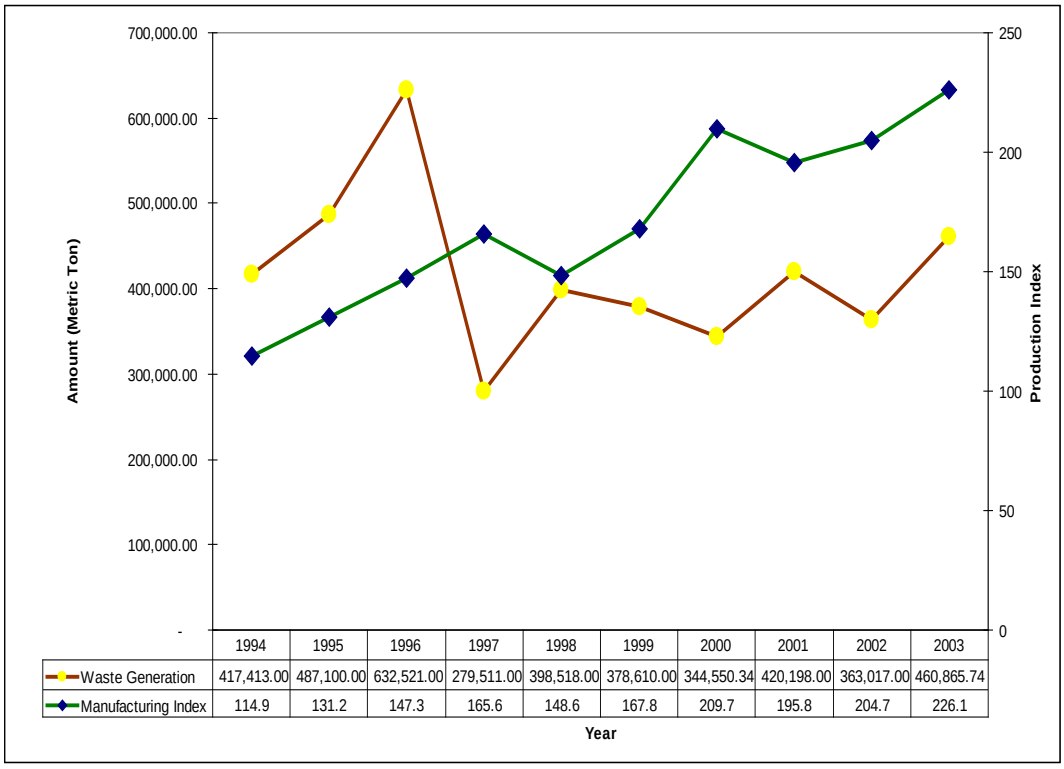
Figure 3: Relation between Industry Production Index and Waste Generation



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Waste Generation	417,413.00	487,100.00	632,521.00	279,511.00	398,518.00	378,610.00	344,550.34	420,198.00	363,017.00	460,865.74
Industry Index	112.4	127.1	141.1	156.1	144.9	158	188.3	180.4	188.8	206.3

Source: Department of Statistics, Malaysia 2005b; DoE 2000, 2004

Figure 4: Relation Between Manufacturing Production Index with Waste Generation.



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Waste Generation	417,413.00	487,100.00	632,521.00	279,511.00	398,518.00	378,610.00	344,550.34	420,198.00	363,017.00	460,865.74
Manufacturing Index	114.9	131.2	147.3	165.6	148.6	167.8	209.7	195.8	204.7	226.1

Source: Department of Statistics, Malaysia 2005b; DoE 2000, 2004

III-2. The Need for Resource Recovery from Waste

Malaysia has accepted many sustainable development principles. Malaysia is also a signatory to multi-lateral agreements which includes Basel Convention, Rotterdam Convention and Kyoto Protocol. These agreements require industries in Malaysia to practice sustainable concept which includes resource efficiency and sustainable waste management. Malaysians are also aware about the importance of practicing sustainable waste management since key markets for Malaysian products such as European, North America, Japan, Australia and New Zealand emphasize sustainable practice. Moreover, in the future ASEAN Free Trade Agreement, it will implement the need for cleaner production emphasizing sustainable waste management. With increasing amount of industrial waste generated, there are opportunities to increase waste recovery as resource. This will help to reduce industrial dependency on natural resources. The practice for waste recovery was supported by Malaysian government through policy, legislation and pro-active role which include economic mechanism.

The trend of industrial wastes generation shows that there is sufficient amount for recovery. In 2008, there are 119 industrial solid wastes recyclers licensed by the Ministry of Housing and Local Government Malaysia (Table 3). For hazardous wastes, 122 recyclers were licensed by the Department of Environment Malaysia in 2006 to recover the wastes (Table 4). Table 5 shows the types of industrial solid wastes recovered by the recyclers. Nasir et.al. (1998) estimated that 70% of total industrial solid wastes generated were recovered. The estimated amount of industrial solid wastes recovered was about 5,405.1 ton/day in 1994, and increased to 8,063.47 ton/day in 2005.

Table 3: Number of Solid Waste Recycler Licensed by Ministry of Housing and Local Government for 2008

State	Number of Recycler
Johor	11
Negeri Sembilan	4
Perak	1
Sarawak	10
Selangor	44
Kedah	1
Melaka	2
Pahang	1
Pulau Pinang	20
Terengganu	1
Federal Territory Kuala Lumpur	22
Kelantan	2
Total	119

Table 4: Number of Hazardous Waste Recycler Licensed by DoE in Malaysia for 2006

State	Number of Recycler	Type of Waste Recycled in Each State
Johor	18	33
Negeri Sembilan	2	4
Perak	11	17
Sarawak	2	2
Selangor	32	44
Kedah	10	3
Melaka	9	9
Pahang	3	12
Pulau Pinang	31	15
Terengganu	1	6
Federal Territory Kuala Lumpur	3	1
Total	122	

Source: Data of DoE

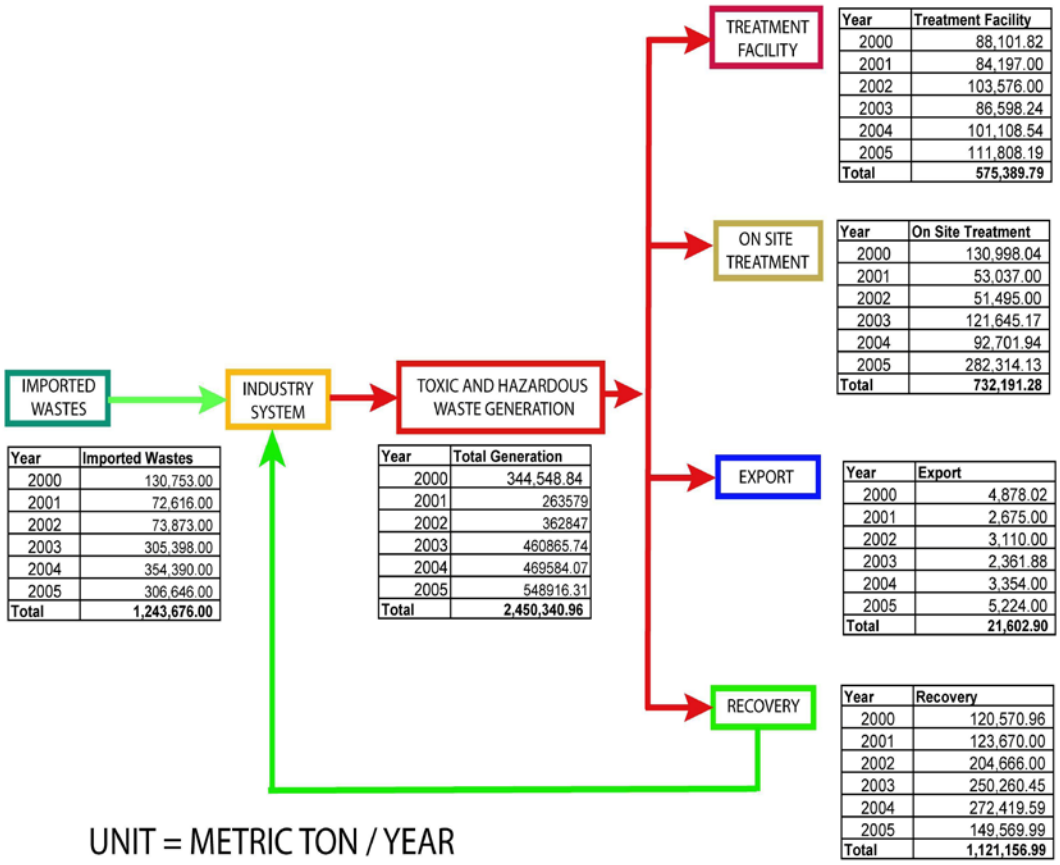
Table 5: Example of Recoverable Materials

Type of Manufacturing Industry	Type of Waste
Electrical and Electronics	Paper, box, glass, scrap metal, wood, plastic, sludge, domestic waste, copper, aluminum, cast iron and steel
Mineral, concrete and ceramic	paper, carton box, glass, wood, plastic, concrete waste, metal and drum
Metal engineering	metal (copper, iron, aluminum) paper, carton box, glass, wood and plastic
Food and Beverages	paper, carton box and plastic
Pharmaceuticals	paper, carton box and glass
Paper, packaging and labeling	plastic and paper shreds
Chemicals	paper, carton box, glass, woods, plastic, metal (zinc, nickel, chromate, alodine)
Rubber	Paper, carton box, plastic, hydroxide metal sludge, vulcanized rubber waste, jute
Textiles	textile waste

Approximately 45.75% of hazardous wastes have been recovered from total wastes generation from 2000 to 2005 (Figure 5). Increasing trend of wastes recovery was observed, where recovery increased from 35% in 2000 to 58% in 2004. However, the amount of waste recovered was reduced to 27% in 2005. This significant amount of waste recovered from hazardous waste showed the potential for these wastes to be recovered and to generate economic benefits. Many types of these wastes were being traded both in the local and international markets and the demand for these wastes is increasing (Malaysia 2006). Within the period of 2000 to 2005, 1.12 million metric ton of industrial

hazardous waste has been recovered. Using estimated value of RM 4,000 (USD 1081) per metric ton, estimated value of industrial hazardous waste recovery within this period is RM 4.48 billion (USD 1.21 billion) The total value of industrial hazardous waste recovery cycle between year 2000 to 2005 in Malaysia which includes importation of this waste is estimated at RM 9.46 billion (USD 2.56 billion) (3.4 million metric ton).

Figure 5: Flow of Industrial Hazardous Waste Stream from 2000 to 2005



Year	Imported Wastes
2000	130,753.00
2001	72,616.00
2002	73,873.00
2003	305,398.00
2004	354,390.00
2005	306,646.00
Total	1,243,676.00

Year	Total Generation
2000	344,548.84
2001	263579
2002	362847
2003	460865.74
2004	469584.07
2005	548916.31
Total	2,450,340.96

Year	Treatment Facility
2000	88,101.82
2001	84,197.00
2002	103,576.00
2003	86,598.24
2004	101,108.54
2005	111,808.19
Total	575,389.79

Year	On Site Treatment
2000	130,998.04
2001	53,037.00
2002	51,495.00
2003	121,645.17
2004	92,701.94
2005	282,314.13
Total	732,191.28

Year	Export
2000	4,878.02
2001	2,675.00
2002	3,110.00
2003	2,361.88
2004	3,354.00
2005	5,224.00
Total	21,602.90

Year	Recovery
2000	120,570.96
2001	123,670.00
2002	204,666.00
2003	250,260.45
2004	272,419.59
2005	149,569.99
Total	1,121,156.99

Source: Modified from DOE 2003, 2004, 2006

However, waste recovery for resource in Malaysia is still at an infant stage. To ensure sustainability of industrial waste recovery, government support through policy, legislation and pro-active role is needed. Since technology for industrial waste recovery is ready and continuously being developed along with increasing demand for recovered industrial waste for other uses, it will become an important activity for economy and environmental need. Industrial waste recovery is an emerging economic activity. Recovery of industrial solid wastes, such as plastic, steel, paper and glass has become an important support industry. It provides alternative resources and reduces dependency on natural resource such as oil for plastic. Moreover, it also helps industry to reduce manufacturing process costs, increases efficiency of resources utilization, promotes environmental friendly product design and reduces impacts on the environment and human health.

IV. The challenges for a Sustainable Industrial Waste Recycling in Malaysia

Most of industrial waste recovery was conducted in a small scale input. Earlier from 1980s to 1990s, scavengers were the main operators in recovering waste (Nasir et.al. 1998). However, with the increasing demand of waste for alternative resources, waste recovery is now being done by companies. There are now many companies that have been issued license for industrial wastes recovery. However, the existing practice was not supported with a good infrastructure to ensure that this activity is conducted in a sustainable and environment friendly manner. This is one of the challenges of industrial waste recovery in Malaysia. The infrastructures required for a sustainable industrial waste recovery could be divided into three sectors: the governance, the physical and the economic infrastructures.

The governance infrastructure plays an important role, as it provides the infrastructure for good management to minimize impacts on the environment and human health. Governance infrastructure for managing industrial waste recovery in Malaysia has provided a good foundation that is based on legislation. As shown in Table 2, the key legislations and stakeholders listed were directly or indirectly involved in governing industrial waste recovery in Malaysia. The legislation for industrial wastes recovery in Malaysia focuses on two types of wastes; industrial solid wastes, and industrial hazardous wastes.

The key stakeholders in managing industrial solid waste generated by industry are the Ministry of Housing and Local Governments and its two departments, namely the Department of National Solid Waste Management and the Department of Local Government, governing the law. The solid wastes contractors companies, industries and solid wastes recyclers have also become key stakeholders as governed by the law (Table 2). Recovery of industrial wastes has become an important supporting activity for manufacturing industries. Wastes recovered and recycled by factories in Malaysia are turned into basic materials to produce other products. Paper and aluminium cans recycling has been achieving good responses and found to be successful in Malaysia. Other materials recycling scheme is in the process of research and development, and hope that it will start off soon. Moreover, the industrial solid waste recovery through recycling program has been the main agenda in Malaysia. The National Strategic Plan for Solid Waste Management (Strategic Plan) 2007 prioritizes reduction, reuse, recovery and recycling of waste as well as greater use of environment friendly materials (Malaysia 2006).

Legislation for recovery of hazardous wastes in Malaysia was done through Environmental Quality Act (EQA) 1974. The Local Government Act 1976 and the Customs and Excise Act are two laws that support the EQA 1974 enforcement. The EQA 1974 defined hazardous wastes as scheduled waste and referred to 58 categories and 107 types of wastes. Recovery of scheduled wastes was given priority in 2005, when an amendment was made under Part IV of EQA 1974. There was no significant impact of changes since the definition of scheduled waste was changed. However, the categorization and code for the waste was changed. Previously, under the 1989 regulation, scheduled waste was categorised by specific source or non-specific source. This was changed in 2005 regulation by focusing on waste type and industrial process. On top of these, changes made in 2005 regulation amendment were made to detail out how waste and recycled waste should be transported and emphasized the need for reporting and

enhancement of database for management purpose. The key stakeholders involved for recovery of industrial hazardous waste are the Department of Environment (DoE) and supported by the Department of National Solid Waste Management.

Legislation enforcement will require good governance infrastructure for effective enforcement. The involvement of many stakeholders is required to ensure effective governance. This includes understanding the boundaries of responsibility and actions for each enforcement agency. Synchronization of acts and regulations by relevant agencies is necessary. Strong institutional support has been identified as a critical factor in the future of legislation enforcement (Sham 1997). Hence, institutional structure is important for achieving effective governance infrastructure and good management system in establishing other supporting systems.

The physical infrastructure is also important for recovery activities by the wastes generator, the transporter and the recycler. The existing infrastructures available which support industrial wastes recovery are transportation system, recovery centres, treatment centres and landfills. Industrial solid wastes recovery in Malaysia has been done with lack of environmental concern. Recycling facilities available run as a junk yard. However, there are companies with better facilities which prioritize modern and clean process, but the number is small. On the other hand, hazardous waste recovery facilities and its collection system are monitored by the Department of Environment (DoE). Hazardous wastes recovery is controlled and done in environmentally friendly approach. The critical issues in the physical infrastructure identified are supports system for the collection of wastes, modern and environment friendly recycling facilities and human resources. Technology development and application is required to improve the physical infrastructure. The most important technology is to enhance the capability of recovery facilities to recycle more types of industrial waste, especially the hazardous wastes. In this way, this will help to supply more alternative resources, and will reduce dependency on natural resources.

The financial and economic infrastructure includes mechanisms and tools to ensure efficient wastes recovery activities. This is important to ensure that industrial wastes recovery is economically viable, and that it recycles virtually all of the materials use, emitting only micro amounts of waste and pollutants, while providing increasingly high quality services. Thus, the mechanisms and tools should be placed into policy options for resource conservation to facilitate the sustainability of affordable environmental investment through waste management and cleaner production (Marans and Lee 1993; Kjaerheim 2005). To ensure effective mechanisms for financial arrangement, it is important that the strategy for the mechanisms be institutionalized within the management regime of key stakeholders. The mechanisms should not be introduced or used as a voluntary action especially by the business and industrial players. Thus, financial and economic tools should also include financial support, insurance services, market system and trade promotion (Table 6).

Table 6: Financial or Economic Tools for Industrial Waste Recovery in Malaysia

Economic Tools	Financial Tools
▪ Market incentives ▪ Labour levy ▪ Tax reduction for cleaner production ▪ "Polluters pay" principle ▪ Market promotion for environmental friendly products	▪ Deposit and refunds system ▪ Rebate mechanisms for purchasing cleaner technology or equipment ▪ Low insurance premium for environmental friendly industry and products promoting waste recovery ▪ Finance or loans to produce cleaner products ▪ Finance or loan for waste recovery and recycling of waste as a resource

V. Role of Malaysian Government Agencies and Industries for Waste Recycling in the Southeast and East Asia Region

Industrial waste recovery has become an important economic activity in Malaysia. Industrial Master Plan 3 for Malaysian industry clearly stated that the importance of industrial waste recycling, and this activity was supported through incentives mechanism under the Promotion of Investments Act 1986. Therefore, Malaysian authority and industries will also play an important role for the future of the industrial waste recovery. With increasing demand for industrial waste recovery activity in the South East Asian and East Asian region, it is critical that Malaysian government and its industries play a key role towards ensuring sustainability of industrial waste recovery in these regions.

There are existing mechanisms where government of Malaysia, business and its industries could be involved directly or indirectly. The most common mechanisms are by utilizing the Government to Government agreement between two countries. This mechanism is suitable for the need of the two countries involved, but the mechanism might not be accepted by other countries in the region. However, in Southeast Asian region, there is an existing ASEAN mechanism where current politic, economic, cultural and social relationships have been established for more than three decades. On top of this, there are specific economic and trade agreement especially under the Indonesia-Malaysia-Thailand Growth Triangle (IMT-GT) and Brunei, Indonesia, Malaysia and Philippines East Asian Growth Area (BIMP-EAGA).

The government of Indonesia, Malaysia, and Thailand recognized the potential of the IMT-GT sub-region. In 1993 the IMT-GT program was launched. The IMT-GT cooperation aimed to accelerate the sub-region's economic transformation, through the following activities:

- exploiting complementarities and comparative advantages;
- enhancing competitiveness for investments and exports, and promoting tourism;
- lowering transport and transaction costs; and
- reducing production and distribution costs through scale economies.

The establishment of the IMT-GT sub-region was characterized by many economic complementarities, geographical location, long historical, cultural and

linguistic ties. IMT-GT includes area of 14 provinces in Southern Thailand, 8 states of Peninsular Malaysia and the island of Sumatera consisting of 10 provinces. There are many activities that have been achieved in the IMT-GT since its establishment in 1993. The cooperation has expanded its geographical coverage and has witnessed the establishment of many partnerships and alliances, with the private sector playing the main role. Key achievement of IMT-GT includes the following:

- travel and tourism, with robust growth in the number of travellers within and from outside IMT-GT, the operation of more airlines, increase in frequency of flights to the sub-region, operation of more hotels, and improvement in mobility of people in the sub-region;
- sea transport, in which four new routes were opened;
- land transport, with the improvement in road linkages between Penang and Songkhla, and construction of Trans-Malaysia-Thailand Bridge;
- telecommunications, with construction of submarine fibre optic cable link between Malaysia and Sumatera;
- energy, with the conclusion of inter-country power sharing agreement between Malaysia and Thailand;
- trade and investment, with the development of border markets and barter trading within the sub-region; and
- human resource development, with the establishment of UNINET, a cooperative form of education, research and exchanges among research and training institutions in the IMT-GT.

The Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area (BIMP-EAGA) sub-regional cooperation initiative was formally launched in 1994 as a key strategy of the participating governments to address the social and economic development of their less developed and more remote territories. (BEMBC 2009). The immediate objective is to encourage increased trade, investments and tourism in the sub-regions which cover the island economies of Brunei; North, Central, South and Southeast Sulawesi, Central, East, West and South Kalimantan, Maluku and Irian Jaya in Indonesia; Sabah, Sarawak and Labuan in Malaysia; and Mindanao and Palawan in Philippines. Its long-term goal is to change the economy of BIMP-EAGA from resource based extraction to higher order processing and non-resource based activities. Significantly, development of this sub-regional grouping rests on the private sector as the engine of growth, with the governments providing the facilitative environment that will allow the promotion of private sector investments. BIMP-EAGA cooperation aims to increase trade, tourism and investments within and outside the sub-region by:

- Facilitating the free movement of people, goods, and services;
- Making the best use of common infrastructure and natural resources; and
- Taking the fullest advantage of economic complementation.

This cooperation mechanism can be use for supporting industrial waste recovery in the South East Asian region. However, there is a need to establish policy and strategy shared and agreed by member's country which includes monitoring regime and enforcement agreement for movement of waste. The policy and strategy will drive the process of cooperation between government agencies and industries in the region. This will include harmonizing standards use for enforcement, trade and transportation of

wastes as a resource. Towards ensuring industrial waste recovery, the cooperation mechanism also must determine the role of government agencies, business and industries of the country. Market mechanism and financial support system must be established. Along with increasing demand, there is a need for technology and human resource development to ensure sustainability of the industrial waste recovery. Upon success of this cooperation mechanism, it can be expanded to other countries in the South East Asian and East Asian Region.

VI. Conclusion

Industrial waste recovery in Malaysia has emerged as an important industrial and economic activity. It has good potential because managing industrial wastes as a resource through wastes recovery activity will create alternative resources and will minimize the negative impact of waste to the environment and human health. This activity will also provide jobs and business opportunities. The challenges to ensure sustainability for industrial waste recovery in Malaysia as discussed above require full commitment of all key stakeholders. Political will and business commitment will promote establishment and effectiveness of infrastructure especially the governance, the economy and technology development. These infrastructures should be put in place to achieve sustainable industrial wastes recovery in the country. The requirement for recovery of industrial wastes as a resource is an important activity especially for resource efficiency, and contributes towards achieving sustainable industrial development which has been highlighted in the National Policy on the Environment 2002 and in the statement of the Eight Malaysia Plan (Malaysia 2001). Moreover, the Malaysian government agencies, business and industries can also play an important role in the Southeast Asian and East Asian region. Through cooperation mechanism especially with the ASEAN, BIMP-EAGA and IMT-GT as well as with countries like Japan, China and South Korea will help to promote the development and sustainability of industrial waste recovery in the region.

References

Abdul Nasir Abdul Aziz, 2007. Institutionalising Solid Waste Management in Malaysia. Department of National Solid Waste Management, Ministry of Housing and Local Government Malaysia

ADEME (French Agency for Environment and Energy Management), 1999. *Product Design and Environment*. Paris: ADEME.

Azni Idris, Bulent Inanc and Mohd Nasir Hasan, 2004. "Overview of waste disposal and landfills/dumps in Asian countries," *Journal of Material Cycles and Waste Management* 6 (2): 104-110.

BEMBC, 2009. BIMP-EAGA Roadmap to Development 2006-2010. <://www.dpbs.org/bembc/narrative.html> (accessed on 12 March 2009).

Brookfield, H., 1994. *Transformation with Industrialization in Peninsular Malaysia*. Kuala Lumpur: Oxford University Press.

Department of Environment Malaysia (DoE), 1995. "Malaysia Environmental Quality Report," (1994). Kuala Lumpur.

Department of Environment Malaysia (DoE), 2000. "Malaysia Environmental Quality Report," (1999). Kuala Lumpur.

Department of Environment Malaysia (DoE), 2003. "Malaysia Environmental Quality Report," (2002). Putrajaya.

Department of Environment Malaysia (DoE), 2004. "Malaysia Environmental Quality Report," (2003). Putrajaya.

Department of Environment Malaysia (DoE), 2006. "Malaysia Environmental Quality Report," (2005). Putrajaya.

Department of Statistic Malaysia, 2005a. "Annual Survey of Manufacturing Industry," (2003).

Department of Statistic Malaysia, 2005b. "Index of Industrial Production April," (2005). Place published (?) or put "Unpublished" if not published.

Economic Planning Unit, Malaysia (EPU), 2009. "Key Economic Indicators." <http://www.epu.gov.my/New%20Folder/MEIF2008.htm> (accessed date).

Erkman, S., 2002. "The Recent History of Industrial Ecology in Ayres, R.U. and Ayres, L.W (eds)," *A handbook of Industrial Ecology*., UK:. Edward Elgar, Cheltenham

Gotoh, S., 1987. „Waste management and recycling trend in Japan,". *Resources and Conservation*. 14: 15-28.

Hirayama, N., Gotoh, S. and Yajima, T., 1987. "Recovery of mercury and other metals from used battery cells – The CJC Demonstration Plant in Hokkaido Japan,"*Conservation and Recycling* 10 (4):237 – 241.

Jamaluddin, J., 1993. "Issues on environmental management through legislative measures in Malaysia," *Journal of Social Science and Humanities* Volume (42); (43): 181-204. UKM, Bangi.

Jo Dewulf and Herman Van Langenhove, 2005. "Integrating industrial ecology principles into a set of environmental sustainability indicators for technology assessment," *Resources, Conservation and Recycling*, 43 (4): Issue 419-432.

Jun Ui, 1984. "An Overview on Solid Waste and Hazardous Waste in Japan," *Conservation and Recycling*, 7 (2-4): 67-71.

Kjaerheim, G.,2005. "Cleaner production and sustainability," *Journal of Cleaner Production,* (13) 4: 329-339.

Malaysia, 1996. "Economic Report 1995/96," Ministry of Finance, National Printing,

Malaysia.

Malaysia, 1997. "Malaysia International Trade and Industry Report," (1996/1997). Ministry of International Trade and Industry. Kuala Lumpur.

Malaysia, 2001. "Eight Malaysia Plan 2001 – 2005." Economic Planning Unit, Prime Ministers Department, Putrajaya, Malaysia.

Malaysia, 2006. Ninth Malaysia Plan 2006 – 2010. Economic Planning Unit, Prime Ministers Department, Putrajaya, Malaysia.

Marans, R.W. and Lee, Y.J., 1993. "Linking recycling behavior to waste management planning: A case study of office workers in Taiwan," *Landscape and Urban Planning*, 26 (1-4) : 203-214.

Nadzri Yahya, 2008. Overview of Solid Waste Management in Malaysia. Workshop on Carbon Finance and Municipal Solid Waste Management in Malaysia, 29 January 2008. Department of National Solid Waste Management, Ministry of Housing and Local Government Malaysia.

Nasir, M.H, Kamil, M.Y, Azmin, S.N and Rakmi, A.R., 1998. "Issues and problems of solid waste management," in Mohd Nordin Hasan et.al., eds. *National Review on Environmental Quality Management in Malaysia; Towards the Next Two Decades*. pp. 179 – 225. . Bangi: Institute for Environment and Development, Universiti Kebangsaan Malaysia.

Pongrácz, E. and Pohjola, V.J., 2004. "Re-defining waste, the concept of ownership and the role of waste management," *Resources, Conservation and Recycling*, 40: 141–153.

Rahmah, I., 2001. "Dasar untuk Meningkatkan Mutu Pengurusan Sisa Pepejal: Peruntukan Undang-Undang Serta Perubahan yang diperlukan (Policy to improve quality of solid waste management: Legislative requirement and changes needed," in Siwar et. al., eds. *Dasar Memperbaiki Pengurusan Sisa Pepejal Perbandaran (Policies to Improve Municipal Waste Management).* pp. 13 – 18. Bangi: Institute for Environment and Development (LESTARI), UKM.

Rasiah, R. 2002. *Manufactured Exports, Employments, Skills and Labour in Malaysia*. International Labour Organization.

Recycling Point Dot Com, 2003. <http://www.recyclingpoint.com.sg/Articles/> (accessed 3 December 2003).

Samad, A.H., 1994. "Agriculture and industry – vertical integration," in Brookfield, H., ed. *Transformation With Industrialization in Peninsular Malaysia*. pp.____. Kuala Lumpur: Oxford University Press..

Sham, S., (1997). *Environmental Quality Act 1974: Then and Now*. Bangi: Institute for Environment and Development (LESTARI), UKM.

Taylor, M and Ward, M 1994. "The regional dimension of industrialization," in Brookfield, H., eds. *Transformation with Industrialization in Peninsular Malaysia.* pp. ___. New York: Oxford University Press.

The Star, 2003. "*RM 12 million disposal costs shock Selangor exco*. 4 December 2003.

Chapter 4. An Overview of 3Rs in Singapore

Thian-Guan PECK
National University of Singapore

I. Introduction

This report provides an overview of how Singapore manages its solid wastes from both municipal and industrial sources. The management of toxic and hazardous waste is not covered in this report.

Singapore is relatively a small country. Its land area in 2007 was reported to be about 707 sq km. Its population grew from about two million in 1970 to four million in 2000. The quantity of solid wastes produced per year from 1970 to 2000 also increased in tandem with the growth in population, rapid industrialization and increase in Gross Domestic Product (GDP) (Table 1).

Table 1. The Amount of Solid Wastes Produced Per Day Compared to Singapore's Population and GDP.

Year	1970	1980	1990	2000	2007
Population ('000)	2,074.5	2,413.9	3,047.1	4,027.9	4,588.6
GDP (S$ mil)	5,804	25,117	66,778	159,840	243,168
Amount of Solid Wastes (Tonnes per day)	1,200	2,600	5,700	7,700	7,000

Source: National Environment Agency and Statistics Singapore (2007)

It was quickly realized at that time that given the scarce land resource in the country and with the rapid increase in waste generation, the landfill technology was not sustainable. Up to the 1970s, all municipal wastes were landfilled. The only landfill that continued to operate then at Lorong Halus, was also closed in 1999. Since then, several concrete actions were taken (by the National Environment Agency) to reduce the amount of solid wastes generated per day.

II. Solid Waste Management Strategies

Several strategies were implemented to address the problems on waste in the country. This resulted to a reduction in the quantity of wastes generated from 7,700 tonnes per day in 2000 to 7,000 tonnes per day in 2007. The strategies included the following:

Strategy 1: Volume Reduction
Strategy 2: Waste Recycling
Strategy 3: WasteMinimization

II-1. Volume Reduction

II-1-1. Waste Collection

The huge amount of municipal waste generated daily required a highly efficient collection and disposal system. Otherwise, in hot and humid climate of Singapore, municipal and domestic wastes would quickly putrefy resulting in smell, propagation of vectors and other public health issues.

Over the years, Singapore has developed one of the most efficient refuse collection systems in the region. To improve collection efficiency and service quality, the waste collection service was privatised in 1999. Singapore is divided into nine geographical sectors and waste collection companies have to bid for the licence to provide refuse collection services in each sector. Currently, the refuse collection services are provided by four appointed Public Waste Collectors. The system was put in place in 2001, with primary objectives to improve collection efficiency and service quality. The public waste collectors (PWCs) are awarded seven-year contracts to service a sector, including the collection of recyclable materials from households under the National Recycling Programme.

II-1-2. Incineration

Incineration was adopted as the most effective method of waste disposal. Incineration reduces the volume of wastes by as much as 90%. In the process, energy is recovered for power generation. The bottom ash is then landfilled, after ferrous metals have been removed.

The first incineration plant was commissioned in 1979. Since then, three other incineration plants were set up. With limited land available for waste disposal, Singapore's policy for solid waste management is to reduce the volume of waste that goes to the landfill by incinerating all incinerable waste at the four Waste-to-Energy Plants. In 2007, 2.57 million tonnes of waste was disposed at the refuse disposal facilities and about

2.38 million tonnes (92.7%) of the refuse was incinerated. The remaining non-incinerable waste such as sludge, silt, shipyard waste, construction and demolition waste, and the incineration ashes are disposed at the offshore Semakau Landfill.

The total effective incineration capacity of the existing incineration plants amounts up to 8,200 tonnes per day. This is sufficient to handle all incinerable wastes currently generated in Singapore, which is slightly more than 7,000 tonnes per day. A fifth incineration plant is expected to start its operation in mid 2009 to replace the another one that is nearly at the end of its operation lifespan.

II-1-3. Recovering Energy from Waste

The waste heat of the incineration process produced about 954 million kWh of electricity which is about 2 to 3% of the total electricity generated in Singapore. Scrap metal was also recovered in the plants with magnetic devices. The quantity of scrap metal recovered in 2007 amounted to 14,000 tonnes. They were sold to local steel mill which reprocess the metal into steel products.

The amount of refuse going to the landfill has gradually decreased over the last 10 years while the amount of waste disposed at waste-to-Energey Plants have gone up (Table 2).

Table 2. Amount of Refuse Disposed at the Waste-to-Energy Plants and the Landfill Over a Period of 10 Years

Year	Landfill ('000 Tonnes)	Waste-to-Energy Plants ('000 Tonnes)	Total Refuse Disposed of ('000 Tonnes)
1998	958.1	1884.1	2842.2
1999	756.2	2036.3	2792.5
2000	357.2	2440.1	2797.3
2001	251.3	2550.9	2802.2
2002	204.3	2421.3	2625.6
2003	193.8	2311.2	2505.0
2004	219.6	2263.0	2482.6
2005	270.1	2278.6	2548.7
2006	234.5	2329.1	2563.6
2007	187.3	2379.5	2566.8

Source: National Environmental Agency (2007).

II-1-4. Establishment of the Semakau Landfill

The incineration ash, as well as the non-incinerable wastes, are disposed at the Semakau Landfill. The offshore landfill started operating on April 1999 after the last

landfill on the mainland was used up. It has a capacity to contain 63 million m^3 of waste and is expected to last until 2045. The cost for the landfill is about US$915 million (please give the equivalent in US$). Every day, about 500 tonnes of non-incinerable waste and 1,500 tonnes of incineration ash is sent to the landfill.

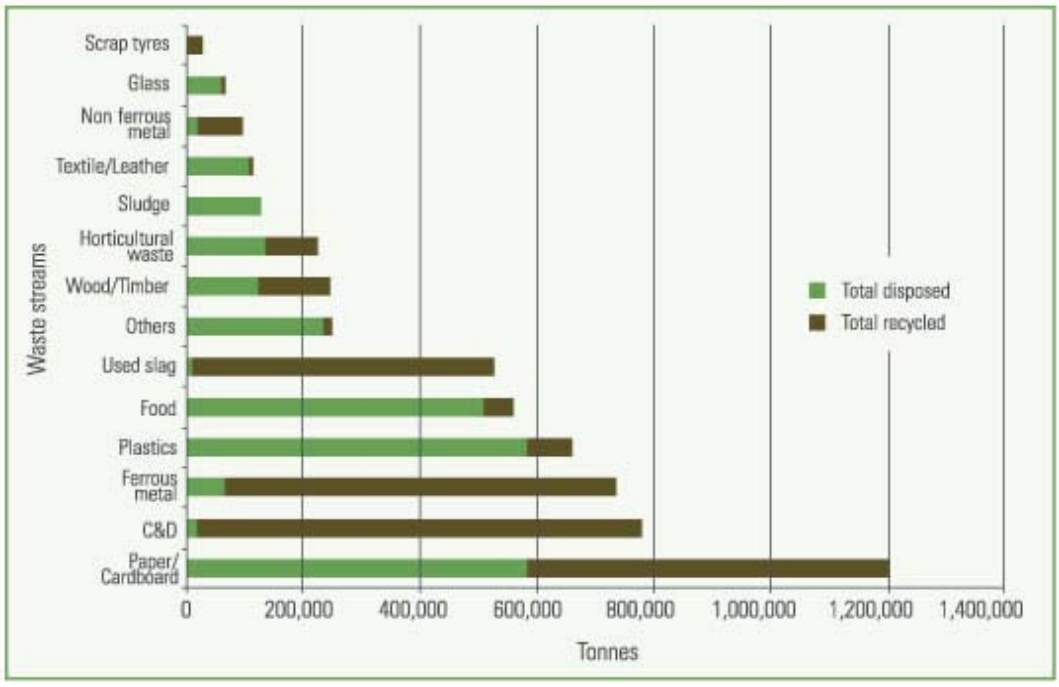
Members of the public are allowed to visit the Semakau Landfill to learn about the waste management of Singapore. The landfill is now an attractive eco-tourism site that co-exists with the vibrant marine biodiversity of the inter-tidal walk on the same island. A visitor centre was set up with an information gallery and posters to educate visitors about solid waste management. Arrangements can be made for visitor groups to do bird watching or star gazing activities.

II-2. Recycling

The second waste management strategy is recycling. The recycling programmes began in 2001 when the quantity of waste generated reached its peak at 7,700 tonnes/day. These programmes targeted the public households, condominium, private apartment estates, schools and industrial estates.

Figure 1 compares the quantity of the different types of wastes disposed of and recycled. In 2007, 54% of wastes were recycled. The quantity of used slag recycled is close to 100%. Some 91% of ferrous metal wastes, 98% of construction and demolition (C&D) waste, 41% of horticultural wastes and 51% of paper waste were recycled. The target is to recycle 60% of Singapore's wastes by 2012.

Figure 1. Waste Generation in Singapore



Source: National Environment Agency (2007)

II-2-1. National Recycling Programme

The National Recycling Programme was launched in April 2001. Under this programme, the public waste collectors licensed by the National Environmental Agency are required to work with recycling companies to implement door-to-door collection of recyclable material in both public housing estates and landed properties within their servicing sectors.

Public estates dwellers are given recycling bags and residents in landed properties are given bins to put in recyclable materials. They will put out their recycling bags or bins outside their door for collection by recycling companies on a predetermined collection date. The recyclables collected include clean paper, plastic, glass containers, metal cans and old clothing.

To encourage the public to play a pro-active role in recycling and for a more cost effective system, the fortnightly collection programme was replaced with centralized recycling bins placed strategically at some places of the residential estates. There is at least one set of centralized recycling depositories for every five blocks of flats. About 3,800 recycling bins are also placed in public areas such as outside subway stations, shopping streets and malls.

The government has also made it mandatory for all condominiums and private apartments to provide receptacles for recycling within their estate. Managing agents and management councils of these establishments are guided by the National Environment Agency to set up the structured waste recycling programmes.

II-2-2. Recycling in the Schools

In September 2002, a structured waste recycling programme was launched in the schools. The aim of this recycling programme is to educate and inculcate the recycling habits amongst students. The recycling programme involves the setting up of a Recycling Corners with recycling bins for paper, cans, plastic bottles and other educational materials. The amount of recyclables collected is measured to monitor the programme. Over 95% percent of the schools have taken part in this programme.

II-2-3. Recycling of Industrial and Commercial Waste

Non-domestic waste from industries and commercial premises accounts for about 50% of the waste disposed at the waste disposal facilities. Recycling bins are placed at convenient locations such as lift lobbies of each block of the industrial estates for factories to deposit recyclable waste. Designated areas have been set up at bin centres

within industrial estates for wooden pallets for reuse or recycling. A guide on waste minimization, published by the National Environment Agency with the assistance from a Working Group which comprised of five different corporations, was also developed to help companies reduce waste through more effective and efficient use of resources, reusing and recycling. The guide was developed to assist companies to reduce waste at source and to recover more recyclables from the industrial sector for reuse and recycling, thereby helping the industries improve productivity and profitability

II-2-4. Plastic Recycling

The amount of plastic waste generated is about 660,000 tonnes per year and about 11% is recycled. There are several companies that are engaged in this recycling activity as a business. Most would collect waste plastics for resale without further processing. One company in the Sarimbum Recycling Park is involved in the entire recycling process – from sorting, melting, shredding and granulation. The final product is plastic resins.

II-2-5. Wood Recycling

The amount wood waste generated per year is about 250,000 tonnes. About 52% is recycled through shredding the wood and carbonizing to make it into technical wood products, pallets, furniture or charcoal. Branches and trees received through tree pruning are sent to the composting plants to be processed into compost for planting and landscaping work.

II-2-6. Food Waste

The Asia's first major bio-mechanization and renewable energy plant was built in Singapore in 2007. It has the capacity of processing up to 800 tonnes of organic waste per day. At full capacity, the plant can reduce more than half of the food waste currently delivered to the incineration plants. The material will be recycled into sanitized nutrient rich compost as a soil media for organic farming and the landscaping industry. Biogas is also harnessed for the production of renewable electrical energy.

II-2-7. Recycling of construction and demolition waste

The waste generated from construction or demolition activities amounts to about 780,000 tonnes/year. These wastes cannot be incinerated and about 98% are recycled. The waste is made into fine or coarse aggregates that can be made into concrete products or used for road kerbs.

II-2-8. Copper Slag

A large volume of used copper slag is collected from the major shipyards in Singapore. A new plant that is capable of processing 360,000 tonnes of copper slag per year was opened in October 2008. The processed copper slag is then used in the process for making concrete.

II-2-9. Case study of a recycling company

Veolia Environmental Services is one of the four public waste collectors in Singapore. It provides integrated waste management services, which includes waste collection, disposal and recycling. The company collects glass bottles, plastics, metal, clothing and paper from private and government housing estates, schools, government establishments, hawker centres and shops. The company provides door-to-door collection service. In this system, households place their co-mingled recyclable wastes in plastic bags supplied by the company and leave these recyclables along with their trash. The recyclables are collected at predetermined intervals and brought to the plant for sorting.

A second method of collection is through the recycling stations. There are recycling stations at strategic locations in public housing estates. At each recycling station, there are two bulk bins. Each bin has a capacity of 660 L. The blue bin is for paper and the yellow bin is for light recyclables. There is one recycling station for every five blocks of apartments (approximately 500 households). Like the recyclables from the house-to-house collection, the co-mingled recyclable wastes from the recycling stations are brought to the Veolia's plant for sorting.

Veolia has a third programme which it claims distinguishes itself from its competitors. Veolia promotes recycling with the help of the Resident Committees in the various public housing estates. The Resident Committees organise monthly recycling day for the precinct under their charge. In this programme, the residents can exchange their recyclable wastes for food items at pre-determined recycling points. For every 5 kg of recyclables, the resident could get either a cup noodles or a canned food item such as sardines. This programme was started in 2004 and has been very successful. According to Veolia, up to 2,000 kg of recyclables can be collected in a two-hour session.

The logistics of collection and its associated cost are the main challenges facing waste collection companies. In private housing estates such as condominiums where units are spread out, one set of bins is required for every 100 households. This is five times less efficient compared to public housing estates.

At the sorting plant, the wastes are unloaded onto a conveyor belt. The waste stream is then sorted manually into five main types of wastes:

a. PET bottles
b. HDPE bottles
c. Plastic bottles of mixed composition

d. Mixed plastic
e. Paper

The workers also separate out the Tetrapack containers and glass bottles. After manual sorting, the conveyor then transports the waste to an automatic sorter. The sorter separates out ferrous metals and aluminium cans from the waste stream. The remaining wastes are consolidated and then brought to the incineration plant for final disposal.

The current economic crisis has affected the recycling industry. For example, it is difficult to get an attractive price for used plastic bottles and paper. According to Veolia, the cost of recycling is very similar to the cost of waste incineration. This does not help to make recycling an attractive option.

There is a general lack of public awareness, understanding and appreciation of recycling. Hence, the wastes collected by the company are still co-mingled. This increases the cost as sorting is necessary. Efforts in raising awareness should be stepped up. According to Veolia, this can be done in four stages and the key message at each stage is as follows:

Stage 1: Recyclable wastes and trash should be thrown into separate bins
Stage 2: Recyclable wastes should be thrown into different bins according to material type
Stage 3: Recyclable wastes should be thrown into different bins according to material type and containers should be fully emptied before throwing them into recycling bins
Stage 4: Recyclable wastes should be thrown into different bins according to material type and containers should be fully emptied and flattened before throwing them into recycling bins.

II-2-10. Recycling Park

A former landfill site at the north-western part of Singapore was redeveloped into a recycling park after it was closed in September 1992. The dumping ground, which is about 20 hectares, would need 30 to 40 years of stabilisation before it could be utilised for more permanent developments. In an effort to boost the waste recycling industry in Singapore, specifically in bulk waste streams, the National Environment Agency (NEA) obtained approval to utilise part of the closed landfill site for recycling activities.

The Sarimbun Recycling Park provides a low cost solution for entrepreneurs to operate recycling facilities in Singapore. Tenants lease the land for a 3-year tenure with the option to extend to a maximum of three terms. The breakdown of companies according to the types of wastes recycles is given in the table below.

Table 3. Breakdown of Tenants at the Sarimbun Recycling Park

Type of Waste Recycled	Recycled Products	Number of Companies
Construction& Demolition	Recycled aggregate, Road Kerb, Drain Channel and aggregates	5
Horticultural & Wood	Refurbished pallets, Compost, Charcoal, briquettes	4
Street cleansing waste	Sorted leaves, soil	1
Plastics	Plastic resins	1
Tyres	Rubber crumbs (Tyre derived fuel)	1

Source: National Environment Agency Website (2009)

II-3. Waste minimization

Waste minimization programmes were introduced after 2006. The recycling programmes that were implemented before that time might not be sufficient to sustain waste reduction due to the rapid increase in waste generation. Thus, several efforts were made to reduce waste at the source. Two of the more significant programmes are the Singapore Packaging Agreement and the Bring Your Own Bag Day.

II-3-1. Singapore Packaging Agreement

As packaging waste constitutes about 35% of the domestic waste in Singapore, there is a potential to reduce packaging waste in the municipal waste stream. Signed on 5th June 2007, the Singapore Packaging Agreement represents a landmark collaborative effort between the government, industry and non-governmental organizations to work towards reducing packaging waste.

The objective of this agreement is to reduce packaging waste arising from consumer products, raise community agreement on packaging waste minimization and introduce supply chain initiatives that foster the sustainable use of resources in packaging. The signatories include five industry associations representing more than 500 companies, 19 individual companies, two non-governmental organizations (NGOs), the Waste Management & Recycling Association of Singapore and four public waste collectors. The agreement is voluntary which aims to provide flexibility to adopt cost-effective solutions to reduce packaging waste, but they have an undertaking to fulfil the following actions:

a. Meet certain recycling targets for recovery of packaging materials and have a review of these targets within two years of signing the agreement. The targets are:

1. Glass – 50 %

2. Metals (ferrous) – 95 %
3. Metals (non-ferrous) – 90 %
4. Paper – 55 %
5. Plastic – 23 %

b. Prepare annual work plans which include actions to meet the recycling targets and improve the sustainability of packaging.

c. Follow a packing code of practice where environment considerations are incorporated in their packaging.

II-3-2. Bring Your Own Bag Day

Started in April 2007, Bring Your Own Bag Day is a campaign to encourage shoppers to bring their own reusable bags to reduce wastage and promote resource conversation. Every first Wednesday of the month, major supermarkets will encourage shoppers to either buy a reusable bag or voluntarily donate 10 cents for every plastic bag taken at the checkout counter. The proceeds will then go to a registered charity to fund other environmental campaigns. This campaign has further extended from a monthly basis to every Wednesday since June 2008.

Survey shows that on average about 60% of the people supported the campaign by bringing their own reusable bags, purchasing new reusable bags, decline taking any plastic bags or make donations for each plastic bag they take.

II-3-3. Waste Minimization Through Standardization

Wooden pallets are commonly used in the industry for the transit of goods. In Singapore, these pallets come in 13 different sizes. Oftentimes, incoming goods often had to be unloaded and repacked into new wooden pallets as those from the company's suppliers are of a different size and they did not fit into shelves of the company's own warehouses. Thus, companies end up with many wooden pallets which they need to dispose of. Many of these are still in good condition.

This problem was first noticed in 1995/96 when several companies undertook their ISO 14001 environmental management system (EMS) certification audit. These companies were among the first few in Singapore to implement the ISO 14001 EMS. Companies implementing EMS were required to identify aspects of their business which had an impact on the environment. Several of these companies reported that waste from wooden pallets was significant.

At the same time, the need for pallet standardization, from a productivity improvement perspective, was also mooted. A pallet standardization working group was

set up by the Efficient Consumer Response (ECR) Council of Singapore. ECR is a private sector initiative comprising of suppliers, manufacturers, distributors and retailers. The pallet standardization project was managed by the then Singapore Article Number Council, now known as GS1 in close collaboration with the then Singapore Productivity and Standards Board (now called SPRING Singapore which is the national standards body) which co-chaired this working group with the logistics arm of National Trade Union Congress (NTUC). NTUC owns and operates a chain of supermarkets. After several meetings attended by a number of stakeholders, the group agreed on a four-way 1 m by 1.2 m standard size as it conformed to the international standard ISO 6780, "General-purpose flat pallets for through transit of goods - Principal dimensions and tolerances".

A pilot study was undertaken to understand the implications of standardizing pallet size across the Fast Moving Consumer Goods industry. It was found out that the usage of warehouse space was optimized. Wastage was also reduced as manual transfer of goods from one pallet to another of a different size was no longer necessary. It also eliminated the use of a slave standard pallet as a base for the non-standard pallets to sit on. Previously, a slave standard pallet was used so that the non-standard pallet can be handled by the forklift without having to change the forklift blades. With an estimated of about 300,000 wooden pallets in circulation, the estimated cost savings was estimated to be S$2.6 million per year in the Fast Moving Consumer Goods industry alone.

III. Conclusion

Despite the growing population and the gross domestic product, the total waste generation grew steadily. It reached a peak of about 7,700 tonnes per day in 2001 and then fell gradually to 7,032 tonnes per day in 2007. This decrease was due to the implementation of several waste management initiatives such as volume reduction, waste recycling and waste minimisation.

The critical success factors that contributed to the improvement of waste management includes the partnership of public sectors, private sectors and the people, an integrated approach for dealing with waste management and long term planning and targets for policies. To further encourage recycling, the following programmes need to be reviewed:

- Education and awareness building programmes
  Recycling rate, especially within the domestic sector, can be further improved. Currently, it is observed that recycling especially in the public housing sector is not active as storing recyclables at home would take up precious space. In addition, recycling collection points within the public housing estate are not very conveniently located and would generally require people to walk a few hundred

metres from their homes. Therefore, education programs need to be more aggressive to educate people that recycling should be a way of life, as evidenced in the European countries where it is common for people to drive to recycling collection centres to dispose of recyclables.

- Cooperation between public waste collector and grass root organizations
  Public waste collectors could work more closely with grass root organizations to promote recycling. The "Trash-to-Cash" scheme operated by one public waste collector enjoyed some success. Other public waste collectors could explore similar initiatives to promote greater recycling amongst the community it serves.

- Pricing of waste disposal services including incineration fees
  Due to heavy subsidy from the government for incineration of waste, it is more convenient and sometimes cheaper to throw away wastes than to recycle them. For instance, food waste recycling costs the same as incineration but requires upfront waste management procedures to separate the food wastes from general wastes.

Acknowledgements

The author would like to thank Ms. Lina Goh and Mr. Ong Wei Tao for their assistance in the preparation of this paper.

References

IUT. (2006). 800 Tons per Day Bio-Methanisation Plant in Singapore. <http://www.iutglobal.com/iut-projects-singapore.asp> (accessed 17 January 2009).

Lee Yuen Hee, Waste Management and Economic Growth, Centre for Governance and Leadership, World Cities Summit Issue, Jun 2008. <http://www.cscollege.gov.sg/cgl/pub_ethos_7g3.htm#top> (accessed 22 January 2009).

Ministry of the Environment and Water Resources Website. <http://app.mewr.gov.sg/web/Contents/Contents.aspx?ContId=26> (accessed 22 January 2009).

National Environment Agency. Guidebook on Waste Minimisation for Industries.

<http://www.nea.gov.sg/cms/rcd/guidebook/Guidebook.pdf> (accessed 17 January 2009).

National Environment Agency. (2007). Environmental Protection Division Annual Report. <http://app2.nea.gov.sg/annualreport.aspx> (accessed 17 January 2009).

Standards and Testing News. <http://www.standards.org.sg/files/Vol8No4Art1.htm> (accessed 22 January 2009).

Singapore Statistics. <http://www.singstat.gov.sg/stats/themes/people/popindicators.pdf> and <http://www.singstat.gov.sg/stats/themes/economy/hist/gdp2.html> (accessed 22 January 2009).

Chapter 5. Promoting Recycling Industries as a Part of Industrial Policy in Japan

Michikazu KOJIMA

Institute of Developing Economies, JETRO

Introduction

In most countries in Asia, recycling policy is not regarded as a part of industrial policy. Ministries in charge of industry are likely to be not interested in the recycling industry. But in Japan, the Ministry of International Trade and Industry (MITI), now, Ministry of Economy, Trade and Industry (METI) initiated some policies in the field of promoting recycling in early 1970s. This paper reviews some industrial policies for promoting recycling by MITI and METI. In Section 1, the background of starting recycling industrial policy is explained. One of the first steps undertaken by MITI was the implementation of policy on the establishment of industrial associations specializing in recycling. In section 2, the activities of these organizations are also summarized, such as making guidelines for classification of used paper and supports to industrial waste information exchange programs. In Section 3, supports for technological developments are reviewed. Japanese government has supported experimental, pilot and demonstration project of recycling technologies since 1970s. In Section 4, Eco-town Project which is a kind of recycling industrial park is reviewed. Section 5 deals with recent activities on recycling particularly the Japanese Industrial Standard (JIS) for recycled product. Section 6 overviews how the ministry develop such policies, based on dialogue with industries.

I. Background of Recycling Industrial Policy

In 1950s and 1960s, Japan suffered from air pollution and water pollution. At that time, industrial waste was indiscriminately disposed of into river or air, or incinerated without pollution control. It was around 1970s that pollution control regulation was tightened and enforcement was strengthened. The Air Pollution Control Law and the Water Pollution Control Law were enacted in 1968 and in 1970, respectively. From the installment of wastewater and emission treatment facility, industrial wastes such as sludge and dust were generated. Although, the official statistics did not exist, but it was seen that industrial waste were likely to increase rapidly, thus the air and waste pollution control was strengthened.

In 1970, the government enacted the Waste Disposal and Public Cleansing Law. Although the Ministry of Welfare was in charge of waste management in general, the law required MITI to guide the management of industrial waste and control the recycling of waste materials.

In addition to legal obligation, the concept of “Difficult Waste” (Tekisei Shori Kon-nanbutsu) was a pressure to industries and MITI to start the activities on recycling. Along with the process of economic development, new waste such as plastic waste, electronic appliances and automobile were generated. In conventional waste treatment facility including incinerator these wastes could not be treated properly. Local

governments were considering to put the responsibility of waste disposal on manufacturers of these products. For example, the local government and the Ministry of Welfare were against on the plan of manufacturers to use plastic bottle for milk. In February 1974, an advisory committee for Tokyo metropolitan government made a report on "difficult waste." These movement forced MITI and industries to do something about recycling.

The Industrial Structure Council, an advisory committee, also proposed in May 1971 the development of "closed system" which did not emit any hazardous substances into the environment. Particularly, the development of the social closed system for solid waste was emphasized. It also mentioned that putting responsibility on manufacturer would not solve the problem.

MITI made a committee for considering policy on utilizing waste in 1973. Interim report was compiled in 1974, which emphasized the importance of recycling to save resources (MITI, 1974). The report reviewed the current situation and future direction of waste paper, end-of-life vehicle, plastics, waste oil, waste tire, waste steel can, waste aluminum can, waste home appliances and so forth. It identified the technologies to be developed, and the roles of stakeholders. The arguments on roles of stakeholders were a reaction on how to address the growing volume of "difficult waste." The Industrial Structure Council made the sub-committee of utilizing waste, which made a report on recycling policy in 1977.

II. Industrial Association for Recycling

II-1. Establishing Industrial Association for Recycling

In 1970s and 1980s , several major associations or organizations specializing on recycling, such as the Paper Recycling Promotion Center and the Clean Japan Center (CJC) were established with support from MITI. Table 1 shows the major industrial associations for recycling established in this period.

Table 1. Selected Industrial Association for Recycling in Japan

Name of Association	Year of Establishment	Examples of Activities
Plastic Waste Management Institute	1971	R & D on plastic recycling, study on recycling in foreign countries, data collection for LCA (Life Cycle Analysis)
Steel Can Recycling Association	1973	Promoting recycling of steel can, data collection for LCA, campaign against

		scattering garbage
Aluminum Can Recycling Association	1973	Pilot collection program in 1974, creating recycling mark of aluminum can, data collection on recycling of aluminum can
Paper Recycling Promotion Center	1974	Guarantees for member company, activities to improve quality of used paper, data collection
Association of Electronic Home Appliances (original name: Center for Promotion of Recycling Home appliances)	1974	Technological development of recycling home appliances, designated organization for Home Appliance Recycling Law since 2000.
Iron and Steel Recycling Institute (original name: Japan Iron and Steel Scrap Industry Association)	1975	Industry data collection and management, negotiation on behalf of industry, improving business practices in the industry
Clean Japan Center	1975	Supporting industrial information exchange program in 1980s, study on recycling technology, information dissemination on 3R
Nippon Slag Association	1978	Research on quality and technologies for iron and steel slag product, investigate and collect information on production, supply and demand of iron and steel slag products

II-2. Classification for Collecting Recyclable Waste

There are many kinds of recyclable wastes. If a waste is mixed with other wastes, the recycler should sort out the waste from other waste. So recycling costs becomes higher. To utilize the recyclable wastes effectively, Japan developed a classification of recyclable wastes and criteria for receiving recyclable wastes.

Classification of recyclable wastes depends on the technology of recycling. It is obvious that paper, plastics and steel cannot be recycled in a one system. But people may not be aware of types of recyclables. To make smooth transactions of recyclable wastes, standard classification was resorted to by the Japanese government and association of recyclers.

To cite an example, the papers are classified into several categories. Recycling process of each category of paper is slightly different from others. The value of waste papers is also different. It is not clear which one is the oldest classification of recyclable waste paper in Japan. The Ministry of Commerce and Industry made the “Classification of Waste Paper” in 1939, which classified waste paper into 27 categories. Current

classification was done in 1971 by the Paper Recycling Promotion Center, consisting of 9 categories and 29 sub-categories. The nine categories are “hard white shavings; cards,” “white woody shavings; white manila,” “fine printed paper,” “woody printed paper,” “old newsprint,” “old magazines,” “craft browns,” “old corrugated containers,” and “others.”

The criteria for receiving recyclable wastes are also important. If contraindications are mixed with recyclables and put into recycling process, the recycled material may not be sellable. Recycling factory also loses money, if it buys non-recyclable wastes at price of recyclable wastes. If each of the users has its own criteria, the collector faces difficulty to handle recyclable waste. On the other hand, collectors can earn more money when they mix non-valuable waste with valuable recyclable waste and sell it at value of recyclable waste. This situation made it necessary to determine the criteria that set the minimum standards of contraindications and allowable level of other paper wastes.

To make these kinds of the criteria, the Paper Recycling Promotion Center conducted a survey in 1979 to the paper mills and consolidators. The survey showed that 33.3% of paper mills have written criteria for receiving used paper and 59.1% have the criteria but not in written form. Findings showed that the instability in transactions resulted due to unclear criteria, as well as due to the different criteria set by each of the paper mills. Consequently, both paper mills and consolidators recognized the importance of having common criteria. They considered that the criteria would ensure stable supply of qualified used paper to paper mills and that the criteria could reduce the claims of paper mills from the consolidators. The survey identified the problems in the quality of used paper, such as water content, allowable level of mixed other type of paper, and contraindications. The results of the 1979 survey were scrutinized by committees consisting of representatives from paper mills, consolidators, the government’s Ministry of International Trade and Industry, as well as from the Clean Japan Center--a foundation specializing waste management and recycling, and from the Paper Recycling Promotion Center.

The criteria had been revised several times because new types of papers and new technologies of treatment have been introduced. The revisions were also undertaken by a committee consisting of stakeholders. The latest contraindications for used paper are listed in Box 1 and Box . The range of the contraindications and specifications continue to be extended.

Similar classifications, standards, or guidelines for sorting of recyclable waste have been developed, such as in the case of glass cullet of bottles. To make this kind of criteria, it is noted that stakeholders participated and accorded in the formulation process. In Japan’s experience, the survey was used as starting point for stakeholders to reach a common understanding of current conditions and problems (refer to Box 1, Box 2, and Table 2).

Box 1 Contraindications for Waste Paper Listed in Criteria in 1979

Carbon, resin processed paper, oiled paper, waxed paper, aluminum foil, plastic processed paper, non-woven fabric, cellophane, synthetic paper, expanded polystyrene, pitch, plastic bag and others.
Source: Paper Recycling Promotion Center (1979).

Box 2 List of Contraindications for Waste Paper in 2005

List A: materials whish is not related to raw materials for paper which may cause big problem
1) Stone, glass, metals, sand, and wood tips, etc.
2) Plastics
3) Resin-impregnated paper, parchment paper, textile
4) Tarpaulin paper, waxed paper, construction materials such as gypsum board
5) Textile printing paper, thermal foaming coated paper, synthetic paper, non-woven fabric
6) Paper touched with infectious waste in medical facilities and others
7) Other materials which may cause damages to process or products

List B: Materials which is not good for mixed with raw materials for paper
1) Carbon
2) Carbonless paper
3) Vephinyl or polyethelen coated or laminated paper
4) Adhesive tape (but adhesive tape attached on the carton box is excluded.
5) Thermal paper, perfumed paper
6) Other materials not suitable for paper production

Source: Paper Recycling Promotion Center (2006).

Table 2.Criteria for Standard Quality of Waste Paper

	Contraindications		Other Papers	Moisture
	List A	List B		
Newspaper	Not acceptable	Less than 0.3%	Less than 1% *	Less than 12%
Carton	Not acceptable	Less than 0.3%	Less than 3%	Less than 12%
Magazine	Not acceptable	Less than 0.5%	Less than 5%	Less than 12%
Miscellaneous Paper	Not acceptable	Less than 0.5%		Less than 12%
Office paper	Not acceptable	Less than 0.5%		Less than 12%

Source: compile from Paper Recycling Promotion Center (2006)
* excluding inserted leaflet.

II-3. Waste Information Exchange Program

Industrial waste information exchange program has been conducted by some local government sine 1970s. CJC helps the development of such programs in some prefecture. In addition, CJC organizes the joint industrial waste information exchange

program, which covers more than two prefectures. This program is reviewed in Chapter 10 in this report.

II-4. Financial Support

Since 1960s, government has provided low interest loan for pollution control investment, through some semi-governmental organization. In 1970s, some recycling industries such as lead acid recycling industries made investment in pollution control equipment (Kojima and Jain, 2008). Japanese government still maintains low interest loan for investment for environmental protection, including investment in waste treatment and recycling.

Industrial associations also play a role in such kind of investment. Industrial association was an information dissemination channel to companies on such programs. In addition, Paper Recycling Promotion Center also has program to give guarantee of borrowers, when a member of the association borrows the money from bank.

Central and local governments have provided some tax incentive for investment in specific recycling facilities. For example, in early 1970s, accelerated depreciation was applied to industrial waste treatment plants including plants recycling plastic industrial waste. From FY 2008 to 2010, the tax base for property tax is reduced to three forth in the first three years after investment.

III. Support Technological Development

Agency of Industrial Science and Technology had research project on the Technology for Resource Recycling System from 1973 to 1982. The project was called "Star Dust 80". The project covered several recycling technologies such as crashing, and physical and chemical segregation of plastics, home appliances and mixed metals. The pilot plant was built and operated in Yokohama around 1980. It was a combination of segregation, composting, pulping, and plastic waste petro-chemical processes. Although the plant was operated, the quality of pulp and composting was not sufficient enough. So the system was not fully utilized. But some technology developed in the project became a basis of further development of recycling technology such as recovery of substances by gasification.

CJC also developed several pilot plants for developing recycling technology. In FY 1975, the center established and operated recycling plants for home appliances, tyre and oil sludge. The pilot recycling plant for home appliances was developed in Chiba prefecture with Center for Promotion of Recycling Home Appliances. Tyre recycling

plants were developed in Osaka and Hyogo prefecture with Japan Automobile Tyre Manufacturers Association, Mechanical Social Systems Foundation and others.

NEDO (New Energy and Industrial Technology Development Organization) also supports technological development in recycling industries. For example, demonstration plant making “eco-cement”, which utilized ash from incinerator of household waste and sludge from sewage treatment in cement production, was supported by NEDO form 1994 to 1998. CJC organized technical committee to manage experiments. The demonstration plant was established in Aichi prefecture. After the demonstration project, commercial plant was developed in Chiba, with support of Eco-town project, which will be explained in the following section.

IV. Eco-town Project: Recycling Industrial Park

Japan’s Eco-town project started in 1997. In the Eco-town project, local governments with private companies promote recycling and waste minimization using the industrial infrastructure of the region. Ministry of Environment and METI have supported the activities, especially the development of advanced recycling facility.

In introducing the eco-town project in a certain region, the local government prepared a proposal of eco-town. This proposal l was scrutinized by both ministries, with the view that this was to be served as model to other regions. So far 26 eco-towns have been approved. The types of eco-town vary depending on the situation in the areas. For example, in Kitakyushu eco-town, recycling factories are built and operated in an eco-industrial park. Basically, the factories are newly developed. Collaboration with research institution located in the region is also stressed. In Kawasaki, another eco-town, linkages of steel, chemicals and other relatively big industry are enhanced. Additional new facilities have also been constructed.

If a recycling factory is not located in the region for a certain type of waste, or if the capacity of recycling factories is not enough to utilize a certain type of waste, establishing a co-industrial park is one of the policy option.

V. JIS for Recycling

Japanese Industrial Standard (JIS) specifies standard of industrial activities including standard for products and testing method in Japan. The legal foundation of JIS is the Industrial Standardization Law. JIS covers tens of recycled products and testing methods, to promote consumption of recycled product. Table 3 shows examples of standards that have been formulated.

The process to formulate the standard is as follows. Industrial association or others can submit the draft of JIS to Japan Industrial Standards Committee. Based on

consultation with experts and stakeholders, Japan Industrial Standards Committee establishes the standard and publicizes it.

Table 3. Recycled Products in Japan Industrial Standards

Code	Year Established	Latest Amendment or Confirmation	
A5011-1:2003	1997		Slag aggregate for concrete – Part 1: Blast furnace slag aggregate
A5011-2:2003	1997		Slag aggregate for concrete – Part 2 :Ferronickel Slag aggregate
A5011-3:2003	1997		Slag aggregate for concrete – Part 3 :Copper slag aggregate
A5011-4:2003			Slag aggregate for concrete – Part 4: Electric arc furnace oxidizing slag aggregate
A5015:1992	1979	2003	Iron and steel slag for road construction
A5021:2005			Recycled aggregate for concrete-class H
A5022:2007			Recycled concrete using recycled aggregate class M
A5023:2006			Recycled concrete using recycled aggregate class L
A5031:2006			Melt-solidified slag aggregate for concrete derived from municipal solid waste and sewage sludge
A5032:2006			Melt-solidified slag material for road construction derived from municipal solid waste and sewage sludge
A5731:2002			Recycled plastics inspection chambers and covers for rainwater
A5741:2006			Wood-plastic recycled composite
A5905:2003	1957	1994	Fiberboards
A5908:2003	1957	1994	Particleboards
A6201:1999	1958	2004	Fly ash for use in concrete
A6206:1997	1995	2002	Ground granulated blast-furnace slag for concrete
G3111:2005	1956	1987	Rerolled carbon steel
G3117:1987	1969	2004	Rerolled steel bars for concrete reinforcement
K6313:1999	1951	2003	Reclaimed rubbers
K6316:1998		2003	Vulcanized particulate rubber
K6329:1997	1954	2002	Retreaded tires
K6370:1999	1955	2003	Compounded stock for retread and repair
K6450:1999		2003	Rubber block and rubber pavement – test methods
K6930:1994		2006	Reclaimed granular molding materials of agricultural polyvinyl chloride film
K6931:1991	1979	2001	Reclaimed plastics bars, rods, plates and piles
K6932:2007	1981	2006	Recycled plastics stakes
K7390:2003			Testing methods for reclaimed poly(ethylene terephthalate)(PET) moulding materials from PET bottle
K9797:2006			Unplasticized poly (Vinyl chloride) (PVC-U) three layer pipes with recycled solid core
K9798:2006			Unplasticized poly (Vinyl chloride) (PVC-U) three layer pipes with recycled foamed core
L3204:2000	1985	2005	Recovered fiber felts
R5214:2003	2002		Ecocement
P4501-1993	1962	1998	Toilet tissue papers
Z1506:2003	1951	1997	Corrugated shipping containers

Source: Compiled from Japan Standard Association (2007).

To speed up the establishment of Sound Material-cycle Society, JIS Committee made Action Program for Environmental JIS in 2001, which also covers standards related to recycling. Some items specified in the Action Program were requested by the local government, which wanted to use recycled products. The lack of a clear standard to ensure the quality of recycled products was an obstacle for using these products. .

An expert pointed out that some of the JIS for recycled products are lacking in the specified testing method for environmental safety. There might be a room to improve the standards in Japan. But in general, creation of standards for recycled goods improves the reliability of recycled products.

VI. Dialogue with Industries and Other Stakeholders.

In Japan, if ministries are planning to make new regulation or amend the existing one, they organize council meetings, which recommend the direction of policies. The Ministry of Environment has a Central Environment Council that conducts dialogues with stakeholders on environmental policies. MITI (METI) has also organized Industrial Structure Council to have formal dialogue with industries and other stakeholders, on industrial policy including those for recycling industries.

One of the reports by the Industrial Structure Council, "What should be Direction of International Trade and Industrial Policy in 1970s?", which was published in 1971, mentioned the necessity of technological development of system of recycling solid waste. In 1975, Industrial Structure Council formulated Sub-committee for recycling waste. The sub-committee made a report in 1977, which pointed out the weakness of recycling non-valuable waste, insufficient technological development on recycling and environmental problem from recycling business. To solve these problems, the reports recommended establishment of comprehensive recycling policy. It also emphasized that policy measures should be developed, taken into account the marketability of waste.

Table 4. Categories and Obligation in Law for the Promotion of Utilization of Recyclable Resources

	Explanation	Industry/Products
Designated resource-saving industries	Business entities are required to reduce generation of by-products	Pulp and paper; inorganic chemical manufacturing; iron-making and steel-making/rolling; primary comer smelting and refining; automobile manufacturing
Designated resource-recycling industries	Business entities are encouraged to use recyclable resources and parts	Paper manufacturing; glass container manufacturing; rigid PVC pipes and pipe fitting manufacturing; copier manufacturing
Specified reuse-promoted products	Required to ensure rational use of raw material; prolong	Automobiles; home appliances; PC; Pachinko machines (a type of game

	product life and reduce generation of other used products	machine); metal furniture; gas and oil appliances
Specified reuse promoted products	Manufacturers are required to promote the use of recyclable resources and recovered products	Auto mobiles; home appliances; PC; pachinko machines; copier; metal furniture; gas and oil appliances; bathroom units and kitchen systems; devices using compact rechargeable batteries
Specified labeled products	Manufacturers are required to label these products to facilitate sorted collection	Steel cans and aluminum cans; PET bottles; compact rechargeable batteries; PVC construction materials; paper/plastic container and packages
Specified resource-recycled products	Manufacturers are required to Promote self-collection and recycling	PC; compact rechargeable batteries
Specified by-products	Business entities are required to promote the use of these by-products as recyclable resources	Coal ash generated by the electricity industry; soil and sand; a lab of concrete-asphalt and lumber generated by construction industry

Source: Compiled from various information.

After some efforts in 1980s, the Industrial Structure Council made the first Guideline for Waste Treatment and Recycling. The guideline has been revised for several years. The latest one is the ninth Guideline published in 2006. The nine guideline targets 35 items and 18 industries, which covers 70% of municipal solid waste and 40% of industrial waste.

The Law for the Promotion of Utilization of Recyclable Resources enacted in 1991 was supporting the dialogue on recycling policy between industries and MITI. The law was modified in 2000, and became the Law for the Promotion of effective Utilization of Resources. Based on this law, the MITI specified the responsibilities of manufactures or business entities in several categories, as presented in Table 4.

Although the punishment for non-compliance companies is not strong, the law defines responsibilities of implementing 3Rs on manufacturers.

Conclusion

Industrial policy for recycling has been a driving force to change Japanese economy to be more sustainable. In some Southeast Asian countries, integration of recycling policy into industrial policy is still weak. This paper hopes that the experiences in Japan as presented in this paper, can provide useful information on how to formulate similar policies in the region.

References

Kojima, Michikazu and Amit Jain, 2008. “Controlling pollution and small-scale recycling industries: Experiences in India and Japan,” in Michikazu Kojima, ed. *Promoting 3Rs in Developing Countries: Lessons from the Japanese Experience*. pp. 36-58. Japan: Institute of Developing Economies- JETRO.

Sangyo Kozo Shingikai, 1971. *Sangyo Kozo Shingikai Chukan Toshin – 70 Nendai no Tsusho Sangyo Seisaku no Kihon Houkou ha ikani arubekika* (Industrial Structure Council, *the Mid-term Recommendation of Industrial Structure Council – What should be the Basic Direction of Industrial Policy in 1970s*. (in Japanese). Place of Publication: Publisher.

Ministry of International Trade and Industry (MITI), 1991. *Tsusho Sangyo Seisaku Shi* (History of Ministry of International Trade and Industry) (in Japanese). Place of Publication: Publisher.

Paper Recycling Promotion Center, 1979. *Koshi no hyoujun kikaku ni kansuru chousa kenkyu houkokusho*, Clean Japan Center.

Paper Recycling Promotion Center, 2006. Koshi no hyoujun kikaku (Criteria for Standard Quality of Waste Paper), revised version on November 29, 2006 (in Japanese), downloaded from http://www.prpc.or.jp/ on March 15, 2009.

Takamatsu, Hideaki, 1980. “Star-dust’80 keikaku no genjo,” (Status of star-dust’80 plan) *Kankyo Kenkyu*, 28: 64-72 (in Japanese).

Chapter 6. 3R Policy and Related Activities in Thailand

Thumrongrut Mungcharoen
Kasetsart University

I. Introduction

Although 3R polices are still in the initial phase in Thailand, several initiatives have been undertaken to promote 3R, including the activities under the name of Cleaner Production (CP). From the perspective of enhancing competitiveness and economic incentive, CP is recognized as a successful tool. There has been rapid expansion in the applications of CP from industry to other sectors, especially education and research. In addition, cement industries started to utilize waste as alternative fuel and raw materials.

This paper reviews some efforts to promote 3R, including Cleaner Production programs and the usage of waste in cement industries and waste to energy facility.

II. 3R Related National Policies

Thai government has implemented some policies related to 3R in this decade. In January 2002, the government endorsed "National Master Plan on Cleaner Production". "Government Green Procurement Plan" was also endorsed in January 2008.

In order to tackle problem of resource depletion, pollution, hazardous waste, lack of land fill sites, global warming and others, the government has taken some efforts to preserve environment and natural resource and to improve green competitiveness of industries. Tools are cleaner production or cleaner technology, Life Cycle Assessment (LCA), Eco-design and Environmental Labeling (listed in ISO 14000). Government green procurement also pushes activities for greening the industry from the demand side. Not only the Ministry of Natural Resource and Environment, but also Ministry of Industry, and National Metal and Materials Technology Center have been interested in this filed and have conducted some programs. Thailand Environment Institute, Federation of Thai Industry and some universities have collaboration with these ministries.

One of latest initiative by the government is Government Green Procurement Plan. The Green Procurement Plan has some targets, in terms of percent of units (department level) implementing Green Procurement and percent to budget for each product purchase (see table 1).

Table 1. Target of Government Green Procurement Plan

Year / Item	2008	2009	2010	2011
Percent of Units	25	50	75	100
Percent of Budget	25	30	40	60

Source: Green Procurement National Plan

III. Cleaner Production in Thailand

III-1. Background

The activities to promote Cleaner Production were started in 1990. Backgrounds of the concern on cleaner production are as follows.

- Rapid expansion of the manufacturing industry is reflected not only by the increase in GDP, but also by the rapidly increasing rate of air, surface water, and soil pollution.
- "Command and control" (CAC) approach, based on European & American pollution control models, relying on laws and regulations establishing emission limits and the subsequent enforcement.
- The success of CAC approach has been limited due to the stringent environmental standards which are beyond the capacity of existing industries or certain industrial sectors in Thailand.
- The situation is further worsened by a generally incompetent monitoring and enforcement measures, resulting from insufficient manpower and training in the government sector.

In response to the continuing environmental degradation and the perceived limitations of the CAC approach, Thailand has included "CP" in the 8th National Economic and Social Development Plan (starting 1999). The plan promotes cooperation among government agencies, private organizations, local communities and individuals for environmental conservation by ***preventing*** generation of pollution at the source (commonly known as Cleaner Technology or CT) and finding solutions for existing pollution loads. See Table 2 for the list of important CP and related projects.

In order to share the knowledge of experts on CP, in 1998 Cleaner Technology Education and Research Consortium was established. It was initiated by NSTDA. Thai National Pollution Prevention Roundtable (TNPPR) was also set up in 1999 and has meeting every 2-3 months hosted by members such as NSTDA, Tourism Authority of Thailand (TAT), TISTR, PCD, DIW and others. The first annual meeting of TNEC was held at PCD on Dec 2001. The CP working groups on Education and R&D, Agriculture and Tourism, Industry and Government have been formulated.

Table 2. List of Important Cleaner Production and Related Projects

	Program	Donor and implementing organization	Activities
1990-1995	Industrial Environmental Management Program	USAID, IEM-FTI	CT in 38 factories (12 textile, 8 pulp & paper, 5 food, 5 iron & steel, 8 chemical factories)
1994-2001	Environmental Advisory Assistance for the Industry	GTZ, DIW	CT in leather tanneries, palm oil mills, fish processing, starch & derivatives, metal finishing
1996-2001	Network for Industrial & Environmental Management (NIEM)	UNEP, TISTR	CT in Pulp & Paper factories
1996-1998	Promotion of Cleaner Technology in Thai Industry	DANCED, TEI, and IEM-FTI	CT audit for Food/Metal Finishing and textile Industries. Set up CT information Center (CTIC) at TEI.
1997-1998	Participatory Approach to Environmental Management and Clean-up in Samut Prakarn Province	EU and TEI	Set up Participatory Environmental Management Committee. CT Audit for Auto parts and Agrochemical Industries.
1996-present	CT Internship Program	NSTDA, Universities and Industries (GUI concept)	Education and Research Program (Internship Program, courses on CT, LCA and Eco-design at universities)
1998-2000	Industrial Pollution Prevention and Cleaner Technology Transfer in Samut Prakarn	ADB and PCD	Project on Cleaner Production for Industrial Efficiency (CPIE)
1999-present	Sector Specific COP CT-manuals	CT unit at DIW	Make Sector Specific Code of Practice (COP) or CT-manuals
1999-2000	CT in Industry (Miyazawa Project)	DIW, TEI, FTI etc.	
1999-2001	CT in Industry and Farming	DANCED, TEI	
2000-2002	CT in Municipalities: Rachaburi & Bangpong	PCD & TEI	
2001-2002	CT & Benchmarking in Schools	DGE, TEI, NEPO	
2001-2004	Cleaner Technology Transfer Program	ADB and DEQP	
2005-2007	3R National Strategy Project in Model Countries	IGES, Ministry of Environment, Japan	Model countries: Thailand, Philippines, Malaysia, Cambodia

Note: ADB: Asian Development Bank
DANCED: Danish Cooperation for Environment and Development
DEQP: Department of Environmental Quality Promotion
DIW: Department of Industrial Works
DGE: Department of General Education EU: European Union
IEM-FTI: Industrial Environmental Management Office in Federation of Thai Industries
IGES: Institute for Global Environmental Strategies
GTZ: German Technical Cooperation GUI: Government-University-Industry
NEPO: National Energy Policy Office
NSTDA: National Science and Technology Development Agency
PCD: Pollution Control Department

TISTR: Thailand Institute of Science and Technological Research
TEI: Thai Environment Institute
USAID: United States Agency for International Development UNEP:
United Nations Environmental Programme

III-2. Some Programs for Cleaner Production

Thai government started Cleaner Production activities in 1990s. Based on various projects, experts of CP have been formulated. The Department of Industrial Works (DIW) in Ministry of Industry has promoted CP to Thai industry since 1998. They organized the experts to make Code of Practices on CP. The purpose of "Code of Practices" (COP) is to be used as guidance for specific industry in order to enhance competitiveness and reduce wastes (preserve natural resources). COP covers several CP measures, Environmental Performance Indicators (EPI) for benchmarking, and case studies. Up to February 2009, there are 12 CP Code of Practice (COP) for following industries: Dairy (Milk), Natural rubber, Pineapple canning, Frozen seafood, rice noodles, tapioca starch, fish canning, electroplating, Thai vermicelli, Wooden furniture, rice mill and Meat processing.

Pollution Control Department (PCD), MONRE has promoted CP to community and service sector since 1996. There are several projects (and manuals) for Schools, Hotels, Pig farm, Dyeing, Food, Sauce, Fruit drink, Cold storage, etc.

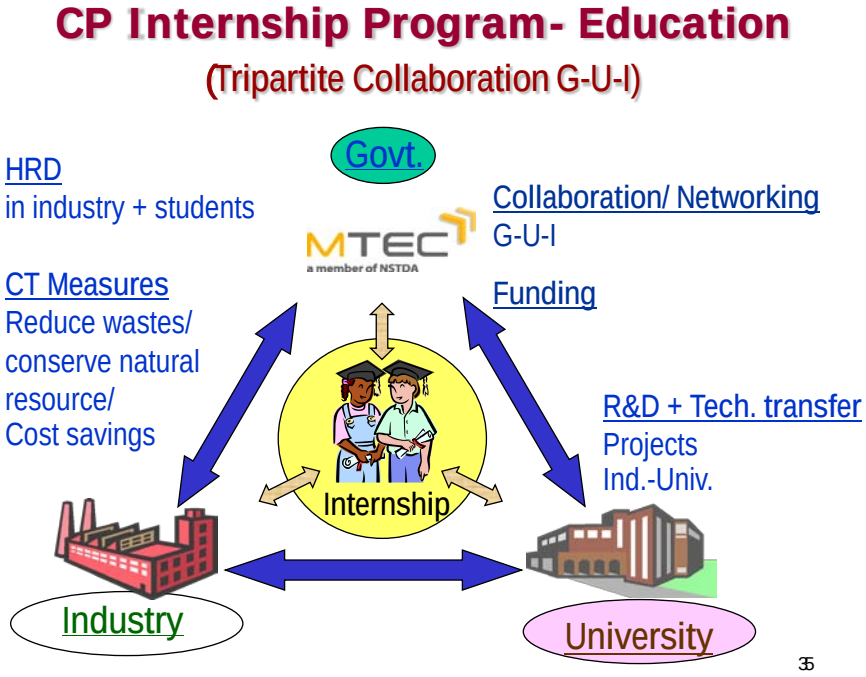
CP Internship Program in Thailand is operated by government, universities and industries (Figure 1). National Metal and Materials Technology Center under Ministry of Science and Technology is the program coordinator and the funding agency. Industry is on-site coordinator. Industries also bear the cost of per diem to student interns. CP experts and researchers in universities are mentors for student interns. The program has started since 1996, eight universities across the country are now participating the program: Chiangmai University, Khon Kaen University, Thammasart University, Chulalongkorn University, Kasetsart University, Mahidol University, King Mongkut University of Technology and Prince of Songkla University. Outputs of the project are human resource development of student interns and factory staffs, CP technology transfer to industry, pollution reduction and economic benefits. The first step of the CP internship program is recruitment of factories, students and faculties. Three day training workshops for factory coordinators, student interns and faculty members are organized. In the next step, CP audit is performed and the initial proposal is presented by student interns. After that, CT detail audit is performed, while low/no cost CT measures are implemented. Progress report is also presented. Final proposal is presented, after third CT audit is conducted.

Questionnaire survey for participated industries and faculty members during 2003 to 2007 showed that 76% percent of proposals had been implemented. While the investment was about 17 million baht, the CT measures can save about 50 million baht per year. Student interns also got experiences to improve the production processes.

Table 3. Output of CP Internship Program (2005-2008)

Year / Output	2005	2006	2007	2008
No. of university in the network	7	7	8	8
No. of Industrial Companies	102	106	111	67
No. of Students involved	204	222	238	142
No. of Faculty Members involved	165	153	153	100
No. of Coordinators from Industry	102	106	111	67
No. of CP-Options proposed	>102	>123	317	193
Expected Savings (Million Baht / year)	>153	>69	>125	>53
No. of Student's Research Projects	12	17	39	24

Figure 1.



III-3. Discussion for implementing Cleaner Production Program

Some success factors have been observed from various CP projects. Commitment of top management is an essential starting point to implement CP. CP expert team should have determination, creativity, ability and knowledge. Cooperation from all stakeholders including all employees is needed. Incentive mechanism for employee to participate CP, such as staff education, 2 ways communication and reward program should be carefully designed. Data on use of resource and generation of waste should be collected.

In addition, based on the experiences in Cleaner production activities, we learn following lessons. First, from the view point of capacity of target companies, CP

measures should be distinguished into two categories: good housekeeping (simple + no/low cost) for small and medium enterprises, and technology improvement (complicate + high cost) for large enterprises. Second, CP measures need both CP expert and industrial specific expert to work together. Third, it is important to highlight CP economic benefit. Fourth, cost of utilities (especially water/ wastewater treatment) should reflect the real cost (normally subsidized in developing countries). Fifth, Govt. should implement environmental tax/ polluter pay principle (assign all external cost related to environment.)

IV. Waste reduction and Recycling measures in Cleaner Production Program

Practical use of CP concept and practices for Thai industry cover both *simple options* as well as *sophisticated technology options* resulting in the reduction of production cost, reduction in pollution generation as well as improved environmental protection.

In the cleaner production pilot projects, some waste reduction and recycling measures were applied. For metal finishing industry, membrane filtration system to recover heavy metals and produce de-ionized water was installed. Spray rinse and static rinse after chromium handling and drag-out recovery tank were also applied. By these measures, water and chemical consumption can be reduced. Nickel was recovered by reverse osmosis system. Payback period was only 1.3 year.

Regarding rice noodle factory, by applying CT, starch, water and energy consumption were saved. Washing system was changed from mechanical (impeller) to pneumatic (compressed air) system. Continuous extrusion line package with automatic cutting machine was installed together with water reuse system and thermal insulation of steam equipment. Housekeeping practice was also improved. Economic costs and savings were estimated as Table 4.

Table 4. Economic Benefits of CP for a Rice Noodle Factory

CP Measures	Investment (Baht)	Savings (Baht/year)	Payback Period (Year)
1. Apply First in first out concept for rice storage	5,000	46,420	0.11
2. Install waste reuse system	91,000	48,710	1.87
3. Install washing rinsing system	75,800	79,730	0.95

Environmental Benefits are as follows.

Reduce starch loss (& solid waste, BOD in WW)	13,185 kg/yr
Reduce water consumption (& wastewater)	4,259 m^3/yr

Service sector can also make waste reduction by applying CP measures. Regarding hotel, solid waste segregation and organic/food waste composting save annually 78,413 baht and 4,000 baht respectively. A hospital can save annually 25,000 baht by segregation of infected and general wastes, 84,000 baht by the use of bulk package of juice and sauce, and 60,000 baht by recycling program.

V. Utilization of Waste by Cement Kilns and Waste to Energy Facility

Department of Industrial Works has announced the list of licensed facilities for disposal of waste or unusable materials, and classified these facilities into 2 main groups (DIW, 2007). The first group divided into 4 types: disposal of waste by cement kiln (9 facilities), disposal of waste by industrial waste incinerators (3 facilities), disposal of waste (hazardous and non-hazardous) by landfill (3 facilities), and disposal of non-hazardous waste by landfill (3 facilities). In the second group, 53 factories are classified as separation and recycling facilities.

V-1. Cement Kilns

Industrial solid waste is incinerated in cement kiln as substitutes to fuel and raw material or unqualified wastes. Typical wastes for fuel substitution are biomass such as rice husk, paper and cloth. These wastes are going to the unit of cement kilns. Examples of co-material or raw material substitution are steel slag, fly ash and bottom ash. These wastes are going to raw material preparing unit. Unqualified wastes such as contaminated wastes are also incinerated in the cement kilns.

Right now, the three cement manufacturers, TPIPL, Siam City Cement (SCCC), and Siam Cement Group (SCG), have a total capacity of industrial waste incineration around 411,703 tons/year (2007). Table 5 shows the volume of waste used by SCCC and SCG. TPIPL accepted about 121 thousand ton of hazardous waste annually.

Table 5. Disposal and Utilization by Cement Kiln of SCCC and SCG (Unit: ton)

	Waste	Total	Alternative fuel	Alternative raw material	Incineration disposal
Siam City Cement (2006)	Hazardous	101,414.46	6,606.52	68,107.42	26,700.52
	Non-hazardous	244,226.49	54,906.09	184.442.93	4,877.47
Siam Cement Group (2007)	Hazardous	132,329.55	50,352.09	66,440.45	15,537.01
	Non-Hazardous	167,476.52	44,886.36	107,588.93	15,001.23

Source: based on manifest data to DIW.

V-2. Waste to Energy Facility

Currently, there are 3 waste-to-energy plants in Thailand that can handle the industrial waste (Table 6).

Table 6. Incinerator for Industrial Waste

Facilitators	Maximum capacity (ton/year)	Status	Technology
Department of Industrial Works	12,600	Waiting a tender	Waste to Energy
OM TECNOS Company	960	Operational	
Bangpoo Environmental	36,500	Operational	Waste to

Complex			Energy

VI. Conclusion and Further Steps

Concept of 3R has not been fully adopted in national policy of Thailand, so far. But cleaner production programs cover waste reduction and recycling in manufacturers and service sectors. Such programs generate economic benefits and environmental benefits. In addition, some plants to utilize waste have been developed, such as waste to energy facility. Cement industries also utilize waste as alternative fuel and raw materials.

Based on the experiences of CP student intern program, human resource development on cleaner production is very important. With support of government, industries and universities should have collaboration program for Cleaner Production. Such programs can enhance human resources save resources. Industries also enjoy the cost savings.

One of the limitations of cleaner production is the fact that basic scope is limited to the production process in a factory. in order to reduce waste further in economical way, it may be necessary to work with other recycling factories. Although it is not mentioned in this paper, some other activities have been implemented in Thailand, such as Waste Information Exchange Programs and Eco-Town Programs, which will be reviewed in other papers.

References

Department of Industrial Works. <http://www.diw.go.th/>.

Industrial Environment Institute, The Federation of Thai Industries. <http://ftiweb.off.fti.or.th/iei/>.

Institute for Global Environmental Strategies <http://iges.or.jp/en/index.html>.

Integrated Waste Management for Thai Hotel Industry Report, 2000.

National Metal and Materials Technology Center. <http://www.mtec.or.th/>.

Pollution Control Department. <http://www.pcd.go.th/>.

Thailand Environment Institute. <http://www.tei.or.th/>.

Thailand Network of Eco-Efficiency and Cleaner Production. <http://www.tnec.info/>.

Chapter 7: Cleaner Production and the Necessity of Promoting Recycling Industry in Vietnam

HAI Trung Huynh

Institute for Environmental Science and Technology

I. Introduction

Vietnam's population is 86.16 million and distributed in 63 provinces and towns under direct control of the central government and/ or local governments. Being at the beginning of the industrialization and modernization period, the GDP growth rate of Vietnam in 2008 was 6.23%, the proportion of industry and construction in GDP (39.91%) is higher than that of agriculture (21.99%) and service (38.1%) (GSO, 2008). At present, the country is facing to an end of the Socio-economic 10-Year Strategy (2001–2010), which aimed to bring out the country from its under-developed status; to greatly improve people's physical, social and cultural living conditions; and to establish the foundation for Vietnam to become a modern industrialized country by 2020.

Rapid economic growth over the last years without taking appropriate attention to waste management has caused remarkable environmental degradation, especially on the problems of industrial and environmental pollution in urban cities. Vietnam now has 605,000 small and medium-sized private enterprises and around 1,800 major state-owned enterprises. Since 2006 and 2007, the country's industry has joint the ASEAN (Association of Southeast Asian Nations) Free Trade Area (AFTA) and the WTO (World Trade Organization), respectively. However, still 80% of Vietnamese enterprises are rated as having medium and low-level technology – this increased pressure on the environment**.** The amount of waste coming from industries, hospitals as well as households is facing the big challenges. The questions such as, "how to control it?", "how to minimise it?", and "how to recycle it?" are still the open-ended questions to environmental managers and policy makers. Vietnam is step by step trying to effectively manage it, and a number of environmental organizations as well as the environmental science and technology centres have proved the best efforts in protecting the natural environment.

II. Waste Management in Vietnam

II-1. Waste Generation

Vietnam's waste amounts to over 12 million tons each year, of which, majority is from urban cities (Table 1). In 2000, the average solid waste load per capita was 0.5-0.7 kg/person/day in large cities, this increased to 0.9-1.2 kg in 2008 (MONRE, 2008). In

addition, the solid waste was not separated at source, the industrial waste was mixed with domestic waste during collection, and transported to the landfills. A considerable proportion of domestic waste was disposed in canals, ponds, and lakes that caused water surface pollution and hampered the water flow movement. For toxic waste, the main measure to deal with it was to keep it in the factories' stocks, however this would bring about the risk of ground pollution within the factory's area in the long term. By the uncontrolled growth of industries and commercial institutions in the country, the problem is further compounded.

Table 1. Waste Generation in Vietnam in 2008

Category of waste	Sources	Total generation (1,000 t/yr)	% of total non-agricultural waste generation		
			Urban	Rural[1]	Total
Municipal waste	Residential Commercial	10,240	-	-	80
Industrial waste[2]	Industries	2,176	-	-	17
Hazardous healthcare	Hospitals	384	-	-	3
Total non-agricultural waste		12,800	51,56	48,44	100
Agricultural waste	Cultivation Livestock	64,560	0	100	100

Source: GSO, 2008 and MONRE, 2008.

Parallel with the industrialization of the country, the amount of industrial waste has been increasing. In 2008, more than 2.5 million tons of industrial waste was generated, of which 15% was hazardous waste (GSO, 2008). It was forecasted that by 2010, the industrial waste generation would be 3.2 million tons. In urban areas, industrial waste amounted approximately 22.5% of total municipal waste in Vietnam. The main sources are waste from light industries (occupied about 48% of total industrial waste), chemicals (24%), metallurgy (20%) and food processing (8%). In recent years, together with the development of information technology, the demand on electronic and telecommunication equipment in Vietnam is gradually creasing (Table 2), creating a stimulated market for development but also increasing electronic waste disposed to the environment. Electronic waste is considered hazardous waste. However, there has not been any specific study or full statistics on this waste in Vietnam.

[1] Rural industrial waste derives from craft villages
[2] Industrial waste excludes mining waste

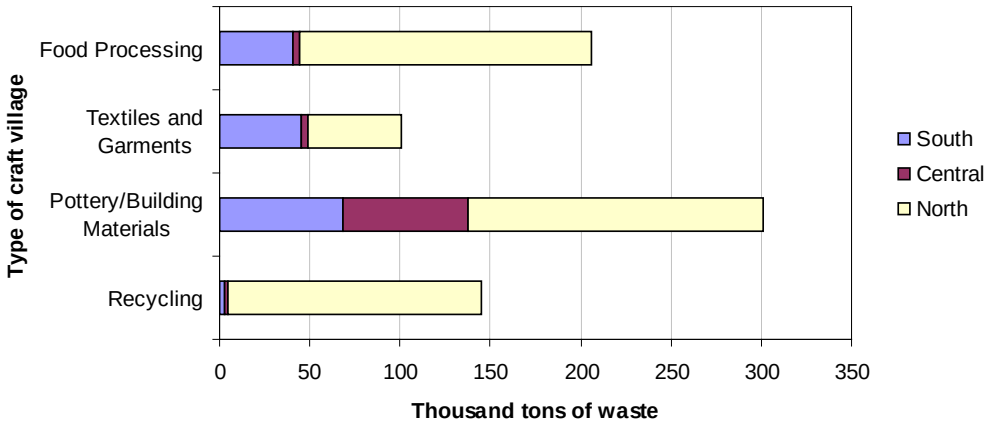
Table 2. Annual Growth Rate (%) of Electronic and Telecommunication Equipments

Product	2000	2005	2010
Home electronic appliances	12-15	12-15	10-13
Informatics and software equipment	15-20	20-25	25-30
Information and communication equipment	20-25	15-20	15-18
Industrial and specialized equipment	10-15	15-20	20-25

Source: UNS-HNU, 2006.

In rural areas, waste from agricultural production, forestry activities and traditional fisheries such as tree bark, leaves, paddy rice, seed husks, animal manure, etc. is used mainly as a source of fuel, fertilizer or is dumped. However, the amount of industrial waste generated from craft villages such as plastic, metal, persistent chemical residues is increasing rapidly, and is concentrated in the North. Waste problems have started appearing in populated areas (Figure 1).

Figure 1. Waste Generation from Craft Villages in Vietnam



Source: MONRE, 2005.

II-2. Waste Collection

According to Urban Environmental Companies (URENCOs), the average solid waste collection rate in cities reached 90% while it was only 40% in rural areas. A large portion (50-55%) of the municipal waste is organics such as kitchen waste. Usually, there are two systems of waste collection and disposal. In the first system, household collects their wastes in nylon bags and bins within their homes, and members of households along with workers of

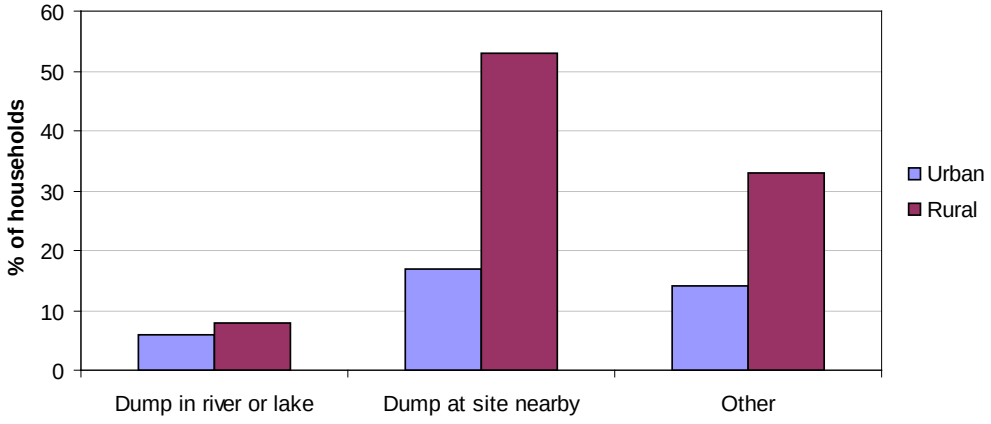
the local URENCO deposit them into the carts, and finally dispose by trucks to the dumping sites. The second approach is through communal storage in the living quarters. The Department of Transport and Urban Public Works (DTUPWs) and URENCO are the main authorities responsible for the administration of waste management in cities. In the case of electronic waste handling in Vietnam, a great number is collected by waste purchase units and recycled at craft villages and recycling units. For an industrial waste, it is classified at source under treatment method: reuse, recycle or discharge. Reusable and recycled wastes are sold to recycling units, non- recycled parts are collected, transported and treated by signing contract with local URENCO to landfill or store.

II-3. Treatment and Disposal

The treatment of solid waste is an urgent issue in Vietnam. Waste from traditional industrial areas is still collected and treated together with domestic waste and transported to dumping sites. There is only about 50-60% of the total toxic wastes that are being collected separately including hospital waste. The recyclable waste is mainly separated by the informal sectors. It is a limited, unorganized and unsystematic way of reusing and recycling solid waste. Waste recycling units are in small-scale with backward technology, which contributes much to the environmental pollution. In cities, a minimal amount of waste which is about 1.5-5% is made into bio-fertilizer and humus using hygienic technology (INEST, 2008).

Dumping is the most popular method of waste treatment in Vietnam. Currently, none of the dumping sites meets technical environmental requirements (sanitary landfill); and only 17 provinces treated waste by engineered landfills (GSO, 2008). In rural areas, self-disposal is common with no collection and disposal services, as shown in Figure 2. These dumping sites are seriously contaminating the soil, water and air environment.

Figure 2. Percentage of Self-disposal Waste by Households



Source: MONRE, 2005.

For hazardous waste, it is collected by licensed hazardous waste handling company, and stored on site and discharged with wastewater effluent. After classification, un-recyclable waste is treated by burning in incinerators or co-processing in industrial boilers, brick kilns, shaft cement kilns. Almost these treating units have small scale, use manual operation and with low or without control. The common technology of treating electronic waste is by burying or storing. Most of electronic waste in the North is collected by URENCO Hanoi, and then treated at Nam Son waste treating complex.

II-4. Waste Recycling

As mentioned, currently there is no large-scale systematic waste recycling facility in Vietnam. Recycling industry is only established in forms of craft village, small family business or private enterprises. These premises mainly operate for recycling paper, plastic, ferrous metals, aluminium, lead (Table 3) with backward technology and rudimentary equipment that are causing not only low economic benefit but also serious environmental pollution.

Table 3. Waste Recycling in Craft Villages

Materials	Quantity, Tons/year	Product, Tons/year	% being collected
Plastic	25.200	22.900	90.9
Paper	51.700	45.500	88.0
Metal	735.000	700.000	95.2
Total	811.900	768.400	94.6

Source: MONRE, 2005.

Recently, after receiving attention from the government, creating incentives for recycling is of priority in waste management. Waste exchanges and eco-industrial park is promoted in Bien Hoa 1 industrial zone. In the case of electronic industrial waste, the reuse part is relatively limited because the Vietnamese electronic sector has been focusing on using disassembly for spare parts. However, the recycling potential of this waste is high. About 80% of total electronic industrial waste can be recycled, according to MONRE's estimation.

Current polices for waste recycling management

In order to promote the environmental industry development harmonizing to economic growth, the basic institutional framework have set forth relatively. The detailed

regulations concerning to waste management and targets are to be striven for waste reuse/recycling/regeneration activities. The followings are some of great significances:

- Decision "No.152/1999/QD-TTg" by Prime Minister on approval of “solid waste management strategies in Urban and industrial zones of Vietnam towards 2020”;
- Amended Law on Environmental Protection (LEP) (became effective in July 2006) has spent section 1, 2, 3 of chapter III for solid and hazardous waste management;
- “*National Agenda 21”* provides further direction and could serve as a vehicle for improved cross-sector coordination; and
- Many other by-law documentations on environmental protection including collection of pollution fees, waste discharge, and waste management. The brief description of these documents is shown in Table 1 – Annex 1.

III. Cleaner Production Implementation in Vietnam

Cleaner Production (CP) has gained world acclaim for its proven ability to reduce industry's environmental burden while simultaneously improving industry's bottom line. The concept was pioneered by the 3M company and a few other large USA (The United State of America) - based processing industries. They realized in the mid 1970's that it could make far more sense- and money- to prevent waste and emissions in the first place, rather than to treat and control waste and emissions after these have been generated. Although it took until the mid 1980's before attempts were made to transfer the experience to small- to medium-sized enterprises, Cleaner Production practices and technologies for these enterprises developed and disseminated rapidly since then, particularly in Europe, North America, and more recently in Australia, New Zealand and South and East Asia as well.

Cleaner production was brought to Vietnam in 1998 by the Vietnam Cleaner Production Centre (VNCPC) of the Institute for Environmental Science and Technology (INEST), in the form of capacity buildings, and in-plant consultancy toward industry. From the beginning, VNCPC has been providing leadership and encouraging partnerships to promote the concept of CP on a national scale. Nowadays, cleaner production has become more popular and has attracted the interest and attention of almost enterprises as well as other related organizations in Vietnam. Outlined below are some of the policies and activities on cleaner production in Vietnam.

III-1. Policies and Legal Framework

CP activities in Vietnam have been based on relevant legislation and policies. Due to the broad content of regulations on environmental protection, this paper will focus on policies related to the prevention and control of environmental pollution in industrial production, and specifically on cleaner production.

III-1-1. Vietnam Agenda 21

The Government of Vietnam issued the "Strategic Orientation for Sustainable Development in Vietnam (Vietnam Agenda 21)" [3] on 17 August 2004, which gives orientations for the implementation of Agenda 21 in Vietnam.

The objective of the sustainable development in environmental terms is to utilize natural resources appropriately and effectively; prevent, stop, solve and control environmental pollution; protect the living environment; protect the national parks, natural preservation zones, bio-atmosphere preservation areas; preserve bio-diversity; overcome environmental degradation and improve the environment's quality.

In addition, the above mentioned overall objective gives eight main principles, of which principles four and five prescribe to "develop the environmentally friendly and clean production models", and to give priority to the "wide application of modern, clean and environment friendly technology. It then goes on with 18 priority areas.

CP is then linked to 7 of 18 priority areas as the followings:

a) Priority economic areas no 1, 2, 3

- Maintain rapid and stable economic growth rate based on continuous improvement in effectiveness, content of science and technology, thrifty utilization of natural resources and the environment.
- Shift production and technology modes as well as consumption patterns towards cleaner and environmentally friendly direction on basis of thrifty utilization of non renewable natural resources, minimization of the amount of toxic waste and substances with difficult dissolubility, maintain the society and individuals' lifestyle which is in harmony and close to nature.
- Implement the clean industrialization process. Formulate planning on industrial development with appropriate structures of industries, job categories, technologies and equipments that must comply with environmentally friendly principles as early as possible; actively prevent and deal with industrial pollution; and develop "green industries".

b) Priority natural resources and environment areas no 2, 3, 6, 7

- Protect water environment, sustainable utilize water resources.
- Appropriately and thriftily utilize mineral resources in a sustainable manner.
- Reduce air pollution in urban and industrial areas.

[3] Decision No. 153/2004/QD-TTg, on 17 August 2004, by Prime Minister

- Effectively manage solid and toxic wastes.

Priority economic areas, 3 in particular present a good basis for the promotion of cleaner production.

III-1-2. Strategy on Environmental Protection and Its Action Plan

National Strategy for Environmental Protection (NSEP) to 2010 and vision toward to 2020 was approved on 2 December 2003 (Decision 256/2003/QD-TTg).The NSEP states that "pollution prevention must be viewed as the key solution in combination with pollution control and treatment, remedy of degradation and improvement of the environmental quality", which includes "promoting the adoption of clean technology and cleaner production lines and the use of environmentally friendly and less pollution raw materials and fuels". The NSEP goes on by defining objectives and targets for 2010 and 2020, followed by 19 major activities and 36 specific programmes. The targets include a strong objective for implementing cleaner production that by 2010, all new establishments should apply cleaner technology or be equipped with waste minimization and treatment facilities to meet the environmental standards."

III-1-3. Law on Environmental Protection and Main Environmental Legislations

The Law on Environmental Protection (LEP) was issued on 27 December 1993, and became effective on 10 January 1994. The ammended LEP has adopted by the National Assembly [4] in the end of November 2005, and has come to enforce on 1 July 2006. The new LEP contains 15 chapters and 136 articles, of which the 12 following articles are related to cleaner production: 5; 6; 20; 23; 33; 43; 49; 108; 110; 116; 117; and 120.

The government encourages organization, and individual to utilize properly the environmental components, to apply advanced technology, cleaner technology, utilize waste, save materials, use renewable energy and bio- products in research, production and consumption.

Beside the LEP (2005), a number of other laws contain chapters related to environment. Their related clauses are summarized in Table 4.

[4] No. 52-2005-QH11; This Law was passed by Legislature XI of the National Assembly of the Socialist Republic of Vietnam at its 8th Session on 29 November 2005.

Table 4. Clauses related to Environmental Protection in Other Laws

Law	Clauses and/or description
Law on Science and Technology	Defines the tasks of Vietnam's science and technology as focusing on "proper use of natural resources and environmental protection"
Law on the Exploitation of Natural Minerals (1996) and Law on Petroleum (2003)	"the activities in this fields must apply appropriate technology, carry out measures in environmental protection, make availability of prevention measures on pollution and incidents " "be responsible for environmental remediation after exploitation"
Law on Water Resources (1998)	"the discharge of hazardous substances, untreated wastewater or wastewater that not meet the environmental standard to the water source is forbidden".
Law on Aquatic Product (2003)	"Methods, tools, measures of massive destroy in exploration, fishing are forbidden" "Application of Law on water resources on aquatic activities"
Law on encouragement of domestic (1999) and foreign investment (2000)	Encouragement and priority of investment on cleaner production, cleaner and environmental friendly technology conformance to all requirements of environmental impact assessment for investment projects

Some legislations related to industrial activities in Vietnam relevant to CP are shown in Table 2 in Annex 2.

III-1-4. Industrial Development Policy and Strategy

Ensuring a harmonization between socio-economic growth and environmental protection for sustainable development and an increased living quality is the key objective of the Government's socio-economic development plan 2006-2010[5], which sets out ambitious targets for improvement including:

1. 40% of urban areas have waste water treatment facilities;

[5] The five year socio-economic development plan 2006-2010 - Ministry of Planning and Investment Hanoi - March 2006.

2. Deal with 75% of establishments that cause serious environmental pollution;
3. 100% of newly-established manufacturing units adopt environmentally friendly technology;
4. 50% of production units and businesses have environmental protection tools; and
5. 3% of natural land is covered by forest.

The fifth principle of the Strategic Orientation for Sustainable Development in Vietnam states that: "Science and technology is the foundation and momentum for the country's industrialisation, modernisation, quick, strong and sustainable development. Priority should be given to wide application of modern, clean and environmentally friendly technology in production industries especially in the sectors and fields which have far reaching impact and capability to stimulate the development of many other sectors and production fields."

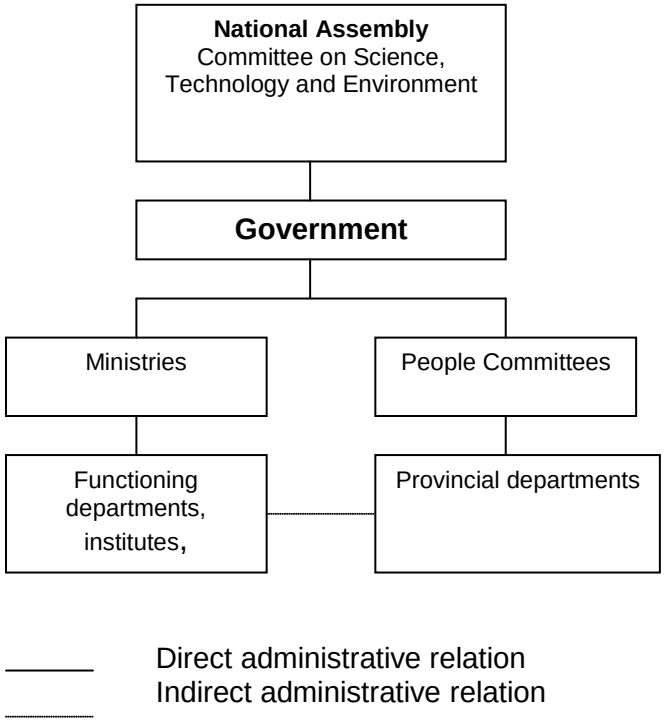
Based on the strategy of socio-economic development, the strategy for industrial development toward 2010 identified "industry is the key factor for economic growth of Vietnam with a speed 1.7 to 1.8 times higher than GDP growth" (i.e. 12-13% per year compared to 7-8% per year of GDP). In order to meet the target, technology innovation and upgrade are the decisive factors for development and improvement of competitiveness. The strategy also stated that the development must go with environmental protection. The national orientation on industrial development is defined as "selective industrial development toward modernization with priority given to export oriented sectors. Focuses should be placed on environmental friendly technology to ensure investment efficiency and the sustainability of the national industry".

III-2. Institutional Framework (The Actors)

III-2-1. Authorities (National and Local)

Figure 3 gives an overview of the Vietnam State's organization. At the top management level, the Committee on Science, Technology and Environment supports the National Assembly in the related fields.

Figure 3. Vietnam State's Organization



Ministries involved in CP:

1. Ministry of Natural Resources and Environment (MONRE): Its main responsibility is to develop environmental protection law.

    a. Vietnam Environmental Protection Administration (VEPA), supports MONRE to implement and enforce legislation although it also has a consulting role.

    b. Department of Natural Resources and Environment (DONRE): Provincial Up to date, 41 DONREs have set up a natural resource and environment division. These divisions will work on, but not limited to, environmental certificates, environmental impact assessment, environmental monitoring and environmental protection fees.

2. Ministry of Planning and Investment (MPI): It hosts ministry for Agenda 21, provides orientation for sustainable development and is in charge of the planning and investment.

a. The Department of Science, Education and Environment (DSEE) is supporting MPI in integrating annual and five year plans of other line ministries, universities and associations in order to propose appropriate policy measures and planning mechanisms, for the sector's specific plans. DSEE is the executive organization for Agenda 21.

b. The Institute of Development Strategy (IDS) is the administrative body of MPI that carries out researches to help develop and formulate socio-economic strategies; master plans; sectoral, local and regional development master plans; and national investment master plans.

3. Ministry of Industry and Trade (MOIT). It is responsible for state management of the industrial sector namely mechanical engineering, metallurgy, new energy, renewable energy, oil and gas, minerals mining, chemicals (including pharmaceutical industry), industrial explosion materials, consumer-goods industry, foodstuff industry and other processing industries throughout the country.

a. Science and Technology Department (STD) is the assistant body of the MOI in the management of science, technology, environment, standard, product quality, information technology and industrial ownership. The STD is the executive department of the Danish Project on Cleaner Production in Industry (2005-2010).

b. Institute for Industry Policy and Strategy (IPS) is the administrative body under MOI to carry out researches, studies in order to help development of strategies and policy for industry.

c. Industrial Safety Techniques and Environment Agency is an agency directly under the MOIT which fulfills the state management functions in terms of industrial safety technique and environmental protection in the industry and trade sector.

4. Ministry of Science and Technology (MOST). Its role is to manage activities of the state on science and technology, science and technology capacity building, product quality measurement standards, intellectual properties, atomic energy, radiation and nuclear safety.

a. The Department for Science and Technology (STD) is the assistant body of the MOST in the management of science, technology development of the following sectors.

b. The Department for technology Assessment and Inspection is the assistant body of MOST in unifying the management of evaluation, appraisal and examination of technology, technology transfer and provides consultancy in this field.

c. The National Institute for Science and Technology Policy and Strategy Studies (NISTPASS) is a research organization established in 1996 from the two former organisations: National Institute for Science and Technology Forecasting and

Strategy Studies (NISTFASS), and the Institute for Science Management (ISM) founded in 1978. In 2001, NISTPASS was awarded the Medal of Labour by the President of the Socialist Republic of Vietnam for its significant contributions to the science and technology development.

III-2-2. Universities and Research Institutes

1. Universities: Vietnam has 246 public and private universities and colleges[6], of which 42 offer training on environment (32 universities). So far, the following universities have introduced cleaner production as a 2-3 credit subjects[7]: University of Technology and University of Natural Sciences (from Vietnam National University of Technology Ho Chi Minh city), Ho Chi Minh city University of Technology, Van Lang University, Can Tho University, Hue University, Nha Trang University, Hai Phong University, Thai Nguyen University, Da Nang University, Hanoi University of Technology, University of Civil Engineering, Hanoi University of Science. The National Economics University is also integrating cleaner production into their existing topic on environmental economics.

2. Research institutes and centres: The following institutes and centres are mostly active in cleaner production:

   a. The Vietnam Cleaner Production Centre (VNCPC, www.vncpc.org) was founded in April 1998 at the Institute for Environmental Science and Technology, Hanoi University of Technology. It is a centre of excellence and advocacy in the field of CP. It is funded by the Swiss State Secretariat for Economic Affairs (seco) and is part of the UNIDO/UNEP (spell out) network of national cleaner production centres.

   b. The Vietnam Productivity Centre (VPC, www.vpc.org.vn) was established in 1997 under the Directorate for Standards and Quality (Ministry of Science & Technology). Its aim is to assist organizations and communities nationwide to improve their productivity and quality. VPC maintains a close and regular cooperative relationship with the Asian Productivity Organization (APO).

   c. The Energy Conservation Center of Ho Chi Minch City (ECC-HCMC) is working directly under the Department of Science and Technology of Ho Chi Minh City (DOST) since May 2002. Its aim is to gather dedicated scientists and technologists and managers from various industries in making policies, offering resolutions and training on efficient energy use and energy conservation for all of socio-economic components.

[6] MOET. <http://www.moet.gov.vn/?page=8.8&loai_bphan=261> (accessed 20 March 2009)
[7] Vietnam cleaner production Centre, Annual report 2006.

A list of international programmes and projects as well as a private sector and other organizations in the filed of CP are shown in the Table 3 and 4 of Annex 3, respectively.

III-3. Implementation

The main types of CP services to companies include rapid in-plant assessments or quick scans, and full CP in-plant assessments under the form of classical consultation services or combining with training.

1. Main types of CP services to companies:

Table 5. Annual Savings Achieved From CP Consultancy[8]

Sector	Elect., Mwh	Coal, ton	FO, ton	DO, ton	Gas, ton	Water, m^3	Chemicals, ton	Annual sav., USD	Invest., USD
Textile	6,991	1,747	6,510	0	0	1,014,223	496	2,011,205	506,149
Paper	44,338	24,541	1,901	0	0	2,906,570	1,228	3,297,851	766,246
Metal	911	490	111	21	41	150,203	77	503,414	307,481
Construction Materials	6,746	5,330	0	285	208	2,064,314	2.677	1,081,404	593,669
Food and beverage	727	383	163	30.2	0	80,143	60	797,434	173,840
Others	1,690	4,732	29	0	0.2	1,115,477	22	367,642	372,892
Total	61,403	37,223	8,714	336.2	249	7,330,930	4,560	8,058,950	2,720,277

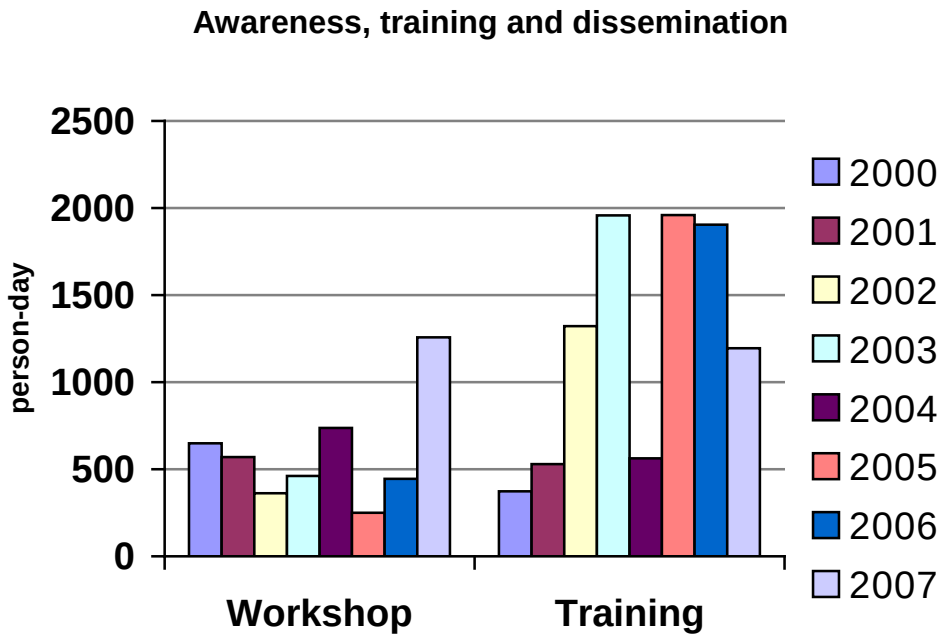
CP not only helps companies improve and protect the environment as well as saving non-renewable natural resources (through the reduction of water, chemical, and energy consumption) but also bring high economic efficiency with low investment costs to the company (annual saving is 8,058,950 USD while the investment is only 2,720,277 USD)..

-a. Quick scans, or rapid CP in-plant assessments, consist in a rapid review and evaluation of the CP improvement potential of a company. During a half-day or one-day company visit (depending on the company's size and process complexity), the consultant evaluates in which areas a company has the most potential for economic and environmental improvement through the application of CP and gives a rough estimation of how much these improvements could be done. The idea is to show the company the benefits it might get from the application of

[8] Annual report VNCPC 2007

CP, in the hope that the management will then be ready to invest in a full CP assessment.

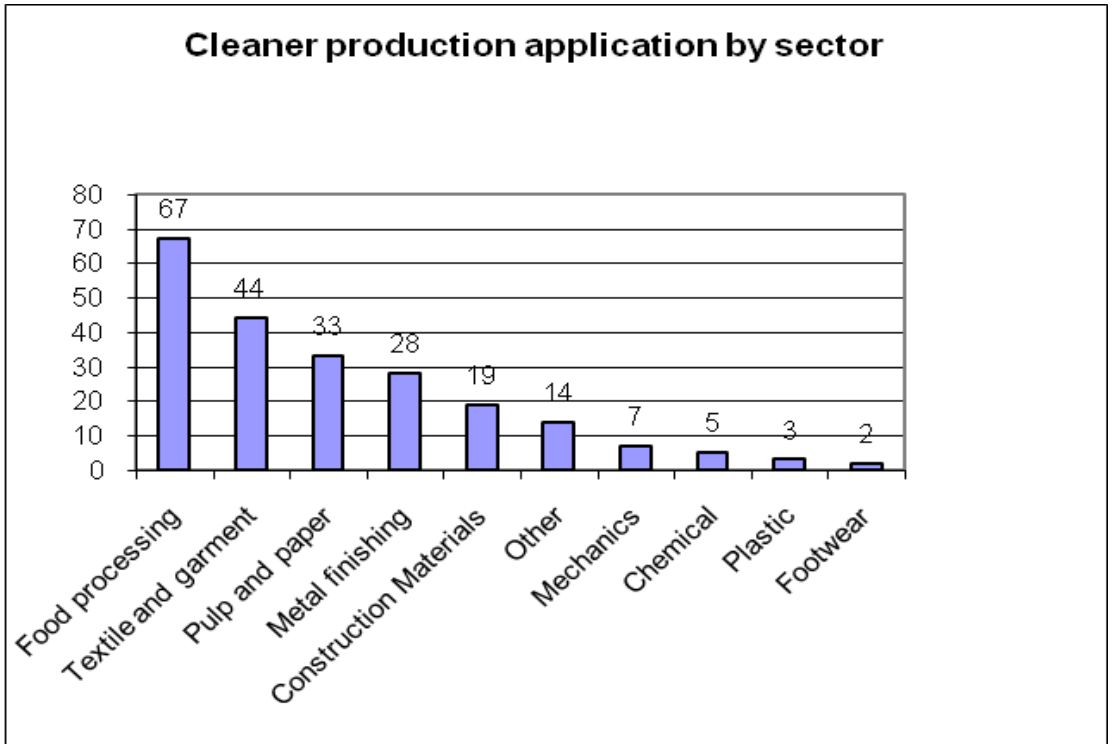
Figure 4. Awareness, Training and Dissemination Conducted by VNCPC[9]



b. Full CP assessments, covers duration of 6 to 12 months, depending on the size of the company and the resources devoted to the assessment. The objective is to analyze the situation of the company, develop ideas for potential improvements, determine their technical and financial feasibility as well as the environmental relevance, and develop an action plan for their implementation. The assessment can cover the whole company or focus on selected processes. While the company staff is carrying out the work under the responsibility of a CP team, the consultants visit the company on a regular basis to support the team and to ensure that the assessment is progressing according to plan. The ultimate objective is that the company will be able to apply CP on a continuous basis even after the consultants have achieved their support. This requires not only the acquisition of specific skills, but also significant changes of attitudes within the company staff and the management.

[9] VNCPC annual report, 2007

Figure 5. Cleaner Production Application by Sector[10]



2. Forms of CP services:

a. Consultation in classical consultation services, a consultant provides concrete advice for the implementation of one or several CP improvement measures (so-called CP options). The implementation is done either by the company or by the consultant/ consulting firm. One advantage of this solution is the possibility of quick implementation and thus achieved the desired results. The main disadvantage is that CP and its continuous improvement attitude are not integrated into the company's culture and the improvements tend to be short-lived, as the company management and workers promptly fall back in their previous habits and ways of working. Classical consultation usually does not lead to a sustained application of CP within the company.

b. Combining CP Assessment and Training: In order to provide a practical experience for trainees (mainly future CP consultants) as well as comprehensive

[10] VNCPC report

training to company's staff, trainings can be organized in combination with in-company assessment. The trainees follow the team to work in company for the first hand experience. The staffs of participating companies join in-class training with other future cleaner production promoters. In this case, CP assessments take in the form of a series of modules combining in-class training, in-company visits and consulting. This form works out especially well when the training is designed for a specific sector.

CP combined with related topics and environmental management tools

Despite its economic attractiveness in many respects, CP may not seem very attractive for a company manager when he evaluates the time he needs to put into it compared with the income he can get from spending time on other activities, e.g. sales. This hurdle, however, can often be overcome by combining CP programme with other services in a package that will better suit the needs and demand of the targeted client.

Table 6. Prioritize the Importance of CP and CP Related Services to the Business [11]

Order	Service	Consultancy,%	Training, %	Training and Consultancy, %	No Specification, %
1	Rapid CP Assessment	16	2	14	68
2	Full CP Assessment	21	8	14	57
3	Technology Gap Assessment	14	4	11	71
4	Energy Saving Advice	12	3	9	76
5	Financial Engineering	7	4	11	78
6	OHS	9	5	9	77
7	Design 4 Sustainability	9	4	12	75
8	Maintenance	4	5	16	75
9	Certification to a standard	7	2	5	86
10	CSR	15	2	7	76

[11] Surveying data by VNCPC, May 2006.

Companies were asked to indicate if they would prefer direct consultancy or training services or a combination of both. % is a % of the response rate for each service category. Responses have ranked other services relating to CP as low priorities in comparison with the CP services.

Cleaner production and energy efficiency:

One of the most obvious benefits through cleaner production application is energy saving. With the focus to specific thermal and/or electric use, the benefits can be quantified nearly immediately after the implementation. 20% of VNCPC's participating companies applied this programme even after benefiting from cleaner production assessment. Since the price of energy is increasing, the company has motivation in applying cleaner production. Similar idea can be applied to water efficiency, but this is not realized yet.

Cleaner production and hazardous waste management:

Using the same approach in cleaner production with focus to the usage of hazardous materials, cleaner production helps identify, reduce and thus manage the hazardous wastes. A programme is currently still going on in Nam Dinh province with 15 companies. The first batch composed of nine companies was completed with positive results. The curbing toxic chemicals as well as the amount used in the manufacturing process will result in the reduction of hazardous waste.

Cleaner production and occupational health and safety or social issues:

Similar to the hazardous waste management programme, cleaner production focuses to the working conditions and chemicals used in the companies. The application proved to be successful in 15 participating companies in Phu Tho province.

Cleaner production and end-of-pipe:

Obviously cleaner production helps reduce treatment cost. It is introduced now as a tool before designing end-of-pipe facility by VNCPC' CP trainees, particularly the ones in Ho Chi Minh city, where the environmental pressure and enforcement are highest. A typical example is CP application to reduce wastewater effluents (in both volume and effluent concentration) to reduce the size of the necessary wastewater treatment plant (WWTP), thereby significantly reducing the required investment. In certain cases, the reduction of the size of the WWTP also helps some companies with limited available space to avoid relocation. In other cases, the WWTP can even be avoided thanks to the application of CP.

CP and environmental regulation, relocation programmes, land use:

The DONRE HCMC has published a black book, which lists all polluters and a green book with good environmental performance companies. In order to be listed in the green

book, companies need to take actions to improve their environmental performance, and cleaner production can help.

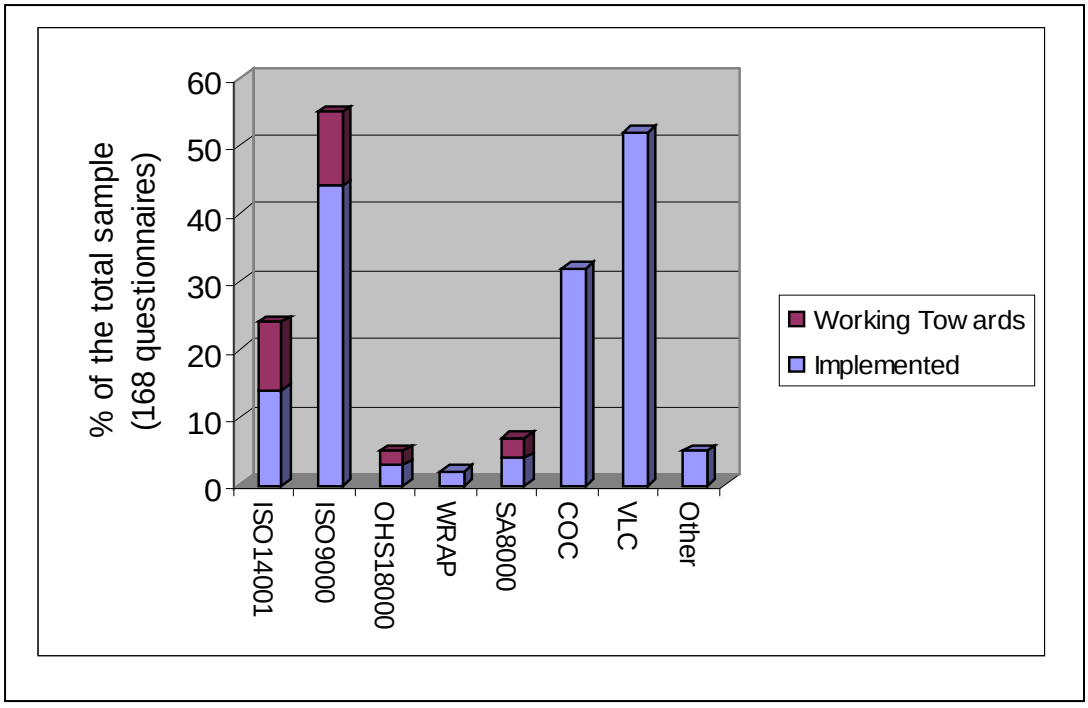
Following the decision 64/2003/QD-TTg on relocating the polluters and the current relocation programme of SMEs from resident areas to industrial parks, cleaner production can be a useful tool in designing phase/re-engineering or study on investment to avoid costs associated to relocation.

Although in practice this combination is not used enough yet, the DONRE of HCMC is considering to explicitly link the granting or extension of land use certificates to environmental performance and the application of CP by the concerned enterprises.

Environmental Accounting Management:

This tool has been introduced last year in Vietnam, mainly through training and case studies that serves training purpose. The number of application is still limited, but with promising market, particularly in export oriented, international and/or multinational companies, obviously cleaner production can be integrated in developing improvement options. Sai Gon Beer in Phu Yen applied environmental accounting management with support of a cleaner production expert.

Figure 6. Companies Working Toward to Standards [12]



[12] Surveying data by VNCPC, May 2006

Of 168 questionnaires analysed, only 52% of companies identified the Vietnam Labour Code as a standard they worked to. This indicates that there is a lack of awareness among industries about the basic labour law of Vietnam. As expected, ISO9000 is the second highest implemented standard. It is encouraging to see reasonable levels of awareness of ISO14001 in contrast to very low levels of OHS 18000 (ISO9000: Quality Management System certified by the International Standards Organisation demonstrates consistency of product quality; ISO14001: Environmental Management System certified by the International Standards Organisation demonstrates continual environmental improvement; and OHS 18000: Occupational Health and Safety (OHS) management system controls company's OHS risks and demonstrates its commitment to provide a safety working environment).

Environmental Management System:

Eighty-five (85) companies in Vietnam were ISO 14001 certified by December 2004. Application of CP provides continuous improvement actions, which is required for maintaining this certificate. Xuan Hoa Company (metal finishing in Vinh Phuc province) passed the surveillance audit despite some non-conformance thanks to the continuous application of CP. Ha Tien II Cement Company (Can Tho) can use the CP assessment as a base for its ISO 14001 application.

Incentives schemes:

With regards to the existing incentives, it appears that the only instruments currently enforce are user charges (e.g. on water and energy products) and fines which can be levied by Environmental Inspectorates in cases where environmental legislation has been violated. Environmental fines, if levied at all, typically do not have a tremendous financial impact on the enterprises fined, rather they are perceived as detrimental for the company image.

Multilateral Environmental Agreements/ International Conventions:

CP can also be integrated into projects related to the implementation of Multilateral Environmental Agreements like the Kyoto protocol (Kyoto protocol to the United Nations Framework Convention on Climate Change, and in particular the Cleaner Development Mechanism), the Basel Convention (Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal), or the Stockholm Convention (Stockholm Convention on Persistent Organic Pollutants).

IV. Shortcomings in Waste Management System and the Necessity of Promoting Recycling Industry in Vietnam

IV-1. Shortcomings in Management System

The summary on waste management and cleaner production issues in Vietnam shows that the problem of non-separated waste is further compounded. Dumping is the most popular method of municipal waste and non-toxic industrial waste disposal. The recycling industry is only established in forms of craft village or private enterprises. These premises mainly operate in recycling paper, plastic, ferrous metals, aluminum, lead with backward technology and rudimentary equipment causing not only low economic benefit but also serious environmental pollution. Hazardous waste is collected by licensed hazardous waste handling company, treated by incinerators with small scale, manual operation and low control.

It is obviously that the amount of waste that needs to be treated in Vietnam can be reduced if the recycling industry of the country develops. As mentioned, with high recycling potential, recycling activities can strongly be produced locally and supplied to rural areas. However, there remain a large number of shortcomings identified, which include the following:

- There has not been a clear division of responsibilities between different waste management agencies.
- There is a lack of appropriate investment in facilities for collection, transportation and separation that meet technical and environmental requirements. Modern facilities for recycling collected waste and treating toxic waste are also limited. It is a fact that recycling activities have not been done in all sectors, only mainly implemented spontaneously in informal sectors with backward technology.
- Community awareness of environmental problems and health safety concerning waste is still low. There has not been a wide participation from the communities and private sector in waste collection and management. As mentioned, one the most important obstacles in developing of recycling industry is a custom of disposing and storing home electrical and electronic, which have been used.
- Regulations of waste management operators, industries and other line agencies, and authorities suffer many gaps in enforcement and insufficient supervision of waste management practices. For example, there is no detailed regulation on take-back systems that have been promulgated until now. In order to put the take-back regulation into the practice, it is essential for Government to put additional efforts on establishing more detailed legislation on this system.
- Regulations are not effectively enforced because resources and institutional capability to implement Vietnam's policy framework is still weak. The role of various governmental agencies and limited interagency coordination is still overlapped.
- There is no systematic monitoring of waste (including solid and hazardous waste) generation, collection and composition - (based on the decision No. 16/2007/QD-TTg by Prime Minister on Jan 29, 2007 ratified the plan on developing national natural resource and environmental network toward 2020). For instance, in the recent years, the import of waste as materials for domestic production has been allowed and regulated (according to article 43 - amended Environment Protection Law). This permission has facilitated the local recycling business to exploit recyclable materials from the wider regions. However, the low capacity for monitoring imported industrial

waste puts pressure on the environment of Vietnam due to the increase in illegal waste trade.

Besides those shortcomings and threats, it is seen that there are significant opportunities for the development of recycling industry. The demand on some recycling products is very high, especially in rural areas. Moreover, the industry is receiving the great focus of the government.

Figure 7. SWTO Analysis of Recycling Management in Viet Nam

Strengths	Weakness	Threat	Opportunities
- Can reduce the total amount of the waste for landfill - High recycling potential - Can be produced locally (supplied to rural areas)	- Lack of appropriate investment in facilities - Low community awareness - Lack of resources and institutional capability - No systematic monitoring	- Recycling activities mainly implemented spontaneously in informal sectors with backward technology - Waste import is permitted	- Receive great focus of the Government - Demand on some recycling products - Production price will be decreased

IV-2. Necessity of Promoting Recycling Industry in Vietnam

From 2015, as a member of ASEAN, Vietnam will have to eliminate all import duties for the Inclusion list of products traded within the region; and as a member of WTO, the country will complete the reduction of all committed import tariff lines to the final bound rates (which are the lowest rates). The deeper economic integration, therefore, will create more opportunities as well as challenges for Vietnam's economy and environment. For example, in the case of electronic waste, the trend of tariff reduction together with improved living standards in Vietnam will make more and more obsolete electronic appliances be scrapped into the environment. The amount of electronic wastes in the country will rapidly increase. It is also a toxic crisis if some substances contained in the waste (such as lead, beryllium, mercury, cadmium etc.) are not properly treated. Therefore, in order to gain the complete benefits of economic integration, it is essential to tackle the issues of waste recycling urgently.

Some correlative principles are contained in the enforced laws and regulations (Articles 5, 65, and 67 of the LEP, Decree 59/2007/ND-CP, Decree 174/2007/ND-CP). These principles could provide a management system to deal with the waste recycling in particular and solid waste problem in general. However, up to now, the current legal framework in Vietnam lacks clear guidelines on waste recycling management.

In Vietnam, waste recycling activities are mainly spontaneous. The waste-handling infrastructure executed by informal sector has developed. Purely business-driven e-waste recycling factories have established without any government intervention. Shortcomings in capacities, skills and technologies may put workers and the environment at considerable risk. Therefore, some of the recycling processes are extremely harmful and need to be transferred to formal industries. Moreover, zero-waste society is now an important issue all over the world. Waste management issues in Vietnam should focus on special attention to social awareness and public policies toward sustainable waste management. This requires a technology and legal support from the government and other stakeholders.

In the recent years, the Government of Vietnam has paid special attention in seeking for appropriate management and technical solutions for developing the recycling industry in the country. Currently, the "National strategy for waste reduction, reuse and recycling until 2020" is being prepared by MONRE (called 3R strategy) with specific targets until 2020 as follows:

a) The amount of solid wastes that requires land filling and incineration will be cut down to 50% of the total volume of collected wastes while 50% will be reused and recycled; 100% of solid wastes will be collected; 50% household waste and 100% industrial waste will be separated at source;

b) 75% of household organic waste shall be processed to composted fertilizer; 50% industrial waste shall be recycled, and 90% of the construction solid wastes will be reused/recycled;

c) The amount of non-environmental packages produced and distributed shall be decreased to 10% of 2005; and

d) 1% of industrial enterprises will use cleaner production technologies; 100% of exported products and 70% of domestically consumed products will be environmentally labelled; 50% of businesses will apply ISO 14000 environmental management system.

At present, the 3R decree and Extended Producer Responsibility (EPR) decision are also in preparation. In order to promote the development of recycling industry, the Vietnamese policies may need to focus on the following matters:

- Develop collection and material classification systems for recycling;
- [Consumption's stimulation and develop] (Promote the use of and improvement of recycled products);

- Support financial resources to develop waste recycling;
- Implementation of the national waste recycling management;
- Concretize regulations of support financial resources and land for recycling;
- Develop policies to establish recycling of individual wastes; and
- Promote international cooperation.

V. Conclusion

Parallel with rapid economic growth, industrial sectors in Vietnam have indicated to have a high rate growth in both quantity and diversification, satisfying increasing requirements of consumers. However, this also has resulted in the appearance of the new wastes, and growing environmental pollution. In the waste management system, a large number of shortcomings have existed because responsibilities between different concerned agencies have not been cleared and mechanism for the service is still heavily subsidized.

In this report, with the introduction of waste legislation in the form of regulations directives, a significant move towards sustainable waste management is becoming a legal requirement. Under increasing waste discharge quantity by high economic growth, the laws concerned about proper waste treatment should be enacted. In addition, the action to promote 3R should be soon conducted for reducing the final disposal waste quantity and restraining consumption of natural resource.

In order to protect the environment as well as save natural resources, the Government's emphasis is now being placed on increasing recycling and promoting more sustainable waste management practices, and better coordination between the public, private and independent sectors, and all concerned with the management of waste and reusable materials.

References

1. The Basel Action Network (BAN) and Silicon Valley Toxics Coalition (SVTC), 2002. Exporting Harm: The High-Tech Trashing of Asia. <http://www.unige.ch/iued/wsis/DEVDOT/00166.HTM> .

2. MONRE (Ministry of Natural Resources and Environment), 2008. National Environmental Report 2007. Hanoi, Vietnam.

3. MONRE (Ministry of Natural Resources and Environment), 2005. National Environmental Report 2004. Hanoi, Vietnam.

4. GSO (General Statistical Office), 2008. Thong cao bao chi ve so lieu thong ke kinh te xa hoi nam 2008. Press release (December 2008). < http://www.gso.gov.vn/> .

5. INEST (Institute for Environmental Science and Technology), 2006. Project report: 01C – 09/07 – 2005 – 1 "Classification of Solid Waste of Electronic Industry in Hanoi and Propose Management and Technology Measure to Recycling and Reusing". Hanoi, Vietnam.

6. Government of Vietnam, 2005. Amended Law of Environmental Protection. Vietnam.

7. INEST (Institute for Environmental Science and Technology), 2005. National project report KC-08-09: "Scientific and Practical Bases for Recommendations of Measures to Improve Environmental Conditions in Craft Villages in Vietnam". Hanoi, Vietnam.

8. UNS-HNU (University of Natural Science - Hanoi National University), 2006. Proceedings of the Workshop on Current Status of Electronic Waste in Vietnam and Managing Solutions 2006-2010. Hanoi, Vietnam.

9. ASEAN Council of Japan Alumni (ASCOJA), 2007. Proceedings of the 17th ASCOJA Conference on "Community Based and Integrated Waste Management". Jakarta, Indonesia.

Annex 1

Table 1. Main Legal Documents for Solid Waste Management in Vietnam

No.	Name of Document	Over view	Date issued
1.	Decision No. 152/1999/QĐ-TTg on strategy on solid waste management in urban and industrial zones	Gradually establish a synchronous system on solid waste management in urban and industrial zones to control the pollution and environmental protection for sustainable development in industrialization and modernization stage	10th July, 1999
2.	Decision No. 155/1999/QĐ-TTg on regulations on hazardous waste management	The regulations on hazardous waste management to prevent and minimize their generation and adverse impacts on the environmental quality and public health. Mapping out the responsibilities of institutions, privates involve to discharge, collect, transfer, store, treat… hazardous waste….	16th July, 1999
3.	Decision No.2575/1999/QĐ-BYT on regulations of medical waste management	Mapping out the responsibilities of all health services over country to manage medical waste.	27th August, 1999
4.	Decision No. 15/1999/-QĐ-TTg of the Prime Minister approving the "Strategy for solid waste management in rural areas and industrial estates in Vietnam towards 2020 ".	Gradually establish a comprehensive system on solid waste management in the urban and industrial areas to control the pollution, environmental protection towards to sustainable development in industrialization and modernization term of the country.	10th July, 1999
5.	Decision No 62/2001/ QĐ-BKHCNMT on technical documents of incinerators of medical waste	Stipulations on the basically technical requirements on incinerators of medical waste, was used as technical bases for assessing and approving the incinerators of medical waste	21st November, 2001
6.	Decision No 60/2002/QĐ-BKHCNMT regarding to promulgation on technical guideline of hazardous waste dumping	Technical guidelines provides the methodologies, Principles, and criteria to minimize and prevent the hazardous waste 's impacts on public health, environmental quality and integrated feasible approach for sanitary landfills for hazardous waste for every localities	7th August, 2002
7.	Decree No: 13/2003/NĐ – CP on list of hazardous goods, transportation of hazardous goods on road	Stipulations on list of general hazardous goods, the transportation by road. Especially for radioactive substances, transportation activities have to comply with Decree No 50/1998/NĐ-CP dated in 16th July 1998. Otherwise, for transportation of industrial explosive substances, Both this decree and Decree No 47/CP dated in August 12 th 1996	19th February, 2003
8.	Decision No. 64/2003/QD-TTg. Approving the plan for thoroughly handling establishments which cause	Establishes roles and responsibilities for identification and reporting the worst pollution sources, and modes or implementation to address these sources.	22nd April, 2003

No.	Name of Document	Over view	Date issued
	serious environmental pollution.		
9.	Decision No. 256/2003/QDD-TTg on approval of national environmental protection strategy until 2010 and vision toward 2020	Target to 2020: prevent basically the critical pollution, recovery the environmental declination and improve the environmental quality to ensure the sustainable development and public health. Target to 2010: Solve basically the environmental degradation in industrial zones, condensed community in big cities and rural zones, recover the pollutions on river branches, and explore properly the natural resources and preserve the biodiversity sustain…	2nd December, 2003
10.	Decision No. 153/2004/QĐ-TTg on the promulgation of sustainable development orientation in Vietnam (National agenda 21)	Sustainable development orientation in Vietnam is a framework strategy as legal bases for the ministerial, local, institutional agencies to act and ensure the close and reasonable coordination between economic, social development and environmental protection	17th August, 2004
11.	Decision No. 34/2005/QD-TTg for promulgating the Government's action program for implementation of the Politburo's Resolution No. 41/NQ-TW of November 15, 2004.	...maps out responsibilities and actions of the government and the people for implementation of Resolution #41 above.	22nd February, 2005
12.	Directive No.23/2005/ on promoting solid management in urban and industrial areas	Figure out the responsibility of authorities at level of ministerial, local and relevant to implement the solid waste management in urban and industrial areas	21st June, 2005
13.	Law on Environmental protection 2005	Stipulations on environmental protection activities as policies, measures and human resources for environmental protection, rights as duties of organizations, institutions, individuals… in environmental protection	29th November, 2005
14.	Official document No. 1160/TCHQ-GSQL on customs management for hazardous waste	Stipulations on the transference of hazardous waste to Vietnam's boundary (internal and territorial waters)	24th March, 2006
15.	Circular 12/2006/TT-BTNMT on promulgation of permissible imported waste as raw materials	Stipulation of List of permissible imported waste as raw materials is compliance to regulations at article 42 and 43 of environmental protection law and replacing decision No. 03/2004/QĐ-BTNMT dated 2nd April 2004 on environmental protection for imported waste	8th September, 2006
16.	Decree No. 59/2007/NĐ-CP on promulgating regulations for solid waste management	Stipulation of solid waste management activities, responsibilities of all organizations, agencies, individuals… involving the solid waste	9th April, 2007

No.	Name of Document	Over view	Date issued
17.	Decree No.81/2006/ND-CP Sanctioning of Administrative Violations in the Field of Environmental Protection.	… Prescribes violations of relevant regulations and applicable sanctions and remedial actions.	9th August, 2006
18.	Decree No. 174/2007/ND-CP on discharges of solid waste	Stipulations on environmental discharges from solid waste, fee management and payers…..	29th November, 2007
19.	Circular No. 08/2008/TT-BTC on amending and supplementing circular No 108/2003/TT-BTC on guideline of financial mechanism application in projects related to domestic waste treatment and urban waste funded by ODA	Detail guideline of financial mechanism application in projects related to domestic waste treatment and urban waste funded by ODA	29th January, 2008
20.	Circular No. 39/2008/TT-BTC on guideline implementing the decree No. 174/2007/ND-CP on solid discharge	Concretizing the Decree No. 174/ND-CP on implementing the solid waste discharge as the payers.	19th May, 2008

Annex 2

Table 2. Legislation Related to Industrial Activities in Vietnam Relevant to CP

Date	No	Type and content	Issued by
25 June 1998	36-CT/TW	Directive on strengthening the environmental protection in the period of industrialization and modernization	Politburo
1 July 1998	45/1998/ND-CP	Decree on technology transfers	Prime Minister (PM)
16 July 1999	155/1999/QD-TTg	Decision on the regulation on management of hazardous waste	PM
06 May 2002	1146/BKHCNMT-MTg	National CP Action Plan	Ministry of Science, Technology, and Environment
26 June 2002	82/2002/00-TTg	Decision on the setting up, organization and operation of Vietnam Environment Protection Fund	PM

Date	No	Type and content	Issued by
22 April 2003	64/2003/QD-TTg	Decision on approving the plan for thoroughly handling establishments which cause serious environmental pollution	PM
13 June 2003	67/2003/ND-CP	Decree on environmental protection charges for wastewater	PM
17 August 04	153/2004/QD-TTg	Decision: Strategic orientation for sustainable development of Vietnam (Agenda 21)	PM
15 Nov 2004	41-NQ/TU	Decree on environmental protection during the period of industrialization and modernization	Politburo
9 March 2005	01/2005/TT-BKH	Circular on implementation of the Strategic Orientation for Sustainable Development in Vietnam	Ministry of Planning and Investment
20 May 2005	68/2005/ND-CP	Decree on chemical safety	PM
21 June 2005	23/2005/CT-TTg	Directive on strengthening the solid waste management activities	PM
29 November 2005	No. 52-2005-QH11	LAW ON PROTECTION OF THE ENVIRONMENT	NATIONAL ASSEMBLY
2006		Preparation of a decree on the promotion of CP	Ministry of Industry and Trade

Annex 3

Table 3. List of international projects and programmes related to cleaner production

Existing Partners	Nature of work
UNIDO	CDM
DANIDA Development Cooperation in the Environment (DCE)	Cleaner Production in Industry
UNEP GERIAP	Encourage business energy efficiency to reduce associated GG emissions.
SECO (Hazardous waste management in Nam Dinh)	Waste minimisation
SEMLA (SIDA and MONRE)	Strengthening environmental management and land administration.

UNEP D4S	Development of a project proposal for D4S
VEPA / SDC	Raising the capacity of VEPA to handle and treat PCBs in Vietnam.
CIDA: VCEP	Strengthening provincial and national agencies in the field of Ind. Pollution management
CIDA Making Waste Work for the Economy with NISTPASS	Regional project to alleviate waste challenges
UNIDO / SIDA / DONRE Pollution Reduction in HCMC	Using case studies from previous research to develop policy and build capacities
UNDP GEF small grants programme	Supports demonstration of community level strategies and technologies
UNDP Formulation and Implementation of Agenda 21	Supports Government in formulation of Agenda 21
US-AEP (USAid) Asia Environmental Partnership	Regional Programmer o promote environmentally sustainable growth and improved quality of lie in six Asia Countries
ADB (HCMC DONRE)	HCMC Environmental Improvement. Revolving fund for CO
UNIDO Regional Energy Efficiency Programme	
UNIDO / GEF regional POPS programme	To promote BAT and BEAP for the management of POPS
SDC / UNIDO PCB Management Project	Capacity build Government to manage PCBs
UNIDO (VCCI/VBLI)	CSR
ADB & UNIDO Regional CP for Greater Mekong sub-region	Mekong River Pollution and TEST (Transfer of Environmentally Sustainable Technology) to industries lining the river.

Table 4. Private Sector and Other Organizations in the field of Cleaner Production

Organisation	Activity
The Vietnam Productivity Centre (VPC)	Main focus is management systems including EMS to improve productivity and quality.
Energy Conservation Centre HCMC	Training on energy efficiency and policy development, under DOST
Lefaso	Leather and Footwear business association have been involved in CSR
BLC (Tanneries Project) in partnership with Pentland, Adidas etc	Leather processing consultancy who are developing an environmental standard for tanneries.
Center for development and integration	Economic integration Governance and Privatization and Corporate Social Responsibility in Environment and Labor Aspects
Royal Melbourne Institute for Technology (RMIT)	Provide corporate consultancy support in the field of HR, Management change, Social issues.
Corporations.	Under the Ministry of Industry, 16 industrial sector corporations manage the state-owned companies of the following sectors:
Business Associations	There are over 80 business associations The associations exchange information between their members and support trade promotion.
Industrial Zones	Decree 64 requires the movement of polluting industries from urban areas to industrial zones

Chapter 8. Study on 3R Policy and Waste Exchange in the Philippines

Lisa C. ANTONIO
Philippine Business for Environment

Executive Summary

The Philippines as a nation is implementing various 3R (reduce, reuse, recycle) programs and activities to reduce both the traditional waste such as paper, plastic, scrap metal, kitchen waste; and the second-generation/ non–-traditional type of waste (e.g. those which require special handling, and therefore different policy options) from households and industries. This report discusses measures undertaken in the past ten years, including updates on the national policies on solid waste management, the recently emerging industry waste management approaches and the recycling programs, including waste exchange, and offers some recommendations for scaling up.

A Filipino generates between 0.3–0.7 kg of garbage daily, and the annual generation by households was estimated at 10 million tons, with an expected rise by 40% by the end of the decade. Much of the waste is concentrated in the urbanized areas. In Metro Manila, more than fifty percent of waste collected is organic/ biodegradable, and forty four percent is recyclable. This implies that with proper waste management, only about six percent of the city's waste needs to be specially treated or disposed.

Waste from the waste generators (households, industries, commercial establishments) are either self–-disposed, discharged (illegally or through legitimate waste collectors such as junk shops, eco-aides and municipal collection crews), or sent for recycling (either through waste dealers/ consolidators who in turn bring them to the recycling industries or export these to foreign buyers). Despite increases in the recycling rate, the use of domestically available recyclable resources is still largely limited.

Through the Republic Act (RA) 9003, otherwise known as the Ecological Solid Waste Management (ESWM) Act of 2000, the National Solid Waste Management Commission (NSWMC) was established under the Office of the President, and designated the local government units (LGUs) as the lead implementers. RA 9003 also mandated the creation of the Solid Waste Management (SWM) boards nationwide to develop and implement solid waste management plans. The Act also mandated the establishment of materials recovery facilities (MRFs) in all *barangays*[1]/ villages, as support systems for waste diversion from the landfill; segregation at source; segregated collection; a prohibition against the use of open dumps for solid waste; a shift to the use of sanitary landfills; and a twenty five percent diversion of their solid wastes from waste disposal facilities through reuse, recycling, composting. There are now 2,312 existing MRFs covering about twenty percent of the total *barangays*; and a total of twenty four existing sanitary landfills nationwide, with twenty one more under construction in the next two years (Source: NSWMC).

[1] Barangay is a smallest political unit in the Philippines

RA 9003 also calls for the implementation of a national recycling program, whose components are to include requirements for eco-labeling; environmentally preferable purchasing; and identification of non-environmentally acceptable products and packaging (NEAPP). As a result, the Philippines launched its eco-label, Green Choice Philippines in 2003. Criteria have already been developed for thirty four product categories and the ecolabel has thus far been awarded to twelve products, namely two detergent powder brands (PRIDE and SURF), one detergent bar brand (PRIDE) , five cement brands (Rizal Super Blended Cement, Island Portland Cement, Palitada King Masonry Cement, APO Pozzolan Cement, APO Premium cement), one Natural infill material, X – TEC fully synthetic engine oil, AGIP Extra HTS Engine Oil and AGIP Diesel Sigma Plus Engine Oil. The Green Choice Philippines Seal of Approval is owned by the Philippine government through the Department of Trade and Industry and the Department of Environment and Natural Resources, and is administered by the Philippine Center for Environmental Protection and Sustainable Development, Inc., an environmental non – government organization. (www.pcepsd.org.ph)

The Executive Order (EO) 301 issued in March 2004, requires the executive departments to establish their "Green Procurement Programs", although only little has been done in this area. In January 2009, the President issued EO 774, re-organizing the Presidential Task Force on Climate Change and designating herself as the overall "Chief ." This significantly states that the offices of the Task Force members comprised of the different Cabinet Secretaries, have to "immediately practice proper solid waste management". The EO also sets aside every Friday of the week for the President to "devote five (5) hours to concerns and initiatives for environmental security" (Section 1).

The challenges of the garbage crisis, the renewed policy emphasis and initiatives have encouraged the development and adoption of different waste management approaches and technologies. At the community level, this includes household and municipal composting through efforts of progressive LGUs and non-government organizations (NGOs) like the Recycling Movement of the Philippines and the Metro Manila *Linis Ganda* Foundation. The Department of Science and Technology (DOST) has also been at the forefront of developing technologies for managing biodegradable waste, recyclable materials and the residuals. Many industry groups/ associations have adopted solid waste management as priority areas for their members, to help companies design and implement waste reduction programs that also reduce their operational costs. New business opportunities have resulted in more environment service providers for treating special and hazardous materials such as fluorescent lamps and bulbs, sludge, and contaminated waste. However, there is still much room for expansion here, and treatment costs are not always within the reach of smaller companies, especially those in the regions outside of Metro Manila.

Waste Exchange is one option for managing residual wastes. In the Philippines, the PBE (Philippine Business for the Environment) manages the Industry Waste Exchange Program (IWEP). It operates as an Information Clearinghouse that matches waste generators and waste buyers, and promotes resource recovery through orientation sessions, company in–house seminars, environmental exhibit/ trade fairs, case studies/ publications, waste markets and recyclables collection events, and IWEP advertisements in its quarterly *Business and Environment Magazine*.

Manpower constraints at PBE make it difficult to track all possible waste exchange referrals, or offer services beyond referrals and promotion. Nevertheless, there have been several documented case studies of successful waste exchanges. In addition to IWEP, the Davao City Chamber of Commerce and Industry in the Mindanao area and the Eco-Industrial Exchange Network (Eco–Index) of industrial estates in the Laguna-Batangas area also actively promote waste exchange, with some measure of success.

Continuing challenges exist with the promotion of 3R and Waste Exchange in the Philippines. among which are the lack of enforcement of even basic requirements of RA 9003 (such as the closure of open dumpsites, the establishment of MRFs, and the twenty five percent landfill diversion rate); the lack of widespread knowledge of the potential for waste reuse, and of the appropriate technologies; technology and economic limitations (for waste conversion) for some types of waste (like household batteries and junk cellphones); and the lack of incentives and a viable financial model for programs like IWEP. Thus, among the report recommendations are the following:

1. Improved 3R Knowledge Management - not only for Regional Ecology Centers but also with PBE's own IWEP;
2. Ramping up of advocacy programs for solid waste management using actual success stories;
3. Following through on the Presidential initiative to make the Executive Department and its Cabinet Secretaries accountable for the solid waste of their department;
4. For the citizenry to make their elected officials accountable by turning garbage management into a political governance issue;
5. Environmental investments in SWM as top priority by local governments, and from the private sector for new recycling facilities especially in other parts of the country; and
6. Policy initiatives that create incentives for environment technology development and adoption/ transfer, especially for locally–developed technologies, and setting a national recycling target and performance monitoring system

This report also acknowledges recommendations from the 2008 JICA Study on Recycling Industry Development which called for four key policy programs:

- Recycling Industry Information and Database Management, not only from local end users but also from waste importers/ exporters;
- National Action Plan formulation, for specific recyclable materials of highest value to the country;
- Local Recycling Plans Formulation, emphasizing the importance of source separation of recyclable materials and the development of new business / job opportunities);and
- Development of Recycling Guidelines, i.e., target recycling rates, measures to increase collection rate and use of recycled materials, consensus building.

Acronyms

ADB	Asian Development Bank
DENR	Department of Environment and Natural Resources
DOST	Department of Science and Technology
DTI	Department of Trade and Industry
EO	Executive Order
IWEP	Industry Waste Exchange Program
JICA	Japan International Cooperation Agency
LGU	local government unit
MRF	materials recovery facility
NEAPP	non-environmentally acceptable products and packaging
NGO	non-government organization
NSWMC	National Solid Waste Management Commission
PBE	Philippine Business for the Environment
PRIME	Private Sector Participation in Managing the Environment Project
RA	Republic Act
SWM	solid waste management

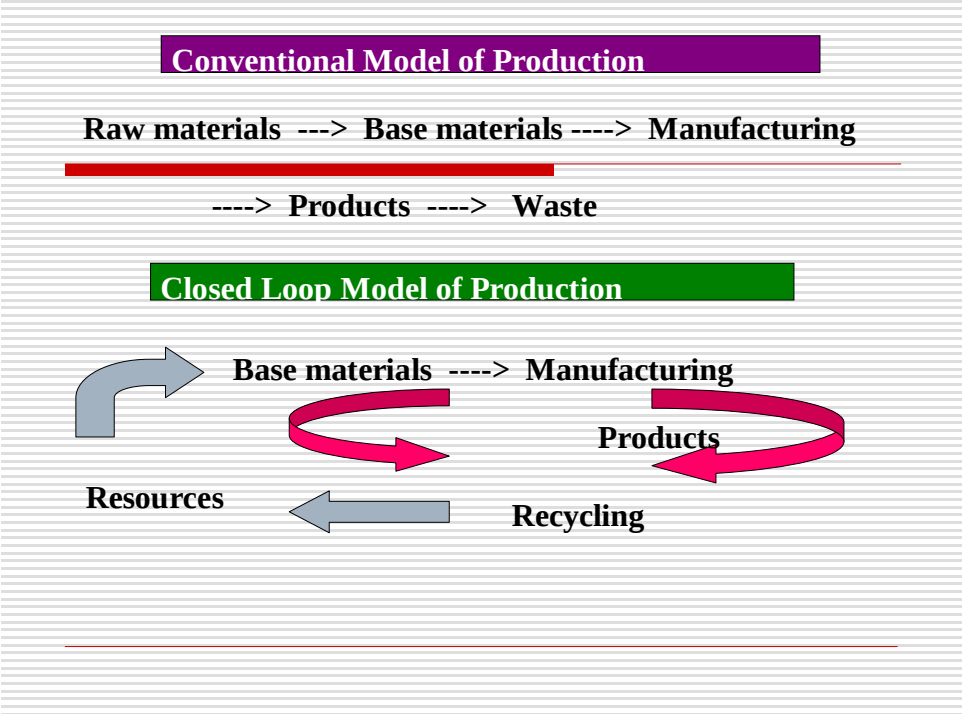
I. Introduction

Human and economic activities to support modern day lifestyles have created unsustainable patterns of production and consumption which have led to crisis proportions of waste, pollution and resource depletion in all parts of the world, and in Asia in particular, with its fast-growing economies.

In response, government and other sectors have begun attempting efforts to reduce waste, and to reuse, recover and recycle still useful waste materials to create an ecocycle society where materials extracted from the environment are managed efficiently and responsibly.

In the domestic sector, these efforts have focused on waste segregation for zero waste management, since as much as 80-90% of household waste is either compostable or recyclable in most developing countries. In the industry, this refers to a Closed Loop Production Model, where potential waste from different parts of the production process are identified and recovered or recycled for on–site or off- site applications. This differs markedly from the traditional production model where waste from the manufacturing process is merely disposed.

Figure 1. The Closed Loop Production Model vs. the Conventional Model



Faced with its own mounting environmental challenges as it pursues economic development, the Philippines is implementing various 3R programs and activities which are the subject of this report. To differentiate this report from other similar previous ones on the Philippine waste management situation, the focus will include 3R practices for second–generation/ non – traditional type of waste (e.g. which require special handling, and therefore different policy options) and recent emerging industry waste management

approaches which need to be considered in the context of deepening regional economic integration, transboundary waste movements and cross- boundary environmental issues.

II. Domestic and Industrial Waste Situation, Composition and Waste Flow in Metro Manila, Philippines

Waste is waste, whether it comes from households, industry, commercial establishments, public markets. It essentially refers to leftover materials, discards that are of no use to its original user even if, as some would argue, there really is no such thing as waste – everything is ultimately a resource or of value to someone or something else, which just happens to be in the wrong place.

II-1. Waste Situation

A Filipino generates between 0.3–0.7 kg of garbage daily, depending on income level. In 2004, the annual generation by households reached 10 million tons, and is expected to rise by 40% by end of the decade. The regions which produce the highest rate of waste are the National Capital Region (NCR) and the Southern Tagalog region (which has a concentration of industrial parks and small industries), accounting for 23% and 13% of the country's total waste volume, respectively[2].

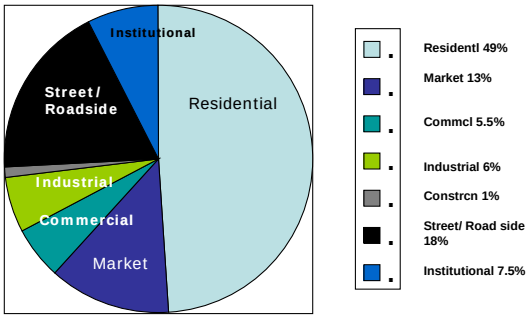
Table 1. Waste Generation by Region, 2000 (in million tons/yr)

NCR	**2.45**	**23.0 %**
CAR	**0.17**	**1.6 %**
Ilocos	**0.50**	**4.7 %**
Cagayan Valley	**0.32**	**3.0 %**
Cen Luzon	**0.96**	**9.0 %**
S Tagalog	**1.42**	**13.3 %**
Bicol	**0.54**	**5.1 %**
W Visayas	**0.82**	**7.7 %**
C Visayas	**0.74**	**7.0 %**
E Visayas	**0.43**	**4.0 %**
W Mindanao	**0.40**	**3.8 %**
N Mindanao	**0.37**	**3.4 %**
S Mindanao	**0.70**	**6.6 %**
Cen Mindanao	**0.33**	**3.1 %**
ARMM	**0.26**	**2.5 %**
Caraga	**0.26**	**2.4 %**
National	**10.67**	**100 %**

Recent data from the National Solid Waste Management Commission (NSWMC) states that Metro Manila generates more than 7,000 tons of garbage daily, compared to 6,700 tons in 2004 (i.e., an increase of at least 5%). Households account for the largest share of wastes produced, followed by market waste. This has prompted the government to step up community education efforts on waste segregation and to provide LGUs with the technical assistance they need to develop their SWM Programs, establish their MRFs and build sanitary landfills.

[2] Source: World Bank. 2001. Philippine Environment Monitor.

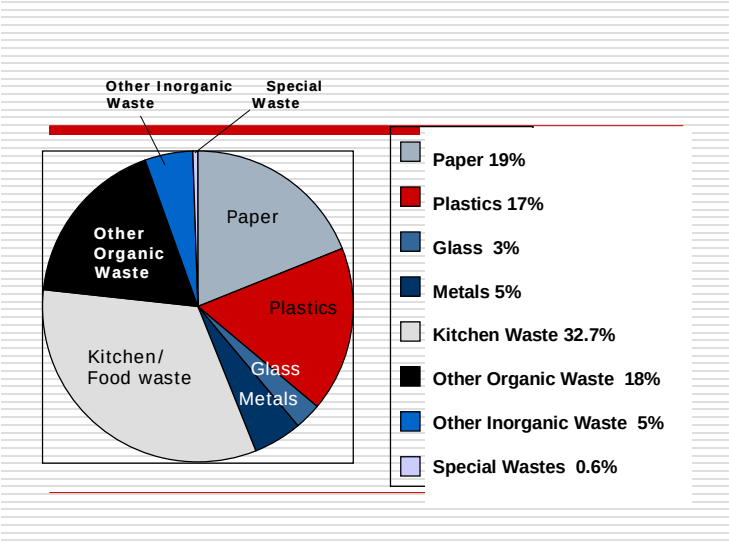
Figure 2. Waste Sources in Metro Manila[3]



II-2. Waste Composition

A waste analysis and characterization survey conducted in five local government units in Metro Manila under the 2003 Asian Development Bank Metro Manila Solid Waste Management Project, showed that more than 50% of waste collected was organic/ biodegradable, and 44% was recyclable. This implies that with proper waste management, only about six percent of the city's waste needs to be specially treated or disposed.

Figure 3. Composition of Disposed Municipal Solid Waste in Metro Manila



A 2008 JICA Study on Recycling Industry Development in the Philippines breaks down the volume of total recyclable materials in the waste stream, projected over the next two years as follows:

[3] National Solid Waste Management Commission

Table 2. Total Recyclable Materials in the Waste Stream (tons)

Materials	%	2006	2008	2010
Paper	19	3,601,317	3,856,274	4,129,280
Plastic	17	3,222,231	3,450,350	3,694,619
Iron	3	568,629	608,885	651,992
Aluminum	2	379,086	405,924	434,661
Glass	3	568,629	608,885	651,992
Total	44	8,339,891	8,930,318	9,562,544

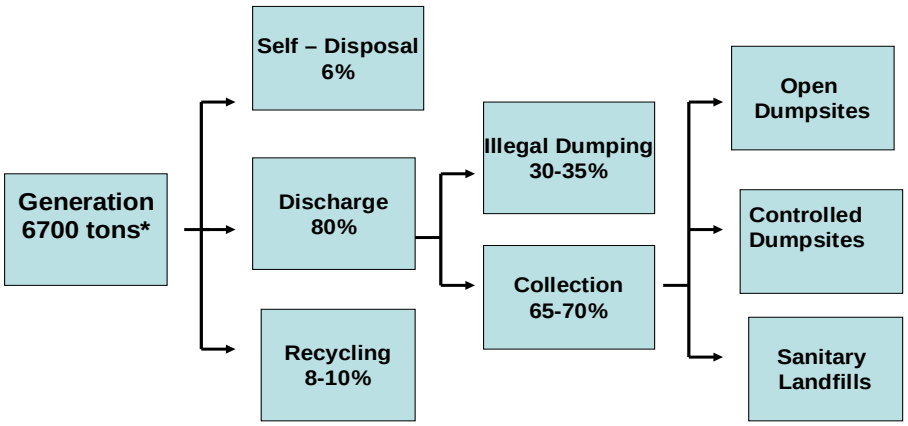
Table 2 shows the largest expected increase in the volume of waste paper, followed by plastics, as a result not only of population growth but also of increased consumerist practices. This implies that "raw material" for the recycling of such items should also increase.

II-3. Waste Flow

Waste from the waste generators (households, industries, commercial establishments) are either self–disposed, discharged (illegally or through legitimate waste collectors such as junk shops/ eco-aides[4] and municipal collection crews), or sent for recycling (either through waste dealers/ consolidators who in turn bring them to the recycling industries or export these to foreign buyers).

[4] Eco – aides were mostly former street scavengers, who have been organized and accredited by the Metro Manila Federation of Multipurpose Cooperatives under the *Linis Ganda* Foundation to collect recyclable materials at the community/ *barangay* levels. The Federation includes 17 individual member multipurpose cooperatives representing the 17 local governments of Metro Manila; at least 572 junk shops, 2500 junk shop workers, 1200 eco- aides and 132 waste truck drivers. (Source: The Garbage Book, 2004.*Solid Waste Management in Metro Manila, Department of Environment and Natural Resources and the Asian Development Bank*.)

Figure 4. Metro Manila Solid Waste Flow



Source: National Solid Waste Management Commission

Various unofficial claims put the recycling rate as high as 28% if waste retrieval by scavengers, and various community and civil society initiatives are taken into account. Nevertheless, the use of domestically available recyclable resources is still largely limited due to:

- Improper/ sporadic segregation of waste materials at sources of generation resulting in lower quality of recyclable materials;
- Lack of incentives to households and other waste generators like commercial establishments;
- Limited technological and financial capacity of local industries for raw material substitution;
- Price fluctuations in the international market and unstable domestic supply of recyclables;
- Logistics difficulties for the transport of recyclables (since the Philippines is mainly an archipelago and there are limited recycling facilities in the regions); and
- Lack of information and widespread network for resource/ recyclables recovery and collection.

The NSWMC estimates that 65-70% of discharged waste is collected in the urban areas, and eventually ends up in controlled dumpsites, sanitary landfills or open dumpsites. Collection efficiency in rural areas is at around 40%. According to the NSWMC, there are 24 existing sanitary landfills nationwide, with 21 more under construction in the next two years (NSWMC, 2008).

To improve the waste management system, Republic Act 9003, otherwise known as the Ecological Solid Waste Management (ESWM) Act, mandates that all *barangays* establish their MRFs, whether individually or in clusters. MRFs are intended as support systems for waste diversion from the landfill. The LGUs need to divert at least 25% of their solid wastes from waste disposal facilities through reuse, recycling, composting and other resource recovery activities within five years after the effectiveness of the Act, and

increased every three years afterwards. According to the NWMSC, there are now 2,312 existing MRFs covering about 20% of the total *barangays* (NSWMC, 2008).

Per capita cost of solid waste management ranges from ₱ 64.00 in Pateros City to ₱ 1,164.00 per person in Makati City (the affluent financial and residential district)[5]. In 2001, over ₱ 3.54 billion (US$ 667 million) was spent on the collection and disposal of solid wastes in Metro Manila, costing approximately ₱ 1,450 ($26.40) per ton (Table 3). Solid waste refers to discarded household, commercial waste, non -hazardous institutional and industrial waste, street sweepings, construction debris, agricultural waste and other non hazardous/ non toxic wastes (ADB 2004).

Table 3. Annual Per Capita SWM Cost & LGU Expense, 2001 (P'000)[6]

Annual Per Capita SWM Cost & LGU Expense, 2001 (P'000)

LGU	Tot Populn	Per Capita Cost	SWM Cost	Tot LGU Budget	%
Caloocan	1,190,087	300	357,077	141,883	*24%**
Las Pinas	477,791	160	76,361	850,009	9%
Makati	449,583	*1164**	418,577	5,270,998	8%
Malabon	342,447	64	22,067	348,800	6%
Mandaluyong	81,426	352	94,123	1,129,801	8%
Manila	1,597,841	360	574,990	4,558,818	13%
Marikina	395,316	134	52,804	778,475	7%
Muntinlupa	383,331	280	91,377	1,059,651	9%
Navotas	232,845	199	43,974	292,836	15%
Paranaque	454,579	402	182,893	1,358,644	13%
Pasay	358,670	680	243,807	1,219,353	20%
Pasig	510,412	314	160,458	1,814,072	9%
Pateros	58,016	64	2988	62,186	5%
Quezon City	*2,196,874**	429	*941,829**	4,467,316	21%
San Juan	118,927	436	46,701	430,373	11%
Taguig	472,329	256	52,370	432,394	12%
Valenzuela	490,579	109	42,716	734,606	6%
	9,811,053				
AVG ALL LGUs	---	393	3,558,345	26,300,215	13%

(Source: ADB Garbage Book, 2004)

An increase in the second–generation/ non– traditional type of waste has been observed in the recent years. This is due to the increased use of new consumer goods like electronic equipment and cellular phones, and the frequent replacement of old home appliances like television sets and refrigerators with the introduction of newer models and the importation of surplus units. Because these materials often have hazardous components, their resulting waste requires special handling.

In general, those units flow from the manufacturers or surplus importers to the retailers, electronic and surplus shops to the consumers. Once rendered as junk (either because of non–working condition or obsolescence), these are sold to junk shops, accredited waste collectors, exporters or recyclers for remanufacturing, reprocessing or recycling. Others are dismantled through informal backyard operations which create

[5] US $ - Peso exchange rate was approximately US$1 – P50 at that time
[6] Source: ADB Garbage Book, 2004

health and safety risks for the workers, and result in some component parts being sent to the dumpsites/ landfills together with municipal waste.

III. National Policy on Solid Waste Management and Recycling

The RA 9003 became a law on January 26, 2001. It introduces measures to "merge environmental protection with economic pursuits, recognizing the re-orientation of the community's view on solid waste and providing schemes for waste volume reduction, resource recovery, recycling and reuse". It goes beyond cleanliness and anti-littering programs to bring solid waste management into the home and workplace of every Filipino, and shifts 3R into a national strategy.

The Act describes the institutional roles and responsibilities of various stakeholders, with the NSWMC (under the Office of the President) as the lead Policy Making body, the Department of Environment and Natural Resources (DENR) as the lead agency for Technical Support and Enforcement, and the LGUs as the lead implementers**.** LGUs can pass the requisite ordinances and can determine the appropriate penalties/ fines for violations, the collection of which is divided between the LGU (40%) and the National SWM Trust Fund (60%), to be used to fund programs under the Act.

It mandates the creation of SWM Boards nationwide to develop and implement solid waste management plans, taking into consideration the physical and socio–economic conditions and needs of the concerned communities. Civil society and the private sector are tasked to initiate, participate and invest in integrated ecological solid waste management projects, manufacture environmentally friendly products and introduce, develop and adopt innovative processes that shall recycle and reuse materials, conserve raw materials and energy, reduce/ prevent waste and pollution.

Complimenting the mandatory requirement for the establishment of MRFs (Section 32), RA 9003 also requires segregation at source (Section 21); segregated collection (Section 23); and a prohibition against the use of open dumps for solid waste (Section 37).

Segregation at source refers to the use of separate and properly marked containers for different types of waste, and intensifying the recovery of materials and post consumer products. Waste is classified as either compostable, recyclable, non – recyclables/residuals, or special waste.

Segregated collection refers to the use of collection trucks/ accredited haulers, compartmentalized waste collection vehicles during collection schedules determined by the *barangays*.

Open dumpsites are to be closed and/or converted into controlled disposal facilities, or otherwise rehabilitated, and more sanitary landfills are to be constructed. According to the NSWMC, there are twenty four existing sanitary landfills nationwide, with twenty one more under construction in the next two years.

A novel provision of RA 9003 is the section on citizens' suits (Sec 52), which allows any citizen to sue any government official for neglecting his duties under the Law, through an arrangement that involves local NGOs, people's organizations (POs) and the

Integrated Bar of the Philippines (IBP) as representatives for the prosecuting parties. Such an approach has successfully put pressure on some local chief executives for the better implementation of the law, such as in the phase–out of open dumpsites and in the establishment of MRFs.

The collection, transport, handling, treatment, and disposal of special wastes is covered by another law, RA 6969, otherwise known as the Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990. Hazardous waste generators and waste management service providers need to register with the DENR and apply for special permits to conduct SWM activities such as transporting and operating treatment or recycling facilities, and importing waste materials. There are currently 82 hazardous waste management providers registered in the DENR database, of which 71 are located in Metro Manila/ Luzon[7].

RA 9003 also calls for the implementation of a national recycling program, whose components are to include Requirements for Eco-Labeling (Section 27); Environmentally Preferable Purchasing (section 28); and the Identification of Non-Environmentally Acceptable Products and Packaging (NEAPP) (Section 29).

With regards to eco-labeling, an eco-labeling body was set up at the Department of Trade Bureau of Product Standards (BPS) co–chaired by the DTI and the DENR, with representatives from NGOs and business sectors. The eco-labeling program aims to guide the Filipino consumer to choose products and services that pose minimum risks to the health and the environment. The Philippine National Eco-labeling Program, dubbed as "Green Choice Philippines", was launched in 2003.
Criteria have already been developed for thirty four product categories and the ecolabel has thus far been awarded to twelve products, namely two detergent powder brands (PRIDE and SURF), one detergent bar brand (PRIDE) , five cement brands (Rizal Super Blended Cement, Island Portland Cement, Palitada King Masonry Cement, APO Pozzolan Cement, APO Premium cement), one Natural infill material, X – TEC fully synthetic engine oil, AGIP Extra HTS Engine Oil and AGIP Diesel Sigma Plus Engine Oil. The Green Choice Philippines Seal of Approval is owned by the Philippine government through the Department of Trade and Industry and the Department of Environment and Natural Resources, and is administered by the Philippine Center for Environmental Protection and Sustainable Development, Inc., an environmental non – government organization. (www.pcepsd.org.ph)

Recognizing the potential influence of the government as one of the largest procurement blocks, the Office of the President also issued Executive Order 301 in March 2004 requiring all departments, bureaus, offices and agencies of the executive branch to establish their Green Procurement Programs. Although this has not been implemented nor monitored, one outcome of this is the inclusion of environmentally preferred criteria in the procurement guidelines of the Department of Budget and Management. A Technical Working Committee, tasked to develop the guidelines for NEAPP, has also been holding public hearings and consultations with business and other sectors, but has yet to finalize a list.

[7] Source: www.denr.gov.ph/nswmc

Very recently, President Gloria Macapagal-Arroyo also issued the Executive Order 774 in January 21 2009, reorganizing the Presidential Task Force on Climate Change and designating herself as the overall "Chief " and significantly stating (in Section 1) that the offices of the Task Force members comprised of the different Cabinet Secretaries, are to "immediately practice proper solid waste management." The EO also sets ~~and setting~~ aside every Friday of the week for the President to "devote five (5) hours to concerns and initiatives for environmental security".

This action created much hopeful thinking from the environmental sector, and bears watching in as much as it also sent a strong message of the link between environmental problems like solid waste and the larger issue of climate change.

IV. Waste Management Approaches

The challenges of the garbage crisis, the renewed policy emphasis and the initiatives taken by the government, civil society and the public sector have encouraged the development and adoption of different waste management approaches and technologies.

IV-1. Community- Based SWM Approaches

Foremost among these is the household and municipal composting, which refers to the biological decomposition of the organic portions of solid waste under controlled conditions to produce compost, a soil–like material high in organic matter, and therefore useful as organic fertilizer[8].

NGOs like the Recycling Movement of the Philippines have popularized an approach they call Zero Waste Management – an "ecological method of handling wastes that facilitates their sanitary retrieval, reuse or recycling through a combination of techniques or procedures which aim at maximum, if not total, use of wastes into healthful, beneficial, productive and aesthetic purposes." There are three basic steps to follow: segregation at source, labeling for efficient handling, and ecologically friendly use and disposal adopting the multi –Fs of recycling: factory returnables, feed, fertilizer, fuel, fine crafts, fermentables and filling materials[9]

Another well known NGO is the Metro Manila *Linis Ganda* Foundation, which established the Metro Manila Federation of Multi-purpose Cooperatives which organized the network of junk shops in Metro Manila mentioned earlier, trained eco – aides and provided them with seed money to collect the recyclables from households and bring them to the junk shops. In 2000, *Linis Ganda* purchased 101,850 tons of waste paper, corrugated boards, plastics and metals which fetched up to ₱ 132.5 million.

Other examples of community-based initiatives include the following:

(a) Doy Pack Recycling Program of the *Kababaihang Iisa and Layuning Umunlad ang Sambayanan* (KILUS) in Bgy Ugong, Pasig, which buys or solicits doy packs and transforms these into useful materials such as bags and place mats;

[8] Ma. Lourdes G. Rebullida, Resource Recovery in Solid Waste Management: Strategies, Initiatives, Policy Issues, 2000.
[9] Ibid.

(b) Bag Making Project of the *Samahan ng Muling Pagkabuhay* Multi Purpose Cooperative (SMP–MPC) of Smokey Mountain (the former infamous open dumpsite), which makes bags, baskets and decorative containers from old newspapers and telephone directories; and

(c) Tile making project (from collected/ sorted garbage) of Barangay *Bagong Buhay* in Pasig City, to name a few.

IV-2. Municipal Waste Management

The most widespread technologies for treatment and disposal of municipal garbage in the Philippines are composting and sanitary landfilling. This is primarily due to the characteristics of our solid waste which are generally high in moisture and organic content and low in calorific value. Incineration is restricted to treatment of infectious medical and hazardous wastes. LGUs generally use landfilling or landspreading as a disposal system. In 1999, each of the 1,607 LGUs operated and maintained their own open dumpsites, but with the passage of RA 9003 LGUs are required to convert these into controlled dumpsites and sanitary landfills.

IV-3. Industry Waste Management

Many industries have also adopted solid waste management as priority areas for their members. They have mounted environment awareness sessions and seminars on solid waste management to help their member companies to design and implement environment programs and waste reduction programs that would also eventually reduce their operational costs. Several of these industry groups are members of the *Business Agenda 21*, a network of industry associations launched by the PBE in 1998. This is in partnership with the Board of Investments (BOI) of DTI, through the United Nations Development Program (UNDP) - assisted Private Sector Partnership in Managing the Environment/ PRIME Project, and its follow up project called the Environmental Management Program for Industry Competitiveness (EPIC). These and other environmental assistance programs for industry, including for small enterprises, have led to more investments in environmental technologies and equipment to reduce waste and pollution.

IV-4. Environment Technologies

Since one of the most common barriers for addressing environmental problems is the lack of technology, both government and the private sector have developed and commercialized new and affordable environment technologies. The Department of Science and Technology (DOST) has also been at the forefront of developing technologies for managing biodegradable waste, recyclable materials and the residuals. Some examples are listed below[10]:

A. Technologies for Biodegradable Waste

- Vermicomposting – with the use of earthworms for creating organic fertilizer/ soil enhancers from wastes
- Bioreactor – for rapid soil composting using an aerated system for small scale applications

[10] www.denr.gov.ph/nswmc

- Biogas digester – for conversion of organic waste into energy and fertilizer through an anaerobic process
- Biodiesel production from used cooking oil – through transesterification
- Magnetic thermo decomposer - using energy from oscillating magnets and thermal breakdown of molecules
- Green charcoal from biodegradable solid waste
- Liquefaction technology to convert garbage into methane gas, organic fertilizer or concrete aggregates

B. Technologies for Recyclable Materials
- Laminates recycling
- Polystyrene recycling
- Glass recycling
- Paper recycling
- Aluminum can recycling
- Tin can recycling
- Plastics recycling
- Used tires as tire – derived fuel
- Co–processing in cement kilns
- Electronics waste recycling
- Remanufacturing of spent Ink and toner cartridges
- Used lead acid battery recycling

C. Technologies for Residuals Management/ Treatment
- Residuals waste processing into non–load bearing concrete materials (e.g. hollow blocks, benches, perimeter walls, traffic barriers) – palingenesis, hydromex technologies

New business opportunities have resulted in more environment service providers for the treatment of special and hazardous materials, such as fluorescent lamps and bulbs, sludge, and contaminated waste. However, there is still much room for expansion here, and treatment costs are not always within the reach of smaller companies, especially those in the regions outside of Metro Manila/ Luzon where such facilities may be sparse or non–existent. Thus, the uptake for these environment technologies needs to be hastened through information sharing, technical and financial assistance, incentives and, most importantly, political will.

V. Waste Exchange as a Strategy for Waste Management and Reduction in the Philippines

Waste Exchange is another option for managing residual wastes, preferably after attempts have already been taken to reduce or reuse waste. In the Philippines, the PBE implements the IWEP, which aims to match waste generators with waste buyers/ treaters.

Waste Exchange is a matching process, a market mechanism, and an environment program all–in–one because it brings together two parties that can mutually benefit from the exchange. It creates a market for still useful waste materials/ by-products, and protects the environment by reducing the waste stream and diverting the amount of waste that goes to landfills. Thus, it generates economic returns for the waste generator and the

waste buyer, promotes resource recovery and recycling of waste back to the manufacturing process, and reduces the environmental impacts from industry waste disposal.

Among the typical users of Waste Exchanges are companies, LGUs, environment entrepreneurs or entities that:

- Are interested in substituting expensive or hard – to – get raw material;
- Are interested in reducing raw material costs by using by-products as production inputs;
- Have surplus products or raw materials;
- Have manufacturing by-products whose marketability they wish to determine;
- Have off-spec or obsolete manufactured products or equipment;
- Looking for ways to cut down disposal costs; and
- Have wastes which can be used by others.

The PBE IWEP operates as a Waste Exchange Information Clearinghouse, which manages a database of waste generators and waste buyers, and promotes waste exchange and resource recovery through orientation sessions, company in–house seminars, environmental exhibit/ trade fairs, and case studies/ publications. It publishes IWEP advertisements in its quarterly *Business and Environment Magazine*, upon request of IWEP users.

The PBE IWEP lists entries under any of the following categories:

- Acids
- Alkalis
- Other inorganic chemicals
- Solvent
- Other organic chemicals
- Oils and waxes
- Plastics and rubber
- Textiles and leather
- Wood and paper
- Metals and metal sludges
- Miscellaneous (glass, electronics, used lead batteries, etc.)

Interested users are requested to register their company using an information form that describes the volume and frequency of waste generated, the industrial process that generates the wastes, the classification and physical state of the waste, and the current handling practices. Registration is done free of charge.

If the PBE IWEP is able to identify a possible match, both parties enter into negotiations to determine whether the transaction pushes through or not, based on such considerations as technical compatibility, quantitative match, economic feasibility, legal/ regulatory factors. Under this set–up, the parties may or may not decide to give feedback to PBE on the outcome of their transaction, which makes it difficult for the IWEP to monitor the actual number of successful waste exchanges that it has facilitated. Manpower constraints at PBE also make it difficult to track all possible waste exchange referrals, or offer services beyond referrals and promotion.

Nevertheless, there have been several documented case studies of successful waste exchanges. These include the following:

- Waste paper into paper mill feedstock;
- Waste textile, waste wood, food waste animal and plant residue waste into compost;
- Cellulose waste into solid fuel;
- Metal scraps for metal recovery;
- Electronic waste for metal and lead recovery;
- Used lead acid batteries for plastics and lead recovery;
- Organic sludge for methane production;
- Incombustible construction waste into construction aggregates;
- Waste plastic into fuel oil;
- Textile scraps into industrial rags; and
- Synthetic waste materials (e.g. scrap tires, rubber and plastic waste, graphite dust), industrial wastes (e.g. bamboo dust, bagasse from the sugar industry, carbon/ petrochemical waste, waste oil), and agricultural wastes (e.g. Rice husks, straw, coconut/ peanut husks) into alternative fuel for cement kilns.

Over the years, IWEP has received over 1,500 waste listings and registered close to 500 company participants. Through the annual Earth Day/ Environment Month Recyclables Collection Events which PBE has implemented with various partners since 2002, it has collected 1,947 m^3 of recyclable materials (equivalent to about 195 ten–ton dump trucks) worth ₱ 3,295,830.00**,** and diverted these from the landfill and on to the local recycling industry. This includes traditional waste such as paper, plastic, aluminum cans, tin cans, scrap metals; and special wastes such as junk electronics and appliances, used lead acid batteries, used ink and toner cartridges. More waste is also retrieved through the regular weekend mall–based Waste Markets/ Recyclables Fairs. This activity has been conducted since 2007, and has become regular features in many places, supported by the DENR, LGUs, the business and NGO community and the media.

Among the benefits experienced by IWEP users are the following:

- Sales revenue and/or avoided disposal costs for waste generators;
- Reduced raw material cost for users;
- Energy savings incurred from processing raw materials;
- Environmental protection;
- Better national perspective on waste management issues;
- Better cooperation among business, industry, government and recycling advocates; and
- Opportunity for companies, trade associations, and chambers of commerce to demonstrate environmental responsibility and accountability.

Despite the above benefits, the success of IWEP is constrained by the lack of similar set–ups in areas outside Metro Manila. An attempt was made in 2001 to create IWEP regional nodes in partnership with the Cebu City Chamber of Commerce and Industry (CCCII) in the Visayas region, the Davao City Chamber of Commerce and Industry (DCCCII) and the PhiVIDEC Industrial Estates in Misamis Oriental which are both in the Mindanao region. However, only the DCCCII IWEP continues to operate, in part because there was no transfer of training/ proper turnover upon the resignation of the designated point persons in the other nodes, or there was lack of interest to sustain IWEP.

The DCCCII reports that, based on a survey of their members, most of the waste materials traded are either waste paper or fiberboard, plastics or used tires (for donation). They also continue to hold monthly Recyclables Collection Events in their area as a continuing promotion strategy for waste exchange. Buying prices, however, have been significantly lower in recent months due to price fluctuations abroad affected by the global financial crisis.

Also, around 2001-2002, the UNDP–assisted PRIME project mentioned earlier, launched an Industrial Ecology (IE) component, with Waste Exchange as a core strategy for closing the production loop. Working with a pilot group of six industrial estates and their volunteer company locators, the IE program established a place-based waste exchange program in the Laguna-Batangas and Bataan area, to take advantage of the industry's proximity with each other, the existing management structure, and the volume of by-products available when aggregated.

The pilot industry estates included the following:

- Carmelray Industrial Park (CIP) 1;
- Laguna International Industrial Park (LIIP);
- LIMA Technology Center (LIMA);
- Light Industry and Science Park (LISP) 1 and 2; and
- Laguna Technopark Incorporated (LTI).

The key strategies used were awareness sessions with the industry estate management and company locators, data gathering and analysis, information dissemination and recyclables collection events for preliminary by–products matching. This resulted in approximately nine tons of total wastes diverted from the landfill, saved garbage hauling costs and hauling fees equivalent to about nine dump trucks, and a ₱ 174,534.00 value redemption from 2004–2006[11].

The group has established itself as the Eco-Industrial Exchange Network (Eco–Index), adding four more Laguna–based industrial parks to its network (i.e., the Carmelray Industrial Park 2, First Cavite Industrial Estate, First Philippine Industrial Park, Calamba Premier Industrial Park), and providing management support for environmental management concerns. Eco–Index, in the long run, aims to encourage industries within these areas to take an active part in minimizing adverse impacts to the environment. Their support programs include the following:

- Advocacy events to promote sustainable industrial development through resource recovery and eco-industrial development approaches and community building initiatives;
- Maintenance of an online portal and waste (by-product) generation database in selected industrial estates;
- Environmental management directory for industrial estates and locators (i.e., list of treaters, list of service providers, list of government agencies, etc.);
- Resource pool for in-house trainings and seminars on:
  - industrial ecology, by product exchange, resource recovery; Regulatory compliance; and other environmental management tools (Environmental Cost Accounting (ECA), Environmental Management System(EMS), etc.).

[11] www.ecoindex.org

- Development of publications, manuals and guidebooks on relevant industrial estate management concerns.

VI. Challenges to Solid Waste Management and Waste Exchange

From the abovementioned discussion, it is apparent that important initial steps have been taken to promote a Philippine eco-cycle society, but still many continuing challenges need to be addressed. Enforcement of even basic requirements of RA 9003 (such as the closure of open dumpsites, the establishment of MRFs, and the 25% landfill diversion rate, etc.) needs to be taken seriously. Key to all of this is the participation of all relevant stakeholders as active players (not as bystanders), with the recognition that solid waste is not a problem of government alone, but a problem of everyone.

Despite stepped–up efforts, there is still lack of widespread knowledge of the potential for waste reuse, and of the appropriate technologies whether the barriers are technical, financial, or attitudinal. At the same time, technology and economic limitations (for waste conversion) also still exist for some types of waste (like household batteries and junk cellular phones).

Without policy incentives and a viable financial model, programs like IWEP face an uphill battle with respect to the continuity of supply in large quantities; improvement in local and national databases; transport and logistics costs for inter – island waste exchanges. IWEP requires a major leap forward to, firstly, improve its database management system; expand to other parts of the country; and to eventually be brought up to a regional level; where it will then be faced with even larger issues regarding matters such as regional standards for tradable waste, technology verification, and country–specific environmental laws and customs procedures.

VII. Report Recommendations

Based on the above discussion, the current study offers the following for consideration by the ERIA study group. Although presented in the context of the Philippine situation, useful implications can be derived for a subsequent region wide approach to 3R.

1. 3R Knowledge Management - Although RA 9003 describes the establishment of Regional Ecology Centers to serve, among other things, as the clearinghouse for solid waste management data and information, these are yet to be fully functional, for reasons that are not clear and therefore have to be uncovered and addressed. As with PBE's own IWEP, an ideal set–up is likely to be hampered by the lack of trained full time personnel, and the lack of funding to offer value added services such as waste characterization, monitoring and documentation. Also, in the case of IWEP which runs as a pro–bono operation, an effective model for financial self–reliance still needs to be developed.

2. Advocacy for better solid waste management needs to be ramped up, through a number of ways, such as:
   - By using actual success stories with demonstrable environmental, social, and economic benefits to communities, business establishments, local governments;

- Popularizing events that make it easy for the public to participate such as the recyclables collection events, mall–based waste markets/ recyclables fairs, and perhaps through a future on–line waste trading system; and
- Giving recognition/ awards, and publishing best practices so that these can be replicated quickly.

3. Following through on the Presidential initiative to make the Executive Department and its Cabinet Secretaries accountable for the solid waste of their department and department's activities will send a strong message to the public

4. Encouraging the rest of the citizenry to make their elected officials accountable by turning garbage management into a political governance issue

5. Environmental investments in SWM should be made a top priority
   - by local governments, as new environmental businesses also create positive social impact through livelihood and income opportunities
   - area-specific recycling market studies can be used to also identify investment opportunities by the private sector for new recycling facilities especially in other parts of the country

6. Policy initiatives that create incentives for environment technology development and adoption/ transfer, especially for locally–developed technologies, mandating their adoption, and setting a national recycling target and performance monitoring system

In addition, the 2008 JICA Study on Recycling Industry Development in the Philippines recommended a number of strategies to enhance recycling performance in the country, involving the government, the private sector, recycling industry and the waste generators. The study paradigm is that recycling performance can be increased if the national and local institutional set–up is strengthened, the recycling system is improved, and awareness of segregation, proper handling and recycling is improved. The study identified the need for four key policy programs[12]:

- a Recycling Industry Information and Database Management (not only from local end users but also from waste importers/ exporters);
- National action plan formulation (for specific recyclable materials of highest value to the country);
- Local recycling plans formulation (emphasizing the importance of source separation of recyclable materials and the development of new business/ job opportunities); and
- Development of recycling guidelines (i.e., target recycling rates, measures to increase collection rate and use of recycled materials, consensus building).

In general, it is my opinion that those who have been working hard to address our solid waste management situation need to put a twist to an old and pressing problem to combat the complacency that afflicts a large part of Philippine society. This twist involves finding ways to, "make the garbage problem a very personal issue – for the homeowner

[12] Study on Recycling Industry Development in the Philippines, Board of Investments – Department of Trade and Industry, and Japan International Cooperation Agency, 2008

or market stall owner who is inconvenienced by a breakdown in the garbage collection schedule, for the business owner who must pay higher hauling/ disposal fees, for the parent whose child can become ill from unhealthy surroundings, for the elected official whose political stock depends on how he rids his locality of unsightly garbage, for the household help and restaurant personnel who can earn extra income from recyclables segregation and collection, or the child who can trade in an empty plastic bottle or soda can for a pencil or notebook."

This study recognizes much yet needs to be done, but it is hopeful since ~~as~~ much is happening today compared to five or ten years ago. Yet we need to act more urgently and swiftly if we are to reverse the downward environment spiral which in the final analysis, is not quite only about managing our waste, but about *Managing Ourselves!*

References

Asian Development Bank, 2004. *The Garbage Book.*

BOI-DTI and JICA, 2008. "Study on Recycling Industry Development in the Philippines."

Executive Order 301, 2004. "Requiring all departments, bureaus, offices and agencies of the Executive branch to establish their Green Procurement Programs", March 2004.

Executive Order 774, 2009. "Reorganizing the Presidential Task Force on Climate Change", January 28, 2009.

Rebullida, Ma. Lourdes G., 2000. *Resource Recovery in Solid Waste Management: Strategies, Initiatives, Policy Issues*. University of the Philippines, 2000.

Republic of the Philippines. Republic Act 6969, 1990 Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990.

Reoublic of the Philippines, 2000. Republic Act 9003, Ecological Solid Waste Management (ESWM) Act, 2000 .

World Bank, 2001. *Philippine Environment Monitor*.

Websites:

NSWMC official website. <www.denr.gov.ph/nswmc> (accessed January 2009).

Ecoindex official website. <www.ecoindex.org> (accessed January 2009).

Greenchoice Philippines. www.greenchoicephilippines.org> (accessed January 2009)

Chapter 9: Waste Management and Waste Information Exchange in Thailand

Panrat PHECHPAKDEE
Industrial Environment Institute, The Federation of Thai Industries

Introduction

The world is currently faced with economic crisis, as well as increasing natural resources and environmental degradation. Global attempts with some measures have been done to deal with environmental problems. However, sometimes complying with existing required procedures have become trade barriers and have burden to industrial operators. Both the government and industrial sector therefore have to adjust themselves by applying the concept of resource maximization under the principles of 3Rs – reduce, reuse and recycle.

According to the studies and researches in Thailand, various types of wastes generated in the country have great potentials to be recovered. The database of the Pollution Control Department (PCD) and the Department of Industrial Works (DIW) in 2007 indicated that in Thailand, domestic wastes in particular, totaled to 14.7 million tonnes a year, out of which only 22% had been recovered. Also, out of 18 million tonnes of industrial wastes generated a year, only 60% had been recovered. More of these have had large potentials to be recovered. Therefore, different sectors have encouraged the government, industries and households to optimize and initiate means for waste exchange so that the matching between those producing wastes and those needing to use them could be enhanced, and the resource utilization within the country could also be maximized.

I. Situation of Wastes in Thailand

I-1. Domestic Wastes

The amount of solid wastes in Thailand continues to rise. Currently, solid wastes generated nationwide are accounted for 14.47 million tonnes or 39,630 tonnes a day (excluding the amount prior to being dumped to waste containers). In Bangkok Metropolitan Area (BMA), 8,897 tonnes of solid wastes a day are collected while 12,433 tonnes a day are collected in other municipal areas. Pattaya city, (the special Administrative in Chonburi Province) accounted 31% of waste generated. Solid waste generated outside the municipal areas, including Tambon Administrative Organizations (TAO) accounted for 18,300 tonnes a day or 46% of the total solid wastes generated nationwide. Compared to the previous year, a decrease of only 0.25 million tonnes (or approximately 1.7%) is reported. The amount of solid wastes within the municipal areas decreased 9% while those outside the municipal areas increased more than 1%. This

could possibly be due to the promotion of recycling within the scope of integrated waste management (see Table 1 and Figure 1). However, the overall rate of solid wastes generation nationwide has remained the same, 0.65 kg. per person per day, as detailed in Table 1.

Table 1: Quantity of Municipal Waste, Classified by Area

Area	Quantity of municipal waste (ton/day)				
	2003	2005	2006	2007	2008
Bangkok	9,356	8,291	8379 (21% - 1.5 kg/person-day)	8,532	8,897
Municipalities and City of Pattaya	12,500	12,635	12,912 (32% - 1 kg/person-day)	13,600	12,433
- Center and East		5,499	5,619		5,859
- North		2,148	2,195		1,745
- North East		2,906	2,970		2,838
- South		2,082	2,128		1,991
Other	18,100	18,295	18,697 (47% - 0.4 kg/person-day)	18,200	18,300
Total	39,956	39,221	39,988 (0.6 person-day)	40,332	39,630

Source: www.pcd.go.th, 2008. and www.timpse.or.th, 2009

Domestic wastes composed of organic wastes (46%), recyclable wastes (42%), toxic wastes (3%) and others (9%).

I-2. Toxic Wastes

The total amount of toxic wastes were generated in Thailand in 2007 accounted for 1.82 million tonnes a year, of which 1.40 million tonnes came from industrial sector, 0.40 million tonnes from households and 0.02 million tonnes from hospitals. Those mostly generated within BMA amounted for 1.191 million tonnes a year or approximately 65% of the total toxic wastes generated nationwide, as detailed in Table 2.

Table 2: Quantity of Hazardous Waste, Classified by Area

Area	Quantity (million tons)			
	Municipal	Industrial	Total	%
Bangkok	0.266	0.926	1.191	65
North	0.020	0.071	0.092	5
East	0.053	0.185	0.238	13

Area	Quantity (million tons)			
	Municipal	Industrial	Total	%
North East	0.018	0.064	0.082	4.5
North	0.029	0.100	0.128	7
South	0.022	0.078	0.101	5.5
Total	0.409	1.424	1.833	100

Source: www.pcd.go.th, 2008

I-3. Industrial Wastes

Industrial wastes are defined as those not being used or the total wastes generated from the entire operation within the working places, including wastes from raw materials generated from the production process of deteriorating products and effluents with toxic components or compositions.

According to DIW, in 2007, industrial wastes with permits to be taken out of the factories accounted for 18 million tonnes, comprising 16 million tonnes of non-toxic wastes and approximately 2 million tonnes of toxic wastes. The main composition of non-toxic wastes was iron, accounting for 31.01% of the total non-toxic wastes generated; the rest were plastics (24.54%) and papers (25.06%).

Table 3: Component and Percentage of Non-Hazardous Waste

No.	Detail	Percentage
1	Paper	25.06%
2	Glass	12.36%
3	Plastics	24.54%
4	Steel	31.03%
5	Aluminium	4.03%
6	Rubber	2.98%

Source: Department of Industrial Works, 2007.

Sources of Industrial Wastes

According to the statistics of DIW, Ministry of Industry, currently there are 126,658 industrial establishments in Thailand. Most of them are located in the Northeast, accounting for 33% of the total establishments, 30% located in BMA and its vicinities, while the least number of industrial establishments is reported in the East, as detailed in Table 4.

Table 4: Distribution of Industry, Classified by Region

No.	Region	Number of Industry
1	North East (33%)	41,705
2	Bangkok and Boundary (30%)	38,345
3	North (12%)	15,288
4	Center (10%)	12,573
5	South (8%)	10,427
6	East (7%)	8,320
Total		126,658

Source: Department of Industrial Works, 2009

Taking a particular focus on industries, Type 3 –polluting industries required to have a permit to operate from DIW. (Type 3 industry is that of which the site location, capacities and construction must obtain a permit before the operation) It was reported that in 2007, there were a total of 65,523 industries under this type; mostly located in BMA and its vicinities, as shown in Table 5.

Table 5: Distribution of Industry Type 3, Classified by Region

Region	Number of Industry
Bangkok and vicinities	27,639
Center	9,274
North East	8,111
North	7,512
East	6,805
South	6,182
Total	65,523

Source: Department of Industrial Works, 2007

In addition, there were approximately 60,000 industrial establishments nationwide generating wastes, out of which 9,780 establishments requested permits to take wastes out of the premises. The highest volume of wastes requested for the permit are reported is Samutprakarn Province, approximately 1.0 million tonnes a year, then followed by Samutsakorn and Bangkok Province, respectively.

Table 6: Quantity of Waste Which Asked Permission to Move Out From the Factory Between 2007 – 2008, Classified by Province

No.	Province	Quantity of Waste (tons)
1	Samutprakarn	1,020,289
2	Samutsakorn	796,187
3	Bangkok	750,131
4	Pathumthani	429,473
6	Rayong	372,960

Source: Department of Industrial Works, 2009.

II. Waste Management in Thailand

II-1. Domestic Wastes

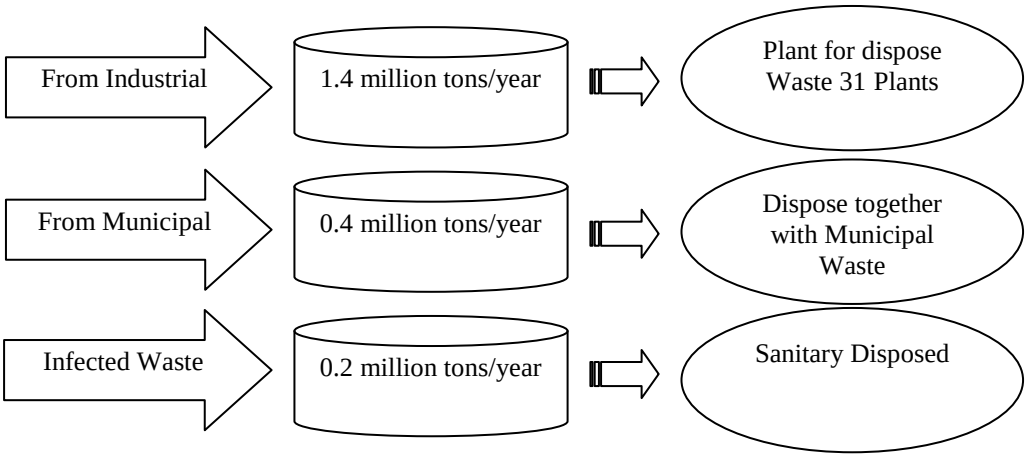
Domestic wastes in Thailand accounted for 14.6 million tonnes a year, of which only 12.3 million tonnes a year was collected (approximately 84% of the total domestic wastes generated). Currently, only 36% of domestic wastes has been technically and hygienically managed and treated through sanitary landfill, incineration or integrated waste management system. And 64% of domestic waste has been open dump site or burning. There are 96 domestic waste treatment plants in Thailand, which include 90 sanitary landfills, 3 incinerations and 3 sites of integrated waste management system (Pollution Control Department, 2007).

In 2007, 3.19 million tonnes of wastes or 22% (the total waste generated in that year are 14.5 million tonnes of wastes) were recovered, out of which approximately 94% was recovered through sorting and trading of recyclable wastes (glasses, papers, plastics, iron and aluminum). These were undertaken through the purchase of old used products, recyclable waste collection project (Pha Paa Recycle Project), Waste Bank in Schools, Recyclable Materials Weekend Market, Community Recyclable Materials Centre, wastes in exchange for rice, among others. The remaining 6% was through the use of organic wastes for the production of organic and biological liquid fertilizer.

II-2. Toxic Wastes

The management of toxic wastes, totaling to two million tonnes a year (0.4 million tonnes of domestic wastes, 1.4 million tonnes of industrial wastes and 0.2 million tonnes of infectious wastes) involved three main stakeholders, which include the waste generators, waste transporters and waste processors. Each of them had the responsibility to ensure that wastes had been managed and treated with no negative impacts on public health and safety, and with least damage on the environment.

Figure 1: The Current Disposal of Hazardous Waste



II-3. Industrial Wastes

II-3-1. Status of Industrial Waste Management Undertaken by Waste Generating Industries

In 2007, there was a small number of waste generating industries who had requested for permits to take wastes out of their operating premises (8.2% of the total registered industries) and who had notified the transport of wastes out of the operating premises (8.2% of the total industries). Only a few proportions of waste generating industries had managed their wastes according to the legislation.

Although the proportion of waste generating industries requesting for the permits has remained low, that of the wastes requested for the permits has been huge, reaching 61.1% and 58.2% of the total toxic wastes generated and non-toxic wastes expected to be generated, respectively. The proportion of notified waste transport was 14.7% and 10.4% of the total toxic and non-toxic wastes generated, respectively. This has indicated that those who has legally requested for the permits for waste treatment and waste transport notification, have been large industries with large volume of wastes generated.

Supposedly, all wastes under the permits would be appropriately treated, approximately 60% of the total toxic and non-toxic wastes currently generated. Therefore, the remaining 40% of the total generated would possibly been inappropriately managed. It is assumed that the small sized industries have generated low volume of wastes.

Industrial wastes with permits for treatment outside the operating premises have mostly been recovered rather than treated. About 61.4% of toxic wastes have been recovered and use as fuel mix or substitutes and others, while approximately 78.4% of non-toxic wastes have been recovered. As for the treatment, non-toxic wastes were taken for landfill and toxic ones for incineration.

II-3.2. Status of Industrial Waste Management Undertaken by Industrial Waste Processors

Currently, there are 427 factories operating as waste processors (excluding those not located at the notified addresses, those terminating their business and those solely sorting their industrial wastes). These factories can be categorized into three according to their types of operation.

Table 7: Number of the Industrial Waste Treatment/Disposal Plant

Type of Management	Hazardous Waste		Non-Hazardous Waste	
	Number (plant)	Capacity (million tons/year)	Amount (plant)	Capacity (million tons/year)
Burn in incinerator	10	8.82	5	8.85
Bury in the landfill	4	0.92	8	0.51
Recycle	196	0.61	204	0.44

According to DIW, the proportion of toxic waste processing factories that notify the transport and receive wastes for treatment has increased from approximately 39.0% of the total number of factories in this category in 2006 to 80.0% in 2007. However, the non-toxic waste processing factories have been quite small, accounting for approximately 15.7% of the total number of factories in this category in 2006.

There have been a total of 14 toxic waste processing factories using incineration and landfill. All of them have notified waste transports and receipts. As for the industrial waste recycling factories, the proportion of those notifying waste transports and receiving wastes for treatment has increased from 38.3% in 2006 to 78.6% in 2007 of all the recycling factories in operation (from a total of 196 factories).

Utilization of Industrial Wastes

In 2007, industrial wastes composed of glasses, papers, plastic, irons, aluminum and rubbers generated were about 13.46 million tonnes, out of which approximately 8.04 million tonnes or 60% were recycled, reused and used as fuel. Compared to 2006, it was found that the proportion of industrial waste recovery decreased by 4%, of which the recovery of papers and irons only was 6% and 7% declined. The proportion of others was quite similar to that of the previous year.

For the utilization of industrial wastes, about three million tonnes (37%) was traded within households and about five million tonnes (63%) were through waste exchange system by producers, importers or distributors and under deposit-refund system. Irons and aluminum have remained the industries of highest recovery with 87% and 71% of the total production, respectively. As Thailand does not have the primary production of irons and aluminum, their wastes are therefore collected as raw materials for product

manufacturing. The lowest waste recovery was found in plastic industry, of which only 21% of the total production was recovered. Rubber industry has 30% recovery, of which the recovery was through the burning of tyre wastes as fuels for cement kilns, totaling 7,223 tonnes or approximately 2% of the total produced.

III. Wastes Related Laws and Legislation in Thailand

There have been a number of laws and legislation related to waste management. The key one is the Factory Act A.E. 1992 (This law provides a legal basis of establishment and control of industrial operation including setting and enforcement of industrial standards.). Other related laws include the Hazardous Substance Act A.E. 1992, controlling wastes containing chemical substances; the Public Health Act A.E. 1992, controlling wastes from all types of activities but currently with enforcement over domestic and infectious wastes; and the Enhancement and Conservation of National Environmental Quality Act A.E. 1992.

The main content of those laws and legislations involves the control and supervision over waste management and treatment, particularly waste collection and transport. Different measures are introduced according to each type of wastes and their origins. The scope of laws and legislations based on types and origins of wastes is summarized in Table 8.

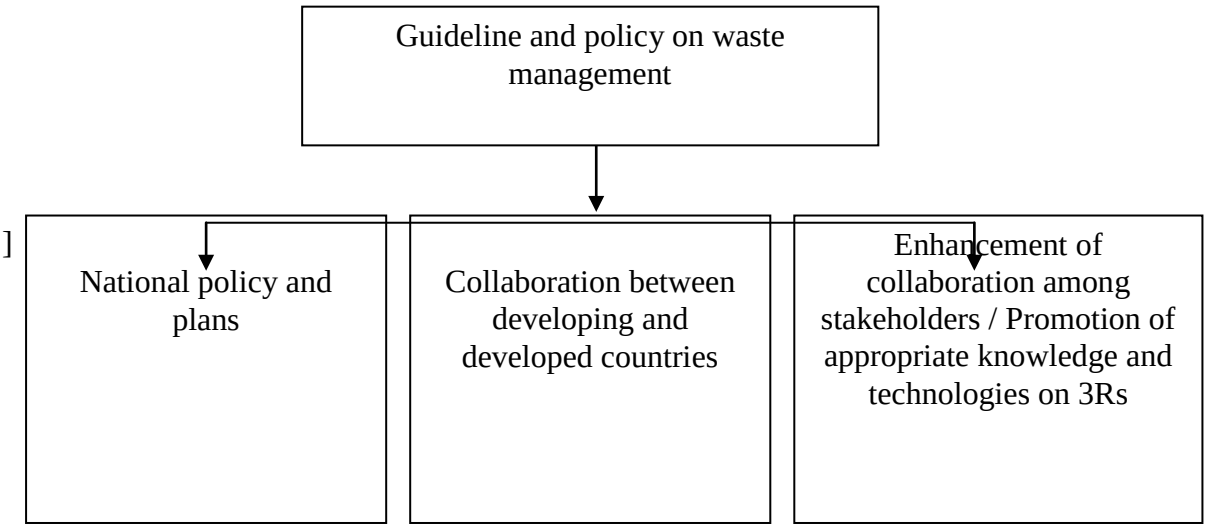
Table 8: Boundary of the Control for Source and Type of Waste

Source / Regulation	Industrial	Hospital	House	Educated Institute
The Factory Act A.E.1992	- Hazardous waste - Non-hazardous waste			
Public Health Act A.E.1992	- Infected waste - Waste (not occur from the process of the production of the factory)	- Hazardous waste - Waste - Infected waste	- Hazardous waste - Waste - Infected waste	- Hazardous waste - Waste - Infected waste
Atomic Energy for Peace Act.	- Radioactive waste	- Radioactive waste	- Radioactive waste	- Radioactive waste
Hazardous Substance Act A.E.1992	- Hazardous waste (only to occupy for chemical waste and transportation)			

IV. Guideline and Policy on Waste Management for Thailand

The guideline and policy for Thailand aims to enhance waste management through the efficient implementation of mechanisms and technologies. This can be summarized as shown in Figure 2.

Figure 2. Guideline and Policy on Waste Management for Thailand



IV-1. National Policy and Plans

Thailand government policies aim to establish efficient waste management system, to enhance waste management in local areas, and to encourage private sector to recycle waste within the organizations so that wastes could be minimized. The government should also ensure that Thailand would not be a waste dumping destination as this would increase pollution to the country.

The national integrated waste management plan has been formulated to encourage the maximum use of resources in an efficient manner, to control wastes at the sources, and to maximize the use of wastes prior to final treatment.

The national master plan on the cleaner production and cleaner technology has been created to enhance the application of cleaner production and cleaner technology so that wastes could be minimized e.g. in pulp and paper industry where cleaner technology has currently been promoted.

The Strategic plan on e-wastes has been formulated as a framework for e-waste management through appropriate waste sorting and management, emphasizing on the Polluter Pay Principle (PPP) that would apply to both manufacturers and consumers, and on the principle of 3Rs in the management of e-wastes.

The strategic plan on packaging and packaging waste management to minimize the volume of wastes has been also drafted. The government has drafted this plan covering four main groups, which includes the following: 1. designers and manufacturers, 2.

product transporters and distributors, 3. consumers, and 4. waste collectors and processors.

The government green procurement policy project has been implemented to minimize pollution and enhance awareness among manufacturers and service providers on all aspects of environmental impacts, including waste minimization.

IV-2. Collaboration between Developing and Developed Countries

Thai government has conducted 3R related projects with developed countries.

Green Manufacturing Technical Assistance Program to encourage cleaner technology, life cycle assessment (LCA) and eco-design have been implemented so that the industrial sector becomes green. In addition, a network of product LCA and eco-design has been established. This is collaboration between the National Metal and Materials Technology Centre (MTEC), Thailand and the Government of Japan under Green Partnership Plan.

Fluorescent Lamp Partnership Program is a collaboration program between the governments of Thailand and Japan for the management of fluorescent wastes, under which waste recycle and the establishment of waste exchange network has been emphasized.

Construction and Demolition Waste Management System, a partnership between GTZ (Thai-German Programme for Enterprise Competitiveness) and Pollution Control Department (PCD) for appropriate management of construction and demolition wastes has been also implemented so that inappropriate waste management could be prevented.

Packaging Waste Project with GTZ's technical support as the preparation for plan and policy on packaging waste management would require further knowledge and various technologies.

IV-3. Enhancement of Collaboration among Stakeholders/ Promotion of Appropriate Knowledge and Technologies on 3Rs

Thai government also have enhanced collaboration among stakeholders on 3R,.Initiation of the recycling-oriented society is started from the eco-town project, which is collaboration program among stakeholders in the national and local governments and private sector to encourage a recycling-oriented society that includes waste sorting, waste recovery, knowledge enhancement and people's participation.

Technical and financial support provision to enhance local capacity to develop appropriate and efficient waste management system are also important.

Capacity building on the 3Rs for local communities should be encouraged, by organizing seminars and workshops on waste management, and including implementation of activities in the pilot sites e.g. waste sorting, waste recycling.

Community participation in the 3Rs under a community 3Rs project has, involved the use of wastes for agricultural purposes, e.g. as fertilizers, and the establishment of recyclable waste bank. All these activities have contributed to 30% of waste reduction.

Guideline, measure, and standard related to the 3Rs should be established, such as, involving the preparation for a guideline on waste management and minimization for communities, standards for different types of packages, measures to control products using recycled materials, to ensure better quality and consumers' satisfaction. The use of

those products could therefore be promoted, including the sorting of packaging wastes and the return of packaging wastes to producers.

1. Industrial Waste Exchange Program encourages the exchanges of information of wastes and waste recycling. Wastes from one factory could possibly be a raw material for another. The information on waste exchange and matching could be done through database calculation. It could reduce wastes and at the same time it could save energy that would otherwise be required to acquire raw materials. This has already been implemented by the Ministry of Industry who would continue for further development in the future.

Green Label Scheme provides a green label to products with least impacts on the environment with comparison with products of the same category. Criteria include the use of raw materials, energy and waste minimization.

2. Under used lead-acid batteries recycling program, 84% of the batteries has been recycled currently.

Promotion of material recovery encourages energy recovery and replacement of raw material in cement kiln under the government support to conserve energy and reduce the use of coal.

Take-Back Program on end-of-life products under which the Ministry of Natural Resources and Environment has initiated projects on the recycling of mobile phones, batteries, other associated accessories and used packages. These wastes would then be collected at the specified waste take-back points or places by those involved.

Pilot program on plastic and foam waste management tries to reduce the amount of plastic and foam wastes as well as the use of these materials in department stores, convenience stores in BMA and its vicinities, including the promotion of recycling.

Thailand Green Purchasing Network was established as a centre for information on the trade of environmental friendly products.

V. Examples of Waste Exchanges in Thailand

V-1. Waste Information Exchange in Thailand

In Thailand, three waste exchange centres are established with clear operation procedures. The objectives are as follows:

1. Encouraging the maximization of resource use in an efficient manner through the application of 3Rs to minimize environmental impacts and costs of industrial waste management;
2. Enhancing waste trading and exchanges as well as waste recovery among industries. These centres have acted as clearing houses for the dissemination of industrial waste recovery related information. In addition, they have been considered the main mechanism connecting factories or business generating wastes

with those in need of wastes for their raw materials or fuels in the production process;

3. Being a source of information dissemination as related to waste management technologies and waste recovery, with various databases involved in order to systematically support waste utilization process;

4. Being a centre where research and development related to waste utilization could be enhanced and where pilot guidelines promoted by the government, private sector and others could be tested and multiplied so that practical implementation could be successfully achieved; and

5. Establishing information network database through websites on the recovery of wastes or residues for industrial production process.

With the establishment of a systematic waste database, the services have therefore not been limited to industries only. The services have additionally been provided to a variety of groups, including the following:

a) Different types of industries e.g. glass industry, chemical industry, etc.;

b) Related government agencies, independent organizations and state enterprises;

c) Academic and research institutions;

d) Private organizations with related business and those who are interested in business operation related to industrial waste management; and

e) The general public who are interested in environmental information and knowledge on the overall waste management.

The three waste exchange centres are composed of 1. Eco-Town program coordinated by DPIM, 2. Material Exchange Center (MEC), and 3. Waste Utilization Data Center (WUDC). The details about the name of the centre, source of support, the start of the operation and current operation are summarized in Table 9.

Table 9: List and Situation of The Centre of Waste Information Exchange in Thailand

Name	Responsible Organization (Website)	Year Started	Situation	Number of visitors (person)
Eco-Town	Department of Primary Industries and Mines (DPIM) (http://eco-town.dpim.go.th)	2007	operating	332,500
MEC	Thailand Environment Institute (TEI) (http://www.tei.or.th/mec/) (supported by Ministry of Energy)	2000	operating	5,377
WUDC	Department of Industrial Works (DIW) (Supported by JICA, Japan)	2001	Stopped operating	15,621

Source : 1) http://eco-town.dpim.go.th 2) www.tei.or.th/mec/ and 3) www.diw.go.th [cited : Jun 3, 2009]

V-1-1. Eco-Town (http://eco-town.dpim.go.th)

The Eco-town project which originated from the concept of establishing an eco-industry has been implemented under the DPIM. It aims to enhance efficient renewal of mineral and metal resources. Its operations involve public relations and organization of events and activities where industrial operators meet and exchange their experiences and views on waste management. The website was developed to collect database on waste management and to ensure project continuity. Regarding the services, wastes have been categorized into 17 types, including glasses, metals, plastics, papers, organic wastes, used computers, etc.

The website provides industrial related information, including 3R business, social network, sources and prices of used products, as well as academic information. It emphasizes on enhancing the knowledge and understanding about waste recovery, technology and environmental management related information and environmental laws and legislation. It is expected that members and those interested individuals or groups would have maximal benefits upon visiting the website. On June 3rd 2009, there were 332,500 visitors to the website as shown in Table 9.

Table 10: Detail of Usage Service for Waste Exchange in Eco-Town Website

Type of Waste	Number of Seller	Quantity (ton/month)	Number of Buyer	Quantity (ton/month)
Metal	7	80	4	10,100
Paper/ paper board	1	Not specify	3	1,000
Wood	1	500	Not specify	Not specify
Glass	1	3,000	Not specify	Not specify
Plastic	246	4,660	182	Not specify
Metal sludge waste	1	50	1	Not specify
Construction material	3	700	-	Not specify
Other	8	30	4	Not specify
Total	274	14,460	194	11,100

Source: http://eco-town.dpim.go.th, 2009.

The examples of waste exchange are as follows:

- The exchange of gypsum waste generated from air pollution treatment system for use in construction material production industry;
- The exchange of sludge from effluent treatment system of food industry for fertilizer to be used by farmers; and The exchange of metal dust from electronic industry for raw material substitutes in cement production industry, among others.

V-1-2. Material Exchange Center (MEC) (http://www.tei.or.th/mec/)

MEC has been operated by Thailand Environment Institute (TEI), under the support of the Ministry of Energy. The Centre has categorized wastes into 38 types, including foam, used mechanic lubricant, defected tyres, sludge from effluent treatment system, paint wastes, etc. The examples of waste exchange are as follows:

- The exchange of wastes from cattle leather, sheep leather, swine leather and artificial leather generated by leather shoes factories with housewife group who take the wastes and use them to produce shoes cleaning carpets, wallets and key chains;
- The exchange of synthetic tyres and xylene generated by car assembling factories and plastic producing factories for the production of cabinet leg pads, furniture and slippery preventing ground; and
- The exchange of used mechanic lubricant from different industries for fuel used in cement production factories, among others.

The Centre has currently been in operation; however, it lacks regular public relations activities and collaboration in providing technical and academic knowledge on the management of those wastes.

V-1-3. Waste Utilisation Data Centre (WUDC)

WUDC was operated by the DIW, under the JICA support. At present, the Centre is not operating anymore as DIW has focused its missions more upon monitoring waste management of industries through electronic system. This is to facilitate industrial operators' requests for permit to operate, as required by law.

V-2. Municipal Solid Waste Exchange in Thailand

The current volume of municipal wastes in Thailand has become a huge problem that needs the central agency's support in managing those wastes. This has been done through knowledge enhancement, activities and events to raise awareness on the dangers of solid wastes on public health and the environment and the establishment of an integrated management system. Apart from government agencies, Thailand Institution of Packaging Management for Sustainable Environment, a non-profit organization, has played an important role. The Institution has gained support from industrial operators who are the five industry member groups of the Federation of Thai Industries (FTI), including plastic industry, pulp and paper industry, glass industry, iron and aluminum industry and members producing related products. It has provided supports on planning, coordinating and implementing activities to ensure that the number of used packages, ending up in solid waste piles nationwide, has been minimized through appropriate and safe means. The successful CEMPRE (The Brazilian Business Commitment for Recycling (Cempre) is a non-profit association dedicated to the promotion of recycling within the scope of integrated waste management) model of Brazil has been introduced and applied according

to economic, social and environmental circumstances in Thailand. The activities of the Institution are summarized in Table 11.

Table 11: Municipal Solid Waste Management Projects

List of Projects	Starting Year	Number of Participants
1. Establishment of recyclable materials by a group of informal waste collectors	2008	197 persons
2. Recyclable materials management in housing development estate	2008	98 Housing development estates
3. Recyclable materials management in undergraduate institutions	2006	10 Institutions
4. Promotion of recyclable materials sorting by municipalities	2007	8 Municipalities
5. Community recyclable materials bank	2006	287 Communities
6. Collaboration for establishing drop-off points with department stores, for charity purposes	2007	9 Department stores (47 Branches) 2 Convenience stores (75 branches)

The Community Recyclable Materials Bank Project has received positive responses and collaboration from communities as seen from the participation of 287 communities. The activity has generated income to communities and dramatically reduced the volume of waste, as detailed in Table 12.

Table 12: Result of the Operation of Project "Bank of Municipal Recycle Waste"

Type of Waste	Quantity (kg)	Income (Baht)
Paper	353,405.04	2,217,616.632
Glass	645,112.90	645,112.90
Plastic	187,655.55	3,222,045.79
Metal/ Aluminium	236,158.91	20,977,955.98
Beverage carton	6,581,90	26,327.60
Other	65,908.30	329,541.50
Total	1,494,822.60	27,418,640.39

In addition to implementing a number of activities, the Institution has developed its website, http://www.tipmse.or.th, providing package related database, including old products purchasing stores, recycle/transformation business, selling and buying price of recyclable materials, communities or organizations involved in recyclable waste management, the ratio of recyclable package wastes to the total volume of package wastes,

and statistics on the volume of recyclable materials. This is to provide the current situation of solid waste management in Thailand to visitors.

V-3. Examples of Waste Exchange Undertaken by Private Sector

The commercial waste exchange has been operating in Thailand for several years already. Business operators like Recycle Engineering Co., Ltd. and SCI Eco Services, Co., Ltd. have realized the market niche and an increasing trend of waste generation, requiring waste management and maximal use of wastes.

V-3-1. Recycle Engineering Co., Ltd.

Recycle Engineering Co., Ltd. has obtained a permit to operate a business on waste quality adjustment (Factory Type 101), waste recovery through refinery and package washing (Factory Type 106). The company is under a joint venture with German partners who import technology, and applying it to the production process. An environmental learning centre has been established within the factory premise, as a learning ground for the government agencies, private sector, academic institutions and other interested public.

It has performed the business operation by obtaining wastes from targeted industries, including painting, automobile, chemical, textile and others, where wastes that could be recovered through refinery could be derived. As far as the management of waste is concerned, the company has categorized customers into two groups, as follows:

1) Customers who bring in their wastes for recycling, take them back and use them in their own production process; and
2) Customers who deliver their wastes to waste processors who would sell them to other industries.

Recycle Engineering Co., Ltd. has categorized the used chemical substances that could be recycled into the following:

Group 1. Chemical solvents e.g. NMP, acetone, MEK, MIBK, methanol, ethanol, IPA, etc.;

Group 2. Hydrocarbon solutions and mixed solvents e.g. thinner, toluene, xylene, etc.;

Group 3. Halogenic solutions e.g. halogenic hydrocarbon, 1,1,2 trichloroethylene, methylene chloride, bromopropane, etc.;

Group 4. Hydrocarbon oil and liquid;

Group 5. Polymer and monomer; and

Group 6. Laboratory wastes.

In addition, the company has implemented activities related to environmental management under the collaboration with both domestic and international organizations, which include the following:

1) Laboratory Waste Management Project, under the collaboration with Merck (Thailand) Co., Ltd., to provide advice on waste storage and receipt of waste for further appropriate treatment; and

2) Environmental Learning Centre Project, under the collaboration with international organizations, who present environmental products like ground brick made from residues, furniture made from plastic wastes, aerobic composted fertilizer from organic wastes and natural renewable sources of energy, etc. It enhances the opportunities among operators to exchange their knowledge and experiences for further business cooperation. It is also a learning centre for the interested pubic.

V-3-2. SCI Eco Services Co., Ltd.

SCI Eco Services Co., Ltd. is a company of cement industry group, providing integrated waste management services, which includes the following:

1) Waste collection, transport, primary treatment, sorting and treatment;

2) Waste burning using cement kiln;

3) Waste recovery as substituting fuel or raw materials for cement production process;

4) Environmental impact monitoring; and

5) Waste analysis service.

Based on the principle of waste exchange, the company acquires wastes from the system, taking into consideration the composition of wastes. The service is charged according to types of wastes, as categorized into the following:

Group 1. Wastes with heat value would be fed into the process in the form of substituting fuel e.g. used mechanic lubricant, thinner, painting wastes, sulfur, etc.;

Group 2. Wastes containing minerals for cement production would be fed into the system in the form of substituting raw materials e.g. sludge, metal dusts, gypsum, etc.;

Group 3. Wastes not within the above categories Groups 1 and 2 would be fed into high temperature cement kiln for elimination so that environmental impacts could be prevented.

Composition analysis of samples of wastes to be fed to the treatment process would be conducted to ensure proper management. This is considered important for reporting and getting a permit to treat wastes, of which the DIW must be notified through electronic system and would then grant a permit accordingly.

Overall, waste exchange business undertaken by private sector involves the receipt of wastes from specific groups of industry, selection of wastes and application of technology for waste management. All these have been performed by business sector with skills, knowledge and understanding on this field. Key problems and challenges include competition as currently there have been a number of companies in Thailand which are involved in the business, and legal aspects has to be strictly enforced to control negative environmental impacts.

V-4. Benefits of the Establishment of Waste Exchange Centre

The benefits obtained in establishing waste information exchange centres include the following:

1. Database related to volume, type and property of wastes in different industries is collected, easy for future use and reference;
2. It will be an important clearing house in enhancing knowledge on industrial waste exchange and waste recovery;
3. Waste trading and exchange among industries for recovery purposes is encouraged;
4. Awareness is raised among industries on waste exchange and recovery;
5. Industrial productivity increases, leading to competitiveness in the global market;
6. Income generation and job opportunities are generated for both short and long terms. Jobs are created for data investigation, anaysis and synthesis, database establishment, website development, document preparation and dissemination, and events and seminars organization. As for the longer term, the establishment of an industrial waste information exchange centre would encourage service business on industrial waste management and waste recovery, including related business of industrial waste collection and transport; and
7. The volume of industrial wastes, which is currently higher than national management and treatment capacity, is reduced.

V-5. Key Problems and Recommendations on the Performance of Industrial Waste Exchange

Based on the above discussion, this report has identified some key problems in the operation of the industrial waste exchange centres and the corresponding recommendations to improve their performance. These include the following:

Key Problems

First, the quality and quantity of wastes do not meet users' needs and requirements. Occasionally, the volume of wastes is low and inconsistent, unable to conclude the trade or exchange deals or negotiations;

Second Capacity of existing recycling facilities is limited, especially as related to technology. The capacity for chemical recovery, recycling of used mechanic lubricant and extracting precious metal from electronic devices cannot compete with the volume of wastes generated;

Currently some types of wastes have potentials for recovery; however, it would require much advanced technology, resulting in high cost. Therefore, commercially, it is not cost effective;

The overall operation of the centres would require supports from different agencies to ensure continuity. These include public relations activities, dissemination of information, awareness raising, and technical and technological support provided to customers and users to ensure effective application to industries; and

The previous operation of the waste exchange centre in Thailand was under project implementation with short term financial support. The services would no longer be available once the project came to an end.

Recommendations

Events and activities should be regularly organized to disseminate information about the Centre to targeted audiences, including workshops in different geographical regions and industrial zones located outside Bangkok and vicinities where those generating wastes could meet waste processors.

The key agency having a significant role in promoting waste information exchange of the country should be identified, as the previous operations were project based –no further progress once the project was completed. Once the key agency is identified with roles specified in the organization's mission, the operation could therefore be sustained in a long run.

Industrial waste management is a business with conflicts, at a certain level. For example, the promotion of recycling or the target on zero landfill could possibly affect landfill waste processors. Consequently, services provided by the Centre should cover all types of customers and maintain their neutral role. At the same time, the Centre should be a channel for those generating wastes to select technologies for more efficient waste treatment. Likewise, waste treatment processors could benefit from acquiring customers both for waste recovery or landfill.

The government should clearly formulate encouraging policy and measures and provide continuous support, including tax incentives for technologies on recycling.

Some laws and legislation considered as a bottleneck to maximizing use of wastes should be amended. Take for instance, a particular type of industrial wastes that have been academically and technically proved, indicating their recovery potentials in other industries and non toxic components, should therefore be granted a rapid process for taking wastes out of the premises.

Technologies and cases of best practice on commercial waste recovery should be regularly disseminated to industrial operators, academicians and interested public, including the organization of annual forum, so that incentives and innovations could be further developed.

In addition, Research and development on new technologies should be promoted both for operation and business levels. Wastes with low volume would gain high economic value or become costly, e.g. technologies for recycling, oil refinery catalysts or technologies for metal recovery, etc.

International collaboration should be encouraged for technological transfer that should be brought to national agenda.

Eco-town should be enhanced in Thailand, as in Japan, so that it becomes attractive incentive that could encourage more waste recovery process.

VI. Conclusion

Waste exchange in Thailand has been faced with a number of problems, including a lack of collaboration and support among those involved, continuation of services, and waste management related knowledge and technologies. Should these problems be overcome and a waste exchange centre is established in a systematic manner where database is developed, public relations activities are regularly undertaken, and strong network is created, it is therefore believed that the centre would significantly contribute to tangible and practical solutions to natural resources and environmental degradation with sustainable outcome.

The establishment of waste exchange centre in Thailand is one of the keys for an efficient waste management. Its operation should involve the establishment of information system management standard. Relevant agencies and institutions should provide support on academic and technical knowledge of waste management and recovery following the principle of 3Rs. Also, a number of activities related to public relations, events organizations and awareness campaigns should be regularly conducted in order to enhance better understanding and waste management standards, and at the same time, to facilitate opportunities and means for waste exchange among industrial operators. This fundamental performance would significantly increase productivity of the industrial sector. Moreover, the establishment of waste exchange centre would open up a new opportunity for setting up national business that could potentially be expanded globally through networks of international collaboration. In this way, it would help promote a better image of Thailand on environmental management and hence reduce trade barriers and increase competitiveness in the global market.

References

1. Department of Industrial Works, http://www.diw.go.th

2. Pollution Control Department, http://www.pcd.go.th

3. Thailand Institute of Packaging Management for Sustainable Environment, http://www.tipmse.or.th

4. Department of Primary Industries and Mines, http://eco-town.dpim.go.th

5. Thailand Environment Institute, http://www.tei.or.th

6. Brazilian Business Commitment for Recycling, http://www.cempre.org.br

7. Recycle Engineering Co., Ltd., http://www.recycleengineering.com

8. SCI Eco Services Co., Ltd., http://www.scieco.co.th

Chapter 10. Industrial Waste Information Exchange Program in Japan

Michikazu KOJIMA
Institute of Developing Economies- Japan External Trade Organization

Introduction

Industrial Waste Information Exchange Program (WIEP) is an attempt to link industrial waste generator and waste user. There are many industrial WIEPs in Japan, which are operated either by the local government, Chamber of Commerce, or private companies. "This paper overviews the industrial WIEPs in Japan and identifies some of the obstacles in its implementation and its implications to other Asian countries."

I. Brief History of Industrial Waste Information Exchange Program in Japan

The government of Oita prefecture initiated the Industrial WIEP in 1976. After the success of the program, other local governments such as Yamaguchi, Ehime and Tochigi also started similar program. Prefectural level governments were main initiators of the program.

Clean Japan Center (CJC), a non-profit organization, which was supervised by the Ministry of International Trade and Industry (MITI), now, Ministry of Economy, Trade and Industry (METI), supported some local government for initiating programs, such as raising awareness and feasibility studies. CJC also organized programs to create linkages of several Industrial WIEPs. It was considered that it might be difficult to match generator and user of some specific waste in a prefecture. The programs were paper-based in the beginning, but they gradually started to use internet.

According to the survey in 2003 by *Indust*, a Japanese magazine focusing on industrial waste management, 22 local governments among 47 prefectures in the country conducted Industrial WIEP. Among them, 20 programs used internet-based information exchange. The remaining two local governments also planned to use internet in the near future. Six local governments asked affiliated public corporation to implement the program.

Table 1. Joint Waste Information Exchange Program in 1987

	Prefectures	Beginning.
West Seto Wide Area	Oita, Ehime, Yamaguchi, Hiroashima, Kagawa, Fukuoka	In 1983, Oita, Ehime and Yamaguchi started the joint program. Gradually other prefectures also joined.
Central North Wide Area	Niigata, Toyama, Yamanashi, Nagato,	In 1984, four prefectures started the joint program.
Kanto Central North Wide Area	Niigata, Tochigi, Gunma	In 1985, three prefectures started the joint program.
North Metropolitan Wide Area	Ibaragi, Fukushima	In 1985, two prefectures started the joint program.

Source: Clean Japan Center (1987).

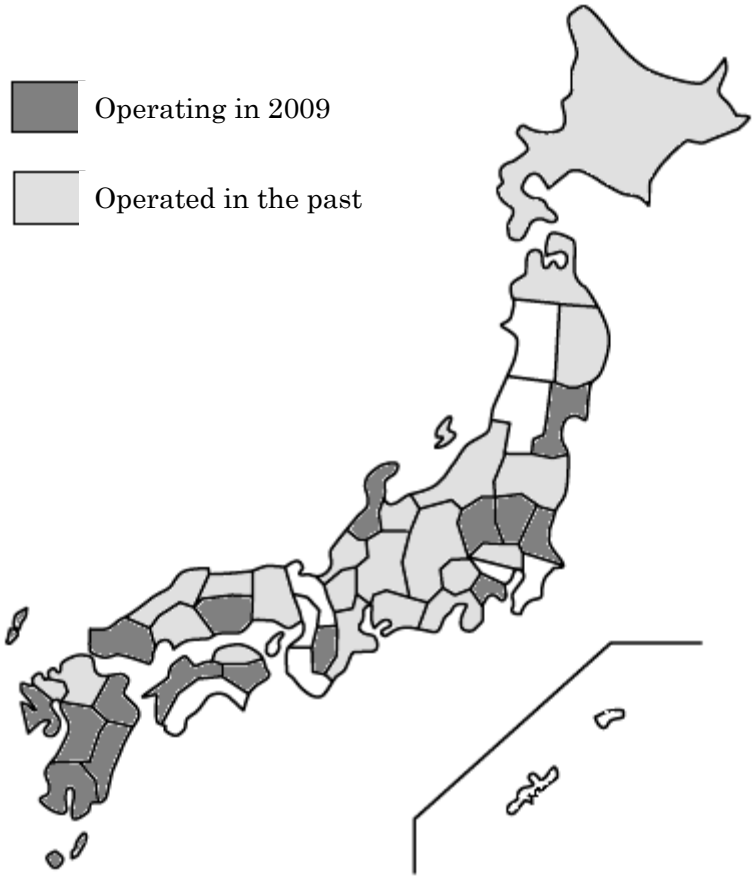
Based on the information on the websites and literatures, among 47 prefectures, 16 prefectures are currently conducting industrial WIEPs, and 19 prefectures had conducted the program in the past (Figure 1).

Around 1990, the activities supporting WIEP by CJC was finished. WIEPs operated by local governments were not so active in 1990s.

Other than local government, at least two local level Chambers of Commerce and Industry conducted industrial information exchange program. Chamber of Commerce in eastern part of Osaka started the program in 1982.

Private companies also started same kind of business. One of the earliest attempts was the program run by Clean Kobe Recycle Co. Ltd., which was established in 1975 by large industries. Web-based matching business was well established by Recycle-one in 2001.

Figure 1. Waste Information Exchange Program Conducted or Supported by Local Government in Japan



Source: Compiled from websites of prefecture government and other literature.

II. Case Studies

In this section, three cases of industrial WIEP are reviewed. The first one is the case of Oita prefecture, which is the first program of waste information exchange initiated by local government. The second one is the joint program run by Chambers of Commerce in Eastern part of Osaka prefecture. The third case is the program operated by Recycle-One, a private company, established in 2000.

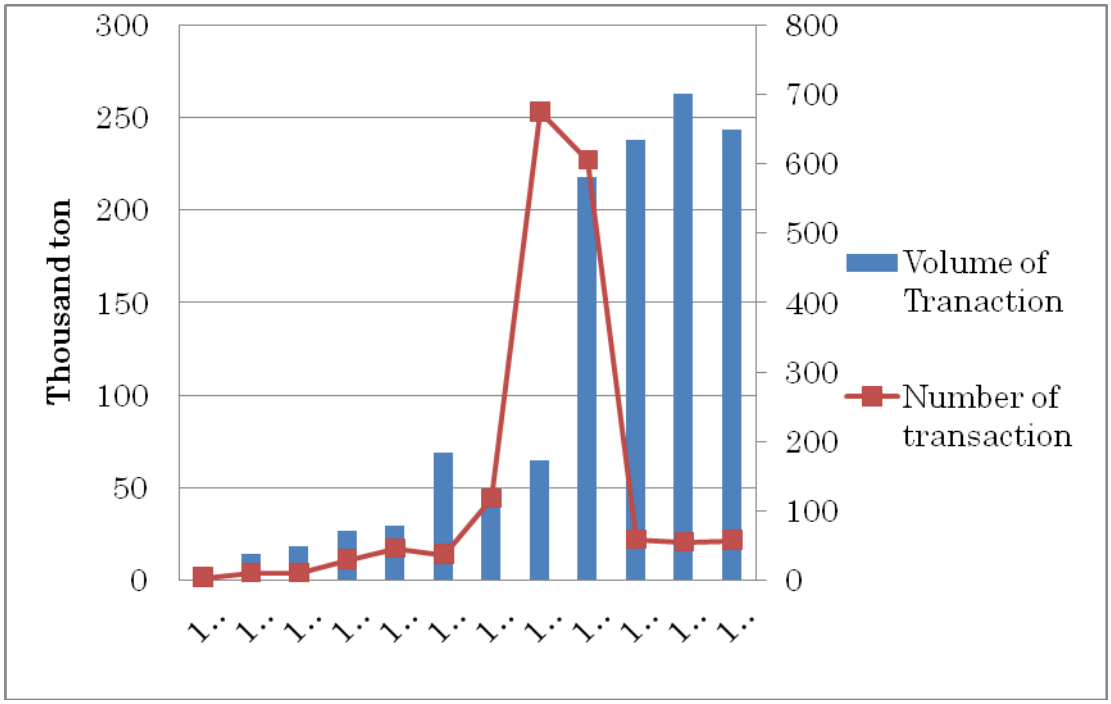
II-1. Local Government: Oita Prefecture

The Oita prefectural government conducted a survey on industrial waste generation in manufacturer and power generation sector in FY 1975 and FY 1976. During the plant visits for this survey, they found out that potentially recyclable wastes

were not utilized. In 1976, they initiated a program on registration of recyclable industrial waste from large waste generator and information dissemination on recyclable waste to potential users. This was the first industrial WIEP in Japan.

In 1979, the questionnaire survey to a number of factories was conducted by Oita prefecture with CJC (CJC, 1980). The survey was subsidized by MITI. It became an opportunity not only to collect information, but also for factories to know about the program. The target industrial sectors included the following: non-ferrous metal smelter, construction, manufacturer, wholesaler and retailer, transportation and communication, cleaning services and cooperatives of farmers and fishermen. In total, questionnaire was sent to 953 establishments. The collection rate of questionnaire reached 75%. Potential supply of waste reached 487 thousand tons, out of which 55.7% could be utilized as fuel, feeds for cattle, neutralizer, and material for land development without any pre-treatment. Potential demand of waste was 203 thousand tons. Through this survey, 26 deals on waste plastics were reached between waste generators and users within half a year.

Figure 2. Result of WIEP in iota Prefecture



Source: Clean Japan Center (1989).

In November 1980, Oita started joint program with Ehime and Yamaguchi Prefectures in coordination with CJC. In April 1983, Kagawa and Fukuoka Prefecture and four cities joined the program. In April 1985, Okayama prefecture and

Hirosihma-city took part in the program. The program was called as e the Joint WIEP in Nishi-Seto Wide Area in Japan. After the region expanded, the number and volume of transaction increased significantly (Figure 2).

II-2. Chamber of Commerce and Industry: East Osaka

Five chambers of commerce and industry in Eastern part of Osaka prefecture started Industrial WIEP in 1982. Another chamber established in 1999 also joined the program.

When the chambers planned to start the program, they asked Osaka Prefecture Government to join the program. But the government turned down the request, because the government was afraid of the opposition from existing waste treatment companies in the region.

Table 2. Examples of Transaction, Through Waste Information Exchange Program

Waste	Utilization	Transaction started
Waste sand from casting	Road construction	1982.9.-
Steel slag	Road construction	1982.9.
Waste concrete and asphalt	Road construction	1982.11
Waste wood	Chip for fuel	1984.1
Sawdust	Flooring material	1983.8
Activated sludge	Fertilizer	1983.6

Source: Data obtained form Kitaosaka Chamber of Commerce and Industry.

After several years of implementation, they shift their priority from waste exchange to waste reduction of factories. Now six chambers organized a joint committee of experts, which consists of several experts from research institutes and universities. Experts review the application from factories, visit the site and make recommendation. Experts are paid through an honorarium, but not as much as the conventional consulting fee. The officer of the Chamber of Commerce said that the voluntary contribution from experts was a key in the success of the program (based on hearing from officers in Kita Osaka Chamber of Commerce and Industry in November 2008).

II-3. Private Business: Case of "Recycle-one"

Recycle-One is a private company that initiated the matching business between waste generators and users through internet in January 2000. The registration fee was collected since 2001. The amounts of fee for waste generators and users are 60,000 Japanese yen and 300,000 Japanese yen respectively. One of the merits of their system is the settlement of an account on the internet. Waste generators and users can make agreement of transaction on the internet. Another merit of this system is that it provides detail information on waste users in the web page. Recycle-one also checks the facility and management of waste users. Even if waste users have licenses from government, Recycle-one excludes some waste users which do not satisfy the required minimum standard.

The matching business grew after a major auto manufacturer registered into their matching service. In the beginning, they believed that would continue to grow by doing this type of service. But gradually they faced high cost to deal with many kinds of wastes, because there were those that difficult to handle, and also the amount of each waste was small. In addition, some manufacturers did not want to reveal the information of waste in detail. Thus, they started consulting services to registered companies, including waste minimization. Recycle-one get information on the waste under the condition of keeping the information confidential. Recycle-one selects several candidates of waste users, and ask them to quote a price of treatment. Recycle-one provide information about the three potential users to waste generator, and the latter will then choose a contractor.

As the number of success transaction decreased, waste generators and users feel it is not beneficial to register in the waste information exchange system. Recycle-one make registration free of charge.

III. Reviews on Industrial Waste Information Exchange Program in Japan

CJC reviewed the experiences of WIEP and tried to identify the obstacles in WIEP and future actions in FY 1985. It pointed out following points:

- In 1984, 13 programs were implemented. 333,664 tons of wastes were traded, based on WIEP;
- By distributing information, WIEP could promote recycling of waste, which was considered as non-useable unless the program was conducted;
- Organizations implementing the program have often no clear target or vision;
- To utilize specific waste which is difficult to recycle, additional treatment is

needed. The WIEPs do not provide advices to waste generator, for reduction of waste; and

- The impact of WIEP program is not captured well, because some trade is triggered by WIEP, but not counted as successful as illustrated in these cases:
  - After the trade based on WIEP, new transaction is agreed between the generator and the user, without WIEP.
  - Companies in same industry got the information of successful case, and made transaction without WIEP.

Indust, which is a Japanese magazine focusing on industrial waste management, conducted a survey on Industrial WIEP in 2003. Results showed that there were 22 local governments which conducted Industrial WIEP; 8 local governments were planning to start or resume the program; and 12 local governments did not have plan to start or resume the program. The problems and difficulties of implementing the programs were pointed out as follows:

- There is no guarantee about the quality of waste;
- There is limited number of waste users;
- There is no guarantee on the ability and compliance of waste users; and
- There are some alternative programs, such as disclosure of the list of recycling companies.

IV. Conclusion

Based on the review of previous literature and interview with staffs in Recycle-one and Kita-Osaka Chamber of commerce, about the industrial WIEP, the following are some of the implications to other Asian countries:

- The number of transaction depends on information dissemination. The number of transaction may decrease in several years. Regarding the remaining waste, it is hard to find users in the region, or hard to be recycled;
- The more coverage area, the more successful transaction; and
- It is better to combine WIEP and consulting services for reducing waste. Thus, the experts' participation is a key to success.

References

Clean Japan Center (CJC), 1980. *"Haikibutsu Koukan Torihiki no Chosa Kenkyu Houkokusho (Oita ken),"* (Report of Study on Waste Exchange Transaction (Oita Prefecture)), Tokyo, (in Japanese).

_____, 1986. *"Hakibutsu Kokan Sokushin Shisutemu Chousa Kenkyu Houkokusho,"* (Report of Study on Waste Exchange Promoting System) , Tokyo, (in Japanese).

_____, 1987. *"Haikibutsu Kokan Sokushin Shisutemu Chousa Kenkyu Houkokusho",* (Report of Study on Waste Exchange Promoting System) , Tokyo, (in Japanese).

_____,1989. *"Dai 3 kai Haikibutsu Koukan Seido Zenkoku Renraku Kyougikai Koen Shiryou,"* (Third National Forum on Waste Information Exchange Program), Tokyo, (in Japanese).

Editors of *Indust,* 2003. "Haikibutsu koukan to risaikuru nintei," (Status of implementing waste exchange and certificate for recycling) *Indust,* 18 (9): 26-31 (in Japanese).

Nippon Consultants Group Inc., 2008. *Kankyo wo Chikara nisuru Bijinesu besuto Purakutyishu* (Best Practices of Business for Environment), Ministry of Economy, Trade and Industry (in Japanese).

Chapter 11. Synthesis on Industrial Waste Information Exchange Program

Lisa C. ANTONIO
Philippine Business for Environment

Michikazu KOJIMA
Institute of Developing Economies, JETRO

Panrat PHECHPAKDEE
Industrial Environment Institute, The Federation of Thai Industries

Introduction

Industrial Waste Information Exchange Program (IWIEP) links suppliers and users of industrial waste to enhance utilization of this waste. Through this program, both the waste treatment cost of waste generator and the input cost of waste users are reduced. In addition, such efficient utilization of resources has an environmental benefit of reduction of waste and of exploitation of natural resources.

Among Asian regions, Japan, Philippines and Thailand have conducted IWIEPs. The basic structure of the program in these three countries is common. A third party collects the information on what kinds of wastes are generated by waste generators and which wastes can be utilized by users, these information will then be provided to waste generators and users to facilitate matching between them (see Figure 1.).

Figure 1. Basic Structure of Industrial Waste Information Exchange Program

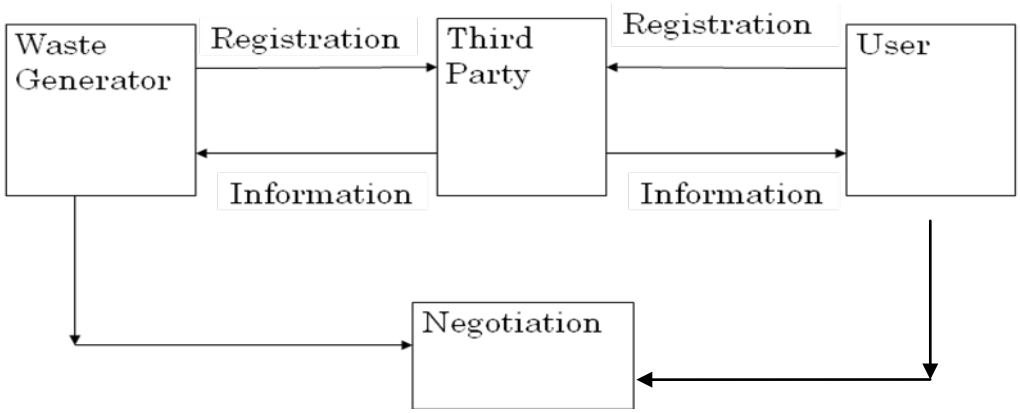


Table 1. Summary of Industrial Waste Information Exchange Programs

Name of Program	Waste Exchange Program	Waste Exchange Program	Recycle One E-market Place	Industrial Waste Exchange Program	Material Exchange Center	Waste Utilization Data Center	Eco-town Program
Country/Region	Japan	Japan	Japan	Philippines	Thailand	Thailand	Thailand
Organization	Oita Prefecture Government, Oita Environmental Preservation Council	Six Chambers of Commerce located in Eastern part of Osaka Prefecture	Recycle One Inc.	Philippine Business for the Environment; Davao City Chamber of Commerce and Industry (southern Philippines); Eco–Index Program	Thailand Environment Institute	Department of Industrial Works	Department of Primary Industries and Mines
Year started and current condition	1976 - ongoing	1982 - ongoing. Consulting service is more emphasized.	2001-present	1994 – present ongoing (PBE IWEP); 2001 – present (DCCCI and Eco – Index)	2000 –present Ongoing	2001- Stop operation	2007 –present Ongoing
Target Area	Oita Prefecture, Information exchange with neighboring prefectures	Member companies of the six Chambers of Commerce	Japan	All companies; also open to non–industry sectors such as NGOs, local governments and individuals who want to buy, sell or trade recyclables	Thailand, Classified waste into 38 categories	Thailand	Thailand Classified waste into 17 categories

Name of Program	Waste Exchange Program	Waste Exchange Program	Recycle One E-market Place	Industrial Waste Exchange Program	Material Exchange Center	Waste Utilization Data Center	Eco-town Program
Registration, and Information Dissemination System	Paper based; Questionnaire; Some information is put on the web.	Paper based	Internet based; Standard for waste users is applied.	Paper based and through optional waste ad listings in PBE quarterly magazine	Internet based and quarterly journal.	Internet based	Internet based
Budget	Prefecture government	Chambers of Commerce	Registration fee was collected until around 2004. Organizers bear the cost.	PBE and IWEP ads in quarterly magazine; DCCCII and Eco - Index	Energy Policy and Planning Office (EPPO), Ministry of Energy (support for first 3 years of the project)	Japan International Cooperation Agency (JICA) and Department of Industrial Works (DIW)	Department of Primary Industries and Mines

Tanaka and Takatsuki (1983) stated that IWIEP was developed in European countries such as United Kingdom and Germany in 1970s. Several state governments in United States, such as California, Minnesota, New Hampshire, Ohio and Tennessee have supported this program.

Each IWIEP in Philippines, Thailand and Japan is reviewed in the previous chapters. This chapter summarizes the programs in the region and discusses the common characteristics of the programs.

I. Summary of IWIEP in the Region

Several IWIEPs have been conducted in Asia. The oldest program in Asia is probably the Waste Exchange Program in Oita Prefecture in Japan which was initiated in 1976. Some local governments and Chambers of Commerce in Japan started similar programs around 1980.

In the Philippines, the Industrial Waste Exchange Program (IWEP) was initiated by the Department of Environment and Natural Resources (DENR). It was started in 1989, but was discontinued in 1992, partly because of limited participation by the industry. IWEP was revived by the Philippine Business for the Environment (PBE), a non-profit organization in 1994. Other place-based waste exchange program in the Philippines are implemented by the by the Davao City Chamber of Commerce (in Mindanao, southern Philippines), and the Eco–Index Program of a group of Industrial estates in Cavite and Laguna (north of Metro Manila).

In Thailand, three industrial information exchange programs have been conducted. The first one is the Waste Information Program by Thailand Environment Institute, which was active around 2005, but is not active right now. The second one is the web-based information exchange project developed by the Department of Industrial Works (DIW) with support from the Japan International Cooperation Agency (JICA). Since the website was not becoming popular, the project is going to be terminated. The third one is the web-based information exchange program, which is a part of the “Eco-Town” Resource Circulating Society Project. The project was started in 2007 by Department of Primary Industries and Mining.

II. Common Characteristics

There are some common characteristics in the IWIEPs in Japan, Philippines and

Thailand. The number of registration of waste information by waste generators and users may not be provided, if they do not know the program. Information dissemination about the program is a key to start such program. In several years, the number of transaction through the program has increased, as the number of participating waste generators and users increased. If the coverage area is extended, the chances of matching also increased.

Questionnaire survey to waste generator and waste users is an option to collect the volume and types of waste generated and the potential capacity of users. Such questionnaire surveys were conducted by Oita prefecture and other local governments in Japan.

But after easy cases are diminished, the number of transaction may also decrease. The difficult wastes, which need specific pre-treatment or technological development, are remained. Without technical supports or consulting service form experts, it may be difficult to match waste users and waste generator.

Based on our studies, most of the programs are free of charge for waste generators and users. The government or the Chamber of Commerce provides the budget for the program. Even those matching services on the internet mostly operated by private companies are free of charge. An exception is the program by Recycle One Inc., which collects registration fee from waste generator and users.

The impact of IWIEP program is not captured well, because some trade is triggered by WIEP, but not counted as successful cases. For example, the transaction is not usually reported, if new transaction is agreed between the generator and the user, after the trade based on IWIEP is made. There are also cases wherein companies in same industry got the information of successful transaction from IWIEP, but they made new transaction with waste users directly, and not through IWIEP.

III. Discussion on Third Party

There are several types of third parties coordinating the programs: government, semi-governmental organization, non-profit organization, Chamber of Commerce, private companies and combination of them (Table 2).

From the view point of waste generators, third party should keep some information confidential. For example, some manufacturers want to keep their usage of

materials confidential. There are possibilities that someone can guess the usage of some materials in the production from waste characteristics. Thus, third party should be a reliable one. Companies in some countries consider the government or semi-government to be more reliable than private, while others consider the private companies to be more reliable. Appropriate settings of the third party depend on the relationship between government and private companies.

Table 2. Types of Third Party

	Description	Example
Government	Government conducts the program by themselves.	Thailand: DIW Philippine: DENR until 1992
Non-Profit Organization including Chamber of Commerce	Government asks semi-governmental organization or NPO to conduct the program and provides fund.	Japan: most of local government program, including Oita and Kanagawa Taiwan : MOEA and Green productivity Foundation Thailand: TEI
	Some Chamber of Commerce or NPO implements WIEP by themselves.	Japan: Chamber of Commerce in Northern part of Osaka Prefecture Philippines: PBE, DCCII, Eco-Index
Private Companies	Web-based matching business by private companies.	Funai Consulting Co. "Sanpai-Web", Recycle One Inc., "Recycle One e-market place", Material-Link "Risaikuri.net", e-dreamer "recycle-o".

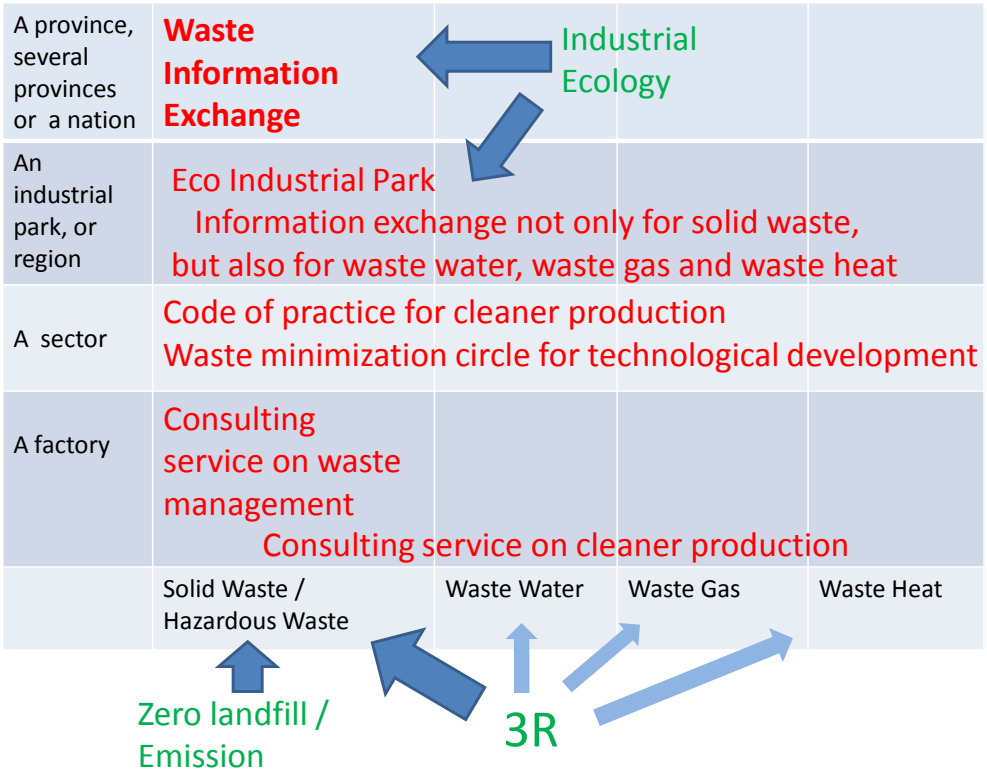
The program runs by private companies may not be sustainable, because it is difficult to get enough income from coordination of such programs. Income may be generated not only from information exchange, but also from consulting services or advertisement on the website.

IV. Other Activities Related to Industrial Waste Information Exchange Program

There are many types of programs and concepts promoting waste reduction and recycling industry, other than IWIEP. The IWIEP is targeting various industries in a

specific region. The target area is usually wider than the program for eco-industrial park, thus it is very difficult for WIEP to deal with waste water, waste gas and waste heat.

Figure 2. Relationship of Waste Information Exchange and Other Concepts



WIEP can be coordinated with other programs such as cleaner production and eco-industrial park. IWIEP may find the way on how to utilize the wastes, which cannot be reduced or utilized through cleaner production program or eco-industrial park program.

Although IWIEP focuses on industrial waste generator, it is possible to design the program to link household and waste recycler. In developing countries, waste dealers including waste picker and consolidator are actively working. Other options include conduct of collection event such as those organized by PBE with its different partners for Earth Day and Environment month celebrations, and the weekly or monthly mall-based recyclable fair/ waste markets organized by the Ayala Malls and the SM Supermalls, as mentioned in Chapter 8.

Reference

Tanaka Masaru and Takatsuki Hiroshi, 1983. *Gendai no Gomi Mondai:Gijutsu hen*

(Current Waste Problem: Technology) (in Japanese). Chuou Houki, Tokyo.

Appendix: Mapping Document on 3R Policy

Michikazu KOJIMA
Institute of Developing Economies, JETRO

Atsushi TERAZONO
National Institute for Environmental Studies

This section overviews legislation, ministries, programs on 3R in Indonesia, Japan, Malaysia, Philippines, Singapore, Thailand and Vietnam.

Countries in the region have adapted 3R principles in environmental protection and waste management laws. One of the earliest legislation is Act for the Promotion of Utilization of Recycled Resources of Japan enacted in 1991. Japan has enacted several legislations for promoting 3R in these two decades, including Fundamental Law for Establishing a Sound Material-Cycle Society. Philippines enacted Ecological Solid Waste Management Act in 2001, which has various articles to promote recycling, such as establishment of material recovery center, and formulation of strategy to develop market for recycled goods. Viet Nam's Environmental Protection Law revised in 2005, Malaysian Solid Waste Management and Public Cleansing Act enacted in 2007 have some articles on promoting recycling.

Due to various settings of responsibilities of ministries across the region and various stakeholders involving in 3R, ministries in charge of or related to 3R are different in the region. All of ministries in charge of environment in the region have some activities on 3R. But other ministries are also active in some countries. For example, Ministry of Construction in Vietnam and Ministry of Public Works in Indonesia are in charge of infrastructure development including the waste treatment facilities. In Malaysia, Ministry of Housing and Local Government is responsible for municipal solid waste management. Ministry of Economy, Trade and Industry in Japan, and Ministry of Industry in Thailand are active to encourage development of recycling industries in the countries.

One of the important policy measures which is going to be applied in various countries is Extended Producer Responsibility. Japan and South Korea have some experiences of mandatory take-back programs by manufacturers, more than 10 years. Viet Nam's Environmental Protection Law, Malaysian Solid Waste Management and Public Cleansing Act, and Indonesian Solid Waste Act have articles related to extended producer

responsibility. Thailand made public the draft of act on e-waste recycling, which is also trying to apply EPR. The detail regulations are being prepared by each government. Other than mandatory approach, voluntary agreement between government and private sector is another option to encourage efforts of private sectors on recycling and waste reduction. Singapore government made voluntary agreement on recycling packaging waste with retailers and industries in 2007.

Regarding industrial waste reduction, cleaner production program have been implemented in Thailand, Vietnam, Indonesia and Philippines. Although Cleaner production also covers energy savings and efficient use of water, waste reduction and recycling can generate the benefit to industries.

Industrial waste information exchange programs have been conducted in Japan, Philippines and Thailand. Viet Nam, Malaysia, and Singapore have not conducted such program.

This mapping document is initial attempt to overview the current activities. We are planning to expand the scope of mapping document, in terms of coverage of topics and countries. We are planning to add item-wise information on recycling, recycling infrastructure, industrial standard of recycled goods, trade regulation on recyclable waste and others into the mapping document. The target area will be expanded to other ERIA member countries.

Following tables are prepared by authors, based on various information, presentation and comment from the experts of the working group.

Mapping Document of 3R-related Regulation, Ministries and Programs

	Definition/Explanation	Indonesia	Japan	Malaysia	Philippines	Singapore	Thailand	Vietnam
Basic Law	Basic/Main Environmental Law	Environmental Management Act # 42/1982 replaced by # 23/1997	The Basic Environmental Law	Environmental Quality Act (1974)	Presidential Decree (PD) 1151 - Phil. Env Policy & PD 984 - Pollution Control Law	The Environmental Public Health Act	The Enhancement and Conservation of National Environmental Quality Act (1992)	Environemetal Protection Law (2005)
	Basic/Main Law for Circular Economy		Fundamental Law for Establishing a Sound Material-Cycle Society				Investment Promotion Act (1977)	
	Other Basic Laws related to waste management		Law for Promotion of Effective Utilization of Resources				The Factories Act (1992)	
Solid Waste	Basic/Main Law for Solid Waste Management	Solid Waste Management Act # 18/2008	Waste Management and Public Cleansing law	Solid Waste Management and Publice Cleansing Act(2007)	Ecological Solid Waste Management Act(2001)	The Environmental Public Health Act	Amendment of the Public Health Act (1992)	Environemetal Protection Law (2005)
Hazardous Wawste	Basic Law or regulation on hazardous waste management	Gov-Reg #19/1994 juncto #12/1995, replaced by #18/1999 juncto # 85/1999	Waste Management and Public Cleansing law	Enironment (Scheduled Waste)Regulation	Toxic Substances and Hazardous and Nuclear Wastes Control Act (1990, RA6969)		The Hazardous Substances Act (1992)	Decision No.23/2006/QD-BTNMT, Circular No.12/2006/QD-BTNMT
Transboundary Movement of Hazardous Waste	Regulation on Transboundary Momvent on hazardous waste	Basel Convention Ratification by President Regulation # 61/1993	Law for the Control of Export, Import and Others of Specified Hazardous Wastes and Other Wastes	Environment (Scheduled Waste)Regulation	Toxic Substances and Hazardous and Nuclear Wastes Control Act (1990, RA6969)	Hazardous Waste (Control of Export, Import and Transit) Act	The Hazardous Substances Act (1992)	Decision No. 12/2006/QD-BTNMT
Other Recycling Regulations	Specific regulation on recycling	Environmental Minisitry Regulation for HW waste recycling # 02/2008	Law for the Promotion of Sorted Collection and Recycling Containers and Packaging					
			Home Appliance Recycling Law					
			Law for the Recycling of End-of-Life Vehicles					
			Law for the Promotion of Recycling and Related Activities for Treatment of Cyclical Food Resources					
			Construction Material Recycling Law					

	Definition/Explanation	Indonesia	Japan	Malaysia	Philippines	Singapore	Thailand	Viet Nam
Major Ministries, Agencies	Ministry in charge of Environment	State Ministry of Environment	Ministry of the Environment	Department of Environment in Ministry of Narutal Resource and Environment	Department of Environment and Natural Resources	National Environmental Agency	Pollution Control Department, Ministry of Natural resouces and Environment	Ministry of Natural Resource and Environment
	Minsitry in chatge of Municiple Waste		Ministry of the Environment	Ministry of Housing and Local Government		National Environment Agency (NEA)	Department of Health; Ministry of Public Health	People's Committee/ Department of Construction
	Ministry in charge of public works inclduing waste management	Ministry of Public Works, only for domestic waste					Department of Provincial Administration, Ministry of Interior	Ministyr of Construction
	Ministry in charge of Hazardous Waste		Ministry of the Environment	Department of Environment in Ministry of Natural Resource and Environment	Department of Environment and Natural Resources		Pollution Control Department	Ministry of Natural Resource and Environment
	Ministry in charge of Industry		Ministry of Economy, Trade and Industry		Board of Investment, Department of Trade and Industry	Ministry of Trade and Industry	Depatment of Industrial Wors, Ministry of Industry	Ministry of Industry and Commerce
	Ministry in charge of Small and Midium Enterprise				Department of Science and Technology (non - regulatory)	Agency for Science, Technology & Research	The Office of Small and Medium Enterprises Promotion	People's committee/ Department of Industry and Trade/ Ministry of Industry and Trade
	Ministry in charge of Technological Development				Department of Science and Technology	SPRING Singapore		Ministry of Science and Technology
National target	Type of national target on recycling	Public Work Ministry Regulation # 26/2006	Resource Productivity: 60% reduction, Cyclical Use Rate (Usage rate of recycled goods): 40-50% increase, Final Disposal Amount: 60% reduction, set in the 2nd Fundamental Plan for Establishing a Sound Material-Cycle Society for FY2015 compared to FY2000		mandatory 25% solid waste diversion from waste disposal facilities through reuse, recycling, etc.. w/n 5 yrs of the ESWMA; with an increase every 3 yrs	Recycling Rate 60% in 2012	Recovery rate 30% in 2009 (2005-2009)	
Legal basis of implementing EPR		Solid Waste Management Act 18/2008		SWPCM Act	Ecological Solid Waste Management Act(2001)			Article 67 of the Law on Environmental Protection (2005) for radioactive waste, battery, home appliances, Decree No. 80/2006/NĐ-CP on guiding for enforcement of the Law on Environmental Protection (2005)
EPR (including Shared responsibility)	Types of Responsibility		Packaging and Container (Mainly financial)					
			Specific Home Appriances (Mainly Physical Responsibility to producer)				Draft regulation on e-waste	
			Automobile(Mainly Physical Responsibility to producer					
			Computer (Mainly Physical Responsibility to producer)					
Recycling Obligation to Waste Generator			Construction Waste			It is mandatory for condominiums and private appartments to have receptables within the estates for collection of recyclables.		
			Food waste from large waste generator					

Programs		Indonesia	Japan	Malaysia	Philippines	Singapore	Thailand	Viet Nam
Voluntary Collection Program	Mobile Phone		Mobile phone	Nokia	mobile phone and accesary	Nokia	Take-back Program for end-of-life Mobile phones, Batteries and Packaging	3R (reduce – recycle – reuse) project funded by JICA was done in 4 precincts in Ha Noi: Phan Chu Trinh, Thanh Cong, Lang, Nguyen Du
	others		Small home appliances, in some prefectures	Compute (HP, Dell)			Used lead-acid batteries recycling	*"Program of food recyclable boxes"* in 21 primary schools in Phu Nhuat, III, I precinct and Binh Thanh Precinct
						Packaging agreement (non-binding)	Promotion of Material Recovery, Energy Recovery and Replacement in Cement Kiln	
							Pilot Program on Plastic and Foam Waste Management	
							Thailand Institute of Packaging Management for Sustainable Environment, 2006	
							Collection of Fluorescent Lamp	
	Collection Event				Collection Event organized by PBE, Malls,			
Rating Program in General, Awards for SWM	Award for companies on Environmental aspect including waste	PROPER Rating Program for industrial activity ADIPURA for clean city award		Haibiscas Award	Annual Model Local Govt Unit (LGU)/ Barangay Awards for Eco - Waste Mgt		Industrial Prime Minister Awards	
	Award for Local Government on environmental aspectincluding Waste	ADIPURA			Mother Nature Award (Industry) - Pollution Control Association of the Phils/ PCAPI; Excellence in Ecology and Economy (E3) Awards - Phil. Chamber of Commerce and Industry; Industry *`Lason' / (Poison) Awards - Sagip Pasig (NGO)*		EMS for SMEs Award	*"Environmental initiatives prize of WB"* for Vietnam
							Good Governance Award	
Industrial Standard			"Action Program for Promoting Formulation of Environmental JIS"			Standardization of Wooden Pallets		
Eco-Labeling	Type I (ISO 14024)		Eco-mark, started in 1989	SIRIM started in 2008.	Green Choice Phils			Article 34 of the Law on Environmental Protection for encouraging the habits to consume the friendly products
	Type III		Eco-leaf					
Promoting Recycling Industry			Tax incentive for some specific industry					
			Eco-town Program: 26		Eco industrial Park	Sarimbun Recycling Park	Eco-town Program	
Green Public Purchasing			Green Purchasing Law, Green Contract Law, 2007	Tax incentives for environmental goods	(Presidential Order 301)		Green Procurement Plan, 2008	
Cleaner Production Center		National Cleaner Production Center			Cleaner Production Program - Dept of Science and Technology, Industrial Technology and Devt Institute		Thailand Network for Eco-efficiency and Cleaner Production	Vietnam Cleaner Production Center
							Cleaner Technology Research and Education Consortium	