Chapter 1

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

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March 2009

This chapter should be cited as
Hotta, Y. (2009), 'Development of the Policy Concepts for Eco-Efficient Industrial Activities: 3Rs, Zero Emissions, Eco-industrial Parks, and Others', in Kojima, M. and E. Damanhuri (eds.), *3R Policies for Southeast and East Asia*. ERIA Research Project Report 2008-6-1, pp.1-21. Jakarta: ERIA.

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

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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.

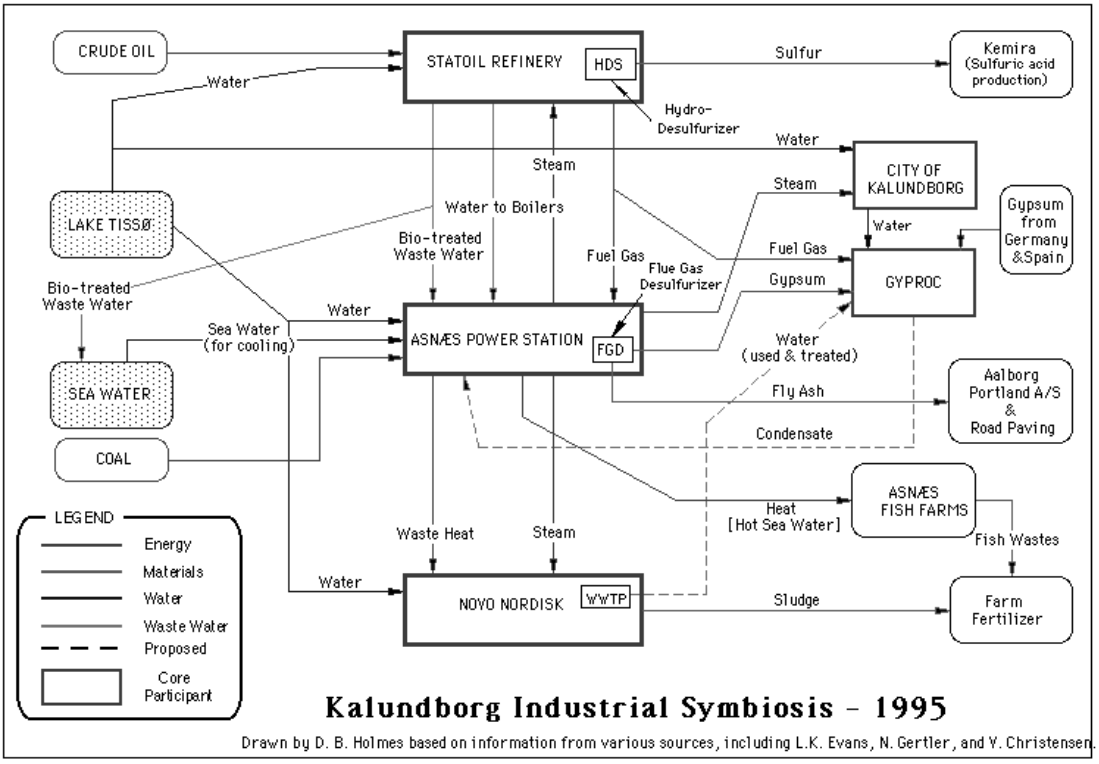
ZE has been recognized widely among the industrial sectors of Japan. Also, since the major so-called famous companies and local governments have started to launch their own ZE activities, it has been recognized more widely in Japanese society. The discourse of ZE allows central government, local government 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.

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