TOWARDS SUSTAINABLE SOLID WASTE MANAGEMENT IN ISKANDAR MALAYSIA: USING THE JAPANESE ECO-TOWN CONCEPT

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ABSTRACT

The management of solid waste continues to be a major challenge of sustainable development, particularly in the rapidly growing cities of developing countries. Population growth along with fast pace urbanization and industrialization has raised the resource consumption and waste production and creating greater pressure on the environment and public health. Being a rapid developing region in Malaysia, Iskandar Malaysia faces similar issue. In view to plan Iskandar Malaysia towards sustainability by circular metabolism via recycling and recovery practice, this paper attempts to explore the concept of Eco-town development in Japan, particularly the case of Kawasaki Eco-Town.

1. INTRODUCTION

1.1 The Challenge of Waste in Iskandar Malaysia

Iskandar Malaysia (formerly known as Iskandar Development Region, IDR or South Johor Economy Region, SJER) is the third largest metropolitan in Malaysia. The vast new region with encompassing of 1.7 million populations and an area of 2,217 square kilometers is aspires to be a strong and sustainable metropolis. Towards fulfilling the vision above, addressing constant growing amount of waste in Iskandar Malaysia (Figure 2) is no doubt among the key challenges in attaining greater environment sustainability.

In response to deal with the ever-increasing waste generation, this paper presents an overview on the Eco-Town solid waste management concept in Japan and look forward to learn the lessons from the Kawasaki Eco-Town. The discussion will be focused on the idea and brief history of Japan Eco-Town development in waste minimization by urban and industrial symbiosis and circular metabolism, a case study on the Kawasaki city in Japan and highlighting the key success factors in developing Eco-Town.

2. INNOVATIVE JAPANESE SOLID WASTE MANAGEMENT

2.1 Background of Eco-Town

Development of Eco-Town in Japan was arising from the critical issues on environmental degradation and economy crisis during the end of industrialization era (early of 1990s) (Van Berkel et al, 2009a). The earlier rapid growth of economy and industrial development on the past decade had raised the level of waste generation...
whilst the landfill capacity stayed very limited. In 1995, the municipal waste was recorded at 50 million tons per year and industrial waste was 400 million tons per year. Meanwhile, the existing landfill sites for municipal wastes were estimated to be exhausted in next 8 years and industrial wastes were 3 years (OECD, 2002). At the same time, Japan faced economy stagnation triggered by the collapse of bubble economy and led to the decline of industry sector. Numerous industries had shifting their investment and manufacturing base to developing and industrialization countries. As a result, many local governments suffered from the severe decrease in tax revenue and employment. To address the environment and economy challenges above, Central Government of Japan Ministry of International Trade and Industry (currently known as Ministry of Economy, Trade and Industry) and Ministry of Health and Wealth (program later was transfer to Ministry of Environment) initiated the Eco-Town program in 1997 (Fujita 2008; Van Berkel et al, 2009a). In the first fiscal year, 4 Eco-Towns were established and by January 2006, this number had increased to 26 (Figure 3) (Fujita, 2006).

Figure 3: Japan Eco-Towns. (Source: Fujita, 2006)

2.2 Concept of Eco-Town

Japan Eco-Town maybe misleading at first glance as it does not imply with any big conceptual idea of green city planning approach either Ecocity by Register (2006), Eco Town by Department for Communities and Local Government, London (2007), ECOCITY by European Union funded Research Project (2009) or eco-city green field developments project by Arup, an international built environment consultancy (2006). It is only part of big eco city planning concept above which emphasis on resource and waste management of the urban environment system (GEC, 2005; Guilamo, 2007) (Figure 4). The idea of Japan Eco-Town is a planning and management efforts in organizing the industries in the designated area to practices 3Rs (reduce, reuse and recycle) and symbiotic resource recycling network with other industry, commercial and residential sectors of the designated area (JETRO, 2006; Bahn-Walkowiak and Bleischwitz, 2007; UNEP and GEC, 2009).

Figure 4: Eco-Town in eco city planning concept. (Adapted from GEC, 2005)

The initial idea of Eco-Town was a defined area of an industrial estate in applying Zero Emissions concept a.k.a Zero Waste concept by United Nation University’s Zero Emissions Research Initiative in 1994 (GEC, 2005). The concept calls for the waste minimization through the establishment of a recycling system to promote waste exchange between the industries. In simple term, it was known as Zero Emission Industrial Park or resource recycling industrial park (Fujita et al., 2004). Thereafter the recycling cycle has been expanded to involve city region the new term have been taken to Eco-Town are Urban and Industrial Symbiosis (Van Berkel et al., 2009a; 2009b). The symbiosis is the synergistic opportunities arise from geographic proximity of urban waste sources with material exchange across various industries. With the above characteristic, Eco-Town could be the model for circular metabolism, a widely accepted famous resource and waste strategy by Girardet (1999). The circular metabolism is a theoretical idea of the close loop urban system in utilising waste as resource for environment and economy sustainability.

3. AN OVERVIEW ON KAWASAKI ECO-TOWN

3.1 Background

In 1997, Kawasaki city together with Kitakyushu city, Gifu prefecture and Lida city have been approved by the Japan National Government to implement the first Eco-Town program (GEC, 2005; Fujita, 2006; Van Berkel et al, 2009b; Maki, 2011). Nowadays, Kawasaki city is recorded as one of the leading Japanese cities in environment management particularly in the field of natural resources and solid waste management (Yong Geng et al., 2010).

Figure 5: Context of Kawasaki City and Kawasaki Eco-Town. (Adapted from Hashimoto et al., 2010; Maki, 211)
The success of Kawasaki Eco-Town has been widely demonstrated and discussed by many environmentalists on the global arena as the best practices on sustainable solid waste management for developing countries to learn from. The city is located between Tokyo and Yokohama, the first two largest cities in Japan. The size of the city is about 144 square kilometers and home to 1.4 million inhabitants, they are predominantly the commuters from Tokyo (Official Website of Kawasaki City). Kawasaki is an industrial city with large enterprises on the coastal area and small and medium enterprises (SMEs) on the inland area (GEC, 2005). The industries Kawasaki comprises of petrochemical, engineering, food, and electronic and logistic (Van Berkel et al, 2009b; Maki, 2011). From the above, Iskandar Malaysia shared much similarity with Kawasaki city in term of population, industrial activities and geography. Hence, the practices of Kawasaki Eco-Town would be much feasible to implement in Iskandar Malaysia.

During 1990s, Japan Government introduce Eco-Town program on the 2,800 hectare of coastal industrial areas in Kawasaki City. The primary aim of the Kawasaki Eco-Town is effective utilization on solid waste into raw materials of industries. Under the Eco-Town program, an exclusive 77,642 square meter zero emission industrial complex for leading environmental enterprises is established (Figure 6). It is now home to 16 green small and medium enterprises, including several metal fabrication manufacturers and a recycled paper mill. Apart of the development on centralised industrial complex, the government has provided about 25.8 billion JPY (~1.05 billion RM) subsidies in setting up five new recycling facilities. The subsidized recycling facilities consist of three waste plastic recycling plants (producing blast furnace in steel production), producing raw materials in concrete formwork production and producing raw materials in ammonia production); a paper recycling plants (recycling unsorted and contaminated paper waste) and a polyethylene terephthalate (PET) to PET recycling plants (Table 1). Besides, there are two non government subsidised recycling facilities (an electric appliance recycling plant and a cement production plant with reusing waste material) were constructed as part of the Kawasaki Eco-Town.

Table 1: Subsidised recycling facilities in Kawasaki Eco-Town. (Source: Van Berkel et al, 2009)

<table>
<thead>
<tr>
<th>No.</th>
<th>Types of Recycling Facilities</th>
<th>Investment (M JPY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plastic for blast furnace</td>
<td>2744</td>
</tr>
<tr>
<td>2</td>
<td>Plastic for concrete formwork</td>
<td>2607</td>
</tr>
<tr>
<td>3</td>
<td>Unsorted Contaminated waste paper</td>
<td>5015</td>
</tr>
<tr>
<td>4</td>
<td>Plastic for ammonia production</td>
<td>7400</td>
</tr>
<tr>
<td>5</td>
<td>PET to PET</td>
<td>8000</td>
</tr>
</tbody>
</table>

3.2 Material Flow

In 2011, about 14 years after the introduction of Eco-Town program, Kawasaki Eco-Town records 14 resource recycling and symbiotic projects with involving nine distinct industries of municipal waste collectors, municipal wastewater treatment plant and a group of private enterprises (Van Berkel et al, 2009b). According to the latest investigation done by Van Berkel et al. (2009b), the symbiosis comprising steel production via scrap iron and steel, stainless steel production by using scrap stainless steel, fluorescent lights recycling from fluorescent light tubes, home appliances dismantling from home appliances, recycled paper making by archives and mixed paper waste, reusing industrial water from treated municipal wastewater, concrete formwork production through mixed plastic waste, recycling PET bottles, electricity generation from blast furnace gas, ammonia production from mixed plastics waste, production of alternative blast furnace from mixed waste plastic, utilizing waste plastic as alternative cement fuel, using wastewater treatment sludge as alternative cement raw materials and using blast furnace slag to substitute cement materials. The by-products and waste exchange has brought the benefit on 565,000 tonnes of solid waste reduction and estimated economic opportunity of more than 13.3 billion JPY (~0.54 billion RM).

4. LESSON LEARNED

In ensuring the successful development Eco-Town, GEC (2005) and Van Berkel et al. (2009a) stress on the 4 main factors: legislation framework, financial aid, awareness and consensus building and technology. Each of these factors is further explain as below.

Firstly, legislation framework plays a vital role into the formation governance and regulation system to initiate, guide and support the implementation of Eco-Town. The Basic Law for Establishing the Recycling Based Society provides quantitative target for nation has given clear direction for every development to achieve it. Besides, the recycling and green purchasing legislation offer the sufficient supply of waste and market of eco friendly products. This will promote the recycling industries as the investment risk has been significantly reduced.

Secondly, financial support from central government is essential to aid the local government and local enterprises in Eco-Town Development. The fund enables local municipal to execute the town planning, awareness promotion and outreach activities. On the other hand, the subsidies for the promotion on local business to invest in the innovative recycling projects.

Awareness and consensus building is also part of the critical criteria for Eco-Town Development. There is a need to widespread among all levels of government, civil society and private sectors about the dangerous of waste pollution and the important of environment. On the other hand, consensus building with outreach, consultation, engagement and planning activities between the stakeholders from all walks of life in making sure the Eco-Town is fit into local context and setting up the appropriate recycling facilities.

Last but not least, technology do comes into development of Eco-Town. Technology is required for industry process to turn the waste into resource and
products. Additional improvement on recycling technology to venture into new solution and product, research and development supports from academia and research institute is important too.

5. LESSON LEARNED

Based on all the above concept and criteria of Japan Eco-Town, Iskandar Malaysia may not be able fulfil the above criteria without strong support of legislation, finance as well as the stakeholder commitment. Yet, the exploratory on Eco-Town in Japan of this paper could draw a new paradigm to move Iskandar Malaysia a step forward closer to sustainable solid waste management.

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