Chapter 7

Establishing Industrial Standard for Recycled Waste: The Case of Malaysia

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CHAPTER 7

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1. Introduction

Mass production of products which escalated with increasing demand triggered industrial activities. Industrial revolution especially during 18th and 19th century created many manufacturing wonders. Enduring good quality of products, standards were used to ensure certain level of acceptance for the products. Standards existed since the beginning of recorded history of industrialization. Early example of standard was the creation of calendar. Five thousand years ago the Sumerians in the Tigris/Euphrates valley devised a calendar which was very similar to the one we are using today. Later the Egyptians were the first to develop the 365-day calendar and can be credited with logging 4236 BC as the first year in recorded history.

The application of standards continues and in modern day standard being established during World War 2 by British Government. The standards was introduced during the war as there were quality problems in many British high-tech industries such as munitions. The solution was to require factories to document their manufacturing procedures and to prove by record-keeping that the procedures were being followed. The name of the standard was BS 5750, also known as a management standard because it did not specify what to manufacture, but how to manage the manufacturing process. The development of standards continues with increasing complexity and demand and supported with advance technology development. Recently, each country in the world developed their own standards for products, services and activities. Furthermore, to ensure the level of playing field for international trade, international standards have been established. The International Organization of Standardization (ISO) plays an important role, focusing at early years of its establishment on manufacturing products. Although ISO standards is technical, their implementation goes beyond solving technical problems to delivering positive results in economic, environmental and societal spheres (Bryden, 2008). The ISO has a membership of 157 national standards institutes from countries large and small, industrialized and developing, in all regions of the world. ISO develops voluntary technical standards which add value to all types of business operations. They contribute to the dissemination of technology and good business practices. They support the development, manufacturing and supply of more efficient, safer and cleaner products and services. They make trade between countries easier and fairer.

ISO standards also safeguard users and consumers, and make many aspects of their lives simpler.

Standards play an important role for industry development. Standards are critical for international trade because incongruent standards can be barriers to trade, giving some organizations advantages in certain areas of the world. Standards provide clear identifiable references that are recognized internationally and encourage fair competition in free-market economies. Standards facilitate trade through enhanced product quality and reliability, greater interoperability and compatibility, greater ease of maintenance and reduced costs. As for the waste recycling industry, availability of standards is important to ensure sustainability of the industry and minimizing impacts to the environment and human health.

For the waste recycling industry, there are important drivers or factors which play important role in establishing and implementing standards. A standard requires stakeholders and institutional support. The governments of a country, the main implementer and enforcer of standards need important inputs from industries, business sectors, financial institutions and consumers. Legislation must also be established along with standard to ensure effective applications and compliance. Standards should be developed in line with technological development, thus it requires human resources for many important activities especially for enforcement and technology development for standards enhancement. This is important and thus, technology development for product should be handled immediately and competitiveness of products technology should not be slowed down by lack of standards. Compliance for standards must be supported not only by the government and its legislative role, but other support system must be also be in place. This support system must come from industry and business entity which will ensure trade and market suitability in applying the standards. Financing and insurance scheme should also be developed and be established to facilitate standards compliance by industry and business. These drivers or factors should be integrated to ensure that the standards for waste recycling industry are able to deal with the increasing demand of recycled materials for industry in many parts of the world. Hence, many countries especially the developed countries have established their own waste recycling standards.

2. Country Experience in Establishing and Implementing Standards for Waste Recycling

The need for good waste recycling scheme requires a system which includes effective management regime. In addition, there should also an assessment and monitoring program or system in place to ensure the sustainability of the waste recycling industry. Therefore standards play an important role. Many countries have developed or have established their own waste recycling standards. The standards are developed according to the needs of its local industries and of other countries. As the demand for recyclable materials increases, these standards are reviewed to ensure ability of these materials to be exported or imported. Most of the waste recycling standards available have been developed by developed countries. This section highlighted examples of the establishment and development of waste recycling standards of selected countries and region.

2.1. European Union Waste Recycling Standard

One of the main regions which developed early its standards for waste recycling is the European Union (EU) countries. EU has established its environment policy which has evolved significantly since the 1970s. This policy provides the EU countries a cleaner air and water, and a better understanding of the importance of a healthy environment. It is one of the policy areas that is most supported by EU citizens, who recognise that environmental problems go beyond national and regional borders and can only be resolved through concerted action at EU and international level (European Commission, 2005). One of the critical environmental issues in Europe has been waste. Increasing problem in managing waste by its member countries, drove them to undertake national measures to control and manage waste efficiently. This led to the creation of the Waste Framework Directive (75/442/EEC), and the Hazardous Waste Directive (91/689/EEC) both adopted in 1975, and later to the Waste Shipment Regulation. The Waste Framework Directive establishes a framework for the management of waste across the European Community. It defines important terms, such as '**waste**', '**recovery**' and '**disposal**', to ensure that a uniform approach is taken across the European Union. The directive requires Member States to:

- give priority to waste prevention and encourage reuse and recovery of waste

- ensure that waste is recovered or disposed of without endangering human health and without using processes which could harm the environment
- prohibit the uncontrolled disposal of waste, ensure that waste management activities are permitted (unless specifically exempt)
- establish an integrated and adequate network of disposal installations
- prepare waste management plans
- ensure that the cost of disposal is borne by the waste holder in accordance with the polluter pays principle
- ensure that waste carriers are registered

The Hazardous Waste Directive framework legislation complements the Waste Framework Directive by providing a framework for the control of hazardous waste. It lists a number of properties of waste which render it hazardous (such as explosive, flammable, carcinogenic, or corrosive). Although the Directive does not substantially augment the requirements of the waste framework directive as regards permitting and registration of waste management facilities, it contains additional requirements concerning the mixing of hazardous waste, record keeping and international shipments of waste. The Directive requires Member States:

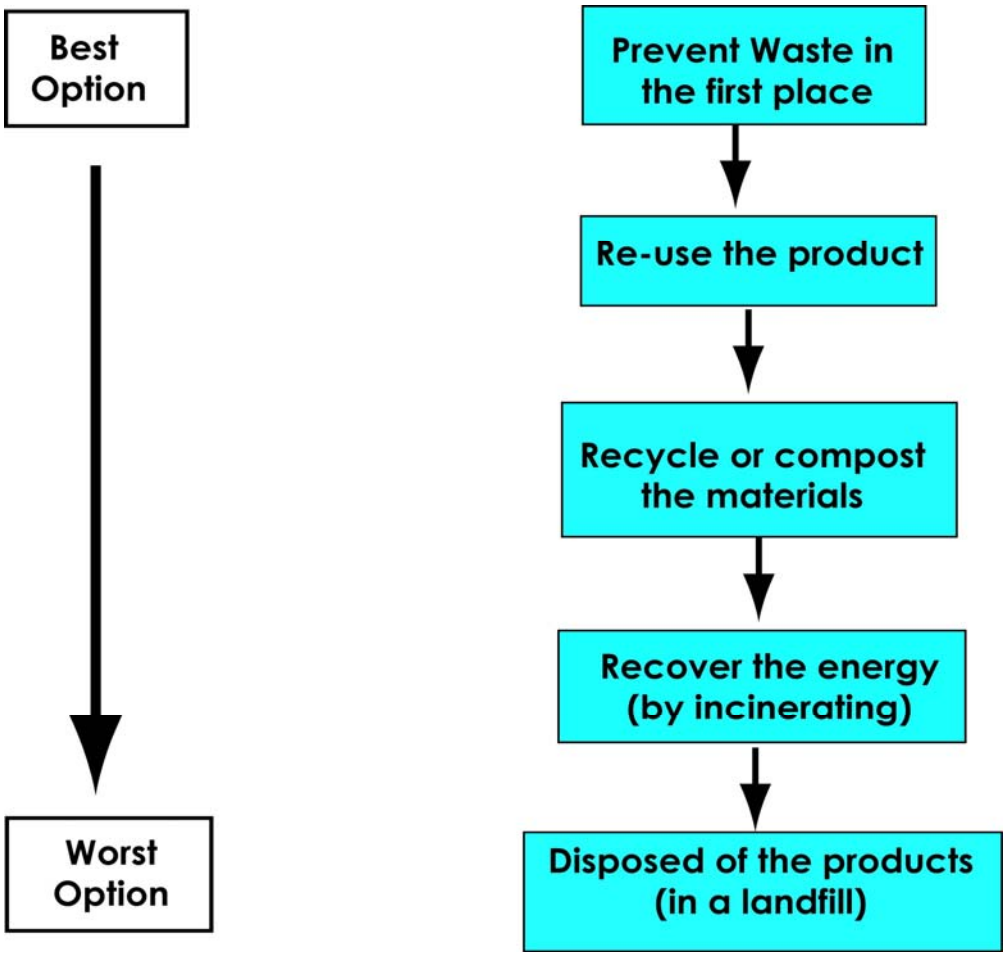
- a record of every site where tipping of hazardous waste takes place
- the prevention of the mixing of non-hazardous and hazardous waste
- the separation of hazardous waste from other waste where technically and economically feasible
- hazardous waste to be transported, packaged and labelled in accordance with international and European Union standards
- waste to be transferred with an identification form
- producers and disposal sites to be inspected
- permitted sites to keep records for three years

In 1996, the Waste Strategy Communication from the European Commission (EC) identified three strategies to improve the waste management regime:

- Reinforced the notion of a waste hierarchy (Figure 1)
- Re-affirmed the “polluter pays” principle with regards to waste (so that those who produced waste should have to pay the cost of treatment)
- Developed the concept of priority waste streams.

The improvement also prioritized waste recycling, re-use and energy recovery over the disposal of waste. EU legal framework for waste management has been strengthened to ensure recycling of waste. This includes the EU–European Council Regulation (EEC 880/92), Directive of Packaging and Packaging Waste (94/62/EC), and the Waste Framework Directive (WFD 75/442/EEC) of 1975 (revised in 1991 and codified in 2006)

Figure 1 Waste Hierarchy for Management in European Union



Source: European Commission, 2005.

Development of common reference standards for recycling in EU become important as the Commission's position is that common EU standards are a better solution for the EU both environmentally and economically. To ensure the proper functioning of the internal market for recycling and the high level of environmental protection and to prevent the threat of "eco-dumping", it is proposed to set minimum

standards across the community for recycling activities and recycled materials. Establishing standards for waste recycling in EU is not an easy task. Several Member States, and regional or local authorities of EU, tend towards protectionism in the area of waste. Hence the notion of waste treatment standards for EU is multi-faceted. It depends on the following conditions:

- Which process is the most appropriate for a given waste;
- The pressures exerted on the environment by a waste management facility;
- The efficiency of a recovery process; and
- The quality of the output of a recycling operation.

Therefore the existing European Ecolabel will help in supporting waste recycling and recycling standards and its process. The European Ecolabel established in 1992, is a voluntary scheme. The scheme objective is to encourage businesses to market products and services that are kinder to the environment. Products and services awarded the Ecolabel carry the flower logo, allowing consumers - including public and private purchasers - to identify them easily. Today the EU Ecolabel covers a wide range of products and services, with further groups being continuously added. Product groups include cleaning products, appliances, paper products, textile and home and garden products, lubricants and services such as tourist accommodation. The European Commission manages the scheme at EU level to ensure correct implementation of the Ecolabel Regulation (EC) No 66/2010. The Ecolabel Helpdesk assists the Commission on a number of different matters, including marketing. Collaborating with EU Commission is the The European Union Ecolabelling Board (EUEB) responsible for developing, publishing and promoting criteria for product groups in order to minimise the environmental impacts of a wide range of products and services over their whole life-cycle. EUEB is made up of the Competent Bodies from each Member State and the interested parties that form the Consultation Forum. The Competent Bodies are independent and impartial organisations, responsible for implementing the EU Ecolabel scheme at national level. They are members of the EUEB responsible for drafting Ecolabel criteria, assessing applications and awarding the Ecolabel to companies that apply. They play a central role in the operation of the EU Ecolabel scheme and should be the first point of contact for any questions.

With support of EU ecolabel scheme, it promote the establishment of common standards for waste recycling for EU countries, which help to protect the environment in the whole of the EU. For long term requirements, it will reduce the complexity of the legislation that controls shipments of waste destined for recovery. The common standards will help to build a strong internal market for recycling and recovery and good for economic development as well.

2.2. The Federal Republic of Germany Waste Recycling Standard

The Federal Republic of Germany has experienced industrial development since the 17th century. As one of the most important industrial and developed countries in Europe and the world, Germany has become an important country to be considered, in its experience in managing industrial waste. Waste has become a critical issue in Germany, thus for the past three decades, the government has been taken steps to better manage the waste.

Legislature plays a key role in waste management. The Waste Disposal Act was enacted in 1972 with the primary aim to shut down the uncontrolled refuse dumps and replace them with central, regulated and supervised landfill sites under the responsibility of regional and local governments. This act was established as a response to the increasing illegal disposal of waste (Schnurer, 2002). However this Act was not able to control waste generation and disposal. In the 1980's, the critical waste disposal crisis prompted calls for a drastic reduction in waste generation to reduce waste disposal problems. The government of Germany has determined the importance of controlling waste generation, and in 1986, the Waste Avoidance and Management Act, was introduced.

The Act introduced the principle that the avoidance and recycling of waste had to be given precedence over waste disposal. It also established a foundation of product responsibility. To strengthen this Act, the Packaging Ordinance, was introduced in 1991. This ordinance has become key product of waste policy based on the Waste Avoidance and Management Act of1986. The Packaging Ordinance applied the carrot and stick principle, to promote waste avoidance and recycling. The responsibility shifted towards industry and business and encourages them to design products and packaging for waste avoidance. Essentially, the rule was that manufacturers of packaging, and distributors of packaged products, were to accept the return of empty packaging from its most recent owner and to recycle it (Schnurer, 2002).

The packaging ordinance has led to the establishment of the Dual System (Duales System Deutschland, DSD) which also called Green Dot System (Rousso and Shah, 1994). The DSD dual system in Germany, is run by a stock corporation owned by a large number of packaging manufacturers, product manufacturers, retail companies and waste management companies. The stock corporation organizes nationwide collection and transportation of packaging waste and sorts it into individual, recyclable fractions. The system contracts private and public waste management companies to provide these services on its behalf. The DSD scheme cooperates with guarantors to ensure and verify the adequate recycling of the individual packaging materials (glass, metals, paper/board, plastics and composites). The system is financed by the so-called "green dot", a license fee which manufacturers or users of packaging must pay to the dual system. This system implementation control by specific standards ensures that the recyclable materials recovered or collected is up to the requirements.

Germany emphasizes the need for resource conservation and recovery, and identified waste as a resource. In 1994, the Closed Substances Cycle and Waste Management Act was introduced to promote the close substance cycle in waste management in order to conserve natural resources. The Act pursued hierarchy targets of waste avoidance – recycling – disposal and to ensure environmentally friendly waste disposal. Later the legislation for waste recycling in Germany was strengthened by the establishment of Ordinance on Waste Recovery and Disposal Records (Nachweisverordnung - NachwV) in 2006. This enabled Germany to achieve the highest recovery quotas worldwide. Already over half of both municipal and production waste now undergo recovery. For some waste types, recycling quotas are even higher - e.g. packaging (82%), batteries (66%), and graphic paper (81%). With such achievements the needs for responsive standards is important. These standards will ensure that the recycling industry in Germany is sustainable.

In response to the EU's WFD and the Thematic Strategy on prevention and recycling of waste, Germany has enhanced its existing legislation regime to ensure sustainable implementation of the waste recycling program. The Germany legislative and standards have been synchronized to support EU WFD, as well as adhere to the EU's directive on waste, as follows:

- EC Framework Directive on Waste (75/442/EEC), 1975.
- EU Directive on the Landfill of Waste, 1990.

- EU Directive on the Incineration of Waste, 2000.

The key to waste management in Germany is *Product Responsibility* (Schnurer, 2002). This includes taking into account the responsibility of key stakeholders. The stakeholders involved the commitment of government agencies, including the Federal Environment Ministry, regional and local governments. Other important stakeholders were industries, businesses and consumers. These stakeholders also play important roles on the establishment and development of standards for waste recycling industry in Germany. With increasing demand for recyclable materials, Germany has developed and established waste recycling and recycling standards. Currently, there are 57 waste recycling standards and 128 recycling standards developed by Germany (Table 1). The waste recycling standards were used for recycling of waste while the recycling standards were used for materials, process and supporting activity which will be used for recycling activity or manufacturing i.e. includes virgin materials, intermediate products and transportation. These standards focus on many aspects of the waste recycling industry from collection and recovery, process of recycling, additional materials use, manufacturing of new products, testing, sampling, pollution emission control, transportation and support service.

Table 1 Waste Recycling and Recycling Standards Applied in Germany

Standards	Germany	Foreign
Waste recycling standards	57	157
Recycling standards	128	469

Source: German Institute for Standardization (Beuth), 2010

To assure good waste management, the Federal Republic of Germany emphasizes avoidance and recovery of resources from waste. The political credo of modern waste policy for Germany is: Avoidance, recycling, environmentally sound disposal (Figure 2). It also promotes industries and businesses to design production systems, products and packaging to reduce waste and allow for recovery (recycling or reuse) as well as environmentally safe disposal. Product responsibility implements both regulatory measures and commitment by the producers and distributors (The Federal Environment Ministry, Federation of Germany, 2003).

Figure 2 Avoidance, Recycling, Environmentally Sound Disposal

Source: The Federal Environment Ministry, Federation of Germany, 2003.

2.3. The United States of America Waste Recycling Standard

The need for good management systems for waste is critical. Environmental disasters such as the incident in Love Canal, New York, (1954 – 1980) required more attention on waste management. The wide spread of pollution generated from waste resulted in environmental damage and impact to human health and livelihood. In response to this, the Congress of USA passed the Solid Waste Disposal Act (SWDA) in 1965. SWDA established a framework for all states to better control the disposal of waste from all sources and set minimum safety requirements for landfill at local settings. However, the SWDA failed to control increasing waste generation. In addition to domestic and solid waste from industry, hazardous waste generated from industries was increasing. More than four million tons of chemicals were produced and synthetic chemicals production was increasing in 1965 (USEPA, 2002). The United States Environmental Protection Agency (USEPA) was formed in 1970 to better handle waste management. Recognizing the failure of the SWDA, which was found to be not strong enough to address the hazards posed by increasing waste

generation, the Congress passed the Resource Conservation and Recovery Act (RCRA) on 21st October, 1976. The goals of the RCRA included the following:

- To ensure that waste is managed in a manner that protects human health and the environment;
- To reduce or eliminate, as expeditiously as possible, the amount of waste generated, including hazardous waste; and
- To conserve energy and natural resources through waste recycling and recovery.

The RCRA was intended to depart from the end-of-pipe solutions previously used in the SWDA approach. Federal and state governments work together with basic programs provided by the federal government while the state governments implement the programs according to their needs and strength. The RCRA banned open dumping and provides a comprehensive national program to encourage source reduction, recycling and safe disposal of solid waste. As for hazardous waste, the RCRA mandated very strict requirements for the treatment, storage and disposal of waste to minimize present and future risks.

The USEPA shifted its approaches from a regulatory focus to fewer regulatory and more voluntary actions. These approaches were implemented through the Waste Wise Program, launched in 1994. The waste management hierarchy prioritized reuse, recycle and last disposal of waste. The program cultivated and recruited partners from businesses, tribes, state governments, universities and corporations to reduce waste generation. The aim of the program was to reduce by half the amount of waste generated by 2005. The program emphasized source reduction and environmentally sounds recycling over treatment and disposal (USEPA, 2002). In 2002 there were 1,200 partners who gave their full commitment to reduce waste. Since the enactment of the RCRA, many achievements have been acknowledged thus minimized impact of waste on human health and the environment. Hazardous waste generation has been reduced from nearly 300 million tons to 40 million tons from 1976 to 2002. The recycling program managed to reduce 62 million tons of waste a year from being disposed in landfills. The USA national recycling rate has increased to 28% in 2002.

Waste recycling in USA has achieved a significant target. However, the recycling activities require specific standards for the recyclable materials and intermediate products. There are currently 45 national standards for waste recycling in USA (ANSI, 2010). The USEPA Responsible Recycling (R2) guidelines show the importance of guidelines and standards for electronic waste recycling requirement

illustrate support the enforcement of the legislative system for waste management and recycling in USA. The R2 provide waste recycling guideline for electronic waste recycling. The USEPA R2 practices for use in accredited certification programs for electronic recyclers. The purpose of this document is to take a first step in addressing the need for effective and business friendly guidelines. This situation lead to development of a commonly accepted set of R2 practices for the electronics recycling industry. The R2 is a means of verifying if an electronics recycling company is forthright and responsible about how it manages used of end-of-life electronic equipment. At the same time, responsible electronics recyclers want a means of highlighting their values and performance to customers. This includes a process where industry, business and government agency work together to develop and establish electronic waste recycling standards. Moreover, the Consumer Electronics Association (CEA) of US pursues for the need for a national recycling standards that will soon transform businesses and what these changes mean for the consumer electronics industry in the future.

The three case studies shows that in developing and establishing standards for waste recycling industry there is a need to have an institutional system and structure which includes government, research institution, business, industry, recycler and consumers. The institutional system play important role in determining type of standards need to be develop, how it will be implemented and what need to be done in order to enhance the standards for future needs. Example of institutional system and structure is the EUEB of European Union where the eco-label board play important role to determine the best approach in developing and implementing standards. Technology knowledge and development is one of the important factors. Therefore input from industry, business, recycler and research institution help in developing technological information for waste recycling standards. Responds from standards users is critical as to ensure the effectiveness of the standards. Bottom-up approach is an important mechanisms and process for feedback which will ensure the effectiveness of standards application. The mechanisms could be embedded within the institutional system and structure. Here industry, business and consumers input play important role in providing responds towards effective and accepted standards. Countries in the process of developing its national standards must take into consideration on the requirements and development of standards in other country. There should be mechanisms to accommodate the process of converging of standards

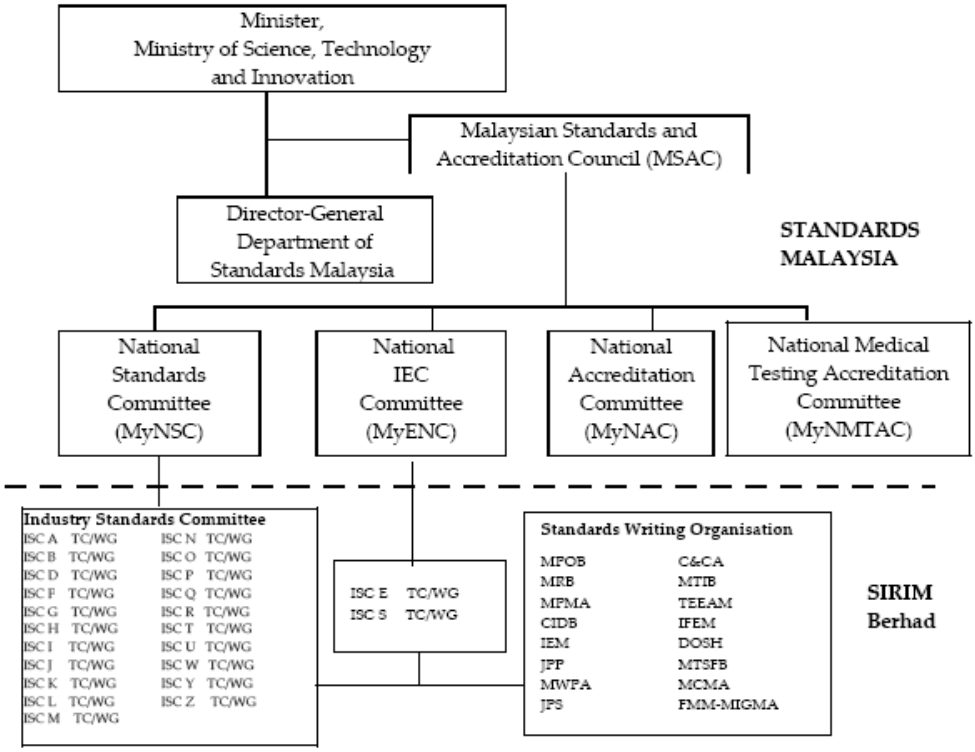
from other countries for inclusiveness of individual national standards to be easily accepted by many countries e.g. European Union countries.

3. Initiative Towards Development of Standards for Sustainable Industrial Waste Recycling Industry in Malaysia

The need for waste recycling standards has become critical as the industry expands. The industries and businesses as well as the enforcement agencies require standards to ensure effective performance, responsibility, sustainability of industries and environmental protection. In developing such standards, the process needed must be addressed. Malaysian standards development and establishment process is discuss as follows.

Legislative requirements through The Standards of Malaysia Act 1996 (Act 549) is the law which governs matters relating to standardisation and accreditation activities in Malaysia. The Act establishes the Department of Standards Malaysia (STANDARDS MALAYSIA) as the National Standards and Accreditation Body. The Act additionally establishes a Standards and Accreditation Council (MSAC) as the highest body to advise the Minister of Science, Technology and Innovation on standardisation and accreditation. The Council has established four advisory committees on standardisation and accreditation in order to discharge its duties and functions related to standardisation and accreditation in accordance with the provisions of the Act. The four committees are the National Standards Committee (MyNSC), the National Accreditation Committee (MyNAC), the National IEC Committee (MyENC) and the National Medical Testing Accreditation Committee (MyNMTAC). MyNSC and MyENC have established sector based Industry Standards Committees (ISC) to oversee the technical work related to standardisation for the specific sectors. As provided for by the Act, STANDARDS MALAYSIA has appointed SIRIM Berhad as the sole national agency to coordinate standards development activities in Malaysia and to represent Malaysia in international standardisation activities. SIRIM Berhad has in turn appointed other organisations and associations as Standards Writing Organisations (SWO) to assist in the task of developing standards for specifically defined scopes. Figure 3 shows the Malaysian Standards and Accreditation Institutional Structure.

Figure 3 Malaysian Standards and Accreditation Institutional Structure



Source: Department of Standards Malaysia, 2009

The process of developing a Malaysian Standard can be summarised into a four-step process as illustrated in Table 2. Figure 4 below shows the stakeholders involved in the process of developing Malaysian Standards.

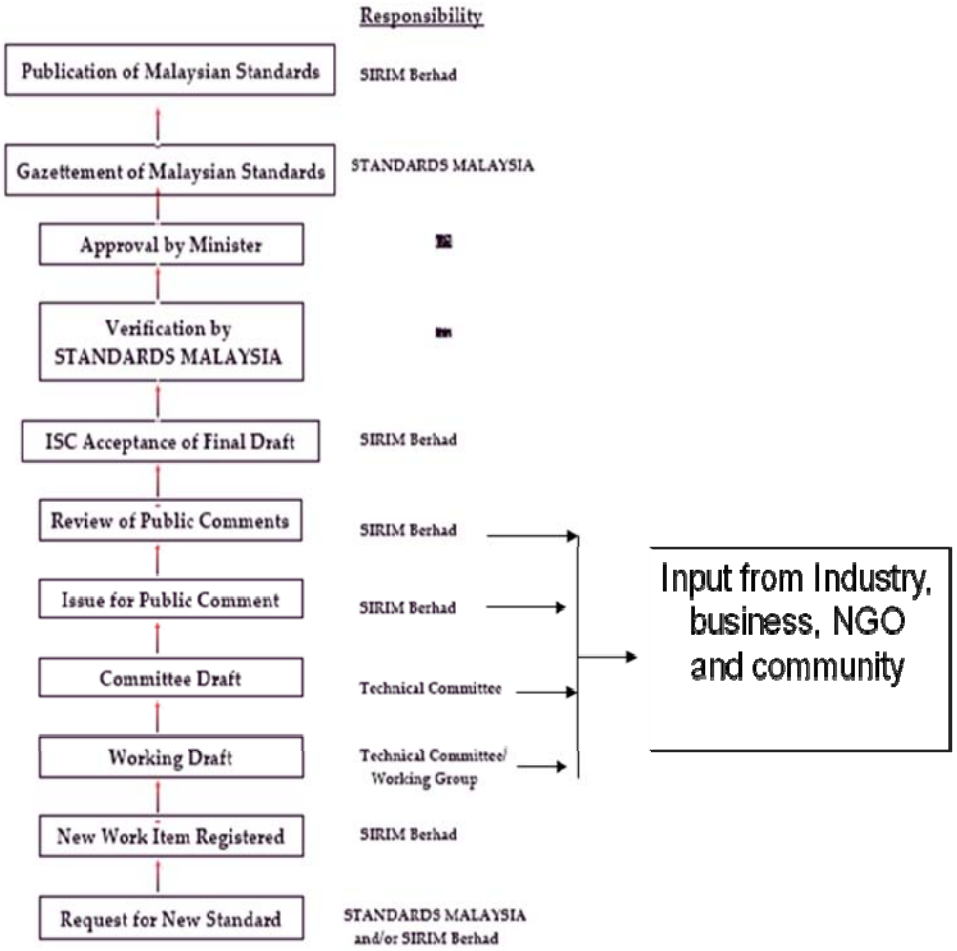
Table 2 Stage and Process for Developing Malaysian Standard

Stage	Process
Proposal stage	The first step in the development of a Malaysian Standard is to confirm that a particular Malaysian Standard is needed. A new work item proposal (NP) is initiated from external and internal (SDCs) requests or from internal reviews including the Periodic Review. The request is then submitted for formal approval by the relevant Industry Standards Committee (ISC). Upon approval of the proposal, the project is assigned to the relevant existing technical committee (TC) or working group (WG), or a new TC or WG may be established to undertake

	the project.
Preparatory stage	Deliberation of a project is carried out by the TC or WG taking into account the operational policies for standard development. Upon finalisation of the draft and consensus is reached within the TC/WG, the Draft Malaysian Standard (DMS) is issued for Public Comment for a period of 60 days. Information regarding DMS for Public Comment is circulated to ministries, government departments, quasi-government bodies, professional or scientific bodies, trade or industrial associations and etc. Upon the closing date of the Public Comment, the DMS is reviewed by the TC or WG to address comments received (if any). All comments are responded to. The DMS incorporating comments received and accepted (if any) during the Public Comment is then finalised for submission to the ISC.
Approval stage	Upon acceptance by the ISC, the Final Draft Malaysian Standard (FDMS) is submitted to STANDARDS MALAYSIA to be forwarded to the Minister of Science, Technology and Innovation for final approval as a Malaysian Standard and gazetted.
Publication stage	Once a Malaysian Standard has been approved, it is sent for publication and listed in the Malaysian Standards Catalogue.

Source: Department of Standards Malaysia, 2009

Figure 4 Development Processes of Malaysian Standards



Source: Modified from Department of Standards Malaysia, 2009

In response to the environmental requirements, Malaysia has established the Eco-Label regime in 2005. SIRIM Malaysia Bhd is the agency responsible in developing and enforcing eco-label. Eco-label plays an important role towards establishment of recycling waste or materials standards in Malaysia. The scheme helps to provide important criteria for recycling of waste in Malaysia. The four eco-labelling criteria identified (on the product, packaging or letterhead) are as follows:

- Environmentally degradable and non-toxic plastic packaging material
- Hazardous metal-free electrical and electronic equipment

- Biodegradable cleaning agents
- Recycled paper

These criteria claim on 18 products.

- Environmentally degradable & non-toxic plastic packaging material
- Hazardous metal-free electrical & electronic equipment component & parts
- Biodegradable cleaning agents
- Recycled paper
- Biofibre composite construction material
- Food-grade lubricants
- Floor mat
- Fabric care product
- Tableware from biomass
- Adhesives
- Water-based adhesives
- Paper-based packaging products
- Organic fertiliser
- Recycled rubber products
- Shampoo
- Shower liquid products
- Solid body soap products
- Recycled plastic products

All of these products with eco-label promote recycling or have information that the products are recyclable after use. However it did not provide any specific standards on how to recycle.

4. Establishing Standards for Waste Recycling in Malaysia

Waste recycling has become an important economic industry in Malaysia. With increasing amount of industrial waste generated daily by domestics and industry, recycling helps to minimize problems related to the need for more land to disposed wastes. With the reduction of natural resource availability, recycling provides

alternative resources. This creates opportunities to establish resource recovery for industrial waste. With the Government support through policy, legislation and pro-active role, waste recycling industry will become major industry soon. As of 2004, 55 industrial solid wastes recyclers were licensed by the Ministry of Housing and Local Government Malaysia. While for hazardous wastes, 122 recyclers were licensed by the Department of Environment Malaysia in 2006 to recover the wastes. Estimation made has found that 70% of total industrial solid wastes generated and about 5 to 10% of domestic waste were recovered. Industrial solid wastes recovery increased from 5,405.1 ton/day in 1994 to 8,063.47 ton/day in 2005. Approximately 45.75% of hazardous wastes have been recovered from total wastes generation from 2000 to 2005. Thus increasing trend of wastes recovery observed, from 35% in 2000 to 58% in 2004. Between 2000 to 2005, 1.12 million metric tons of industrial hazardous waste have been recovered (DoE (2001, 2003, 2006)).

With such demand for waste recycling industry the need for industrial waste recycling standards is crucial. Current practice for waste recycling industry is based on demand supply requirement. In Malaysia, waste recycling monitored by the existing legal requirement which focusing more on promotion for waste recycling. Two important legislative are:

- The Solid Waste and Public Cleansing Management Act (SWPCMA) 2007; and
- The Environmental Quality Act 1974, Schedule Waste Regulation 2005.

Specific standards for waste recycling industry in Malaysia are not available and standards for recyclable material and recycled products are not well addressed in the waste minimization plan or strategy in Malaysia. Compliance of standards for recyclable materials happen only for export requirements, adheres to import country standards. With the increasing number of recyclers and materials being recycles the need for waste recycling industry standards are urgently needed. This will guarantee the quality of recyclable materials as demand by consumers. The Standards will play an important role in supporting enforcement of legislation. With establishment of the standards, it will help to ensure fair practice on waste recycling industry. It will also stabilize fair value of recycled goods and will strengthen market and trade mechanism for both local and international. Implementation of the standards will also minimize environmental and human health impact caused by the industry.

Availability of standards for waste recycling industry in Malaysia will help to ensure the sustainability of the industry in the future. However, prior to the development of standards there are many factors that need to be addressed. First, Malaysia needs to have common definition of recyclable materials and intermediate products. The definition is critical as this will ensure effective and acceptable standards for waste recycling industry in the country. In implementing standards, legislative support must also be in place. The existing legislative structure need to be enhanced to include waste recycling industry needs. The recycling industry requires general and specific waste recycling guidelines. Data from technical information of wastes characteristics need to be developed. This database is important to support waste recycling standards maintenance and enhancement. Therefore, valuation or assessment tools of standards for recyclable goods or intermediate products must be identified. The standards also need to be supported by technology development and innovation to understand the processes involve in waste recycling. This should include the handling and transportation of recyclable goods or intermediate products as well as possible impact to the environment and human health. Currently, there are 21 standards that have been established for the recycling industry in Malaysia (Table 3).

Flexibility of standards must be in place. Standards should not start as mandatory; hence voluntary must be the first action to be introduced to the waste recycling industry. It is difficult to make mandatory new standards which are not familiar to the recycling industry in Malaysia. Voluntary process must be supported with awareness and education process to ensure that all key stakeholders in waste recycling industry understand and able to accept the use of the standards. However, as the situation improves and when there is an increasing acceptance and capability of stakeholders, the standards could be enforced as mandatory. Standards for recyclable materials and intermediate products must focus on quality and adhere to specification demanded by industry. The manufacturing and recycling process guidelines will ensure key recycling players to achieve this condition.

Table 3 Malaysian Standards (MS) for Recycling Industry

	MS Number	Title
1	MS ISO 22628:2009	Road vehicles – Recyclability and recoverability – Calculation method (ISO 22628:2002, IDT)
2	MS 2080:2008	Ecolabeling criteria for recycled paper
3	MS 1904:2006	Specification for polyethylene plastics moulding and extrusion materials from recycled post consumer (HDPE) sources.
4	MS 1388 : 1995	Specification for high slag blastfurnace cement.
5	MS 1389 : 1995	Specification for Portland blastfurnace cement.
6	MS 1387 : 1995	Specification for ground granulated blastfurnace slag for use with Portland cement.
7	MS ISO 3037:2008	Corrugated fibreboard – Determination of edgewise crush resistance (unwaxed edge method) (ISO 3037:2007, IDT)
8	MS ISO 3034:2007	Corrugated fibreboard – Determination of thickness (ISO 3034:1975, IDT)
9	MS 1912:2006	Wood-based panels - Fibreboards - – Specification.
10	MS 1786:2005	Woodbased panels – Fibreboard, particleboard and oriented strand board – Terminology (ISO 17064:2004, MOD)
11	MS ISO 13820:2004	Paper, board and corrugated fibreboard – Description and calibration of compression – Testing equipment.
12	MS 398:1976 (CONFIRMED:2004)	Specification for corrugated fibreboard boxes.
13	MS ISO 186:2003	Paper and board – Sampling to determine average quality (ISO 186:2002, IDT)
14	MS ISO 535 : 2001	Paper and board – Determination of water absorptiveness – Cobb method
15	MS 1226 : PART 1 : 1991	Pulverized-fuel ash part 1: Specification for pulverized-fuel ash for use as cementituos component in structural concrete.
16	MS 1494:2000	Specification for billets for hot rolled non-alloyed steel bars and rods

17	MS 1495:2000	Specification for blooms for hot rolled non-alloyed structural steel sections
18	MS 224:2005	Retreaded pneumatic rubber tyres for cars and commercial vehicles – Specification
19	MS 571 : 1991	Specification for ingot tin
20	MS 18:1971	Specification for toilet tissue paper
21	MS ISO 15270:2008	Plastics – Guidelines for the recovery and recycling of plastic waste (ISO 15270:2008, IDT)

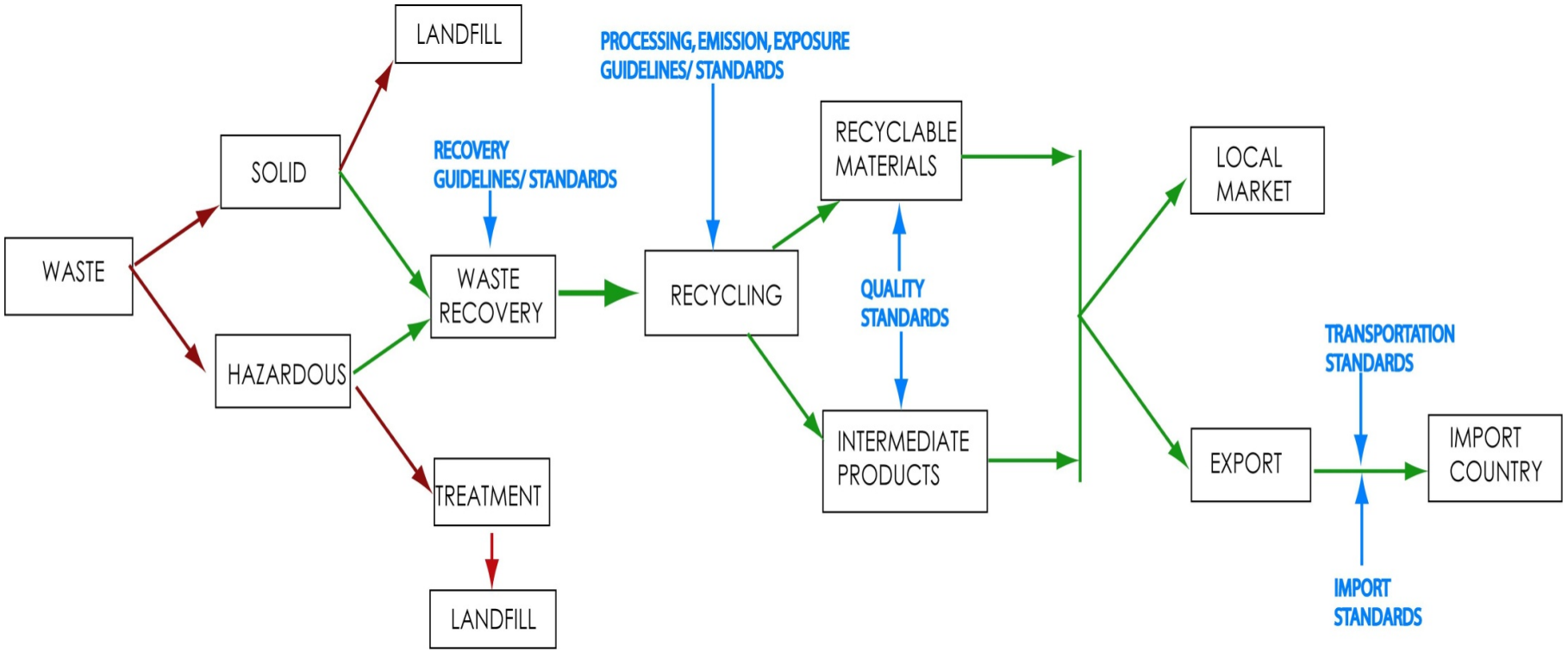
Source: SIRIM, 2009

Inculcating life cycle thinking in manufacturing and recycling process helps to ensure good quality and minimized impact to the environment. Hence, standards for emission or exposure of materials process need not to be established as long as the recycling process complies with the existing country environmental standards. As for the movement of the recyclable materials and intermediate products, the standards for transportation of recycling materials which might be considered as toxic or hazardous materials, must comply with the Basel convention procedures. Figure 5 illustrate how the roles of standards should engage in each process of waste recycling industry in Malaysia. The recovery guidelines and standards determine type of waste suitable for specific recycling purpose. This guidelines and standards must be supported with separation at source methods. As for the recycling process and activity, guidelines and standards must be in place to ensure that the recycling process and activity have minimum impact to the human health and environment which also includes guidelines and standards for emission and exposure. The quality standards are critical as to ensure that the recyclable materials meet the requirements needed by the consumers. Transporting recyclable materials which are considered as hazardous require specific transportation standards. This is important since most of the recyclable materials are export and import products. The standards which monitored the waste recycling industry play important role to ensure that the recyclable materials comply with legal requirements of imported country.

5. Conclusion and Recommendation

Malaysia's waste recycling industry has grown significantly in the past two decades. Demand for greater market of recyclable materials and intermediate products for local and international requires standards to ensure good quality. Hence, the need for standards for sustainable waste recycling industry is crucial. The current practice will need dynamics and flexible standards which are supportive to recycling industry and sustainable development. To ensure that the country's waste recycling industry can penetrate to the international market, there is a need to synchronize Malaysian standards with other countries' standards for easy use or for compliance for recyclable materials and intermediate products to be exported or imported. Thus, the mechanisms and infrastructure for synchronization of standards need to be established. However, the concern for protection of sovereignty especially for local industry against the need for regional and global compliance or safety must also be seriously addressed.

Figure 5 Role of Standards in Waste Recycling Industry in Malaysia



References

ANSI, 2010. "Records of National Waste Recycling Standards," <http://www.nssn.org/search/IntelSearch.aspx> (accessed 23 February 2010).

Bryden, Alan, 2008. "How ISO Contributes to a Sustainable World: ISO Secretary-General," <http://www.iso.org/iso/pressrelease.htm?refid=Ref1177 > (accessed 15 January 2010).

Department of Standards Malaysia, 2009. "Guide to the Malaysian Standards System.".http://www.standardsmalaysia.gov.my/v2/index.php?option=com_content&task=view&id=93&Itemid=113# accessed 2nd January 2010.

Department of Environment Malaysia (DoE), 2001. *Malaysia Environmental*

Quality Report 2000. Putrajaya.

Department of Environment Malaysia (DoE), 2003. *Malaysia Environmental*

Quality Report 2002. Putrajaya.

Department of Environment Malaysia (DoE), 2006. *Malaysia Environmental*

Quality Report 2005. Putrajaya.

European Commission, 2005. The Story Behind the Strategy: EU Waste Policy. http://ec.europa.eu/environment/waste/pdf/story_book.pdf accessed 19th February 2010.

German Institute for Standardization (Beuth), 2010. <http://www.beuth.de/cn/bGV2ZWw9dHBsLWhvbWUmbGFuZ3VhZ2VpZD1lbg**.html> (Accessed 23 February 2010).

Rousso, A.S. and Shah, S.P., 1994. "Packaging taxes and recycling incentives: The German Green Dot Program," *National Tax Journal*, 47: 689–701.

Schnurer, H., 2002. German Waste Legislation and Sustainable Development: Development of Waste Legislation in Germany *Towards Sustainable Closed Substance Cycle*. Federal Environment Ministry of Federal Republic of Germany.

SIRIM, 2009. "Malaysian Standards (MS) Online," SIRIM Berhard, Minister of Finance Incorporated <http://www.msonline.gov.my/msonline> (accessed 2 November 2009).

The Federal Environment Ministry, Federation of Germany, 2003. "General Information Waste Management," <http://www.bmu.bund.de/en/1024/js/english/waste/information/> (accessed 14 August 2003).

USEPA, 2002. *25 Years of RCRA: Building Our Past To Protect Our Future*. Office of Solid Waste and Emergency Response, USEPA. EPA-K-02-027..

Acronym

IEC: International Electrotechnical Committee

ISC: Industry Standards Committee

TC: Technical Committee

WG: Working Group

CIDB: Construction Industry Development Board

MPOB: Malaysia Palm Oil Board

JPS: Department of Irrigation and Drainage, Ministry of Natural Resources and Environment

DOSH: Department of Occupational Safety and Health

FMM-MIGMA: Federation Of Malaysian Manufacturers – Malaysian Industrial Gases Manufacturers Group

MCMA: Malaysian Cable Manufacturers Association

MRB: Malaysian Rubber Board

MPMA: Malaysia Plastic Manufacturing Association

IEM: The Institution of Engineers Malaysia

JPP: Department of Sewerage Services

MWPA: Malaysian Wood Preserving Association

C&CA: The Cement & Concrete Association of Malaysia

MTIB: Malaysia Timber Industry Board

TEEAM: The Electrical and Electronics Association of Malaysia

IFEM: The Institution of Fire Engineers (UK) Malaysia Branch

MTFSB: Malaysian Technical Standard Forum Berhad

MCMA: Malaysian Cable Manufacturers Association