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**Towards Harmonized Recycling Certification in Asia
-Exploring the Feasibility and Potential Benefits of Harmonized
Recycling Certification -**

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**Background Paper for
Special Event on Possible Introduction of Recycling Certification in Asia
at Greater Mekong Sub-region (GMS)
Sub-regional training workshop on
building capacity to deal with the illegal shipments of
e-waste and near-end-of-life electronics
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IGES Discussion Paper

Towards Harmonized Recycling Certification in Asia

-Exploring the Feasibility and Potential Benefits of Harmonized Recycling Certification -

This report was developed as a background paper of Special Event on “Possible Introduction of Recycling Certification in Asia” at Greater Mekong Sub-region (GMS) Sub-regional training workshop on building capacity to deal with the illegal shipments of e-waste and near-end-of-life electronics from 10 July to 13 July 2012, Hanoi, Viet Nam. The report is based on a research project conducted by Institute for Global Environmental Strategies funded by scientific research fund “the Environment Research and Technology Development Fund “ of the Ministry of the Environment of Japan.

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1. Introduction

As resource demand grows in line with the rapid economic growth of developing countries in Asia in recent years, so too has the transboundary movement of recyclables in Asia. Although developed economies such as Japan, Republic of Korea or Taiwan have established collection and treatment mechanisms for recyclables, international trade based on gap in demands in recyclables has become a loophole of domestic recycling mechanism. At the same time, widespread urbanized life style in developing Asia has resulted in increasing consumption of electric and electronic products thus in increasing generation of e-waste. Considering environmental risks from unsound treatment of e-waste, establishment of appropriate treatment mechanism of e-waste is desirable in these countries. Recyclers tend to regard recyclables mainly as potential resources with economic value and not pay enough attention to potential hazards. This raises environmental and health risk of e-waste recycling based on cheap, improper recycling and treatment without proper environmental protection measures. Considering informal nature of recycling market of developing countries, uncertainty of the origins (i.e. from whom and where) of collected recyclables may be a barrier for recyclers or users of recyclables in using recyclables from developing countries from the perspective of Corporate Social Responsibility.

The Basel Convention has been stagnated by discussion over Basel Ban Amendment which includes prohibition of the export of hazardous waste from developed to developing countries. To breakthrough this stagnation, an omnibus decision on the Indonesian-Swiss Country Led Initiative (CLI) on improving the effectiveness of the Basel Convention was adopted at the 10th Conference of the Parties of the Basel Convention held in October 2011. Within this initiative, the requirements to allow the 1995 revision of the Basel Convention to come into force were clarified (includes contents which prohibit the export of hazardous waste from developed to developing countries, including for the purpose of recycling). On the other hand, a recent study by IGES, University of Tokyo, and Akita University showed that short term shortage in supply of metals¹ for example will mainly be met by increasing supply of scrap materials thus recyclables². At the same time, the countries without ratifying Basel Ban Amendment will be able to export hazardous recyclable wastes but would face increasingly stronger pressure. Since most of recyclables has both potentially hazardous and valuable nature, international trade of recyclables will not be effectively and automatically

¹ In this study, examples of metals were iron and copper. However, implication on increasing needs for scrap would be applicable to other metals.

² IGES (2012), Heisei 23 nendo Kankyo Keizai no Seisaku Kenkyu: Ajia wo chushin to shita Shigen Junkan System no Kankyoteki, Keizaiteki, Shakaiteki Eikyoku Hyokani Kanusuru Kenkyu Saisyuu Kenkyu Houkokusho (FY 2011 Policy Studies on Environmental Economics: Evaluation of Environmental, Economic, and Social Impacts of Resource Circulation System in Asia, Final Research Report), Hayama, Japan: Institute for Global Environmental Strategies.

managed in more environmentally sound manner by implementing Basel Ban Amendment. In addition, many countries both developed and developing countries does not have a facility such as integrated smelter to manage both hazardousness and resource potential of e-waste. Considering that quality recycling facilities is necessary for treating these recyclables both in developed and developing countries, this will add strong international pressure to the development of mechanisms to manage recyclables in environmentally and socially sound manner. The resolution will also incorporate decisions on guidelines on environmentally-sound management (ESM), with Japan taking the initiative in studies in this area.

However, international policy discussions focusing on the Basel Convention tend to lean towards a regulatory and supervision of “illegal trade” but not giving incentives to best practices when dealing with the trade of waste and recyclables. On the other hand, when one looks at the reality of the expansion of the transboundary movement of recyclables driven by economic and market principles, such as economic growth and increased resource demand in developing countries in Asia (China, in particular), mechanisms to ensure proper trade in recyclables are crucial to promote sound recycling business.

In addition, movements to certify qualified recycling businesses for electrical/electronic equipment waste have emerged as a global trend, mainly in the United States and Europe. Responsible Recycle and e-Stewards are certification systems for recycling businesses in the U.S. In Europe, actions are in place to set standards for technology and management of recyclables (WEEELABEX) from electric and electronic equipment waste, including transport, sorting, storage, treatment and final disposal. These standards will be included in the requirements for CENELEC, which is the European standard. Also, Australia and New Zealand have created common standards for recycling facilities and both countries are strengthening the management of waste electric and electronic products.

In connection with this, the Institute for Global Environmental Strategies (IGES) is conducting research on the possible introduction of recycling certification systems in Asia over a two-year period from FY 2011 to FY 2012 as a research project funded by the Environment Research and Technology Development Fund of the Ministry of the Environment of Japan. This research will contribute to the examination of the potential introduction of balanced, international standards with regard to certification of environmentally-sound recycling businesses in Asia.

2. Aim of Workshop & Recycling Certification Targets

With the participation of experts from research institutes, governments, international organisations, businesses and certification bodies, this workshop will identify opportunities to nurture good behavior of recycling businesses and to promote the proper trade of recyclables in Asia. Through this, the workshop will aim to exchange ideas and share experiences on how best to make use of certification systems for nurturing “good” recycling businesses.

The **recycling certification system** discussed at this workshop is a voluntary system/standard that **aims to easily identify businesses that properly manage and treat resources in recycling markets, with national governments, third party certification bodies or trading companies issuing certification for qualified recycling businesses, and making information public.** Although certification (first-party certification) through an internal audit is not a part of this definition, it includes certification by affiliated industry groups (second-party certification) and third-party certification that uses standardised specifications. The recyclable resources targeted in this research include waste electric and electronic products. In this case, recyclables take two general forms i.e. post-consumer waste and industrial waste. The first is waste generated from consumed products(including scrap). The second includes electric and electronic items/components derived from the byproducts, industrial waste and business waste resulting from the production process of electric and electronic items (scrap parts that do not fit standards, etc.)

3. Introduction of Recycling Certification and Expected Outcomes

The following three benefits are expected from the introduction of recycling certification systems to identify environmentally-sound recycling businesses.

Promotion of environmental, occupational health and safety management

In order for the promotion of recycling to contribute to the sustainable development of Asia, it is important that recyclable resources do not end up in improper treatment processes. To ensure this, the central and local government must cooperate to lower incentives for cheap and potentially damaging treatment and recycling, such as is seen in the treatment of strong acids and open incineration, by effectively executing environmental and labour standards. For this purpose, it is necessary to clarify environmental, health and safety management guidelines at the facility level.

Fostering quality recycling businesses

The use of technology and facilities that allow for sound environmental management as well

as quality resource recovery (higher rate in recovery of important resources) is necessary for the proper treatment of recyclable resources. As well, a rapidly-developing Asia anticipates an increase in the generation of industrial waste, byproducts and business waste. In many cases, the treatment of such waste cannot be processed by emitters alone. Therefore, it is necessary to foster and nurture credible waste and recycling contractors to bridge this gap. Recycling certification systems provide an opportunity to identify and foster contractors that can conform to proper treatment guidelines as well as operate under efficient recovery technology.

Encouragement of sound domestic transaction and international trade of recyclables

It is necessary to build a market that contributes to resource efficiency and covers environmental protection so that recovered resources may circulate freely. For this purpose, it is necessary to encourage the development of a recycling market by securing the transparency of domestic transactions and international trading of recyclable resources. In other words, what required is a mechanism that is able to make direct and reliable connections/matching between emitters and quality recycling businesses in domestic markets.

Likewise, the number of countries with facilities that can transform waste into a recyclable resource is limited. Considering this situation, establishment of international recycling network of quality recyclers or regional recycling hub would be an option to ensure environmentally sound and economically efficient management of recyclables. . If recycling certification is introduced at the regional level and the transboundary movement of recyclable resources to qualified recycling businesses can be promoted, it can contribute to improvement in resource efficiency and environmental protection through economy of scale in the region. Furthermore, the flow of recyclable resources to internationally certified recycling businesses in the Asian region may simplify procedures set out in the Basel Convention.

4. Points to Consider in the Introduction of an International Recycling Certification System in Asia

The following may be points to consider in the introduction of an international recycling certification system in Asia for the management of waste electric and electronic equipment with consideration of three expected benefits, which explained in previous section. To understand minimum standards and to identify potential area where voluntary certification scheme would be useful, IGES has conducted a research reviewing existing national permits and approval system of recycling facilities in nine countries/region in Asia as well as looking

into seven existing voluntary certification schemes of WEEE recyclers.

Environmental, occupational health and safety management

As minimum regulatory requirements, the main objective for permits and approval system of recycling facilities under both existing recycling related laws and hazardous waste management related laws is to ensure environmental, health and occupational safety management in the recycling process (see Table 1 in reference). Likewise, existing voluntary recycling certifications (see Table 2 in reference) for waste electric and electronic equipments (e.g. Responsible Recycling and e-Stewards) require environmental management system and additionally require occupational health and safety management system as well. Environmental, occupational health and safety management is a fundamental object for recycling certifications.

Granting incentives for fostering environmentally sound recycling businesses

Variations can be seen for each country in the **establishment of incentive mechanisms** that are instrumental to the capacity training and development of quality contractors, which is the second point to consider in the introduction of international recycling certification systems. It is necessary to examine the association with incentives to carry out sound recycling that takes into account the entire process from collection to treatment for waste electric and electronic equipment, and not a system that only sets out regulations. The use of subsidies from an electrical home appliance fund for certified recycling businesses, in the case of Taiwan, could be considered an effective means to collect electric and electronic equipment waste from households in response to the common issue of the informal recycling sector in each country. Special licensing systems have also been set up entrusting hauling and pick-up to the informal sector and for final treatment to be carried out by qualified treatment/recycling businesses (Malaysian case).

In addition to incentive to facilitate quality recycling businesses, depending on different targets in recycling chains, there are various forms of incentives such as an incentive for industries emitting recyclables, incentive for environmentally-sound management, or incentive for proper international trade.

Thus, it is worth examining the **provision of incentives to emitters to select qualified treatment/recycling businesses** and easing import-export procedures for hazardous waste that falls under the Basel Convention for transactions between certified recycling businesses.

Traceability and mass balance system to encourage domestic transactions/international trading of recyclable resources

The development of a **Chain of Custody**³ **throughout recycling chain** is important for encouraging domestic transactions/international trading of recyclable resources. The method for ensuring reliability in the downstream of current recycling chain is mainly enforced through detailed capacity assessment for downstream recyclers, audits of actual treatment, and written contracts. In addition to this, the following are important elements for an **effective Chain of Custody System: sufficient information about quantity, important control point management, and sufficient training and management of employees**. In particular, our country case-studies and our comparative analysis of existing voluntary recycling certification systems showed that **a traceability system and mass balance system in the recycling chain serve as the keys** to ensure sufficient quantity of information and control point management. A traceability system such as a manifest system is for tracing waste stream in each treatment process. And a mass balance system can record weights based input/output data on materials such as metals going in and out from a treatment facility.

That said, however, existing systems grant certification to individual recycling businesses, and at present, only certifies a “point” in the recycling chain. The next step in the certification process should be moving forward from the certification of “points” to the certification of “channels” that connect point A to point B along the recycling chain. For this purpose, it is necessary to develop a system that recognises the Chain of Custody, such as forest certification, using FSC as an example. In order to add value to end products, the Chain of Custody is executed in the supply chain, however, there is no such existing value-address for end-products from quality recycling chain. In other words, under current recycling mechanism, there are no clear differences in value of recycled products either which are from quality recycling process or not. A system that promotes the preferential use of recycled materials in electric and electronic equipment and adds relative value through the Chain of Custody is necessary to accomplish this objective.

Object/target of certification

How to classify different recycling functions could be a key for effective recycling certification. The function of recycling businesses can be divided into three general categories: collection, transport and sorting; storage and dismantling; and

³ “Chain of Custody” refers to experience of certification mechanism of forest stewardship council. This is a certification mechanism to certify whole supply-chain from production, manufacturing, trading and routes towards final consumers. Chain of Custody for waste electrical and electric equipments in recycling chain can be possible to maintain from collection, logistics, treatment toward recovered materials through verifiable system of traceability at each stage.

treatment/recycling of products, components, and materials. In order to avoid unnecessary requirement to waste collectors or transporters, it is necessary to examine possible development of certification for different category of recycling functions, such as is being carried out standards of collection, logistics and treatment by WEEELabex (see Table 2). With regard to collection, transport and sorting of resources, there are advantages of integrating informal sectors into the formal recycling chain, as concerns about environmental pollution, worker safety and health impacts are low.

Although the influence of scrap contractors that are able to store, make transactions/trade, and dismantling goods is high in informal recycling in developing countries, one of the challenges for integrating into formal recycling activities is that these type of scrap contractors are often not recognised as recycling businesses in the certification and licensing systems in developing countries in many cases.

Role of emitters is crucial

Emitters of e-waste can be manufactures which generates industrial by-products and waste, households which generates end of life products, and professional users including governmental bodies which can be a large and reliable source of end of life products.

Especially, as an implication from the existing recycling certification systems, product manufacturers as an emitter of industrial by-products, play a major role in the success of existing recycling certification systems.

It is important to include product manufacturers in the structure of recycling certification as emitters, in addition to the three above-mentioned categories within the recycling process. Even in the cases with take-back system for WEEE is established through the EPR-based recycling laws, certification of quality recyclers would contribute to streamline the system that commission treatment of waste products collected from households to credible recycling businesses (e.g. e-Stewards Enterprises). .

For collection of emitted wastes from household and professional users, it is more about how to establish recycling mechanisms such as those based on EPR principle or to adjust market of secondhand- products. Thus, it is not only about certification.

Responses to diversity in the Asian region

When transitioning certification mechanisms into international standards, differences in geographical, political and business development should be reflected. For example, many countries in the region have not introduced recycling laws on the basis of extended producer responsibility. When looking at the status of Asian countries with regard to improvements in laws and regulations, we can see that they are roughly divided into two groups: countries/region that have implemented recycling related laws specialising in the management of waste electric and electronic equipment (e.g. Japan, Republic of Korea, China, or Taiwan; See Table 1), and countries that manage the disposal of this type of waste based on the management of hazardous waste (e.g. Indonesia, Thailand⁴, Philippines, Viet Nam, and Malaysia; See Table 1). Both types differ greatly in their responses to managing such waste.

It is necessary to consider whether certification should be promoted as either bottom-up or top-down in Asian countries in order to promote recycling businesses to certification systems, EU's case is considered as Top-down approach since the WEEE directive created EPR based recycling systems in this region. WEEELABEX is closely working with WEEE directive for the next revision. On the other hand, the case of United States of America case such as R2 and e-Stewards can be considered as bottom up approach since recycling regulations are depends on states and US-EPA encourage recycling sectors for waste electrical and electronic equipments to certificate their activities. Thus, under these certification schemes, business sectors need to take voluntary actions in countries without EPR based recycling law. Asian cases can be based on to bottom up since regulations are very much diverse among countries. However, top down approach can be taken among the countries where EPR based recycling law are implemented.

In addition, **it is similarly important to consider whether to promote participation in certification systems using a top-runner approach to encourage best practices approach or an approach to cut off unsound business conducts (borderline approach).** When utilising a borderline approach, a **ranking system for the capacity of recycling business facilities** should be considered an appropriate policy response as it is possible that the situations in countries that have not currently developed appropriate responses may remain as is. By introducing a ranking system, dismantling of waste products or treatment of non-hazardous materials (e.g. single material like plastic, metals etc.) can be managed by businesses that are ranked low, and specialised treatment/management such as metal

⁴ Thailand has developed a draft of EPR based recycling law however it has not been approved yet.

recovery from printed circuit boards can be designated to specified businesses that are ranked high. With certification systems, equipment/parts that may have an adverse impact on the environment or workers due to improper recycling can be identified, and regulations for treatment can be laid down, making it highly compatible with a ranking system.

From these perspectives, it is necessary to examine international recycling certification systems for the greater Asian region that **considers systems that reflect differences in treatment capacity, without adversely affecting the foster of quality recycling businesses.**

Certification system requirements and quality recyclers

Existing certification systems have respectively set original requirements for certification. These can be categorized into the three expected outcomes (See Table 3 for details).

Requirements related to environmental, occupational safety and health management and organisational/management matters include the following: (1) compliance with legal requirements, (2) introduction of Environmental Management System, (3) identification of hazards/risks, (4) occupational safety and health standards, (5) Awareness and competency of staff, (6) monitoring/recording/reporting systems, (7) emergency responses and (8) securing revenue resources (insurance for accidents, etc.),

Traceability and proper domestic transactions/international trade is often managed through the following requirements: (9) ensuring environmentally sound management in downstream (10) domestic traceability, (11) international traceability.

Items related to capacity improvement and development of recycling industries are in general set as follows:(12) regulations for the removal of pollutants, (13) quality management of reused materials, (14) reuse, (15) treatment and handling, (16) storage, (17) separate collecting and classification, and (18) deleting data from waste electric and electronic equipment.

Our case study in Asian countries has shown that the followings are characteristics of quality recycling businesses.

- Ensuring traceability of trading partners to prevent open dumping after extraction of valuable materials.
- Analysis of the content of recyclable resources at the request of emitters.
- Introduction of mass-balance tool and understanding of rates for recycling and

reclamation at the request of emitters.

- Sound management of residues.
- Acceptance of recyclable resources in line with technology and treatment/management capacity, etc.

The above characteristics deserve an examination as candidates of required conditions for quality recycling businesses.

5. Issues for Discussion at Workshop

The workshop aims to discuss whether it is possible to introduce recycling certification to recyclers of waste electric and electronic equipments in Asia. The following are the examples of issues for discussion at the workshop.

Basic points

- What is the most effective definition of recyclers? Is it suitable to be categorized into different functions? Would a certification system have to cover all functions and stages of the recycling and waste management chain or would it be sufficient to certify only certain parts of the chain? Is it sufficient to certify individual treatment facilities or do certification systems need to cover whole recycling and waste management chains?
- What are the requirements and conditions for quality recyclers?

Objectives

- To what extent could recycling certification contribute to the following objectives?
 - Environmental, health, and occupational safety management
 - Development of quality recyclers
 - Ensuring appropriate domestic transaction/international trade

Lessons from existing certification systems

- Are the requirements in existing certification systems reasonable and effective?
- What are the weakest or most critical parts of existing systems?
- Who would be certifiers for effective and reliable certification mechanism? Can private organization operate and implement such certification mechanism?
- What motivates recycling companies to become certified and why do certain emitters prefer to contract with certified recyclers? How can these drivers be strengthened?
- How we can ensure chain of custody? Are ensuring “traceability” and “mass-balance accounting” enough for this purpose?
- In addition to certification mechanism itself, what kind of additional measures are

needed to ensure quality recycling?

Asian Context

- In your opinion, how feasible is the idea to establish regional recycling centers or international recycling hubs based on a harmonized certification system?
- What are the key factors that influence whether such an initiative would succeed or fail?
- How to reflect diversity of recycling market in Asia?

Table 1. Comparison of Management of Waste Electric and Electronic Equipment & Recycling Certification Systems by Country

		South Korea	Taiwan	China	Indonesia	Thailand	Philippines	Viet Nam	Malaysia	Japan	
Presence of waste electric/electronic related systems (household/PC)	System	○	○	○	×	×	×	×	×	○	
	Application	Law on waste electric/electronic products and resource recycling for automobiles (2008)	Waste Disposal Act (2006)	Regulations for the collection, treatment, and management of waste electric/electronic products (2008)	Currently, waste electric/electronic equipment is managed under frameworks for both hazardous waste and municipal solid waste.	Waste electric/electronic equipment is managed under the law on hazardous waste. However, a draft of a recycling law has been drawn up.	Waste electric/electronic equipment is managed under RA6969 as hazardous waste.	Waste electric/electronic equipment is managed as hazardous waste.	Waste electric/electronic equipment is managed as hazardous waste.	Law for Recycling of Specified Kinds of Home Appliances (1998); Law for the Promotion of Effective Utilities of Resources (2001)	
(1) Proper environmental / health management	Proper treatment capacity (Conditions for licensing recycling businesses for waste electric/electronic equipment)	System	○	○	○	○	○	○	○	○	
		Application	Work permit, proper treatment of waste, proper installation of facilities, proper treatment methods, wastewater management, land use restrictions after use, etc.	Work permit, proper treatment of waste, proper treatment facilities, proper treatment methods, standards for sites, factories and required facilities, environmental protection technology, etc.	Standards for sites, factories and required facilities, environmental protection technology, impact assessment	Permission for treatment of hazardous waste; technical guidelines have been defined for the storage, collection, treatment, and use of hazardous waste	Permission granted to recycling businesses based on standards for sites, factories and required facilities	Permission granted to recycling businesses based on standards for sites, factories and required facilities	Permission for businesses carrying out recovery, collection and treatment (regional DONRE or VEA if activities cross state lines). In reality, there are a number of informal sectors that are operating without permission.	Businesses are separated into those that dismantle equipment and those that recover metals. EIA reports are required by the latter. Work permission (information on financial conditions, institute address, local government, etc.)	Past legal compliance, institutional standards according to Waste Disposal and Public Cleansing Law, use of renewables, permission for use, permission for collection and transport, conformity with various environmental related laws and regulations, achievement of re-commercialisation and recycling rates
	Inspections (compliance with standards) (by government)	System	○	○	○	○	○	○	○	○	○
		Application	On-site inspections by staff from environmental departments and Korea Environment Corporation	Number of inspections by government-contracted auditors (double checks prior to transport and after recycling), check for proper conduct of business	Paper-based inspections, on-site inspections, check of amount treated with new and former exchange programmes Checks of downstream contractors are weak	Formal approval of hazardous waste operators after 2-3 month examination period. Irregular audits implemented by Ministry of Environment.	Minimum of once a year	On-site inspections by EMS local offices. Checks for transportation manifest, inspection of treatment methods, etc., and imports/exports.	Regular on-site inspections by VEA and irregular inspections by environmental police. However, in practice, control of informal sector is limited.	On-site inspections by DOE staff (after construction of factories)	Storage of implementation reports, track records, and home appliance recycling tickets
	EMS (company standards, project implementation system) (industry/company)	System	○	×	×	○	×	×	○	○	○
		Application	Research on standard preparation for the proper reuse of facilities for waste electric/electronic equipment compiled by KAEE.	Government provides handbooks such as for standards on submitting treatment plans, labour safety management and fire prevention.	No particular regulations	Indonesia government requires that companies submit EIA	No standards set, in particular. Company standards are independent.	None, in particular. Philippine Environmental Partnership Programme (PEEP) assessment point	EIA is required when applying for licensing, however, this is not applicable to the informal sector.	Metal recovery contractors are required to submit EIA.	CFC management reports, on-site inspections of producers, decision to check items by individual manufacturers or economic body
(2) Development of quality recycling businesses	Recommendation system to improve achievement rates	System	○	○	○	×	○	○	×	×	
		Application	Achievement of amount required for reuse, and amount required for recovery (charges for not meeting requirements)	Conditions for providing subsidies (achievement of renewable resource rates and establishment of monitoring equipment in addition to proper treatment capacity)	Specification of treatment contractors for recovered items in law on exchanging household equipment. Establishment of subsidies and assistance to regular recycling contractors through regulations on the recovery, treatment and management of waste electric/electronic equipment.	No ranking system in place for recycling businesses, however, a ranking system for environmental management activities for all companies is in place (PROPER).	Start of ranking system for waste treatment, recycling businesses (2010~). Awards for excellent businesses.	Environmentally excellent companies (awards given for observance of environmental standards, recognition of eco-friendly activities, and no violations of the law for a 3-year period)	None, in particular.	Hibiscus Award for companies in all industries. No award system in place limited to recycling industries.	Recommendation sticker system for well-performing stores handling household equipment recycling tickets (appeals to well-performing retailers), certification system for well-performing industrial waste contractors (only for contractors with permission to operate, appeals to quality recycling plants)
(3) Encouraging transactions / trading	Manifest / Traceability	System	○	×	○	○	○	○	○	○	
		Application	Use of online manifest system (EcoAS) for movement within country.	Control documentation that indicates movement of items from consumers to retailers, and retailers to recycling plants is currently being developed.	Although a system has been developed to record the names of waste electric/electronic equipment, types and numbers, and contractors that are concerned with the weight/amount of equipment, as well as to manage information, it has not resulted in any unified application.	Manifest is required for movement of hazardous waste. E-manifest is being developed.	Implemented with a 6 page manifest. E-manifest has also been introduced.	Possible to confirm flow of materials from hazardous waste generators to transporters, and treatment contractors using manifest. Generators of hazardous waste are responsible for treatment until receiving certificate of treatment from final waste treatment contractors.	Manifest system for hazardous waste is in place, however, there are many cases in which the manifest is not applicable due to transactions in waste electric/electronic equipment by the informal sector.	Manifest system for hazardous waste is in place. E-manifest is also in place, however, its use is low. Although the manifest is applied to industries, the flow of household equipment after recovery by scrap dealers cannot be managed/traced.	Household equipment recycling tickets (from consumers to retailers, under producer responsibility to recovery)

Reference

Table 2. Certification Systems of Recycling Businesses for Waste Electric/Electronic Equipment

	Responsible Recycling (R2)	e-Stewards	R2/RIOS (Recycling Industry Operating Standard)	WEEELabex			Recycler Qualification Program for End of Life Electronics Recycling	European Recycling Platform (ERP)	Australian/New Zealand Standard, Collection, Storage, Transport, and Treatment of Used Electrical and Electronic Equipment
				Collection	Logistics	Treatment			
Standard/certification establishment period	Issued 10/30/2008	7/22/2009 Version 1.0 issued Version 2 is currently under development for issuance in spring 2012)	2008 (Jointly implemented with R2)	Issued 5/2/2011			Guidelines issued 10/27/2010	ERP established in 2002	Draft announced: March 2012 Comments accepted: To March
Promoting organisation	R2 Solution	Basel Action Network (BAN)	ISRI	WEEEFORUM			Electronics Product Stewardship Canada (EPSC)	ERP	Undecided
Type of promoting organisation	Developed by national government (USEPA), but management carried out by NPO, R2Solution. Acquisition recommended by national government.	NGO Acquisition recommended by national government.	Electronic scrap industry	Recycling industry			Industrial sector including product manufacturers	Product manufacturers	-
Number of facilities registered by country	U.S. (178), Canada (5), Mexico (2), UK (5), India (1), China (1), Singapore (1), Malaysia (1)	OECD countries. Currently, U.S. (30 companies certified, 19 companies pending), Mexico (1 company certified)	U.S. (33), Mexico (2), UK (1)	EU countries			Canada	Approx. 30% of recyclers are registered in 12 countries in Europe (Austria, Netherlands, Finland, France, Germany, Ireland, Italy, Norway, Poland, Portugal, Spain, UK) (Ex: of ~150 companies in France, 30 are registered)	Australia, New Zealand
Certifying body	Third-party certifying organisation designated by ANAB (third-party certification). Self-declaration also possible (first-party certification).	Third-party certifying organisation designated by ANAB (third-party certification)	ANAB-accredited R2/RIOS Certifying Body (third-party certification)	WEEELABEX (development of third-party certification in future) (second-party certification)			Recycler Qualification Office (second-party certification)	ERP (second-party certification)	Undecided
Characteristics	•Export possible with conditions •Acquisition recommended through USEAP website.	•Export banned, in principle (possible only in OECD countries) •In form added to R2, acquisition recommended on USEPA website.	•R2 and RIOS double standard •External appeal (R2/RIOS mark)	•In cooperation with CENELEC, offers perspective of standardisation in Europe			•Export of plastic and mixed plastic to non-OECD countries	•Producer responsibility body carrying out WEEE directive. •Although not a certification scheme, audits are carried out for recycling businesses and management carried out to determine if WEEE recycling is conducted properly.	
(EHSM related)	•Importance attached to environmental and occupational safety through EHSM.	•Strong elements of workers' health and safety (OHS18001 and SA8000)	Acquisition of QEH&S Management (ISO14001, ISO9001, OSHA18001)						•Not necessary to develop EMS
(Standards for specifications and treatment of environmentally-harmful products/parts)	•Specification and treatment of parts through creation of FOCUS Materials.	•Regulating treatment of environmentally-harmful parts/products containing specific chemical substances		•Criteria on sound treatment of environmentally-harmful products/parts			•Demand for separation/treatment of each part/materials		Establishment of treatment regulations for specific products/parts
(Standards for recovery, transport, treatment)		Planned addition for recovery/collection operators (Version 2.0)		•Regulations for recovery/collection, transport, treatment					•Comprised of general requirements, requirements for collection/storage facilities, description of reuse, requirements for transport, requirements for treatment.
(Ensuring credibility in downstream throughout the recycling chain)	•Inspection and auditing of treatment/management operators downstream in the recycling chain to process Focus Materials.	•Accountability of recycling chain downstream for treatment of hazardous e-waste: (a) capacity assessment, (b) contracts, (c), encouragement of standards for downstream recyclers, (d) verification of destination when transporting, (e) ensuring transparency for clients		•Carrying out monitoring of recycling chain downstream. Business operators must track and document activities for the recycling chain downstream.			•Recyclers must conduct capacity assessments for recyclers in the downstream of the recycling chain. At the very least, they must keep a record of the flow and materials handled, as well as what percentage was directed to recyclers downstream.		•Conduct of assessment and inspection of recyclers in the downstream through records of treatment
(Mass balance management and traceability)		•(a) Mass balance management of incoming and outgoing waste electric/electronic equipment, (b) 100% monitoring and management of destination, (c) provision of information to recycling clients in the downstream of the recycling chain, (d) development and maintenance/improvement of the latest recycle chain flow chart.		•Management of input and output using the original mass balance system (Rep Tool) developed by the WEEEFORUM.			•Tracking and reporting of the quantity and "chain of management" for treated products/parts/materials.		•Linkage between mass balance and treatment flow.
		•Also e-stewards for recyclers and Stewards Enterprises for product manufacturers							

Table 3. Comparison of Standards for Certification Systems of Recycling Businesses for Waste Electric/Electronic Equipment

Point	Criteria	Responsible Recycle(R2)	E-stewards	WEEELabex Collection	WEEELabex Transportation	WEEELabex Treatment	Recycler Qualification Program for End of Life	RIOS	Australian/New Zealand Standard, Collection, Storage.		
1	Compliance with Legal Requirements	Comply with conditions or standards (environmental and emission standards) required by the country, region, international treaties, etc. Obtain approval, licenses, etc. from appropriate competent authorities to the national or local government.	○ Provision 3(a)	○ Section 4.3.2	○ Section 4.1	○ Section 4.1	○ Section 4.1	○ Part A 2.2	-	○ Section 1.5	
2	Introduction of Environmental Management System	Establish policies or goals for environmental management on voluntary basis, introduce systems in facilities to achieve goals, and manage operations based on the system.	○ Provision 1	○ Section 4.1 ISO14001 certification required	×	○ Section 4.2	○ Section 4.2	○ Part A 1.0	○ Corresponds to ISO14001	×	
3	Identification of Hazards and Risks	Identify hazards or risks to the environment	○ Provision 5	○ Section 4.4.6.1	○ Section 4.2.2	○ Section 4.3.2	○ Section 4.3.2	○ Part A 3.0.	-	○ Section 1.6.1	
4	Occupational Safety and Health	Avoid exposure to occupational and safety hazards in working environment	○ Provision 4	○ Section 4.4.6.1, Provision 4	×	Although Section 5 mentions handling/trade and storage, there is no mention about workers health.	Although Section 5 mentions handling/trade and storage, there is no mention about workers health.	Although Section 5 mentions handling/trade and storage, there is no mention about workers health.	○ Part A. 5.0	○ Corresponds to OHSAS18001	○ Covered in Section 5
5	Awareness and Competency of Staff	Enable workers to understand hazards or risks of hazardous wastes and handle it in appropriate manner	×	○ Section 4.4.2	○ Section 4.3	○ Section 4.4	○ Section 4.4	○ Part A 1.2.	-	○ Sections 1.6.3, 1.6.4	
6	Monitoring, Recording, and Reporting	Collect and keep record of information such as material flow or emission status (exhaust gas or effluent) and report it to the appropriate authority.	○ Provision 7	○ Sections 4.5.1, 4.5.4	○ Section 5.5	○ Section 5.5	○ Section 5.9	○ Part A 1.4. (Monitoring), Part A 1.5. (records), Part A 1.3. (Document Process)	-	○ Sections 5.3, 5.5, 1.8	
7	Emergency Response	Have capacity to deal with unexpected situations which can have a negative effect on the environment.	○ Provision 11	○ Section 4.4.7	○ Section 4.3.1	○ Section 4.4.1	○ Section 4.4.2	○ Part A 10.0	-	○ Section 1.6.2	
8	Secure Financial Resources	Financial stability and insurance policies which can accommodate unexpected situations (such as accidents or closure of the facility).	○ Provision 11	○ Sections 4.4.6.8, 4.4.8	×	○ Section 4.3.5	○ Section 4.3.5	○ Part A 2.4. and 2.5	-	×	
9	Ensure ESM in Downstream	Ensure ESM in downstream recycling chain or destined country	○ Provision 5	○ Section 4.4.6.5. a)	○ Section 4.6	○ Section 4.7	○ Section 4.7	○ Part A 12.0	-	○ Sections 5.3, 5.4	
10	Domestic Traceability	From receipt of waste electric/electronic equipment to final disposal, traceability of product flow trading weight should be ensured, including for parts that have been removed.	○ Provision 7	○ Section 4.5.1	○ Section 4.4	○ Section 4.7.3	○ Section 4.7.5	○ Part A 6.1	-	○ Domestic transport in Section 4.4. Traceability in Section 5.3.	
11	International Traceability	Traceability from product flow, trade weight, and product export through to final disposal should be ensured in international dealings/trade (exports, imports).	Provision 7: Indicated in Section 4.5.1. However, in Section 4.4.6.7, on tracking and agreement by OECD countries documentation is required. Criteria at time of international trade is unknown.	○ Section 4.4 indicates proper treatment based on tracking and documentation in the transportation chain and in Provision 5. Responsibility for monitoring for transboundary transport.	○ Section 4.5 indicates proper treatment based on tracking and documentation in the transport chain until the start of treatment and in Provision 5.	○ Section 4.5: Tracking and documentation required for downstream of recycling chain until consigned by WEEE as treated and status has been updated as end-of-waste.	○ International trade is mentioned in Part A.11 (transportation criteria).	-	○ Section 5.3 Between Australia and New Zealand, and in Section 4.5 when international procedures are followed and permission is granted.		
12	Guidance for Removing Contamination	Removal of environmentally-harmful hazardous materials and parts containing hazardous materials.	○ Provision 2	○ Section 4.4.4.6	×	×	○ Sections 5.3-5.8	○ Part A 4.5. (in environmental management)	-	○ Section 5	
13	Quality Management of Recycled Materials	Quality management of renewable materials.	×	×	×	×	×	○ Corresponds to ISO9001	×	×	
14	Reuse	Regulations for reuse of products and parts.	○ Provision 6	○ Section 4.4.6.2	○ Section 4.5	○ Section 4.6	○ Section 4.6	×	-	○ Section 3	
15	Treatment	Removal of environmentally-harmful hazardous materials and parts containing hazardous	×	○ Section 4.4.6.4. a)	○ Section 5.1	○ Section 5.1	○ Section 5.1	○ Part A 6.0, 11.0	-	○ Sections 1.7, 2.5	
16	Storage	Proper storage of collected products/items.	○ Provision 9	○ Section 4.4.6.4. a)	○ Section 5.2	○ Section 5.2	○ Section 5.2	○ Part A 6.2-6.8	-	○ Section 2	
17	Separation, Collection and Sorting	Sorting, separation and collection of waste electric/electronic equipment.	×	×	○ Section 5.3	○ Section 5.3	×	×	-	No mention in collection criteria. Small mention on separation in Section 5.2 on treatment and handling.	
18	Data Destruction	Destruction or deletion of data saved on collected waste electric/electronic equipment.	○ Provision 8	○ Section 4.4.6.3	×	×	○ Sections 4.6.2, 5.3.3	○ Part A. 7.0	-	○ Section 1.9	