EU-Japan Centre for Industrial Cooperation

Waste Management and Recycling in Japan

Opportunities for European Companies (SMEs focus)

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Disclaimer

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Executive summary

This report is primarily intended for EU Small and Medium Enterprises (SMEs) that consider approaching the Japanese waste market and is meant to give them an overview of this sector as well as recommendations to take advantage of the business opportunities it offers.

The Japanese waste market is a mature market but it is still in evolution due to environmental, economic, social and political circumstances, domestically and around the world. Resource scarcity and energy dependence call for a circular economy, further exploiting waste as a resource. The overall reduction of waste generation is also one of the main objective.

When considering entering this market, companies should first understand the main concern (limited space) and conception (responsibilities' sharing) that drove the Japanese approach to waste management.

Biomass and R&D for strategic materials recovery from urban mines appear to be the most promising opportunities for EU SMEs in Japan. Regarding treatment facilities, few new constructions are to be expected in the near future but the many existing plants throughout the country are potential outlets for innovative machinery and technology as replacement parts.

Same as for other sectors, finding a good partner is often the first and most important step to enter the market. As a natural result, the main expectation from companies towards support organization is to introduce them to relevant parties and help them build a network.

List of abbreviations

ACRA	Japan Aluminum Can Recycling Association
CAT23	Clean Authority of Tokyo 23 cities
EU	European Union
FIT	Feed In Tariff
FY	Fiscal Year (in Japan from April 1st to March 31st)
GHG	Greenhouse Gas
HH	Household
IGES	Institute for Global Environmental Strategies
JCPRA	The Japan Containers And Packaging Recycling Association
JEFMA	Japan Environmental Facilities Manufacturers Association
JEMAI	Japan Environmental Management Association for Industry
JESCO	Japan Environmental Storage & Safety Corporation
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
kt	kilotons
LCA	Life Cycle Assessment
MAFF	Ministry of Agriculture, Forestry and Fishery
METI	Ministry of Economy, Trade and Industry
MLIT	Ministry of Land, Infrastructure, Transport and Tourism
MOE	Ministry of the Environment
MSW	Municipal Solid Waste
NIES	National Institute for Environmental Studies
NIMBY	Not In My Backyard
PCB	Polychlorinated biphenyl
PWMI	Plastic Waste Management Institute
RE	Renewable Energy
SME	Small and Medium Enterprises
TMG	Tokyo Metropolitan Government
UBC	Used Beverage Cans
UNCRD	United Nations Centre for Regional Development
UNEP	United Nations Environment Programme
WEEE or e-waste	Waste Electrical and Electronic Equipment
WtE or W2E	Waste-to-Energy

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Introduction

Japan and Europe currently have to face identical challenges, such as environmental sustainability, energy independency and international competition for strategic materials.

Historically, health concerns have been the main drivers of the waste policy. However, issues related to waste evolved together with the economic development and population growth. Nowadays, the difficulty not only lies in a boost of the quantity of trash but also in the increasing complexity of handling the wastes' streams due to the diversity and composition of the garbage generated by the modern society. In that context, the pattern "Mass production, Mass consumption, Mass disposal" that prevailed during economic growth is not sustainable anymore.

In parallel, developing countries turning into consumer societies lead to an increase of the global consumption implying a higher demand for resources, strategic for some, and Japan itself is poor in raw material resources[1]. Strategic sectors for the Japanese economy, starting with the high-tech industry, require rare earths and precious metals, most of it coming from China. Rarefaction of materials leads up to stronger competitiveness among countries and independence issues. The negative impact is not only environmental with the Earth bearing less resources, it bears also economic and political consequences.

Another topical challenge is energy. Here again, demand is increasing worldwide and resources such as petroleum or natural gas have a finite stock, are imported (mainly from unstable regions) and emit Green House Gases for which there is a commitment to cutting. Nuclear power seemed to be a solution but the terrible events of Fukushima Daiichi Nuclear Power Plant in March 2011 aroused the public awareness on the side effect and forced Japan to drastically review its energy policy. Europe has started its green revolution earlier, granting a leader position regarding renewable energy.

A further major change that has importance for governments and companies is the growing interest of the population regarding environmental matters. People care more and more about the impact of human behaviour on the climate, exploitation of natural resources, and alike. They aspire to greener politicies and more eco-friendly products. To meet the expectations and keep a good image, political leaders and businesses have to take into account this growing tendency.

[1] Earth Debt Day 2015 occurred in August 13th. According to the estimation of the Global Footprint Network, Japan would need "5.5 countries of its own size to meet its consumption requirements".
http://www.zmescience.com/ecology/environmental-issues/resource-overdraft-9354793/

In this context, both Japan and Europe came to the conclusion that exploiting waste as a profitable resource instead of a costly burden, by creating a circular economy, would be a good way to resolve simultaneously several challenges. Thus, the fact that EU and Japan share the same common interest is a good ground for cooperation.

Furthermore it is important for companies to realize that entering the Japanese waste market is also of strategic importance when considering being active in other Asian countries. The Asian region now accounts for about 40% of all waste generated worldwide[2]. Neighbouring economies are at a lower stage of development and waste treatment is not a priority yet. Nevertheless, it is expected that they will profit from advanced economies' past experience and have a close look on the practices of developed countries, especially in Japan who is the model of the region. All the more so that Japan is deeply involved in the regional promotion of waste reduction, reuse and recycling (so-called 3Rs). Being present in Japan can be a first step into new markets with high potential needs.

This report first provides an overview of waste management and recycling in Japan, including the legislative framework, the organization of household as well as industrial wastes treatment and the use of waste as an energy source. The 2nd part presents potential business opportunities and challenges for EU small and medium enterprises. The last part consists of recommendations for companies and support organizations[3] when considering entering the Japanese waste market.

Methodology

This report is based on desk research for analysing the past and present market situation, the current issues as well as future projects. On a second step, a number of interviews were conducted with companies related to the waste business, support organizations, professional associations and official bodies to gather feedback from the field and advices for a successful presence in Japan. In addition, exhibitions related to waste management and renewable energy as well as incineration and recycling plants have been visited.

2 Annual Report on the Environment MoE p. 26

3 The term "support organizations" in this report designates institutions, such as Chamber of Commerce or business and trade associations, whose purpose is to assist companies in their business development.

A. WASTE MANAGEMENT AND RECYCLING IN JAPAN AND EUROPE

1. Legislation

a. Legal Framework

Europe and Japan's legislation related to waste followed a similar pattern as they had to face similar challenges.

Waste regulations first started in response to sanitary concerns regarding public health. Pollution scandals, such as Minamata disease[4] in Japan or Seveso Waste Shipment scandal in Europe[5], led to legislative reinforcement and stricter regulation regarding, for example, emission parameters in incineration plants or waste transportation.

In parallel, the economic growth progressively led to a pattern "Mass production – Mass consumption – Mass Disposal". In addition to landfill shortage, the new waste streams became more and more problematic due to the variety and complexity of all the new products available on the market, especially in the electric and electronic fields. In response, a wide range of laws related to specific wastes such as packaging or WEEE have been enacted.

In addition, other issues such as climate change, material resources' depletion or energy supply shortage turned up. The policy makers and industrials became aware of the economic value of waste and the approach shifted from thinking about waste as an unwanted burden to considering it as a valued resource. Waste management objectives changed from sole quantity to quantity and quality.

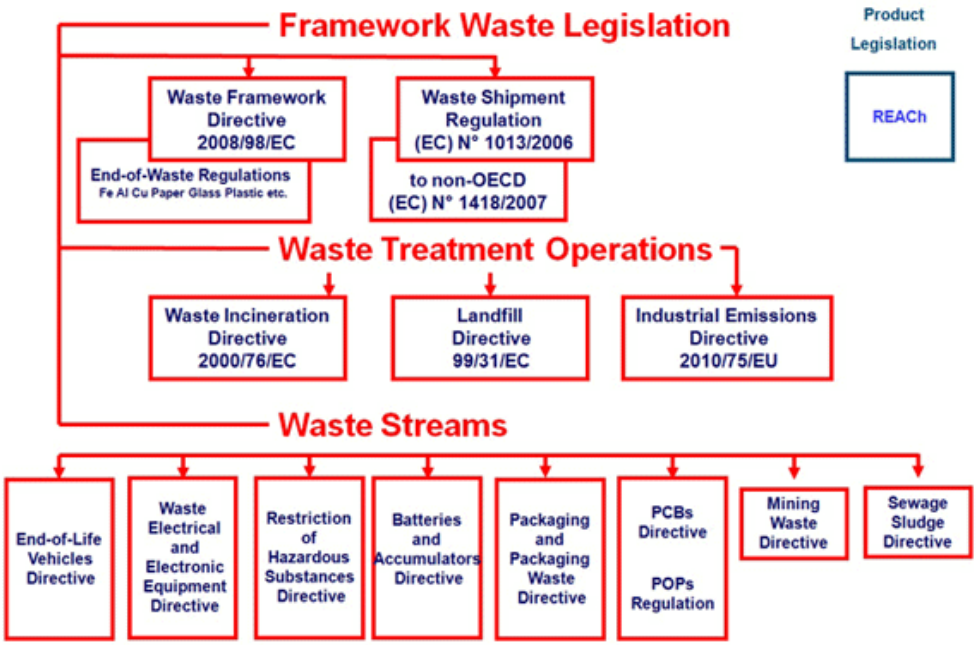
More recently the increasing interest and sensitivity of the citizens regarding environmental issues contributed to the enhancement of the legislative framework and business practices towards a more sustainable society[6].

Thus, the legislative framework evolved towards a waste management policy and practice that combines protection of the environment and human health while capitalizing on the economic and

4 Disease caused by methyl mercury discharged from a chemical factory in Minamata City, Kumamoto Prefecture, Japan (occurrence of the disease was first confirmed in 1956)
5 Barrels of dioxin waste resulting from a chemical accident in a plant located in Seveso, Italy, disappeared during transportation and turned up in an abandoned abattoir in Northern France (1983)
6 UN Resolution A/RES/42/187 defines sustainable development as "meeting the needs of the present without compromising the ability of future generations to meet their own needs"

strategic advantages[7].

Figure 1: European legal framework



Source: Eurometrec, http://www.eurometrec.org/html/waste-laws.php

Note: A review of the European waste policy and legislation is currently ongoing

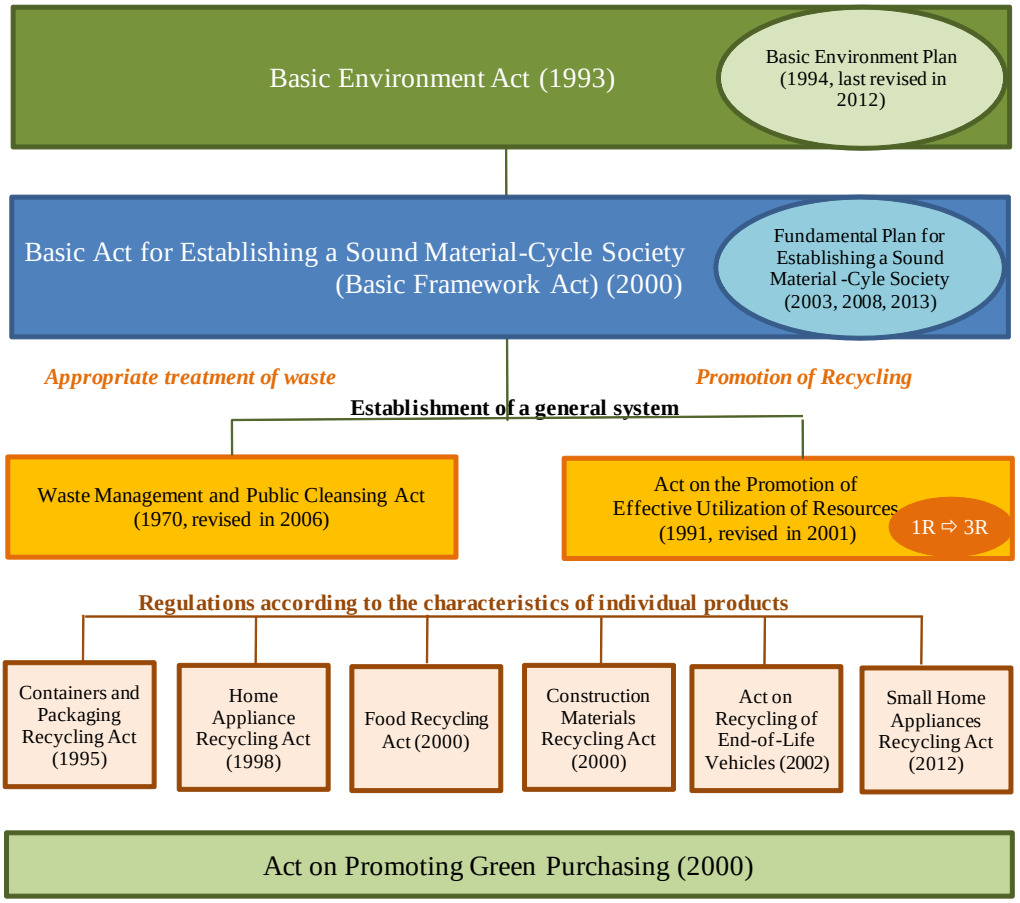
The 7th Environment Action Programme[8], which will guide European environment policy until 2020, sets the following priority targets for waste policy in the EU:

- ✓ Reduction of the quantity of waste generated;
- ✓ Maximization of recycling and re-use;
- ✓ Limitation of incineration to non-recyclable materials;
- ✓ Phasing out landfilling to non-recyclable and non-recoverable waste;
- ✓ Ensuring full implementation of the waste policy targets in all Member States.

Source: European Commission, http://ec.europa.eu/environment/waste/

[7] A figure representing the history of legal systems regarding the development of a sound material-cycle society (post-war period to the present) is displayed Annex 1.
[8] http://ec.europa.eu/environment/newprg/

Figure 2: Legal system for Establishing a "Sound Material-Cycle Society"



Main source: History and Current State of Waste Management in Japan, 2014, MoE

An outline of the main legislations is given below[9]. A table with the original name in Japanese, ministry in charge and links to some of the text laws in English and/or Japanese is provided in annex 1.

Basic Act for Establishing a Sound Material-Cycle Society (Basic Framework Act)

The Basic Framework defines the vision of a material-cycle society. The aim is to better control the consumption of natural resources and reduce the impact on the environment.

Fundamental Plan for Establishing a Sound Material-Cycle Society

This 5 year plan is formulated by the national government to settle the strategies to further develop a

[9] Main sources: History and Current State of Waste Management in Japan, 2014, MoE; Legislation and Policies to Create a Recycling-Oriented Society , METI http://www.meti.go.jp/english/information/downloadfiles/cRecycle3R20403e.pdf; SAPIENS 4.2 | 2011 : VOL.4 / N°2 https://sapiens.revues.org/1161

sound material-cycle society according to the Basic Framework Act. It serves as basis for other national programs.

- ✓ The 1st plan (2003) defined a sound-material society and introduced indicators to quantify the level of development of initiatives for the establishment of a sound-material society.
- ✓ The 2nd plan (2008) set as objective a low-carbon society and established regional circulation networks to develop initiatives that meet local resource needs.
- ✓ The 3rd plan (2013) shifted from solely quantitative objective to also take into account the quality aspect. The strategy is focused on reinforcement of the 2Rs Reduce and Reuse (see below paragraph on 3R concept); recovery of useful metals; reinforce initiatives for security and safety as well as international cooperation.

Waste Management and Public Cleansing Act

The Waste Management and Public Cleansing Act provides control of the generation of waste, appropriate treatment of waste (including recycling), regulations regarding waste treatment facilities and waste management operators and the establishment of waste treatment standards.

Act on the Promotion of Effective Utilization of Resources

The Act on the Promotion of Effective Utilization of Resources fosters the recycling of reusable resources, encourages easy-to-recycle structures and materials, defines labelling for separate collection of waste at source and promotes the efficient use of by-products.

Act on the Promotion of Sorted Collection and Recycling of Containers and Packaging (Containers and Packaging Recycling Act)

Target: Steel and aluminium cans, glass and plastic bottles, plastic and paper containers and packaging, cardboard, paper cartons

The Containers and Packaging Recycling Act defines the role and responsibilities of the parties involved and establishes the collection and recycling scheme, namely sorted disposal by consumers, separate collection by municipalities and recycling of the waste by the manufacturers. It also requires parties to conduct actions to reduce waste generation.

Act on Recycling of Specified Kinds of Home Appliances (Home Appliance Recycling Act)

Target: Home air conditioners, refrigerators and freezers, TVs, washing machines and clothes dryers

The Act defines the role and responsibilities of the parties involved and establishes the collection and recycling scheme. Waste generators bring waste home appliances to retailers and pay the recycling costs, the home appliance retailers deliver the accepted waste to manufacturers and manufacturers recycle the waste home appliances

Act for Promotion to Recover and Utilize Recyclable Food Resources (Food Recycling Act)

Target: Food waste, residue from the production and processing of food products, unsold or leftover at wholesalers and retailers, etc.

The Food Recycling Act aim at the reduction of food waste generated by the different entities and establishes a system for the recycling food waste.

Construction Materials Recycling Act

Target: Lumber, concrete, asphalt

The Construction Materials Recycling Act defines obligations of contractors and ordering party when demolishing or constructing buildings, including the sorting of demolition debris and recycling of construction waste.

Act on Recycling of End-of-Life Vehicles

Target: Automobiles

The Act on Recycling of End-of-Life Vehicles provides that vehicle owners pay a recycling fee in advance and that car makers have the obligation to accept shredder residues, Chlorofluorocarbons (CFCs) and air bags and to recycle them (CFCs have to be destroyed)

Small Home Appliances Recycling Act

Target: Small electric or electronic appliances used in household and designated by government ordinance such mobile phones, hair dryers, digital cameras, etc.

The Small Home Appliances Recycling Act defines an incentive-oriented system to encourage involved parties to develop their own waste collection and recycling scheme. The main purpose is to recover useful metals contained in these devices and properly dispose of hazardous substances.

Act on Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (Act on Promoting Green Purchasing)

The Act on Promoting Green Purchasing aims at developing the demand for products that minimize environmental impact by fostering the purchase of eco-friendly goods and services lead by national and local government initiative[10].

In addition, the following texts may also have an impact on waste treatment and management in Japan:

- ✓ Basic Environment Law and Basic Environment Plan
- ✓ Act on special measures concerning removal of environmental problems caused by

[10] http://www.env.go.jp/en/laws/policy/green/4.pdf

specified industrial waste

- ✓ Act on special measures for promotion of proper treatment of PCB wastes
- ✓ Act to promote the development of specified facilities for the disposal of industrial waste
- ✓ Act on Control of Export, Import and Others of Specified Hazardous Wastes and Other Wastes (Japanese domestic law corresponding to the Basel Convention)
- ✓ Guideline for Governance of Waste and Recycling for Discharger[11]

b. 3Rs, Waste Hierarchy and Life-Cycle Assessment

i. 3Rs: Reduce, Reuse, Recycle

Figure 3: The 3Rs

Making one step forward for people, the Earth and the sky.
The Rs represent "reduce," "reuse" and "recycle." The three figures are taking one step forward, evoking a sense of progress. Orange represents people, green the Earth, and blue the sky.

Source: METI

The 3Rs is an acronym for "Reduce", "Reuse" and "Recycle" and is employed to promote a sustainable society towards Japanese citizens and businesses as well as on the international stage, especially towards developing Asian countries. It is closely bound to the Japanese feeling known as "*Mottainai*"[12], which means not letting things that have value go to waste.

- ✓ "*Reduce*" the amount of waste generated by using resources more efficiently and wisely and by extending the useful life of products.
- ✓ "*Reuse*" is to use the same items again, as products or parts, as long as they are usable, after proper treatment if necessary.
- ✓ "*Recycle*" refers to material recycling; "recyclable resources" should be used as raw materials to make new products.

Not expressed in the 3R but according to Japanese legislation, if material recycling is not feasible, then thermal recycling should be undertaken. Eventually, proper disposal is required if it there is no other option.

[11] http://www.meti.go.jp/policy/recycle/main/3r_policy/policy/pdf/governance/governance(eng).pdf
[12] The word first appeared in the 13th century and now belongs to the concepts supposed to best describe Japanese spirit. Kenyan environmentalist Prof. Wangari Maathai spread the concept out of Japan
http://mottainai.info/english/
http://www.abc.net.au/radionational/programs/philosopherszone/mottainai3a-a-philosophy-of-waste/6711302

The concept of 3R was officially launched in 2000 but the notion of recycling was introduced back in 1991 in the Act on the Promotion of Effective Utilization of Resources and the following acts focusing on specific targeted streams.

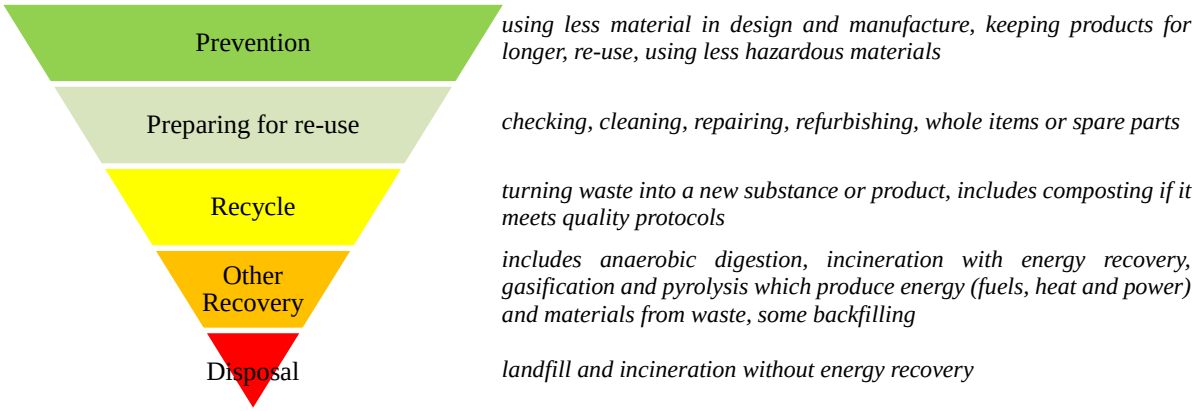
Design for environment (DfE)[13] implements concretely the 3R concept into the entire life cycle of products, from designing and manufacturing (e.g. by minimizing resource consumption for production) to recycling and disposal of end-of-life products (e.g. through easier to dismantle products or labelling for separate collection).

The 3rd Fundamental Plan sets among its objectives the promotion of the 2 Rs Reduce and Reuse in order to decrease the amount of waste generated instead of solely focusing on the recycling part.

ii. The Waste Hierarchy

The European Union's approach to waste management is very similar to the 3Rs. Defined by the Waste Framework Directive, the five-step "waste hierarchy" sets the following priority order, ranked according to environmental impact: prevention, (preparing for) reuse, recycling, recovery and, as the least preferred option, disposal (which includes landfilling and incineration without energy recovery)[14].

Figure 4: The Waste Hierarchy



Source: UK Government, Department for Environment, Food & Rural Affairs, https://www.gov.uk/waste-legislation-and-regulations

[13] Towards a 3R-Oriented, Sustainable Society: Legislation and Trends 2010
[14] Article 4 of the revised EU Waste Framework Directive
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:EN:PDF

iii. Life Cycle Assessment

Life-Cycle Thinking and Life-Cycle Assessment (International: ISO 14040:2006[15], Japan: JIS Q 14040:2010[16]) is a "Cradle to Grave"[17] approach in which all stages of the product life is taken into account, from the supply of raw materials to the disposal of the remaining waste through manufacturing, transportation, distribution, use, etc. The overarching idea is to reduce the overall impact on the environment and avoid shifting an issue from one stage to another. It is a support tool for decision-making that balances the potential environmental benefits and drawbacks of different options when implementing new measures, for example it can help determine if incineration might be in some cases more appropriate than recycling[18]. Life-Cycle Thinking is therefore a backbone for strategies related to a sustainable use of natural resources as well as the prevention and recycling of waste.

In Europe, the European Commission's Integrated Product Policy Communication (COM (2003)302) identified Life-Cycle Assessment (LCA) as the "best framework for assessing the potential environmental impacts of products". Article 4 (2) Waste Framework Directive (2008/98/EC) stipulates: "When applying the waste hierarchy referred to in paragraph 1, Member States shall take measures to encourage the options that deliver the best overall environmental outcome. This may require specific waste streams departing from the hierarchy where this is justified by life-cycle thinking on the overall impacts of the generation and management of such waste."

In Japan[19] the 3rd Fundamental Plan mentions that "in promoting such recycling, we need to give importance on the view point of LCA (Life Cycle Assessment), where recycling would not end up with heavier environmental loads through a substantial increase in the consumption of required energy, with due considerations to the balance with global warming measures."

c. Pollution control in Japan

Concerning the exhaust gas from incineration facilities, the Air Pollution Control Act[20] regulates the emission of sulphur oxide, dust, hydrogen chloride and nitrogen oxide, while dioxins are controlled by the Act on Special Measures against Dioxins[21]. As many toxic substances in exhaust gas move into

[15] http://www.iso.org/iso/catalogue_detail?csnumber=37456
[16] http://www.webstore.jsa.or.jp/webstore/Com/FlowControl.jsp?lang=en&bunsyoId=JIS+Q+14040%3A2010&dantaiCd=JIS&status=1&pageNo=2
[17] "The full life cycle assessment (LCA) of a product or process, from the extraction of raw materials, through manufacturing and use, to final disposal. This assessment examines the product's net environmental burden, including the consumption of raw materials and energy, emissions to air and water, and solid waste generation." http://livingprinciples.aiga.org/cradle-to-grave/
[18] Life Cycle Thinking and Assessment for Waste Management (Europe): http://ec.europa.eu/environment/waste/publications/pdf/Making_Sust_Consumption.pdf
[19] LCA Society of Japan (JLCA): http://lca-forum.org/english/
[20] http://www.japaneselawtranslation.go.jp/law/detail/?id=2146
[21] http://www.japaneselawtranslation.go.jp/law/detail/?id=2270&vm=04&re=02&new=1

dust, dust has been designated by law as specially controlled waste (because of its toxicity) and should be therefore disposed of by designated methods such as melt-solidification, cement solidification and chemical treatment (heavy metal fixative treatment)[22].

When looking on the below chart, Japan's pollution thresholds appear much loose compared to European standards. In addition, there is no obligation for continuous monitoring. Nevertheless, prefectural governments have the possibility to set more stringent emissions limits and according to the Japan Environmental Facilities Manufacturers Association (JEFMA), local governments usually draw up tender specifications close to Europe's figures. A side effect of this local power is significant differences across the country, especially between heavily urbanised areas, which tend to set stricter limits, and more rural prefectures.

Table 1: Pollution control

Parameters	**Europe (daily average)**	**Japan**	**Japan (customers' usual specifications according to JEFMA)**
	0ºC, Dry 11% O_2	0ºC, Dry 12% O_2	
Dust	10 mg/m³	40 mg/m³	10 mg/m³
HCL	10 mg/m³	700 mg/m3 (430ppm)	50 - 55 ppm
HF	1 mg/m³	No regulation	No need for regulation
SOx(SO_2)	50 mg/m³	122 m^3_N/h	50 – 55 ppm
NOx(NO_2)	200 / 400 mg/m³	513mg/m3 (250ppm)	< 50 ppm
Dioxins and furans	0.1 ng-TEQ/m³	0.1 ng-TEQ/m³ include Co-PCBs	0.1 ng-TEQ/m³ include Co-PCBs
CO	50 mg/m³	38mg/m3 (30ppm)	30 ppm
Hg	0.05 mg/m³	No regulation*	0.05 Based on the policy of local goverment

Source: JEFMA, Japan Environmental Facilities Manufacturers Association

(*) Mercury (Hg): Following the Minamata Convention, an amendment of the Pollution Air Control

[22] JLCA NEWS LETTER LIME2_C2.10-C2.13_2014: http://lca-forum.org/english/pdf/No18_Chapter2.10-2.13.pdf

Act as been approved and should enter into force by the end of fiscal year 2015 to set a limit to Mercury emissions[23].

d. Objectives regarding Climate Change

Based on the UN Framework Convention on Climate Change and the Kyoto Protocol, the world's governments have committed themselves to make efforts to curb global warming and therefore to reduce the emissions of so-called "greenhouse gas" (GHG). As wastes contain methane, which emits 20folds more GHG than CO2, proper management is an important factor.

Japan is currently the world's fifth-largest greenhouse gas emitter. End of April 2015, the government proposed to cut the greenhouse gas emissions by 26% below the 2013 level by 2030[24], as its contribution to the global summit on climate change that will take place in Paris in December 2015 (COP21 Paris[25]).

Government officials said that using 2013 as reference implies a higher reduction target than other major developed countries. However, this choice is criticized, as the amount of CO2 was particularly high at that time due to the Fukushima accident and the use of thermal power instead of nuclear. If converting the benchmark year from 2013 to 1990, the reduction would be 18%[26].

In addition, the Japanese Government took the decision to increase the part of renewable energy in its electricity mix from 10% in 2014 to 24% in 2030[27].

Japan's commitment to climate change and the development of a sustainable society is also expressed in its active participation in external development finance. Indeed, Japan was in 2010 the main contributor of climate-related development finance globally[28].

In comparison with Japan, the European Union has announced a target of reduction of at least 40% below the 1990 level by 2030. The Renewable Energy Directive[29] sets a target of 20% of EU total energy needs to be achieved with renewables by 2020.

[23] http://www.complianceandrisks.com/regulations/japan-air-pollution-control-law-1968-amendment-on-implementation-of-the-minamata-convention-on-the-mercury-etc-law-march-2015-26471/
[24] http://www.reuters.com/article/2015/07/17/us-japan-carbon-idUSKCN0PR0A220150717
[25] http://www.cop21.gouv.fr/en/cop21-cmp11/climate-change-and-decisions
[26] http://www.japantimes.co.jp/news/2015/07/17/national/japan-sets-26-percent-cut-in-greenhouse-gas-emissions-as-2030-target/?utm_source=digg#.VbXqg7Oqqkr
[27] http://www.energies-renouvelables.org/newsletter/15-juillet-2015/fondations-flottantes-tricolores-japon.asp
[28] http://www.euractiv.com/sections/development-policy/infographic-financing-climate-change-and-development-317108
[29] http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32009L0028

e. The Circular Economy Concept

The term "Circular Economy" aggregates various concepts related to the efficient use of resources and refers to a new industrial model that is "restorative by design". The objective is to become less dependent on primary energy and materials inputs. It opposes the existing linear model of "take – make – dispose" that is progressively leading to resource depletion. The often associated image of "cradle to cradle" convey the idea of a closed loop, connecting all parties involved, in which waste is seen as an input. Renewable energy is also a component of the scheme. The cycle can be divided into two parts: eco-design, an approach that takes into account the environmental impact of the product during its whole lifetime, and waste management.

The Ellen MacArthur Foundation was created in September 2010 with the objective of speeding up the transition to a regenerative, circular economy and published in January 2012 the first report of the series *Towards the Circular Economy*[30]. These Circular Economy reports provide an analysis from a business perspective and highlight the economic benefits of a transition to circular business models. According to the third volume of the report, released in January 2014 and entitled *Accelerating the scale-up across global supply chains*, "over US$1 trillion a year could be generated by 2025 for the global economy and 100,000 new jobs created for the next five years if companies focused on encouraging the build-up of circular supply chains to increase the rate of recycling, reuse and remanufacture. This would maximize the value of materials when products approach the end of their use".[31] In this context, circular economy is becoming a growing trend, especially in developed countries.

Because of its geographical and geological conditions, Japan always had to cope with natural resource scarcity. Following the oil crisis that occurred in the 1970s, the country was forced to review its dependence on raw material imports.

Japan's implementation of circular economy was based on a three-pronged approach[32]. Under the first one, structural adjustments have been conducted to reduce the dependency on oil, and industrial structures have been optimized to ameliorate the efficiency of energy utilization. The second aspect encompassed the enactment of a comprehensive legal framework focused on resource and waste management. Various policies have been implemented since the 1970s, with an intensification since 2000. The final angle consisted of the instillation of the concept of circular economy into the society

[30] http://www.ellenmacarthurfoundation.org/business/reports
[31] http://www.ellenmacarthurfoundation.org/business/reports/ce2014
[32] http://reports.weforum.org/toward-the-circular-economy-accelerating-the-scale-up-across-global-supply-chains/favourable-alignment-of-enablers/#view/fn-46

through a sound educational system, combined with public awareness campaigns towards environmental matters, in order to change the social economic behavior.

To follow the flow of materials, Japan has created various indicators and set targets that are regularly updated. In addition, guidelines, standards and markings have been introduced to facilitate disassembly and separated collection. Recovered materials are, wherever possible, reused for the manufacturing of new products, forming a closed-loop.

Thanks to these measures, high recycling rates (particularly for metal) have been reached and only a marginal proportion of waste is disposed in landfill. Besides, the concept of circular economy is deeply anchored into the Japanese society, adding thereby a social dimension to the economical one.[33].

The European Commission published a *Manifesto for a Resource Efficient Europe*[34] in December 2012 in which it acknowledges the necessity of a shift towards a resource-efficient economy. The topic is currently under discussion and an ambitious circular economy strategy is expected to be presented by the end of this year (2015). The Commission estimates that "using resources more efficiently will also bring new growth and job opportunities. Better eco-design, waste prevention and reuse can bring net savings for EU businesses of up to EUR 600 billion, while also reducing total annual greenhouse gas emissions. Additional measures to increase resource productivity by 30% by 2030 could boost GDP by nearly 1%, while creating 2 million additional jobs."[35] Further estimation mention that an effective circular economy package would bring savings of around €336 billion on raw materials every year.[36]

[33] "Analyses of Japanese Circular Economy Mode And its inspiration significance for China", Advances in Asian Social Science (AASS) 725 Vol. 3, No. 4, 2012, ISSN 2167-6429
[34] http://europa.eu/rapid/press-release_MEMO-12-989_en.htm
[35] http://ec.europa.eu/environment/circular-economy/index_en.htm
[36] http://www.euractiv.com/sections/sustainable-dev/recycling-industry-under-pressure-falling-raw-material-prices-317710

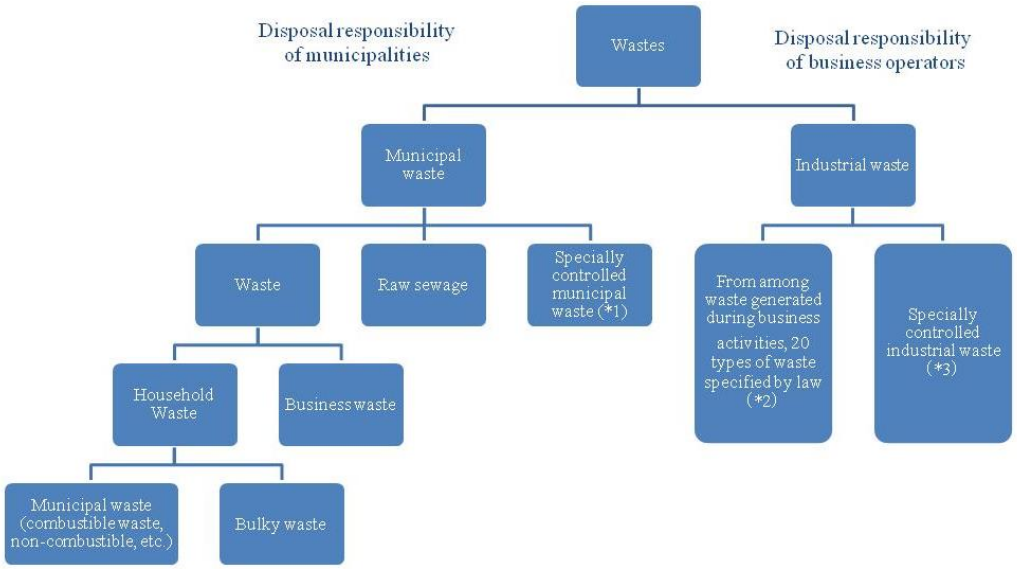
2. Outline of the Waste Treatment

a. Definition and Classification of waste

In Japan, waste is defined in the Waste Management and Public Cleansing (Article 2, paragraph 1) and "refers to refuse, bulky refuse, ashes, sludge, excreta, waste oil, waste acid and alkali, carcasses and other filthy and unnecessary matter, which are in solid or liquid state (excluding radioactive waste and waste polluted by radioactivity)."[37]

Basically, wastes are classified into "Municipal Solid Waste" and "Industrial Waste". Within each of these categories exist "specifically controlled waste" that refer to wastes that are explosive, toxic, infectious or of nature otherwise harmful to human health and/or the living environment.

Figure 5: Categories of waste in Japan



*(*1) Waste that may be harmful to human health and the living environment or is explosive, toxic, or infectious*

*(*2) Cinders, sludge, waste grease waste acid, waste alkali, waste plastics, paper waste, wood waste, fiber waste, animal and plant remains, solid animal waste, rubber scrap, metal scrap, glass scrap, concrete waste, ceramic waste, slag, debris, animal excrements, animal bodies, dust, imported waste, materials used to treat the above industrial waste*

*(*3) Waste that may be harmful to human health and the living environment or is explosive, toxic, or infectious*

Source: History and Current State of Waste Management in Japan ; MOE, Environmental White Paper

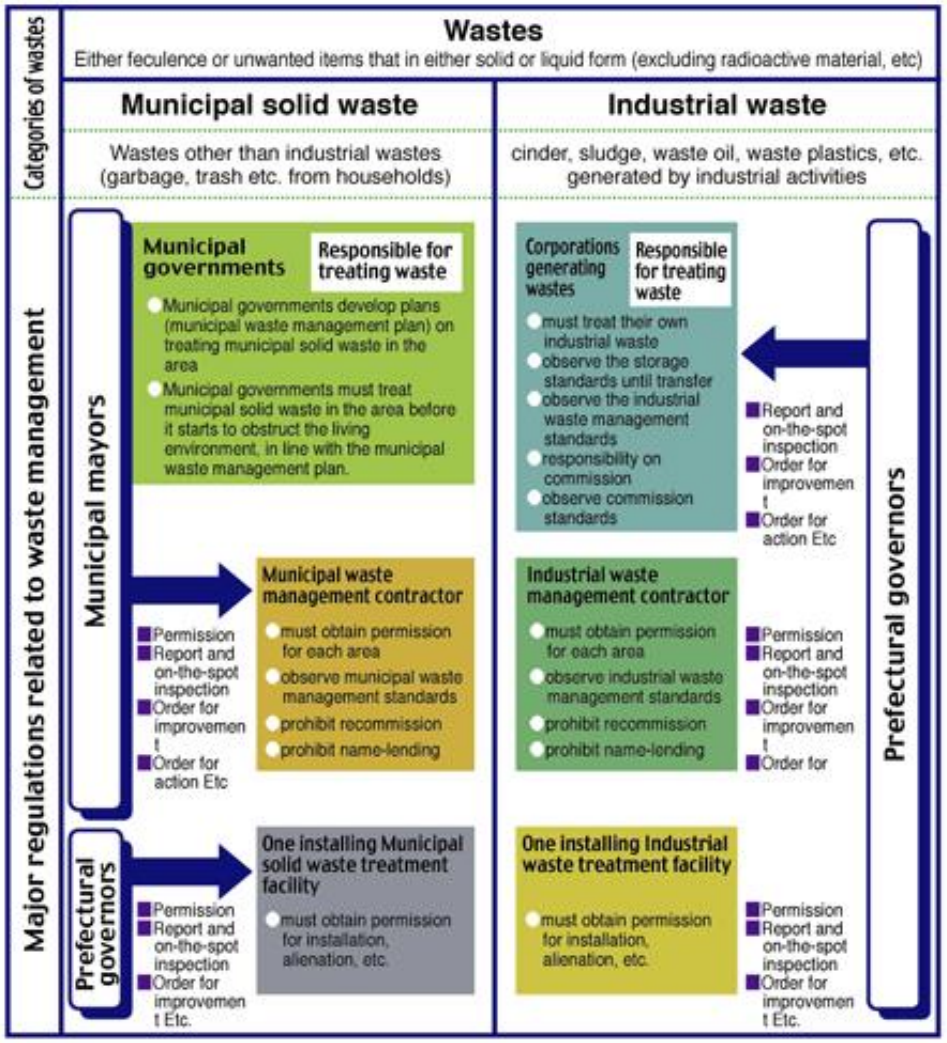
[37] In Europe, Article 3(1) of the new Waste Framework Directive defines waste as 'any substance or object which the holder discards or intends or is required to discard'

b. Roles and responsibilities of different entities

The responsibilities for waste treatment are shared among the different entities involved: national and local government, business operators, consumers, etc. Each entity has a definite role to play and collaboration is essential for the good running of the scheme.

The Extended Producer Responsibility (EPR) principle, in which producers bear a certain degree of responsibility for proper recycling and management of the products that they produced even after the products are used and disposed of, is a concept that exists both in Japan and Europe.

Figure 6: Outline of the Waste Management and Public Cleansing Law



【Outline of the Waste management and Public Cleansing Law】

Source: Ministry of Environment, https://www.env.go.jp/en/aboutus/pamph/html/00pan120.html

A figure explaining the relationships between national and local governments and waste-generating business operators in the Waste Management Act is provided in annex 2. Below some additional information:

The National government gathers and analyses information on waste, enacts laws and regulations, sets up national strategies and provides support to municipalities and prefectures.

Prefectures provide support to municipalities, formalise waste plants and supervise industrial waste managed in areas under their jurisdiction, including granting licences for waste disposal facilities. Prefectures also have the capacity to set emissions limits.

Municipalities are responsible for managing municipal waste within areas under their jurisdiction, oversee the development of waste infrastructure and promote measures to reduce the quantity of waste generated among the residents.

Waste generating business operators are responsible for properly managing industrial waste generated from their corporate activities. Business operators must also develop products and containers that be easily managed when they are processed as waste, and provide information about how to manage them.

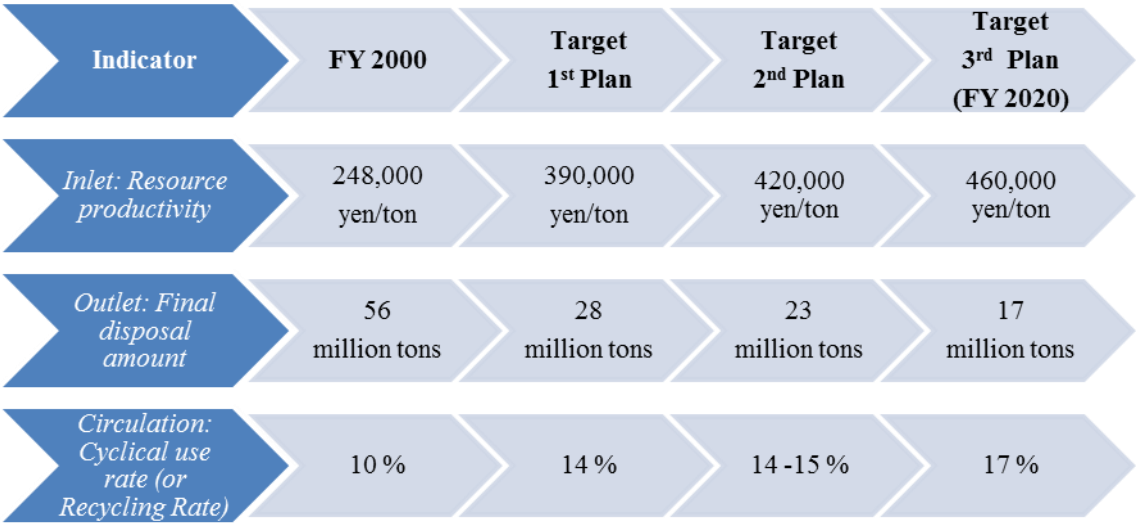
Waste generators (consumers) are required to cooperate with national and local governments, for example by using recycled products or through correct waste disposal.

Educating the population, for example through the teaching of the 3R and inculcation of the *mottainai* spirit at school, is a key aspect of the Japanese strategy in waste management. The involvement and cooperation of the consumers - waste generators is particularly emphasized, especially concerning the importance of sorting the wastes properly.

c. Material flow indicators

To monitor the development of a sound material-cycle society in Japan, the Fundamental Recycling Plan defined three indicators that represent different dimensions of the material flow, namely "resource productivity" qua entrance, "final disposal amount" qua exit and "cyclical use rate" (also called "recycling rate") qua circulation. According to the progress of implementation, the targets are reviewed upon revision of the Fundamental Plan.

Figure 7: Material Flow Indicators



Source: Annual Report on the Environment, the Sound Material-Cycle Society, and Biodiversity in Japan 2014, Ministry of the Environment (diagrams in annex 3)

Definitions according to the Third Fundamental Plan for Establishing a Sound Material-Cycle Society (May 2013)[38]

Inlet: Resource productivity (= GDP/input of natural resources)

Input of natural resources is defined as the total amount of domestic and imported natural resources and imported products. Resource productivity represents a comprehensive indicator of how effectively industries and people utilize resources in their daily activities (how much they create affluence with fixed amount of resources) by calculating the real gross domestic product (real GDP) per certain amount of input of natural resources.

Outlet: Final disposal amount

Amount of landfill disposal waste. The indicator is directly linked to the issue of securing final disposal (landfill) sites of waste.

Circulation: Cyclical use rate or *Recycling rate* (= amount of cyclical use / amount of cyclical use + natural resources input)

This indicator represents the share of cyclical use (reuse and recycled use) to total input in the

[38] https://www.env.go.jp/en/focus/docs/files/20131018-79.pdf

economy and society.

These indicators reveal steady improvements, and the goals set in the Second Fundamental Plan for FY2015 for the recycling and final disposal amount have been achieved prior to the target year.

A number of other 3R indicators[39] also exist and the use of such reference model is promoted throughout Asia to monitor the progress of national strategies and policy goals. Annex 1 of the Ha Noi 3R Declaration[40], discussed and adopted at the 4th Regional 3R Forum in Asia and the Pacific (2013), lists potential indicators that countries can implement.

d. Municipal waste

Municipal governments in Japan are in charge of the collection, treatment and disposal of Municipal Solid Waste (MSW) within areas under their jurisdiction but actual operations are usually performed by local private companies. MSW are generally managed locally as authorizations are required to exit waste out of the municipality and local governments would have to face strong opposition from the residents of the destination place ("Not In My Backyard"[41] syndrome). One of the consequences is the discrepancy of waste management between cities as the available budget and resources largely differ, especially considering the current issue of (rural) municipalities under financial pressure. Another aspect of the responsibility being borne by municipality is that the satisfaction of the local citizens and businesses may drive decisions related to waste management.

According to the data on municipal waste emission and disposal, incineration plants, landfills and expenditures[42], the total waste emissions and waste emissions per person per day slightly declined from 45,230,000 tons in FY2012 to 44,870,000 tons in FY2013 (-0.8%). Per person, it represented a daily waste emission of 958 grams (-0.6% from 964 grams in previous year)[43].

In the European Union, the amount of municipal waste generated per person in 2013 amounted, in average, to 481 kg (ranging from less than 300 kg in Romania, Estonia and Poland to 747 kg in Danemark), down by 8.7% compared with its peak of 527 kg per person in 2002.[44]

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[39] IGES, 3R Policy Indicator Factsheets: http://pub.iges.or.jp/modules/envirolib/upload/4977/attach/3RIndicator_B5report_web.pdf
[40] MoE: https://www.env.go.jp/en/focus/docs/files/20130318-67.pdf
[41] "Not In My Backyard Situation (abbreviated NIMBY) where one or more members of a community oppose establishment of an inherently undesirable project (such as a hazardous waste dump or radioactive material storage), or an otherwise desirable project (such as a school or shopping center), too close to their homes from fear of its negative consequences" http://www.businessdictionary.com/definition/not-in-my-backyard-NIMBY.html
[42] Data on Municipal waste emission and disposal, incineration plants, landfills and expenditures in FY2013: https://www.env.go.jp/press/files/en/fy2013.pdf
[43] In case foreigner population is excluded from overall population 972 grams, down 0.6% from 979 grams in previous year
[44] http://ec.europa.eu/eurostat/documents/2995521/6757479/8-26032015-AP-EN.pdf/a2982b86-9d56-401c-8443-ec5b08e543cc

i. Sorting

National laws provide a general framework but details for the implementation is let to the local governments according to the regional characteristics and needs. Therefore, the sorting instructions are not homogeneous across Japan but vary from city to city. The separating system may count over 30 categories of refuse[45]. The correct sorting at source is a determinant step in the running of the Japanese waste treatment scheme.

Recyclables such as glass, paper, PET bottle, plastic, etc. have to be cleaned and disposed separately. The law introduced material marks[46] to help citizens distinguish the different categories.

Incombustible wastes (called in Japanese "moenai gomi") are wastes that cannot be burned, such as ceramics or metallic products. These wastes will be disposed in landfills.

Combustible wastes ("moeru gomi") correspond to the wastes that are neither recyclables as resources nor incombustible. Kitchen waste and clothes for example are usually considered as combustible.

Large-sized wastes are wastes over 30 cm. These wastes cannot be discarded within the normal collection system but citizens have to call the municipality to arrange a special delivery and must pay a fee.

ii. Collection

Privately managed garbage bins can be found in parks, near vending machines or convenience store. However, public trash containers disappeared from the streets as an anti-terrorism measure following the Tokyo subway sarin attack perpetrated in 1995 by the Japanese sect Aum Shinrikyo. It is now considered as an incentive for people to be responsible for and manage their own garbage and Japanese usually bring their trash back home for sorted disposal.

Collection frequency of households' garbage is also dependent on municipality. Garbage is usually put into bags that are then handled manually by garbage collectors.

Apart from the separate collection from municipalities, residents may also have the possibility to bring

[45] Example of Kamikasu, Tokushima Prefecture: http://www.theguardian.com/environment/2008/aug/05/recycling.japan

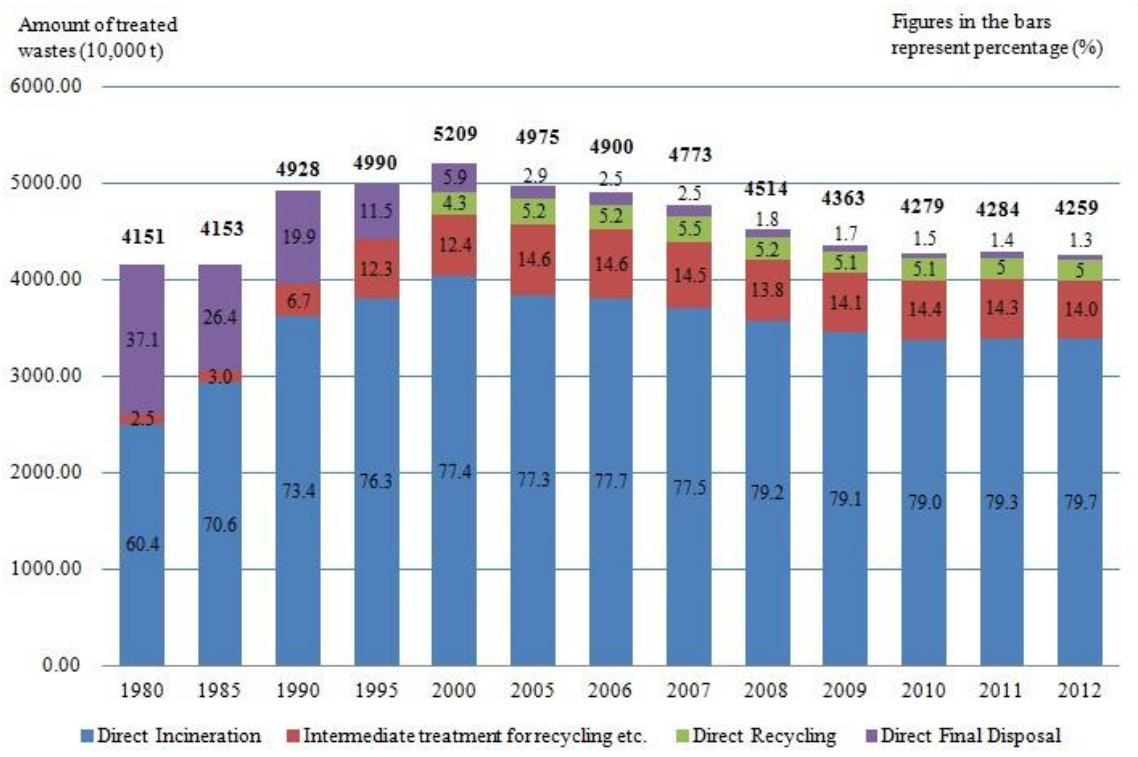
[46] A.3.a.iii Packaging Waste, Identification Mark

their garbage to collection boxes installed in municipal facilities (usually for specific types of wastes, such as textiles) or to take part to group collection (volunteer groups collect and sell recyclables to a processing company).

iii. Waste Treatment Methods

In Japan, incineration is clearly the most popular waste treatment method. Efforts have been mainly focused on reducing the amount sent to landfill.

Graph 1: Municipal Waste Treatment Methods in Japan



Source: Handbook on Resource Recycling Legislation and Trends in 3R, 2014 (METI)
Complete chart for the period 1980-2012 in Japanese in annex 4

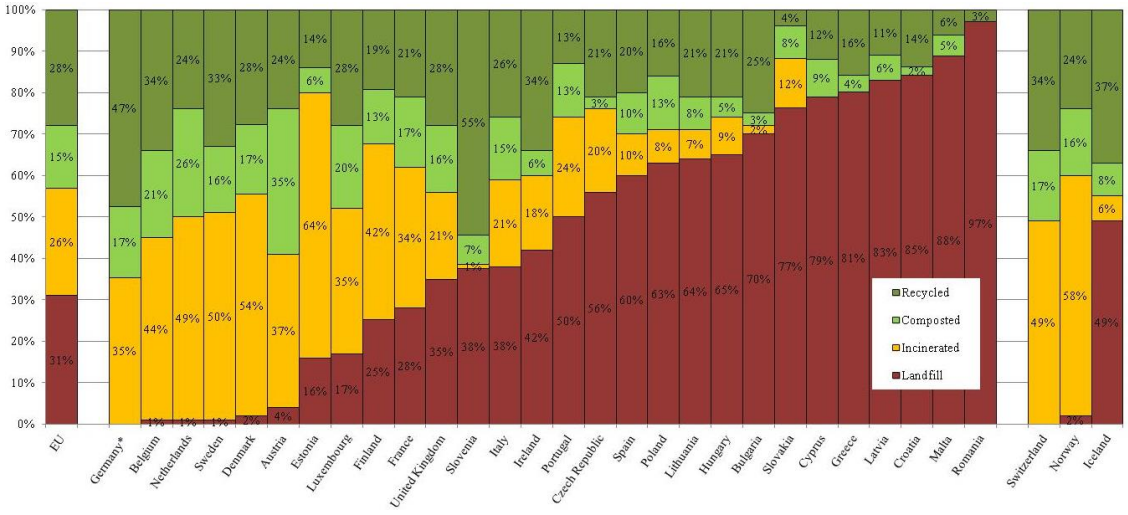
In FY2013, the quantity of waste disposed of by landfill decreased by 2.4% from previous year to 4,540,000 tons. The waste reduction rate lay by 98.6% (98.7% in previous year) while the direct landfill disposal rate was of 1.4% (1.3% in previous year).

A total of 9,270,000 tons of waste has been recycled (+ 0.1%). The recycling rate increased

marginally from 20.5% in FY2012 to 20.6%.

For comparison, the EU's 2008 Waste Framework Directive calls for recycling of at least 50% of household waste by 2020. In 2013, 31% of the Municipal Waste were landfilled, 26% incinerated and 43% recycled or composted. However, as depicted in the graph below, this average figure hides a very disparate waste handling among European countries.

Graph 2: Municipal Waste Treatment in 2013, EU28 + Switzerland, Norway and Iceland



Germany: data on incineration include treatment for disposal*

Source: Eurostat

http://ec.europa.eu/eurostat/documents/2995521/6757479/8-26032015-AP-EN.pdf/a2982b86-9d56-401c-8443-ec5b08e543cc

Waste incineration

As seen above, incineration is the most widely used method for treating waste in Japan. It is particularly popular because it reduces the size by 1/20, thereby responding to the concerns related to limited landfill sites, and it is considered as more hygienic compared to landfill.

In 2013, the number of waste incineration plants declined while the capacity per plant rose marginally. 28.0% of all plants were equipped with power generation facilities, and the total power generating capacity increased.

The bottom ash used to be melted into slag[47] to further reduce the size of the residue. However, as this technique requires a lot of energy, it is progressively abandoned since the Fukushima disaster as an energy saving measure.

Landfill

Due to its small size, Japan has limited existing capacity and little potential for future enlargement. The availability of landfill sites is therefore of primary concern and a main driver in Japan's waste management policy. The available capacity has fallen for 15 years in a row since 1998 and, despite some fluctuations, the number of landfill sites has followed a downward trend since 1996. In some regions (e.g. Kanto and Chubu) waste has to be transported to other areas due to insufficient local landfill capacity. In addition, if the bottom ash is no longer reduced into slag, the volume to be landfilled is expected to increase. Therefore, new means to use the bottom ashes have to be developed and implemented.

As of 31st March 2014, the available capacity amounted to 107,410,000 cubic meters (down 4.3% from 112,260,000 cubic meters in previous year). It corresponds to 19.3 remaining sustainable years (19.7 years in previous year).

iv. Waste disposal expenditure

In FY2013, spending on waste disposal services increased slightly to 1,851.0 billion yen (1788.5 billion yen in previous year). The main categories of expenditure were "Construction and improvement" for 257.5 billion yen (208.8 billion yen in previous year) and "Disposal and running costs" that accounted for 1,473.8 billion yen (1,465.2 billion yen in previous year).

MoE has established a subsidy system for waste treatment plants installed by municipalities[48].

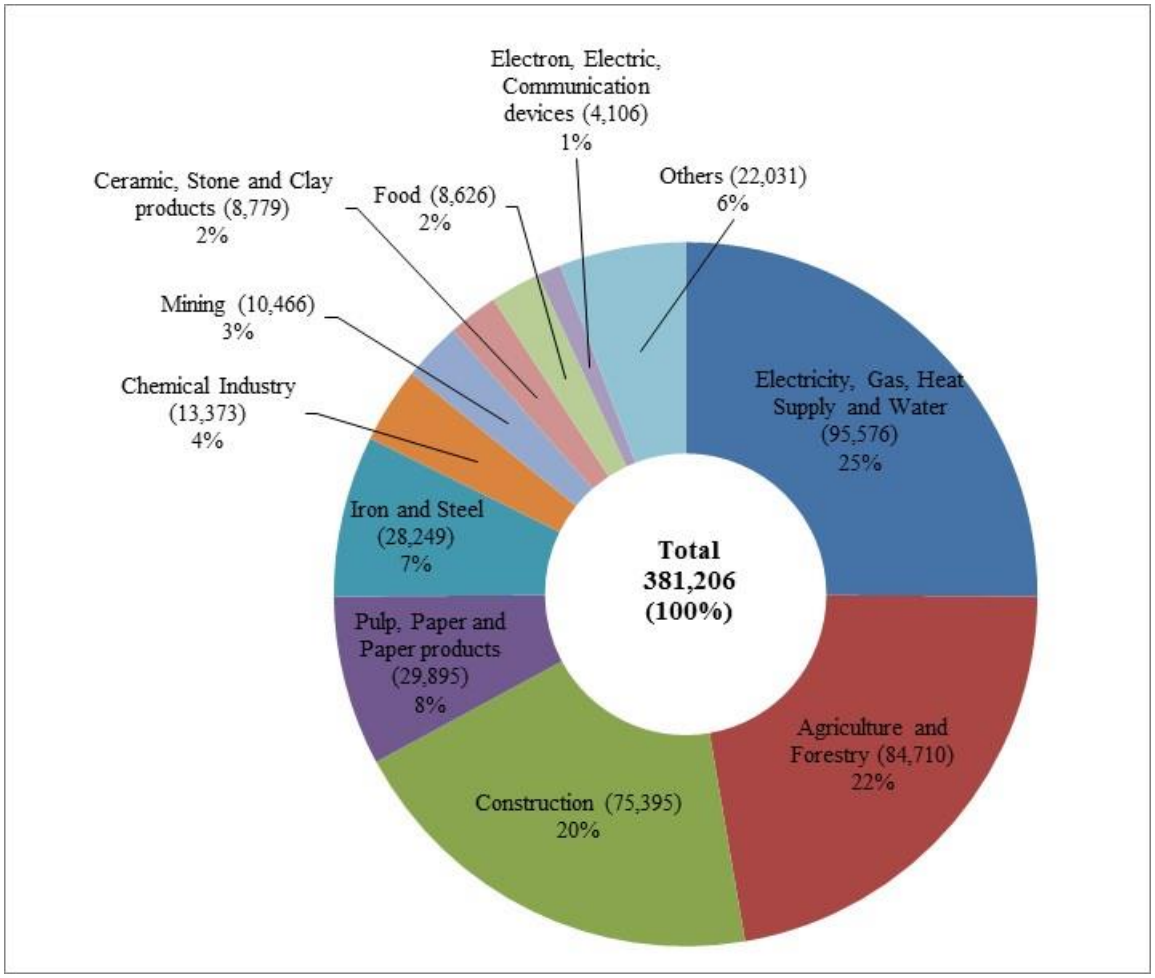
e. Industrial waste

In Japan, three industries, namely Electricity, Gas, Heat & Water, Agriculture & Forestry and Construction dispose together more than two third of the total amount of the industrial wastes discharged.

[47] "When the bottom slag from combustible waste is melted at a high temperature of over 1200 degrees Celsius and rapidly cooled, the material turns into sandy slag. As slag, the volume is almost half that of ash and approximately one-fortieth of its original state as waste. The process of making decomposes dioxins within the ash and traps in the heavy metals, which make it safe to be used for construction material." Source: Waste Report 2015, CAT 23

[48] http://www.jefma.or.jp/english/fit_subsidy/Subsidy%20from%20MOE_20140618.pdf

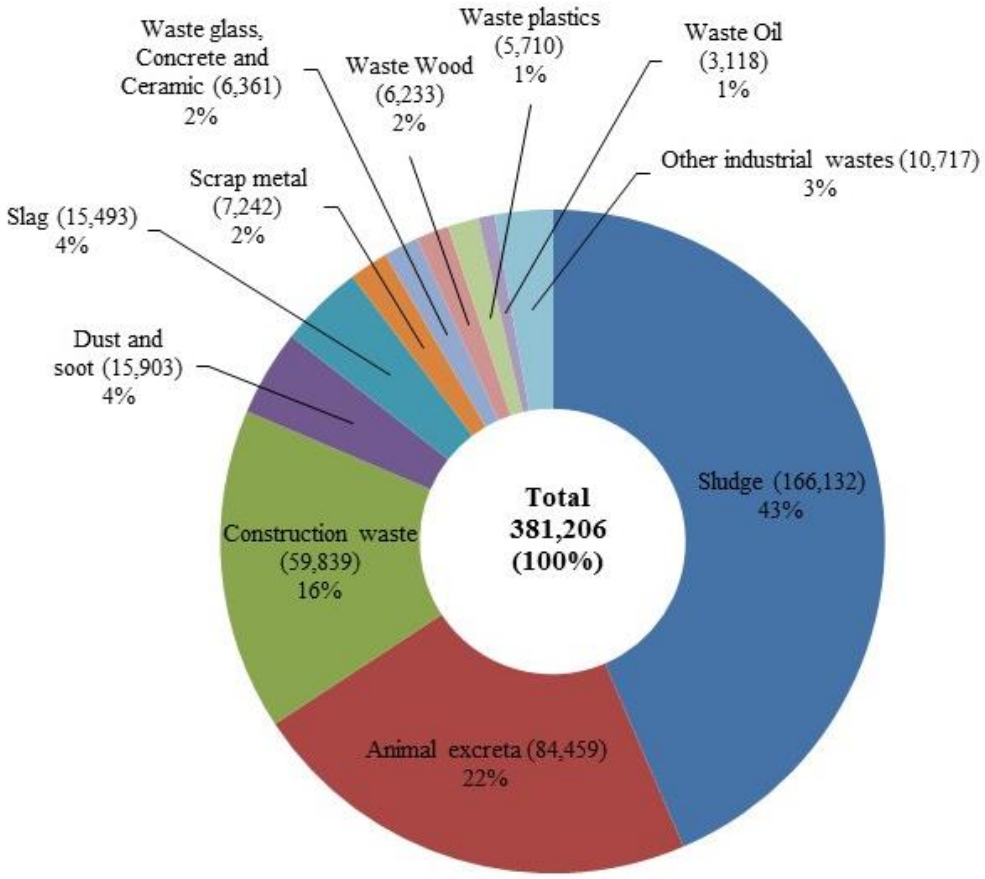
Graph 3: Amount of Industrial Waste by Industry in Japan in 2011



Source: Handbook on Resource Recycling Legislation and Trends in 3R, 2014, METI

A breakdown of industrial waste by category shows that sludge, animal excrement and construction waste represent more than 80% of the total amount.

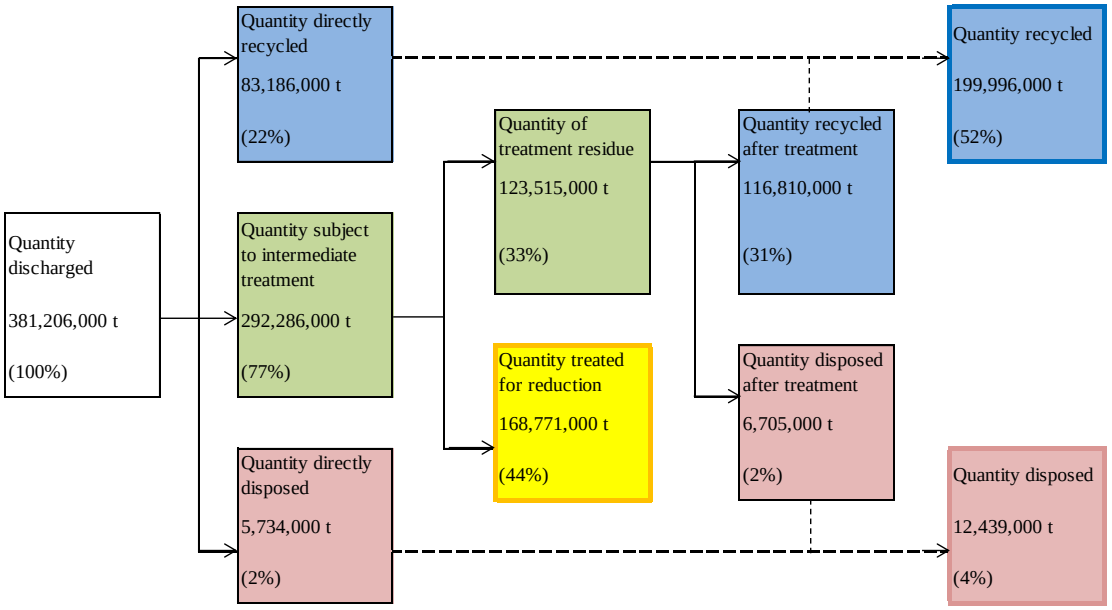
Graph 4: Amount of Industrial Waste by Category in Japan in 2011



Source: Handbook on Resource Recycling Legislation and Trends in 3R, 2014 (METI)

The total quantity of industrial wastes discharged in Japan has been slowly decreasing in recent years and amounted to about 381 million tons in 2011. The recycled amount remains stable at 52%. Intermediate treatment include process such as sorting, crashing, dewatering and incineration.

Figure 8: Flow of the treatment of Industrial wastes (2011)



Source: Handbook on Resource Recycling Legislation and Trends in 3R, 2014 (METI)

f. Competitive landscape

Companies active in the waste and recycling industry can be classified in following types: large companies (usually active in several environmental sectors), small and medium size companies and private financed initiatives (PFI) & public private partnerships[49]. In some cases, the SMEs are affiliated with the large companies.

In 2009, there was a total of 23,045 establishments of industrial and general waste disposal businesses throughout Japan, among which 59.4% were establishments with less than 10 employees[50]. The obligation for municipalities to manage their own waste within their jurisdiction, the hurdles for transporting wastes outside the local boundaries and the need of prefectural authorizations to operate has fostered the activity of local companies. In case of waste collection, the activity is mostly performed by small local operators and there is no significant national player.

Regarding the recycling of packaging waste from households, the Japan Containers and Packaging Recycling Association (JCPRA) listed for 2014: 53 companies active in the recycling of glass bottles,

[49] Recycling & Waste Management, Elsje Verhulst
[50] JETRO, Environment Technologies in Japan – Survey Reports on Wastes Treatment and Recycling (FY2012)

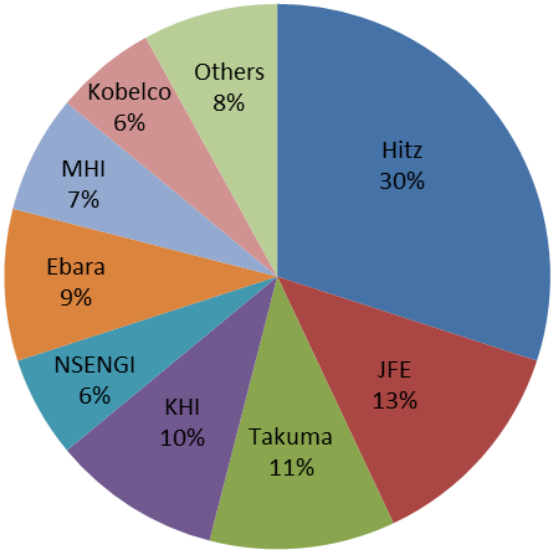
45 for paper, 54 for plastic and 52 for PET bottles[51]. Some companies recycle several waste types.

Large corporations represent more than half of the non-metal waste management industry. Japan Environmental Safety Corp (PCB wastes), Daiei Co. Ltd, JFE Kankyo Corp., Nippon Steel Corp. and Shinano Environmental Improvement Corp. were the industry leaders in 2010 with respectively 6.0%, 3.2%, 3.1%, 2.8% and 0.2% of production share[52].

Regarding the recycling of metal waste and scrap, the main players in 2010 were Asahi Holdings Inc. (19.4% production share), Hanwa Co. Ltd (11.7%), Mitsui Mining & Smelting Co. Ltd (10.2%), Dowa Holdings Co. Ltd (6.4%) and Matec Inc. (2.6%)[53].

According to the Japan Environmental Facilities Manufacturers Association (JEFMA)[54], their members have received and are constructing about 90 per cent of orders. Company information sheets and technical information sheets about their technology can be found under: http://www.jefma.or.jp/mem_co_contents.html

Graph 5: Main players on the Japanese Market 2012 – 2014 by supplier



Source: Vaccani European Market Share Analysis of Thermal Waste Treatment Plants, 2015 Edition (provided by JEFMA)

[51] JCPRA: http://www.jcpra.or.jp/english/tabid/612/index.php
[52] Euromonitor International August 2013. Passport - Recycling of Non-Metal Waste and Scrap in Japan: ISIC 372
[53] Euromonitor International August 2013. Passport - Recycling of Metal Waste and Scrap in Japan: ISIC 371
[54] Japan Environmental Facilities Manufacturers Association (JEFMA) was established in 1962 as an association consisting of leading manufacturers who undertake design, manufacture and construction of environmental facilities including waste treatment plants and pollution control equipment, with the objectives of (1) improving the level of technology of its members through mutual exchange of research information, (2) supplying local municipalities with environmental facilities having improved quality and reliability, and (3) conservation of the living environment. Source JEFMA, http://www.jefma.or.jp/englishpage_f.htm

3. Specific waste streams

a. Packaging waste

i. Outline of the system in Japan

The "Containers and Packaging Recycling Law" was enacted in June 1995 and implemented in April 1997. It has been revised in April 2007 and a second amendment is currently under discussion.

Containers and Wrapping are defined as items "that become unnecessary once the merchandise has been consumed or otherwise separated from them."
Selective collection applies to:

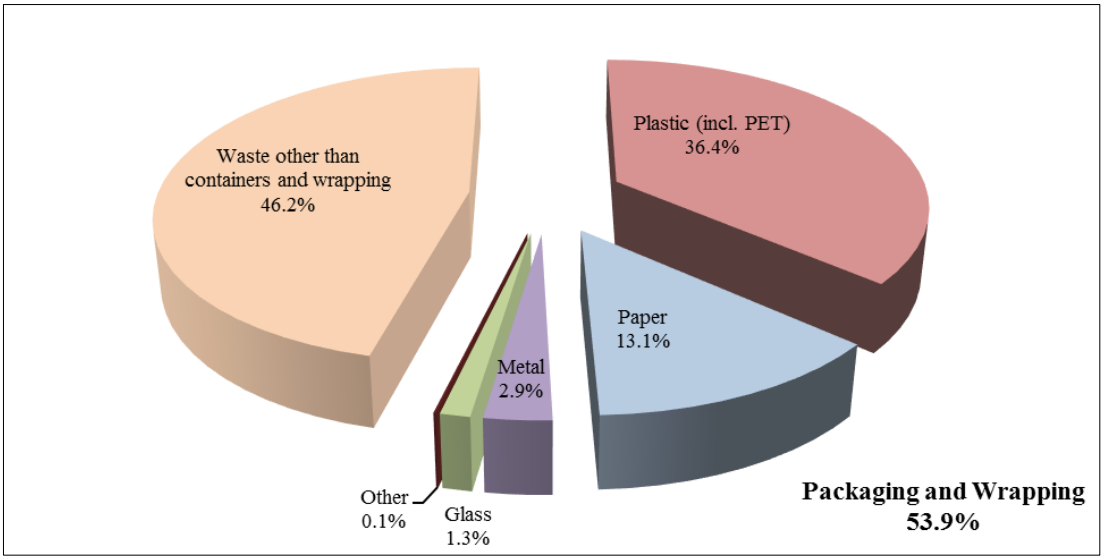
- ✓ Glass containers
- ✓ PET bottles
- ✓ Paper Containers and Wrapping
- ✓ Plastic Containers and Wrapping and styrene foam trays
- ✓ Steel cans
- ✓ Aluminum cans
- ✓ Paper drink packs
- ✓ Corrugated cardboard

Recycling obligations only apply on the first four above-mentioned categories as the other four are traded on the market.

Note: The Act is currently under revision and a possible change of the scope seems to be among the topics of discussion.

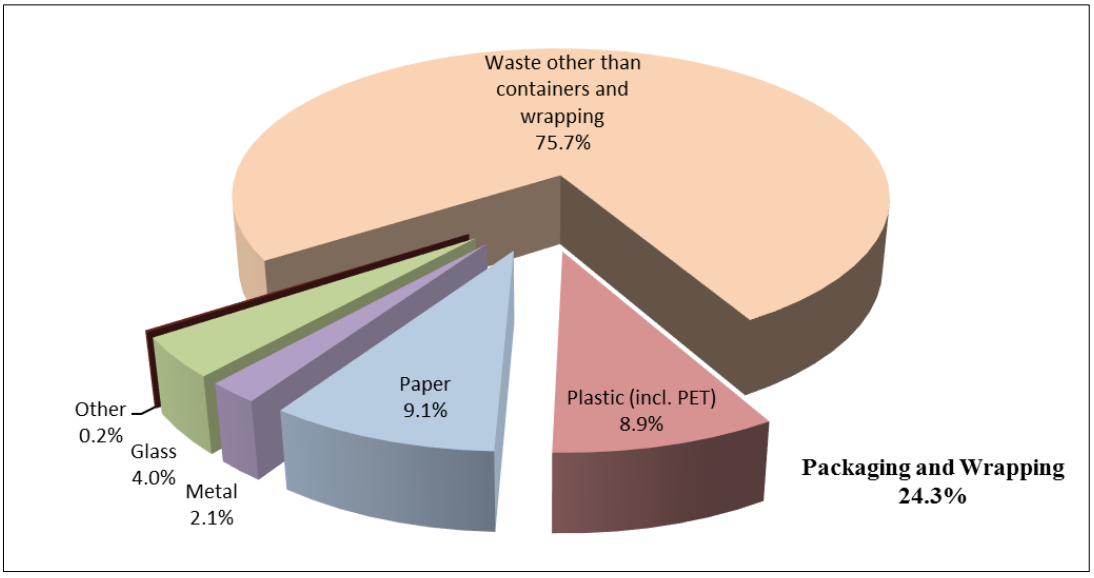
Packaging represents approximately 54% of HH waste in term of volume and 25% in terms of weight.

Graph 6: Ratio of Containers and Wrapping in Household Waste (in terms of Volume)



Source: JCPRA

Graph 7: Ratio of Containers and Wrapping in Household Waste (in terms of Weight)



Source: JCPRA

The Act introduced the concept of Extended Producer Responsibility (EPR) for the first time in Japan. It assigns roles and responsibilities on all parties involved: sorted disposal on consumers, selective collection on municipalities and recycling obligations on specified business entities.

Specified business entities are medium or large-scale business entities that use “containers” or

"wrapping" in manufacturing or selling their products; manufacture containers; import and sell "containers" or merchandise in "containers" or "wrapping". Small-sized business entities can be exempted from their recycling obligations under certain conditions (sales and number of employees).

The Japan Containers and Packaging Recycling Association (JCPRA) is a government-designated Organization based on the Container and Packaging Recycling Act that works in collaboration with the government, municipalities, business entities and consumers.

Table 2: Number of contracting business entities and of municipalities with contract

	2000		2007		2013	
	Companies	Municipalities	Companies	Municipalities	Companies	Municipalities
Glass bottles	3,803	1,430	3,715	1,230	3,287	1,229
PET bottles	962	1,707	1,292	1,082	1,303	1,198
Paper	41,206	83	52,597	154	59,330	147
Plastics	56,944	435	69,117	988	74,914	1,064
Total	**59,449**	**2,086**	**71,409**	**1,571**	**76,571**	**1,546**

Source: JCPRA

The main role of JCPRA is to help specified business entities to fulfill their recycling obligations by conducting the recycling operations on their behalf in exchange of a "recycling fees".

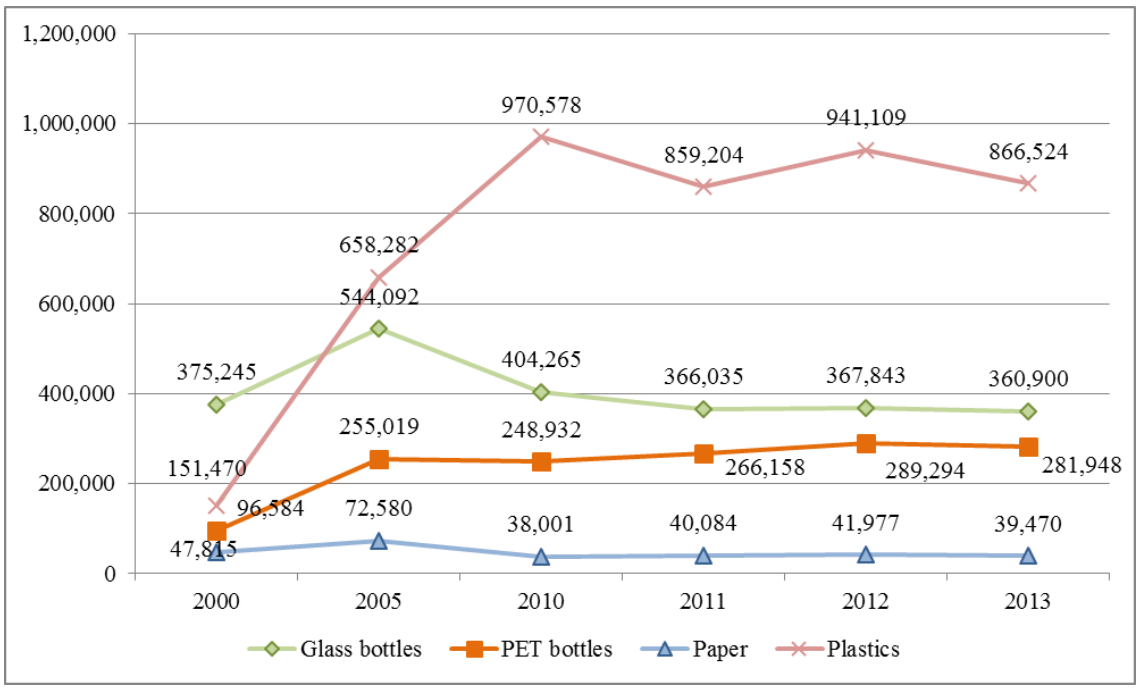
Recycling fee (yen) = Estimated Amount of Output (kg)
x Calculation Coefficient x Recycling Unit Cost

The *Estimated Amount of Output* is calculated by the business entities.
The amounts and ratios used as the basis for the *Coefficient* change yearly and are provided by the Japanese government. The *Coefficient* varies according to business classification and packaging type.
The *Recycling Unit Cost* is set yearly by JCPRA.
The *Coefficient for Calculation* and *Recycling Unit Cost* for the year 2015 can be found on the website of JCPRA[55] and is given in annex 5 of this report.

The total amount of recycling obligation is calculated by the competent ministries. It is based on the amount of selective collection planned by municipalities and the amount which can be recycled.

[55] JCPRA: http://www.jcpra.or.jp/Portals/0/resource/eng/2015.pdf

Graph 8: Volume of requested recycling (tons)



Source: JCPRA

As a general rule, material recycling is favored compared to energy recovery according to the 3R principle but LCA is also taken into account. Currently, incineration plants cannot bid into the JCPRA system but this might also change as part of the Act revision.

Table 3: Use of recycled products (2013)

		Sales Volume (tons)	Percentage
Glass bottles 332,970 tons	From bottle to bottle	249,101	74.81%
	Others	83,867	25.19%
PET bottles 168,805 tons	Textiles	73,635	43.60%
	Plastic sheet	69,108	40.90%
	Bottles	19,581	11.60%
	Molded products	6,081	3.60%
	Others	400	0.20%
Paper 24,715 tons	Materials	23,109	93.50%
	Materials for other than paper	190	0.80%
	Refuse Derived Fuel	1,416	5.70%
Plastics 434,035 tons (Plastics: 433,532 tons + Tray: 504 tons)	Molding materials	171,285	39.50%
	Pyrolytic oil	0	0.00%
	Reducing agent in blast furnaces	28,801	6.60%
	Chemical raw materials for the coke oven	174,969	40.40%
	Synthetic gas	58,476	13.50%
	Molding materials	504	100%
	Pyrolytic oil	0	(-)

Source: JCPRA

ii. Packaging waste reduction

Whoever has been in a Japanese supermarket could notice that products tend to be overwrapped and that there is a large potential for reducing the amount of packaging used. However, this practice is deeply rooted in the culture and would require a radical change of mentality. As the reduction of plastic shopping bags is mainly dependent on a proactive consumer behavior, a special attention is paid to this item to raise awareness[56].

According to a survey led by MoE in 2012 [57] all 47 prefectures and almost 90% of 19 government-designated cities, 41 major urban cities and 23 wards of Tokyo have implemented actions to reduce plastic bags as of February 1st, 2013. The measures include for example charging for the shopping bags (35 prefectures and 31 government-designated cities, major urban cities and wards) or offering benefits to customers (20 prefectures and in a total of 24 government-designated cities, major urban cities and wards). These initiatives have led to a growing refusal rate for plastic bags and increasing numbers of clients bringing their own bags.

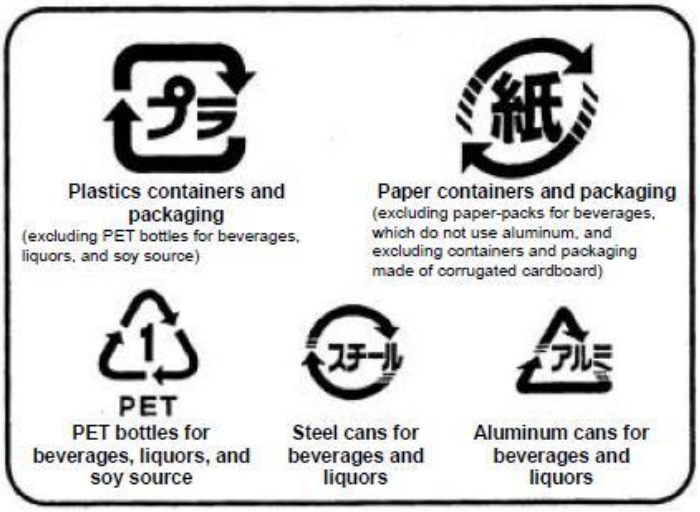
iii. Identification Mark[58]

Based on the Resource Effective Use Promotion Law, Identification mark have been designed to facilitate the correct sorting of single packaging parts by consumers when they dispose of the waste.

As a general rule, marking obligation (as well as recycling obligation), do not apply to containers and wrapping of merchandise consumed for the purpose of business activities[59].

[56] Annual Report on the Environment, the Sound Material-Cycle Society, and Biodiversity in Japan 2014
[57] JFS: http://www.japanfs.org/en/news/archives/news_id035126.html
[58] METI: http://www.meti.go.jp/policy/recycle/main/data/pamphlet/pdf/mark_Indication.pdf
[59] Pamphlet: "Containers and Packaging Recycling Law"

Figure 9: Identification Mark



Source: METI

Figure 10: The Green Dot

The Green Dot, that is widespread in Europe as a financing symbol, is not used in Japan and there is therefore no need to put it on the packaging. However, as it is a registered trademark, a royalty-free world-wide license agreement has to be concluded with Pro-Europe and DSD, in case it appears on the packaging[60].

Source: Pro-Europe

iv. Aluminium Beverage Can

Aluminium can be recycled infinitely without any loss of its properties. Moreover, recycling of post-consumer aluminium products saves up to 95% energy, which represents a saving of over 9kg of greenhouse gases per kilogram of aluminium produced[61].

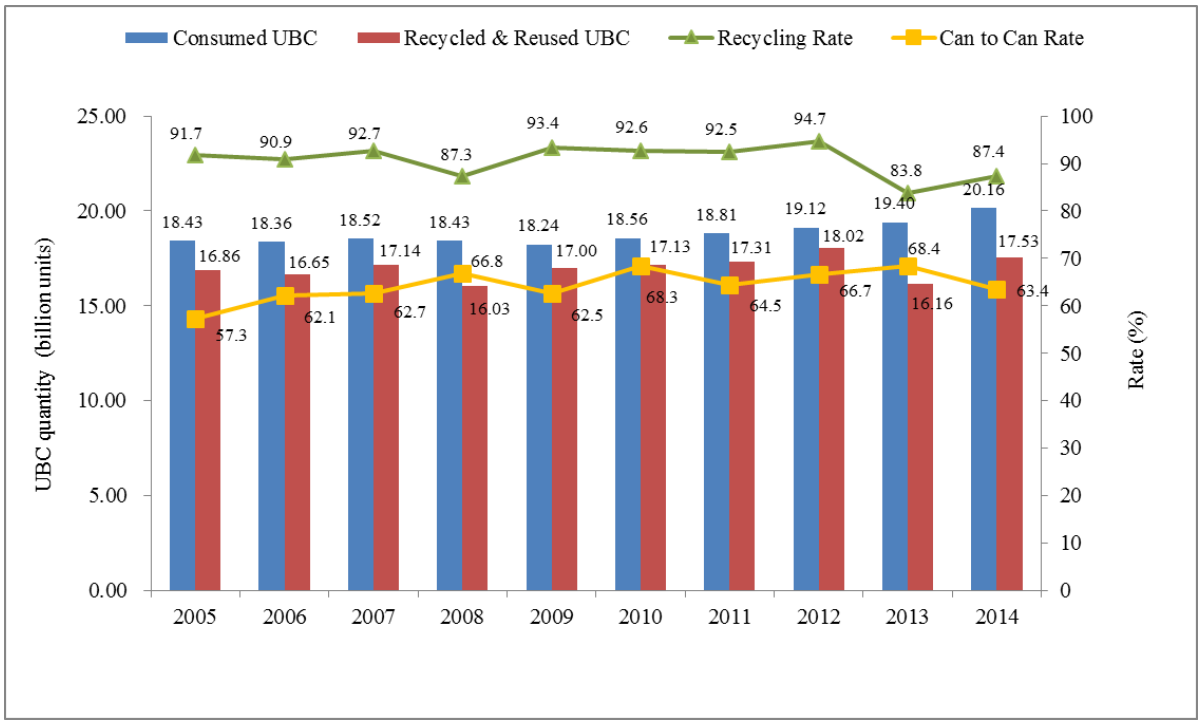
The aluminium recycling industry is well established in mature markets such as Europe, North-America and Japan and is developing in countries like Brazil, China, India and Russia. Japan moved from domestic primary production to recycling in the 1980s following the oil shocks and the rising cost of energy of the 1970s.

Japan figures among the top recyclers of used beverage can (UBC) in the world[62]. In FY2014[63], almost

[60] http://www.pro-e.org/The-Green-Dot-Trademark.html
[61] http://recycling.world-aluminium.org/uploads/media/fl0000241.pdf
[62] http://www.alumi-can.or.jp/data/kunibetu_recycle.pdf

20.16 billion cans (312,950 tons) were consumed in Japan. Among them over 17.53 billion units (273,491 tons) were recycled or reused, achieving a recycling ratio[64] of 87.4% and enabling the saving of 8.1 billion kWh electricity, which represents the consumption of almost 56 million Japanese household (considering an average consumption of 271 kWh/month) for 16 days. The Can-to-Can recycling rate[65] lay at 63.4% (compared to 68.4% in FY2013). The Japan Aluminium Can Recycling Association (ACRA) explains the decreasing rate in recent years by an increase of scrap export[66] and is pleading for recycling on domestic market.

Graph 9: Aluminum Can Recycling Rate



Source: Japan Aluminium Can Recycling Association (ACRA)

Five key factors have been identified by the Japan Aluminium Can Recycling Association to explain the success of the Japanese can recycling system:

- ✓ An almost perfect "Separate collection" system.
  Separating at source reduces impurity in the waste stream.
  1850 municipalities have edited detailed disposal instructions.

[63] Source: Japan Aluminum Can Recycling Association
[64] Recycling Ratio = Recycled & Reused UBC / Consumed Aluminium Cans
[65] Can to Can Recycling Ratio = Recycled UBC allocated to Can manufacturing / Recycled & Reused UBC
[66] http://www.bloomberg.com/news/articles/2014-09-04/recycling-drives-japan-scrap-past-lme-aluminum-chart-of-the-day; http://www.bloomberg.com/news/articles/2013-11-12/japan-aluminum-scrap-exports-seen-at-record-as-south-korea-buys

- ✓ A nationwide recycling network.

  UBC are collected through voluntary group, supermarkets and shopping centres and companies as part of their CSR activities and sold to resources recyclers (over 800 buyers).

- ✓ Environmental Education at primary school

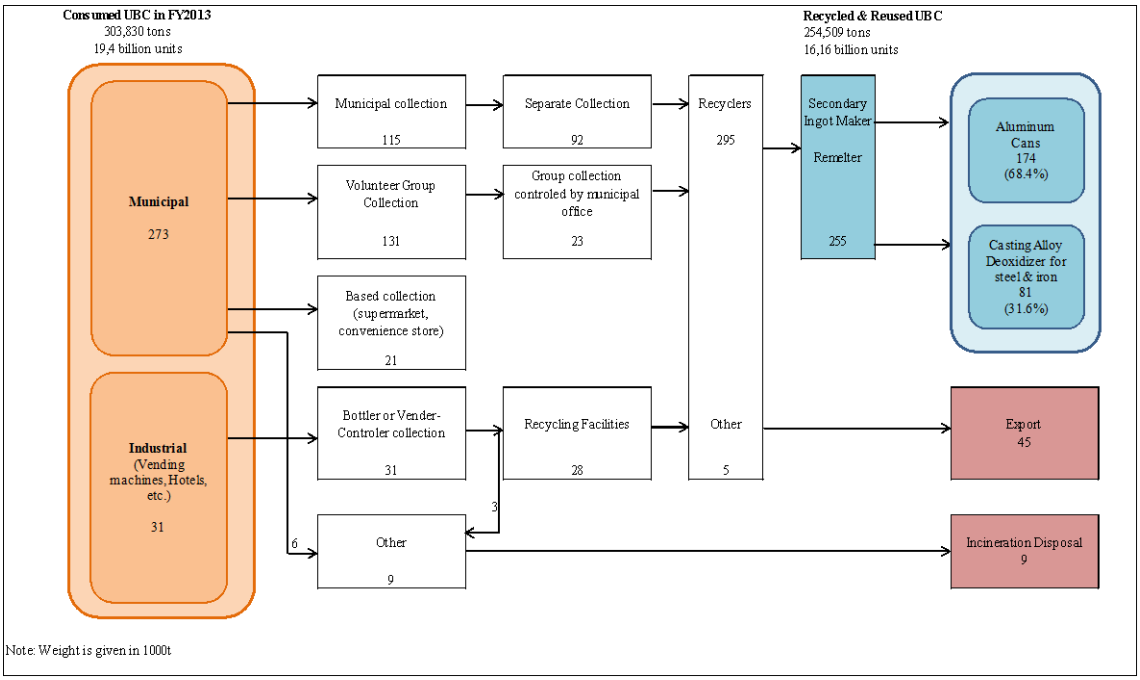
  Schoolchildren are sensitized to the environmental and socio-economic advantages of recycling, through special curriculum for environmental education or the possibility to purchase books etc. through the collection and sale of UBC.

- ✓ Strong support of ACRA to community groups

  ACRA supports and encourages community groups (e.g. voluntary groups, elderly people's clubs, neighbourhood communities, etc.) with advice and information about recycling.

- ✓ An active recycling market that fosters the development of applications for recycled aluminium (e.g. ingot for beverage can, automobile parts, deoxidizer for steel production)

Figure 11: Aluminium Can Recycling Flow FY2013



Source: ACRA

Original in Japanese in annex 6 and available on http://www.alumi-can.or.jp/data/sairiyo.pdf

Apart from UBC, some other key areas for the recycling of aluminium are Transportation (one third of total aluminium demand is for the transportation sector as more and more aluminium is used in the new car models (60 kg in the first half of the 1990s, 100 kg in the second half of the 1990s and 150 kg currently[67]). Dismounting and shredding system have been implemented for the recycling of used cars) as well as the building and construction sector (e.g. window sash, aluminium nut).

In Europe, metal and/or aluminium packaging recycling schemes can be classified into three main categories[68]:

- ✓ Separate collection of UBC through designated deposit systems, voluntary take back systems, incentive based projects or separate collection schemes
- ✓ Multi-material packaging collection systems where aluminium is separated in the sorting plant
- ✓ Extraction from the bottom ashes of MSW incinerators as aluminium nodules

The European collection rate of all aluminium packaging lies at around 50%. In case of UBC it reaches almost 70% in average but greatly differs (from 30% to almost 100%) depending on the country. On top of the ranking, Sweden is leading with 91% thanks to a deposit system, followed by Switzerland (90%) where a voluntary prepaid recycling charge applies.

b. Food waste

The UK's Institution of Mechanical Engineers (IME) estimates in its report "Global Food - Waste Not, Want Not" (January 2013) that between "30% to 50% (or 1.2 to 2 billion tonnes) of all food produced on the planet is lost before reaching a human stomach."[69]

In Europe, up to 179 kg of edible food is wasted annually per EU citizen and according to the Commission food waste may reach 126 million tonnes per year by 2020 if nothing is done.[70] The 2014 Circular Economy package set a 30% waste reduction (including food waste) target by 2025 but it was withdrawn by the European Commission in January 2015 and a "more ambitious" version is expected by the end of 2015[71].

Despite the fact that Japan is highly dependent on import for satisfying domestic food demand (the

[67] ACRA, Aluminium Recycling in Japan, May 2013
[68] http://recycling.world-aluminium.org/uploads/media/fl0000241.pdf
[69] http://www.imeche.org/docs/default-source/reports/Global_Food_Report.pdf?sfvrsn=0
[70] http://www.euractiv.com/sections/sustainable-dev/france-boosts-efforts-tackle-food-waste-317165
[71] http://www.euractiv.com/sections/sustainable-dev/france-boosts-efforts-tackle-food-waste-317165

self-sufficiency rate currently lies under 40%, lowest among major developed countries[72]) almost 18 million tons of food are wasted annually, including 5 to 8 million tons food loss (i.e. still edible when disposed of)[73]. The exigency for freshness and unclear labeling[74] are often pointed out as explaining factors.

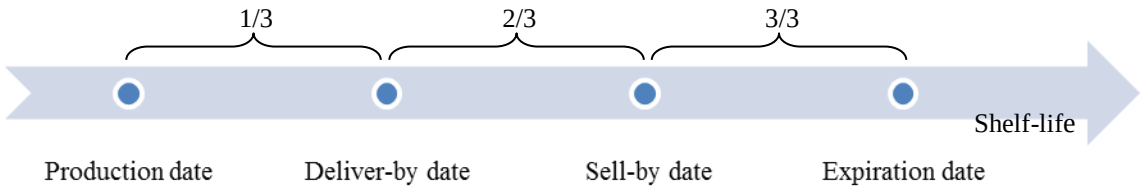
The Act on the Promotion of the Recycling of Recyclable Food Resources, known as Food Recycling Act, was enacted in 2000 (revised in 2007) in order to reduce the generation of food waste and to recycle it, primarily as raw materials for animal feed and fertilizer. The Act established a system for recycling, defined the responsibilities of the different entities involved and set reducing and recycling rates and targets. The Act is being revised in 2015 with the objective to further reduce the amount of food waste produced and enhance recycling (animal feed, fertilizer, methane). Among the amendments, new industries are required to reduce the amount of food waste and new recycling targets to be reached by FY2019[75] have been set.

Table 4: Former and New Recycling Targets in the Food Recycling Act

Food manufacturers and processors	85%	95%
Food wholesalers	70%	70%
Food retailers (e.g. supermarket)	45%	55%
Restaurants	40%	50%

In addition, a further objective of the government is to change the common business usage known as "one-third rule"[76]. Under this practice, food manufacturers and wholesalers have to deliver the product within the 1st third of the shelf-life and the product has to be sold before the end of the 2nd third.

Figure 12: One-Third Rule in the food industry



Source: Second Harvest

[72] http://foodtank.com/news/2014/04/food-losses-and-waste-reduction-as-one-way-to-secure-food-in-japan
[73] http://2hj.org/english/problem/ ; http://www.slideshare.net/FAOoftheUN/fighting-food-loss-and-food-waste-in-japan
[74] http://www.japantimes.co.jp/opinion/2013/01/21/editorials/an-appalling-waste-of-food/
[75] MAFF: http://www.maff.go.jp/j/council/seisaku/syokusan/recycle/h26_03/pdf/data2-2.pdf
[76] http://foodtank.com/news/2014/01/improving-the-food-supply-chain-in-japan

Food waste is part of the Biomass Industrialization Strategy that includes i.a. measures to promote ethanolization and bio-gasification technologies. The plan includes the creation of a collection system by type, the enforcement of recycling through methane gasification, solid fuel conversion and combined utilization with sewage sludge and animal waste, as well as application of FiT scheme. The average utilization ratio is aimed to increase from 27% in 2009 to 40% in 2020[77].

c. E-waste

According to the UNU report 2015[78], Japan produced 2.2 million tons in 2014, ranking thereby third, behind the US (7.1 million) and China (6 million) who generated together around a third of the global total (32%). Germany and India follow with 1.8 Mt and 1.7 Mt respectively. When considering the production per capita, 17.3 kg were generated per inhabitant in Japan while the main e-waste producers are European countries: Norway topping the list with 28.4 kg/inh., followed by Switzerland (26.3 kg/inh.), Iceland (26.0 kg/inh.), Denmark (24 kg/inh.) and the UK (23.5 kg/inh.).

i. Outline of the system in Japan

In the late 1990s, rapid economic growth combined with the change of lifestyle resulted in an augmentation in the quantities and types of the waste streams. The increasing flow became more and more difficult to manage by municipalities. In particular, the spreading of electrical appliances, complex to handle once discharged, became a growing issue. At first, WEEE used to be shredded to recover some materials and then disposed in landfills. It resulted in a shortage of the final disposal sites capacity and it proved to be not adapted considering the valuable and/or hazardous materials contained in such appliances. In this context, the Act on the Recycling of Specified Kinds of Home Appliances (Home Appliance Recycling Act) was enacted in 1998 and came into force in 2001. The main objectives were the proper disposal of the waste as well as effective utilization of useful resources. Electronic appliances are also subject to the Japanese RoHS[79] and Japan Marking of Specific Substances (J-Moss)[80]. The Act also requires the recovery and processing of the chlorofluorocarbon (CFC).

[77] MAFF: http://www.maff.go.jp/e/pdf/reference6-8.pdf
[78] Baldé, C.P., Wang, F., Kuehr, R., Huisman, J. (2015), The global e-waste monitor – 2014, United Nations University, IAS – SCYCLE, Bonn, Germany
[79] http://www.rsjtechnical.com/WhatisJapanRoHS.htm
[80] http://www.rsjtechnical.com/WhatisJ-Moss.htm

Four categories of products are currently targeted in this Act (scope enlarged in April 2009):

- ✓ Home air conditioners
- ✓ TVs (Cathode-Ray Tube [CRT], LCD, and plasma TVs)
- ✓ Refrigerators and freezers
- ✓ Washing machines and clothes dryers

Table 5: Number of waste home appliances collected at designated sites across Japan in FY2014

	Number of collected appliances (thousands of units)	Percentage of total
Air conditioners	2,225	20.50%
CRT TVs	1,872	17.20%
LCD and plasma TVs	847	7.80%
Refrigerators and freezers	2,775	25.60%
Clothes washers and dryers	3,142	28.90%
Total of four designated types	10,862	–

Source: METI, http://www.meti.go.jp/english/press/2015/0623_01.html

This Act is based on Extended Producer Responsibility (EPR) principle[81].

Consumers and businesses, as waste generators, are responsible for the proper returning to the retailers from who they bought the products and bear the costs for the collection, transportation and recycling of end-of-life products. In Japan, consumers pay the fees when they dispose of the waste, while in Europe the fee is paid at the purchase of the appliance.[82]

Home appliance retailers' have to accept the waste home appliances and deliver them to manufacturers.

Home appliance manufacturers' have to collect and recycle the home appliances they manufactured or imported. Specific manufacturers (small and medium-sized manufacturers who have manufactured or imported less than a certain number of units[83]) can entrust this responsibility to so-called "designated

[81] "Extended producer responsibility means that producers bear a certain degree of responsibility for proper recycling and management of the products that they produced even after the products are used and disposed of." METI, http://www.meti.go.jp/english/information/downloadfiles/cRecycle3R20403e.pdf

[82] http://www.lib.kobe-u.ac.jp/repository/81000054.pdf

[83] Production/Importation volume is not more than 900,000 units air conditioners / 900,000 for television sets / 450,000 for refrigerators and freezers and 450,000 for washing machines and dryers

bodies" (here the Association for Electric Home Appliances, AEHA) who also recycle home appliances from manufacturers no longer on the market or that cannot be identified.

The payment after-use-system[84] roots on two main reasons. First, it enables the collection of recycling fees for products that were sold before the passage of the law. Secondly, the payment-after-use system takes into account the very long usage periods of electric appliances during which the collection cost and recycling process might change, reflecting thereby the true cost of recycling to consumers.

The recycling rates[85] for each category currently exceed the targets specified in the Home Appliance Recycling Act.

Table 6: Recycling Rates specified in the Home Appliance Recycling Act

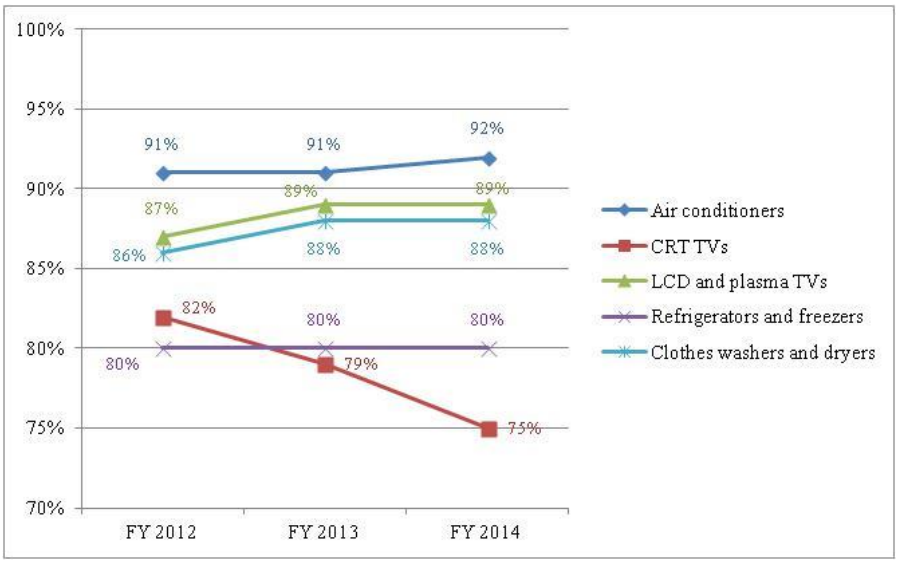
	Recycling targets	
	FY 2001-2008	From FY2009
Air Conditioners	60% or higher	70% or higher
Washing Machines	50% or higher	65% or higher
Dryers	Product added in April 2009	
Refrigerators and Freezers	50% or higher	60% or higher
Cathode ray tube TVs	55% or higher	55% or higher
LCD/plasma TVs	Product added in April 2009	50% or higher

Source: History and Current State of Waste Management in Japan, Ministry of the Environment

[84] http://www.lib.kobe-u.ac.jp/repository/81000054.pdf

[85] "Recycling is defined as "removing parts and materials from used home appliances and reusing them as parts or raw materials for new products or transferring them, with or without charge, to those who will reuse them. "Recycling" includes thermal recovery or using waste as fuel. However, it is currently required to satisfy the designated recycling rates* only in terms of recycling of waste as parts or raw materials of new products. * Recycling rate = Weight of materials recycled / Weight of units treated for recycling" METI, http://www.meti.go.jp/policy/recycle/main/english/law/home.html

Graph 10: Home Appliance Recycling Act - Recycling rates
(actual results from the last three years)



Source: METI, http://www.meti.go.jp/english/press/2015/0623_01.html

In 2012, the Act on the Promotion of the Recycling of End-of-life Small Electronic Devices and Other Electrical Appliances (Small Home Appliance Recycling Act) that targets small electronic and electrical appliances such as mobile phones, digital cameras, hair dryers, etc. was enacted. The main drivers for the implementation of this legislation include the large amount of useful metals contained in these devices (such as iron, aluminium, copper and precious metals) and the risk for health and environment if the waste is not handled properly due to the presence of hazardous metals.

In this scheme, interested parties (consumers, municipalities, retailers, manufacturers, etc.) are encouraged to collaborate to set up together their own waste collection and recycling system. Consumers have to sort and dispose of their waste in accordance with the collection procedures in force in their place of living. Municipalities collect and deliver the waste to recycling operators (including certified operators) who will proceed to the dismantling and crushing of the discharged products and then deliver the sorted materials to business operators (e.g. metal refineries to recover metal). The recovered and recycled materials are finally delivered to manufacturers as raw materials to produce new products.

According to a survey conducted by the Ministry of the Environment in May 2014, more than 20% of municipalities were not collecting waste home appliances and did not plan to do so (40% of

municipalities answered that they do)[86]. The government collected around 24,000 tons of end-of-life products in fiscal year 2013 and targets 140,000 tons for this fiscal year[87].

As the legislation concerning Small Appliances came into force recently (April 2013), only few data is currently available and it is difficult to draw any conclusion yet about its effectiveness or areas of improvement.

Personal Computers recycling began on October 1st 2003, based on the "Act for Promotion of Effective Utilization of Resource". Prior to this date, the collection and treatment of used PC was managed by local authorities. Under the new system, manufacturers themselves collect used PCs and make effective reuse of their parts and materials. The recycling of PCs purchased before the start of the PC recycling program are subject to a "collection and recycling fee", to be borne by the user. Used PCs that cannot be collected by any manufacturer, can be collected and recycled, for a fee, by PC 3R Promotion Association[88].

ii. Current issues in Japan related to e-wastes

E-wastes are an opportunity and a challenge at the same time. Indeed, as they contain valuable resources, such as precious metals (gold, etc.) that are essential for high-tech products, they can be considered as "urban mines" [89]. Taking into account that access to resources is becoming more competitive due to an increase in the global demand and the scarcity of these materials, recovering materials from waste could be a strategic asset. On the other hand, e-wastes also contain toxic materials (such as heavy metals and chemicals) that are harmful for the environment and human health.

Illegal dumping[90]

To avoid paying the recycling fees, waste home appliances are sometimes dumped illegally.

122,000 units were disposed illegally in 2000 (the year before the Home Appliance Recycling Act became effective) and a sharp increase (+40%, 175 thousand units) has been observed after the Act came into effect. Recently, the level is just above the pre-enforcement level. However, when compared to the total generation of used home appliances, the rate of illegal dumping remains rather low (0.51% for 2011)[91].

[86] "Japan recyclers help on 'urban mining'", Nikkei Asian Review, April 20, 2015
[87] "Japan recyclers help on 'urban mining'", Nikkei Asian Review, April 20, 2015
[88] PC 3R Promotion Association http://www.pc3r.jp/e/index.html
[89] http://eurobiz.jp/2013/10/urban-mining/ ; http://cordis.europa.eu/event/rcn/141741_it.html
[90] http://www.lib.kobe-u.ac.jp/repository/81000054.pdf
[91] EPR-based Electronic Home Appliance Recycling System under Home Appliance Recycling Act of Japan, Hotta, Santo and Tasaki

Illicit export of e-scrap

It is estimated that more than 50%[92] (or roughly 2/3[93]) of the targeted waste home appliances are collected and recycled according to the provision of Act. Around one third is exported to foreign countries (mainly developing countries) as used items, scrap or resources. This represents for Japan a loss of resources and concerns are strong about the proper treatment of the waste products in these countries.

Recycling fees

The disposal fees of the appliances have drastically increased since the implementation of the new recycling law. A lack of transparency regarding the usage of recycling fee revenues is pointed out in reports on the topic[94].

Limit of the technology

The current technology seems to be insufficient and/or with a weak economic viability.

New waste types: solar panels

Following the Fukushima nuclear disaster and the introduction of the Feed-in Tariffs (FiT) in July 2012, renewable energy - and photovoltaic (PV) in particular – have been booming in Japan. More and more solar panels have been installed across the country, on private rooftops as well as newly built power plants. According to a Bloomberg survey[95] Japan may install up to 12.7 gigawatts of solar power in 2015, world second after China.

This growth will lead to a sharp rise of waste once these panels have reached the end of their life (the average lifespan is about 25 years). According to a working group set up by the Japanese Ministry of Environment, the quantity of PV modules that could end up in landfills is expected to increase progressively: from 2,400 tons by the end of this fiscal year (March 2016) rising to 28,000 tons by 2030 and finally around 770,000 tons by 2040, accounting thereby for six percent of all waste in Japan[96].

Currently, used solar panels are handled as industrial wastes and most of them are disposed of in landfill since there is no framework or system in place to recycle old modules.

[92] EPR-based Electronic Home Appliance Recycling System under Home Appliance Recycling Act of Japan, Hotta, Santo and Tasaki
[93] E-Waste Management in Japan: a focus on Appliance Recycling, F. Yoshida and H. Yoshida
[94] EPR-based Electronic Home Appliance Recycling System under Home Appliance Recycling Act of Japan, Hotta, Santo and Tasaki and "E-Waste Management in Japan: a focus on Appliance Recycling", F. Yoshida and H. Yoshida
[95] http://www.bloomberg.com/news/articles/2015-05-18/get-ready-for-solar-boom-from-china-plants-as-asia-demand-swells
[96] http://www.japantimes.co.jp/news/2015/06/23/national/770000-tons-of-solar-panels-to-end-up-in-garbage-in-2040/

The proper treatment of used solar panels is necessary for environmental as well as economic reasons. Solar panels are mostly made of glass (about 70% of the weight) but also contain valuable components, such as cooper and silver, as well as substances hazardous to the environment, such as lead and selenium. Moreover, according to the calculation of the study group, the costs from having to remove PV panels from landfills could outweigh the economic benefits of the energy resources gained during their lifetime.

To handle this situation, the Ministry of Environment together with the Ministry of Trade, Economy and Industry, and industry organizations intend to establish guidelines and implement measures for "removal, transportation and processing of solar power generation equipment."[97] by the end of this fiscal year (March 2016).

Apart from recycling, another suggestion of the study group was to encourage (domestic) manufacturers to develop more environmental friendly manufacturing processes that require less lead or selenium.

d. PCB waste

Polychlorinated Biphenyl (PCB) were very popular for various industrial use due to their properties. In the 1970s researches revealed their dangerousness on human health so that they got gradually banned and existing stock have to be destroyed.

PCBs fall under the scope of three of the most important international legally binding instruments on chemicals and wastes: the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and the Stockholm Convention on Persistent Organic Pollutants.

i. Historical Background and Evolution of the Legislation

Following the outbreak of the Kanemi Oil Poisoning disease in 1968, the Japanese Government decided to stop the production and distribution of PCB in 1972. From 1973, all the 39 attempts from the private sector to install treatment facilities (incinerators) were rejected from the local population, mainly due to the fear of toxic gas emissions. Meanwhile stored PCB waste started to go missing. In 2001, UNEP adopted the "Stockholm Convention on Persistent Organic Pollutants (POPs)" and the

[97] http://www.pv-tech.org/news/japan_to_implement_solar_module_recycling_and_recovery_measures

same year Japan enacted the "Law Concerning Special Measures for Promotion of Proper Treatment of PCB wastes" (known as "PCB Special Measures Law"). This law set a deadline[98] for the treatment of all PCB wastes (initially by July 2016 but it has been extended to 31st March 2027 in the 2012 revision). Additionally, PCB waste holders must report every year to prefectural government the quantity and weight of stored and treated PCB waste. Finally, assignment or transfer of PCB waste is strictly restricted.

The Japan Environmental Storage & Safety Corporation (JESCO)[99] has been established in 2004 and runs five regional PCB waste treatment facilities throughout Japan[100] to handle pure PCB wastes. New treatment methods by decomposition instead of incineration have been developed to be accepted by the population.

Regarding low-level PCB wastes, no special provision has been taken in the initial stage of the PCB Special Measures Law. At that time, the only known low-level wastes were contaminated transformers of electricity poles of utility companies. As these companies had the capacity to treat the waste by themselves and were in the stage of constructing facilities, the Basic Plan merely stipulated that these contaminated wastes had to be treated by the utility companies themselves. Only after establishment of the law, it turned out that there were other types of PCB contaminated waste, that the amount was huge (almost the same as transformers on the poles) and that many of these waste holders had not the capacity to treat the wastes by themselves. Consequently, the government took measures for these low levels in 2009. Low-level PCB wastes have been integrated into the Waste Management and Public Cleansing Law (they do not enter into the scope of the PCB Special Measure Law) and a certification system has been implemented so that private companies approved by MoE can treat low-level PCB wastes.

ii. Threshold (graduation standard)

To consider an equipment as treated, most countries apply the international standard of 50 ppm but remain free to set a lower limit. Japan has set the limit at 0.5 ppm which is the lowest in the world.

When taking the decision, government officers recognized that 0.5 ppm was too low and some experts advocated that 2 ppm would be reasonable. However, the local people continuously negotiated for a lower rate and as the situation remained blocked for 30 years, the government had no choice but to accept a very low threshold to be able to start operation. As the process is in its final stage now, this

[98] The Stockholm convention set 2028 as deadline for the elimination of all PCB wastes
[99] http://www.jesconet.co.jp/eg/index.html
[100] Kitakyushu, Toyota, Tokyo, Osaka and Hokkaido

rate will not be discussed anymore.

iii. Outline of the system

High-concentrated and pure PCB wastes

JESCO (Japan Environmental Storage & Safety Corporation) is a private sector company, which has been established by law and founded by the government. Its staff is composed of people employed by JESCO, dispatched from other private companies, and dispatched from national/local governments. JESCO is in charge of the treatment of high-concentrated (over 5000 ppm) PCB wastes and since 2014 carry out the interim storage related activities in Fukushima Prefecture. As the scope of action is defined by law, JESCO cannot expand or revise its business activities without a revision of the law. There is currently no plan to modify the scope related to the PCB activity.

Low level PCB wastes

Low level PCB wastes (0.5 to 5000 ppm) are out of the scope of JESCO but handled by 20-30 private sector facilities approved by the government[101]. JESCO itself consigns such facilities for the low-level PCB wastes generated in their facilities.

The Waste Management and Public Cleansing Law lists seven possible processes: Incineration, Dechlorination, Hydrothermal oxidization decomposition, Reduction and Thermochemistry decomposition, Photodisintegration, Plasma decomposition and Cleansing. If a company is considering another process, the technology has to be authorized beforehand by MoE. The authorizing procedure is handled under a specific committee constituted by scientific experts.

Approved operators mostly opt for incineration or cleansing. Cleansing methods have been introduced quite recently. Kanden Engineering was the first company approved for cleansing in May 2014. As of September 2015, six companies have been approved for cleansing. Presently, the cleansing process is performed by mobile units. This method enables on-site cleaning of large polluted transformers that are difficult to transport. Although also applicable to small transformers or capacitors, this process is not appropriate for such products. It seems that a fixed cleansing facility, capable of treating small to big transformers and capacitors, might open in the near future.

An outline of the procedure of certification is provided in annex 7. The Japan Industrial Waste Management Foundation (WMF)[102] provides a secretary service regarding the application. The approval decision is taken by MoE, assisted by a special committee composed of experts for the

[101] http://www.env.go.jp/recycle/poly/confs/tekisei/14pcb/ref06.pdf
[102] http://www.sanpainet.or.jp

technical aspects.

Export

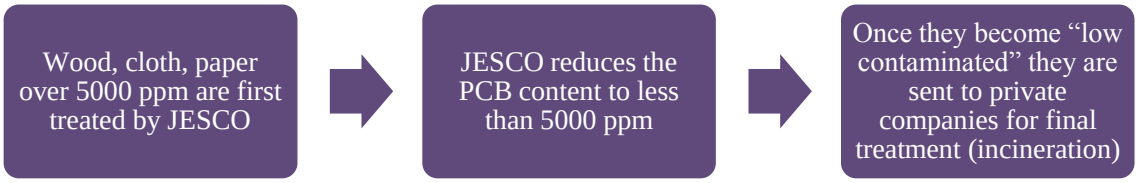
According to Japanese Waste Management and Public Cleansing Law waste must be treated domestically and export of PCB wastes is strictly prohibited, whatever the level of concentration. As the government took the commitment to treat all PCB wastes in Japan and will take all the necessary measures to achieve this objective in due time, exporting to treatment facility abroad is not perceived as necessary.

iv. Treatment costs

JESCO displays its price list on its website[103]. Outsiders usually believe that the low threshold is the reason for the high costs but JESCO points out that it is a misunderstanding. According to JESCO, the high costs are mainly due to the treatment method (chemical decomposition) and the high standard for safety measures, such as exposure management or the prevention of evaporation during the pre-treatment stage. JESCO has to put much effort in safety, regulation and control management in order to meet the expectation of the local residents who require the disclosure of any information, even in case of leakage within the facility.

In addition, the treatment of elements such as wood, paper, cloth, etc. impregnated with PCB oil used to be also a source of high costs as these products are more difficult to handle than other PCB wastes (transformers, capacitors). However, thanks to a new organization of the process, involving private companies to handle low contaminated waste, the treatment of this category became recently easier and cheaper.

Figure 13: Outline of the new system for the treatment of some PCB waste



Source: JESCO

This new structure only applies to wood, cloth, and paper. Metal, iron, and ceramic are still treated by JESCO from high level to 0.5 ppm as they are easy to handle and can be sold to material recyclers after

[103] http://www.jesconet.co.jp/customer/pdf/ryokinleaf150401.pdf

treatment.

As low-level PCBs wastes are handled by private companies, no standard price list is available. However, the fees for the treatment of low-level PCB wastes are said to be much cheaper compared to those of JESCO. In addition, due to the increasing number of competitors on the market, the price is decreasing and is expected to decline further. As reference only, the price list published by the Ehime Prefectural Waste Disposal Center in April 2014 mentioned 116,600 JPY/kL for waste oil and 800 JPY/kg for transformers or capacitors.

v. Future perspectives

End of July 2015 a working group has been created to discuss the current issues, especially the identification of all equipment containing PCB and the processing of all PCB wastes[104]. In the first case, an estimation based on a survey led in Kitakyushu city considers that around 10% of the high-level PCB waste is currently unidentified. This figure includes equipment containing PCB that are still in use. This issue is even more problematic in case of contaminated equipment as it would imply checking the level of all the possible equipment and in some cases it would lead to stopping the operations of plants which would be very expensive. Regarding the processing of all the PCB wastes, it seems that some holders are reluctant to consign their waste due to their limited financial capacity. The conclusion of the subcommittee are expected to be submitted to the main committee by the end of this year and it may result in a revision of the law or an action plan for the government.

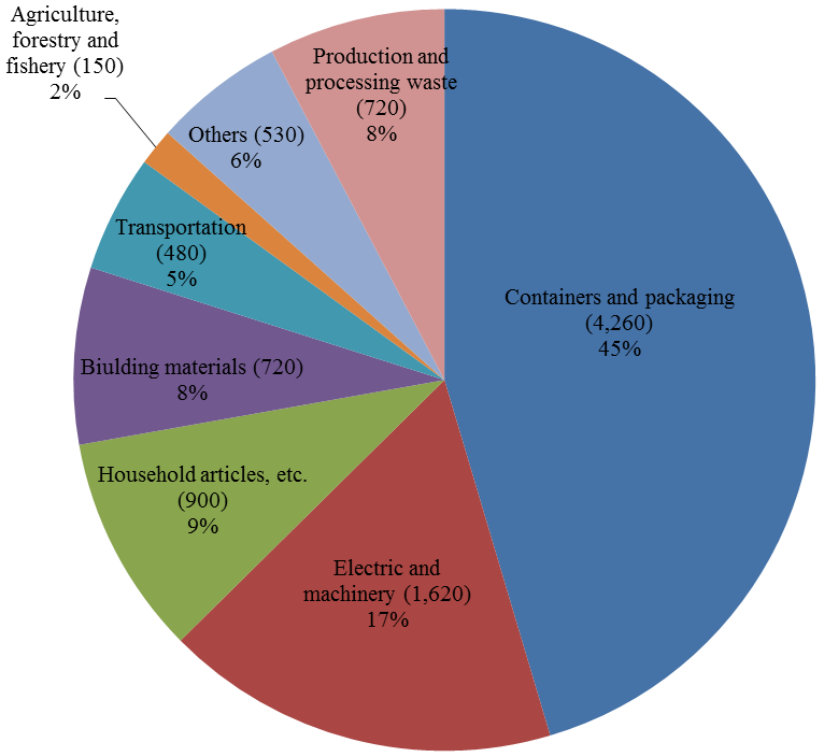
e. Plastic waste

Plastics are widely used in the contemporary society but most plastic material originates from limited resources. In Japan, plastics are made from naphta (crude gasoline) produced by refining crude oil. PWMI estimates that in 2011, 11220 kt (thousand tons) of naphta was used in the production of plastic materials. Approximately 6% of combined crude oil and imported naphtha consumed annually serves to create plastic products. In 2012, over 40% of plastic production was used in film and sheets (including bags, packaging and sheeting for construction and building materials)[105].

Yearly disposal of waste plastics in Japan is roughly estimated at 10 million tons/year. For 2013, PWMI reports 4540 kt of domestic (general) plastic waste and 4860 kt industrial plastic waste.

[104] Statistics available in Japanese: http://www.env.go.jp/recycle/poly/confs/tekisei/14pcb/mat01.pdf
[105] An Introduction to Plastic Recycling 2013, Plastic Waste Management Institute

Graph 11: Breakdown of total plastic waste by field



Source: PWMI Newsletter nr 44, 2015.4, Plastic Waste Management Institute

Containers and packaging represent almost 70% of domestic waste, while Electric and Machinery (28.6%), Container and package (22.4%) and Production and processing waste (14.8%) are the main generators of industrial waste[106].

Technological development has been very active in the industrial and research sectors and the number of patents grew significantly from 1990 to 2000. The main drivers were landfill shortage and the need for Energy Intensive Industries (EIIs) such as iron/steel, cement, and chemical industries to develop new technology and businesses[107]. Presently, plastic can be recycled through various methods. LCA is used to determine which method is the most appropriate taking into account various factors (overall impact on the environment, type of plastic, etc.).

[106] PWMI Newsletter nr 44, 2015.4, Plastic Waste Management Institute
[107] BDC Vol. 13, 1/13 print ISSN 1121-2918, electronic ISSN 2284-4732

Table 7: Three forms of recycling

Category in Japan	Method of Recycling		Method of recycling category in Europe
Material recycling	Recycling to make: Plastic raw materials Plastic products		Mechanical recycling Recycling to make: Plastic raw materials Plastic Products
Chemical recycling	Monomerization		Monomerization Feedstock recycling
	Blast furnace reducing agent		
	Coke oven chemical feedstock recycling		
	Gasification	Chemical feedstock	
	Liquefaction	Fuel	
Thermal recycling	Cement kiln		Ernergy recovery
	Waste power generation		
	RPF, RDF		

Source: Plastic Waste Management Institute (PWMI), An Introduction to Plastic Recycling 2013

Material or Mechanical Recycling (= production of new plastic using plastic waste as a raw material) A large proportion of the plastic recycled through mechanical recycling comes from industrial plastic waste due to its quality, homogeneity and availability in large quantity. HH plastic wastes contain various plastic types and the constant evolution of the properties of the packaging, in order to follow consumers' way of life (such as plastic that can go to microwave for bento, etc.), makes material recycling more difficult. Nevertheless the Container and Packaging Recycling Law and Home Appliance Recycling Law have driven the material recycling method for household's plastic waste. In FY2014, 50.6% of the 669,620 tons of plastic recycled through JCPRA has been material recycled[108].

A further hurdle for the material recycling of HH plastic waste is the limited potential of the recycled material. For safety and hygienic reasons, packaging with food contact, which account for a large part of the plastic packaging used, has to be virgin and cannot not be of recycled origin. Used plastics emitted from home thus become textile products, packaging material (but only packaging that do not come into contact with food), stationery, etc. which have less value. However, a "PET bottle - to - PET bottle" scheme has been recently developed in which a layer of recycled plastic is slipped between two layers of virgin plastic, the recycled part being thereby not in direct contact with the beverage. This process might foster demand for recycled plastic.

[108] JCPRA

Chemical recycling

The usage of plastic waste as reducing agent in the blast furnace process is based on a dehydrochlorination method developed by a group of Japanese stakeholders of the plastic industry (PWMI, Japan PVC Environmental Affairs Council, Vinyl Environmental Council and JFE Steel Corporation (formerly NKK) at the request of NEDO).

The liquefaction method is rather uneconomic and associated with risk of ignition or explosion so that it is almost abandoned and companies have withdrawn from the market.

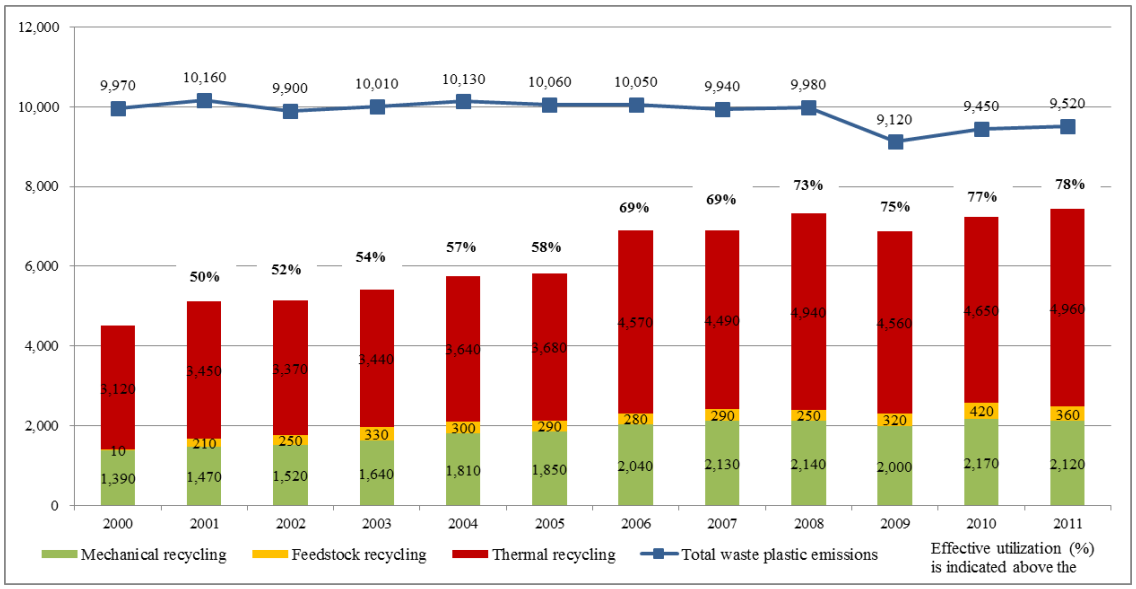
Thermal recycling (incineration)

Incineration was first restricted due to the emission of toxic substances but as the technologies evolved and became safer, the Waste Disposal Law was revised in May 2005 to stipulate that "first, emission of waste plastic should be reduced, after recycling should be promoted; any remaining waste plastic should not go to landfill as it is suitable for use in thermal recovery." In June 2006, an amendment of the Container and Packaging Recycling Law was adopted to include, under certain limit, RDF and other forms of thermal recycling as recognized recycling method in addition to material recycling, feedstock recycling and thermal recycling through liquefaction and gasification. Since then, the recycling of plastic through the thermal method has been increasing, all the more so that plastic, and more specifically polyethylene, polypropylene and polystyrene have high calories making waste plastics a valuable fuel. In addition, the demand for refuse paper and plastic fuel (RPF) as an alternative fuel to oil has been increasing among pulp manufacturers.

According to the Plastic Waste Management Institute, Japan has achieved an effective plastic utilization rate of 82% in 2013, a figure on constant rise[109].

[109] PWMI Newsletter nr 44, 2015.4, Plastic Waste Management Institute

Graph 12: Trends in quantity and rate of effective utilization of plastic waste



Source: Plastic Waste Management Institute (PWMI), An Introduction to Plastic Recycling 2013

4. Waste as energy source

Japan is poor in fossil energy and highly depends on import. Nuclear seemed to be a solution but in the aftermath of the tsunami and following Fukushima disaster, Japan had to review its energy policy in depth. Securing long-term energy supplies has become a top priority issue for Japan and the promotion of renewable energy is part of the new policy[110].

Waste can be transformed into energy either through biological treatment or incineration. This part will first depict the (renewable) energy market in Japan with a focus on bioenergy (biomass, biofuels, biogas[111]) and then show how incineration plants added energy recovery features to their initial purpose of waste treatment.

a. Renewable energy in Japan

Renewable energy (RE) sources are considered as a solution to respond simultaneously to several challenges. From an environmental perspective, it helps reduce greenhouse gas emissions and fight against global warming. From a social point of view, the awareness and concerns of the population towards the impact of conventional energy sources on the environment and their potential dangers for human health are growing, especially since Fukushima. Finally, from an economic perspective, the raw "materials" (sun, wind, etc.) for renewable energy are, unlike most conventional energy sources, available onsite (no import required) for free and the cost of producing energy from renewable energy sources is expected to decrease in the future[112].

Bioenergy has some specific characteristics compared to other renewable forms of energy such as solar, wind or hydro. First, the "raw material" has to be produced and/or collected with its afferent costs while the primary resource for the other forms (sun, wind, water) is available for free. Secondly, the feedstock is subject to controversy due to the competition with others uses (i.e. energy vs. food, feed or fibre) and the impact of the production. To this regard, waste as raw material is generally accepted more easily by the population. Finally, the generic term of biomass covers a wide variety of raw materials whose physical and chemical properties vary significantly. From this perspective, the

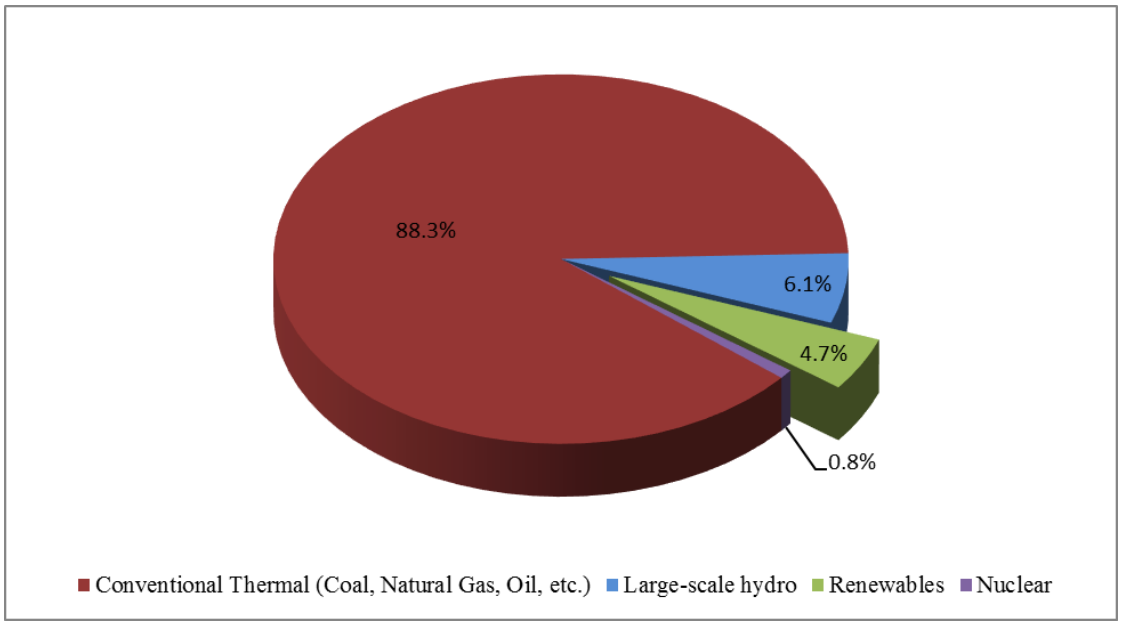
[110] FY2012 Annual Report on Energy, (Energy White Paper 2013) Outline
http://www.meti.go.jp/english/report/downloadfiles/2013_outline.pdf
[111] Definitions from http://europa.eu/rapid/press-release_MEMO-15-5181_en.htm#_ftn6
"Biomass is derived from different types of organic matter such as energy plants and forestry, agricultural or urban waste. Biomass can be used for heating, cooling, producing electricity and transport biofuels.
Biofuels and bioliquids originate from renewable resources using biomass. They are currently mostly processed from agricultural crops or plants. Second generation biofuels are being developed from cellulose biomass feedstock.
Biogas can be produced from organic waste through anaerobic fermentation and obtained from landfill gas. It can be used to produced heat, electricity or in vehicles adapted to run on natural gas."
[112] Report EREC

heterogeneity of waste (compared to the homogeneity of other sources such as wood or crops) and variation in supply makes it more difficult to exploit. [113]

i. Energy sources

Fossil fuels are largely dominant in Japan and RE (excluding large-scale hydro) represented less than 5% of overall energy generation in Japan in 2013. Large-scale hydro alone amounts even more as RE in total.

Graph 13: Overall energy generation in Japan, in FY2013, by source



Source: JFS, http://www.japanfs.org/en/news/archives/news_id035258.html

[113] For more information about Clean Energy in Japan, please refer to the report of Mr S. Lambrecht:
http://www.eu-japan.eu/sites/eu-japan.eu/files/clean-energy-paper-27feb-finale.pdf
For a focus on solar, please refer to the report of Mr E. Hahn:
http://www.eu-japan.eu/sites/eu-japan.eu/files/reports/MINERVA/PVinJapan_Report_Minerva%20Fellow.pdf

Table 8: Estimated power generation, by type and by proportion of total power generation in Japan (FY2013)

Type of Renewable Energy	Estimated Annual Power Generation Capacity(GWh)	Share of Total (%)
Solar photovoltaic (PV)	13,981	1.27%
Wind	5,201	0.47%
Geothermal	2,596	0.24%
Small-scale hydropower	17,422	1.58%
Biomass	12,524	1.14%
Total	**51,724**	**4.7%**

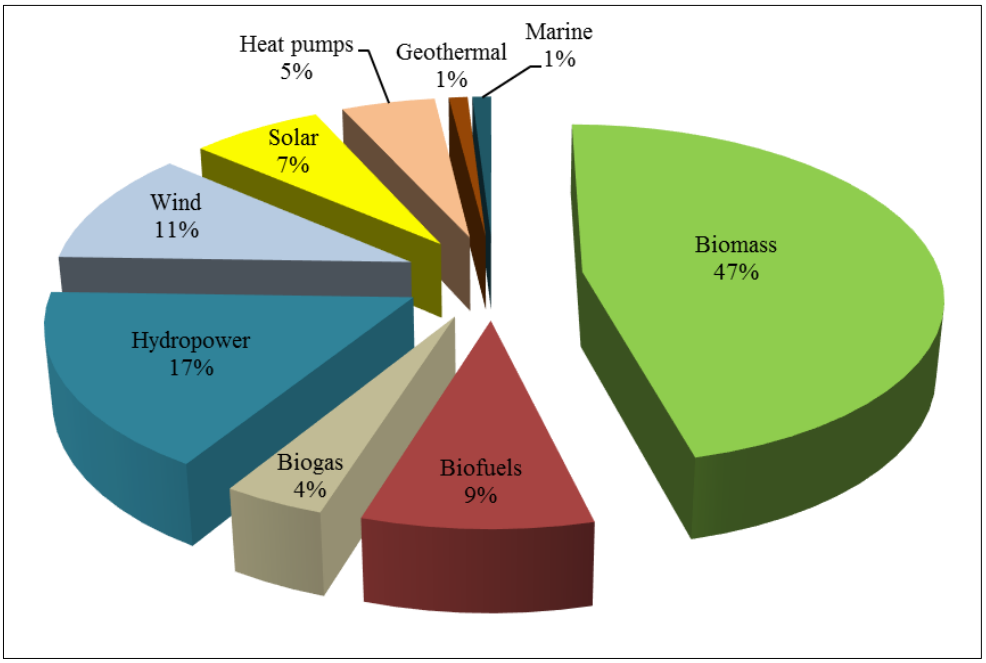
*Note: *Total Power Generation in Japan: renewable energy generation (estimated in the "Renewables Japan Status" report) added to power generation, including major electric power utilities, other electric power producers, and in-house power generation (based on "Energy Data and Modeling Center [EDMC)] data" and the "Statistical Handbook of the Japan Electric Association").*

Source: JFS, http://www.japanfs.org/en/news/archives/news_id035258.html

In comparison, the renewable energy market in Europe is much more developed. According to a progress report[114] on 2020 renewable energy targets published in June 2015 by the European Commission, the renewable energy share of final energy consumption lay at 15.3% in 2014 and 25 Member States are expected to meet their 2013/14 national targets. In terms of sources, biomass accounted for almost the half of the renewable energy sources in 2014.

[114] http://eur-lex.europa.eu/resource.html?uri=cellar:4f8722ce-1347-11e5-8817-01aa75ed71a1.0001.02/DOC_1&format=PDF
http://europa.eu/rapid/press-release_IP-15-5180_en.htm
http://www.biomassmagazine.com/articles/12080/report-highlights-eu-progress-in-reaching-2020-renewables-goals

Graph 14: Projection of the main renewable energy sources and shares in total renewable energy demand in the EU in 2014

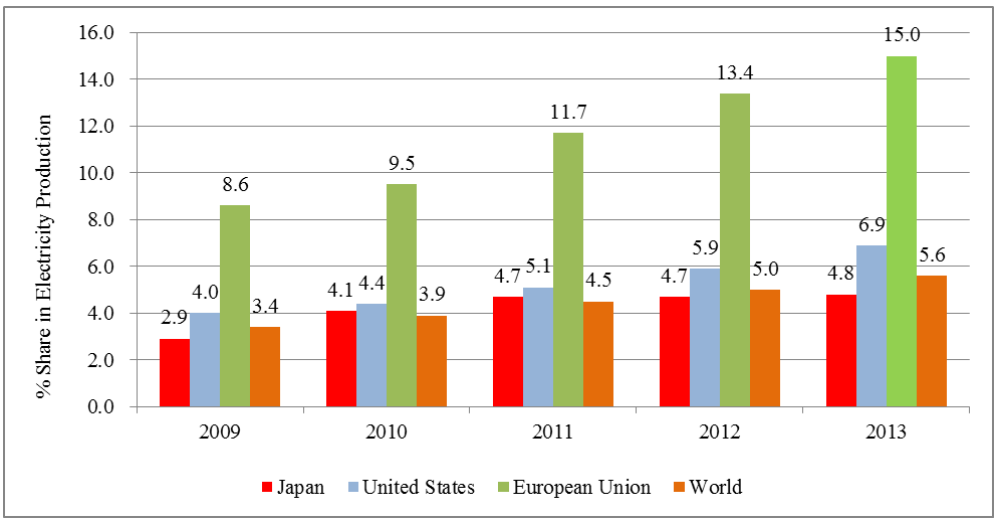


Source: European Commission, http://europa.eu/rapid/press-release_MEMO-15-5181_en.htm#_ftn5

ii. Electricity production

As can be seen on the graph below Europe is clearly the world leader in electricity production through renewable (excluding hydro) while Japan's production is low and increases only slowly.

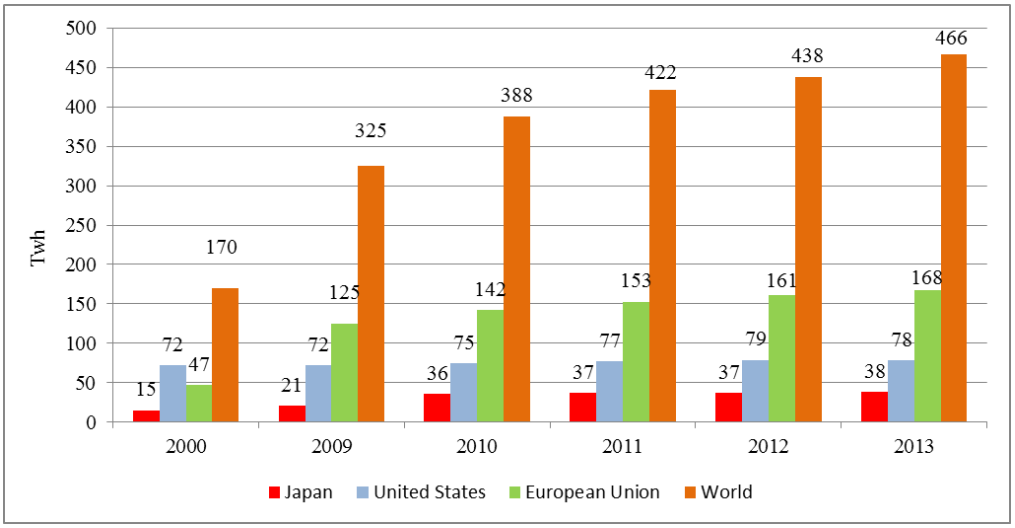
Graph 15: Share of Renewables (excluding Hydro) in Electricity Production



Source: Enerdata - Global Energy and CO2 Data

http://www.enerdata.net/enerdatauk/press-and-publication/energy-news-001/biomass-bioenergy-japan_29798.html

Graph 16: Electricity Production from Biomass



Source: Enerdata - Global Energy and CO2 Data

http://www.enerdata.net/enerdatauk/press-and-publication/energy-news-001/biomass-bioenergy-japan_29798.html

b. Biomass Strategy in Japan

During the Edo Period (1603 – 1867), Japanese society had established a system based on its domestic biological resources completely independent from outside, a closed loop that linked rural areas and cities (farmers growing food, human excreta from cities used in the fields, etc.)[115]. Supporters of biomass refer to this past to promote biomass as a tradition anchored in the Japanese culture.

The Ministry of Agriculture, Forestry and Fisheries (MAFF) has drawn up several plans for the promotion of Biomass[116], including legislation and measures for the parties involved (farmers, municipalities, companies, etc.). In 2002 (revised in 2006), the Japanese Government approved the Biomass Nippon Strategy, a basic national strategy to utilize biomass as valuable resource, in consideration of technology, social system and economy. The Biomass Town program[117] started in 2004 as planned in the Biomass Nippon Strategy. The Basic Act for the Promotion of Biomass Utilization was enacted in 2009. Its purpose was to drive forward biomass utilization through the setting of fundamental principles, national measures and actions that promote biomass usage. The Act also draw up the National Plan for the Promotion of Biomass Utilisation and created the National Biomass Policy Council. The National Plan for the Promotion of Biomass Utilization was approved in 2010. It set up the basic policy to expand the use of biomass and provided government measures. It also defined targets for 2020 from three perspectives: revitalization of rural areas (Municipal and Prefectural Biomass Utilization Promotion Plans), creation of the biomass industry (for 500 billion JPY) and prevention of global warming. The targets 2020 for biomass utilization by type are displayed in annex 8. Further, the Plan fostered research and development of technologies related to biomass, for example advancement of energy collection technologies, including ethanolization and bio-gasification for waste paper or the promotion of ethanolization and bio-gasification technologies for food waste. The Great East Japan Earthquake that stroke in 2011 marked a turn in the energy policy of Japan and the renewable energy market benefited new incentives. The Biomass Industrialization Strategy (2012) was composed of seven initiatives, namely basic strategy, technological strategy, entrance (colleting) strategy, exit (selling) strategy, specific strategies, comprehensive support strategy, and overseas strategy. A "Biomass conversion technology roadmap" that identifies conversion technologies and biomass types for realizing biomass industrialization was drawn up. The "targeted conversion technologies and biomass for industrialization" can be found in annex 8. Further it created an integrated and coordinated scheme that covered all aspects of the biomass industry, and established a stable policy framework to promote investment into biomass related market. In order to support and

[115] JFS: http://www.japanfs.org/en/news/archives/news_id035324.html
[116] MAFF: http://www.maff.go.jp/e/pdf/reference6-8.pdf
[117] See chapter A.5.d.iii

develop the biomass related market, various incentive measures, including for example assistance for R&D or tax reduction have been designed.

c. Feed-in Tariff

In the wake of the accident at the Fukushima Daiichi Nuclear Power Station in March 2011, there was a need to offset the shutdown of the nuclear reactors and the country decided to diversify its energy base.

The system of Feed-in Tariff (FiT) for renewable energy has been introduced by the "Act on Purchase of Renewable Energy Sourced Electricity by Electric Utilities", passed into law in August 2011 and effective from 1 July 2012, in order to encourage the development of renewable energy resources. Under the FiT scheme, electric utility operators are required to purchase electricity generated from renewable sources (Solar PV, Wind power, Hydraulic power, Geothermal and Biomass - Wastes figure in several subcategories of the category "Biomass") at a fixed price over a fixed duration. The METI bears responsibility for determining the purchase price and purchase period for each category of renewable energy at the beginning of every fiscal year (1 April – 31 March). The extra costs incurred are recovered through surcharges to the electricity consumers. The surcharge rate is also settled yearly by METI.

For Fiscal Year 2015, purchase prices related to photovoltaic power continued to decrease. In the category "Biomass", the sub-category "Wood (unused)" (which include for example forest thinning) has been divided into two to distinguish facilities that generate "less than 2,000 kW" and those who generate "2,000 kW or more" electricity. The category "less than 2,000 kW" is granted a higher purchase price (40 yen/kWh vs. 32 yen/kWh). The purchase prices of the other renewable energy sources (land-based wind power, offshore wind power, geothermal power, small and medium hydropower, and biomass except unused wood biomass) remained stable. The complete FY2015 list of purchase prices is displayed in annex 9.

Even if several European countries foster the use of renewable energy through schemes like FiT there is no European purchase list and every country handles it independently. According to stakeholders, the Japanese tariffs for biomass are considered as the best in the world.

d. Incineration

Historically, incineration has been the main waste treatment method due to a lack of space for landfills and the obligations to treat waste locally. The primary objectives were therefore volume reduction and easy disposal process rather than energy recovery. It resulted in many small-scale plants for the use of individual municipalities, which made the generation of electricity or recovery of heat uneconomic. However, with the promotion of "thermal recycling", modern Waste-to-Energy plants are now incentivized to recover energy. Most of them now use the electricity generated by waste incineration to run the plant and sell the surplus to power supply companies.

Table 8: Waste incineration plants, as of March 31, 2014

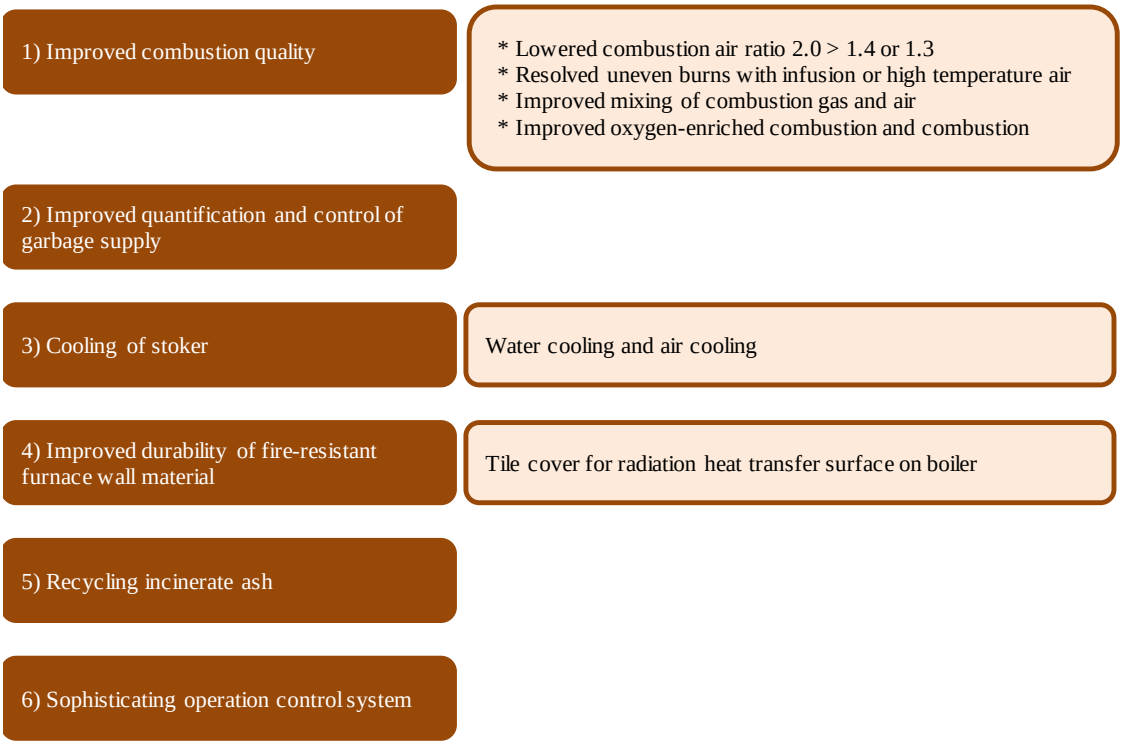
	FY2013	FY2012
Number of plants	1,172	1,189 (-1.4%)
Capacity	182,683 tons/day	184,426 tons/day
Capacity per plant	156 tons/day	155 tons/day
Number of plants using residual heat	778	781
Number of plants with power generation facilities	328 (28.0% of total)	318
Total power generating capacity: (in previous year)	1,770,000 kilowatts	1,754,000 kilowatts (+0.9%)

Source: Municipal solid waste emissions and disposal in FY2013, MoE
https://www.env.go.jp/press/files/en/fy2013.pdf

The technology is in some cases of European origin, imported by Japanese companies who bought the licence and adapted it to the Japanese market. Japanese incineration facilities use several incinerating methods: stoker furnaces, fluidized bed furnaces and gasification fusion resource furnaces with the objective of ash recycling. Stoker type represents 70%[118] of all furnaces and still knows significant improvement including technologies to reduce toxic emissions and to improve heat recovery to create a system which generates efficiently clean electricity.

[118] Solid Waste Management and Recycling Technology of Japan (February 2012), MoE

Figure 14: New-generation incinerators (improvement and objective)



Source: Solid Waste Management and Recycling Technology of Japan (February 2012), MoE

Low air incineration that aims for high-efficiency power generation figures among the newest stoker furnace technology[119].

The modernization of installations has improved energy recovery from municipal waste incineration. However, Japan is still very far from European's records[120]. One of the reasons of the poor results is the small size of the facilities in Japan. In addition, most of the heat is lost due to the housing infrastructure in Japan that makes it not possible to deliver the heat generated. As a matter of fact, central/district heating is not widespread as in Europe and generally every single housing possesses its own individual heating/cooling appliance. In that context, only facilities located nearby the waste incineration plant (typically municipal pools) can be supplied with heat.

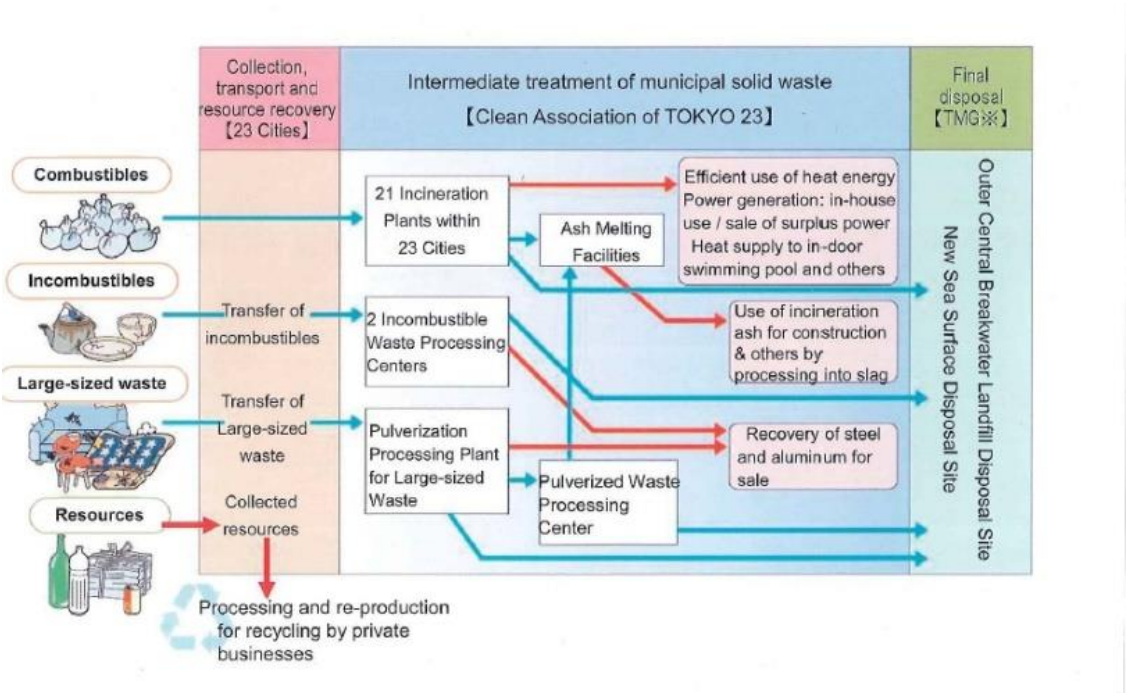
[119] Solid Waste Management and Recycling Technology of Japan (February 2012), MoE
[120] ISWA, Waste-to-Energy Working Group

5. Concrete examples of waste management in Japan

a. "Tokyo Model": Clean Authority Tokyo (CAT23)

In 2000, the Municipal Solid Waste (MSW) duty was transferred from the Tokyo Metropolitan Government (TMG) to the 23 Cities of Tokyo. The 23 Cities established together the Clean Association of TOKYO (now called Clean Authority of TOKYO or CAT23) to perform the intermediate treatment (pulverization and incineration) while collection and transport is performed by each city. The final disposal landfill site is owned and managed by TMG (consigned by 23 Cities and CAT23).

Figure 15: Flow of municipal solid waste in 23 cities of Tokyo



Source: Skills & Passion for Clean Environment, Clean Authority of TOKYO

Combustibles

Throughout the 23 cities of Tokyo, there are currently 19 incineration plants in operation and 2 in renovation. There is no plan to increase the number, nor enlarge the capacity.

It takes around nine years for demolition/reconstruction (four years planning and five years demolition/construction). The planning phase consists in dialogue with local residents as well as environmental assessments, cost/impacts evaluation, etc. As the plants are constructed near habitation

areas, understanding and acceptance of the population is crucial. As public facilities, the process is subject to tendering. In practice the construction of plants has been implemented by Japanese construction companies so far but some of the technology used is patented from Europe. The machinery is used as long as possible but some machines do not last as long as the plant itself and need to be replaced. Replacement also occurs to take technical improvements into account.

As seen in the next table, stocker type incinerators are the most spread in Tokyo as it can handle large amount of waste and is more stable.

Table 9: Facilities List of Clean Authority of TOKYO

6. Facilities List of Clean Authority of TOKYO 23cities

(As of December2014)

	Plant name	Date completed	Property area (approx. m²)	Incinerators: Type ※1		Scale (Ton x units of incinerators)	Incineration capacity (tons/day)	Maximum designed heating value (kJ/kg)	Power output (kW)	Ash-melting furnace	Supplying heat outside the plant	Stack height (m)
Incineration plants	Hikarigaoka	September 1983	23,000	A	Mitsubishi Martin	150×2	300	11,300	4,000	—	○	150
	Meguro	March 1991	29,000	A	NKK Corp Vølund	300×2	600	11,700	11,000	—	○	150
	Ariake	December 1995	24,000	A	Mitsubishi Martin	200×2	400	14,200	5,600	—	○	140
	Chitose	March 1996	17,000	A	Kawasaki Sun	600×1	600	12,100	12,000	—	○	130
	Edogawa	January 1997	27,000	A	NKK Corp Vølund	300×2	600	12,100	12,300	—	○	150
	Sumida	January 1998	18,000	A	Hitachi Zosen Von Roll	600×1	600	13,000	13,000	—	○	150
	Kita	March 1998	19,000	A	Mitsubishi Martin	600×1	600	12,100	11,500	—	○	120
	Shin-koto	September 1998	61,000	A	Takuma HIN	600×3	1,800	13,400	50,000	—	○	150
	Minato	January 1999	29,000	A	Mitsubishi Martin	300×3	900	13,400	22,000	—	—	130
	Toshima	June 1999	12,000	B	Ishikawajima-Harima Fluidized bed	200×2	400	13,400	7,800	—	○	210
	Shibuya	July 2001	9,000	B	Ebara Fluidized bed	200×1	200	13,400	4,200	—	—	150
	Chuo	July 2001	29,000	A	Hitachi Zosen Von Roll	300×2	600	13,400	15,000	—	○	180
	Itabashi	November 2002	44,000	A	Sumitomo W+E	300×2	600	12,100	13,200	AC arc	○	130
	Tamagawa	June 2003	32,000	A	Ishikawajima-Harima Rotary stoker	150×2	300	12,100	6,400	Rotary surface melting	○	100
	Adachi	March 2005	37,000	A	Ebara HPCC	350×2	700	12,100	16,200	Plasma melting※2	○	130
	Shinagawa	March 2006	47,000	A	Hitachi Zosen Von Roll	300×2	600	12,100	15,000	Fixed surface torch	○	90
	Katsushika	December 2006	52,000	A	Takuma SN	250×2	500	12,100	13,500	Plasma melting	○	130
	Setagaya	March 2008	30,000	C	Kawasaki Fluidized bed	150×2	300	12,100	6,750	Plasma melting	○	100
	Ota	September 2014	92,000	A	Takuma SN	300×2	600	14,800	22,800	—	—	47

Nerima and Suginami incineration plants are currently not under operation due to renewal of the facility.

※1 Incinerator types
A — Stoker type (Full continuous combustion)
B — Fluidized bed type (Full continuous combustion)
C — Gasification melting furnace (All continuous operation)

※2 Adachi incineration plant stops operation of its ash-melting furnace.

	Name of facility	Date completed		Type of equipment	Scale
Chubo	Chubo Incombustible Waste Processing Center Plant 2	October 1996	◎	Hitachi Zosen Transverse-rotary horizontal hammer mill	48t/h x 2 units
	Pulverization Processing Plant for Large-sized Waste	June 1979	×	Kyokuto Kaihatsu Kogyo Transverse-rotary vertical hammer mill	27t/h x 2 units
	Pulverized Waste Processing Center	July 1962	×	Ebara Fluidized bed	180t/day x 1 furnace

※Chubo Ash-melting facility currently stops its operation.

	Name of facility	Date completed		Type of equipment	Scale
Ota Plant	Keihinjima Island Incombustible Wastes Processing Center	November 1996	◎	Kyokuto Kaihatsu Kogyo Transverse-rotary vertical hammer mill	8t/h x 4 units

	Name of facility	Date completed		Type of treatment	Scale
Shinagawa Plant	Shinagawa Cleaning Facility (Night soil facility)	January 1999	○	Dilution (reduced water and chemicals)	100t/day

◎ Processing plant for incombustible waste
× Processing plant for large-sized waste
○ Processing plant for night soil

Source: Waste Report 2015, Clean Authority of TOKYO

The electricity and heat produced by incineration are used within the plant to operate the facility. Surplus electricity is sold to power companies while heat is sold to heat supplying company or provided free of charge to heat public facilities in the vicinity of the incineration plant (pools, etc.). According to the Waste Report 2015, the amount of electricity sold is equivalent to approximately 159,000 average households (assuming that one household uses 3,600 kWh per year)

Table 10: Beneficial use of heat for FY2013

Total generated power	1,130.1 million kWh
Electricity sold	571.6 million kWh
Income from electricity sold	9,804.3 million yen
Supplied heat (charged)	547,000 GJ
Income from heat sold	183.2 million yen

Source: Waste Report 2015, Clean Authority of TOKYO

The bottom ash used to be further treated into slag but some of the facilities are closing[121] since the Tohoku Earthquake as part of energy saving measures. Instead of producing slag, the power generated by waste incineration is distributed in the grid for public usage and trial projects have been implemented to use the bottom ash in cement for the construction sector[122].

Incombustible wastes are processed in one of the two incombustible waste processing centers (CHUBO Incombustible Waste Processing Center and the Keihinjima Island Incombustible Waste Processing Center). After pulverization and separation, ferrous metals and aluminum are recovered as resource while the rest is landfilled.

Large-sized wastes are first separated manually into combustible and incombustible wastes. After pulverization and separation, ferrous metals are recovered as resource. The remaining pulverized waste is incinerated or landfilled.

Landfill: A New Sea Surface Disposal Site is currently under construction. It is considered as the last site available in Tokyo and is expected to last only 50 years. In order to reduce the amount disposed of in landfill, one alternative currently under trial is to use bottom ashes in the construction industry to produce cement. However, this solution comes with additional costs for the treatment, transport and

[121] Only 3 out of 7 are still open and only 2 will remain
[122] http://www.union.tokyo23-seisou.lg.jp.e.de.hp.transer.com/kanri/haiki/kumiai/oshirase/sementogenryouka.html

management.

Together with the municipalities, CAT23 also endeavors to "educate" Tokyo residents, for example by organizing visits of the incineration plants or editing brochures, in order to enlighten them about the benefit of a sustainable society and encourage them to cooperate with the local governments (correct sorting, etc.).

A further mission of CAT23 is to promote the "Tokyo Model" abroad, especially in Asia. In cooperation with JICA, MoE, municipalities, private sector, etc. it organizes and/or participates in workshops, seminars and other activities to present what it has achieved. As recognition of its accomplishments, CAT23 ended finalist of the Davos Competition "The Circulars", category "The Ecolab Award for Circular Economy Cities & Regions"[123], that rewards cities who achieved particularly well in the field of sustainable society.

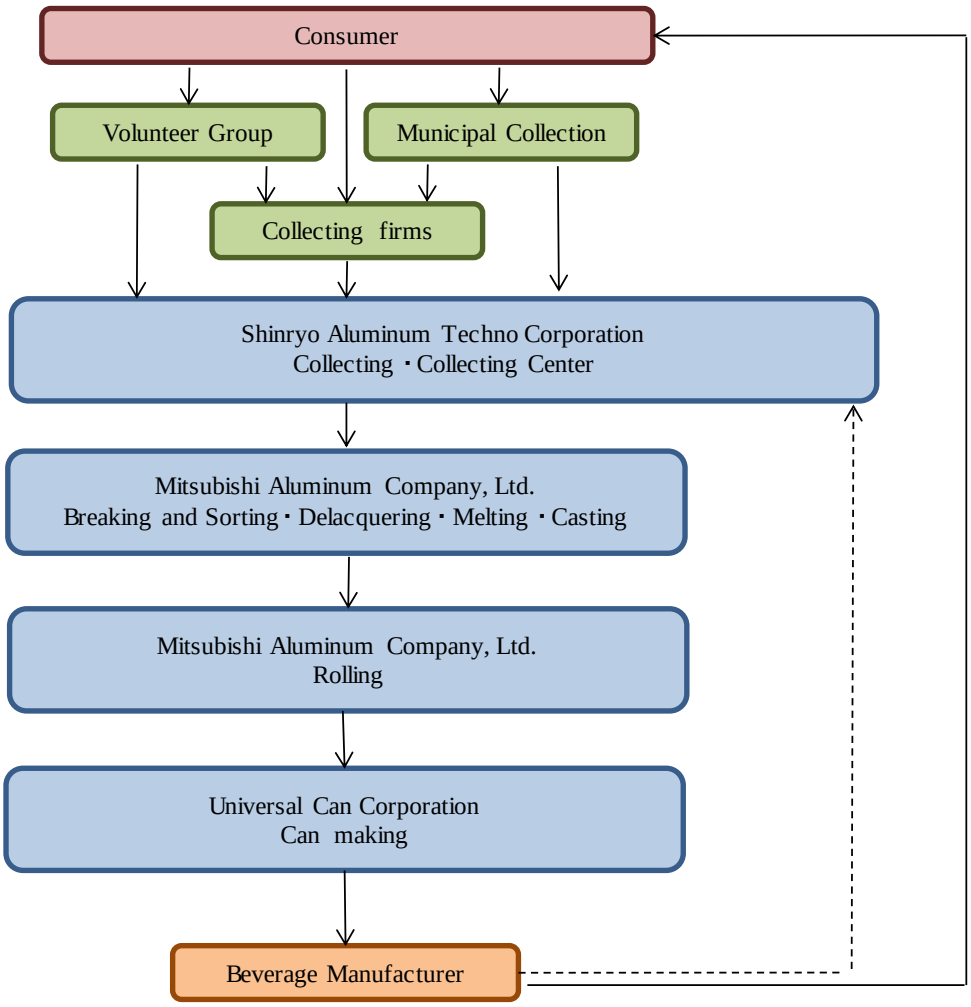
b. Mitsubishi Material Corporation: "Can to Can" recycling system

Mitsubishi Materials Corporation[124] is active in the aluminum can recycling business since the 1970s. In 2001, a plant was built to collect UBC and produce directly slabs for manufacturing new cans. In 2005, Universal Can Corporation was created by integrating the aluminum beverage can businesses of Mitsubishi Materials Corporation (can manufacturing process ranging from aluminum rolling to aluminum can manufacturing and recycling) and of Hokkai Can Co., Ltd. (now Hokkan Holdings Limited) which operations ranged from beverage, food container manufacturing to filling. Shinryo Aluminum Techno Corporation is a subsidiary of Universal Can Corporation.

Along with several Group members, including Universal Can, Mitsubishi Aluminum Co., Ltd., and Shinryo Aluminum Techno Co., Ltd., Mitsubishi Materials Corporation has established a unique integrated system of UBC recycling in which every stage, from manufacturing to recycling, is operated within the Group. Fuji-Oyama plant located in Shizuoka Prefecture is the only one in Japan that uses UBC recycled onsite. UBC become the raw material for new aluminum cans through a repetitive cycle of collection, melting, casting, rolling and production. Scrap resulting from the recycle process is reintegrated, eliminating thereby any loss.

[123] https://thecirculars.org/finalists visited in June 2015
[124] https://www.mmc.co.jp/corporate/en/csr/pdf/CSR2012_01.pdf

Figure 16: Mitsubishi Materials Corporation "Can to Can" recycling system



Source: Al Info 2014 (Universal Can Corporation)

Figure 17: Mitsubishi Material Corporation, Aluminum Recycling Flow

1)	Collecting	Aluminum cans are collected through the joint efforts of volunteers, local authorities and collecting firms.
2)	Collecting Center	Collected aluminum cans are delivered to the collection center.
3)	Breaking and Sorting	After insect control, steel cans and waste are separated out.
4)	Delacquering	Aluminum cans are baked to remove coatings.
5)	Melting	Aluminum cans are melted.
6)	Casting	Melted aluminum cans are cast into slabs for rolling.
7)	Rolling	The slabs are rolled and turned into can stock.
8)	Can making	Can stock is punched out and turned into cans. Once finished cans are printed, they are shipped to beverage manufacturers.
9)	Filling	Cans are filled by beverage manufacturers and shipped to the market.

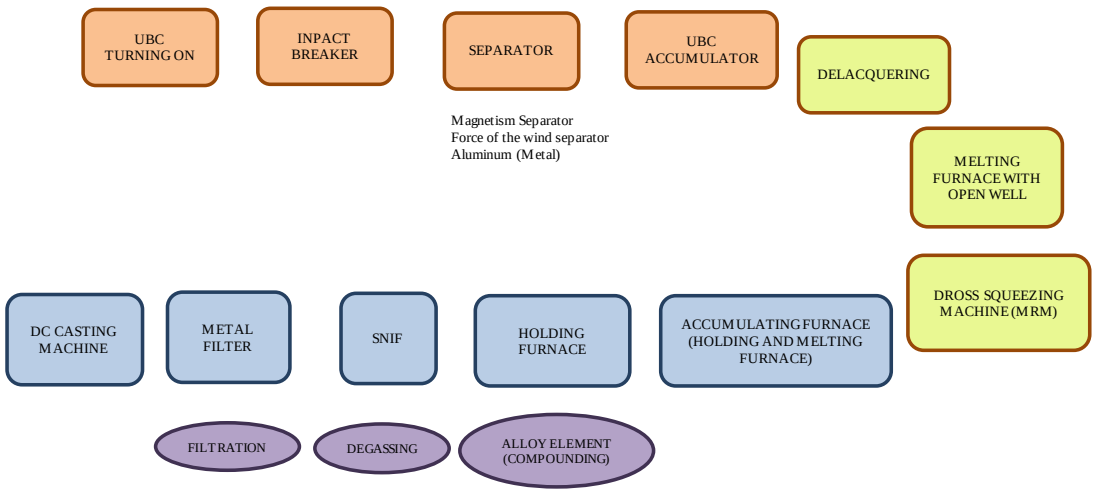
Source:

Image: Universal Can Corporation, Website (http://www.unican.co.jp/en/03/index.html)

Recycling process explanations: Universal Can Corporation, Can for You! Corporate Profile (http://www.unican.co.jp/en/02/pdf/unican2008.pdf)

Aluminum recycling technology has originally been inspired by US manufacturers and adapted for the Japanese market and still today, the US is more a model than Europe. However, the separator machinery is of Italian origin. Machinery for Delacquering and Furnaces (Melting Furnace with open well, accumulating furnace (holding and melting furnace) and holding furnace) are Japanese technology. UBCs total recycling system is Mitsubishi unique technology. Environmental load is evaluated by LCA (Life Cycle Assessment).

Figure 18: Outline of UBC recycle process, flow chart from throwing UBC to casting ingot



Source: Mitsubishi Aluminum Co., Ltd

Considering that there is no aluminum in Japan, that the primary aluminum production from its ore necessitates a huge amount of energy, and that the price of energy in Japan is very expensive, this integrated "can to can" system is at the same time cost saving and environmentally friendly:

- ✓ Energy saving: manufacturing recycled ingots requires approximately 3% of the energy needed to smelt new ingots.
- ✓ CO2 reduction: the process emits 30% less CO2 is emitted than the ordinary processing
- ✓ Closed Loop Recycling: all activities of recycling and manufacturing are performed by companies of the group, granting more independency and stability

In 2005, Mitsubishi Material Group received certification of "Ecoleaf Environmental Label"[125].

[125] "EcoLeaf environmental label uses the LCA method to quantitatively show the environmental information of products through life cycle stages from the extraction of resources to manufacturing, assembly, distribution, use, discarding and recycling." http://www.ecoleaf-jemai.jp/eng/

c. Ishizaka Sangyo Co., Ltd.: Construction waste

Located at Miyoshi-town in Saitama prefecture, the company, Ishizaka Sangyo Co., Ltd., was founded in 1971 by Yoshio Ishizaka. His daughter, Noriko Ishizaka, took over the presidency in 2002.

The plant is specialized in “separation and classification” of mixed industrial waste from construction site (demolition of houses/buildings) from the whole Kanto area and the recovered materials are then sold. The company is famous throughout Japan not only for its performance in waste recycling and cutting edge facility but also for its management style and practices as well as its involvement in the community.

i. Waste recycling

The company applies the concept of "Zero Waste"[126] and reached 95% of recycling/reduction of volume efficiency without simple incineration in 2014[127].

The industrial waste from the construction sites is divided into 3 categories: wood, concrete and mixed wastes.

Wood is transformed into chips for fuel, boards and papers and is then supplied to major manufacturers in Japan. Using its know-how, Ishizaka also produces cattle beds. Remaining wood chips are sold to a biomass plant for thermal recycling.

Concrete wastes are sorted by removing impurities and are crushed into small pieces. After three-phase grinding process, finished products are used as backfilling material for road works and site preparation.

Mixed wastes are sorted by materials (concrete, paper, plastic, wood, metal and others). The separation is done using their in house-developed system (including wind sorting machine, grinder and gravity sorter) and by hand. After separation, materials are compressed for transportation. Paper will be

[126] Resource life cycle under which all materials are reused and no trash is sent to simple incineration or landfill
[127] Yamayuri Club, Factory Tour with Kiuchi Midori, Special Issue, Spring 2015

recycled as material such as cardboard and toilet paper while non-rigid plastic will be recycled thermally at the factory as recycled plastic fuel (RPF). Metal materials such as iron, aluminum, stainless steel and brass are dismantled and sorted, using magnet heavy machines and manual procedure, in a dedicated "valuables plant".

ii. Plant features

The company has introduced various innovative energy-saving technologies, including electric powered heavy equipment instead of with fuel-type ones (e.g. a hydraulic shovel developed together with the machine manufacturer, Hitachi Construction Machinery), thermal barrier coatings, roof greening, top light, solar panels and LED. Rainwater is used for cleaning and the resulting wastewater is treated for reuse.

R&D is continuously ongoing. The company collaborates with various research institutes and universities (e.g. Gunma prefecture, Gunma University, Keio University and Gunma Public Industrial Technology Center) to develop new solutions in case of recycling/sorting issues and to continually improve its machinery. Ishizaka uses parts of various makers to create their own system. Maintenance and reparation are usually done onsite by themselves so that they do not have to rely on the makers.

iii. Management

Ms Noriko Ishizaka introduced an innovative management style prioritizing the community-based business and emphasizing the company's social responsibility. She focused on waste reduction and employees' education. The company has been awarded 7 international standards [128] for its management practices and becomes the first Japanese company integrating 7 standards.

The company also endeavors to implement some Japanese traditional values, such as "*Omotenashi*"[129], "*Shitsurai*"[130] and obtained the Hospitality Award from the METI.

iv. Community involvement and promotion of a sustainable society

Besides the recycling plants, the company runs various activities including the maintenance of the

[128] ISO9001, 14001, 50001, 27001, 22301, 29990 and OHSAS18001
[129] *Omotenashi* or Hospitality is one of Japan's core value and key word during Tokyo's campaign for 2020 Summer Olympics and Paralympics.
[130] *Shitsurai*: "putting decoration suitable for the season or ritual in appropriate indoor places" and thought of how to offer the taste of the four seasons.

surrounding forest of "*Satoyama*"[131], a folklore museum, a restaurant that serves local products, etc. in order to maintain a close contact with the surrounding population and raise people's awareness regarding protection of the environment. The company considers that the support of the local residents is of particular importance in the waste business as the surrounding population is usually reluctant to the idea of having a waste plant nearby.

Investigating the company's business model could prove beneficial to European businesses from an industrial point of view as well as an opportunity to better understand and experience Japan's soul and spirit in an industrial context.

d. Programs for the creation of "New-Towns"

Various projects for the creation of "New Towns" have been initiated throughout the country in the past 20 years. Mainly based on governmental incentives, these programs set a framework aiming at developing a more sustainable society while stimulating the economy. Various aspects of urbanization and lifestyle are covered, including for example heating, transportation or waste management. The proper running highly relies on coordination and cooperation among the stakeholders, including national and local government, private companies, local residents, etc.

i. Eco-Towns

The Eco-Town program was the first of these "New-Town" creation projects. The initiative was launched jointly by MoE and METI in 1997.

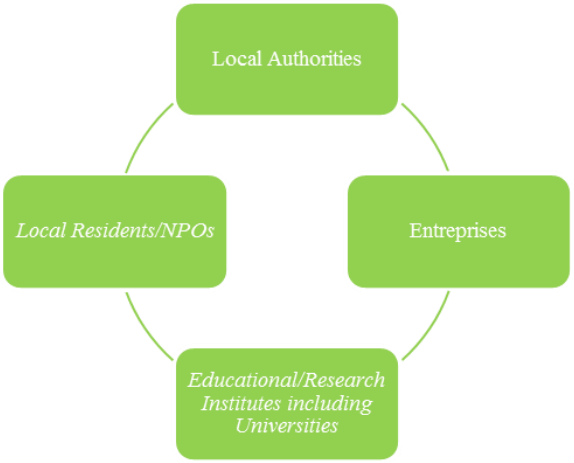
The main drivers were a serious shortage of the landfill capacity as well as a decline in key industrial sectors such as steel, cement or chemical. The Eco-Town program was thereby meant as a way to simultaneously solve waste management issues and revitalize the local economy.

The scheme has been inspired by the city of Kalundborg, Denmark, which is considered as a model for industrial symbiosis. The core idea was to make the best use of regional resources to achieve rational utilization under the concept of Zero Emission[132]. An important feature was to take into account the regional characteristics and gain the involvement of various local players.

[131] *Satoyama*: Japan's traditional agricultural landscapes with harmonious human-nature interactions; cf. IPSI, the International Partnership for the Satoyama Initiative http://satoyama-initiative.org/

[132] Zero Emission Concept: a concept to shift all the wastes generated from an industry sector to utilize as material in other industry sector, aiming at removing any types of wastes, MoE: https://www.env.go.jp/en/recycle/manage/eco_town/index.html

Figure 19: Roles of relevant parties in Eco-Towns



Local Authorities

- ✓ Leading organizations for promoting environmental town-building
- ✓ Policy mix and promotion of cooperation among administrative departments
- ✓ Approaches for higher efficiency in resource recycling in the region
- ✓ Roles for achieving wide-area recycling
- ✓ Promotion of environmental education

Enterprises

- ✓ Roles as the leading organization for implementing projects
- ✓ Roles for achieving promotion of prevention
- ✓ Approaches for higher efficiency in resource recycling in the region
- ✓ Roles for achieving wide-area recycling

Educational/Research Institutes including Universities

- ✓ Research and development concerning recycling technologies
- ✓ Development of evaluation methods
- ✓ Development of human resources utilizing people who can play the part of leaders or coordinators

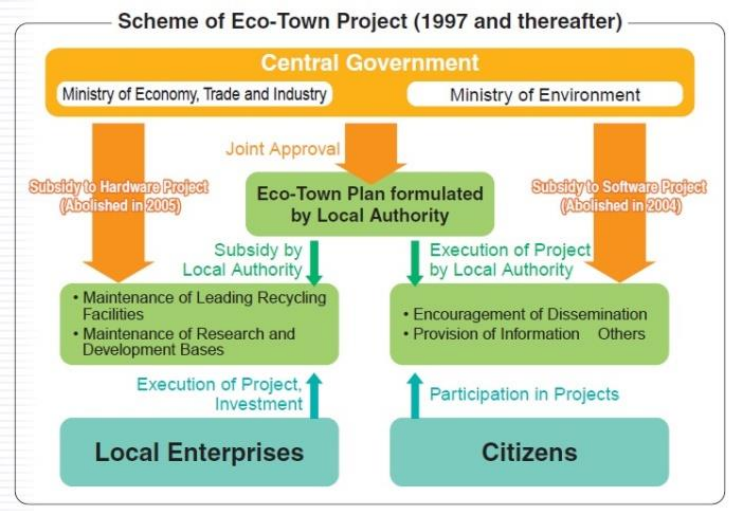
Local Residents/NPOs

- ✓ Involvement in environmental town-building projects
- ✓ Positive utilization of recycled goods
- ✓ Cooperation for waste segregation

Source: Eco-Town Projects / Environmental Industries in Progress, METI

To be part of the program, a local government had to submit an "Eco-Town Plan" to METI and MoE. The criteria included originality, innovativeness as well as the potential to act as a model for other local governments (sharing experiences, know-how and problems was an integral of the agreement). Selected projects submitted by local governments and private organizations were granted financial support.

Figure 20: Scheme of Eco-Town Project (1997 and thereafter)



"Hardware Projects": creation, upgrade or maintenance of innovative recycling facilities and associated infrastructure

"Software Projects": outreach activities that can contribute to the realization of a recycling-oriented society (e.g. town planning or community recycling)

Source: Eco-Town Projects / Environmental Industries in Progress, METI

Between 1997 and 2006, twenty six local governments have been selected as Eco Towns throughout Japan. As a result, 170 plants started their operation, including 61 plants subsidized by the national government. The new facilities were in majority waste plastic recycling plants (56) and waste food recycling plants (31), but recycling plants for home appliance, end-of-life vehicles and waste metal refinery plants also emerged[133].

Eco-Towns can roughly be classified into four categories[134]:

- ✓ Promotion of establishment of a sound material-cycle society by regional industrial infrastructure (example: Kawasaki Eco-Town)
- ✓ Promotion of establishment of a sound material-cycle society by attraction of enterprises policy (example: Kita-Kyushu Eco-Town)
- ✓ Promotion of establishment of a sound material-cycle society by citizens' involvement (example:

[133] BDC Vol. 13, 1/13 print ISSN 1121-2918, electronic ISSN 2284-4732
[134] Eco-Towns in Japan, Implications and Lessons for Developing Countries and Cities, Global Environment Centre Foundation (GEC, 2005)

Minamata Eco-Town)

- ✓ Waste management and town planning (example: Naoshima Eco-Town)

The program faced two main challenges, namely illegal dumping and a weak demand for recycled materials, and was extended until these issues got solved. Illegal dumping was reduced through stricter legislation and higher fines while the prices for recycled materials rose on the international market and the domestic demand increased through new legislations.

The Eco-Town program is considered as a success with benefits for all the stakeholders.

Figure 21: Benefits of the Eco-Town program

Main source: Eco-Towns in Japan, Implications and Lessons for Developing Countries and Cities, Global Environment Centre Foundation (GEC, 2005)

Such programs are usually run for 2-3 years making the 10 years lifespan of Eco-Town exceptional. After the program stopped in 2006, some of the cities were chosen as Eco-Model Cities (Kita-Kyushu was the 1st Eco-Model City and 1st Eco-Future City). From 2010 an Advancement Program for Eco Towns has been carried out with the objective to face the new challenges such as competition from new rivals, demand for higher standards, etc. From 2014, focus has been put on the creation of Low

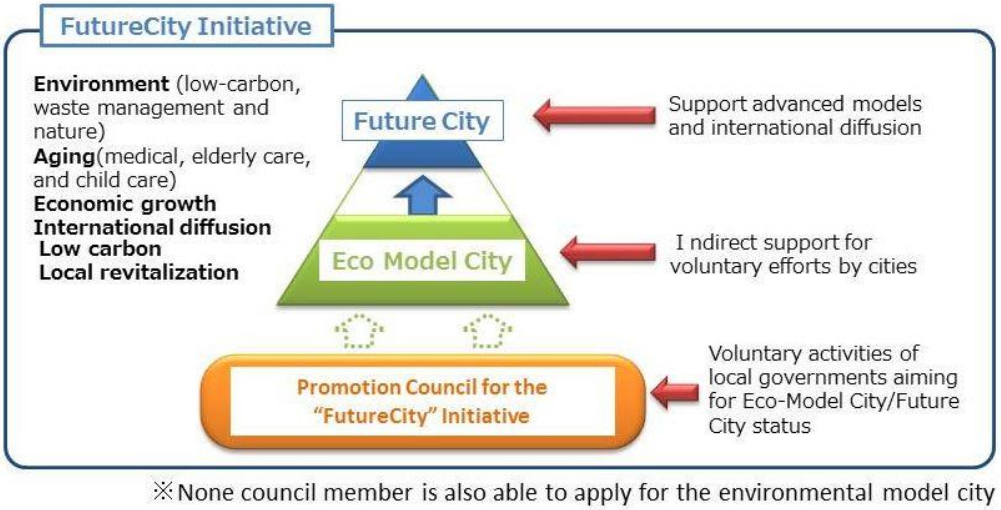
Carbon Zones that coexist with a Sound Material-Cycle Society in Eco-Towns. One of the objective is to create a so-called "double-zero emission" model zone in which recyclable resources are used while carbon emissions are reduced[135].

ii. Eco-Model City and "FutureCity" Initiative (FCI)

In 2008, the G8 summit took place in Lake Toya, Hokkaido and one of the major topics on the agenda was tackling climate change with a shift to a low carbon society[136]. That same year, the Cabinet Administration Office introduced the Eco-Model City program with a focus on GHG reduction[137]. 13 cities were selected among the 82 applications to become Eco-Model Cities[138].

The "FutureCity" Initiative (FCI)[139] was introduced in 2010 in the New Growth Strategy[140] of the Cabinet and launched in 2011. Besides reducing CO2 emission, a further objective of FCI is to form a triangular relationship between environment, economy and society, and to improve quality of life.
The two initiatives were re-organized in March 2013 so that the Eco-Model City initiative has been integrated into the FutureCity Initiative and the 11 Future Cities were chosen among the Eco-Model Cities[141].

Figure 22: FutureCity Initiative



Source: JFS, http://www.japanfs.org/en/files/future_city_02_en.jpg

[135] http://eri-kawasaki.jp/english/wp-content/uploads/images/S3-1-Shoji.pdf
[136] MOFA: http://www.mofa.go.jp/policy/environment/warm/coolearth50/initiative.pdf
[137] http://www.kantei.go.jp/jp/singi/tiiki/kankyo/seminar2008/04murakami.english.pdf
[138] IGES: http://www.iges.or.jp/en/archive/kuc/pdf/activity20110727/4-1_Japan.pdf
[139] http://future-city.jp/ ; MOFA: http://www.mofa.go.jp/policy/environment/warm/cop/rio_20/pdfs/presentation1.pdf
[140] METI (2010): http://www.meti.go.jp/english/policy/economy/growth/report20100618.pdf
[141] JFS: http://www.japanfs.org/en/projects/future_city/index.html

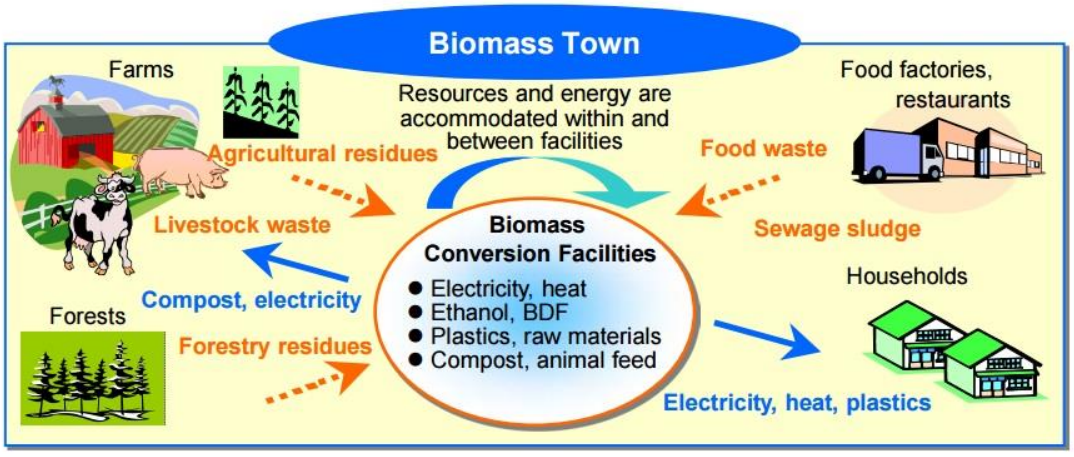
The Japanese government identified the FCI as one of 21 national projects in its "New Growth Strategy" published in June 2010. The government also designated FCI as one of the national projects specified in its "Japan Revitalization Strategy" adopted in June 2013.

iii. Biomass Town and Biomass Industrial Community

The Biomass Town Program started in 2002, supported by MAFF and the main objectives were local revitalization and job creation in rural areas through biomass industrialization.

A Biomass Town is defined as "an area where a comprehensive biomass utilization system is established and operated through the cooperation of various stakeholders in the area. Each step from biomass generation, conversion, distribution and use is linked together among the stakeholders, and their biomass utilization is stable and appropriate to the community in the area".[142]

Figure 23: Biomass Town



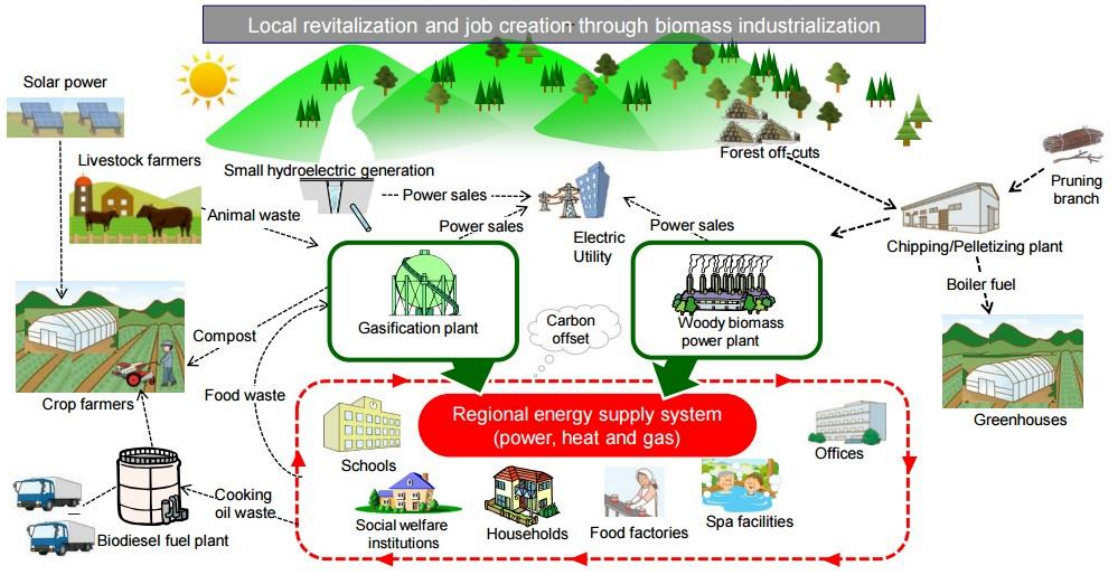
Source: MAFF

The target of 300 biomass towns by 2010 has been achieved and this incentive program terminated. The Biomass Industrial Communities, as part of the Biomass Industrialization strategy (2012), are supposed to develop the concept further by "promoting biomass industrialization by creating an environmental-friendly and disaster-resistant community centred on the biomass business

[142] MAFF: http://www.maff.go.jp/e/biomass.html

(industry)"[143] with a focus on energy producing.

Figure 24: Local revitalization and job creation through biomass industrialization



Source: MAFF

The target is to create 100 Biomass Industrial Communities within 5 years (some cities upgrade from Biomass Towns and some new cities) but it will be probably difficult to reach as the regulation is more severe than for Biomass Towns. Indeed the Biomass Industrial Community plan requires a long preparation work including long-term business plan (15-20 years) and relationship with many stakeholders. MAFF organizes 1 or 2 calls per year for plan submission during a limited period of time. Selected cities receive subsidies from the government but this time the government wants Biomass Industrial Communities to be more independent and work more with local business.

iv. Smart cities

"Smart City" is a project run under the supervision of METI.

On the Japan Smart City Portal[144], "Smart Cities" are defined as "a new style of city providing sustainable growth and designed to encourage healthy economic activities that reduce the burden on the environment while improving the QoL (Quality of Life) of their residents." New advanced technologies and systems are developed in various fields, such as heat and energy, information and

[143] MAFF: http://www.maff.go.jp/e/pdf/reference6-8.pdf
[144] http://jscp.nepc.or.jp/en/index.shtml

communication technology (ICT) and infrastructure (including waste management). These innovative solutions aim at creating a sustainable and low carbon society. Operational experiments have been run in four locations, namely Yokohama (Kanagawa Prefecture), Toyota City (Aichi Prefecture), Kansai Science City (Kyoto, Osaka, and Nara Prefectures) and Kitakyushu (Fukuoka Prefecture).

Tokyo is also developing into a smart city. Extensive information about business opportunities for EU companies can be found in the report "Tokyo Smart City Development in Perspective of 2020 Olympics"[145] of Ms Clarisse Pham.

[145] http://www.eu-japan.eu/tokyo-smart-city-development-perspective-2020-olympics-opportunities-eu-japan-cooperation-and-busine

B. POTENTIAL BUSINESS OPPORTUNITIES FOR EU COMPANIES

1. Opportunities

This part will first point out some of the most attractive features of the Japanese market in general and then of the waste market in particular to finally map the potential business opportunities and areas of cooperation that result from these favourable conditions.

a. Opportunities of the Japanese market in general

Japan is the world's third-largest economy and according to one of JETRO's latest report on business environment[146], it ranks among the most attractive and dynamic business hubs in the world. The country enjoys a stable economic, political and legal system as well as good living conditions. Generally, cost is not the main criteria as Japanese are ready to pay more for quality and service.

From a business perspective, it is commonly agreed that once an agreement has finally been reached the implementation usually proceeds smoothly and the collaboration is expected to last on the long run. Thanks to these intimate and long-term relationships, the parties can enjoy stability, flexibility and mutual support, even in case of unexpected market turmoil.

Further, Japan is perceived worldwide as a quality reference so that being active in Japan might act as a foothold for a further expansion in Asia or even other developed countries.

Europe and Japan have been historically strong partners and the Free Trade Agreement and Strategic Partnership Agreement that are currently in discussion will likely reinforce these bounds. There exist good complementarities between European and Japanese technologies, export experiences and working style. The resulting synergies may create successful partnerships on the domestic market or for common projects abroad.

b. Opportunities of the Japanese waste market

In view of the resource scarcity and energy dependence the country is facing, waste management is absolutely necessary to achieve and maintain a sustainable society. The Great East Japan Earthquake and resulting Fukushima accident marked a decisive turn for environmental related businesses, especially in the field of renewable energy where the Feed-in Tariff are among the best in the world.

[146] http://www.jetro.go.jp/en/invest/reports/pdf/talktojetro_en.pdf

In addition, all the new products and new materials that are used in our daily lives or in industrial sectors will sooner or later become waste that will need proper treatment. Other external factors, such as the Tokyo Olympics & Paralympics Games in 2020, an increasing number of tourists and foreigners, an ageing population, and alike may induct some changes in the way waste is handled. Waste management evolves in parallel of the society, so that there will always be a need for new advanced technologies and processes.

Environmental matters enjoy special attention for years in Japan and the sector benefits from governmental support, including various incentive measures such as the Feed-in Tariff or the New-Town programs. The awareness of the population regarding these questions being high, i.a. thanks to sensitization measures starting from childhood, it is in the interest of companies and politic to foster this sector and continuously implement new environmental measures.

In that context, environment related industries enjoy favourable conditions. According to the 3rd Fundamental Plan, the size of the market related to sound material-cycle society is estimated at approximately 39 trillion yen with approximately 990,000 people employed. The Kankyo Tanken survey 2015[147] published by MoE confirmed the confidence and favourable outlook of this sector.

Highly relevant for providers of advanced technologies and machinery is the trained workforce that that makes it easier to find personal for maintenance, and a greater protection of intellectual property rights compared to certain countries in development. Most of the interviewed companies stated that they did not face particular difficulties due to Japanese specific technical requirements or standards. According to their experience, procedures generally requires lots of documentation and in some cases technical adjustments or additional tests but no barrier has been reported as such.

Europe is recognized as leader in the field of renewable energy and environmental industry. In particular, Germany, The Netherlands and the Nordic countries are highly praised in Japan for their clean energy realizations and efforts in the last decades[148].

c. Business Opportunities on the Japanese waste market

The 3rd Fundamental Plan for Establishing a Sound Material-Cycle Society (2013) identifies various issues that Japan is currently facing, sets priorities and recommends measures to implement. The

[147] Kankyo Tanken survey: http://www.japanfs.org/en/news/archives/news_id035282.html
[148] Why Japan, Rob Van Nylen (2013)

matters listed below are a selection of the topics that might become business opportunities for European SMEs.

Establishing a Social and Economic system where efforts for the 2Rs can be further promoted

Until to now, attention has mainly been paid to the 3rd R "Recycle" and the Plan considers that new measures should be taken to foster the Reduction of waste and Reuse of products in order to decrease the overall quantity of waste, thereby lessening the need for "Recycling". Among the efforts and actions, the Plan mentions cutting food loss, expanding the reuse market, educating the consumers to change their lifestyle or asking the business sectors to provide long-lasting and saving-products.

This is an opportunity for businesses that can provide products or services related to these 2Rs. Some initiatives have recently been launched in Japan, as for example a project initiated by the Japan Weather Association to limit food waste using weather forecast[149].

Also this might represent a subject of bilateral discussions between the governments and related organizations about best practices.

Advanced use of recycled resources and securing of resources

The Plan pleads for the decoupling between environmental load and economic growth. For that purpose, green innovation and a competitive recycling industry should be further developed and promoted. The Plan points out that the current recycling process often results in a deterioration of the material quality and that the costs are still high. Thus efficient and reasonably priced recycling processes would enjoy a competitive advantage.

In addition, securing stable supply of strategic materials such as rare metals are identified as a priority by exploiting urban mines instead of underground resources. This topic particularly refers to the stream of e-wastes and is also of strategic importance for Europe so that it may induce partnership opportunities in research.

Moreover, in view of the energy situation following the Great East Japan Earthquake, generating energy from waste (including biomass) is perceived as necessary, with subsequent business opportunities for biomass and waste-to-energy (incineration) businesses, including technology

[149] http://www.the-japan-news.com/news/article/0002397048 ; http://asia.nikkei.com/Politics-Economy/Economy/Cloudy-with-a-chance-of-reduced-tofu-consumption?page=2

transfer.

Ensuring security and safety

In the aftermath of the Great East Japan Earthquake and Tsunami that occurred in March 2011, Japan had to deal with a vast amount of post disaster wastes. Handling these waste was a major challenge[150] and required specialized technologies in the field of waste sorting and waste-type specific treatment methods.

The Plan called for the development of a waste disposal scheme in case of large scale disaster that has been meanwhile announced by the Japanese Ministry of Environment. A cooperating network, composed of experts from NIES, universities and companies, is planned to be settled in late September 2015. The network's activities will include assistance to local governments for a better preparation and coordination in case of natural disaster[151]. Through a better preparation and more reactivity, the new system will strengthen the feeling of safety and security, thereby improving the confidence of national as well as foreign people and companies. The business environment should benefit from the establishment of this reliable framework. In addition, considering the current climate change, it is likely that natural disasters will occur more often. In that context, the know-how developed by Japan might be useful in case of large-scale disasters in Europe.

Under this issue of safety and security the plan also refers to radioactive substance contaminated waste and other toxic waste such as PCB waste or asbestos waste. These specific waste streams require a specialized know-how that European companies could assuredly offer to Japan.

Integrated efforts to create a sound-material and low-carbon society co-existing in harmony with the nature and advancement of local recycling zones

Japan encourages initiatives that aim at developing a sustainable society while revitalizing a number of local zones throughout the country. The Plan underlines the importance for recycling systems to adapt to the particular characteristics of each region. Furthermore, cooperation, for example between rural and urban areas, should be promoted for mutual benefit.

The various New Town programs are a chance for companies to implement innovative processes and technologies. New Towns are considered as showcase for advanced practices and enjoy a good visibility. Besides, the small scale of local recycling zones seems particularly adapted to SMEs.

[150] http://postconflict.unep.ch/publications/UNEP_Japan_post-tsunami_debris.pdf
[151] Jiji Press, Japan to Create Network for Quick Postdisaster Waste Disposal, 2015/08/08

Appropriate treatment of waste

To tackle the issue of illegal dumping and/or inappropriate treatment, the government pleads for a reinforcement of the "Responsibility of waste generator", including preventive and punitive measures.

The Plan also points out the difficulty for some municipalities to manage their waste within their jurisdiction so that a re-organisation including a reduction of the number of facilities and the development of final disposal sites that cover a broader area may have to be envisaged. On the other hand, the Plan advises to keep developing final disposal sites for industrial waste as they played a major role in handling the waste that resulted from the Great East Japan Earthquake.

For waste related companies, this commitment for the reinforcement of the waste management framework ensures the necessary stability of the system. Regarding the matter of final disposal sites, it may lead to extension works or the construction of new facilities.

International efforts

In this section the Plan highlights the efforts of Japan to promote the 3Rs in the Asia Pacific region (for example through the Regional 3R Forum in Asia[152]), thereby supporting the creation of sustainable societies in developing countries while revitalizing the domestic economic. However, the government recognizes that, despite some Japanese success in the field of waste management equipment such as incineration, US and European waste management and recycling industries' appear to be more advanced in overseas operations.

The growth potential of waste related businesses in the Asian region is high and European and Japanese companies could take advantage of their respective strengths and complementarities to approach together these countries and offer comprehensive solutions.

The Plan also mentions illegal exports and imports of circulative resources that would require a reinforcement of the border control measures and recognizes at the same time that the movement of resources should in some cases be facilitated. Import/export of waste, not only of circulative resources but also of waste with negative value, is a topic that need to be discusses on international level.

[152] UNCRD: http://www.uncrd.or.jp/index.php?menu=389

In terms of sector, following opportunities could have been identified.

Machinery and equipment

Japan has already constructed a large number of facilities across the country so that there is currently no need for additional capacity. However, it might result in potential opportunities for repair works and/or partial replacements to extend the life of existing facilities or to improve the technology. As more than half of the waste disposal businesses are small enterprises, the demand is likely to be for small- and medium sized machinery and equipment.

Regarding the waste sorting and collection process, Japan is surprisingly over reliant on manpower: manual separation at home and in recycling plants, garbage bags thrown manually in the trucks by garbage collectors, etc. Considering the ageing population, the necessary workforce for manual garbage collection or factory work might become an issue in the near future. Therefore, more automation could appear as a logic solution. There seems to be discussions concerning an evolution of the current sorting system, from manually based towards more automation, but no official information is available. However, as explained before, people's active participation has been so much emphasized as a key factor for achieving a sustainable society that it would require an appropriate approach and adapt the national communication accordingly.

In addition, it has been reported that Japan has an interest in Mechanical biological treatment (MBT) technology in which EU is strong.

Opportunities related to incineration facilities and landfill

Incineration is the most widely spread disposal method and landfill shortage is among the main concerns. In that context, the stopping of slag poses serious concerns. Solutions for an effective use of bottom ash would be welcomed.

In addition, Europe being stricter in the field pollution control, European technology offers safer standards which might be a competitive advantage considering the awareness of the population regarding pollution matters.

Opportunities related to special streams

The issue of *food waste* may result in opportunities for companies active in the field of biomass, anaerobic digestion[153] (especially separation technologies for anaerobic digestion system) and organic fertilizer. Japanese farmers tend to prefer solid fertilizer rather than liquid fertilizer but incentives try to promote them. Together with the development of a sustainable society and green energy, it is likely that bio-products will become more popular. However, as pointed out by the EBC sustainability committee, "Japanese agriculture is overly reliant on chemicals input and more sustainable farming practices, including the usage of organic fertilizer, should be implemented".

E-waste is one of the most overlooked recyclable resources, with extremely high value precious metals such as copper, iron, aluminium, silver and gold unrecovered and sent to landfill. Reports estimate that only 24-30% of e-waste is treated in Japan, and although 556,000 tons were collected and treated in 2013, it is still only one quarter of the total[154].

Japan and Europe both lack of resources of strategic raw materials but at the same time, they are major producers of e-waste so that they should take advantage of this resource. As the techniques seem to be currently limited, research partnerships might be of mutual interest and could be promoted for example within Horizon 2020 (Joint Calls).

The WEEE Directive started in Europe in 2002 and covers from the beginning a wide range of devices. As the implementation of the Small Home Appliance Recycling Act is fairly new in Japan, European companies may use their experience regarding collection and treatment of these equipment (technology transfer to Japan).

Regarding *solar panels*, the study group in charge of formulating recycling measures for this new waste stream referred to measures implemented abroad, especially in Europe. As a matter of fact, as PV installations started in Europe in the early 1990s[155], the number of waste panels is expected to increase in the coming years. Aware of the potential problem, the European PV industry has already started to prepare and strive in developing solutions across all stages of the product life cycle, including for example the set up of its own privately funded take-back and recycling schemes such as PV CYCLE which has been operating across Europe since 2007.

Furthermore, photovoltaic panels have been added to the scope of the new EU directive 2012/19/EU

[153] http://jp.fujitsu.com/group/fri/downloads/events/other/20140627research-meeting-report-jan2.pdf
[154] http://mhwmagazine.co.uk/LatestNews/Impact_solution_success_at_Recycling_Equipment_Expo,_Japan-18917.html
[155] http://www.solarwaste.eu/pv-waste-legislation/

concerning Waste Electrical and Electronic Equipment (WEEE) that entered into force on 13 August 2012 and had to be transposed into national law by 14 February 2014.

Europe has thereby gathered a recognized expertise in managing and recycling old solar panels. This forerunner experience is valuable for countries such as Japan that started to install solar panels more recently. PV CYCLE has reportedly already started to take advantage of the situation. It is currently only operating its recycling schemes in Europe but is reported to have consultation with international associations, authorities and researchers on setting up similar schemes elsewhere, including Japan.[156]

Japan has committed to the elimination of *PCB wastes* by 2026. As the treatment has started relatively recently and the threshold for being considered as PCB wastes very low, the volume of the stocks is still large. In addition, due to the long-storage period, leakage cases have started to occur. An acceleration in the treatment is therefore highly desirable.

JESCO is the only authorized entity for the treatment of pure PCB wastes. However, private companies can obtain a certification to handle low-concentrated PCB waste. Presently (as of September 2015), most authorized companies opted for incineration and the few that are offering a cleansing method are operating with mobile units which are rather adapted to big transformers. The construction of fixed facilities for the cleansing small transformers / capacitors (ballasts) carcasses might therefore represent a business opportunity.

Marine litter is also a hot topic. According to scientists, around 8 million tons of plastic are discharged yearly in the ocean and a study forecasts a tenfold increase in the next decade[157]. These plastic wastes have a dramatic impact on the marine wildlife and also affect the human population. Japan, as an island country, is particularly dependent on the surrounding water. In addition, the country had to face an increase of waste washed up on the beaches as a consequence of the 2011 tsunami. Further, Japan will probably have to deal in the near future, with the million cubic meters of tires which have been immerged in the 1960s to create artificial reefs. At that time, it was seen as a solution to attract marine life but it turned out that tires contain toxic material. Countries like France are now removing the tires and will treat them[158].

In that context, initiatives aiming at tackling marine litter (e.g. The Ocean CleanUp[159]) or know-how

[156] http://www.pv-tech.org/news/japan_to_implement_solar_module_recycling_and_recovery_measures
[157] http://news.nationalgeographic.com/news/2015/02/150212-ocean-debris-plastic-garbage-patches-science/; http://www.independent.co.uk/environment/plastic-waste-in-ocean-to-increase-tenfold-by-2020-10042613.html
[158] http://phys.org/news/2015-05-france-reverse-tyres-artificial-reefs.html
[159] http://www.theoceancleanup.com/blog/show/item/worlds-first-ocean-cleaning-system-to-be-deployed-in-2016.html

in handling such waste streams would be favorably welcomed. In addition, as it is a worldwide issue, projects could be deployed in other areas and act as a showcase of EU-Japan cooperation.

Opportunities related to (renewable) energy

The events of 2011 have resulted in a drastic change in the energy policy of Japan and Japan finally entered the market of renewable energy, long after Europe. Europe has set as forerunner ambitious objectives and various policy instruments that resulted in the development of advanced technologies and expertise. Thanks to the legislative framework and diverse incentives, European companies now enjoy a leading role in renewable energy technologies around the world.

The *bioenergy* market in Japan is in an expansion stage and according to business professionals, an opportunity "window" is open. 33 Biomass Power Plants are scheduled for 2016[160] and according to a tentative list provided by Japan Organic Recycle Association, more than half of the Japanese biomass players have a European partner or use European technology (mainly German origin).

Comparing the number of plants with the energy produced, it appears that the *Waste-to-Energy* scheme is more efficient in Europe than in Japan, confirming the leading position of European WtE technologies. Regarding *co-generation*, it seems that in Japan, heat is not perceived as very useful and according to stakeholders, the demand would be low. As a matter of fact, Japanese do not consider heating as necessary in most of the Japanese regions and generally Japanese housing are very little heated, even in winter. On the other hand, cooling appears as much more important. Therefore *tri-generation* or performent and energy efficient cooling systems could be more in demand.

Organic Rankine Cycle (ORC) turbines are especially efficient in small-scale facilities, so that it may appear suitable for the Japanese market. However, apart from the fact that the turbine units need to meet the technical standard of the Electricity Business Act, Japanese legislation requires constant human supervision, which makes this technology less attractive as its main feature is the economic advantage of not requiring human presence onsite. Nevertheless, the recent partnership between Mitsubishi Heavy Industry and Turboden[161] may create new market conditions.

[160] http://www.cmtevents.com/aboutevent.aspx?ev=150514&name=Japan-Biomass-Power-Market&
[161] https://www.mhi-global.com/products/category/organic_rankine_cycle.html

2. Challenges

Generally speaking, the Japanese market is considered as a difficult market and the industry of waste management and recycling is not an exception. Companies will encounter the same kind of problems for market access as documented for other sectors. This part first summarizes the difficulty of the Japanese market in general and focus on the waste sector in a second step.

a. Challenges of the Japanese market in general

The Japanese language and other cross-cultural differences are only the most apparent challenges.

The market is tough and competitive with strong domestic players who already have the indispensable network and references, and as a rule, Japanese tend to favour national products and manufacturers. On top of that, Japanese are of course loyal to their existing business partners. According to business consultants, if the foreign technology is not at least 40% better than the domestic is, Japanese will buy national.

Furthermore, in a country that considers that "The customer is God"[162] a high level of service and perfect quality are only seen as normal. In this view, a deal is not considered as finished after the delivery because Japanese usually expects free maintenance and after-sale service. To this regard, foreign companies are often considered as being too "tolerant" concerning the defect ratio and the lack of zeal to improve.

In that context, even if the Japanese progressively become more opened at the idea of working with foreigners, a number of restraints remain and doing business with foreigners is still perceived as difficult. Some Japanese seem to think that the Japanese market is just so different from the European one that European technologies or practices cannot possibly match with the Japanese demand.

The main challenge is therefore probably the close client-supplier relationships that needs to be created before the actual business can start. Japanese are not eager to take risk and tend to prefer continuity and stability. Mutual trust is the key but it is time-consuming.

Another time-consuming factor is the long decision process. Since decisions in Japanese companies are often the result of extensive consultations with many people from various departments within the

[162] "kyakusama wa kamisama"

whole organization, the decision making process is particularly long and several meetings are necessary to reach an agreement.

b. Challenges of the Japanese waste market

The waste and recycling market is a mature market, already established and structured, with large players, habits, etc. Incineration is historically very popular, anchored in the practice, lots of investment has been allocated for improvement of the technology and it enjoys support from the authorities and population. The introduction of new practices would not only encounter resistance from a technical perspective but also in view of the existing way of processing. More generally, it seems that, as Japanese usually consider their features as unique to Japan and perceive the European waste market situation as completely different, they tend to think prima facie that European practices and technologies are not suited to their particular needs.

In parallel, the NIMBY[163] syndrome is quite strong, especially when it comes to hazardous waste. Residents are often reluctant to have a treatment plant opening near their living area. Therefore the communication with the local population is very important. However, gaining understanding and acceptance is reported as being sometimes difficult even for Japanese local companies, so that it is likely to be even harder for foreigners.

Another major challenge is that a decrease in the quantity of waste is to be expected, considering the declining population and the various measures aiming at reducing waste generation in the first place. The current capacity of existing waste treatment facilities is therefore sufficient to cover the demand. Under these circumstances, a downtrend of capital investment by manufacturers and reduction in demand from the public sector that used to support the waste and recycling market were recently observed[164]. The environmental business market is predicted to move from conventional waste disposal to new energy systems such as those for energy saving, renewable energy and environmentally friendly products[165].

A further hurdle is that, for historical reasons, the waste business industry suffers from a somewhat negative reputation. In addition, as it is a small sector in which all the stakeholders know each other quite good, hearsay can spread quickly. Besides, foreign manufacturers are usually not in direct contact with the final client and a consultant often plays the role of intermediary. The room for discussion and opportunity to present innovative solutions is thereby quite limited as consultants will

[163] "Not In My Backyard", cf. footnote 41
[164] http://www.jetro.go.jp/en/invest/attract/energysystems/futureenrgysystems130207.pdf
[165] http://www.jetro.go.jp/en/invest/attract/energysystems/futureenrgysystems130207.pdf

not try to find the most suited option for the project but will only look for the exact product they have been appointed for.

In case of public facilities, the contracts are subject to public tenders, a procedure difficult to access for foreigners. Therewith, the administrative structure and responsibilities' sharing between national, prefectural and local government might appear unclear and complex.

Regarding the waste-to-energy market (incineration and bio-energy), only electricity is supported and there is no or little consideration towards the heat usage. In parallel, the lack of infrastructure for an efficient usage of heat makes this business less attractive.

Euromonitor International has calculated an "Attractiveness Index of Recycling of Metal and Non-metal Waste and Scrap Among Other Japan Industries". This index takes into consideration various factors including industry growth, demand stability, profitability, bargaining power, entry barriers, etc. The note awarded to Japan is 2 out of 10 (1= low and 10 = high)[166].

[166] Passport - Recycling of Metal Waste and Scrap in Japan: ISIC 371, Euromonitor International August 2013 and Passport - Recycling of Non-Metal Waste and Scrap in Japan: ISIC 372, Euromonitor International August 2013.

C. RECOMMENDATIONS

1. Recommendations for European companies

Some basic business recommendations are key in Japan, regardless of the industry or product/service category. Therefore, the last part of this report will begin with general recommendations of doing business in Japan. It will follow with more specific recommendations for the waste management sector.

a. General recommendations of doing business in Japan

i. Using the support services available in Japan

Support organizations can provide useful information to assess the market potential beforehand and provide assistance to enter the market through various services. Even after the company is established in Japan, support organizations can be of help, for example by enhancing the network. Below is a non-exhaustive list of support organizations that can provides useful information or tools to European SMEs.

National

Embassies, Chamber of Commerce, Trade Organizations in Japan and in the home country, etc.
The services provided by these entities usually include information about the Japanese market, sectorial market researches, networking events, support for participation to trade exhibitions, and alike. These organisations often enable to create a bound with fellow compatriots already active on the Japanese market and is good first step to create a network in Japan.

Japanese side

The Japan External Trade Organization (JETRO)[167] is a government-related organization whose mission is to promote mutual trade and investment between Japan and the rest of the world. It was created in 1958 to promote Japanese exports abroad. Nowadays, its core activity is to attract foreign direct investment into Japan and support Japanese SMEs to maximize their global export potential. JETRO's headquarters are located in Japan but the organization has deployed offices worldwide. Useful tools for European SMEs include i.a. various reports about the Japanese market, a Business Matching Site[168] and an online database of fairs and exhibitions[169].

[167] https://www.jetro.go.jp/en/
[168] https://www.jetro.go.jp/ttppoas/index.html
[169] https://www.jetro.go.jp/en/database/j-messe.html

Professional Associations can provide sector specific information and precious contacts. They usually gather the trendsetters of the industry. In some cases, these associations are in direct contact with decision-making bodies and/or provide recommendations for the evolution of the sector. Becoming part of these associations usually grants credibility and visibility. Although some of them display a full range of information in English, most of the available documentation and communication is in Japanese. A non-exhaustive list of professional associations related to waste is provided in annex 10.

The Manufactured Imports and Investment Promotion Organization (MIPRO)[170] was established in 1978 to promote imports of foreign manufactured products. Since 2004, the organization provides information on investment in Japan with the view to developing related businesses.

European side

The *European Business Council* (EBC)[171] holds the role of European (EU) Chamber of Commerce in Japan and acts as the trade policy arm of 16 European National Chamber of Commerce and Business Associations in Japan. Its mission is to improve the trade and investment environment for European companies in Japan. For that purpose EBC committees identify barriers and use various lobbying tools to bring along the necessary changes.

The *EU-Japan Centre for Industrial Cooperation*[172] is a unique venture between the European Commission and the Japanese Government. It is a non-profit organisation aimed at promoting all forms of industrial, trade and investment cooperation between the EU and Japan and at improving EU and Japanese companies' competitiveness and cooperation by facilitating exchanges of experience and know-how between EU and Japanese businesses. In addition to workshops and training programs, following services might be particularly helpful for European SMEs:

✓ Portal EUbusinessinjapan.eu[173]

This online information portal is designed for European companies seeking to break into the Japanese market. It aims to bring together and make available online all information which could be beneficial to EU companies wishing to develop business in or with Japan. The registration is free and grant full access to publications, webinars, database, etc.

Companies can thereby access to a wide range of information about Japan in order to gain a better

[170] http://www.mipro.or.jp/english/
[171] https://www.ebc-jp.com
[172] http://www.eu-japan.eu/
[173] http://www.eubusinessinjapan.eu/

understanding of the market and making a first assessment of the business environment.

✓ Step in Japan[174]

The service, which is offered free of charge, acts as a landing pad for SMEs based in the EU+ territory[175], planning on entering into or expanding within Japan. The initiative encompasses a full range of essential support measures for businesses, including a free office space in Japan, full access to meeting and seminar facilities within the Centre's premises, a help desk for information inquiries on business in Japan and assistance with using the Enterprise Europe Network service while in Japan.

This service is particularly adapted for companies who have already investigated the market and have some concrete projects and contacts.

✓ Government Procurement[176] and Japan Tax & Public Procurement Helpdesk[177]

The Centre coordinates the translation and dissemination of information on public procurement opportunities published by Japanese local government authorities. Having terminated the update of the procurement notices of local government located in the area struck by the Great East Japan Earthquake, it now maintains a new government procurement information portal providing automatic English translations of tender notice information provided by local government authorities throughout Japan.

The Japan Tax & Public Procurement Helpdesk provides companies with an insight into their business opportunities in Japanese government procurement and assistance with tax questions. The JTPP Helpdesk aims to support European SMEs in their commercial endeavours in Japan and provides a range of services in the areas of public procurement and tax issues and strives to lessen the hurdles that might impede your business activities.

This service might prove useful for companies wishing to contract with public bodies, for example for the construction of a facility or the collection of HH wastes.

✓ NCP H2020[178]

The EU-Japan Centre for Industrial Cooperation is the National Contact Point for Horizon 2020 Research and Innovation programme in Japan, providing practical information, individual guidance as

[174] http://www.eu-japan.eu/other-activities/step-in-japan
[175] EU+ includes: EU, Montenegro,Turkey, FYROM, Iceland
[176] http://www.eu-japan.eu/government-procurement
[177] http://www.eu-japan.eu/japan-tax-and-public-procurement-helpdesk/
[178] http://www.eu-japan.eu/innovation-st-cooperation

well as partner search.

This service is fit for European companies looking for research partners in Japan.

✓ Enterprise Europe Network (EEN)[179]

Enterprise Europe Network (EEN) is present in 52 countries and counts over 600 partner organizations. Its mission is to provide information and support to SMEs in the fields of international business cooperation, innovation, knowledge and technology transfer and cooperation in EU programmes. Since January 2011, Enterprise Europe Network - Japan is coordinated by the EU-Japan Centre for Industrial Cooperation with the support of the Japanese Ministry of Economy, Trade and Industry (METI).

EEN offers free of charge advices about the Japanese market and can help European SMEs to find business/technological partners, to identify potential sources of finance or funding, to collaborate in R&D projects, to be informed about open calls and/or to receive e-Alerts on business opportunities. To be introduced to relevant local partners in Japan, EU SMEs first have to submit their business/technology profiles to the local EEN partner in their home countries[180].

Horizon 2020 Research and Innovation programme[181]

Horizon 2020 Research and Innovation programme is the financial instrument to implement the EU 2020 flagship initiative called "Innovation Union". With a budget of almost €80 billion[182] available over 7 years (2014-2020), it is the biggest EU research and innovation programme ever. Horizon 2020 is not only the successor of the Framework Programme FP7, but also includes the Competitiveness and Innovation Framework Programme (CIP) and European Institute Innovation and Technology (EIT). Under this new form, the Innovation component is all the more emphasised.

Horizon 2020 is structured into 3 pillars, namely "Excellent Science" which includes for example basic/frontier research or the purchase of world-class infrastructure and research equipment; "Industrial Leadership" that encourage businesses to invest more in research, becoming thereby more innovative and efficient, getting more competitive and able to create jobs and "Societal Challenges" which refers to projects closer to the markets and with a direct impact on the citizens. This pillar is subdivided into 7 priority challenges. Waste is one of the key topics in the subsection "Climate Action, Environment, Resource Efficiency and Raw Materials"[183]and is also addressed in other subsections such as "Sustainable use of biological resources" and "Secure, Clean and Efficient Energy". Moreover,

[179] http://www.een-japan.eu/
[180] http://een.ec.europa.eu/about/branches
[181] http://ec.europa.eu/programmes/horizon2020/en
[182] Horizon 2020 in brief, 2014 (All figures are quoted in current prices)
[183] http://ec.europa.eu/programmes/horizon2020/en/h2020-section/waste

Horizon 2020 has been identified in the Communication of the European Commission "Towards a circular economy: A zero waste programme for Europe" as a support to address the research and innovation challenge[184].

Small and medium enterprises (SMEs) are seen as a key source of jobs and innovation and are therefore granted a special attention (funding of at least €3 billion allocated to the SME instrument). As international cooperation in research and innovation is a source for new ideas and knowledge, it is essential to bring together the most recognized experts on a worldwide scale. The participation to Horizon 2020 is therefore not limited to the EU Member States and researchers from across the world are welcomed. Japan, as a high-advanced country with a strong R&D culture and with whom the EU share a wide range of shared interests, is clearly identified as an important cooperation partner for the EU. In the Roadmap for Cooperation between Japan and the European Union[185], energy security and access to critical raw materials are mentioned expressly as common challenges and priority areas for future cooperation. In this context, Japanese participation is not only welcomed in all Calls for Proposals under Horizon 2020 but there are also Joint Calls. Examples of calls related to waste are given in annex 11. New calls are planned to be released in October 2015.

The EU-Japan Centre for Industrial Cooperation is the National Contact Point in Japan and provides practical information on all aspects of Horizon 2020, individual guidance as well as partner search[186].

ii. Generic recommendations regarding the Japanese market

Companies should be aware that the Japanese market requires finance, time and human-resources, not only during the prospecting stage but also to remain on the market in the long-run. A long-term strategy must be thoroughly designed and companies should not expect rapid results.

A large part of the success and business performance depends on the network and personal relationships. Companies should therefore put much effort in creating a network and domestic references from the very beginning.

While it is obvious that the participation to major fairs is a must, companies have to keep in mind that it is not sufficient. Prospects and existing customers have to be visited regularly, not only for business purposes but also to be visible and cultivate the relationship. It is especially necessary in the market penetration stage but even once the business is running, it is important to continue to be seen as a proof

[184] http://eur-lex.europa.eu/resource.html?uri=cellar:aa88c66d-4553-11e4-a0cb-01aa75ed71a1.0022.03/DOC_1&format=PDF
[185] http://ec.europa.eu/research/iscp/pdf/policy/annex_roadmaps_sep-2014.pdf
[186] http://www.een-japan.eu/content/boosting-sme-research-and-innovation

of serious willingness to operate on the Japanese market and to deepen the relationship with the Japanese partners. A non-exhaustive list of the next exhibitions related to waste in Japan is provided in annex 12. N-EXPO that is held yearly in May in Tokyo is the most relevant for the waste industry. Fairs in Europe should not be neglected and the number of Japanese visitors might be a good indicator to estimate the potential of the product on the Japanese market.

As the main concerns when dealing with foreigners are related to service and maintenance, companies should therefore pay particular attention to these aspects. Having a physical presence in Japan is reassuring and should be considered at an early stage for equipment manufacturer.

While it will not be expected that a foreigner masters the Japanese business etiquette, attention should pay to some basics such as punctuality. Credibility is also a key value for Japanese and it is important that European companies keep their promises and fully fulfill what has been agreed, in due time. It is therefore unbearable to check internally beforehand the feasibility of the agreement and the entire commitment of the management team, avoiding any need for change.

Prospecting the Japanese market is cost intensive and companies should be ready to invest the necessary financial resources. While it might be attempting to try to do some savings on items that appear secondary, it must be remembered that Japanese pay much attention to details and image plays a key role. Another cost item that is too often sacrifice is the budget for a professional interpreter. However, companies should never spare money on a good interpreter as this person will represent the company and more than the mere words, s/he needs to be able to understand and decipher the unspoken.

iii. Presence in Japan

Agent

Unanimously, finding the right partner is considered as the corner stone so that particular attention should be paid to the selection process.

As everything in Japan, finding the right partner is a long process and building mutual trust is also time-consuming. To speed-up the market entry, some companies may be attempted to conclude dealership agreements with several partners, without setting any severe rules, with the idea to choose a major partner after comparison. However, this way of processing might be perilous. As a matter of fact, in case of failure from one of the Japanese partner, rumours might spread and the European brand risks to lose its credibility, even if it is not its fault. Therefore, it is important to find a reliable partner from

the very beginning and exclusive partnership is usually preferable. Another common error when selecting a partner seems to be to limit the partner search on companies who can speak English. Market-relevant criteria, such as the technical knowledge, the network, the access to strategic information, the capacity to work with policy bodies, authorities and other key players, and alike should be considered in priority. Another important aspect is that companies should be of equal size to have a balance. On top of that, the feeling is a decisive criterion as the personal relation is perceived as more important than the company-to-company relation. Considering the difficulty to enter the "uchi"[187] or in-group, it was impressive to hear several of the interviewed companies/agents designing their partner as "friend" and the personal bound that has build up, including receiving the family at home for dinner or during week-ends.

Once the partner has been chosen, mutual trust will build progressively. It is important to constantly reinforce this relationship. European companies have to rely on their Japanese partner and accept that they know the local market better.

Distributor/Sogo shosha/Senmon Sosha

Japanese sogo shosha are general trading companies. They are huge and influent and cover a wide range of products and materials. They are used to work with foreigners and usually take in charge all the administrative aspects, making the market entry much easier. However it is difficult to approach them directly, and it is said that companies can be referenced only if they have been either hunted or introduced. As Sogo Sosha usually have branch offices worldwide, it might be easier to contact their representation in home country than directly the headquarters in Japan.

Senmon shosha are smaller trading companies that specialize in a limited range of products.

In case of sale through a distributor, it is important to define exactly the role of the distributor. Some of them expect that the manufacturer do the marketing and sales.

Set up a business

Legal and physical presence in Japan depends on the business sector and the stages of the market penetration. Offices in Japan reassure clients especially regarding maintenance and after sale service and is therefore particularly recommended for machinery manufacturers. In addition, it is perceived as a sign of engagement and readiness to be on the Japanese market for the long-term.

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[187] Uchi-soto in the Japanese language is the distinction between in-groups (uchi, 内, "inside") and out-groups (soto, 外, "outside"). (Wikipedia)

According to the report "All about Starting a Business in Japan"[188] (Michio Matsuzaki, 2013) foreign companies generally establish a business presence in Japan in one of three modes, namely Representative office, Branch office, Subsidiary company. A description is provided in annex 13.

b. Sector specific recommendations

When raising the topic of waste in Japan, it appears that two major considerations usually arises to explain the Japanese approach and uniqueness. During this research, European practices and technologies have been discussed with Japanese stakeholders. The concerns formulated to explain why it could not work in Japan were often related to these two aspects. It is important for European companies that consider entering the Japanese waste market to grasp Japanese's conception in order to be able to offer products and services adapted to the markets' characteristics and stakeholders' expectations.

"Japan is a small country"

The size and geographical condition of the country is one of the key drivers in the history and present state of waste management in Japan. Due to the concerns about landfill shortage, waste management process and technologies have been developed in view of reducing the volume of waste. This explains the particular place enjoyed by incineration.

Further, the limited available space was often cited as a reason why equipment, such as collecting or sorting machines, solid garbage containers or large garbage trucks, which are common in Europe would be hardly implementable in Japan as Japanese recycling plants, shops, households, streets, etc. are smaller than in Europe.

"Everyone has to bear the responsibility of its own waste"

Making waste generators responsible for the waste they produce is considered as an incentive to waste reduction and sharing the responsibilities among the parties involved is at the core of the laws related to waste. This conception has been instilled into the society through school education and various communication campaigns, successfully resulting in people carrying their waste back home and respecting the sorting guidelines. In that context, reintroducing street garbage boxes or replacing the manual sorting by consumers with automatic sorting machines in factories would not only represent additional costs for municipalities, it would also come against the very message the authorities are striving to insufflate for years.

[188] "All about Starting a Business in Japan"[188], Michio Matsuzaki, 2013 (available on http://www.eubusinessinjapan.eu/)

Under this motto, municipalities have to treat their waste within their jurisdiction and the government also justifies the ban on export of certain types of waste by the fact that these waste have to be treated domestically.

Individual responsibility has also been cited as a reason with central/district heating would not be popular in Japan.

i. Generic recommendations for Japanese waste market

This part is mainly based on return of experience "from the field", i.e. European companies, Japanese agents/distributors and support organizations such as the Chamber of Commerce and Industry. It summarizes a number of practical operational recommendations specific for the waste management sector.

Japanese have to be convinced with hard facts. Organizing demonstration with self-trial and factory visits is appreciated. In addition certifications from independent organizations and references are reassuring.

The various New-Towns programs are a chance for companies to implement innovative processes and technologies. New-Towns are considered as showcase for advanced practices and enjoy a good visibility. Besides, the small scale of local recycling zones seems particularly adapted to SMEs. Companies could try to promote their technology to potential candidates.

Technology and machinery improvement and replacement have to take into account space limitation, reduction of operational costs, reduce pressure on the environment and of course provide an efficient after-sales service.

When constructing a waste treatment facility, the main problem companies have to face is the NIMBY syndrome. Residents do not want to have wastes coming from other areas near their living place and this is particularly true in the case of hazardous waste. Obtaining the support from the local governments and local population is difficult and requires a partner onsite with contacts and influence.

In case of environment-related technologies, Europe enjoys a good reputation and the EU origin should be emphasized. Companies coming from Germany, The Netherlands or the Nordic countries can also point out their country of origin.

As waste is a mature market, companies need to or very specialized product with competitive advantage or look for niche market.

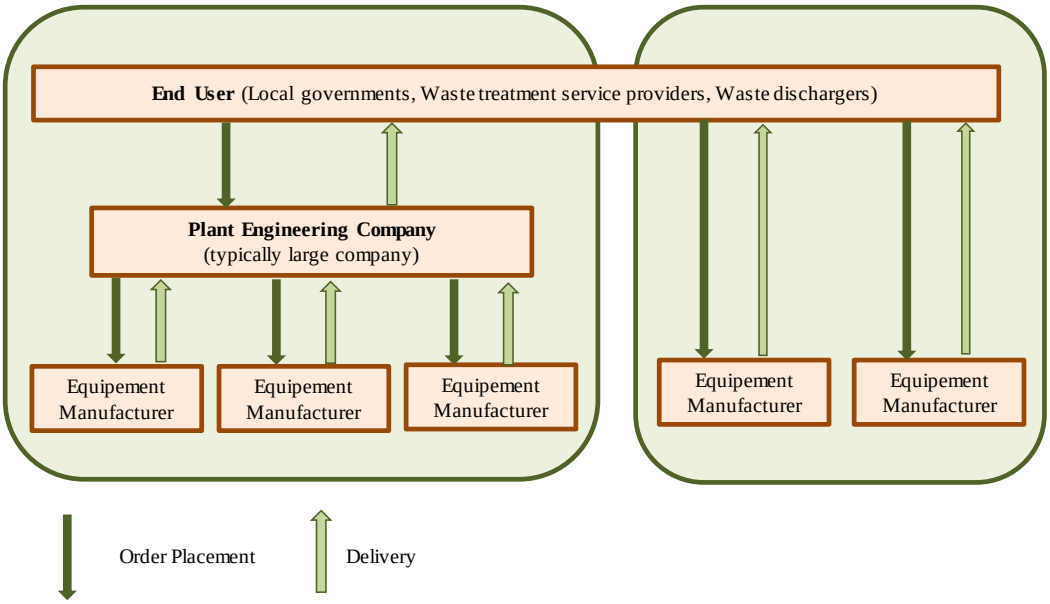
For companies involved in R&D, working with Japanese partners may grant access to new knowledge, technology and/or tools. Companies are advised to follow the calls of research programms such as Horizon 2020.

ii. Market access

Market access routes differ according to the type of product / technology or partnership that is targeted.

Regarding orders in waste treatment / recycling industry, JETRO distinguishes two cases[189]. The first case is when the construction of a complete waste treatment facility is procured to a plant engineering company. The latter is usually a large company that uses its own technology and/or places orders to specialized manufacturers for specific parts. In the second case, order placement and delivery are performed directly between the equipment manufacturer and the end user (local government, waste treatment service provider, waste discharger).

Figure 25: Flow of Order Placement / Reception for Equipment



Source: JETRO, Environment Technologies in Japan, Survey Reports on Wastes Treatment and

[189] JETRO, Environment Technologies in Japan, Survey Reports on Wastes Treatment and Recycling (FY 2012)

Recycling (FY 2012)

Contracts with public bodies (construction of a facility, collection of HH wastes, etc.) are subject to tenders so that the market entry is quite limited for foreign players. It is therefore recommended to have a local presence and/or a partner onsite that is familiar with the tendering process or act as subcontractor.

Figure 26: Process for constructing a waste management plant in Japan

Source: JEFMA

SMEs can also try to cooperate with a large foreign company already active on the Japanese market. This is more likely to happen if the two companies are already in contact in Europe.

Another strategical approach would consist of European and Japanese companies to first start a collaboration on a common project in a third country and take advantage of this partnership to enter the Japanese market on a second step.

2. Recommendations for European support organizations

The purpose of this section is to formulate some recommendations on how to improve the conditions for EU SMEs in Japan.

The recommendations formulated below are mainly based on comments and wishes expressed by companies during interviews conducted for this research. The section has three purposes. First, it is meant to summarize the needs and expectations of SMEs so that support organizations can better tailor their services. It includes actions to promote European companies/technologies in Japan or to support them during their market entry phase. Secondly, it identifies relevant topics in the waste-related sector that would be worth investigating further or around which business events could be launched. Finally, it lists some topics that might be useful to discuss with Japanese competent bodies.

a. Services that meet the needs and expectations of SMEs

i. Networking

Companies chiefly expect from support organization help to meet stakeholders, to find partners and/or clients and to create and broaden their network.

Support organizations should therefore put many efforts on expanding their own network in order to be able to introduce European SMEs to suited potential partners/clients and decision-makers. Tools like the EEN database could prove very useful for SMEs and should be promoted among Japanese business people.

In addition, highly targeted matchmaking events would be welcomed. Participants of past EU-Gateway programmes[190] praised this type of business missions that enabled them to meet a number of valuable potential partners and clients. There are currently no business missions organised in Japan under the EU Gateway umbrella, increasing the need for similar programs to be launched.

ii. Presence on fairs & exhibitions

A country pavilion enables small companies to participate to major exhibitions that they could not

[190] http://www.eu-gateway.eu/

afford otherwise and newcomers can benefit from the advices of support organization on-site. In addition, a large booth presenting various technologies and expertise of a country grants more visibility.

A number of fairs and exhibitions dealing with waste take place in Japan (a non-exhaustive list is provided in annex 12) but unfortunately, only few foreign exhibitors participate and among them very few newcomers. N-EXPO appears to be the most relevant exposition for waste related businesses. As the exhibition hall is divided according to the activity sector, it might be difficult for a single country to organize a country pavilion. Indeed, it would be difficult to gather enough companies on one sector and in case of companies active in different sectors, the placement would not be adapted. In that context, one EU pavilion in one or several hall(s) could be an option. The EU umbrella would especially benefit companies whose country enjoy less recognition in the environmental sector than the usual leaders.

Most of the exhibitions organize seminars or conferences in parallel of the event. Step in as a speaker to present European technologies and companies and to give advises for successful European-Japanese collaboration would greatly enhance the visibility and be the opportunity to meet a large number of potential partners.

iii. Communication

Communication widely differs from one country to another and is not just a matter of language. A mere translation of the company pamphlet will not be enough to provide potential partners or clients the information he is looking for. Worse, culture difference could lead to damaging mistakes. Support organizations are familiar with the culture and business manners and could therefore give tailor-made advices and/or provide guidelines about expected information and layout in Japan and common errors that should be avoided.

b. Topics for research or cluster missions

Waste is a vast and complex topic that can hardly be completely covered in a single document. The present report was meant to give an overview of the Japanese market and identify areas of potential interests for European SMEs. The following topics appear as particularly promising and would be worth investigating further in the frame of H2020/Joint Calls, the Minerva fellowship programme[191], Cluster support missions or alike.

[191] http://www.eu-japan.eu/other-activities/minerva-fellowship

- ✓ *Biomass*

  The biomass market is in its expansion stage and European technology in this field is particularly praised.

  As waste constitutes only a subcategory, a dedicated report that would analyse every sources, outlets and actual stand of the technologies would provide a comprehensive view.

  Another approach would be to focus on biomass from wood, in relation with the forest management in Japan. As Japan is covered with about 70% forest, wood has the potential to become a major energy source available onsite. European countries having forests located in mountainous areas, such as the Alps in Austria, have a valuable know-how and machinery that might represent a business opportunity in Japan.

- ✓ *Recovery of strategic materials in urban mines*

  This topic is of strategic importance for both Europe and Japan. Research is still ongoing for the development and/or improvement of technologies. A study about the research partnership opportunities could include the current techniques and identify, support or promote appropriate joint programmes such as H2020.

- ✓ *Circular economy, with a focus on eco-design*

  Circular economy is the future economic model upon which will develop new policies and business strategies. A thorough understanding of the concept and exchange of best practices would be relevant for both companies and policy makers.

  Eco-Design being the first half of the circle, a focus on this aspect would be a pendant and complete the present report.

- ✓ *Partnership between European and Japanese to approach third country markets (in Asia or Africa for example)*

  The waste-related markets are already mature in Europe and Japan limiting the business opportunities. On the other hand, waste treatment is becoming a major concern in a number of developing countries.

  This report could investigate the complementarities of European and Japanese technologies and the potential synergies and cooperation.

c. Topics for discussion

The following topics might be appropriate for further discussions and/or exchanges of best practices between European and Japanese stakeholders.

Legislation

EBC has already brought to attention the issue of the import/export of waste with negative value. Small PCB wastes also enter in this category so that this specific might be included in the existing actions.

The national legislation regarding pollution could be strengthen. This would seem natural in regard to the commitment in prevision of COP21 and other international commitment.

Identification mark on packaging may in some cases appear as an import/export barrier and have a negative impact on the environment if the waste cannot be disposed of properly just because it does not carry the mark. Especially in the case of plastic, the application of the international sign indicating which plastic (PE, PET, etc.) is used should be enough.

Organisation & Infrastruture

It might be appropriate to reconsider the sorting and collection system, especially in view of the Olympics & Paralympics 2020 and other foreseen evolution of the society.

The heating/cooling infrastructure may benefit from more efficiency. This topic may be related to other ongoing discussion regarding construction in Japan.

Best practices exchange

As Europe and Japan are two developed economy that are facing similar challenges, it would be constructive and mutually beneficial to exchange best practices on how to achieve a circular economy or how to reduce the generation of waste.

Conclusion

Among the key concepts that shaped waste management in Japan figure in the first place the lack of space for landfill and responsibilities' sharing.

Presently, resources scarcity and energy independency are the new drivers of the industry. The further development towards a circular economy appears as necessary, not only for the sake of the environment but also from an economic perspective.

Apart from the general favourable business conditions of the Japanese market, the waste sector benefits from a comprehensive legislative framework, various governmental incentives, and a high awareness from the population.

The report identified biomass and urban mines as key areas with great potential for European businesses. In the first case, European companies enjoy years of experience while the market of renewable energies in Japan is just opening. In the second case, rare materials are of strategic importance for both parties but the technology is not fully developed yet so that R&D partnerships would be of mutual interest. In addition, innovative machinery and equipment have opportunities to enter the market as replacement parts in one of the manifold existing facilities. The various New-Town programs are a good outlet for launching innovative solutions. Finally, combining the synergies to approach third countries market also appeared as a potential partnership opportunity.

On the other hand, as the Japanese waste market is mature, competitors are already established and it is very difficult to enter for newcomers, all the more for a foreigner. In addition, the general operation of waste management is already settled so that European practices and its corresponding machinery and technologies are in some cases difficult to transpose.

As in other sectors, Japan's market entry requires a good preparation beforehand. EU SMEs mainly expect from support organizations help to get introduced to the right partner, support during exhibition and very practical advices, for example regarding communication.

To complete this report, a research about circular economy with a focus on "eco-design" would give a comprehensive view on this new business model. Also, investigating synergies opportunities for entering third market countries would be an original approach to collaboration between European and Japanese companies.

Annex

Annex 1: Legal framework

1-a) Figure: History of legal systems regarding the development of a sound material-cycle society (post-war period to the present)

1 – b) Japan legal framework

Annex 2: Relationships between national and local governments and waste-generating business operators in the Waste Management Act

Annex 3: Material Flow Indicators

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8-a) Target of biomass utilization by type (2020)

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Annex 9: Feed-in Tariff in Japan, FY2015 list of purchase prices

Annex 10: List of Japanese institutions and professional associations related to environment and waste (non-exhaustive)

Annex 11: Example of H2020 calls related to Waste

Annex 12: Exhibitions related to environment and waste (non-exhaustive)

Annexe 13: Types of Business Legal Entities of Japan, "All about Starting a Business in Japan"1, Michio Matsuzaki, 2013

Annex 1: Legal framework

1-a) Figure: History of legal systems regarding the development of a sound material-cycle society (post-war period to the present)

	Major issues	Laws Enacted
Post-war period to the 1950s	- Waste management for environmental sanitation - Maintenance of a healthy and comfortable living environment	* Public Cleansing Act (1954)
1960s to 1970s	- Increase in the amount of industrial waste and emergence of pollution problems as a result of rapid economic growth - Waste management for environmental protection	* Act on Emergency Measures concerning the Development of Living Environment Facilities (1963) * Waste Management Act (1970) * Revision of the Waste Management Act (1976)
1980s	- Promotion of the development of waste management facilities - Environmental protection required for waste management	* Wide-area Coastal Environment Development Center Act (1981) * Private Sewerage System Act (Johkasoh Law) (1983)
1990s	- Waste generation control and recycling - Establishment of various recycling systems - Management of hazardous substances (including dioxins) - Introduction of a proper waste management system to cope with diversification in the type and nature of waste	* Revision of the Waste Management Act (1991) * Act to Promote the Development of Specified Facilities for the Disposal of Industrial Waste (1992) * Japanese Basel Act (1992) * Act on Special Measures against Dioxins (1999) * Containers and Packaging Recycling Act (1995) * Basic Environment Act (1993) * Revision of the Waste Management Act (1997) * Home Appliance Recycling Act (1998)
2000-	- Promotion of 3R measures aimed at the establishment of a sound material-cycle society - Enhancement of industrial waste management - Enhancement of illegal dumping regulations	* Basic Act for Establishing a Sound Material-CycleSociety (2000) * Construction Recycling Act (2000) * Food Recycling Act (2000) * Revision of the Waste Management Act (2000) * Act on Special Measures concerning Promotion of Proper Treatment of PCB Wastes (2001) * Automobile Recycling Act (2002) * Act on Special Measures concerning Removal of Environmental Problems Caused by Specified Industrial Wastes (2003) * Revision of the Waste Management Act (2003 to 2006, 2010) * Small Home Appliance Recycling Act (2013)

Source: History and Current State of Waste Management in Japan, 2014, MoE

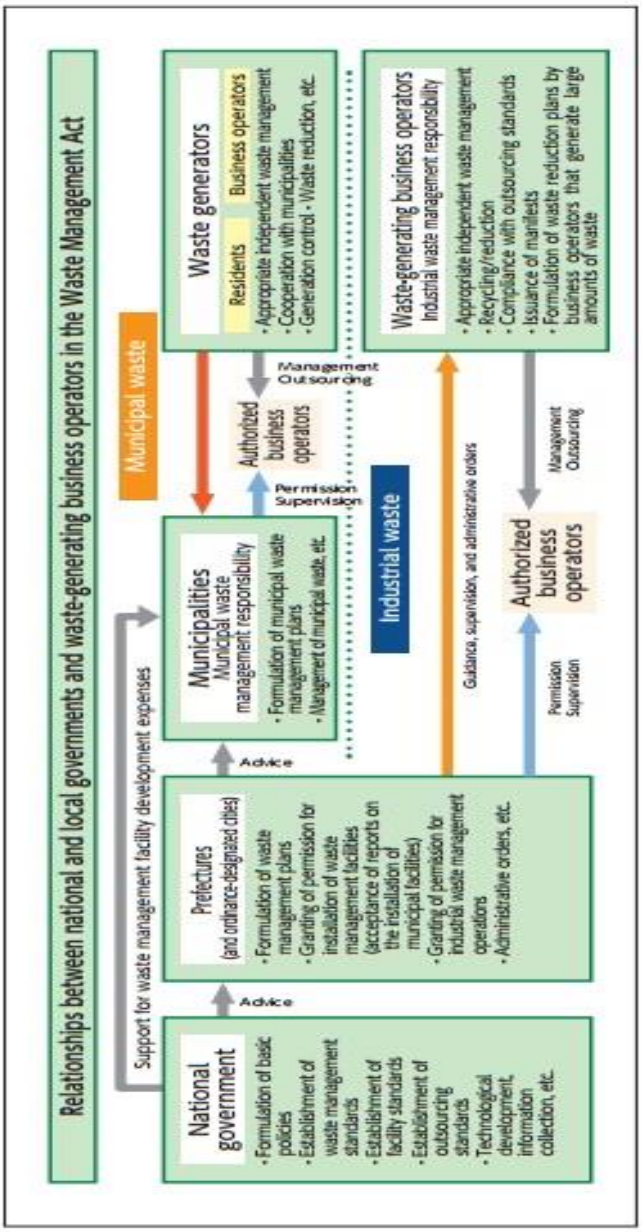
1 – b) Japan legal framework

Name in English * ***Please note it may differ according to sources***	**Name in Japanese**	**Competent Minister(s)**	**Text Law**
Basic Environment Law (and Basic Environment Plan)	環境基本法	MoE	Full text in English: http://www.env.go.jp/en/laws/policy/basic/
Basic Act on Establishing a Sound Material-Cycle Society (Basic Framework Act)	循環型社会形成推進基本法	MoE / METI	Full text in Japanese & English: http://www.japaneselawtranslation.go.jp/law/detail/?id=2042&vm=03&re=02&new=1
Fundamental Plan for Establishing a Sound Material-Cycle Society	循環型社会形成推進基本計画		Full text in English: http://www.env.go.jp/en/recycle/smcs/3rd-f_plan.pdf
Waste Management and Public Cleansing Act	廃棄物の処理及び清掃に関する法律	MoE	Full text in English: The full text of the law: http://www.env.go.jp/en/laws/recycle/01.pdf Cabinet Order of Waste Management and Public Cleansing Law http://www.env.go.jp/en/laws/recycle/02.pdf Regulations of Waste Management and Public Cleansing Law http://www.env.go.jp/en/laws/recycle/03.pdf

Act on the Promotion of Effective Utilization of Resources	資源の有効な利用の促進に関する法律	MoE / METI	Full text in Japanese & English: http://www.japaneselawtranslation.go.jp/law/detail/?id=80&vm=03&re=02&new=1
Act on the Promotion of Sorted Collection and Recycling of Containers and Packaging (Containers and Packaging Recycling Law)	容器包装に係る分別収集及び再商品化の促進等に関する法律	MHLW / METI / MAFF / MOF	Full text in Japanese & English: http://www.japaneselawtranslation.go.jp/law/detail/?id=88&vm=03&re=02&new=1
Law on Recycling of Specified Kinds of Home Appliances (Home Appliance Recycling Law)	特定家庭用機器再商品化法	MoE / METI	Full text in English: http://www.meti.go.jp/policy/it_policy/kaden_recycle/en_cha/pdf/english.pdf
Law for Promotion to Recover and Utilize Recyclable Food Resources (Food Recycling Law)	食品循環資源の再生利用等の促進に関する法律	MAFF	Outline in English: http://www.env.go.jp/en/laws/recycle/10.pdf CHECK for last Version
Construction Materials Recycling Law	建設工事に係る資材の再資源化等に関する法律	MLIT	Outline in English:

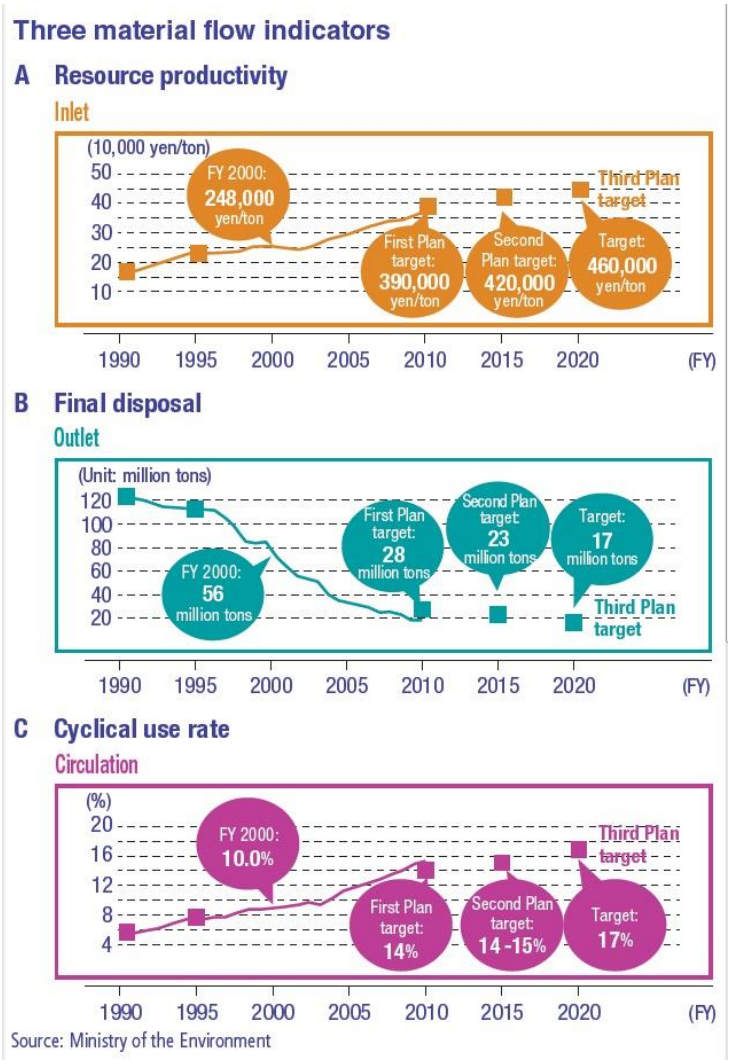
			https://www.env.go.jp/en/laws/recycle/09.pdf
Law on Recycling of End-of-Life Vehicles	使用済自動車の再資源化等に関する法律	METI	Full text in English: http://www.japaneselawtranslation.go.jp/law/detail/?id=127&vm=02&re=02&new=1
Small Home Appliances Recycling Law	小型家電リサイクル法	MoE / METI	More information in Japanese: https://www.env.go.jp/recycle/recycling/raremetals/law.html
Act on Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (Act on Promoting Green Purchasing)	国等による環境物品等の調達の推進等に関する法律	MHLW / METI	Provisionnal translation in English: http://www.env.go.jp/en/laws/policy/green/index.html

Annex 2: Relationships between national and local governments and waste-generating business operators in the Waste Management Act



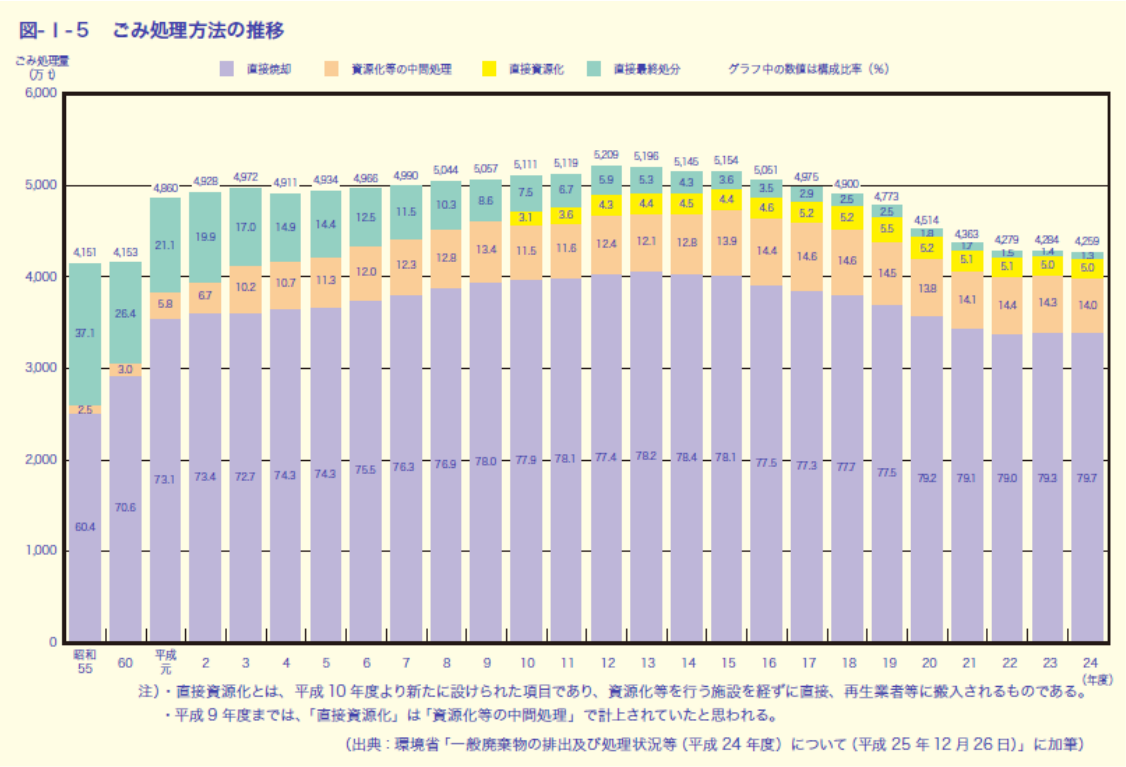
Source: History and Current State of Waste Management in Japan, MoE

Annex 3: Material Flow Indicators



Source: Annual Report on the Environment, the Sound Material-Cycle Society, and Biodiversity in Japan 2014, Ministry of the Environment

Annex 4: Waste Treatment Methods in Japan



Source: Handbook on Resource Recycling Legislation and Trends in 3R, 2014 (METI)

Annex 5: Recycling Unit Cost and Coefficient

for 2015

The Japan Containers and Packing Recycling Association①

Recycling Unit Cost and Coefficient

Recycleing Unit Cost

Packaging	Glass Bottles			PET Bottle	Paper Packaging	Plastic Packaging
	Colorless	Amber	Other Colors			
Unit Cost	4.4yen/kg	5.8yen/kg	9.4yen/kg	3.3yen/kg	13.0yen/kg	47.0yen/kg

without Consumption tax

Coefficient for Calculation

Ordinary Calculation — **Use**

Business Classification		Glass Bottles			PET Bottle	Paper Packaging	Plastic Packaging
		Colorless	Amber	Other Colors			
Container	Food Manufacturing	0.35358	0.39215	0.84412	0.61252	0.04989	0.69986
	SoftDrink,Tea,Coffee Manufacturing	0.40264	0.33257	0.82390	0.57749	0.04823	0.70120
	Alcoholic Beverage Manufacturing	0.32468	0.36992	0.84960	0.61971	0.04897	0.72755
	Oil/fat Processing,Soap,Synthetic Detergent,Surfactant and Paint Manufacturing	—	—	—	—	0.04985	0.66138
	Pharmaceuticals Manufacturing	0.51020	0.40709	0.86684	—	0.05134	0.71664
	Cosmetics,Toothpaste,Other Toiletries Manufacturing	0.39482	0.30799	0.82786	—	0.05113	0.68985
	Retail Sales	—	—	—	—	0.05102	0.71578
	Other Industries	0.33892	0.40400	0.78020	—	0.05116	0.71420
Wrapping	Wrapping	—	—	—	—	0.03940	0.49105

Ordinary Calculation — **Manufacture**

Business Classification		Glass Bottles			PET Bottle	Paper Packaging	Plastic Packaging
		Colorless	Amber	Other Colors			
Container	Food Manufacturing	0.01368	0.00282	0.03039	0.04070	0.00158	0.02653
	SoftDrink,Tea,Coffee Manufacturing	0.02064	0.01884	0.03845	0.07319	0.00253	0.01439
	Alcoholic Beverage Manufacturing	0.01567	0.00694	0.02736	0.03357	0.00220	0.00497
	Oil/fat Processing,Soap,Synthetic Detergent,Surfactant and Paint Manufacturing	—	—	—	—	0.00154	0.04804
	Pharmaceuticals Manufacturing	0.00296	0.01610	0.01186	—	0.00011	0.00408
	Cosmetics,Toothpaste,Other Toiletries Manufacturing	0.00671	0.00078	0.01832	—	0.00032	0.02622
	Retail Sales	—	—	—	—	0.00025	0.00817
	Other Industries	0.00912	0.02639	0.15153	—	0.00024	0.00521
Wrapping	Wrapping	—	—	—	—	—	—

Coefficient for Calculation

Simplified Calculation — **Use**

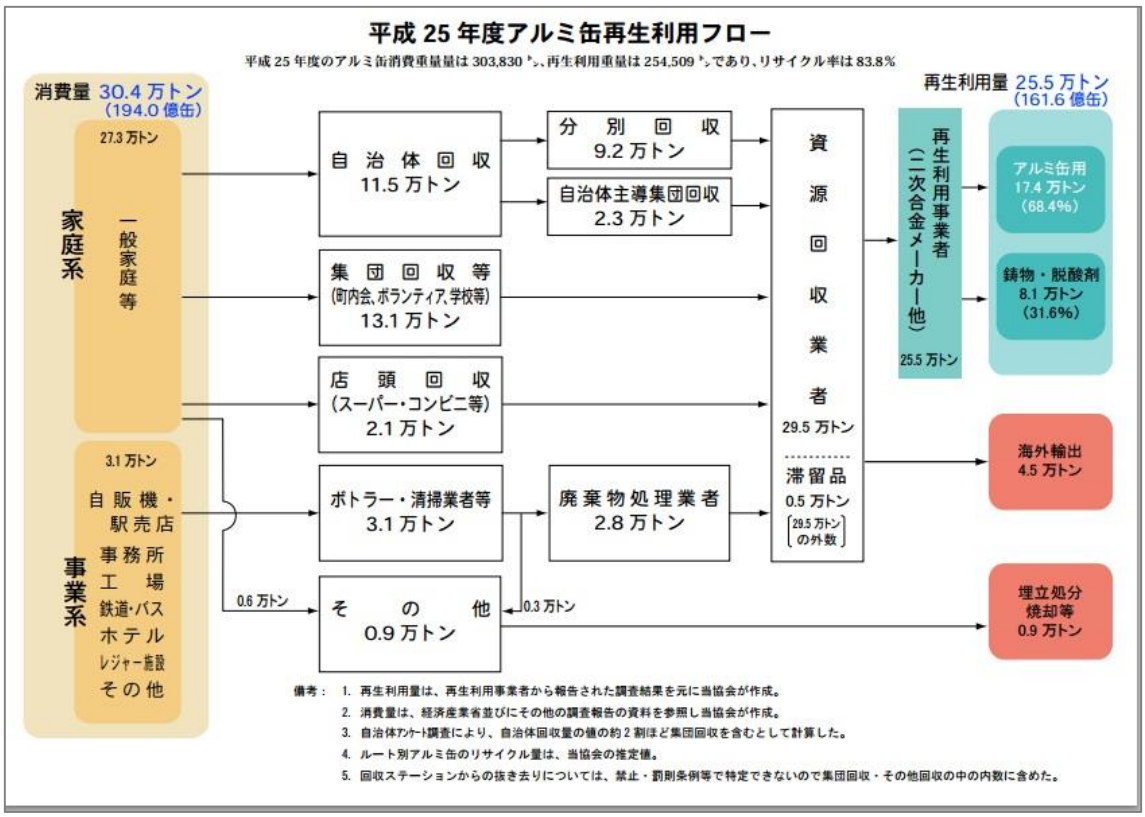
Business Classification		Glass Bottles			PET Bottle	Paper Packaging	Plastic Packaging
		Colorless	Amber	Other Colors			
Container	Food Manufacturing	0.33590	0.35293	0.80192	0.55127	0.04241	0.59488
	SoftDrink,Tea,Coffee Manufacturing	0.38251	0.29931	0.78271	0.51974	0.04341	0.59602
	Alcoholic Beverage Manufacturing	0.22727	0.25894	0.63720	0.49576	0.04163	0.47291
	Oil/fat Processing,Soap,Synthetic Detergent,Surfactant and Paint Manufacturing	—	—	—	—	0.04735	0.59524
	Pharmaceuticals Manufacturing	0.25510	0.30532	0.78015	—	0.02567	0.28665
	Cosmetics,Toothpaste,Other Toiletries Manufacturing	0.39482	0.30799	0.74508	—	0.04601	0.65536
	Retail Sales	—	—	—	—	0.04082	0.60841
	Other Industries	0.28808	0.10100	0.70218	—	0.04093	0.39281
Wrapping	Wrapping	—	—	—	—	0.02758	0.34373

Simplified Calculation — **Manufacture**

Business Classification		Glass Bottles			PET Bottle	Paper Packaging	Plastic Packaging
		Colorless	Amber	Other Colors			
Container	Food Manufacturing	0.01368	0.00282	0.03039	0.04070	0.00142	0.02388
	SoftDrink,Tea,Coffee Manufacturing	0.02064	0.01884	0.03653	0.06953	0.00253	0.01439
	Alcoholic Beverage Manufacturing	0.01410	0.00659	0.02463	0.03021	0.00220	0.00472
	Oil/fat Processing,Soap,Synthetic Detergent,Surfactant and Paint Manufacturing	—	—	—	—	0.00154	0.04804
	Pharmaceuticals Manufacturing	0.00296	0.01610	0.01186	—	0.00011	0.00306
	Cosmetics,Toothpaste,Other Toiletries Manufacturing	0.00671	0.00078	0.01832	—	0.00032	0.02622
	Retail Sales	—	—	—	—	0.00023	0.00735
	Other Industries	0.00730	0.01452	0.12122	—	0.00020	0.00391
Wrapping	Wrapping	—	—	—	—	—	—

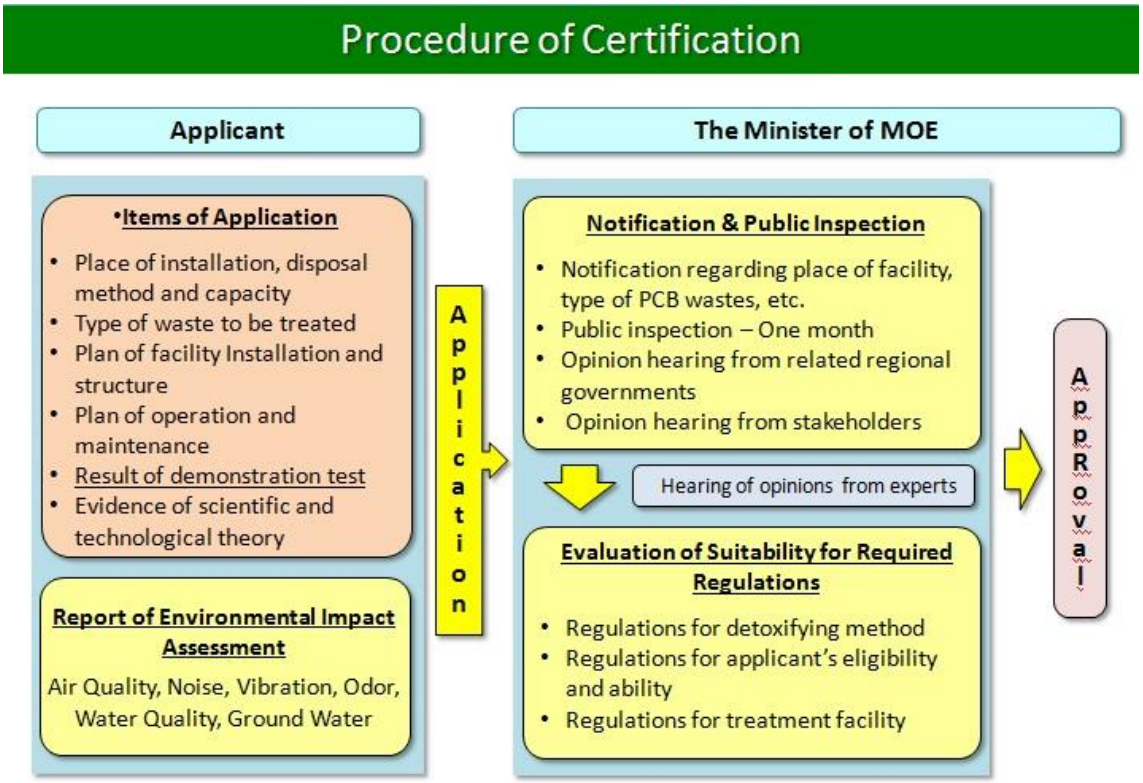
Source: JCPRA, http://www.jcpra.or.jp/Portals/0/resource/eng/2015.pdf

Annex 6: Aluminium Can Recycling Flow FY2013



Source: Aluminum Can Recycling Association, http://www.alumi-can.or.jp/data/sairiyo.pdf

Annex 7: Procedure of Certification (low-level PCB waste)



Source: Japan Industrial Waste Management Foundation

Annex 8: Biomass in Japan

8-a) Target of biomass utilization by type (2020)

Type of biomass	Amount generated annually	Present and target utilization ratio 2009 → 2020
1 Animal waste	Approx. 88 million tones	90% → 90%
2 Sewage sludge	Approx. 78 million tones	77% → 85%
3 Black liquor	Approx. 14 million tones	100% → 100%
4 Waste paper	Approx. 27 million tones	80% → 85%
5 Food waste	Approx. 19million tones	27% → 40%
6 Sawmill wood residue	Approx. 3.4 million tones	95% → 95%
7 Wood waste from construction	Approx. 4.1 million tones	90% → 95%
8 Non-edible parts of food crops	Approx. 14 million tones	85% → 90%
9 Forest off-cuts	Approx. 8 million tones	0% → 30%

Note: 1 Black liquor, saw mill wood residue, forest off-cuts are dry-weight, all others are wet weight.
2 Target for energy crops is 400,000 carbon tones produced by 2020.

Source MAFF, Biomass Policies and Assistance Measures in Japan,
http://www.maff.go.jp/e/pdf/reference6-8.pdf

8-b) The biomass conversion technology roadmap

Targeted conversion technologies and biomass for industrialization	
Technologies	● Methane fermentation & composting ● Combustion ● Solid fuel conversion (pellet, bio-coke, RPF, etc.) ● Liquid fuel conversion (First generation technologies for ethanol and biodiesel)
Biomass	● Woody biomass, food waste, sewage sludge, animal waste, etc.

Source: MAFF, Biomass Policies and Assistance Measures in Japan
http://www.maff.go.jp/e/pdf/reference6-8.pdf

Annex 9: Feed-in Tariff in Japan, FY2015 list of purchase prices

Reference: FY2015 list of purchase prices

Categories			FY2014	FY2015
Photovoltaic power	10 kW or more		32 yen	29 yen (April 1 to June 30)
				27 yen (from July 1)
	Less than 10 kW	When generators are not required to install output control equipment	37 yen	33 yen
		When generators are required to install output control equipment		35 yen
Land-based wind power	20 kW or more		22 yen	22 yen
	Less than 20 kW		55 yen	55 yen
Offshore wind power	20 kW or more		36 yen	36 yen
Geothermal power	15,000 kW or more		26 yen	26 yen
	Less than 15,000 kW		40 yen	40 yen
Small and medium hydropower	1,000 kW or more but less than 30,000 kW	Installing fully new facilities	24 yen	24 yen
		Utilizing the existing head race channels	14 yen	14 yen
	200 kW or more but less than 1,000 kW	Installing fully new facilities	29 yen	29 yen
		Utilizing the existing head race channels	21 yen	21 yen
	Less than 200 kW	Installing fully new facilities alone	34 yen	34 yen
		Utilizing the existing head race channels	25 yen	25 yen
Biomass	Wood (unused)	2,000 kW or more	32 yen	32 yen
		Less than 2,000 kW		40 yen
	Wood (general)		24 yen	24 yen
	Wood (waste materials of buildings)		13 yen	13 yen
	Waste materials		17 yen	17 yen
	Methane fermentation		39 yen	39 yen

Source: METI, http://www.meti.go.jp/english/press/2015/0319_01.html

Annex 10: List of Japanese institutions and professional associations related to environment and waste (non-exhaustive)

Name	Internet
3R Knowledge Hub	http://www.3rkh.net/index.php
Association of Electric Home Appliances (AEHA)	http://www.aeha.or.jp/
Aluminum Can Recycling Association	http://www.alumi-can.or.jp/index.html
Asia Biomass Office	http://www.asiabiomass.jp/english/
Clean Japan Center	http://www.cjc.or.jp/
Council for PET Bottle Recycling	http://www.petbottle-rec.gr.jp/english/
Friends of the Earth Japan	http://www.foejapan.org/en/
Glass Bottle 3R Promotion Association	http://www.glass-3r.jp/
Institute for Global Environmental Strategies (IGES)	http://www.iges.or.jp/en/
Institute for Sustainable Energy Policies	http://www.isep.or.jp/en/
Japan Council for Renewable Energy (JCRE)	http://www.renewableenergy.jp/council/english/
Japan Environment Association	http://www.jeas.or.jp/english/index.html
Japan Environmental Sanitation Center (JESC)	http://www.jesc.or.jp/en/index.html
Japan for Sustainability (JFS)	http://www.japanfs.org/
Japan Industrial Waste Information Center	http://www.jwnet.or.jp/en/index.html
Japan Organics Recycling Association	http://www.jora.jp/txt/eng/index.html
Japan Renewable Energy Foundation	http://jref.or.jp/en/
Japan Waste Management Association	http://www.jwma-tokyo.or.jp/asp/english/index.html
Japanese Business Alliance for Smart Energy Worldwide	http://www.jase-w.org/english/top/
Japan Containers and Packaging Recycling Association (JCPRA)	http://www.jcpra.or.jp/tabid/603/index.php
Japan Environmental Facilities Manufacturers Association (JEFMA)	http://www.jefma.or.jp/englishpage_f.htm
Japan Environmental Management Association for Industry (JEMAI)	http://www.jemai.or.jp/english/

Japan Industrial Waste Management Foundation	http://www.sanpainet.or.jp/
New Energy Foundation	http://www.nef.or.jp/english/aboutnef/index.html
National Institute for Environmental Studies (NIES)	http://www.nies.go.jp/
Plastic Packaging Recycling Council	http://www.pprc.gr.jp/en/
Plastic Waste Management Institute (PWMI)	http://www.pwmi.or.jp/ei/index.htm
Steel Can Recycling Association	http://www.steelcan.jp/english/index.html
The Japan Society of Industrial Machinery Manufacturers (JSIM)	http://www.jsim.or.jp/english/01.html
The Japan Society of Material Cycles and Waste Management (JSMCWM)	http://jsmcwm.or.jp/international/

Annex 11: Example of H2020 calls related to Waste

Under the previous Framework Programme FP7
CWIT - Countering WEEE Illegal Trade
http://cordis.europa.eu/project/rcn/110051_en.html
Japanese Participant: UNU (United Nations University)

Under H2020, calls 2013-2015 included
Prospecting Secondary raw materials in the Urban mine and Mining waste
http://cordis.europa.eu/project/rcn/193869_en.html
Japanese Participant: UNU

Waste: A resource to recycle, reuse and recover raw materials
Topic: Eco-innovative solutions (WASTE-6a-2015)
http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/2114-waste-6a-2015.html

Topic: Ensuring sustainable use of agricultural waste, co-products and by-products (WASTE-7-2015)
http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/2115-waste-7-2015.html

In October 2015, new calls should be released.

Calls encouraging cooperation with Japan or Joint calls include projects related to Critical Raw Materials. Even though these calls are not directly link with waste, it underlines the shared interest of both Japan and the EU to tackle the issue of critical raw materials.

FP7 / JST (Japan Science and Technology Agency)
Development of New Materials for the Substitution of Critical Metals, 2013
http://ec.europa.eu/research/industrial_technologies/pdf/eu-japan-2013_en.pdf

SC5-13 (Challenge 5) Coordinating and supporting raw materials research and innovation - Strategic international dialogues and cooperation on raw materials with technologically advanced countries
http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/calls/h2020-sc5-2014-one-stage.html

Annex 12: Exhibitions related to environment and waste (non-exhaustive)

JETRO provides an online database that lists trade fairs in Japan and Overseas in various sectors: JETRO Online Trade Fair Database (J-Messe), https://www.jetro.go.jp/en/database/j-messe/

Below a non-exhaustive list of exhibitions related to environment and waste.

In grey: past exhibitions for which the 2016 edition was not announced at the time of writing this report.

Date	Name	Place	Description	Website
2015/05/18 - 2015/05/20	Japan Biomass Power Market	Hilton Tokyo	Biomass	http://www.cmtevents.com/aboutevent.aspx?ev=150514&name=Japan-Biomass-Power-Market&
2015/06/17 - 2015/06/18	Kyushu Eco Fair 2015	Fukuoka Kokusai Center	Techology and Products related to CO2 discharging business / to environement support / to promote recycling society	http://www.noma.or.jp/show/bs-eco/index.html
2015/09/08 - 2015/09/10	Natural Energy Expo 2015	Yokohama (PACIFICO Yokohama)	i.a. Biomass	http://www.nikkan-event.jp/nh/
2015/10/13 - 2015/10/16	Japan Pack	Tokyo (Tokyo Big Sight)	Packaging Machinery Show	http://www.japanpack.jp/en/index.html
2015/11/11 - 21015/11/12	Energy Storage Summit Japan	Belle Salle Shibuya First	Energy-storage technologies	https://enstor.messe-dus.co.jp/home/
2015/11/18 - 2015/11/20	Tokyo International Industry Exhibition	Tokyo (Tokyo Big Sight)	Information, Environment, Healthcare/Welfare, Machines/Metals	http://www.sangyo-koryuten.tokyo/english/
2015/11/25 - 2015/11/27	INCHEM TOKYO (Plant Engineering Show, Innovative Products Show, Innovation in Water Management Show, ECO-MAnufacture Show)	Tokyo (Tokyo Big Sight)	Chemical and process industries, plant facilities and engineering as well as energy conservation, environmental measure and water treatment for industries.	http://www.jma.or.jp/inchem/
2015/12/10 - 2015/12/12	Eco-Products	Tokyo (Tokyo Big Sight)	Features environmental technologies and environmentally-friendly products and services	http://eco-pro.com/2015/english.html
2016/02/18 - 2016/05/19	Eco-Tech Fair Kawasaki	Todoroki Arena, Kawasaki City	Environmental technologies	http://www.kawasaki-eco-tech.jp/contents/about.html
2016/03/09 - 2016/03/11	The 3R International Scientific Conference on Material Cycles and Waste Management	Hà Noi, Vietnam	Promotion 3R in Asia-Pacific	http://www.3rincs.org/
2016/04/06 - 2016/04/08	Plastic Japan	Tokyo (Tokyo Big Sight)	Plastics/composites materials as well as its manufacturing and processing technologies	http://www.plas.jp/en/
2016/05/24 - 2016/05/27	N-EXPO (New Environment Exposition)	Tokyo (Tokyo Big Sight)	3R (Reduce, Reuse, Recycling), Resource Recovery / Recycling, Control & Improve of Air Pollution, Water Contamination, Soil Contamination, Waste Disposal and New energy	http://www.nippo.co.jp/eng/n-expo015/ http://www.nippo.co.jp/eng/n-expo016/
2016/06/15 - 2016/06/17	Smart Community Japan / Biomass Expo	Tokyo (Tokyo Big Sight)	Smart Community, Biomass, Plant Factory & Smart Agriculture, Next Generation Vehicle, Cloud Community, PPS (Power Producer and Supplier)	http://www.nikkan.co.jp/eve/smart/english/index.html
2016/06/29 - 2016/07/01	Renewable Energy Exhbition	Tokyo (Tokyo Big Sight)	Renewable Energy, incl. biomass and energy policies	http://www.renewableenergy.jp/2015/english/
2016/07/13 - 2016/07/16	Eco-Friendly Office/Factory Expo	Tokyo (Tokyo Big Sight)	Energy-saving products and technologies	http://www.eco-expo.jp/
2016/07/26 - 2016/07/29	Sewage Works Exhibition (SWE)	Nagoya International Exhibition Hall (Portmesse Nagoya)	Collection and treatment of wastewater for public procurement of municipal wastewater projects. It covers planning, designing, construction, and operation and maintenance.	http://www.gesuidouten.jp/en/
2016/09/08 - 2016/09/09	International Industrial Fair Kobe	Kobe	i.a. Environment & Energy	http://www.kobemesse.com/?page_id=3520

Annexe 13: Types of Business Legal Entities of Japan, "All about Starting a Business in Japan" 1 , Michio Matsuzaki, 2013 (available on http://www.eubusinessinjapan.eu/ after registration)

Followings are those types of business legal entities of Japan.

In case a foreign incorporation launches a business in Japan:

Representative Office

A representative office would fit to the preparatory stages of a business launch by a Foreign Company in a small scale in order to study Japanese markets and to plan for business structures etc. in future. A representative office can be easily set up without registration. A representative office is, however, not permitted to get involved in any of actual sales transactions in Japan. Furthermore, the representative office can neither open a bank account nor make lease contracts of real estate for an office etc. as a corporate entity as such. Therefore, a representative office needs a representative person who makes such agreements/contracts on individual capacity.

Branch Office

In order for a Foreign Company to operate a business actually involved in any kind of transactions in Japan the foreign company needs to set up a branch office or a subsidiary company. A branch office can be more easily set up than a subsidiary company, which only needs to locate an office, assign a representative of the office and be registered with needful information. Unlike a representative office it can open a bank account and make a lease contract of real estate for its office as a business legal entity. However, a branch office is regarded as a local and also as a part of organizations of a foreign company that operates business transactions upon authorization by its HQ in the foreign country. Therefore, all those liabilities and credits as outcomes of its business operations and transactions are to ultimately belong to the HQ.

Subsidiary Company

In order for a Foreign Company to be a business legal entity in Japan for operating all kinds of business transactions, it needs to set up a subsidiary company in the form of Kabushiki-Kaisya (KK - a stock company) or of Goudou-Kaisya (hereafter GK as an LLC - a limited liability company) or others. A subsidiary company is regarded as an independent corporate entity established under the Japanese laws concerned so that all the liabilities and credits belong to the subsidiary company as such as well as other Japanese corporations in common. There would be other forms of incorporating a business in

Japan than a subsidiary company is to set up a joint venture company with a Japanese company or an investment company by having a foreign company own equities as a partner of Japanese investors.

In case a foreign entrepreneur launchs a business in Japan:

Those foreign entrepreneurs as individuals, who do not have any foreign company and are planning to newly launch a business in Japan, can set up a corporate entity established under the Japanese laws concerned as an independent company in the form of KK, GK or others as well as other Japanese companies in common.

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This research is based on various sources, including reports, pamphlets, newspaper articles, interviews, presentations, etc. References are given in footnote. The below list is a non-exhaustive summary of the main documentation used (non-exhaustive list).

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