



Country Chapter

State of the 3Rs in Asia and the Pacific

The Socialist Republic of Viet Nam

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ABBREVIATIONS

C&D	Construction and Demolition waste
DMC	Domestic Material Consumption
DOC	Department of Construction
DONRE	Department of Natural Resources and Environment
EPR	Extended Producers Responsibilities
GDs	Gross Domestic Products
GHG	Greenhouse Gases
GSO	General Statistics Office
IGES	Institute for Global Environmental Strategies
ISPONRE	Institute of Strategy and Policy on Natural Resources and Environment
LEP	Law on Environmental Protection
MOC	Ministry of Construction
MOH	Ministry of Health
MOIT	Ministry of Industry and Trade
MONRE	Ministry of Natural Resources and Environment
MSW	Municipal Solid Waste
UDW	Urban Domestic Waste
UNEP	United Nations Environment Programme
URENCO	Urban Environment Company
VEA	Viet Nam Environmental Administration
VNEEP	Viet Nam Energy Efficiency Program

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A: WASTE DEFINITION

The legislations system in Viet Nam comprises of: (i) Constitution; (ii) Laws and Ordinances and; (iii) By-law documents including Decrees (issued by Government), Circulars (issued by ministries) and Prime Ministerial decisions. With regards to waste management, there have been definitions on different terms on waste and 3R such as: waste; scraps; discarded products; waste management and waste reuse, recycling... These terms have been defined by the following legislations:

- Law on Environmental Protection 2014 (LEP 2014);
- Decree 38/2015/ND-CP on waste and scrap management;
- Decision 16/2015/QD-TTg on take-back and treatment of discarded products;
- Circular 36/2015/TT-BTNMT on management of hazardous waste;
- Inter-ministerial circular 58/2015/BYT-BTNMT on medical waste management.

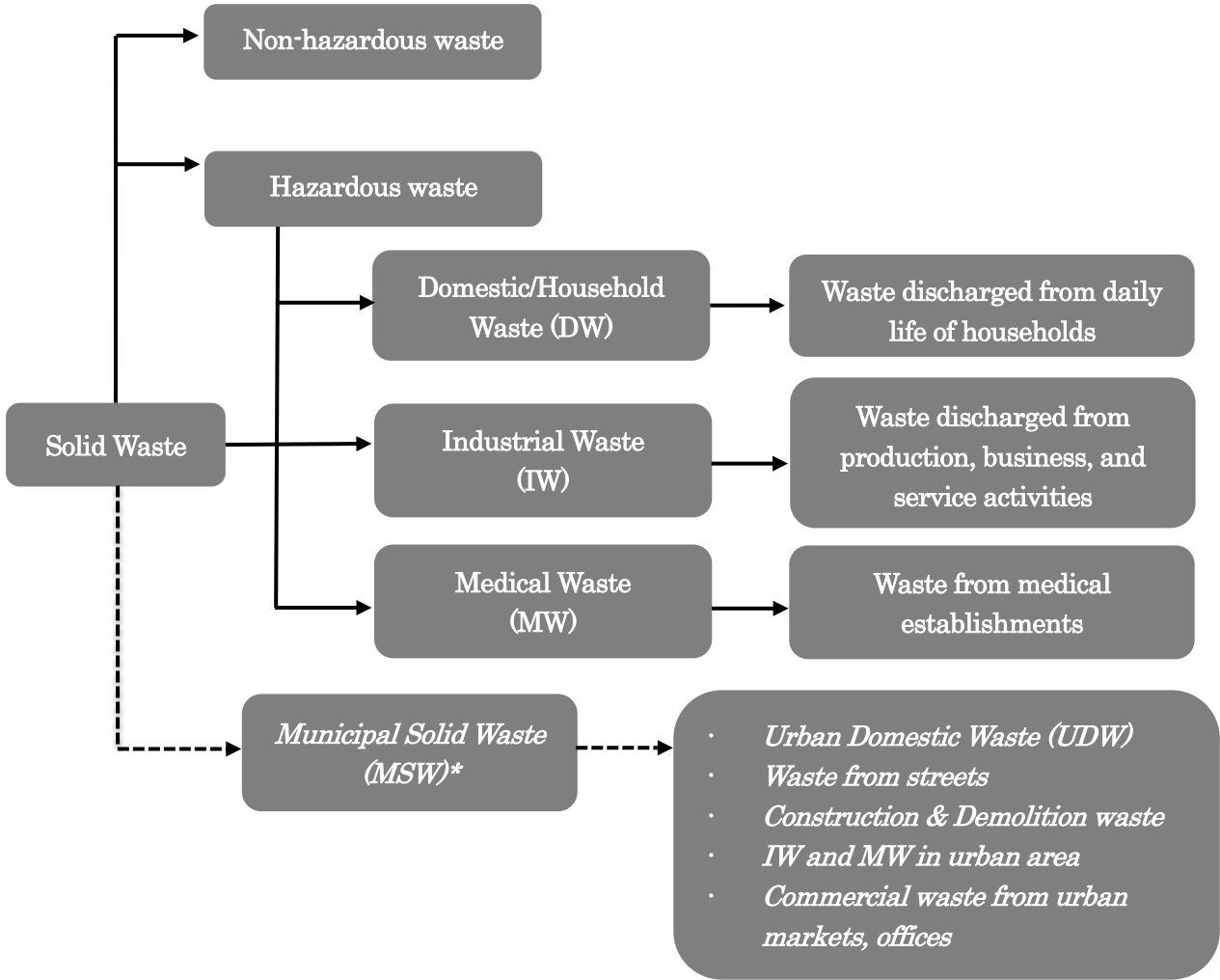
I. Waste and Related Definitions

- **Waste** means materials that are discharged from production, business, services, daily life, or other activities (LEP 2014).
- **Hazardous Waste** means a waste that contains any of toxic, radioactive, infectious, flammable, explosive, corrosive, poisonous, and other hazardous characteristics (LEP 2014).
- **Solid Waste** is the waste in the solid or muddy form (or sludge) which are discharged from production, business, services, daily life, or other activities (Decree 38/2015/ND-CP).
- **Non-hazardous Waste** is the waste that does not belong to the list of hazardous wastes or belong to that list but contains hazardous component below the hazardous threshold (Decree 38/2015/ND-CP).
- **Household (domestic) Solid Waste** is the solid waste that is discharged in the human daily life (Decree 38/2015/ND-CP).
- **Industrial Solid Waste** is the solid waste that is discharged from the production, business, services activities (Decree 38/2015/ND-CP).
- **Medical Waste** are materials in solid, liquid, gaseous forms that discharged by the medical establishments, consists of hazardous medical waste and non-hazardous medical waste (Inter-ministerial circular 58/2015/BYT-BTNMT on medical waste management).
- **Scrap Materials** mean materials recovered, sorted, selected from materials, products removed from the process of production or consumption for use as an input material for other production processes (LEP 2014).
- **Discarded Products** mean wastes derived from products which have been expired or discarded after use (Decision 16/2015/QD-TTg).

From reviewed legislations it has been observed that there is no clear definition of municipal solid waste (MSW) in Viet Nam as usually defined in other countries. Instead, waste has been classified into: (i) non-hazardous and; (ii) hazardous, and can also be categorised as household/domestic, industrial or medical. In the national environment reports, however, MSW has also been mentioned and addressed although there is not any clear definition. It is understood unofficially that MSW

means waste generated from urban areas and includes: domestic/household waste; street waste; construction and demolition (C&D) waste; generated waste from office, hospital, industries, markets in urban areas. More often used is the concept of urban domestic waste (UDW), which means waste generated from urban households. It is estimated that the UDW accounts for around 60-70% of MSW in Viet Nam (MONRE, 2011).

Hazardous waste is regulated by the Circular 36/2015/TT-BTNMT on management of hazardous waste. According to this Circular, hazardous waste is classified into 19 groups based on their sources, characteristics, state of existence, etc.



Note: *MSW is defined unofficially, not by legislations but stated in the National Environment Report

Figure A-1 Solid waste classification in Viet Nam

II. 3R and Related Definitions

- **Waste Reuse** is the re-use of the waste directly or after preliminary processing without changing its characteristics.
- **Preliminary Processing of the Waste** means using mechanical/physical measures for changing physical characteristics such as dimensions, moisture, temperature to facilitate segregation, storage, transportation, reuse, recycling, co-treatment, treatment for blending or separating the waste compositions to meet the management procedure.
- **Waste Recycling** is the process of using technological/technical measures to recover valuable compositions from the waste.
- **Energy Recovery** from Waste is the process of energy recovery from waste transformation.
- **Waste Treatment** is the process of using technological, technical (different from preliminary processing) to reduce, eliminate, isolate, burn, dispose, landfill the waste and hazardous compositions of the waste.
- **Co-treatment of waste** means combination of an existing production process to recycle, treat or recover the energy from the waste in which the waste will be used as materials, fuels or treated.

(Decree 38/2015/ND-CP on waste and scrap management)

It is observed that waste reuse and recycling, including energy recovery, and waste treatment have been defined quite clearly by the Decree 38/2015/ND-CP. Waste prevention and reduction, however, have not been addressed and defined in the current environmental legislations of the country.

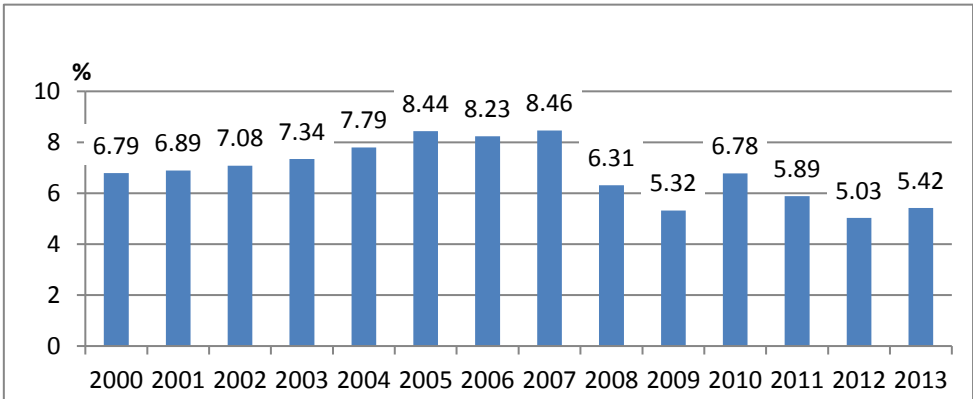
B: COUNTRY SITUATION

I. Background Information on Waste Management

1. General information about the country

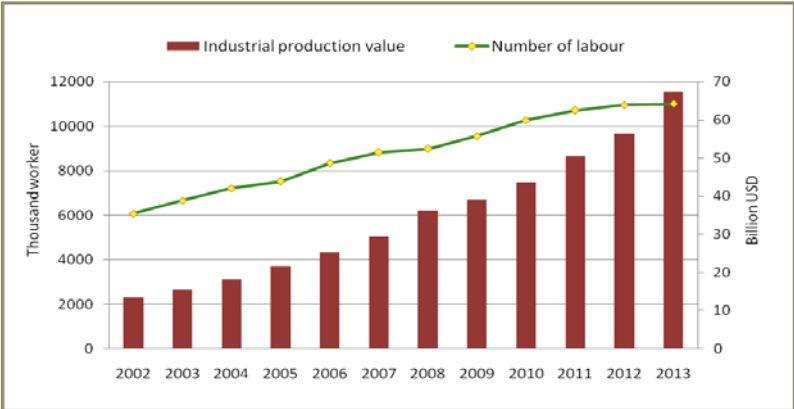
Viet Nam is the easternmost country on the Indochina Peninsula in Southeast Asia. It is bordered by China to the North, Lao PDR to the Northwest, Cambodia to the Southwest, and the South China Sea to the east. The area of Viet Nam is approximately 330,000 km²; the population was 90.7 million by the end of 2014 and is continuing to grow.

Since the adoption of the *Renovation* policy in 1986, the country has experienced a relatively high economic growth (showed in Figure B-1 for the last 13 years) and joined the middle-income group with GDP per capita in 2015 of USD2,109 (GSO, 2015). This is due to the strong industrialization process (Figure B-2) which has led to remarkable poverty reduction, with the poverty rate of around 70% in 1980 falling to nearly 10% in 2012 (Figure B-3).



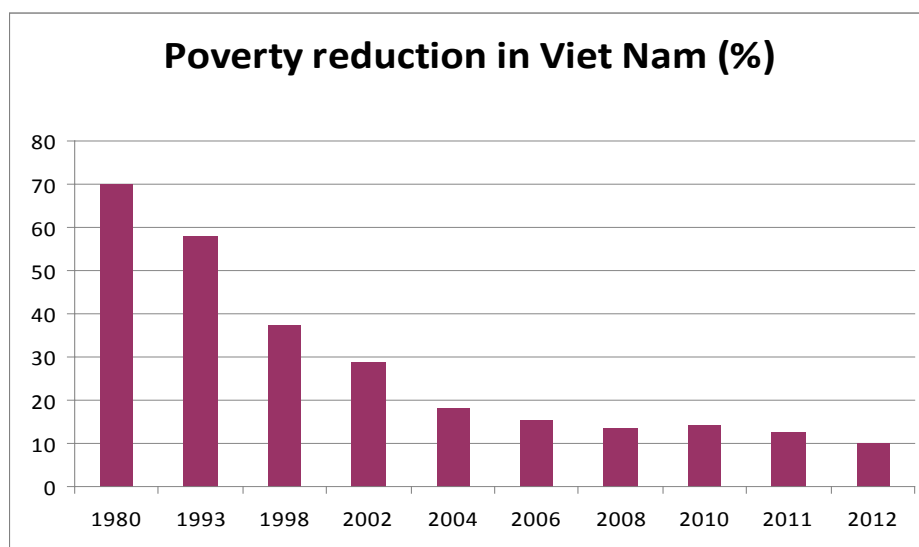
(Source: General Statistics Office, 2014)

Figure B-1 Viet Nam GDP growth rate in 2000-2013



(Source: General Statistics Office, 2014)

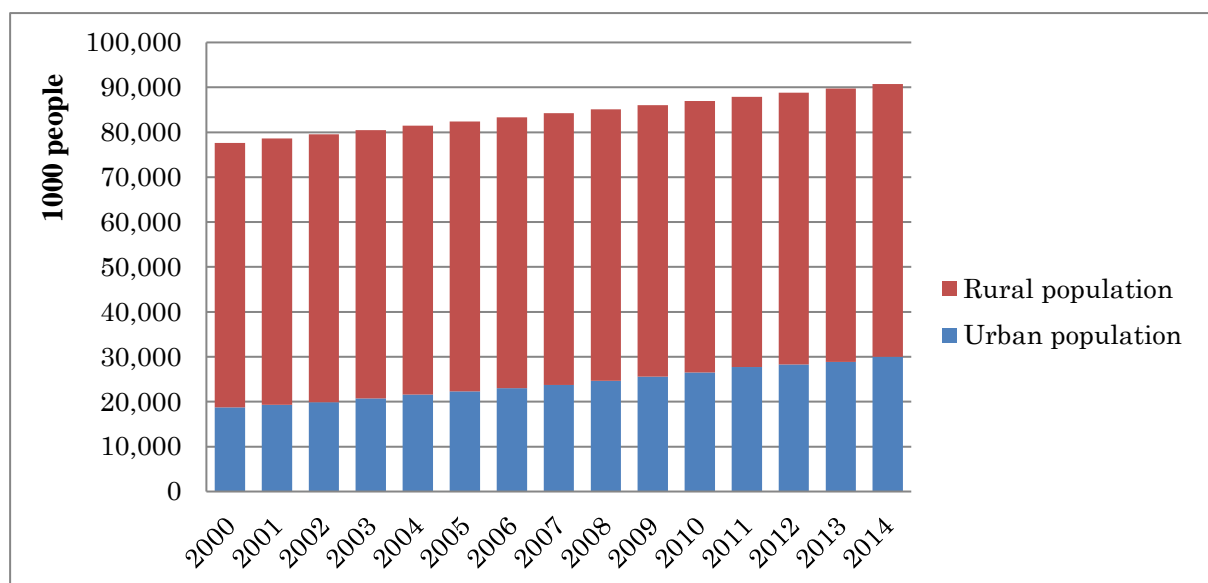
Figure B-2 Industrialization in Viet Nam in 2002-2013



(Source: General Statistics Office, 2014)

Figure B-3 Poverty reduction in Viet Nam in 1980-2012

Besides that, Viet Nam has also experienced a rapid urbanization in the last two decades. The urban population has increased continuously and reach more than 30 million people, equivalent to 30%, of nearly total 91 million people in 2014 (Figure B-4).



(Source: General Statistics Office, 2015)

Figure B-4 Urban population increase in Viet Nam in 2000-2014

Population growth, urbanization and better living standards have resulted in higher consumption needs, generating more waste. Research has shown that based on income per capita, people in urban

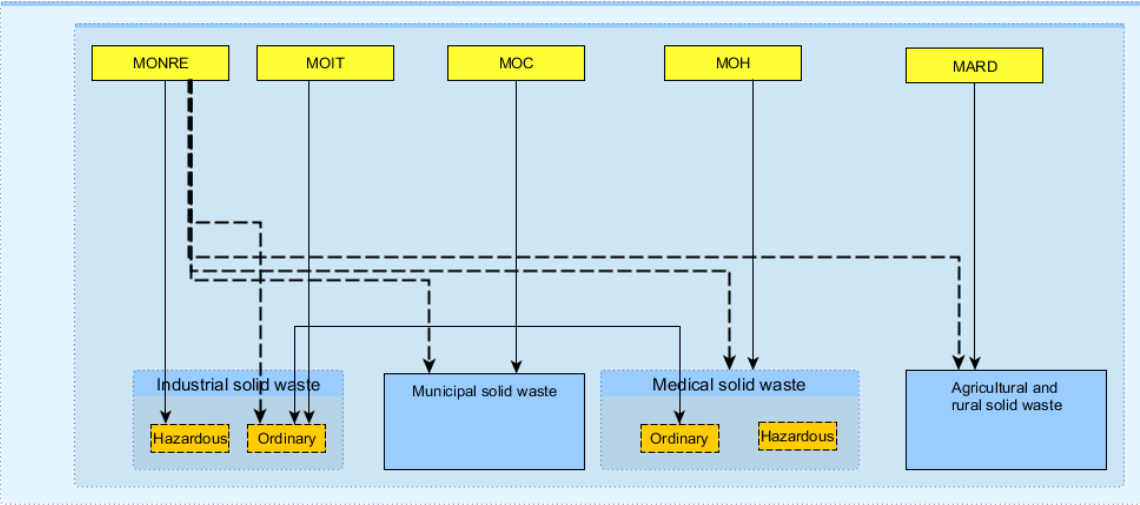
areas consume 2-3 times more natural resources (electricity, daily life commodities, fuel) than those in rural areas; the volume of waste generated by them is also 2-3 times higher than in rural areas (MONRE, 2011).

2. Institutional organization of waste management

A) National level

In general, the major state authority responsible for environmental affairs in Viet Nam is the Ministry of Natural Resources and Environment (MONRE)¹. Under MONRE, the Viet Nam Environmental Administration (VEA) is responsible for state management in the environment sector. Under VEA, the Waste Management and Environment Promotion Agency (WEPA) has been assigned with responsibilities on waste management.

In addition, other line ministries are also directly involved in waste management activities as regulated by the LEP 2014. According to this, MONRE takes overall responsibility on waste management and direct management of hazardous waste. The Ministry of Construction (MOC) is responsible for development of master-plans, standards for waste treatment facilities and management of C&D waste. The Ministry of Agriculture and Rural Development (MARD) is responsible for management of agricultural and rural waste. The Ministry of Health (MOH) is responsible for management of solid waste in hospitals and medical establishments and the Ministry of Industry and Trade (MOIT) is responsible for development of environmental industry and industrial waste (LEP, 2014).



(Source: JICA, Study Report on Solid Waste Management in Viet Nam, 2011)

Figure B-5 Institutional Framework on solid waste management in Viet Nam

The structure of relationship among Vietnamese government agencies on solid waste management is showed in the Figure B-5.

¹ Besides the environment, the MONRE is also responsible for state management on other 7 sub-sectors: landuse, water resources, mineral, hydrometeorology, survey and mapping, sea and island and remote sensing.

B) Local level

At local/provincial level, there are a number of agencies participating in waste management including Provincial People's Council, Provincial People's Committees (PPCs), Department of Natural Resources and Environment (DONRE), Department of Construction (DOC) and Urban Environment Company (URENCO).

Provincial People's Council is the local parliament of the province/city, elected by local people and has law-making function at local level. Provincial People's Committees (PPCs) are the executive agencies of the People's Council, responsible for state administration at the local level with overall responsibility for waste management in the province/city. Department of Construction (DOC) is responsible for municipal solid waste management in coordination with DONRE. The Department of Natural Resources and Environment (DONRE) plays an important role in waste management with respect to monitoring environmental quality, managing and implementing waste management policies and regulations issued by MONRE and PPC. However, the role of DOC and DONRE in solid waste management depends on the characteristic and organization of each city/province and these may differ from each other.

Urban Environment Company (URENCO) (this may have a different name in different cities/provinces based on its role and functions) is the main state-owned company in charge of waste collection, transport, and treatment in the province or city. Regarding landfill projects, URENCO is often assigned to be the agency being the owner of the landfill project, who then also manages and operates the landfill over its operation life. Besides this, URENCO may also be in charge of solid waste collection, maintaining hygiene in public places, public lighting, planting and maintenance of roadside trees.

II. Current Status and Challenges on 3Rs and Waste Management

1. Current status of 3Rs and waste management

A) Waste generation

According to a study, conducted by the MOC in 2014, the generation of the household waste in urban areas is ~ 31,600 ton/day and in rural areas is 31,500 ton/day. Therefore total household waste is about 63,000 ton/day nationwide or nearly 23 million ton/year in 2014 (N.H.Tien, 2014).

B) Solid waste prevention and reduction

Waste prevention and reduction have not been paid enough attention in Viet Nam in both production and daily life. In production field, measures such as cleaner production, waste audit, and ISO 14000 have not been actively implemented by industries. In 2009, the National Strategy on Cleaner Production in Industry up to 2020 was approved, however, according to an assessment in 2015, only around 24% of enterprises have applied cleaner production measures (VNCPC, 2016).

Besides, there have not been any incentive policies or compulsory measures for households to reduce their solid waste generation. The solid waste fee system is based on a flat rate but not a volume based or pay-as-you-throw mechanism like in some other countries.

C) At-source segregation

At-source household solid waste sorting has not yet become a popular practice in Viet Nam, but rather has only been experimented on household garbage under some pilot projects in major cities. So far, two main 3R programs have been implemented positively in Hanoi and Ho Chi Minh city, financed by international and domestic budgets. With underdeveloped infrastructure and unsystematic management, in many cases, separated wastes have been collected and disposed together thus reducing the effectiveness of these programs, indicating that people have not taken up the habit of separating wastes.

However, some recyclable solid waste has been sorted by households and garbage collectors to sell to recycling craft villages. Spontaneous sorting of recyclable solid waste is continuously carried out from the originating places to gathering points until final landfills.

With regards to industrial waste, most recyclables are sorted right from where they are generated for reuse and recycling. As a result, recyclables will be used as materials for production in the industries themselves. Other scraps which are non-reusable for such production processes but could possibly be used for secondary production will be gathered and sold to recycling units. The rest will be moved to the waste storage of companies or collecting units to transport to treatment facilities.

Regarding the health sector, most medical solid waste is generally sorted as per the regulations of the MOH in all central hospitals as around 95% hospitals have implemented this segregation nationwide (MONRE, 2011).

D) Collection and transportation

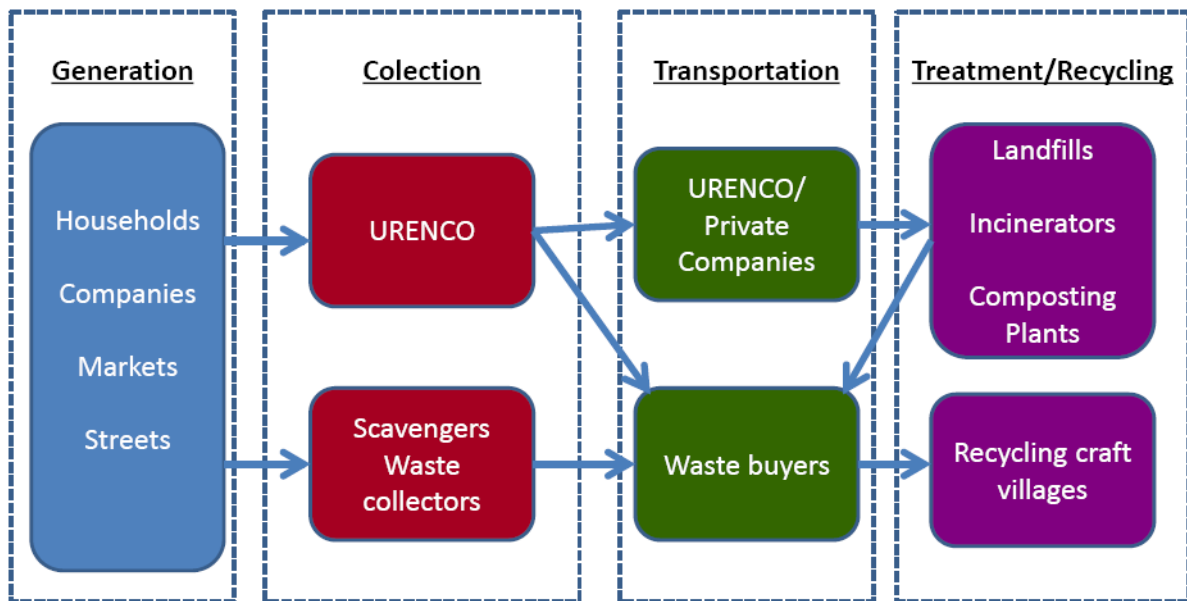
According to the National Environment Report 2011-2015, the rate of household solid waste collection in urban areas reached an average of 84-85%. This rate is rising in accordance with the grade of cities. The lowest rate is at cities under grade IV with an average collection rate of 65%, and the highest one belongs to Hanoi city (special city) with 98% (MONRE, 2015). Waste collection is implemented usually by URENCO companies but also private companies especially in major cities. In Ho Chi Minh city, for example, 50% of generated waste volume is collected by private companies.

In rural areas, the collection rate is 40-55% varying by localities, in small towns it could reach 60-80% while in remote mountainous area it is even below 10%. In rural area, the household solid waste is usually collected by an environmental sanitation team for each hamlet. In some localities, private companies also participate in collecting and treating solid waste (Tien N.H, 2014).

E) National waste flow

According to a study conducted by the Viet Nam Economics and Policy Research institute

(VEPR) in 2015, waste management flow can be described in Figure B-6.



(Source: VEPR, 2015)

Figure B-6 Scheme of waste management in Viet Nam

F) Solid waste reuse and recycling

Regarding household solid wastes, most Vietnamese families have a habit of segregating recoverable garbage such as plastics, papers and metals to sell to garbage-collectors. Thanks to this collecting system, recyclable materials are separately collected and shipped to recycling craft villages. It is estimated that around 8-12% volume of collected municipal solid wastes have been recycled by this way (MONRE, 2011).

Recycling activities in craft villages, however, are informal with backward technologies and usually cause major pollution which impacts the environment and public health. Serious impacts have been observed in paper, metal, plastics and electronic waste recycling villages in Hung Yen, Bac Ninh, and Hai Duong provinces.

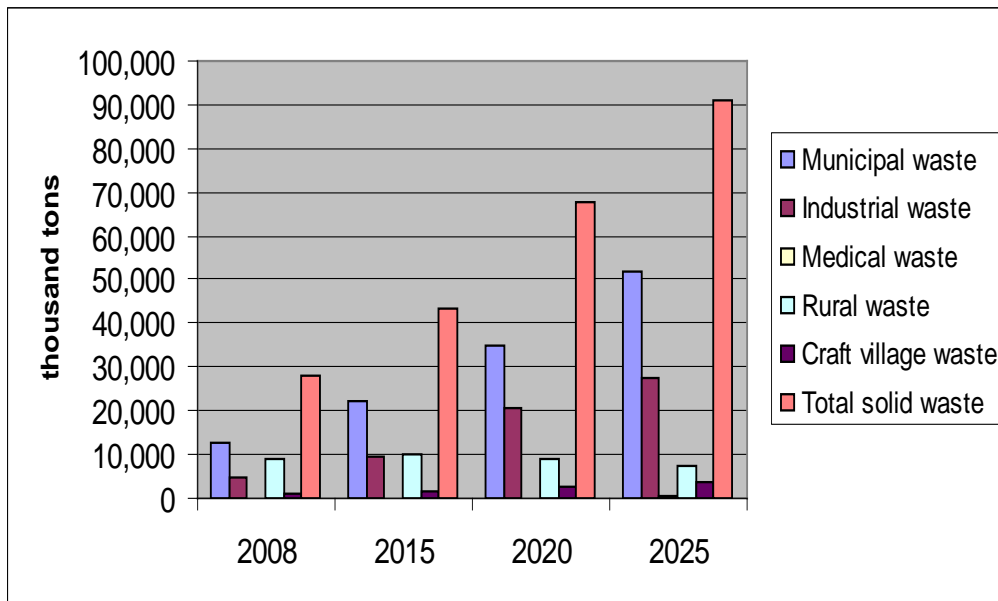
In the area of compost production from household garbage, despite recent developments and application of some technologies, the number of compost production facilities is not so large and is distributed mainly in some main cities. The compost market is not really developed, and farmers still prefer using chemical fertilizers for crop production.

2. Some challenges/constraints for 3Rs and waste management in Viet Nam

A) Rapid increase in waste volume and types

Viet Nam is a developing country with rapid urbanization, industrialization and population growth with a growing middle-income class and changing consumption patterns. The generated waste volume will then increase in future and is estimated to reach a total of around 69 million ton in 2020 and 91 million tons in 2025 (Figure B-7). Besides that, there is a threat

of illegal import of waste from other countries to Viet Nam under “scrap import”. Furthermore, new waste types such as e-waste, C&D waste, food waste, and disaster waste will emerge as new issues that need to be resolved.



(Source: MONRE, MOC, 2009)

Figure B-7 Waste generation projection in Viet Nam by 2025

B) Lack of clear responsibilities and/or coordination/cooperation among management agencies at different levels; lack of systematic database on waste management

As described above, solid waste management in Viet Nam has been assigned to different ministries including MONRE, MOC, MARD, MOIT and MOH. However, at local level, there are certain areas in which the assignment is not clear and there are overlaps between sectors. For example, in some cities (such as Ha Noi, Hai Phong, Hue) municipal solid waste is the responsibility of the DOC, but in others (such as Ho Chi Minh City, Da Nang) it is the responsibility of DONRE.

Besides that, there is a lack of inter-provincial, inter-regional coordination and collaboration in waste management. Each province/city maintains its own management but not in a wider network.

Furthermore, there is a lack of a time-series and consistent database on waste management at national level. As shown in this study, there are differences in the results of some studies/researches and the official data by MOC/MONRE due to different applied methodologies and scale of landfills/treatment facilities as well as the time of the survey. This will lead to difficulties in projection, planning and development of waste management strategies and master plans.

C) Shortage of an adequate financial investment

Financial investment for waste management in Viet Nam is quite low, does not meet the

demand and is not equally allocated. The main source comes from the state budget and more than 90% of it is allocated for waste collection and transportation while the budget for waste treatment is very low, mainly for landfilling. The solid waste management charge is quite low, about 21,000 VND (0.9 USD) per household per month in urban area and 16,000 VND (0.7 USD) per household per month in rural area (Tien.N.H et al, 2016), averaging around 0.5% of household expenses. The total collected charges can cover less than 60% of the total waste management cost and in some municipalities it covers only 20-30% the cost.

D) Informal recycling and landfilling are popular and cause environmental degradation

Waste recycling is implemented mainly by the informal sector in craft villages with backward technologies causing environmental pollution and health impacts. A suitable solid waste treatment technology has yet to be found for Viet Nam to limit landfilling, which is still the main disposal method. Although about 54-77% of the urban domestic waste is organic (MONRE, 2015), composting technology is not well applied due to difficulties in selling compost fertilizers. Burning and waste-to-energy technologies seem to be promising but they are expensive and would need more time to be used widely in the country.

E) Low awareness on integrated management of solid waste

There is still low awareness and sense of responsibility of leadership at different levels, as well as businesses and communities, in relation to integrated solid waste management. Focusing mainly on economic growth and profit-making, management agencies and businesses still neglect environmental requirements in their activities including waste reduction, reuse and recycling measures. Solid waste prevention and reduction are not yet widely practiced and promoted, especially in daily life. Communities are still not aware of the benefits of at-source solid waste sorting and waste reduction.

III. Policy on 3Rs and Waste Management

Policy on waste management in Viet Nam started with the **Law on Environmental Protection 1993**, which has regulated general provisions on environmental protection and waste management. Later on, in 1999, the Prime Minister approved the **National Strategy on Waste Management in Urban and Industrial Area to 2020**. Up to that time, 3Rs had not been emphasized or paid much attention in waste management.

With 3R initiative taken place in 2004 by Japan, Viet Nam has introduced and emphasized the 3Rs concept and principles into the **Law on Environmental Protection 2005**. In this law, for the first time, waste segregation at-source, reuse and recycling were regulated in detail. In particular, the concept of extended producer responsibility (EPR) was introduced. By-law documents and regulations have also been developed for hazardous waste and medical waste.

In 2009, the **National Strategy on Integrated Solid Waste Management to 2025, vision to 2050** has been adopted. The Strategy has defined clear directions for waste management, set the objectives and tasks and solutions to achieve the targets. Although its targets seem to be ambitious, the Strategy has made clear the integrated approach of solid waste management by which the 3Rs

should be strengthened while landfilling should be limited.

Table B-1 3R and waste management related targets in National Strategy of Integrated Solid Waste Management to 2025, vision to 2050

Target	To 2020	To 2025
Rate of municipal waste collection	90%	100%
Recycling rate of municipal waste	85%	90%
Collection rate of C&D waste in urban areas	80%	90%
Recycling rate of C&D waste in urban areas	50%	60%
Reduction rate of plastics bags in super market compared with 2010	65%	85%
Rate of municipalities implementing waste at source segregation and recycling facilities	80%	100%
Collection rate of non-hazardous industrial waste	90%	100%
Reuse and recycling rate of non-hazardous industrial waste	75%	-
Collection rate of solid waste from households in rural areas	70%	90%
Collection of solid waste from craft villages	80%	100%

Source: Prime Minister Decision 2149/QĐ-TTg.

Table B-2 List of discarded products to be taken back and treated

STT	Discarded products	Time to be applied
I	Batteries	01 July 2016
II	Electric and Electronic equipment <i>Compact and fluorescent lamps</i> <i>Computers; computer display; CPU</i> <i>Printing machines; fax, scanner machines</i> <i>Camera, video camera</i> <i>Mobile phones, ipad</i> <i>DVD; VCD; CD and other players</i> <i>Photocopy machines</i> <i>TV; fridge</i> <i>Air conditioners; washing machines</i>	01 July 2016
III	Lubricant oils	01 July 2016
IV	Tyres	01 July 2016
V	End-of-life vehicles	01 January 2018

Source: Prime Minister Decision 16/2015/QĐ-TTg dated 22 May 2015

In 2012, in the context of climate change, Viet Nam has issued **National Strategy on Environmental protection to 2020** and **National Strategy on Green Growth**. In 2013, the **Resolution 24/NQ-TW on proactive response to climate change, strengthening natural resource management and environmental protection** has been adopted by the Viet Nam Communist Party. These documents again repeated the needs of promoting 3Rs as a measure to promote resource efficiency and greenhouse gases (GHG) reduction. Revised **Law on Environmental Protection 2014** has kept the defined integrated solid waste management approach

and tried to make clearer the functions and tasks of line ministries in waste management. The EPR policy has also been elaborated with the Prime Minister's Decision 16/2015/QD-TTg with detailed discarded products which need to be taken back and treated/recycled (Table B-2). Current key policy and legislations on waste management in Viet Nam is presented in Box 1.

Box 1. Key legislations for waste management in Viet Nam

- Party Resolution 24/NQ-TW dated 03 June 2013 on Proactive Responses to Climate Change, Enhanced Natural Resource Management and Environmental Protection.
- Law on Environmental Protection 2014.
- Decree 38/2015/ND-CP on waste and scrap management.
- Decision 16/2015/QD-TTg on take-back and treatment of discarded products.
- Circular 36/2015/TT-BTNMT on management of hazardous waste.
- National Strategy for Environment Protection Until 2020 and Vision Toward 2030 (Decision No. 1216/QD-TTg dated 05 Sep 2012).
- National Strategy for Integrated Management of Solid Waste Until 2025, and Vision Toward 2050 (Decision No. 2149/QD-TTg dated 17 Dec 2009)
- National Strategy for Green Growth (Decision 1393/QD-TTg, dated September 25, 2012) and National Action Plan for Green Growth 2014-2020 (Decision 403/QD-TTg dated March 20, 2014)
- Master plan for the construction of solid waste treatment sites in 3 key economic areas in the North, Centre and South of Viet Nam to 2020 (Prime Minister Decision 1440/QD-TTg dated 06 October 2008).
- Master plan for the construction of the solid waste treatment site in the key economic area of Mekong Delta to 2020 (Prime Minister Decision 1873/QD-TTg dated 11 October 2010).
- Solid waste treatment investment program for the period of 2011-2020 (Prime Minister Decision 798/QD-TTg dated 25 May 2011).
- Masterplan for solid waste management in Cau river basin to 2020 (Prime Minister Decision 2211/QD-TTg dated November 14th, 2013).
- Masterplan for solid waste management in Nhue-Day river basin to 2020 (Prime Minister Decision 223/QD-TTg dated February 12th, 2015).
- Master plan for solid waste management in Dong Nai river basin to 2030 (Prime Minister Decision 07/QD-TTg dated January 6th, 2015).

Through the years, waste management policies and legislations in Viet Nam become more and more complete and elaborate. Integrated solid waste management and 3Rs measures have gradually introduced into regulations. However, there is still a lack of detailed legislations on different types of wastes such as e-waste, C&D waste, and food waste, which needs to be developed in the future.

IV. Major Treatment and 3R Related Technologies

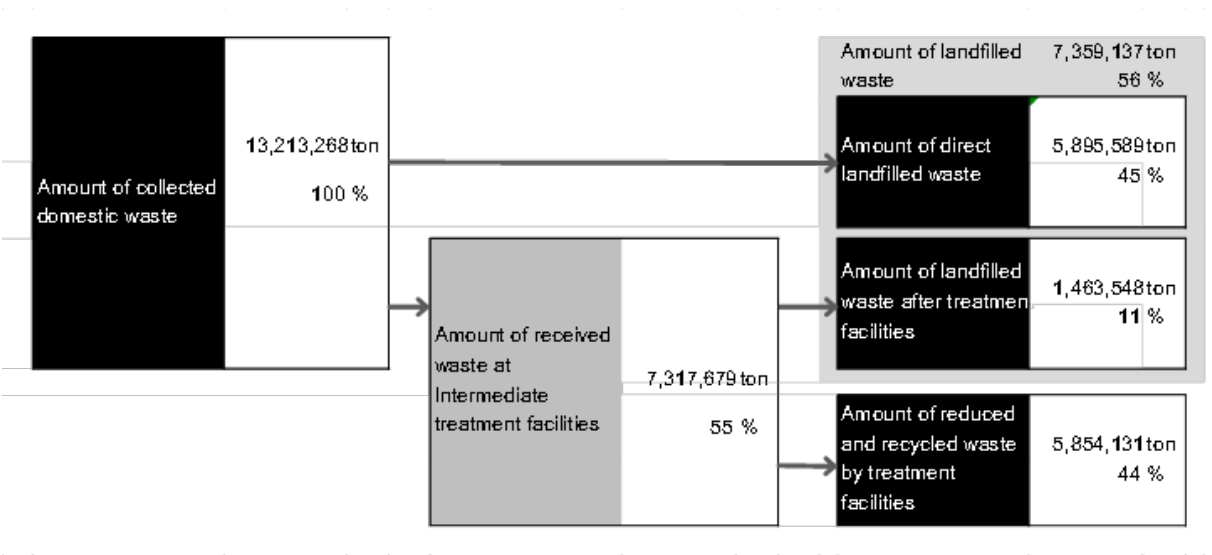
1. Landfilling

According to MONRE National Environment Report in 2011, amount of landfilled solid waste accounts for 76-82% of collected waste, of which about 50% is controlled landfill and 50% uncontrolled (MONRE, 2011).

According to MOC data in 2015, there are around 660 landfills (excluding small landfills at commune level) with total area of 4,900ha, of which 203 landfills are sanitary (~31% of landfills). Of these 660 landfills, 5.7% are over 20ha; 59.3% are between 1-20ha and; 35% are below 1ha. Some big landfills include Nam Son (Hanoi) – 83.5ha; Khanh Son (Da Nang) – 48.3ha; Cu Ebur (Dak Lak) – 22ha; Da Phuoc (Hochiminh city) – 128ha.

Till 2015, there are around 35 treatment facilities for UDW with total capacity of 6,500 tons/day, for example, Da Phuoc complex (3,000-5,000 tons/day), Cu Chi complex (Hochiminh city – 1,000 tons/day). With regard to treatment technology, 5 facilities are incinerators, 12 composting and 18 are mixed with both incineration and composting (Tien N.H. et al, 2016).

In 2015, according to another investigation conducted by the JICA project “Solid Waste Viet Nam”, however, there are a total of 573 landfills, of which 29% are hygienic and 71% are unhygienic (Wada H., 2016). The study has also come up with a finding that the percentage of landfilled domestic solid waste in Viet Nam is about 56% of collected waste, while 44% has been either recycled, composted or incinerated (Figure B-8).



(Source: Wada H., 2016)

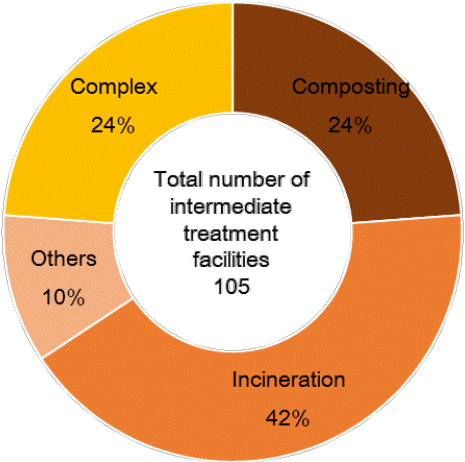
Figure B-8 Material balance of domestic solid waste in Viet Nam in 2014

2. Composting

According to a study conducted by the Institute of Strategy and Policy on Natural Resources and Environment (ISPONRE), Viet Nam and the Institute for Global Environmental Strategies (IGES), there were about 41 composting plants in Viet Nam in 2013, of which 28 are in operation, 10 are under construction and 3 had stopped working (ISPONRE, IGES, 2013) (See ANNEX 1).

With regards to the technologies, it has been observed that most composting plants have similar production technologies, including screening (mechanical and manual), aerobic with compulsory aeration or without aeration, and anaerobic composting. Due to poor quality raw materials, all plants have to separate waste before beginning compost production. Most plants apply aerobic technology with compulsory aeration, while only two others use aerobic technology without compulsory aeration and one uses anaerobic technology. The average maturation period is 45 days, the minimum is 15 days (in Ha Long Bio-technology Waste Treatment Plant), the longest is 70 days (Waste-to-organic Humus Treatment Plant, Ha Noi).

There are several foreign composting technologies applied including those from France, Korea, Spain, Finland, and Germany. Domestic technologies such as An Sinh-ASC, SERAPHIN, Tam Sinh Nghia have also applied with lower investment and treatment costs. It is worth noting that the MOC has licensed five domestic municipal solid waste treatment technologies: (i) SERAPHIN of the Green environment company; (ii) An Sinh-ASC of Tam Sinh Nghia company; (iii) technology to compress solid wastes into material blocks of the Hydraulic Machine Company; (iv) Incineration technology of the Research Center for the application of new technology and environment, and; (v) Incineration technology BD-ANPHA of Duc Minh Limited Company.



(Source: Wada H., 2016)

Figure B-9 Number and type of intermediate waste treatment facilities in Viet Nam in 2014

In 2014, Wada H. also found out that there are 105 intermediate waste treatment facilities nationwide in Viet Nam. Of these 105 facilities, 25 are composting plants (accounting for 24%), 25 are complex, implementing both composting and incineration (accounting for 24%), 44 are incinerators

(accounting for 42%) and 11 are other (accounting for 10%) (Wada H., 2016) (Figure B-9).

It has been observed that most composting plants have not been operating at full capacity, some plants have even stopped operations due to many difficulties related to capital, production technology and markets. The lack of at-source separation of waste materials leads to low quality of compost products, not meeting local requirements, and production costs being high while product price remains low. Consequently, the market for compost is still very limited.

3. Incineration/burning

According to Wada H., there are 44 incinerators nationwide (Wada H, 2016). These burning technologies with different scales from 10 tons/day to 150 tons/day have been applied in some localities particularly in cities, in densely populated urban areas or districts, and in communes.

The advantage of this method is that waste is treated thoroughly. The method eliminates the possibility of polluting waste, reducing the volume and weight of waste to a minimum; saves the land of treatment facilities; short processing time; enable to recover thermal energy. However, the costs of investment, operation and processing are high. Management, operation and maintenance of the whole system are complex. It is difficult to completely eliminate the risk of environmental pollution due to technical problems or due to lack of quality control of input waste or violation of workers in operating the incinerators.

In the area of health, a majority of hospitals burn health waste in manual incinerators without exhaust treatment systems. Some hospitals install modern incinerators but they are not under operation due to ambient population area. It is not so popular but in some rural areas open burning is still carried out.

4. Waste-to-energy

Until 2016, there is only 01 waste-incineration-for-electricity plant in Nam Son, Hanoi, with capacity 20MW and 75 tons of waste per day. This plant has been inaugurated in December 2016 and treats only industrial and hazardous waste. Another waste-to-energy project started feasibility study in Ho Chi Minh City.

The most popular waste-to-energy method is biogas production from husbandry. It is estimated that there are around 500,000 biogas tanks nationwide, mainly in rural areas at the household scale with volume below 10m³. According to the Biogas Project, supported by the Netherlands, until 2011, there were around 15,678 biogas tanks. These small biogas tanks are usually used for cooking and lighting in households but are not yet applied for electricity production. In Viet Nam there are around 17,000 pig production farms but until now just about 100 biogas stations (with volumes of 100-200m³). Therefore, there is major potential for development in the future (VNEEP, 2012).

Other waste-to-energy technologies are very limited. Collecting methane and other gases from dumping sites is not common, and is only applied at a few modern ones in Hanoi and Ho Chi Minh cities.

V. Current and Future Investment Plans (Including Mega Projects, Master Plans, Infrastructure Development Plans) in 3Rs and Waste Management

1. Master plans

Viet Nam still lacks appropriate infrastructure for 3Rs and waste management as 69% of 660 landfills are unhygienic. The government has taken measures in requesting localities (63 provinces/cities) to develop masterplans for their waste management. Until now, most of the localities have developed and submitted their masterplans to the MOC (N.H.Tien et al, 2016).

Moreover, at the national level, the Prime Minister has also approved five masterplans of solid waste management, namely: (i) Masterplan for three key economic areas in the North, Central and South; (ii) Masterplan for key economic area of Mekong Delta; (iii) Masterplan for the Cau River basin; (iv) Masterplan for the Nhue-Day River basin; and (v) Master plan for the Dong Nai River basin.

The Masterplan for three key economic areas in the North, Central and South has been approved by the **Prime Minister Decision 1440/QD-TTg** in October 2008, and the Masterplan for key economic area of Mekong Delta was approved by the **Prime Minister Decision 1873/QD-TTg** in October 2010.

The objectives of these master-plans are to develop a network of regional solid waste treatment facilities to thoroughly treat, recycle or reuse wastes; to restrict waste landfill and increase the effectiveness in treatment of solid wastes, especially hazardous solid wastes; and to mobilize various resources from society for investment in solid waste management and treatment facilities.

The viewpoint of the planning is that the master plans should serve on a provincial and inter-provincial basis and they must be in line with the socio-economic development planning, construction and other regional related plans. The priority should be given to waste reuse and recycling technologies, restricting dumping/landfilling in order to fully handle environmental pollution and to increase effective land use.

The plans also emphasize that the application of suitable solid waste treatment technologies should be based on local conditions in each province. For provinces with limited land but high volume of organic solid waste, the composting option should be selected and applied.

For three key economic areas in the North, Centre and South of Viet Nam, there are seven inter-provincial solid waste treatment sites identified in the plans. However, for the key economic area of the Mekong Delta only, there are five provincial solid waste treatment sites (i.e. An Giang, Kien Giang, Ca Mau, and Can Tho (two sites) and one inter-provincial solid waste treatment site, a hazardous solid waste treatment site of 20 ha, located next to the solid waste treatment site in Ca Mau (Table B-3 & Table B-4).

Table B-3 Solid waste treatment sites in three key economic zones

No.	Name of treatment center	Location	Area	Scope of service
I	Northern key economic zone			
1	Nam Son treatment facility	Nam Son commune, Soc Son district. Hanoi	140-160 hectares	<ul style="list-style-type: none"> Industrial solid wastes of Hanoi city and Vinh Phuc. Bac Ninh and Hung Yen provinces Daily-life solid wastes of Hanoi city region
2	Son Duong treatment facility	Son Duong commune, Hoanh Bo district, Quang Ninh province	100 hectares	<ul style="list-style-type: none"> Industrial solid wastes of Quang Ninh province. Hai Phong city and Hai Duong province Daily-life solid wastes of Quang Ninh province
II	Central Vietnam key economic region			
1	Huong Van treatment facility	Huong Van commune, Huong Tra district, Thua Thien-Hue province	40 hectares	<ul style="list-style-type: none"> Industrial solid wastes of Thua Thien-Hue province and Da Nang city; Daily-life solid wastes of Thua Thien-Hue city
2	Binh Nguyen treatment facility	Binh Nguyen commune, Binh Son district, Quang Ngai province	70 hectares	<ul style="list-style-type: none"> Industrial solid wastes of Quang Nam and Quang Ngai provinces; Daily-life solid wastes of Quang Ngai province region
3	Cat Nhon treatment facility	Cat Nhon commune, Phu Cat district, Binh Dinh province	70 hectares	<ul style="list-style-type: none"> Industrial solid wastes of Binh Dinh provinces and some provinces south and west of Binh Dinh province Daily-life solid wastes of Binh Dinh province
III	Southern key economic region			
1	Tan Thanh treatment complex	Tan Thanh commune, Thu Thua district. Long An province	1,760 hectares	Daily-life solid wastes and industrial solid wastes of Long An province and Ho Chi Minh city
2	Northwest Cu Chi hazardous industrial solid waste treatment facility	Cu Chi district, Ho Chi Minh city	100 hectares	Hazardous industrial solid wastes of Ho Chi Minh city and Binh Duong and Tay Ninh provinces

Source: Prime Minister Decision 1440/QĐ-TTg, 10/2008.

Table B-4 Solid waste management sites in the key economic zone of Mekong Delta

No.	Province/City	Location	Size	Targeted objects
1	An Giang	Chau Thanh district	About 50 hectares	Ordinary household, industrial and hospital solid waste of Long Xuyen city and part of Thoai Son and Chau Thanh districts
2	Kien Giang	Hon Dat district	About 50 hectares	Ordinary household, industrial and hospital solid waste of Rach Gia city, Hon Dat district and adjacent areas
3	Can Tho city	O Mon district	About 47 hectares	Ordinary household, industrial and hospital solid waste of Can Tho city
4	Can Tho city	Thoi Lai district	About 120 hectares	Ordinary household, industrial and hospital solid waste of Can Tho city-after 2020
5	CaMau	Area about 20-30 km north of Ca Mau city	About 100 hectares	Ordinary household, industrial and hospital solid waste of Ca Mau city, U Minh district and adjacent industrial parks from 2025.

Source: Prime Minister Decision 1873/QĐ-TTg, 10/2010.

The Masterplan for solid waste management in Cau river basin to 2020 (approved by the **Prime Minister Decision 2211/QĐ-TTg** in November 2013) has identified 15 waste treatment complexes to be constructed by 2020 in six provinces including Bac Kan, Thai Nguyen, Vinh Phuc, Bac Giang, Bac Ninh and Hai Duong. According to the Masterplan for solid waste management in Nhue-Day river basin to 2020 (approved by the **Prime Minister Decision 223/QĐ-TTg** in February 2015) there are 18 waste treatment complexes to be constructed by 2020 in four provinces/cities including Ha Noi, Nam Dinh, Hoa Binh and Ha Nam. Similarly, the Master plan for Dong Nai river basin (approved by the **Prime Minister Decision 07/QĐ-TTg** in January 2015) has set up a total of 34 waste treatment complexes to be built by 2020 in eight provinces/cities including Dac Nong, Ninh Thuan, Binh Thuan, Binh Phuoc, Dong Nai, Long An, Hochiminh City, Ba Ria – Vung Tau.

2. Investment

With underdeveloped infrastructure, Viet Nam needs a big investment to upgrade its waste treatments facilities. The master plans for three economic zones and for the Cau river basin estimated the financial budget needed for construction of waste treatment facilities to 2020. Similarly, master plans for the Nhue-Day river basin and the Dong Nai river basin have also estimated the investment budget for phases up to 2020 and 2020-2030.

According to these plans, Viet Nam will need around USD3 billion to 2030 of which USD2.2 billion is up to 2020 and 809 million for the period between 2020 and 2030 (Table B-5). The investment

will come from the following sources: (i) state budget; (ii) ODA capital and foreign aid; (iii) investment loan/credit; (iv) domestic and foreign investors and; (v) other.

Table B-5 Investment plan for development of solid waste management facilities to 2030

No	Master Plan	Number of treatment complexes (area -ha)	Investment needs (mil. USD)	
			To 2020	2020- 2030
1	Masterplan for three key economic area in the North, Central and South;	7 (2,300 ha)	9,683 billion VND (~598 million USD)	-
2	Masterplan for key economic area of Mekong Delta;	5 (367 ha)	-	-
3	Masterplan for the Cau River basin;	15 (377 ha)	10,000 billion VND (~476 million USD)*	-
4	Masterplan for the Nhue-Day River basin to 2030;	18 (392 ha)	4,500 billion VND (~205 million USD)**	3,100 billion VND (~141 million USD)
5	Master plan for the Dong Nai river basin.	34 (4,714 ha)	20,300 billion VND (~923 million USD)**	14,700 billion VND (~668 million USD)
Total			44,483 billion VND (~2,202 million USD)	17,800 billion VND (~809 million USD)

Note: *, **: Exchange rates are estimated at 21,000VND/USD in 2013 and 22,000 VND/USD in 2015. (Source: Prime Ministers Decisions)

To promote investment into this area, the Government has adopted incentive policies, such as provision of preferential land (free land use, site clearance support), tax breaks, infrastructure investment (roads, energy, electricity, water supply, sewerage and communications) and support for technology research and development, labour training, and loans and investment credit to solid waste management and 3Rs projects.

VI. Current Potential of Market for Waste Management and the 3Rs-Related Businesses

It is difficult to estimate the potential market for waste management and 3Rs-related businesses in Viet Nam in details. However, it can be observed that there is high potential, for the following reasons: (i) the waste generation is continuing to grow due to population increase, fast economic development and urbanization; (ii) waste management infrastructure is under developed while the need is very high and; (iii) the country's policy is to promote integrated solid waste management and 3Rs measures.

As mentioned above, waste generation is increasing with the forecast total volume to be around 69

million tons in 2020 and 91 million tons in 2025 (MONRE, MOC, 2009). According to the National Environment Report on solid waste, urban domestic waste increases 10-16% per annum on average. The MSW generation per capita will reach 1.4 and 1.6 kg/person/day in 2020 and 2025 respectively. It is forecast that urban domestic waste (UDW) will reach around 61.6 thousand tons/day in 2020 and 83.2 thousand tons/day in 2025 - an increase of 2.37 times in 2020, and 3.2 times in 2025 compared with 2010 respectively (MONRE, 2011). With regards to industrial waste, according to estimates by the Institute of Strategy and Policy on Industrial Development, MOIT, there will be 9.0 – 13.5 million tons of industrial waste in 2020 (MONRE, 2011).

In the master plans for development of solid waste management facilities in economic zones and river basins, there are also projections on waste generation. It is forecasted that waste generation is highest in Dong Nai river basin, almost three times that of Cau and Nhue-Day river basins. For the Cau river basin, in 2020, the highest share is industrial waste accounting for 42% while in Nhue-Day and Dong Nai river basins, MSW has higher shares at 64% and 56% in 2020 respectively. This means that, Dong Nai river basin will have higher pressure from solid waste in comparison with other regions. The total waste generated in the three river basins will be around 81,000 tons/day in 2020 (Table B-6).

Although waste generation is increasing rapidly, waste management infrastructure and implementation are underdeveloped and with many constraints. The collection rate is just 83-84% in urban areas and 40-55% in rural areas. As a result, about 16% of MSW and nearly 50% of rural waste is not collected and is discarded improperly causing environmental pollution. 56% of collected solid waste is still landfilled and 71% of the 573 landfills nationwide are unhygienic (Hideki Wada, 2016). There are 105 immediate treatment facilities but there are still many constraints to the technologies of these facilities. Recycling activities now take place mainly in craft villages with backward technologies, causing major pollution to the environment and impacting health.

Table B-6 Projection on waste generation in Cau, Nhue – Day and Dong Nai river basins to 2020 and 2030

No	Type of solid waste	Cau river basin (tons/day)		Nhue – Day river basin (tons/day)		Dong Nai river basin (tons/day)		Total for the 03 river basins (tons/day)	
		2020	2030	2020	2030	2020	2030	2020	2030
1	Domestic waste	4,410	-	9,100	11,200	28,700	35,800	42,210	-
2	Industrial waste	6,500	-						
3	Waste from craft villages	2,060	-	2,200	3,700	15,000	26,800	25,760	-
4	C&D waste	460	-	2,100	4,000	4,400	5,600	6,960	-
5	Hazardous waste*	2,000	-	750	1,250	3,400	6,000	6,150	-
Total		15,430		14,150	20,150	51,500	74,200	81,080	

Note: *: Hazardous waste is without medical hazardous waste.

Source: Synthesized from Prime Ministers decisions No 2211/QĐ-TTg dated 14/11/2013, 223/QĐ-TTg dated 12/02/2015 and 07/QĐ-TTg dated 06/01/2015 for solid waste management in river basins

After almost 30 years renovation, Viet Nam has achieved a certain amount of success in socio-economic development. In the context of climate change, economic crisis on global scale, Viet Nam has adopted a new direction for development, namely green growth, the growth that should be based on quality and productivity improvement. As mentioned above, 3Rs have been emphasized as the key measures for integrated solid waste management, thus to increase the diversion rate and limit waste landfilling. With this policy, the potential of market for waste management and the 3Rs-related businesses is very promising in the years to come.

C: 3R INDICATORS

I. Total MSW Generated and Disposed, and MSW Generation Per Capita (by Weight)

There is a lack of a consistent inventory of waste generation and waste management in Viet Nam. Until now, MONRE has conducted investigations for solid waste and officially published national reports on waste twice, in 2004 and 2011.

According to the National Environment Monitor 2004, the total MWS generated was 6.4 million tons in 2003 (MONRE, 2004). In the National Environment Report 2011, it was found that the total volume of urban municipal solid waste generated nationwide increase by an average of 10 - 16% a year. Domestic urban solid waste (DUW) in most urban areas accounts for 60 - 70% of the total volume of MSW (in some urban areas it can even reach 90%). The ratio of MSW generated per capita has reached 1.00 kg/person/day in 2010 (MONRE, 2011) (see Table C-1 and Table C-2).

Table C-1 *MSW generation in 2003 – 2013, projection to 2025*

Year	MSW generation (tons/year)	Reference
2003	6,400,000	MONRE National Environment Monitor 2004
2007	6,453,930	MONRE National Environment Report 2011
2008	7,609,885	
2009	8,842,125	
2010	9,571,760	
2013	11,497,500	Tien N.H., 2014
2014	13,213,268	Wada H, 2016.
2015	15,330,000	<i>Estimated/projected by the VEA in the MONRE National Environment Report 2011</i>
2020	22,484,000	
2025	30,368,000	

Table C-2 *MSW generation per capita in 2007 – 2010*

Year	MSW per capita (kg/person/day)	Reference
2007	0.75	MONRE National Environment Report 2011
2008	0.85	
2009	0.95	
2010	1.00	
2015	1.2	<i>Estimated/projected by the VEA in the MONRE National Environment Report 2011</i>
2020	1.4	
2025	1.6	

1. Related Hanoi 3R goals: Goal 1: Significant reduction in the quantity of municipal solid waste generated.

There is not much progress in waste reduction in Viet Nam. There is no effort in try to reduce domestic waste generation. With regards to reduction of industrial waste, as mentioned above, there has been some effort made, such as cleaner production, ISO 14000, and waste audit. The National Strategy of Cleaner Production in Industry was approved by the Prime Minister in 2009. The purpose of this strategy is to push forward the application of cleaner production in industries. Implementation in reality, however, is still limited and by 2015, there are just 24% enterprises applied cleaner production measures (VNCPC, 2016).

II. Overall Recycling Rate and Target (%) and Recycling Rate of Individual Components of MSW (Primary Indicator)

1. Recycling Rate

There is still no official, consistent and scientifically based data regarding the recycling rate of any kind of waste at national level published by the government in Viet Nam. However, the National Environment Report 2011 estimated the recycling rate of MSW would be around 8-12% by volume. This recycling activity is implemented mainly by the informal sector in craft villages (MONRE, 2011).

According to a JICA study in 2011, recyclable waste such as plastics, paper, and metal accounts for 8.2% of the total collected waste (JICA, 2011). These recyclables are usually collected by waste scavengers, transported to recycling craft villages and 90% of them are transformed into plastics, paper, and metal products while 10% becomes waste after recycling (MONRE, 2011).

2. Diversion Rate

According to Wada H., the diversion rate of collected solid waste in Viet Nam nationwide is around 44% while 56% still went into landfills in 2014. Specifically, there were 13,213,268 tons of solid waste collected in 2014, of which 7,317,679 tons (55%) was transferred to intermediate facilities and 5,895,589 tons (45%) went directly to landfills. As a result, the total diverted waste amount was 5,854,131 tons (44%) and the rest (56%) was landfilled (Wada H, 2016) (see Figure B-7).

3. Recycling Target

The **National Strategy for Integrated Management of Solid Waste Until 2025, and Vision Toward 2050 To 2025** set up the target of recycling as follows:

- To 2020: 85% of MSW will be recycled, reused, recovered for use as an energy source or to produce organic fertilizer.
- To 2025: 90% of MSW will be recycled, reused, recovered for use as an energy source or to produce organic fertilizer. (see Table B-1).

4. Related Hanoi 3R goals: Goal 3: Significant increase in recycling rate of recyclables

Viet Nam is still a poor country and there are still people working as scavengers/waste-pickers to collect recyclables for selling to recycling units in craft villages. Thus the recycling rate of recyclables is quite high and significant. According to the National Environment Report 2011, recycling rate of recyclable paper, plastics and metal could be around 90% (MONRE, 2011).

Besides that, the diversion rate of the country's domestic waste has also been improved as 44% of collected domestic waste has been diverted from landfilling either by composting, recycling or incineration.

The problem is that there is still no consistent and time series statistical data for waste recycling in Viet Nam.

III. Amount of Hazardous Waste Generated and Disposed in Environmentally Sound Manner (Primary Indicator)

According to the statistical inventory from the VEA, total hazardous waste generated nationwide is around 800,000 tons/year (Hien et al, 2015). Up to June 2015, there were 83 licensed enterprises for hazardous waste treatment with a capacity of around 1.3 million tons/year (VEA, 2015). The total volume of hazardous waste collected and treated by these licensed enterprises is 165,624 tons; 186,657 tons; and 320, 275 tons in 2012, 2013 and 2014 respectively (Hien et al, 2015).

Table C-3 *Collected and treated hazardous waste in 2012 – 2014*

Year	Collected and treated hazardous waste (tons/year)	Reference
2012	165,624	Hien et al, 2015
2013	186,657	
2014	320, 275	

1. Related Hanoi 3R goals: Goal 9: Develop proper classification and inventory of hazardous waste

Viet Nam has issued a Circular 36/2015/BTNMT on hazardous waste, which defines various classifications. According to this, hazardous waste can be classified into 19 categories of waste by their sources, as follows:

- 1) Waste resulting from exploration, mining, quarrying, and treatment of minerals, petroleum, and coal
- 2) Waste from manufacture, formulation, supply, and use of inorganic chemicals
- 3) Waste from manufacture, formulation, supply, and use of organic chemicals
- 4) Waste from thermal power plants and other combustion plants
- 5) Waste from metallurgy and casting industry
- 6) Waste from manufacture of building materials and glass
- 7) Waste from chemical surface treatment and coating of metals and other materials
- 8) Waste from the (mfsu) of coatings (paints, varnishes and vitreous enamels,) adhesives, sealants

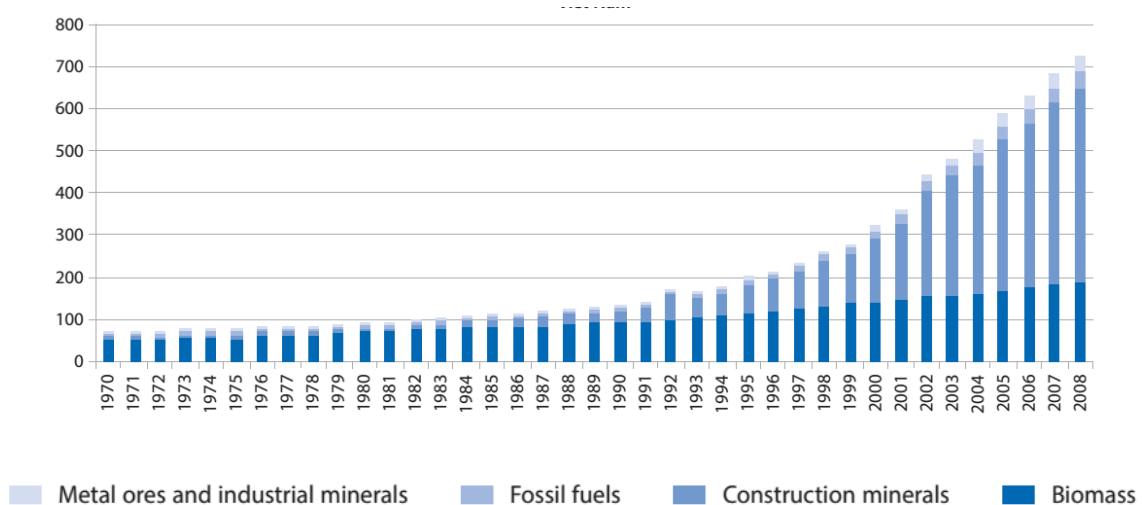
- and printing inks
- 9) Waste from wood processing and the production of panels and furniture, paper, and pulp
 - 10) Waste from the leather, fur and textile industries
 - 11) Construction and demolition waste (including excavated soil from contaminated sites)
 - 12) Waste from waste management facilities, waste water treatment plants and preparation of water intended for human consumption and water for industrial use
 - 13) Waste from human or animal health care (except domestic waste arising from human or animal health care)
 - 14) Waste from industry
 - 15) Expired equipment, vehicles, and waste from dismantlement, maintenance of equipment, vehicles
 - 16) Household waste and municipal waste from other sources
 - 17) Oil waste and waste from liquid fuels, organic solvents, refrigerants and propellants
 - 18) Waste packaging; absorbents, wiping cloths, filter materials and protective clothing
 - 19) Other waste material

Inventory of hazardous waste, however, has not been implemented consistently and until now there has been no national inventory with official data on hazardous waste but only some data from a study in Table C-3.

IV. Indicators Based on Macro-level Material Flows (Secondary Indicator)

1. Domestic Material Consumption (DMC)

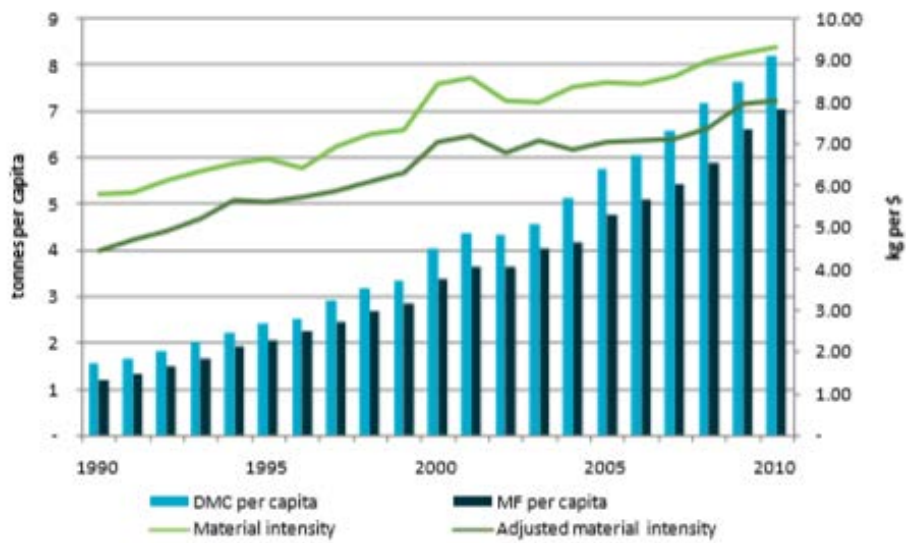
According to OECD study in 2014, domestic material consumption (DMC) of Viet Nam (including: metal ores and industrial minerals; fossil fuels; construction materials and; biomass) has increased more than 10 times in nearly four decades, from ~70 million tons in 1970 up to more than 700 millions tons in 2008 (Figure C-1).



(Source: OECD, 2014)

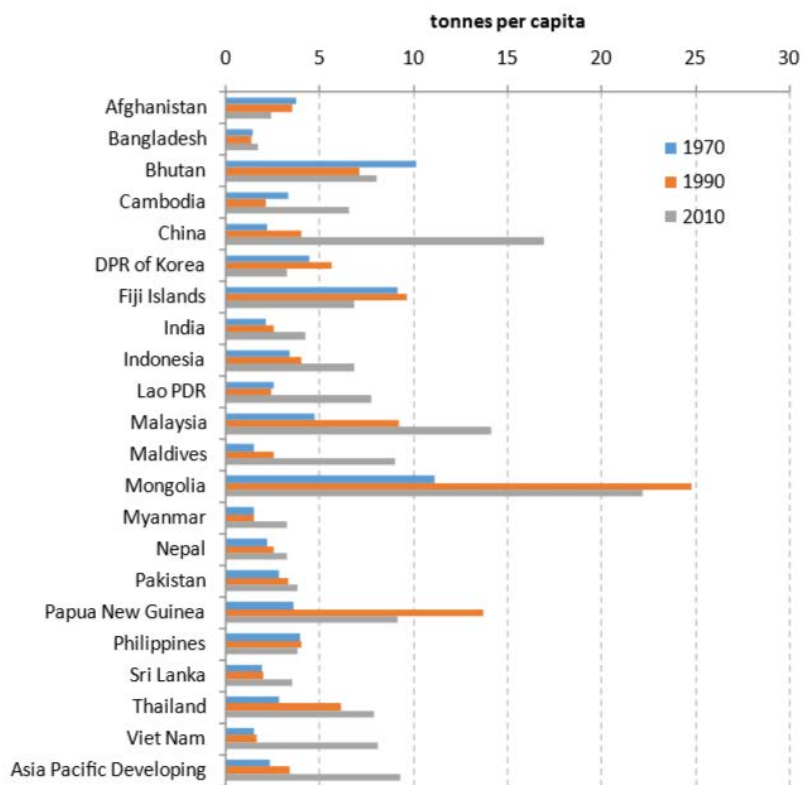
Figure C-1 DMC in Viet Nam in 1970-2008 (million tons/year)

2. Domestic Material Consumption (DMC) per capita



(Source: UNEP, 2015)

Figure C-2 DMC per capita and material intensity in Viet Nam in 1970-2010



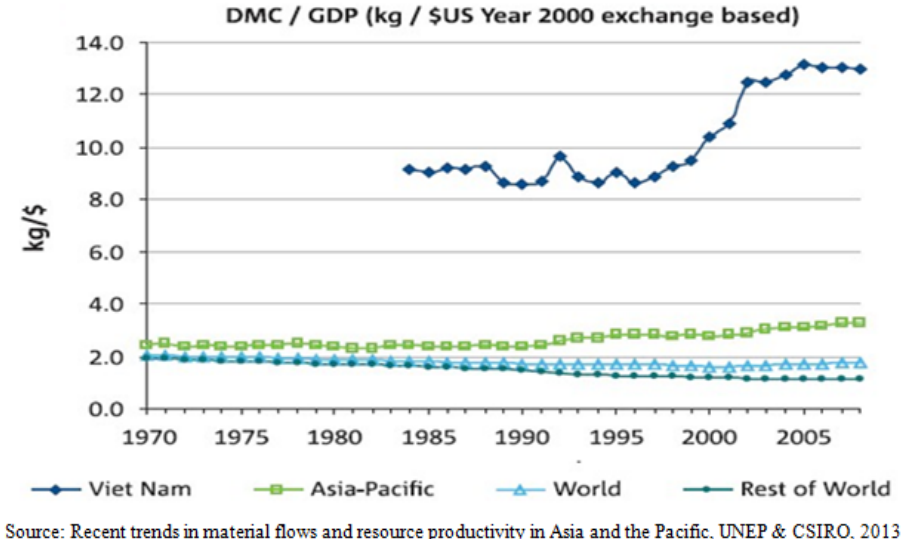
(Source: UNEP, 2015)

Figure C-3 DMC per capita of Viet Nam in comparison with other countries in the Asia – Pacific region

According to the UNEP study “Indicators for a Resource Efficient and Green Asia and the Pacific” in 2015, the DMC per capita of Viet Nam is increasing rapidly over 40 years, from more than 1.5 kg/person/year in 1970 up to more than 8.0 kg/person in 2010 (UNEP, 2015) (Figure C-2). DMC per capita of Viet Nam is higher than that of India, the Philippines, lower than China and almost at the same level as Thailand and at the average level for the Asia-Pacific region (Figure C-3).

3. Resource Intensity (DMC per USD GDP)

Viet Nam is a country that has achieved relatively high economic growth in the last 30 years. However, the economic growth is mainly based on resource exploitation. UNEP&CSIRO study in 2013 showed that the resource intensity of Viet Nam increased from 1985 to 2005 and reached 13 kg/USD in 2005. The country’s resource intensity is one of the highest in the world as it is more than four times the average for the Asia-Pacific region and six times the world average (Figure C-4).



(Source: UNEP&CSIRO 2013)

Figure C-4 Resource intensity in Viet Nam in 1985-2005

4. Related Hanoi 3R goals: Goal 17: Improve resource efficiency and resource productivity by greening jobs nation-wide in all economic and development sectors

Viet Nam resource efficiency is one of the lowest in the world and in the Asia- Pacific. Having recognized that fact, the country has issued policies to improve resource efficiency, specifically the **Party Resolution 24/NQ-TW on responding to climate change, strengthening natural resources management and environmental protection** in 2013 and the **National Strategy on Green Growth** in 2012.

According to the Party Resolution 24/NQ-TW “The values of natural resources must be fully assessed, valued and accounted for in the economy; they must be strictly managed and protected; they must be economically exploited and used with efficiency and sustainability; and they must be

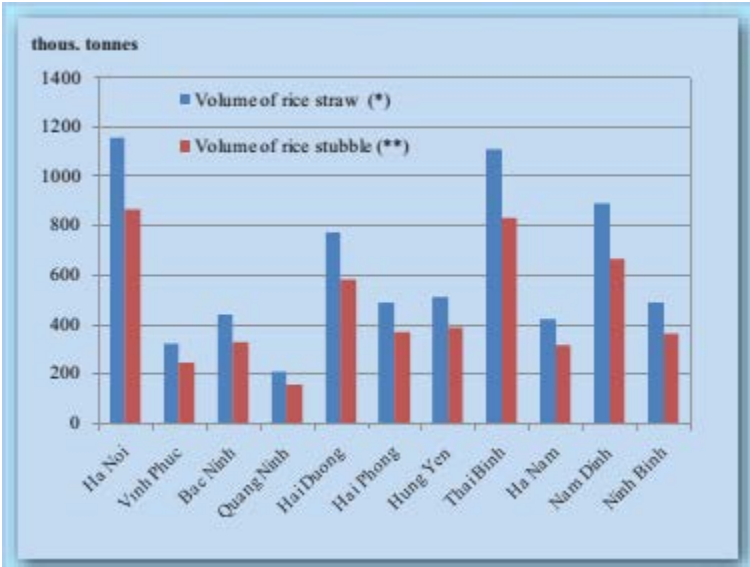
associated with socio-economic development goals to ensure resource security. Attention must be paid to the development and use of renewable energies, new materials and recycled materials”. The directions policy is to “enhance investigation and assessment of potentials, reserves, economic values, current state and shifts in trends of national natural resources. Plan, manage, exploit and use national resources in a rational, efficient and sustainable way. Promote the development and use of new and renewable energies, new materials, new fuels and alternatives as substitutes for conventional resources”.

Progress in resource efficiency, however, still faces constraints such as the thinking of growth based on resources and backward technologies in production processes.

V. Amount of Agricultural Biomass Waste Used (Primary Indicator)

Biomass waste in Viet Nam is generated mainly by agricultural production activities including cultivation (dead plants, pruned plants, and weeds), harvesting (rice straw, rice stubble, rice husk, bran, corn cob, and corn stover), fertilizer package waste, waste from animal husbandry, animal slaughter, milk, and aquaculture processing.

There are no consistent data on biomass waste generated in the agricultural sector in Viet Nam. In the MONRE National Environment Report 2011-2015, it has been estimated that there were around 76 million tons of rice stubble annually and more than 80 million tons of solid waste from husbandry (MONRE, 2015). Some of generated rice stubble in Red River delta provinces are presented in Figure C-5 and some of generated solid waste from livestock production are presented in Table C-4.



(Source: MONRE, 2011)

Figure C-5 Estimated volume of rice straw and rice stubble remained on the fields in several provinces in the Red river Delta

Table C-4 Total volume of solid waste from animal husbandry in Viet Nam in 2009-2013

No	Livestock category	Average volume of solid waste (kg/head/day)	Total waste volume (thousand tons/year)				
			2009	2010	2011	2012	2013
1	Cow	10	22,000	21,500	19,500	18,600	18,500
2	Buffalo	15	15,800	15,900	14,600	14,000	13,800
3	Pig	2	20,000	20,000	19,400	19,000	18,900
4	Poultry	0.2	20,400	21,000	23,000	22,000	22,600
5	Goat, sheep	1.5	750	706	684	725	726
6	Horse	4	149	131	126	120	113

Source: MONRE, 2015

1. Reuse and recycling of agricultural waste

Traditionally, the waste generated from cultivation process has usually been reused by households as fuel for cooking. In recent years, however, rice straw and stubble are no longer used as fuel due to development of electricity, gas and coal. Instead of that, most of the rice straw and stubble are burned on the field after harvesting. Rice husk has also been used as raw material for burning to produce electricity in the Mekong River delta.

With regards to the husbandry waste, it has usually been treated through biogas technology. According to the Viet Nam Energy Efficiency Program (VNEEP), there are around 500,000 biogas tanks nationwide, mainly in rural area households with a volume below 10m³. (VNEEP, 2012). The Biogas program for Vietnam's Animal Husbandry sector has assisted farmers nationwide to build around 150,000 biogas projects throughout the country (MONRE, 2011).

At the moment, Vietnam's animal husbandry is mostly on a household scale. Household animal husbandry waste is mostly treated in biogas tank to produce husbandry feed and fertilizer for cultivation. About 19% of animal husbandry waste is directly discharged into the environment without treatment.

2. Related Hanoi 3R goals: Goal 11: Promote full scale use of agricultural biomass waste and livestock waste through reuse and/or recycle measures

Biomass waste has been used widely for reuse and recycling in Viet Nam. Rice stubble and husk have been used for cooking fuels, livestock production waste has been promoted to be recycled for biogas. Although 100% of biomass is still not re-used or recycled, it can be observed that good progress has been achieved in promoting the reuse and recycling of agricultural biomass and livestock waste.

VI. Marine & Coastal Plastic Waste Quantity (Primary)

There are not any official statistics or study/research data on marine and coastal plastics waste in Viet Nam so far.

1. Related Hanoi 3R goals. Goal 12: Strengthen regional, national, and local efforts to address the issue of waste, in particular plastics in the marine and coastal environment

There has not been much effort or progress on waste control in the marine and coastal environment, particularly for plastics. The **Law on Marine and Islands Natural Resources and Environment** was adopted by the National Assembly in 2014. In this law, there is a chapter with regulations on pollution control, oils spill response and sea dumping. According to this, discharging sources should be controlled, all wastes should be treated to meet environmental standards before discharging into the sea, all floating waste should be collected and treated properly. However, the plastics waste has not been mentioned in the regulations.

VII. Amount of E-waste Generation, Disposal and Recycling. Existence of Policies and Guidelines for E-waste Management (Primary)

Although the volume of e-waste (discarded/broken TV, refrigerators, electric fans, computers, electronic devices) is increasing, no consistent or time-series data are available in Viet Nam. According to the survey conducted by JICA and URENCO Hanoi in 2007, the volume of electronic waste is presented in Table C-5.

Table C-5 Electronic waste generated in Vietnam between 2002 and 2006

(Units: pieces/sets)

Year	TV	PC	Mobile phone	Refrigerator	Air conditioner	Washing machine
2002	190,445	62,771	80,912	112,402	17,778	184,140
2003	222,977	77,845	86,467	140,916	24,706	214,271
2004	261,542	90,447	103,414	162,262	29,853	249,094
2005	308,076	110,123	472,707	194,570	39,157	287,910
2006	364,684	131,536	505,268	230,856	49,782	327,649

Source: MONRE, 2011

H. T. Hai *et al* in their research have estimated amount of e-waste from household in Viet Nam varied from 1.8 million units (~ 61,100 tonnes) to 3.8 million units (~113,500 tons) in 2010 and e-waste amount from industry was much smaller than from household (H.T.Hai et al, 2015).

In general, the amount of e-waste is increasing due to the development of the electronic industry as well as increasing demand for new electronic devices. Prices of electronic products continue to decrease, also designs change constantly making them become more suited to many different people and making the life of electronic devices increasingly shortened. In projection, URENCO has

estimated that there will be about 10.6 million pieces of electronic and electric good in 2020 (including 4.85 million TVs, 2.27 million refrigerators, 2.6 million washing machines and 873 thousand air conditioners) (UNRENCO and JICA, 2007). Similarly, N. D. Quang et al has also estimated of 12.1 million pieces (including 6.5 million TVs, 3.4 million refrigerators, 1.9 million washing machines and 284 thousand air conditioners) in 2020 (N.D.Quang et al, 2009).

Almost all electronic waste is handled through the following steps: (1) Devices that can be fixed will have their function extended by repair shops; (2) Broken products will be dismantled into different parts such as capacitors and circuits to be sold to repair shops; (3) Electronic waste is dismantled and recycled to collect metals (Cu, Pb, Al, Au, Ag,...), plastics, bronze wires and; (4) Remaining parts that cannot be sold will be discarded along with municipal waste (MONRE, 2011).

In Viet Nam, e-waste has been classified and should be treated as hazardous waste. Apart from the policy on extended producer responsibility (EPR), Viet Nam has no specific policy/regulation on the treatment of e-waste.

1. Related Hanoi 3R goals: Goal 13: Ensure environmentally sound management of e-waste

There are not many achievements in environmentally sound management of e-waste in Viet Nam. Treatment of e-waste in Viet Nam is still implemented by the informal sector in recycling units in craft villages, causing pollution to the environment and impacting on health. National efforts are recognized as trying to introduce the EPR mechanism, which will be enacted from July 2016 to deal with many kinds of e-waste.

VIII. Existence of Policies, Guidelines, and Regulations Based on the Principle of Extended Producer Responsibility (EPR)

As mentioned in Part B, EPR was introduced to Viet Nam by the Law on Environmental Protection 2005, which was enacted in July 2006. This law was not brought into full play until now, 10 years later, in 2016. In 2013 the Prime Minister issued the Decision 50/2013/QD-TTg (dated 9th August 2013) on retrieval and disposal of discarded products to implement the Article 67 of the Law on Environmental Protection, 2005.

However, in 2014, the Law on Environmental Protection 2005 was revised and LEP 2014 was adopted. The Law again emphasized the policy on EPR and the Prime Minister issued the Decision 16/2015/QD-TTg to replace Decision 50/2013/QD-TTg. This decision has regulated the list of discarded products and roadmaps to be applied (see Table B-2). For the time being, MONRE is preparing the circular on guidance of implementation of Decision 16/2015/QD-TTg.

Thus the information about EPR in Viet Nam can be presented in Table C-6 below.

Table C-6 Situation of EPR implementation in Viet Nam

Status of implementation	Name of the policies (Year)	Product items covered by the policy
Fully Implemented	-	-
Postponement period before full implementation	Decision 16/2015/QD-TTg has been issued to replace Decision 50/2013/QD-TTg on take-back and treatment of discarded products	Items: (i) Batteries; (ii) Electric and electronic equipments; (iii) Lubricants oils; (iv) Tyres; (v) End-of-life vehicles (see Table B-2 for more details).
Under preparation of specific legislations	MONRE is developing the circular on implementation guidance of Decision 16/2015/QD-TTg.	
Existence of provisions supporting EPR principle		
Based on voluntary approach/agreement		

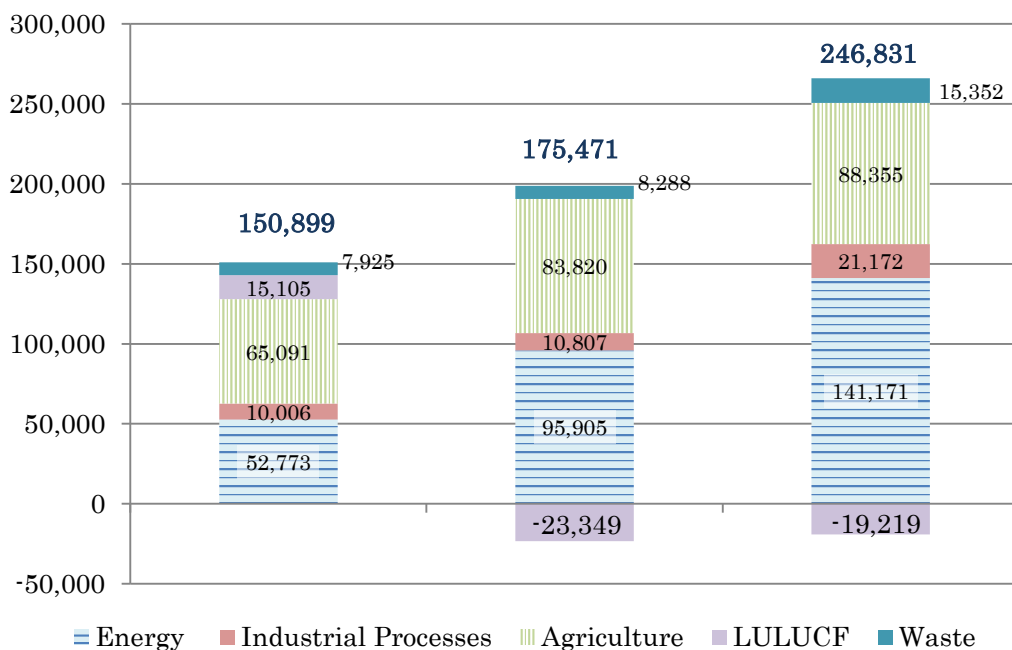
Source: Developed by Author:

1. Related Hanoi 3R goals: Goal 15: Progressive implementation of EPR

Although introduced since the LEP 2005, the EPR mechanism has just been set up in 2015 and is due to be enacted in July 2016. There are still constraints in awareness of people and enterprises; take-back mechanism; treatment/recycling technologies and development of a formal recycling sector in the country.

IX. GHG Emissions from Waste Sector

In Viet Nam the inventory for GHG emissions has not been implemented annually as in developed countries. Until now, it three inventories have been conducted – the first time in 1994; the second time in 2010 for the year 2000; and a third time in 2014 for the years 2005 and 2010. Estimations for GHG emissions in 2000, 2005 and 2010 from all sectors are presented in Figure C-6.



(Source: MONRE, JICA, 2014)

Figure C-6 GHG emissions in Viet Nam for the years 2000, 2005 and 2010

According to the inventory results, in 2000 the total GHG emissions from waste were 7,925.18 thousand tonnes of CO₂-eq (~5.25% of total emissions); in 2005, 8,288 thousand tonnes (~ 4.72% of total emissions without LULUCF) and in 2010, 15,352 thousand tonnes (~6.22% of total emissions without LULUCF) (Table C-7).

Table C-7 GHG emissions from waste sector in Viet Nam in 2000, 2005 and 2010

Indicators	Year	Data (Gg of CO ₂ -eq /year)
Total GHG Emissions from Waste Sector	2000	7,925
	2005	8,288
	2010	15,352
CH ₄ emissions from solid waste landfills	2000	5,596.92
	2005	2,304
	2010	5,005
CH ₄ emissions from industrial wastewater	2000	1,335.81
	2005	837
	2010	1,617
CH ₄ emissions from domestic wastewater	2000	28.35
	2005	3,443
	2010	6,827
N ₂ O emissions from human sewage	2000	964.10
	2005	1,694
	2010	1,838
CO ₂ emissions from waste incineration	2000	-
	2005	8
	2010	65

Source: Data for 2000 are from the Second National Communication to UNFCCC (MONRE, 2010). Data for 2005 and 2010 are from the National GHG Inventory report 2010 of Viet Nam, The project "Capacity Building for National GHG Inventory in Viet Nam" (MONRE, JICA, 2014).

However, it has been noted by the 3rd inventory report in 2014 that the methods and data used for the inventories for the three years (2000, 2005 and 2010) are not consistent, therefore any detailed comparison or analysis should not be conducted (MONRE, JICA, 2014).

1. Related Hanoi 3R goals: Goal 18: Maximize co-benefits from waste management technologies for local air, water, oceans and soil pollution and global climate change

Viet Nam is one of most seriously impacted by climate change in the world, especially due to sea level rise and climate extremities. Before 2012, the country did not belong to the ANNEX 1 of the Kyoto Protocol and therefore was not obliged to reduce GHG emissions. With development of COP 20 and especially the Paris Agreement at COP 21, all countries must submit and implement the Intended Nationally Determined Contribution (INDC) for GHG reduction. In its INDC of 2014, Viet Nam committed to reduce GHG emission by 8% without international support and by 25% with international support by 2030 compared with the baseline scenario.

With that commitment, many studies/research are being conducted for reducing GHGs, while improving waste management in many sectors such as transportation, agriculture, industry, construction, and waste management. There are also pilot projects but there are still on a limited, small scale such as collection of methane from Nam Son (Hanoi) and Binh Thanh (Hochiminh City) landfills.

It can be observed that efforts to reduce GHGs in Viet Nam are at the beginning stage.

D: EXPERT’S ASSESSMENT ON 3R POLICY IMPLEMENTATION

I. Achievements through the 3Rs Approach

3R approach has been introduced and institutionalized in Viet Nam through a number of legislations such as the LEP 2014; the National Strategy on Integrated Solid Waste Management to 2025, vision to 2050; and the Party Resolution 24/NQ-TW. Waste reduction, reuse and recycling and limiting waste landfilling have been emphasized as a priority in these policies. Besides that, an institutional system of waste management has been developed. Legislation and regulations on waste management have been issued on general, hazardous waste, and medical waste; the EPR mechanism has been institutionalized; master-plans on waste management have been adopted. Organizational arrangements of waste management have been set up with a central role played by MONRE and with assignments of different line ministries.

II. Benefits of the 3Rs and Environmentally Sound Waste Management

The benefits of 3Rs and environmentally sound waste management in Viet Nam until now has been that awareness on concepts of integrated solid waste management, 3Rs, and circular economy had been introduced and understood by policy makers, environmental management people at national and local level. Such an understanding about the importance and benefit of 3Rs will create a basis for promoting this concept in the future.

III. Key Findings from the Facts

While the 3Rs policy is clear and has been introduced into national strategy, law and by-law documents, implementation in reality is still very weak. It seems that the National Strategy on Integrated Solid Waste Management has not been implemented as planned.

- Waste reduction is not paid enough attention and has not been implemented or very weak implementation in industries. For domestic waste, there has not been any specific initiative/activity to promote waste reduction. Waste reuse has been on a limited scale. Waste recycling is still implemented by the informal sector, caused pollution and impacts to human health and environment. With regards to disposal, landfilling is still the main method for collected household waste.
- Besides that, there has not been a clear and official definition of MSW. The lack of a systematic database on waste generation and waste management also causes difficulties and constraints for waste management.

IV. Hanoi 3R Goals and Progress Assessment

There is a need for deeper analysis to assess the progress of Hanoi 3R goals in Viet Nam. From collected information and data for these nine related goals, it could be noted that there has been limited progress of 3R goals in Viet Nam. From the nine related goals, only the “waste diversion and recycling rates” and “biomass waste utilization” have achieved some progress while the other related goals are still far from the desired targets (see Table D-1).

Table D-1 *General assessment of related Hanoi 3R goals*

Hanoi Goals	Assessment
Goal 1: Significant reduction in the quantity of municipal solid waste generated.	Not yet implemented
Goal 3: Significant increase in recycling rate of recyclables	According to some study, there has been some good diversion rate (44%) of waste, but officially, the rate of recycling of MSW is still low, estimated of 8-12%.
Goal 9: Develop proper classification and inventory of hazardous waste	Proper classification has been set up, however, the inventory has not been implemented.
Goal 17: Improve resource efficiency and resource productivity by greening jobs nationwide in all economic and development sectors.	Not yet improved. Resource intensity has been still very high as compared with regional and world level.
Goal 11: Promote full scale use of agricultural biomass waste and livestock waste through reuse and/or recycle measures	<i>Good implementation as most of the agriculture biomass and livestock waste has been reused or recycled</i>
Goal 12: Strengthen regional, national, and local efforts to address the issue of waste, in particular plastics in the marine and coastal environment.	Not yet implemented.
Goal 13: Ensure environmentally sound management of e-waste	Not yet implemented.
Goal 15: Progressive implementation of EPR	The regulation has been issued but not yet implemented.
Goal 18: Maximize co-benefits from waste management technologies for local air, water, oceans and soil pollution and global climate change	It is just in the first stage.

Lessons learnt

The awareness of the policymakers and adoption of the regulations are not enough to achieve a good performance in waste management and 3Rs. Furthermore, waste management and the 3Rs need investment to develop adequate infrastructure such as waste collection, transportation, recycling and disposal facilities. Being a developing country Viet Nam still needs more time to gain a the better income status and thus to have more resource for improvement of waste management. For the time being, Viet Nam will step-by-step improve its infrastructure, as well as to complete the policy system on 3Rs and waste management.

V. Recommendations

- *Development and completion of policies on waste management with focus on 3Rs:* Viet Nam needs to continue to complete the legislation system on waste management with a focus on 3Rs. Specifically, there are some actions need to be taken: (i) Review and revision of the National Strategy on Intergrated Solid Waste Management; (ii) Impose a solid waste collection charge based on volume of discharge waste, thus reducing waste generation; (iii) Develop and implement successfully the circular on EPR mechanism as regulated by LEP 2014 and Decision 16/2015/QD-TTg; (iv) Develop master plans for waste management in all provinces and cities; (v) Additionally, legislations/regulations on management of different types of wastes such as e-waste, C&D waste, and food waste should be developed in the years to come.
- *Promote active and efficient implementation of existing policies and master plans on waste management:* Viet Nam needs to push forward the successful implementation of: (i) National Strategy on Cleaner Production in Industry for minimization of solid wastes in production; (ii) Controlling strictly scrap import to avoid illegal waste import as required by LEP 2014; (iii) Formalization of recycling activities through development of recycling industry as directed by the National Strategy and Action Plan on Green Growth for development of recycling industries; (iv) Improvement of waste management infrastructure through an effective implementation of promulgated solid waste management master plans.
- *Enhancing scientific researches/studies and technology transfer on 3Rs and waste management:* (i) Promote study/research on waste reduction, recycling, waste-to-energy, reduction of GHG in waste and related sectors; (ii) Promote technology exchange and transfer from developed countries on waste management and ensure they are suitable for Viet Nam.
- *Institutionalise the MSW concept and promote development of a consistent and time-series database on waste management and 3Rs:* The concept of MSW and other kinds of waste should be reviewed, studied carefully and institutionalized clearly as in other countries. Viet Nam should also develop a set of indicators for waste management, the system of collection and build a systematic, time-series database on waste management.
- *Awareness raising and creating behavior change in lifestyle:* (i) Raising awareness of communities on 3Rs; (ii) Creating behavior changes and encouraging an environmentally-friendly lifestyle for the people such as buying products with no or less packaging, reusing bags many times and using naturally decomposed packaging.

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ANNEX

Composting Plants in Viet Nam

No.	Name of composting plants	Address	Province	Operation year	Capacity of the plants		Technologies		Production costs (VND/tons)	Tipping fee (VND/tons)
					Design capacity (tons of compost per day)	Actual capacity (tons of compost per day)	Domestic Technology	Foreign Technology		
I	In-operation composting plants									
1	Urban waste processing plant, Phu Tho waste treatment and processing plant Co., Ltd	Team 6, Van Phu ward, Viet Tri city, Phu Tho province	Phu Tho	1998	15	21	Aerobic with compulsory aeration		194.000	194.000
2	Waste-to-organic humus treatment plant, Gia Lam urban environment enterprise	Kieu Ky commune, Gia Lam distric, Ha Noi city	Ha Noi	2009	23	11 - 12	Aerobic with compulsory aeration			181.470
3	Cau Dien composting plant	Nhue Giang street, Tay Mo, Tu Liem, Hanoi				35	22		Spain (Aerobic with compulsory aeration)	
4	Hai Duong APT-SERAPHIN Environment JSC	Viet Hong commune, Thanh Ha dist	Hai Duong	2011	35	30		Spain (Aerobic with compulsory aeration)		244.000
5	Trang Cat waste treatment plant, Hai Phong urban environment Co., Ltd	Luong Khe, Trang Cat, Hai Phong province	Hai Phong	2009		12		Korea (Aerobic with compulsory aeration)		

No.	Name of composting plants	Address	Province	Operation year	Capacity of the plants		Technologies		Production costs (VND/tons)	Tipping fee (VND/tons)
					Design capacity (tons of compost per day)	Actual capacity (tons of compost per day)	Domestic Technology	Foreign Technology		
6	Ha Long bio-technology waste treatment plant	GroupNo.25+26, Ha Khanh ward, Ha Long city, Quang Ninh province	Quang Ninh	2008	50	30	VIBIO			100.000
7	Solid waste treatment plant, Nam Dinh environment Co., Ltd	Hoang village, Loc Hoa commune, Nam Dinh city	Nam Dinh	2003		59		France (Aerobic with compulsory aeration)		
8	No. 3 Environment JSC	Thanh Thuy commune, Thanh Liem dist	Ha Nam	2008						
9	Solid waste treatment 3, Tam Sinh Nghia Investment - Development JSC	Ngoc Thuy commune, Duy Tien dist								
10	Waste treatment plant, Ha Tinh urban project management one member Co., Ltd	Cam Quan commune, Ha Tinh	Ha Tinh		200					
11	Thuy Phuong waste treatment plant, Tam Sinh Nghia Investment - Development JSC	Team no.12, Thuy Phuong ward, Huong Thuy town, Hue city	Hue	2007	50	50	Aerobic without compulsory aeration		1.114.300	177.500

No.	Name of composting plants	Address	Province	Operation year	Capacity of the plants		Technologies		Production costs (VND/tons)	Tipping fee (VND/tons)
					Design capacity (tons of compost per day)	Actual capacity (tons of compost per day)	Domestic Technology	Foreign Technology		
12	Hoi An waste treatment plant, Quang Nam	Oc Bau Thuong village, Cam Ha commune, Hoi An city, Quang Nam province	Quang Nam	2012	11,5	3 - 4		France (Aerobic with compulsory aeration)		246,668
13	Tan Hiep solid waste treatment zones	Tan Hiep commune, Cu Lao Cham, Hoi An city								
14	Integrated natural resources restoration Center, Management Board of Sustainable waste and for poor people	No. 153 Ure, Kon Tum city	Kon Tum	2011	15	1 - 1,25	Combine domestic and foreign technologies (Aerobic with compulsory aeration)			
15	Nhan Phu composting plant	Nhan Phu ward	Binh Dinh			1 - 2				
16	Long My composting plant/ Quy Nhon urban environment Co., Ltd	Long My ward, Quy Nhon city				200	30			
17	Nam Thanh Ninh Thuan Construction - Trade and Production Co., Ltd	Kien village, Loi Hai commune, Thuan Bac distric, Ninh Thuan province	Ninh Thuan	2002	100	60	Aerobic without compulsory aeration			

No.	Name of composting plants	Address	Province	Operation year	Capacity of the plants		Technologies		Production costs (VND/tons)	Tipping fee (VND/tons)
					Design capacity (tons of compost per day)	Actual capacity (tons of compost per day)	Domestic Technology	Foreign Technology		
18	Dong Xoai domestic solid waste treatment plant, Binh Phuoc Environment Technology Investment and Development JSC	Hamlet no.1, Tien Hung commune, Dong Xoai town, Binh Phuoc province	Binh Phuoc	2009	30	15	Aerobic with compulsory aeration		398.000	259.566
19	Trang Dai waste treatment plant, Dong Xanh Environment JSC	Trang Dai ward, Bien Hoa city	Dong Nai			250				
20	Tan Phu waste treatment plant, Da Loc Trade and Construction Co., Ltd	Bau May hamlet, Phu Thanh commune, Tan Phu dist					20 - 25	X		
21	VietStar JSC	Tay Bac STZ treatment solid waste, Thai My commune, Cu Chi distric, HCM city	HCM	2009	150	75		America (Maturation with mixing)		240.000
22	Viet Nam waste solution Co., Ltd (VWS)	Da Phuoc complex solid waste treatment, Da Phuoc commune, Binh Chanh dist					100			
23	Cu Chi household waste treatment and recycling plant, Tam Sinh Nghia Investment - Development JSC	No. 17 Chanel, Thai My commune, Cu Chi Dist								

No.	Name of composting plants	Address	Province	Operation year	Capacity of the plants		Technologies		Production costs (VND/tons)	Tipping fee (VND/tons)
					Design capacity (tons of compost per day)	Actual capacity (tons of compost per day)	Domestic Technology	Foreign Technology		
24	Ca Mau domestic solid waste treatment plant, Cong Ly Construction - Trade - Toursim Co., Ltd	Tan Xuyen ward, Ca Mau city	Ca Mau	2012	44	20	Aerobic with compulsory aeration		369,133	200.000 - 280.000
25	Organic Fertilizer Production Company	Ly Thuong Kiet street, No.4 ward, Soc Trang city	Soc Trang							
26	Rach Gia waste treatment plant, Tam Sinh Nghia Investment - Development JSC	My Hung Hamlet No 1/7A, Hon Dat distric, Kien Giang province	Kien Giang	2011	50	50	Aerobic with compulsory aeration			
27	Waste treatment plant	Hong Dan dist	Bac Lieu	2011			Anaerobic			
28	Household waste treatment plant, Phuong Thao Development - Construction JSC	Hoa Phu commune, Long Ho dist	Vinh Long	2013	100			Germany (Anaerobic)		

II Composting plants under construction										
29	Waste treatment plant, Nam Thanh Ninh Thuan Manufacture and Trade - Construction Co., Ltd	Van Tien commune, Yen bai city	Yen Bai	05/2013	20			Aerobic		
30	Waste treatment plant	Tuy Duc dist	Dak Nong	07/2014						
31	Phan Thiet waste treatment plant, Tam Sinh Nghia Investment - Development JSC	Tien Thanh commune, Phan Thiet city and Ham My commune, Ham Thuan dist	Binh Thuan							
32	Tai Tien Co., Ltd	Phu Thanh commune, Tan Phu dist	Dong Nai							
33	Sonamdezin Service JSC	Tay Hoa commune, Trang Bom dist			200					
34	Waste treatment plant, Tay Ninh environmental technology JSC	Hamlet no.1, Nghia Hung commune, Tan Chau dist	Tay Ninh							
35	Binh Duong Water Supply and Sewerage and Environment Co., Ltd	11 Ngo Van Tri street, Phuc Loi ward, Thu Dau Mot town	Binh Duong	5/2013	420				Finland (Aerobic with compulsory aeration)	
36	Waste treatment plant, Tam Sinh Nghia Investment - Development JSC	Hamlet 3, Tan Dong commune, Thanh Hoa dist	Long An							
37	The complex of waste treatment, VWS	Tan Thanh commune, Thu Thua dist			5			Anaerobic		
38	Waste treatment plant									

III	Stopped composting plants									
39	Xuan Son waste treatment plant, Thanh Cong Cooperative	Xuan Son commune, Son Tay town, Ha Noi	Ha Noi	2008	200	120	SERAPHIN			
40	Ha Vu Environment Co., Ltd	No. 36B Lan Ong street, Hong Bang dist, Hai Phong	Hai Phong							
41	Dong Vinh waste treatment plant, Seraphin Green Environmental Technology JSC	Hung Dong commune, Vinh city	Nghe An							

Source: ISPONRE, IGES, Review of composting activities in Viet Nam, 2013.