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SYNTHESIS REPORT

EVALUATION OF CURRENT STATUS AND
RECOMMENDATION ON PROMOTION OF
TRANSITION TO CIRCULAR ECONOMY IN
VIETNAM

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This Synthesis Report was prepared to support the transition from conventional economy to circular economy in Vietnam. The activity aims at evaluating and proposing models of circular economy suitable for Viet Nam in the context of implementing the sustainable development goals and responding to climate change, serving the key inputs policy recommendations on circular economy, which will be used as an input for the preparation of national development policy framework in the next 10-year period from 2021 to 2030 in Viet Nam and 5-year Socio-economic Development Plan (SEDP) 2021-2025.

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For more information on policies and regulations on circular economy in Vietnam, please contact info@isponre.gov.vn.

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Preface

The rapid economic growth of Viet Nam over the past decades has been accompanied by substantial depletion of natural resources and serious environmental pollution. This leads to an urgent need to find a more efficient and sustainable economic model. Currently, the circular economy represents an alternative to the linear economic model (take-make-consume-dispose) that combines growing raw materials consumption and low efficiency of resource use, thus resulting in massive waste generation. On the other hand, in the new economic model – circular economy, material inputs and waste generation are minimized through eco-design, recycling and reusing of products. Materials are kept in the closing cycle by prolonging their lifespan for as long as possible through the designs for durability, maintenance and repair.

In this context, the Vietnamese Government fully recognizes the necessity in creating a resource-saving and environmentally friendly society by adopting the circular economy approach as a core component of their national sustainable development strategy. The ultimate objective of circular economy is to achieve the decoupling of economic growth from natural resource depletion and environmental degradation, as well as responding to climate change.

This Synthesis Report, based on a set of thematic study reports on circular economy, completed by the researchers of Institute of Strategy and Policy on Natural Resources and Environment, gives special emphasis to the following chapters; theoretical basis of circular economy; international experience and lessons learned for Viet Nam; current status of institution and existing models related to circular economy; and recommendations, objectives and solutions to promote the transition to circular economy in Viet Nam. These chapters show the key opportunities as well as challenges in embracing the new concept of circular economy in the context of Viet Nam which is regarded as one of the fast-growing emerging economies in ASEAN.

Transforming the challenges into opportunities requires an influential role of the government in strengthening policies by establishing high-level leadership, promoting industry and community participation in industrial associations, community groups, professional networks, and NGOs to connect and work together in the circularity system.

This Synthesis Report is published as part of the generous support by the European Union and the UN Environment Programme to disseminate knowledge and promote transition to circular economy in Viet Nam. Furthermore, the analysis is strongly believed to help the country identify policy challenges and opportunities associated with this new economic model and provide best practices towards a successful circular economy.

Associate Professor Nguyen Dinh Tho

President

Institute of Strategy and Policy on Natural Resources and Environment

Abbreviations

CE	Circular Economy
CP	Cleaner Production
EU	European Union
IPCC	Intergovernmental Panel on Climate Change
ISPONRE	Institute of Strategy and Policy on Natural Resources and Environment
OECD	Organization for Economic Cooperation and Development
SD	Sustainable Development
UNEP	United Nations Environment Programme

INTRODUCTION

Background

It is believed that a model of traditional economy or linear economy is mainly based on the exploiting natural resources to provide input to the economic system. In linear economy, most production, consumption and disposal activities have resulted in depletion of natural resources, increase in waste and pollution and degradation of the environment. To deal with environmental constraints in the context of climate change, in recent decades, many new approaches have been studied and applied in many countries such as “green economy”, “low-carbon economy”, “zero waste” and “circular economy”. In the realization of the sustainable development goals, “circular economy” has become the popular approach in many national policies and national development strategies in the world ^[1]. Transition from a “linear economy” to “circular economy” is the inevitable global trend. In a circular economy, resources input, waste, emissions and energy leakage are minimized by slowing, closing and narrowing material and energy loops, such as long-term design, maintenance, repair, reuse, recycling, refurbishment and recycling.

According to the World Bank ^[3], Vietnam lost 5.18% of GDP in 2013 due to air pollution. The impact of polluted water on human health alone could reduce the country’s GDP by 3.5 percent ^[4]. Along with that, the depletion of natural resources and energy, land pollution and degradation, and especially climate change, are seriously affecting Vietnam’s economic development. To implement the direction of “rapid, sustainable development” in the context of developing a socialist-oriented market economy, implementing sustainable development goals and international commitments that Vietnam has signed, the transition to a “circular economy” should be considered a priority in the next stage of the country’s development.

Objectives

General objective

The Synthesis Report aims to provide the theoretical and practical basis to promote the development of circular economy in Vietnam, thereby proposing viewpoints, approaches and solutions to its socio-economic development based on circular economy models.

Specific objectives

- To systematize the theoretical basis of circular economy;
- To evaluate the implementation of other countries, then draw lessons learned for Vietnam to adopt appropriate approach to circular economy;
- To analyze the current status of policies and laws and the existing models incorporating circular economy principles in Vietnam;
- To propose perspectives, objectives and solutions to promote the transition to circular economy in Vietnam.

Methodology

To achieve the objectives mentioned above, the following methods have been used to develop the Synthesis Report:

- Literature review: Analysing existing information; including legal framework (strategies, policies, laws, decrees, decisions, etc.), reports and information from official websites relating to circular economy, environmental protection and sustainable development.
- Consultation with relevant experts in the field of environmental protection and sustainable development in Vietnam.
- Collection and assessment of opinions and recommendations on finalization of Synthesis Report in a range of consultative workshops.

The Synthesis Report contains 4 Chapters:

- Chapter I presents the theoretical basis of circular economy, focusing on different perspectives and approaches to circular economy.
- Chapter II assesses international experience in the implementation of circular economy.
- Chapter III analyzes the current status of policies and regulations related to circular economy and existing models integrating circular economy principles in Vietnam.
- Chapter IV proposes recommendations on viewpoints, objectives and solutions to promote the transition to circular economy in Vietnam.

1. Overview of Circular Economy

1.1 The connotation of the circular economy and the circular economy models

Circular economy (CE) is not a new concept. Schivelbusch ^[5] points out that the first ideas about material circulation appeared in agriculture from the eighteenth century. By 1966, Boulding compared the Earth as a spaceship in space and argued that a circular economy system is required to sustain human survival on Earth ^[6]. Best known, however, is the Stahel and Ready report ^[7] on the automotive and construction industries, with the core idea of extending product life cycle will help save energy and labor force of this industry. From there, they argue that an economy with closed cycles, preferring reuse, repair and reproduce goods over the production of new goods, would have a positive effect in job creation, economic competition, and saving resources. This is a ground-breaking new perspective at that time. In the following years, the circular economy concept has comprehensively developed. According to the statistics carried out by Kirchherr, Reike and Hekkert ^[8], there are 114 interpretations of circular economy, including simple interpretations such as circular economy as emission reduction, to more complex concepts like 3R and 4R. Some typical concepts can be mentioned as follows:

According to Preston^[9], CE is the approach to change the function of resources in the economy. Waste from factories can become an input to other manufacturing processes, and products can be repaired, recycled, reused, rather than thrown away.

In particular, the Circular economy concept presented by the Ellen MacArthur Foundation at the 2012 Global Economic Conference is also widely accepted. CE is a system that regenerates and restores information through proactive plans and designs. It replaces the concept of “end of life” of materials with the concept of restoring, moving towards using renewable energy, instead of using harmful chemicals that harm the reuse, and aiming to reduce waste through the design of materials, products, engineering systems and business models within the system ^[10].

Kraaijenhagen, Van Oppen&Bocken states that ^[11] *“Circular economy is an economic system where products and services are traded in closed loops or closed cycles”*.

According to Singh and Ordenez ^[12]: *“Circular economy is an economic strategy that promotes an innovative way to convert existing linear consumption systems into a circle, through material savings”*.

In its research report, the organization Arcadis stated ^[13]: *“Circular economy is a concept in which growth and prosperity are separate from natural resource consumption and ecosystem degradation. By not disposing of used products and materials, and instead rerouting them according to the right value chain, we can create an economically developed society in balance with nature”*.

Renowned researchers Haupt, M., Vadenbo, C. và Hellweg ^[14] also stated: *“Circular economy is a production and consumption system with minimal loss of material and energy through extensive reuse, recycling and recovery”*.

Rizos et al ^[15] believe that CE focuses on resource aspects in the economy by limiting and reusing raw materials for the economy and using waste as a resource to reduce natural resource consumption.

The United Nations Industrial Development Organization (UNIDO) indicates that CE is a new way to create value, and towards the ultimate goal of prosperity. It works by extending product life through improved design and maintenance, moving waste from the end of the supply chain back to the beginning, thereby using resources more efficiently by using used many times, not just once ^[16].

The European Union (EU) defines: *“Circular economy is to maintain the value of products and materials for as long as possible in the economy, and to limit waste, through the application of waste hierarchies such as is referred to in Article 4 of Directive 2008/98/EC of the European Parliament and of the Council”*.

The United Nations Environment Programme (UNEP) defines *“Circular economy as an economy where the value of products, raw materials and resources is maintained in the economy for as long as possible and at the same time to minimize waste”* ^[17]. Both the United Nations Environment Programme ^[18] and the Organization for Economic Cooperation and Development ^[19] argue that circular economy is the best way to break the long-standing relationship between economic growth and negative environmental impacts.

To summarize the modern circular economy concepts, Geissdoerfer et al ^[20] gave a specific view of circular economy, which is *“a system in which resources and waste, emissions, energy loss are minimized through slowing, narrowing, and closing the movement cycles of materials and energy. This can be achieved through long-term design, maintenance, repair, reuse, reproduction, renewal and recycling”*. This concept is very close to the perspective of the circular economy as 9R of the Dutch Government ^[21].

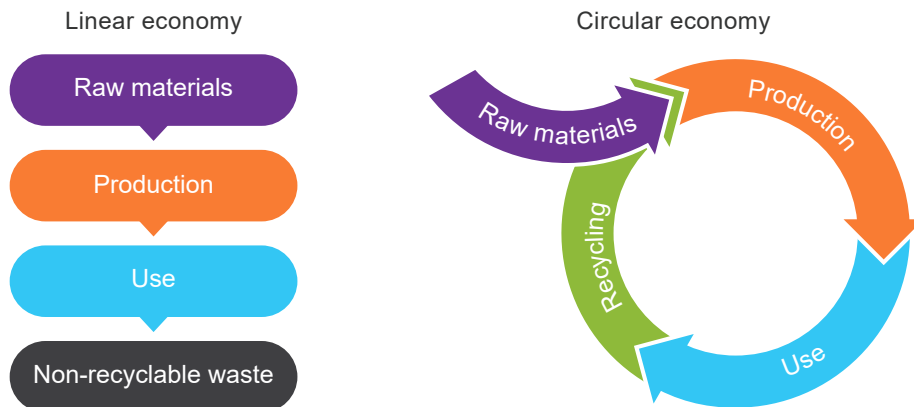


Figure 1.1. Linear economy and circular economy

Source: Reports of the Dutch Government [21]

Thus, at present, there are many viewpoints on CE. However, it can be seen that CE is an alternative that replace the previous linear economic development approach (**Figure 1.1**). CE can connect the end of the line back to the starting point, keep the flow of material used for as long as possible, restore and re-create the products and materials at the end of each production or consumption cycle. We find that the definition of UNEP to be the most universal and updated among the above definitions, where the definition of the European Union, in particular, is similar to that of UNEP.

The concept of CE has originated from many different fields and has undergone many stages of change. Therefore, the following points should be considered to comprehensively understand the current concept of CE:

- (i) Circular economy brings economic benefits. Implementing the circular economy does not mean sacrificing economic benefits to achieve environmental goals. Instead, it could create more jobs and good economic competition, save resources, and help increase benefits for businesses and society. The following are the original statements of Stahel và Reday [7];
- (ii) CE is not the goal to be reached but it is considered the path to sustainable development;
- (iii) Enterprise is the central driving force of CE. Besides, the Government plays a constructive role while consumers, organizations and every citizen play an important role in implementing CE [22];
- (iv) CE is not just the circulation of materials but also reduction of the use of materials that are difficult to recycle;
- (v) CE is not a homogenous model for the whole economy, but the economy can include many circular economy models (e.g. model of material circulation in manufacturing, model of circulation in the supply chain). Therefore, there is no standard to define or assess whether a country or a city “is already in circular economy”. On the other hand, the existing CE indicators aim to monitor rather than assessment of the CE implementation.

- (vi) CE does not only refer to waste treatment. On the contrary, circular economy considers waste as resources ^[23, 24]. Accordingly, circular economy represents a change in philosophy and approaches in which waste is regarded as a product of the manufacturing process, like commercial products. Therefore, the term “design waste” was born that requires production processes to be established from the beginning so that the generated waste can be reused, recycled, or served as input to another manufacturing process^[25, 26]. Since then, the circular economy aims to connect economic activities in a calculated manner to create a unified combination, forming circulating circles in the economy. This is a new feature of the modern circular economy concept compared to many previous circular economy concepts.
- (vii) Accordingly, the relationship between sellers and consumers in circular economy will also change in a different way compared to the previous linear economy. Products will see trends of being rented, borrowed or shared, and if sold, there will still be mechanisms or commitments to retrieve the product after use ^[26]. For example, the mechanism of Extended Producer Responsibility – EPR.
- (viii) Due to their characteristics, CE models can be implemented in a single or even interdisciplinary field to promote material circulation.

1.2 Content and principles of development of circular economy models

As stated above, current circular economy is not just about waste management and utilization. Therefore, it is necessary to consider circular economy in a system with the five following stages:

- (i) Design: It aims to create green products, increasing recyclability, and reusing. Design in circular economy includes not only product design, but also waste design;
- (ii) Manufacturing: It includes cleaner production, emission reduction and material circulation in the production stage;
- (iii) Consumption: It includes better services, more eco-conscious and intelligent consumers;
- (iv) Waste management: It includes sorting, end-of-life collection, and remanufacture;
- (v) From waste back to resources: It includes waste recycling and reusing resources.

The systematic approach with these five stages is the fundamental difference between the current and previous perspectives on CE ^[26, 27]. (UNIDO) has outlined these five stages along with four main goals/benefits of the circular economy: Reduce environmental footprint; Generate increased income; Reduce resource dependency; and Minimize waste ^[16].

Circular economy has three basic principles, including:

- *Preserve and enhance natural capital by the management of rational use of resources and regeneration of natural systems; especially promoting the use of renewable energy.*
- *Optimize resource yields by circulating products and materials in both biological and technical cycles as long as possible.*
- *Foster effectiveness of the system by minimizing the negative externalities through sustainable design at the beginning of the manufacturing process* ^[10].

The CE's principles are derived from the universal principles of matter conservation and entropy principle. According to the Law of Material Conservation, matter changes from one form to another, moving from one place to another, not being born or lost by itself, and Entropy's Law states that it is impossible to transition from disordered state to disordered state without outside intervention. According to these laws, it is also important to note that circular economy is not an infinite circulation of materials, but the circulation stops when the cost of circulating resources is greater than the cost of using new resources.

With the above principles, the transition to circular economy is considered an important component in the pathway to sustainable development (**Figure 1.2**). This view is also completely in line with other common and well-known principles. Both UNEP and the World Bank believe that the implementation of Green Growth, Circular Economy, and Green Economy is the appropriate pathway towards Sustainable Development in the context of a changing world economy and the increasingly complex impacts of climate change ^[29, 30]. Researchers Georgeson, Maslin and Poessinouw ^[31], after analyzing many different views of the world on the above terms, also propose the development sequence from Green Growth to Green Economy and the ultimate target is Sustainable Development.

Specifically, in recent years, circular economy has been recognized by many countries as the pressure from resource depletion and waste is increasing and seriously affecting the human life and health ^[18, 33]. Even in the early 2010s, many researchers and policy makers also proposed the viewpoint of "reducing growth" (Degrowth), because of concerns about the risks of environmental pollution and degradation ^[34, 35, 36]. However, CE with its specific and clear approach, has shown how to decouple economic growth and environmental degradation.

1.3 Models towards circular economy

Circulation in the economy can exist at different levels such as: (i) industry level (e.g. sectors of construction, agriculture, forestry and fishery; (ii) by territory (at national, regional and local levels); and (iii) corporate level (e.g. circulation patterns within enterprises; circulation in industrial zones, urban areas, residential clusters). There has been five popular business models towards CE in the past decade:

- Circular supply chain model: When a company needs resources that are rare or harmful to the environment, they have to pay more to buy or find alternative sources of raw materials. Such raw materials can be recycled, reused or biodegraded, thereby help to reduce costs and market risks.
- Recovery and recycling model: In this model, waste from production and consumption systems are “recycled” and used for other purposes. Companies can obtain valuable components in discarded products, or recycle waste.
- Model to extend the product’s life cycle: Consumers often throw away damaged, outdated, or unnecessary products. However, many of the discarded products still have use value. Through repairing, upgrading, refurbishment, or remarketing of products, companies can maintain the economic benefits of these products for a long period. To do this, companies need to move from simply selling products to actively maintaining product compatibility. Besides, the relationship between the companies and customers also need to change from a single exchange/purchase to a long-term relationship, in which companies can provide services on upgrading or exchanging old for new products based on the specific requirements of each customer.
- Sharing platform model: In developed countries, up to 80% of items in a household are only used for about one month and then thrown away. The platform sharing model is being supported by modern digital technologies, creating new relationships and new business opportunities for consumers and businesses (especially small businesses). As a result, the consumers can rent, share, exchange or lend things they own but rarely use. With this model, the production of commonly used products consumes less resources, while consumers have more opportunities to earn additional income and save money.
- Product-as-a-Service Model: What if both the manufacturer and the retailer bear the same “total cost of ownership”? In this case, many companies would immediately change their strategies and focus on longevity, reliability, and reusability of the product. When consumers rent a product through the Product-as-a-Service Model, the business model will have a fundamental change since the effectiveness and durability of the product will be more focused than the quantity.

1.4 Circular economy in the realization of sustainable development goals (SDGs 2030)

Sustainable development is always the highest goal of all development. It is the development of “meeting the needs of the present generation without compromising the ability of future generations to meet the needs” [37]. In Vietnam, sustainable development has always been considered as the goal of all endeavors: “Sustainable development is development that meets the needs of the current generation without compromising the ability to meet the needs of the current generation. That demand of future generations on the basis of a close and harmonious combination between economic growth, ensuring social progress and environmental protection”- Article 3, Law on Environment Protection 2014 of Vietnam.

In the context of many new challenges such as the depletion of natural resources, environmental degradation and especially climate change, the implementation of sustainable development is becoming more and more difficult. The goals of sustainable development therefore need to be more specific for each area. Hence, from the previous three major areas (economic, social, environmental), researchers and policy have identified 17 goals of sustainable development (17 SDGs), including: 1-No poverty; 2-Zero hunger; 3-Good health and wealth-being; 4-Quality education; 5-Gender equality; 6-Clean water & sanitation; 7-Affordable and clean energy; 8- Decent work and economic growth and; 9-Industry, innovation and infrastructure; 10-Reduce inequalities; 11-Sustainable cities and communities; 12-Responsible consumption and production; 13-Climate action; 14-Life below water; 15-Life on land; 16-Peace and justice strong institutions; and 17-Partnerships for the goals. These sustainable development goals are even so comprehensive that they have replaced the Millennium Goals, which have become a guide for countries towards sustainable development.



Figure 1.2: 17 Sustainable Development Goals

Source: the United Nations report [38]

In the context of implementing sustainable development, circular economy plays an important role as follows:

- Circular economy minimizes the exploitation of natural resources and minimizes waste discharged into the environment, a necessary condition for sustainable development and response to climate change;
- Sustainable development creates requirements to promote circular economy.

The transition from linear to circular economy can be considered as inevitable in the context of realizing the goals of sustainable development. As analyzed above, the transition to CE will help reduce resource exploitation and emissions, including greenhouse gas emissions. Thus, CE supports SDG 12-Responsible consumption and production and SDG 13-Climate action. Moreover, CE also promotes SDG 9-Industry, innovation and infrastructure, SDG 14-Life below water; SDG target 15-Life on land; and SDG target 17-Partnerships for the goals ^[34]. Thus, CE can have a direct impact on the 6 pillar goals of sustainable development that explains why the transition to circular economy is now widely implemented by many countries across the world.

Likewise, the transition from linear economy models to circular economy will contribute to the implementation of the target “rapid and sustainable development” that are set out in the Vietnam Socio-Economic Development Strategy 2011-2020. Because at that time, the socio-economic development no longer goes hand in hand with the increasing exploitation of natural resources and emissions into the environment. This is clearly confirmed in the statements of OECD ^[19] and UNEP ^[18].

1.5 The relationship between the circular economy with green economy, blue economy, low-carbon economy, and digital economy

In addition to green growth and circular economy, other concepts such as Blue economy, Digital economy, Performance economy, Sharing economy, Knowledge-Economy and other concepts that are not currently well defined, will be noticed and asserted their need in new contexts and new challenges. These concepts also combine with Green Growth and Circular Economy to contribute to building Green Economy. For example, the concept of Blue Economy has just recently appeared when the role of the marine economy has received increased public attention.

2. Criteria for evaluating circular economy models

To measure and evaluate progress in the implementation of CE, the EU has developed and published a set of indicators on CE (**Table 1.1**).

Table 1.1: Indicators for circular economy in the EU

No	Indicator
Production and consumption	
1	EU self-sufficiency for raw materials (<i>percentage</i>)
2	Green public procurement
3	Generation of municipal waste per capita (<i>Kg per capita</i>)
4	Generation of waste excluding major mineral wastes per GDP unit (<i>Kg per thousand euro, chain-linked volumes (2010)</i>)
5	Generation of waste excluding major mineral wastes per domestic material consumption (<i>percentage</i>)
6	Food waste (<i>million tonnes</i>)
Waste management	
1	Recycling rate of municipal waste (<i>percentage</i>)
2	Recycling rate of all waste excluding major mineral waste (<i>percentage</i>)
3	Recycling rate of overall packaging (<i>percentage</i>)
4	Recycling rate of plastic packaging (<i>percentage</i>)
5	Recycling rate of wooden packaging (<i>percentage</i>)
6	Recycling rate of e-waste (<i>percentage</i>)
7	Recycling of biowaste (<i>kg per capita</i>)
8	Recovery rate of construction and demolition waste (<i>percentage</i>)

No	Indicator
Secondary raw materials	
1	End-of-life recycling input rates (EOL-RIR) (<i>percentage</i>)
2	Circular material use rate (<i>percentage</i>)
3	Imports from non-EU countries
4	Exports to non-EU countries
5	Intra EU trade
Competitiveness and innovation	
1	Gross investment intangible goods (<i>percentage of gross domestic product (GDP) at current prices</i>)
2	Persons employed (<i>percentage of total employment</i>)
3	Value-added at factor cost (<i>percentage of gross domestic product (GDP) at current prices</i>)
4	Number of patents related to recycling and secondary raw materials

Source: <https://ec.europa.eu/eurostat/cache/scoreboards/CE/index.html>

Practice from China also identified the need to build effective evaluation system to obtain accurate information. Indicators should include economic development index, green development index and human development index (**Table 1.2**).

Table 1.2: Circular economy indicators at a macro level in China

No	Indicator
Resource output rate	
1	GDP/total consumption of the main mineral resource
2	Output of energy $\frac{1}{4}$ GDP/Energy consumption

No	Indicator
Resource consumption rate	
1	Energy consumption per unit of GDP
2	Energy consumption per added industrial value
3	Energy consumption of steel (copper, aluminum, cement, fertilizer, paper) / steel production (copper, aluminum, cement, fertilizer, paper)
4	Water withdrawal per unit of GDP
5	Water withdrawal per added industrial value
6	Total amount of freshwater consumption/total amount of steel production (copper, aluminum, cement, fertilizer, paper)
7	Coefficient of irrigation water utilization
Integrated resource utilization rate	
1	Recycling rate of industrial solid waste
2	Industrial water reuse ratio
3	Recycling rate of wastewater
4	Safe treatment rate of municipal waste
5	Recycling rate of iron scrap
6	Recycling rate of non-ferrous metal
7	Recycling rate of paper
8	Recycling rate of plastic
9	Recycling rate of rubber
Waste disposal and pollutant emission	
1	Industrial solid waste for final disposal
2	Industrial wastewater discharge
3	SO ₂ emissions
4	COD discharge

Source: Geng et al (2012)

Applying circular economy model not only creates positive impacts on the environment and society, but also helps increase significant economic benefits. Indeed, it is estimated that between 2015 and 2030, circular economy is expected to bring at least US \$4,500 billion globally ^[40]. In Europe alone, CE could bring net savings of € 600 billion, creating 580,000 jobs while reducing total annual greenhouse gas emissions by 2 % to 4 % ^[41]. In Australia, CE could bring in about AU \$ 26 billion in net benefits per year ^[42, 43].

Recognizing such benefits, many countries have developed and implemented policies and regulations related to CE for a long time with various approaches. In Europe, the Netherlands took the first step since the 1970s with the “Lansink ladder” that prioritizes the prevention and limitation of waste generation, promoting reuse and recycling, and then incineration before sending waste to landfills ^[44]. Germany issued Closed Substance Cycle and Waste Management Act in 1996 ^[45, 46]. The United States adopted a market-based approach in waste management in 1677 ^[47]. In Asia, Japan initiated the Basic Law for Establishing a Recycling-Based Society in 2002 ^[48]. In 2009, China promulgated Circular Economy Promotion Law ^[49].

Synthesizing 45 strategies for circular economy and more than 100 CE cases in the world, Kalmykova et al (2018) have drawn the conclusion that there are currently two approaches to circular economy ^[50]:

- (i) Systemic economy-wide implementation: This approach aims to design and develop the new macro-scale establishment (e.g. city, industrial park) in which business and production activities are placed into a closed loop. The successful models are replicated in other regional areas.
- (ii) Implementation with a focus on a group of sectors, products, materials, and substances: This approach is based on the application of CE principles in priority sectors or products. It also promotes good initiatives and best practice in line with the characteristics of priority sectors. Successful case studies can be referred to EU, Canada (plastic waste); the USA, Australia (e-waste), Finland (the world’s first national roadmap to a circular economy focusing on Finland’s dominant sectors: sustainable food system, industrial loops, transportation and logistics).

However, it should be noted that these two approaches are not completely distinguishable from each other. For example, there could be the circulation of one or certain materials in an industrial park. Therefore, in many countries, it can be seen that these two approaches being used in combination, depending on the specific context of each country.

1. European countries

1.1 European Union – EU

The EU clearly identifies that circular economy not only refers to waste matter. Therefore, European Commission suspended the issuance of Legislative Proposal on Waste in 2014 and replaced this Proposal with the Circular Economy Package in 2015 to have broader approach of the whole economic processes, including the production and consumption of secondary raw material markets ^[51]. Susequently, EU has developed and implemented EU Action Plan for the Circular Economy and Ecodesign Working Plan 2016-2019 ^[52]. Since then, each member country has also adopted its own actions to promote the transition to circular economy in line with EU Action Plan.

Notably, EU Action Plan for the Circular Economy indicated the approach to CE based on product life cycle, including: (i) Production, especially Redesign; (ii) Consumption; (iii) Waste Management; and (iv) Turn waste back into resources (Secondary Raw Materials) (**Figure 2.1**).



Figure 2.1: The circular economy model of the EU

Source: Council of the European Union ^[51]

In addition to identifying the four stages of CE as mentioned above, the EU Action Plan also identifies 6 priority areas for CE, namely: Plastics, Food waste, Important raw materials, Construction and Demolition, Biofuels and Biological Products ^[27]. In these areas, to promote economic, social and environmental benefits, the European Union also proposes several specific objectives as follows:

- Promote and increase the rate of urban waste reuse and recycling to a minimum of 70% by 2030;
- Increase the recycling rate of packaging waste to 80% by 2030, with an interim target of 60% by 2020 and 70% by 2025, including specific targets for each specific material;
- Prohibit the burial of recyclable waste: plastic, metal, glass, paper and cardboard and biodegradable waste by 2025, while member countries should try to eliminate virtually run out of landfills by 2030;
- Continue to promote the development of the market for secondary materials (raw materials from recycled waste) of high quality, including evaluating the added value of waste end criteria for specific materials;
- Ensure products from recycled waste are of high quality.

The transition to CE, in which the value of products, materials and resources is maintained in the economy for as long as possible and waste generation is reduced, is an essential contribution to EU's efforts to develop a sustainable, low-carbon, and resource-efficient economy.

In addition, solid waste regulations along with action plans have also been adopted by the EU. Specific action plans include commitments on product design (Ecodesign), development of strategic content in plastics and chemicals, major initiative to fund innovative projects under the sponsor the Horizon 2020 research program of EU in important areas such as plastic waste, food waste, construction, key raw materials, consumption and public procurement.

This EU Action Plan includes implementation content and specific implementation timeline (**Table 2.1**).

Table 2.1: The EU's circular economy implementation plan

Implementation content	Timeline
Manufacturing	
Emphasis on the circular economy aspects of future product requirements according to the Ecodesign directive.	2016 onwards
Plan for Ecodesign 2015-2017 and requires European standardization organizations to develop standards for material efficiency to establish future Ecodesign requirements for durability, repair and recyclability of the product.	December 2015
Putting regulations done on television.	Late 2015 or early 2016
Review options and action plans for the policy framework more coherently through different series of activities of the EU product policy in order to contribute to the circular economy development.	2018

Implementation content	Timeline
Manufacturing	
A guide to circular economy into the best available Technical references (English - BREFs) for several industrial sectors.	2016 onwards
Resource exploitation plan for waste management.	2018
Establish an extensive European network of technology infrastructure for small businesses to integrate advanced manufacturing technologies into the manufacturing process.	2016
Consider how to improve the efficiency of the Ecosystem Management and Accounting Program in the EU (EMAS) and the pilot program on environmental technology verification (ETV).	2017
Develop a knowledge base to improve and support small and medium enterprises to gradually replace toxic substances in the production process.	2018
Consumption	
Quality assurance for consumer product group, with suggestions for improvement (recommendation by Commission on Online Selling).	2015 - 2017
Action plan on consumer complaint content.	2016
Analyze the ability to suggest requirements for information provision in the context of ecodesign use.	2018
REFIT for Ecolabel, and actions to improve efficiency.	2016
Evaluate the capabilities of a planned independent testing program.	2018
Use Ecological Footprints in products to measure and update environmental information.	2016 onwards
The Green Public Procurement Action Plan: enhance integration of circular economy requirements, support growth including through training programs, and consolidate use in procurement by the Commission and other funds of the EU.	2016 onwards

Implementation content	Timeline
Waste management	
Amend legislation proposal on waste.	December 2015
Improved cooperation with member states to better enforce EU waste legislation and combat the illegal transport of vehicles at the end of their life cycle.	2015 onwards
Strengthen enforcement of revised waste regulations.	2016 onwards
Promote voluntary certification of treatment facilities for major waste / recycling streams.	2018 onwards
Initiative on turning waste into energy under the framework of the Energy Alliance.	2016
Identify and disseminate good practices in waste collection systems.	2016 onwards
Secondary raw material market	
Development of quality standards for secondary raw materials (especially plastics).	2016 onwards
Recommended for a separate regulation for fertilizers.	Early 2016
The bill sets out minimum requirements for reused water for irrigation and to recycle groundwater.	2017
Promote safe and cost-effective water reuse, including guidance on integrating water reuse in water planning and management, relevant BREF best practices, and support for innovation through the European Innovation Partnership and Horizon 2020).	2016-2017
Analysis and policy options to resolve the link between chemicals, products and waste legislation, including how to reduce presence and improve tracking of critical chemicals in products.	2017
Measures to facilitate the transport of waste across the EU, including electronic data exchange (and possibly others).	2016 onwards
Further develop the EU raw material information system.	2016 onwards

Implementation content	Timeline
Industry action	
Plastic	
Strategy on plastic in circular economy.	2017
Specific action to minimize the discharge of plastic waste into the sea towards the 2030 Sustainable Development Goals.	2015 onwards
Food waste	
Develop a common method and index for measuring food waste.	2016
Stakeholder platform for verifying the achievement of SDGs on food waste, sharing best practices and evaluating progress.	2016
Clarify relevant EU legislation regarding waste, food and feed to facilitate the distribution of food and use of food previously intended for animal feed.	2016
Research ways to more effectively use food labels.	2017
Important material	
Report on important raw material and circular economy.	2017
Improved communication between manufacturers and recyclers on electronic products.	2016 onwards
European standard for the efficient recycling of electronic waste materials, waste batteries and other complex related end-of-life products.	2016 onwards
Share best practices in recovering important raw materials from mining and landfill waste.	2017
Construction and demolition	
A guide to pre-demolition assessment for the construction industry.	2017
Voluntary industry-wide recycling method for construction and demolition waste.	2016
Key indicators for evaluating a building's lifecycle environmental performance.	2017 onwards

Implementation content	Timeline
<i>Biomass and bio-based materials</i>	
Guide and disseminate best practices on the use of stratified biomass and support innovation in this sector through Horizon 2020.	2018-2019
Ensure cohesion and synergy in circular economy when checking the sustainability of bioenergy in the Energy Union.	2016
Evaluate the contribution of the Bioeconomic Strategy 2012 to the circular economy.	2016
<i>Innovation and investment</i>	
Initiative “Industry 2020 and circular economy” in Horizon 2020.	October 2015
Pilot project for “innovation agreement” to address possible legal obstacles to innovation initiatives.	2016
Target approach to encourage EFSI funding applications and support the development of investment projects and platforms in line with circular economy.	2016 onwards
Outreach and communication activities are targeted to assist member states and the region in attracting Joint Policy funds for circular economy.	2016 onwards
Supporting member countries and regions to enhance innovation for circular economy through smart specialization	2016 onwards
Evaluate the possibility of building a foundation together with EIB and national banks to financially support circular economy.	2016
Engage with stakeholders in the implementation of this action plan through existing fora in key areas.	2016 onwards
Supporting a wide range of stakeholders through actions on public private partnerships, collaboration platforms, support for voluntary business practices, and exchanging best practices.	2015 onwards
<i>Monitoring</i>	
Building a monitoring framework for circular economy	2017

Source: European Commission^[63]

After the adoption of this Action Plan, the EU began its implementation. The first must include the guarantee of legal rules for consumer goods. Next, the European Commission introduced the regulations on fertilizers called “creative agreement”. This can be seen as an attempt by the European Commission to connect producers and investors to strengthen the transition to CE. As of May 2018, the countries with the best CE results are Germany, the UK and France that have strong recycling systems and high levels of innovation in the fields of industrial production. Other developed countries also tend to have better CE results, partly due to the fact that they have a larger economy with more private investment and patents in their economies.

Following the Action Plan, the European Commission presented the Eco-design Plan 2016-2019 as part of the Clean Energy Package for all EU citizens. This Plan covers not only energy efficiency, but also a more systematic exploration of the ability to “establish product requirements in line with the circular economy such as durability, reparability, upgradability, design for disassembly, reusability and recyclability”.

At the same time, together with the introduction of the Eco-design Plan, the European Commission also launched a platform which includes the European Investment Bank (EIB) that comprised of financial market participants, enterprises and the European Commission, to increase awareness and participation of investors ^[54].

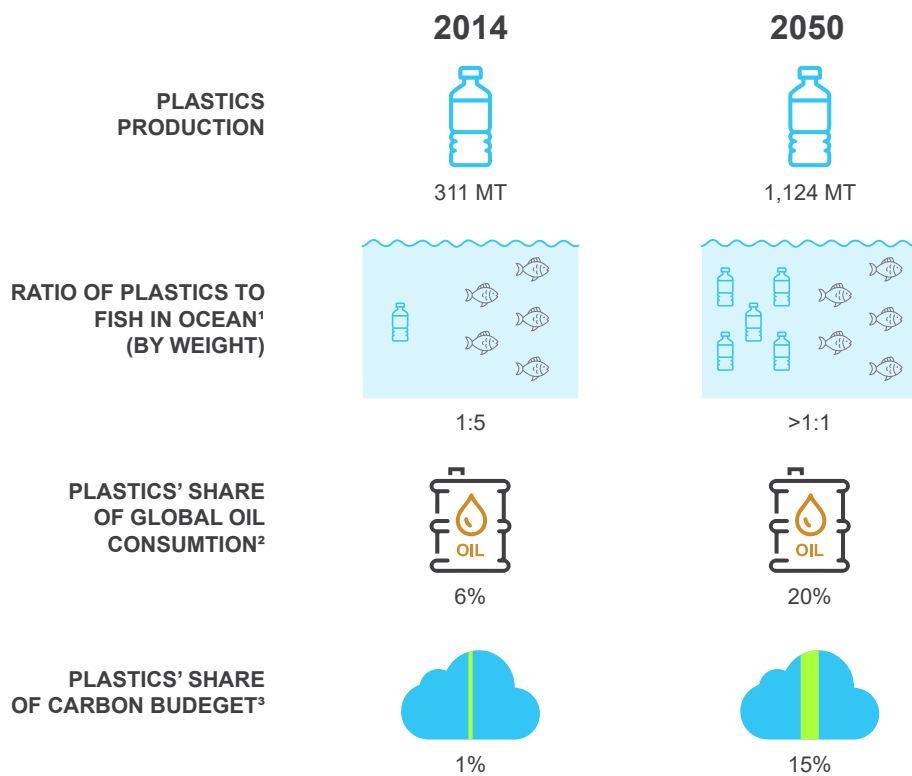


Figure 2.2: Projections of plastic waste to 2050 worldwide

Source: [Jocelyn Blériot WCEF2019: One word: plastics](#)

Most recently, due to pressure from the current situation and forecasts of plastic waste in the world, for example, Ellen MacArthur's forecast of 1.12 billion tons - more than the total amount of fish in the ocean (**Figure 2.2**), EU has adopted more drastic measures. On March 27, 2019, the European Parliament agreed on ambitious measures proposed by the Commission to treat marine debris coming from the 10 most common single-use plastic products found on beaches. This is considered a revolutionary step towards the elimination of non-recyclable products. This is completely consistent with the circular economy philosophy in which no waste is discharged into the environment.

In addition, the European Union Commission also identifies progress towards a circular economy as a challenging task that needs a monitoring framework to measure progress towards CE according to product and service life cycle. This is why the monitoring framework has a set of ten indicators which are grouped into four phases and CE aspects: (1) production and consumption, (2) waste management, (3) secondary raw materials and (4) competitiveness and innovation.

1.2 Netherlands

The starting point for approaching circular economy in the Netherlands began in 1979 when Ad Lansink's policy on waste management was approved by Parliament. Accordingly, this policy provides a hierarchy of waste management (also known as "Lansink scales") that prioritizes the prevention and reduction of waste generation, promoting reuse and reuse of waste, and waste incineration before sending waste to landfills ^[44].

It took 10 years before new policies on waste prevention and reuse were launched. In 1990, 30 priority waste sources were selected to implement ambitious waste treatment programs. These waste sources range from tires, batteries, packaging to used oil. This new Dutch approach has effectively enabled the prevention, reuse, and recycling of waste streams. At the same time, an environmental industry was born based on the development of all types of waste management and recycling technologies.

Recently, on September 14, 2016, when the EU promulgated the circular economic package in 2015, the Netherlands officially launched a government-wide program for a circular economy in the country by 2050. This program aims to share the Cabinet's ambitions with a variety of stakeholders in which the interim objective is a 50% reduction in the use of primary raw materials (from minerals, fossils, and metals) by 2030. This Program sets up immediate goals together with a roadmap for actions by 2050. Accordingly, the Government is responsible for designing actions to achieve these goals. Besides, the Government also plays as a market regulator as well as create connections among relevant stakeholders to promote the transition to circular economy¹.

¹ A Circular Economy in the Netherlands by 2050

1.3 Republic of Germany

The implementation of CE in Germany is based on “top-down” approach. Germany has promulgated the Closed Substance Cycle and Waste Management Act since 1996, with the core idea of material circulation. Germany is aware that their heavy industries require a lot of input materials so that the material circulation will help reduce dependency on resources, while ensuring the long-term sustainable development of the whole economy. Therefore, the Law provides frameworks to implement waste management in a closed cycle. Since then, Germany has approached the circular economy at the national level, promoting various models of waste minimization, reuse, recycling and incineration to produce electricity and heat. Over the past decades, Germany has developed a number of ambitious energy, industrial, and environmental policies at the national level. Consequently, Germany plays an important role in these fields at the European level.

According to the Organization for Economic Cooperation and Development (OECD), the solid environmental framework has made Germany a pioneer in sustainable development. This also proved that a low-carbon economy was likely to be more efficient and compatible with growth (OECD, 2012). Furthermore, Germany’s National Strategy for Sustainable Development was adopted in 2002 that set out the guiding principles for national policies in all sectors. Despite many changes in the German Government over the years, this Strategy still provides the basis for establishing specific goals and actions. For example, Germany has attempted to significantly increase energy efficiency as well as decouple energy consumption and greenhouse gas emissions from economic development ^[55].

The German Government sets natural resource-saving goals for holistic environmental protection, including reducing landfills, conserving biodiversity, and using more sustainable resources. In particular, sustainability is a fundamental principle in German policies. An important factor in the country’s transition to a sustainable society is the application of CE principles.

At the European level, a number of legal frameworks have been adopted to promote the CE in the region, such as the EU Waste Framework Directive, the EU Landfill Directive, and the EU Packaging and Packaging Waste Directive. Accordingly, Germany adopts a number of strategies to promote an approach to CE at the national level, including waste minimization, reuse, recycling, and waste incineration to generate electricity and heat. One cornerstone of the German recycling policy framework is the Packaging Act (Verpackungsverordnung) which was passed in 1991 ^[55].

Germany has committed to a 40% reduction in greenhouse gas emissions if other EU member states agree with the EU's 30% reduction target by 2020. The objective is indicated in the German Integrated Energy and Climate Program which sets policy measures for the energy sector. Some policies to implement these goals include key measures such as the Renewable Energy Act (Erneuerbare-Energiene-Gesetz, EEG) and eco-tax reform.

1.4 France

Since 2017, the French Government has started to develop a circular economy, with the goal of halving the amount of waste to landfills and recycling 100% plastic waste by 2025 ^[56]. The roadmap was enacted in April 2018, highlighting 50 measures to promote a shift to circular economy, covering production, consumption, waste management and community participation. This has also attracted the participation of private sector with the establishment of the Textile Recycling Valley in northern France that aim to recover 50% of waste fabric and recycle 95% of the amount of fabrics in 2019.

1.5 Denmark

Denmark has many leading companies in circular economy solutions, along with long-standing traditions of innovation policies, stimulating the economy and long-term strategic commitments on efficient use of energy and renewable energy. Denmark outperforms the EU on most selected resources and creativity.

Even in a country that already has a strong potential like Denmark, the transition to circular economy can bring lasting benefits to a more creative, resilient and more efficient economy. Positive effects on the Danish economy in 5 sectors, accounting for 25% of the economy ^[57]. From those 5 areas, Denmark has identified 10 opportunities to implement circular economy. More specifically, the greatest economic potential is determined in the fields of construction, real estate, food and beverage.

While the majority of the ten opportunities to access circular economy identified in Denmark can generate huge profits, there are still non-financial barriers that limit further expansion or curb growth. To implement circular economy with the above expectations, Denmark has outlined a short-term scenario for 5 years (2020) and a long-term scenario for 20 years (2035 has been identified), in which each scenario has estimated adaptation rates and value creation. The year 2035 was chosen to be a pivotal year in order to get a full review of opportunities, without going too far for businesses and stakeholders having difficulty evaluating specific opportunities. Descriptive scenarios provide a general context to identify and assess different opportunities, by articulating how the business environment and consumer behavior, as well as technology, can evolve in future.

In addition, Denmark is now approaching circular economy based on the model of Kalundborg industrial park. Specifically, in the town of Kalundborg, several industrial companies of very different industries exchange waste and resources with each other in a complex pipe network. This circulatory system provides participants with cheaper energy and raw materials, while reducing waste disposal costs. However, the establishment of such an industrial park requires vision and ability to choose and design very well of managers, especially, it takes very long time (decades). The symbiosis model of Kalundborg is considered as a lesson to create similar models in other Danish interdisciplinary industrial parks.

1.6 Finland²

Finland is one of the leading countries in developing circular economy. The circular economy model is considered as a solution to build a sustainable society on the basis of public-private partnership. Since 1967, Finland has shaped the promotion of a circular economy. Accordingly, SITRA (Finnish Innovation Development Fund) was established with the mission: forecasting development trends in the world; capacity building training for ministries and branches; carbon neutral circular economy development; participate in forums and projects for sustainable economic development; promote renewable production and recovery and reduce waste; connecting the consumption of goods and services to ensure maximum efficiency and friendly with the environment. Finland is also the first country to build and issue a national circular economy development roadmap. In 2016, Finland's circular economy development roadmap was built with the participation of government agencies, representatives of the public and private sectors, and organizations. The 2016 roadmap for circular economy development is considered as a kick-off step for the transition to Finnish circular economy, which includes 6 strategic projects and dozens of pilot programs. The priority areas set out in the roadmap are the traditional sectors that have dominated the development of Finland such as the sustainable food system, the forest-based loops, and the circular cycle, technical loops, transport and logistics, and joint actions. Accordingly, 6 strategic projects include:

² <https://www.sitra.fi/en/projects/critical-move-finnish-road-map-circular-economy-2-0/>

creative, resilient and more efficient economy. Positive effects on the Danish economy in 5 sectors, accounting for 25% of the economy ^[57]. From those 5 areas, Denmark has identified 10 opportunities to implement circular economy. More specifically, the greatest economic potential is determined in the fields of construction, real estate, food and beverage.

- (i) Regional co-operation project: The local food supply project applies sustainable production to the Finnish people through the kitchens of the units in the public sector.
- (ii) A pilot plant project applying new techniques in the production of electrical and electronic equipment, thereby evaluating the reuse of rare and precious materials.
- (iii) The Helsinki Metropolitan Smart & Clean project creates new export concepts based on low carbon smart transport by mining open data.
- (iv) The project to develop probiotics to replace the role of fossil fuels is promoted on a large industrial scale.
- (v) Project A collaborative model of industrial ecosystems in the Arctic continues to be tested in Northern Finland to enhance industrial symbiosis.
- (vi) The Project of World Circular Economy Forum aims to introduce the best solutions for circular economy application.

In the two years after Finland issued the national circular economy roadmap, the concept of circular economy has begun to appear in community forums, at the same time being detailed in specific activities. In addition, SITRA has continued to promote extensive cooperation in circular economy, accordingly based on the results achieved under the 2016 circular economy development roadmap to build a roadmap of Finland towards circular economy in the 2016-2020 period (hereinafter referred to as Roadmap 2.0). The basics of Roadmap 2.0 include:

- (i) Strategic objectives:
 - Renovate the foundation of competitiveness, give priority to the application of circular economy solutions in developing competitiveness and economic growth strategy.
 - Make a transition to low carbon energy, promote energy efficiency and set higher goals in national climate and energy policies.
 - For the purposes of the Paris Agreement to be met, consumption and production will no longer rely on the unlimited use of natural resources.

Daily activities are catalysts for transition. The goal of cutting carbon emissions by 50% in the first half of 2030 requires the adoption of a new approach to ownership, culture, taxation, and income distribution.

(ii) Vision for stakeholders:

- For central agencies: Central management agencies need to consider and adjust all administrative domains affecting the circular economy. The core solution is coordination of ministries and branches.
- For the locality: The circular economy creates an innovative platform for industrial and public procurement policies, education and training, and more efficient land use solutions.
- For businesses: Business strategy is built on a new foundation. Circular economy requires a new type of cooperation between enterprises as well as between business and the public sector.
- For the people: People's daily choice becomes a sustainable choice. The transition to circular economy requires a large contribution from the people.

2. North American Countries

2.1 Canada

In Canada, the approach to circular economy has generally been overshadowed by the national goals on climate change and clean growth. Currently, Canada has not issued an integrated and comprehensive strategy on CE and cooperation to promote the deployment of CE.

The establishment of the National Zero Waste Council may be regarded as the approach to CE in Canada. This initiative aims to build a partnership among relevant stakeholders, namely governmental agencies, businesses, and non-governmental organizations to prevent waste generation and to promote the transition to CE in Canada. Based on inter-agency cooperation, the National Zero Waste Council has pushed innovation in the design, production, and use of products. The Council also has set up specific actions and activities for waste generators, thus contributing to a reduction in resource and energy consumption.

Founded by Metro Vancouver in collaboration with the Federation of Canadian Municipalities in 2013, the Council has united, among others, six of Canada's largest metropolitan regions – Metro Vancouver, Toronto, Montreal, Halifax, Calgary, and Edmonton. The Council is comprised of key business and government leaders, academia, and non-profit organizations. The main mission of the Council is to call for national action and systems change to address waste generation based on cooperation among business, government, and the community, at the national and international level, as an agent of change for waste prevention and reduction in the design, production, and use of goods. As a result, the Council released guiding principles as follows:

- Commit to collaboratively working with business, government, and community partners to develop new solutions.
- Adopt a waste prevention and reduction framework that positions Canadian cities and businesses to compete globally in an emerging resource-constrained economy.
- Align with global and international initiatives.
- Promote the economic, social, and environmental benefits associated with the conservation of resources.
- Consider local and global consequences and long term impacts.

Furthermore, the Council has also pursued the two strategic directions, including Design change and Behavior change. Accordingly, Design change is to catalyze change in the design of products and packaging to reduce the material intensity and allow them to be more easily reused, recycled, and recovered while Behavior change is to catalyze change in behavior, among all stakeholders and sectors of society, to reduce the amount of waste entering the waste stream.

On November 28, 2018, based on the principles and orientations set out by the National Zero Waste Council, the Ministry of Environment and Climate Change (ECCC) together with the Ministry of Health (HC) launched the Canada-wide Strategy on Zero Plastic Waste that outlines a vision to keep all plastics in the economy and out of the environment.

Previously, more than 89% of plastic has been buried and burned when adopting the current waste management programs. Consequently, the new Canada-wide Strategy on Zero Plastic Waste introduces an integrated system that focuses on areas where changes are needed across the plastic lifestyle from design to collection, clean-up, and value recovery.

This strategy sets out the measures and actions needed such as awareness and education, research and innovation, and market-based regulations and tools. Designing is expected to be one of the priority actions to achieve the overall goal of 100% recyclable and recyclable plastic products. Canada also plans to reduce the amount of e-waste plastic exported to other countries to recycle more domestically ^[58].

2.2 United States of America

In the United States, the circular economy is formed based on a market-based approach. The Market-Based Approaches (MBAs) provide opportunities for businesses and organizations to be free to participate in trading goods and services related to environmental protection, resource management, and response to climate change in compliance with the law of market supply and demand. In particular, the MBAs encourages behaviors through market signals rather than instructions and directives of the Government. On the other hand, the Government's policies emphasize initiatives on CE and the replication of good CE practices.

The example can be seen in the case of the electric waste market in the State of Colorado. In 2013, the “Electronic Recycling Jobs Act” prohibits the disposal of waste electronic devices (e-waste) in Colorado. The enterprises immediately began to collect and recycle e-waste. Thus, a market has been established in which the buyers were households and the sellers were companies who collecting and recycling e-waste. As a result, these activities have contributed to local environmental protection and created more jobs. In particular, the State of Colorado did not have to pay for the treatment of environmental pollution caused by the e-waste ^[47, 59]. After that, many similar markets have been formed that accelerate the development of the area of waste collection and treatment. The area is considered to bring high profits for investors in the United States.

In addition, some US cities have also developed and issued the “Zero waste” Strategy with the goal of no more waste to the environment by 2030. Cities will have to change from the way a current cost-based approach to a resource-based approach, by treating waste as an asset that needs to be managed, rather than just exercising liability. Since then, the roadmap has been set, and associated with very specific policies, such as promoting public-private cooperation, food waste management, wastewater collection and treatment, recycling construction waste, and establishing facilities for donation and recycling ^[60].

3. Asian countries

3.1 China

China and Japan are the first two countries that formally adopt policies on CE at the national level ^[33]. Faced with the decline in natural resources and many serious environmental pollutions, China had a strong motivation to look for more suitable development. As a result, China has taken the CE approach through the Cleaner Production Promotion Law that comes to effect in January 2003. This Law is enacted to enhance cleaner production, increase the efficiency of the utilization rate of resources, reduce and avoid the generation of pollutants, protect and improve environments, ensure the health of human beings and promote the sustainable development of the economy and society.

Followed by the Circular Economy Promotion Law that took effect from 2009. The National Development and Reform Commission (NDRC) is mainly responsible for the implementation of CE. NDRC has conducted two pilot projects on CE with the participation of 109 enterprises, 33 industrial zones, 7 provinces, and 19 cities.

In recent years, the Chinese Government has integrated the CE principles into its plans with a focus on policies at the municipal level. China deployed the CE approaches at three levels, including macro (city, province, and district), meso (symbiosis association), and micro (single object such as companies). The priority areas are the environmental industry, urban infrastructure, and ecosystems.

More specifically, the above Chinese CE Strategy aims to promote clean production at the enterprise level (micro-level), operate the industrial ecosystem in industrial zones (meso-level), and develop eco-cities at the regional level (macro-level). The trials have been carried out since 2005 in seven industrial sectors and 13 industrial zones, and in 10 eco-cities and eco-provinces (e.g. Beijing, Shanghai, Chongqing, Yang, Ningbo, Hebei, Dong Lang, Liaoning, Shandong, and Jiangsu) under the direction of the NDRC.

The development of eco-city includes three main aspects of the CE as follows:

- The industrial system of the CE (ecological industry, ecological agriculture, and service industry);
- Construction of urban infrastructure, particularly circulating water, energy recovery, and solid waste recycling;
- Ecological security with the emergence of green buildings, improving the quality of the living environment, and protecting the environment.

The legal aspect is also emphasized by China in its outreach strategy. Some issues related to the law, such as mobility, people's participation and lessons learned from developed countries must be addressed effectively. In addition, practice from China indicates the need for an effective scientific evaluation system to obtain accurate information and to improve guidance. Evaluation indicators should include economic development index, green development index and human development index.

China is constantly introducing new laws to improve the efficiency of circular economy and the sustainability initiatives associated with these indicators. Every five years, the Chinese government comes up with a new 5-year plan, with the various sustainability goals and economic growth targets that China wants to achieve. China has implemented the circular economy action plan and strategy through the "11th Five-Year Plan", the "12th Five-Year Plan" and is currently implementing the "13th Five-Year Plan".

The main challenge in building China's circular economy is how to engage businesses in the supply chains involved in cooperating to turn output into input materials. The economic benefits achieved for the parties are quite clear. Recycled, remanufactured, and locally sourced materials are often cheaper, thus helping to increase profits for businesses. At the national level, the increasing use of homegrown materials to replace imported sources has also enhanced China's resource security.

Since the 11th Five-Year Plan, through the development of circular economy, China's unit energy GDP consumption, raw material consumption, water consumption have decreased significantly, the scale of the resource recycling industry has continued to expand, the rate of resource production has increased and industrialization has initially been reversed. OECD statistics show that China's resource use has decreased: from 4.3 kg of raw material per unit of GDP in 1990 to 2.5 kg in 2011. However, the total resource consumption China's resources have grown five times over the past two decades, from 5.4 billion tons to 25.2 billion tons due to the country's economic boom.

For industrial manufacturing, China promotes the development of circular economy in high-tech industries, accelerate the transition of traditional industries with high technology and advanced technology, eliminate processes, technologies and equipment, upgrade traditional industries, promote corporate restructuring, strengthening industrial and economic concentration on the scale and strongly developing agriculture. Development areas and concentrated areas of heavy chemical industry will be planned, built and transformed according to the requirements of circular economy. Importers propose comprehensive control requirements for land, energy, water and discharge use, and development of core resource-related industries for industrial development. Industrial ecological accumulation and effects constitute an industrial chain with efficient resource recycling and improvement of resource production efficiency.

3.2 Japan

The Japanese Government has created a comprehensive legal framework for transition to a recycling-based society. The Basic Law for Establishing a Recycling-Based Society came into force in 2002, providing quantitative targets recycling and dematerialization for the long term.

As a result, Japan's recycling rate for metal has been significant-98% ^[61]. In 2007, only 5% of Japan's waste went to landfills, compared to 48% for the UK in 2008. The Japanese Recycling Law for electrical home appliances led to the great majority of electrical and electronic products being recycled, compared to 30%-40% in Europe ^[62, 63]. Of these appliances, 74%-89% of the material contained are recovered ^[64]. Many of these materials are returned to the manufacture of the same type of products. This can be regarded as a basis for Japan to develop a truly circular economy.

The transit to a circular economy in Japan since 1991 were driven by a number of reasons:

- Japan has a high population density and limited land space. This forced the Japanese Government to find alternatives to landfills since the 1950s. Moreover, the incineration has been replaced since the 1990s due to concerns about dioxins which could interfere with hormones, damage the immune system, and cause reproductive and developmental problems and cancer;
- Japan is one of the large industrial producers, but its domestic metal and mineral resources are scarce. This provides opportunities to develop the remanufacturing and recycling industries. Meanwhile, it is difficult to underestimate the relevance of the importance of access to raw materials in Japan as public policy for the circular economy;
- Japanese business culture emphasizes collaboration that results in a comprehensive approach to CE.

At the national level, the implementation of CE is measured by using:

- Resource productivity indicator that measures material use as a proportion of GDP;
- Indicator for cyclical use rate of materials in the economy, measured by the material reused as a proportion of total material used by the economy;
- An output indicator, measuring how much waste is buried in landfills.

These indicators are aligned with specific targets. The government measures indicators for a societal effort toward a circular economy. For example, the size of the market for rental and leasing of goods, the amount of reusable packaging sold, and the number of local authorities adopting residual waste collection.

The comprehensiveness and collaboration are central to the CE system in Japan. The communities, in particular, have played an important role in the transition to CE through their daily actions, such as separating recyclables or paying recycling fees. Manufacturers fulfill their obligations by using more recycled materials and making longer-lasting products that are easier to repair and recycle. The existing CE system in Japan has three key features:

- The consumer-friendly collection is the system for collecting old appliances for recycling. Old appliances are collected by retailers either in-store or when delivering a new appliance. For old IT equipment, the manufacturer can make requests to local authorities to collect at the doorstep or can take to any post office for returning. This routine is popular across Japan so that the perception of CE is well understood and easily applied.
- Consumers pay fees in advance for electronics at the point of purchase, including the cost of transport and recovery. The customer does not have any disincentive to participate when a product comes to the end of its life. Furthermore, penalties for fly-tipping are also strict.
- Recycling infrastructure is co-owned because the law requires consortia of manufacturers to run disassembly plants to ensure their direct benefit from recovering materials and parts. Companies, therefore, invest for the long term in recycling infrastructure. Because the companies own both manufacturing and recovery facilities, they can send product designers to disassembly factories to experience the frustrations of taking apart a poorly designed product. Some companies even put prototypes through the disassembly process to make sure they are easy to recover.

The CE system in Japan is built on collaboration and incentives. The implementation of the CE system has shown high profits, for example, the reuse and recycling sector was worth £163 billion in 2007 (7.6 percent of GDP) and employed 650,000 people ^[61].

3.3 Republic of Korea

South Korea began implementing their circular economy by focusing on waste treatment and recycling. This makes South Korea the second highest recycling rate country among OECD countries in 2013 ^[65]. In 2017, the Korean Ministry of the Environment (2017) has announced the promulgation of resource circulation rules from the beginning of 2018 to implement circular economy. Accordingly, the Law on Resource Recirculation includes such things as “recirculation resource identification”, “resource circulation efficiency management”, “evaluation of cyclic cycle availability” and “waste disposal fee”. In addition, the law also includes policies to reduce waste in all processes from production, distribution, consumption to product disposal and to promote recycling.

In particular, “Performance management of natural resources” is applied to the discharge plant designated on 100 tons or other waste discharge over 1,000 tons. It sets a custom target for each factory to assess the material circulation and the extent to which the plant needs to reduce waste. If a manufacturer makes products that are difficult to recycle, the “evaluate the availability of a cycle” will apply to this situation. This policy requires manufacturers to reduce the use of non-recyclable materials or make products more recyclable. An assessment plan must be conducted every three years, where, if a factory does not improve their situation, the incident will be published publicly on the internet. If a municipality or manufacturer uses a landfill/incineration method, they must pay a “waste disposal fee” of between 0.01-0.02 €/kg depending on the type of waste. Waste that is not harmful to the environment and is traded for a fee will be verified in the “recirculation resource identification” if it meets the standard requirements. Factories will also be inspected routinely to meet the standards ^[66].

3.4 Taiwan

Taiwan has a high population density but does not have the resources to meet essential needs. Taiwan imports 98.8% of fossil fuels, 98% of metals and 71.8% of its biomass needs. Along with that, Taiwan has 20 years of experience in recycling and the recycling rate is currently equivalent to that of Europe ^[67]. However, there are still problems like pollution, illegal factories and waste. The above issues require the Taiwan Government to adopt a more comprehensive and systematic approach, which is circular economy.

The Taiwan government supports the development of circular economy by taking action based on the four pillars of green growth: law, regulation, market incentives, innovation and connectivity. On June 1, 2018, TCEN (Taiwan Circular Economy Network) invited industry representatives to sign a “green” agreement to promote circular economy implementation. In particular, three industrial alliances have been established in the fields of plastic, electronics and construction to seek opportunities for cyclic cooperation. Since then, other alliances have been formed to tackle the problem of marine waste as well as the solar industry.

3.5 Singapore

As a small nation, Singapore recognizes the need to balance economic development and environmental sustainability. Therefore, the circular economy’s thinking approach is perfectly suitable in the context of scarce resources and land in this country.

Singapore implements circular economy in various ways, including the implementation of an extended manufacturer responsibility system (EPR), starting with electronic waste by 2021. In addition to electronic waste, Singapore is also studying the feasibility of expanding EPR to packaging waste. In addition, the Government of Singapore also strengthens cooperation and support among industries. As a result, a Closing the Waste Loop Initiative called for research funding under the “Closing the Waste Loop Initiative” towards the design of more sustainable plastic materials. The goal here is to allow plastic to be more reusable, easier to recycle to increase the value of waste plastic (MEWR) ^[68].

4. Lessons learned for Vietnam

From the above anecdotes, there are two popular approaches to CE, including (i) Systemic economy-wide implementation; and (ii) Focus on a group of sectors, products, materials, and substances.

Regarding the systemic economy-wide implementation, the key strategy is to create a closed-loop system within a geospatial space (e.g. ecological industrial zones, eco-cities, etc.). Vietnam could adopt this approach based on the scale of industrial zones since some locals are owning industrial parks and large factories in which waste from factories would become a valuable input to another. It is feasible to build several eco-industrial parks in Vietnam. At the same time, the government should issue preferential strategies and policies for businesses to participate in the CE system.

The second approach to CE is based on focusing on a group of sectors, products, materials, and substances. For example, Canada's approach through "Zero plastic waste" strategy aims to plastic waste recycling ^[58] or the EU's approach that provides strong legal ground for waste management, namely reducing landfill, increasing the reuse and recycling of municipal waste and packaging waste, and improving the extended producer responsibility (EPR). This approach could be applied in Vietnam in various strategies to involve related stakeholders, especially the private sectors and communities. Specifically, Vietnam can launch campaigns to raise people's awareness of a certain aspect of CE such as minimizing, reusing, and recycling plastic waste. In addition, this approach is also suitable for specific industries such as transportation, information technology, and the food industry.

It is also found that CE models of other countries have been developed in three levels: macro level (national, provinces, cities), meso (industrial symbiosis, eco-industrial parks), and micro (single firm, product). At any level, circular economy models are aimed at circulating materials, reducing resource extraction and minimizing waste to the environment. On the other hand, it is believed that circular economy models at the micro level are the core of the implementation of CE since single corporates could make up industrial symbiosis; then industrial symbiosis or industrial parks could build up cities or even the entire economy. Therefore, international experience showed that businesses are the central driving force of circular economy while the government plays a constructive role.

In addition, the above experience also indicated some common actions to promote the transition to circular economy as follows:

- To complete the legal system which specifies the objectives and tasks to be performed; incentive measures; and responsibilities of stakeholders.

- To develop and issue a detailed action plan and implementation roadmap for the transition from linear economy to circular economy. Specific actions for each task and each sector are in line with the roadmap of CE implementation, focusing on product design, manufacturing processes, consumption, waste management, management of secondary materials, priority industries, innovations and new initiatives.
- The transition to circular economy is not limited to certain materials or sectors. It is a systemic change that affects the entire economy. However, countries often start to adopt CE models in a number of priority sectors. The popular priority sectors include plastic, construction, industry, and agriculture.
- Enterprises play a central role in implementing circular economy. Besides, they are encouraged to participate in programs of governments and non-governmental organizations on assistance in the transition to CE models to ensure voluntary innovation, environmental protection initiatives, saving resources and improving competitiveness.
- The application of circular economy models should be in line with technical, financial and human resources conditions. The Kadlundborg industrial park model in Denmark is remarkably successful due to strong financial and technical basis of Denmark. Especially the enterprises have high awareness of opportunities and benefits of this model while the managers have good visions. This model also requires the construction of appropriate infrastructure^[69]. The symbiosis model of Kalundborg is considered as a typical lesson to build circular models in other interdisciplinary industrial zones in the world. In case of Vietnam, it requires infrastructural, financial and technical preparation.
- To share successful experience and involvement of all stakeholders. There should be prestigious forums and websites of the Government, programs to commend and share experiences of successful organizations and businesses in the transition to circular economy to inspire and raise awareness on environmental protection, thus connecting and encouraging stakeholders to voluntarily participate in implementing CE principles in their activities.
- To develop a data information system on circular economy. It should actively support the establishment of a circular economy information system and technical advisory service system to provide information on technology and management, for example consultancy, technology transfer and training.

CURRENT STATUS OF INSTITUTION AND EXISTING MODELS RELATED TO CIRCULAR ECONOMY IN VIETNAM

1. Policies and legal framework for promoting circular economy development in Vietnam

Vietnam is now in an era where the world is rapidly changing. Vietnam has faced many emerging issues related to natural resource management, environmental protection and climate change that requires Vietnam to adopt appropriate policies and actions. At the same time, many countries have recognized circular economy (CE) as a new approach to decouple the economic growth and environmental degradation and pollution. As a result, it requires to establish a solid legal foundation in the transformation process to circular economy and society. In this context, this Synthesis Report conducted a review on Vietnamese Party, the government's policies and legal documents to find out the existing legal gaps and shortcomings to promote the transition to CE.

1.1 Vietnamese Party's policies

- *Directive No.36/1998/CT-TW of the Political Bureau*

The Directive No.36/1998/CT-TW dated June 25, 1998, is one of the most important and earliest policies of the Party on environmental protection and development of green products that clearly stated the justification for “issuing policies on tax and credit to support the application of clean technologies” and “the adoption of cleaner technologies that help industrial manufacturing establishments to use less raw materials and generate less waste”.

- *Resolution No. 41-NQ/TW of the Political Bureau on environmental protection in the period of accelerating national industrialization and modernization*

The Resolution No. 41-NQ/TW dated November 15, 2004 is an important policy that directly directs the environmental protection in the period of accelerating national industrialization and modernization to create extensive changes in awareness and action, innovation in leadership, and particularly changes in the implementation of environmental protection activities in the entire society. The Resolution has identified the viewpoints, objectives, tasks, solutions and implementation organization to address environmental problems in line with the perspectives of the National Socio-Economic Development Strategy in the period of 2001 - 2010: “Rapid, efficient and sustainable development, economic growth goes hand in hand with social justice and environmental protection”. The Resolution also identified “To encourage the economical use of natural resources and energy;

production and use of clean energy, renewable energy, products and product packaging that do have no or minor negative impact on the environment; and recycling and reusing recycled products. It also gradually applies measures to force manufacturers and importers to retrieve and treat used products that they manufacture and/or import”. Consequently, the Resolution provides the basis for formulating and completing relevant policies to promote green consumption.

- *Directive No. 29-CT/TW*

Directive No. 29-CT/TW dated on January 21, 2009 of the Secretariat to continue promoting the implementation of Resolution No. 41-NQ/TW emphasized the “Implementation the environmental improvement and recovery plan in the seriously contaminated and degraded areas; formulation and rolling out of the national target program on pollution remediation and environmental improvement”. The Directive also required the application of science and technology into manufacturing processes, strictly handling environmental pollution violations, as well as increase the production and use of environmentally friendly products.

- *Platform on National Construction in the transition period to socialism 2011*

In the Platform on National Construction in the transition period to socialism 2011, the National Party Congress identified major orientations for national economic, cultural and social development in which environmental protection is the responsibility of the entire political system, the society and the obligations of all citizens. It also pointed out a range of tasks to achieve the objectives, including:

- (i) To combine pollution control, prevention and remediation with ecological environment restoration and protection.
- (ii) To develop clean energy and clean production and consumption.
- (iii) To focus on conducting research, forecasting and implementing solutions to respond to climate change and natural disasters.
- (iv) To manage, protect, restore and effectively use the national resources.

- *Resolution on Socio-Economic Development Strategy 2011-2020*

It is said that many primary objectives of the National Strategy for the period of 2001 – 2010 have been implemented. The achievements are attributed to the whole nation's development. Nevertheless, the achievements have not yet commensurated with the country's potentiality. The national economic development has not sustainable. The Eleventh Congress of Vietnam Communist Party reviewed the implementation of Socio-economic Development Strategy for the period of 2001-2010 and made decision on the Strategy for the period of 2011-2020.

The viewpoints of the National Strategy of the period of 2011 – 2020 indicated that rapid development had to go side by side with sustainable development. Socio-economic development shall consider environmental protection and proactively respond to climate change.

The Strategy set out the environmental objectives in which up to 2020, all new business and manufacture facilities would apply clean technologies or be equipped with devices that help reduce pollution and waste treatment; more than 80% of existing business and manufacture facilities meet environmental standards. Urban areas from type 4 and above and all industrial zones and export processing zones would have waste water treatment centralized system. 95% of regular solid waste, 85% of toxic waste and 100% of medical waste would be treated in line with relevant technical regulations. The environment in heavily polluted areas would be improved and rehabilitated. The harmful effects of natural disaster would be restricted. It also would proactively respond to climate change, especially the rise of sea water level.

- *Resolution on the five-year Socio-Economic Development Plan 2016-2020*

The Five-year Socio-Economic Development Plan 2016-2020 defines the proactive respond to climate change, effective management of natural resources and environmental protection as one of the overall objectives. The Plan also sets out four environmental indicators, in which 85% of hazardous waste and 95 - 100% of medical waste would be treated in line with relevant technical regulations by 2020. To achieve the objectives, the Plan identified a range of key tasks and solutions.

- *Resolution 24-NQ/TW of the Central Executive Committee on proactive response to climate change, improvement of natural resource management and environmental protection*

The Resolution identifies viewpoints, objectives and tasks as follows:

(i) Viewpoints:

Actively responding to climate change, strengthening natural resource management and environmental protection are of particularly significant issues, great impact, relationships, interactions and decisions on the sustainable development of the country; being the grounds and premise for planning guidelines and policies of social economic development, security and national defense and social security assurance. This is one of the most important tasks of the entire political system, the responsibility and obligation of the agencies, organizations, businesses and communities, in which the state plays a key role, under the leadership of the Party and the participation and monitoring of the entire society. Natural resources are national assets, the resources and natural capital particularly important for development of the country. Natural resources must be assessed adequately with their values, valuation, accounting in the economy, closely managed and protected; effectively, economically and sustainably exploited and used associated with the target of social and economic development, natural resources security assurance. It shall focus on the development and use of renewable energy, new and recycling materials.

(ii) Objectives:

- By 2020, proactively adapting to climate change, preventing natural disasters, reducing greenhouse gas emission, having basic change in the exploitation and use of natural resources in the sustainable, effective and rational direction, curbing the rising levels of environmental pollution, reducing biodiversity in order to ensure the quality of the living environment and maintaining ecological balance towards a green and environmental friendly economy.
- By 2050, actively responding to climate change; effectively, economically, rationally and sustainably exploiting and using natural resources; ensuring quality of living environment and ecological balance, striving to obtain environmental targets equivalent to the current level of the industrialized countries in the region.

(iii) General tasks:

Promoting the conversion of growth model associated with the restructuring of economy towards green growth and sustainable development.

In conclusion, the term “circular economy” has not officially used in the Party’s policies. Nevertheless, the principles of CE have been mentioned in many policies’ documents, for example, “clean consumption” and “recovery and rational and efficient use of national resources” (in the the Platform on National Construction in the transition period to socialism 2011), “green economy” (in the National Socio-Economic Development Strategy 2011-2020), especially promoting the growth model associated with restructuring the economy towards green and sustainable growth (in the Resolution No. 24-NQ/TW).

1.2 Government's policies and regulations

While the linear economy follows the “take-make-dispose” model, the circular economy prioritizes the management, use and regeneration of natural resources in a closed loop as well as reducing generated waste by considering waste as a new source of raw materials for production. Currently, Vietnam is facing typical challenge of a linear economy, namely excessive exploitation of natural resources and generation of a large amount of waste that result in the high risk of resource depletion and environmental degradation. On the other hand, the demand for raw materials and energy is normally high to serve the production of goods for domestic consumption and export. This has led to the rapid increase in the amount of solid waste generated. Accordingly, waste management, especially management of plastic waste and packaging waste, has become a growing concerns in Vietnam.

One of the causes leading to the above challenges is the inadequacies and shortcomings in policies and regulations. Although Vietnam has issued many policies and regulations on resource management and waste management, the enforcement has been still ineffective. For example, sub-law documents such as Decree No. 36/2017/ ND-CP, Decree No. 46/2015/ND-CP, Decree 38/2015/ND-CP are not specified and clear when it comes to the assignment to direct, guide and organize the implementation of state management of solid wastes.

Vietnam is now applying a new approach that can transform from a “linear economy” to a “circular economy”. Currently, Vietnam has not yet introduced a specific law on CE, but many Party policies and government regulations have referred to the CE principles, such as rational and economical use of natural resources, waste reduction, collection, reuse and recycling, development of environmentally friendly products, and industrial symbiosis. As a consequence, the review and assessment of inadequacies of relevant policies and regulations helps to identify legal gaps for the transition to circular economic development, as well as creating a solid basis for the development of specific legal regulations on CE in Vietnam.

1.2.1 Policies and regulations on waste management

a) Current status of policies and regulations on waste management

Vietnam has issued a range of mechanisms, policies, regulations and guidelines for integrated management of solid waste and MSW. At macro level, Ministry of Construction (MOC) chaired and coordinated with relevant ministries to develop and submit to the Prime Minister for approval of the National Strategy on integrated management of solid waste by 2025 with a vision towards 2050³. In 2018, as assigned by the Prime Minister, MOC had cooperated with MONRE to review this Strategy and submit to Prime Minister for issuance of the revised National Strategy for integrated management

³Decision No.2149/QĐ-TTg dated December 17, 2009

of solid waste to 2025 with vision towards 2050. Many important regulations on waste management have been promulgated such as Law on Environmental Protection 2014, Law on fees and charges 2015, Decree No.38/2015/ND-CP on management of waste and scrap. MONRE has developed and issued environmental national technical regulations on waste and scrap, including: National technical regulation on industrial waste incinerator (QCVN 30:2012/BTNMT), national technical regulation on MSW incinerator (QCVN 61-MT: 2016/BTNMT), national technical regulation on construction of infrastructure related to waste treatment facilities, environmental national technical regulation for imported iron and steel scrap used as raw materials (QCVN 31:2018/ BTNMT), environmental national technical regulation for imported plastic scrap used as production materials (QCVN 32:2018/ BTNMT), environmental national technical regulation for imported paper scrap used as raw production materials (QCVN 33:2018/BTNMT).

When it comes to plastic waste, the Government has also issued documents directing the implementation of solutions to gradually cope with serious environmental pollution caused by plastic waste. Some key legal documents can be listed as follows:

- Decision No.582/QD-TTg dated April 11, 2013 of Prime Minister approving the scheme on enhancing the control of environmental pollution due to the use of non-biodegradable plastic bags by 2020.
- Decision No. 491/QD-TTg dated May 7, 2018 of the Prime Minister approving the adjustment of the National Strategy on integrated management of solid waste to 2025 with vision towards 2050. One of the key tasks identified in the Strategy is to review and evaluate the results of the implementation of the Prime Minister's Decision No.582/QD-TTg approving the scheme on enhancing the control of environmental pollution due to the use of non-biodegradable plastic bags by 2020; limit and then end the import, export and supply of types of persistent plastic bags used in daily life since 2026 in trade centers and supermarkets.
- Decision No.1746/QD-TTg dated December 4, 2019 of the Prime Minister approving the National Plan of Action on management of plastic waste in oceans by 2030.

Under Decree No.38/2015/ND-CP (amended and supplemented by Decree No.40/2019/ND-CP dated May 13, 2019), solid waste is currently classified and managed according to different types, including: hazardous waste, MSW, ordinary industrial solid waste and other specific waste such as waste generated from medical, construction, agricultural and transportation activities. Among the above types of solid waste, the responsibility for state management of hazardous wastes has been assigned to MONRE. On the other hand, it is said that MONRE takes unified state management of other types of solid waste (including MSW) while relevant ministries are responsible for technical management according to their functions and tasks prescribed by law. To illustrate, in case of MSW, MONRE is in charge of development of technical guidelines and procedures on classification, storing, transferring, reuse, recycling, treatment and recovery of energy from domestic solid waste. Furthermore, MONRE shall manage and inspect environmental protection activities related to management of MSW. Whereas, MOC is responsible for guiding the management of construction investment of MSW

treatment facilities under the approved plan; method of preparation, cost management and service evaluation methods of MSW treatment; declaring technical and economic norms on collection, transportation and treatment of MSW, and construction investment capital rate of MSW treatment facilities. The Ministry of Science and Technology (MOST) is assigned to take charge and cooperate with MOC and MONRE to verify MSW treatment technologies that are newly studied and applied for the first time in Vietnam. Meanwhile, Decree No. 40/2019/ND-CP stipulates that MONRE will take a leading role and coordinate with MOST and relevant ministries/line ministries to issue specific criteria; appraise, evaluate and declare MSW treatment technologies.

In 2019, Resolution No. 09/NQ-CP of February 3, 2019 was issued, in which the Government agreed to assign MONRE to be the focal point of unified state management of solid waste; and assign chairmans of Provincial People's Committee to be fully in charge of for waste issues and waste treatment in the localities. At the same time, MONRE shall take the prime responsibility and coordinate with the Ministry of Justice and concerned ministries and agencies to review, amend and supplement relevant legal documents and submit to competent authorities for promulgation to adopt this Resolution.

b) Challenges of solid waste management

The current implementation of solid waste management, especially the capacity of state management agencies from the central to local levels, has not met the practical requirements for environmental protection. Regarding the management model and coordination mechanism among ministries, branches and localities in solid waste management, before the Resolution No. 09/NQ-CP was promulgated, the Government assigned MONRE to be the focal point of solid waste management at central level. However, at the local level, the state management of solid waste had been assigned to different specialized agencies including the Department of Construction (DOC), Department of Natural Resources and Environment (DONRE), Department of Agriculture and Rural Development (DARD). According to the survey results, 35 provinces/cities have appointed the Department of Construction as a specialized agency to advise and assist the Provincial People's Committee in solid waste management while 20 provinces/cities have chosen DONRE. Other 8 provinces/cities have assigned the task of waste management to both DOC and DONRE. At the same time, there is a lack of effective and transparent MSW management model. Due to the absence of appropriate incentives and mechanisms to attract investment, most MSW is collected, transported and treated by the provincial Urban Environment Companies. The domestic solid waste management in rural areas has not been heavily invested. In rural areas, the collection and transportation of domestic solid waste are mainly organized by local authorities (at commune level) and local communities at small scales with limited equipment, facilities, and human resources.

Currently, there are several major challenges in MSW management related to classification and appropriate treatment of technologies for classified waste. The existing regulations on classification at source have been unenforceable. Until now, most provinces and cities have not yet implemented waste separation at source on a large scale. Some big cities have undertaken a pilot program on waste classification at source, namely Ho Chi Minh city, Da Nang and Dong Nai. Most wastes are classified into some categories such as flammable waste, recyclable waste and other types of waste. For example, Ho Chi Minh City has divided the pilot program on MSW classification at source into many phases. From 2015 to 2016, the pilot model was applied to one resident cluster or one ward in one district, then being replicated in 6 districts. After that, this model has been expanded in 24 districts from 2017. To promote the classification of MSW at source, Ho Chi Minh City People's Committee has issued Decision No. 44/2018/QĐ-UBND regulating classification of MSW at source. Nevertheless, the reality shows that the separation at source was not as effective as expected. Normally, recyclable materials are often collected and recycled by households and unofficial collectors rather than official units, while almost all localities do not have specific collection equipment for each classified waste. Therefore, in many cases, waste collected from households are put together in the same containers when transported. In addition, some treatment facilities only use similar methods to deal with both classified and unclassified waste.

As mentioned above, regulations on waste classification at source are not highly enforceable due to lack of appropriate incentives. At present, spending on collection, transportation and treatment of MSW comes from the local government budget. Accordingly, the local government budget is allocated based on the needs of each provincial, district, and commune level. At provincial level, Department of Finance is responsible for assisting the Provincial People's Committee in allocation of local government budget. The financial sources for MSW management are various, including cleaning fee or prices of services for the collection and transportation; environmental non-business funding; capital sources for investment in building solid waste treatment facilities. However, the costs collected from organizations and individuals generating hazardous wastes only partially offset for collection and transportation. In localities, the fee is mostly collected per households. Some localities identify the fee based on the number of members in each household rather than the actual amount of waste generated or type of waste generated. This may discourage the reduction, classification, recycling and reuse of waste. Besides, the investment for MSW facilities construction come from State budget, ODA, and other sources of capital. The private sector has also participated in the field of MSW treatment. However, the State capital used to invest in waste facilities construction still accounts for about 80% (35% from State budget and 45% from ODA capital)⁴.

⁴ Ministry of Construction (2017) Report on the implementation of the National Strategy on integrated management of solid waste to 2025, with a vision to 2050.

The classification of solid waste at source is prescribed in the Law on Environmental Protection 2014, the Decree No. 38/2015/ND-CP, and the Decree No.40/2019/ND-CP. Specifically, the Law on Environmental Protection 2014 states:

- Article 50 – Controlling and processing of marine and island environment pollution

“Waste substances discharged from the mainland to the seas and derived from the sea and islands must be statistically reported, assessed and subject to any measure to be taken to prevent, reduce and dispose them to achieve accepted standards set out in the technical regulations on environment.”

- Article 95 – Responsibility to classify conventional solid wastes

“Owners of manufacturing and business establishments, organizations, households, and individuals that generate conventional solid wastes are responsible for classifying them at source to facilitate their recycling and treatment”.

The responsibility of the owner of the solid waste sources in waste classification at source is also specified in other provisions of the LEP 2014, including responsibilities of production, business and service establishments (Article 68); of manufacturing establishments involved in the trades encouraged by the Government in craft (Article 70); of hospitals and health facilities (Article 72); of research facilities and laboratories (Article 79); and of organizations, households and individuals (Article 81).

However, the regulations on waste classification at source was implemented in a few provinces. The legal documents guiding in details the LEP 2014 only stipulate general provisions on responsibilities of Provincial People’s Committee in guiding and organizing the classification of MSW⁵; responsibilities of ministries/line ministries in management of waste classification⁶. Until now, the relevant management agencies have not issued technical guidelines/procedures for managing the waste classification at source, such as provisions on packaging and storage equipment of MSW at home or public service areas, provisions on means of transport and treatment methods for each group of classified MSW.

According to the statistics of MONRE⁷, there are currently 1,322 treatment facilities for MSW in which 78 are provincial facilities. Among these treatment facilities, there are 381 solid waste incinerators, 37 composting facilities and 904 landfills. However, only 20% existing landfills are sanitary. Some facilities use combustion technology for electricity generation and composting, namely solid waste treatment facility at Truong Tho hamlet, Truong Xuan commune, Thoi Lai district, Can Tho province and waste treatment facility in Ly Trach commune, Bo Trach district, Quang Binh province.

⁵ Article 15, Decree No.38/2015/ND-CP dated 24/4/2015 of the Government on management of waste and scraps

⁶ Clause 1b Article 27; Clause 1b Article Decree No.38/2015/ND-CP dated 24/4/2015 of the Government on management of waste and scraps

⁷ Ministry of Natural Resources and Environment (MONRE, 2019c). The report on an overview of the current solid waste management situation and some recommendations on solutions in the future.

Of the total amount of MSW collected, about 71% (equivalent to 34,000 tons/day) are buried in landfills, excluding waste from compost processing facilities and ash and slag generated from incinerators; 16% (equivalent to 7,600 tons/day) is treated for producing fertilizer; 13% (equivalent to 6,200 tons/day) is burnt in incinerators. The percentage of MSW sent to landfills in big cities is quite high (e.g. in Ho Chi Minh city: 70%; Da Nang: above 90%). The capacity of landfills in big cities are currently overloaded, and are likely to cause serious environmental pollution. The recycling rate for MSW is about 8 – 12% and 3.24% in urban and rural areas, respectively. It can be seen that waste has not been considered as materials for recycling and reuse. Most of the generated waste is sent to landfills that cause air pollution and water/soil contamination. Pollution resulting from landfills also creates negative social impacts. For example, there have been many complaints of people living nearby polluted landfills. In some cases, the Government had to deal with the lawsuits over such environmental disputes (e.g. lawsuits on the landfill Nam Son, Da Phuoc, Khanh Son). On the other hand, the annual cost for MSW treatment is around 981,120 million dong⁸. In recent years, it has witnessed a shift from burial technologies to combustion technologies, including energy recovery and non-energy recovery technologies. Before 2010, there were 34.4% composting facilities and 31.8% landfills with only 4.5% incinerators. The localities have faced difficulties in selecting appropriate management models and technologies for MSW treatment. Most imported solid waste treatment technologies were not suitable for Vietnam (unsorted waste, low heating value, high air humidity) while equipment and technologies made in Vietnam have many limitations.

The principles for selection of MSW treatment technologies are prescribed in Article 19, Decree 38/2015/ND-CP:

- i. *Technology of daily-life solid waste treatment shall include:*
 - a) *Organic fertilizer processing technology;*
 - b) *Combustion technology;*
 - c) *Sanitary landfill technology;*
 - d) *Technology for recycling, energy recovery, producing products from the useful composition of daily-life solid waste;*
 - e) *Other environmentally friendly technologies.*
- ii. *Selection of the processing technology of daily life solid waste under the following criteria:*
 - a) *For technology:*
 - *The capacity in processing daily-life solid waste, flexibility, consistence in size, expansion of treatment capacity;*
 - *The degree of automation, localization of equipment line; rate of treatment, reuse, recycling, landfill of daily-life solid waste;*

⁸ According to statistics, the total volume of domestic solid waste collected nationwide is nearly 38,000 tons /day and night; the waste handled according to the prescribed standards about 32,000 tons/day and night, of which the rate of waste sent to landfills is about 70%. If the cost is calculated according to the unit price of the Ministry of Construction in the Decision No. 1354/QĐ-BXD dated December 29, 2017 on the construction investment capital rate and the average, daily-life treatment cost for one ton of solid waste with hygienic landfill technology is 0.12 million VND/ton. The cost for solid waste treatment in a day nationwide is estimated at 2,688 million VND (32,000 tons x 70% x 0.12 million).

- *Priority of technology assessed and verified by competent agencies that meet technical regulations and standards and are in accordance with conditions of Vietnam;*
- *Manage, operate and maintain in accordance with degree, capacity of local human resources.*

b) For environment and society:

- *Guarantee of environmental technical regulations and standards;*
- *Save of land use;*
- *Save of energy, recovery capability in the treatment process;*
- *Training and using of local manpower.*

c) For economy:

- *Cost of treatment consistent with the affordability of locality or not exceeding the treatment cost declared by competent agencies;*
- *The ability to consume products from technologies of treatment, recycling of daily-life solid waste.*

iii. Based on the provisions of Paragraph 2 of this Article, the provincial People's Committees or the investors shall choose the treatment technology of daily-life solid waste in accordance with their local conditions.

In addition, in accordance with the Government's Decree No. 38/2015/ND-CP dated April 24, 2019 on waste and scrap management, the Ministry of Science and Technology is assigned to assume the prime responsibility for evaluation and appraisal of new solid waste treatment technology applied for the first time in Vietnam. The Government's Decree No. 40/2019/ND-CP stipulates that MONRE shall assume the prime responsibility and coordinate with MOST and concerned ministries and line ministries in promulgating specific criteria for appraisal, evaluation and announcement of MSW treatment technologies. At the same time, in order to overcome the shortcomings related to solid waste management and treatment mentioned above, the Government issued Resolution No. 01/NQ-CP dated January 1, 2019 that assigned MONRE to develop and submit to the Prime Minister "Scheme on treatment technology model of MSW and waste in rural areas". Nevertheless, there are no specific measures to encourage the application of environmentally friendly technologies, best available technologies (BAT) and treatment technologies combined with energy recovery. For example, the priority for energy recovery from waste has been mentioned in a few official documents such as the Prime Minister's Decision No. 2149/QD-TTg dated December 17, 2009 approving National Strategy for integrated management of solid waste to 2025, with vision towards 2050; the Prime Minister's Decision No.1440/QD-TTg dated October 6, 2008 approving the Master Plan on construction of solid waste treatment facilities in three key economic regions by 2020; the Prime Minister's Decision No.1216/QD-TTg dated September 5, 2012, approving the National Strategy on Environmental Protection to 2020, with a vision to 2030; Decision No.1030/QD-TTg dated July 20, 2009, approving the Scheme to promote environmental industry in Vietnam by 2015, with a vision to 2025; mechanisms and policies to prioritize the development of power generated from solid wastes such as exemption or reduction of land-use and land-rent fees; reduction of corporate income tax;

supporting incentives when applying the clean development mechanism (CDM). These mechanisms and policies have not been specified nor consistent, thus hindering the development of waste-to-energy technology in Vietnam. The Prime Minister's Decision No. 31/2014/QĐ-TTg of May 5, 2014, on supporting mechanism for development of power generation projects using solid waste in Vietnam provides articles on purchase price, and requires such projects to be included in the master plan for the power industry. Currently, due to the lack of specific guidelines for the implementation of the Planning Law, this kind of project has not yet been added to the National Power Development Master Plan. Furthermore, under the Decision No. 31/2014/QĐ-TTg, the purchase price is only applied to projects in which the power plant uses main energy from solid waste directly burnt or combustion gas collected from the solid waste landfill to produce power or supply part or the whole power generated to the national grid.

1.2.2 Policies and regulations on environmentally friendly products

a) Current status of policies and regulations on environmentally friendly products

- ***Regulations on environmentally friendly products***

According to the Organization for Economic Co-operation and Development (OECD), environmentally friendly products are products that are manufactured in which their negative effects on environmental components such as water, air, soil and ecosystems are prevented, minimized or eliminated.

In Viet Nam, the concept of “environmentally friendly products” was initially defined in Law on Environmental Protection 2005 (LEP 2005). Under the LEP 2005, production and trading of environmentally friendly products are environmental protection activities that are encouraged⁹. The Government provides preferential incentives relating land use, taxation and financial support to production and consumption of environmentally friendly products. The concept of environmentally friendly products has been legalized in Decree No. 80/2006/ND-CP detailing and guiding the implementation of a number of articles of the Law on Environmental Protection. The Clause 2 Article 18 of the Decree No. 80/2006/ND-CP specifies the definition of environmentally friendly products¹⁰ that must meet one of the following requirements:

- Being recycled from waste that comply with prescribed environmental standards;
- Being easy to decompose in nature after use;
- Being non-polluting products produced to substitute natural material;
- Being organic agricultural products;
- Being graded with eco-labels by a state-accredited organization.

⁹ Clause 7 Article 8

¹⁰ Clause 6 Article 5

Additionally, the definition of environmentally friendly products is clearly stipulated in Decree No. 04/2009/ND-CP¹¹ providing for incentives and support for environmental protection activities: *“Environmentally friendly product means a product which, throughout the process of exploitation of its raw material or its manufacture, existence and use or after its disposal, causes less harm to the environment than other products of the same type and being certified eco-labels by a state-accredited organization”*.

After the Law on Environmental Protection (amended) was passed by the National Assembly in 2014, the provisions on environmentally friendly products are basically the same (See *details in the Table 1*). Environmentally friendly products are defined in the Clause 9, Article 3, Decree No. 19/2015/ND-CP detailing the implementation of a number of articles of Law on Environmental Protection (amended): *“Environmentally friendly products are the ones meeting eco-label criteria and eco-label certification”*.

Following the Circular No. 41/2013/TT-BTNMT dated December 2, 2013 of MONRE providing procedures of certification of eco-labels for environmentally friendly products, eco-labels as specified in this Circular shall be referred to the Vietnam Green Label, thus eco-label criteria shall be the criteria of Vietnam Green Label. The product will be certified with Vietnam Green Label as long as it complies with Vietnam Green Label criteria issued by MONRE. These Vietnam Green Label criteria are available on the website of Vietnam Environment Administration. The minister of MONRE has issued several Vietnam Green Label criteria applied to 5 product categories; battery, office paper, coating for construction, printer, and laptop. Most of these criteria are quantitative. The eco-label certification in Vietnam is voluntary. To register for a Vietnam Green Label, the applicant shall prepare a dossier in accordance with Article 7 of the Circular No. 41/2013/TT-BTNMT and then submit to the Vietnam Environment Administration (VEA) under the MONRE that is assigned to state management of Vietnam Green Label Program. Within five working days since the date of receiving a dossier of registration, the VEA shall be responsible for consideration of completion and validity. In case the dossier is not completed or invalid, the VEA shall issue a written request for amendment, supplement and completion of the dossier. Within twenty working days since the date of accepting the dossier in terms of completion and validity, the VEA shall undertake assessment of the dossier on the basis of appropriate level of the registration dossier with the criteria of Vietnam Green Label. In the case of a satisfactory testing result, VEA shall sign the Decision on certification of Vietnam Green Label and notify the enterprise. After that, the enterprise shall label their products with Vietnam Green Label. The Decision on certification of Vietnam Green Label is valid within three years since the date of issuance. After the Decision is expired, the enterprise shall re-register in compliance with laws.

¹¹ The Decree has expired.

**Table 3.1. Provision on environmentally friendly products
in LEP 2005 and LEP 2014 (amended)**

LEP 2005	LEP 2014 (amended)
<p>Article 5. The Government's policies on environmental protection</p> <p>...</p> <p>Clause 6. <i>Providing preferential incentives relating land use, taxation and financial support to environmental protection activities and production and consumption of environmentally friendly products; and harmonizing environmental protection with effective use of environmental components for development.</i></p>	<p>Article 5. The Government's policies on environmental protection</p> <p>...</p> <p>Clause 6. <i>Providing financial and land preferences and supports for environmental protection activities, manufacturers and traders of environmentally friendly products.</i></p>
<p>Article 6. Environmental protection activities to be encouraged</p> <p>...</p> <p>Clause 5. <i>Registration for facilities meeting environmental standards and environmentally friendly products.</i></p> <p>...</p> <p>Clause 7. <i>Investing in the construction of facilities for manufacturing environmental protection equipment and instruments; engaging in the production and business of environmentally friendly products; and providing services for environmental protection.</i></p>	<p>Article 6. Environmental protection activities to be encouraged</p> <p>...</p> <p>Clause 5. <i>Registration for eco-friendly establishments and products; manufacturing, trading and consumption of environmentally friendly products.</i></p>
<p>Article 33. Development of clean and renewable energy and environmentally friendly products</p> <p>...</p> <p>Clause 4. <i>The Government shall encourage the production and consumption of less polluting and natural degradable products; clean energy production from waste; and the production, importation and operation of machinery, equipment and means of transport using clean and renewable energy.</i></p>	<p>Article 151. Incentives and support for environmental protection activities</p> <p>1. <i>The Government shall provide incentives and support for the following environmental protection activities:</i></p> <p>...</p> <p><i>đ) Manufacturing and trading environmentally friendly products;</i></p>

LEP 2005	LEP 2014 (amended)
<p>Article 34. Building up environmentally friendly consumption practices</p> <p><i>1. The Government shall encourage organizations and individuals to consume recycled products from waste, organic products, naturally degradable packaging, eco-labeled products, and environmentally friendly products.</i></p> <p><i>2. The Ministry of Culture and Information, press and information agencies shall, in collaboration with the Ministry of Natural Resources and Environment, have the responsibility for propagation and introduction on environmentally friendly products and goods to encourage their consumption.</i></p>	

Vietnam currently has two other types of eco-labels, namely the sustainable tourism label (hereinafter referred to as Green Lotus Label) and the energy efficiency label (hereinafter referred to as Energy-saving Label) that are managed and certified by other ministries.

(i) Green Lotus Label has been managed by the General Department of Tourism under Ministry of Culture, Sports and Tourism since 2012. The certificate of Green Lotus Label is granted to tourism businesses which meet the standards of environmental protection and sustainable development, with proven efforts to protect the environment by using natural resources and energy efficiently. Thus, this contributes to preservation of heritage and development of the local economy, culture and society, and pursue sustainable tourism development.

The Green Lotus Label has five levels: from the lowest level with 1 green lotus to the highest level with 5 green lotuses which are given according to the criteria of the sustainable tourism label of Green Lotus. All properties that have been assessed and classified to Green Lotus environmental standards will be issued with a complementary sign according to the grade achieved. The registration for Green Lotus Label is completely voluntary and the certification is valid for two years. The accommodations certified with Green Lotus Label can use the label for their brand advertising.

The set of criteria for the sustainable tourism Green Lotus Label includes 81 criteria with a total of 154 points and 25 bonus points, divided into 3 levels: standard level (30 criteria), superior level (29 criteria), and premium level (22 criteria). Criteria at the standard level are fundamental and necessary, and can be easily implemented, mainly for internal management purposes, whereas the superior and premium-level criteria are more demanding and difficult to obtain.

At the same time, the set of criteria set for the Green Lotus Label are classified into 4 groups: A (Sustainable management), B (Maximization of socio-economic benefits for local communities), C (Elimination of negative impacts on cultural and natural heritages), and D (Elimination of negative impacts on the environment) (UNEP (2016), SWOT analysis of Vietnam Green Label Program Report)

(ii) Energy-saving labels are managed by the General Department of Energy under Ministry of Industry and Trading that focuses on reduction of energy consumption and CO₂ emission rather than assessing the overall lifecycle of energy consuming devices and equipment.

According to Decree No.21/2011/ND-CP dated 29/3/2011 of the Government detailing the Law on economical and efficient use of energy and measures for its implementation, there are two types of energy labels:

- Comparative energy label which provides information on energy consumption rate, type of energy, energy yield and other information to enable consumers to compare products of the same type in the market. Currently, comparative energy label has five levels of energy performance from one star to five stars in which the five-star label shows the best energy performance.
- Confirmative energy label which shows that the device and equipment has the highest energy yield compared with other devices or equipment of the same type. Accordingly, the certified device and equipment has to meet the level of energy efficiency or exceeded the high energy performance (HEP) prescribed by the Ministry of Industry and Trade for each period.

Energy labeling is not required for all electrical equipment but compulsory for the equipment and appliances in the List prescribed in the Decision No. 04/2017/QĐ-TTg dated March 9, 2017, of Prime Minister (**Table 3.2**).

Table 3.2. List of equipment and appliances are entitled to the mandatory energy labeling and minimum energy efficiency standards and roadmap for implementation

No	Name of product category	Roadmap to energy labeling	Minimum energy efficiency standards applied
Household appliances			
1	Straight fluorescent tubes	Mandatory energy labeling from April 25, 2017	TCVN 8249:2013
2	Compact fluorescent bulbs		TCVN 7896:2015
3	Magnetic and electronic ballasts for fluorescents lights		TCVN 8248:2013 TCVN 7897:2013
4	Air conditioners		TCVN 7830:2015
5	Refrigerators		TCVN 7828:2013 TCVN 7829:2013
6	Household washing machines		TCVN 8526:2013
7	Electric cookers		TCVN 8252:2015
8	Electric fans		TCVN 7826:2015
9	Video cameras		TCVN 9537:2012
10	LED light bulbs	Non-mandatory energy labeling until December 31, 2019	TCVN 11843:2017 TCVN 11844:2017
11	Electric kettles with a water reservoir	Mandatory energy labeling from January 1, 2020	TCVN 7898 : 2009
Office and commercial equipment and appliances			
12	Photocopiers	Non-mandatory energy labeling	TCVN 9510:2012
13	Computer monitors		TCVN 9508:2012
14	Printers		TCVN 9509:2012
15	Commercial freezers	Mandatory energy labeling	TCVN 10289:2014
16	Laptops	Non-mandatory energy labeling until December 31, 2019 Mandatory energy labelling from January 1, 2020	TCVN 11848:2017

No	Name of product category	Roadmap to energy labeling	Minimum energy efficiency standards applied
Industrial equipment and appliances			
17	Distribution transformers	Mandatory energy labelling from April 25, 2017	TCVN 8525:2010
18	Electric engines		TCVN 7540-1:2013 TCVN 7540-2:2013
Means of transport			
19	Automobiles for the transport of up to 7 persons	Mandatory energy labeling	
20	Automobiles for the transport from 7 to 9 persons	Non-mandatory energy labeling until December 31, 2018 Mandatory energy labeling from January 1, 2019	
21	Automobiles	Non-mandatory energy labeling until December 31, 2019 Mandatory energy labeling from January 1, 2020	

The energy labeling is likely to put pressure on manufacturers to produce high-performance products, forcing businesses and importers to provide products that meet or exceed the specified energy efficiency standards. As a result, consumers also have the demand power to choose proper energy saving or energy efficient products available on the market. Because the Energy-saving Label program is compulsory, ministries and branches, namely General Department of Customs, Ministry of Finance, Ministry of Science and Technology, provincial Department of Industry and Trade, have actively been engaged in the Program's activities, for example, monitoring the certified products. This Program has also involved many manufacturers and traders of energy devices that are subject to energy labeling.

- **Regulations on green public procurement**

The concept of “green public procurement” has been legalized in a number of legal documents in different sectors. In the field of environmental protection, Article 44 of LEP 2014 and Article 47 of Decree No.19/2015/ND-CP specify as follows:

- (i) The head of agencies and units using state budget shall prioritize the public procurement of products:
 - Environmentally friendly products certified with Vietnam Green Label by MONRE; products from waste recycling and treatment that are certified by the competent state authorities.
 - Production of gasoline, diesel and biological energy certification of conformity; biochar; energy from the use of wind power, sunlight, tidal, geothermal energy and other forms of renewable energy.
- (ii) The Ministry of Finance shall take charge and coordinate with the Ministry of Natural Resources and Environment to develop the regulations on public procurement of environmentally friendly products as specified in the laws.
- (iii) Organizations and individuals shall prioritize the purchase of environmentally friendly products in accordance with the MONRE’s guidelines.

In the energy sector, Law on economical and efficient use of energy 2010 regulates the energy use in state-funded investment projects and agencies/units (Chapter VII). Accordingly, the Government issued the Decision No. 68/2011/QĐ-TTg dated December 12, 2011, of the Prime Minister promulgating the List of energy-saving devices purchased agencies using State budget, including straight fluorescent tube, compact fluorescent bulb, ballast for fluorescents light, electromagnetic ballast, electronic ballast, electric fan, air conditioner, refrigerator, distribution transformer, public lighting device, solar water heater, camera, computer screen, printer, and photocopier. When purchasing the category of products in this List, agencies using State budget must purchase the products certified with Energy Star Label or comparative label with 5-star rating from January 1, 2013.

In the construction sector, the Construction Law 2014 regulates that it should prioritize the use of local and environmentally friendly materials in construction design (Clause 4, Article 79). Furthermore, the Circular No.13/2017/TT-BXD dated December 8, 2017 of Ministry of Construction providing the use of unbaked building materials in construction work (Article 3) as follows:

Construction work funded with state budget capital/off-budget state capital/loans from enterprises with State budget capital greater than 30% shall use unbaked building materials with prescribed rate for each region in the whole country: (i) 100% in Hanoi and Ho Chi Minh city; (ii) At least 90% in urban areas from grade III and above; and at least 70% in remaining areas in northern midland provinces and southeast provinces ; (iii) At least 70% in urban areas from grade III and above; and at least 50% in remaining areas in remaining provinces.

- At least 80% of total amount of building materials used in a building comprising 9 storeys or more must be unbaked building materials.
- For a number of works that do not use unbaked building materials due to particular requirements, they must be considered and accepted by competent state management agencies.
- The Government encourages the use of unbaked building materials in construction works regardless of capital sources and number of storeys.

- ***Regulations on incentives and support for investment in production of environmentally friendly products and for production and consumption of environmentally friendly products***

Law on Investment 2014 regulates business lines eligible for investment incentives (Article 16) that include the production of new materials, new energy, clean energy, renewable energy; production of products with at least 30% value added, energy-saving products but exclude the production of environmentally friendly products. However, the List of business lines eligible for investment incentives stipulated in Law on Investment 2014 could be amended and supplemented under the authority of the Government. As a result, Decree No.19/2015/ND-CP which prescribes incentives and support for investment in production of environmentally friendly products is consistent with Law on Investment 2014.

The incentives and support for investment in production of environmentally friendly products are regulated in Decree No.19/2015/ND-CP replacing those in Decree No.04/2009/ND-CP. They are incentives that support infrastructure and land, capital and tax, price and product consumption, and others as follows:

Regarding incentives and support on infrastructure and land, Decree No.19/2015/ND-CP specifies that the project owner investing in the construction of facilities which manufacturing environmentally friendly products (hereinafter referred to as project owners) shall be entitled to the incentives for land rent as prescribed in regulations on land like the subjects in the field of special investment incentives.

However, the cases that are exempted from or enjoy reduction in land rent and water surface rent (Article 19, 20 in Decree No.46/2014/ND-CP dated 15/5/2014 of the Government on collection of land rent and water surface rent) do not cover the investment in the construction of facilities which manufacturing environmentally friendly products. Instead, the project owners could enjoy the land rent exemption or reduction in the case Minister of Finance, based on the proposal of Ministers, Heads of ministerial-level agencies, Governmental agencies and Chairmans of the Provincial People's Committees, submits the request to Prime Minister for approval.

- As for incentives for investment capital, project owners shall be entitled to loan at preferential interest rate no more than 50% of state interest rate of investment credit announced by the competent authorities at the time of lending; the total loan shall not exceed 70% of the total construction investment; entitled to prioritized assistance after investment or guarantee of loan. The Ministry of Natural Resources and Environment shall provide instructions on loan and post-investment assistance of interest rate and guarantee of investment credit for projects receiving loan from Vietnam Environment Protection Fund. The provincial People's Committee shall provide instructions on loan and post-investment assistance of interest rate and guarantee of investment credit for projects receiving loan from the local environmental protection fund.

- For preferential enterprise income tax, the enterprise income from the implementation of new investment projects (investment in the construction of facilities which manufacturing environmentally friendly products) shall be entitled to the preferential enterprise income tax like the subjects in the field of environmental protection under regulations of law on enterprise income tax. According to the Law No.32/2013/QH13 on the amendments to the Law on enterprise income tax, the tax rate of 10% for 15 years is applicable to incomes of enterprises from the execution of new projects of investment in environmental protection.

- For preferential import and export tax, the environmentally friendly products certified with Vietnam Green Label by MONRE and products from the recycling and treatment of waste that are certified by the competent state authorities shall be entitled to preferential import and export tax like the subjects in the field of special investment incentives under regulations on import and export tax. The exemption and reduction in export tax for these types of products is specified in the Circular No.128/2016/TT-BTC dated 09/8/2016. According to the above, it is said to exempt from export duty for environment-friendly products listed in the Export Tariff, which are granted Vietnam Green Label certificates as guided by MONRE, and to give 50% export duty reduction for products from waste recycling and treatment activities listed in the Export Tariff as certified by the state competent agencies under the Ministry of Natural Resources and Environment's guidance (if the reduced export duty rate applicable to the commodity item is lower than the floor rate of the export duty bracket prescribed by the National Assembly Standing Committee for such item, the floor export duty rate shall be applied). In case of export of environment-friendly products and products from waste recycling and treatment activities which are not listed in the Export Tariff, when carrying out the customs procedures, the customs declarant must provide the corresponding codes of the 8-digit codes of the exported articles in the preferential import tariff; and the export tax rates for such articles shall be 0%.

- Regarding support on price and product consumption, project owner carrying out the activities and supply of environmentally friendly products certified with Vietnam Green Label by MONRE and products from the recycling and treatment of waste that are certified by the competent state authorities, if meeting the criteria of public-utility products and services shall be entitled to the price support under regulations on production, supply of public-utility products and services. Following Article 7 of the Government's Decree No.130/2013/ND-CP on production and provision of public – utility products and services, the Ministry of Finance shall assume the prime responsibility for, and coordinate with line ministries and provincial-level People's Committees in, formulating and guiding price subsidy and support levels, the price subsidy and support sequence and procedures suitable to the characteristics and situation of production and provision of public-utility products and services.

- Concerning the consumption support for products, head of agencies and units using state budget must prioritize the public procurement of environmentally friendly products certified with Vietnam Green Label by MONRE. This includes products from the recycling and treatment of waste that are certified by the competent state authorities when purchasing such types of products. For organizations, individuals, enterprises and cooperatives producing and disseminating types of film, television program on environmental protection to raise people's consciousness in environmental protection, the expenses for implementing such activities shall be recorded in the production expenses.

b) Challenges in regulations on the development of environmentally friendly products

Currently, Vietnam has issued a number of policies and legal regulations on green public procurement, but these documents have not been completed nor effectively implemented. The important legal document governing the procurement of goods or services serving the operations of state management agencies is the Law on Bidding No. 43/2013/QH13. Unfortunately, there is no provision for green procurement in the project's preparation, pre-feasibility study, or appraisal. The Law on Bidding regulates that the selection of contractors in the procurement has to be based on technical, quality or price requirements. Decree No.63/2014/ND-CP on implementation of a number of articles of the Law on Bidding specifies articles on selection of contractors without consideration of "environmental aspect".

The Green public procurement was officially stipulated in the legal document, namely the Law on Environmental Protection 2014, but it is only required as "voluntary" rather than "compulsory". There has been a few sub-laws that prescribe "compulsory" green public procurement. For example, the Prime Minister's Decision No.68/2011/QD-TTg on promulgation of the List of energy-saving devices purchased by agencies using State Budget and Circular No.13/2017/TT-BXD regulating the use of unbaked building materials in construction. However, such regulations have not been specified nor in line with other regulations on public procurement.

The regulations on incentives and supports for investment and production of environmentally friendly products have not been specified and are difficult to implement in practice, so much so that they may not attract the participation of investors.

According to the Government's Decree No.19/2015/ND-CP, the provisions on incentives and supports for environmentally friendly products mainly refer to provisions in other laws that only stipulate the general principles instead of detailed instructions for implementation. So far, many sub-laws guiding the adoption of incentives and supports for environmentally friendly products have not been issued, and therefore the enforcement has been ineffective. To illustrate, Article 47 of the Decree No.19/2015/ND-CP indicates that the head of agencies and units using state budget must prioritize the public procurement of production of environmentally friendly products which are certified with Vietnam Green Label; and products from the recycling and treatment of waste certified by competent state authorities, namely MONRE, when purchasing such products. However, MONRE has not promulgated the list of product types from recycling and treatment of waste, but only issued a number of Vietnam Green Label criteria for certain types of products that provide the legal basis for enterprises to register for Vietnam Green Label. Consequently, the enterprises would not receive incentives and supports until their products are certified with Vietnam Green Label. This partly reflects the inadequacies of the regulations on environmentally friendly products since the environmentally friendly products in Vietnam are defined as products certified with Vietnam Green Label. Likewise, the manufacturers that do not meet the Vietnam Green Label criteria will not be eligible for incentives or support for environmentally friendly products. Currently, MONRE has published Vietnam Green Label criteria for only 14 types of products while the number of products certified with Vietnam Green Label is still limited (53 products).

On the other hand, the market for sustainable products in Vietnam has remained small. The majority of enterprises are small or medium-sized, focusing on some categories of eco-products, namely organic agriculture and recycled products. Such enterprises have faced many challenges, such as large investments related to innovation technology, the improvement of manufacturing processes, and replacement of input material. There has been some confusion among business owners on how to choose clean technologies due to limited capacity and expertise. In addition, the implementation of corporate social responsibility (CSR) and investment in environmental protection in Vietnam are low, while the demand for domestic consumption of eco-products is not high. Domestic consumers currently pay attention to the price, the quality and the design rather than the environmental friendliness of the product. As for the trend in economic globalization and regionalization, the demand for sustainable and eco-products is likely to increase. There should be more supportive policies and stronger incentives to encourage enterprises to invest in the manufacturing of environmentally friendly products.

1.2.3 Policies and regulations on development of industrial symbiosis

a) Current policies and regulations on development of industrial symbiosis

Under the Government's Decree No.29/2008/ND-CP dated 14/3/2008, industrial park means a zone that specializes in the production of industrial goods or provision of services for industrial production. Until March 2020, Vietnam has established 335 industrial zones, of which 260 industrial zones were put into operation¹². Industrial zones play a role as one of the drivers of economic growth and attract large investments, especially foreign investment. However, the rapid development of industrial zones without appropriate management probably create negative impacts on the environment caused by wastewater pollution, air pollution and solid waste generation.

There are existing legal documents that outline general principles to encourage enterprises to set up closed-loop systems and industrial symbiosis, for example, water circulation and reuse and recycling of waste is regulated in the Government's Decree No.38/2015/ND-CP dated April 24, 2015 on waste and scrap management. Under the Clause 4, Article 4 of Decree No.38/2015/ND-CP, waste water must be collected, processed, reused or transferred to units with suitable functions to reuse or treat to meet environmental standards before being discharged into the environment.

In addition, following the Government's Decree No.24a/2016/ND-CP dated 05/4/2016 on management of construction material, owners of facilities that use ash, slag, gypsum from thermo-power plants, chemical fertilizer plants, metallurgical plants shall undertake classification and preliminary treatment of ash, slag and gypsum to ensure they meet technical regulations and standards on raw materials used for production of building materials. Particularly, in 2017, the prime minister approved the scheme to promote treatment and use of ash, slag and gypsum discharged from thermal power plants, chemical and fertilizer plants for production of building materials and for use in construction projects. Ash, slag or FGD (Flue Gas Desulfurization) and PG gypsum, whether pre-treated or post-treated, which conforms to technical standards, regulations and instructions to serve as raw materials used for production of building materials and in construction projects shall be classified as building material commodities and subject to applicable laws and regulations on commodity products. Owners of waste-discharging facilities and facilities for processing and use of ash, slag, FGD and PG gypsum as raw materials for production of building materials or for use in engineering and construction projects shall be obligated to comply with regulations laid down in Article 40 of the Decree No. 24a/2016/ND-CP. In case ash, slag, FGD or PG gypsum is unlikely to be processed, used as raw materials for manufacturing of building materials or for use in construction projects, they may be treated like non-recyclable solid wastes.

Furthermore, the regulations on direct financial support related to the development of eco-industrial zones are stipulated in the Government's Decree No. 45/2012/ND-CP dated May 21, 2012 on industrial promotion. This Decree provides policies on encouraging and supporting organizations

¹² Source: Report of Department of Economic Zones Management, Ministry of Planning and Investment

and individuals in participating in the rural industrial production development and employing cleaner industrial production methods. The budget for industrial promotion activities and the budget for applying cleaner industrial production include national industrial encouragement budget and local industrial encouragement budget. National industrial promotion budget is budget used for industrial promotion activities managed and organized by the Ministry of Industry and Trade. Local industrial promotion budget is managed by provincial People's Committees, People's Committees of districts or communes, and used for industrial promotion activities implemented locally.

In particular, the project "Implementation of Eco-industrial park (EIP) initiative for sustainable industrial zones in Vietnam" has been jointly implemented by the Ministry of Planning and Investment and the United Nations Industrial Development Organisation (UNIDO) since 2014. The EIP initiative in Viet Nam was the first project co-funded by the Global Environmental Facility (GEF) and the State Secretariat for Economic Affairs (SECO) of the Swiss Federal Department of Economic Affairs, Education and Research through the Global Resource Efficient and Cleaner Production (RECP) Programme. The implementation of the EIP Initiative has made important contributions to the promulgation of the Government's Decree No.82/2018/ND-CP on the management of industrial zones (IZ) and economic zones (EZ) in Vietnam. The Decree took effect since July 2018. The Decree 82/2018/ND-CP is the first legal document in Vietnam providing a legal basis for the transition from traditional industrial parks to eco-industrial parks. According to the Decree 82/2018/ND-CP, eco-industrial park means an industrial park in which enterprises get involved in cleaner production, make effective use of natural resources and enter into manufacturing cooperation and affiliation in order to tighten industrial symbiosis to promote economic, environmental and social efficiency in these enterprises. At the same time, the Decree also stipulates that industrial symbiosis existing in an industrial park means cooperation between enterprises within an industrial park or with enterprises operating in other industrial parks in order to optimize the use of input and output factors, such as raw materials, water, energy, wastes and waste products, etc., during the manufacturing process. By virtue of cooperation, enterprises can build a network intended for exchanging factors necessary for production activities, share infrastructure and utilities necessary for production, improve the technological process and promote business and production efficiency. These provisions show that in industrial symbiosis, the enterprise could carry out small circulation models in their individual business such as water circulation or in their cooperation with other counterparts, for example exchanging byproducts and waste. Thus, industrial symbiosis can be regarded as one of the small circular business models of the circular economy.

b) Shortcomings in current policies and regulations on the development of industrial symbiosis

Industrial parks are mainly developed according to the model of multi-sector industrial zones that aim to attract secondary investors. It is claimed that the existing managers of industrial parks have not paid attention enough to the arising environment and social issues when developing industrial parks. On the other hand, many evidences show the economic efficiency of industrial symbiosis such as minimizing negative impacts on the environment surrounding industrial parks; enhancing efficient use of resources and saving energy; investing in the construction of social infrastructure to ensure the workers's living conditions; and promoting the cooperation among enterprises in the industrial park and the cooperation among the industrial parks in the region to create large-scale production clusters and increasing added values.

Regulations on industrial symbiosis only prescribe the principles rather than specific instruction for implementation in practice. To illustrate, circulating water use in the industrial park is encouraged, but there are no specific incentives. The Government's Decree No. 54/2015/ND-CP only provides provisions on incentives for economical and efficient water use activities in the following cases: (i) Organizations construct or renovate, upgrade waste water collection and treatment work items with the scale of 40 m³/day or more, meeting the national technical standards for water quality, in accordance with the purpose of re-use, and use such water amount for at least 80% of their activities; (ii) Organizations construct or renovate, upgrade, invest in-depth work items in order to use water cyclically for their activities at least 500 m³/day, excluding cyclic water use for cooling and other cyclic forms under production process, technology.

Furthermore, financial incentives for adoption of cleaner industrial production stipulated in Government's Decree No.45/2012/ND-CP are difficult to implement in practice. Many localities have no budget for industrial promotion activities or lack the legal basis for budget allocation. According to Circular No. 26/2014/TTLT-BTC-BCT of Ministry of Finance guiding establishment, management and use of industrial promotion budget, there is no specific provision regarding expenditure on local industrial promotion activities. Instead, Provincial People's Committees had to make regulations on the management of local funding and stipulate the maximum expenditure to promote local industrial activities that are suitable for its budget capacity (Article 9).

Another policy issue is the lack of regulations that allow enterprises to exchange waste and undertake industrial symbiotic activities. For example, under the framework of the project "Implementation of Eco – industrial park initiative for sustainable industrial zones in Vietnam", the enterprises had great demand for waste exchange. For example, the Hoa Khanh Industrial Park (Da Nang province) Vinamilk's factory has treated nearly 2000m³ of wastewater meeting Class A standards daily. At the same time, the neighboring paper factory has to buy water for processing raw materials at the cost of 7,000 VND/m³; but the water quality may be even be lower than Class A wastewater. The exchange of wastewater between Vinamilk and this paper factory would have brought both economic and environmental benefits. However, in practice, the waste exchange did not take place due to lack of legal basis in Vietnam.

1.2.4 Policies and regulations on efficient use of natural resources

a) Current status of policies and regulations on the efficient use of natural resources

In recent years, Vietnam is one of Southeast Asia's most dynamic and fastest growing economies. Along with its economic development, natural resources have been overexploited, particularly its non-renewable resources. Outdated technologies and poor management have also resulted in inefficient use of natural resources while causing serious environmental pollution and degradation, affecting the public health considerably.

Vietnam has issued many legal documents regulating the effective and economic exploitation and use of natural resources. The existing legal documents can be divided into two groups: (i) Group of legal documents providing general provisions on economic and efficient use of all types of natural resources; (ii) Group of legal documents providing specific provisions on economic and efficient use of each type of natural resource.

(i) Group of legal documents providing general provisions on economic and efficient use of all types of natural resources:

- Law No. 44/2013/QH13 on thrift practice and waste combat (2013): This Law provides the thrift practice and waste combat in the management, exploitation and use of resources. According to the interpretation of terms in this Law, Resources include land, water resources, mineral resources, and resources in sea areas, continental shelf, airspace, and other natural resources. Resources and assets which are invested in and managed by State are public property belonging to the entire people's ownership and being uniformly managed by the State as the owner's representative. The practice of thrift and combating wastefulness in the management, exploitation and use of natural resources is mainly defined as principles and orientations. Accordingly, provisions on management, exploitation and use of natural resources, including land, water resources, minerals, forest resources (Articles 47, 48, 49, 50) shall comply with strategies, master plans, and plans on protection and development of respective type of natural resources and with relevant regulations. Also, under this Law, the use of recycled resources and renewable energy is determined as a mode of efficient thrift practice and waste combat.

- Law No. 55/2014/QH13 on Environmental Protection: This Law regulates policies on environmental protection in which natural resources will be sourced and used in an economical manner. It shall develop green and renewable energy; strengthen recycling, reuse and minimize waste. The environmental and natural resource protection activities shall be associated with responding to climate change and ensuring environmental security¹³.

¹³Article 5, Law on Environmental Protection 2014

The Law on Environmental Protection also list the course of actions that are advised to take to protect the environment, including: protect and use natural resources in an appropriate and cost-efficient manner; minimize, collect, reuse and recycle waste¹⁴. Waste management is a primary content of the national master plan for environmental protection¹⁵.

- The Law No. 45/2009/QH12 on Severance Tax: Severance tax is an important financial instrument through which the Government exercises its management roles and functions in the sourcing process and use of natural resources among organizations and individuals, as well as to supplement revenue sources for the State Budget, thus achieving socio-economic development goals. The Law No. 45/2009/QH12 on severance tax was approved by the National Assembly in 2009. This Law was developed on the basis of completing the previous Ordinance on Severance Tax as well as referencing to other relevant laws such as Mineral Law. The 2009 Law on Severance Tax provides specific provisions on categories of natural resources in the frame of severance tax tariff. Severance tax-liable objects include metallic minerals, non-metallic minerals, crude oil, natural gas, coal gas, natural forest products other than animals, natural aquatic products including marine animals and plants, natural water including surface water and groundwater, and natural swallow's nests and other resources prescribed by the National Assembly Standing Committee.

- Law No.71/2014/QH13 amending some articles of tax laws: The provisions of Law on Severance Tax on severance tax-liable objects and tax exemption are revised. Accordingly, Clause 7 Article 2 is amended as follows: *"7. Natural water, including surface water and underground water, except for natural water used for agriculture, forestry, aquaculture, and salt production"*. Besides, Clause 5 Article 9 is amended as follows: *"5. Tax on natural water used by households and individuals for their everyday life is exempt"*.

- Law No. 57/2010/QH12 on Environmental Tax: Prior to 2010, Vietnam did not have a separate tax collected on products and goods when used to cause negative environmental impacts. However, the Government has issued and implemented many financial measures to encourage investors to participate directly in environmental pollution treatment activities as well as use resources economically and effectively, thus contributing to environmental restoration. These measures are implemented through a number of taxes such as land tax, agricultural land use tax, natural resource tax, excise tax, corporate income tax; and through fees and charges applied to the activities affecting the environment such as environmental protection fee for wastewater, environmental protection fee for mineral exploitation, environmental protection fee for solid waste. In addition, a number of tax policies such as policies on special consumption tax, corporate income tax, export tax, and import tax also have incentives for environmental protection activities. However, the revenue from such environmental protection fees is still very limited because these fees have low legal status and low rates, resulting in low impact and efficiency, while protecting the environment has not been the primary goal of the above-mentioned taxes.

¹⁴ Article 6, Law on Environmental Protection 2014

¹⁵ Article 9, Law on Environmental Protection 2014

Incentives for investment in the production of environmentally friendly products, zero-import tax rate, or low tax rates when buying products and equipment serving environmental protection activities have not directly affected consumer behavior and manufacturing. On November 15, 2010, the National Assembly passed the Law on Environmental Protection Tax that went into effect on January 1, 2012. This Law has created a synchronous and stable legal framework, and contributed to behavioral change among organizations and individuals, from raising awareness of environmental protection in investment, production and consumption, overcoming shortcomings in existing relevant policies, to creating additional financial resources for environmental protection activities.

- Law No. 07/2017/QH11 on Technology Transfer. This Law specifies the requirements for transfer. Under this Law, advanced technologies, new technologies and clean technologies that are suitable for socio-economic conditions of Vietnam shall be encouraged for transfer from foreign countries to Vietnam or domestically if any of the following requirements is satisfied:

- Produce high-quality and highly competitive products against those produced by the existing technology of the same type;
- Produce national key products from domestic findings on scientific research and technological development;
- Generate new manufacturing and processing services, industries, sectors. Breed and cultivate new varieties which have been tested;
- Save resources, energy or fuels in comparison with the existing technology of the same type in Vietnam;
- Generate or use new or renewable energy; highly efficient energy storage methods;
- Generate machinery/equipment to improve educational and training quality; medical machinery/equipment and pharmaceutical products serving medical diagnosis and treatment, protection of human health and improve the physical strength for Vietnamese people;
- Discover, handle or forecast natural disasters or epidemic diseases; serve, search and rescue activities; protect environment and cope with climate change and reduce the greenhouse gas emissions;
- Assist the ongoing production based on production chains with high socio-economic efficiency;
- Create products which concurrently serve national defense, security and civil purposes;
- Develop and modernize traditional handicrafts. The Law regulates the transfer of technologies that shall be restricted.

- National Strategy on Cleaner Production in Industry is stipulated in Decision No. 1419/QD-TTg dated September 7, 2009 by the Prime Minister. The objectives of the strategy is to apply cleaner production in industrial facilities to improve the efficiency natural resources usage, raw materials; emissions and pollution reduction, protecting and improving environmental quality and human health for sustainable development.

- National Strategy on Green Growth is approved in the DecisionNo. 1393/QD -TTg dated September 25, 2012 by the Prime Minister. It aims to restructure and improve economic institutions for the efficient use of energy and natural resources as well as its competitiveness. The strategy shall be implemented by investing in technological innovation, natural capital and green economic instruments. This can help reduce poverty, respond to climate change and ensure sustainable development. There has been two out of three specific targets of the strategy that focus on efficient use of natural resources: (a) Restructuring and improving economic institutions towards greening of existing sectors and encouraging development of economic sectors efficiently using energy and natural resources with highly added value; (b) Increase the study and application on advanced technology in order to use natural resources more efficiently, and reduce the intensity of greenhouse gas emissions, and contribute to an effective response to climate change. Specifically, one of the solutions is (a) Formulating and completing laws and policies to decisively and effectively implement the Water Resources Law, Land Law, Mineral Law, Environmental Protection Law and related regulations, strengthen the application of administrative and economic instruments under the principle of “the polluter pays” (b) Establishing effective administrative management organizations, strengthening the system of natural resources management and protection in the Central an localities (c) Boosting, developing and widely applying technologies on its natural resource usage for greater efficiency.

(ii) Group of regulations specifying economical and efficient use of each type of natural resources:

- Land Law No.45/2013/QH13: The Land Law regulates the principles for land use: Economy, effectiveness, environmental protection, and causing no harm to the legitimate interests of users of adjacent land¹⁶. The Law also defines the principles of master plans formulation and plans for land use. It shall use land economically and efficiently and utilize natural resources sensibly, together with environmental protection and climate change adaptation¹⁷.

- Law No. 17/2012/QH13 on Water Resources: This Law specifies throughout the Government’s principles and policies on water resources. Water resources shall be managed, protected, and used in an economical and effective manner to pursue socio-economic sustainable development and to ensure national defense and security. These principles are reflected in the regulations on strategies and master plans on water resources (Article 14, 15). The specification is stipulated in the articles on measures of saving and effective use of water (Article 39); restriction of water loss in water supply systems (Article 40); incentives for saving and effective use of water (Article 41); science and

¹⁶ Article 6, Land Law 2013

¹⁷ Article 35, Land Law 2013

technology development for saving and effective use of water (Article 42); exploitation and use of water resources for agricultural production (Article 46); exploitation and use of water resources for industrial manufacture and exploitation and processing of mineral (Article 49); exploitation and use of water resources for other purposes such as researches on science, medicine, sport, tourist (Article 51).

- Mineral Law (2010): Vietnam has issued the Ordinance on Mineral Resources in 1989. After that, Vietnam issued Mineral Law in 1996 that was revised in 2005. In 2010, the new Mineral Law took effect on July 2011. The Mineral Law 2010 stipulates that the Government assures minerals will be protected and utilized in rational, economical and effective manner. The development of a mineral strategy must comply with sustainable socio-economic development and economical exploitation and utilization of minerals. A mineral strategy must contain the following contents: (a) Guiding viewpoints and objectives of geological baseline surveys of minerals, protection of unexploited minerals, mineral exploration, mining, processing and rational and economical utilization of minerals; (b) Orientations for geological baseline surveys of minerals, protection of unexploited minerals, exploration and mining of each group of minerals, and post-mining processing, and rational and economical utilization of minerals in the strategy period; (c) Major tasks and solutions in geological baseline surveys of minerals, protection of unexploited minerals, exploration and mining of each group of minerals, post-mining processing and rational and economical utilization of minerals; and national mineral reserves.

- Law on Natural Resources and Environment of Sea and Islands (2015): This Law regulates natural resources of sea and islands and integrated management of natural resources of sea and islands. Natural resources of sea and islands include biotic resources and non-biotic resources within sea blocks, seabed, underwater landmass, shoreline areas, archipelago, islands, shallow areas, sandbank that belong to sovereignty, sovereign rights and national jurisdiction of Vietnam. Integrated management of natural resources of sea and islands means activities of planning and organizing the implementation of policies, mechanism and means for intersectoral and inter-regional coordination to ensure natural resources of sea and islands are used effectively. It should also maintain function and structure of ecosystem for sustainable development, protection of sovereignty, sovereign rights and national jurisdiction of Vietnam over the sea, and ensure national defense and security. The Government's policies on natural resources and environment of sea and islands are stipulated in general articles. The Government shall guarantee natural resources and environment are managed, protected and used in an appropriate, effective and sustainable way under its strategy and plans for socio-economic development, protection of national sovereignty and the assurance of national defense and security. The strategy development for sustainable utilization and use of natural resources and environment of sea and island shall satisfy the demands for appropriate and effective use of natural resources, protection of the environment of sea and islands, climate change adaptation, protection of national sovereignty, while ensuring national defense and security and preserving its cultural heritage.

Law on economical and efficient use of energy (2010): Energy use plays a key role in Vietnam's greenhouse gas emissions scenario since it could contribute to fulfilling the country's commitments in responding to climate change. Efficient use of energy also helps to ensure national energy security. The Law on economical and efficient use of energy is approved on June 17, 2010 which provides articles on economical and efficient use of energy in manufacturing, construction, public lighting, transport, agricultural production, services and households, investment projects and agencies/units using the State Budget.

b) Shortcomings in policies and regulations on the efficient use of natural resources

Although Vietnam has issued many legal documents governing the economic and efficient exploitation and use of natural resources, most of the existing legal documents only provides the principles and direction without specific guidelines for implementation. Some types of natural resources, namely minerals are regulated in many legal documents while other natural resources (e.g. land, forest, biodiversity) are stipulated in few legal documents. In addition, a number of related policies and regulations that indirectly promote the economic and efficient use of natural resources, such as a reduction-recycling-reuse (3R) mechanism, cleaner production, green public procurement have not been specified in guiding legal documents.

Ultimately, it can be seen that legal regulations on economic and efficient use of natural resources are scattered in various legal documents. There has also been overlapping and even conflicts among such regulations. Therefore, the enforcement of regulations on economical and efficient use of natural resources has been relatively low in Vietnam.

2. Current status of the state management apparatus organization system to promote the transition to circular economy in Vietnam

Due to the nature of Vietnam's socio-political regime, the Government not only issues policies and regulations, but also has to directly administer the implementation of such policies and regulations, particularly the provision of many basic public services and social services (e.g. education, health, environmental protection, clean water). Therefore, the Government will play a constructive role in the development of a circular economy, whereas the Government shall create the institutions and policies to change the direction of linear economy, as well as being the entity that leads businesses and inhabitants towards the circular economy. This approach requires interaction and coordination between ministries, branches and localities to find suitable solutions. The Report has reviewed the functions and tasks of a number of ministries, branches and localities that are closely related to the transition to circular economy in Vietnam, specifically as follows:

2.1 At central level

- **Ministry of Natural Resources and Environment (MONRE)** is a governmental agency performing the function of state management of land; water resources; minerals and geology; environment; hydrometeorology; climate change; survey and cartography; integrated management of marine and island resources and protection of the marine and island environment; remote sensing; and state management of public services in the fields under its management.

Some functions and tasks related to CE include:

- Direct, guide, inspect and implement the following assigned tasks: pollution control, waste management, environmental quality management, environmental rehabilitation and restoration, nature and biodiversity conservation, prevention and response to environmental incidents as prescribed by law.
- Propose to promulgate specific regulations and policies on taxes, fees, and other economic instruments to mobilize and use resources for environmental protection.
- Guide, examine and organize the implementation of policies, laws and make decisions on strategies, plans, programs, schemes and projects on prevention and control of water source pollution, deterioration and depletion. The tasks also include the restoration of deteriorated or depleted water sources and response to and remediation of water source pollution incidents so as to economically and effectively use water sources from river basins under the Ministry's management for integrated and multiple purposes.
- Develop water conservation models; to provide public information about water-saving models, technologies and equipment; to guide the observance of regulations on incentives for water conservation activities.
- Publicize and provide information and data on water resources, use of water resources, water shortage in river basins and measures to regulate, distribute and use water economically.
- Guide, examine and organize the implementation of strategies on sustainable utilization and use of marine and island resources and environment protection, such as policies and laws on integrated management of marine and island resources after being approved by state management agencies.

- **Ministry of Industry and Trade (MOIT)** is a government agency performing the management function of industry and commerce, covering sectors of power, coal, oil and gas, renewable energy, chemicals, industrial explosives, mechanical industry, metallurgy, mining and mineral processing industry, food industry, supporting industry, environmental industry, high-tech industry, industrial clusters, cottage industry, industrial promotion, domestic trade, import and export, cross-border commerce, foreign market development, market management, trade promotion, e-commerce, commercial services, international economic integration, competition and protection of consumer's interests, trade remedies, and public services under the scope of state management of the MOIT.

Some functions and tasks related to CE include:

- Chair and coordinate with MONRE and relevant line ministries and localities to implement the tasks prescribed in the National Strategy on Cleaner Production in Industry; annually provide outcome report to the Prime Minister.
- Approve and manage the implementation of master plan for renewable energy and power.
- Promulgate or submit for issuance policies on the development of renewable energy.
- Be responsible for state management of energy saving and efficient use of energy as prescribed by law.
- Chair and coordinate with relevant ministries to develop and submit to authorities for promulgation of mechanisms, policies and lists of priority products in the industries under the scope of state management of MOIT.

• **Ministry of Planning and Investment (MPI)** is a government agency which performs the functions of state management over planning, development investment, and statistics, including the provision of general advice on strategies, master plans, plans for national socio-economic development and public investment. Such plans include the mechanism and policies for economic management, domestic investment, foreign investment into Vietnam and Vietnam's investment abroad, economic zones, official development assistance (ODA) source, preferential loans and foreign non-governmental aids, bidding, development of enterprises, collective economy and cooperative sector, on statistics and, lastly, performs the state management over public services in sectors and fields under its state management as prescribed by laws.

Some functions and tasks related of CE include:

- Deal with requirements of environmental protection in the strategy, general planning and plan of social-economic development of the country, region, project, and work under authorities of the National Assembly, Government, Prime Minister, to attract investment while overseeing law enforcement on environmental protection.
- Act as the focal agency for green growth, assumes the prime responsibility for, and coordinate with the ministries, sectors concerned and People's Committees of centrally-affiliated provinces and cities in green growth strategy. The plan shall guide, monitor, evaluate, examine and review the implementation of the strategy and report to the Prime Minister on a regular basis. MPI assumes the prime responsibility and coordinate with relevant ministries to determine the tasks and key projects in each specific phase for submission to the Prime Minister for consideration.
- Formulate, and examine the implementation of master plans on the development of economic zones nationwide (including industrial zones, export processing zones, border gate economic zones and other types of economic zones).

- Organize the appraisal of plans on the development of economic zones and the establishment of economic zones by localities, coordinate with concerned ministries, branches and People's Committees of provinces and centrally run cities in the implementation and development of economic zones after they are approved.
- Guide, examine and report on the investment development situation and the operation of economic zones. Assume the prime responsibility, coordinate with concerned agencies in proposing models and management mechanisms and development policies for economic zones and special administrative-economic units.

• **Ministry of Construction (MOC)** is a Government agency performing state management in construction planning, architecture, construction investment activities, urban development, urban technical infrastructure and industrial parks, economic zones, hi-tech parks, housing, offices, real estate market, building materials, and state management of public services in the field under the MOC management as the law stands.

Some functions and tasks related to CE include:

- Organize the implementation of law enforcement on environmental protection in construction activities, such as infrastructural structures of water supply, water drainage, solid waste and urban waste water treatment, centralized service production area, construction material production bases, trade villages, centralized rural residential area and other activities in the area of management.
- Provide guidance on the use of resource and energy on environmentally friendly construction materials.
- Implement efficient use of energy in construction, green building and green growth under the ministry's state management as prescribed by laws.
- Review, assess the performance of the planning on solid waste management approved by the Prime Minister; instruct local authorities to review and adjust the planning on solid waste management included in the urban planning to be in consistent with objectives, missions and methods of adjustments to the strategy.
- Provide guidelines, urge and inspect the development of a roadmap towards the practice of daily-life solid waste collection, transport and treatment services.

• **Ministry of Agriculture and Rural Development (MARD)** is a government agency performing the function of state management in the sectors and fields of agriculture, forestry, salt production, fisheries, irrigation, natural disaster prevention and control, rural development and state management of public services in the sectors and fields under its management as prescribed by law.

Some functions and tasks related to CE include:

- Organize the implementation of law enforcement in production, importing, exporting, use of chemicals, plant protection chemicals, veterinary drugs, fertilizers, waste generated in agriculture and other activities in management.
- Promulgate detailed technical guidance on collecting and storing waste discharged from agriculture; boost the inspection, supervision and provide guidelines for the collection, transport and storing of packaging of chemical pesticides, fertilizers or veterinary drugs in agricultural practices.

- **Ministry of Transport (MOT)** is a government agency that performs state management on road, rail, inland waterway, sea and air transport nationwide, as well as public services in the sectors and fields under its management as prescribed by law.

Some functions and tasks related to CE include:

- Oversee the implementation of law enforcement on environmental protection in construction activities and infrastructures of traffic, traffic vehicle management and other activities in the area of management.

- **Ministry of Health (MOH)** is a government agency performing the state management of healthcare services, including the following fields and sectors: preventive medicine, medical diagnosis and treatment, rehabilitation, medical examination, forensic examination and forensic psychiatric assessment, traditional medicine, reproductive health, medical equipment, pharmaceutical products & cosmetics, food safety, health insurance, population, state management of public services within the scope of its management.

Some functions and tasks related to CE include:

- Organize the implementation of law enforcement on environmental protection in the areas of health, food hygiene safety, burial and cremation activities, organizing statistics of waste sources, evaluation of pollution degree, treatment of medical waste from hospitals, medical institutions and other activities in the area of management.

- **Ministry of Science and Technology (MOST)** is a governmental agency which performs functions of state management on science and technology, including scientific research, technology development and innovation activities, development of science and technology potentials, intellectual property, standards, metrology and quality control, atomic energy, radiation and nuclear safety. The agency also oversees public services in fields under the Ministry's management as stipulated by law.

Some functions and tasks related to CE include:

- Launch a national plan for scientific research on solid waste treatment technologies and provide guidelines for applying appropriate solid waste treatment technologies;
- Foster the study or transfer of solid waste treatment technologies that are environmentally-friendly, including waste generated from agriculture and agricultural by-products;
- Chair and coordinate with the Ministry of Natural Resources and Environment, Industry and Trade, Agriculture and Rural Development in conducting a research on advancing solid waste recycling technologies in trade villages.

- **Ministry of Finance (MOF)** is a governmental agency that acts as the state management in finance, including state budget, tax, fees and other revenues of the state budget, national reserve, state financial funds, financial investment, corporate finance and financial services. MOF also oversees customs, accounting, independent auditing, insurance, prices, securities, while conducting the ownership rights to the State's investment capital in enterprises according to regulations of the Law.

Some functions and tasks related to CE include:

- Provide guidelines to balance and allocate capital of state budget and other sources to carry out the missions specified in adjustments to the national strategy for integrated management of solid waste in 2025 with vision towards 2050.
- Assume the prime responsibility and coordinate with the Ministry of Planning and Investment to submit the estimates to authorities for approval and ensure funding for the implementation in accordance with current regulations; coordinate with the Ministry of Planning and investment to formulate policies encouraging all economic sectors, organizations and individuals to invest in Vietnam's green economy.

2.2 At local level

Some functions and tasks of People's Committee of provinces and centrally-affiliated cities related to CE:

- Review and adjust the planning on solid waste management included in the urban planning; prepare and launch the plan to develop solid waste treatment facilities.
- Actively seek and mobilize economic sectors to participate in investments in local daily-life solid waste separating, collection, transport and treatment. Impose and enact plans on municipal solid waste collection, transport and treatment services; ensure the consistency in methods for treating solid waste in rural settlements.
- Provide guidelines for separating solid waste at source in the areas under management pertaining to local authority.

- Allocate annual state funding for environmental protection to provide assistance, locally, in treating daily-life solid waste, rehabilitating closed landfills and handling spontaneous landfills. Develop solid waste treatment models suitable for each local authority;
- Equitize state-owned enterprises providing daily-life solid waste management service;
- Inspect and take action against violations in solid waste management as authorized;
- Set up campaign for capacity building, awareness and responsibility of agencies and individuals on managing solid waste and environmental protection in the area;
- Develop programs, action plans and administrate the green growth strategy; solidifying the tasks and integrating into the five-year and annual socio-economic development plan while simultaneously ensuring funding for local projects.

3. Practical models of the circular economy in Vietnam

Although the term “circular economy” (CE) has not been officially used in the Vietnam Party’s policies, nor in legal documents, the CE principles have been integrated into many economic models. Some typical models can be named, such as eco-industrial parks, cleaner production models, waste recycling craft villages, or circulation initiatives of enterprises.

3.1. Circular-economy-related models in the agricultural sector

Currently, the farm is considered as a model to promote efficient and sustainable development of rural agriculture. Many localities across the country have applied the Garden-Pond-Stall model (referred to as VAC in Vietnamese); the Garden-Pond-Stall-Biogas model (referred to as VACB in Vietnamese); and the Garden-Pond-Stall-Forest model (referred as VACR in Vietnamese). The VACB is regarded as an initiative to reduce waste and increase the rational use of agricultural residues and soil fertility. Besides, this model aims to contribute to the safe treatment of animal waste, generation of renewable energy, thus preventing environmental pollution and reducing greenhouse emissions. In fact, the small-scale biogas plants are said to be more effective than the large-scale biogas plants that still generate a large amount of unused gas. It is also difficult for some large-scale biogas plants to meet the requirements of the National Technical Regulation on the effluent of livestock (QCVN 62-MT:2016/BTNMT) so that many owners have no motivation for operation and maintenance.

With the support of the Asian Development Bank (ADB), the Ministry of Agriculture and Rural Development (MARD) implemented the Low Carbon Agricultural Support Project in 10 provinces, including Lao Cai, Son La, Phu Tho, Bac Giang, Nam Dinh, Ha Tinh, Binh Dinh, Tien Giang, Ben Tre, Soc Trang from 2013 to 2019. The project has piloted a new technology machine to separate and process animal manure. Some households with a scale of over 2,000 pigs were able to run such machine two slots a week, producing about one ton of compost per slot. From this production, the farmers could get an additional income of tens of millions of dong per month from processing animal manure.

After successfully applying this technology, many pig farms were able to better manage the environmental pollution in their breeding areas. Subsequently, some pig farms have expanded their business scale, for example, the pig farm in Cam Xuyen, Ha Tinh province, has increased the number of pigs from 3,000 to 7,000 (Management Board of agricultural projects, 2019). Recognizing the good results from the application of the VACB model, the People's Council of Ha Tinh province has proposed to support 70% of equipment costs for livestock farms, where this is only a pilot project in 10 provinces. The replication of the VACB model has not been widely deployed.

Technologies to reduce negative environmental impacts caused by the livestock industry normally earn much lower profit than other industries. As a result, the Government should pay more attention and create incentives and support for farmers to invest in effective and sustainable technologies to handle environmental pollution.

Other models, namely Garden – Pond – Stall – Forest (referred as VACR in Vietnamese), is connected to forestry activities in mountainous provinces, and Garden – Pond – Lake (referred as VAH), which is known as a farm on the sand in the Central provinces, has also developed and provided good income to the locals. These models, however, are difficult to replicate in other regions due to the different geographical characteristics.

3.2 Circular-economy-related models in the manufacturing and industrial sectors

Industrial zones (IZs) have a great contribution to the socio-economic development of Vietnam through enhancing industrial production and export values, generating revenue for the State Budget, and creating millions of jobs. However, the massive increase in industrial activities and the expansion of industrial zones in Vietnam have resulted in adverse impacts on the environment and human health. Furthermore, many initiatives of cleaner production and efficient use of resources have not been applied. Industrial symbiosis and eco-industrial parks are quite limited. In the industrial park, the services are not fully provided or at the low quality.

To deal with the above challenges, the Global Environmental Facility (GEF) and the State Secretariat for Economic Affairs (SECO) of the Swiss Federal Department of Economic Affairs have sponsored Vietnam to implement the project “Implementation of eco-industrial park initiative for sustainable industrial zones in Vietnam”. This project was implemented from 2015 to 2019 that piloted the model of eco-industrial parks in three industrial zones, including Khanh Phu Industrial Park (Ninh Binh province), Hoa Khanh Industrial Park (Da Nang city), and Tra Noc 1&2 Industrial Park (Can Tho). The project aimed to select good examples of how low-carbon and resource-efficient technologies are implemented. The specific objective was to evaluate at least 60 enterprises in the three selected industrial zones and to identify which enterprises were willing to implement and invest in cleaner production solutions. Also, the project's target was to have a minimum of 45 enterprises that significantly reduced their consumption of materials and electricity.

Three industrial parks are consulted for efficient use of resources and cleaner production to help enterprises increase their productivity, reduce resource consumption, greenhouse gas emissions, pollutants, as well as improve water-use efficiency and chemical safety management. These changes at the corporate level are expected to contribute to the transformation of existing industrial zones into eco-industrial zones.

The project has achieved positive results in raising awareness of the eco-industrial parks, promoting enterprises in the industrial zones to apply technological innovation, cleaner production solutions, and efficient energy use. At the end of phase 1 of the project, it is estimated that the enterprises saved about 32.86 billion VND by saving materials, water, energy, and chemicals in their production activities. At the end of phase 2, the enterprises in Da Nang and Can Tho saved 1.39 billion VND and 13.99 billion VND, respectively (Vietnam Cleaner Production Center, 2017).

Based on the positive results of the eco-industrial park initiatives, the Ministry of Planning and Investment (MPI) has submitted the Government to issue Decree No.82/2018/ND-CP dated May 22, 2018, on the management of industrial zones and economic zones that stipulates the concept and criteria of eco-industrial parks and assigns responsibilities of ministries and branches in guiding the development of eco-industrial parks. By definition, eco-industrial park means an industrial park in which enterprises get involved in cleaner production, make effective use of natural resources, and enter into manufacturing cooperation and affiliation to tighten industrial symbiosis to promote economic, environmental, and social efficiency in these enterprises.

However, there has been a lack of specific regulations on waste exchange, resulting in low waste circulation activities among enterprises. In fact, the opportunities for industrial symbiosis have not been put into practice because it requires that the enterprise operating in the industrial park be responsible for the treatment of all forms of waste and their waste discharge shall comply with strict regulations.

Under the project “Implementation of eco-industrial park initiative for sustainable industrial zones in Vietnam”, the enterprises in the industrial parks have a high demand for waste exchange. For example, in Hoa Khanh Industrial Park (Da Nang province) Vinamilk factory discharges nearly 2000m³ of waste water daily which is treated to reach class A of the national discharge standards. At the same time, the neighboring paper factory needs to buy water for the processes of raw materials at the price of 7,000 VND/m³ with the quality even lower than class A treated effluent. The exchange of waste water between Vinamilk factory and the paper factory is likely to bring both economic and environmental benefits to businesses and society. However, the exchange did not take place because of the lack of legal mechanisms.

The results of the eco-industrial pilot models show the potential of transforming traditional industrial zones to eco-industrial zones. Crucial factors for a nationwide replication of the eco-industrial model to become successful requires collaboration among the private sector, planning and management of eco-industrial zones, the promotion of industrial symbiosis activities, and the capacity of stakeholders.

3.3. Circular economy-related models in the protection of natural resource

In Vietnam, the ecological economic model has been studied and deployed since the 1980s. The eco-economic model is regarded as a development model to protect existing ecological environment and natural landscape. The eco-economic model is also a system of interaction between organisms and the environment under human control to achieve sustainable development goals. A specific ecological economic system model is designed and built in a defined ecological region where human activities such as production, utilization, and use of natural resources occur.

In an economic development, natural resources are extensively used for many activities that have resulted in ecological imbalance. The ecological-economic model is designed to circulate the material flow to bring high environmental and economic efficiency, ensuring the self-regulation of the entire system.

According to the characteristics of each geographical region, the ecological economic models have been practiced in many localities by organizations such as the Institute for Ecological Economics, Can Tho University, Ministry of Science and Technology. Most pilot models were built under the sponsorship of international organizations namely IUCN, SIDA, Canada Children's Fund, and Toyota Vietnam. These pilot models were said to contribute to improving people's lives, natural ecosystems, while minimizing pollution. It is crucial to assess the sustainability and circulation of these ecological economic models. Theoretically, to evaluate the circulation of the model, it is necessary to consider three principles, including rational use and regeneration of natural resources; maximizing the circulation of waste and materials, and minimizing negative externalities. The existing eco-economic models in Vietnam have met goals for the first two principles mentioned above.

3.4 Circular economy-related models in energy use and development

- **Geothermal energy:** Vietnam has more than 300 sources of hot mineral water with surface temperatures ranging from 30°C to 105°C. These hot mineral water resources are distributed in the Northwest and Central regions. Some are currently exploited for tourism activities. Unfortunately, there is no comprehensive evaluation of the potential to utilize geothermal energy in Vietnam.

- **Solar energy:** Based on the study "National assessment of development potential of grid-connected solar photovoltaic projects in Viet Nam until 2020 with a vision to 2030" conducted by the Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ) GmbH in Viet Nam and the General Directorate of Energy, Ministry of Industry and Trade (MOIT), it indicated that the total economic potential of ground-mounted solar projects in Viet Nam is at least 7 Gigawatt (GW) at the present market conditions. The potential is higher than the national solar target of 0.8 GW by 2020. However, with the decrease of investment costs and financing costs that will happen once the market starts growing, the potential can reach several hundred Gigawatt between 2021 and 2030, much more than the target of 12 GW by 2030.

With its geographical location, Vietnam is considered a country with huge potential for solar energy, especially in the Central and Southern regions. Currently, most solar energy projects have been implemented in Binh Thuan and Ninh Thuan provinces. Other localities also have great potential for solar power, namely Tay Ninh, Binh Duong, Binh Phuoc, Long An, and Ba Ria - Vung Tau. In the current market context, Vietnam's solar power projects may face many challenges due to financial obstacles, but when market demand increases and cost decreases, solar power is likely to expand rapidly.

- The Prime Minister issued Decision No.11/2017/QĐ-TTg, dated April 11, 2017 on mechanisms for the encouragement of the development of solar power in Vietnam. Following this Decision, MOIT announced Circular 16/2017/TT-BCT on project development and model power purchase agreements applied to solar power projects. This Circular specifies: (i) Solar power planning and development; (ii) Electricity pricing of solar power projects; (iii) Model power purchase agreements applied to solar power projects; and (iv) Responsibilities of organizations and individuals involved. The Circular also stipulates that The selling price of electricity at the place of electricity delivery (VAT exclusive) shall be VND 2,086/kWh (equivalent to U.S. cent 9.35/kWh, according to the central exchange rate of VND over USD, as quoted by the State Bank of Vietnam on April 10, 2017, which is VND 22,316/USD).

- **Wind energy:** As for wind power, Vietnam has large wind resources compared to other countries in Southeast Asia. However, current data on wind power potential in Vietnam is incomplete due to lack of research and measurement.

It is estimated that Vietnam's potential for wind power sourcing may fluctuate from 1,800 MW to over 9,000 MW, some even recorded the potential of over 100,000 MW. The wind energy potential is higher in the central and southern regions of the country, particularly the Central Highlands, islands, and coastal regions). Currently, there is one wind farm with a total capacity of 30 MW in operation and another wind farm with a capacity of 90 MW under construction. The use of wind energy sources are currently limited to only about 3 MW.

Vietnam has strong support for wind power development since wind power is expected to meet the rapidly growing electricity demand. Vietnam is now completing the institutional framework for renewable energy development. The wind power is planned to account for 5% and 11% of total electricity production by 2020 and 2050, respectively.

A key component of the approved incentive mechanism to promote wind power development is the regulated electricity price (FIT). FIT is 7.8 US cents / kWh. In particular, EVN (Vietnam Electricity Group) is obliged to buy electricity from wind power projects at the price of 6.8US cent / kWh. Price from the state budget for investors of wind power projects are compensated at 0.1US cent / kWh (from Vietnam Environment Protection Fund). In addition, this support mechanism also includes the reduction and exemption of corporate income tax, import taxes, land use fees, VAT, and environmental fees.

- **Hydropower:** Vietnam has a large potential for hydroelectricity, thanks to favorable natural conditions. The total hydropower capacity of Vietnam is about 35,000MW, of which 60% is concentrated in the Northern region, 27% is distributed in the Central region and 13% is in the Southern region. The potential can be harvested at about 26,000MW, corresponding to nearly 970 planned projects that will likely produce more than 100 billion kWh annually. There can be up to 800 projects of small hydroelectricity with a total power capacity of about 15-20 billion kWh/year.

At present, hydropower development is implemented in accordance with two important legal clauses as follows:

- Prime Minister's Decision No. 2068/QD-TTg dated November 25, 2015, approving the Vietnam Renewable Energy Development Strategy to 2030, with a vision to 2050. The Decision defines hydropower development orientation in which the electric power produced from the hydropower source shall be increased from around 56 billion kWh in 2015 to around 90 billion kWh by 2020, and around 96 billion kWh in 2030. The capacity of storage hydropower source is likely to reach 2,400 MW by 2030 and about 8,000 MW by 2050.

Prime Minister's Decision No.428/QD-TTg dated March 18, 2016, approving the revisions to the National Power Development Plan for the period 2011-2020 with a vision to 2030. The Decision sets specific objectives of which it prioritizes the development of renewable energy resources for electricity production; increases the proportion of electric power generated by renewable energies (excluding large-scale, medium-scale, and pumped-storage hydropower) at about 7% by 2020 and over 10% by 2030.

- **Biomass energy:** It is estimated that energy potential from wood-based biomass can reach approximately 14.6 million tons of oil equivalent in 2030 and 14 million tons in 2050. The biomass energy potential from agricultural waste is forecast at about 20.6 million and 26.3 million tons of oil equivalent in 2030 and 2050, respectively, while biomass energy potential from urban waste is forecast at 1.5 million tons of oil equivalent in 2030 and 2.5 million tons in 2050. Development of biomass energy contributes to ensuring national energy security; minimizing environmental pollution; increasing business productivity in the energy, agriculture, forestry, and marine sectors¹⁸.

Vietnam has sufficient conditions for biofuels products at a commercial scale. The raw materials used in producing ethanol as biofuel components are extracted from cassava, maize, and sugarcane that are known as popular plants in Vietnam.

¹⁸ MSc. Le Minh Huong, Institute of Financial Policy and Strategy, Renewable Energy in Vietnam: Potentials, current status, and solutions, 2017

Currently, the total ethanol output in Vietnam is around 50 million liters that are used for various purposes. Therefore, biofuel use would only replace a small part of fossil fuel consumption.

The current sugarcane farming area of Vietnam is more than 300,000 hectares. The annual amount of sugarcane is about 17 million tons while the ethanol production yield from sugarcane is also very high. Cassava starch is the second main raw material for ethanol production, and Vietnam also has about 430,000 hectares of cassava with the annual cassava production of about 7 million tons. In addition, another biofuel-making plant is the *Jatropha* that adapts to many ecological zones in Vietnam. Its seed oil possesses biodiesel and jet fuel production potentials. The Green Energy Vietnam (GEVN) has cooperated with the Center for Biotechnology (Vietnam Academy of Forestry Science) to introduce the *Jatropha* demonstration model on sandy soil, dry soil, and hill land in Dak Lak, Ninh Thuan, Binh Dinh, Binh Phuoc, Quang Tri, Thua Thien - Hue, Vinh Phuc, and Phu Tho.

3.5 Circular economy-related models in infrastructure and construction

The eco-village is an ecosystem-based adaptation model that ensures sustainable management of natural resources and capacity building of local communities. Also, eco-village applies both traditional and indigenous knowledge, and modern scientific knowledge in production, organization of living spaces, educational and cultural activities, as well as health care for the community. The eco-village model aims to protect and preserve soil and water, the two basic elements for food production. There has been two pilot eco-villages in Vietnam, namely, the eco-village of Ba Vi (Ha Tay) and the eco-village of Kim Lu - Na Ri - Bac Kan.

3.6 Circular economy-related models in manufacturing

Cleaner production has been defined by the United Nations Environment Programme (UNEP) as “the continuous application of an integrated preventative environmental strategy to processes, products, and services to increase efficiency and reduce risks to humans and the environment”. Therefore, when it comes to the process, cleaner production conserves raw materials and energy, eliminating hazardous materials and reducing the amount and toxicity of all waste at the source. As for products, cleaner production helps to reduce negative effects throughout the life cycle of the product, from design to disposal stage. Regarding the services, the process integrates environmental factors into the design and development of services for cleaner production.

Since 2000, the Ministry of Industry and Trade (MOIT) has implemented a number of cleaner production activities. The number of enterprises currently participating in cleaner production projects in Vietnam is relatively small. By 2005, there were about 180 industrial enterprises in 34 provinces engaging in cleaner production activities, mainly in big cities such as Ho Chi Minh City, Dong Nai, Binh Duong, Nam Dinh, Phu Tho, Viet Tri, Thai Nguyen, Hanoi (Vietnam Cleaner Production Center, 2017).

Cleaner production is now recognized as a strategy that creates economic efficiency while minimizing environmental pollution. However, it is difficult to apply cleaner production in Vietnam due to limited financial resources and access to new technologies, thus hindering the expansion and replication of cleaner production models. In particular, cleaner production mainly focuses on reducing emissions, rather than designing waste prevention, and as a result, one of the three basic principles of the CE, which is to minimize negative externalities through waste and pollution design, has not been properly implemented.

3.7. Circular economy-related models in waste treatment

In recent years, along with the strong development of all economic sectors, production in recycling craft villages across the country has also increased rapidly. There are some conventional recycling villages, such as the plastic recycling villages Trung Van (Hanoi city) and Vo Hoan (Nam Dinh province), the copper casting village Da Hoi (Bac Ninh province), and the aluminum recycling village Yen Binh (Nam Dinh province). It is said that the waste recycling craft villages are the most typical examples of CE in Vietnam. In these craft villages, waste recycling business is operated by households with outdated recycling technologies that cause serious pollution.

To illustrate, many households in the plastic village Trung Van in Hanoi city have collected or purchased plastic waste such as plastic bags and plastic bottles. The plastic waste is then recycled for producing plastic raw materials, ropes, plastic bags, or supplying plastic manufacturers. However, in the plastic recycling processes, waste is discharged directly into the environment instead of being treated in compliance with regulations. The Bac Ninh province has over 70 craft villages of which 62 are traditional. Namely, the bronze casting village Dai Bai is well known for more than 1,000 years of its traditional copper casting and metal laminating with raw materials are non-ferrous metal scrap (aluminum, copper, lead) such as wire rods and copper billets. The amount of raw material is about 5,000 tons/year while the amount of fuel consumption in manufacturing processes, including coal and electricity, is around 2,500 tons/year. Consequently, a large amount of emission and solid waste has been discharged into the environment, causing direct and indirect adverse impact on the environment and serious soil contamination in Dai Bai village.

Similarly, the craft village of Binh Yen (Nam Dinh) has 304 households recycling aluminum from waste. On average, this village recycles nearly 1,500 tons of aluminum scrap each month. In Binh Yen village, the daily process of casting aluminum from cans generates tens of tons of hazardous solid waste, while the wastewater from product cleaning is up to 500m³/day. Before 2013, all hazardous solid waste and wastewater were dumped directly into the environment without any treatment¹⁹.

¹⁹ General Department of Environment (2013)

<http://vea.gov.vn/vn/quanlymt/kiemsoatonhiem/Pages/Nam-%C4%90%E1%BB%8Bnh-M%C3%B4i-tr%C6% B0% E1% BB% 9Dng-l% C3% A0ng-ng% E1% BB% 81-B% C3% ACnh-Y% C3% AAn-% C3% B4-nhi% E1% BB% 85m-suspect% C3% AAm-tr% E1% BB% 8Dng-.aspx>

The contaminated water also flowed into the irrigation systems that polluted many hectares of rice fields. According to the monitoring results the MORE in Binh Yen craft village, the concentration of suspended solids in surface water in Nam Ninh Hai River, in which the wastewater from manufacturing establishments was discharged, is 12.2 times higher than the relevant Vietnamese technical regulations. In 2013, Nam Dinh province invested 85 billion VND in a project on pollution remediation and environmental improvement in Binh Yen craft village, including the construction of the solid waste collection system, and the centralized water treatment system. However, many challenges still remained in the environmental protection of Binh Yen craft village²⁰.

In general, although the recycling craft villages contribute to the circulation of raw materials in the economy, their outdated recycling processes generate a great amount of waste, especially solid waste. Such collection and treatment of waste in craft villages are recognized as a great challenge for local authorities.

3.8. Circular-economy-related models of corporations in Vietnam

Heineken Vietnam is a subsidiary of Heineken, one of the world's leading international brewers. With a strategy towards creating positive impact on the people, the planet, and the economy, Heineken Vietnam takes effort to integrate sustainability into their core production and business activities to set new benchmarks in sustainable development through continuous improvements, rigorous assessment, and the communication of their progress. Accordingly, in 2017 and 2018, Heineken Vietnam was recognized as the most sustainable company in Vietnam by the Vietnam Chamber of Commerce and Industry (VCCI) based on the annual Corporate Sustainability Index.

Heineken Vietnam is a pioneer in promoting and applying the CE model in its activities. The clear goal of this model is to find alternatives to reconstruct, reuse, and recycle materials to extend the material's life and maximize its value. This model is believed to bring many benefits to various stakeholders in the supply chain. To illustrate, in 2017, Heineken Vietnam sourced about 54,000 tons of rice husks - a type of agricultural waste – to generate thermal energy. This initiative allowed four of its six breweries to brew 100 percent with carbon-neutral renewable energy and also provided significant income for farmers as well as the suppliers in the biomass energy industry. Furthermore, Heineken Vietnam continues to find alternatives to utilize waste from its factories where 99.01% of waste is recycled or re-used and only about one percent of waste lost or sent to landfills. Similarly, the wastewater is treated, then being used for various purposes. Even biogas from wastewater treatment systems is used to generate thermal energy.

Another Heineken Vietnam's CE initiative is collecting and recycling beer bottle caps into raw materials to build a bridge for the local community. It is said that most of the Heineken packaging has been reused or recycled. However, the bottle caps are very small and have low economic value so that they are often discarded rather than being collected and recycled.

²⁰ Northern Center for Environmental Monitoring (2016)

http://cem.gov.vn/VN/TINTRANGCHU_Content/tabid/330/cat/115/nfriend/3750083/language/vi-VN/Default.aspx

To deal with this situation and reducing waste discharge into the environment, Heineken Vietnam has piloted the project of building a bridge made from recycled bottle caps. The first bridge was built in Chau Thanh District, Tien Giang province that makes the daily commute much less challenging for local people, thus helping improve their living conditions. Following the success of the project in Tien Giang, this initiative will expand across Vietnam.

Another CE related model in Vietnam is the plastic and paper recycling sector. Currently, recycled plastic and paper products are now widely used in other industries as well as in daily life in Vietnam. The used plastic and paper is collected through official and unofficial channels from many sources, including households, schools, organizations, companies, factories, supermarkets, shops, railway stations, bus stations, and airport. Used paper has two types; recyclable and non-recyclable. The non-recyclable type includes thermal paper, paper adhesive, tape, carbon paper, cellophane, plastic or wax coated paper, milk cartons or drinks refreshments, candy wrappers, lunch boxes, cups and paper plates, paper towels, wipes used, paper coatings, paper chemicals and food. The used plastic and paper retrieved is then sent to recycling plants and craft villages.

The Vietnam plastic and paper industries have both rapidly grown with an annual rate of 16-18%. In 2018, the production of the two sectors was 8.3 million tons and 3.7 million tons of semi and final products respectively. However, there have been insufficient materials for production in these two sectors that require the import from the international market. According to preliminary figures, up to 77% of the materials are imported for the domestic production of plastic, while materials for the paper sector is only 57%. The production of paper is much more dependent on imported scrap (49% of material demand) than that of the plastic sector (7% of material demand). As a result, the development of the plastic sector depends largely on the availability, quality, and prices of imported resin while that of the paper sector depends on imported scrap.

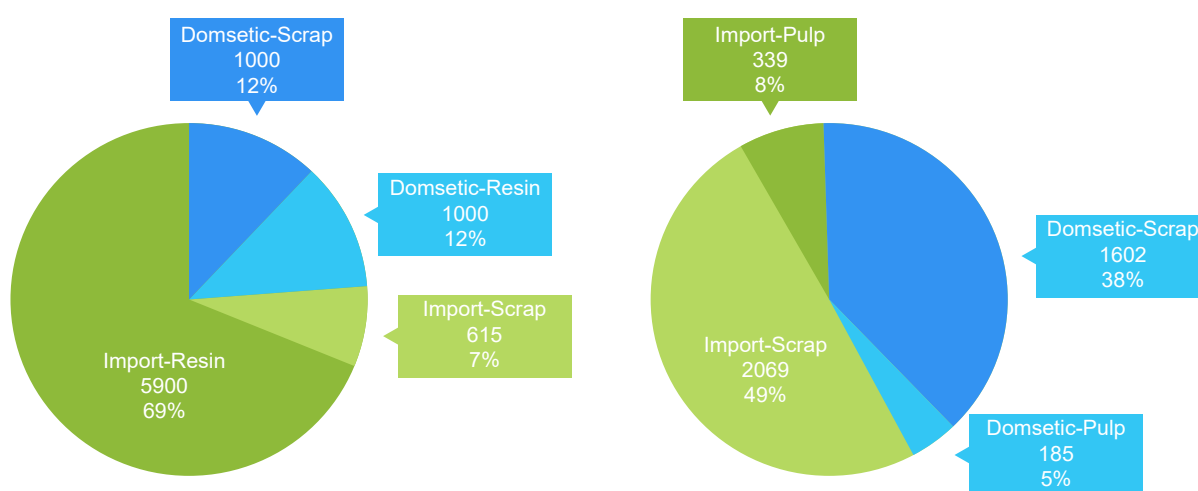


Figure 3.1: Material structure of plastic and paper production (thousand tons)

The rapid growth of the paper and the plastic industry in Vietnam has resulted in serious pollution, which poses increased risks to the environment and human health. Instead of yielding environmental benefits, the paper and plastic recycling industry that involves a multi-step process in which scraps are converted into products or resins that have generated significant amounts of waste pollutants. One of the reasons is that the recycling industry in Vietnam, especially paper and plastic sectors, is regarded as a low-tech industry characterized by small paper and plastic craft villages scattered across the country. In the past, the recycling establishments were mainly households that did not consider the social and environmental impacts caused by their business. Today, some large paper companies including FDI have been set up, driven by the dramatic increase in the demand for paper products²¹.

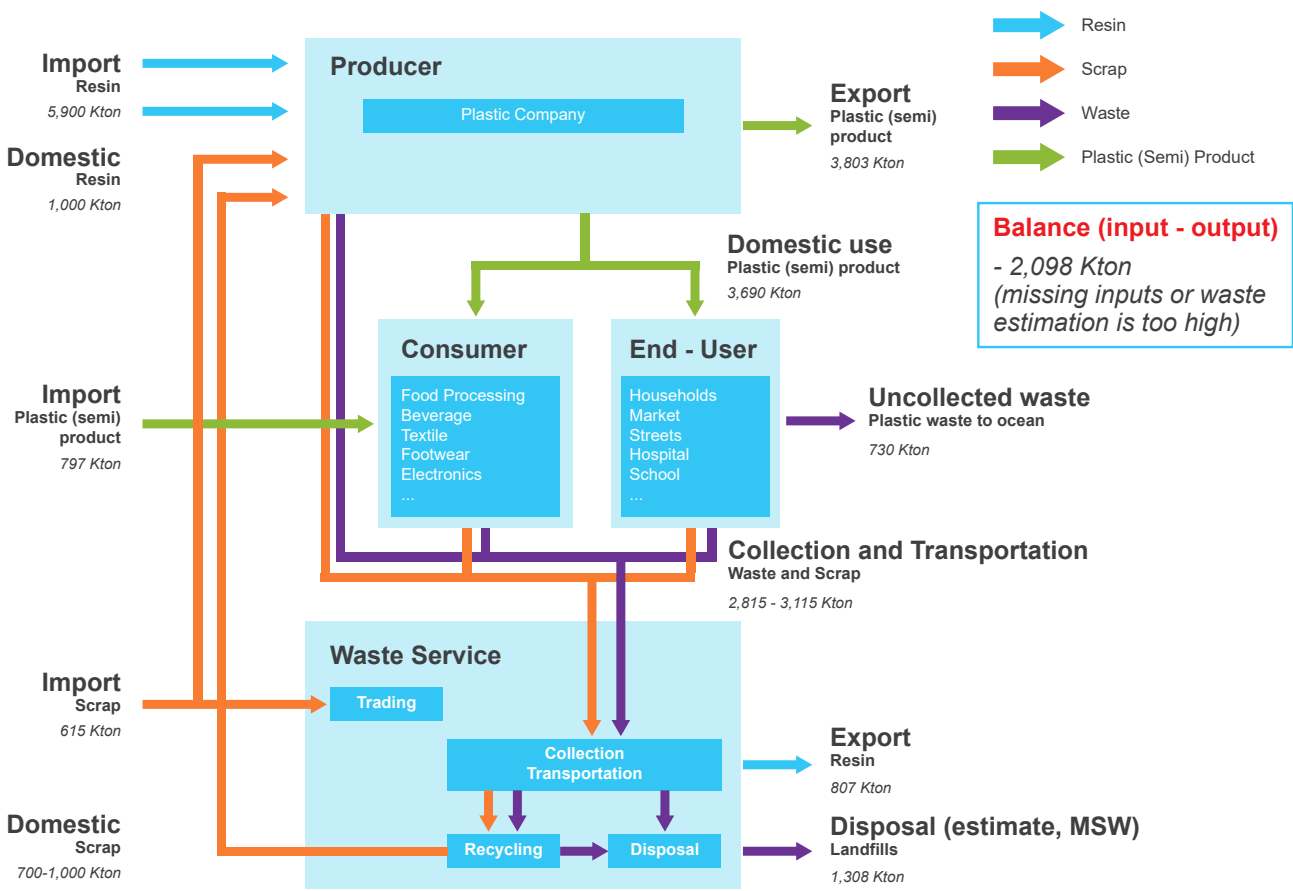


Figure 3.2: Material flow in the plastic sector

²¹ VCCI, Report on Vietnam Materials marketplace

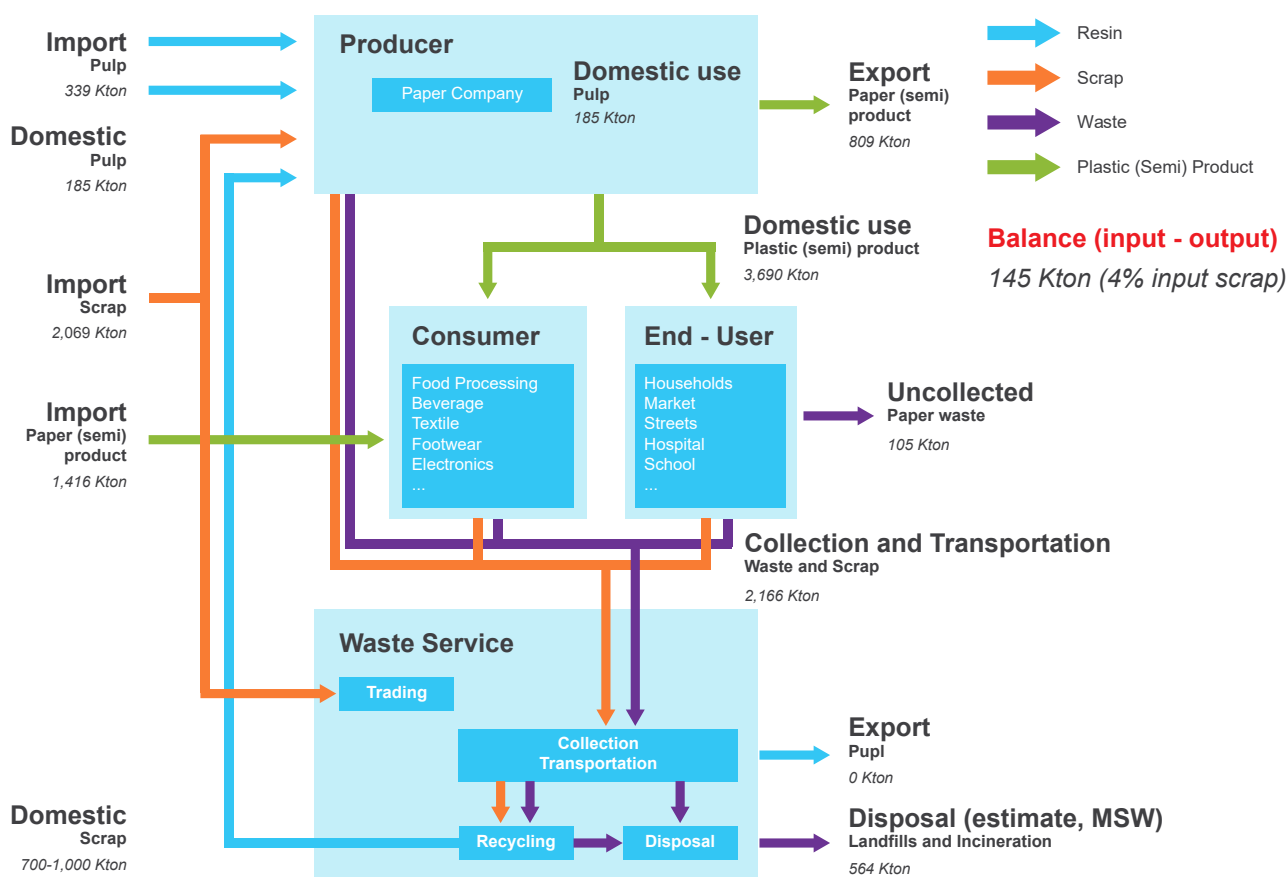


Figure 3.3: Material flow in the paper sector.

4. Potential to apply circular economy model in specific industries in Vietnam

4.1 Plastic industry

4.1.1 Overview of the plastic industry

According to a report of the Vietnam Plastics Association (VPA), the plastics industry has become one of Vietnam’s fastest growing industries with an annual growth rate of 16-18 percent. The growth rate was maintained from 16-20 percent per year in the period of 2010-2015 and 11.3 percent per year in the period of 2016-2018 [73; 74]. In 2017, Vietnam’s plastic industry consumption was at approximately 5.9 million tons of raw plastic materials, equivalent to 63 kg of plastic consumption per capita. The plastic consumption per capita increased by 10.6%/year, from 3.8 kg in 1990 to 63 kg in 2017 [74].

VPA indicates that the plastic industry depend on more than 80% of imported plastic materials. In 2018, Vietnam imported roughly 5.59 million tons of plastic material, worth 9.1 billion USD, that increased by 11.9% in volume and 20% in value in compared with 2017. Consequently, it is forecast that by 2023, the plastic industry requires 10 million tons of plastic resin of which only 26 percent can be supplied in domestic markets.

Vietnam has faced serious environmental pollution caused by plastic waste. Since the last decade, the increasing waste in general and plastic waste has become the biggest concern in Vietnam. The plastic consumption per capita increased by 11 times, from 3.8 kg in 1990 to 41 kg in 2015. To date, the nations' total plastic waste is over 1.8 million tons annually, and still growing at a rate of 10-15 percent per year ^[75]. Only 27 percent of the plastic waste is recycled, while a large amount of plastic waste went into the sea and to landfill. As a consequence, Vietnam became the fourth in the world with the most marine plastic discharge with roughly 0.73 million tons of marine plastic debris annually ^[2]. In addition, plastic waste accounted for about 8%-16% of waste to landfill ^[71].

4.1.2 Opportunities and challenges to apply circular economy model in the plastic industry

The plastic industry plays an important role in Vietnam's economy, as it is one of three priority areas for development of supporting industries, according to Decision No.9028/QD-BCT of Ministry of Industry and Trade.

The bill approves the master plan for supporting industrial development by 2020 with a vision to 2030. Under this Master Plan, manufacturing projects, including spare plastic parts and components are entitled to preferential and incentives policies under the Prime Minister's Decision No.12/2011/QD-TTg dated 24/2/2011 on issuing the list of products of supporting industry to be developed with priority. Likewise, Prime Minister's Decision No.1483/QD-TTg dated 26/8/2011 promulgates the list of products of supporting industries prioritized for development.

In 2011, the Ministry of Industry and Trade approved the Master plan for plastic industrial development by 2020, with a vision towards 2025 in Decision No.2992/QD-BCT. It aims to develop Vietnam's plastic industry to become a leading economic sector with high growth and sustainability. It also gradually builds and develops the plastic industry, from production of raw materials to final processing, plastic scrap handling and processing of raw materials, increasing the proportion of domestic raw materials to become the autonomy industry. It plans to restructure the group plastic products by reducing plastic packaging products and household plastics, while increasing the proportion of construction materials and engineering plastics.

In recent years, the Ministry of Natural Resources and Environment, related ministries, line ministries, and localities have actively implemented many alternatives, such as reviewing and revising existing mechanisms and policies to reduce the amount of plastic waste generated, while increasing the recycling and reusing of plastic waste, thus preventing the harmful impacts of plastic waste on the environment. The Prime Minister's Decision No. 491/QD-TTg dated May 7, 2018 approved the adjustment of the National Strategy on integrated management of solid waste to 2025 with vision towards 2050.

The plan identifies specific objectives for dealing with urban solid waste where 100% environmentally-friendly plastic bags are used in trade centers and supermarkets to replace every-day plastic bags. More importantly, the end goal is to limit then end the import, export and provision of types of plastic bags used in daily life, trade centers and supermarkets by 2026.

Currently, MONRE is coordinating with relevant ministries and line ministries to finalize a legal system on waste management that focus on: (i) supporting policies and incentives for production and consumption of environmentally friendly materials; (ii) imposing stricter sanctions against violations of environmental protection regulations, especially regulations on waste management; (iii) only allowing the import of high-recyclable plastics; and (iv) increasing environmental protection tax on non-biodegradable plastic bags; and create consumer markets for environmentally friendly bags.

At the same time, the Government has also issued a number of documents that strictly regulates the import of scrap for use as raw production materials. Documents such as Directive No.27/CT-TTg dated 17/9/2018 of the Prime Minister focuses on urgent solutions to strengthen management of the import and the use of imported scrap as raw production materials, and the Government's Decree No.40/2019/ND-CP detailing the implementation of the Law on Environmental Protection.

As a result, the management regulation of plastic scrap import has become increasingly strict. The Government has issued many preferential policies for enterprises to invest in modern equipment and technologies to recycle waste. According to VPA, the demand for raw materials for domestic plastic production has increased cumulatively by 10% annually, which is a huge potential for the development of the recycled plastic industry. This practice also yields other benefits, such as saving energy and non-renewable resources for primary plastic production, and reverting serious degradation of marine environment and soil erosion. Moreover, the domestic plastic recycling segment is likely to provide 50% of raw materials for the plastic manufacturing industry. It is said that if Vietnam can use the recycled materials at 35-50% a year, plastic firms can reduce production cost by more than 15%.

4.2 Agricultural industry

4.2.1 Overview of the agricultural industry

Over the past 20 years, Vietnam has made great strides in agricultural industry. Vietnam is now one of the top five exporters of six agricultural commodities, including rice, pepper, coffee, cashew, and shrimp that greatly contribute to poverty reduction, social stability and food security. However, Vietnam's agricultural growth is mainly based on expanding production, increasing the use of land and natural resources, and using a large amount of fertilizers and chemicals. As a result, its agricultural industry is now facing significant challenges due to environmental pollution and degradation. The overuse of natural resources together with environmental pollution has reduced Vietnam's competitiveness in the international market.

This requires the restructuring of the agricultural industry to create more economic value, bring higher efficiency for farmers and consumers, as well as cutting down the use of natural resources, labor and hazardous chemicals.

According to a study by the World Bank (2018), the overuse of natural resources, especially water resources has led to the degradation in environment in many key agricultural production regions of Vietnam. For example, the expansion of shrimp farms along with the abuse of chemicals and antibiotics in the Mekong Delta has destroyed the mangrove ecosystem on a large scale, causing fresh water pollution. The expansion of coffee and rubber cultivation in the Central Highlands has also contributed to an increase in deforestation and the loss of biodiversity and groundwater resources. The causes of the environmental problems of the agricultural industry include inadequacy in existing policies and regulations, poor management, and lack of knowledge. Over the past decades, Vietnam's agricultural policy orientation has focused on increasing agricultural productivity to ensure food security and promote economic growth and exports. Therefore, the policies encouraged expansion of land cultivation, increased intensification, and increased use of materials to improve productivity rather than paying attention to environmental protection. Farmers do not have to pay or pay very little for the resources they use, such as water provided by the irrigation system, but small-scale agricultural production has resulted in high transaction costs. Consumers are not aware of the environmental impacts of agricultural products, so they have not created pressure for producers to change their farming techniques. Also, crop producers have not realized the current situation and changes in natural resources and environment, for example the groundwater and saltwater intake in the Central Highlands, saline intrusion in the Mekong Delta as well as appropriate techniques. Research activities, for many years, has focused mainly on increasing the productivity instead of solutions and technologies that help reduce environmental impacts.

Currently, the Government issued Directive No.25/CT-TTg that set out several tasks and solutions to develop the processing industry of agro-forestry-fishery products and mechanisation of agricultural production. The Directive has also set a target in which Vietnam strives to be among the world's top 15 most developed countries in agriculture by 2030 with agricultural processing rank in the world's top 10. Vietnam is expected to become a deep processing and logistics centre of the global agricultural trade. To achieve the above goal, the development of sustainable, environmentally friendly agriculture through the circular economic model appears to be the inevitable trend. In the CE model, waste and by-products from one manufacturing process become inputs to another, thus creating high-quality products, minimizing waste into the environment.

4.2.2 Opportunities and challenges to apply circular economy model in agricultural industry

Vietnam has many opportunities to promote circular economy practices in agriculture. In circulated agricultural production, the by-products are generated and through the process of physical, chemical, and biological transformation to become another kind of agricultural products or inputs for various industrial manufacturing.

These processes help to optimize the economic values for the producers. In particular, when applying modern technologies in agricultural circular economy models, not only can it turn by-products into products, but also generate energy (electricity, biodiesel, heat) to serve mechanization and automation in agricultural production.

Currently, Vietnam has not made full use of agricultural by-products. For example, farmers only benefit mainly from rice production, where one cultivated hectare yields five tons of grain and 7 tons of rice straw. Only 10% of the rice straw is re-used as food for cattle while the remaining is burnt for site clearance for the next crop. The burning of agricultural residues emits pollutants that harm public health and cause serious air pollution. In addition, it also indicates that the livestock industry is estimated to generate 80 million livestock waste per year of which about 36% is discharged directly into the environment without treatment. Agricultural by-products such as rice husk ash can be used in production process of fertilizer or silicon which in turn becomes the raw material for manufacturing of glass, while livestock waste can be converted to fertilizer, or converted to energy for farm operation²².

As the Government of Vietnam aims to join the world's top 15 most advanced countries in agriculture in the next 10 years, many policies and regulations have been issued to create favorable conditions for the transition to a circular economy as follows:

- Prime Minister's Decision No. 899/QĐ-TTg dated 10/6/2013 approves the scheme "Agricultural restructuring towards raising added values and sustainable development". One important scheme in this plan is the environmental orientation that aims to reduce negative impacts on the environment due to the extraction of resources serving agriculture, forestry, and fisheries; enhance the management efficiency and the use of resources (land, water, sea, forests); consider mutual effects and potential of resource extraction; enhance the measures for reducing greenhouse gas emission; efficiently and safely use chemicals, pesticides, and waste from breeding, farming, processing, and handicraft; preserve biodiversity. It also encourages the application of environmental standards together with a strict supervision mechanism to stimulate the development of green agricultural supply chain.

- Government's Decree No.84/2019/ND-CP dated 14/11/2019 on fertilizer management: The Decree regulates fertilizer classification; applications, procedures and competence pertaining to issuance of Decision on recognition of fertilizer for trade in Vietnam; fertilizer import, state inspection of fertilizer import.

- Prime Minister's Decision No.491/QĐ-TTg dated 07/5/2018 approving adjustments to national strategy for integrated management of solid waste to 2025 with vision towards 2050. The Decision points out particular objectives related to agricultural sector as follows:

- 80% of solid waste discharged from cattle and poultry farming will be collected, reused or recycled into compost, biogas and treated meeting environmental protection requirement;

²² <https://www.vcci.com.vn/nong-nghiep-tuan-hoan-bien-nhung-thu-tuong-bo-di-thanh-%E2%80%9Cvang%E2%80%9D>

- 80% of agricultural by-products generated by businesses of agriculture must be collected, reused or recycled into friendly-environment materials, fuels or products;
- 100% of chemical and pesticide packaging used in agriculture industry must be collected, stored and handled as regulated by laws.

The Government requires that solid waste discharged from agricultural practices must be collected, reused, recycled into environmentally-friendly materials, fuels and products. Also, it needs to increase the collecting and handling of chemical or pesticide packaging used in agriculture as prescribed by laws. The Ministry of Science and Technology is assigned to foster the study or transfer of solid waste treatment technologies that are environmentally-friendly, waste generated from agriculture, agricultural by-products. The Ministry of Agriculture and Rural Development is assigned to promulgate detailed technical guidance on collecting and storing waste discharged from agriculture; boost the inspection, supervision and provide guidelines for the collection, transport and storing of packaging of chemical pesticides, fertilizers or veterinary drugs in agricultural practices.

- Prime Minister's Decision No.24/2014/QĐ-TTg dated 24/3/2014 on support mechanism for development of biomass power projects in Vietnam: This Decision provides support mechanism for development of projects generating power by biomass energy in Vietnam.

- Circular No.29/2015/TT-BCT dated 31/8/2015 of Ministry of Industry and Trade providing procedures for developing and approving master plans for development and use of biomass energy. Under this Circular, biomass energy used for production of electricity is defined as by-products, waste in agricultural production, agricultural and forestry processing and other types of plants which may be used as fuel for electricity production.

Research on case studies and best practices to apply circular economy principles to the Vietnamese context (2020) identified the key areas of agricultural sector should have prioritized actions for promoting circular economy practices including:

- Fertilizer management and use of organic fertilizer.
- Agricultural residue/waste management and agricultural residue/waste to products and energy. The study also indicated some existing gaps in implementing the actions, in terms of supporting policy, institutional capacity, technical capacity, market development, and user awareness, particularly:
 - Lack of supporting policies for managing fertilizer and promoting agricultural residue/waste to energy practices (i.e. low feed-in tariff for biomass-generated power).
 - Lack of effective collaboration among stakeholders (public, private, academia, and farmers) in delivering good practices for circular agriculture.

- Lack of technical capacity for treatment, reuse, and recycling of agricultural residue/wastes; use of secondary agricultural raw materials for producing organic fertilizers (i.e. technical standards for certifying the quality of organic fertilizers; testing the key parameters of organic fertilizers).
- The market for organic fertilizers and biomass-based energy is less developed.
- Lack of farmer's awareness on good practices (i.e. farmers are familiar with using inorganic fertilizers, but not organic fertilizers; burning of agricultural residue/wastes are common).

4.3 Construction industry

4.3.1 Overview of the construction industry

In the past ten years, the construction sector has been growing at 8.5% annually in Vietnam. According to the Business Monitor International (BMI), the construction sector's growth rate will remain at about 7.6% from 2018-2025 since infrastructure investment is considered a top priority, and urbanization has been increasing rapidly across the country. Vietnam has the potential to become Southeast Asia's new industrial center that contributes to expanding the industrial construction sector. It also witnessed a trend of smart residential areas and smart buildings, using environmentally friendly building materials.

Overall, Vietnam's construction, renovation, and demolition have generated a large amount of demolition waste (hereafter referred to as CDW. According to MONRE ^[70], it is reported that the CDW waste generation accounts for 10–12% of total municipal solid waste generation (about 60,000 tons/day). The current practice for CDW treatment is disposal at landfills, and the illegal dumping that can cause risks to human health and environment including transportation obstacle (i.e. CDW on pavements) can lead to accidents, impact on the urban landscape, air pollution (dust), and degraded infrastructure (i.e. sewer blockage).

4.3.2 Opportunities and challenges to apply circular economy in the construction industry

The main components of CDW can be recycled and reused. These materials contribute directly to saving resources, scaling down areas for CDW at landfills, and reducing the risk of environmental pollution and damage on the urban landscape. The Government has issued a number of mechanisms, policies, and laws to promote the application of circular economy principles in the construction industry, specifically:

- Construction Law No.50/2014/QH13: The Construction Law regulates requirements on having appropriate design solutions and reasonable construction costs; ensuring synchronism within the work and with related works; ensuring conditions on comforts, hygiene and health for users; creating conditions for people with disabilities, the elderly and children to use works. Taking advantages and limiting unfavorable impacts of natural conditions; prioritizing the use of local and environment-friendly materials (Article 79).

- Government's Decree No.24a/2016/ND-CP dated 05/4/2016 on management of building material: The Decree provides general policies on building material development, savings on natural resources of minerals and energy, and environmental friendliness (Article 37). The Government shall encourage and create favorable conditions for organizations and individuals to carry out research and development, application of science and technology for investment and production of building materials, savings on natural resources, minerals and energy, and environmental friendliness. These organizations and individuals shall receive investment incentives and subsidies from the state. The Government shall limit and gradually remove all dated production facilities that consume too much energy and are likely to cause environmental pollution.

- Government's Decree No.38/2015/ND-CP dated 24/4/2015 on management of waste and scraps: The Decree regulates management of solid waste from construction activities (Article 50). Under the Decree, solid waste from construction activities (including renovation and demolition of works, called as construction solid waste) must be classified and managed as follows:

- Soil, sludge from excavation, dredging topsoil, digging the foundation piles shall be used to cultivate the crop land or suitable land areas;
- Gravelly soil, solid waste from construction materials (brick, tile, grout, concrete, adhesives materials overdue) shall be recycled as construction materials or reused as backfill materials for the buildings or buried in construction solid waste landfill;
- Recyclable solid waste such as glass, steel, wood, paper, plastics shall be recycled and reused.

- Prime Minister's Decision No.491/QD-TTg dated 07/5/2018 approving adjustments to national strategy for general management of solid waste to 2025 with vision towards 2050. One of the key specific objectives indicates that 80% of ash, slag and gypsum discharged from power, chemicals and fertilizer plants shall be recycled, reused and treated as materials for production, construction, land grading, etc., meeting the environmental protection requirement. It needs to enhance the recycling and reusing of ash, slag and gypsum as materials for production, construction and land grading to meet the environmental protection requirement.

- Prime Minister's Decision No.1696/QD-TTg dated 23/9/2014 on measures to treat ash, slag and gypsum from thermal power, chemical or fertilizer plants for the production of building materials. The main objectives of this Decision include:

- Treat ash, slag and gypsum from thermal power, chemical or fertilizer plants to meet technical regulations and standards to become materials used for building material production, minimize environment pollution, save space for landfill sites, make contribution towards reducing exploitation of natural resources for building materials, ensure the sustainable development;
- Outline the roadmap to complete installation of line equipment for treatment of ash, slag and gypsum that can meet technical regulations and standards to become materials for building material production at thermal power, chemical or fertilizer plants;
- Increase the amount of domestic gypsum used as materials for construction in order to gradually reduce and restrict imported gypsum. Create a market in ash, slag and gypsum to be treated for building material production.

- Prime Minister' Decision No.452/QD-TTg dated 12/4/2017 approves the proposal to boost treatment and use of ash, slag and gypsum discharged from thermal power plants, chemical and fertilizer plants for production of building materials and for use in construction projects. The Government introduced their viewpoints on treatment and usage of ash, slag and gypsum:

- Ash, slag and gypsum (including gypsum obtained from furnace fumes emitted from thermal power plants, abbreviated as FGD (Flue Gas Desulfurization) gypsum; gypsum discharged from chemical and fertilizer plants, abbreviated as PG (Phosphogypsum) gypsum) must be treated and used in an effective manner. Use of ash, slag, FGD and PG gypsum for production of building materials and in construction projects can promote the reduction of land use in areas such as storage yards, and reduce natural resources and minerals for production of building materials sustainably.
- Plant owners shall take responsibility to treat and use ash, slag and FGD and PG gypsum produced during the production process.
- Ash, slag or FGD and PG gypsum, whether pre-treated or post-treated, which conforms to technical standards, regulations and instructions to serve as raw materials used for production of building materials and in construction projects, shall be classified as building material commodities and subject to applicable laws and regulations on commodity products.
- Ash, slag or FGD and PG gypsum conforming to technical standards, regulations and instructions shall be preferred for use as raw materials for production of building materials, engineering and construction projects (civil, industrial engineering and construction, traffic and transportation, agriculture and rural development and mine backfilling works, etc.).
- The Government shall provide preferential treatment policies for organizations or individuals that treat the use of ash, slag, FGD and PG gypsum as raw materials for production of building materials or in engineering and construction projects.

Although CDW has its significant potential for reuse and recycling, at present, it has not been given priority for construction development and recycling facilities. Related state agencies have issued strategies on solid waste management, but there are currently no detailed technical instructions to promote the treatment and recycling of CDW. At the same time, the necessary standards for recycling CDW and guidelines on the use of recycled materials (e.g roadbed material) have not been fully regulated.

Based on the research on case studies and best practices to apply circular economy principles to the Vietnamese context (2020), the following key areas of construction sector should receive prioritized actions for promoting circular economy practices:

- Circular design for construction sector.
- Appropriate management of CDW; reuse and recycling of waste/secondary materials (i.e. CDW, ash and slag generated at power plants and steel mills) for producing construction materials. There are some existing gaps in implementing the actions in terms of supporting policy, institutional capacity, technical capacity, market development, and user awareness, particularly:
 - Lack of supporting policies for circular construction (i.e. lack of concept, goal, regulatory framework for circular construction; insufficient legal foundation for organizations and individuals to carry out CDW related projects; lack of financial incentives).
 - Lack of effective collaboration among stakeholders (public, private, and academic sector) in delivering good practices for circular construction.
 - Lack of technical capacity for promoting circular design for construction sector and reuse and recycling of secondary materials for producing construction materials (i.e. lack of materials/products database; lack of green building material testing, labelling, and certification system; lack of technical standards/guidelines for circular design and passive design for buildings; treatment and use ash and slag generated at power plants and steel mills for producing construction materials; limited information on the potential use of ash and slag due to lack of scientific basis).
 - The market for circular construction is less developed (i.e. market supply of recycled materials is not always reliable; lack of information on recycled materials suppliers and recycled materials).
 - Lack of knowledge on good practices for circular construction (i.e. architects and design engineers do not consider recycled materials and products for project design and specification; uncertainty on whole life durability of recycled materials and products; perceived culture among construction professionals that recycled materials and products are inferior).

RECOMMENDATION ON VIEWPOINTS, OBJECTIVES AND SOLUTIONS TO PROMOTE THE TRANSITION TO CIRCULAR ECONOMY IN VIETNAM

1. Viewpoints

By studying international perspectives and considering the new development context of Vietnam, it proposes specific viewpoints, objectives and solutions to promote transition to CE in Vietnam as follows:

- Circular economy (CE) is a priority in the development of green economy to achieve sustainable development goals (SDGs) in Vietnam.
- Transition to CE in Vietnam contributes to achieving SDGs. It is crucial and timely to develop a roadmap, mechanisms, policies, and legislations for such transition.
- Transition to CE in Vietnam should be based on market principles. The Government plays a main role in enabling environmental policies while enterprises are the driving force in this transition. Each organization and citizen has an important contribution to the implementation of CE in all activities.
- CE brings economic benefits to businesses and society. CE requires businesses and communities to become more active and creative in order to develop suitable CE models in their fields.
- The plan gives priority to some strategic breakthroughs, namely technical infrastructure, human resources and science & technology to accelerate the transition to CE in Vietnam.

These viewpoints should be integrated into Vietnam's Socio-Economic Development Strategy 2021 - 2030 and the 5-year Socio-Economic Development Plan 2021 - 2025 as follows:

“Solving harmoniously the relationship between economic development and environmental protection by encouraging the implementation of a circular economy model. Developing a roadmap, mechanisms, policies, and regulation to formulate and operate circular economy models, contributing to the achievements of sustainable development goals”.

2. Objectives

To harmonize the relationship between economic development and environmental protection by encouraging the implementation of circular economy model, thus contributing to the achievements of sustainable development goals.

3. Proposed solutions for the socio-economic transition to circular economy and society

3.1 Improve the institutional system for transition to the circular economy in compliance with the socialist-oriented market economy

- Design and implement policies through trial and improve the legal framework to create favorable conditions for the transition to CE based on market principles.
- Institutionalize market principles as well as the “polluter pays principle” or “externality cost” so that environmental cost is incorporated into pricing for environmental pollution remedy, environmental rehabilitation, and habitat restoration, especially waste treatment (e.g. solid waste treatment should be charged at market prices).
- Enhance the application of economic instruments and financial mechanisms to regulate and accelerate the transition to CE (e.g. environmental taxes, environmental protection fees, and environmental rehabilitation deposits, payment of ecosystem services, eco-labels, green public procurement, green bonds, and deposit-refund system).
- Consolidate the local government system; clearly define roles, responsibilities and authority between the Central and local levels.
- Promote the role of people, businesses, socio-political organizations, professional organizations, and communities in the formulation. Review, and supervise the practice of policies and laws on natural resource management and environmental protection, especially waste management.

3.2 Restructure the national economy in association with the transition to the circular economy

Implement economic restructuring in which core industries related to CE are formed.

- In the industry segment, it is to prioritize the development of the green industry; pilot some clustering models in priority industries and develop new, energy-efficient, and environmentally friendly construction materials.

- In the agricultural segment, invest and develop organic agriculture and hi-tech agriculture²³, and promote farmer cooperation and linkages in agricultural production.
- In the services segment, develop environmental services²⁴ (e.g. drainage and wastewater treatment services; collection, treatment, disposal and recycling services; pollution remedy and waste management services).
- In the tourism segment, develop eco-tourism based on using, preserving, and restoring the functions of natural ecosystems.
- It is encouraged to establish eco-friendly markets and recycled products.

3.3 Develop regions and economic zones to enhance intra-regional and inter-regional connectivity, focusing on regional and multi-sectoral masterplan

- Design appropriate circular economy models for regions and economic zones in conformity with each region's characteristics and sustainable development goals.
- Build new rural models associated with circular economy and as below circular economy and increase investment in infrastructure, equipment, and technologies for waste management in rural areas.
- Develop an integrated management of water resources based on administrative boundaries and river basin levels.
- Synchronously develop and replicate models of coastal economic zones and eco-industrial parks in line with the formation and development of marine economic centers.
- Formulate linkages between regions in management and use of natural resources and environmental protection, focusing on the effective use of inter-provincial and inter-regional resources (such as water resources and natural habitats); as well as prevention and minimization of inter-provincial and inter-regional environmental issues and conflicts (wastewater, and ocean plastic waste).

3.4 Support strategic infrastructure construction to accelerate the transition to circular economy

- Prioritize investing in waste collection and treatment infrastructure.
- Promote the development of renewable and clean energy infrastructure for socio-economic development and ensure energy security.

²³ Article 2 of Decision No.66/2015/QĐ-TTg of Prime Minister regulating criteria and procedures for recognition of hi-tech agricultural zones: A hi-tech agricultural zone means a centralized production area where high technologies are applied to produce at least one advantageous agricultural product which ensure high yield, quality, added values and environmental-friendly manner under regulations of laws

²⁴ According to the Prime Minister's Decision No.39/2010/QĐ-TTg dated 11/5/2010 on the promulgation of the System of Vietnamese product industry, it can be seen that a number of product groups related to environmental services has been classified in Group E including E37: Drainage and wastewater treatment services; E38: Waste collection, treatment, disposal and recycling services; E39: Pollution treatment and waste management services.

3.5 Enhance mobilization and efficient use of investment resources

- Continue restructuring public investment. Investment capital is arranged to focus on low-carbon production and consumption.
- Encourage and attract non-state budget investment. Enhance public-private partnerships for infrastructure development for the green industry, eco-industrial parks, organic agriculture, and environmental services.
- Build financial institutions to support cleaner production enterprises and enterprises that apply circulate economic models in their businesses.
- Promote innovation among economic organizations and cooperatives that apply circular economic model in their operations.
- Promote the development of “green credit” and “green banking”; encourage investment in renewable energy, clean energy, and low-carbon production and consumption sectors.
- Discontinue the operation of projects with outdated technologies that cause environmental pollution or resource-intensive projects.

3.6 Develop human resources, education, and training to meet practical requirements

- Improve human resources capacity associated with labor restructuring that is required in the transition to circular economy (e.g. education and training of green jobs).
- Enhance campaigns and education activities to raise awareness of environmental protection and encourage sensible use of resources.
- Integrate knowledge and skills on circular economy practices (e.g. reducing, sorting, recycling, and reusing of waste, water and energy saving) in educational programs at all levels.
- Foster knowledge and provide case studies for government officials at managerial and policymaking levels, particularly those involved in the strategies, planning, and socio-economic developments.
- Organize training courses to improve the capacity of environmental protection and management, especially solid waste management for specialized government officials at the central and local levels.
- Support capacity building for agencies in both public and private sectors that are in charge of cleaner production, energy-saving, and waste recycling.
- Issue guidance for enterprises on how to use financial and technology tools to apply circular economy models in production and business activities.
- Design and implement communication programs to raise public awareness of schools, residential communities, state agencies, and production and business establishments on environmental protection, focusing on the reduction, classification, and reuse and recycling of solid waste.

3.7 Support scientific and technological breakthrough solutions and innovation to promote the transition to circular economy

- Implement regulatory sandbox schemes to promote the practice of circular economy models in all industries.
- Apply innovative technologies to circular economy models to improve the efficiency of manufacturing processes.
- Strengthen the operation of the national innovation system and innovation ecosystem.
- Build systems on national and local data and knowledge centers to create learning networks and peer-to-peer support systems.
- Enhance international cooperation in natural resources management and environmental protection, especially the protection and use of natural resources, and solid waste management.
- Accelerate the application of the best available technology (BAT) to gradually replace the existing outdated production lines that cause serious environmental pollution.

3.8 Improve the social perspectives and social responsibility in the transition to circular society

- Build a circular society where people are more engaged and actively responsible for reducing, reusing, and recycling waste.
- Promote green lifestyle and sustainable production and consumption.
- Improve social responsibility of enterprises and residents in compliance with legislation on environmental protection and the efficient use of resources.

3.9 Strengthen national defense, ensure national security, social order during the transition to circular economy

- Ensure national independence, sovereignty, territorial integrity, and the country's interests concerning natural resource management and environmental protection (e.g. issues related to transboundary hazardous waste, imported scrap which are used as raw materials).
- Ensure water security; promote cooperation with upstream countries and international organizations in protection and use of transboundary watercourses, especially the Mekong Delta and Red River.
- Support domestic enterprises to implement terms of commitment on natural resources and the environment in new-generation free trade agreements (e.g. terms on clean energy, low-emission technologies, renewable energy).
- Thoroughly handle establishments that cause serious environmental pollution.

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