

# Zero Plastic Waste in Vietnam

-- Based on an Innovative 3R Strategy

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**Abstract:** Currently, plastic products bring loads of benefits to people and are commonly used in Vietnam. However, abusing and discharging plastic goods also affecting the living environment. With increasing development in the plastic industry in Vietnam, the government needs to consider a solution to reduce the harmful environmental effect of plastic use. Vietnam has made some actions to fight against the “White pollution” problem. However, the current situation is not perfect for the public and for the country itself. Therefore, an ambitious vision can be proposed: in 2050, zero plastic waste in Vietnam will be achieved by implementing innovative 3R (Reduce, Reuse and Recycle) strategies. By 2050, all plastic in Vietnam will be recovered for their highest and best use, and no materials are sent to landfills or incinerators. To meet this goal, Vietnam will work from plastic’s production stage to its end life stage. From 2020-2030, Vietnam would introduce biodegradable plastic technology and enable every person to use biodegradable plastic; From 2030 to 2040, in the consumption stage, Vietnam will propose a better recycle system policy and enhance the governance to the public to make sure all biodegradable plastic is collected and recycled; From 2040 to 2050, Vietnam will introduce new technology to transfer the waste to energy. However, these strategies are critically examined and therefore several recommendations will be provided to help Vietnam to achieve the vision by 2050.

**Keywords:** Plastic Waste, Management, 3R Strategy, Vietnam.

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## 1. Introduction

Plastic pollution is considered a serious global environmental problem (Lacy et al., 2019). Over the past decades, wild marine animals face the heaviest threats because there are plastic debris and waste that pollute the ocean and coastal habitat. There are five south-east Asian countries are responsible for more marine plastic waste leakage than the rest of the world combined - and Vietnam has been listed as one of them (Lacy et al., 2019). According to Hai and Tuyet (2010), the plastic industry will have an increasing growth in Vietnam. Therefore, it is essential for Vietnam to control plastic waste and to reduce the negative effect of plastic on the environment. In this case, it is good for Vietnam to make a new vision for a sustainable future: to achieve zero plastic waste by 2050. Hence, the main goal of this essay is to solve the proposed question: How to achieve zero plastic waste in 2050 in Vietnam? In the following part, by using the evidence-oriented methodology, this essay will first discover the current situation and problems of plastic in Vietnam, and then propose a new vision with pathways based on innovative 3R strategy. Then the action plans and strategies are provided and discussed critically, followed by several suggestions and a future outlook.

## 2. Analysis

### 2.1. Current Situation in Vietnam

According to Greenhub (2019), Vietnam is the fourth country which has the most plastic waste in the world, and there are at least 730,000 tons of plastic waste leaking to the sea every year. Plastic waste not only harms the health of marine lives but also affected people’s health and life if it goes landfill directly. Truong and Vu (2019) has pointed out a business as usual scenario of Vietnam that if Vietnam

maintains the pace of use of plastic products, an additional 33 billion tons of plastic will be produced and therefore more than 13 billion tons of plastic waste will be recycled improperly or leak into the ocean by 2050.

To help to solve the plastic issue, Vietnam has made a good move from the source of plastic: the government has focused more on its domestic plastic waste by banning import from outside, for example, banned the import from China for recycling plastic in 2018. Moreover, Vietnam also implements 3R initiatives (Lacy et al., 2019). However, the recycling system for plastic in Vietnam has not been developed. The waste sorting and collection rate is very low, as different types of waste are put together and collected by waste trucks. Also, Due to insufficient investments in waste recycling technologies and resources, plastic recycling technology is outdated and not effective, costs much and pollutes the environment. Policies do exist but overlaps and conflicts remain; lack of enforcement. Moreover, Vietnam is a tourism-oriented country with a beautiful seacoast, therefore plastic problem needs to be solved to boost its economy and protect the environment (Jager and Munchau, 2020). Besides, to make plastic more environmentally friendly, the raw material of plastic can also be changed to reduce its harmful effect on the environment.

### 2.2. New Vision

Therefore, an ambitious vision could be provided, there would be no plastic waste in Vietnam in 2050. To achieve this new vision, there are several pathways to go. The vision can be divided into three parts based on 3R principles. 3R (Reduce, Reuse, Recycle) is the main principle to lead Circular Economy (Ranta et al., 2018). Combined with a current circumstance in Vietnam, an innovative 3R strategy (Reduce, Recycle, Recover) can be provided to guild the action plans, which shown in Table 1.

**Table 1.** Timeline of Action Plans

Timeframe	Goal	Action Plans
2020-2030	Reduce Single-Use Plastic Waste: All Plastic Product is Biodegradable	Building Infrastructures Introduce New Technologies Long-term R&D Investment on Technologies
2030-2040	Recycle Plastic Waste: All Plastic Produced can be Collected and Recycled	Plastic Classification Policy New Ordinance to Governance Producers and Public to do Collection
2040-2050	Recover Plastic Waste: All Remaining Non-recyclable Plastic can be Convert into electricity	Introduce New Recovery Technology

### 3. New Pathways

#### 3.1. Phase 1: 2020-2030: Reduce the Amount of Plastic Waste to be Managed: Biodegradable Plastic Production

Firstly, it is important to reduce waste from the production side. In recent years, plastics synthesized from petroleum have caused increasing environmental pollution (Wang et al., 2012). The replacing non-degradable petroleum plastics with biodegradable plastics are the future developing trend of the polymer materials industry. Biodegradable plastic is a type of microorganism that exists through nature, Such as polymer plastics that are degraded by the action of mould (fungi),

bacteria and algae (Brodhagen, 2015). Although Vietnam has started produced plastic in 2019, the total amount is not sufficient for the demand of the whole country because there are just a few producers of biodegradable plastics (Greenhub, 2018). Therefore, infrastructures of the plastic need to be firstly constructed for 3-5 years to ensure plastics manufacturers are shifting to environmentally friendly materials. In the next step, different biodegradable plastic technologies could be introduced in another 5 years. Biodegradable plastics have many types. Therefore, the Vietnam government also needs to introduce different technologies for diverse use. Table 2 shows the main types of technology for biodegradable plastics.

**Table 2.** Main types of technology for biodegradable plastics (Source from: John et al., 2015)

Plastic Type	Advantages	Application
Polyhydroxyalkanoates (PHA)	Biodegradability, biocompatibility	Drug release, organ transplantation, agricultural film
Polylactic Acid (PLA)	Good biocompatibility, degradability and derived from biological materials	Wrapping paper, agricultural greenhouse film, drug slow-release, insecticide, compost film
Polybutylene succinate (PBS)	Good biocompatibility and bioabsorbability, low production cost, high melting point, good mechanical properties and heat resistance	Live production, medicine, agriculture
Polycaprolactone (PCL)	Good biodegradability, excellent drug permeability	Microencapsulated pharmaceutical preparations, food packaging Materials, surgical sutures, medical equipment
Polyglycolic acid (PGA)	Good biodegradability and biocompatibility	Absorbable suture material, drug sustained release Materials, bone fixation materials, tissue repair fields

In the next step, R & D investment should remain and the amount of funding needs to be increased every year to ensure to advance the technologies and lower their cost in the future. Biodegradable plastic is recyclable under a certain

circumstance. Therefore, the next step needs to be regulating the collection and recycling system, to achieve all biodegradable plastic can be recycled and reused goal.

### 3.2. Phase 2: 2030-2050 Waste Recycling

#### Better Waste Sorting and Collection

In terms of waste recycling, Vietnam can learn from Sweden, as they have a successful and highly effective recycling system. In 2016, all Sweden's trash got disposal:

about 52% of total waste was burned to transform to energy, 47% of waste are recycled and only 1% of the waste left to be landfilled. The amount of energy generated from waste alone provides heating to one million homes and electricity to 250,000. (Hage and Söderholm, 2017).



Figure 1. Waste Classification in Sweden (Source from: Hage and Söderholm, 2017)

In the sorting part, Vietnam can make classification of different waste be clearer. Sweden has divided the waste into seven types and represented by different colours, shown in Figure 1. In this way, Vietnam can implement plastic classification policy. Residents can put different types of waste into certain coloured bags to make them easily recycled (Brodhagen, 2015). In 2030, with the widely use of biodegradable plastic, these biodegradable plastics can also be classified based on different recycling method they need. For example, PLA can be carried by a green coloured bag. Residents can use a certain coloured bag to carry certain plastic waste and put them into the same colour container. To enhance governance, identify code can be printed on each family's recycling bin and to monitor if this family does well in waste sorting.

In the collection and governance part, everyone has the responsibility to make the system more effective. Following the ordinance, Swedish producers have the responsibility to collect, remove and recover the packaging waste which is able to be recycled from their customers. Most plastic can be recycled to reuse, while the rest of plastics are used for energy recovery instead of landfills. (Parliamentary Auditors, 1999). Vietnam does not have this kind of ordinance. Therefore, the Vietnam government can complete the ordinance with more detailed instructions to force the producer to provide effective waste collection system. As municipalities, they are also responsible for supervising the collection of their plastic waste. Although they do not receive economic driving compensation as a producer, they still need to be motivated by some social norms which can also be provided by the government. Therefore, Vietnam can learn from Sweden's supervision system and improve it to make it better.

### 3.3. Phase 3: 2040-2050 Energy Recovery

#### Convert Plastic Waste into Electricity

To achieve zero plastic waste goal, only producing innovative biodegradable plastic is insufficient. When it comes to the end of life stage, the disposal of plastic still needs to be considered. In fact, there are still much single-use plastic needs to be disposal (RTI International, 2012). Energy recovery is a suitable method to dispose of plastic waste reasonably, as advancing technologies are able to convert the

energy in plastics into electricity, synthetic gas, fuels to lower the greenhouse emissions (American Chemistry Council, 2020). Therefore, the government can regard plastic waste as a resource and produce more energy to use.

Vietnam should introduce the technology that converts the waste into electricity, because Vietnam will meet shortage of electricity in a few years. The shortage is mainly because of the delay of power projects and each of them have 200MW capacity (Shi, 2019). Pyrolysis is a suitable choice. Pyrolysis is one of the best technology for converting plastic waste into energy (liquid fuel), which is the good material used to generate electricity. It has been used in Makkah and has produced about 87.91 MW of electricity using plastic waste in 2016 (Reham et al., 2016).

To implement this policy, the government can hold some campaigns to motivate the public to help collect the existing non-disposal plastic which is not collected before. For example, concerning more about shaping people social norms to facilitate household recycling behaviour.

## 4. Discussion

#### Key Barriers to Implement 3R strategies

Firstly, producing biodegradable plastic is a good way to reduce non-recyclable plastic and increase the rate of reusing plastic waste. However, the economic cost and time cost is huge. Vietnam may find hard to implement this strategy and to maintain doing it. In this case, the government can choose to invest more in technology and make it more advanced. In this way, they can earn profit from advanced technology when it is sold to other countries and therefore to create break-even situation in the future.

Secondly, in terms of the recycling system, there is a good waste recycling system implemented. However, public awareness may not increase at the same level. In fact, putting waste into the wrong bin may make more difficulty in the recycling process. Therefore, increasing public awareness of recycling plastic is still important. Hage et al. (2016) stated that the most essential factor that motivates consumer behavior is the convenience of the waste collection system. Additionally, the Vietnam government can consider giving more information or instructions to the public, for example, print clear labelling of containers. Moreover, People may be

hard to identify different types of plastic, as some of the plastics look similar. In this case, the government can print identity label on each plastic packaging or products to address this issue.

Thirdly, Energy Recovery Energy recovery is an effective method to deal with plastics fractions that cannot be recycled sustainably (Plastic Europe, 2020). However, the process of energy recovery produces pollution, which may hinder the way of implementing this policy. This issue can be solved by new patent released in China: New pollution disposal system for the waste recovery process.

Overall, the scope of this vision is board, so that many aspects of plastic disposal still needs to be discussed, for example, the microplastic added in cosmetics. These issues can be discussed in the future.

## 5. Conclusion

In conclusion, there are three main pathways for Vietnam to achieve its ambitious vision: Zero Plastic Waste by 2050, following the principle of innovative 3R strategy (Reduce, Recycle, Recover), and action plans are designed to meet the goals at each timeline: Firstly, introduce biodegradable plastic technologies to achieve 100% biodegradable plastic production by 2030; Secondly, formulate biodegradable plastic waste classification policy and introduce governance towards behavior of producer and public, to ensure all plastic products waste can be collected and recycled by 2040; Finally, collect the rest non-recyclable plastic, converting them into electricity, to address electricity shortage in Vietnam by 2050. Although there are some barriers or disadvantage of these action plans, including lack of money in investment process, low awareness of public, and high pollution problem, several recommendations combined with Vietnam situation are provided. However, the vision is hard to achieve, as there are still many detailed area not concerned. If this vision would achieved successfully, Zero Waste vision can be considered by Vietnam in the future.

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