ECOLOGICAL EDUCATION FOR SCHOOLS IN HOI AN

A Teacher´s Guide

HỘI AN

UN environment programme

IETC Technology for Environment

IGES Institute for Global Environmental Strategies

CCET IGES Centre Collaborating with UNEP on Environmental Technologies

ECOLOGICAL EDUCATION FOR SCHOOLS

in Hoi An - A Teacher´s Guide

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GHG:	Greenhouse gas
SCP:	Sustainable consumption and production
SDGs:	Sustainable Development Goals

Preface

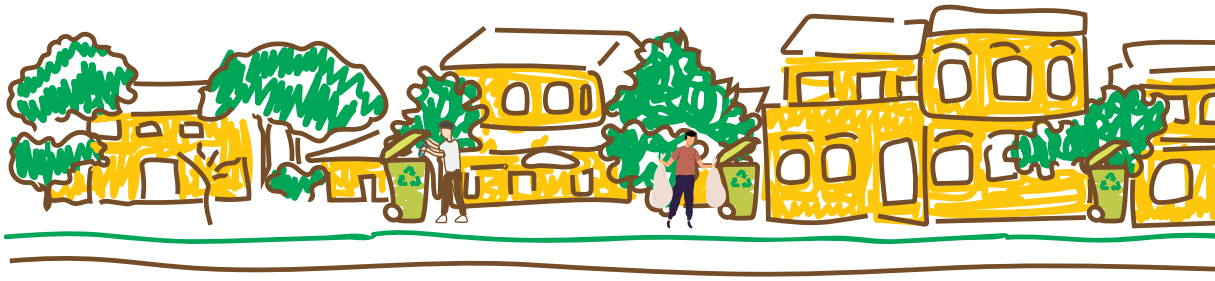
The ancient city of Hoi An was declared a World Cultural Heritage Site by UNESCO on December 4, 1999. After more than a decade of development, Hoi An´s economy continues to grow and develop evenly in all areas, especially in the tourism sector. However, this development faces many risks such as environmental pollution, increasing waste, climate change, natural disasters and epidemics, all of which challenge the development of Hoi An City

In December 2009, the City People´s Committee (People´s Committee) announced a plan to build **"Hoi An – An Eco-City"** Following that, in 2017, an Action Plan was approved for Hoi An to become **"An Eco-city - Raising awareness and responsibility for environmental protection of enterprises"**. Notably, on September 30, 2021, Hoi An City People´s Committee, Quang Nam Tourism Association and related parties held a signing ceremony and announced the **"Business plan framework to reduce waste towards Hoi An"**. – A green destination for the period of 2021-2023". These are Hoi An´s strong commitments to promote the sustainable development goals.

In order to achieve these goals, education plays a very important role. In Hoi An, environmental education activities have been carried out in formal and extracurricular settings for many years with promising results. Some environmental education materials were developed and communicated to teachers. In particular, the "One hour for a cleaner Hoi An" Campaign is regularly held every Friday afternoon. However, Hoi An does not currently have any environmental education materials that have been compiled for teachers and updated in line with Viet Nam´s Sustainable Development Goals and the 2030 Agenda. In collaboration with Hoi An City, the Faculty of Education of Da Nang University, and the IGES Centre Collaborating with UNEP on Environmental Technologies (CCET), this material entitled **"Ecological Education for Schools in Hoi An: A Teacher's Guide"** has been developed. It was prepared to support teachers and others involved in education and communication in promoting an ecological lifestyles. It integrates knowledge, skills and practical experience into a training programme for primary and secondary school students to promote ecological lifestyles. It is our hope that these learning materials will contribute to the promotion of environmental education activities for sustainable development in Hoi An City.

Vice-Chairman of Hoi An People's Committee

Nguyen Minh Ly



Acknowledgments

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Introduction

On December 15th, 2009, the People´s Council of Hoi An City approved a Resolution on "Building Hoi An as an Eco-City", with three specific criteria aiming to ensure balanced and sustainable development, not only promoting economic and social development, but also focusing on environmental protection. During the process of building the eco-city, Hoi An has been promoting many activities to protect the environment and natural resources, which have achieved many remarkable results in recent years. Despite the fact that the city has a population of only about 100,000 people, due to its being a tourist city, Hoi An attracts more than 5 million visitors annually (as reported in 2019), which is expected to continue to increase in the coming years. Therefore, one of the great pressures on the city is the effective management of a large amount of domestic waste (from households, restaurants, hotels and commercial areas), including plastic waste leaking into or retained in the environment every day. Rational use and effective management of these waste not only contributes to the reduction of environmental pollution and resource saving, but also contributes significantly to reducing greenhouse gas (GHGs) emissions and to promoting sustainable lifestyles and consumption for each individual and community and for the whole of society.

Within the framework of cooperation between the Environmental Agency of Hoi An City, the University of Da Nang and IGES Centre Collaborating with UNEP on Environmental Technologies (CCET), this environmental education guide, titled **"Ecological Education for Schools in Hoi An: A Teacher's Guide"**, has been developed as a supporting document for teachers and those involved in education and communication activities in Hoi An schools to promote a so-called "eco-lifestyle" through integration of knowledge, skills and practical experience in training programs for primary and secondary school students.

Introduction

"Ecological Education for Schools in Hoi An: A Teacher's Guide"

The "Ecological Education for Schools in Hoi An: A Teacher´s Guide" covers various environmental issues from the 2030 Agenda for Sustainable Development with its 17 global Sustainable Development Goals (SDGs), including climate change, biodiversity, air, land and water pollution, waste management, and sustainable consumption and production. Particular attention is given to waste management (including food waste or organic waste and plastic waste) and climate change, because these environmental issues are closely related to the daily activities of students and are also important issues for Hoi An. The topics can be easily added and continuously updated by teachers in their curricula in the future based on their needs. The note can also be used as a reference to improve knowledge and spread an eco-lifestyle in the community in general.

This Teacher´s Guide consists of three main parts. Part 1 gives an overview of Hoi An, including the plan for "Building Hoi An as an Eco-City" and some of the results achieved. Part 2 provides some key teaching contents related to eco-lifestyle, which, within the scope of this Teacher´s Guide, includes: (i) sustainable development in general, (ii) waste management (domestic waste, plastic waste and hazardous waste), (iii) waste-to-resource conversion, and (iv) sustainable consumption and production models in Hoi An. Part 3 introduces specific lessons and actions to promote sustainable lifestyles for students, with lecture content related to the four subjects mentioned above.

I. Introduction to Hoi An City

1.1. Geography

Located in Quang Nam Province, Hoi An is a class-3 urban area. Covering an area of 61.71 km2, the city is located on the north bank, toward the downstream end of the Thu Bon River. Its geographical position extends from 15°15´26" to 15°55´15"N latitude and from 108°17´08" to 108o23´10"E longitude. The city is about 9 km from National Highway 1A to the east, 25 km from Da Nang City to the southeast, and about 50 km from Tam Ky City to the northeast. The mainland of the city covers an area of 46.22 km^2 (accounting for 74.9% of the total natural area of the city). The inner city center of Hoi An includes the wards of Minh An, Son Phong and Cam Pho, in which the Ancient Town of about $5km^2$ is recognized by UNESCO as a World Cultural Heritage Site (December 4th, 1999).

Figure 1. Administrative map of Hoi An City

1.2. Climate

Hoi An has the following climate characteristics

- Temperature: The highest temperature is 38°C and the lowest is 16°C, with an average yearly temperature of 27°C.

- Humidity: Humidity is 75% in the dry season and 85% in the rainy season, for an average annual humidity of 83%.

- Precipitation: There are 2 distinct seasons, the dry season from January to August and the rainy season from September to December. The average yearly rainfall is 2,504.6 mm/ year. October and November are the two months with the highest rainfall, while January, February, March and April have the lowest rainfall.

- Hours of sunshine: The average hours of sunshine in many years is 2,158 hours/year. May has 248 hours of sunshine, making it the month with the most sunshine, while December has the least with 12 hours.

- Wind regime: There are usually two wind regimes in the year. The northeast monsoon usually appears from September to January of the following year, and the southwest monsoon usually appears from February to August. Additionally, during the year, the city experiences the cool and pleasant southeast monsoon, alternating between northeast and southwest monsoons.

- Storms: Storms usually appear in September, October and November, often bringing heavy rains that cause flooding across the city.

In general, Hoi An features a humid tropical monsoon climate with the characteristics of a coastal area. This creates favorable conditions for the development of marine and aquaculture industries. However, Hoi An is also affected and impacted by many storms, tropical depressions, saltwater intrusion, erosion, etc. during the year…

1.3. Population

As reported in 2019, Hoi An has a population of 98,599 people, with a big gap between the urban population and the rural population. According to the Quang Nam Statistical Yearbook 2017, the urban population accounted for about 79% (74,361 people) while the rural population accounted for nearly 21% (20,218 people).

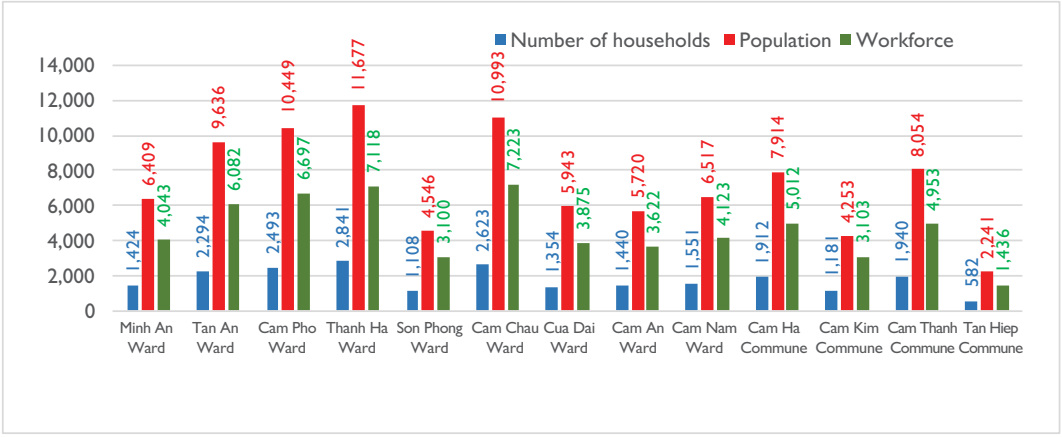


Figure 2. Distribution of population and workforce in the city in 2016 (according to Hoi An White Book 2018)

The population is densely concentrated in urban wards, including Tan An, Cam Pho, Thanh Ha and Cam Chau. In addition, because of the high employment rate in urban areas, especially from the development of the tourism economy, the number of workers in urban areas is much higher than in peri-urban areas.

1.4. Economy

Under the average economic structure of Hoi An during the period 2014–2018, the value of services, tourism and trade accounted for 65%; industry, cottage industry and construction accounted for 27%; and agriculture, forestry and fishery accounted for 8%. In 2019, there was steady growth and development in all economic sectors. Gross output in constant 2010 prices was estimated at VND 11,780.9 billion with an increase of 14.34% compared to 2018, 5.22% higher than the target in the plan. Per capita income reached VND 53.1 million, an increase of VND 3.1 million compared to the plan.

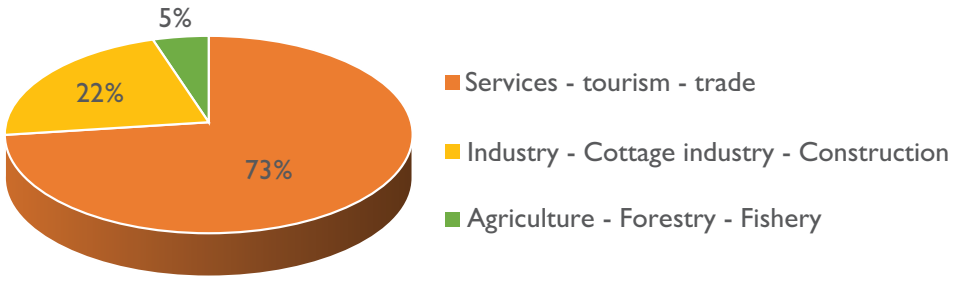


Figure 3. Structure of gross output of economic sectors of Hoi An City (2019)

In 2019, the services, tourism and trade sector continued to grow and play a key role in the economic structure of Hoi An. Gross output of the sector is estimated at VND 8,563.6 billion. Industry, cottage industry and construction achieved steady growth with an estimated gross output of VND 2,603.9 billion. The gross output of the agriculture, forestry and fishery sector reached VND 613.32 billion (Center for Culture, Sports and Radio-Television of Hoi An City).

Besides the advantage of being located near Quang Nam Province´s Chu Lai Airport and Da Nang City´s modern international airport, Hoi An also has a special advantage with its location on the "World Heritage Road located in Central Vietnam" with its most attractive destinations including Hoi An, My Son and Hue. This is considered a favorable condition enabling Hoi An to attract a large number of domestic and foreign tourists.

The tourism, service and trade sector play key roles in the economic structure. Cottage industry has a diverse development. Agriculture is gradually shifting towards modern ecological agriculture, gradually developing the marine economy suitable to the level and capacity of the city.

1.5. Eco-City

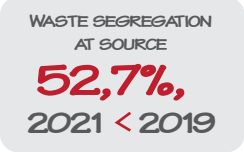
Based on the policy of "Building Hoi An as an Eco-City" from 2009, the city has been promoting the protection of natural resources and the environment. Currently, the City People´s Committee is coordinating with domestic and foreign organizations to implement projects for environmental protection and sustainable development, including the "Improved Municipal Solid Waste Practices to Reduce Short-Lived Climate Pollutants (SLCPs) in Vietnam"

project funded by the Federation of Canadian Municipalities (FCM) and "Local Solutions for Plastic Pollution" (LSPP) project funded by the United States Agency for International Development (USAID) with coordination by the Centre for Supporting Green Development (GreenHub). These projects help Hoi An gradually achieve positive results in building Hoi An as an "eco-city":

The report on implementation of Plan No. 801/KH-UBND, dated April 7th, 2021, of the Hoi An City People´s Committee on solutions to reduce the use of plastic bags and single-use plastic products, improved efficiency of waste reduction, separation and treatment at the source to protect the environment of Hoi An in 2021 pointed out some results achieved as follows:

- Most agencies, units and schools no longer use single-use plastic bottles and cups at offices and meetings.

- Some local businesses have converted to use eco-friendly items to serve the needs of customers.



- Three Materials Recycling Facilities (MRFs) have been piloted and put into operation in Cam Thanh, Tan Hiep Communes and Cam An Ward, which contribute to reducing a significant amount of biodegradable and recyclable organic waste.

- Despite the remarkable results achieved, there are still outstanding problems. According to statistics, the total amount of single-use plastic waste in 2021 will increase by 3,52% compared to 2020. The rate of waste separation at the source in 2021 will reach 52,7%, a decrease of 17,3% compared to 2019 (70%).

- It can be seen that communities, enterprises, production, business and service establishments have not paid due attention to environmental protection and waste separation at the source and reducing the use of plastic bags and single-use plastic products. Consequently, the policies proposed by the city have not achieved the desired results. Waste separation at the source has not been maintained by the local people and has tended to decrease in recent years despite improved propaganda activities.

- It is clear that, in the current context of Hoi An, it is essential to implement environmental education in the community and integrate it into school programs, especially at primary and secondary schools. Environmental education helps students and community understand the close relation between our daily living habits and lifestyle with the surrounding natural environment, thereby helping them have the right awareness and adjust consumption habits and daily activities in a more environmentally friendly manner.

II. Lesson I: Sustainable Development Goals (SDGs)

Part 1: General information

A. SDGs

1. What are the SDGs?

The SDGs are a set of targets which are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace and justice. Sustainability means to avoid the overuse of natural resources in order to maintain an ecological balance.

The SDGs are created by the United Nations and promoted as the Global Goals for Sustainable Development. There are 17 goals and 169 specific targets for the goals.

Figure 4. Sustainable Development Goals (SDGs)

2. Why are they important?

The 2030 Agenda for Sustainable Development was launched in 2015 to end poverty and set the world on a path of peace, reverse climate change, and create prosperity and opportunity for all on a healthy planet, guaranteeing the human rights of all.

3. How can they be achieved?

They require immense political will and ambitious action by all stakeholders, but global efforts to date have been insufficient to deliver the change we need, jeopardizing the Agenda´s promise to current and future generations. The number of people suffering from food insecurity is on the rise, the natural environment continues to deteriorate at an alarming rate, and dramatic levels of inequality persist in all regions. Change is still not happening at the speed or scale required. Now, due to COVID-19, an unprecedented health, economic and social crisis are threatening lives and livelihoods, making the achievement of the SDGs even more challenging. The livelihood of half the global workforce has been severely affected. More than 1.6 billion students are out of school, and tens of millions of people are being pushed back into extreme poverty and hunger, erasing the modest progress made in recent years[1].

Delivering the SDGs requires renewed ambition, mobilization, leadership and collective action, not just to beat COVID-19 but to recover better together, winning the race against climate change, decisively tackling poverty and inequality, truly empowering all women and girls, and creating more inclusive and equitable societies everywhere.

The Government of Vietnam, on May 10th, 2017, issued the "National Action Plan for the Implementation of the 2030 Agenda for Sustainable Development" (SDG NAP). The SDG NAP clearly outlines what Vietnam is committed to implementing under the 17 SDGs with detailed terms, and sets out targets, tasks and assignments of responsibilities for all agencies and sectors. The education sector plays an extremely important role in propagating, educating and raising society´s awareness of sustainable development, the SDG NAP and the implementation the SDGs in Vietnam (the Ministry of Education and Training takes the main responsibility for SDG 4 "Ensure inclusive and equitable quality education" and SDG 13 "Respond in a timely and effective manner to climate change")[2].

1. https://unstats.un.org/sdgs/report/2020/

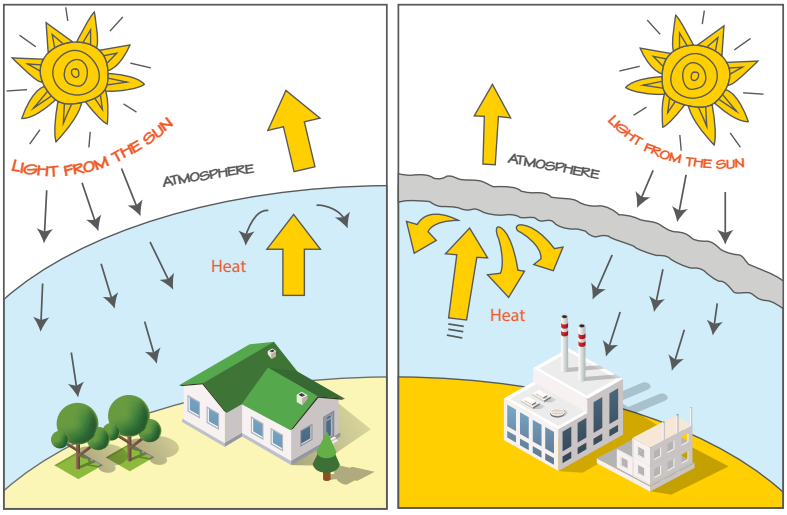
2. For details of the full text of the Agenda, please refer to: https://vietnam.un.org/sites/default/files/2020-08/ke%20hoach%20hanh%20dong%20quoc%20gia_04-07_VN_CHXHCNVN%20%281%29.pdf

B. Climate Change and Global Warming

1. What is climate change, and how does global warming happen?

Climate change is a long-term shift in global or regional climate patterns. The following phenomena represent global climate change.

- From 1880 to 2012, average global temperature increased by 0.85°.
- Oceans have warmed, the amounts of snow and ice have diminished, and from 1901 to 2010, the global average sea level rose by 19 cm as oceans expanded.
- Given current ongoing emissions of greenhouse gases, it is likely that by the end of this century, the increase in global temperature will exceed 1.5°C compared to 1850 to 1900 in all but one scenario. Consequently, average sea level rise is predicted to be 24–30cm by 2065 and 40–63cm by 2100.
- In the period from 2010 to 2019 was the warmest decade ever recorded, bringing with it massive wildfires, hurricanes, droughts, floods and other climate disasters across all continents.



The earth maintains the proper temperature by wearing the blanket of the atmosphere (without the blanket of the atmosphere, the average temperature is would to become 19 degree below zero).

Now the blanket of atmosphere becomes too thick, because the gas warming the earth has increased excessively. This causes global warming.

Figure 5. Greenhouse effect

The rise in the temperature worldwide is called “global warming.” The atmosphere wraps the earth like a blanket. Thanks to the blanket, the earth catches heat given from sunlight and makes the temperature comfortable for our lives. Now, the blanket of atmosphere is getting too thick because the gas warming the earth is increasing too much. This is called the “greenhouse effect” and these gases are called “greenhouse gases” (GHGs).

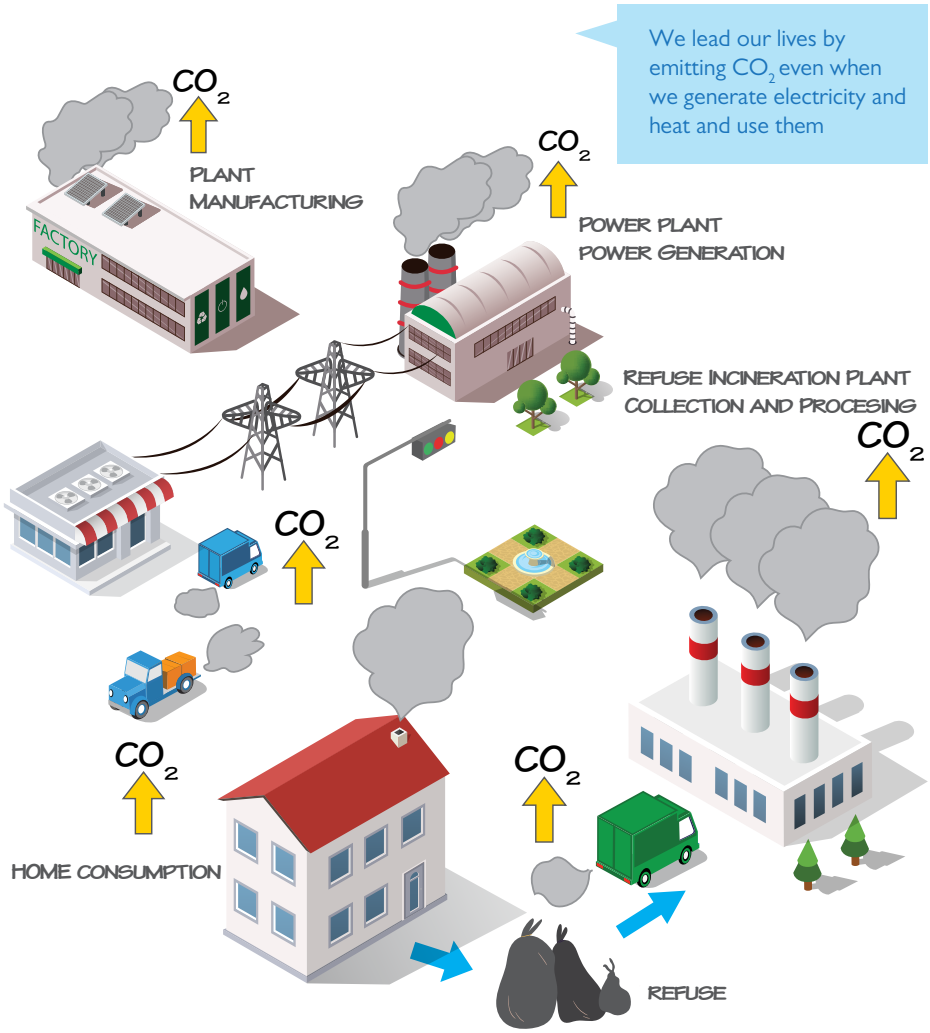


Figure 6. CO_2 emissions around our community

Most GHGs are natural. Water vapor is the most common, and it causes most of the greenhouse effect on Earth. Other GHGs are carbon dioxide (CO_2), methane (CH4), nitrous oxide (N2O), ozone (O_3) and some artificial chemicals such as chlorofluorocarbons (CFCs).

2. Why is it important?

Climate change will cause average global temperatures to increase beyond 3°C in

the period from 2081 to 2100, and will adversely affect every ecosystem. Already, we are seeing how climate change can exacerbate storms and disasters, as well as threats such as food and water scarcity, which can lead to conflict. Doing nothing will end up costing us a lot more than if we take action now. To limit global warming, greenhouse gas emissions must begin falling by 7.6% each year starting in 2020.

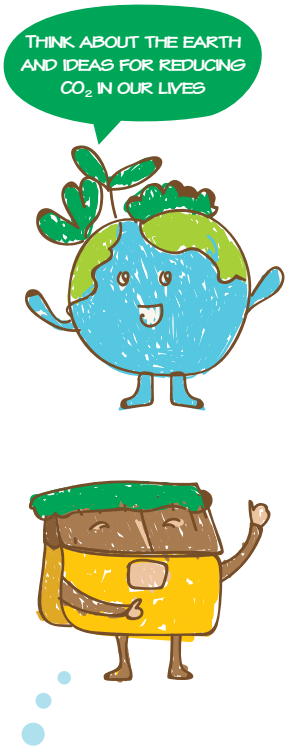
3. How can we mitigate global warming?

SDG 13 urges action to combat climate change and its impacts. Climate change is now affecting every country on every continent. It is disrupting national economies and affecting lives, costing people, communities and countries dearly today and will cost even more tomorrow.

Vietnam ratified the Paris Agreement in 2016 and has engaged in keeping global temperature rise this century well below 2°C, while pursuing efforts to limit the temperature increase even further to 1.5°C[3]. To achieve this, GHG emissions must be reduced to net zero by 2050. Not only nations but many businesses and investors are also committing themselves to lowering their emissions, not just because it is the right thing to do, but because it makes economic and business sense as well.

CO_2 which is the primary GHG emitted through human activities, is released by burning fossil fuels like oil, coal and natural gas from transportation, energy and industry. We can help to reduce GHGs by using energy and resources more wisely, transforming waste to resources, and planting trees which absorb CO_2 and give off oxygen (O_2). The figure 7 below shows the amount of CO_2 emitted by each daily activity.

3. https://www.un.org/sustainabledevelopment/climate-change/



"Environmental issues, prevention of global warming, reduction of CO_2… I do understand the global environment but the scale of issues are too large to see what I should begin with."

For such a person, the following are methods of global warming prevention you can do right now and the amount of CO_2 you can save per year.

IDEAS IN OUR LIVES	CO^2 AMOUNT THAT CAN BE SAVED PER YEAR
IN THE LIVING ROOM	
▸ **Heating / Cooling**	
• **Temperature:** - If cooling temperature is raised by one degree (28 degrees)	CO_2 29.2 KG
- and warning temperature is lowered by one degree (20 degrees)	CO_2 11.2 KG
• **Energy-saving lighting** - If lights are replaced with compact fluorescent lights	CO_2 29.4 KG
▸ **TV**	
- If the use is reduced by one hour per day	20-INCH CRT CO_2 5.9 KG 20-INCH LCD CO_2 19.8 KG
- If TV screen brightness is adjusted to optimum	32-INCH PLASMA CO_2 9.5 KG 5-INCH CRT CO_2 53.2 KG
▸ **PC**	
- If the use is reduced by one hour per day	DESTOP CO_2 11.0 KG LAPTOP CO_2 1.9 KG
IN THE BATHROOM	
▸ **Water heater** (reheating feature) Taking a bath without intervals	CO_2 87.0 KG
▸ **Shower** Not letting water run unnecessarily	CO_2 29.1 KG
IN WASHING	
▸ **Washing machine** - Washing clothing collectively Reducing washing frequencles based on the machine capacity	CO_2 2.1 KG
IN THE KITCHEN	
▸ **Electric refrigerator** - Adjust to the optimum temperature. If the temperature is adjusted from high to low	CO_2 21.6 KG
- Install behind the wall by allowing appropriate space	CO_2 15.8 KG
▸ **Dishwasher-dryer** - Wash dishes collectively when the machine is used. If dish washing is changed from manual washing to machine washing	CO_2 37.6 KG
▸ **Microwave oven** - Use microwave oven for preparing vegetables	CO_2 15.4 KG

Figure 7. Suggestions for the reduction of CO_2 emission

Every one of us can help limit global warming and take care of our planet. By making choices that have less harmful effects on the environment, we can be part of the solution and influence change. The energy, food and transport sectors each contribute about 20% of lifestyle emissions. From the electricity we use to the food we eat and the way we travel, we can make a difference.[4]

4. https://www.un.org/en/actnow

Figure 8. Take action to reduce GHG emissions[5]

a. Save energy at home

Most of our electricity and heat is powered by coal, oil and gas. By using less energy by lowering your heating and cooling, switching to LED light bulbs and energy-efficient electric appliances, washing your laundry with cold water, and hang-drying it instead of using a dryer, switching off electrical equipment after using, controlling the air conditioner at a temperature higher than 26 degrees Celsius you will also save money!

b. Walk, bike or take public transport

The world´s roadways are clogged with vehicles, most of them burning diesel or gasoline. Walking or riding a bike instead of driving will reduce GHG emissions and help your health and fitness. For longer distances, consider taking a train, and carpool whenever possible.

c. Eat more plant-based foods

Eating more vegetables, fruits, whole grains, legumes, nuts and seeds, and less meat and dairy, can significantly lower your environmental impact. Producing plant-based foods generally results in fewer GHG emissions and requires less energy, land and water.

5. https://www.un.org/node/143154#drive-less

d. Fly less

Airplanes burn large amounts of fossil fuels, producing significant GHG emissions. That makes taking fewer flights one of the fastest ways to reduce your environmental impact. When you can, meet virtually, take a train, or skip that long-distance trip altogether.

e. Cut your food waste

When you throw food away, you´re also wasting the resources and energy that were used to grow, produce, package and transport it. When food is buried in a landfill, it produces methane, a powerful GHG, so use what you buy and compost any leftovers.

f. Reduce, reuse, repair and recycle

Electronics, clothes and other items we buy cause carbon emissions at each point in production, from the extraction of raw materials, to manufacturing, to transport, to market. To protect our climate, buy fewer things, shop second-hand, repair what you can, and recycle.

g. Change your home's source of energy

Ask your utility company if your home´s energy comes from oil, coal or gas. If so, see if you can switch to renewable sources such as wind or solar. Or install solar panels on your own roof to generate energy for your home.

h. Switch to an electric vehicle

If you plan to buy a car, consider going electric, as more and cheaper models are coming on the market. Even if they still run on electricity produced from fossil fuels, electric cars help reduce air pollution and cause significantly fewer greenhouse gas emissions than gas or diesel-powered vehicles.

i. Choose eco-friendly and local products

Everything we spend money on affects the planet. You have the power to choose which goods and services you support. To reduce your environmental impact, buy local and seasonal foods, and choose products from companies committed to cutting their GHG emissions and waste and using resources responsibly. By doing so, you will not only reduce transport costs and environmental impacts through fewer pesticides, but also help farmers in your community or city.

j. Speak up

Speak up for bold action by all sectors of society. Appeal to world leaders, urge your city, region and university, and encourage businesses to take urgent action toward net-zero emissions. Concrete steps by global and local leaders will determine our ability to rapidly transition to a climate-resilient future.

k. Join hands

Join hands to protect the existing ecosystem including poplar forest, coconut forest along the coast. Additionally, more of them should be planted to help with erosion and coastal erosion. Ecological conservation areas need to strictly protect and maintain the diversity of ecosystems.

Part 2: Hoi An's case

A. Eco-city

In 2009, the project to build Hoi An into an eco-city was approved for the first time, with three "criterion groups" to ensure the protection of the natural and social environment and sustainable development.

Criterion group 1: Ensuring the natural environment: **"Clear – Green – Clean – Beautiful".** The goals in this criterion group are set out to ensure a green, clean and beautiful natural environment with contents such as:

- Clarifying the traffic system
- Ending flooding in road areas (except in the case of major floods)
- Ensuring that sidewalk corridors are periodically swept, clean and well-ventilated
- Arranging street lights and signs, warnings and billboards properly
- Planting more trees in public areas
- Fully meeting needs for clean water of people and families in suburban areas
- Ensuring quality of the water and air environment, reaching the prescribed levels in National Technical Regulations (QCVN)
- Collecting and treating garbage
- Arranging and cleaning public toilets and trash cans

Criterion group 2: Ensuring the social environment: **"Convenient – Safe – Civilized – Friendly and bold with local identity".** This criterion group is built to ensure the requirements for the social environment, creating a civilized, safe and friendly society for local people and tourists. Some of the major contents are as follows:

- Building a coherent and solid political system
- Properly organizing emulation movements in cities, wards and communes
- Ensuring security and order in neighborhoods and residential areas
- Restricting and preventing fires, explosions and natural disasters, and taking supported measures when incidents occur
- Preserving cultural values for tangible and intangible cultural heritage
- Ensuring a high annual achievement rate of cultural families, villages, communes and wards

Criterion group 3: Ensuring the sustainability of natural resources and protecting the natural environment, including:

- Conserving the Cu Lao Cham ecosystem
- Protecting and developing the nipa palm ecosystem
- Using environmentally friendly building materials
- Using clean energy sources
- Properly preserving and exploiting water and mineral resources
- Reducing population growth
- Designing and constructing buildings in a natural environment-friendly manner, saving materials and energy, and preserving the traditional architecture of Hoi An
- Propagating and guiding people to use Eco - friendly products

In addition to these evaluation criteria to help Hoi An achieve sustainable development goals, the city has also introduced contents aimed at economic development without causing damage to the environment.

- Development strategy for the tourism industry towards ecotourism with educational activities and guidance on environmental knowledge through experiential activities, and tourism activities with the participation of local people, activities for environmental protection, ecosystem maintenance, conservation and development of longstanding cultural values in Hoi An.

- For industry and manufacturing, it is essential to select investment projects in clean technology which are suitable to the environment, advantages and local potential, relocating production facilities that pose a risk of causing pollution to people in residential areas and urban areas.

- **Developing traditional craft villages** which are associated with tourism activities to attract investment in production and services, thereby solving employment problems for local people. Creating typical cultural products and souvenirs for tourists to Hoi An.

- **For agriculture,** it is necessary to: manage the use of crop-protection products (such as pesticides, herbicides, etc.) by expanding the organic vegetable garden; develop concentrated poultry and cattle rearing areas for communes, wards and suburbs; encourage people to not raise livestock and poultry in the city; and effectively implement the prevention and control of poultry and livestock epidemics in the locality.

- **For fishery,** it is necessary to develop offshore fishing such as deep-sea fishery and reduce inshore and offshore fishing, and to organize propaganda and mobilize fishermen to strictly comply with state regulations on exploitation processes, sea food fishing and environmental protection.

- **Restoring traditional fishing villages in Cam An, Tan Hiep, Cam Kim, etc.,** . to enrich the cultural products of Hoi An Heritage.

B. Impacts of climate change on Hoi An

Vietnam is identified as one of the countries likely to be most affected by climate change. The frequency and intensity of natural disasters has increased in recent years due to the impacts of climate change, causing huge losses in terms of life, property, infrastructure, economy, culture and society in addition to negative impacts on the environment. The Ministry of Natural Resources and Environment (MONRE) developed and promulgated "Climate Change: Sea Level Rise Scenarios for Vietnam" in 2009, which was updated in 2016[6].

Hoi An is prone to climate change impacts due to its geographical location at the end of rivers and estuaries, and its rather low-lying terrain. Research results of MONRE and experts show that:

6. Details of climate change scenarios updated to 2016: https://vihema.gov.vn/wp-content/uploads/2015/12/01.-Kich-ban-BDKH-va-NBD-cho-VN_2016-Tieng-Viet.pdf

- The temperature of the whole country of Vietnam continues to increase in all emission scenarios. Particularly for Quang Nam province, including Hoi An, the average annual temperature increases to a maximum of 2,6°C by the end of the century under the RCP4,5 medium emission scenario, and 4,2°C in the RCP8.5 high emission scenario. Furthermore, there is a difference in the variation of average temperature between seasons, with the highest increase of up to 5°C in summer by the end of the century in the RCP8,5 high emission scenario.

- Hoi An´s yearly rainfall in the latter half of the century also tends to increase. Especially, the maximum 1-day rainfall intensity and rainfall (Rmax1day) also tend to increase, showing that the rainfall is getting heavier, leading to an increase in urban flooding as mentioned above.

- More attention is being paid to extreme events, in which storms are an important feature. Many research findings show that climate change has not increased the frequency of tropical cyclones, but large typhoons with unusual characteristics have occurred more frequently, especially super typhoons. Despite having a smaller scope of activity, cyclones often have quite high wind speeds, which can reach levels of 11 or 12, and this phenomenon also tends to increase due to the impact of climate change.

- There is a significant rise in sea level in coastal areas of Vietnam in recent decades. The ocean in the Central region, which includes Hoi An, has increased by an average of 2,9 mm/year.

Some considerable impacts of climate change on Hoi An include:

a. Floods affecting ancient buildings and people's lives in the city

Flooding is the biggest threat to Hoi An. In the worst-case scenario, Hoi An may suffer from many factors at the same time such as high tides, super typhoons, cold air, tropical convergence zones, disturbance of east winds, upstream flooding, etc. The maximum sea level rise is over 1 meter, while the storm surge may be up to 3,5 meters, which results in a

total rise of over 4.5 meters. Because of the relatively low terrain, only 1.25 meters higher than sea level, a water mass 3–4 meters high causes coastal erosion. Combined with heavy rain, these watershed floods will cause severe and prolonged flooding. Hoi An has been flooded up to 3.5 meters deep in the past. In the future, with the impact of climate change, the flood level may increase from 3.5 to 4.5 meters. With the terrain gradually rising from the south to the north, Bach Dang Street along Hoai River experiences the deepest flooding. Other streets further inland, such as Tran Phu, can be flooded by more than 3.5 meters.

PROLONGED HEAVY FLOODS

Heavy floods could last up to 2 weeks, which will seriously damage the ancient structures with wooden materials and lime wall. About 70 ancient houses, or 10% of the ancient houses in Hoi An, have deteriorated and may collapse due to severe floods. Floods also cause many other impacts on community life and epidemics.

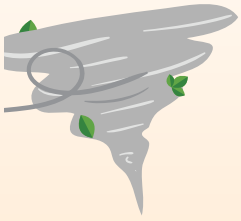
b. Sea level rise resulting in flooding and coastal erosion

COASTAL EROSION AND INUNDATION

If the water level rises by 1.03 meters, seawater will penetrate deeper inland, there will be more flooded land, and more beaches will be changed. Sea level rise in addition to changes in wave, wind and current regimes will put pressure on the coastal land structure. Moreover, over-exploitation of groundwater, especially illegal sand mining, and the impact of hydropower dams upstream deplete alluvium in the downstream of the Vu Gia - Thu Bon river system, making the soil structure weaker and more vulnerable to waves. As a result, coastal erosion at Cua Dai beach in Hoi An is becoming more and more serious, causing adverse consequences for tourism and economic development in the marine economy.

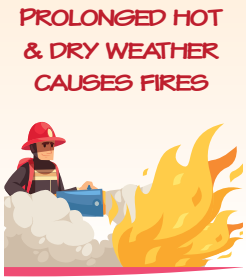
c. Impacts of wind and storms on Hoi An

SUPER TYPHOONS STRONG WIND



Houses in Hoi An are roofed with double tiles, increasing their ability to withstand strong winds, tornados and storms. However, super typhoons with wind speeds above level 16, as mentioned above, and great wind pressures will be difficult for such houses to withstand. Old houses in Hoi An are close together, with their roofs connected, so the collapse of one house due to wind storms could create a domino effect, causing the risk of the collapse of many other houses

d. Impacts of droughts



Due to the impacts of climate change, heat waves and droughts will appear more and more frequently and last longer. In Hoi An, droughts often occur in the dry season. Droughts caused by hot and dry weather will become severe, lasting for a long time, especially in El Nino years, easily resulting in water shortages for production and daily life, and creating favorable conditions for fires particularly in the old quarter where the buildings are mainly made of wood.

e. Other impacts due to climate change

Along with higher sea levels, global warming also causes many other changes in the ocean that have not been discovered. The warming of the surface water layer along with the increase of CO2 and other gases has increased the acidification of seawater, increasing salinity. Changes in the chemical properties of seawater can lead to changes in the chemical properties of the lower atmosphere in addition to the characteristics of the coastal air environment such as salinity, acids and salts, increasing the rate and degree of corrosion and causing damage to ancient buildings in Hoi An. Moreover, the high heat will lead to an increased thermal load, increasing the material degradation process. Higher humidity will lead to faster and more severe damage to wood trusses by termites.

Part 3: Suggestions for teaching activities

A. For primary schools

This content can be included in lessons for different subjects such as science, sociology, fine arts, etc. in the main curriculum. For extracurricular programs, teachers can organize activities as follows:

1. Organizing a drawing contest with topics such as: "My dream world by 2030" or "Hoi An in my eyes by 2030"

2. Organizing a drawing contest on protecting the environment with the topic "Family and School"; and festival: "Hoi An children join hands to protect the environment"

3. Organizing and guiding students in family sharing sessions about the future of Hoi An with parents, taking notes and sharing them with classmates

4. Organizing experiential activities to visit coastal landslide sites and let students discuss environmental protection issues

5. Creating a set of pictures or photos about actions for a "Green, Clean, Beautiful" Hoi An

B. For secondary schools

This content can be included in lessons for different subjects such as natural sciences, history, geography, etc. in the main curriculum. For extracurricular programs, teachers can organize activities as follows:

1. Organizing a contest to make a video or photo collection about Hoi An´s environmental issues

2. Organizing a speech contest with topics such as: "Building Hoi An as an eco-city" or "What can teenagers do to preserve the ancient town of Hoi An"

3. Organizing experiential activities to visit coastal landslide sites and let students discuss environmental protection issues

4. Organizing volunteer activities such as cleaning Cua Dai beach or increasing awareness in the neighborhood to separate waste at the source

5. Keeping a personal "green living diary"

6. Organize picnics at farms that are combined with small competitions. Students will build a menu that ensures adequate energy (calories) for all ages, ensuring. The organic vegetables are used mainly and processing of meat, fish are limited, etc. Besides, teachers teach students to save food. (Guiding students to buy and use local seasonal produce)

III. Lesson 2: Solid waste management

Part 1: General information

A. Waste management

1. Waste and pollution

Garbage has become a major global environmental concern, as the amount of garbage has increased tremendously, particularly in low- and middle-income countries where rapid urbanization and industrialization has been taking place.

Industrialization has encouraged "take-make-use-dispose" linear economies. Many goods are produced, used and thrown away easily and quickly without being used for a long time, reused or repaired. Every time we throw something away, we are throwing away the materials, energy and money that were used to produce it.

Once things are thrown away, they turn from products into trash, which is collected from households, businesses and ends up in landfills or dumpsites. This creates water pollution from leachates and toxic sludge, and air pollution in the form of horrendous smells and methane gas, which is a natural product of the decomposition of organic material. When waste heats up during the decomposition process and comes into contact with methane gas pockets, landfill fires with a lot of smoke may occur. Such pollution impacts the surrounding communities and people working at the sites with toxic gases and water which can be a cause of lung and heart complications as well as irritation of the eyes, nose and throat. Emissions of methane gas also contribute to global warming.

Trash that escapes from landfill sites, or is littered or uncollected, also pollutes the land, water and air. (Figure 9)

Figure 9. Waste pollution

2. Why do we need to manage waste?

According to a World Bank study, the world generates 2.01 billion tonnes of municipal solid waste annually, and this number is expected to grow to 3.40 billion tonnes by 2050[7]. As reported in 2018 by the World Bank, up to 60–70% of waste collected in Vietnam will be buried in unsanitary landfills. Overcrowding of landfills is an immediate situation—no longer a future threat—and will become even more serious in many places. Vietnam is expected to generate 54 million tonnes of domestic waste by 2030.

7. https://openknowledge.worldbank.org/bitstream/handle/10986/30317/9781464813290.pdf

Waste causes serious effects on health, human life and the natural environment. Open or spontaneous landfills create pollution hotspots that badly affect the landscape and our living, learning, playing and entertaining spaces.

3. How can we better manage waste?

The "waste hierarchy" is a simple ranking system used for the different waste management options according to which is the best for the environment. The most preferred option is to prevent (reduce) waste, and the least preferred choice is disposal in landfill sites. Good waste management has to be planned and implemented in accordance with the waste hierarchy.

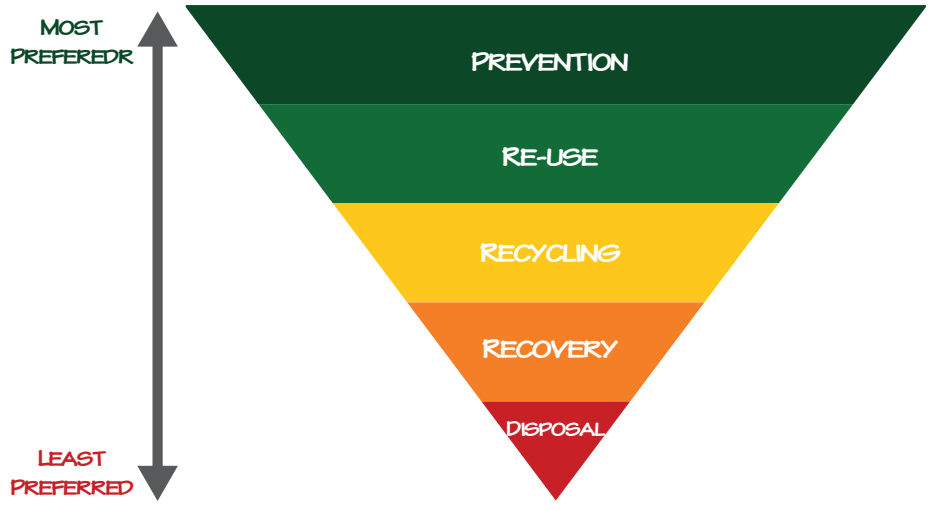


Figure 10. Waste hierarchy[8]

B. The 3Rs (Reduce, Reuse, Recycle)

1. What are the 3Rs?

The 3Rs are "Reduce, (prevent), Reuse, Recycle", the three options at the top of the waste hierarchy. Among them, Reduce (prevent) is the most environmentally-preferable option, followed by Reuse and Recycle.

8. https://ismwaste.co.uk/help/what-is-the-waste-hierarchy

WHAT CAN WE DO?
DO YOU KNOW ABOUT THE 3RS?

R1: REDUCE WASTE	R2: REUSE USE THINGS REPEATEDLY	R3: RECYCLE TURN WASTE INTO RESOURCES
• Try not to generate waste, by using things with care as much as possible • Use your own shopping bag and "my bag" and try not to ask for supermarket plastic shopping bags • Ask for things you have bought to be wrapped as simply as possible	• Use things again and again by remaking or repairing them • Repair toys and clothes instead of throwing away • Give old clothing and toys to others when you don´t need them	• Recycle waste into different things to use them again • Remake old newspaper and milk paper cartoons into new newspaper and toilet paper • Make compost from kitchen waste in a compost treatment container

2. Why are they important?

All three Rs help to cut down the amount of waste we throw away. They all conserve natural resources, landfill space and energy, which eventually lowers the risk of environmental pollution and global warming, and improves public health.

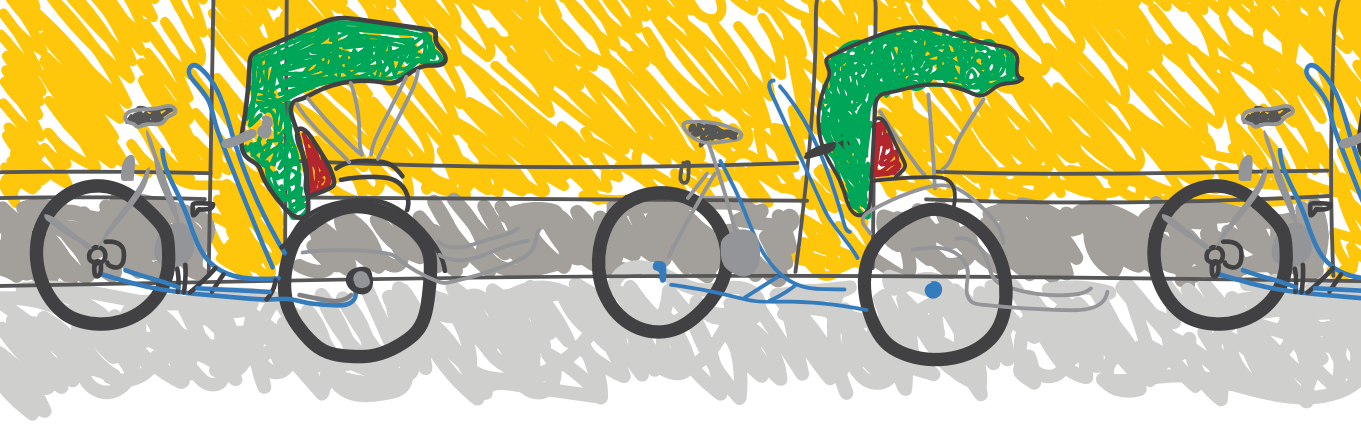
3. How do we start? Waste separation at the source

Waste separation is indispensable for better waste management and must be performed before waste is generated, be it a home or an institution. This greatly helps in providing localized solutions, improving collection efficiency and maximizing resource recovery from waste. Above all, waste separation at the source is key to success in the 3Rs.

Our waste includes a variety of things such as kitchen scraps, plastic packages and bottles, paper, aluminium cans, etc. The waste generated at households can be broadly divided into four categories but categorization may differ in each municipality. Waste generators including households, schools and offices must follow the rule of source separation set by the municipality in concern

(i) Recyclable materials: things that have economic value and can be recycled. Examples: paper, plastics, glass bottles, cans, metals, etc

(ii) Biodegradables / organic waste: waste typically originating from plant or animal sources, which may be broken down by other living organisms. Examples: leftover vegetables and fruits, meat, rice, bread, fish, leaves and branches, etc..



(iii) Hazardous waste: waste that is a potential threat to public health or the environment. Examples: electronic goods, oil paint, toilet cleaners, poisons, pesticides, batteries, etc.

(iv) Other types of waste: waste that does not belong to the categories above.

Many cities often have separation rules for waste collection, so that the same types of waste can be collected and later treated. Find out what kind of things are included in the waste at your home. What kind of rules does your area have?

Part 2: Hoi An's case

A. Waste generation and management in Hoi An

1. Waste generation in Hoi An

As revealed in data from the Hoi An Public Works Joint Stock Company on the total amount of solid waste collected in the city from 2015 to 2020, the amount of solid waste generated increased continuously from 2015 to 2019. Since 2016, the average annual increase has been about 3,700 tonnes per year (with an average annual growth rate of about 9%). In 2020, the amount of solid waste generated in Hoi An decreased due to the impact of the COVID-19 pandemic (Figure 11).

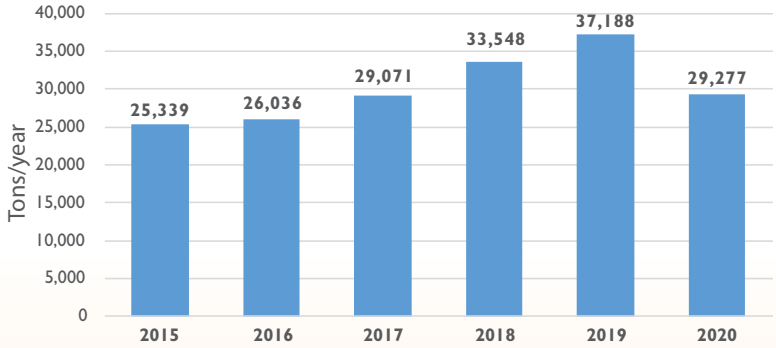


Figure 11. Total amount of solid waste generated in Hoi An from 2015 to 2020 (tons/year) (Hoi An Public Works Joint Stock Company, 2020)

Waste generation rates from different sources in Hoi An are shown in Figure 12.

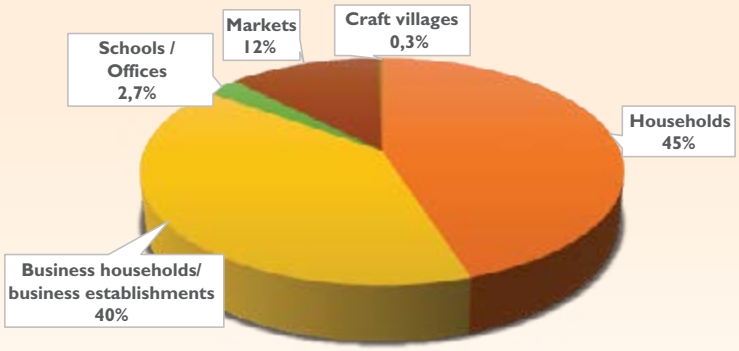


Figure 12. Solid waste generation rates by source in Hoi An (unit: %)

Households (45%) and business establishments (40%) generate the largest amount of solid waste in Hoi An, followed by markets (12%) and other sources.

According to statistics of the Hoi An Public Works Joint Stock Company, the total amount of waste collected per year at Hoi An and Tan An markets in the period 2015–2019 increased from 1,497 tonnes in 2015 to 1,839.6 tonnes in 2019.

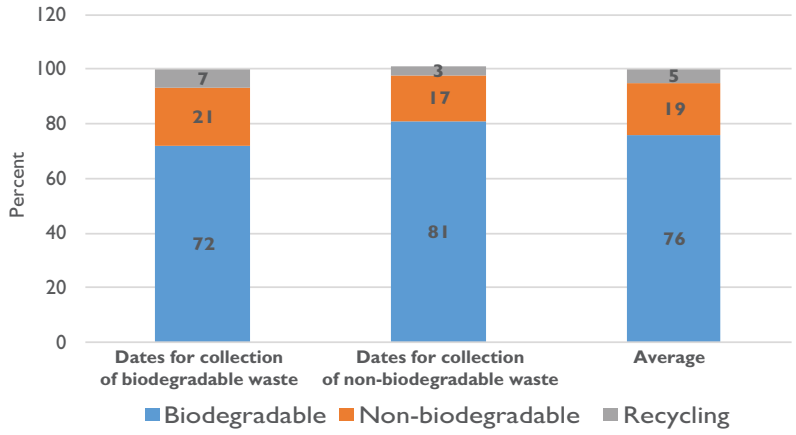


Figure 13. Percentage of market solid waste composition in Hoi An in 2018 (Source: Hoi An City Waste White Book 2018)

Assessment of the composition of market solid waste in Hoi An by the City People´s Committee shows that the average rate of biodegradable waste accounts for the majority (76%), followed by non-biodegradable waste at (19%) and recyclable waste at (5%). However, plastic waste is not included in the solid waste composition of Hoi An´s markets. Additionally, biodegradable waste accounts for a high percentage (over 70%) on dates for collection of both biodegradable waste and non-biodegradable waste.

According to statistics of Hoi An Public Works Joint Stock Company, there is a continuous increase in the amount of solid waste generated from households in the period from 2015 to 2019, similar to population growth and per capita income.

Table 1. Amount of solid waste generated by households, 2015–2019

Year	Amount of solid waste generated by households (unit: tonnes)
2015	18,465
2016	18,959
2017	21,636
2018	25,774
2019	28,351

(Source: Hoi An Public Works Joint Stock Company, 2020)

According to audit results of waste at schools in Hoi An, organic waste accounted for a relatively high rate (55,39%), inorganic waste accounted for 18,78%, and plastic waste, textiles and hazardous waste accounted for 23,09%, 2,44% and 0,3% respectively (Figure 14)

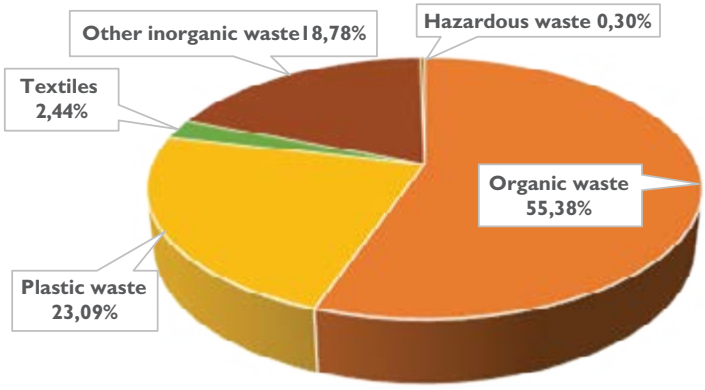


Figure 14. Percentage of solid waste in schools by types (unit: %)

2. Waste management in Hoi An

Domestic waste in Hoi An is currently collected by the Hoi An Public Works Joint Stock Company in its network of 13 communes and wards. From November 1st, 2012, the Hoi An City People´s Committee started waste separation at the source in 4 pilot wards including Minh An, Son Phong, Cam Pho and Tan An. From May 1st, 2014, waste separation at the source was carried out in the whole city. As a result, waste must be separated in advance and collected daily during prescribed hours. The collection schedule for each type of waste is arranged alternately. Biodegradable waste will be collected on Mondays, Wednesdays, Fridays and Sundays, and non-biodegradable waste will be collected on Tuesdays, Thursdays and Saturdays. Specifically, waste collection and transportation activities of the Hoi An Public Works Joint Stock Company are as follows:

- For waste in narrow streets and alleys, waste collection by handcarts will be gradually replaced by electric waste trucks, which is more convenient.
- Waste on sidewalks and some roads will be cleaned and collected by workers by handcarts.
- For waste in Hoai River, Hoi Muong Canal, Trang Keo Lake and Dong Hiep Embankment, workers will be arranged to collect and pick up waste floating on the water surface.
- At the markets, small traders will collect their own waste and keep it in containers arranged in a certain gathering area near the markets, and waste will be collected daily by specialized vehicles at fixed hours.
- Construction material waste such as bricks, crockery, porcelain, soil, rubble, etc. will be treated by the people themselves. The City People´s Committee has not yet developed a plan for collection and treatment of this type of waste.
- Waste from business establishments, schools and offices will be collected as household waste or under a waste collection contract with the Hoi An Public Works Joint Stock Company.
- For hazardous waste collected with domestic waste such as batteries, light bulbs, chemical tanks and accumulators, etc., after collection, the company will classify and store them. Every year, the Hoi An Public Works Joint Stock Company signs contracts with the Urban Environment Limited Company (URENCO), Central Branch, for transportation and treatment

According to results of survey and data collection, the flow of solid waste generated in Hoi An is summarized as below:

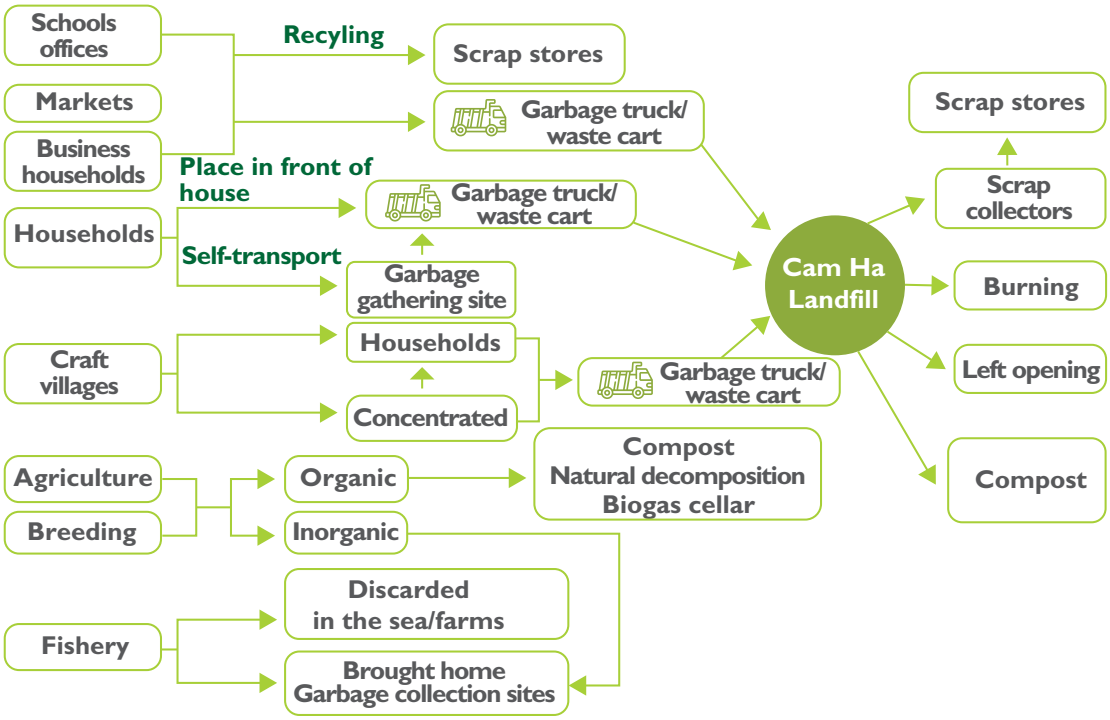


Figure 15. Flow of solid waste in Hoi An [9]

Despite early waste separation at source (in 2012), up to now this work has coordinated, however, some households still are not aware of waste classification. There is no clear difference in composition of waste collected. As Cam Ha landfill is currently overloaded, this situation has become a significant issue that will require the cooperation of all stakeholders.

9. Solid waste audit report in Hoi An City (IUCN, 2020)

Part 3: Suggestions for teaching activities

1. For primary schools

Some teaching activities related to waste education at primary schools are:

1. Training through organizing games or flashcards on waste separation at the source for students and implementing waste separation at the source. Teachers can design these themselves or use an existing set of flashcards on waste separation at the source for their students, and monitor their behavior changes by arranging waste cans for separation as per the training.

2. Organizing film screenings on waste and its harmful effects. Waste management models in the world and around Vietnam can be used as a reference.

3. Introducing a "Zero Waste School" model

4. Requesting students to learn about waste separation at home and discuss this issue with their parents for effective implementation by the whole family

5. Giving stamps or stars as rewards for good activities

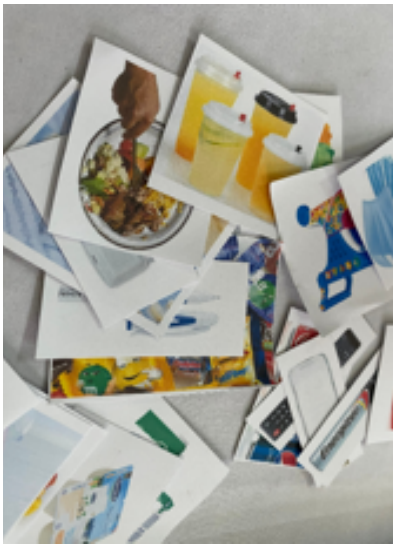


Figure 16. Actual implementation of activities

2. For secondary schools

Some teaching activities related to waste education at secondary schools are:

1. Introducing waste collection and treatment systems in Hoi An and guiding students in making media publications (videos, infographics, panels, posters, leaflets) to propagate to the community and primary school students about waste separation at the source in Hoi An

2. Training through organizing games or flashcards on waste separation at the source for students and implementing waste separation at the source.

3. Organizing "talk shows" about waste, its harmful effects and solutions to waste management (by a speech contest in English or Vietnamese)

4. Instructing students in scientific research on waste treatment solutions. Teachers can inspire creativity and environmental responsibility in students by introducing student initiatives at home and abroad (for example: waste trap model, smart trashcan model, etc.)

5. Additional illustrations can be found from the following site:

https://baodantoc.vn/hoc-sinh-quang-ngai-sang-tao-thung-rac-thongminh1609819716478.htm
https://nhandan.com.vn/tin-tuc-giao-duc/hoc-sinh-sang-tao-nghe-thuat-tu-rac-thai-tai-su-dung-335913

IV. Lesson 3: From waste to resource

Part 1: General information

A. Organic waste / biodegradable waste

1. Organic waste and pollution

Usually, organic waste makes up the biggest fraction of total waste generated at home, with a high generation tonnage but low recycling rate. It is biologically degraded and broken down into carbon dioxide, water, methane or simple organic molecules by microorganisms, and thus is sometimes called biodegradable waste.

The organic portion of waste is considered a source of contamination of soil, water and air if disposed of improperly, and requires greater attention for efficient and effective resource recovery. Commingled waste most likely goes to a dump or landfill site. When dumped organic waste is covered with earth, it is then broken down by microorganisms and the earth´s heat under anaerobic conditions. In this case, methane gas is produced by a process of fermentation. (Methane is a powerful greenhouse gas, 22 times more potent than carbon dioxide, contributing to global warming)

2. Why is organic waste management important?

Organic waste can instead be treated to produce compost, renewable fuels and other products, create jobs, and support local agriculture and forestry. Treating organic waste also reduces waste disposal costs and leads to cleaner (and more profitable) recyclables, as well as avoiding GHG emissions.

3. How can we better manage organic waste?

The kitchen is where organic waste is generally found in the household, consisting of leftover food, coffee grounds, apple cores, fruit and vegetable peels, egg shells and other kinds of food by-products. What can we do with these?

Like the waste hierarchy, there is a hierarchy for food waste (Figure 17).

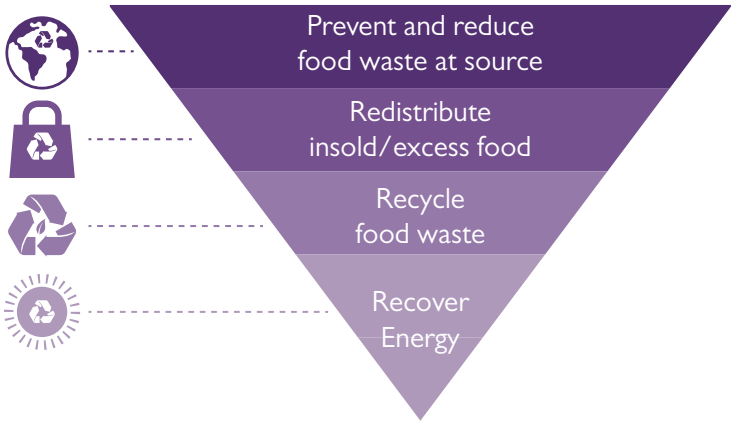


Figure 17. Food waste hierarchy[10]

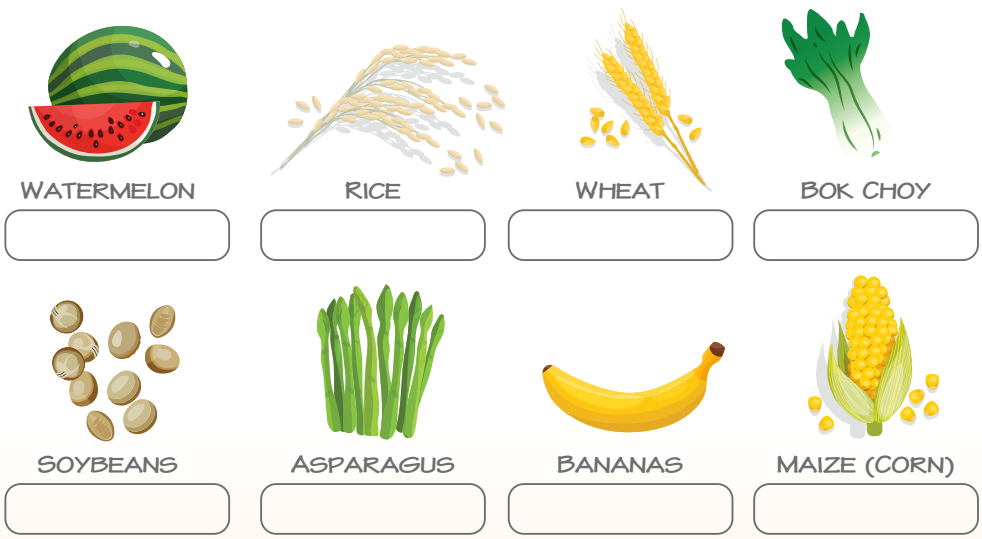
a. Reduce food waste at the source

Every time we throw food away, part of our money is wasted. Growing food takes time, hard work and resources. Wasting food means we are wasting these resources, too.

We should order, buy and cook just enough, and properly store leftovers for use the next day. At the same time, appreciate farmers for the time, resources and hard work required to grow food.

While the preferred approach is to prevent the generation of food waste at the source, not all food waste is avoidable (for example, bones, shells and husks). Food waste that cannot be avoided should be recycled where possible

Do you know how long it takes to grow these crops before they can be harvested?
Find out and fill in the blanks with the correct answers.



Other resources such as fuel and manpower are used to transport food to Singapore from countries as far as Brazil

It takes weeks, months or even years to grow food and get it to your table but it takes just seconds to waste it. Wasting food causes unnecessary strain on our environment.

Figure 18. Suggested question for children

b. Redistribute excess food

Do you have any canned food that you are unlikely to consume? As long as cans are unopened and not expired, you can donate them to those who need it in your community. It´s a great way to prevent food waste and help the needy at the same time.

Figure 19. Food donation

If food items are opened or used but still edible, donate them to nearby farmers who have animals to feed. Make sure that non-edible items such as poisons, hazardous chemicals, and pieces of plastic and glass are not included.

c. Segregate and recycle food waste (compost)

Composting is a natural way of recycling organic waste, such as fruit peels and eggshells, which turns organic materials into compost. Insects, worms, bacteria and fungi all together help organic materials to turn into compost. This process is called “decomposition”.

Find out what kind of small creatures are in the composting pile. You can do composting at your home using the methods introduced here to speed up decomposition.

Below are some composting methods which are commonly used in Hoi An and nearby cities (Figure 20).

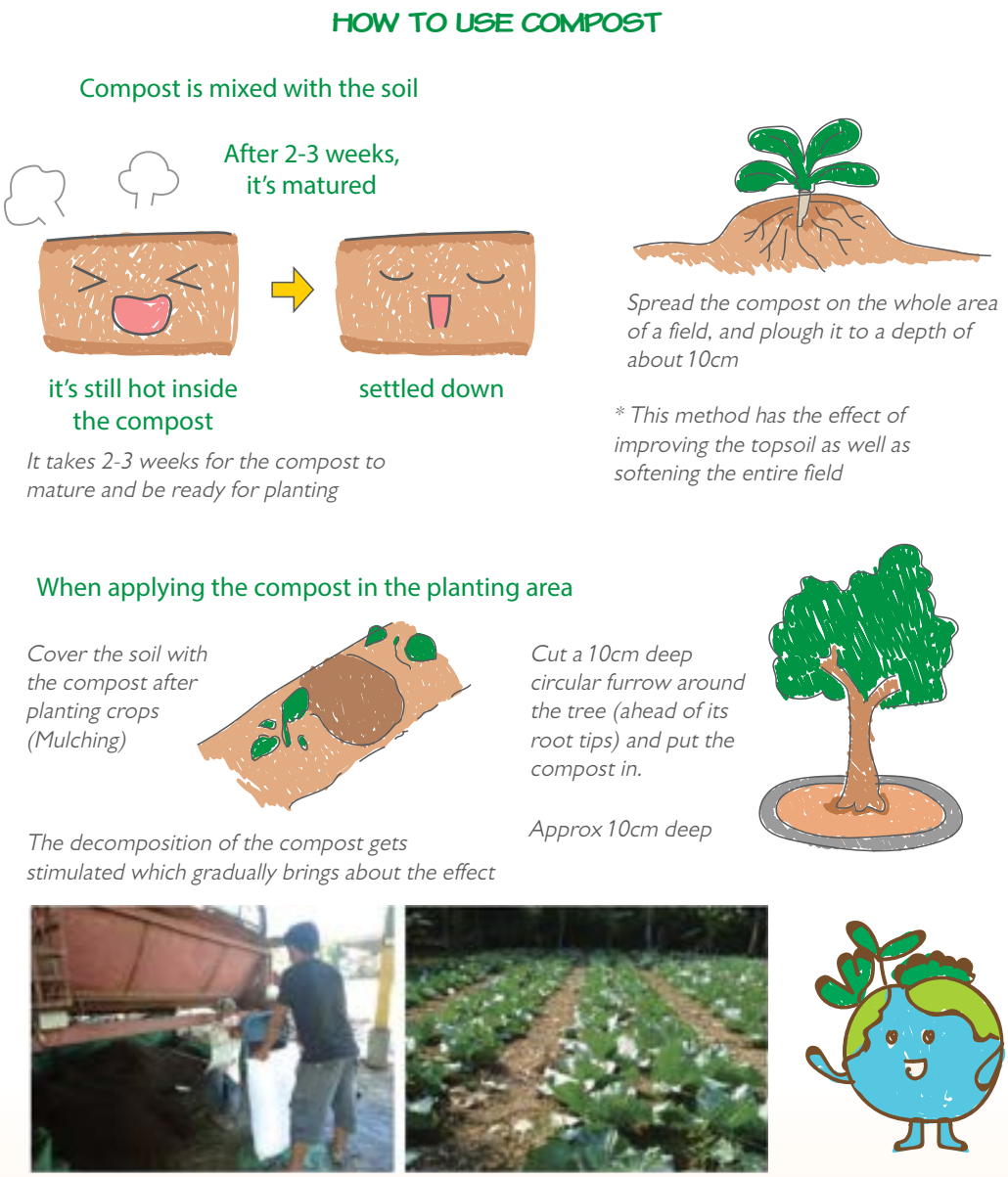


Figure 20. Composting methods

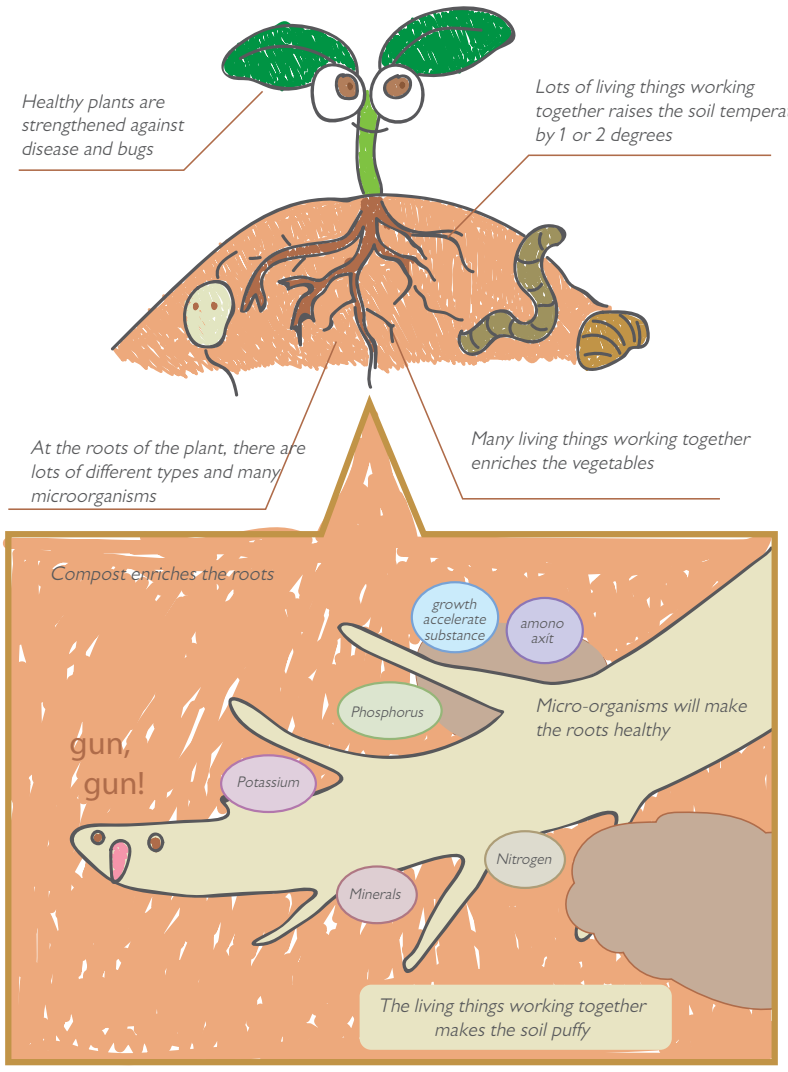


Figure 21. Advantages of composting

d. Recover energy

There are various ways to generate energy from organic waste. Methane that can be produced at landfills is a powerful GHG, but at the same time it can be used as a fuel for ovens, homes, water heaters, kilns, automobiles, turbines and other things.

One of the technologies to treat organic waste is biogas technology. Typically, a biogas system uses food waste, animal manure and other organic waste and converts the biomass into biogas (methane) and valuable bio-fertilizer.

Find out more about biogas and make poster presentations in groups. Discuss the benefits of biogas technology.

B. Plastic waste

1. Plastic waste and pollution

At present, many products that we use in our daily life are made of plastic or packaged in plastic. Increasing consumption results in more plastic waste. Plastics account for approximately 10% of total municipal waste. We all use plastic because it is cheap and convenient to use. The Ocean Conservancy reported that China, Indonesia, the Philippines, Thailand and Vietnam dump more plastic in the sea than all other countries combined. Since most plastics are made from petroleum or natural gas with chemical additives, plastics are harmful to the environment and last for hundreds of years.

a. Marine plastic pollution

One type of plastic pollution is the accumulation of plastic products in the environment, which adversely affects wildlife and wildlife habitat. Thin plastic objects such as plastic bags can be blown away by the wind or can flow into rivers and eventually enter the ocean. This can cause drainage problems on land and pollution at sea.

Plastics in the ocean can degrade, but it takes a long time. It is estimated that a foam plastic cup will take 50 years, a plastic beverage holder will take 400 years, a disposable daiper will take 450 years, and fishing line will take 600 years to degrade. While the plastic decomposition process is slow, plastic is broken into smaller pieces due to exposure to sun, rain and other environmental conditions, resulting in the release of toxic chemicals. This happens not only in the ocean but everywhere in the world. Once plastics are broken into tiny particles, they easily pass through water filtration systems and end up in the ocean, 50 posing a threat to aquatic life. In fact, plastic has already entered the food chain. Animals

carry microplastics in their bodies. When they eat, those microplastics are also ingested. Since one animal eats another, microplastics can move through the food chain. Eventually, we human beings end up eating fish and shellfish whose stomachs are contaminated with plastic. What happens to the toxins and chemicals that are associated with these plastics?

b. Air pollution from plastic burning

Another type of plastic pollution is air pollution generated by open burning of plastic waste. Open-air burning of plastic occurs at lower temperatures (lower than 850°C), and normally releases toxic fumes such as dioxins and furans. Dioxins stay a long time in the environment and are very toxic, and they can cause genetic modifications, cancer, respiratory problems and many other health problems.

Since plastics are generally made from petroleum, when the plastic is burned, it increases carbon emissions, which contributes to global warming.

2. Why is plastic waste management important?

Plastic is one of the most popular materials used around the world. From shampoo bottles and shopping bags to computers and batteries, all have some element of plastic in them. Since it is used so commonly all over the world, the amount of waste generated from plastic is enormous.

Despite a lot of advantageous properties, the ways plastic impacts the environment can´t be neglected. Plastic can´t be easily decomposed, so it stays in the environment for hundreds of years. Managing plastic waste is a challenging task, but it is very important to properly manage the plastic in order to avoid numerous ill effects on the environment and ecosystem.

3. How can we better manage plastic waste?

The plastic waste generated can be managed using the waste hierarchy. Since plastic cannot be destroyed easily, the 3Rs present the best alternative, as described below.

Reduce: Reduce the use of plastic as much as possible. The less plastic we use, the less waste will be generated. Using alternatives to plastic can solve this problem to a large extent. For example, using paper or cloth bags instead of polythene bags helps in reducing the use of plastic. Many big companies and organizations have already stopped the use of plastic and turned to other alternatives.

- Refuse plastic carry bags from shopkeepers and carry your own bag when you go shopping.
- Carry your own water bottle and avoid buying bottled water.
- Bring a reusable container to keep food in and avoid buying packaged food.

Reuse: Reuse plastic products that will lead to reductions in plastic production. For example, a plastic bottle can be used several times. Similarly, instead of throwing away a polythene bag, reusing it can help in plastic waste management.

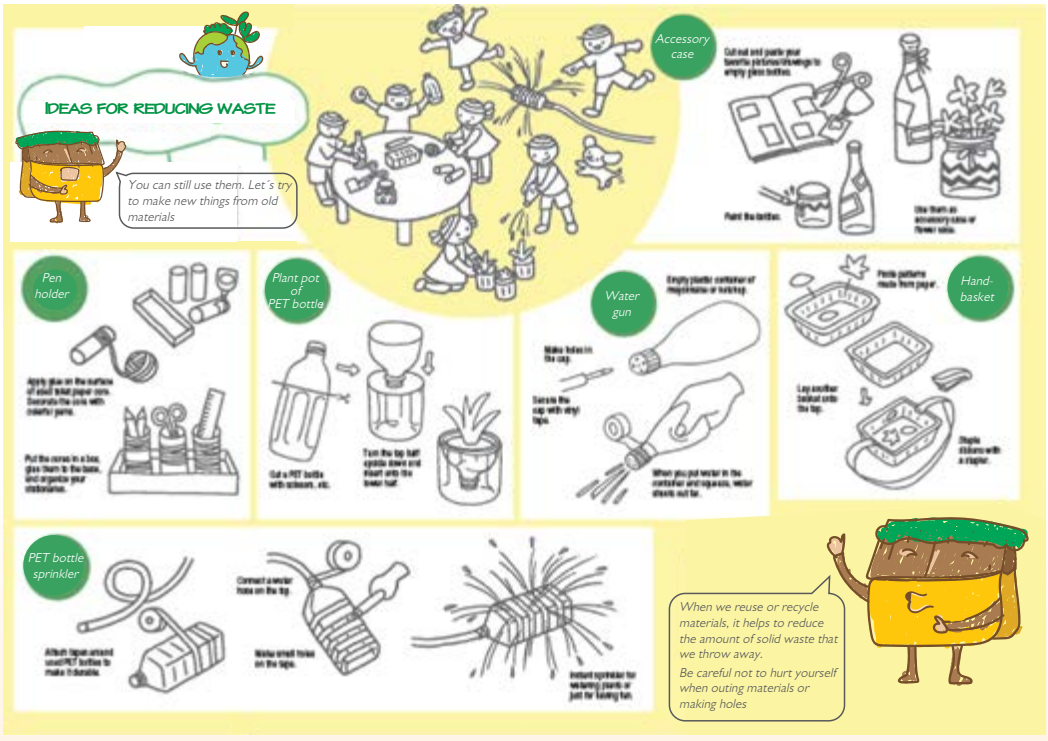


Figure 22. Recycling ideas

Recycle: Recycling is converting used plastic products into raw plastic and then making this into another product to be used again. This promotes lower production of plastic and hence will reduce the amount of waste generated.

Not only organic and plastic waste but other types of waste can be recycled. What materials are more likely to be recycled? What will happen to the following materials after separation and recycling? See if you can find out and connect them with a line.

Figure 23. Game about the recycled waste

There are different methods and companies that convert recyclable waste into resources. Find out what kind of recycling is in your city. What kind of recyclable waste do they collect, and what are they converted into? Find out what kind of other recycling methods there are in the world that are not available in your city.

After reduction, reuse, and recycling, there will still be some that cannot be reused nor recycled. This waste is called residue and is usually taken to landfill sites. If there is a treatment plant such as an incinerator, residues are treated with a controlled incinerator that limits the emission of toxic dioxin and furans.

Thanks to technology development, conventional incinerators have been replaced with Waste to Energy (WtE) incinerators, which convert chemicals from waste residues into practical forms of energy like electricity, heat or steam.

Part 2: Hoi An's case

1. MRF model

There have been many models of waste treatment in the community of Hoi An, that has received support from domestic and foreign organizations such as the Federation of Canadian Municipalities, IUCN, WWF and others to implement waste management activities. Among these, the Materials Recovery Facilities (MRF) model is considered one of the most effective and sustainable approaches.

From initial activities such as waste separation at the source and waste auditing to creation of a database and compilation of a general document on the waste database, which serves as a basis for proposing and orienting management work to connect community organization movements, initiatives and international participation, Hoi An has built the MRF model towards sustainable management of solid waste including all waste sources and related aspects including emissions, transportation, collection and disposal, with the priority being to maximize resource efficiency.

The MRF model was piloted in Cam Thanh, Tan Hiep communes and Cam An Ward, with such stages as sorting recyclable waste, making compost, and collecting and separating waste at the source on the scale of residential communities, schools and villages.

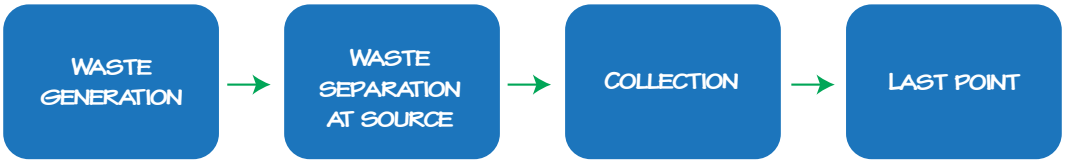


Figure 24. Domestic waste management map for Hoi An

After being separated, waste generated by households, restaurants, schools and offices is collected by garbage trucks and transported to solid waste treatment plants. The procedure is as follows:

(1) Organic waste is put into the compost pit or collected and transferred to the MRF model (for households lacking green space) for treatment;

(2) Recyclable waste is sorted and collected by informal collectors;

(3) Other waste is collected by garbage trucks or self-managed groups and transferred to the MRF model or transfer station.

The MRF model is not only an on-site treatment station but also a place for the local community to learn about integrated domestic solid waste management. Built for community tourism, research and construction in community or at schools to collect recyclable waste and make compost at a small scale, the model is also a place to store sorted domestic waste, including compost bins and bins for domestic solid waste and non-biodegradable waste. Rural communities or even cities, schools and units that need support for other development such as tourism, often call for cooperation to build these recycling and reuse facilities.

2. Green tourism

In recent years, Hoi An has strong growth momentum and is one of the destinations attracting domestic and international tourists, with 5.35 million visitors visiting and staying in 2019. However, the rapid growth of the tourism industry poses the problem of environmental pollution and increasing waste in Hoi An, especially plastic waste from tourism service activities. To limit the amount of waste discharged into the environment, local authorities, businesses and communities have been making collective efforts to reduce waste, especially reducing the use of disposable plastic products, aiming at building Hoi An into a green destination in the future.

Figure 25. Actual products

Organized by Emic Travel - Travel Company, Ltd. in collaboration with Green Youth Collective, a "resource restoration" tour opened up opportunities for tourists to experience waste recycling models in Hoi An. Currently, tourists participating in the tour have the opportunity to experience more than 130 bio-recycled products sold at the Refillables store (Cam Thanh commune, Hoi An City). Food, fruit, cooking oil, leftover soap, discarded cloth and others are processed into new products such as soap, household cleaners, dishwashing liquid and handbags, as well as essential oils refined from local trees and fruits.

In addition, the company currently has 5 environment and community responsibility tours, including: **"Soap of Hope"**, **"Cloth for Life"**, **"Composting"**, **"Growing Reeds and Reed Straws"**, **"Nursing Herbs"**. When participating in the tours, tourists will have the opportunity to experience these activities. Not merely a tourist experience, this aims to raise awareness about environmental protection.

Similarly, to share the idea of environmental protection in tourist attractions, a **"Waste pickup tour"** was deployed by Hoi An Kayak Tourism Company in 2017. By participating in this tour, tourists themselves use a racket in a kayak to pick up trash on the 8km-long waterway along Hoai River from Cam Thanh commune to Hoi An ancient town. This special service has attracted many participants, especially foreign tourists. Each trip can bring back from 300 to 500 kilograms of waste. The tour is not for business purposes. Foreign tourists are charged $10 (equivalent to more than 200,000 VND/person) to join the tour, while it is free for locals. The money covers the cost of organizing and operating garbage collection vehicles and boat transport vehicles on return.

Tourism combined with environmental protection, such as picking up trash, changing the plastic bags brought by tourists to biodegradable bags, etc., has become a trend

among travel companies in Hoi An in particular and Vietnam in general. Traveling is now no longer simply for a change in atmosphere and relaxation, but also for creating values for the community and society.

A tour of An Nhien Farm – which is an environmentally friendly school, enables visitors to participate in outdoor activities close to nature. There are also tours to learn about nature and environment, tours providing skills, practice making daily life items such as soap, lessons on protection of the environment and natural resources, and lessons about waste management approaches.

Figure 26. Green tourism activities

- On Cu Lao Cham island, both the local people and tourists absolutely do not use plastic bags.

- Schools in Hoi An city are implementing and guiding students not to use single-use plastic items at schools, which has resulted in many practical effects.

Hoi An has seen an increase in the number of waste-recycling models. Although most of them have been small-scale, they rapidly spread among accommodation establishments and enterprises, and also attract the attention of the community.

Part 3: Suggestions for teaching activities

1. For primary schools

Some teaching activities related to waste recycling education at primary schools are:

Figure 27. Examples made from recycled paper and flowerpots made from waste

1. Organizing a recycling day at the school to stimulate students´ creativity using everyday discarded items, such as "We say no to plastic waste"; or "Say no to plastic bags and plastic bottles" festival. On this day, students will bring their own recycled items to school for display and presentation.

2. Organizing a "small plan" movement, sorting scraps to donate and raise funds for the school to support needy families.

3. Organizing and guiding students to compost at school and building a school garden model.

2. For secondary schools

Some teaching activities related to waste education at secondary schools are:

1. Teachers accompanying students in implementing recycling activities at home and at school, such as composting, recycling old items to make toys, and building playgrounds.


Figure 28. A playground made entirely from recycled materials

2. Integrating recycled products into technology subjects to stimulate student engagement[11]. Teachers can guide students on how to choose a gift that is suitable for the gift givers, helping to reduce the solid waste.

Figure 29. A handbag made from recycled instant noodles

3. Teachers learning about waste audits and guiding students to implement waste audits at schools, and monitor and assess waste generation and management at school on a monthly basis. The process is as following:

- Statistics of sources and types of solid waste: school supplies, packaging, water bottles, straws, kitchen waste, leftovers, etc
- Waste classification: organic waste, non-biodegradable garbage, recyclable waste, etc
- Statistics on the waste volume for the week.
- Make a plan for waste treatment, including: the organic waste composted into fertilizer for plants in the school, plastic bottles recycled and others put in the trash
- Proposing measures to reduce waste, including: limiting the use of packaging, using your own bottles, not leaving leftovers, etc

11. Teachers can join the Facebook group "Recycling Ideas" to get more information: https://www.facebook.com/groups/1894953704095836

V. Lesson 4: Responsible consumption

Part 1: General information

A. Sustainable consumption and production

1. Definition

In 1994, the first definition of sustainable consumption and production (SCP) was proposed at the Oslo Symposium. However, the concept has evolved over time thanks to contributions from various agencies. In 2011, the definition introduced provided by UNEP was as follows: "SCP is a holistic approach to minimising the negative environmental impacts from consumption and production systems while promoting quality of life for all".

2. Key principles of SCP

In 2014, UNEP released some of the key principles of SCP outlined to guide framework for relevant policy analysis and action:

- Improving quality of life without increasing environmental degradation and without compromising the resource needs of future generations.

- Decoupling economic growth from environmental degradation by:

  • Reducing material/energy intensity of current economic activities and reducing emissions and waste from extraction, production, consumption and disposal.

  • Promoting a shift of consumption patterns towards groups of goods and services with lower energy and material intensity without compromising quality of life.

- Applying life-cycle thinking which considers the impacts from all life-cycle stages of the production and consumption process.

- Guarding against the rebound effect, where efficiency gains are cancelled out by resulting increases in consumption.

3. Sustainable approach model at different points in the product life cycle

Different sustainability tools can be used to achieve the goals:

- Applying different SCP initiatives and models at each point in the product life cycle.

- Applying the same to the economy as a whole, to industries and to products.

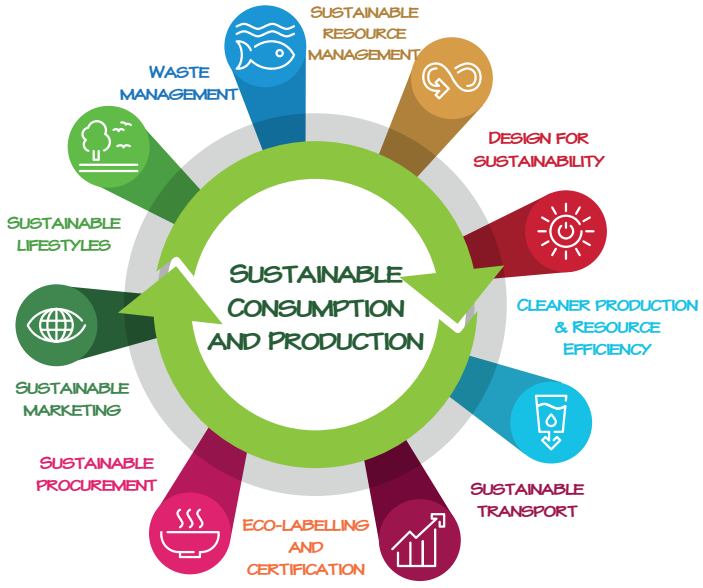


Figure 30. SCP approach model

B. Responsible consumers

1. What is a responsible consumer?

A responsible consumer can be defined as someone who is conscious of their consumption habits and who chooses to have—even demands—a more positive impact on society, economy, health and the environment from the producers of goods and services. A responsible consumer also acknowledges the impacts associated with products´ different stages (from production to transportation and disposal) and tries to buy those with a lower impact.

2. Why is this important?

Responsible consumption is a way of consumption that takes into account the foundations of sustainable development. It is also about decoupling economic growth from environmental degradation, increasing resource efficiency and promoting sustainable lifestyles. SDG 12 (Responsible consumption and production) can also contribute substantially to poverty alleviation and the transition towards low-carbon and green economies[12].

12. Reference: https://www.un.org/sustainabledevelopment/wp-content/uploads/2019/07/12_Why-It-Matters-2020.pdf

3. How can we become responsible consumers?

We should learn about how products are made and how much resources are used, and how this affects the environment.

a. Consume local products

This helps the economy in your area. If local producers gain from their work, they will continue to generate wealth and jobs in the community. It also contributes to energy saving and the reduction of GHG emissions, given that transporting products from far-off places generates more emissions.

b. Avoid wasting food

Plan ahead. Buy only the amount that you can consume before it is spoiled.

c. Avoid wasting water

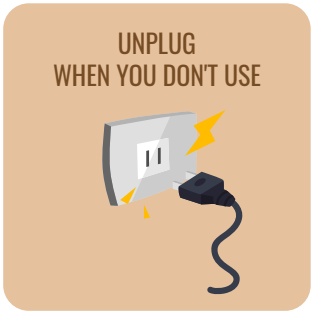
Simple tasks such as turning off the taps and only using what you need all demonstrate a more responsible attitude, particularly when some parts of the world have little water and have to work hard to get it.

d. Buy less plastic products

This isn´t always easy because so much of what we buy in the shops is packaged in plastic, but if there is an alternative in glass or metal, think about buying it instead as these materials are much easier to recycle. If there isn´t, question if you really need it and, if not, refuse to buy it. If enough people stop buying products in plastic, the companies making them will have to consider alternative packaging.

e. Use containers for refilling

Refuse to buy single-use plastic items and refill your own container instead.



f. Cut down or cut out meat and fish from your diet

The amount of water needed and food grown to feed the animals reared for human consumption is staggering and is having a major impact on climate change. Cow dung produces methane and are one of the largest contributors of GHGs.

Fish can be contaminated with microplastics. Plastic is not biodegradable, and almost every piece of plastic ever made still exists somewhere. A lot of it ends up in waterways and oceans. The plastic breaks down into smaller and smaller pieces and often is mistaken as food by fish and seabirds.

g. Reduce the amount of energy that you use

Only use what you need. Switch electrical items off, turn the heating down and consider changing your energy provider to an alternative that supports green energy.

h. Buy organic vegetables and fruit[13]

Healthy soil makes healthy plants and vegetables. Learn how you can grow healthy plants using compost made from organic waste. What is the difference between chemical fertiliser and composting? Ask experts or visit libraries to find out more about eco-friendly farming.

13. https://www.dotrythisathome.com/steps-to-becoming-a-responsible-consumer/

Part 2: Responsible consumption in Hoi An

In recent years, along with the development and orientation of the city to build Hoi An as an eco-city, to achieve its goals of sustainable development and environmental protection, the City People´s Committee has enacted policies to encourage enterprises´ economic restructuring and development towards sustainable production and sustainable consumption.

Hoi An introduced policies to promote sustainable consumption in the community and encourage sustainable production among local businesses. Some businesses are pioneers in the production of sustainable products, such as the Reform Plastic project for recycling low-value plastic into plastic boards to replace other materials in furniture processing.

Figure 31. Reform Plastic project

In this project, plastic waste, after sorting, will in turn pass through 2 large hoppers via a conveyor belt and be cut into plastic flakes and washed. All wastewater from washing waste will be biologically treated by a separate system and then cleaned to form a slurry. After that, plastic flakes will be transferred by a motor to the drying station and to the gathering area. Here, plastic flakes will be put into a heat-press machine to be pressed into plastic boards (1.2m x 1.4m)

Figure 32. Products from the Reform Plastic project

Figure 33. Refillables Store

The Refillables store (Cam Thanh commune, Hoi An City) has more than 148 products that are friendly to the environment and consumers´ health, which are bought and sold using reusable packaging. After 2 years of operation, this small-scale social enterprise has saved more than 13,045 packages that were reused instead of being discarded.

In Hoi An city, tourists and local people are often given eco-friendly bags to replace plastic bags. Products to replace nylon bags and single-use plastic utensils, plastic straws and food containers, made from local materials such as bamboo, reeds, grass, paper, bagasse, banana leaves, etc., are becoming more and more enthusiastically received. Many production facilities are not only providing goods but also providing vocational training and guiding tourists to craft and create souvenirs to bring back when traveling to Hoi An.

Part 3: Suggestions for teaching activities

1. For primary schools

Some teaching activities related to waste recycling education at primary schools are:

1. Organizing visits to the organic vegetable garden in Cam Thanh, introducing organic agricultural products in Hoi An to students, selling addresses and encouraging them to share with their parents[14]. It is also possible to integrate "Local products for local consumption in Hoi An

Figure 34. A visit to Thanh Dong organic vegetable garden in Cam Thanh Commune

2. Organizing promotion days for Hoi An´s products at school on a monthly basis to promote typical handicraft products from craft villages such as Lantern Craft Village, Hoi An Silk Village and Kim Bong Carpentry Village, Thanh Ha Pottery Village, and local agricultural products such as Tra Que Vegetable Village and Cam Thanh Vegetable Village

Figure 35. Thanh Ha Pottery Village

14. Official website of Hoi An Organic Vegetables group: http://hoianorganic.com.vn/

2. For secondary schools

Some teaching activities related to waste recycling education at secondary schools are:

1. Integrating Hoi An-specific local products into local education subjects, and setting assignments or mini-projects to promote typical local products (cuisine, handicrafts, agricultural products, seafood, etc.). Students will learn about the development history of craft villages, understand and feel the beauty and pride of the local heritage, indigenous knowledge and experiences of the ancient Hoi An people.

2. Organizing film screenings on sustainable consumption topics for students. Some sample materials available in online are[15]:

"The Story of Stuff" originally released in December 2007, is a 20-minute, fastpaced, fact-filled look at the underside of our production and consumption patterns. The film exposes the connections between a number of environmental and social issues. (Link with Vietnamese subtitles – *https://www.youtube.com/watch?v=pW4uBYBixC4*)

Figure 36. Bamboo products by Mr. Tan, an artisan in Cam Thanh commune[16]

"Re-thinking Progress: Explaining the Circular Economy and How Society Can Re-think Progress" explores how through a change in perspective we can re-design the way our economy works - designing products that can be "made to be made again" and powering the system with renewable energy. (Link with English subtitles – *https://www.youtube.com/watch?v=zCRKvDyyHml*)

15. Summary of teaching resources on sustainable consumption at all school levels: https://en.unesco.org/sites/default/files/selected-resources-sdg12.pdf

16. Mr. Tan´s Facebook link: https://www.facebook.com/tan.vo.9026

"Combatting Plastic Pollution With Sustainable Bio-Based Packaging". In this video, FAO highlights the importance of substituting fossil-based with sustainable bio-based food packaging made of agriculture and wood residues. If these raw materials are sourced locally, it will also help improve farmers´ livelihoods and enhance rural development. (Link with English subtitles – *https://www.youtube.com/watch?v=vgJ3et8KK_o*)

3. Having students experience making bamboo products—traditional handicraft products in Hoi An—and share their feelings.

ECOLOGICAL EDUCATION FOR SCHOOLS

in Hoi An - A Teacher´s Guide

UN environment programme

IGES
Institute for Global Environmental Strategies

CCET
IGES Centre Collaborating with UNEP on Environmental Technologies