TREE
Micro- and project-based learning programme for Teaching ciRcular Economy and Ecological awareness in VET

Funded by the European Union

# TRAINING LESSON 1 - Part 2 (Plastic sector)

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| **Title** | - **Plastics and their role in the CE** |
| **Part of the training course referred to in this lesson** | - □ Part 1 General information about sustainability and CE<br>Part 2 Specific Information about:<br>□ Wood sector<br>X Plastic sector<br>□ Agrifood sector |
| **EQF level** | Level 3 |
| **Where the lesson was tested** | // |
| **General Learning objective(s) according to the Bloom Taxonomy**<br>https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/ | □ **Create** Produce new or original work (design, assemble, construct, investigate, formulate)<br>□ **Evaluate** Justify a stand or decision (appraise, argue, defend, critique, select, support)<br>□ **Analyze** Draw connections among ideas (differentiate, organize, relate, compare, distinguish, test, experiment)<br>□ **Apply** Use information in new situations (execute, implement, solve, use, demonstrate, operate)<br>X **Understand** Explain ideas or concepts (classify, discuss, describe, identify, locate, translate)<br>□ **Remember** Recall facts and basic concepts (define, duplicate, list, memorize, repeat) |
| **Specific learning objective(s)** | ● To understand the impact that plastic items, particularly the disposable ones, have on our health and on the environment;<br>● To learn about the EU strategies to cope with plastic waste and pollution;<br>● To understand what it is and why it is needed to create a Circular Economy for plastic;<br>● To understand learners' footprint when it comes to the use of plastics; |

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| | ● To learn about alternatives to plastic. |
| **Cognitive, socioemotional and behavioural outcomes based on** https://www.unesco.de/sites/default/files/2018-08/unesco_education_for_sustainable_development_goals.pdf | **SDG 4 "Quality education"**<br>Cognitive learning objectives: the learner understands the important role of culture in achieving sustainability; the learner understands that education can help create a more sustainable, equitable and peaceful world.<br><br>Socio-emotional learning objectives: the learner is able to recognize the importance of their own skills for improving their life, in particular for employment and entrepreneurship; the learner is able to engage personally with ESD.<br><br>Behavioural learning objectives: the learner is able to use all opportunities for their own education throughout their life, and to apply the acquired knowledge in everyday situations to promote sustainable development.<br><br>**SDG 12 "Responsible consumption and production"**<br><br>Cognitive learning objectives: the learner understands how individual lifestyle choices influence social, economic and environmental development; the learner understands production and consumption patterns and value chains and the interrelatedness of production and consumption (supply and demand, toxics, CO2 emissions, waste generation, health, working conditions, poverty, etc. ); the learner knows about strategies and practices of sustainable production and consumption.<br><br>Socio-emotional learning objectives: The learner is able to communicate the need for sustainable practices in production and consumption; the learner is able to encourage others to engage in sustainable practices in consumption and production; the learner is able to envision sustainable lifestyles; the learner is able to feel responsible for the environmental and social impacts of their own individual behaviour as a producer or consumer.<br><br>Behavioural learning objectives: The learner is able to promote sustainable production patterns; the learner is able to take on critically on their role as an active stakeholder in the market; the learner is able to challenge cultural and societal orientations in consumption and production.<br><br>**SDG 13 "Climate action"**<br><br>Cognitive learning objectives: the learner understands the current climate change as an anthropogenic phenomenon resulting from the increased greenhouse gas emissions; the learner knows about prevention, mitigation and adaptation strategies at different levels (global to individual) and for |

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| | different contexts and their connections with disaster response and disaster risk reduction.<br><br>Socio-emotional learning objectives: the learner is able to encourage others to protect the climate; the learner is able to collaborate with others and to develop commonly agreed-upon strategies to deal with climate change; the learner is able to understand their personal impact on the world's climate, from a local to a global perspective; the learner is able to recognize that the protection of the global climate is an essential task for everyone and that we need to completely re-evaluate our worldview and everyday behaviours in light of this.<br><br>Behavioural learning objectives: the learner is able to evaluate whether their private and job activities are climate friendly and – where not – to revise them; the learner is able to anticipate, estimate and assess the impact of personal, local and national decisions or activities on other people and world regions; the learner is able to support climate-friendly economic activities. |
| **Green skill(s) addressed** | □ Creative problem-solving<br>X Forward-thinking<br>□ Monitoring skills<br>□ Analytical skills<br>□ Lean production<br>□ Maintenance and repair skills<br>X Pollution prevention<br>X Eco-design<br>□ Management skills<br>X Impact quantification<br>□ Life-cycle management<br>□ Science skills<br>X Waste management<br>X Environmental auditing<br>□ Ecosystem management<br>□ Other_____ |
| **Duration** | 15 minutes |
| **Structure and content of the lesson** | **INTRODUCTION**<br><br>Since World War II, plastic objects have become increasingly common, to the point of becoming indispensable for many. Different types of different plastics have also been invented to create more and more objects with this material that is so ductile, cheap,durable, and easily available. So it should not surprise us that after the age of stone, metal, etc. some experts have come to call ours "the plastic age."<br><br>However, in more recent times, plastics have come under fire for being one of the most polluting materials. In fact, today a lot of plastic is produced that is not properly disposed of, ending up polluting soils, seas, rivers and lakes.<br><br>But before talking about the effects of plastic on the environment, it is good |

to clarify what is meant by the term "plastic." In fact, this umbrella term is used to refer to materials that are also very different from each other, so much so that it would be more correct to speak in the plural of "plastics." The principal thermoplastic polymers resins are 7:

1. PET or PETE (Polyethylene terephthalate) is the most common one. It is used in fibres to produce clothes or in food and beverage containers. It is best not to reuse (or limit reuse) of this type of plastic since it is designed as disposable. In fact, it is usually not easy to clean or reuse, and in any case it is not advisable to do so because of some hard-to-remove chemicals that are in some cases carcinogenic.
2. HDPE (High-Density Polyethylene) is used for detergent containers or oil bottles. It is one of the most commonly recycled types of plastics together with the previous one (PET/PETE).
3. PS (Polystyrene) is one of the most common thermoplastic polymers in landfills. It is not recyclable and it is not advisable to reuse it due to some chemical components. E.g. It is used for food containers and plastic tableware.
4. Plastic bags are usually made of LDPE (Low-Density Polyethylene). It can be safely reused or repurposed but it is rarely recycled.
5. PP (Polypropylene) is a corrosion-resistant addition polymer and it is used, for example, for chips bags and yogurt containers. It is recyclable and reusable.
6. PVC (Polyvinyl Chloride) is soft and flexible and that is why it is used for food wrapping. It is the third most produced after PET and PP.
7. Polycarbonate, BPA, and Other Plastics. Basically anything of this thermoplastics are recyclable or reusable as they have also a negative effect of human hormones.

(For more on this have a look at the Short Lesson - Types of plastics and microplastics of this course).

**TOPIC 1: THE IMPACT OF PLASTIC ON THE ENVIRONMENT**

Plastic has become such a common material that as much as 360 million tons of it were produced globally just in 2018. Moreover, the total amount of plastic produced during the first decade of this century is higher than the total amount produced in the entire last century. Every year, around 8 million tons of plastic waste arrive to the oceans from the coasts and travel, carried by currents, creating real "islands" made of plastic. The biggest plastic island is known as “Pacific Trash Vortex” and is located in the Pacific ocean, between California and Hawaii. Although there is no definite measure of the size of this island, it is estimated to be between 700 thousand km2 to 10 million km2 wide (an extent comparable to the Iberian Peninsula).

Plastic creates harm to both the environment and human health in a number

of ways, such as:

- chemical elements added to plastics can be absorbed by the human body, as well as by animals. In fact, most plastic objects, even the bigger one, do not degrade. They tend over time to break into smaller plastic fragments that are more difficult to collect and remove from the natural environment and are more easily ingested by animals. Although the harmful and toxicological effects of microplastics on animals and humans, the long-term effects are still largely unknown;
- plastic can endure in water for hundreds of years and can be the vehicle through which invasive animal species and bacteria can move to new habitats, altering them;
- Plastic in the ground or in landfills can pollute the subsoil and groundwater through its chemicals.

In addition, the impact on the environment of plastic production must be considered. According to Knoblauch (2022), "*around 4 percent of world oil production is used as a feedstock to make plastics, and a similar amount is consumed as energy in the process*". But cleaning up the environment from the plastic already there also comes at a cost. Europe, for example, spends 630 million euros each year to clean up its coasts and beaches of plastic waste. Of all the plastic produced, moreover, only 10% is recycled globally and only 15% incinerated. The rest is taken to landfills or dumped into the seas. In the future, plastic use is expected to further increase significantly (an increase of about 10 times between 2020 and 2025 is expected).

Problems related to the use of plastic are mainly related to its use in the manufacture of items that have a use time that can range from a few minutes to a few hours, such as plastic bags, cutlery, or glasses. Disposable items, then, are among the most polluting considering that the energy to produce them and the energy to dispose of them have a huge impact on the environment compared to the actual use we make of these items and the benefit we derive from them.

**TOPIC 2: STRATEGIES TO OVERCOME PLASTIC POLLUTION**

In 2018, the European Commission adopted the EU Plastic Strategy, which is now part of the New Circular Economy Action Plan. This strategy aimed at changing the way plastic objects are designed, produced, used and recycled in EU countries in order to:

- lower the carbon footprint caused by the production of plastic;
- make plastics more easily recyclable and increase demand for recycled plastics from consumers and manufacturers;
- discourage / ban the use of disposable plastics;
- invest in bio-based, biodegradable and compostable plastics.

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| | Moreover, on 3rd July 2021 a ban of plates, cutlery, straws, balloon sticks and cotton buds made of single-use plastic entered into force. According to this ban, these objects will not be placed anymore in the markets of the EU member states. The same happened to cups and food and beverage containers made of expanded polystyrene. This ban represents a clear and important stance against plastic disposables made by the EU.<br><br>In addition, from 2024 it will be mandatory for all beverage manufacturers in Europe to use a new type of cap for plastic bottles, called a tethered cap. Some companies, anticipating the entry into force of this obligation, have already taken steps to change the design of their caps. The idea for this new law stems from a study done on the design of plastic caps, among the items most commonly found in the seas and on land. Instead, the new cap will remain attached to the bottle and will be more difficult to lose.<br><br>Some European countries have also banned plastic bags from supermarkets, replacing them with biodegradable bags that definitely have a reduced environmental impact.<br><br>States and international organisations can do a lot on the issue of plastics and waste, but individual citizens also play a key role. In fact, the actions and choices that each of us puts forth every day and the ideas that each of us decides to promote are the real engine of change. Private individuals are not only the implementers of change, but are also initiators of further change when they inform themselves and present to companies and public agencies (at the local, regional, or national level) their demands. One example of how consumer demands are being met is by food, natural pharmacy, and cosmetics companies that have committed to more sustainable practices in recent years, and an increase in membership in the Union for Ethical BioTrade from 2016 to 2020 has been reported.<br><br>The important role of consumers was also emphasised in a report on the circular economy for plastics in which a comparison was made between mixed and separate waste collection. Mixed waste collection is when consumers do not have to make any differentiation between the products they throw away, while separate waste collection is when consumers are required to sort their waste. This second option is the one that brings the most benefits to the environment, because it allows a higher percentage of plastic to be recycled (62% vs. 6 % of the mixed waste collection) and less plastic goes to the landfill (11% instead of 37% of the mixed one).<br><br>So what can we as consumers do to reduce our plastic consumption and plastic waste?<br><br>- Always prefer reusable alternatives to disposable ones, especially if they are made of plastic. For example: canvas bags, water bottles, reusable Q-tips, bamboo toothbrushes;<br>- Prefer large packages of the products we use most often. In fact, if |

you know you will use a product, buying one package instead of many smaller ones can reduce your environmental impact by producing less trash;
- Buying solid shampoo, bubble bath, deodorant, conditioner allows you to avoid buying these products in plastic containers;
- Stop buying bottled water. Try getting used to having a water bottle with you at all times to fill up in drinking fountains or taps. In addition to saving money, it will also allow you to reduce your environmental impact.

**TOPIC 3: CIRCULAR ECONOMY FOR PLASTIC**

The concept of Circular Economy and its main implications were described in a dedicated lesson in Part 1 of this training course.

It has been already pointed out that most of the plastic produced in the world is not recycled but ends up in landfills, or is burned or dispersed into the environment. That is why it was thought to create a way to make plastic a more sustainable material at every stage of its life. The entire value chain of plastics, from conception to recycling, is therefore being rependered, with the aim of reducing $CO^2$ and greenhouse gas emissions, producing less waste and using recycled materials as much as possible.

Creating a circular economy for plastics is critical to safeguarding the lives of animals, humans, along with entire ecosystems. To do this, however, certain actions must be taken:

- one must first work on the design of plastic products. Many of them contain dyes or additional products that do not allow them to be recycled. Therefore, companies that produce plastic products should standardise the types of plastics used so as to maximise their recyclability and make this process easier.
- consumers must actively participate in the shift toward a circular economy, for example, by supporting the most "sustainable" and green brands, informing themselves, and recycling properly.
- manufacturers must eliminate unnecessary plastic from the items they produce, especially packaging. Consumers can also, in a sense, "eliminate unnecessary plastic" by buying alternatives made of other materials and perhaps reusable.
- governments must facilitate the transition to a circular economy in the plastics sector and legislatively standardise rules for the disposal or recycling of plastics.

**CONCLUSION**

There are many different types of plastics that are used to make so many of

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| | the objects we use on a daily basis. Depending on the type of polymer, plastics may have different characteristics and may or may not be recyclable. The problem with plastics, and especially with disposable plastics, is that they are only partially recycled, while most of them end up in landfills, incinerators or the environment. That is why the EU, states, some companies and consumers are taking steps to combat the use of disposable plastics and to maximise their recycling.<br><br>Following this direction, some experts have begun to talk about the circular economy for plastics, that is, the dictates of the circular economy adopted for this sector. The aim is to produce less waste, reduce environmental impact, recycle more, and increase the value chain of this material. |
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| **Interactive questions for R3** | What is the "Pacific Trash Vortex"?<br>A. Is a type of plastic polymer, easily reusable and recyclable.<br>**B. Is a garbage island that has been created off the coast of California. (correct)**<br>C. Is a method that can be used to recycle plastic, reducing the amount of this material that ends up in landfills.<br><br>What are the most commonly recycled thermoplastic polymers?<br>A. **PET & HDPE (correct)**<br>B. PET & PP<br>C. PVC & PP<br><br>Starting from 2024…<br>A. The EU will ban plates, cutlery, straws, balloon sticks and cotton buds made of single-use plastic.<br>B. the EU will implement a combination of mixed and separate plastic waste collection.<br>**C. It will be mandatory for all beverage manufacturers in the EU to use the "tethered cap" for plastic bottles. (correct)** |
| **Keywords** | plastic, disposable, sustainable, pollution, waste |

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| **Questions for reflection** | 1. Provide other examples of plastics' impact on the environment.<br>2. What do you do in your everyday life to reduce your consumption of disposable plastic?<br>3. Can you think about and provide other ways to encourage the shift toward a CE for plastic? |
| **Additional resources** | Documents/ articles:<br>- Baztan J., Bergmann M., Booth A., Broglio E., Carrasco A., Chouinard O., Clüsener-Godt M., Cordier M., Cozar A., Devrieses L., Enevoldsen H., Ernsteins R., Ferreira-da-Costa M., Fossi M-C., Gago J., Galgani F., Garrabou J., Gerdts G., Gomez M., Gómez-Parra A., Gutow L., Herrera A., Herring C., Huck T., Huvet A., Ivar do Sul J-A., Jorgensen B., Krzan A., Lagarde F., Liria A., Lusher A., Miguelez A., Packard T., Pahl S., Paul-Pont I., Peeters D., Robbens J., Ruiz-Fernández A-C., Runge J., Sánchez-Arcilla A., Soudant P., Surette C., Thompson R.C., Veldés L., Vanderlinden J-P., Wallace N. (2017). *Breaking Down the Plastic Age*. 10.1016/B978-0-12-812271-6.00170-8. https://www.researchgate.net/publication/312009814_Breaking_Down_the_Plastic_Age<br>- The European Commission (2021). The New Circular Economy Action Plan https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf<br>Videos:<br>- Interesting Engineerings (2020). *How plastic is destroying our environment and what to do about it.* Youtube. https://www.youtube.com/watch?v=G8MO_8Zfu3Q<br>- https://environment.ec.europa.eu/topics/plastics/single-use-plastics/eu-restrictions-certain-single-use-plastics_en<br>- Ellen MacArthur Foundation (2020). We Need a Circular Economy for Plastic - Ellen MacArthur Foundation on Breaking the Plastic Wave. https://www.youtube.com/watch?v=O3l45a6ZIkA&feature=emb_imp_woyt<br>- Ellen MacArthur Foundation (2020) *The vision for a circular economy for plastic*. https://www.youtube.com/watch?v=xmTQA-RNygQ |
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| | written/ to invite the reader to pay attention to essential information.<br><br>  It indicates a question for reflection |
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