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

Funded by the European Union

TRAINING LESSON 3 - Part 2 (Plastic sector)

Title	○ Plastic waste management
Part of the training course referred to in this lesson	□ Part 1 General information about sustainability and CE Part 2 Specific Information about: □ Wood sector X Plastic sector □ Agrifood sector
EQF level	Level 2 or Level 3, in case of doing the optional tasks.
Where the lesson was tested	//
General Learning objective(s) according to the Bloom Taxonomy	□ **Create** Produce new or original work (design, assemble, construct, investigate, formulate) □ **Evaluate** Justify a stand or decision (appraise, argue, defend, critique, select, support) X **Analyze** Draw connections among ideas (differentiate, organize, relate, compare, distinguish, test, experiment) □ **Apply** Use information in new situations (execute, implement, solve, use, demonstrate, operate) X **Understand** Explain ideas or concepts (classify, discuss, describe, identify, locate, translate) □ **Remember** Recall facts and basic concepts (define, duplicate, list, memorize, repeat)
Specific learning objective(s)	• Understand what plastic waste management means. • Learn about different methods of plastic waste management • Understand the place of plastics in the European circular economy. • Analyze how plastic is recycled in local context
Cognitive, socioemotional and behavioural outcomes based on	**SDG 4 Quality Education** <u>Cognitive learning objectives:</u> • 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 Socio-emotional learning objectives: ● The learner is able through participatory methods to motivate and empower others to demand and use educational opportunities. ● The learner is able to recognize the intrinsic value of education and to analyse and identify their own learning needs in their personal development. ● The learner is able to recognize the importance of their own skills for improving their life, in particular for employment and entrepreneurship Behavioural learning objectives: ● The learner is able to contribute to facilitating and implementing quality education for all, ESD and related approaches at different levels. 2 ● 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 **SDG 6 Clean Water and Sanitation** Socio-emotional learning objectives: ● The learner is able to communicate about water pollution, water access and water saving measures and to create visibility about success stories. **SDG 12 Responsible Consumption and Production** Cognitive learning objectives: ● The learner understands how individual lifestyle choices influence social, economic and environmental development. Socio-emotional learning objectives: ● 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. Behavioural learning objectives: ● *The* learner is able to plan, implement and evaluate consumption-related activities using existing sustainability criteria. ● the learner is able take on critically on their role as an active stakeholder in the market.
Green skill(s) addressed	X Creative problem-solving X Forward-thinking X Monitoring skills X Analytical skills X Management skills □ Impact quantification X Life-cycle management X Science skills

	X Lean production	X Waste management
	□ Maintenance and repair skills	X Environmental auditing
	X Pollution prevention	□ Ecosystem management
	X Eco-design	□ Other_____
Duration	20 min.	
Structure and content of the lesson	INTRODUCTION Before we start the topic of Plastic waste management, it is important to understand what the word “management” means. It comes from the word “manage”, which means to manage. Management is a process of planning, decision making, organizing, leading, motivating and controlling the different resources to reach its goals efficiently. In this lesson we will talk about the ways to manage plastic waste. **TOPIC 1: TYPES OF PLASTIC WASTE, ACCORDING TO THEIR SOURCE** Plastics can be found in almost all areas of human activity today – agriculture, medicine, transportation, pipelines, electrical and thermal insulation, packaging, manufacturing of household and electronic goods, furniture and other items for daily or specific use. Plastic waste can be classified as industrial and municipal plastic waste according to their origin; these groups have different qualities and properties and are subject to different management strategies. 1.1. Municipal/household plastic waste Municipal plastic waste usually remains part of municipal solid waste (MSW) as it is discarded and collected as municipal waste. The various sources of plastics for MSW include household items (food containers, disposable cups, plates, cutlery, CDs, soda bottles, water pipes and gutters, flooring, etc.), agricultural (mulching film, fodder bags, fertilizer bags, etc. Thus, household plastic waste is mixed with other waste and heterogeneous in composition. In order to recycle it, it is necessary to separate the plastic from other household waste. For mixed plastics, mechanical separation equipment is currently available. For example, using a wet separation process, mixed plastics can be separated into two groups: those with a density greater than water, such as polystyrene and polyvinyl chloride, and those with a density lower than that of water, such as polyethylene, polypropylene and expanded polystyrene. Although technologies for the separation of household waste have been studied extensively, it is not yet possible to mechanically classify them and obtain marketable fractions. So household waste separation would be a better	

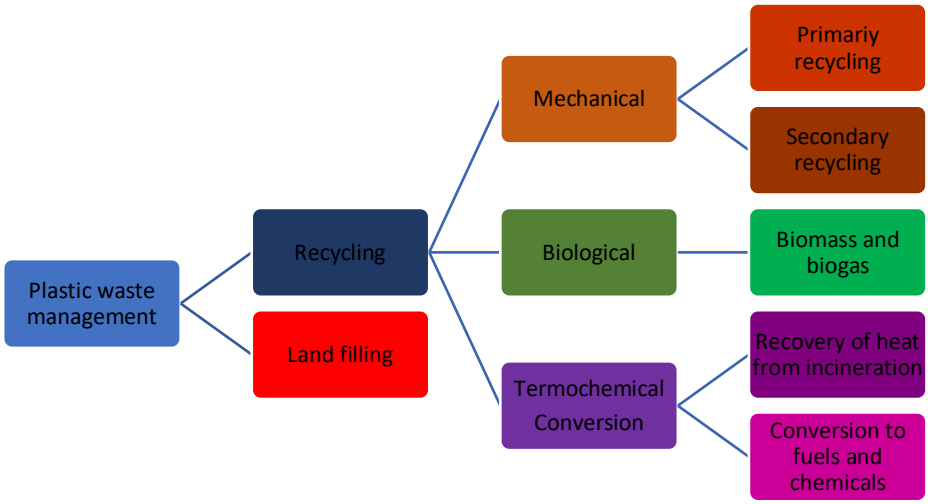
option where household waste is disposed of separately into three parts: 1 - paper, 2 - glass and metal, and 3 - plastics.

1.2. Industrial plastic waste

Industrial plastic waste arises from various productions. The majority of industrial plastic waste has relatively good physical characteristics, i.e. it is sufficiently clean and free of contamination and is available in relatively large quantities.

Municipal plastic waste is heterogeneous while industrial plastic waste is homogeneous in nature.

TOPIC 2: DIFFERENT METHODS OF PLASTIC WASTE MANAGEMENT



2.1. Land filling

Landfill disposal is becoming undesirable due to legislative pressure and the poor biodegradability of commonly used packaging polymers. The requirements for the construction of the landfills are high, a concrete isolated base is placed to prevent the passage of harmful substances from the waste into the soil during rains, the waste is periodically covered with earth. These landfills require constant maintenance. On the other hand, plastic waste has a high volume-to-weight ratio, which makes it unsuitable for landfilling, as the dimensions become both daunting and expensive.

2.2. Mechanical recycling

Mechanical recycling is the reprocessing of used plastic to obtain new similar products. It is a type of primary and secondary plastic recycling where homogeneous waste plastics are turned into products of almost the same or lower quality than the original product.

Although at first glance mechanical recycling of plastic waste appears to be a 'green' operation, reprocessing is not cost-effective as it requires a lot of

energy to clean, sort, transport and process, including the additives used to provide a working product.

Recycling plastic household waste is particularly difficult when it is contaminated with biological residues or, as is often the case, a mixture of different types of plastics.

Sometimes mixed plastic waste is used in the manufacture of underground chambers to increase the strength of concrete.

2.3. Biological recycling

As we know plastics are not biodegradable and this is one of the main environmental problems. To solve this problem, biodegradable polymers are being developed that can be converted back to biomass in a realistic time frame. Biodegradable plastics are already being used successfully in different countries. They are mainly introduced in the food industry and catering. This plastic photodegrades in six weeks.

It has the potential to be used in other areas, for example for computer or automotive components. However, there are a number of concerns regarding the use of biodegradable plastics. First, these plastics will only degrade if disposed of under appropriate conditions. For example, a photodegradable plastic product will not degrade if it is buried in a landfill where there is no light. Second, they can cause an increase in emissions of the greenhouse gas methane, which is released during the anaerobic digestion of the material.

2.4. Thermal recycling/incineration

Generating energy by burning plastic waste is generally a good solution for waste polymers, as they replace fossil fuels and thus reduce the CO2 load on the environment. A positive effect is that with this method it is not necessary to sort waste and plastic waste, they can be burned with other types of waste. However, in most developed countries there is public distrust of waste incineration, due to the released greenhouse gasses and some highly toxic pollutants. This currently limits the potential of waste-to-energy technologies.

2.5. Chemical recycling

Chemical recycling, or tertiary recycling, aims to convert the waste polymer into starting monomers or other valuable chemicals. These products are useful as raw material for various industrial processes or as transportation fuels.

In the future, the vast amount of plastic waste produced can be processed with a properly designed method to produce fossil fuel substitutes. A suitable process to convert waste plastic into hydrocarbon fuel, if designed and implemented, would then be a cheaper partial substitute for petroleum without emitting any pollutants. It will also take care of hazardous plastic waste and reduce crude oil imports. (Achyut Panda, 2010)

Another model of chemical recycling is the production of polymer-mixed bitumen road: The process of laying roads using waste plastic has been

	designed and the technique has been successfully applied to the construction of flexible roads. (Javeriya Siddiqui and Govind Pandey, 2013) The methods used to manage plastic waste are currently not fully effective and still do not solve the problem. This requires increasingly stronger actions in the direction of the production, consumption and trade of plastics, as well as the possibility of the transition to a circular economy. **Conclusion** Plastics play an important role in our society and the waste generated at the end of their use is unavoidable. The time has come for urgent decisions on plastic waste management. The methods considered in this lesson are only a partial solution. The responsibility for proper waste management lies with everyone, from separate household collection to methods of processing and recycling.
References	Achyut Panda, 2010. Thermolysis of waste plastics to liquid fuel: A suitable method for plastic waste management and manufacture of value added products--A world prospective - Thermolysis of waste plastics to liquid fuel: A suitable method for plastic waste management and manufacture of value added products—A world prospective - ScienceDirect Christopher Igwe and Iheoma C. Nwuzor Novel, Trends in plastic waste management, Springer Nature Switzerland AG 2019 - Novel trends in plastic waste management | SpringerLink Govind Pandey, 2013. A Review of Plastic Waste Management Strategies, Javeriya Siddiqui and - Microsoft Word - 14.ISCA-ORJEvS-2013-247 (scinapse.io)
Interactive questions for R3	1. What are the two types of plastic waste according to the source - - **Household, Industrial** - Agricultural, Industrial - Agricultural, Household 2. All plastic waste is biodegradable - True - **False** 3. Land filling is the most effective method of recycling -True - **False**
Keywords	Recycling – biological, mechanical, thermal and chemical.
Questions for reflection	1. Students are asked to familiarize themselves with the report of the European Commission for the Environment EEA Report No 18/2020, which tells about the history of plastics and their impact on the environment and climate and examines their place in the European circular economy. A

	discussion or other practical activity is held in class depending on what the teacher finds suitable. https://www.eea.europa.eu/publications/plastics-the-circular-economy-and/ ● 2. STUDENTS DO RESEARCH ON INDUSTRIES IN THEIR REGION/COUNTRY FOR GOOD PRACTICES FOR REUSING PLASTICS, PLANTS FOR RECYCLING PLASTICS OR USING THEM TO OBTAIN ENERGY, FUELS, LUBRICANTS, ETC. THE STUDENTS PRESENT THE RESULTS OF THE STUDY.
Additional resources	//
Icons & related info for the hints of the PowerPoint presentation	 This hint is used to indicate that there's a link to other websites with additional information.  This is used within the PPT to indicate that something important is written/ to invite the reader to pay attention to essential information.  It indicates a question for reflection
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