PLASTECO – SUPPORTING EU REGIONS TO CURB PLASTICS WASTE AND LITTERING

INPUT PAPER

for the Study Visit on effective waste management policies & measures to reduce plastics waste landfilling & incineration

Prepared by the Office of the Regional Government of Styria
Directorate 14 – Water Management, Resources and Sustainability
Department Waste and Resource Management

PLASTECO Interreg Europe
European Union
European Regional Development Fund

Das Land Steiermark
Abfall- und Ressourcenwirtschaft

Contents

1. Introduction

The widespread plastic pollution necessitates a strong reaction from EU regions to address growing environmental and health concerns. PLASTECO, in line with the "European Strategy for Plastics in a Circular Economy", will support participating territories to take the steps necessary for a transition towards a "new plastics economy". The focus will be on advances in waste management, eradication of single-use plastics from regional value chains and spurring growth through eco-innovation.

PLASTECO covers the areas waste management, public procurement, funding/investments, secondary raw materials, and awareness raising.

PLASTECO supports eight partners from eight EU countries, through joint policy learning efforts and exchanges of experiences, to benefit from the momentum of the EU plastics strategy and achieve their goals in terms of protecting the environment, increasing resource efficiency, alleviating health effects, and boosting innovation.

PLASTECO enables partners and key stakeholders to assess the current situation, potential, and barriers in their regions as well as to identify pathways for sustainable growth in plastics value-chains, and to design new policy measures and regulations.

The Office of the Regional Government of Styria, Directorate 14 – Water Management, Resources and Sustainability (Department Waste and Resource Management) will organize a Study Visit as a part of the project activity "Interregional Learning and Capacity Building". The topic "effective waste management policies and measures to reduce plastics waste landfilling and incineration" will be covered in the course of the Styrian Study Visit.

The Input paper is intended to prepare the partners for this Study Visit and to provide them with an overview of the covered topics - all focusing on plastics.

The Study Visit not only serves the exchange of knowledge and good practice examples but also the networking of the international partner regions. In this sense, all partners are expected to participate with members of their stakeholder groups and external experts in the Study Visit.

Since the Study Visit will take place in November 2021, the partners will receive the input paper approximately two weeks before the Study Visit. The partners are also supposed to submit the input paper to their stakeholders in advance.

After the Study Visit, a summary report will be provided to summarize the event and the knowledge gained as well as the content of the discussions held.

2. Thematic background

The following subsections will provide a brief overview of why Austria is a role model in the field of effective waste management and in particular reducing plastic waste landfilling and incineration.

In addition, the following subsections should provide the partners with the necessary information on these topics, which they need to implement the knowledge from the Study Visit and good practices in their regions.

2.1. Legal background of effective Waste Management measures in Austria[1]

Waste management in Austria is based on the five-level waste hierarchy. Deviations are permissible if another option yields the best result from the point of view of environmental protection. This requires consideration of the entire life cycle of the products.

Looking ahead to the year 2050, the key elements of a vision for a resource-conserving circular economy are the minimization of raw material and energy consumption over the entire life cycle through sufficiency (responsible use of resources) and the use of regenerative resources.

Three strategies for implementing this vision are shown in figure 1 and include the five-stage waste hierarchy, the principle of innovation and technological developments, and

[1] *Wellacher/Schaffernak/Lichtenegger*, STUDIE: Umsetzung der EU-Kunststoffstrategie in der Steiermark-Ausgangslage, Potentiale, technische Möglichkeiten und Maßnahmen, erstellt im Rahmen des Projektes IMKREIST, Lehrstuhl für Abfallverwertungstechnik und Abfallwirtschaft, Montanuniversität Leoben (2020) 15ff.

the approach of a climate-neutral and environmentally sound circular economy in accordance with the precautionary principle.

The Measures to achieve the set targets are waste management planning, waste taxes, subsidies, regulatory instruments (especially StAWG 2004), public information awareness raising, and national and international cooperation. Through cooperation, the province of Styria can benefit from the exchange of information for the implementation of solutions to waste management problems. Furthermore, indicators are necessary to illustrate the progress of Styria towards a circular economy.

The following indicators were considered particularly suitable by the Regional Government of Styria:

- Total amount of waste from households and similar establishments in kg per capita,
- Volume of residual waste in kg per capita,
- Ratio of residual waste as well as bulky waste to separately collected waste,
- Composition of residual waste with regard to the percentage of incorrectly disposed waste,
- Re-use and recycling rates for municipal waste in accordance with EU requirements,
- Number of re-use businesses and repair businesses in Styria,
- Number of member companies in the Green Tech Cluster Styria including turnover, jobs as well as the number of environmental innovations brought to market level.
- CO_2 emissions through the management of waste from the municipal sector and
- environmental effects achieved through funding from the Regional Government of Styria as part of the Regional Program for Operational Environmental Protection (WIN).

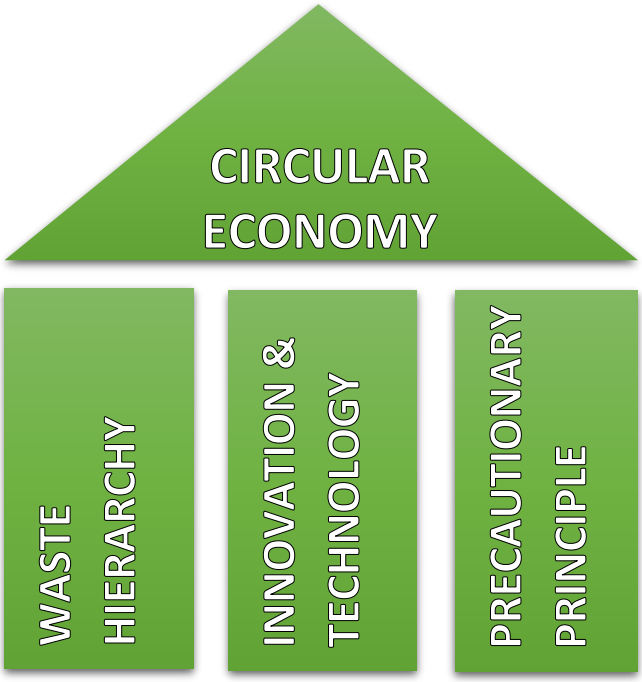


Figure 1: Strategies for the implementation of a resource-efficient circular economy in Styria.

The following legal acts regulate waste management and the implementation of a vision for a resource-conserving circular economy in Austria:

- **The Austrian Waste Management Act 2002**[2]

The Austrian Waste Management Act 2002 implements the objectives of the **Directive 2008/98/EC on waste**[3] at national level. Essential elements of waste management are the precaution for future generations, the principle of sustainability, climate protection and resource saving. Waste management in Austria is based on the principle of precaution and sustainability. In this respect, harmful or detrimental effects must be avoided, emissions of air pollutants must be kept as low as possible, and resources must be conserved.

In addition, during material recycling, the waste should not have a higher potential hazard than comparable primary raw materials and only such waste may remain whose disposal does not pose a risk to future generations.

Other regulations relate to general treatment obligations for waste owners, the collection or treatment of waste, the approval of collection and recovery systems, the approval and inspection of waste treatment facilities, company waste officers and waste management concepts, and the authorization to issue ordinances. The detailed design and implementation of waste management law is regulated by a large number of national regulations.

- **The Styrian Waste Management Law (StAWG) 2004**[4]

The Styrian Waste Management Law is a provincial law and regulates the management of waste in Styria. In order to implement the waste management objectives and principles, a provincial waste management plan must be drawn up and evaluated as well

[2] Austrian Waste Management Act 2002: https://www.ecolex.org/details/legislation/waste-management-act-2002-lex-faoc089286.

[3] *European Parliament and the Council*, Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02008L0098-20180705.

[4] *Regional Government of Styria*, Styrian Waste Management Law 2004: https://www.ecolex.org/details/legislation/styria-waste-management-law-2004-lex-faoc072671/.

as updated every six years. For the collection and treatment of municipal waste, communities must provide a public collection service.

Further requirements concern the organization of the collection by the municipalities, the obligation to connect to the public system, the number and size of the collection containers as well as their placement and use, the issuance of a waste regulation and the collection of fees and cost refunds by the municipalities. Ownership of the municipal waste shall pass to the waste management association in charge when it is loaded onto a public collection vehicle. Accordingly, the waste management association in charge is also responsible for the treatment (reprocessing or disposal) of the municipal waste.

- **The Styrian Waste Management Plan (LAWP) 2019[5]**

The Styrian Waste Management Plan is the third waste management plan based on the StAWG 2004. In addition to an inventory of waste production in Styria, this document contains a presentation of Styrian treatment facilities, forecasts for the development of waste production in Styria, goals for sustainable waste and resource management, and strategies for waste prevention and waste treatment.

The Regional Government of Styria allocates financial expenditures for different sectors of waste management: Subsidies for projects and studies of waste management and sustainability, promotion of environmental and waste consulting services at waste management associations, implementation of projects and studies on waste management, promotion of non-profit institutions in the field of sustainable waste and resource management, specialized information, awareness raising as well as public relations and the promotion of operational measures for sustainable waste and resource management.

- **The Austrian Landfill Ordinance 2008 (Deponieverordnung)[6]**

[5] *Regional Government of Styria*, The Styrian Waste Management Plan (LAWP) 2019: https://www.abfallwirtschaft.steiermark.at/cms/beitrag/10177492/136114083.

[6] *Federal Ministry for the Environment*, Ordinance on waste disposal sites 2008: https://www.ecolex.org/details/legislation/landfill-ordinance-lex-faoc033823/.

This ordinance regulates the state-of-the-art outfitting and operation of deposits on landfills according to articles 28 and 29 of the Austrian Waste Management Act.

The Landfill Ordinance 2008, which came into force in Austria on March 1, 2008, implemented the contents of the Landfill Directive (1999/31/EC), the Waste Directive (2006/12/EC) and the Council Decision establishing criteria and procedures for the acceptance of waste at landfills (2003/33/EC) into national law. With the Landfill Ordinance 2008, Austria has a system of regulations in the field of waste landfilling that goes far beyond the minimum requirements by EU law.

It is particularly important that the Landfill Ordinance contains a landfill ban. This landfill ban applies to waste with a TOC (total organic carbon) content of more than 5 percent by mass, which means that non-treated waste with a higher plastic content may no longer be landfilled since 2004. In addition, the extensive waste acceptance procedure, as well as the classification of landfill classes, and the inclusion of regulations for the implementation of reporting obligations through electronic data management (EDM) as new measures should be mentioned.

- **The Austrian Contaminated Sites Designation Ordinance 2004 (Altlastensanierungsgesetz)[7]**

The Austrian Contaminated Sites Designation Ordinance provides the legal basis for financing the remediation of contaminated sites. These measures are financed through the contaminated site tax that must be levied by the Austrian Customs Administration. The contaminated site tax is a self-assessment tax and applies to landfilling, the storage of waste for disposal for more than one year, the storage of waste for processing for more than three years, the backfilling of uneven terrain or the backfilling of mountains with waste, as well as the other landfilling of waste above or below ground, the incineration of waste in an incineration or co-incineration plants, the use of waste for

[7] *Federal Ministry for Agriculture and Forestry, Environment and Water Resources,* Ordinance by the on designation of contaminated sites and their classification in priority classes 2004: https://www.ecolex.org/details/legislation/contaminated-sites-designation-ordinance-lex-faoc077683/?q=contaminated+sites+austria&xdate_min=&xdate_max=.

the production of fuel products and the input of waste, (except metallurgical waste) into a blast furnace for the production of iron.

2.2. Austrian PLASTIC Waste Management

2.2.1. Austrian targets

In 2018, around 0.95 million tons of plastic waste (" homogeneous" plastic waste, such as plastic films or polyolefin waste, and the plastic percentage of waste containing plastic, e.g. bulky waste, WEEE) were generated in Austria. Around 80 % of the plastic input was in mixed waste with varying contents of plastic.[8]

Figure 2 shows the amount of plastic waste generated in Austria in 2018. The blue part of the pie chart shows pure plastic waste. The red part is mixed waste with varying amounts of plastic. Yellow marks the plastics in paints and coatings and purple the plastics in cured paints and coatings. Green is plastic sludge and orange marks plasticizers. The amount of plastic waste in Austria were determined mainly on the basis of annual waste reports from waste collectors and treaters. Not only the "pure" types of plastic waste were taken into account, but also those plastic fractions contained in mixed waste streams and composite fractions. Rubber waste was also included. The plastic contents of the individual waste types were estimated on the basis of literature data and, on a case-by-case basis, the expertise of experts.[9]

[8] *Aspäck*, STUDIE: Regionale Analyse und Prognose der Recycling Quotenentwicklung in der Steiermark anhand des RIL-Ternärdiagrammes und Prognose der mittelfristigen Entwicklung erstellt im Rahmen des Projektes IMKREIST, Lehrstuhl für Abfallverwertungstechnik und Abfallwirtschaft, Montanuniversität Leoben (2020) 3f.

[9] *Umweltbundesamt,* Kunststoffabfälle in Österreich: Aufkommen und Behandlung (2017) https://www.umweltbundesamt.at/fileadmin/site/publikationen/rep0650.pdf 10.

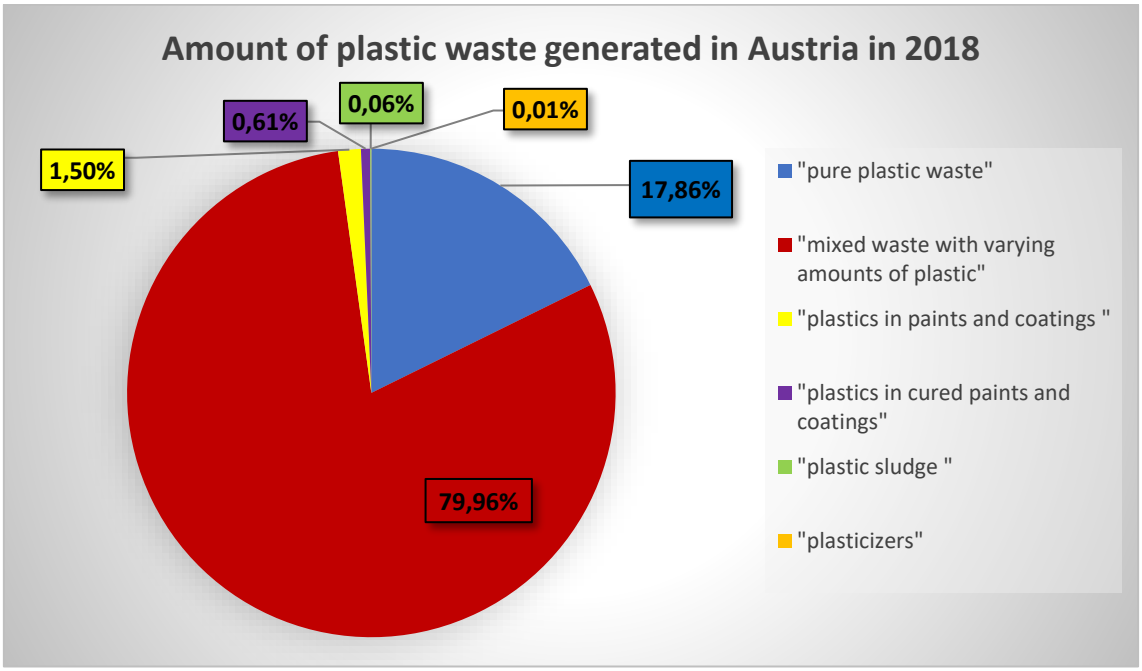


Figure 2: Data-Source: Umweltbundesamt, "Plastic waste generated in Austria in 2018 in percent" https://secure.umweltbundesamt.at/edm_portal/cms.do?get=/portal/informationen/daten-zahlen-grafiken.main.

With the change of the Directive of the European Parliament on waste (2018) and the creation of the Circular Economy Package for the member states of the European Union, new recycling targets for municipal and packaging waste by 2025, 2030 and 2035 have been defined. The transition of the European Union to a recycling society should succeed with resource-saving and sustainable waste management.

The practical analysis of the development and prognosis of recycling quotes within Styria is built on a theoretical foundation based on legal framework conditions on European, national, state and local level. This is followed in general by the organizational structures in the Waste Management industry in Styria, the emergence of all municipal waste and the development of recycling rates on European and national level, as well as challenges and measures in Austria and Styria.[10]

[10] *Aspäck*, STUDIE: Regionale Analyse und Prognose der Recycling Quotenentwicklung in der Steiermark anhand des RIL-Ternärdiagrammes und Prognose der mittelfristigen Entwicklung erstellt im Rahmen des Projektes IMKREIST, Lehrstuhl für Abfallverwertungstechnik und Abfallwirtschaft, Montanuniversität Leoben (2020) 3f.

2.2.2. Waste collection infrastructure & Recycling quotes in Styria[11]

Before looking at the recycling quotes in Styria, the Styrian waste collection infrastructure for plastic packaging will be briefly presented.

In line with the "polluter pays" principle, producers and importers in Austria will in future be charged a tax of an average of 80 cents per kilogram of plastic packaging placed on the market. This is known as Extended Producer Responsibility (EPR) and is an environmental policy instrument that makes producers responsible for managing the after-use phase of a product. The producer tax is intended to be ecologically staggered. If packaging is particularly suitable for recycling or contains a proportion of recycled material, the tax is reduced. In addition, the tax is linked to the EU plastic tax that has to be paid: if Austria's recycling rate increases, the tax burden from the plastic tax decreases. The savings are passed on to producers and importers through a reduced producer tax. The tax has a triple incentive effect. It rewards the use of alternative packaging materials as well as plastics with recycled content, leads to a higher recycling rate and thus also to lower producer taxes.[12]

The "*Verpackungskoordinierungsstelle gemeinnützige Gesellschaft mbH*"[13] - *"VKS*" for short - is responsible for the successful coordination of tasks in the various collection systems relating to the separate collection of packaging waste. It was founded as a company of the federal government and lies within the sphere of influence of the Federal Ministry for Climate Action (BMK). The founding of the VKS had become necessary due to the market opening of separate packaging waste collection established at the European Union level.

The "*Altstoff Recycling Austria AG"*[14] is among others, such a collection system for plastic packaging in Austria. In order to obtain unmixed fractions, the light packaging fraction collected in the yellow bag or yellow waste garbage can is sorted. The fractions obtained

[11] *Aspäck*, STUDIE: Regionale Analyse und Prognose der Recycling Quotenentwicklung in der Steiermark anhand des RIL-Ternärdiagrammes und Prognose der mittelfristigen Entwicklung erstellt im Rahmen des Projektes IMKREIST, Lehrstuhl für Abfallverwertungstechnik und Abfallwirtschaft, Montanuniversität Leoben (2020) 71f.
[12] *Federal Ministry for Climate Action,* 3-Punkte-Plan gegen Plastikflut in Österreich (2021) https://www.bmk.gv.at/service/presse/weitere-presseinformtionen/3punkteplan.html.
[13] See: https://www.vks-gmbh.at/ueber-uns.html.
[14] See: https://www.ara.at/en/.

in this process are further processed into recyclate, which can be reprocessed into products. LDPE films (low density polyethylene), as well as HDPE hollow bodies (high density polyethylene), PET beverage bottles (made out of polyethylene terephthalate, polystyrene and polypropylene), as well as EPS foams (expanded polystyrene, polystyrene foams) are sent for material recycling.
In Styria, plastics from the packaging collection are taken over for recycling by the company *Ecoplast Kunststoffrecycling GmbH* in Wildon.

The following overview within the Styrian recycling rates is presented by examining the recycling quotes within the municipal waste, as well as the mixed municipal and packaging waste groups through the RIL-tenarydiagram on the state level.

Lightweight composite packaging is more difficult to recycle due to its complex material composition since the products are sometimes made of many different mixed plastics. Due to their heterogeneity, they can hardly be separated during the sorting and treatment process, whereby the economic and ecological costs are higher the more complex the material is. Pollution levels of the plastics due to, for example, incorrect disposal in the residual waste garbage can also influence the possibility of recycling.[15] Therefore, more than 66% of these plastics are sent for thermal treatment.

[15] For more information see: *Küppers,* Potential of Sensor-Based Sorting in Enhanced Landfill Mining under Consideration of the Effects of Defilements, Dissertation at Montanuniversität Leoben (2020).

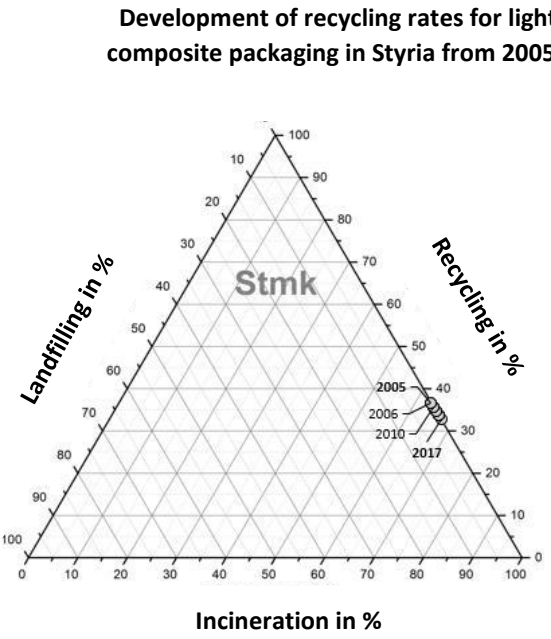


*Figure 3: „*Development of recycling rates for lightweight composite packaging in Styria from 2005 to 2017“ (Source: *Aspäck, STUDIE: Regionale Analyse und Prognose der Recycling Quotenentwicklung in der Steiermark anhand des RIL-Ternärdiagrammes und Prognose der mittelfristigen Entwicklung erstellt im Rahmen des Projektes IMKREIST, Lehrstuhl für Abfallverwertungstechnik und Abfallwirtschaft, Montanuniversität Leoben (2020) 71.*

As it is shown in figure 3, while in 2005, 36.7% of lightweight composite packaging were recycled and 63.3% were thermally processed, in 2017 the rates are only 33.4% and 66.6%, respectively. The main factor to this shift lies in the household collection systems, which are particularly affected by misthrows and the material is not sufficient in quality for a recycling process. Likewise, the products should be made simpler in their construction, so that better sorting and recycling is possible. At this point, digitalization and data communication within Recycling 4.0 are playing an essential role. This involves exchanging material, produce and process data in order to design better performance systems, starting with the manufacture of products and ending with recycling and recovery cycles.

Further measures within the circular economy package should allow products made of plastic to be manufactured in such a way that they are also easier to separate and recycle. In sorting technology, measures for detection and separation processes, techniques for image and shape recognition and the use of artificial intelligence, among others, are already being applied to obtain recyclable material more efficiently. Another

aspect is raw material recycling, which is not yet practiced in Styria. An additional measure to be mentioned is the extension of the deposit system in Austria to plastic beverage bottles in order to obtain sorted materials through this collection.

As part of the amendments to the European Waste Framework Directive (2018), new recycling targets were set for municipal waste. A recycling rate of 55% is to be achieved for all municipal waste by 2025, 60% by 2030 and 65% by 2035. In addition, depending on the fraction, further quotas are set for 2025 and 2030 within the Packaging Framework Directive (2018). These are 50% and 55% for plastic packaging, respectively. In Styria, there was a high positive dynamic of recycling rates and a strong reduction of landfill rates between 1993 and 2017. Likewise, within these 14 years, due to the reduction of landfilling, the share of incineration increased. This is mainly due to the legal framework, but also because of the structures and processes within waste management in Austria and in Styria. Based on this development, an ongoing increase can be expected for the medium-term forecast of recycling rates.

Until 2017, there was an average growth of the recycling rate of 0.61% per year for municipal waste in Styria. Although there are always slight fluctuations between the individual years, there was nevertheless an increase due to innovations, new regulations, and improvements in waste management structures in Styria. This assumption of a slight increase based on the past up to the present is also made for the future, although the fluctuations and the influences on it cannot be estimated and therefore a constant growth of 0.61% per year for municipal waste in Styria is assumed. By 2025, the recycling rate is expected to develop to 64%, with the incineration rate decreasing to 35%. After another 5 years, the rate increases from 64% to 67%, reaching 70% by 2035. The rate for energy recovery through incineration decreases by another 6% by 2035. Landfilling is nevertheless an integral part of sustainable waste management, as there is no return to the product cycle for a fraction of waste after pretreatment. This mainly concerns waste which is excluded from the cycle due to hygienic standards, or represents inert material, as well as material contaminated with pollutants. No deterioration or reduction in the landfill rate is assumed, so the rate stagnates at 1% over the entire period.

If the targets are achieved as presented in the forecast, Styria will be well above the prescribed recycling targets of the European Union, as it is in the present, at 59%. By 2025, the province is expected to be above 9% of the set target of 55%, by 2030 it is expected to be above 7% and by 2035 it is expected to be above 5%.

In summary, there is a very positive trend in regard to the recycling goals of the European Union at the development and forecast level in Styria, whereby there is also the potential for improvement in the collection rates of recyclable municipal waste within the waste management associations.

2.2.3. Recycling infrastructures in Styria [16]

Now the current situation of the recycling of Styrian plastic waste shall be summarized. The estimated recycling quantities of Styrian waste in 2018 is amounted to 12,313 t or 9% of the plastic share of the relevant waste fractions. The following waste fractions are relevant for this: packaging light fraction municipal as well as commercial, textiles, used tires and Waste of Electrical and Electronic Equipment (WEEE). The recycling rates are already determined for the light fraction according to the new calculation method of the EU and for textiles, WEEE and scrap tires still according to an unknown calculation method.

There are 365 used material collection centers in Styria. In some of these used material collection centers, municipal plastic packaging waste is collected by citizens and employees according to product or polymer type. This is for example the case in the municipalities of Leoben, Leibnitz, Ratschendorf, Riegersberg and Schachen. Clear and colored films, styrofoam, PET bottles, bottle caps, HDPE hollow bodies, composite beverage cartons and other materials are collected separately there.

[16] *Wellacher/Schaffernak/Lichtenegger*, STUDIE: Umsetzung der EU-Kunststoffstrategie in der Steiermark-Ausgangslage, Potentiale, technische Möglichkeiten und Maßnahmen, erstellt im Rahmen des Projektes IMKREIST, Lehrstuhl für Abfallverwertungstechnik und Abfallwirtschaft, Montanuniversität Leoben (2020)24 ff.

The largest plastic sorting plant in Austria is located in Graz, which is operated by *Saubermacher Dienstleistungs AG*[17]. The plant input consists of packaging waste from households (collected in the "yellow garbage can" and the "yellow bag") and commercial enterprises.

Picture 1: Sorting plant by Saubermacher Dienstleistungs AG in Graz, Source: https://saubermacher.at/anlagen/.

The capacity of this plant is about 32,000 t/a. Plastic packaging is sorted by type and color. About 40% of the output materials are pre-concentrated for material recycling, the rest is used as substitute fuels in the cement industry. The process sequence starts with a bag opener. Then the input material is fed into a drum sieve with 50 mm and 250 mm hole width. The sieve pass <50 mm becomes replacement fuel, the sieve fraction 50-250 mm is further transported to a circular vibrating sieve with 50 mm hole width, and the sieve overflow >250 mm goes directly to the sorting platform, where interfering and valuable materials from the sieve pass are manually sorted out. In the circular vibrating sieve, there is another separation between the sieve passage <50 mm and the sieve overflow >50 mm. The sieve passage again becomes refuse derived fuel. Downstream of the circular vibrating sieve is an air classifier, whereby light fractions are separated, fed to manual sorting and all useful fractions are pressed into bales. The sieve overflow 50-250 mm, from which the light fractions have been removed, passes through an overband magnet, which separates ferrous metals from the fraction. Subsequently, ballistic separation occurs with screening of the material at 50 mm. The screened material becomes refuse derived fuel. Subsequently, the cubic and the flat fraction >50 mm are

[17] See: https://saubermacher.at/.

each subjected to multi-stage sensor-based sorting. PET, HDPE, PP and PS are sorted by means of NIR technology, and PET is further separated by color with a downstream color sorting system. The individual polymers are again manually re-sorted and pressed into bales as different useful fractions.

Other sorting plants for plastic waste or packaging waste from the "yellow garbage can" are known for Styria, but they appear negligible in terms of input material and capacity. In addition, there are individual waste management associations in Styria that operate manual sorting plants.

The plastic recycling plant of the company *Ecoplast Kunststoffrecycling GmbH*[18] in Wildon processes 47,000 t of plastic waste annually into recyclates. The input material comes from post-consumer areas of lightweight packaging waste from Austria and abroad, as well as commercial plastic waste. The recycling plant operates three lines, the newest of these came on line in 2019.

The process steps can be summarized in five steps: Mechanical pretreatment, sorting, washing, drying and extrusion. Foreign and impurity materials are separated at each stage. As separation technologies, the float-sink, hydro-cyclone and centrifuge processes are used.

[18] See: https://www.ecoplast.com/.

Picture 2: plastic recycling plant of the company Ecoplast Kunststoffrecycling GmbH in Wildon, Source: https://www.ecoplast.com/.

In Austria, there are a total of 38 plastics recycling plants with a total capacity of 319,000 tons. Both plastic waste and other waste containing plastics are treated in these plants. The fields of activity in these plants range from the shredding of Styrofoam to the production of recyclates, products/semi-finished products and construction materials. For Styria, in addition to the *Ecoplast* plant, three plants are mentioned, one for sorting construction materials, two for shredding Styrofoam and the plastics recycling plant *Kunststoff-Recycling dekura GmbH & Co. KG*[19] *in Tillmitsch*. At this facility, secondary raw materials in the form of regrind and re-granulates are produced from PVC pre- and post-consumer materials as well as from commercial plastic waste.

Excursion: The state-of-the-art sorting plant operated by Hackl[20]

In the course of the Study Visit, the participants are going to explore the most modern waste facility run by the *Hackl company*[21] in Wulkaprodersdorf (Burgenland). The following characteristics distinguish this facility as particularly innovative.

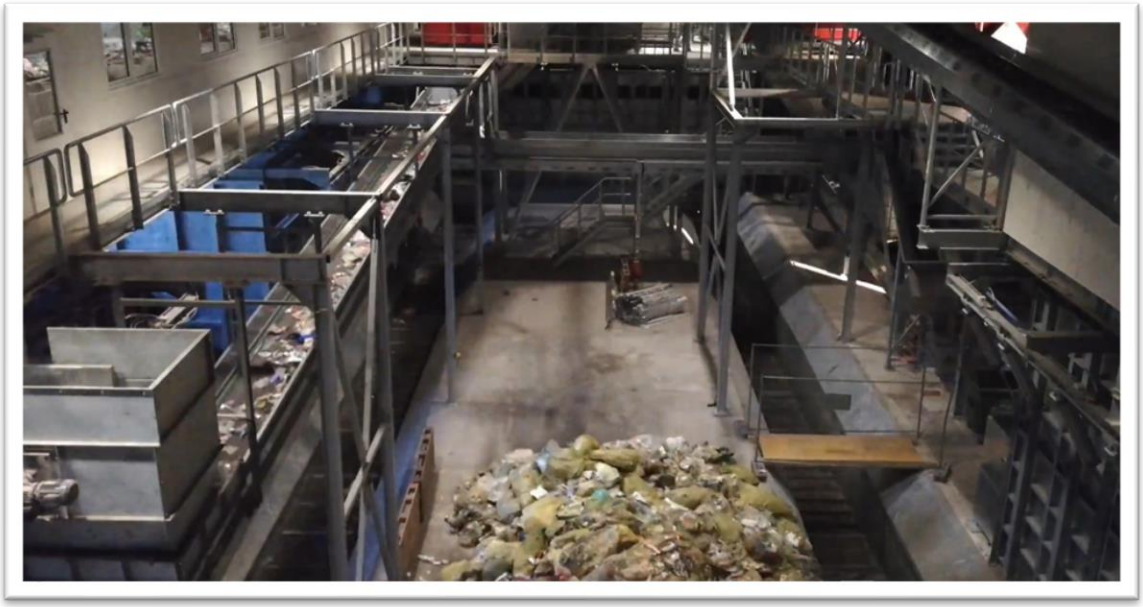
[19] See: https://www.dekura.de/.
[20] *Hackl,* Innovative Anlage: https://www.hackl-container.com/anlage/
[21] See: https://www.hackl-container.com/unternehmen/.

The plant consists of several parts, which are spatially separated, namely the input storage, the mechanical pre-treatment incl. substitute fuel production, the sorting of recyclable materials, the finished storage of substitute fuels, as well as the area for the production of "premium" substitute fuels.

The plant's annual capacity is about 38,000 tons and is intended primarily for lightweight packaging, commercial waste, construction site waste and bulky waste.

The plant operators have followed innovative approaches in planning and constructing the facility. Two sorting robots with artificial intelligence are in use. The control of the plant works without a control room, using only tablets. And the parameterization of the plant components is done via QR codes.

Of course, the machine does not replace employees, but it does support them. Specifically, 25 new employees were hired because of the new system, although the same input volume as before can be processed. However, as expected, efficiency has improved: the output of recyclable materials for the circular economy has increased significantly.



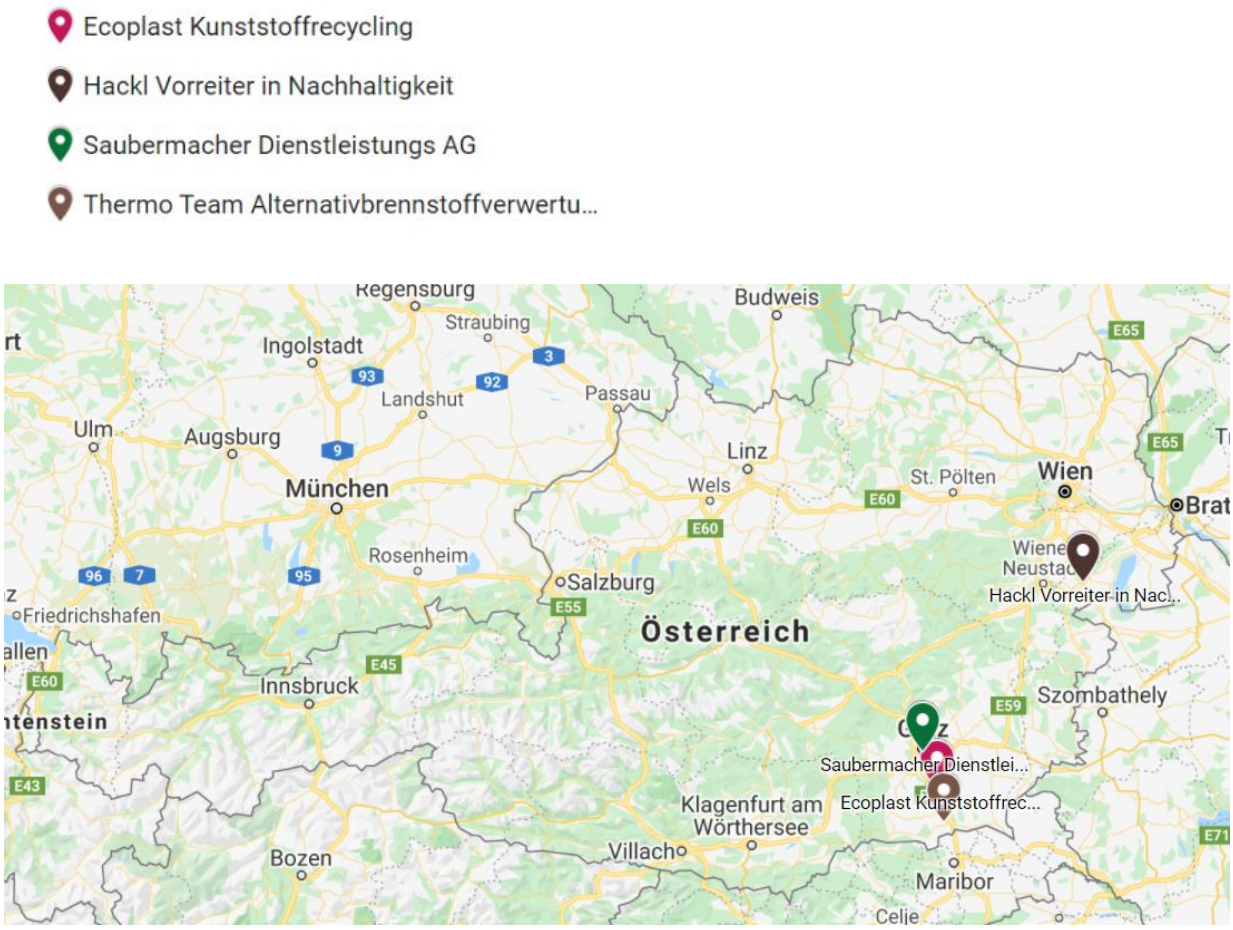
Picture 3: Screenshot from "Hackl Container - new waste treatment plant - Fast Motion Camera 01" https://vimeo.com/411372622/b893bd86a9.

The plant is heated exclusively with the outgoing air from the compressors used, with heat exchangers in the sorting cabins further reducing the heating and cooling capacity by 75%. By increasing extraction in the halls, dust pollution in the surrounding area is

kept as low as possible and new filter technologies also minimize the impact on the environment.

Participants will learn more about this facility on site. During the visit, participants will also have the opportunity, to ask any questions that may arise.

Picture 4 shows where the three discussed facilities, namely the plastic sorting plant by *Saubermacher Dienstleistungs- AG*, the plastic recycling plant of *Ecoplast Kunststoffrecycling GmbH* as well as the waste facility run by *Hackl company*, and the incineration plant by *Thermo-Team* are located.



Picture 4: Source: https://www.google.at/maps created via"mymaps".

The contact details of the facility operators can be found below:

Name/facility	address	phone	E-Mail /website
Ecoplast- Kunststoffrecycling Ges.m.b.H	Untere Aue 21, A 8410 Wildon	0043/3182 3355	info@ecoplast.com www.ecoplast.com
Oswald Hackl e.U.	Hutweide 1, A 7041-Wulkaprodersdorf	0043/268748020	office@hackl-container.at www.hackl-container.com/
Saubermacher Dienstleistungs AG	Puchstraße 41, A 8020 Graz	0043/59800-5000	kundenservice@saubermacher.at www.saubermacher.at/en/
Thermo Team Alternativbrennstoffverwertung	Retznei 34, A 8461 Ehrenhausen	0043/3453 40967	office@thermoteam.at www.thermoteam.at/

2.2.4. Incineration technologies implemented in the region[22]

Non-recyclable plastic must be incinerated. At least the energy contained in the materials is used by incineration to generate electricity or to provide process heat. Figure 4 shows the development of the use of incineration (marked red) and landfilling (marked grey) of municipal waste in Austria over the years, starting in 1989-2018.[23]

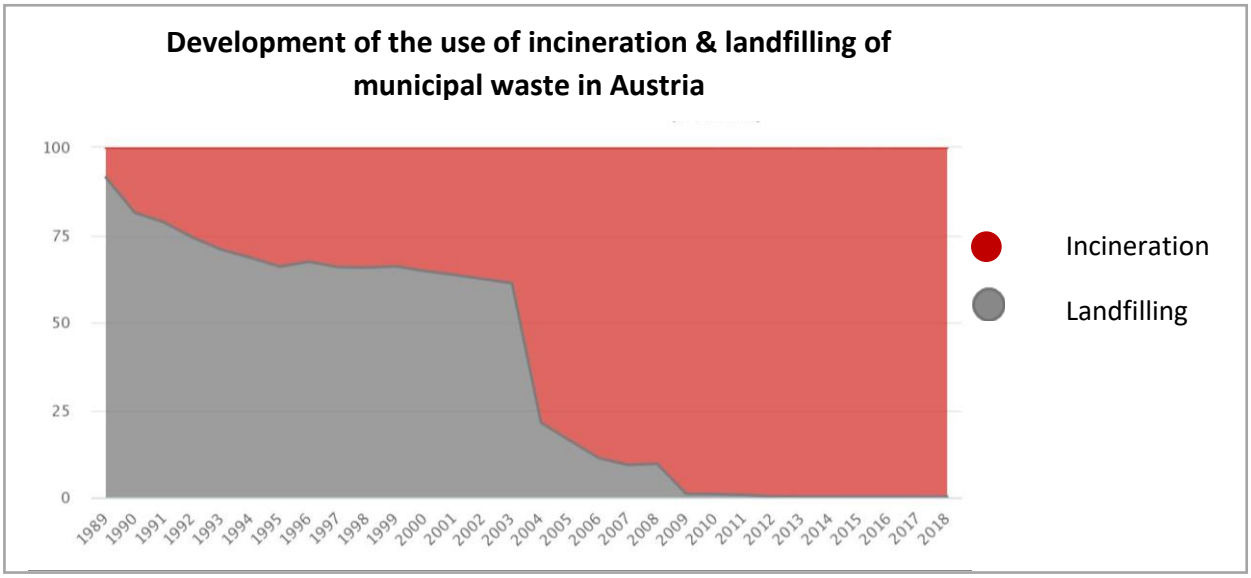


Figure 4: Data-Source: Umweltbundesamt, "Thermal recovery and landfilling of municipal waste (first treatment steps)"https://secure.umweltbundesamt.at/edm_portal/cms.do?get=/portal/informationen/daten-zahlen-grafiken.main.

Concerning the incineration technologies, a differentiation must be made between grate firing, mainly in waste incineration plants, fluidised-bed firing, calciner firing and rotary kiln technology. Within the scope of processing and recycling of substitute fuels, plastic streams (including used tires, shredder lightweight fractions, high-calorific plastic fractions) are also highly relevant. The waste streams have to be cleared of impurities

[22] *Wellacher/Schaffernak/Lichtenegger*, STUDIE: Umsetzung der EU-Kunststoffstrategie in der Steiermark-Ausgangslage, Potentiale, technische Möglichkeiten und Maßnahmen, erstellt im Rahmen des Projektes IMKREIST, Lehrstuhl für Abfallverwertungstechnik und Abfallwirtschaft, Montanuniversität Leoben (2020) 50f.
[23] *Umweltbundesamt,* „Verwertung und Beseitigung von Siedlungsabfällen (erste Behandlungswege)" https://secure.umweltbundesamt.at/edm_portal/cms.do?get=/portal/informationen/daten-zahlen-grafiken.main.

and pollutants by splitting processes and processed to substitute fuels of different qualities.

The grate firing is mainly used for volume reduction and immobilization of non-processed waste. The overall objective for the use of this incineration technology is the harmless and non-hazardous disposal of waste. The input is made up mainly of mixed municipal and commercial waste.

In the case of fluidised-bed incineration plants, waste with a calorific value of 12-18 MJ/kg, which has been pre-treated, is being used. In Styria, there is a fluidised-bed incineration plant for thermal utilization of residual materials in Niklasdorf (*Energie- und Abfallverwertungs GmbH ENAGES*[24]).

In rotary kilns, high-calorific (18-25 MJ/kg) and fine-grained substitute fuels (<35 mm) are used in the primary firing as fuel for cement production. In the cement plant of *Lafarge Perlmooser AG* in Retznei[25], a rotary kiln with substitute fuels with a minimum calorific value of 22 MJ/kg is in operation. The substitute fuels for this are prepared on site in the *Thermo-Team plant*[26].

In the future, it is expected that sorting plants will be built upstream of mixed municipal waste incineration plants to separate out recyclable plastics in concentrates.

2.2.5. Monitoring methods & practices[27]

The European Union set new targets and objectives for waste management in 2018 with the amendment of Directive 2008/98/EC on waste (circular economy package), which must be implemented and achieved by the member states. Therefore, there are new targets within waste management for preparation of reuse and recycling

[24] See: https://www.enages.at/.
[25] See: https://www.lafarge.at/.
[26] See: http://www.thermoteam.at/cms/front_content.php?lang=1.
[27] *Aspäck*, STUDIE: Regionale Analyse und Prognose der Recycling Quotenentwicklung in der Steiermark anhand des RIL-Ternärdiagrammes und Prognose der mittelfristigen Entwicklung erstellt im Rahmen des Projektes IMKREIST, Lehrstuhl für Abfallverwertungstechnik und Abfallwirtschaft, Montanuniversität Leoben (2020) 6; as well as: *Wellacher/Schaffernak/Lichtenegger*, STUDIE: Umsetzung der EU-Kunststoffstrategie in der Steiermark-Ausgangslage, Potentiale, technische Möglichkeiten und Maßnahmen, erstellt im Rahmen des Projektes IMKREIST, Lehrstuhl für Abfallverwertungstechnik und Abfallwirtschaft, Montanuniversität Leoben (2020) 52ff.

to lead the member states into a more efficient waste management system. In the course of a study commissioned by the Regional Government of Styria and carried out by the University of Leoben, Chair of Waste Processing Technology and Waste Management, 19 measures were developed in order to implement the EU Plastics Strategy. Most of them cause changes at several waste management levels.

The following measures serve the implementation of the EU Plastics Strategy in Styria and allow a permanent monitoring at these waste management stages:

- *Increase the waste management budget*
- *Data collection*
- *Awareness raising*
- *Ecodesign of products*
- *Optimization of operational material flows*
- *Reusable instead of disposable*
- *Support and promotion of reparations*
- *Re-use stores*
- *The Polluter pays waste charges*
- *Improvement of waste collection centers*
- *Deposit on disposable beverage bottles*
- *Personalized waste collection*
- *Demanding of extended producer responsibility*
- *Considerate waste collection*
- *Improvement of the source sorting*
- *Expansion of sorting capacities*
- *Extension of the state of the art for sorting facilities*
- *Expansion of recycling capacities*
- *Extension of the state of the art for recycling plants*

To achieve the new recycling targets, measures are required for a cut-rate infrastructure that starts with waste separation and collection systems, continues with proper monitoring of material flows and ends with the treatment and recycling of municipal waste. The optimization of these waste management systems, regardless of whether they are publicly or privately owned, is an essential factor in achieving the goals within the prescribed circular economy package.

An evaluation of the success of the aimed targets in Styria will be carried out in the course of the Styrian Waste Management Plans (LAWP)[28]. The Styrian Waste Management Plan 2019 is a forward-looking concept for a resource-saving circular economy and was decided by the Regional Government of Styria. It is the basis for waste management planning for the upcoming six years at the regional styrian level and aims to improve the implementation of the waste hierarchy, to increase innovation and technological development, and to implement the precautionary principle.

2.3. Benefits for partner regions as a result of the Study Visit

It will be particularly educational for the participating partner regions to be able to visit the Austrian best practice models on site and to have their everyday application observed and explained. On site, the partners can talk to the plant operators about drivers and obstacles. In addition, the real qualities of the recycled materials can be examined by the participants themselves and on site.

The Study Visit also offers the possibility for the partners to exchange ideas with the regional administration. The key data from the Styrian regions are also brought closer to the partners and thus the partners can compare them with their own key data.

Partners have the opportunity to talk and discuss future technological developments with scientific attendees from the region. It is also a special aspect of the Study Visit and its organization that the participants will get to know the interplay between administration, science, and the private sector in Austria along the entire value chain.

3. Discussions

During the Study Visit, partners will be able to ask any questions they might have about the best practice models presented and to discuss them with the plant operators and the other participants. In this respect, the implementation of the technologies already successfully used in Austria can also be promoted in other partner regions and new contacts for further cooperation can be made.

[28] *Regional Government of Styria,* The Styrian Waste Management Plan: https://www.abfallwirtschaft.steiermark.at/cms/beitrag/10177492/136114083.

After the excursions and the lectures, the organizers have planned enough time for the participants to talk to each other about the presented methods, technologies and the acquired knowledge.

4. Organisation of the Study Visit

4.1. Date and attendees

The Office of the Regional Government of Styria, Directorate 14 – Water Management, Resources and Sustainability (Department Waste and Resource Management) will host the "A3.4 Study visit on effective waste management policies and measures to reduce plastics waste landfilling and incineration". The Study Visit will take place in the project's 5th semester, as scheduled in the Application Form. The event will be held in November 2021 and shall last from 22.11. November until 25.11. November. The working language will be English.

The PLASTECO Application Form foresees approx. 40 participants in total. The target audience include all those representatives of institutions and persons that can be impacted by the project outcomes and are interested in using project outputs and results to implement effective waste management policies and measures to reduce plastics waste landfilling and incineration in their regions.

The Application Form provides a list of key regional stakeholders per project partners. These stakeholders need to be invited to the Study Visit. Nevertheless, the partners are advised to invite any other institutions such as environmental agencies, regional development agencies, higher educational institutes, research centers, chambers of commerce, professional associations and public authorities which are involved in the decision-making process and/or interested in triggering policy development.

The Styrian regional stakeholders shall participate as well. These Styrian key stakeholders include: representatives of the Federal Environmental Agency, representatives of the Styrian Chamber of Commerce, representatives of the Green Tech Cluster as well as representatives from the Styrian universities (University of Leoben, Karl Franzens University Graz, Graz University of Technology).

4.2. Study Visit as an on-site event

The Study Visit is scheduled for November 2021 and will include three days of activities. Due to the progress of the European Vaccine Strategy, it is expected that an on-site event will be possible in compliance with the COVID 19 protective measures. The organizers will adapt the Study Visit accordingly to these protective measures. Conveniently, most of the excursions during the Study Visit will take place outdoors.
The following COVID 19 protection measures shall be implemented in full compliance with national restrictions and guidelines while on-site event:

- At the beginning of the Study Visit, participants are tested on the COVID virus, if they have not been vaccinated already.
- The facilities must be properly ventilated and air-conditioned. They should also be accessible for all participants.
- Throughout the Study Visit, a minimum distance of 1.5 meters from any other participant must be respected. The facilities must also be selected in accordance with the guidelines.
- The availability of sanitizers and protective equipment (e.g. masks) must be ensured during the entire Study Visit. The participants must adhere to these rules and will also be controlled by the organizers.
- Organizers also pay close attention regarding the serving of food and beverages and implementing safer options. Here, prior coordination takes place with the caterers to implement appropriate precautions.

4.3. Session format

The Study Visit in Austria is planned to be held in presence, but if this should not be possible due to the pandemic situation, the learning and delivery methods and techniques used will not differ fundamentally from each other.

In order, to make the topics and good practice examples as understandable and as comprehensive as possible for the participating partners and their stakeholders, the following methods will be used.

- **On-site visit of the state-of-the-art facilities in Austria:** The most modern waste separation and recycling plants will be presented to the partners during the planned excursions on the Study Visit days. If the study visit is held online, an alternative to the on-site presentation of these facilities will be organized.
- **Oral presentations by regional experts:** In addition, presentations on the topics held by experts from the regional waste management industry and the scientific sector will be a fixed component of the study visit. The lectures represent the theoretical part of the Study Visit.
- **Interactive sessions such as round table discussions:** The methods described above, such as the visit to facilities and the expert presentations, are intended to lead to fruitful discussions among the participants. Enough time will be scheduled throughout the Study Visit for asking questions and for debating. Round table discussions will also be part of the event and shall serve the exchange among each other and the reflection of the acquired information.

Furthermore, the Annex provides a feedback form, which the organizer should distribute to participants to fill in. The completed feedback forms will be reviewed by Styria, to evaluate the applied learning and capacity methods.

4.4. Agenda

AGENDA

22.11.2021	**Day of arrival**
8 PM:	City tour in Graz & Group Dinner (tbc)
23.11.2021	
9-12 AM:	**Workshop Part I** • Brief presentation of PLASTECO & introduction to Study Visit • Implementation of the Single Use Plastics Directive in Austria (Federal Ministry for Climate Action) • Legal regulations & implementation of the packaging collection ("Verpackungskoordinierungsstelle") • Presentation Recyclability of plastics (Prof. Pomberger, Montanuniversitaet Leoben) • PCCL Presentation- Multilayer Detection (Polymer Competence Center Leoben GmbH)
2-5 PM:	**Workshop Part II** • Sustainability Paper Presentation • Workshop in order to acitvity "A4.1" (RETHYMNO) **Freetime/Group Dinner**

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AGENDA

24.11.2021

9- 11:30 AM:

Field Visit

- Presentation of the Input Paper (GreenTechCluster Graz)
- Company Introductions

1-6 PM:

- Saubermacher Dienstleistungs AG, Graz & Feldkirchen (plastic sorting plant & material scanner)
- AKG Plastics Wildon
- "Ressourcenpark" Leibnitz (regional household waste collection center with differentiated houshold packaging collection)

6:30 PM

Sightseeing & Dinner at Styrian Winelands

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AGENDA

25.11.2021

8:30 AM-14 PM:

Departure & Field Visit

- Steering Group Meeting (RETHMNO)
- Departure to Vienna International Airport
- Stop at Hackl Container GmbH (cutting edge plastic packaging sorting plant)

Lunch

Onward transport to Vienna/ Graz will be organised if required!

Please note that this agenda is a suggested plan that may be adapted according to the Covid-19 guidelines that are in effect at the time of the Study Visit.

4.5. Providing the summary report

Styria will provide a summary report to present the outcomes of the Study Visit. The summary report is intended to help the partners and their stakeholders to discuss and implement the knowledge gained from the Study Visit in their regions. Summary reports are short written communication documents, which aim to convey information related to the discussions and activities carried out during Study Visit proceedings. The summary report should include the following aspects:

- Documentation of the interventions of participants and the overall discussion within each session.
- Drawing conclusions from the round table discussions and the debates in each session of the Study Visit.
- Brief presentation of the policy recommendations for the development of action plans based on the interventions of the participants and the conclusions drawn from the discussion.
- Presentation of an evaluation of the Study Visit based on the comments and feedback from participants.
- Presentation of the metrics of the Study Visit (number of registered participants, type of participants, duration).

The following **guidelines** have been developed for providing assistance and guidance on how to summarise and present the main conclusions drawn from the Study Visit. In this sense, the summary report should be drafted as follows.

At first, short summaries for each session of the Study Visit shall be developed. The summaries should include the context and objectives of the session, as well as the key argumentation from the interventions of participants, and conclusions and findings extracted from the overall discussion.

Furthermore, the evaluation forms shall be reviewed, and the main conclusions presented. The author should summarise the key pitches and ideas as drawn from the forms completed by Study Visit participants. It is highly recommended that any ideas

(e.g. policy advices) that could contribute to the improvement of regional policies in the field should be integrated.

The next step is to compare the key arguments/conclusions drawn with any relevant results and findings from PLASTECO thematic studies and guides on similar policy aspects. Identify convergences and divergences between findings.

Then provide guidelines (in the form of policy recommendations) on how to utilise the key conclusions drawn to design policy measures and action plans to promote the adoption of policy measures that lead to EU region's transition to a new plastics economy. The guidelines on how to integrate the lessons learnt in the PLASTECO action plans, as well as any policy advice that may be derived from the analysis of evaluation forms, should be described in a way that is simple, brief, and easy to follow.

Finally draft the summary report. The Study Visit summary report should be drafted clearly and concisely, focusing on the conclusions drawn from knowledge sharing and consultation processes that took place during the Study Visit sessions. To meet its purpose, the summary report should include the following:

- Overview and statistics, e.g. the number of participants and the type of organisations represented.
- Short description of the sites visited and the reasons for their selection.
- Summary of the main observations and lessons learnt from field visits and the key discussion points and conclusions from topics discussed.
- Brief presentation of policy recommendations for the development of action plans, based on the interventions of the participants and the conclusions drawn.
- The evaluation of the visit, based on participants' feedback.

5. References

Aspäck, STUDIE: Regionale Analyse und Prognose der Recycling Quotenentwicklung in der Steiermark anhand des RIL-Ternärdiagrammes und Prognose der mittelfristigen Entwicklung erstellt im Rahmen des Projektes IMKREIST, Lehrstuhl für Abfallverwertungstechnik und Abfallwirtschaft, Montanuniversität Leoben (2020).

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Annex: Feedback Form

„A3.4- Study Visit on effective waste management policies & measures to reduce plastics waste landfilling & incineration"

Organised by: the Office of the Regional Government of Styria
Directorate 14 – Water Management, Resources and Sustainability
Department Waste and Resource Management
Date: 22.11.2021-25.11.2021

Name	
Organisation	

Please answer the following questions regarding the PLASTECO Study Visit 2021 by rating on a 1 to 5 scale. 1 represents the lowest score and 5 represents the highest score and level of satisfaction.

	1	2	3	4	5
How would you rate the Study Visit's overall organisation?					
Would you say that all the relevant topics were covered during the Study Visit?					
How would you rate the quality of the discussion during the Study Visit?					
Did the presentations of our experts have an informative structure?					
Have you been pleased with the excursion destinations?					
The Study Visit will lead to improvements in the proposed policies					
The Study Visit has been useful and productive.					

Further comments & suggestions: