LOCAL PLANS TO PRIORITIZE INTERVENTIONS

DT1.4.2

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PP03 - ATM, Tyrol, Austria

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1. Introduction

The aim of the present document is to finalize the data collections and analysis built in DT1.3.2 (Report of the quantity of industrial waste in the CIRCE2020 industrial areas), DT1.3.3 (Report of the present destinations of industrial waste) and DT1.3.4 (M-scale analysis of the physical flows at local industrial system level). In a short way, this document summarizes the process that leads to pilot cases identification, from the recognition of waste production & destination to the physical flows maps. The present process to prioritize the interventions is also supported by a permanent consultation with local stakeholders (administrations located in the pilot regions, trade and industrial associations, environmental authoritities etc.) to come to a shared hierarchy of waste flows to optimize and/or to close (in DT1.1.3 and DT1.4.1).

2. Waste flows analysis

2.1. Short description of the pilot area

The Austrian pilot region comprises of the administrative province of Tyrol. Situated in the heart of the Alps, Tyrol has a population density of 59 inhabitants/km² (746,153 inhabitants; 12,640 km²). Elevation reaches from 465 m to 3,798 m. Tyrol covers in total 12,640 km², of which the land cover/land use is classified as follows: forest 39 %, other cover 27 %, high mountain pastures 23 %, agricultural area 9 %, settlement area 1.4 %, and water bodies 1 %. The permanently habitable area amounts to 1,573 km² (12.4 % of total area).

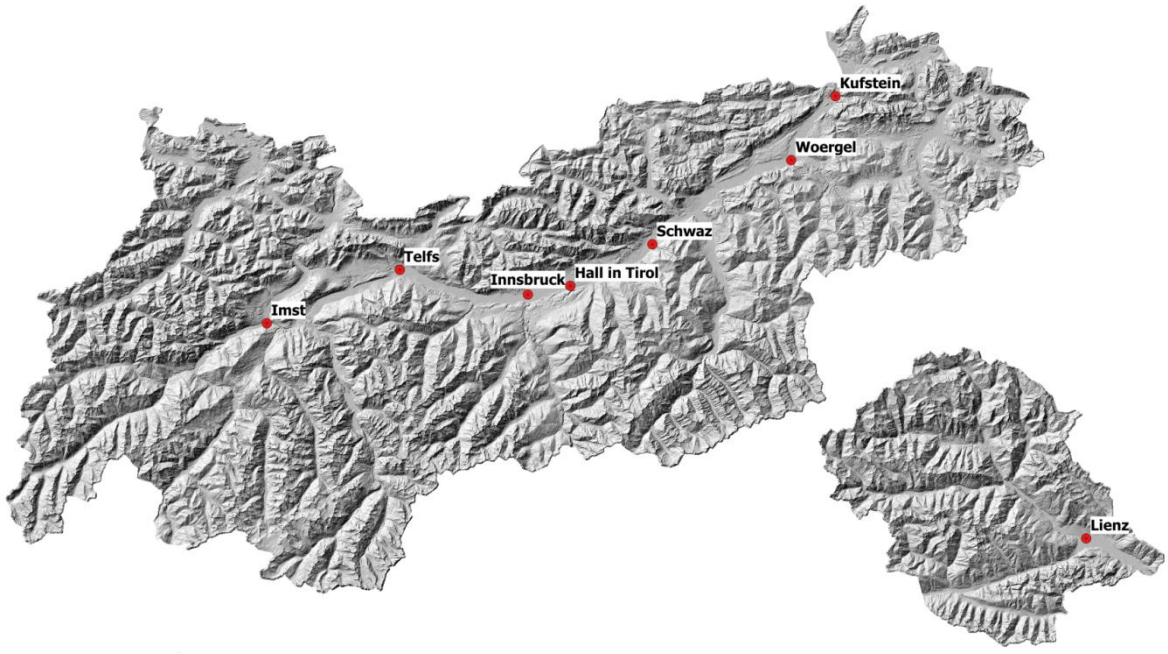

Figure 1: The pilot region Tyrol with the major cities and towns.

The strongest economic sector in respect to the economic output (gross value added) is the tertiary sector (services), with 70.5 %, followed by the secondary sector (manufacturing), with 28.7 %, and the primary sector (forestry and agriculture) with 0.8 %.

In general, the structure of the Tyrolean economy predominantly consists of small enterprises, of which more than 50 % are one-person enterprises (i.e. no employees), and approximately 90 % employ less than 10 staff.

2.2. Source and quality of data

Although all data regarding waste origin and destination is annually collected and managed within EDM, very strict data protection laws make it impossible to extract and analyse any of this information.

For Austria, available data are fragmented, have various different origins, sources, scales, reference bases, reference years, etc. The most recent and most complete overview is provided by the Austrian Waste Management Inventory (2017). The Inventory (2017) includes data available until October 2016, and mass flows and information on waste treatment facilities available until the end of 2015, if not stated differently.

On Tyrolean level publicly available data for waste production is scarce. The best available data is published in the most recent Austrian Federal Waste Management Plan, the data of which is from 2015 (BMLFUW, 2017).

2.3. Overview of the main treatment operation in Tyrol

Waste treatment in Tyrol is somewhat different from the other parts of the country. Tyrol has no Waste Incineration Plant (WIP) for the thermal treatment of mixed municipal wastes from households and similar establishments; therefore, those wastes have to be transported to the nearest WIP in Linz, in the federal state of Upper Austria, or to WIPs in the neighbouring countries of Southern Germany (Rosenheim) or Switzerland.

Data for the waste treatment in Tyrol are available only for municipal waste. Municipal waste in Austria also includes industrial waste produced by businesses that are similar to households.

The major part (144,000 t, 38.5 %) of the total of 373,700 t of Tyrolean municipal wastes are treated thermally, either directly or after treatment in mechanic-biological treatment, mechanical treatment, or in composting facilities. In 2016, the directly incinerated municipal wastes from households and similar establishments amounted to 70 % of all thermally treated wastes.

1. The different waste streams, their quantities and their respective treatment in 2016 are shown in Figure 2.

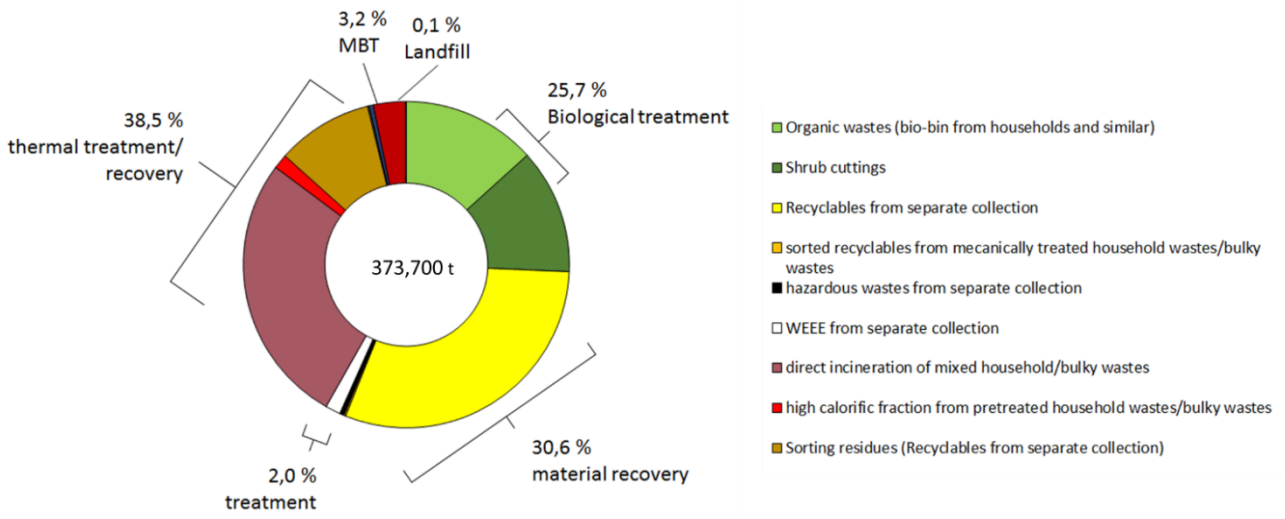

Figure 2: Tyrolean waste treatment and treated amounts in 2016. Data source: Federal State Government Tyrol, 2018.

Tyrolean wastes from households and similar establishments are treated in 28 mechanical (including one mechanical-biological) waste treatment plants in order to separate the waste into different fractions for further recycling, thermal recovery and landfilling (Figure 3).

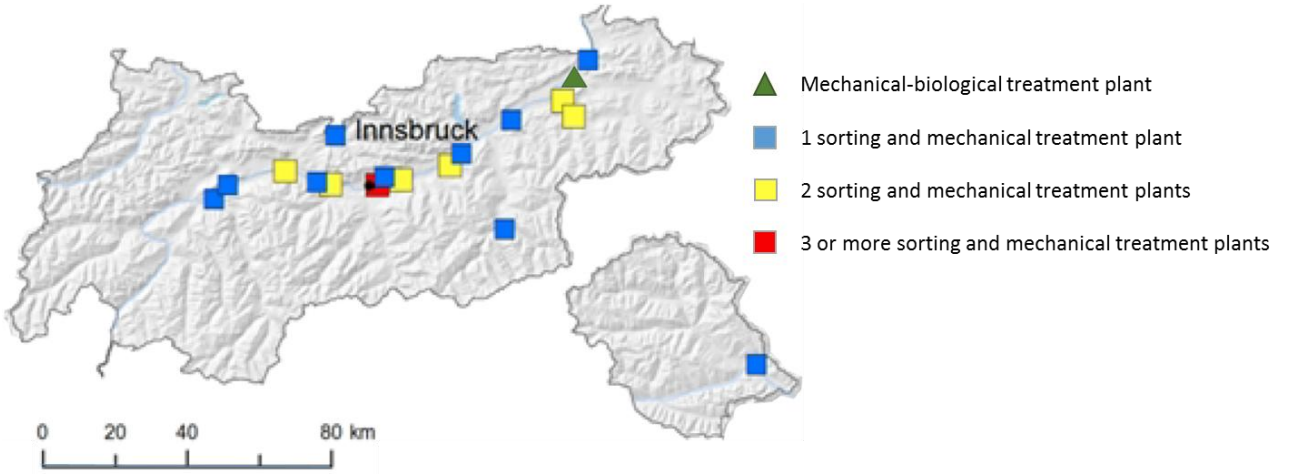

Figure 3: Facilities for the pre-treatment of municipal wastes from households and similar establishments. Data source: adapted from Federal Ministry for Sustainability and Tourism, 2017.

3. Most promising waste flows

In order to select waste flows which are relevant for Tyrolean businesses in total 27 stakeholder interviews were conducted. The stakeholders represented regional administration, private companies, business support associations and universities. The interviews were carried out on a one-to-one basis, between December 2017 and May 2018. In addition to this feedback, the willingness of companies to cooperate and potential ideas for a circular solution were relevant criteria for the selection of in total 10

waste streams (Table 1). To gather this information, some parts of the steps 'Matchmaking with enterprises' and 'Closing the loop' were done earlier than scheduled.

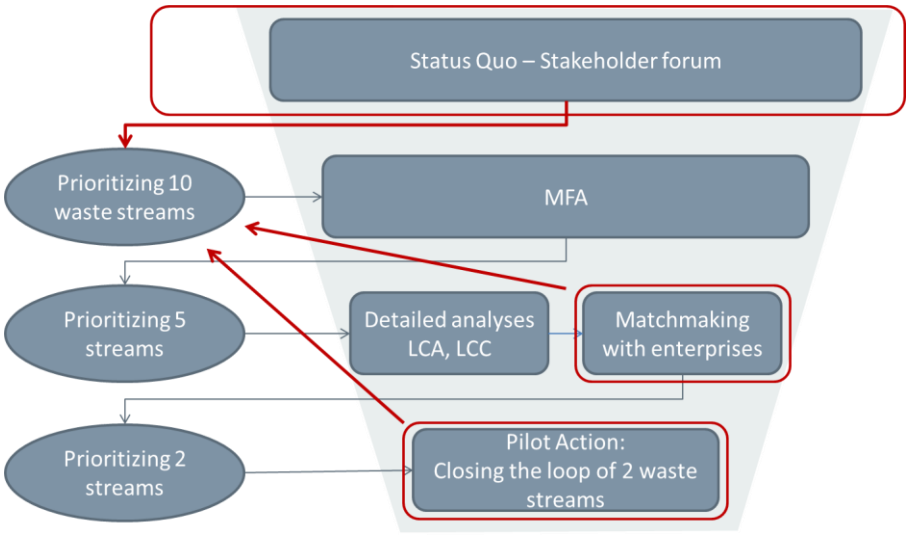

Figure 4: Work flow of the project steps. Indicated in red are the steps which were considered for the selection of the 10 waste streams.

Table 1: Selected waste streams for material flow analysis.

	Waste streams	Waste producing enterprises	Economic sector	Circular solution idea
1	Waste wood	Several companies	Several	Wood gas power plant
2	Sheep wool, minor quality	Sheep Breeding Association	Primary production	Fertilizing pellets
3	Non-saleable vegetables (rejects)	Farmers	Primary production	Rejects retail / convenience food
4	Old bread	Bakery	Food production	Animal feed
5	Organic waste	Supermarkets, restaurants, hotels	Food production, gastronomy, tourism, retail	Production of regional soil
6	Grease trap waste	Restaurants, hotels	Gastronomy and tourism	Biodiesel
7	Sewage sludge	Wastewater treatment plants	Sewerage	Phosphate recycling
8	Filter cake	Paint producer	Chemical industry	
9	Sifted limestone (0-25mm)	Chemical producer	Chemical industry	Soil-pH neutralizer
10	Calcium carbide production residue	Chemical producer	Chemical industry	

For these 10 waste streams a material flow analysis (MFA) was carried out. For each of the ten waste streams several indicators and criteria were developed and evaluated in order to compare the current situation with a future alternative when the circular solution is implemented. Indicators and criteria were as follow:

- **Waste Hierarchy** as a priority for waste management, with a potential waste hierarchy score of: 5 for prevention; 4 for preparing for re-use ; 3 for recycling ; 2 for other recovery; 1 for disposal

- **Moral & social relevance**: Is the newly created circular solution product of moral and ethical relevance?
- **Jobs**: Does the process of valorisation create jobs?
- **Willingness to cooperate**: Is a partner structure existing / established across the entire process chain (producer, collector / processor, distributor / consumer)?
- **Market demand**: Is there a market/demand for the new output product, preferably regional?
- **Technical feasibility**: Is the concept/idea technically feasible within the project duration?

As a result 5 waste streams were prioritized.

1. None-saleable vegetables (rejects)
2. Sheep of minor quality
3. Organic wastes
4. Waste wood
5. Grease Trap Waste

These are discussed in detail (see chapter 4.3) to choose the most promising two waste streams, which will be subject to Life Cycle Assessments, Life Cycle Cost Analyses and Technology Readiness Scouting.

4. The role of stakeholders

4.1. Stakeholder interviews

In order to select waste flows which are relevant for Tyrolean businesses in total 27 stakeholder interviews were conducted. The stakeholders represented regional administration, private companies, business support associations and universities. The interviews were carried out on a one-to-one basis, between December 2017 and May 2018. This approach was regarded as the most feasible method to approach stakeholders, in particular busy CEOs, high ranking officials from business support associations and from administrations.

The stakeholder interviews aimed to gather information on whether it is needed to optimize the private waste management of companies and if yes, which waste streams are relevant, in what way and why.

To approach relevant stakeholders, ATM was supported by the Tyrolean Economic Chamber. Due to this cooperation ATM was able to send essential project information to the environmental and resource managers of most of the industrial businesses in Tyrol, asking to participate in the project and to cooperate in analysing and optimizing their waste streams. In addition, stakeholders with general knowledge and insight in Tyrolean waste management were interviewed and asked if they know of companies who might be interested.

4.2. Interview outcome and its utilization

The waste streams that were mentioned during the interviews and the respective potential circular solutions, were collected and built the basis for a pre-selection. These wastes streams were checked for redundancy and similarity and if necessary united and as a consequence narrowed down to 10 waste streams (see Table 1). These 10 waste streams were analysed in a Material Flow Analysis (see chapter 3).

During the interviews potential circular solutions for each of the waste streams were developed and outlined. These built the basis the MFA evaluation. For this evaluation, in addition to the calculation of the waste hierarchy, 9 regional waste managers were asked to rate these 10 waste streams objectively according to five predefined criteria (see chapter 3).

Based on these results, 5 waste streams were selected, which will be subject to further analyses.

4.3. Outline of the circular solution of the 5 selected waste streams

1. None-saleable vegetables (rejects)

The circular solution plans to cooperate with regional farmers to reduce their food waste produced in the production process. Vegetables which are rejected to be sold through conventional market channels, such as supermarkets, because of their size (too big or too small), their shape (wonkey, too straight, etc) or colour (not according to marketing regulations), often are left on the field and ploughed under or are used for biogas production or composting. These rejected vegetables are planned to be used for the production of convenience food, e.g. fresh and ready to be used soup seasoning.

Discussion of waste stream regarding further analyses

- Data availability is problematic. Only sporadic and selective data exist from case studies about food waste in primary production
- No data available how much of the food wasted in primary production is potentially usable (i.e. hygiene issues)

- Environmental impacts (e.g. eutrophication of rotting vegetables on the fields) is only point by point and has no meaning for regional assessments
- Decision: won't be considered in further analyses

2. Sheep wool of minor quality

Sheep wool of which is soiled, in the wrong colour (mixed colours), is slightly mouldy is not fit for use in the textile industry. This wool is being discarded of and usually gets incinerated. To also make use of this wool the circular solution plans to cooperate with the regional Sheep Breeding Associations to also collect this wool and used to produce soil fertilizer pellets. These wool fertilizer pellets will then be marketed and distributed through regional garden centres.

Discussion of waste stream regarding further analyses

- Circular solution idea holds only very little innovation potential, as the solution and technology is already established
- Low potential to significantly improve current situation by implementing the circular solution idea
- Company partners showed little urgency to improve current situation
- LCA, LCC and technology brokerage contribute low added value in order to optimize current situation
- Decision: won't be considered in further analyses

3. Organic wastes

Organic wastes have a high potential to efficiently produce renewable energies. However, the potential for this has not yet been exploited in its entirety in Tyrol. Depending on the source of the organic wastes two different pathways for circular solutions are planned.

3.1 Organic wastes separately collected

In Austria there is an organic collection system in place, for which biowastes from households, restaurants, supermarkets, etc. are stored in so-called bio-bins and are collected by the municipality. The majority of the collected organic wastes are destined for biogas production in Waste Water Treatment Plants in co-digestion together with sewage sludge. The remaining digested sewage sludge has to be incinerated. The circular solution plans to set up a state-of-the-art collecting system in supermarket and restaurants and to transport the pre-processed organic waste to mono-digesting biogas plants. The digestate is planned to be composted and used to produce regional soil.

Discussion of waste stream regarding further analyses

- Circular solution idea holds only very little innovation potential, as the solution and technology is already established
- Low potential to significantly improve current situation by implementing the circular solution idea
- Company partner is predominantly interested in improving the existing collecting system
- LCA, LCC and technology brokerage contribute low added value in order to implement the circular solution ides
- Decision: won't be considered in further analyses

3.2 Organic waste from residual waste

The residual waste from households and similar establishments has 20% of organic content due to miss-placements. The circular solution plans to separate this organic content from the low calorific fraction in several steps and to use it for bio gas production in co-digestation in WWTPs.

Discussion of waste stream regarding further analyses

- Strong synergies with parallel project regarding the separation of organic fraction in residual waste
- Collection of relevant and necessary data during the parallel project
- Development of prototype technology already on-going
- Committed company partners to pursue this matter
- LCA, LCC and technology brokerage are appropriate analyses to consider environmental and economic impacts of the circular solution and very useful insights for the company partners
- Decision: will be considered for further analyses

4. Waste wood

Only waste wood of the highest quality (clean and untreated) can be shredded and used to produce chip boards. All other waste wood is incinerated. The circular solution idea plans to use also waste wood of lesser quality in a wood gas power plant and to produce three products: warmth, energy and activated bio-charcoal.

Discussion of waste stream regarding further analyses

- Strong synergies with parallel project regarding improving the performance of activated charcoal derived from natural and sustainable resources (wood)
- Collection of relevant and necessary during the parallel project
- Committed company partners to pursue this matter
- LCA, LCC and technology brokerage are appropriate and very useful analyses to consider environmental and economic impacts of the circular solution
- Decision: will be considered for further analyses

5. Grease trap waste

Every professional kitchen according to the law should have a grease trap installed in the sink, to separate kitchen oils from the wastewater. This trap needs to be emptied and cleaned in regular intervals, however this is not the case in real life and grease traps fill up and overflow. If emptied regularly, the fat contents of the grease traps is added to the WWTP's sewage sludge and co-digested together with organic waste in biogas plants located at the WWTP. The Circular Solution idea is to optimize the grease trap waste collection and combine it with the collection of organic waste. The old kitchen fats are planned to be better valorised and used to produce bio diesel.

Discussion of waste stream regarding further analyses

- Data availability is problematic. Only sporadic and selective data.

- Strong synergies with a parallel project regarding the improving the data base on grease traps
- Collection of relevant and necessary data during the parallel project. Won't be available in due time to be used in CIRCE project
- Also parallel project will conduct a LCA and LCC and there is no need to do the same with bad data quality also in CIRCE
- Decision: won't be considered in further analyses

4.4. S3 Input

Up to date (25.09.2018) 32 stakeholders have been involved in the project and approximately 40-45 meetings have been held. One of these stakeholders was the Austrian S3 Manager, interviewed in Vienna, 19.09.2018.

According to the S3 manager and the S3 website there are eight priorities in Austria:

- Information and communication technologies
- Material sciences and intelligent manufacturing
- Climate change
- Quality of life
- Intellectual, social and cultural sciences
- Life Sciences
- Service Innovations and Tourism
- Bio-Economy and Sustainability

Circular economy is part of the last point "Bio-Economy and Sustainability". No particular activities or efforts regarding circular economy were known to the S3 Manager.

The next step here will be to better connect with the regional S3 managing authority, to find out about particular efforts, activities and opportunities to acquire funds.