



CIRCI → Circular industry

Introducing circular economy into
industrial processes

Creating an Industrial Side-Stream Database

A Guide to Circular Economy in Industry



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This is a short Guide or Handbook to building a database of side-stream materials.

Our aim is to provide a short, transparent and very hands-on overview of what it takes to build such a database. We strive to incorporate all the experience and knowledge gained while building the Slovenian and Norwegian Databases in order to promote the database to other industries, aiming to expand it geographically and branch-wise.

Our ambition is to help promote side-stream material databases and encourage other countries and regions to build their own ones – which will help make the data comparable and enable it to be used for interregional applications and collaboration.

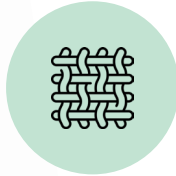
This Guide can be used by anyone, but we find it to be most beneficial for business support organizations, clusters, research, and other organizations with close connections to industrial companies.

Please feel free to use all information collected in this publication for your own use and further application.

Andreja Hlišč,
Director of the Electrical Industry
Association, Slovenia

What are side-stream materials?

Side-stream materials are defined as a substance or object created in a production process where the main purpose is not the production of this substance or object.



Side-stream materials are not considered waste if the following conditions are met:

- further use of this production residue is guaranteed and not only possible;
- this material can be directly used without any further processing other than normal industrial processes;
- this residual production is produced as an integral part of the production process;
- this side-stream material meets the requirements set for its use by regulations governing products, chemicals, environmental protection and human health protection, and further use of this side-stream material will not have any harmful effect on the environment and human health.

The utilization of side-stream materials in production can lead to circularity in industry and thus enable the efficient use of all materials.

The Path to Circular Industry



1 Data input

Companies enter their sidestream material data into the database. They decide between public disclosure or limited sharing options.



5 Circular business models

Industrial symbiosis and the circular economy model are realized in industrial processes.



4 Understanding the benefits

All stakeholders understand the benefit to integrating circularity into their business. They can be well informed on the value of sidestreams as a source of raw materials.



3 Connection

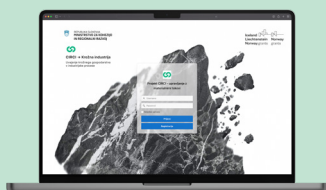
Forming connections between industry sectors and companies allows for a sustainable flow of secondary materials, reduces waste, lowers costs and ensures reuse of materials.



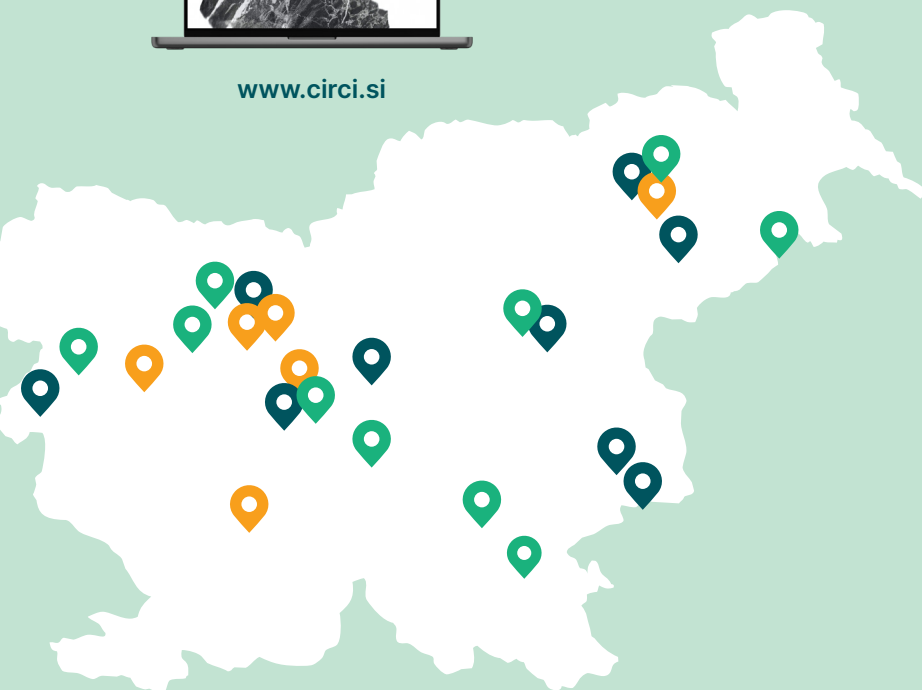
2 Idea formulation

By analyzing the data in the database, companies come up with ideas on reutilizing the materials in their own production or selling them off to a buyer.

Slovenian database of industrial side-stream materials

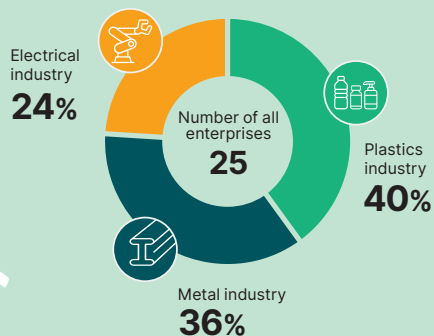


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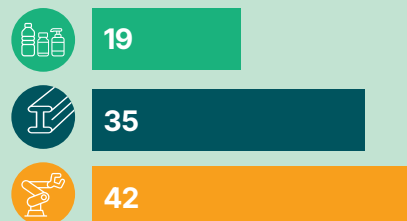


Data collected during the duration of the CIRCI project (January 2024)

Number of enterprises by industry



Number of material flows by industry



Number of total flows

96

In order to conduct a productive side-stream material mapping within a company or industry, the flow of mapping and data processing must be continuous and clearly determined at the start of the project. The following are some of the most important and recommended steps to follow:

1. Planning

The planning phase is an essential step to define the objectives and goals of the final product – the database. It should clearly identify all stakeholders, as well as the scope and boundaries of material mapping. In the planning phase, the database owner should:

- **Identify the expertise needed for data collection in selected industry**
While it's recommended to focus on industries in which your organization has specific expertise, the option of expansion into other industries should be left open. This means the data collection should be as uniform as possible, giving in to some restraints or specifics of each industry.
- **Select or create a web interface for the database**
Data collection should take place through a web interface, as other methods such as MS Excel allow for insufficient data quality and increase the possibility of missing data. A full questionnaire of data points should be pre-determined.
- **Initiate contact with stakeholders**
Paint a clear picture of the stakeholders within the project, including financing partners, experts, database managers and database users – companies.
- **Define ownership of data and database infrastructure**
Through an NDA, the organization should clearly establish that ownership of data remains with the companies (database users). This increases trust and transparency when discussing potential usage or sharing of side-stream materials between companies to increase the economy's circularity rate. Similarly, the database infrastructure should have a clear ownership structure to ensure regular maintenance.

2.

Data collection

The methodology of data collection is the core activity of side-stream material mapping and database creation. The following activities which should take place within this phase include:

- **Identify data collection methodology**

The previously determined web interface for data collection must be thoroughly explained to companies or other sources of data and the online data collection should be supported by personal contact, such as phone interviews and availability for possible questions.

- **Estimate the timeline**

Based on the benchmarking conducted between two side stream material databases, the approximate time for securing participation and collecting initial data inputs from companies lasted from 1 – 4 months, utilizing 3 FTEs on average.

- **Data quality checks**

To ensure that the data in the database can be comparable and of good quality, industry experts should conduct regular data quality checks on selected material. It's recommended that an initial quality check is performed at the time of the first data input and then supplemented yearly. Alternatively, an automatic quality check can be implemented in the functionality of the database.

- **Initial promotional activities**

While the database is not publicly available in the initial stages, promotional activities such as social media awareness campaigns, expert opinions on side-stream material reuse and exposure at public events are vital to the continuous expansion of the user base in the future.



3.

Database structure and management

In preparation for public access to the database, it is paramount to think of a user-friendly design and secure data management structure, to build trust between the data owner and data users and make the process of data mapping and side stream utilization easier. It is recommended to realize the following functionalities within the database:

- **Ease of registration procedure of new users**

Generally, there are two possibilities for new user registration: automatic and manual. Since the side stream material database deals with sensitive company data, it is recommended that each user is manually screened by the owner of the database to ensure compliance with the rules and regulations governing the data.

- **Ease of side stream data input**

On the contrary, the input of side stream data should be as clear as possible for the user to complete by themselves. It's recommended that data is input in characteristic groups, such as Basic information (i.e. name, material, industry, ...) or Volume (i.e. batch volume, production type, yearly volume, ...). For additional information, an info button can be added near the input field, which provides a detailed description of input requirements.

- **Ease of information exchange**

In order to encourage communication between users and inter-company utilization of material streams, a chat function or a 'request more information' function can be added to the database.

- **Database administrators**

The functions of data administrators should be clearly defined and their contact information available for users to resolve any questions or concerns immediately as they occur.



4. Promotion and awareness

Promotions and awareness-raising campaigns are the core activities to support the sustainability and longevity of the side stream database. Not only can they expand the reach of users and thus promote circularity in the industry, but they can also prove to be beneficial to the widespread adoption of industrial waste reuse methods and waste policy modifications. The following are only some of the many promotional activities that can be performed:

- **Workshops**
By far the most beneficial to building relationships and fostering industrial symbiosis are innovation workshops, which spur the participating companies to think about their own side streams and innovative ways to utilize them – be it in their own production processes or through collaboration with another industry.
- **Public sector support**
It's important to establish a dialogue with relevant public entities and garner their support to raise awareness of circular policies with the general public. Once the general public can appreciate the efforts put into side-stream utilization, the effects can be seen in an overall improvement of the company image and a faster transition toward a zero-waste society. In addition, collaboration with the public sector as a financing partner is recommended to strengthen the common goal of a circular economy.
- **Branding and public image**
A clear and recognizable database graphic design can be key to continuous and steady growth progress. Especially in countries or industries where a similar database is already in use, a wholesome approach to branding can be a distinguishing feature that allows better exposure in events, academic conferences or promotional materials.
- **Direct and personal contact**
Keeping direct and personal contact with potential database users has proven to be most beneficial in terms of helping them with the initial and ongoing mapping of side streams. This allows the company to slowly and surely make the strategic shift to utilizing side streams in the production processes.



Circular industry project



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Introducing circular economy into industrial processes

The CIRCI project was funded by the Norwegian Financial Mechanism and Slovenia's Ministry of Cohesion and Regional Development from May 2022 to February 2024.

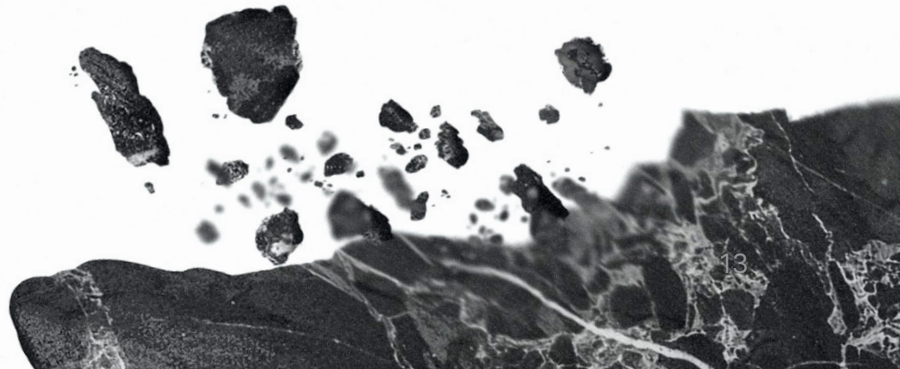
The application of circular economy principles in industry processes

The CIRCI - Circular Industry Project advocates reducing the volume of material flows of virgin materials and establishing the circulation of most materials in production processes. The project's goal was to establish a database of secondary materials generated in production processes, which can be transformed into raw materials for another industry or production process.

About the CIRCI project

Slovenia and Norway have adopted several strategic documents and implemented numerous projects on the topic of circular economy. There are also several initiatives and programmes at the EU level that will accelerate the transition to a green, digitalized, and competitive Europe. However, the need of companies (due to economic, political, and global pressures) for concrete incentives is increasingly visible. The complexity of supply chains and the disruption of material flows due to the global shortage of raw materials

and the consequence of the pandemic and other geopolitical disturbances is a situation that needs to be addressed with concrete proposals and measures to achieve the desired green goals. The main objective of the CIRCI project is to improve the eco-efficiency of the Slovenian and Norwegian (industrial) ecosystems and to increase awareness about a circular economy through innovation.



CIRCI project partners



Electrical Industry Association

Electrical Industry Association (SLO)

The Electrical Industry Association (Zbornica elektroindustrije) is an independent, voluntary, non-profit, interest-based association that connects economic entities performing profitable economic activities in the electronic and electrical industry and other interested parties dealing with related activities and related services in the market. The Electrical Industry Association is a branch association of the Chamber of Commerce and Industry of Slovenia (Gospodarska zbornica Slovenije).



TECOS Slovenian Tool and Die Development Centre (SLO)

TECOS (Razvojni center orodjarstva Slovenije) is a renowned European technology centre with a mission to be a strategic development partner of R&D-oriented production companies in the fields of toolmaking and material processing technologies. The mission of TECOS is to support the manufacturing sector in the development of new solutions and technologies, testing and production of these solutions, optimization of production, and transition to a green and digital economy.





Institute of Metals and Technology (SLO)

The Institute of Metals and Technology (Inštitut za kovinske materiale in tehnologije) has over 60 years of experience in physical metallurgy, technologies, metals and alloys investigation and in supporting the Slovenian and western Balkan countries' metal industry through fundamental and applied research and its obtained knowledge.



EYDE Cluster (NOR)

The EYDE-Cluster (Eyde-klyngen) is the Norwegian Centre of Expertise (NCE) for Sustainable Process Industry, striving for the transition to a sustainable future. Its members range from multinational companies to regional suppliers, research organizations and education institutes. It's based in the southern Norwegian region.



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