MAESTRI
Total Resource and Energy Efficiency Management System for Process Industries

Practical Guide

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Audience: production managers, environmental managers, waste managers, R&D managers.
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User Guide to engage in industrial symbiosis through the T4IS

In this User Guide you will

1 **Learn about the concept of industrial symbiosis**
2 **Understand how to develop an industrial symbiosis project**
3 **Understand how to increase the likelihood of success**

Industrial symbiosis means, in practical terms, the recovery or reuse of secondary outputs from production processes as alternative inputs to other production processes. This happens at the level of production process, thus, the entities involved in the exchanges can be processes within the same factory, processes from different factories belonging to one company or processes from factories belonging to different companies.

One of the main challenges for its wide application is the high degree of contextualisation of the potential symbiotic solutions. In this regard, the appropriateness of the solutions to a certain context is strongly influenced by a set of factors, such as the type of production processes of companies involved in the symbiotic exchange, the geographical landscape and industrialization approach of the region and specific sectorial and / or national regulations and policy.

Within the MAESTRI project, a stepwise process has been developed to support the identification and analysis of potential symbiotic solutions, the Toolkit for Industrial Symbiosis (T4IS). The T4IS constitute a self-guided process to engage in industrial symbiosis and develop symbiotic exchanges. It supports the identification of possible alternative uses for exploitable wastes and their value creation strategies, independently of the business context. Thus, it is framed in a very flexible way, in order to provide support in multiple cases and contexts.

The T4IS seeks to change how companies look at their waste, by considering that everything has potential to have or create value. Thus, the entire T4IS uses the term "waste resource" as an initial attempt to change companies' perception of waste and support the mind-set shift towards seeing waste as a new type of resource for companies. The T4IS guides companies along four steps framed as "How to" questions. A brief overview of these steps is provided herein.

The T4IS - a self-guided process to engage in industrial symbiosis and develop symbiotic exchanges.

How to see waste. A systematic analysis of value captured, destroyed and missed in production processes lays the foundation to identify waste resources. This step results in a comprehensive list of resources within production processes and facilities that can be potentially subject to industrial symbiosis, such as waste streams, secondary outputs and input resources.

How to characterise waste. The previously listed resources, specifically waste streams and secondary outputs, are categorised following a method based on widely known classifications

at European level (i.e. EWC, CPA and CAS Registry Number®). This is complemented with operational data to fully understand their nature and remaining properties, such as their chemical and physical characteristics, their substitutability or replacement potential, their hazardous behaviour and the needed mitigation and neutralisation actions.

How to value waste. The valorisation of waste resources (i.e. waste streams and secondary outputs) follows different strategies. This allows further flexibility to understand knowledge gaps related to possible symbiosis opportunities for each waste resource independently. An analysis is proposed based on different information sources in order to figure out: the potential market value of the resource or its separated components; the existence of implemented symbiotic exchanges involving the resource; the possibility to find solutions in the closest company network.

How to exploit waste. Actions to better exploit the valorised resources in the previous step are defined here. This involves identifying and understanding the exchange partner as well as configuring and developing the value creation and delivery system to make the best use out of the waste resources.

The T4IS addresses the need for tools and methods to support self-organised industrial symbiosis. Companies looking at innovating their operations can initiate the process by selecting a production area for analysis. The T4IS supports the definition of opportunities and the analysis of ideas to obtain higher value from the resources within that area. The use of the T4IS is envisaged to need initially some expert facilitation and training from T4IS developers and afterwards companies will be able to use it themselves and integrate the steps in their own innovation processes.

Actions to successfully use the T4IS

Schedule several on-site visits to plant, production areas and shop floor to ensure that all processes are taken into account and details do not get missed.

Dedicate time to select carefully the classification standard to be used for waste and secondary outputs.

Create a multidisciplinary team to work on the T4IS, bringing together expertise on energy and resources efficiency practices, production operations, purchasing and sales operations, business and innovation practices.

Consider the search for symbiotic opportunities as part of the innovation strategy of the company and integrate T4IS activities within company operations for new products / business areas development.

>> More information
MAESTRI Deliverable 4.3 "Toolkit for Industrial Symbiosis", available at: https://maestri-spire.eu/downloads/technical-materials/

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