

DT1.3.4 - M-SCALE ANALYSIS OF THE PHYSICAL

FLOWS AT LOCAL INDUSTRIAL SYSTEM LEVEL

1. Subtitle

2. Version 1
3. MM YYYY





4. Introduction

4.1. Main data collection problems

Companies operating in the Industrial Park in Tatabánya have been contacted by the researchers to assess and analyse their primary and secondary material flows, by-products, waste streams and waste management practices. Evaluation of the existing waste stream symbioses has also been undertaken to explore the opportunities for co-operation between the participating companies.

The companies completed electronic information request sheets in advance, based on which 5 companies were visited in June 2018 for personal meetings and interviews on the topic area in question.

In general, the companies were interested in further exploring the possibilities that industrial symbioses can offer. All of the visited companies were open to show the methods and practices they use at present in logistics, material and waste flow management and expressed their interest to foster eco-innovation and create mutually-profitable transactions to improve their existing practices by exploiting and utilising the principle of symbiosis.

Although geographic positioning is a key factor in industrial symbiosis, the companies stated that they would be willing to expand the research area to create further business opportunities by finding partners to reduce primary material needs beyond the boundary of the industrial park.

Discussions included the opportunity to examine best practice solutions for water optimisation, collection, handling and usage of captured rain water and energy exchange. Currently these issues have not been addressed and such possibilities could be shared within the industrial park by creating a communication and information exchange platform between the companies.

Company profiles and the selection of site

The array of companies operating in the industrial park in Tatabánya show a harmonised characteristic in the business area. A significant number of the companies located in the industrial park are suppliers to the automotive industry, whilst the second largest group is mainly consists of medical aid producer firms.

Participating companies are branches of international supplier chains with binding corporate policies on monitoring efficiency in material, waste and productivity management. All of the factories are qualified by ISO 9001, 14001 and 50001. The processes used are up-to-date and data are readily available and professionally managed. Targets for efficiency in the companies are set by internationally-developed strategies, but representatives handle and welcome any new methodologies to upgrade their processes.

During the personal interviews, representatives of the companies named the following as the main factors for choosing this industrial park as their site of operations - close proximity of the highway, good location of the industrial park, the availability of an educated workforce and special taxation as arrangements.

None of the companies had mentioned resource efficiency or possible co-operations with any other neighbouring company as a dominant factor considered during the selection process for the proper location of their factory.

Waste management operations of the companies

As stated above, participating the companies have adequate regulations in force to manage their by-products and wastes and their employees are trained accordingly.

Though they supply similar industries, due to their special nature it is difficult to find homogenous or supplementary material and waste streams within the premises apart from the selectively-collected waste that is similar to the household fractions, mainly generated by the 10.000 employees and operational logistics.

The companies have tender processes to select the waste management partners that are responsible for the proper transport and treatment of their hazardous and non-hazardous wastes.



On-site waste collection is well-organized for all of the companies visited, with different fractions of waste being separated at source and transferred to waste collection and storage yards within the factories. Collected fractions compacted and baled on-site where possible. Some of the companies have chosen waste management partners that are actually operating within the factory, effectively taking part in the post-production management processes.

There is a significant amount of hazardous waste that ends up in incinerators (mostly in Győr and Dorog) and some companies have waste fractions for which they can find no recycling options, therefore they also end up in incinerators. The companies, as will be explained later, are interested in diverting these wastes from incineration so as to save expenses and to reach international environmental targets as well.

As all of the companies have different production outputs, their waste streams are different also. By checking only the EWC codes, it is possible to find similarities, but after visiting their factories the diversity of their operations is more than visible. The biggest fraction of waste within the visited companies is delivered to incineration. Some of the reasons for this treatment option is that they use the same solutions on a corporate level or that there is currently no recycling possibility for the materials they use and, hence, they ultimately remain to be incinerated.

The local service provider plays an active role in collecting the municipal solid waste and also the packaging waste from the companies. The residual waste is currently transported to the landfill in Tatabánya, the packaging waste is mostly recycled in Hungary. It is still possible to increase the quantity of the recyclable packaging by introducing separate waste collection at the sites where it is currently not available, or by subsequently sorting the mixed municipal solid waste, in order to take out all the packaging materials which can be recycled.

After analysing the existing waste flows it is obvious that all of the visited companies take care about their waste and try to find the best way to handle it. They try to avoid landfilling and if they can choose between landfill and incineration, they choose the latter as a more environmentally-friendly solution. Incineration with energy recovery, as exists at both of the above-named incineration plants, produces electricity, which is transferred into the electrical network, as renewable energy.

Role of the Industrial Park operator

The operator of the Industrial Park does not play any role in the management of the material or waste flows, so these are solved and handled by each company individually. Municipal solid waste management is collected by the only service provider, NHSZ Tatabánya Zrt. The provider is also seeking opportunities for efficiency-raising and has also expressed its interest for involvement in the present project.

Participating companies have expressed their interest for co-operation in additional areas, such as training, education or finding solutions for illegal waste dumping in the territory of the industrial park and have named the operator of the park as the best link and possible organiser for these activities.

It is hard to involve the Operator of the industrial park but this would give a boost to circular initiatives.

Cooperating companies: summary of the outcomes of the personal meetings and interviews undertaken by the researchers

Bridgestone Tatabánya Manufacturing Ltd.

The company is the Hungarian branch of one of the biggest tyre manufacturers in the world that produces 1.8 million pieces of tyres in its factory in Tatabánya. In 2017 the Company has announced to exponentially expand its production, quadruple it by 2020 to 7.2 million pieces of tyres.

At present they operate with ISO 14001, their goal is to have an ISO 50002 soon. Reduction of the quantity of waste generated, the quantity of water used and improving their energy efficiency - in line with their global corporate goals - are the top priorities of their environmental strategy.



Within the factory and in the office spaces they operate selective collection of waste. Recycling in material is taken into account when choosing a waste management partner although in case of for the most significant waste they generate - waste tyres and unvulcanised tyres - they cannot find any partners for recycling in material.

Besides the only option being incineration for the tyre wastes delivery of the waste causes them a major financial burden.

During the discussion it was highlighted by the representatives of the Company that they do not identify industrial symbioses within the industrial park as huge potential, but would be more interested to have a special solution for tyre manufacturers, as Hungary hosts the most outstanding tyre manufacturers within its territory generating a huge sum of vulcanized and unvulcanised tyre waste during productions. (Continental, Hankook, Bridgestone and soon Apollo tyres are produced in Hungary)

CCL Design Hungary Ltd.

The company produces labels for electronic products and has operated since 1999 in Tatabánya. They have selected the premises to supply the Central and Eastern European market.

They operate with ISO 9001, and 14001 quality standards, have no environmental strategy, but an environmental policy is in place.

They do not operate reverse logistics and all of residuals from their production lines (paper/plastic and plastic/plastic composites) are sent for incineration.

The company is dedicated to establishing separate collection of office wastes and they would like to apply the green office concept.

Feedback has been gained that more activity and co-operation between the companies in the field of environment, education or specific workshops would be at their interest.

COLOPLAST Hungary Ltd.

The factory produces ostomy care products in Tatabánya. They opened their facility in 2002.

During the selection process for sites, industrial symbiosis did not play any role in their decision and location, proximity to highway and an available educated workforce were the key factors for choosing Tatabánya.

They are operating to ISO 9001, 14001 and 18001 quality standards.

The company also uses reverse internal logistics for trays, pallets and wrapping materials - reducing their waste generation.

Separate collection for all residues from their production line is in place, from which the composite plastic residue of the actual product (the ostomy bags) presents the most significant problem. Its composition and production technology currently makes it impossible to recycle, leaving incineration as the only viable disposal option and this is a worldwide problem for the company. Due to the significant annual generation quantity (4,200 tonnes) of this waste, they also face the problem of treatment capacity at the of incinerators and the significant financial burden of the associated gate fees.

No specific environmental strategy is in place, but they operate with standard index numbers to measure efficiency.

The Company is eager to explore the possibilities that industrial symbiosis could offer. Feedback on possible co-operation for environmental and technical education was gained from the representative of the Company.



Grundfos Hungary Manufacturing Ltd.

The factory producing pumps and electro-motors and opened their premises in the early 2000's. During the selection process of the site location, proximity to the highway, availability of educated employees and the advantages given by the municipality played key roles in choosing Tatabánya.

They have expanded their production in Tatabánya and also have a factory in Székesfehérvár (60km from the site in Tatabánya).

They operate ISO 9001, 14001, 50001 qualification systems.

Wastes other than the municipal solid fractions are managed by one company, which was chosen through a tender. They operate a centralised procurement system.

Some of the materials they use, especially the special aluminium, which are generated throughout the production process as by-product or refuse material is delivered to their own smelter in Denmark to create new raw materials.

In the case of waste management, they are interested in quick returns. They are assessing the possibility to use reverse logistics and return some of the materials to their suppliers which they have identified as reusable. They already use reverse logistics in pink EPS, carton forms and in some aluminium packaging products.

They organise selective collection days for their employees on a yearly basis. Waste of electric and electronic equipment can be delivered to the factory by the employees and the company assures the proper handling of the waste.

They also have separate collections for paper, cardboard, accumulators, batteries, plastics and plastic cups. Though they have reached 98.7% recycling rate for the solid wastes that they generate, they would be interested in replacing single-use products with reusable products, mostly in packaging. That would also make traceability of their material flow more transparent.

They study circular economy and are committed to achieve the goals set in their corporate environmental, energy and waste strategy.

Their energy strategy includes a limit in use of overall energy sources which is fixed at the 2008 level. This means that even with expansion Grundfos shall be below the 2008 level of energy use worldwide.

Their next target is water efficiency. Usage of rain water in the pump testing pools of the factories is a key issue. They are also targeting a decrease in the ammonia level of their sewage water.

Henkel Hungary Ltd.

The factory produces adhesives and glues for the automotive and hygiene industries in the Industrial Park and has operated there since 2011. Henkel relocated its production from Vác, Hungary and from Poland to Tatabánya, with proximity of the highway and the already developed industrial park with its logistic centre being the most important factors during decision making process.

They operate ISO 9001, 140001 and 50001 quality standards.

The separate collection within the factory needs improvement as plastic collection is only available in the canteen.

At the production areas employees are trained to operate separate collection, out of which reverse logistics are used for pallets and rags which they also wash before sending it back to the supplier.

Cooler blocks are used to transport chemicals that cannot be reused due to quality protocols, therefore 7-800 kg/month are sent to incineration.



The environmental strategy of the Company includes the minimisation of waste generated, and the increase of water and energy efficiency of the factory. They also monitor the monthly consumption levels and the overall aim is to decrease the present consumption by 3 percent.

Solutions for rain water capture and usage would be interesting for them, as water is used to built into their products.

Qualification for by-product would be interesting for them also to reduce the waste amount generated. IBC tanks and big bags are also generated in high quantities.

Impreglon Kft.

The plant was built in 1999 as a greenfield investment in Tatabánya. They offer surface treatments for the automotive industry, railway industry, building of agricultural machines, food industry and construction industry.

They operate ISO 9001 quality standard.

They don't have separate collection of wastes for the employees and they also do not plan to introduce it.

The Company uses reverse logistics for gutterboxes and pallets, reducing their waste generation. They use special metal drying racks for the painted metal parts and they try to use these racks as long as possible. They clean and re-paint them from time to time to keep their material in a good condition for long-term use.

There is a special waste after their production, a mix of metal particles and sand, which is delivered to landfill, but they would like to find a better solution for handling this kind of waste.

5. MFA tool results

Taking a look at the waste treatment of the pilot area it could be seen disposal hardly reaches 1 % in case of the interviewed companies operating in the Tatabánya Industrial Park. Energy recovery is the dominant waste treatment option (70%). Material recycling is only 28 %. So the main challenge will be to analyse the incinerated, energetically recovered waste streams that might have the potential to be either recycled or to be reused internally or by other partners.

Criteria for the selection of relevant flows:

Each cooperating companies were visited and their whole manufacturing process were analysed including waste management issues. Based on the interviews with the relevant experts within the industrial park, the most critical flows were identified; mainly those offering a challenge to be recycled. As an option now mainly incineration is widely applied, but the materials could have been reused and recycled instead.

Three CE indicators were applied to quantify the opportunities and results that could be realized with a more conscious waste management regarding the identified waste flows listed below: **Waste hierarchy indicator, recycling target and the generation of industrial waste.**

5.1. List of relevant flows

1. Plastic waste - EWC 070213

Coloplast is one of the world's leading manufacturers of ostomy products. They operate globally, employing about 11,000 people. Waste generated in all of their factories has a specific characteristic and



composition. Due to the production lines and the quality control mechanisms the biggest amount of homogenous waste - 4200 tonnes only in the production site in Tatabánya - is generated by them.

Composition of the waste under the code is:

PE	50 -70%,
PP	12-25%
PET, aPET	10-20%
PVC	0-10%
EVA	0-10%
Polyamide	1-2%

As all of their production sites around the globe deliver this waste stream for waste incineration, it would be a major breakthrough if the project could find a way to recycle this kind of composite material. The identified solution would offer a global impact as solution could widespread used by the Company. The realistic initial material recycling target could be 20%. But this could be increased gradually further if the “test” could work properly.

Social impact:

This material could be broken apart by hand, it could be also an idea to start a social enterprise supporting the employment of disabled people. This idea could be also examined during the further analysis.

The identified alternative treatment option could have an international impact, since it could be applied in all other countries where Coloplast operates.

2. Cooler blocks - EWC 160306

Cooler blocks are used by Henkel when they transport some ingredients for their production. The blocks do not have any direct contact with the chemicals transported, only with its packaging materials. As the quality and safety regulations are very strict, Henkel cannot reuse cooler blocks again. After their first use, cooler blocks shall be handled as waste, which then is delivered to an incineration plant.

This practice shall be revised, as both economically and environmentally it causes a major loss not only for the Company. The goal shall be to find - legal, technical and economic - solution to re-use these cooler blocks several times again.

3. Mixed packaging waste - EWC 150106

Most of the Companies visited identify their IBC tanks, Big Bags and mostly plastic materials with this code. Further analyses shall assess and determine exact material flows under this code.

There is a high chance that materials under this code could easily be re-used or their recycling options could be identified to create symbiosis.

Other material not yet predetermined:

Thanks to the dialogue that started amongst the companies due to the project and with the proper involvement of the operator companies it might happen that other synergies could be identified regarding energy usages, water consumptions and other symbioses.

4. Waste tyres

Now all the generated amount by Bridgestone (more than 1000 t) is sent to incineration - the distance between the waste generated and the treatment facility is almost 300 kms. Bridgestone would be interested to have a special solution for tyre manufacturers, as Hungary hosts the most outstanding tyre manufacturers within its territory generating a huge sum of vulcanized and unvulcanized tyre waste during



productions (Hankook, Continental and soon Apollo). So analysing the recycling alternatives could also have a multiplying effect. As a pilot action if we could recycle 10 % of the generated amount in Tatabánya that could be a good start of finding a solution for the tyre manufacturers.

6. Conclusions and recommendations

As the outcomes of the research clearly reveal, the companies operating in the Industrial Park in Tatabánya are interested and willing to further co-operate in the project to assure the highest possible level of efficiency of their activities both financially and environmentally.

The geographical scope of the project could be expanded due to the relatively modest size of the industrial park and the close proximity of other industrial parks and areas such as those in Oroszlány, Székesfehérvár or even Szigetszentmiklós. At the same time, further personal meetings need to be held with the companies that are still interested.

Although during the first round of assessment it appeared that there was no symbiotic transfer of wastes within the Companies in the industrial park, there are several areas of activities where symbiosis can be created and efficiency in the use of raw materials, by-products or waste materials could be increased.

Several issues regarding the proper management of certain waste streams have already been discovered, where the companies would be interested to find improved solutions (e.g. to divert streams from incineration) which also offer opportunities for co-operation, research and development.

Further separation or separation at source of municipal solid waste fractions provides a field for improvement, in which efficiency also could be developed.

Best practice solutions for water optimisation, collection, handling and usage of captured rain water and energy exchange possibilities will be shared within the industrial park by creating a communication and information exchange platform between the companies.

During expansion of the industrial park, the possibilities for industrial symbioses between new and existing companies will be highlighted and discussed during the site selection process in order to examine options for corporate advantages.

7. Attachment

MFA tool excel