EPOS INSIGHTS #19

Led by:

INDUSTRIAL SYMBIOSIS FROM A PROCESS INDUSTRY PERSPECTIVE

EPOS insights are publications summarising the most relevant outcomes of the EU funded EPOS project. The overall aim of the EPOS project is to enable cross-sectorial industrial symbiosis and provide a wide range of technological and organisational options for making business and operations more efficient, more cost-effective, more competitive & more sustainable across process sectors.

INTRODUCTION

This EPOS insight describes the approach to industrial symbiosis from a process industry perspective: from awareness raising, over conduction of preliminary LESTS surveys and identification of symbiosis potentials, leading to detailed SWOT analyses of the most promising opportunities as well as the difficulties met during the process.

METHODOLOGY

- Awareness raising
- Preliminary LESTS (Legal, Economic, Spatial, Technical, Social) survey
- List of potential Industrial Symbiosis projects
- SWOT analysis of most promising opportunities

In all industrial sites within (and beyond) the EPOS clusters, the first step towards industrial symbiosis is the raising of awareness for the various opportunities that could emerge from valorising and sharing currently un(der)used resources with neighbouring companies. This initial step is followed by a preliminary LESTS survey to understand the existing collaborations in the cluster, as well as the needs and requirements of the individual companies and to screen for the potential barriers. The results of the LESTS analysis are then condensed into a broad set of synergy opportunities to improve energy and resource efficiency in the clusters. Based on their relevance to the companies, SWOT analyses were carried out to provide the partners with an in-depth understanding as well as recommendations for implementation.

SWOT: SYMBIOSIS CASE BETWEEN MINERALS – CEMENT

The preliminary LESTS survey identified a potential synergy between the minerals and cement sectors to improve resource efficiency by reusing by-product streams from one industry to replace raw material in the other sector.

At their site in the EPOS Hull cluster in the north of England, Omya operates a chalk quarry for use in their own production. Some of the quarried material is not suitable for the production process due to inferior quality. Part of this by-product stream is hence used for quarry land reclamation, whereas the remainder is sold to an external partner at a low price.

The nearby CEMEX production process generates cement kiln dust (CKD), which has to be disposed. The amount of generated CKD is similar to the amount Omya uses for quarry land reclamation.

The symbiosis case hence suggests using the quarry by-product stream as raw material for cement production in exchange for using CKD as alternative quarry restoration material as shown in Figure 1.

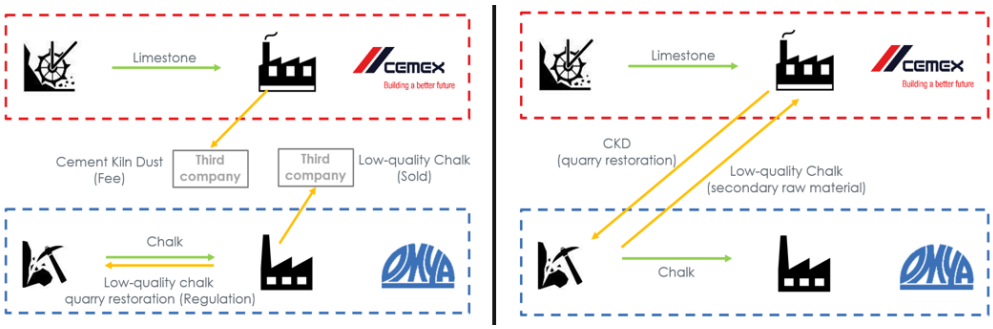

Figure 1: EPOS Hull: Business as usual (left) vs. symbiosis case (right)

The detailed SWOT analysis showed that transportation costs represent a major constraint for the chalk exchange, even more as the material would need to be transported over a toll bridge. The intended use of CKD as alternative quarry restoration material however offers an attractive business case due to a significant reduction in disposal cost. Further investigation revealed that this potential cannot be exploited due to legal restrictions, as the existing Omya permit requires that the restoration material used must originate from within this quarry itself. Since CKD is a hazardous material, it also encompasses a high environmental risk and would require careful management, making it unsuitable for quarry land reclamation. Considering the legal and economical hurdles in realising this opportunity, the investigation was suspended, and the final project status was set on stand-by.

Strength	Weakness
Significant costs avoided if CKD could be diverted from landfilling	Omya chalk cannot compete economically with raw material from CEMEX's own quarry as transport would have to run over toll bridge
Valorise by-product which cannot be used in Omya process due to quality restrictions	Existing quarrying permit does not allow to use external material for restoration
Chalk properties are well suited for CEMEX production process	CKD can only be disposed in specific cells where a protection isolates it from groundwater
Opportunities	**Threats**
The same transport trucks could be used for backhaul logistics between the parties	High environmental risk of CKD disposal as Omya quarry is located in a high vulnerability groundwater zone
Reduce CO_2 emissions from CEMEX raw materials	

Table 1: SWOT analysis of by-product synergy in EPOS Hull cluster

REPLICATION IN RUDNIKI CLUSTER

The identified synergy was replicated in the EPOS Rudniki cluster in Poland, which also hosts both a cement and an industrial minerals plant. Similar to the Hull cluster, the Omya plant processes raw material from an on-site quarry, however in this case the quarried material consists of dolomite instead of chalk. The quarry has an excess of raw material that cannot be used in the production due to quality constraints. This quarry by-product is currently not valorised and used to refill the quarry.

The CEMEX production at Rudniki generates a lime meal by-product stream, consisting of limestone blended with some CKD. The lime meal is currently used by CEMEX as an aggregate in the clinker production.

The detailed SWOT analysis carried out for the EPOS Rudniki cluster revealed multiple hurdles against the identified symbiosis, especially the fact that the chemical properties of the Omya quarry by-product are not suitable for use in the cement production. With this part of the synergy gone, no viable business case could be drafted for the lime meal exchange, even more as the low volumes and missing backhaul opportunity would make the implementation uneconomical.

Strength	**Weakness**
Use of two un(der)used by-product streams from both Omya and CEMEX as replacement raw material in the other sector	Lime meal properties are partly compliant with Omya specifications (must not contain CKD)
The symbiosis is compatible with the core processes of both partners	Dolomite properties are not compliant with CEMEX specifications (too high MgO content)
The material is easy to transport by truck/train	Large distance between the sites
Opportunities	**Threats**
Make use of backhaul logistics when transporting dolomite from Omya to CEMEX and lime meal from CEMEX to Omya	Volume of available lime meal may be insufficient as it is also used within normal CEMEX process
Dolomite extraction could be increased as Omya quarry has excess capacity available	

Table 2: SWOT analysis of by-product synergy in EPOS Rudniki cluster

CONCLUSION

As observed in the two EPOS clusters, a promising symbiosis case may not be beneficial when evaluated in detail at a specific site due to local restrictions. The investigation has however raised awareness amongst the partners for the various opportunities to improve energy and material efficiency that can emerge from such synergies.

Despite not being viable in the EPOS clusters due to local restrictions like toll roads, the presented case is generally applicable and hence outlines the potential economic benefits and sustainability improvements at other locations across Europe. It can provide a quick and effective means to review and identify similar synergy potentials at other locations, and likewise serve as guideline for the involved sectors to investigate and promote further industrial symbiosis initiatives with neighbouring companies.

REFERENCES

[1] EPOS Insights 2, Analysis of 5 European industrial clusters.
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