INDUSTRIAL SYMBIOSIS IN THE FOS-SUR-MER REGION (FR): ARCELORMITTAL (FOS-SUR-MER) AND INEOS (LAVERA)

BUSINESS CASE 1 - NAPHTHALENED GASOIL

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 insight summarises the preliminary analysis and results of one EPOS business case, detected at the French cluster in Lavera. The potential new synergy involves ArcelorMittal Fos-sur-Mer and INEOS Lavera. The first recommendations, based on the 5 LESTS aspects (Legal, Economic, Spatial, Technical and Social), are given in view of promoting cross-sectorial symbiosis in the Fos-sur-Mer region (FR).

IS BUSINESS CASE (ARCELORMITTAL AND INEOS)

Naphthalened gasoil valorisation from ArcelorMittal Fos-sur-Mer to INEOS Lavera

Opportunity description

The synergy opportunity consists in valorising naphthalened gasoil produced by ArcelorMittal, as a secondary raw material at the INEOS refinery.

The stream is generated during coke oven gas (COG) stripping. Pure gasoil flows opposite the COG and captures impurities contained in the gas, mainly naphthalene. After stripping, the gasoil is currently recycled internally at ArcelorMittal’s plant. Instead, it could be used as a substitute for crude oil at the INEOS plant. Based on the first sample analysis, the stream meets INEOS’ quality specifications.

The initial interest for ArcelorMittal is to find an innovative solution to reduce naphthalened gasoil consumption on its site and reduce the related environmental impact. However, the synergy revealed to be of higher interest as it might trigger economic benefits for both companies and the development of a circular treatment service provided by INEOS.
Both companies already have the required equipment and infrastructure to set up the synergy. No additional investment would be required. The ArcelorMittal stream is legally declared as a by-product and can easily be handled and sent to INEOS. The latter is used to handle hydrocarbons and could blend the stream with its current raw materials.

**Assessment methodology**

The boundaries of the business case are defined by considering all stakeholders currently involved in the business as usual (see Figure 2). The stakeholders are: INEOS Lavera, INEOS’ crude oil provider, ArcelorMittal Fos-sur-Mer and ArcelorMittal’s gasoil supplier. In order to be implemented, the synergy must be profitable for the central parties involved, or at least create other forms of value, less tangible, such as brand image or regulation compliance.

As the synergy consists in sending naphthalened gasoil from ArcelorMittal to INEOS, the former would need to find a substitute for this stream to use in the plant. This statement leads to three potential synergy scenarios:

- S.1: ArcelorMittal’s fuel provider supplies the steel plant with gasoil. INEOS’s crude oil consumption is reduced, INEOS pays to get ArcelorMittal’s stream on a price indexed on gasoil prices and it valorises the aromatic compounds.
The ArcelorMittal site is in close periphery of the INEOS plant, at 20 km by road. It is assumed that ArcelorMittal will pay for transport costs.

Data has been collected thanks to the collaboration between the INEOS and ArcelorMittal teams in the EPOS project and completed with public information (BREF, trading websites) and Strane Innovation’s expertise. Key quantitative data used for the assessment are: distance separating sites, stream volumes, calorific values, processing costs and material costs.

- **S.2**: ArcelorMittal receives only its original gasoil and pays a treatment service to INEOS for regenerating the naphthalened gasoil. The exchange works as a closed loop. The service price is indexed on crude oil refining costs. INEOS crude oil consumption reduces, and it valorises the aromatic compounds.

  - **Figure 4: Synergy scenario n°2**

- **S.3**: the scenario is the same as in S.2, except that ArcelorMittal stops its relationship with its current gasoil supplier. INEOS supplies ArcelorMittal with heavy fuel from its refinery.

  - **Figure 5: Synergy scenario n°3**

The ArcelorMittal site is in close periphery of the INEOS plant, at 20 km by road. It is assumed that ArcelorMittal will pay for transport costs.

Data has been collected thanks to the collaboration between the INEOS and ArcelorMittal teams in the EPOS project and completed with public information (BREF, trading websites) and Strane Innovation’s expertise. Key quantitative data used for the assessment are: distance separating sites, stream volumes, calorific values, processing costs and material costs.

- **Figure 6: First economic assessment**
This preliminary business case has the goal to trigger interest of decision-makers from both companies. It gives an idea of the project feasibility and its environmental footprint. Once convinced, companies could further the assessment by their own means. As these are only preliminary results further assessment is required to evaluate any additional costs.

Focusing on ArcelorMittal and INEOS, S.1 is not viable for the former and eventually for the latter. It cannot be implemented as such. However, S.2 and S.3 are viable for both companies, with a highest viability for the third scenario. It is mainly due to the choice of a lower grade fuel to substitute naphthalened gasoil at ArcelorMittal and not directly to core of the synergy. Both scenarios can be implemented and should be studied in detail by companies.

If considering the whole system of actors, the synergy creation does not globally create economic value, independently of the scenarios (cf. red line of Figure 7). The global system is well balanced and even slightly negative.

The synergy would always be negative for the crude oil provider business, and probably for the gasoil provider, as INEOS and ArcelorMittal would choose to implement S.2 or S.3. This specific synergy implies value destruction for some of the actors. This conclusion might change when considering other forms of value such as: regulation compliance, brand image, environmental, social and innovation values.

Environmentally, the synergy seems to be positive as it will reduce the emissions of VOCs, even if a substitute stream for ArcelorMittal will be required. Socially, this specific synergy should have a negligible impact. In terms of innovation, this synergy has a high potential to develop new activities for petrochemical industries and promotes changes towards a more circular business model which are challenging to set up in process industries.

Further evaluations are required to assess in detail the magnitude of these values. This ongoing work is in collaboration with Quantis, Strane Innovation, UGent and the industrial partners.
CURRENT CHALLENGES

The following challenges were identified and must be considered for case replication:

• Quality: Discussions are ongoing between both companies to definitively state what is the composition of stream and its compatibility with INEOS’ process.

• Quality risk: Refineries are not inclined to introduce non-conventional streams in their processes as it might have important impacts on emissions and processes (e.g. catalysts). A strict quality control must be set up when a stream arrives at INEOS’ site.

• Substitute stream quality: ArcelorMittal must check what grade of substitute stream can be used in its plant.

SWOT ANALYSIS

<table>
<thead>
<tr>
<th>Strength</th>
<th>Weakness</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The IS is compatible with the core processes of both partners</td>
<td>• The quantity of the naphthalene gasoil is not significant for INEOS</td>
</tr>
<tr>
<td>• The material is easy to transport via truck</td>
<td>• Emissions caused by transport of material could reduce the environmental benefits of the IS</td>
</tr>
<tr>
<td>• Investment costs may prove minimal</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Economically beneficial for both parties</td>
<td>• It may take time to acquire permits to transport naphthalene gasoil via truck</td>
</tr>
<tr>
<td>• Can pave way for further collaboration</td>
<td>• A market for naphthalene gasoil can result in diverting the flow from INEOS, hence ending the IS</td>
</tr>
</tbody>
</table>

Table 1: SWOT analysis of IS case - naphthalene gasoil from ArcelorMittal Fos-sur-Mer to INEOS Lavera

• L: The IS will not implicate any existing contracts of either party, which reduces the time for implementation. Since there is no need to change the regulatory status of the gasoil stream from ArcelorMittal to INEOS and the use of naphthalene gasoil at INEOS is also covered by the permits that INEOS already holds, the legal aspects of the synergy appear to not cause any delays.

• E: Investment costs may prove minimal to realise the symbiosis.

• S: The material is easy to transport via trucks between the two sites. Both sites have storage facilities to store the material for bulk transport. Spatial aspects from LESTS methodology are well covered in this synergy.
• **T:** The technology to support the symbiosis is already available at the site of INEOS Lavera. The symbiosis is compatible with the existing technologies of both industries, and thus there is no requirement for technical training for the staff.

• **S:** Since the symbiosis will not cause a significant change in the existing business practices of either of the partners, the impact of the synergy on the nearby community will be negligible. The symbiosis activity will pave the way for further collaboration between the industries.
Interested in this work? Please contact us at info@project-epos.eu

www.spire2030.eu/epos

@projectepos

The research project receives funding from the European Community’s Framework Programme for Research and Innovation Horizon 2020 (2014-2020) under grant agreement no. 679386. This work was supported by the Swiss State Secretariat for Education, Research and Innovation (SERI) under contract number 15.0217.

The opinions expressed and arguments employed herein do not necessarily reflect the official views of the European Commission nor of the Swiss Government.