INTRODUCTION

This insight summarises the preliminary analysis and results of an EPOS synergy business case detected at the French cluster in Lavera. The potential new synergy involves ArcelorMittal Fos-sur-Mer and INEOS Lavera. Initial recommendations, based on the five 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)

Direct steam cracker coke valorisation from INEOS Lavera to ArcelorMittal Fos-sur-Mer

Opportunity description

The business case considers the possibility of INEOS sending one of its solid waste streams to ArcelorMittal for both energy and material valorisation.

Depending on its characteristics, the INEOS steam cracker coke could be used in several ArcelorMittal processes:

- The sinter plant, as a fine combustible (coke breeze) if the carbon content (%C wt.) meets 75-95% and Ø < 10mm
- The blast furnace, as a direct substitute of conventional coke if 75-95%C wt. and 10 mm < Ø < 80 mm
- The coke oven, as a substitute of coal if %C wt < 75.

INEOS’ coke meets ArcelorMittal’s requirements regarding sulphur content. This point is crucial as environmental constraints are very strict.
Both companies already have the required equipment and infrastructure to set up the synergy. No additional investment would be needed and there would be almost no impact on the organisations.

The synergy creation is an opportunity for both companies to reduce their costs. It is also an opportunity for ArcelorMittal to innovate and initiate a dynamic in order to substitute more conventional coke. The main issue is legal, as the stream is defined as a waste. A procedure for legal status modification would be required.

**Assessment methodology**

The boundaries of the business case are defined by considering all stakeholders currently involved in the business as usual scenario (see Figure 2). The stakeholders are: INEOS Lavera, ArcelorMittal Fos-sur-Mer, INEOS' waste handler and ArcelorMittal’s coal supplier. For there to be a possibility of implementation, the synergy must be profitable at least for the parties directly involved in the stream exchange.

Three scenarios have been considered depending on the coke usage (Figure 3):

- **S1**: sinter plant
- **S2**: blast furnace
- **S3**: coke oven

![Figure 2: Business as usual](image1)

![Figure 3: Synergy scenarios](image2)
All scenarios aim at reducing the use of virgin raw material at the ArcelorMittal plant and for INEOS to stop paying for treatment services by a waste handler. It is assumed that:

- the coke is given for free
- the coke can be directly reused
- the transportation costs are paid by INEOS

However, when considering the entire system, INEOS’ waste handler would still need a fuel, as its business is to provide heat to its customers. This leads to the definition of three additional scenarios, depending on the fuel substitution:

- SA: European coal
- SB: Tyres
- SC: Wood

The combination of the two types of scenarios led to nine analysed scenarios.

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

**CONCLUSION**

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

![Figure 4: Preliminary economic assessment](image)

Focusing only on ArcelorMittal and INEOS, the synergy creation seems to be viable for both organisations in all scenarios (S1, S2 and S3; SA, SB, and SC have no impact for either of the companies). Figure 4 gives the range of benefits created. Most of the value generated is for INEOS, due to the service treatment costs avoided. It is stable for all three scenarios. The largest benefits for ArcelorMittal are created if the coke can be used in the blast furnace. Transport costs are considered to be insignificant. The synergy viability for the two central stakeholders (ArcelorMittal and INEOS) is ensured and is one of the required conditions for implementation in addition to the coke quality.
However, considering the four actors involved, the global system viability is ensured in only two of the nine scenarios (Figure 5, red line): coke use in the blast furnace and use of coal as a substitute for the waste manager (S2-SA) and use of tyres as a substitute (S2-SB). Such a result is relevant from the territorial perspective as the synergy might be highly beneficial for a small number of stakeholders (S2-SC), but have a negative balance for the whole community. Concertation between the four actors, and eventually public authorities, might be of interest to ensure the global viability of the project.

An environmental impact assessment might differ from the economic assessment conclusions, though the synergy does seem to be environmentally viable. It will require less coal extraction and importation and less coal processing (S1 and S2). Truck transport emissions are balanced between the business as usual and the new synergy scenarios. Uncertainties are located on the use of alternative combustibles used by INEOS’ waste manager. Depending on the scenario (SA, SB, SC) the global impact may vary.

Further environmental analyses are ongoing and are led by Quantis, leader in LCA.

CURRENT CHALLENGES

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

- **volume**: the stream’s annual volume is low, such that, the steel company’s decision-makers may have no interest in evaluating the case, given the potential transaction costs (e.g. time dedicated)
- **volume**: petrochemical companies try to limit coke formation in their steam cracker to increase their performance; the coke stream can be even lower
- **particle size**: particle size is a key point in defining where the coke can be used
- **quality**: the quality and carbon content of the coke might vary
- **administration**: a change in the legal status of the waste is required
SWOT ANALYSIS

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<tr>
<th>Strength</th>
<th>Weakness</th>
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<tbody>
<tr>
<td>• The IS is compatible with the core processes of both partners</td>
<td>• The quantity of the coke is not high enough to fulfil the requirement of ArcelorMittal</td>
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<tr>
<td>• The material is easy to transport via truck</td>
<td>• Emissions caused by the transport of material</td>
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<td>• Investment costs may prove minimal</td>
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<tr>
<th>Opportunities</th>
<th>Threats</th>
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<td>• Could prove economically beneficial for both parties</td>
<td>• Conventional suppliers of coke can easily replace INEOS as the supplier of coke for ArcelorMittal</td>
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<tr>
<td>• Can pave way for further collaboration</td>
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Table 1: SWOT analysis of IS case - coke from INEOS Lavera to ArcelorMittal Fos-sur-Mer

- **L**: the regulatory status of coke needs to change for the symbiosis to be implemented. The existing contract between INEOS and its waste provider could prolong the start of the symbiosis between INEOS and ArcelorMittal.

- **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.

- **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, thus there are no additional technical training requirements 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.
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