

Low Carbon Industrial Manufacturing Parks



Industrial Symbiosis

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More information

Public LOCIMAP reports will be available through its website at www.locimap.eu

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1. Summary

There is nothing new about industrial symbiosis! As long as industrial activity has existed people have recognised the economic importance of deriving added value from industrial ‘residues’. There are many good examples of such symbiosis, but the potential for more is high especially across industrial sectors.

The good practice of reducing or minimising resources through integration is well documented through approaches such as BASF’s Verbund principle in the chemicals sector, the development of integrated steel works, refineries and pulp & paper works. However the potent term ‘industrial symbiosis’ with its conscious parallel with symbiotic relationships in the natural eco-system has gained widespread recognition as the best practice delivering win-win solutions for business and the environment.

The implementation of industrial symbiosis is at the centre of the LOCIMAP project in relation to the development of future industrial parks. These because of the close proximity of stakeholders offer the opportunity for both residual utility, as well as material, exchanges and integration. The LOCIMAP project has quantified the relevance to the delivery of a low carbon economy and indeed more than that to the survival of much of the heavy industry associated with Europe. Central to this thinking has been the conscious avoidance of single sector (the chemical, cement or power industry for example) integration and a focus on opportunities that arise by full integration of cross-sector synergies.

These opportunities are fully explored in the forthcoming publications within this LOCIMAP White Paper series. This paper aims to set the scene for the understanding of industrial symbiosis, examples of its present deployment, and some of the driving forces behind the creation and benefits to industrial parks.

2. Introduction

In 2010 a group of 14 European companies and organisations responded to the European Commission’s call to examine the future for low carbon manufacture at integrated industrial complexes (Parks). The LOCIMAP - Low Carbon Industrial Manufacturing Parks - project is the result and has been looking critically at the way European Industrial complexes might develop strategies and technologies to meet the challenges of legislative pressures, public policy and economic competitiveness.

The energy & resource intensive sectors which lie behind the development of the parks we have in Europe – are very significant part of the economy. Nearly 7m jobs and over 450,000 companies are involved¹. The project team comes from these sectors and represents 4 industrial parks and a number of sectors all with intrinsically high energy demands. The commitment of the members to novel and sustainable approaches is absolute. These parks and others across Europe have already made great progress in improving the internal operating efficiencies. But more is needed.

The LOCIMAP project aims to provide fresh insights into the technical and organisational changes needed to secure the future for them and others like them across Europe.

¹ Spire Roadmap 2012. Found online at <http://www.spire2030.eu/>

3. What is Industrial Symbiosis?

Industrial symbiosis is defined as collaboration between two or more companies where to exploit each other's surplus materials and energy which often go unused. There will be bilateral contracts so that all parties have a financial benefit to help strengthen corporate competitiveness.

By taking advantage of the residual flows, the drag on the world's resources is reduced, and less primary energy used in production. This leads to a big win for both business and the environment due to recovering value previously lost, reducing material and energy inputs. Simultaneously industry achieves the goal of lower CO2 emissions and hence increasingly avoids additional costs.

However in a sense there is nothing new about industrial symbiosis, other than the name itself. Creating value from bi-products has a long history for example the valorisation of lanolin from the treatment of wool. The upswing of the term industrial symbiosis and the efforts made in many places to make use of it is related to tougher economic conditions and environmental policies affecting energy intensive production in the Western world.

However it is not just the chemical industry which lays claim to good practices as in the BASF case; both the iron & steel industry with the development of the integrated steel works and the pulp and paper industry are other exemplars of good practice.

The understanding and promotion of these good practices and the parallel with symbiotic relationships in the natural eco-system further developed in the study of the evolution of Kalundborg. This small region in Denmark originally coined the term when it was realised how commercial agreements had driven the integration of traditionally separate industrial activities,

The term 'industrial symbiosis' is therefore a very effective mental lever for the understanding and promotion of good business practice through inter-stakeholder (whether that is industry or public sector) exchange of residual materials and utilities streams that delivers both business and environmental benefits.

BASF's Verbund principle enables them to add value as one company through efficient use of our resources. With its six Verbund sites and 376 additional production sites, BASF supports customers and partners in almost every country in the world. Verbund is all about intelligent interlinking of production plants, energy flows and infrastructure. Also, know-how and customers are intelligently connected to each other.

The Verbund system creates efficient value chains that extend from basic chemicals right through to high-value-added products such as coatings and crop protection agents. In addition, the by-products of one plant can be used as the starting materials of another. In this system, chemical processes consume less energy, produce higher product yields and conserve resources. In that manner, they save on raw materials and energy, reduce emissions, cut logistics costs and exploit synergies. These solutions enable BASF to sustain competitiveness in every world region while making customers more successful.

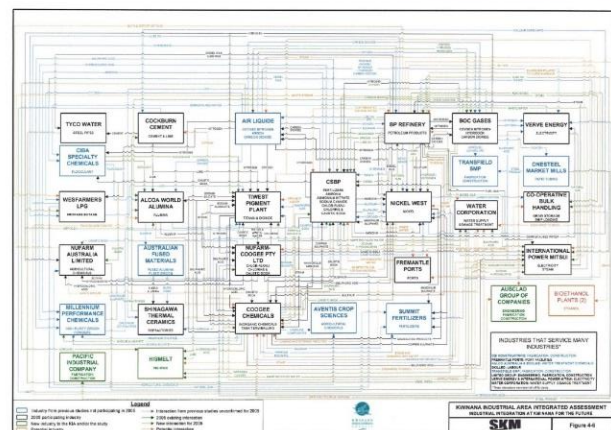
The Verbund principle extends beyond production and technology to embrace our employees. We combine and interlink the experience and expertise of our workforce to form the best team.

4. Examples

Four industrial parks, all of which are quality examples of the practical implementation of industrial symbiosis principles have been an integral part of the LOCIMAP project. They are; BASF representing the Tarragona park in Spain, a site based primarily on the production of organic chemicals; Kokkola industrial park in Finland based primarily on the production of inorganic chemicals; Sembcorp representing the Wilton site in the UK and Kalundborg in Denmark

Earlier this year a further international survey on eco-innovation parks by the Federal Office for the Environment FOEN, ERA-NET ECO-INNOVERA also described European and non-European industrial parks implementing eco-innovation (technologies, processes and services) or industrial symbioses. More than 160 eco-innovation parks in 27 countries are detailed following a set of eco-criteria. Success factors are identified, lessons learned from best practices are summarized and recommendations are made to support park developers and operators to design and manage industrial parks or urban/industrial mixed areas towards eco-innovation

It has to be said that not all examples of industrial symbiosis take place within a park setting. The UK's pioneering National Industrial Symbiosis Programme (NISP) is a prime example of non-park exchanges. Naturally these put a bias on material exchanges rather than utility exchanges. An example of industrial symbiosis concept with both material and utility exchanges exists at the South Kwinana Industrial Area (KIA) of Perth on Australia's West Coast. KIA is a park where many different industries are established and is the largest industrial area in Western Australia. Due to the large distances, it has been necessary to cooperate with each other in order to be able to compete with other parts of the world.



Finally, the increasing awareness of the benefits of industrial symbiosis may be gauged by the number of calls that are documented within the Horizon 2020 programme, specifically under the SPIRE Partnership approach to opportunities across energy intensive sectors.

5. How to get started, what is required?

Whilst much is written about material and energy exchanges, technology and innovation, industrial symbiosis is fundamentally about a business mind-set.

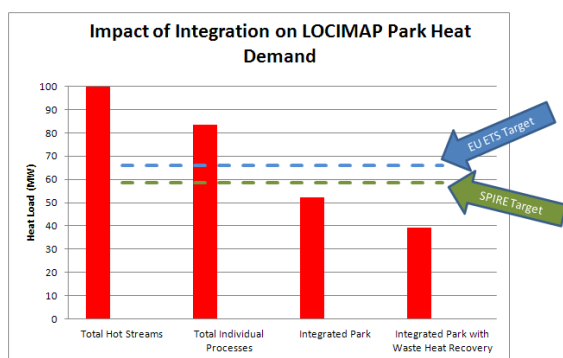
A pre-requisite for the implementation of industrial symbiosis is leadership and a willingness to explore mutual benefits through collaborative business processes. Studies have shown that one of the crucial factors for the establishment and pursuit of industrial symbiosis is the interest and engagement from the top managements of each partner involved.

History shows that the catalyst for this way of thinking may well originate in a 'needs must' situation, e.g. the need to solve the freshwater supply to the industrial complex at Kalundborg, a task too large for any individual company to undertake in isolation. Other initiating factors include legislation on emissions and financial instruments that motivates industrial symbiosis actions.

In order to develop a new symbiosis project it is essential that a leader emerges to take the initiative and set up the interactions between potential partners. Since it is senior management who must take the final decision, it's important that they participate in the first studies. The next step is to perform the initial feasibility studies.

The project has found that in establishing a new industrial symbiosis the confidence and confidentiality of partners is the most significant factor followed by the economic benefits which must exist.. All parties need to work together to find new solutions – and the project clearly shows that significant cross sector benefits do exist.

6. Benefits and potential



LOCIMAP analysis shows that extended cross sector integration can save well over the target 21% of energy use v 2005 set by EU and SPIRE for the energy intensive industries.

The additional benefits from industrial symbiosis are many. The bi-product exchange of residual materials reduces the amount of material to landfill (which is the very last option for waste handling and often associated with high costs), decreases the release of CO₂ and other polluting emissions due to both direct and indirect carbon savings. The use of residual heat further reduces CO₂ emissions.

However what drives these positive environmental benefits is inevitably the business benefits accruing from the increase in sales, the reduction in raw material costs and increase in profitability. When combined with the creation of new business and the creation and sustaining of jobs, increased asset utilisation and the reliance on innovation and the incorporation of training there is an incredibly powerful agenda in support of the application of industrial symbiosis.

CO₂ emissions currently arising directly from major industry under EUTS total over 489 million TPA. (Carbon Market data). LOCIMAP will show that Industrial Symbiosis can impact these using mainly existing process and tools. However some developments in ICT are making the discovery of opportunities much simpler and quicker. These will be explained later in this series of papers, alongside suggestions for new business paradigms which support the approach.

7. Conclusion

Industrial symbiosis has been developed systematically in only a few places. Up to now it has tended to be relate to single industrial sectors (e.g. chemical Parks, steelworks etc.)

What LOCIMAP sees as the future is systematic application of industrial symbiosis to the development of existing and future industrial parks. It will argue in other papers in this series that the principles behind industrial symbiosis are nevertheless under-exploited, particularly in relation to cross-sector synergies. The magnitude of this under-exploitation will be shown to be highly significant to the delivery of the low carbon economy, the prevention of carbon leakage from Europe and the development of a closed loop economy.

LOCIMAP partners will cover these issues in future papers which will address:

- The Smart Future Park
- New Operational & Organisational Structures