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## INDUSTRIAL ECO-PARKS AS DRIVERS OF THE CIRCULAR ECONOMY

Franck Aggeri, Professor at MINES ParisTech

Industrial eco-parks are one of the oldest forms of circular economy. A recent report for the World Bank<sup>1</sup> summarizes the position and puts forward recommendations for ways to promote them as drivers of the circular economy. Eco-parks are industrial zones that promote collaborations between businesses and with local communities, generating environmental, social and economic benefits. Eco-parks that foster exchanges of materials, water, energy and information between interdependent businesses operating complementary activities—along the lines of natural symbioses—are described as examples of industrial symbiosis.

Worldwide, the number of industrial eco-parks is growing rapidly: up from 245 in 2001 to 438 in 2020. They are found particularly in Asia (China, Japan and South Korea) and Europe. Some of them, such as Kalundborg in Denmark, are very well known and have been studied extensively. Every empirical study highlights the potential these forms of symbiosis have to drastically reduce the environmental impacts of industrial activities by promoting synergies, as well as the economic benefits associated with shared resource management. The report stresses that creating industrial symbiosis, including the choice of technologies, depends on the types and quantities of materials and resources available in and around the parks, as well as the number of possible local uses for them. Every situation is different and must be studied in detail beforehand to identify the potential that can be exploited.

The report looks at technologies, infrastructure, governance systems and business models in three types of activity found at industrial eco-parks: energy, water, and materials and waste. 35% of eco-parks have installed renewable energy sources; almost 50% have adopted efficient water practices to optimize water use and recuperation; and 52% have set up an industrial symbiosis program to recover waste and material flows within the park, particularly to generate heat.

Aside from the adoption of technologies that favor circular economy approaches (water treatment, cogeneration, waste processing, pyrolysis, CO<sub>2</sub> recovery units, etc.), the report focuses on business models and collective governance, two key factors for success. Promoting circularity necessarily entails designing

business models that demonstrate the tangible benefits of resource pooling for all participants. And adopting collective governance is crucial to this. The report highlights the fact that designing symbiotic networks requires a park operator that can organize exchanges of flows of materials, water, energy and waste between companies; establish legally binding contracts between the parties; invest in and manage pooled infrastructure; take charge of R&D and trials on behalf of industrial companies; monitor the technical and scientific horizon, and set up dashboards and performance indicators. In other words, park operators play an essential role in promoting and incorporating the principles of the circular economy. Their actions can overcome the two main impediments to ramping up exchanges between industrial companies: lack of information about resources and materials available for recovery, and lack of trust between actors when it comes to sharing confidential data and committing to joint investments.

The report lists three recommendations for leveraging circular economy strategies. First, it recommends setting up digital platforms to identify reserves of materials and waste and their sources, as at the Norrköping industrial park in Sweden. Second, it encourages local and national authorities to establish tax incentives, create financing mechanisms and make it easier for parks to share the lessons learned. Third, it recommends that park operators adopt the World Bank and UNIDO industrial eco-park toolbox, which provides detailed guidance on rolling out circular economy principles for projects of this type.

Among the examples examined in the report, the Ulsan industrial eco-park in South Korea illustrates the symbiotic relationships that have emerged between an industrial eco-park and its surrounding metropolitan area (see diagram). Part of the municipal waste is incinerated to produce energy that is used to power the park. Another part of the municipal waste is used to produce gas by methanization, and sewage is used to generate biogas through aerobic digestion. The gas produced is then used as fuel by industrial companies in the park. Integrating urban and industrial ecosystems in and around an eco-park makes it possible to increase and scale up circular economy practices.

<sup>1</sup> World Bank. 2021. Circular Economy in Industrial Parks: Technologies for Competitiveness. World Bank, Washington, DC. ©World Bank. <https://openknowledge.worldbank.org/handle/10986/35419> License: CC BY 3.0 IGO.

## Urban-industrial symbiosis in Ulsan EIP, Republic of Korea

