OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

TCPP
TUNISIAN CLEANER PRODUCTION PROJECT

INDUSTRIAL ECOLOGY




Challenges and solutions for
improving the performance of industrial parks and strengthening Tunisia's economic fabric

TCPP
TUNISIAN CLEANER PRODUCTION PROJECT

TUNISIAN CLEANER PRODUCTION PROJECT

The Tunisian Cleaner Production Project (TCPP) is part of the cleaner production (CP) initiative developed by the United Nations Industrial Development Organization (UNIDO). It is co-funded by the Swiss State Secretariat for Economic Affairs (SECO) and the International Centre for Environmental Technologies (CITET).

The CP initiative already has been tested in more than 50 countries. In each country a National Center for Cleaner Production was designated to serve as a point of reference on CP. CITET was chosen in Tunisia. UNIDO appointed consulting firm SOFIES to carry out the knowledge transfer and serve as an International Reference Center.

The project's main **objectives are**:

- **Strengthen Tunisia's capacity** in the technology, methods, and tools of environmental engineering, while improving the **competitiveness of Tunisian companies**
- **Ensure sustainable improvement in companies' performance** with the help of support that aims to stimulate and facilitate the implementation of recommended actions.

Areas of focus

The TCPP encompasses several areas of focus that present innovative methods for meeting Tunisia's needs in terms of resource management and environmental and social performance:

1. Cleaner Production
2. Industrial Ecology
3. Life Cycle Analysis and Water Footprint
4. Energy Efficiency and Renewable Energy
5. Sustainable Hotel Industry

Budget € 2.5 million

Time frame 5 years (2010–2015)

Area of focus **2**

Industrial Ecology (EI)

Benefits for companies, GMGs, and regions

Improve the **economic and environmental performance of industrial zones:**

Customized solutions that meet companies' priorities and, in particular, make it possible to:

- Optimize the management of natural resources thanks to innovative solutions, including partnerships among businesses
- Create new sources of revenue and lower costs for managing businesses as a result of reusing waste and coproducts
- Achieve economies of scale by sharing services and infrastructure

Contribute to **regional development:**

- Consolidate the existing economic fabric and create new business ventures
- Improve resilience to outside economic conditions thanks to a secure supply that favors endogenous resources

Scope and beneficiaries

- Identify opportunities and assist companies with implementation in the two industrial parks
- Train two national experts (CITET) and 35 members of associations for maintaining and managing industrial parks (GMGs) to ensure efforts can be replicated
- Mobilize key players at the national level: national agencies, local governments, and professional associations

Industrial Ecology and Industrial Symbioses: when economic activities draw inspiration from natural ecosystems

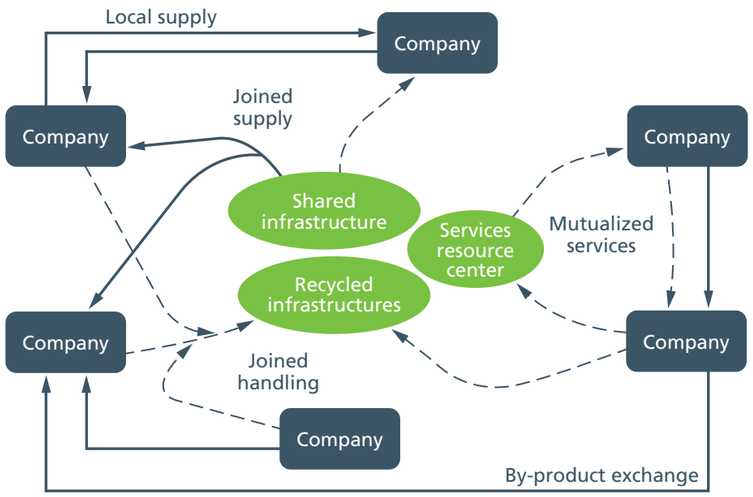
Industrial ecology applies the analogy between natural ecosystems and the industrial system to study, understand, and improve how economic activities use natural resources and to reduce their environmental impact. These tools make it possible for companies to improve their environmental performance and increase their competitiveness thanks to lower production costs and the creation of new sources of revenue. On a regional or national scale, a strategy based on industrial ecology helps to reuse local resources, secures the supply of resources, and lowers the volume of waste while creating jobs and adding value.

Industrial symbioses are one strategy for applying industrial ecology based on partnerships among economic players in an industrial park, a region, or a country. Three types of opportunities for companies emerge:

1. Optimization of resources through the exchange of waste and coproducts (materials, water, energy). One company's waste becomes another's raw material. These measures close the materials loop, encourage recycling, promote energy recovery, and expand the use of local renewable resources while lowering pollutant emissions;
2. Implementation of common services, such as sharing the supply of raw materials or the treatment of certain coproducts;
3. Sharing infrastructure for energy production or generic flows (demineralized water, steam, compressed air, etc.), or for the treatment of certain coproducts.

When applied at the scale of an industrial park, the term eco-industrial park is used. **A dedicated service center** that is active across a park can also largely favor the implementation and replication of industrial symbioses. By offering assistance to companies, it supports innovation, develops attractive business models, helps manage risk, and oversees the supervision and operation of shared facilities and services. In Tunisia, this role can be played by GMGs, associations for maintaining and managing industrial parks.

Various kinds of opportunities created by industrial symbioses



Industrial symbioses allow for the integrated management of resources, making it possible to improve the environmental performance of Tunisia's economic fabric, its competitiveness, and to reduce the amount of waste produced

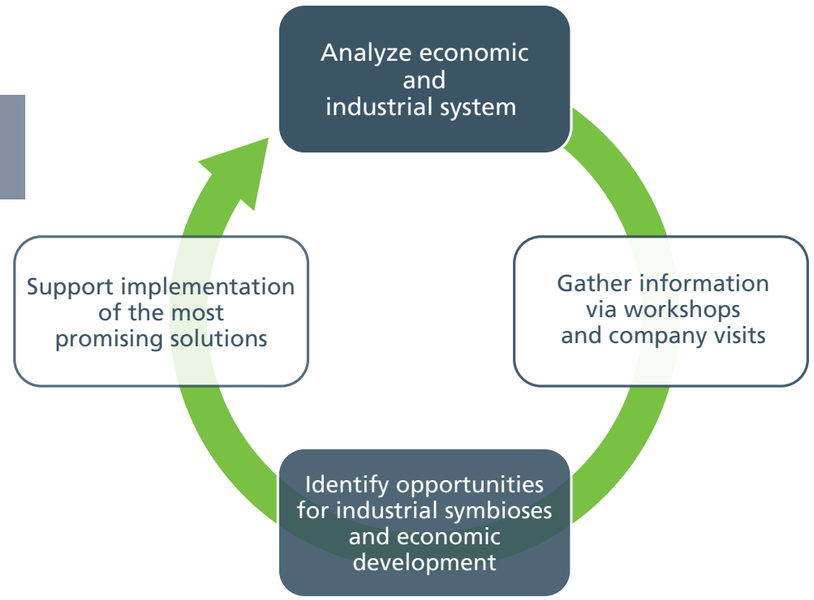
How can symbioses be implemented in an industrial park?

The concept of industrial symbioses is especially well suited to parks or regions that have a predominant secondary sector with significant flows of materials and energy and a diverse economic base.

Industrial symbioses depend on the willingness of businesses to work together. A methodology for company audits was developed to identify and analyze opportunities to create value and possibilities for collaboration. The main implementation phases are:

1. **Analyze the economic and industrial system.** This phase involves identifying and analyzing key industrial sectors, critical natural resources, the primary sources of environmental impacts, and possible opportunities for industrial symbioses using available information. The analysis makes it possible to understand the challenges and interests of stakeholders: companies, park management, public officials, local residents, etc.
2. **Gather information via workshops and company visits.** Les missions de terrain pour collecter des informations détaillées sur les flux de matière et d'énergie sont un préalable nécessaire à l'identification de potentiels et à leur priorisation avec les acteurs concernés.
3. **Identify opportunities for industrial symbioses and economic development.** This phase aims to identify the best opportunities and develop viable business models. It culminates in the creation of a portfolio of projects to present to industrial stakeholders.
4. **Support implementation of the most promising solutions.** Support in the form of technical assistance, as well as assistance with securing funding and project management, is offered to companies to facilitate and accelerate the implementation of chosen solutions.

Implementation phases for industrial symbioses



The implementation method for industrial symbioses is based on a participative approach and fieldwork that makes it possible to identify concrete business opportunities for companies

Learning from international experience

Three international case studies highlight successful symbioses and illustrate their benefits: 1) exchange of waste and coproducts 2) specific opportunities in the cement industry, and 3) shared services and infrastructure.

For more information and analysis, the **International Survey on Eco-Innovation Parks,** conducted as part of the European program ECO-INNOVERA, is available to download:
http://www.bafu.admin.ch/publikationen/publikation/01756/index.html?lang=en

Kalundborg Industrial Park, Kalundborg, Denmark

Monthey Chemical Site, Switzerland

Lafarge cement works, Le Havre, France

Exchanging coproducts: the example of Kalundborg, Denmark

The industrial park and municipality of Kalundborg is the most well known and well documented example of the implementation of industrial symbiosis. A shortage of freshwater led to the project's launch in 1961, fostering close ties among economic players. Numerous exchanges were established, prompted by a common desire to lower costs by making better use of raw materials and industrial waste. Today the Kalundborg Symbiosis Center encourages, facilitates, and manages these inter-company projects (www.symbiosecenter.dk/en).

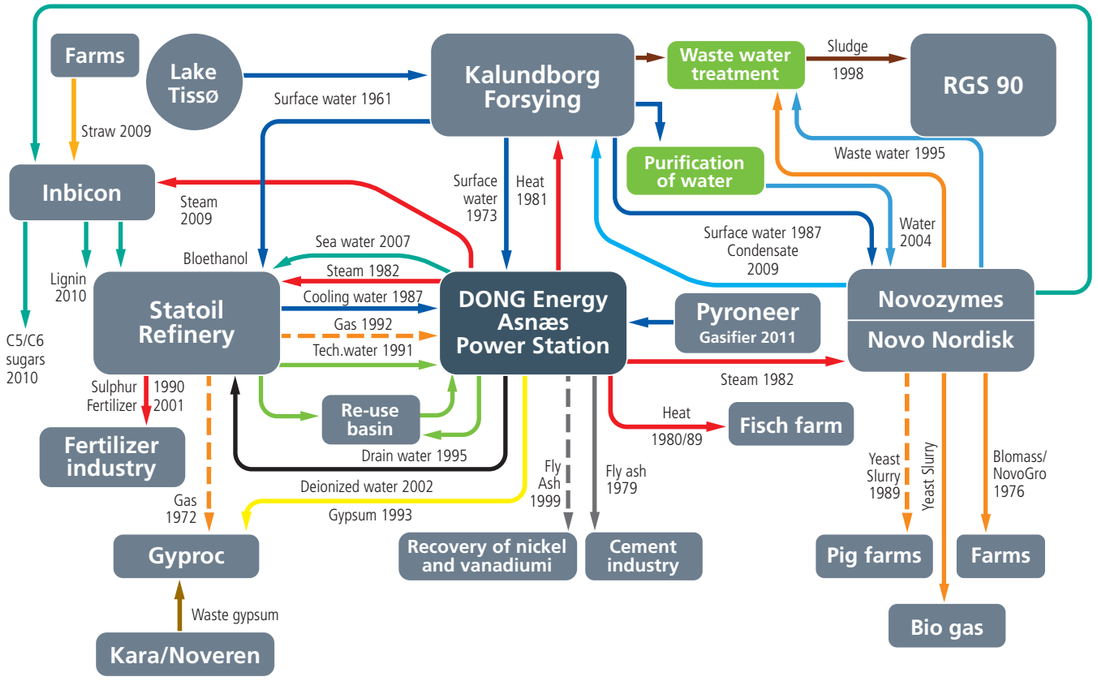
Kalundborg's network of symbioses cuts across a variety of industries, including the world's largest manufacturers of insulin and enzymes, a wastewater treatment facility, a power plant, an oil refinery, a plasterboard manufacturer, plants that treat and recycle waste and contaminated soil, and even agricultural producers. This diversity contributed to the emergence of complementary relationships among companies.

50 years of development bears fruit

More than 30 symbioses have been implemented between 1961 and 2011. With 3 million metric tons of water, steam, and materials exchanged, the symbioses generate annual profits of 11 million euros. The environmental impact is also considerable: fewer natural resources are consumed and polluting emissions have decreased (see table below).

Reduction in resources consumed	Reduction in airborne emissions	Recycled waste
Oil: 20,000t/yr	CO_2: 275,000 t/yr	Fly ash: 65,000t/yr
Nitrogen: 1,300 t/yr	SO_2: 380 t/yr	Sulfur: 4,500 t/yr
Water: 2,000,000 m^3/yr	H_2S: 2,800 t/yr	Liquid biomass: 280,000 m^3/yr
Phosphorus: 550 t/yr		Solid Biomass: 97,000 m^3/yr
Gypsum: 200,000 t/yr		

Industrial symbioses in Kalundborg, 2011



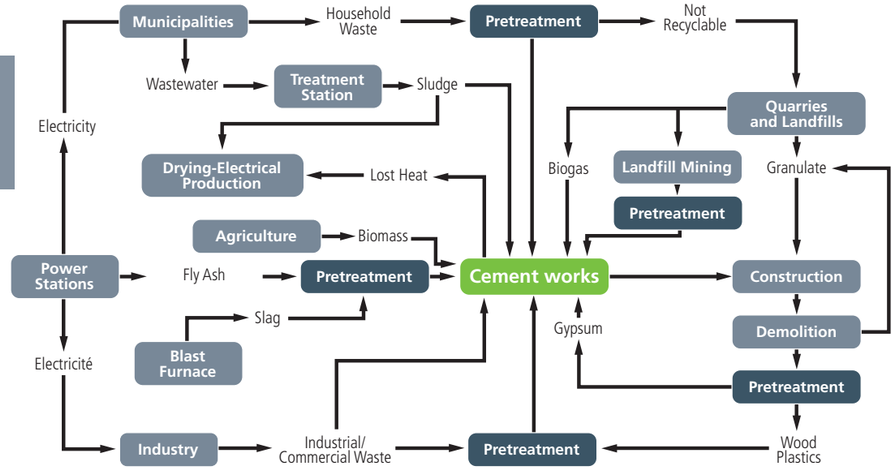
With 3 million metric tons of water, steam, and materials exchanged, the symbioses implemented in Kalundborg generate annual profits of 11 million euros

Exchanging coproducts:
enormous potential of co-processing in the cement industry

Manufacturing one metric ton of cement requires an average of 1.6 metric tons of raw materials and 0.1 metric tons of oil equivalent (TEP). Optimizing the consumption of non-renewable resources is of strategic significance for the long-term development of the cement industry. Industrial symbioses offer numerous possibilities for substituting non-renewable resources at different phases of cement production: substitute raw materials when preparing the raw mix, substitute fossil fuels in the firing phase, or substitute clinker and additives in the grinding phase. A cement works can be at the heart of industrial symbioses (Figure 3).

To be viable, the economic impact of the symbiosis must be visible with a minimum threshold of 5% substitution, or approximately 10,000 metric tons/year. The need for considerable volumes requires stakeholders to be well managed, and necessitates obtaining administrative authorization, mastering supply, and having specific technical and industrial know-how to ensure the quality of substitutes and their integration into the cement manufacturing process.

Opportunities for industrial symbioses in the cement industry



Examples of industrial symbiosis in the cement industry

Energy coprocessing: In the port area of Le Havre, France, Lafarge cement works created a partnership with a landfill operator to mechanically treat 65,000 metric tons of non-hazardous waste with high energy potential. A mechanical pretreatment process makes it possible to adjust the particle size of the energetic fraction and to remove undesirable materials. These "crushed solids" then serve as substitute fuel for manufacturing cement. The substitution rate at Le Havre reached 28% in 2010, with 73,350 metric tons of waste from nine categories including used tires, sludge, meat and bone meal, and used oils. The long-term goal is 50% substitution.

Materials coprocessing: Many kinds of mineral waste can be sources for the iron, silica, alumina, and calcium required for the chemical balance of the raw material used to manufacture cement. The Japanese cement industry leads this field. It reaches substitution rates that can exceed 350 kg of mineral waste per metric ton of clinker. In 2008 the Kanda cement works on Kiuchu Island ranked third in the country with 70 different sources of waste and 387 kg/metric ton of clinker.

Industrial symbioses are an attractive means of reducing the cement industry's pressure on non-renewable resources

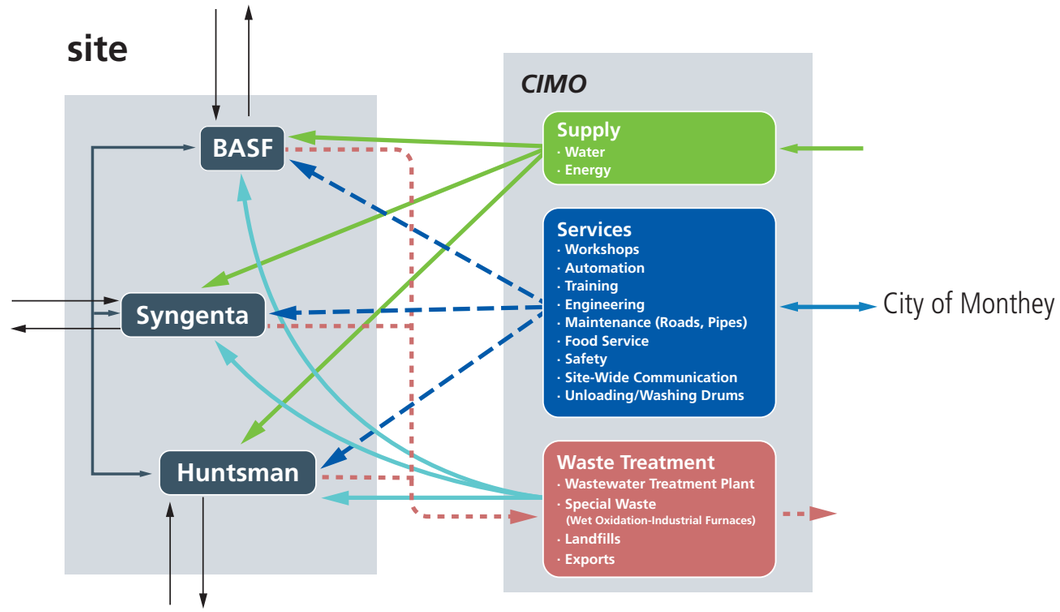
Sharing services and infrastructure:
CIMO, Switzerland

The Monthey Industrial Company, SA (CIMO) was established in 1997 by chemical manufacturers located, at the time, in the Monthey chemical site in Switzerland with the goal of developing common services. CIMO is a joint venture between BASF, manufacturer of pigments and optical brighteners, and Syngenta, producer of plant-based health products

CIMO's main tasks are to design facilities at the chemical site, manufacture and supply generic flows, oversee energy sources (hydraulic electricity, steam, natural gas, compressed air) and water, as well as manage liquid and solid waste. CIMO also provides a variety of services to the entire industrial park (see figure below).

CIMO's actions make it possible to reduce resource consumption and create added value by optimizing industrial processes, sharing solutions, and recycling waste. Recycling efforts include recovering and reusing solvents as fuel, and reusing phosphates and ammonia.

CIMO's role at the Monthey Chemical Site (Switzerland)



A service center helps companies achieve economies of scale and simplifies their lives by overseeing numerous tasks and making it possible for them to focus on their core business

Benefits for companies

The services provided by CIMO enable businesses at the chemical site to achieve economies of scale and reduce their resource consumption. Moreover, CIMO oversees multiple tasks related to logistics and project management, particularly assistance with administrative initiatives, making it possible for companies to focus on the **heart of their business.**

CIMO also helps identify many industrial symbioses that involve exchanging materials and energy among companies at the chemical site and around the region. Its role as manager of the industrial park is key to raising awareness among businesses of the opportunities offered by industrial symbioses and to provide the oversight needed to implement them.

Opportunities for industrial symbioses in Tunisia

The creation of industrial parks in Tunisia faces several challenges, notably performance problems and shortages due to the structural limits of certain parks, growing market pressures, and the process of upgrading the Tunisian economy. Added to this are new market demands, particularly the need to integrate an environmental component in the management of industrial parks.

To address these challenges and advance the long-term development of Tunisian industrial parks, international partnerships were formed in recent years. A bilateral Tunisian-German project sought to improve the long-term management of parks by strengthening the structure and organization of GMGs, associations that maintain and manage industrial parks.

The industrial ecology project implemented as part of the TCPP seeks to optimize the use of resources and reduce the impact of industrial activities by increasing capacity for identifying and implementing industrial symbioses. More specifically, this approach, which targets two industrial parks, aims to:

- **Increase the capacity** of CITET and GMGs with regard to the methodology and tools used for industrial ecology;
- **Identify and implement industrial symbioses** (materials, water, energy, shared services, etc.) among economic players in the parks being targeted;
- **Create a collaborative dynamic** among private economic players and regional organizations, especially the national agencies for economic and industrial planning, waste management, and environmental management;
- **Contribute to the development of new economic activities** based on criteria used by industrial ecology, in particular establish networks to reuse endogenous resources (treatment, recycling) or improve the logistics used to supply companies.

A summary of opportunities to apply industrial ecology in Tunisia is presented for two industrial parks, **Bizerte Business Park (PAEB) and Djebel Oust and Bir M'cherga,** as well as for the entire country.

GMG training workshop

Field visit to a company

Industrial ecology offers solutions that meet the current challenges of Tunisian industrial parks, particularly with regard to waste management and the rational use of resources

PARK 1: BIZERTE BUSINESS PARK (PAEB)

Theme	Opportunities identified	Economic and environmental impact
Reuse waste and coproduts	Metallurgical sector: reuse rolling sludge after degreasing for reintroduction in blast furnaces	- Reduce steel consumption - Reduce the inventory of rolling sludge and its related environmental impacts
	Reuse calamine, slag, and refractory materials as substitutes for raw materials in the construction industry or in cement production	- Reduce the amount of natural resources consumed: alumina, iron oxide, and silicate (cement industry)
	Integrate all flows of non-reusable polyethylene plastics in Bizerte into the only existing stream for these products	- Improve plastics management in the park - Recycle plastics that cannot be reused directly
	Collect used textiles from manufacturers and direct them to local clothing makers for reuse, reprocess them to make insulation, or repurpose them as cleaning rags	- Improve management of waste fabric in the park - Create a regional network to reuse waste fabric
	Implement a treatment process for high-energy waste from the cement industry	- Improve waste management in the park, especially for hazardous waste, by using it as a source of alternate fuel for the cement industry
Share services and infrastructure	Share an existing distillery to recover solvents produced by some companies in the PAEB	- Reduce consumption of new solvents and lower environmental impacts, health risks, and risks associated with storing solvents - Improve the distiller's profitability

PARK 2: DJEBEL OUST AND BIR M'CHERGA

Theme	Opportunities identified	Economic and environmental impact
Reuse waste and coproducts	Reuse waste from bricks, concrete, and marble as raw materials for manufacturing cement (co-processing material)	- Save natural resources: alumina, iron oxide, and silicate (cement industry) - Reprocess large quantities of waste currently being stored (concrete: 40,000 metric tons; bricks: 15,000 metric tons)
	Establish a channel for grinding and reusing inert waste	- Reduce the amount of stored waste and reduce corresponding costs
Share services and infrastructure	Establish a shared transportation system among the industrial park and neighboring regions	- Lower the costs and environmental impacts associated with transporting employees to companies in the park
	Share the supply and the transformation of energy via cogeneration (electricity and heat)	- Lower energy consumption and emissions thanks to greater energy efficiency - Lower energy costs for companies
	Implement a wastewater management strategy to reduce, reuse, and treat effluents	- Lower water consumption - Lower the amount of industrial effluents

OPPORTUNITIES FOR INDUSTRIAL ECOLOGY AT THE NATIONAL LEVEL

Theme	Opportunities identified	Economic and environmental impact
Valorisation de déchets et coproduits	Reuse waste, including hazardous waste, as fuel for manufacturing cement	- Improve waste management and treatment, especially treatment of hazardous waste, by using it as a source of alternative fuel
	Reuse waste from construction materials (bricks, marble, concrete, etc.) in civil engineering projects or as raw materials for cement production	- Save natural resources: alumina, iron oxide, and silicate (cement works) - Reuse inert waste stored in Tunisia's industrial zones
	Reuse organic waste through composting and/or via biomethanization	- Reduce the quantity of organic waste generated and discarded by agrifood companies - Reduce the environmental hazards of storing or improperly disposing of organic waste
	Recycle solvents	- Reduce the amount of used solvents stored by companies and lower their impact on the environment and health - Decrease the consumption of new solvents
	Create a stock exchange for waste	- Encourage companies in industrial parks to exchange information about opportunities to reuse waste - Reuse the waste generated by companies and reduce the environmental impact of industrial parks
	Disseminate information about companies authorized to collect and/or recycle waste	- Meet existing regulations - Optimize companies' waste management by partnering with authorized businesses
	Create collection centers for industrial waste	- Improve and reduce the cost of managing waste in industrial parks - Increase the rate at which waste is reused
Shared services and infrastructure	Improve support services in industrial parks (food service, banking, training, waste collection, administration, etc.)	- Improve operating conditions for companies in industrial parks - Improve the competitiveness and attractiveness of industrial parks - Create jobs
Infrastructure in industrial parks	Redevelop industrial parks to evacuate rainwater, connect to the public sanitation system, build roads, and provide public lighting	- Improve the competitiveness and attractiveness of industrial parks - Improve the evacuation of waste water and reduce water consumption

Reusing waste bricks in the cement industry – Bir M'cherga Industrial Park

In the Djebel Oust and Bir M'cherga Industrial Park, CITET, in partnership with Swiss consulting firm SOFIES, implemented as part of the TCPP an industrial symbiosis between the Bir M'cherga Brickworks (BBM) and the Djebel Oust Cement Works (CJO). The initiative reuses brick waste generated by BBM as raw material for the production of CJO cement.

BBM generates 25 metric tons of waste bricks daily and has 15,000 metric tons stored at its plant. Following meetings, leaders from CJO and BBM agreed to study the technical feasibility of reusing the waste as raw material for the cement works. After visiting BBM's factory in July 2013 to assess the supply of waste bricks, CJO moved ahead with sampling and analyzing the bricks' chemical composition.

Results of the analysis were positive, and the two companies agreed to conduct gradual introductory trials of quantities of waste bricks in the quarries of the cement works. BBM committed to sorting the waste at the source before delivering it to CJO to eliminate plastic strips and to supply small size waste bricks. The first introductory trials were carried out with 1,500 metric tons of bricks and led to convincing results that encouraged the two companies to pursue their partnership with larger quantities of bricks.

Benefits for the companies

By implementing the plan to reuse waste bricks as raw materials for the cement industry, BBM managed its waste, created a reliable recycling channel located nearby (approximately 500 meters), and made better use of the space it reserved for storing waste. Similarly, using waste bricks at its plant enabled CJO to reduce its consumption of raw materials thanks to the clay in the bricks.

«The proposed solution for recycling is beneficial for BBM from an environmental and an economic perspective in terms of waste management.»

Mr. Walid Haj Kacem,
BBM Site Director

«Implementing a recycling channel for brick waste in the cement industry thanks to industrial ecology allows us to reduce our consumption of raw materials and is a good incentive to develop co-processing.»

Mr. Mohamed Tayeche,
CJO Plant Director

Treating industrial wastewater
at the Ben Arous Treatment Plant

In 2001 Tunisia's National Office of Sanitation opened a wastewater treatment plant to lower industrial pollution in Lac Sud in Tunis. Named the Ben Arous Wastewater Treatment Plant, it encompasses:

- A biological channel for treating wastewater from textile and agrifood sources
- A physical-chemical channel with specific procedures for treating wastewater from industries that discharge harmful pollutants: heavy metals, cyanides, nitrites, chromates, and even fats and pigments from printing houses.

The station was designed to treat daily flows of wastewater equal to 5,500m³ and a daily pollutant load of 3,000kg de DBO5.*

The agency entered into agreements with 56 companies to treat wastewater at Ben Arous. Approximately 40 companies located in the Chebedda and Bir Kassaa industrial parks are connected to the plant's network.

The majority of Tunisian industrial parks do not have this type of system. Considerable potential exists to develop new shared plants to recover, treat, and reuse industrial wastewater.

*DBO5 is a unit that measures the biochemical demand for the amount of oxygen required to break down organic material in the water over five days.

Shared management of paper waste
in the Charguia Industrial Park

The GMG that maintains and manages the Charguia Industrial Park II launched a project to share the collection, compacting, and sale of paper to authorized recyclers.

The objective is to acquire a press to compact and package common industrial waste so it can be sold to businesses that specialize in paper recycling. The project's budget is approximately 90,000 dinars (40,000 euros) to purchase the press and cover two years of operating costs, awareness campaigns, and training programs. A portion of the project will be funded by the UN Development Program (PNUD) through the micro-financing program of the Global Environment Facility. The project will last 14 months, beginning in December 2014.

The project allows companies in the industrial park to reduce the cost of managing paper waste and to benefit from a reliable and effective service for collecting and recycling paper waste in accordance with current regulations.

The Tunisian association for maintaining and managing industrial parks (ATGMG) will oversee the aid to the Charguia II GMG for the implementation phase of the project, as well as for organizing meetings to raise awareness among companies in the park. The ATGMG also plans to organize seminars to share their experience working on the project with the goal of replicating it in other Tunisian industrial parks.

How can we promote and implement opportunities for industrial ecology in Tunisia?

✔ **Modernize** the infrastructure, facilities, and services in industrial parks

Industrial ecology is a good i–ndicator of areas that need improvements to promote the long-term development of industrial parks. Infrastructure and facilities for energy, transportation, and water treatment present great opportunities for improvement. Moreover, services related to collecting and treating waste, especially hazardous waste, are currently insufficient to motivate companies to adopt best practices on these issues. **Modernization will improve the attractiveness of industrial parks while making it possible to develop more ambitious symbioses.**

✔ **Adapt** the regulatory framework to promote eco-innovation within industries

Certain restrictions on the development of industrial symbioses are related to Tunisia's current regulatory framework. For example, a 28 September 2010 decree sets values for emissions limits for incinerating waste that do not account for the specificities of co-processing and, thus, hamper its growth in Tunisia. Moreover, the legislation does not allow electricity to be exchanged between two companies that do not belong to the same group. As a result, the development of energy cogeneration is also restricted, and many companies decline to invest in their energy production system. **Adapting the existing framework to remove these restrictions would open opportunities for creating considerable added value on a country-wide scale!**

✔ **Channel and develop** funding mechanisms and other incentive measures

At present, few incentive mechanisms support the development of industrial symbioses in Tunisia—either because they do not allow funding for multi-company projects, or because they do not focus closely enough on the flows that present opportunities for symbiosis. A funding mechanism for projects that reuse waste could help reverse this trend. Moreover, the current policy for buying back and selling electricity is not very attractive to companies, reducing their interest in investing in environmentally friendly energy production such as cogeneration. **Developing incentive mechanisms would help stimulate investors, thus contributing to the revival of the Tunisian economy.**

✔ **Introduce** the concept of eco-industrial parks as a principle of economic development

Raising awareness and motivating political and economic players are the major challenges to implementing industrial ecology on a large scale. To support initiatives at the level of an industrial park, one solution would be to develop an environmental performance certification for industrial parks that applied to existing parks, as well as to planning for future sites. **Taking ownership of the eco-park concept and promoting it, as developed by CITET, Tunisian ministries, and other Tunisian institutions, would be a decisive step toward the sustainable development of industrial parks.**

✔ **Strengthen** the role of the associations that maintain and manage industrial parks (GMGs)

GMGs play a major role in mobilizing companies to support initiatives based on industrial ecology, in promoting the dissemination of best practices, and in strengthening the quality and attractiveness of industrial parks. They can facilitate the incubation and implementation of innovative projects, and raise awareness among companies about the risks of inaction—compliance with regulations and image—and the potential benefits of change, while overseeing certain administrative tasks and managing projects. GMGs also serve as links between the economic sector and other stakeholders, such as local officials, institutional players, partner organizations, and even local residents. **Therefore, expanding the now limited institutional and financial capacity of GMGs is vital to expanding their role as catalysts for eco-industrial development in Tunisia.**

TCPP
TUNISIAN CLEANER PRODUCTION PROJECT

Contact

Ahmed Herzi
Chief Engineer – Assistant Director
Tel (+216) 71 206 433/482 (extension 1505)
Fax (+216) 71 206 642
E-mail: ae.ah@citet.nat.tn

Business Support Office
CITET – International Centre for Environmental Technologies-Tunis
Boulevard du Leader Yasser Arafat
1080 Tunis

Editorial Team

CITET – Ahmed Herzi
SOFIES – Guillaume Massard et Luc Jaquet

ASSOCIATION ATGMG
الجمعية التونسية لمجامع الصيانة والتصرف في المناطق الصناعية
ASSOCIATION TUNISIENNE des GROUPEMENTS de MAINTENANCE et de GESTION des ZONES INDUSTRIELLES

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Departement of Economic Affairs,
Education and Research EAER
State Secretariat for Economic Affairs SECO

UNIDO

sofies
leading sustainability

Centre International des Technologies de l'Environnement de Tunis