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UNIDO Resource Efficient and Cleaner Production (RECP) Programme

Project:

Eco-Industrial Parks (EIPs) in Emerging and Developing Countries: achievements, good practices and lessons learned

Synthesis of case studies

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prepared by ICAST, Geneva

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Cambodia

Cambodia EIP Case Study 1:

Pnom Penh Special Economic Zone (PPSEZ)

Prepared by: Cambodia National Cleaner Production Office
Author: In Sokneang

The park at a glance

Phnom Penh Special Economic Zone (PPSEZ) is a pioneering Special Economic Zone in Cambodia. The project is located on the outskirts of the Phnom Penh capital city (18 km from city centre). Opened in 2008. The total land area of PPSEZ is 360 ha. As on August 2013, 58 companies have signed on for investing in the PPSEZ, of which 38 companies are in operation and the rest of them in the process of finishing their constructions. PPSEZ has provided direct employment to more than 10'000 workers and has targeted to increase this to more than 100'000 workers in the near future. Sectors: Shoe, wire mesh, carton box, plastic, small size motor, garment, food processing, leather product, automobile parts, chemical. In order to provide a clean environment, PPSEZ accepted only small and medium scale enterprises. Land ownership is PPSEZ.

Governance and management

PPSEZ is a private partnership between a Cambodian and a Japanese company. PPSEZ works closely in partnership with government authorities including Cambodian Special Economic Zone Board (CSEZB), Custom and Excise Department, Cambodia Import Export Inspection & Fraud Repression Department, The Ministry of Commerce and The Ministry of Labor and Vocational Training. A private company, Sarom trading, is responsible for solid waste management in PPSEZ. PPSEZ development was projected to cover three phases. The first phase has been completed, with the creation of international-standard infrastructure, including a power station, water supply and sewage systems, internet capability and a dry port. The wastewater treatment plant is operated by PPSEZ.

Assessment and evaluation

Monitoring and evaluation of the environmental and economic-social performances in SEZs including PPSEZ will be conducted by line ministries based on their rule and responsibilities related to the management and investments in the zone. The activities of the zone are reported to the relevant ministries or institutions, the Cambodian Special Economic Zones Board, and the Provincial or Municipal Investment Sub-Committee. Effluent quality of the centralized wastewater treatment facility is continuously monitored to ensure the regulatory values of effluents.

Achievements and impacts

- Besides the centralized wastewater treatment system there are individual wastewater treatment systems (pre-treatment) at each factory depending on the quality and quantity of wastewater from each factory.
- PPSEZ provides high standard infrastructural facilities including good quality road network, independent power and water supply, centralized wastewater treatment and solid waste management, sanitations systems and collection and a dry port for import and export.
- PPSEZ offers social infrastructure including telecommunication, security as well as health clinics, restaurants, banks, office and residential units.

Drivers and success factors

- PPSEZ is considered important for the country's economic development because they lay a production foundation in regions other than the capital and bring infrastructure, jobs, skills, enhanced productivity to enable poverty reduction in rural areas.
- There are several incentives for zone developers, including profit tax exemption, exemption of import duties for infrastructure development, custom duty exemption and land concession.
- Zone investors also get custom duty exemption and VAT incentives.
- Foreign investment: many companies are Japanese, Korean, Taiwanese, and Chinese.

Challenges and lessons learned

- They have problems attracting Cambodian workers.
- PPSEZ is currently still being developed and not fully operational, it is at the second phase.
- PPSEZ have struggled to attract investors and FDI. The increasing volume of investments seen in the PPSEZ is a testament to the fact that the transparent process of implementation is highly valued by investors. The challenge is to learn from what works in the zone and extrapolate this to the Cambodian economy in general.

Suggestions and recommendations

- Hazardous wastes form all factories using chemical substances for should be collected separately and sent for special treatment and 3Rs (reduce, recycle, re-use), should be considered to separate toxic waste and nontoxic waste as well as green waste for composting.
- Wastewater once treated at the centralized facility should be used for non- potable purpose.
- In addition, the development of night shifts in PPSEZ factories can help switching electricity demand to low peak time. In addition, the captive biomass based power plant in this area should be installed.

- Furthermore Cambodian government should also take necessary actions to promote cleaner production, energy efficiency, low carbon development in SEZ by setting policy, legal and regulatory framework.
- Monitoring of environmental indicators (except for effluent water) does not take place yet, special arrangements should be made.

Cambodia EIP Case Study 2:
Sihanoukville Special Economic Zone (SSEZ)

Prepared by: Cambodia National Cleaner Production Office
Author: The Vannthay

The park at a glance

Sihanoukville Special Economic Zone (SSEZ) is located in Pou Thoung Village, Prey Nop District, Preah Sihanoukville (about 212km from Phnom Penh capital city) and was launched in 2008. The first phase of the development area of 528 ha is for industries involved in textiles and clothing, hardware, machinery, steel, light industry as the leading home appliance industries. There are 52 companies that have signed up for investment in the SSEZ of which 27 companies are in operation. Many Chinese companies have expressed their interest in putting investments in SSEZ which will take an initial investment of 320 million US dollars The project aims to get 300 companies. SSEZ has provided employment to more than 11'000 workers so far. Total surface: 1113 ha.

Governance and management

SSEZ is a Private Public Partnership (PPP) founded by a Cambodian company and a Chinese company. The one-stop Office of SSEZ works closely in partnership with government authorities, including Cambodian Special Economic Zone Board, Council for Development Cambodia, Sihanouk Provincial, Cambodia Import Export Inspection and Fraud Repression Department, Ministry of Commerce and Ministry of Labor and Vocational Training. Cambodia has liberalized export policies and licensing and implemented tax reforms providing various incentives to investors.

Assessment and evaluation

The quality of wastewater conform to regulations set by the Ministry of Environment before discharge to the river, because SSEZ is located on the hill so quality of wastewater is controlled directly by technicians from Ministry of Environment. No other monitoring is in place.

Achievements and impacts

- SSEZ has provided indirect employment to many thousand people around the areas such as for renting houses, health care services, foods, transportation who can also increase their living standards.

- SSEZ provides high standard in infrastructure including independent power (near power supply from GS) and water supply, good quality road network, high speed telecommunication network, security, health clinics, bank and near deep-sea port, railway station and international airport.
- Environmental achievements based on two cases: LED light, solar energy for water steam, use of daylight, use of heat layer under the roof and use of steaming pipe system with layers.

Drivers and success factors

- The development of Special Economic Zone including Sihanoukville SEZ, is an important part of the country's economic development because they lay the production foundations in regions other than the capital and bring infrastructure, jobs, skills and technologic enhanced productivity and the prospect of poverty reduction in rural areas.
- Exemption from import duties, custom duties and taxes.
- Foreign investment from China, Ireland, Japan, France and United States.

Challenges and lessons learned

- Some companies have been using good eco-technologies and some techniques to save energy in their factory. But there are a lot of eco-technologies that companies are not yet using.
- Centralized wastewater treatment and a solid waste management system are not yet built in SSEZ. But there are individual (pre-treatment) treatment facilities at each factory depending on the quality and quantity of water and solid waste from each factory.
- Energy efficiency in buildings by using heat layers under the roof of the building, by using sky light on the roof of buildings and construction of heat insulation buildings to save electricity used for light and air conditioning in the building.

Suggestions and recommendations

- In keeping with the Cambodian Government's belief that the private sector is the potential engine for economic growth, promoting foreign investment is a high priority.
- Cambodian Government should also take necessary actions to promote cleaner production, energy efficiency and low carbon development in SEZ by citing policy, legal and regulatory frameworks.
- Examples of potential environmental applications are: installation of solar power plan on the roof (good temperature in SSEZ ranging 28^{o}C - 35^{o}C), installation of wind power plan, reuse of steam to heat cold water before entering boilers (saving time and energy), reuse of wastewater for other purposes such as reusing in the production, and toilet flushing, use and implement energy efficient equipment.
- Monitoring air and water quality should take place.

China

China EIP Case Study 1:
Shanghai Chemical Industry Economic and Technology Development Park

Prepared by: China National Cleaner Production Centre (CNCPC)
Authors: YIN Jie, ZHOU Ming，WEI Xiaoping，LIU Yang and SUN Li

The park at a glance

Shanghai Chemical Industry Economic and Technology Development Park (SCIP) is located in the South of Shanghai city (of major economical importance). Sectors and main products are Petro-chemical and related fine products. IP established in 1996. Eco-Industrial development initiated in 2008. It became a National Demonstrative EIP in 2012. The land is state-owned. (different business models for the companies) .
The size is 2'940 ha, 71 companies employing 17'000 people, with 128'000 inhabitants in the vicinity. Functions now as a highly connected eco-industrial system, taking ethylene and chlorine series products as the upstream products and the fine chemical products as the downstream products.

Governance and management

SCIP Administration Committee (AC) is the administrative body of SCIP, which is a governmental agency of Shanghai Municipal Government. Another company, namely SCIP Development Cooperation Limited, is responsible for the overall development and construction of the park. It also provides public services for the enterprises and institutes in the park.
SCIP has its own human resources service center. It cooperates with the East China University of Science and Technology and the Shanghai Petrochemical Academy for occupational education and training. Centralised public infrastructures include combined heat and power supply, industrial water supply plant, and several specialised pipelines for these industries. Utilities are operated for the whole park by different companies.

Assessment and evaluation

SCIP monitors its achievements every year according to the National Standard for Sector-based Eco-industrial Park, and reports to the Ministry of Environmental Protection (MEP).

A voluntary yearly environmental report addressed to the residents surrounding the park and the employees, improves the transparency, involvement and supervision of the public.

Achievements and impacts

- Award: SCIP became a National Demonstrative Eco-industrial Park in 2012, and considered one of the most successful EIP in the chemical industry in China.
- Initiatives on “Good Relations, Good Neighbours”, “World Environment Day on June 5”, launched by the ISCP, and other individual companies’ cooperation projects with neighbourhood communities promote information sharing and corporate social responsibility.
- Better environmental management, occupational health and safety.
- An Automatic Monitoring Super Station for Ambient Air Quality was built by SCIP together with Shanghai Municipal EPB. It monitors also the typical pollutants of a chemical industrial park, such as volatile organic carbon (VOC).
- An Emergency Response and Management Information System was established.
- An artificial eco-wetland utilises the natural rivel and greening belt to further treat the wastewater from the treatment plant, which can be reused as industrial water and landscape water.
- Application of cleaner production technology.
- With the Leak Detection And Repair (LDAR) project by the company SECCO, VOC emissions were reduced by 14%.
- Several entreprises have invested in more resource efficient technology and now save large amount of energy, steam, or recycle specific chemicals to a great extend. (Lianheng Isocyanate co. Ltd, BASF, ...).
- As example of waste reusing and co-design of two companies' projects, Lucite converts a virulent acid produced by SECCO into a product much safer and in wide use.

Drivers and success factors

- Some of the initial drivers to gather chemical industries were previously backwards technologies and irrational locations causing heavy environmental pollution and serious conflicts with the quality of life of residents.
- National incentive policies: In 2003, the Ministry of Environmental Protection (MEP) jointly with the Ministry of Commerce (MOFCOM) and the Ministry of Science and Technology (MOST) initiated a national-wide initiative to construct the National Eco-industrial Demonstrative Parks. Under this circumstance, SCIP, with the great support from Shanghai Municipal Government, started its eco construction in 2008.
- Park's incentive policies: SCIP formulated various incentive policies for the industrial development in a resource efficient way, with a full supporting measures in finance, administration and infrastructures.
- For instance, SCIP selects strictly only new projects that have a direct relation in the planned product chain.
- Another example is the help provided to obtain the tax reduction for comprehensive utilization of wastes in the production.
- The higher prices and treatment costs for (waste-)water stimulate the residential companies in the park to seek ways to save water.

- The favorable infrastructue notably includes collective management/ treatment/ recycling of wastewater and effluents, and collective production of common inputs such as water, steam, power, etc.
- Like in other Chinese parks, the AC has a strong leadership role. Within each department has its clear responsibilities in the eco-construction of SCIP.
- Some of the world most advanced petrochemical companies, attracted by the favourable conditions in the park, also bring their advanced management concepts and technologies into the park, so as to raise the overall performance.
- All the 28 chemicals manufacturers have carried out CP assessments, and 7 have carried out energy audits. Significant investments were made to implement the water/energy/emissions saving measures.
- Technology eco-innovation is also favored through various kind of research carried out by the SCIP.
- Voluntary: individual enterprises in SCIP are very active in the application of cleaner technologies.

Suggestions and recommendations

- "In addition to the world-leading companies in the chemical industry in SCIP, the local and smaller residential companies in the park should also play their roles in cleaner production and eco-construction of the park. "
- Current challenges are missing.

China EIP Case Study 2:
Guangxi Xianggui Sugar Eco-Industrial Parks

Prepared by: China National Cleaner Production Centre (CNCPC)
Authors: YIN Jie, WU Hao and YUAN Yin

The park at a glance

Guangxi Xianggui Sugar Eco-Industrial Parks is located near Chongzuo city in the Guangxi Province (adjacent to Vietnam). The sugar industry chain plays a decisive role in the regional economic development and involves 12 million people in Guangxi province. The sector food and industries linked with cane sugar making: fermentation industry and bio-fertilizer.
The parc was invested in 2007, and the planned construction period is 2010-2025 in two phases. Private ownership. Owned and independently organised by the Guangxi Xianggui Sugar Group Co., Ltd. Currently there are 4 entreprises, employing 1'350 people. Projected number on completion in 2025 are respectively 8-10 enterprises and 20'000 employees, on 266 ha (comparatively small). The park built 6 eco-industrial chains around cane sugar making, involving deep processing of finished products, and comprehensive utilization of all the sub-products - bagasse, waste molasses, filter mud from wastewater, and sugarcane leaves.

Governance and management

The park's organizer is Guangxi Xianggui Sugar Group Co., Ltd. and the enterprises in the park are the equity shareholders. A "Logistics Service and Management Centre of the Park" manages all related affairs in relevant departments. Most infrastructure such as roads, electricity belongs to external companies or public resources. However a significant part of electivity and heat is generated on site 8 months/year, and wastewater management is fully integrated into the industrial chain.

Assessment and evaluation

Currently there are no detailed plans for future monitoring.
The enterprises in the park integrated 4 management systems according to international norms (GB/T and ISO) into 1 (QEOF) to strengthen capactity building and training. The park human resources training system is promoted by third party instutions.

Achievements and impacts

- All projects in this park are closely related to the cane sugar industry chain, making optimal use of sub-products/resources:
  From the waste molasse, active dry yeast is produced, which is used to extract high nucleotide food additive. From the wastewater of sugar cane processing, water can be reused for irrigation, and filter mud used as organic fertilizer back in the sugarcane plantations. Pulp and paper products for packaging are made from cane leaves.
- During the production season, power usage from the public grid is reduced to below 10% of full power, thanks to the biogas and heat generated from other processes and converted to electricity.
- Significantly increased income from the sale of products derived from waste (paper packaging, organic fertilizer, ...). For instance since molasses have been used to produce yeast, the income has doubled.
- Thanks to the wastewater treatment and the related methane (biogas) production, pollutants emission greatly reduced, e.g. SO_2 previously due to coal-burning, or high COD in wastewater.

Drivers and success factors

- Initial problems: the by-products and wastewater generated were increasing together with the main production, causing serious environmental impacts and complaints from the local citizens.
- The park’s planning and construction was mainly driven by market-oriented forces.
- Strengthened policy guidance and financial support also promoted the eco-construction of the park: in line with the government's energy-saving and emission reduction policies, small amounts of funding was given by several local governmental departments, enough to encourage enterprises to actively apply new eco-oriented technology.

- To plan and implement the circular economy park, the group cooperated with the South China University of Technology, Guangxi University and Plan & Design Institute of Guangxi Hualan.
- This park is planned from the beginning to optimise symbiose between enterprises. New companies are encouraged to join only if they complement the sugar industry chain.
- In this sector of activity, there was a great potential to create closed industry loops.

Suggestions and recommendations

- Improve the plan's planning to avoid duplicated investment and waste of resources.
- The management and administration of the park should be carried out in a unified and coordinated manner as a whole.
- Entrust a professional institution to carry out a systematic monitoring and evaluating system for the environmental, economic and social benefits in the park.
- Implement the centralized power center and agricultural irrigation system surrounding the sugarcane area as suggested to reach "zero dicharge" of wastewater.

EIP Case Study 3:

China EIP Case 3:

Zhenjiang New Energy Industrial Park

Prepared by: China National Cleaner Production Centre (CNCPC)
Authors: YIN Jie, YUAN Yin and WU Hao

The park at a glance

Zhenjiang New Energy Industrial Park is located in the Jiangsu Province near Nanjing and Shanghai, in the rising industrial city of Zhenjiang. It is part of a the Zhenjiang Economic and Technology Development Zone (ZETDZ) which includes 3 industry parks. Sectors are mainly photovoltaic (PV), also new materials and bio-medicine. Established in 2009. State-owned: City of Zhenjiang and ZETDZ. All main types of companies, from fully state-owned to fully private, with PPP and foreign-funded entreprises. Its size is 900 ha, there are currently 30 companies and 2'000 persons employed within the cluster. In addition to the core business area and the supporting industries area, the parc includes a "comprehensive demonstration area", with a photovoltaic power generation demonstration area.

Governance and management

The daily administration is done by ZNEIP Administrative Committee (ZNEIPAC), established formally in 2013, and under the leadership of the ZETDZ Administrative Committee (ZETDZAC). The various parks within the zone (ZETDZ) are assisted by different offices for matters such as fincancial, educational, or sector development.

Operation of public infrastructure:

- External: most is either shared with the ZETDZ or the whole city: power supply – including a part (7.5% in 2012) from new energy and solar PV applications, gas, water, waste water and solid waste treatment.
- Internal: "ZNEIP provides a great convenience for centralized waste treatment and classification".

Assessment and evaluation

- "Because of its short period of establishment, ZNEIP lacks practice in monitoring and evaluating the environmental/economic/social performances of such clusters."

Achievements and impacts

- In the PV industrial chain, entreprises are closely linked, however the difference with a conventional market chain is not clear.
- In this report, most "best practices" presented are achievements in terms of sales of quantity produced. Apart from a general mention, there are very few specific examples or facts of how resources are more efficiently used.
- One enterprise (SiC Processing GmbH) is a leader in recycling and disposal of materials used in the solar photovoltaic and semiconductor industries.
- The zone (ZETDZ) accelerated the amount of new energy applications (such as biomass energy and solar PV). In 2012, 7.5% of the whole zone's total consumption was from new energy and renewable energy, saving the equivalent of 228'000 tons of standard coal.
- Most benefits are to be expected outside the park, through the export of new energy technologies produced on the site.

Drivers and success factors

- Drivers to create the industrial park

- The main driver to create this industrial parc were economical and policy-driven, and supported by a special fund from the government to support this industry branch.
- In response to the global energy crisis and large international and domestic demand for photovoltaic industry products.
- In response to economical difficulties in the branch, since 2013, China issued a series of favourable policies at the national, provincial, and city level to support the development of photovoltaic industry, and launched a special demonstration project.
- Centralization of the new energy enterprises in one specific area also presents a number of social advantages, such as maximum effectiveness of the supporting facilities, diminution of noise pollution in the neighbourhood zones.

- Drivers to convert to or design as an eco-park
    - The authors do not mention the promotion of particular ecological initiatives. The term "eco-parc" seem attributed mainly to the fact that renewable energy technology is produced.

Suggestions and recommendations

- "ZNEIP should further improve the organizational structure with the establishment of leading group, expert group, etc. to regulate the park management.
- Favour investment by using the preferential policies and financing instruments. Formulate incentive measures in favour of talent introduction and training.
- Train the management and entreprises in planning to improve, evaluate, and monitor the environmental/economic/social performances, and in eco-industrial principles. "ZNEIP should establish an information network system to exchange cleaner production and eco-industrial technologies."
- Form and optimise the eco-industrial network with multi-products and multi-chains."

China EIP Case Study 4:
Dalian Development Area (DDA)

Prepared by: Institute of Applied Ecology, Chinese Academy of Sciences
Author: Prof. GENG Yong

The park at a glance

The Dalian Development Area (DDA) is located in the Dalian Municipality, which has a population of 6 million people, Dalian is a famous tourist city on an ecologically sensitive peninsula. The sectors are: Petrochemicals, equipment manufacturing, automobile parts, IT industry, bio-pharmaceuticals, food processing, etc. The special economic zone was founded in 1984. Eco-Industrial development started in the early 2000s. The land is state-owned and the businesses cover a large range of ownership-types. Huge area of nearly 104'000 ha, a total population is over 1.1 million, including 256'000 workers in 2012 and 4'000 companies. In China, it is one of the earliest and leading parks to promote the application of eco-industrial development.

Governance and management

The Administration Commission (AC) of DDA is the city's legal representative at DDA and functions also as the local government. It comprises a large number of departments amongst which:

- The Environmental Protection Bureau (EPB) of the AC is in charge of environmental protection in the park. (It has also hired an environmental management agent in each part or community of the park).

- The development bureau (DB) of AC is a sub-branch of National Development and Reform Commission (NDRC) at DDA. NDRC is the national agency that has been assigned the most significant circular economy responsibility.

Operation of public infrastructure is managed within the park, due to its size. Waste- and water management are integrated into the circular economy sytem. DDA has developped as a satellite industrial city of Dalian, providing social infrastructures such as schools, hospitals, labour training, cultural facilities.

Assessment and evaluation

Due to DDA's dual position as both a national EIP and a circular economy industrial park, two sets of indicators have been applied and regularly used for monitoring: (a) the standards for EIP, issued by the MEP in 2006, and (b) the set of circular economy industrial park indicators, issued by the NDRC. This situation is discouraging for both the administrative committee and the tenant industries, as they do not know what goals they should attain (Geng et al., 2009; Geng et al., 2012a). In addition, this report mentions several lacks of indicators in these sets, and proposes to follow an "emergy analysis and synthesis". Academic efforts are being made to improve the current national indicators.

Achievements and impacts

Due to the long history and particular importance of this park compared to other studies, a number of best practices are worth being mentionned:

- Increased revenue and more jobs created with the recruitment of "scavenger" and "decomposer" companies. These allows, for example, comprehensive solid waste treatment, recycling and reuse through the Dalian Dongtai industrial waste company.
- A centralised wastewater treatment and recycling system was built. The local government invested in this project, allowing a company (Hengji) to now supply recycled water to others. Recycled industrial water is also subsidized, to reduce the water scarcity problem.
- Promotion of and capacity-building on industrial symbiosis: a circular economy promotion center, established in 2009, coordinates industrial symbiosis related activities. It also prepares appropriate policies to remove barriers to eco-industrial development, and attracts international cooperation to transfer knowledge and experience. (For instance with the Sino-Norway joint energy efficiency center).
- Energy-saving and emission reductions: Almost 100 industrial plants have been closed because of inefficiency. Over 200 companies have conducted cleaner production audits. New buildings are encouraged to follow the national "green building" standards. Old gasoline buses and taxis are being replaced by cleaner vehicules.
- A comprehensive eco-industrial development plan was completed.
- The ISO 14001 certification was passed both at the park level and by 119 companies to (thanks to subsidies of up to 50% consulting and certification fees).

- An "awareness and preparedness for emergencies at the local level" (APELL) system was established in the early 2000, with the technical help of United Nations Environmental Program (UNEP) DDA established.

Other general benefits:

- Major increase in environmental performance, for example in land productivity, water and energy efficiency (respectively 20%, 65% and 99% between 2006-2010).
- Increased competitiveness, increased revenues from niche marketing and waste sales, reduced costs previously linked with waste or pollutants discharge.
- Reduced health risks, thanks to better environmental quality and APELL plans.

Drivers and success factors

The drivers are

- Initially, since Dalian is a famous tourist city and has a sensitive coastal line, maintaining a pleasant and clean environment in the region was seen as beneficial to its economic well-being.
- National policies and awards: DDA was selected as an example by two national agencies: by the MEP in 2004 as one of the national eco-industrial park demonstration projects, and in 2005 by the NDRC as one of the national circular economy industrial park demonstration project.
- Economic incentives: Seed funds are available to support "synergy linkages", i.e. the infrastructure necessary to build up industrial symbiosis, such as a pipeline. The AC has a mechanism to seek larger financial support through channels such as low interest loans, investors.
- A large set of green policies for the park were released, particularly more demanding policies for new tenants. Policy enforcement officials are supported by a certain budget and by capacity-building activities.
- Technology support: DDA has taken a leading role in exchanging experience and knowledge on EID locally and internationally, by hosting 50 symposia and workshops. The AC funds R&D activities to identify more industrial symbiosis opportunities.
- Voluntary public participation is encouraged by information (EIP newsletters, television programms, training courses), coordinated by the environmental protection bureau of the AC at DDA.

Challenges and lessons learned

- Institutional barrier: there are two different agencies – namely the EPB and the development bureau – have similar missions, however do not communicate and even given inconsistent guidelines (in particular, two different assessment systems). When economic and ecological interests are seen in conflict, the AC sometimes allies with these bureaus to prevent the enforcement of environmental regulation.

- Small and medium sized enterprise (SME), which represents the majority in DDA, are not adequately supported to participate to eco-industrial development. They can easily bypass the stringent compulsory cleaner production audits.
- In SMEs in China, their is a lack of appropriate training and financial resources to adopt the environmentally superior technologies.
- Still low level of environmental awareness in the general public, some issues such as solid waste management and water resource shortage still puzzled the local government and even limited further foreign investment.

Suggestions and recommendations

In addition to solving the difficulties mentionned above, these main lessons can be drawn:

- The great successes achieved show that in China, a strong leadership from the industrial park managers and enforcement are essential.
- Greening infrastructue (e.g. wastewater recycling plant, co-generation plants) is indispensable for more industrial symbiosis. However it is irrational to rely on tenant industries to invest in such projects, which should therefore be supported by the park managers or the government. DDA illustrates this successfully.
- Need a better understanding that without sustaining ecological services, the sustainable social and economic dimensions of EIP development will not be achieved.
- Need to solve the fragmented institutional problem, for instant with regular meetings between the key officials of different agencies, and also open it to other stakeholders.
- Need to help the SMEs understand the significance of EIP development. Capacity-building could include sharing successful corporate stories, enhance inter-agency cooperation.

China EIP Case Study 5:
Tianjin Economic Development Area (TEDA)

Prepared by: Institute of Applied Ecology, Chinese Academy of Sciences
Author: Prof. GENG Yong

The park at a glance

Tianjin Economic Development Area (TEDA) is located at 50 km from the city center of Tianjin. China’s third largest city,Tianjin has seen unprecedented growth. TEDA was founded in 1984, but Eco-industrial development (EID) at TEDA started in early 2000. In 2004 TEDA was selected as one of China's first national eco-industrial park demonstration projects by Ministry of Environmental Protection (MEP). The main sectors are petro-chemicals, equipment manufacturing, IT industry, bio-medicine, and food processing. The land is state-owned. Large range of business models (joint ventures, private, state-owned enterprises, and wholly foreign owned enterprises). It is a huge EIP with over 10'000 enterprises. GDP: 31.13

billion USD in 2011, exports: 19'846 billion USD in 2011. The total population within the TEDA was over 1.2 million in 2011, including 484'800 employees. Surface nearly 34'000 ha. There are numerous tenant sites, especially companies with a staff of more than 400 employees, have both manufacturing and residential buildings within their compounds.

Governance and management

The administration Commission (AC) of Tianjin Economic Development Area is the official agency of Tianjin Municipality in charge of the daily administration of zone functions. AC is the city's legal representative at TEDA and functions as the local government.
The Environmental Protection Bureau (EPB) of the AC is in charge of environmental protection at TEDA. A low carbon center was established in March 2010. To date, this not-for-profit center is the only Private Public Partnership (PPP) focusing on low carbon development, eco-industrial park and circular economy at TEDA. Another key agency related with resource and environmental management is the development bureau (DB) of AC. NDRC (National Development and Reform Commission) is the national agency that has been assigned the most significant circular economy responsibility. TEDA is probably the only national industrial park to assign EPB to manage circular economy related issues, while other national industrial parks assign such a mission to their DBs. Such an institutional arrangement can facilitate the implementation of both their EIP and CEP projects since all the conflicts can be solved by one single agency.

Assessment and evaluation

As explained in case 4 (DDA), in China both NDRC and MEP issued their national indicators in order to evaluate, monitor, and improve upon various eco-industrial development policies and programs. Due to TEDA's dual positions as both one national EIP project and one national circular economy industrial park project, these two sets of indicators have been applied at TEDA.

Achievements and impacts

- 36 large industrial plants have conducted energy audits and 67 large companies have conducted cleaner production audits in order to identify the potential pollution prevention opportunities.
- Regulatory measures—including environmental impact assessment, three synchronizations (a construction project should be designed, constructed, and put into operation in a synchronized manner), and the system of fees for pollutant discharge—have on the whole alleviated pollution.
- Different measures inspired over 240 companies to pass the ISO 14001 certification. Also TEDA has ISO 14001 certification.
- Special funds have been prepared by the AC to support industrial symbiosis related R&D activities so that more by-products exchange opportunities can be identified among different tenant companies.

- Several preferable policies have been issued in order to promote EID, such as green government procurement, treated wastewater reuse regulations, hazardous and toxic wastes management regulations, etc.
- Both the water treatment plant and wastewater treatment plant have been operated within TEDA. Several tenant companies have their own wastewater treatment equipment at their manufacturing sites.
- Support and seed money from TEDA for Cleaner Production for solid waste.
- Social benefits are increased awareness, improvement in public health, employment creation (e,g, through industrial symbiosis), creation of green communities and schools, community networks.

Drivers and success factors

- This park is in many points similar to the case nr 4 (DDA). An interesting improvement compared to DDA concerns the better synchronized role of the 2 agencies EPB and NDRC. At TEDA, EPB is also assigned to manage circular economy related issues. Such an institutional arrangement can facilitate the implementation of both their EIP and CEP projects since all the conflicts can be solved by one single agency, however there are still problems (see next section).
- Good planning: The AC at TEDA systematically planned its industrial estate, commercial areas, residential communities, and public areas with the goal to “firstly prevent and secondly control” adverse environmental impact. The main planning effort is to pursue waste reduction, reuse and recycling to the maximum extent possible, primarily through system optimization, material management, by-products exchange and economic recovery of residues.
- Unlike other national EIP projects in China, TEDA received the technical support from international experts in its earlier EIP stage.
- The regional industrial symbiosis network covers infrastructure sharing, integrated water, solid waste, land and information management. Various environmental benefits, such as conserving natural resources, reducing solid waste volume, and reducing the burden of the local landfills, have been obtained. 248 companies have joined the local industrial symbiosis activities, resulting in 42 industrial symbiosis partnerships.
- A large amount of investment on supporting public infrastructure at TEDA. Such investment has been used to support infrastructure sharing, such as co-generation, water pipelines, sewage treatment and recycling, and other. This led to increased competitiveness of companies, reduced resource costs, more efficient material use, increased sales due to 'green' and niche marketing, and other. For instance, the by-products exchange among different companies saved 21.19 million RMB in the year of 2012.
- In order to promote industrial symbiosis, the AC at TEDA has also tested economic incentives (both from AC at TEDA and external). Policies for industrial symbiosis include e-waste management energy saving and emission reduction regulation, green infrastructure development guidelines, cleaner production promotion guidelines, water

pollution prevention and control regulation, regulation and promotion of ISO 14001 certification.

- From technology support point of view, research projects related with cleaner technologies and industrial symbiosis have been fully supported by the AC at TEDA. And databases for cleaner production were created.
- Voluntary participation for industrial symbiosis is based on publicity, promotion of EIP education, training courses, and environmental classrooms in companies.

Challenges and lessons learned

- A water reuse/recycle network is important at TEDA since Tianjin is one of the city facing most severe water shortage in China. An integrated water management model identified the potential water reuse/recycle opportunities among different companies in TEDA and evaluated the overall water efficiency.
- There is a large hazardous waste treatment facility with incineration, landfill and recycling. Currently over 80 companies in TEDA have discussed the potential cooperation with the centre, however the treatment fee is higher than what they expect.
- Capacity building is always important for developing countries, such as China, as they lack technology and environmental awareness. In particular, human resources development in solid waste management is a critical need in China. Most government officials and entrepreneurs lack an understanding of environmental principles. Therefore to date, over 200 training workshops have been hosted by the TEDA management.
- There is still a lack of coordination between different agencies. Although the Ministry of Environmental Protection (MEP) is the legal national agency for EIP, due to lack of funds, MEP cannot provide any financial support to any national EIP projects, except a national EIP title for a green image. NDRC is the only national agency that can provide substantial support. Without a legal responsibility in taking care of the circular economy, the officials at DB always take a not-in-my-back-yard (NIMBY) action, thus, leading to lack of financial support from national governments.
- The indicators used for evaluation of EID have some problems (such as lack of indicators on industrial symbiosis, social, prevention-oriented, for businesses), as well as institutional barriers on implementing these indicators.
- Small and medium enterprises (SMEs) at TEDA cannot receive adequate support for their EIP efforts. Unlike larger companies, medium- and small-scale projects can easily bypass the stringent compulsory cleaner production audit requirements. SMEs have relatively lower environmental awareness and often regard environmental protection a heavy burden. SMEs have been growing rapidly in terms of the total number. Their production has caused significant negative environmental impacts.
- Technological challenge: As a developing country, demand for environmentally superior technologies in China is still weak, and both technical capabilities and financial resources are inadequate, with the result that levels of pollution and energy consumption are outpacing economic growth.

- The current information platform is still in its early stage and does not include system thinking into its development.

Suggestions and recommendations

- The EIP development story at TEDA is the most successful one in China. The key for their success is that TEDA management plays a strong leadership. With a scientific EIP plan, releasing appropriate policies and organizing various capacity-building activities, the AC at TEDA coordinates the intertwined relations among different stakeholders.
- The EIP story at TEDA also indicates that eco-industrial development at the industrial park level should consider a broad view, devoting more efforts to understanding how industrial parks, their infrastructure, and industrial operations have compromised ecosystem services, especially regulating services. Results of industrial symbiosis should be disseminated to other Chinese EIP projects.
- Greening infrastructure is indispensable to provide the physical conditions for utility sharing. It is irrational to rely on tenant companies to invest on such projects due to their focus on pursuing higher economic returns. A holistic approach should be pursued.
- International collaboration is important for TEDA's success. These international collaboration projects provide not only the most advanced EIP experiences and expertise but also financial support to TEDA's EIP development, which should be shared by many other Chinese EIP projects.
- Agencies should work more together, now the institutional structure is too fragmented.
- The combination of the planned and facilitated EIP model appears to be most effective to achieve the goals of EIP in China.
- Resources should be allocated to SMEs (see previous section).
- In order to overcome technological barriers, more research efforts should be supported by the AC at TEDA, especially, focusing on developing and testing innovative solutions to solid waste management, water/energy efficiency and industrial synergies among different industrial sectors.

China EIP Case Study 6:
Shenyang Development Area (SDA)

Prepared by: Institute of Applied Ecology, Chinese Academy of Sciences
Author: Prof. GENG Yong

The park at a glance

Shenyang Development Area (SDA), renamed Tiexi New District (TND), is located in Shenyang Municipality, Liaoning province, China. It is one of the earliest heavy industrial

bases in China. The land is state-owned. There is a large range of business models (joint ventures, private, state-owned enterprises, and wholly foreign owned enterprises). The main sectors are chemicals, equipment manufacturing, construction material industry, pharmaceuticals, and food processing. SDA contains 1'300 enterprises. The total population is 1.14 million, including over 300'000 employees. Its GDP was 18.03 billion USD in 2012 and exports: 7.76 billion USD in 2012. The surface is 44'800 ha. There are numerous tenant sites, especially companies with a staff of more than 400 employees, have both manufacturing and residential buildings within their compounds.

Governance and management

Similar to both DDA and TEDA, the Administration Commission (AC) of Shenyang Development Area is the official agency of Shenyang Municipality in charge of the daily administration of zone functions. AC is the city's legal representative at SDA and functions as the local government. Its main administrative functions include enforcing national laws and regional regulations, monitoring environmental protection, levying tax, stipulating economic and social development policies, and managing public financial resources. The Environmental Protection Bureau (EPB) of the AC is in charge of environmental protection at SDA. The bureau includes an environmental impact assessment division, an environmental law enforcement division, a pollution control division and an administrative division. Another key agency related with resource and environmental management is the development bureau (DB) of AC. Currently, 116 R&D organizations have registered and have been operated at SDA.

Assessment and evaluation

Developing a monitoring system for eco-industrial development at SDA is necessary. The existing Chinese national indicators for EIP / circular economy parks (issued by NDRC and MEP, cf. summaries for cases 4 and 5), have not been tested at SDA.

19 COD online monitoring facilities and 20 nitrogen online monitoring facilities have been installed for monitoring those large wastewater discharge companies so that they have to pay more attention to their emissions and avoid illegal discharge.

Achievements and impacts

- In 2003 the AC at SDA decided to establish an EMS (Environmental Management System) according to the ISO 14001 standard and in 2006 passed the ISO 14001 certification.
- To promote cleaner production among their tenants, the local Environmental Protection Bureau (EPB) collected documents and information on cleaner production and provided free consulting services.
- Special funds have been prepared by the AC to support green infrastructure-related activities, such as greening landscape, wastewater treatment plant, ground source heat pumps application, co-generation, water reuse, online environmental quality monitoring system.

- To date, 230 million RMB have been invested to build up water pipelines so that all the tenant companies can discharge their wastewater into local wastewater treatment, rather than discharging them into local water bodies directly.
- With more careful planning, a regional industrial symbiosis network has been established, covering infrastructure sharing, integrated water, solid waste, and energy management. A key industrial symbiosis effort at SDA is energy saving and sustainable energy application at the whole park level, including the reduction of energy consumption through the application of ground source heat pumps (GSHP), district heating and de-sulphurization and de-NOx technologies in the local coal-burning power plants and reduction of energy consumption to promotion of service sectors. Also through symbiosis water consumption and pollution of many substances has been reduced. The application of GSHP at SDA had reduced CO2 emissions by 1.08 million tons and energy saving benefits reached 49846.73 TJ during 2006-2010.
- Social benefits: improved public awareness through capacity building programs and improved public health by reducing solid and hazardous wastes, shared lessons, improved government-business-community relations. As a result of their EIP efforts, nine tenant companies released their corporate social responsibility (CSR) reports in 2012; thirteen tenant companies were ranked as the “green factory” by the Shenyang government. More job creation occurred through industrial symbiosis.
- Some initiatives like wastewater reuse and promotion of industrial symbiosis are PPP. Other measures like green infrastructure, energy saving and emission reduction and capacity building are government led.
- Under the EIP project, 12 industrial plants have been closed because of economic inefficiency and environmental degradation, over 60 coal-burning boilers have been phased out due to their lower energy efficiency and higher emissions, and 105 companies have conducted cleaner production audits. SDA just passed the national evaluation for their EIP project on September, 2013, which means that the management of SDA still need to further work on their EIP project in order to reach all the national EIP indicators.

Drivers and success factors

- From economic incentives point of view, the AC at SDA established a circular economy promotion fund (with a total value of 30 million RMB) to support key industrial symbiosis projects.
- A large amount of investment has been made available to support public infrastructure at SDA for water pipelines, CNG pipeline and heat pumps. This and industrial symbiosis led to increased competitiveness of companies, reduced resource costs, less dependence on coal, increased sales due to 'green' and niche marketing, and other. For instance, annual revenues in six companies through by-products exchanges reached over 10 billion RMB in the year of 2012.
- A set of policies were raised. For instance, a green recruitment policy was stipulated by the AC in 2011: all the new tenant companies have to encourage the use of

renewable/cleaner energy sources, consider filling the niche of current industrial symbiosis, construct their new buildings by referring to national green building standards, prepare their eco-design, cleaner production and waste treatment plans before the new projects start. Other policies include energy saving and emission reduction regulation at SDA.

- From technology support point of view, research projects related to cleaner technologies and industrial symbiosis have been supported by the AC at SDA. Many research organizations at SDA are now undertaking research projects related with environmental technologies with auspices from both governments and industries. Research outcomes are then applied in those industries to quicken the EIP process.
- After Liaoning was selected by NDRC as the only national low carbon development demonstration province in Northeast China, the provincial government increased the research budgets for supporting energy saving and emission reduction related research projects.
- Voluntary participation: a responsible image in the belief that the public is a potentially powerful ally to promote EIP. To date, the AC at SDA has conducted joint activities with other municipal agencies and local enterprises to provide training courses for different stakeholders. In addition, the local media have given wider coverage to reporting the progress of EIP.

Challenges and lessons learned

- In the late 1990s Shenyang was listed as one of "ten dirty cities" in the world.
- Unlike DDA and TEDA, SDA does not provide any financial subsidy to their tenant companies for ISO 14001 certification due to its lower public budget. Until August 2013, only 55 tenant companies had passed the ISO 14001 certifications.
- There is a lack of coordination between different agencies. Similar to DDA, while the EPB of AC at SDA is responsible for promoting EIP, the development bureau of AC at SDA is responsible for promoting circular economy. They do not talk to each other and none of them is superior. They have compromised environmental protection in order to favour pro-growth goals.
- Small and medium enterprises (SMEs) at SDA cannot receive adequate support for their EIP efforts. Unlike larger companies, medium- and small-scale projects can easily bypass the stringent compulsory cleaner production audit requirements. SMEs have relatively lower environmental awareness and often regard environmental protection a heavy burden. SMEs have been growing rapidly in terms of the total number. Their production has caused significant negative environmental impacts.
- Technological challenge: As a developing country, demand for environmentally superior technologies in China is still weak, and both technical capabilities and financial resources are inadequate, with the result that levels of pollution and energy consumption are outpacing economic growth.

- Different from both DDA and TEDA, the AC at SDA has not established an information system to manage their EIP-related activities, resulting in a situation where accurate information is not available to decision-makers.
- SDA planners physically separated its five main industrial pillars into five independent industrial clusters. This impeded the potential linkages among different industrial clusters.
- Comparing with both DDA and TEDA, the public environmental awareness at SDA is still lower. This reflects the fact that people in coastal regions usually care more for their environmental quality due to their advanced economic development and increasing health concerns. However, people in inland areas or west still struggle for economic development and higher income, therefore, paying less heed to environmental issues.

Suggestions and recommendations

- In general, the EIP efforts at SDA show us that a strong leadership from industrial park managers is very important. Due to the complex nature of one EIP project, the industrial park managers (the AC in the case of SDA) have to coordinate the intertwined relations among different stakeholders so that each stakeholder can engage in an open and transparent institutional environment for the planning and development of EIP-related programs.
- Without a solid foundation of sustaining ecological services, the social and economic dimensions of sustainable EIP development will not be realized. Consequently, there is a need to address ecological services and to investigate their implications for the sustainability of their businesses.
- The environmental infrastructure (e.g., wastewater recycling plant) can enhance the efficiency of water and energy usage, and reduce the pollution. These utilities require vast investment which should be supported as municipal engineering projects, rather than relying on tenant companies. The industrial park managers have to consider the holistic impact of greening infrastructure, including economic, social, and more important long term environmental impacts, rather than only focusing on short term benefits.
- The AC at SDA need to develop tailored and adaptive interventions to favour the long-term eco-transformation of their EIP project. As we observed, eco-transformation requires long-term commitment and institutionalization. Since the AC can play a significant role in EIP development, strong institutional capacity and enforcement are essential.
- A weak company network provides few opportunities for self-emerged synergies. Thus the AC must function as a catalyst.
- To improve the ability of the SMEs is critical. More resources should be allocated to help those SMEs so that they can improve their understanding on the significance of developing an EIP at SDA.

- In order to overcome technological barriers, more research efforts should be supported by the AC at SDA, especially, focusing on developing and testing innovative solutions to solid waste management, water/energy efficiency and industrial synergies among different industrial sectors. Currently, there are no international collaboration EIP efforts at SDA.
- Monitoring should be developed.

Colombia

Colombia EIP Case Study 1:
Ecoefficient Industrial Park of Graphic Arts, Bogota

Prepared by: Colombia National Cleaner Production Centre (NCPML)
Author: Carolina Restrepo

The park at a glance

The Ecoefficient Industrial Park of Graphic Arts (PIEAG) is located in an urban area, in the eastern part of the locality named "Los Martires", in Bogota. Area characterized for the presence of industries, commerce, automobile workshops and ironmongery and is known for having one of the largest market places in the city and justice sector offices. Surface: 0.4 ha.
There are 88 establishments: 65 graphic art companies, 12 dining establishments, the rest is used as a storage facility and business premises..

Governance and management

Condominium administration and has administrative rules. Each establishment has its own business and commercial organization. The PIEAG Administration serves as the Condominium security and management of joint services.

Assessment and evaluation

The Environmental Department has established environmental management indicators. The results are presented periodically to managers and from there spread to entrepreneurs.

Achievements and impacts

- 3.5 ton /month of hazardous waste has been avoided through waste management programs.
- Some companies in the eco-park, mainly because their interest and perseverance encouraged by the environmental authority and the academy, have achieved the benefits of eco-park as meeting customer requirements on environmental issues, image and customer reliability and reduced environmental management costs, which has made progress and made companies in the Eco-park more competitive and productive.

Drivers and success factors

The author of the PIEAG report listed no success factors, only difficulties. PIEAG consolidation has seen a number of difficulties for entrepreneurs in the Ecopark, especially for those who have limited financial resources or urgent needs. The following major difficulties are presented:

- Lack of continuity in financial aid being provided, led to discouragement and disbelief generated by entrepreneurs and lack of the eco-park ownership, therefore, it has obstructed all efforts to strengthen partnership and as a group.
- Dependence on public entities, which is unreliable during times of change in policy or government administrations.
- Lack of support of the industry in general.
- Lack of association affects the business strengthening processes and therefore companies lose the opportunity to increase their negotiating power with suppliers, access to finance, attract foreign investment and support for promotion from organizations involved in technological innovation. It also affects the consulting processes, through continuous updates on new technologies and processes.
- Lack of formalization of several companies, affects the public image of the ecopark and creates distrust by clients.
- Lack of management resources.
- Loss of productivity for reasons such as the cost of introducing cleaner production mechanisms, competitive disadvantages with companies outside the eco-park. The lack of monitoring and control activities by the environmental authority to companies outside the park that generates inequality in prices, therefore inequality in productivity, The lack of technological renovation, Oversupply of communication and graphic arts products in the city, and the location of similar companies in the same place sharpens competition.

Challenges and lessons learned

- Main need is access to economic instruments to invest in technological renovation or incentives from the county government to facilitate a bidding process as a business group.
- Needs to reinforce the industrial park concept by being a truly organized group under a strong leadership or head that addresses the needs of the companies and promotes initiatives with the government.
- Teamwork between cluster, government, academic institutions and community: Working together ensures that the interests of the four parts are maximized without harming others.
- To set strategies to develop new processes and optimization of existing technologies with innovation and considerations about new synergies between companies.
- To be open minded and to have willingness to change by participating industries: Companies must have a personal motivation to participate in a team and be prepared to create partnerships that will allow them to maximize their profits.

Suggestions and recommendations

- Creation of a private entity with integrated communications services, which can generate new services for potential clients in the industry, and one that offers a comprehensive answer to all demands of the clients and by favouring the unification of prices in the market to help cope with the competition in the sector.
- Implementation of an export agency, which helps companies by promoting the demand of the foreign communication market.
- Creation of a purchasing unit for the reduction and cost optimization, developed as an electronic platform to improve the negotiation power of the group.
- Achieving chain processes and business partnerships (synergies).
- Have proper leadership of the group.
- Continuity in government aid not only at the economic but also at the political level (incentives, regulations).
- Priority to generate strategies to maintain continuous processes of joint work between the companies in the eco-park.
- Government and community with the aim of being able to respond to the priority needs identified.
- Promote policies that provide long-term support to established ecoparks to stimulate further development.
- From the beginning of implementation an eco-park takes into account two fundamental elements: the support of an integrated national policy and the development of an agenda with goals and commitments that are achievable and verifiable so as to ensure the continuity of implementation activities of the initiative and to keep the interest of those involved in the ecopark.

Columbia EIP Case Study 2:

Eco-Efficient Industrial Park of San Benito, Bogota

Prepared by: Columbia National Cleaner Production Centre (NCPML)
Author: Gloria Restrepo

The park at a glance

The Eco-Efficient Industrial Park of San Benito (the most important industrial area for the leather production of Bogotá) is an initiative proposed by mayors of the Capital District to solve the environmental, economic, social and cultural problems caused by the leather industry located in the San Benito neighbourhood.

The San Benito neighbourhood is located southwest of the city of Bogotá, in Tunjuelito, sixth locality of the Capital District. There are 78 companies with tannery as main industrial sector. Land is owned by private companies.

Governance and management

Establishment (2007) of a Limited Company with Privileged Shares as the administrative figure of the industrial cluster, with the purpose of ensuring the admission of an unlimited number of partners that can actively participate in decision making and auditing of operative

and accountant information, besides having access to social benefits that are offered to its members.

Assessment and evaluation

Integrated management system in which three components are considered: environment, quality and health and industrial security. Actually, no indicators or monitoring programs have been proposed that enable the evaluation of the environmental, social and economic performance of the PIESB. But use of clean production indicators as evaluation tool, only applicable to the indi vidual processes, no indicators are applicable to the whole industrial park.

Drivers and success factors

The initiative of implementation of PIESB arises in answering the need to:

- Develop associated services.
- Relocate and concentrate the activity of leather tanning.
- Improve the efficiency and use of by-products and resources, and the environmental impacts caused by the environment by developing that activity.

Its implementation has had some obstacles that have not enabled its development (including economical resources, continuity of the Government Programs, national policy, agenda of commitments).

Challenges and lessons learned

- The support of an integrated national policy and establishment of an agenda with achievable and verifiable objectives and commitments is required (to ensure the continuity of actions for implementing the initiative and maintaining the interest of the stakeholders involved in it).

- The technical support from environmental authorities and other government entities should be accompanied with command and monitoring programs.

- The feasibility of PIE depends on coordination and implementation of programs that enable the integrated development of economic, social and environmental actions; as well as enabling the construction of synergies among different stakeholders and productive processes such as animal feeding industry and beauty industry.

- The governmental entities should create strategies to support and leverage the PIE initiative, companies should propose those initiatives and lead its development and implementation.

Suggestions and recommendations

- Promoting the development of a national policy that integrates marketing plans, minimization and control of environmental impacts and social and cultural strategies focused on promoting cooperation and the establishment of economies of scale.

- Implementing pilot projects that show the PIE as a key profitable business opportunity, which also generates added value to the production processes in environmental, economic and social terms.

Costa Rica

Costa Rica EIP Case Study 1:
Cartago Industrial Park

Prepared by: Costa Rica National Cleaner Production Centre (CNP+L)
Authors: Akira Hidalgo Segura, Luis Diego Jiménez Gongora, Carlos Manuel Perera Heinrich

The park at a glance

Cartago-Industrial Park (CIP) is located in a Free Zone Industrial Park at Cartago City, one of the oldest communities in Costa Rica and the first capital of the country. It is located about 25 km east of the capital city of San Jose. Surface: 45 ha. There are 33 companies within main sectors of skilled labor, mid-high tech manufacturing and service centres and logistics. The land is owned by Zeta Group. The IP was established in 1985. There are 9'000 people working.

Governance and management

Zeta Group Holdings, a private organization specialized in international real estate investments and real estate development, created the Cartago Industrial Park. The business model of the industrial park is a private-public partnership (PPP). The CIP has been granted Free Zone status.

Assessment and evaluation

A patchwork of policies, regulations and voluntary programs. All tenants will have to comply with applicable national and local laws and regulations.

Achievements and impacts

- The CICR-GIZ project provided the following services to 7 enterprises inside the Cartago Industrial Park: Presentation of a work plan for the accomplishment of preliminary evaluations for participant companies; execution of the preliminary evaluations; report and presentation of the preliminary evaluations and presentation of results to the group of companies.
- The Cartago Municipality and National Institute of Technology (ITCR) is making a collective waste management strategy to promote local business activity outside the Cartago Industrial Park.

Drivers and success factors

- Resource efficiency in energy, materials, and water with the cost savings gained through higher efficiency was the driving force.
- Short period of recovery on initial investment.
- Implementation Plan matched to a great extent with the improvement necessary for equipment maintenance.
- Technical support by CICR staff.
- Opportunity to improve their "green image".
- Development of a highly effective regional by-product exchange provides markets for materials, which were previously discarded as wastes.

Challenges and lessons learned

- Important to have commitment from: the management inside enterprises, the administration of the industrial park, and the executors (technical staff) that support this project.
- Communication between partners is key for the success of the project.
- To elaborate an action plan with details on sharing the costs of each action between the companies and the executor of the project, to establish periodic meetings and to communicate the terms of each action.
- It is necessary to show presence and support in the concrete implementation of actions as well as accomplishment of improvements.
- Transparently to offer technological options for improvements on Web site (resources from companies themselves), to ensure access to presentations, documents and information about the project.

Suggestions and recommendations

- To prepare a general agreement, then individual agreements according to each company, by taking under consideration collaboration conditions between companies, with the park administration, and with the community.
- To establish coordination, administration and communication mechanisms with clear responsibilities.
- To develop confidence and to share basic information with all stakeholders (always making important decisions within the whole group).
- The goal is to share costs, minimum 50%/50% as in a PPP scheme.
- It is favorable to obtain professional support from a local consultant and look for more sources of financing (local banks etc.).
- Define one person in charge (such as a junior advisory) inside the industrial park that discloses information; organizes meetings, makes periodic reports and shows up day to day.
- Form a project core team and recruit key stakeholders.
- Create a vision for the project and set economic and environmental performance objectives.
- Gather information on the current state of the industrial system by conducting baseline audits and surveys of energy, water, and material flows.

- Assess needs and resources in neighbouring communities that could be served by a community enhancement program.
- Develop strategic plans at industrial park and plant levels.
- Recruit public agencies to support the initiative.
- Begin programs to improve in-plant performance (which may be conducted by a Cleaner Production Center).
- Begin programs to develop energy, water, and materials exchanges between firms or in the region.
- Review progress regularly in terms of the performance objectives and goals you have set.

Egypt

Egypt EIP Case Study 1:
6th of October Industrial City

Prepared by: Egypt National Cleaner Production Center
Authors: Ali Abo Sena

The park at a glance

The 6th of October City is a new city, part of the greater urban area of Cairo, Egypt, located 32 km outside the city. The 6th of October City hosts one of the largest industrial zones in Egypt. It is occupied by the Banking sector which is represented by a cluster of branches of all banks in Egypt. This cluster is in an area that is close to the industrial area and serves the needs of the industry as well as residents of the city. The park was established in 1979. Surface: 3'600 ha (second largest New Industrial City in Egypt). 1’400 companies, in the following sectors: chemicals, building materials, metallurgical, engineering, wood, textile, automotive and food. 20% of Industrial Export. Number of employees is 140'000.

Governance and management

The cluster includes fully private, fully state-owned and private public partnership (PPP) enterprises. Seven ministeries and Industrial Development Authority and the Federation of industries and Industrial Chambers are involved in the development and functioning of the industrial cluster.

Assessment and evaluation

There will be monitoring and evaluation of the environmental/economic/social performances by representatives from Industrial Development Authority (IDA) and Egyptian Environmental Affairs Agency (EEAA).

They will use regular ongoing site visits as a methodology for monitoring and evaluating environmental/ economic/ social performance and need to prepare periodical reports.

Achievements and impacts

As the EIP is still at the development stage there have been no achievements yet.

Drivers and success factors

- Install financial mechanisms to provide incentives for those investors who can implement the eco-industrial park.
- Follow up on the implementation of the recommended Cleaner Production (CP) options generated in the cluster by using measurable monitoring parameters.
- Investigate with the ministries on the possibility to introduce and integrate different industrial sectors into fixed finance mechanisms (such as the Industrial Modernization Center (IMC)).
- Establish new regluations and laws to implement eco-industrial parks in new industrial areas.

Challenges and lessons learned

Project not implemented yet.

Suggestions and recommendations

- Implementing eco-industrial parks can assist the Egyptian Industry by developing real interventions, which are sustainable in the long term and can be easily replicated.

- Eco-industrial parks can support the companies in applying CP practices and identifying opportunities to:
    - Reduce water consumption.
    - Increase raw material and product recovery.
    - Reduce energy consumption.
    - Reduce chemicals and materials operation cost.
    - Reduce cost of transportation.
- Establish a global network to exchange EIP experiences of this project.

Egypt EIP Case Study 2:
10th of Ramadan Industrial City

Prepared by: Egypt National Cleaner Production Center
Authors: Ali Abo Sena

The park at a glance

The 10th of Ramadan City is located in Sharkia Governorate in Egypt. 10th of Ramadan city is the largest industrial zone in Egypt, and is considered to be the highest labour intensive area in the country. Area of industry 5'847 ha, total area 38'348 ha. There are 1’300 companies/industries in the following sectors engineering and electrical, food, wood, plastic,

paper, textile, building materials, metal and mechanics, chemical and drugs. There are 129'000 people employed. The produce 20% of Industrial Export.

Governance and management

The cluster includes fully private, fully state-owned and private public partnership (PPP) enterprises. Seven ministeries and Industrial Development Authority and the Federation of industries and Industrial Chambers are involved in the development and functioning of the industrial cluster.

Assessment and evaluation

After implementing the Eco-Industrial Park in 10th of Ramadan city, there will be monitoring and evaluation of the environmental/economic/social performances by representatives from Industrial Development Authority (IDA) and Egyptian Environmental Affairs Agency (EEAA). They will use regular ongoing site visits as a methodology for monitoring and evaluating environmental/economic/social performances and will have to prepare periodical reports.

Achievements and impacts

As the EIP is still at the development stage there have been no achievements yet.

Drivers and success factors

- Install financial mechanisms to provide incentives for those investors who can implement the eco-industrial park.
- Follow up on the implementation of the recommended Cleaner Production (CP) options generated in the cluster by using measurable monitoring parameters.
- Investigate with the ministries on the possibility to introduce and integrate different industrial sectors into fixed finance mechanisms such as the Industrial Modernization Center (IMC).
- Establish new regulations and laws to implement eco-industrial parks in new industrial areas.

Challenges and lessons learned

Project not implemented yet.

Suggestions and recommendations

- Implementing eco-industrial parks can assist the Egyptian Industry by developing real interventions, which are sustainable in the long term and can be easily replicated.
- Eco-industrial parks can support the companies in applying CP practices and identify opportunities to:
    - Reduce water consumption.
    - Reduce raw material consumption and increase product recovery.
    - Reduce energy consumption.
    - Reduce chemicals and materials operation cost.
    - Reduce costs of transportation.

- Establish a global network to exchange EIP experiences of this project.

El Salvador

El Salvador EIP Case study 1:
El Pedregal Inc. Industrial Park

Prepared by: El Salvador National Cleaner Production Center
Authors:

The park at a glance

This industrial park is located in the Free Zone El Pedregal, in the Herradura Road Municipality of Rosario in La Paz in the center-south of El Salvador. There are 12 companies, in the sectors: manufacturing, assembly, manufacturing logistics and manufacturing services. The land ownership is private. Exporting goods and services worth around 214 Million dollars, which represents 10% of total exports from El Salvador free zones in 2012 (it is one of the most important in the country). The land is privately owned. There are 6'500 employees and 18'000 indirect employees.

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Governance and management

Pedregal Inc. has developed an organizational structure based on the association with several companies. No association with public organizations or NGOs, only with private companies. The business structure is entirely private, which works through the investments made by the park management to the total development of the facilities and efficient functioning of the rented buildings.

Assessment and evaluation

There is no defined evaluation methodology of environmental, social or economic indicators, with specific indicators to be recorded. The companies in the park are making improvements individually to obtain the benefits brought by sustainable environmental development.
Monitoring of social development is done through monitoring of indicators made by state agencies.

Achievements and impacts

The most significant measures are described below:

- Replacing artificial lighting by natural lighting.
- Renewal of water pumping system.
- Renovation and improvements of the irrigation system.
- Installation of a common wastewater treatment plant in the industrial park.

Together all these measures have generated a total economic benefit of U.S. $ 13'800 per year for the entire zone. This has allowed the administration to do other projects in the area of social development and in return has generated a growing interest by foreign companies to

rent complexes available to the industrial park. The measures als o reduced CO_2 emissions by 43.67 tons/year.
In addition the park has promoted biodiversity and reforestation in adjacent municipalities.
Social measures include school projects, breastfeeding programs, training for workers and occupational health and safety.

Drivers and success factors

- Defined policies allow government agencies to promote industrial, environmental and energy sustainable development.

Shortcomings:

- The lack of rules regarding characteristics that industrial area must meet in order to be called an Eco-industrial park.
- The benefits this would bring to the companies that are part of these initiatives
- The lack of support due to ignorance of government agencies on negative environmental, social and economic impacts that eco-industrial park development could have on the people.
- It is necessary for local and national authorities to promote more and better strategies to address economic barriers, and technological information to help improving and enhancing the activities industrial zones have made today.

Challenges and lessons learned

- The high cost of electricity is a big obstacle for their growth, as it amounts up to about 60% of the operating costs of their processes.

- Based on the methodology of data collection, it was noticed that firms located within El Pedregal support the initiatives mandated by the administration. However, some companies only develop these initiatives because they are mandated, but they do not show awareness or initiative to strengthen, support and continue to improve the environmental performance of the park.

- The investments for improving environmental performance made by El Pedregal are higher than any other made by other free zones in El Salvador, achieving a strong influence on the companies located within this industrial area and contributing significantly to the economic development focused on increasing business productivity and cost reduction.

- The initiatives for implementing renewable energies are becoming more accepted by the park administration, and thus complement the development of energy efficiency projects. Generating their own clean energy to their users will increase their environmental performance.

Suggestions and recommendations

- It is important to establish performance indicators based on records which can show in a better way the development over the years and the competitiveness of the free zone.

- It is important for free zones in the country to be supported by the several entities involved (stakeholders), to facilitate the implementation of high impact initiatives at a competitive level in the area.
- Obtaining the commitment from all companies within El Pedregal by raising awareness about the benefits of implementing techniques aimed at efficient use of resources and better environmental performance.
- The corporate image of El Pedregal industrial park is well marked for the measures development inside of industrial park. Thus, it is important to recognize efforts to motivate further improvements focused on increasing the competitive development of the free zone.

El Salvador EIP Case study 2:

Miramar Industrial Park

Prepared by: El Salvador National Cleaner Production Center
Authors:

The park at a glance

The Free Zone Miramar is located 20 km from the capital city; in the department of La Paz. Its surface is 24'900 ha total capacity, 8'000 ha industrial roof, 16'900 ha growth capacity. There are 11 companies in operation, 3 companies are not in operation because the building structure needs change. The sectors are manufacturing, manufacturing logistics, and manufacturing services. The park was founded in 2001. The land ownership is public-private. There are 493 direct and 8'000 indirect jobs. The export was US$ 74.5 million in 2012, around 3% of total activity of the cluster.

Governance and management

Structured business model based on the development of each of the firms in the zone and with an administrative side that manages general activities, services and other activities involving the public spaces of the industrial park. No association with public organizations or NGOs, only with private companies. The business structure is entirely private, which works through the investments made by the park management to the total development of the facilities and efficient functioning of the rented buildings

Assessment and evaluation

No specific economic, social and environmental indicators are being tracked. They only verify the indicators made by state agencies.

As a complement, the Industrial Park has interest to develop some measures involving environmental development of all public parties and companies that are within its industrial zone, to achieve more sustainable green development strategies. They are currently working

on the development of indicators for development issues, energy efficiency, and profits and loss CP.

Achievements and impacts

Since its foundation, Miramar has made significant changes in areas of energy efficiency measures, public lighting equipment, waste management projects, promotion for proper use of drinking water among its employees and improvements in the irrigation system of public area. The industrial park administration has developed programs for the preservation of biodiversity by promoting reforestation near the park. Social measures include school projects, breastfeeding programs, training for workers and carrying out awareness workshops.

Drivers and success factors

- Defined policies allow government agencies to promote industrial, environmental and energy sustainable development.

Shortcomings:

- The lack of rules regarding characteristics that industrial area must meet in order to be called an Eco-industrial park.
- The benefits this would bring to the companies that are part of these initiatives
- The lack of support due to ignorance of government agencies on negative environmental, social and economic impacts that eco-industrial park development could have on the people.
- It is necessary for local and national authorities to promote more and better strategies to address economic barriers, and technological information to help improving and enhancing the activities industrial zones have made today.

Challenges and lessons learned

- Many industries within industrial parks confirm that the high cost of electricity is a big obstacle for their growth. The strategic development of Miramar is oriented to overcome this barrier by getting benefits from implementing techniques for efficient use of resources and application of renewable energy.

- Miramar with all their companies together should prepare a strategy that allows companies to unify efforts and achieve development of Energy Efficient projects and Cleaner Production to enable and improve the management of resources and thus have greater environmental benefits.

- The initiatives for implementing renewable energies are becoming more accepted by the park administration, and thus complement the development of energy efficiency projects. Generating their own clean energy to provide to their users will increase their environmental performance.

- Social development initiatives are very notable in the park, achieving remarkable benefits of national development.

Suggestions and recommendations

- The management of economic, environmental and social development demands must be controlled and monitored, because it is important to establish performance indicators based on records that can show, in a better way, the development occurred over the years to enhance competitiveness of the free zone.
- It´s important for free zones in the country to be supported by the several entities involved (stakeholders), to facilitate the implementation of high impact initiatives at a competitive level in the area.
- Obtaining the commitment from all companies within Miramar by raising awareness on the reason for implementation of techniques. These techniques are aimed at efficient use of resources and may lead to the development of new initiatives, and thereby better environmental performance.
- The free zone area must establish an environment that allows companies to centralize development measures and to have greater technical capacity in environmental topics.

India

India EIP Case Study 1:
Nacharam and Mallapur Industrial Parks (Andra Pradesh)

Prepared by: CII Sohrabji Godrej Green Business Centre
Authors:

The park at a glance

Industrial Park Nacharam & Industrial Park Mallapur are the oldest Industrial Parks, located in the Moula–Ali Zone, Ranga Reddy District of Andhra Pradesh (AP), India. The surface is: 364.2 ha with 681 companies (443 Nacharam & 238 Mallapur). Sectors are metal, pharmaceutical, food & beverage, chemicals, plastics. Planning of transformation in EIP started in 2004, the IP started in 1967. Persons employed are 4'000 to 5'000 Mallapur and 10'000-15'000 Nacharam.

Governance and management

In Andhra Pradesh, APIIC (Andra Pradesh Industrial Infrastructure Corporation) is the nodal body for matters related to development & management of industrial structure. Zone level management structures (Zonal Offices of APIIC) are established for managing the industrial parks falling under the boundary of the zone and these Zonal Offices reports to APIIC (HQ). Environment Management & Protection Cell was established in 2004, within APIIC with the technical support of GIZ. Industrial Area Local Authority (IALA)-Service Society act as the

core of the structure and three supporting cells around the core: Finance Cell, Administrative Cell and Environment Cell (EC). Environment Management Cell is managed by APIIC.

Assessment and evaluation

At Nacharam and Mallapur, there is a dedicated institutional structure established for monitoring the environmental performance of the park: the Environment Management Cell (EMC). EMC is involved in monitoring the environmental performance of the park through various parameters like air quality, green belt cover, water quality and maintenance of basic environmental infrastructure. The EMC works in co-ordination with the State Pollution Control Board, IALA and the units operating in the zone. The EMC needs to report the environmental performance data (air quality, water quality, and waste generation details) to the Andhra Pradesh Pollution Control Board (APPCB).

Achievements and impacts

- Online application system (Application for establishing unit in IP).
- Conversion of two of the most polluted IPs in India into EIPs, as part of a pilot project.
- The successful experience in these two parks has prompted APIIC to undertake similar interventions/activities in other IPs in the state, and influence spreads all over the country.
- IALA's role: better utilization and collection of taxes, effective management, avoidance of conflict.
- Capacity building of stakeholders, for exemple through Eco-profit and Eco-club programs.
- Improved waste management, improving livelihood and health.

Drivers and success factors

- Improvement of the environmental performance also improved the IPs competitiveness.
- Expertise and support of experienced organisation (GIZ), including capacity building programs.
- Once GIZ presented the idea of transformation, the Industrial Area Local Authority (IALA) accepted the project and supported GIZ in transforming the park, the IALA played a major role.
- Near urban conglomerate, sewage treatment and Treatment, Storage and Disposal Facility.
- Role of APIIC and changes in institutional structure.

Challenges and lessons learned

- Need of more effective management of hazardous waste.
- The need to explore industrial symbiosis (sharing of resources, raw materials exchange)

- There is a lack of funds.

Suggestions and recommendations

- Remove barriers to EIPs like constraints of area (space), old infrastructures facilities, (initial) improper land use and planning, and deteriorated ground water quality.
- Promote the development of EIPs elsewhere in India.
- Promote more effective waste management.
- Increase participation in the RECP programs.

India EIP Case Study 2:
Andhra Pradesh Special Economic Zone (APSEZ)

Prepared by: CII Sohrabji Godrej Green Business Centre
Authors:

The park at a glance

Andhra Pradesh Special Economic Zone (APSEZ) is the largest multi-products Special Economic Zone (SEZ) in India. It is located on the outskirts of Visakhapatnam city in AP. Surface: 2,264 ha of land at Atchyutapuram Mandal. 39 units, of which only 13 units are operating (SEZ and Domestic Tariff Zone). Sectors are ceramics, speciality chemicals, chemicals, auto-ancillary, petroleum, ferro alloys, power and renewable energy. Currently employed: 2'738 people. Start of transformation in EIP in 2007.

Governance and management

APSEZ is a greenfield project, developed and undertaken by the Andhra Pradesh Industrial Infrastructure Corporation (APIIC); In Andhra Pradesh, APIIC is the nodal body (Zone Development Authority) for matters related to development and management of Industrial Infrastructure. Also, under the SEZ Act 2005, an Approval Committee is formed for monitoring and reporting activities of the units operating within the boundary of the zone.

Assessment and evaluation

At APSEZ, there is a separate institutional structure established for monitoring environmental performance of the park – the Environment Management Cell (EMC). Presently, EMC is involved in maintaining the environmental performance of the park by monitoring parameters such as air quality, green belt cover, water quality and maintenance of basic environmental infrastructure. The EMC needs to report to the Andhra Pradesh Pollution Control Board (APPCB).

Achievements and impacts

- Andhra Pradesh has emerged as one of the most preferred business destinations for manufacturing and service industries in the country.
- The IALA (Industrial Area Local Authority) model for maintaining the service in the parks was applied and led to significant improvement in infrastructure and in collection of taxes. The functioning of the IALA is governed by the APIIC.
- The zoning of the industrial zone is an effective tool for reducing environmental impacts of industrial processes and operations. This proper zoning has helped to protect water bodies and surrounding ecosystems, and has led to synergies.
- Skill development among workers.
- Various APSEZ initiatives, such as site master planning, zoning of the industries, common infrastructure facilities, exploring the possibility of synergies, R&R, etc., were taken by up the developers, resulting in a well laid-out and functional IP.

Drivers and success factors

- APIIC, the developer of the project, has significant experience of developing SEZs and industrial parks across the state.
- Zone Level Management Structures (Zonal Offices of APIIC) are established for managing the industrial parks falling under the boundary of the zone and these Zonal offices reports to APIIC (HQ). APIIC identified several measures taken at every level of development from the policy level (Green SEZ guidelines), park level (Environment Management Cell), unit level (Eco-Club and Eco-Profit Program) and society level (Eco-Drive and Skill Development Centre).
- The zoning tool also contributes to spreading awareness to the public on types of industries and nature of pollution anticipated in their neighbourhood.
- Site location has played a major role in the success of this park. The site is located in the outskirts of Vizag City which is an industrial hub for many heavy and manufacturing industries.
- At APSEZ, appropriate and efficient land use planning was undertaken by the developers.
- Economic and infrastructure development for resettled villagers. There was no basic infrastructure and the standard of living was low. APIIC not only identified the land but also helped the people in building their homes and provided several infrastructure facilities. The extended resettlement and rehabilitation package gained all-round acceptability.

Challenges and lessons learned

- APSEZ can be considered as the first planned eco-industrial park in India. With no similar large industrial development area initiated/implemented until then in the country, it was a risky proposition for the government to invest a huge amount of

capital in such project. Investment attracted by APSEZ has been below expectations (many units proposed their plans for establishing the units in APSEZ, but withdrew due to various reasons). Currently only 13 units of land are operational.

- Some common facilities are yet to be implemented. This could be a possible reason that investments made have not matched expectations, as could be hurdles faced by the ambitious plan of an expressway corridor, lack of industrial environment (among hamlets surrounding APSEZ), general economic situation, etc.

Suggestions and recommendations

- APSEZ, once fully occupied, has the potential to become one of the most successful industrial parks in the country. Therefore infrastructure and economic situation need to improve.
- Use of Site Master Planning as the method for development and designating land use. It is the first step in facilitating Eco-Industrial Development: determines the success of EIPs.
- The zoning of the industrial zone is an effective tool for reducing environmental impacts of industrial processes and operations.
- In addition to Site Master Use and Zoning, other APSEZ initiatives, such as common infrastructure facilities, exploring the possibility of synergies, R&R, etc., all lead to a well laid-out and functional IP.

India EIP Case Study 3:
Mahindra World City, Chennai

Prepared by: CII Sohrabji Godrej Green Business Centre
Authors:

The park at a glance

Mahindra World City (MWC) is located on the outskirts of Chennai city, Tamil Nadu, on the Coramandel (South-Eastern) coast. Mahindra World City aims to be the first Green Integrated Township in India. Sustainable development is the core principle upon which the foundations of Mahindra World City have been built. Chennai is a major automotive hub in India. Surface: 630 ha). MWC is divided into sector specific SEZs (Auto-Ancillaries (8 units), IT (9 units), Apparel and Fashion Accessories (10 units)) and Domestic Tariff Area (35 units). Sectors are: automotive, auto Ancillary, IT, apparel, chemicals, research, design and consulting, industrial equipment, engineering etc. Presently, there are no major polluting industries within MWC. Employment generated: 35'000 (Direct) and 50'000 (Indirect). Seed of development started in 1997.

Governance and management

Governance and management: Mahindra World City Developers Limited, customs officials (only for SEZ), contractors for security, waste management, water supply and sewage treatment, etc. PPP with Tamil Nadu Industrial Development Corporation (TIDCO). At MWC, Mahindra World City Developers Limited are responsible for providing and maintaining common services such as roads, street lighting, waste management, water supply, etc. The scope also included a Domestic Tariff Area along with residential / social infrastructure making it a completely Integrated business city.

Assessment and evaluation

At MWC, the operation and maintenance department is responsible for monitoring and maintaining the environmental, security and safety performance of the park. Services such as security, sewage treatment, waste management, water treatment, internal shuttle services etc., have been outsourced to best in the class service providers, and are directly monitored by MWCDL O&M team. In coordination with the contractors, O&M monitors all the compliance related data such as water consumption and water quality, quantity and quality of waste generated, lake water quality monitoring, ambient air quality, daily monitoring of energy consumption (developers), etc.

Achievements and impacts

- The land acquisition process has been smooth. It was uninhabited land.
- At MWC, equal importance has been given to economic, social and environmental development. Mahindra World City is also registered with Indian Green Building Council for Green Township Rating and will be certified as a Green Township.
- Measures taken to minimize impact on the surroundings: soil erosion control, preservation of existing natural features (like trees), optimal land use planning with green cover, waste and sewage treatment and renewable energy.
- Environmental benefits: more efficient water supply network, and water use, energy conservation and solar rooftop.
- Social benefits: most people employed in the IT sector, there is the potential to generate more than 100'000 direct employment in the project region, integration of the city with the local community, skill training for youth.

Drivers and success factors

- A deliberate decision of PPP model resulted in efficiency gains and value addition through synergies and amalgamation between TIDCO and the Mahindra Group.
- The problems and issues in earlier industrial and urban developments were identified and effectively addressed in the planning of MWC.
- The planning and development of MWC was approached from competitiveness perspective and creating a business opportunity. A deliberate decision was made by

the developers to include the sectors in which the region had a competitive advantage and could be sustained in the long-run.

- Sustainable development is recognized as a core principle upon which MWC is built and is still a key factor influencing day to day decisions at MWC.
- A willingness to provide better services to the units and continuously setting high standards is a priority at MWC.
- Indirect drivers: The Central Government and State Government Policies acted as a stimulus to MWC efforts for attracting several industries to establish their units at Mahindra World City, favourable project location, and presence of relevant institutions and regulations.
- Economic benefits: land investment intensity 0.9 USD Million/ha; land export intensity: 1.6 USD Million/ha (these indicators can be used to compare the performance of industrial parks). This is good performance and also the exports have increased steadily.

Challenges and lessons learned

- Need of site master planning is a building block to Eco-Industrial Development. It determines the success of EIPs, as efficient site master planning results in reduced stress on environment infrastructure, possibility of exploring synergies among industries, disaster management, emergency preparedness, etc. The foremost important influencing factors in the development of site master plan was the consideration of future conditions and expansion. During the conception of MWC, the site master planning was a very new concept to India.
- MWC is a concrete example of development where there is no “trade-off” between Industrial Development and the Environment, and there is harmony between the two. It is important to address issues at an early stage of the project, for example with respect to freshwater use.
- The developers need to understand key factors which can contribute to its success and need to plan accordingly.

Suggestions and recommendations

- Planning as business ecosystem: Earlier in India, industrial parks were planned randomly without any deliberate process or consideration of the users or surroundings. These models were successful in initial years of industrial growth, but in the long run (8-10 years) competitiveness and productivity of the overall park diminishes.
- The main principles of MWC applied to the development were user convenience in availing the service of parks, building and sustaining competitive advantage, ensure harmony between all three aspects of industrial development i.e. Ecology-Industry-Society. It is one of the different models for industrial development in the country and many developing countries including India can look upon and learn from the planning and execution process at Mahindra World City.

India EIP Case Study 4:

Vapi Industrial Estate (Gujarat)

Prepared by: Gujarat Cleaner Production Centre
Authors: Bharat Jain, Chinkal Patel, Dipali Parekh

The park at a glance

Vapi is a core industrial cluster of Gujarat, India. Vapi is one of the oldest estates developed in 1967-68, when the concept of environmental issue did not exist. Surface: 1'140 ha. The land is owned by Vapi GIDC. It houses 1'696 industries, most of which are small scale Industries (SSI) units. Sectors are: chemical plants, mainly for chemical distillation and the production of pesticides, dyes, dye intermediaries and paints. Other major industries include pulp & paper, pharmaceuticals, plastics, rubber, textiles, wood, computer hardware and software, engineering workshops, glass, and food products. 247'000 people are employed. Economic benefits: The economic output (2011-12): VAT 88.9 Million USD, exports (2012-13) 1206.7 Million USD.

Governance and management

Services like water supply scheme, storm water drainage, roads, etc. are being governed by Notified Area Authority (NAA) having members from GIDC (Gujarat Industrial Development Corporation) and representatives from Industrial estate. PPP mode: Central Effluent Treatment Plant of Vapi & Centre of Excellence of Vapi. Vapi Industries Association (VIA) is the most vibrant organ of the Industrial Township. As an integral part of the Notified Area Administrative Committee, VIA has been instrumental in all developmental activities. As a part of pollution control measures by the cluster units, Vapi Waste & Effluent Management Company Limited (VWEMCL) has installed end of the pipeline treatment facilities like common effluent treatment plant (CETP) and transport, storage, disposal facility for hazardous solid waste (TSDF) to control pollution levels and now their focus is shifted to pollution abatement by adopting and promoting Cleaner Production, Cleaner Technology for Cleaner Development Mechanism.

Assessment and evaluation

Gujarat Pollution Control Board is monitoring quality & quantity of effluent from each unit and CETP. For the defaulter there is a heavy penalty including closure of unit. For effective monitoring Vapi Waste and Effluent Management Company Ltd. (VWEMCL) also monitors the quality of effluent. Based on a yearlong monitoring of ambient air and samples collected from 20 stations, an Action Plan was prepared to improve air quality. In addition with all of these, monitoring also includes sampling of ground water from 10 representative tube wells within the estate and 10 wells on periphery of estate and sampling of surface water from River Daman Ganga, where treated effluent is disposed-off.

Achievements and impacts

- GIZ through Gujarat Cleaner Production Centre (GCPC), is providing technical support to VWEMCL for improved performance of CETP in the GIDC Industrial Estate at Vapi.
- VWEMCL provided the facility for collection, transport, storage and disposal of hazardous solid wastes at CSWM site.
- Pilot study by GCPC: how climate change concerns are to be integrated in the planning, design, development and management of the Industrial Estates.
- Industrial symbiosis: plastic waste recycling by the cement industry, consumption of gypsum by cement industry, secondary sludge for composting and more.
- Vapi Industries Association and Indian Chemical Council have organized many seminars and awareness programs in the past for the benefit of the member industries and their staff members.
- Social benefits: GIDC's contribution to the community are in areas of health, education, infrastructure development.
- Cleaner production, fuel switch, sludge treatment and efficient water use are achieved in the textile sector.

Drivers and success factors

- The state authorities/corporations that are responsible for development of industrial estates/parks can play an important role in planning of the industrial estate.
- Financial contribution from the government. of Gujarat and the government of India for establishment and enhancement of treatment capacity.
- Readymade sheds are made available for industries by notified area authority.
- Local manpower and raw material availability.
- Textile industries and chemical industries are complementary to each other.
- Banking and financial institutional aid for R& D is available fostering the cleaner development technologies.
- Active participation from Associations like Vapi Industries Association.

Challenges and lessons learned

- Being one of the old industrial estates, most of the small scale industries are using old technologies.
- Presently, there is no comprehensive reference document on the different sectors of industry that reflects the technological availability, management and other relevant aspects which can be used as a reference document/ guide for selecting and implementing environment friendly techniques.

- Vapi is listed as the critically polluted area, no expansion in the production activities are being allowed for last four years.
- Recently CETP is facing problems related to sludge handling due to high moisture content and in meeting the effluent discharge norms prescribed by the Gujarat Pollution Control Board.
- Some of the reasons for failure of CETP: Input parameters are not properly monitored, Effluents with higher parameter value than permissible inlet parameters are accepted by paying a penalty, lack of personnel training.
- The need has arisen for a secure landfill site to dispose these wastes in an environmentally sound manner to avoid the degradation of the environment. This facility was developed with proper landfill site and an incinerator, however because of some legal problem the site is under closure.
- Safe disposal of treated effluent of GIDC, Vapi is to be carried out by laying pipe line up to deep sea as per NIO recommendation.
- The level of awareness on energy saving among the SME owners in the cluster is poor.

Suggestions and recommendations

- For improvement of process/operations at unit level, environmentally friendly techniques available in BREF document could be selected and tried/tested for the pilot work in selected industries.
- It is very urgent to frame some strategies towards achieving sustainable development in Vapi. This could be possible only through considerable changes/ modifications through policy and institutional initiatives in various areas related to industry and environment. Examples are Extend Pollution Abatement Cost in to the Full Textile Value Chain, Strict Enforcement in pollution control, introduction of economic instruments like effluent taxes, integrated stakeholders efforts, Public-Private-Partnership Project for Industrial Waste Management, and role of importers in pollution management.
- CETP requires fine tuning to achieve prescribed norms.
- Management and worker training can help them incorporate cleaner technologies and environmental planning into work patterns. Governments should encourage cooperative efforts for smaller firms with joint research and development on environmental issues, for example, for joint use of pollution control or waste treatment facilities.
- There should be common hazardous waste incinerator.
- Adopting of 4- R (Reduce, Recover, Reuse, Recycle) strategy.

India EIP Case Study 5:
Naroda Industrial Estate (Gujarat)

Prepared by: Gujarat Cleaner Production Centre
Authors: Bharat Jain, Chinkal Patel, Gopal Chaudhari

The park at a glance

Naroda is a sub urban town in Bapunagar, northeast of Ahmedabad City, Gujarat, India. Naroda Industrial Estate was established in the year 1964, the first Industrial Estate developed by GIDC (Gujarat Industrial Development Corporation) with the prime objective of encouraging entrepreneurship attitude among the Trading Sector, particularly in the Small Scale Industries (SSI) Sector. Number of companies; 1'100. Industrial sectors: pharmaceuticals & dyes, engineering industries, rubber & plastic, food & agrobased, and others. Surface 363 ha. The land is owned by GIDC. Directly employed people: 30'000 and indirectly: 40'000. Economic output: Total Investment 330 Million US $ and Gross Production 1'000 Million US $.

Governance and management

Naroda Industries Association (NIA) was incorporated in 1967. The association is managed by a team of elected officials by the members. Sub-Committees look after day to day operations in the areas of Electricity Supply, Water Supply, Sewerage Facilities, and Infrastructural Facilities etc. Other Sub-Committees look into long term objective like GIDC matters, Infrastructural facilities, power etc. Other organisations are Naroda Enviro Projects Ltd. NIA Charitable Naroda Charitable Hospital Trust, Gujarat Cleaner Production center (GCPC). NIA creates awareness and support in member's efforts on quality, environment, energy management, adaptation of Cleaner Production Techniques, Responsible Production Practice, etc., NIA addresses the needs of the small & medium sector. GIZ got involved in development of EIP in Gujarat (2010), and pilot projects and capacity building (2012) together with GIDC and GCPC.

Assessment and evaluation

Currently GPCB carries out regular water quality monitoring under Global Environment Monitoring System (GEMS), Monitoring of Indian National Aquatic Resources System (MINAR) and regular monitoring program and ambient air quality monitoring in the area under Status of Ambient Air Quality Monitoring Project (SAMP) and National Air Monitoring Programme (NAMP). At present samples from 13 points of the surface water quality monitoring stations are collected and 8 points of the ambient air quality monitoring station are operated; samples are collected regularly as per the CPCB protocol. All the CETPs & TSDFs in the area are monitored and samples are collected regularly. Industrial units located in the area are monitored. With an objective of monitoring, controlling and supporting cleaner production, Naroda Environment Monitoring Committee was set up in 1996.

Achievements and impacts

- NEPL has set up two main projects, Common Effluent Treatment Plant (CETP) of 3 million liter per day (MLD) capacity, which is giving services to the polluting

industries of Naroda GIDC Estate and the first Hazardous Treatment, Storage and Disposal Facility (TSDF) with >1400 member units, giving services to dispose their hazardous waste in a scientific manner.

- The efforts have been made for applying tools at three levels: Micro, Macro, Industrial symbiosis at Naroda to transform Existing Industrial Estate in to Eco Industrial Park: At Micro level there are some cases of adopting CP, PP and RECP. However, more units have to come forward to adopt these strategies. At Macro level (estate level), there is good infrastructure such a roads, water supply network and drainage system.
- Social activities like hospitals, schools, blood bank, etc. are also introduced at Naroda.
- A research project was done by University of Kaiserslautern (Germany) to utilize synergies of industrial ecology networking among the companies towards industrial pollution prevention.
- Case studies of Resource Efficient and Cleaner Production (RECP): ceramics and chemical sector in Naroda. And climate change case study by GCPC, to assess vulnerability of industries to climate change: proper adaptation is enhanced by increasing ones understanding of how and why climate change may affect different sectors.
- The four recycling projects (recycling of spent acid, chemical gypsum, chemical iron sludge, and biodegradable waste) do not only reducing the companies' disposal costs but also raise additional income by selling them to the new market.
- Installation by NEPL of Six Stage Multi Effect Evaporator (Capacity 300 KLD) to treat the high concentrated industrial waste water. There are several case studies listed including: NEPL has installed aeration grid in two equalization tanks and has developed a TSDF site which is accepting hazardous waste from all the units generating hazardous waste in this cluster.
- By transforming non-commercial waste into valuable materials or energy, it gains not only environmental protection but also economic benefit.
- CPC-N has organised training and seminars and capacity building, NIA has met with various international institutes.

Drivers and success factors

- The state authorities/corporations are responsible for development of industrial estates/parks that can play an important role in planning of the industrial estate, including earmarking of required land for CETP/STP, Initiation of CETP and STP in IPs, facilitating formation of SPV/JV Company by member industries.
- Financial contribution from Govt. of Gujarat and Govt. of India for establishment and enhancement in treatment capacity.
- Local manpower and raw material availability.

- Complementarity between textile and chemical industries.
- Banking and financial institutional aid for R& D is available for fostering cleaner development technologies.
- Active participation from Associations like Naroda Industries Association.
- CP centre has been established at GIDC Naroda which helps industry not only for economical production but also for improvement of environment.
- Economic benefits: Greater resource efficiency equals decreased operating costs, enhanced competitiveness, increased return on capital investments, energy security. Stronger connections with suppliers, customers, and community.

Challenges and lessons learned

- In the past forty years, Gujarat has experienced 12 years of drought and the intensity and return period of major drought events have increased substantially in last couple of decades. Also there is expected to be more severe rainfall events. Chemical, Food (Edible Oil) and Textile sectors are highly dependent of water and energy resources. In future there are possibilities of scarcity due to climate change impact. Use of solar or biomass energy will be vulnerable.
- The Industrial Park was treated as a community business. The success of the EIP greatly depends on how each member continuously maintains their relationship with each other and the driving organization. Nevertheless, this high level of cooperation and interdependency becomes a major risk for losing a critical supply if one or some companies walkout from cooperation or the plant closes down.
- The pollution prevention solutions of material substitution or process redesign should take priority over trading toxics within an EIP site.
- In order to fulfill higher standards developers may need a loan in a large amount with longer payback period since some facilities are a common use and do not give profit directly to developers or companies.
- There is no Research Institutional support for development of Industrial Symbiosis at NIE.
- Lesson learned: NIE with its by-product exchange networking successfully creates additional income by reusing and recycling waste with other companies and successfully solves problems of industrial waste which might be difficult if they do it individually.
- Presently, there is no comprehensive reference document on the different sectors of industry that reflects the technological availability, management and other relevant aspects for selecting and implementing environmentally friendly techniques.

Suggestions and recommendations

- Future environmental improvement: adopting cleaner production, setting up wastewater facility, adoption of cleaner fuel, R&D for the chemical, ceramic,

engineering industries to reduce the pollution load, adoption of 4- R (Reduce, Recover, Reuse, Recycle) and other.

- For improvement of process/operations at unit level, environment friendly techniques available in BREF (Best Available Techniques Reference Document) could be selected and tried/tested for the pilot work in selected industries.
- Some policy suggestions to achieve environmentally sustainable industrial development of Naroda: strict enforcement, economic instruments (like effluent taxes and fines), integrated stakeholders efforts, Public-Private-Partnership Project for industrial waste management and role of importers.
- Through a local Cleaner Production centre, CP assessments in more industries could be taken up.
- The international bench mark of water/energy if available can be used to compare the performance of existing industries.

India EIP Case Study 6:

Sachin Industrial Estate (Gujarat)

Prepared by: Gujarat Cleaner Production Centre
Authors: Bharat Jain, Trushit Desai, Chinkal Patel, Dhaval Naik, Shenaz Jadeja

The park at a glance

Sachin is one of the major Industrial cities in Surat Metropolitan Region in Gujarat, India. The town has one of Asia's largest Industrial Areas managed by GIDC.Gujarat Industrial Development Corporation, and several Special Economic Zones exist. Established in 1984. Number of companies: 600. Sectors are textile, diamond polishing, dyes and intermediates, chemicals & pharmaceuticals, engineering and miscellaneous. Surface GIDC Sachin: 749 ha (adjacent are Surat Apparel Park 55 ha and SurSEZ 50 ha). The land is owned by GIDC. Number of people employed within cluster: 45'000. Economic output (Value of Manufacturing Added: 22.00 Million USD/month chemical, 35.00 M USD/month textile, 6.50 M USD/month engineering. Surat has attracted a lot of Foreign Direct Investment in various sectors.

Governance and management

Sachin GIDC is a fully state owned business model, run by GIDC and a Notified Area Authority. There is a Board of Members, who approve engineering works and budgets, levy tax and take care of construction and maintenance of infrastructure. GCPC (a cell of GIDC) promotes CP through services. GCPC, on behalf of GIDC, have the overall responsibility for the activities of developing Eco Industrial Parks in Gujarat. Man Made Textile Research Association (MANTRA) to carry out R & D, testing and technical service activities for the textiles industry. Infrastructure facilities are taken care of by Sachin Infra Environment Ltd

(waste water treatment), Globe EnviroCare Ltd (effluent treatment, waste drum and container recycling systems), Gujarat Environment Protection and Infrastructure Ltd (hazardous waste).

Assessment and evaluation

Apart from this Gujarat State Pollution Control Board, CETP's, Industrial associations and NGO's are actively monitoring the pollution load in the Sachin GIDC area. Installations of CCTV cameras by GPCB has helped to check for stack air monitoring. Water supply network is monitored by the local water supply authority. Both GECL and SIEL have installed flow meters at the inlet and outlet of the CETPs and have their own monitoring committee. GEPIL has installed online monitoring systems on incinerators. Officials of GPCB also regularly monitor the estate.

Achievements and impacts

- Waste water treatment (Industrial water consumption:100 MLD, Waste water generation: 55 MLD), manufacturing and re-use of ferrous sulphate, Catalyzed Hydrogenation using Steel Scrap and fabric waste to energy (planned).
- For air pollution control measures for the flue gas/process emission, industries have adopted multi cyclone, cyclone, dust collector/ scrubbing system.
- The hazardous solid waste disposal site was provided with financial assistance from Government of Gujarat and Government of India.
- GIDC's contribution to the community are in areas of health, education, infrastructure development (drinking water, village infrastructure, construction of schools etc.), environment (effluent treatment, tree plantation and treatment of hazardous waste). The South Gujarat Textile Processors Association is training women. GECL has actively volunteered in social welfare programs.
- Best practices: Stream segregation reduces effluent loads at the CETP, establishment of Cleaner Production centre, separate CETP for textile and chemical industries, increased treatment efficiency reduces the use of chemicals, setting up of TSDF site in vicinity to GIDC estate and cleaning of decontaminated drum and containers.

Drivers and success factors

- GIDC plays a key role and acquires suitable land for Industrial development and provides necessary infrastructure; it also earmarks land and initiates new IPs for CETP / STP and it facilitates funding and formation of SPV/JV Company.
- Financial contribution from Government of Gujarat and Government of India for establishment and enhancement of treatment capacity.
- Local manpower and raw material availability.
- Textile industries and chemical industries are complementary to each other.

- Banking and financial institutional aid for R& D is available for fostering cleaner development technologies.
- Good support from the SGCCI: South Gujarat Chamber of Commerce of Industry.

Challenges and lessons learned

- Due to the recent rise in fuel price of natural gas, industries have switched over to coal and other fuels, which resulted in increase in air pollution.
- There are multiple sources of raw water supply i.e. in addition to GIDC water supply, which ultimately results in lack of control on water consumption for the entire cluster.
- The achievement of energy efficiency in the cluster units is poor and same old technologies are continued.
- Some of the reasons for failure of the two CETP are: Improper Integrated Management System due to different management system of each CETP, lack of proper harmony between CETPs and officials, and lack of personnel training.
- Because of some legal problem the site TSDF (hazardous waste) is under closure.
- Small scale industries have problem of land for expansion of their units. Industries are facing some in-house problems like resource losses due to material handling practices and lack of good housekeeping, energy losses in drying and boiler section. In case of small units, data at national level is inadequate; water and chemical consumption in industries with old machinery may be high.
- There is no research and institutional support for the development of Industrial Symbiosis at Sachin Industrial Estate.
- Presently, there is no comprehensive reference document on the different sectors of industry that reflects the technological availability, management and other relevant aspects for selecting and implementing environment friendly techniques.

Suggestions and recommendations

- CETP and TSDF sites should have control systems so that in no case any harm to environment may occur by either CETP or TSDF sites or any individual industry.
- Environmental suggestions: segregate industrial effluent and domestic effluent streams, R&D of advanced technologies, training, adopting Cleaner Production concepts, common hazardous waste incinerator, adopting 4- R (Reduce, Recover, Reuse, Recycle) strategy.
- For improvement of process/operations at unit level, environment friendly techniques available in BREF (Best Available Techniques Reference Document) document could be selected and tried/tested for the pilot work in selected industries.
- Extend Pollution Abatement Cost to the Full Textile Value Chain: The responsibility for pollution management, should be shared by the textile value chain instead of dyers.

- Some policy suggestions: strict enforcement, economic instruments (like effluent taxes and fines), integrated stakeholders efforts, Public-Private-Partnership Project for industrial waste management and role of importers.
- Applications of Natural Dyes.

Morocco

Morocco EIP Case Study 1:
Sidi Bernoussi Industrial Park, Casablanca

Prepared by: Morocco National Cleaner Production Center (CMPP)
Authors: Hanan Hanzaz & Imane Chafiq

The park at a glance

The coastal industrial park of Sidi BERNOUSSI (one of the largest industrial areas in Morocco) is located east of Casablanca, on the beachfront and on the motorway linking Casablanca to Rabat. The park consists of 2 large industrial areas: Sidi Bernoussi and Sidi Moumen. Surface: 1'000 ha. The land is mostly privately owned. There are 600 companies within the sectors: metallurgic, mechanic, electric and electronics, textile and leather, chemical and para-chemical and agro-food industries and the tertiary sector. 50'000 people are employed. The IP was created in the 1960s.

Governance and management

Association of Economic Operators of Sidi Bernoussi industrial park (IZDIHAR, 1997) had been created in order to defend their interests and improve the overall environment in the park. Industrial parks are put under the supervision of the Ministry of Industry, Commerce and New Technologies (MCINET) and under the Ministry of Energy, Mines, Water and Environment (MEMEE) for environmental protection. Roads infrastructure belongs to the town commune; on this matter, IZDIHAR intervenes with local public authorities and stakeholders in the industrial park to communicate member company's requests and negotiate rehabilitation programs under a Public-Private Partnership. The association serves as a focal point for the mobilization of resources and funding both locally and internationally.

Assessment and evaluation

Economic, environmental and social components. No environmental inventory or environmental management system established. Each stakeholder of the area detains its own monitoring system adapted to specific projects. No tool has been developed for global monitoring of environmental, economic and social performances at the level of the industrial park.

Achievements and impacts

- The Corporate Citizenship project started in 1999. In Morocco, the program was financed by the French Ministry of Foreign Affairs and supported by the Agency for Environment and Energy Management (ADEME). The technical diagnosis conducted in 35 industrial companies connected to the electric network (medium voltage) led to the assessment of potential energy savings, extrapolated to the whole industrial park. Other results were fuel consumption savings, water saving and air pollution reduction. Based on the study results, IZDIHAR negotiated a co-funding from the World Bank and the French Fund for the Global Environment (FFEM) to implement a sustainable development project of the park during the years 2004 to 2008.
- 10 companies installed wast water treatment plants.
- First survey on solid waste management funded by GIZ.
- Awareness raised through environmental initiatives.

Drivers and success factors

- The importance of the park in Morocco (10% of the 500 largest Moroccan companies are located here).
- Funding has been mobilized to improve the environmental, social and economic situation of the members with the creation of IZDIHAR association.
- Other institutions such as CMPP, the National Agency for the Promotion of Small and Medium Enterprises (ANPME), ONEE, FODEP and others, are supporting companies to reduce the pollution generated by their activities.
- A list of the different companies located in the park, facilitating information dissemination among companies regarding different support mechanisms is now available (pilot projects and programs, training, workshops, funding, etc.).

Challenges and lessons learned

- At the project beginning, the national context was less favourable to energy efficiency actions and inertia was observed in industrial mobilization, the slow transmission of information by industries and also decision-making, etc. were also underestimated.
- Before the rehabilitation of the industrial park, several companies were more concerned by the lack of infrastructure than the protection of the environment.
- IZDIHAR as part of the “Industrial Park Groups for Environment” has strengthened the role of industrial park associations and management companies in Morocco and has improved the quality of business parks.
- The Ministry of Energy, Mines, Water and Environment (MEMEE) has designated the Park as a priority area for projects aiming to reduce pollution and has engaged in sustainable management. It is therefore seeking a pilot project that will set an example for other industrial areas.
- The current situation will benefit to IZDIHAR and create a steering committee gathering various stakeholders to develop at first a “Quality Charter of the Industrial Park of Sidi Bernoussi”, to sensitize concerned actors and ponder on actions to be undertaken by each to improve the environment quality in the park.

- ***Suggestions and recommendations***

- Monitoring the quality of the park.
- Creating services (free or paid) for companies, employees and consumers: signage panels, ambulance service, etc.
- Assisting companies in their collective efforts (waste collection, transportation management, etc.).
- Animating the park's life for companies, employees and consumers (information workshop, sports events, information on the park, etc.).

Morocco EIP Case Study 2:
Tangier Industrial Park

Prepared by: Morocco National Cleaner Production Center (CMPP)
Authors: Hanan Hanzaz & Imane Chafiq

The park at a glance

Located at the extreme north of Morocco, Tangier is the main gate of the country to Europe. The Industrial park of Tangier is the main industrial area of northern Morocco and the second largest in the country. Surface : 138 ha. Land ownership by companies. There are 107 companies, in the sectors: textile & leather, agro-food, chemicals and metallurgy. The IP is established in 1975. There are 25'000 employees working.

Governance and management

Business models of the cluster are fully private, fully state-owned, Private Public Partnership (PPP), etc. AZIT is a not for profit association, financed by the member's contributions and services provided among the industrial park such as trainings sessions and workshops, assistance to companies, etc. AZIT represents all the companies within the industrial park collaborating and dealing on behalf of the association members with various national and local stakeholders such as: The Ministry of Industry, Commerce and New Technologies, and The Agency for the Development of Northern Provinces.

Assessment and evaluation

(To be completed, not in report)

Achievements and impacts

- Participation in the "Transfer of Environmental Sound Technology in the South Mediterranean Region" MED TEST project:. A UNIDO green industry initiative supported by the GEF, the Italian Government and the "Strategic Partnership for the Mediterranean Large Marine Ecosystem (LME)" of UNEP-MAP. The project aims at demonstrating the effectiveness of introducing best practices and integrated management systems in industry of the Southern Mediterranean Region. The project was implemented with the local support of CMPP from 2010 to 2011.
- For over 20 years, AZIT is taking the mission of cleaning, maintenance and disposal of industrial waste in the area by the organization of round-trips.

- Dairy industry: Energy recovering from the freezing groups' condensers.
- Water saving meat industry

Drivers and success factors
(To be completed, not in report)

Challenges and lessons learned
(To be completed, not in report)

Suggestions, recommendations
(To be completed, not in report)

Peru

Peru EIP Case Study 1:
Industrial Park «EcoPYMES Pantanos de Villa»

Prepared by: Centre for Ecoefficiency and Social Responsibility / Grupo GEA
Authors: Marcos Alegre, Lourdes Fernández , Denisse Cotrina

The park at a glance
The park is an industrial area in the peri-urban zone located in the South of Lima city, Capital of Peru (where 70% of manufacturing industry in Peru are located). Surface : 13.7 ha. The area belongs to the RAMSAR Convention on wetlands of international importance. The IP was established in 1989. The land ownership is private and public. CER has registered, documented and worked with a total of 137 SMEs that are employing 3'670 persons in this area. However, it is suggested that there are around 300 SMEs in this area that must be registered in the future. Sectors are food, furniture production, textile industry, mechanical services, for cars, pork feeding (some of the sectors are informal).

Governance and management
Central coordination unit: PROHVILLA as public authority in charge of the management and technical support of the Natural Reserve, the Special Regulation Zone and the Buffer Zone. It has a board of directors, a technical, legal and administration office and an office of research and development. PROHVILLA is also promoting ecotourism, and is monitoring and controlling this area. PROHVILLA has registered 193 from 300 companies that have a favourable environmental performance, but they don´t have environmental legal license. They are allowed to function, as enforcement of environmental regulations are low. Business model is based on SMEs and fully private and The Management Committee Pantanos de Villa promotes PPP.

Assessment and evaluation

Monitoring of environmental indicators for companies/industries of materials, energy and water. Methodology chosen and adopted by the CER and includes monitoring of the plan of implementation, training, and consulting to companies and monitoring after implementation and improvement of the reports.

Achievements and impacts

- 25 companies have implemented RECP and are undergoing environmental monitoring.
- 137 industries in five sectors have been identified with the potential development of industrial symbioses.
- Hazardous wastes are managed by PROHVILLA within the scope of the reserved area.
- PROHVILLA performs monitoring, supervision and promotion of research aimed at the preservation of biodiversity.
- The EcoPYMES Pantanos de Villa program improved the competitiveness and the business climate in the local industrial zone.

Drivers and success factors

- The companies' economic benefits and need for a good relationship with local authorities are the main drivers.
- Local authorities must improve environmental conditions in the local area because it is a high visibility zone in Lima.
- The need of the companies to comply with legal standards and norms.
- The growing environmental awareness creates a good climate for this type of projects.
- The Pantanos de Villa Wildlife Refuge received the Blue Globe Award granted by the World Wetland Network (2011).
- National ecoparks initiatives promoted by the Ministry of Production and Ministry of Environment, creates a good institutional umbrella for *EcoPYMES Pantanos de Villa*.

Challenges and lessons learned

- It is important to include public institutions from the beginning of the program.
- Link between RECP voluntary practices and effectiveness in meeting environmental rules and laws.
- Create locally good conditions for eco-industrial park implementation (e.g. social environmental awareness campaigns with mass media; disseminate environmental norms at local level, etc.).
- At SME level, it is very important to have a permanent technical assistance "in situ"
- In most cases, companies that already had some type of certification (or intend to implement certification in the near future) are easier to approach for implementation of strategies for improvements.

Suggestions and recommendations

- Expand the *EcoPYMES Pantanos de Villa* experience to other industrial areas of Lima.
- Identify new eco-innovative potential industrial symbioses to properly promote them (e.g. energy from used oil, materials/waste exchange).

- Provide inputs for national policies for Ministry of Industry based on practical experiences.
- Promote multi-sectoral strategies for eco industrial parks (promote creation of green industry platform and working groups).
- Two different strategies should be developed together with public and private stakeholders. One for existing industrial zones and another one for new eco-industrial parks.

Peru EIP Case Study 2:
Industrial Park «EcoPark Callao»

Prepared by: Centre for Ecoefficiency and Social Responsibility / Grupo GEA
Authors: Marcos Alegre, Lourdes Fernández , Denisse Cotrina

The park at a glance

Coastal industrial park, established in 2008 and located 15 km from the capital of Peru (Lima). Surface: 4'600 ha. There are 10 large companies with 2'000 employees. Sectors are food and beverage, mechanics, metallurgy and 20% of domestic manufacturing industry. The land is owned by the companies.

Governance and management

Central coordination unit: Regional Government of Callao.
Pilot program based on PPP.

Assessment and evaluation

Monitoring of environmental indicators for individual companies.

Achievements and impacts

- The EcoPark Callao programme was developed around the RECP approach, to evaluate the companies' production processes and the identification of potential cleaner production measures that would improve environmental performance through a more efficient use of resources (raw materials, energy, water and other inputs).
  - Seven companies have implemented water recovery and reduction in water reduction measures.
  - Eco Park Callao reduced atmospheric pollution generated by the production of zinc; it reduced energy consumption, greatly enhancing the heat exchange capacity of the cooling tubes.
- EcoPark Callao program promoted the participation and education through the training of senior management.
- Reducing conflicts between government, the community and others through commitment of companies to be more eco-efficient.

Drivers and success factors

- Direct economic benefits through eco-efficiency and continuous improvement: industrial symbiosis, management for increasing productivity, access to investment capital, reduced costs for the use of public services.
- Access to environmental certification.
- Good image and good relationships with stakeholders.
- Need for companies to improve their standards.
- National Policy for EIP (Ministry of Industry and Ministry of Environment).

Challenges and lessons learned

- Need for capacity building for public and private institutions.
- Adequate environmental control and regulation for new industries.
- Effective enforcement for companies to comply with environmental rules and laws.
- Promote clean technology providers in the area of EcoPark Callao.

Suggestions and recommendations

- Corporate Governance / Labour Management:
  - Update several manuals (e.g. job profiles, organization, code of conduct, etc.).
  - Establishment of an ethics committee.
  - Recommendations on how to improve internal and external corporate communications (e.g. as a survey on the work environment, introduction to quality circles, internet-based communication, directly involving employees, etc.).
  - Joint identification of faulty policies with customers and suppliers.

Health and occupational safety

- Introduction to different training programs (e.g., to identify and assess risks and hazards, use of personal protective equipment, evaluating order and cleanliness, employee awareness, monitoring, etc.).
- Create a health and safety committee.
- Introduction to drills and appropriate reactions in case of emergencies.
- Complete the catalogue of indicators.

Peru EIP Case Study 3:

Industrial Park «EcoPark Pucallapa»

Prepared by: Centre of Eco-efficiency and Social Responsibility (CER) / Grupo GEA
Authors: Marcos Alegre, Lourdes Fernández , Denisse Cotrina

The park at a glance

The Ecopark Pucallpa, in the proposal stage in project since 2009, is located in the Peruvian Amazonia approximately 14 km from the city of Pucallpa, Ucayali Region, the central part of eastern Peru. Surface 44 ha. The EIP is in the prososal state since 2009. There are 80 companies, within the sectors sawmills, re-sawmills, agribusiness, metalworking,

woodworking, trade, and other SMEs. But the EIP has not been employing any people yet. The land is privately owned.

Governance and management

Central coordination unit is the Small Business Association (APEMEPD) consisting of the 80 companies which make up the EcoPark Pucallpa. This is a proposed Eco Industrial Park, thus the business model is not implemented yet.

Assessment and evaluation

Monitoring will be done through technical assistance provided by CER with financial support from the Government/UNIDO/SECO.

Environmental monitoring will be done through a quarterly report detailing the monthly environmental performance indicators for each company and other services at Ecopark.

Drivers and success factors

This is a new eco industrial estate so after implementation CER will establish drivers and success factors.

Challenges and lessons learned

CER has contributed to technical advice and consulting regarding the change of land use classification from agricultural to industrial, has provided inputs for the technical concept, layout and feasibility study of *EcoPark Pucallpa,* among others.

- SME and local authorities in small cities and rural areas like Pucallpa City, need more information and training regarding RECP and low carbon industries.
- An EcoPark physical model or *"maquette"* is an excellent tool for project promotion with different stakeholders, to provide technical information and assist in fund raising.
- EcoParks involve important cash investment, therefore there is a need to develop a clear funding strategy based on phases (e.g. funding ecopark basic services and infrastructure by phases).
- EcoPark projects need a multidisciplinary technical team. These type of projects involves social, economic, legal, political and technical issues.
- EcoPark projects need a multi-sectoral institutional coordination mechanism in order to align resources and perspectives from land use authorities to environmental national and local municipality's authorities with private stakeholders.
- One of the main positive environmental impacts will be the use of the sustainable forestry cycle and control of overexploitation of forests, with the use of certified wood in its operations. This will guarantee the origin of the wood from properly managed forest concessions.

Suggestions and recommendations

- It is necessary to finish with the business plan in order to facilitate fund raising and get the necessary funds for the initial phase of the EcoPark basic services implementation (2014).
- It is suggested to develop a more accurate and specific RECP plan considering two aspects of EcoPark development: Construction, and Operation & Maintenance.

South Africa

South Africa EIP Case Study 1:
Western Cape Industrial Symbiosis Programme (WISP)

Prepared by: South Africa National Cleaner Production Centre
Authors: Justin Du Toit, Amy Vice Bufe', Henry Nuwarinda

The park at a glance

Western Cape Industrial Symbiosis Programme (WISP) is a virtual eco-industrial park aimed at linking companies/creating synergies. WISP is not a physical site in the sense of an industrial park, but rather a service, which uses the facilitation/workshop approach to identify and promote beneficial innovative partnerships from under-utilised resources. WISP was established in 2013. 41 "Solution Providers" as of August 2013. It works in the sectors retail and manufacturing and plans to work with agriculture and agro-processing in the near future. WISP is based on the United Kingdom National Industrial Symbiosis Programme (NISP).

Governance and management

In its inception phase, this pilot project has been initiated by the Western Cape Government (under its green economy programme) and is being delivered by the GreenCape Initiative, a sector development agency.

Assessment and evaluation

WISP practitioners conduct site visits as/when required. Their role is not only to monitor and evaluate activities, but also to drive WISP objectives and provide support with respect to legislation and 'red tape' (i.e. unblock technical and legal issues).

GreenCape are still in the process of developing Key Performance Indicators (KPIs) for monitoring and reporting purposes. These KPIs will seek to address cost-savings, environmental reduction, and job creation broadly. As a government funded pilot project, solid results will need to be revealed, especially considering the application for extended funding in 2014. GreenCape are also in the process of developing case studies, which will highlight the impact and benefits of the WISP programme. Only one case study was available at the time of the research.

Drivers and success factors

- Increase in electricity and fuel costs, resulting in companies increasingly showing interest in shared logistics and energy expertise.
- Landfill costs in South Africa. The anticipated new Waste Management Act will almost triple costs associated with the disposal of waste. GreenCape will use the latter as a driver for promoting participation in WISP (expected to come into effect at a later stage).
- Cost savings, as well as increased profits and diversion of waste to landfill.
- Cost-sharing partnership with ISL is of great benefit to the programme, which allows GreenCape to adapt their established methodologies, which saved time and effort with regards to implementing WISP.
- Partnerships with industry organisations (such as the EDP and the Cape Chamber) will also prove beneficial with regards to identifying companies, promoting IS and WISP, and engaging with stakeholders.

Challenges and lessons learned

(Project still in inception phase, and thus lacking sufficient data to track progress)

- Success is reliant on facilitation and consultation, utilising an active rather than a passive approach. Sharing principles of best practice, creating and promoting synergies between companies, and identifying possible savings are aspects of such programmes, which need to be pushed by someone on the ground if the programmes are to succeed.
- Marketing and packaging the programme are another problematic area is. As WISP is a pilot programme, data/evidence to demonstrate the benefits of investing in the idea of industrial symbiosis is unknown.
- Buy-in from smaller companies is most difficult to achieve due to their lack of capacity to follow up on links, but once they come to understand the potential benefits they will come to realise that they have more to benefit from such an initiative than anyone else.
- The partnership with ISL makes initiating and facilitating WISP more efficient, as templates and processes were already in place (and with proven successful track records).
- Sector involvement is dependent on the landscape, but a key driver is nevertheless diversity – build a network of diverse companies, get them to start talking to each other.

Suggestions, recommendations

- WISP stands out as a more effective means to stimulate responsible waste management and promote sustainable industrial and economic development.
- To keep WISP a free service so as to maintain buy-in from industry.

South Africa EIP Case Study 2:

Capricorn Park

Prepared by: South Africa National Cleaner Production Centre
Authors: Justin Du Toit, Amy Vice Bufe', Henry Nuwarinda

The park at a glance

Capricorn Park is located approximately 25km south of Cape Town, in an environmentally sensitive area along the False Bay coastline in Muizenberg. Capricorn Park is sitting on a large aquifer and has a small lake located at its centre. All the land is privately owned, but due to the biodiversity of the landscape is subject to strict environmental regulations. Surface : 70 ha. It was established in 1998. There are approximately 180 companies, in the sectors light industrial / commercial, small / private business enterprise, warehouse storage for various industries. Before settling in the park, a company must go through a screening

Governance and management

Capricorn Park is managed by the CPOA (Capricorn Property Owner's association), which is comprised of the developer, as well as the landowners within the Park. The Environmental Site Officer ensures the implementation of the Environmental Management System and health and safety issues.

Assessment and evaluation

The ESO (Environmental Site Officer) is responsible for monitoring activities that may have an impact on the local natural environment. The ESO is responsible for monitoring water quality levels and enforcing environmental regulations as outlined in the EMS. The ESO has to make a few check and control for monitoring activities as checking the storm water drains for signs of pollutant effluents/spillage or check compliance with regards to landscaping/biodiversity management; conducting periodic audits, etc.

Regular management system and performance audits are to be performed by external auditors. Due to lack of communication with the Park manager, no information regarding general management and enforcement of Park regulation could be obtained.

Achievements and impacts

- With regards to the preservation of biodiversity, Capricorn Park performs well. Strict regulations apply to the Park due to its location, and compliance to the Environmental Agreement with the City Council is essential as it formed the condition of approval to develop the land in the first place. The Park contains a lot of 'green spaces' as 15-25 percent of each plot is required to be left for landscaping.
- Whilst no Park-wide recycling scheme is in operation, most companies in Capricorn Park do use local recycling companies/individuals to collect their recyclable waste. The Coastal Park landfill site has a recycling drop-off facility.
- Capricorn Park is also a smoke free industrial park, and smokestacks and chimneys are disallowed.
- Water quality management through collection of storm water on Capricorn site and discharged into the lake.
- Air quality management and biodiversity conservation.

Drivers and success factors

- Some businesses are attracted to the environmentally-friendly regulations of the Park, as well as its natural scenery.

Shortcomings:

- Some decide against conducting their operations at Capricorn due to the strict environmental regulations.
- Being a contractor (and also one from an NGO and not government) can at times be problematic with regards to enforcing environmental regulations.
- Problems regarding imposing the Environmental Screening Questionnaire.
- Rent is also considered too high by some, which may partially explain the empty units and undeveloped sites.

Challenges and lessons learned

- Industrial symbiosis is largely untapped and could be implemented in an effort to attract more business and investment.
- No sharing of energy resources or waste by-products between the various operations in the Park is encouraged.
- The high turnover of service providers (such as the ESO) creates further challenges with regards to the implementation of projects/programmes and the collection of reliable data.
- The lack of a long-term data stream (i.e. documented history of Park operations) makes it difficult to monitor and evaluate progress and benefits.

Suggestions and recommendations

- One must consider the EMS, the presence of a Park Manager and an ESO and respect them.
- More support from government institutions as well as organisations such as the NCPC-SA is required to develop Capricorn Park as an efficient eco-industrial park.

South Africa EIP Case Study 3:

Rustenburg Platinum Mines Limited (Ltd)

Prepared by: South Africa National Cleaner Production Centre
Authors: Justin Du Toit, Amy Vice Bufe', Henry Nuwarinda

The park at a glance

Anglo American Platinum Limited is the world's primary producer of platinum group metals. Five of the company's wholly-owned South African mines are located within the Rustenburg mining complex (Rustenburg Platinum Mines Limited) which also houses a smelting complex and both a Base Metals Refiner and a Precious Metals Refiner. Rustenburg Platinum Mines Limited is located in the North-West Province, a subsidiary of Anglo American Platinum, which consists of five of the seven aforementioned wholly-owned mines. It is one company, with 20'706 employees. The land owner is Anglo American Platinum Limited. Key sector activities: Mining

Governance and management

The company's corporate governance encompasses the concept of sound business practice, which is inextricably linked to the Anglo American Group's management systems, structures,

policies and culture of governance. The Executive Committee is responsible for implementing the strategies and policies determined by the Board, managing the business and affairs of the Company, prioritising the allocation of capital and reviewing operational and safety procedures throughout the Company. There is a Safety and Sustainable Development Committee.

Assessment and evaluation

- The Minerals and Petroleum Resources Development Act (MPRDA), the National Environmental Management Act (NEMA) and the National Water Act (NWA), and related policies, regulate environmental impacts at Anglo American Platinum mining operations in South Africa.
- All operations are subjected to energy and water audits and legal compliance reviews.
- The Anglo American Platinum Integrated Annual Reports provide a complete overview of the company's financial, social and environmental performance, and the Sustainable Development Reports provide additional details and information to supplement the former report.
- Determining materiality is a critical part of reporting and is done in accordance with the Global Reporting Initiatives (GRI) guidelines which evaluates both internal (policies, risk, opportunities, stakeholder) and external factors (industry-wide factors; mineral policy, legislation and norms; memberships, associations and panels; stakeholders).
- A new programme called Water Efficiency Target Tool (WETT) has been introduced that aims to align water targets across the Anglo American Group. Surface water and groundwater are monitored at all mines and process plants, both upstream and downstream of operations, as well as inside and outside the mining areas in the catchments where Anglo American operates.

Achievements and impacts

- Resource effiency, re-using and recycling water and energy use reduction. Operation at Anglo American are incredibly energy intensive.
- Cleaner production: reducing sulphur dioxide emissions.
- Waste minimization: recycling non-mineral and non-hazardous waste.
- All Anglo American Platinum operations have environmental management systems that are certified against the ISO 14001:2004 standard.

Drivers and success factors

- Anglo American systematically track performance against a range of environmental and social indicators (to ensure legal compliance, but also to identify potential opportunities).
- Sustainability and environmental management are driven by necessity - in the sense of cost-savings (the increasing cost of resources) and the right to grow the business (legal compliance) - as much as by (if not more than) environmental consciousness.

Challenges and lessons learned

- To consolidate Rustenburg into three operating mines, by placing Khuseleka and Khomanani mines (four shafts) on long-term care and maintenance, thus creating a more efficient mining operation.
- Rustenburg processing operations will also be reconfigured to align with the revised mining footprint.

Suggestions and recommendations

The need to restructure the company – to restore profitability and align production with market demand –is required for the long-term sustainability of Anglo American Platinum. 4'900 jobs will be cut.

Tunisia

EIP Case Study 1:
Bizerte Economic Activities Park (BEAP)

Prepared by: Tunis International Center for Environmental Technologies (CITET)
Authors: Ahmed Herzi, Kamel Saidi

The park at a glance

The Bizerte Economic Activities Park (BEAP) is a pilot area for the application of the approach of industrial ecology located in the governorate of Bizerte in the north of Tunisia (about 60 km from Tunis). It was established in 1993. The surface is 81 ha divided between three sites. The land belongs to the government; the management company (DECBEAP) rents lots (lease 15/30 years). There are 62 companies within key sectors: pleasure boating, textile and leather, steel and metallurgical, plastics processing and pharmaceutical industry, trade, catering (packaging) and services. There are 5'470 persons working at the IP.

Governance and management

The BEAP is currently managed by the Company for Development and Operation of BEAP (abbreviated DECBEAP). Which provides three main functions: planning, promotion and maintenance of the park. It provides infrastructure development of a total reliability which offers operators a favourable framework for carrying out their activity.

Assessment and evaluation

The Operator follows economic and social indicators of the park (% occupancy, number of companies, number of employees, value of exports and investment, etc.) and publishes an annual report on the activities of the park.
In addition, the operator assists some companies in regularization of their situations relating to the regulation of classified establishments. The operator tries to find collective solutions to environmental problems of the park like waste management.

Achievements and impacts

- An industrial ecology project is implemented by the International Center for Environmental Technologies of Tunis (CITET) with the support of the Swiss office of expertise in industrial ecology (Sofies). It includes 75 companies for CP tools, LCA and renewable energy.
- Reducing the environmental impact and risks to health and safety at work due to storage of waste solvents.
- Organization of a new recovery systems for used textile for companies across the park to use as insulation or for reuse as degreasing and cleaning cloths: about 180 tons per year of textile waste.
- Recycling Polyethylene waste (PE) and avoid landfill: about 500 tons per year;
- Promotion of co-products by companies in the field of metallurgy: about 3000 tons of rolling sludge.
- Energy recovery from waste generated by the companies in the park in the cement industry. And using some of the waste as inputs in the raw material for cement.

Drivers and success factors

- The Operator (DECBEAP) of the park has resources that allow it to provide services and permits it to have the park well maintained.
- The Operator ensures compliance with environmental regulations by the companies located in the park.
- Park companies can access financing mechanisms for projects and environmental programs in collaboration with CITET (ISO 14001, cleaner production, ecolabel, etc.).

Challenges and lessons learned

- The management of waste and hazardous material is a problem for the enterprises in the park after the closure of the hazardous waste treatment centre in Jradou.
- The co-processing industry has to meet regulatory requirements affecting its work including the limits to the level of emissions from cement co-incinerating waste values.
- The implementation of co-processing requires the identification of the deposit of waste and the establishment of a preparation step prior to using waste in cement.
- This requires significant investment in addition to the existence of an operator who has experience in this type of project.
- The project of industrial ecology has highlighted the potential of existing goods in companies active in the park for new practices and strategies, and their needs by sensitizing companies to optimize resource consumption related issues. It also includes arousing great expectations on the part of companies about the potential identified, the development of new business and public-private exchanges.

Suggestions and recommendations

- The project has identified priority options (industrial symbiosis) to improve resource consumption and waste management.

- The implementation of these options requires the awareness of enterprises and provision of financial and technical support to overcome the constraints of investment and national legislation including those relating to co-processing.
- It would be desirable to establish criteria for a national label for an environmentally friendly industrial zone.

Tunisia EIP Case Study 2:
Industrial Area of Djebel Oust and Bir M'Cherga

Prepared by: Tunis International Center for Environmental Technologies (CITET)
Authors: Ahmed Herzi, Kamel Saidi

The park at a glance

Three sites located in two areas at 30 and 50 kilometers of Tunis, Djebel Oust and Bir M'Cherga. The surface total 228 ha. There are 105 companies within the key sectors: cement, glass, cosmetics, pharmaceuticals, plastics, foundry, chemicals (insecticides), packaging, food processing, etc. There are 23'000 people employed. The land is owned by a person and the lots are sold to enterprises.

Governance and management

Managed by the group of maintenance and management (GMG). It is a non-profit association with public interest having legal personality and bringing together all the operators, owners and occupants of buildings in the industrial area. The GMG is responsible for the maintenance and rehabilitation of public utility services such as roads and public lighting management and removal of garbage and industrial waste.

Assessment and evaluation

The method of calculation of contributions is fixed by the GMG. The GMG follows some economic indicators on companies operating in the area: the number of companies operating, projects, activities, number of employees, etc.

The National Agency of Environmental Protection provides control and monitoring of pollutant emissions generated from industrial enterprises in the industrial area.

Achievements and impacts

- An industrial ecology project is implemented by the International Center for Environmental Technologies of Tunis (CITET) with the support of the Swiss office of expertise in industrial ecology (Sofies). Djebel Oust and Bir M'Cherga were selected as a pilot area. There are two objectives: create a dynamic collaboration between private economic actors and bodies of land management and identify and implement industrial symbiosis (materials, water, energy, etc.).
- Recovery of waste brick and concrete as raw materials in cement industry (to be implmented).

Drivers and success factors

- GMG plays an important roll for the improvement of infrastructure of the area (roads, sanitation, etc.).
- GMG contributes to solve environmental problems in collaboration with industry and public authorities (governorate, municipalities, national office of sanitation, etc.)
- The National Agency for Waste Management (ANGED) provides technical assistance to industry in the field of waste management.
- The companies in the industrial zone can access financing mechanisms for projects and environmental programs in collaboration with CITET (ISO 14001, cleaner production, ecolabel, etc.).

Challenges and lessons learned

- The GMG system suffers from several major flaws and shortcomings among which are included:
  - Companies that were located in the area before the law on GMG came into force argue rightly that in their decision to purchase a lot in an industrial area it was implied that maintenance of areas outside their own land was not their responsibility but it is the responsibility of the developer or the local community.
  - The financial resources available to GMG are generally very poor.
  - GMG has a lack of accountability that led to a lack of visibility and recognition by the industry of the area.

Suggestions, recommendations

- The status of GMG and the release of guardianship that now exceeded the territorial governor should be clarified.
- GMG has the function to become, according to the law, one of the main actors in the management, development and rehabilitation of industrial areas. For that, work must be done according to its status.

Vietnam

Vietnam EIP Case Study 1:
Thanh Long Industrial Park

Prepared by: Vietnam National Cleaner Production Center & Hanoi University of Science and Technology
Authors: Tran Van Nhan, Ngo Thi Nga, Nguyen Hoang Ai Phuong

The park at a glance

Thang Long industrial park (TLIP) Corporation was jointly established in 1997 between Sumitomo Corporation, a world's leading integrated trading house of Japan and Dong Anh Mechanical Company, one of the most successful Vietnamese companies under the Vietnam

Ministry of Construction. Total investment: US$ 90.33 million. In 2007 TLIP was completed. It is located 18 km from Hanoi. TLIP is fully operational with a total of 78 companies active. Sectors: electronics, mechanics, automobiles, refrigeration and motorcycles. Surface: 274 ha. Number of persons employed within the cluster: 63'600. Exports: US$ 2.26 billion (in 2011). It is not an EIP yet, however every decision and activity with regard to the development and management of TLIP has been made in consideration of the environment.

Governance and management

The institutional structure of the industrial park consists of a central coordination unit: the Hanoi Industrial and Export Processing Zones Authority (HIZA), in charge of all the industrial and export processing clusters operating in the area of Hanoi. HIZA assists the relevant governmental authorities in the state management of these clusters. The Department of Natural Resources and Environment (DONRE) of Hanoi is in charge of monitoring and assessing the operation of TLIP with regard to environmental performance. TLIP Corporation is in charge of the management and operation of TLIP and reports to HIZA as well as to the relevant governmental authorities. The management structure consists of a Tenants relation division and a Corporate division with respective responsibilities. TLIP Corporation is responsible for ensuring the individual companies in the cluster to perform their environmental responsibilities (e.g. construct and operate their own waste treatment facilities, establish solid waste collection mechanisms, etc.) as well as being in charge of the environmental performance of the whole cluster.

Assessment and evaluation

The monitoring and assessment activities are undertaken mainly by the TLIP Corporation and individual tenant companies. These companies have the responsibility to report on a regular basis to the governmental authorities which include Hanoi DONRE and HIZA. DONRE also has the right to carry out regular check on the environmental performance. With regard to voluntary initiatives implemented by companies in TLIP, there are no set of regulations for monitoring and assessment or any formal requirement on reporting. The companies have their own systems to monitor and assess the outcomes and effects of their programmes and initiatives and develop their own follow-up systems.

Achievements and impacts

- TLIP Corporation supports the operation of the tenant companies operating on site through providing infrastructures such as land, road, other built environments and shared facilities for administration, training, catering, waste treatment etc. Water, energy and telecom networks and housing for workers are developed and provided by the authority of Hanoi.
- Social infrastructure: TLIP Corporation has invested in fire prevention, clinics, police and security services, and public transport facilities. Other social facilities include post-offices, restaurants, a vocational centre and social activities centre for workers. CSR activities include environmental preservation in the neighbourhood and building schools.

- Achievements in environmental management are treatment of waste water, treatment of emissions and odour (companies have to install own systems), treatment of solid and hazardous waste, and management of trees and plants (23% of area cover).
- Some Japanese companies are pursuing policies guided by an eco-efficiency perspective especially energy and material efficiency. For example Panasonic is creating model factories not only to develop eco-products with sustainable industry practices but also to take a lead role in promoting greater eco-awareness in the community through outreach activities. Canon has an energy saving program.

Drivers and success factors

- The governmental policies to attract foreign and domestic investment in industrial zones since the early 1990s, have contributed to increasing the number of companies in TLIP.
- The establishment and enforcement of laws and regulations have contributed to the improved performance of the manufacturing companies in the industrial park.
- International and national initiatives take place on cleaner production and energy efficiency.
- Since all the companies in TLIP are Japanese or Japan-Vietnam joint stock, the average environmental awareness level is considerably high and the are many environmental initiatives.
- TLIP Corporation has a policy to only serve those companies with investment projects that use modern and high-end manufacture technologies, environmentally-friendly technologies, clean technologies or/and energy-efficient technologies.
- Reduced consumption of energy, water and material provided by the companies in TLIP implies some economic benefits to the companies. A good reputation for environmental performance has led to increased competitiveness of TLIP. Over the years, TLIP has always been the cluster with very high coverage ratio (close to 100%) contrary to many Vietnamese industrial zones.

Challenges and lessons learned

- Review of the current status of industrial parks in Vietnam reveals that none of the clusters being in operation nationwide have the characteristics of an eco-industrial park as defined by UNIDO/UNEP.
- Lessons learned: TLIP was studied in depth and a well prepared plan for its construction and implementation was executed, with environmental considerations being emphasized at very early design stage.
- Lessons learned: There has been a strong commitment shown by the management board of the TLIP Corporation as well as of tenant companies to implement environmental and social responsibilities.

- Environmental management depends a lot on the initiatives of the companies themselves.
- It is not clear how is the enforcement of environmental regulations.

Suggestions and recommendations

- Governmental laws and regulations are key in steering industrial parks and the companies operating within their premises towards eco-industrial direction.
- Companies' policies and codes of conduct determine how far they can go in implementing RECP initiatives beyond legal requirements.
- International and national initiatives are key in raising awareness and promoting the design and implementation of RECP in the industrial park.
- Industrial symbiosis (sharing of resources, raw materials exchange) - needs to be explored and encouraged through advocacy and policy intervention.

Vietnam EIP Case Study 2:

Vietnam-Singapore Industrial Park I

Prepared by: Vietnam National Cleaner Production Center & Hanoi University of Science and Technology
Authors: Tran Van Nhan, Ngo Thi Nga, Nguyen Hoang Ai Phuong

The park at a glance

The Vietnam Singapore Industrial Park I (VSIP I) was initiated by the Governments of Vietnam and Singapore and established in 1996. VSIP is developed as a joint venture between Becamex IDC Corporation, a state-owned enterprise, Vietnam and Sembcorp Development Ltd (SDL), Singapore. The industrial park is 17 km from Ho Chi Minh City. VSIP I has a coverage ratio of 100% with a total of 240 companies currently operating on site. These tenant companies from 22 countries have brought in a total investment of approximately US$ 2.62 billion and create some 96'367 jobs. Surface: 500 ha. Being a showcase of successful industrial parks in Vietnam, VSIP Corporation has been driven by a sustainable development mind-set has been considered one of, if not, the most successful industrial parks in Vietnam from a sustainable development perspective. Sectors: electronics and electricals, pharmaceuticals and healthcare, automotive component, precision engineering, food industry, supporting industries, building and specialty materials, logistics and warehousing.

Governance and management

VSIP I uses the "one-stop-service" principle with regard to industrial parks and zones management. The governance structure consists of a central coordination unit, the Vietnam-Singapore Industrial Park Management Board (VSIP MB), which is the on-site approving authority which comprises governmental officials from relevant ministries to ensure smooth

start-ups and operations of all the companies operating in VSIP I. The Department of Natural Resources and Environment (DONRE) of Binh Duong province is in charge of monitoring and assessing the operation of the industrial park with regard to environmental performance. VSIP Corporation, as an infrastructure company, is in charge of the management and operation of the whole industrial park. In terms of environmental management, VSIP Corporation is responsible for ensuring that the individual companies in the cluster perform their environmental responsibilities (e.g. construct and operate their own waste treatment fac.ilities, establish solid waste collection mechanisms) as well as being in charge of the environmental performance of the whole industrial park. VSIP Corporation also provides supports for investors.

Assessment and evaluation

The monitoring and assessment activities are undertaken mainly by the VSIP Corporation and the individual tenant companies. These companies have the responsibility to report on a regular basis to the governmental authorities which include Binh Duong DONRE and VSIP MB. Binh Duong DONRE also has the right to carry out regular and sudden checks on the environmental performance of facilities. With regard to the voluntary initiatives implemented by the companies, there is no set of regulations for monitoring and assessment or any formal requirements on reporting. The companies have their own systems to monitor. The Green Book initiative (2011), by Binh Duong DONRE contains reports on companies' actions aimed at environmental protection and social responsibility. Among the 47 companies being inscribed in the Green Book 2012, 22 companies are from VSIP I.

Achievements and impacts

- Achievements in environmental management are treatment of waste water (VSIP I is the first industrial park in Vietnam to have a common wastewater treatment facility which is a complete and modern system), treatment of emissions and odour, treatment of solid and hazardous waste, and management of trees and plants (30% of area cover).
- VSIP Corporation supports the operation of the tenant companies operating on site through infrastructures and shared facilities for administration, training, catering, security and waste treatment etc. Water, energy and telecom networks and housing for workers are developed and provided by the authority of Binh Duong province.
- Reports from the companies as well as random check from the authorities record no issues of environmental pollution. No disputes or complaints from the surrounding communities are reported.
- VSIP I has invested in fire prevention as well as a clinic, police and security, and public transport facilities. Other social facilities have been developed which include a post-office, restaurants, vocational centre and social activities.
- A number of companies in VSIP I have ISO 14001 certification such as Procter & Gamble Indochina, Uchiyama, Yakult, Esquel Garment, MHE Demag Vietnam, Takako, Estec, etc. As a result, these companies are continuously seeking to improve

their environmental performance through cleaner production and resource efficiency solutions.

- CSR: Since its establishment in 2003, VSIP Corporation Charity has successfully organised annual charity events to collect some hundred thousand US dollars for the poor. Companies' CSR involves environmental preservation and social development (e.g. building houses and schools).

Drivers and success factors

- VSIP I has been benefited from Sembcorp's strong expertise in industrial park development in general, and environmental management of industrial parks in particular.
- The establishment and enforcement of laws and regulations have contributed to the improved performance of the manufacturing companies in the industrial park.
- International and national initiatives on cleaner production and energy efficiency.
- Being a governmental co-operation between Singapore and Vietnam, and having benefited from Sembcorp's strong expertise in industrial park development, it was developed with a core value for environmental sustainability since the beginning.
- The industrial park has also been an example for being stringent on environmental standards for tenant companies as they require that all the companies who wish to operate in the industrial park ensure the wastewater, emissions and other environmental indicators meet the VSIP I standards before being discharged to the shared systems of the cluster.
- VSIP I only serves the companies with investments that use modern and high end manufacturing technologies, environmentally-friendly technologies, clean technologies or/and energy-efficient technologies.
- Since most of the companies in VSIP I are foreign joint ventures, the common environmental awareness level is considerably high.
- Some foreign companies in VSIP I go beyond meeting the requirements and actively implement various initiatives aimed at environmental and social sustainability. Like Yakult. Especially energy and material efficiency.
- VSIP I was awarded the Green Technology Award by the Vietnam Association for Environmental Protection for good practices in environmental protection and management.
- Reduced consumption of energy, water and material provided by VISP and the companies in VISP implies some economic benefits to the companies. A good reputation for environmental performance has led to increased competitiveness of the IP. Over the years, VISP has always been the cluster with very high coverage ratio (close to 100%) contrary to many Vietnamese industrial zones.

Challenges and lessons learned

Review of the current status of industrial parks in Vietnam reveals that none of the clusters being in operation nationwide have the characteristics of an eco-industrial park as defined by UNIDO/UNEP.

- Lessons learned: VSIP I was studied in depth and a well prepared plan for its construction and implementation was executed, with environmental considerations being emphasized at the very early design stage. The strong expertise brought in by the partner company from Singapore has been of high value to the project.

- There has been a strong commitment shown by the management board of the VSIP Corporation as well as of tenant companies to implement environmental and social responsibilities.

- The support from Binh Duong People's Committee has contributed to the increased effectiveness of VSIP I operations in general and environmental performance in particular.
- Environmental management depends a lot on the initiatives of the companies themselves.
- It is not clear how is the enforcement of environmental regulations.

Suggestions and recommendations

- Governmental laws and regulations are key in steering industrial parks and the companies operating within their premises towards the eco-industrial direction.

- Companies' policies and codes of conduct determine how far they can go in implementing RECP initiatives beyond legal requirements.

- International and national initiatives are key in raising awareness and promoting the design and implementation of RECP in the industrial park.
- Industrial symbiosis (sharing of resources, raw materials exchange) needs to be explored and encouraged through advocacy and policy intervention.

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