UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

IMPLEMENTATION HANDBOOK FOR ECO-INDUSTRIAL PARKS

INCLUSIVE AND SUSTAINABLE INDUSTRIAL DEVELOPMENT

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Swiss Confederation

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

TABLE OF CONTENTS

ABBREVIATIONS

CEO	Chief executive officer
CNPML	Colombia National Cleaner Production Centre
EIP	Eco-industrial park
ELIDZ	East London Industrial Development Zone
GEF	Global Environment Facility
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GRI	Global Reporting Initiative
ICT	Information and communications technology
IDZ	Industrial development zone
IFC	International Finance Corporation
JSAID	Jiangsu Scitury Allied Investment and Development Co., Ltd.
KPI	Key performance indicator
MPI	Ministry of Planning and Investment (Viet Nam)
NCPC	National Cleaner Production Centres
NGO	Non-governmental organization
OECD	Organisation for Economic Co-operation and Development
OH&S	Occupational health and safety
PCP	Programme for Country Partnership
RECP	Resource Efficient and Cleaner Production
SAZ	Société d'Aménagement Zenata
SDG	Sustainable Development Goal
SECO	State Secretariat for Economic Affairs of Switzerland
SEZ	Special economic zone
SME	Small and medium-sized enterprise
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
WBG	World Bank Group
WISP	Western Cape Industrial Symbiosis Programme
ZETDZ	Zhenjiang Economic and Technological Development Zone

GLOSSARY

Eco-industrial park	An eco-industrial park can be defined as an earmarked area for industrial use at a suitable site that ensures sustainability through the integration of social, economic and environmental quality aspects into its siting, planning, operations, management and decommissioning. The term greenfield eco-industrial park is used for completely new EIPs, and the term brownfield is employed when an existing industrial park is transformed into an EIP.
Industrial policy (modern definition)	Any type of intervention or government policy that attempts to improve the business environment, or to alter the structure of economic activity toward sectors, technologies or tasks that are expected to offer better prospects for economic growth or societal welfare than would occur in the absence of such intervention.
Industrial synergies and symbiosis	The term "industrial synergies" covers the concept of industrial symbiosis, but it has a broader focus on the different types of industrial collaborations (Van Beers et al., 2007): 1. Supply synergies and co-location of suppliers and clients: Co-location and clustering of companies in the supply and value chains. 2. Utility synergies: Shared use of utility infrastructure, mainly revolving around water and energy. 3. Service synergies: Sharing of services and activities between companies (e.g. joint training of staff and sharing of maintenance contractors). 4. By-product synergies and waste exchanges (industrial symbiosis): The use of a previously disposed waste (as solid, liquid, gas) from one facility by another facility to provide valuable by-product.
Resource Efficient and Cleaner Production (RECP)	RECP builds on cleaner production in accelerating the application of preventive environmental strategies to processes, products and services to increase efficiency and reduce risks to humans and the environment. RECP addresses the three sustainability dimensions individually and synergistically: • Production efficiency: optimization of the productive use of natural resources (materials, energy and water). • Environmental management: minimization of impacts on environment and nature through reduction of wastes and emissions. • Human development: minimization of risks to people and communities and support for their development.
Sustainable city	A sustainable community is one that is economically, environmentally, and socially healthy and resilient. It meets challenges through integrated solutions rather than through fragmented approaches that meet one of the goals at the expense of the others (Institute for Sustainable Cities definition). The global development agenda of the United Nations advocates in Sustainable Development Goal 11, the need to "make cities and human settlements inclusive, safe, resilient and sustainable."
Tenant companies	Companies that are property owners or leasers in an eco-industrial park.

1) Introduction

1.1 UNIDO AND ECO-INDUSTRIAL PARKS

The United Nations Industrial Development Organization (UNIDO) is a specialized agency of the United Nations that promotes industrial development for poverty reduction, inclusive globalization and environmental sustainability. The responsibility of UNIDO is to contribute to inclusive and sustainable industrial development by improving the environmental performance, resource productivity and safety of existing industries, as well as by supporting the creation of new industries providing environmental goods and services.

Over the past three decades, UNIDO has promoted the mainstreaming of resource efficiency and cleaner production in industries and industrial parks located in developing and emerging economies, through pilot demonstrations as well as global knowledge and dissemination projects.

The first UNIDO pilot initiatives on eco-industrial parks (EIP) were implemented in 2010 in India (Vadodara-Ankleshwar Industrial Area and Dahej Petroleum, Chemical and Petrochemicals Investment Region, in the state of Gujarat). The same year, UNIDO introduced the concept of EIPs in Tunisia, targeting two industrial parks (Bizerte Business Park and Djebel Oust and Bir M'cherga Industrial Zone).

Since 2012, the work of UNIDO in the area of eco-industrial parks has expanded under the joint global Resource Efficient and Cleaner Production (RECP) programme with the United Nations Environment Programme (UNEP), funded by the Swiss State Secretariat of Economic Affairs (SECO). This programme conducted a global assessment of eco-industrial parks in developing countries, targeting 33 industrial parks in 12 countries (UNIDO, 2016a). Since 2015, UNIDO has implemented EIP pilot projects in six countries under the global RECP programme (China, India, Morocco, South Africa, Colombia and Peru). Moreover, an EIP country project is implemented in Viet Nam, funded by the Global Environment Facility (GEF) and SECO.

A summary of these projects is shown in *Figure 1*.

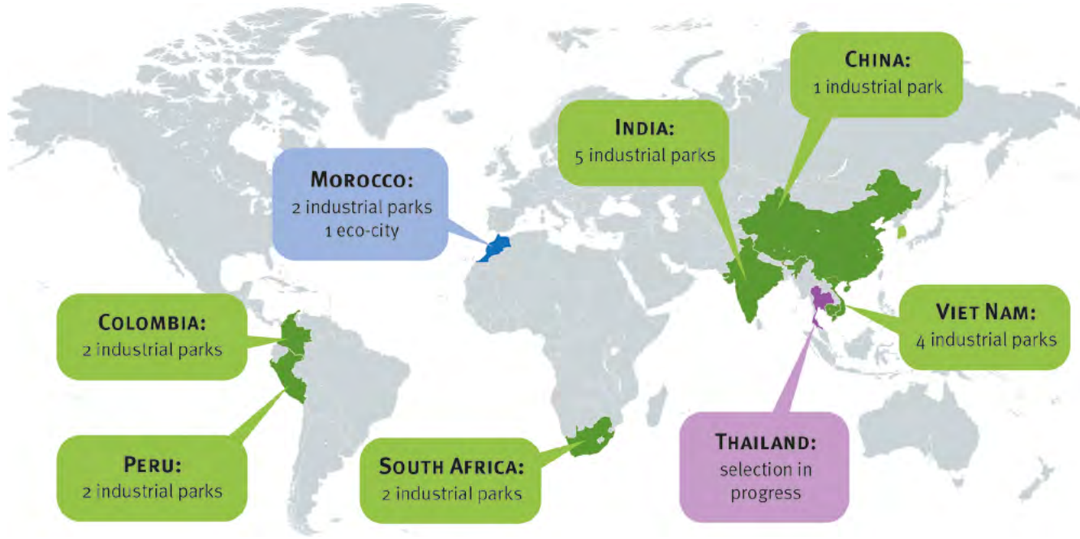

Figure 1: Map of UNIDO's current eco-industrial park projects in developing and transition countries

- **China:** UNIDO is collaborating with the Jiangsu Scitury Allied Investment and Development Co., Ltd. (JSAID) to implement EIP initiatives with a key focus on the promotion and implementation of RECP techniques and industrial synergies. The work is undertaken in the Zhenjiang Economic and Technological Development Zone (ZETDZ) located in the eastern part of Zhenjiang city. Approximately 10 different industrial parks are located in this area, which represents opportunities as well as challenges to implement industrial synergies.

- **Colombia:** UNIDO and the Colombia National Cleaner Production Centre (CNPML) are collaborating on the development of EIP initiatives in Colombia. A pre-assessment phase resulted in the selection of two industrial parks, near the cities of Medellín and Barranquilla. UNIDO support includes RECP assessments in individual companies, the promotion of industrial synergies between companies as well as the strengthening of park management capacities.

- **India:** In India, UNIDO has focused on five industrial parks. Two parks are in the state of Telangana near the city of Hyderabad, one in Andhra Pradesh and two in the state of Gujarat. The work focuses on the implementation of RECP within companies and the development of industrial synergies as well as widespread awareness raising activities in the five industrial parks.

- **Morocco:** In 2006, a dedicated company (Société d'Aménagement Zenata or SAZ) was set up to conceptualize, plan and implement a sustainable city near the city of Casablanca (Zenata). In this project, UNIDO focuses on two industrial parks, namely Zenata Industrial Park (a brownfield park designed to host existing industries previously dispersed throughout the area) and Zenata Cyclopolis - Benichou area (a greenfield park reserved for future industrial activities).

- **Peru:** As part of the UNIDO Programme for Country Partnership (PCP), UNIDO provides technical assistance and policy advice to support the implementation of the National Plan for Productive Diversification, a comprehensive industrial policy established in 2014 and implemented by the Ministry of Production. A key component of the national plan is the establishment of new industrial parks and transformation of existing industrial areas. Specific UNIDO support includes implementing a GEF-funded initiative for the promotion of a sustainable industrial area in Callao, sustainability reviews of industrial park master plans (e.g. Ancón Industrial Park), and evaluation/prioritization of manufacturing sectors for the development of sustainable industrial parks in the country.

- **South Africa:** Two industrial parks with different management models were selected in South Africa, namely Epping City Improvement District (an industrial area close to the city of Cape Town), and East London Industrial Development Zone (Eastern Cape Province). A key focus of the work in South Africa is capacity building activities for park management entities as well as identifying industrial symbiosis options.

- **Thailand:** In 2017, a GEF-funded project preparation phase is being implemented, focusing on industrial and urban symbiosis as well as green chemistry, to reduce the release of hazardous chemicals and greenhouse gas emissions. Industrial parks that will participate in the project have not yet been selected, but several provinces have already expressed interest.

- **Viet Nam:** The Vietnamese Ministry of Planning and Investment (MPI) and UNIDO jointly developed a GEF- and SECO-funded project to introduce and implement management systems in selected industrial zones in the country. The project's objectives are to reduce greenhouse gas (GHG) emissions, water consumption, water pollution, persistent organic pollutants and other chemicals of global concern and to demonstrate innovative, clean and low-carbon practices in industries. Industrial zones are targeted in three different provinces, namely Ninh Binh, Can Tho and Da Nang.

1.2 WHY THIS HANDBOOK?

In promoting and supporting the development of eco-industrial parks, UNIDO aims to mainstream and upscale the application of Resource Efficient and Cleaner Production (RECP) by businesses and government and contribute to sustainable consumption and production. In 2015, 17 Sustainable Development Goals (SDGs) were accepted as a set of targets and indicators by United Nations members to frame their agendas and political policies. Eco-industrial parks can serve as a catalyst to all SDGs (to various extents), but most explicitly to SDG 9, to build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.

Numerous publications, tools and studies, delivered with UNIDO support, are directly or indirectly related to the development and implementation of eco-industrial parks. The rationale for this handbook is to bring together the technical experience of UNIDO in developing and implementing EIP projects as well as to provide demonstrated guidance in this area.

This handbook is intended to be applicable to:

- Industrial parks in various international contexts with core focus on transition and developing countries
- All development stages of industrial parks (e.g. scoping and concept planning, pre-feasibility and feasibility studies, investment decisions, design and construction, operation, redesign and optimization)
- Industrial parks with different characteristics (e.g. types of industry sectors in park, park size, level of technology development, park management model)

1.3 OBJECTIVES OF THIS HANDBOOK

The overall aim of this handbook is to assist private and public sector stakeholders with the practical implementation of eco-industrial park concepts into existing industrial parks (brownfields) and new industrial parks (greenfields).

This handbook aims to:

- Assist practitioners with the implementation of EIPs, covering scoping EIP interventions, awareness raising, policy support, park management models, upscaling resource efficiency and industrial synergies/symbiosis, performance monitoring and benchmarking, and contribution to sustainable cities.
- Summarize the success factors which are important to consider when implementing EIP approaches.
- Clearly outline the implementation steps of EIP development.
- Introduce practical tools available to support the implementation of EIPs.
- Present practical examples to illustrate lessons learned and benefits from international experiences.
- Raise awareness of the benefits and added value of EIPs, including alignment with international priorities such as the Sustainable Development Goals, climate change mitigation and sustainable and inclusive industrial development.

1.4 WHO IS THIS HANDBOOK FOR?

The key beneficiaries of this handbook are governmental institutions seeking to develop or adjust current industrial park-related policies, and private sector stakeholders who are involved in the actual development and improvement activities of eco-industrial parks.
The target audiences for this handbook are:

- Industrial park operators and management
- Industries and businesses operating in the industrial parks
- Governments and regulators responsible for the development and operation of industrial parks
- Providers of infrastructure and utility services for industrial parks
- Private sector organizations responsible for industrial land development
- Financial sector and funding agencies
- International support organizations and service providers, including National Cleaner Production Centres (NCPCs), development agencies, technical and management consultancies
- Educational institutions providing training and capacity building services

Building on the points above, the intended use of the handbook by targeted stakeholders is summarized in Table 1.

Intended use of the handbook						
Stakeholders / **Intended use**	Develop improvement opportunities and reduce risks in design and planning of industrial parks	Inform investment decisions, funding allocation and due diligence studies, access funding	Assist with scaling up, replicating, promoting existing good EIP practices	Gain recognition and build market profile	Serve as consolidated approach to provide better services and support to customers	Provide a practical approach to support decision-making within their own organization
Park operators and management	✔	✔	(✔)	✔	✔	✔
Park tenants (industries and business)	✔	(✔)				✔
Governments and regulators	✔	✔	✔	✔		✔
Private sector organizations in industrial land development	✔	✔	✔	✔		✔
Financial sector and funding agencies		✔	✔			✔
International support organizations and service providers	✔	✔	✔		✔	✔
Educational institutions			✔			

Table 1: *Intended use of the handbook by targeted stakeholders*

1.5 WHAT IS AN ECO-INDUSTRIAL PARK?

Throughout the world, eco-industrial park approaches are characterized by different definitions, classifications and contexts. A recent UNIDO study on the review of eco-industrial park practices (UNIDO, 2016a) concluded the following:

- Eco-industrial parks mean different things to different parties.
- Practice does not yet match ambition.
- Process and continuous improvement-based approaches appear most useful.
- Lack of experience, awareness, supporting regulations and their enforcement slow down the development and implementation of eco-industrial parks.
- Many good practice elements exist, yet need to be brought together and implemented routinely in planning, development and management of industrial parks.

Various definitions are used in relation to eco-industrial parks. This handbook refers to the following definition, commonly employed at UNIDO, which recognizes the importance of the three pillars of sustainable development and of integrating EIP considerations into all phases of the development and operations of industrial parks:

An eco-industrial park can be defined as *"a community of manufacturing and service businesses located together on a common property. Member businesses seek enhanced environmental, economic, and social performance through collaboration in managing environmental and resource issues."* (Lowe, 2001)

In this regard, compliance with national and local regulations is the baseline for all industrial parks, whatever the geographical location and specific characteristics of the park. Eco-industrial parks therefore should go beyond compliance with local and national regulations on environmental and social requirements ("compliance+").
Under the current cooperation between UNIDO, the World Bank Group and GIZ such minimum requirements are being developed with the aim to enable a streamlined international framework for eco-industrial parks. Different terminology is used by different organizations in different countries (e.g. sustainable industrial parks, low carbon zones, green industrial areas). Each title alludes to a dedicated area for industrial development supported with park level infrastructures and utility services which enhance their business performance, while at the same time addressing technical, infrastructural, managerial, environmental, social, economic and monitoring aspects to make the area more sustainable.

1.6 WHY ECO-INDUSTRIAL PARKS?

International good practices illustrate that the types of economic, environmental, and social benefits from eco-industrial parks vary greatly and go well beyond the conventional business case benefits (UNIDO, 2016a; Van Berkel, 2006; WBG, 2016).
The benefits are not just commercial but also strategic, leading to reduced exposure to risk, increased competitiveness, business development, production continuity and a better reputation with key stakeholders.
Eco-industrial parks enable companies to benefit from greater collaboration and exchanges within companies (between management, technical and environmental staff, finance, etc.), as well as between companies, government and service providers. Companies are enabled collectively to turn environmental problems into business solutions by using resources efficiently and cooperating through shared infrastructure.

The main economic benefits are direct and indirect employment creation; cost savings due to reductions in waste disposal, resource and energy consumption; and increased competitiveness. Some eco-industrial parks report higher foreign direct investment in their parks. Indirect benefits are often more difficult to quantify but are important for the long-term economic sustainability of the park and the companies. These can include indirect employment creation through skills upgrading and training, technology transfer, positive image, demonstration effect arising from application of best practices, and regional development.

Environmental benefits from eco-industrial parks are very diverse and include reduction of pollution levels, more efficient use of resources (e.g. raw materials, water, energy), preservation and protection of biodiversity and nature, and reduction, reuse and recycling of wastes. Additionally, improved management of chemical and hazardous substances in an eco-industrial park can lead to significant environmental benefits.

Social benefits from EIP development range from the creation of local jobs, better working and labor conditions, local community well-being and community outreach, improvement of gender
equity, crime prevention and better security. Eco-industrial parks often involve the creation of a social infrastructure as well, which is particularly important for developing countries. Examples include vocational training centres, skills development training as well as broader community services.

Drivers, such as access to finance, technical support, role of government agencies, policies and economic benefits were noted by most of the cases analyzed by a UNIDO comparative study (2016a). Drivers highlighted in international cases are to a large degree specific to the respective industrial parks. One of the most significant drivers for eco-industrial parks remains grounded in business competitiveness.
Industries operating in well-designed and well-managed eco-industrial parks are in a better position to take advantage of resource efficiency, value-adding and risk-mitigating measures and services available at the park level. The full list of drivers and barriers in terms of EIP developments can be found in the UNIDO global assessment (2016a).

From an industrial competitiveness perspective, the main drivers for eco-industrial parks are:

- Reducing operating costs and improving productivity
- Greening supply and value chains
- Mitigating climate change
- Improving resource supply security, management and efficiencies (e.g. materials, water, energy)
- Reducing business risks, by recognizing that environmental and social risks are economic risks
- Addressing environmental and social topics relevant to local community and government to ensure long-term license to operate industrial parks