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Challenges of the linear model of production in industrial parks/clusters and the drivers of change in circular economy approaches.

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Overview

- Current Linear Economic Model
- Circular Economy Model
- Transforming Industrial Parks to Eco Industrial Parks
- The role of Eco Industrial Parks in the transition to Circular Economy
- Examples of CE in EIP

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Current linear economic model

RAW MATERIALS → PRODUCTS → WASTE

In the linear economy, raw materials become new products. After use, they are removed from the economy, returning to the environment as pollution.

Water and food → **Waste water**

Energy and fuels → **Emissions into the atmosphere**

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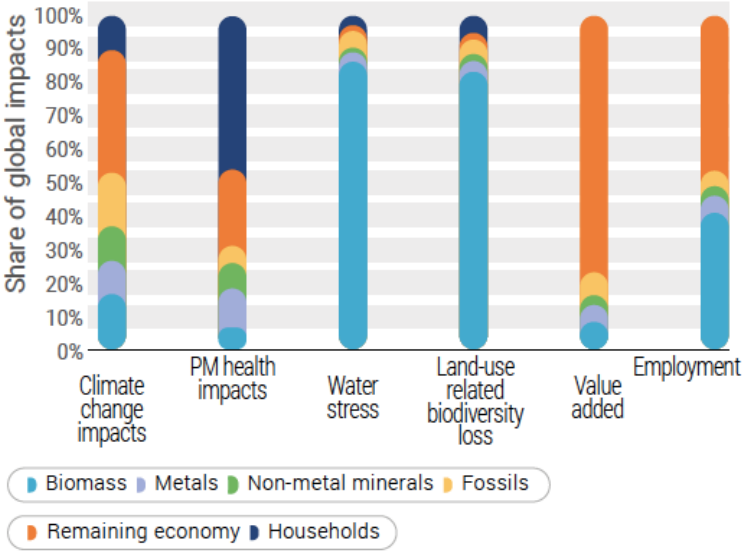
Global impacts of resource consumption



- ~50% of climate impacts
- ~90% of water stress
- ~90% of biodiversity loss due to land use

BUT

Production and consumption also create lots of **value added** and **jobs**

Global Resource Outlook 2019 (https://www.resourcepanel.org/reports/global-resources-outlook), International Resource Panel, 2019

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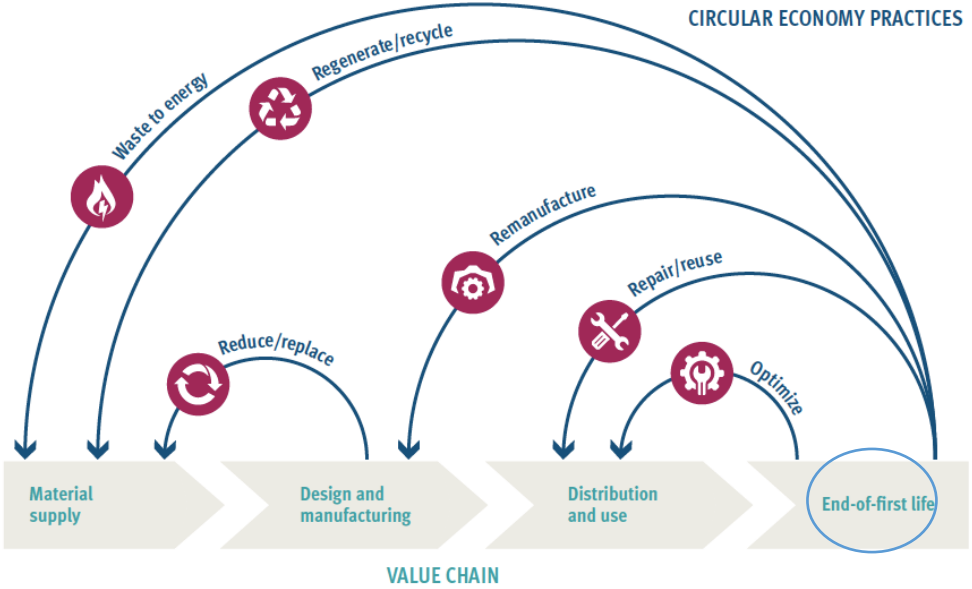
Circular economy

- Returns products, parts and materials into use several times
- By
  - Designing products to last
  - Maintaining value for as long as possible in the economy
  - Minimizing generation of waste and pollution, and
  - Using renewable energy along value chains, as much as possible



- Enablers: **Innovation, Digitalization, Leadership, Partnership and Collaboration** between businesses, governments, and citizens

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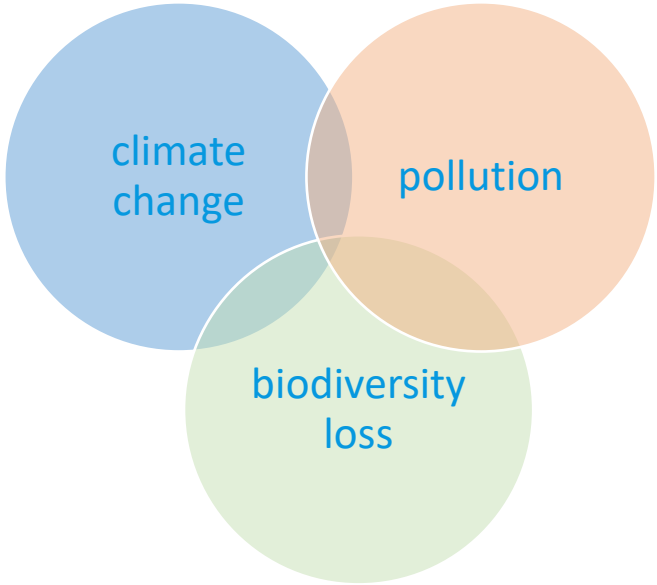
Circular economy addresses 3 interlinked challenges



It is an economic transformation

- Upgrades industries through ***innovation***,
- Increases ***competitiveness***,
- Creates ***new jobs*** and
- Increases ***resilience*** of firms and countries.

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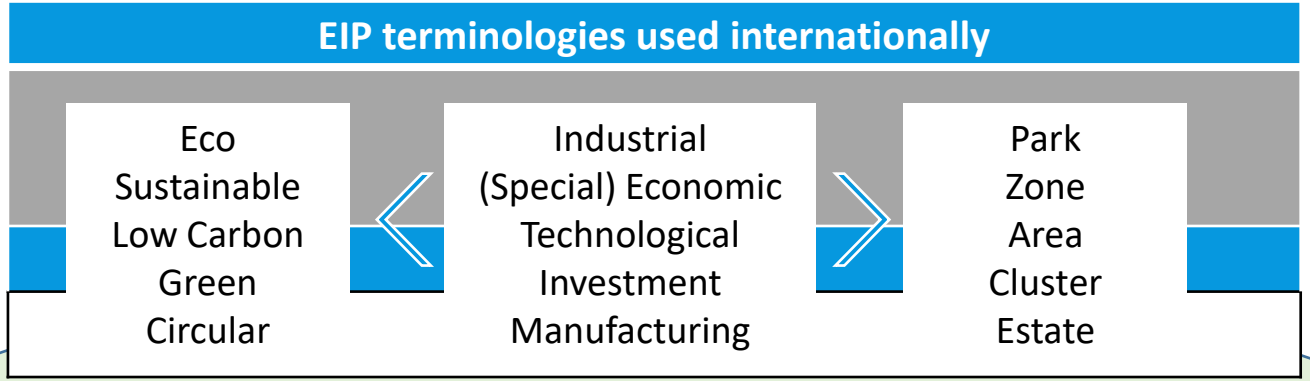
Eco-Industrial Parks: The concept



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. By working together, the community of businesses seeks a collective benefit that is greater than the sum of individual benefits each company would realize by only optimizing its individual performance.

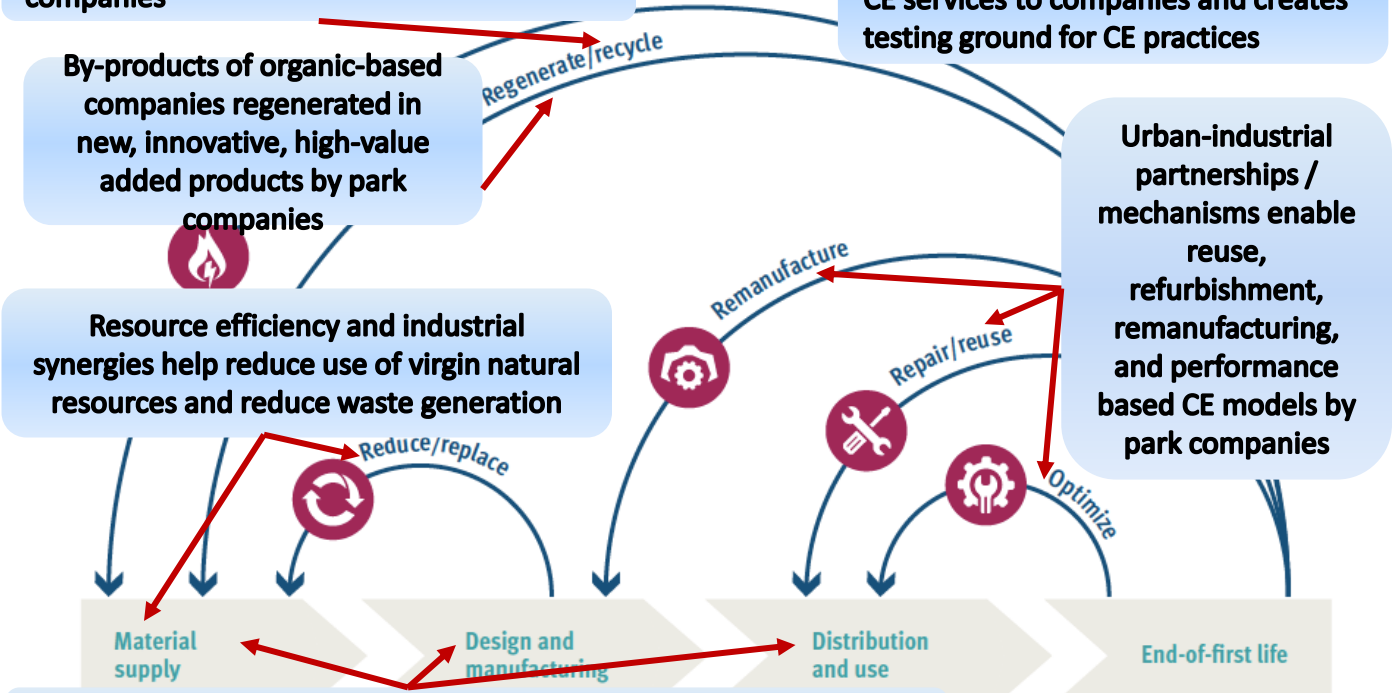
Recycling facilities synergies between park companies

Overall, park management facilitates CE services to companies and creates testing ground for CE practices

By-products of organic-based companies regenerated in new, innovative, high-value added products by park companies

Urban-industrial partnerships / mechanisms enable reuse, refurbishment, remanufacturing, and performance based CE models by park companies

Resource efficiency and industrial synergies help reduce use of virgin natural resources and reduce waste generation



Joint learning on ecodesign, new market requirements, digitalization, CE business models offered to park companies and their suppliers

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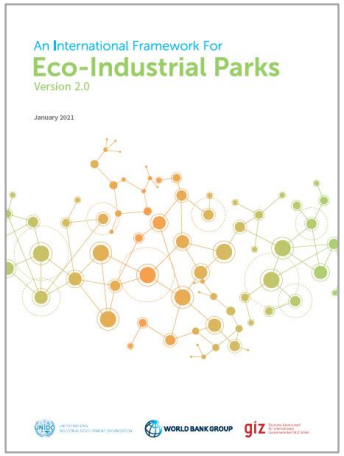
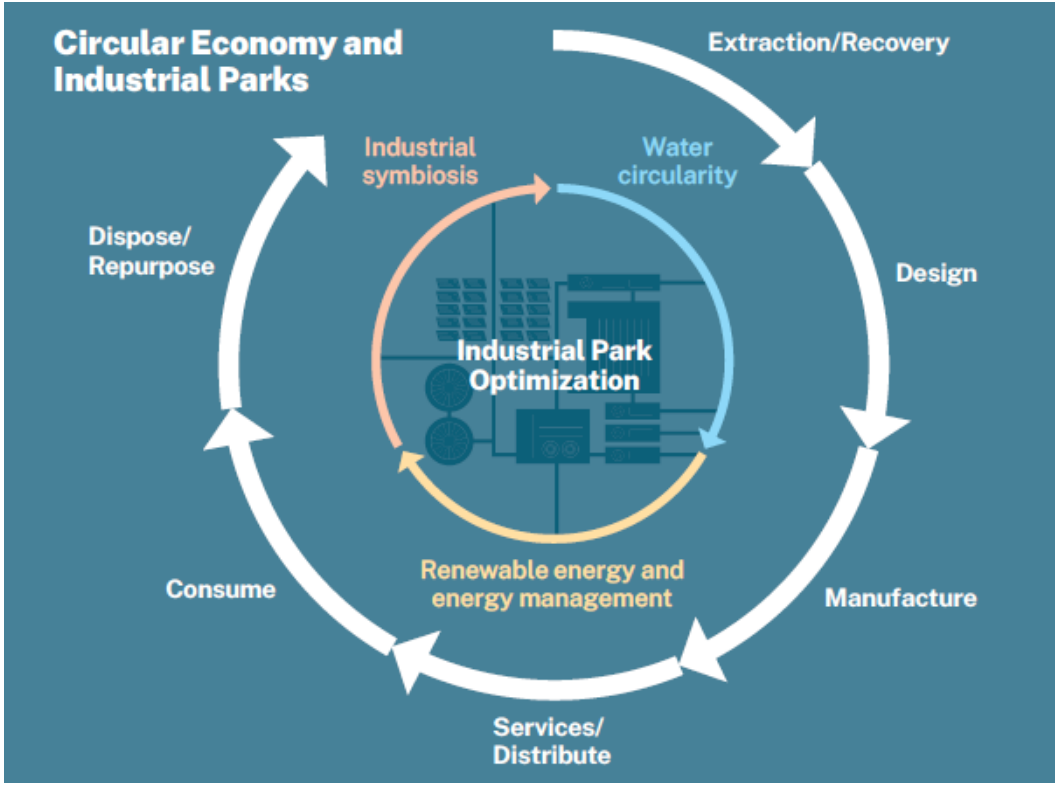
Eco-Industrial Parks (EIPs)

Circular economy principles applied in industrial parks



International Framework for Eco-Industrial Parks by UNIDO, World Bank and GIZ
(Published in 2017, Second edition in 2021)



Source: Circular Economy in Industrial Parks: Technologies for Competitiveness. The World Bank. 2021

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Industrial parks can adopt a combination of different strategies to foster the circular economy

- Fostering the establishment of recycling enterprises and sorting facilities rendering services to tenant firms
- Rethinking business models for improved energy, water, and waste management at the park level
- Harnessing digital technologies to increase resource circularity and material exchange
- Promoting green investments
- Generating circular business models and circular products

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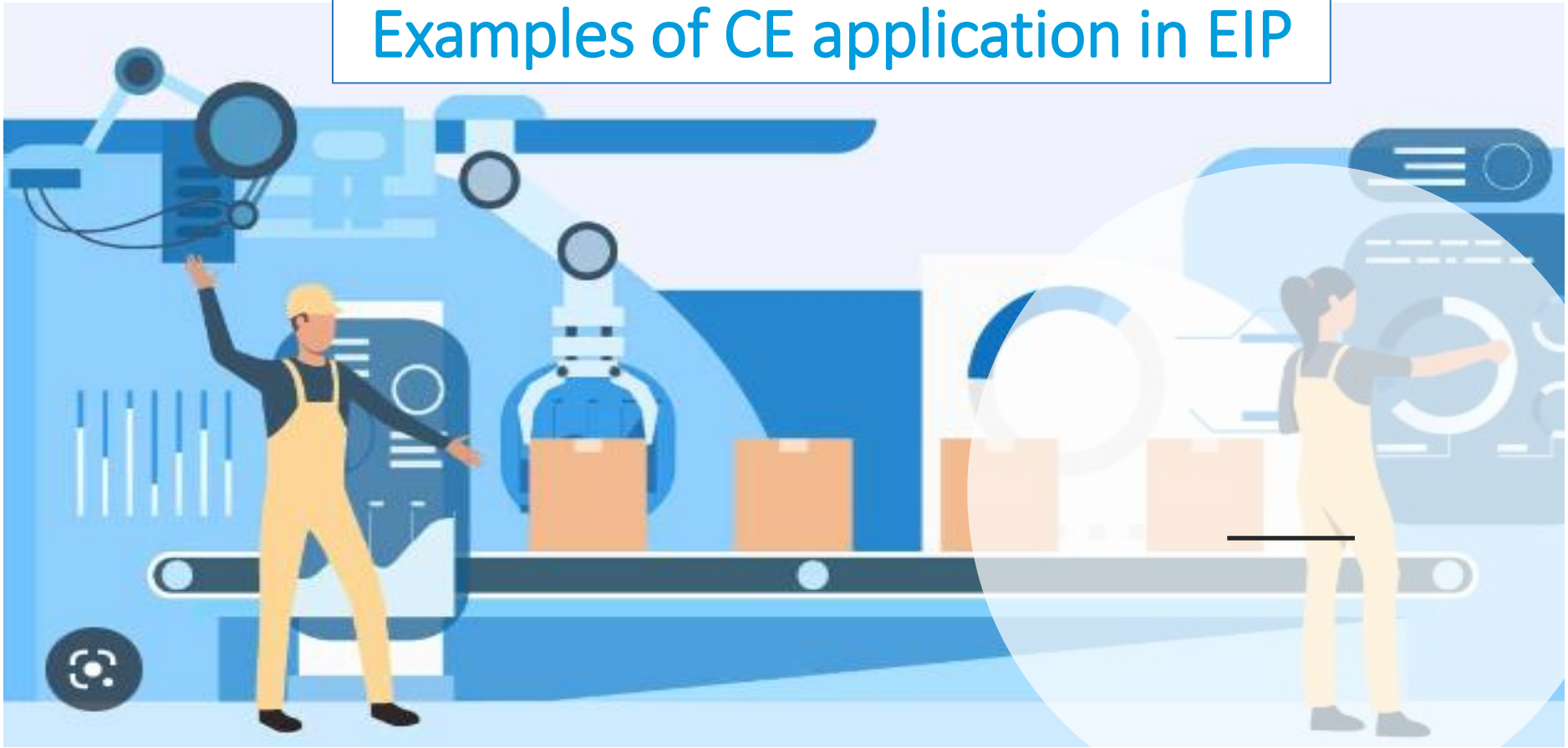
Examples of CE application in EIP



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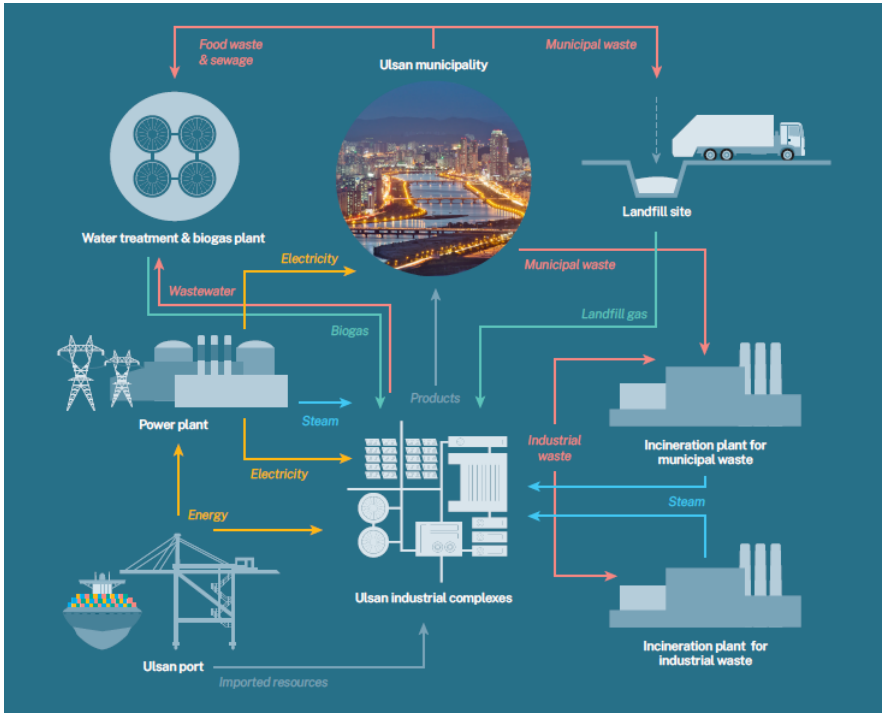
Urban-industrial symbiosis in Ulsan EIP, Republic of Korea

Ulsan metropolitan city and its EIP are engaged in a symbiotic relationship in which urban wastes are being used by tenant firms within the EIP in three ways:

- Part of the municipal waste is incinerated, and the energy generated is used to generate steam, which is transported to the EIP.
- The remainder of the waste is dumped in a landfill, the gas from which is transported to the EIP and used as a primary fuel for production processes of the tenant firms.
- Food waste and sewage of the municipal region is used to generate biogas through aerobic digestion which is used as a fuel for the EIP.



Ground-mounted solar technology in Konya Organized Industrial Zone (OIZ) (Turkey)

Circular economy solution and technologies

Ground-mounted solar farms with a total capacity of 4.5 megawatts were built on three pieces of nonoperational land within the park (figure B3.5.1). The total size of these solar farms is approximately 65,000 m^2. In this case, the energy generated in the industrial park is distributed to tenant firms.

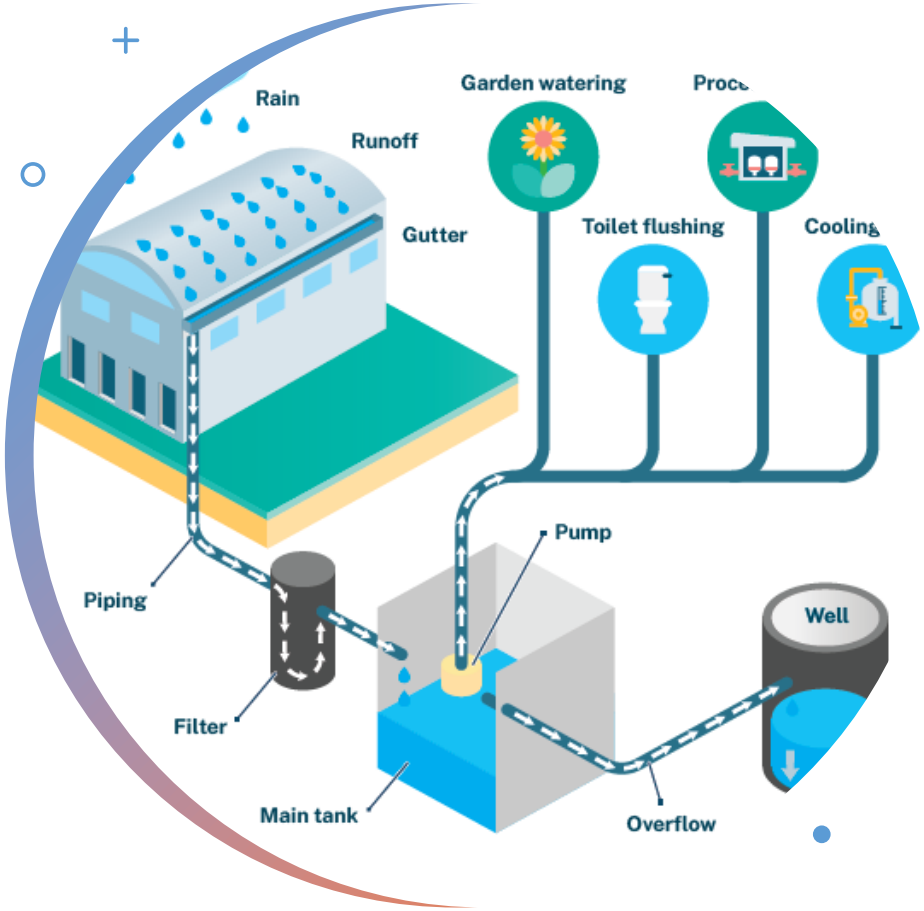
Results

- **Utility cost savings:** Considering the average tariff in 2019 ($0.087/kWh) and total power generation potential, annual power cost savings for the park are approximately $804,000.
- **Annual greenhouse gas reduction:** 4,420 tCO_2e (considering only grid electricity is replaced and the grid emission factor of Turkey is 478 tons/GWh).

Konya OIZ authority.

Roof-mounted solar technology in Batamindo IP

- 472 kW (first stage)
- total planned 5 KW



Schematic diagram of typical rainwater harvesting system

Circular economy approaches are critical in industrial parks and EIPs operating in water-stressed areas, especially in minimizing the withdrawal of depletable freshwater and maximizing water/wastewater reuse. Three technologies stand out for providing innovative and cost-effective solutions in water-stressed industrial parks: rainwater harvesting, desalination, and membrane technologies

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WWTP for Material recovery

Heavy and valuable metal recovery technology in Tianjin Industrial Park, China

- Electroplating is a finishing process for coating metal objects and is widely used in automotive
- It is known as one of the most polluting processes due to the complexity of the heavy metal and toxic content in its wastewater effluents
- an electroplating wastewater treatment system is operated through the combination of a centralized effluent plant
- deposits are sent to the centralized wastewater treatment plant, where they are further refined to extract metals that can be reused in the source electroplating plants operating in the industrial parks.

Photo credit: Lakeview Images.

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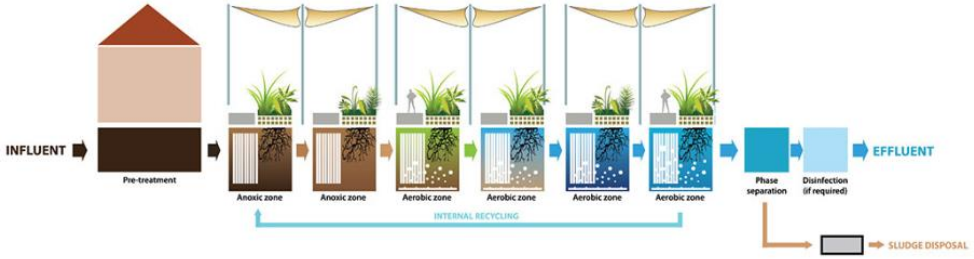
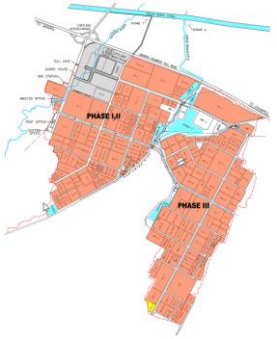
Nature Based Solutions for WWT (food chain reactor)



- CAPEX (30% savings)
- OPEX (60 % savings)
- 20% less sludge
- aesthetically pleasing treatment plant



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1. Vietnam: Ninh Binh Gas Company & Khanh Phu IP: Utilizing the exhaust gas for producing liquified CO_2

The chemical process for producing Nitrogen fertilizers from air and natural gas (methane) yields a side stream of very pure CO_2

Instead of venting this out in the atmosphere as a GHG, a neighboring company captures and pipes it for further processing and liquifying.

The clean liquidized CO_2 is used in medical and food industries

Ninh Binh Fertilizer Plant

Benefits:

- Reduce over 74,000 tons of emissions released into the environment each year.
- It is expected to increase capacity to 12,000 m^3 CO_2/hour

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2. South Africa: “Using AI to turn CO2 emissions from food industry into baking soda” in Babelegi Industrial Park

- Emissions Capture Company (ECCO): converts CO_2 emissions from Nestlé company into water and food-grade bicarbonate of soda in another industry

Benefits:

- 25-75% of scope 1 **CO_2 emissions captured**
- Carbon footprint of baking soda 22 times lower than in conventional baking soda production
- **Recycling 70,000 m^3 of water per year** saves up to 1.4 million m^3 needed for the conventional baking soda production

Conclusions

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Conclusions

- Eco-Industrial parks (EIPs) are important building blocks of the circular economy (CE).
- The impact of EIPs in promoting CE is greater in combination with support to key value chains.
- Industrial park developers and operators have vital roles to play in mainstreaming CE principles.
- Promoting stakeholder collaboration is key to developing innovative, locally tailored, and technically and economically workable CE solutions.
- Build new business models to mainstream CE approaches such as innovative contract agreements, e.g., in product-as-service CE business models and financing options, e.g. public-private partnerships that move CE forward.

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Conclusions

- Strengthen institutional capacity, competencies and skills in the industrial ecosystem, particularly for CE-industrial parks nexus.
- Policy and financial incentives are critical to addressing barriers and creating synergies among various CE solutions adopted within and across industrial parks.
- Promote innovation to achieve technology solutions in line with the CE in industrial parks.
- Create knowledge sharing networks and pre-competitive spaces for businesses in and outside of industrial parks on CE.
- Synergies between circular economy practices in industrial parks and industry sectors is needed to maximize potential benefits.
- Educate citizens on benefits of CE to help create demand for circular products.


Thank you!
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