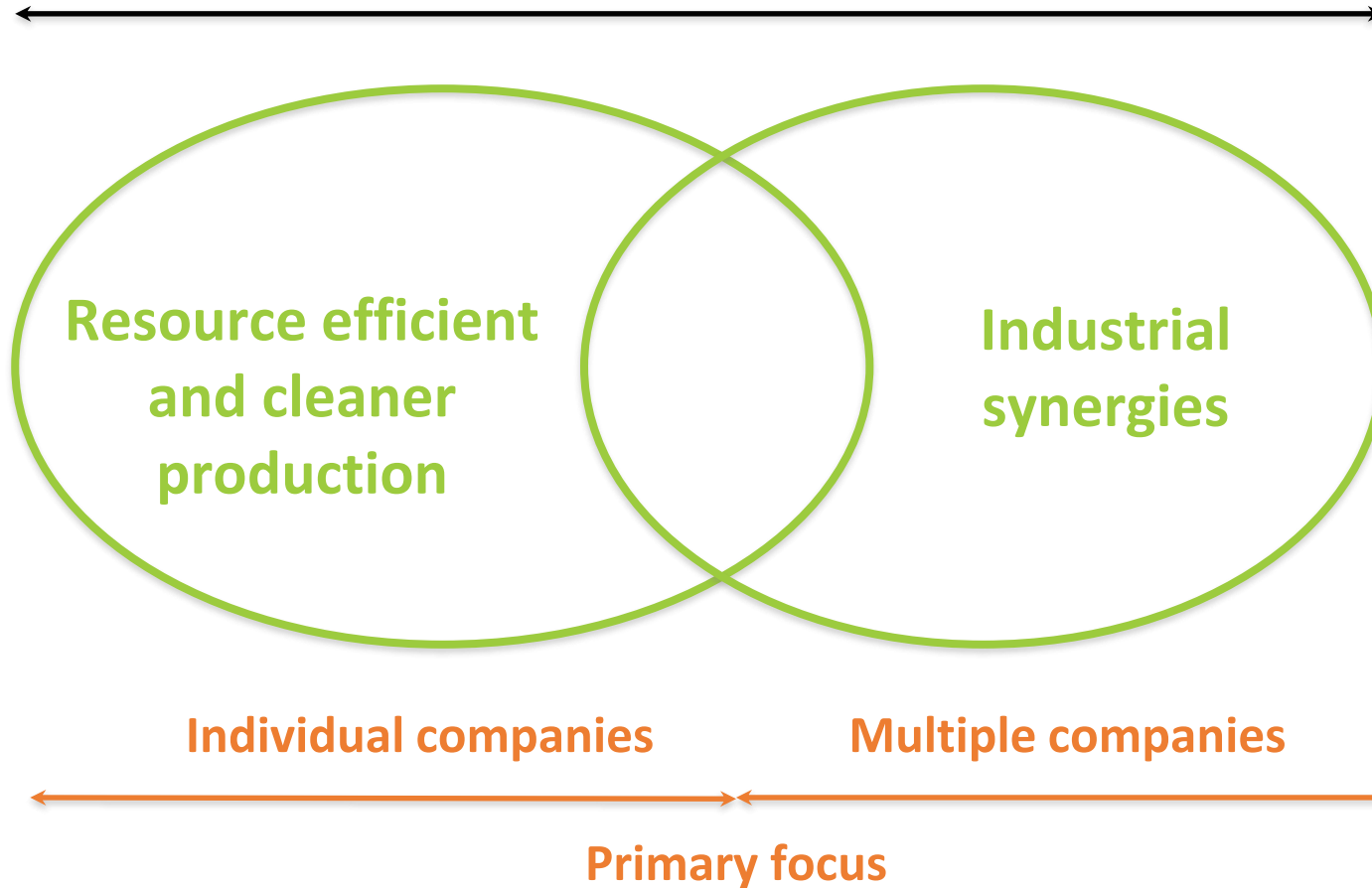


# RECP and Industrial Synergies: key elements of EIPs and clusters

Improve economic, environmental, and social performance and increase resource efficiencies



# RESOURCE EFFICIENT AND CLEANER PRODUCTION

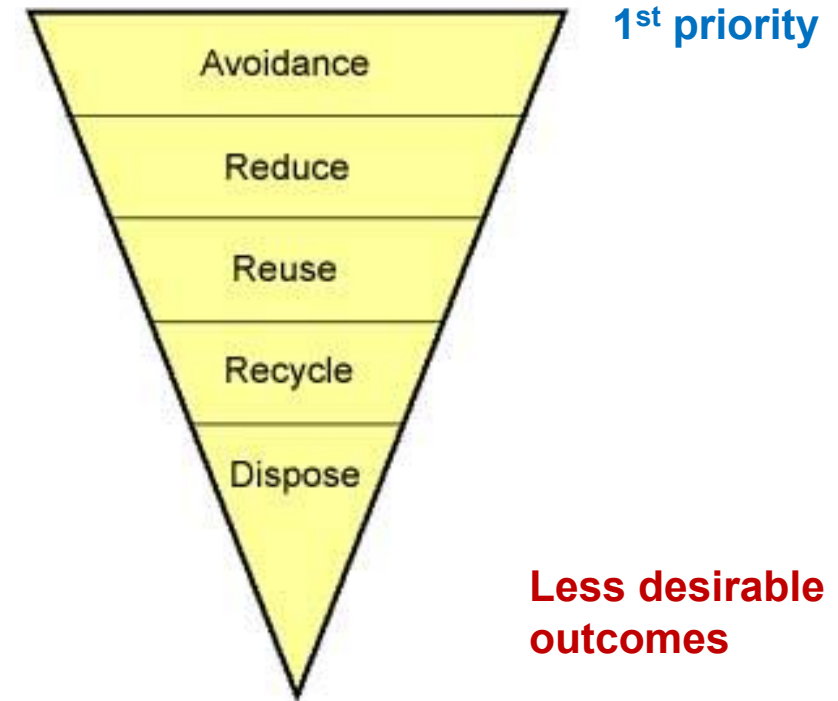


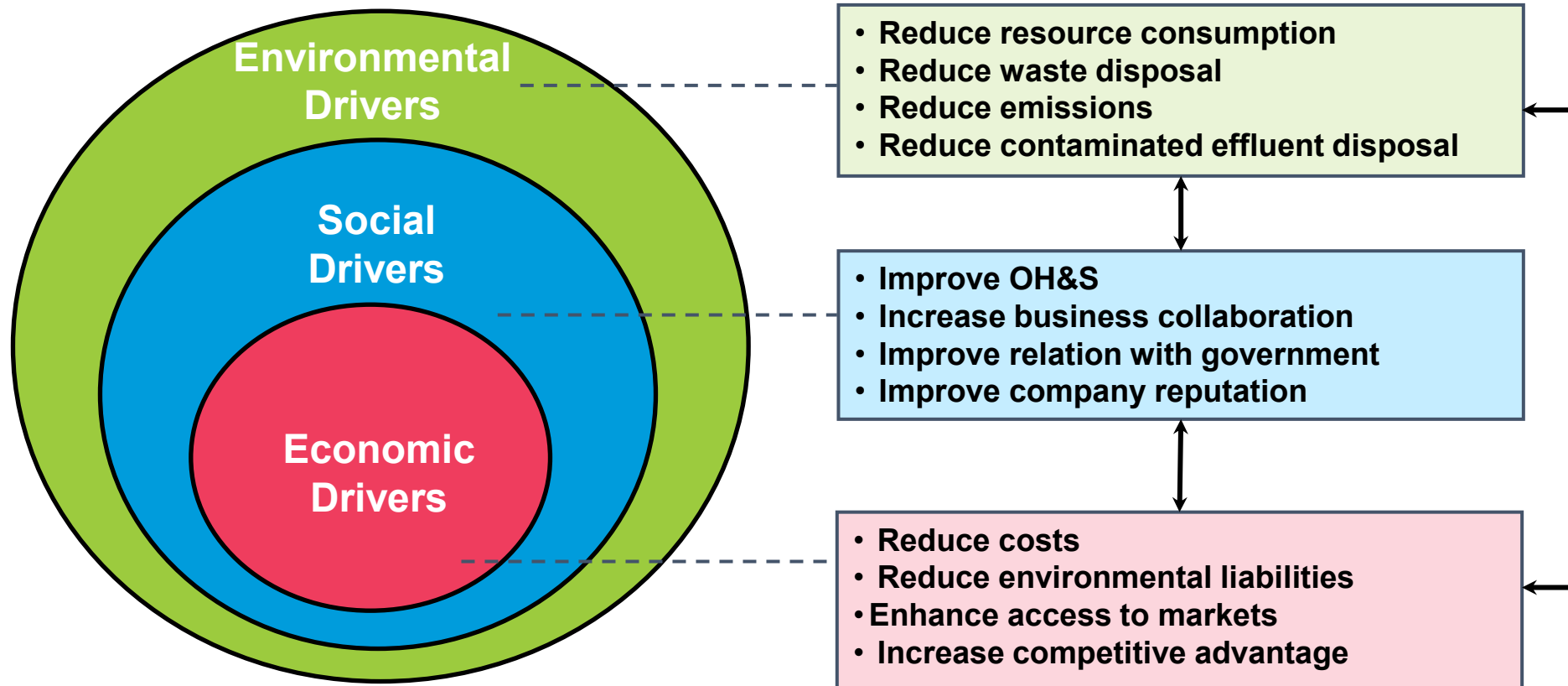
## DOING MORE WITH LESS!

Preventive approach to processes, products and services to increase efficiency and reduce risks to humans and the environment

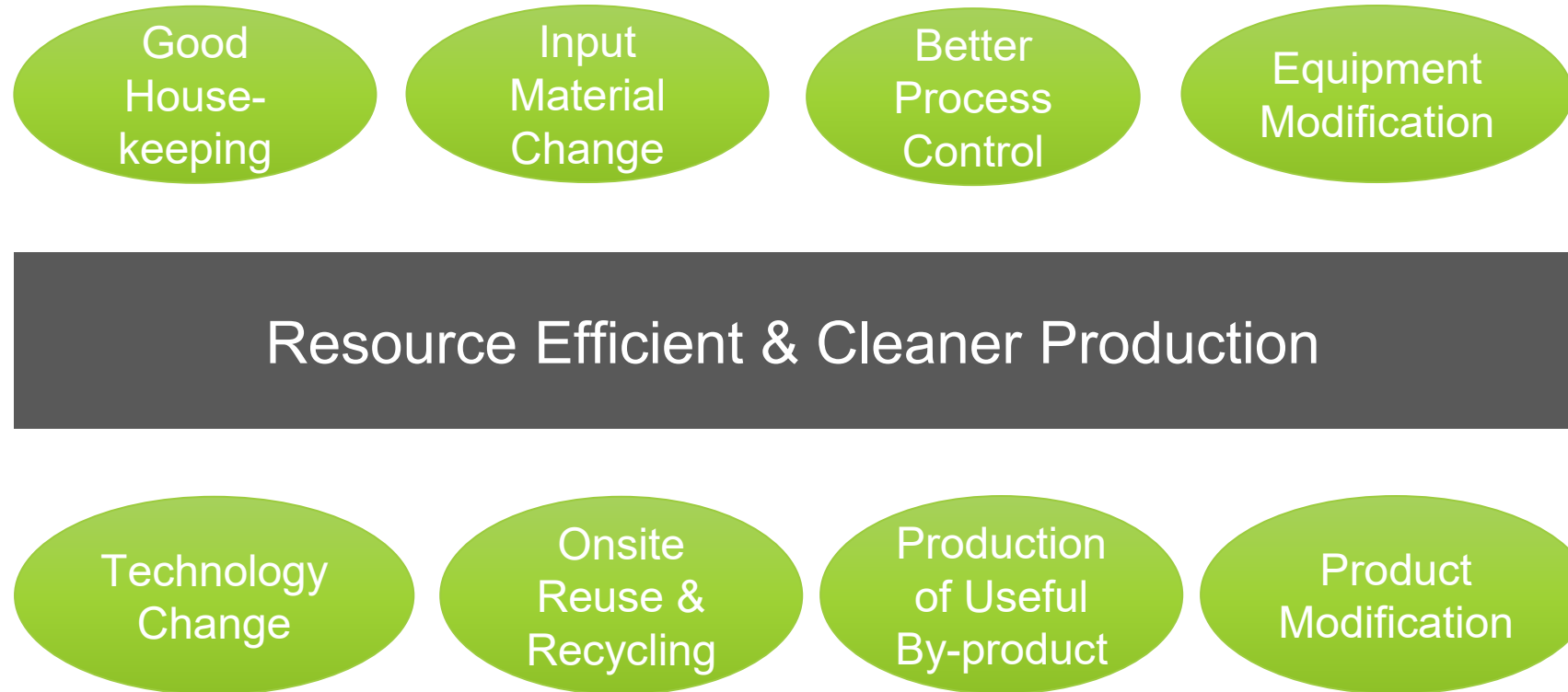
### Focus

- Low-hanging fruit opportunities (“good housekeeping”)
- Investment opportunities





**Environmental and social risks are business risks ! \$\$\$**

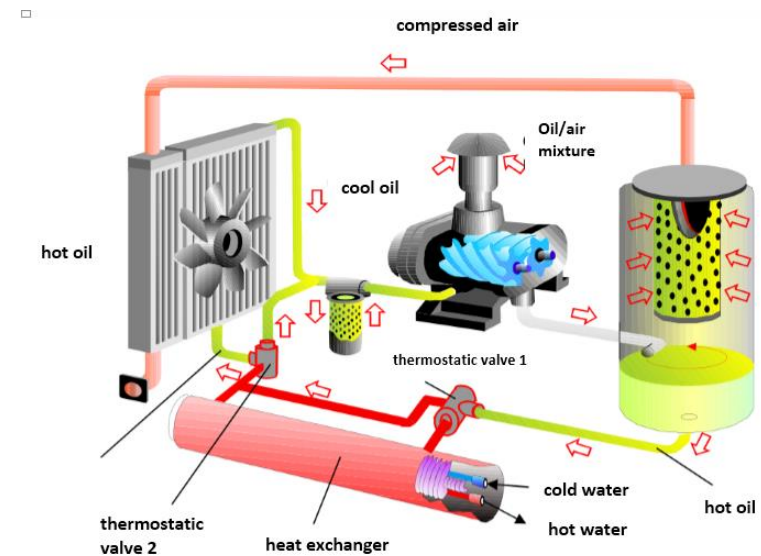


**Technology  
Change**

## Heat recovery from compressors for water heating

- Furniture company implemented RECP option to equip 4 air-cooled compressors with additional water-cooled heat exchanger. Water temperature can reach 75°C.
- Heat from compressors is now utilized for hot water supply

Item	Value
Average power consumption of the compressor	35 kW
Heat extraction potential	24.5 kW
Hours of utilization per year	3,000 hours
Heat extraction per year	73,500 kWh
Reducing natural gas consumption (equivalent)	7,737 m <sup>3</sup>
Natural gas cost	0.55 US\$/m <sup>3</sup>
Economic benefits	4,300 US\$/yr
Water amount for heating up from 12 to 55°C per year	2,600 m <sup>3</sup>
Compressor upgrade cost	1,110 US\$
Cost of auxiliary equipment to connect to hot water supply system	3,600 US\$
Payback period	1.1 years



Energy savings	Annual savings			Investment	Payback
	US\$	kWh	tCO2/year	US\$	Years
Repair steam leaks	US\$ 2 075	19 520	22.5	US\$ 0	Immediate
Boiler economiser	US\$ 45 000	42 500	11.8	US\$ 117 600	2.6

Water savings	Annual savings		Investment	Payback
	US\$	Kiloliters (kl)	US\$	Years
Optimise floor cleaning	US\$ 810	551 kl	US\$ 0	0
Good housekeeping (e.g. machine cleaning, pressure control)	US\$ 56 500	43 649 kl	US\$ 29 400	≤ 1 year

Waste savings	Annual savings		Investment	Payback
	US\$	Amount	US\$	Years
On-site solid waste recovery	US\$ 6 555	125 000 kg	US\$ 0	Immediate
Use of alternative fuel at boiler	US\$ 63 520	95 000 liters	US\$ 46 320	0.7



Source: National Cleaner Production Centre South Africa.

## Many good practices exist:

- <http://ncpc.co.za/energy-efficiency/case-studies-and-success-stories-4>
- <http://ncpc.co.za/services-about-ncpc-2/case-studies-and-success-stories>

Click on weblink to find practical examples relevant to your company

## Preparation

- Motivation, commitment & team
- RECP Profile

## Initial assessment

- Process flow chart & factory layout
- Walk through audit

## Detailed assessment

- Analysis of materials, energy and water balances
- RECP opportunity generation

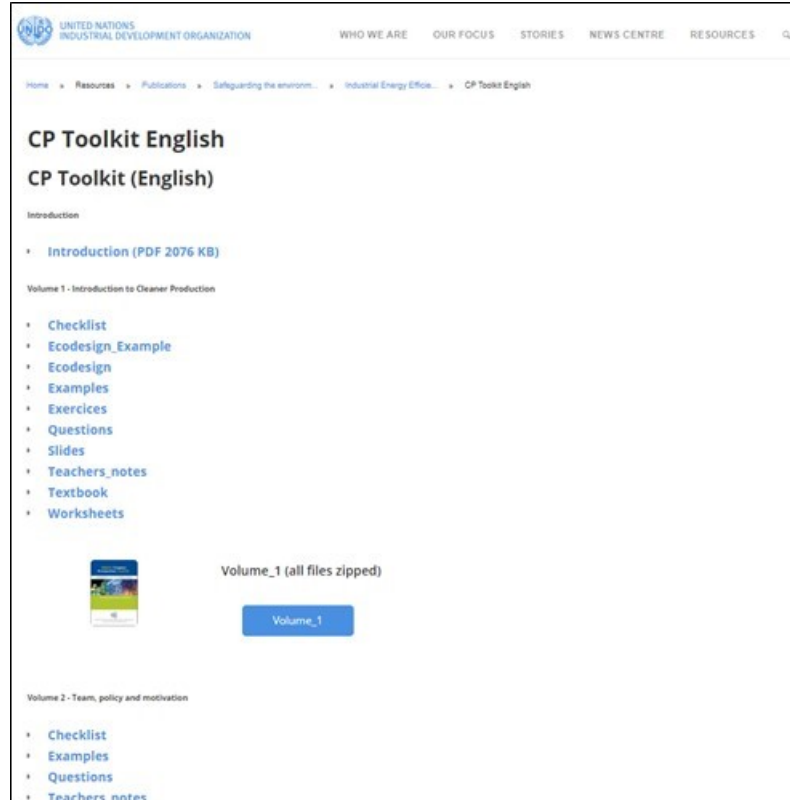
## Feasibility studies

- Technical Evaluation
- Economic Evaluation

## Implementation

- Project implementation & investment
- Ongoing monitoring & evaluation

## UNIDO (2006). Cleaner Production Toolkit.



[www.unido.org/resources/publications/safeguarding-environment/industrial-energy-efficiency/cp-toolkit-english](http://www.unido.org/resources/publications/safeguarding-environment/industrial-energy-efficiency/cp-toolkit-english)

## UNEP and UNIDO (2010). PRE-SME – Promoting Resource Efficiency in Small & Medium Sized Enterprises Industrial training handbook



<http://wedocs.unep.org/handle/20.500.11822/7961>

**MATERIAL  
USE**

**Surface Treatment  
Metals**



**Surface Treatment  
Organic Solvents**



Not all-  
inclusive

**WASTES**

**Waste  
Incineration**



**Waste  
Treatment**



**Waste Electrical and  
Electronic Equipment**



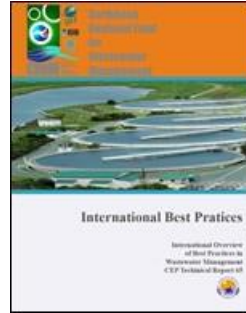
**Persistent Organic  
Pollutants**



Available from: <https://eippcb.jrc.ec.europa.eu/reference/>

## WATER

### Wastewater Management



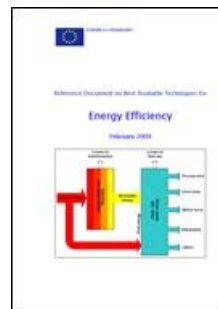
### Wastewater and Gas Treatment Chemicals Sector



Not all-inclusive

## ENERGY

### Energy Efficiency



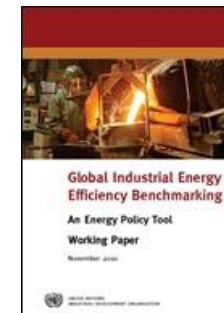
### Industrial Cooling Systems



### Large Combustion Plants



### Energy Efficiency Benchmarking



Available from: <https://eippcb.jrc.ec.europa.eu/reference/>

# INDUSTRIAL SYNERGIES



- **Utility synergies and infrastructure sharing:** Shared use of utility infrastructure, mainly revolving around water and energy (e.g. water recovery and energy cogeneration).
- **Supply synergies and co-location of suppliers and clients:** Co-location and clustering of companies in the supply and value chains (e.g. producers and suppliers of raw materials, fabricators, manufacturing, business clients).
- **By-product synergies and waste exchanges:** The use of a previously disposed by-product (as solid, liquid, or gas) from one facility by another facility to produce a valuable by-product.
- **Service synergies:** Sharing of services and activities between industries in an industrial zone (e.g. joint training of staff and sharing of maintenance contractors).
- **Urban-industrial synergies:** Interlinkages and collaborations between companies and cities/municipalities on the collection, processing and reuse of materials, wastes, energy and water streams.



### By-product synergies:

- Reuse of up 40,000 tonnes/yr lime kiln dust for desulphurisation of flue gases
- Reuse of 10,000 tonnes/yr of by-product gypsum for soil amendment



### Utility synergies:

- 116 MW Cogeneration facility, saving 170,000 tonnes/yr of CO<sub>2</sub> emissions
- 6000 ML/yr Kwinana Water Recycling Facility. Capital costs of US\$ 15 million recovered through long-term water supply contracts



### Supply chain synergies:

- Air Liquide and BOC Gases supplying gases to multiple industries
- Cement plant supplying cement products to construction companies



### Service synergies:

- Air and water quality monitoring, facilitated by Kwinana Industries Council (KIC)
- Dialogue events with community and government agencies (every 2 months)

### Benefits

- Reduced landfilling costs
- Lower raw material costs
- Creation of local jobs
- Reduced operating costs
- Water and material security
- Increased energy, water, and material efficiencies
- Reduced emissions
- Reduced landfilling

Lack of competitively priced and secure water and energy supply is a potential showstopper for companies to locate and operate in industrial parks



## Waste to energy facility Kwinana Industrial Area, Australia

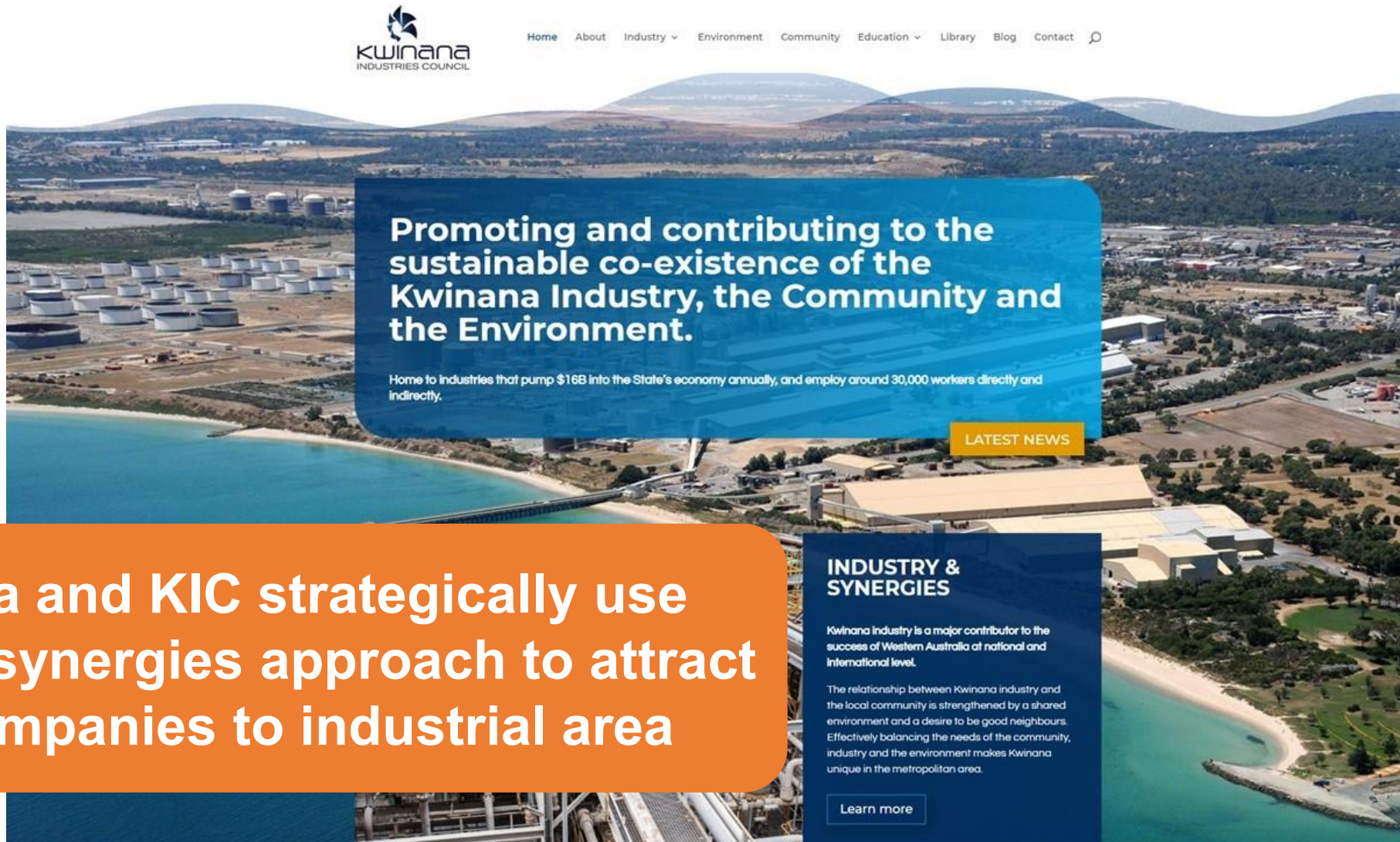
- Process up to 400,000 tons of waste from municipalities per year
- Production capacity of 36 MW
- 800 jobs during construction work, and 60 permanent jobs for operation and maintenance



For urban-industrial synergies, consider:

- Organic wastes
- Plastics
- Paper and cardboard
- Textiles
- Electronic waste
- End-of-life tyres
- Used fuels and oils
- Glass
- Construction and demolition waste
- And more...

**These are business opportunities!**  
**How can these opportunities be unlocked in Moldova?**



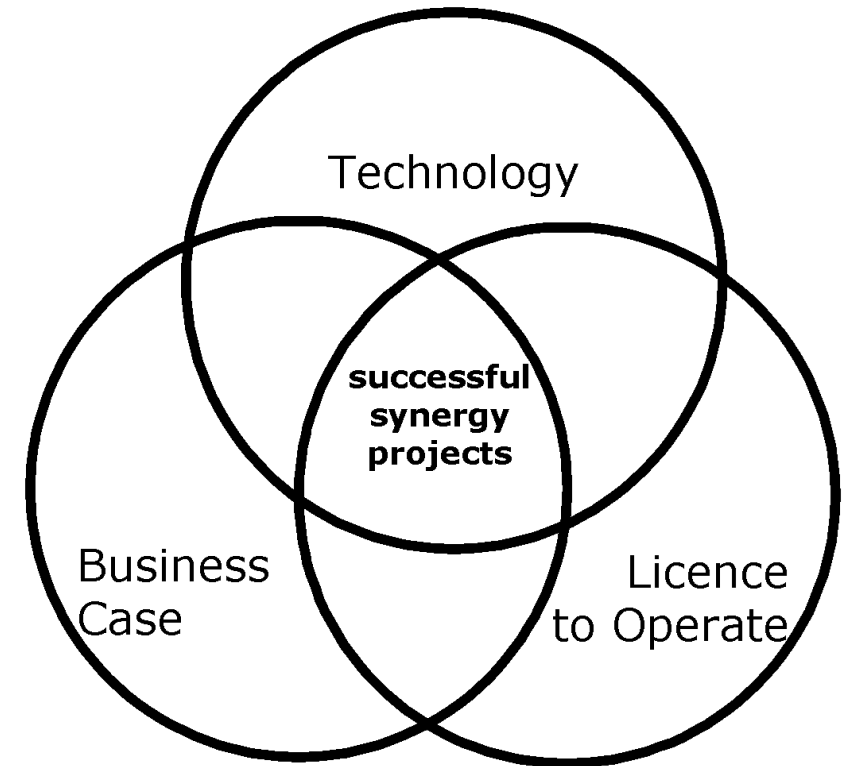
**Kwinana and KIC strategically use industrial synergies approach to attract new companies to industrial area**

**EcoPlus** is managing industrial parks (17) and technology-oriented business parks (4) in Lower Austria

- **Real estate offer:** customized rental properties
- **Highly developed infrastructure:** rail connection, freight station, post office, customs office, restaurants, video surveillance, guidance system etc.
- **Accreditation by klimaaktiv “green building standard”** (thermal renovation; new buildings)
- **Investor service hub:** support in funding and subsidies
- **Support tenants in dealings with authorities** (i.e. obtaining operating permits, trade license etc.)
- **Support for municipalities** in developing communal and intercommunal business locations
- **Industry network creation**
- **Research Centre** and links with Technopol locations
- **Coordinate media efforts:** obtain good publicity for events



- **Business case of synergies**
  - Need to understand and demonstrate broader sustainability benefits
- **Industry champions**
  - Crucial for synergy development
- **Key role for industrial zone management**
  - Platform for industry collaboration



Source: Van Berkel, 2006

The identification of synergy opportunities can be done through various ways:

- **Mapping and connecting company inputs and outputs**
  - What outputs from companies (e.g. effluent streams, wastes / by-products, emissions, waste heat) could be used as input for another company?
- **Bilateral discussions with park management and tenant companies**
  - When explaining industrial synergies concept, they will often come up with ideas directly themselves
- **Review of international experiences**
  - Industrial synergies happen in many industrial parks around the world.
- **Opportunity identification workshops**
  - This usually involves bringing together park management and tenant companies for half-day, and identify and prioritize synergy opportunities through facilitated group discussions
- **Use of automated tools**
  - e.g. UNIDO's Industrial Symbiosis Identification Tool



# OVERVIEW OF UNIDO'S ECO-INDUSTRIAL PARK TOOLS

## Planning tools Park level

### EIP Concept Planning Tool

Assist in sustainable design of an industrial park

### Master Plan EIP Review Tool

Guide sustainability review of existing Master Plan

## Implementation support tools Park level

### EIP Assessment Tool

Assess park against International EIP Framework and identify EIP opportunities

### EIP Management Services Tool

Strengthen and advance services provided by park management to tenant companies

### Access to Finance Tool

Identify, review and access available financing options for feasible EIP initiatives

### Industrial Symbiosis Identification Tool

Support the identification of waste exchanges between companies

### Gender Assessment Tool

Assess park on gender-responsiveness and coordinate action

## Implementation support tools Country level

### EIP Selection Tool

Select parks with high potential for EIP development and successful EIP projects

### EIP Policy Support Tool

Support EIP policy development and implementation processes

## Monitoring tools Park level

### RECP Monitoring Tool

Monitor and report results of RECP assessments in industrial parks

### EIP Opportunities Monitoring Tool

monitor and report impacts from EIP opportunities in industrial parks

UNIDO's EIP Toolbox is available online:  
<https://hub.unido.org/eco-industrial-parks-tools>

## Search by-products / wastes

UNIDO Industrial Symbiosis Identification Tool (V2)

IDENTIFY INDUSTRIAL SYMBIOSIS OPTIONS

### SEARCH BY-PRODUCTS / WASTES

GO TO  
INSTRUCTIONS

SEARCH BY  
COMPANY

REFERENCES

Kindly make your selection under "By-product / waste": Other cells are populated automatically...

1. First, make your selection here!

2. This box lists similar by-products, or alternative names that are sometimes used.

3. Who could sell or buy this by-product? Here you can find companies potentially interested in your by-product

4. More information? Please consult "References" for weblinks and academic articles

By-product / Waste	Similar by-product(s)	Possible providers	Possible users	Practical examples	Comments
<i>Wood residues</i>	Lignin residues Starch scrap Pellets Waste paper sludge/pulp Bark	Ethanol plant Starch industry Paper industry Wood industry	Coal power plant Biomass power plant Briquette factory Pressboard/plywood plant Cement factory & construction Fertilizer	Kalundborg Tianjin Guangxi Guitang Styria Kawasaki	

### Search by company type

UNIDO Industrial Symbiosis Identification Tool (V2)

#### IDENTIFY INDUSTRIAL SYMBIOSIS OPTIONS: SEARCH BY COMPANY TYPE

GO TO INSTRUCTIONS

SEARCH BY-PRODUCTS / WASTES

REFERENCES

Possible inputs	Alternative or similar inputs	Possible providers	Practical example(s)	Comment(s)
Fume silica		Zirconia producer	Kwinana	
Lead slag		Batteries recyclers or producer	Tianjin	
Blast furnace slag	Steel slag    Blast furnace sand	Iron and steel industry	Kawasaki    Shandong    Liuzhou    Styria	Steel slag (variable composition) is rather used in the construction sector (e.g. railroad ballast) than in cement production
Construction waste	Concrete waste    Demolition debris	Waste collection system	Kawasaki	
Fly ash		Coal power plant    Biomass power plant	Kalundborg    Tianjin    Liuzhou    Guangxi Guitang    Styria	The type of coal used must be accounted for. Metals such as vanadium can be extracted from fly ash.
Gypsum	Calcium sulfate	Coal power plant    Phosphoric acid production    Pottery/ceramic industry    Iron and steel industry	Kalundborg    Kwinana    Tianjin    Styria	Usually produced by desulfurization processes.
Petcoke	Petroleum coke	Oil refinery	Eclépens    Styria	
Sludge		Waste water treatment plant	Kawasaki    Kwinana    Tianjin	Substitute for raw material in cement industry
Waste with high calorific value	Waste tires    Wood, plastic residues (...)	Waste collection system	Almost everywhere	
Waste oil (lubricant)	Spent lubricant    Spent solvent	Waste collection system    Chemical industry	Styria    Ulsan    Eclépens	Must not contain halogenated solvent

#### 1. Select a company

**Cement factory & construction**

2. Which inputs **could you buy** from a neighbouring company?  
(or)  
Which inputs **could you sell** to a neighbouring company?

3. What type of **company might sell** this input as a by-product?  
(or)  
What type of **company could be interested to buy** your by-product?

4. **More information?**  
Please consult "References" for weblinks and academic articles

Possible outputs	Alternative or similar outputs	Possible users	Practical example(s)	Comment(s)
Lime kiln dust		Iron and steel industry    Titanium oxide producer	Kwinana	For desulfuration or for chlorine removal
Steam (low temperature)	Waste heat	district heating    Desalination plant    Greenhouse heating	Eclépens	Pressure and temperature must be determined