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Green Transitions in Practice

Korean Eco-Industrial Parks: Lessons Learned and Implications for Replication

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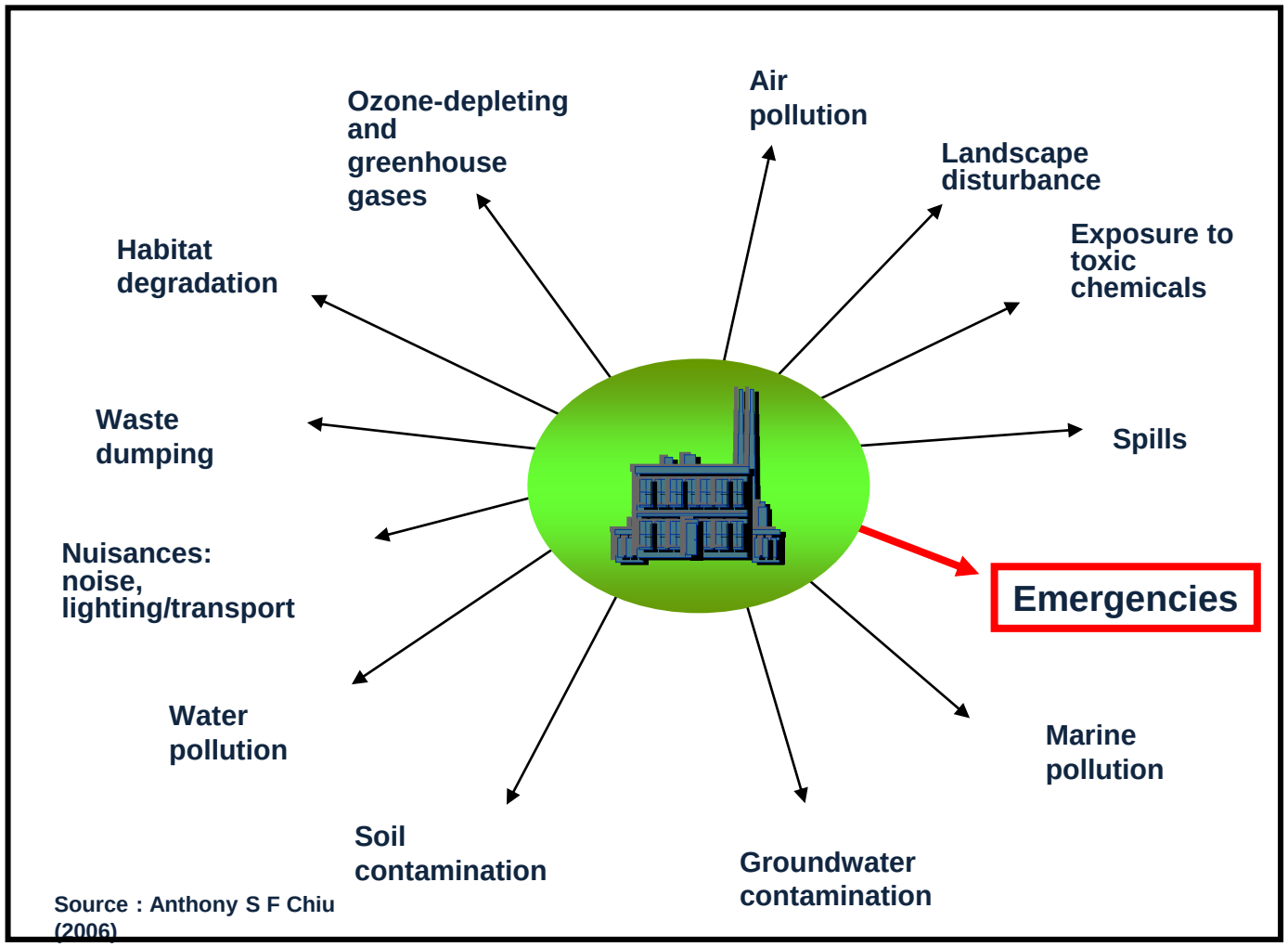
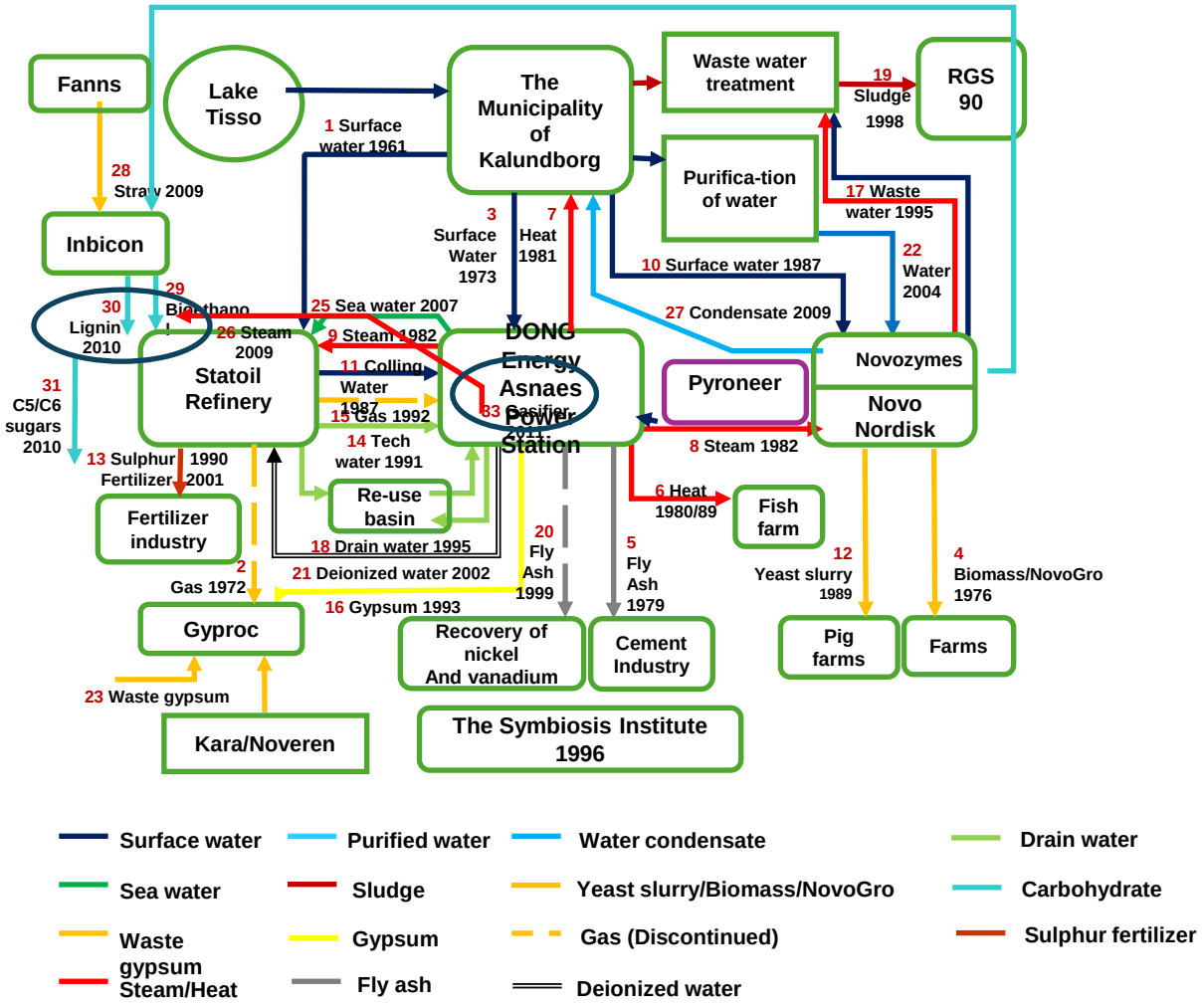
Industrial Parks(Area, Cluster, Zones, etc...)

Economic Growth vs. Environmental Challenges



Serendipitous Emergent Kalundborg Industrial Symbiosis System:

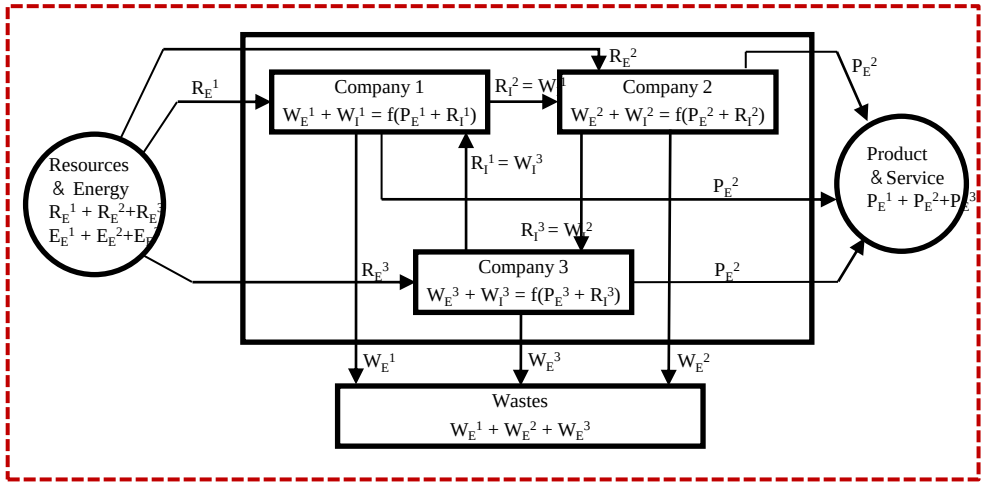


Marian, 2015

Planned IS System

Eco-industrial Park

A community of manufacturing and service business located on common property. Members seek enhanced environmental, economic and social performance through industrial symbiosis



R: Resource
E: Energy cost
W: Waste

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3 Phase-15 years Korean EIP Master Plan: (‘05~’19)

- **2005. 11 :** 1st Phase — **Pilot** : 5 industrial complexes
- **2010. 06 :** 2nd Phase — **Diffusion** : 46 industrial complexes with a Standard EIP model
  (EIP design project for Bangladesh Chittagong Economy Processing Zone : ‘12)
- **2015. 01 :** 3rd Phase — **Completion:** national EIP networks

- **EIP Transition Strategy**
  Regional EIP Center
  Feasibility Study
  Business Development

- **Benefits**
  Economic
  Environmental
  Social

IS proposal	Feasibility Study(%)	Commercialization(%)	Participating Company
655	355(54.2%)	235(66.2%)	1831

National Fund(Mi. $)	Investment(Mil. $)	Revenue(Mil. $)	Participating Company	Jobs
80	761.3	376.9/yr	1831	992

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Data Based R&BD Approach

Potential RECP & IS Identification-> Feasibility Study ->Implementation

Scope

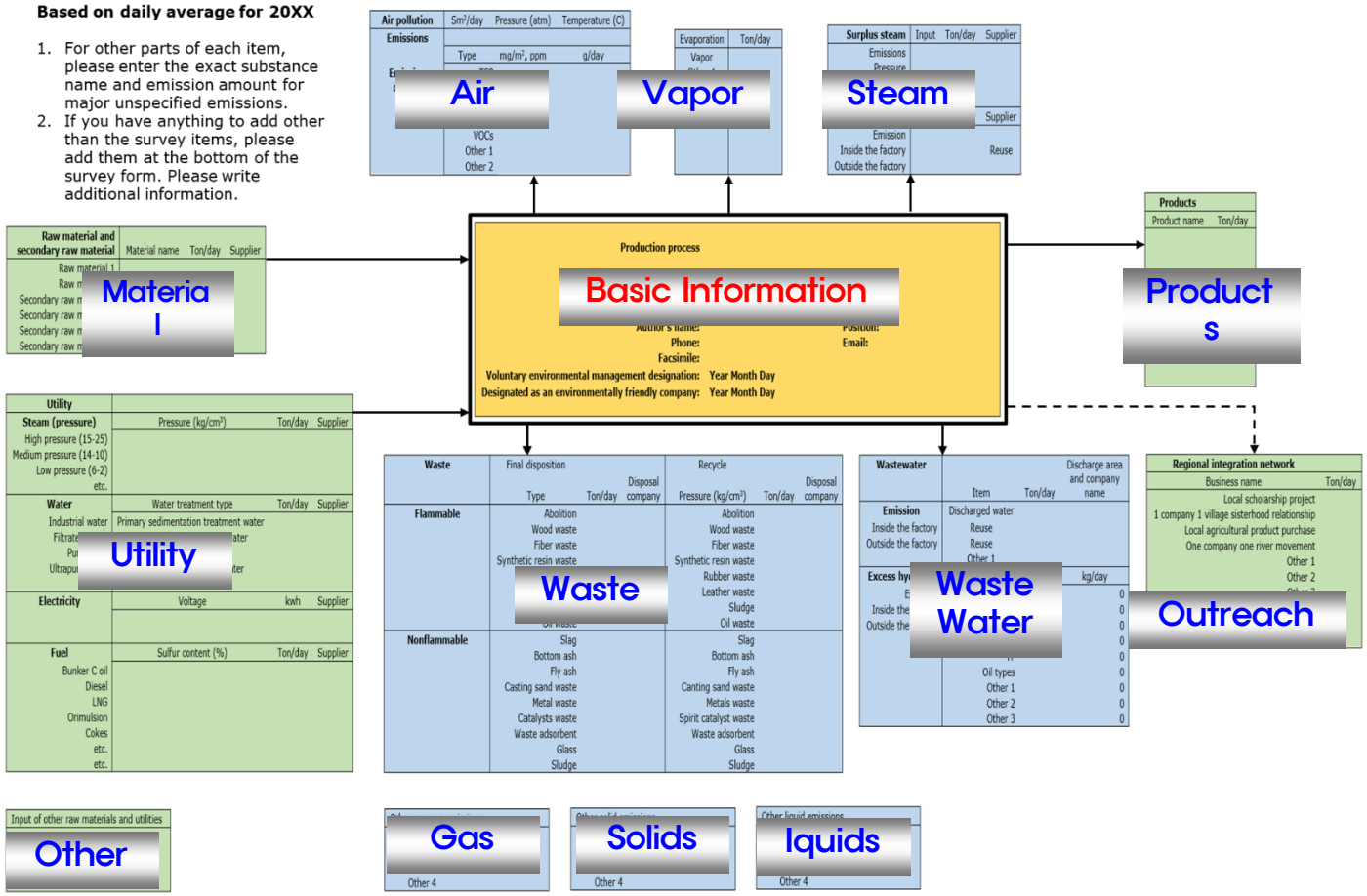
RECP

Industrial Symbiosis

Ulban Symbiosis

National Symbiosis

International Symbiosis



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IS Business Feasibility

Value Creation

$$\triangle B = B_a - B_b = \left(\sum_{i=1}^{n} P_{i,a} - \sum_{i=1}^{n}(R_{i,a} + E_{i,a} + W_{i,a} + O_{i,a})\right) - \left(\sum_{i=1}^{n} P_{i,b} - \sum_{i=1}^{n}(R_{i,b} + E_{i,b} + W_{i,b} + O_{i,b})\right)$$

P: Revenue from products
a: after the IS project
b : before IS project
B: Economic gain
R_i: Resource cost
E_i: Energy cost
W_i: Environmental management cost
O_i: Operating cost

Business Feasibility

$$\frac{B}{C} = \sum_{t=0}^{n} \frac{B_t}{(1+r)^t} \Big/ \sum_{t=0}^{n} \frac{C_t}{(1+r)^t}$$

$\Delta B = \Delta(Cost\ reduction + Revenue\ generation + Complinace\ cost$
+Treatment cost)($ or $/yr)
C = investment ($ or $/yr)

Environmental Benefit (separate calculation)

$$EE = \sum_{i=1}^{n}(W_i + A_i + w_i)$$

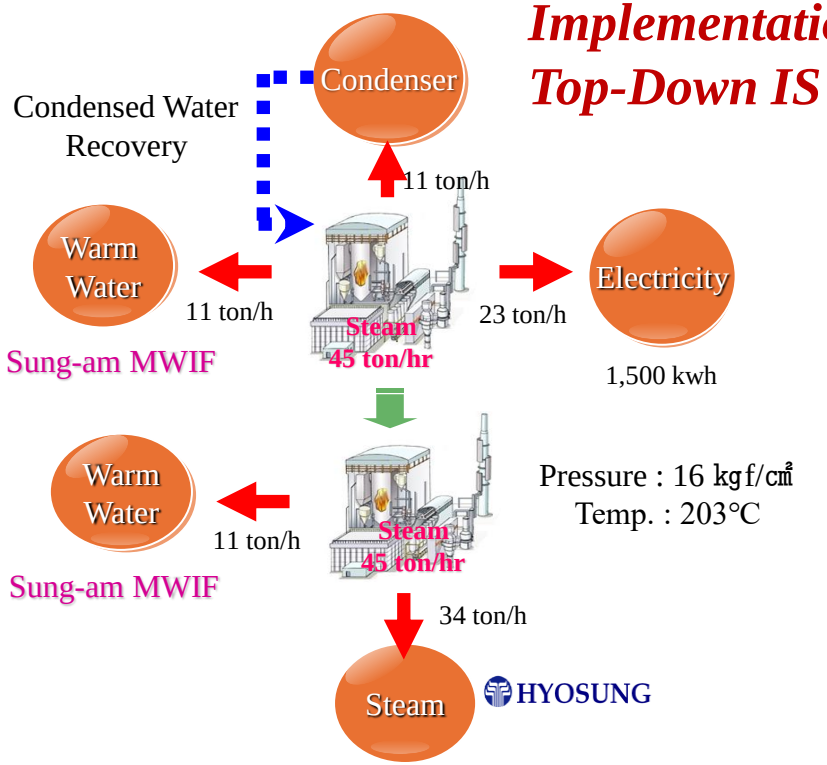
$$\Delta EE = EE_a - EE_b = (\sum_{i=1}^{n} W_{i,a} + \sum_{i=1}^{n} A_{i,a} + \sum_{i=1}^{n} w_{i,a}) - (\sum_{i=1}^{n} W_{i,b} + \sum_{i=1}^{n} A_{i,b} + \sum_{i=1}^{n} w_{i,b})$$

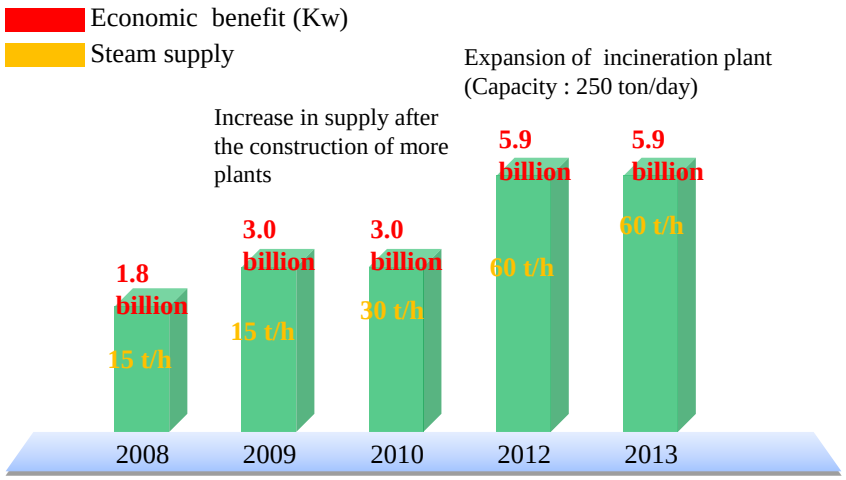
EE : Environmental effect, EE_a : EE of EIP project, EE_b : EE of Baseline project

W_i : Waste generation, A_i : Air emission, w_i : Waste water generation

IS Business Case

Sungam MWIF – Hyosung Company steam network (2008)

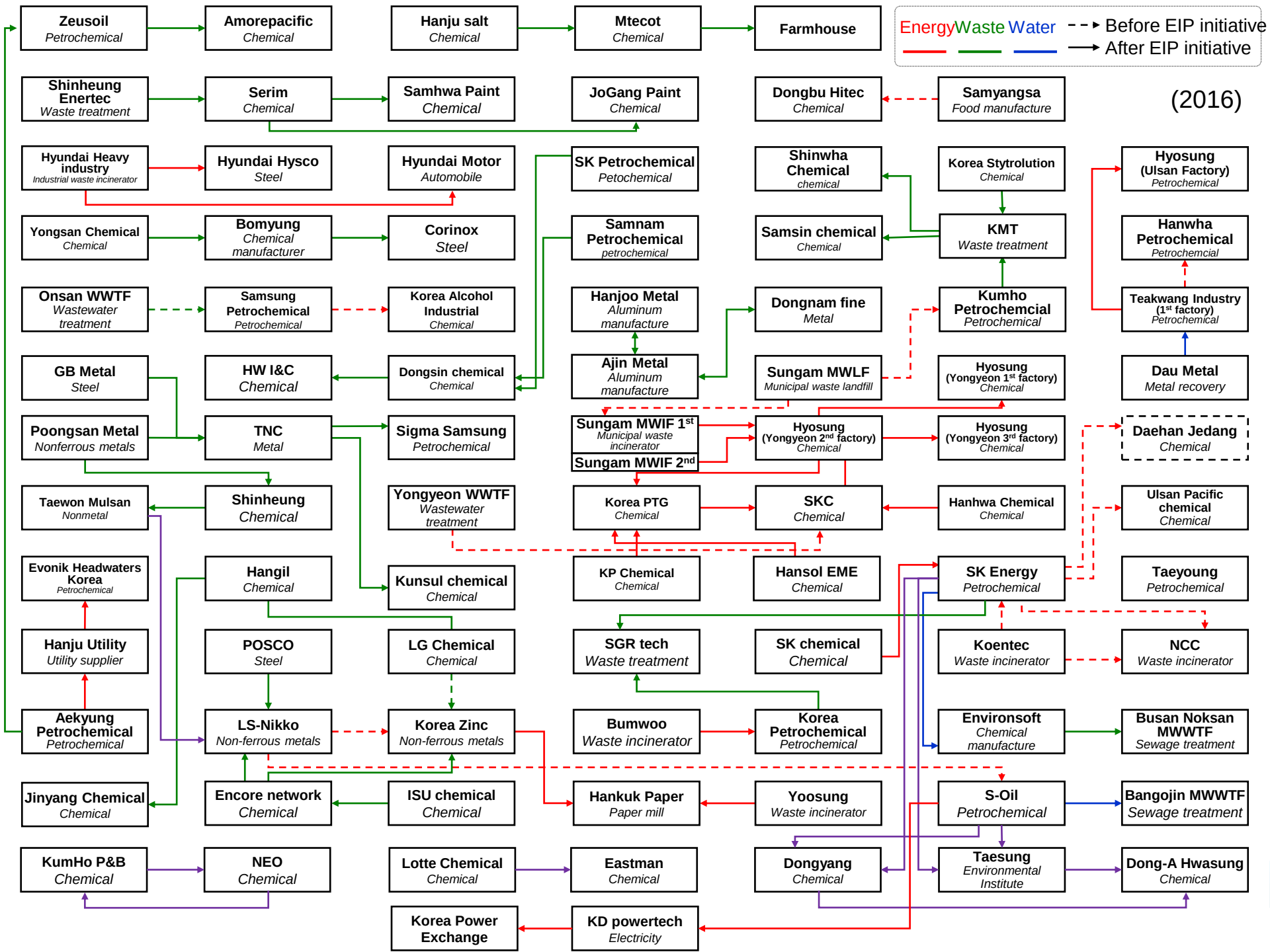




- Investment: 5 million US$
- Economic benefit: 7.1 million US$/yr (steam selling and B-C reduction)
- Environmental benefit: 55,500 ton CO_2/yr, 176.8 ton air pollutants/yr
- Establishment of new factories (Employment for 140 people)

Kalundborg Serendipious Networkings

Ulsan Data-based Planned Networkings



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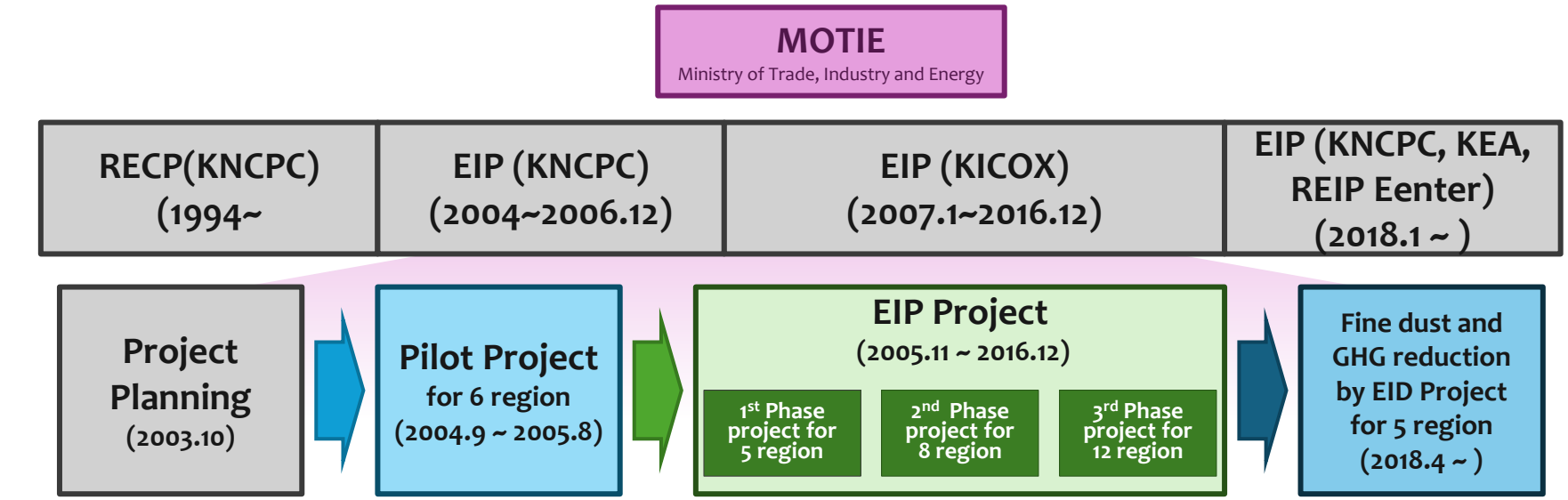
Evolution of Korean Green Industrial Innovation



Execution Organization	Local Research Institutes and Univ.	Regional Center in KICOX (Ulsan Regional EIP Center in KICOX)	Independent Corporation (Ulsan EID Center)
Role of Execution Org.	Establishment of EIP Master Plan	IS item exploration and R&B Supporting for company in Industrial Park	IS item exploration and R&B execution for corporation

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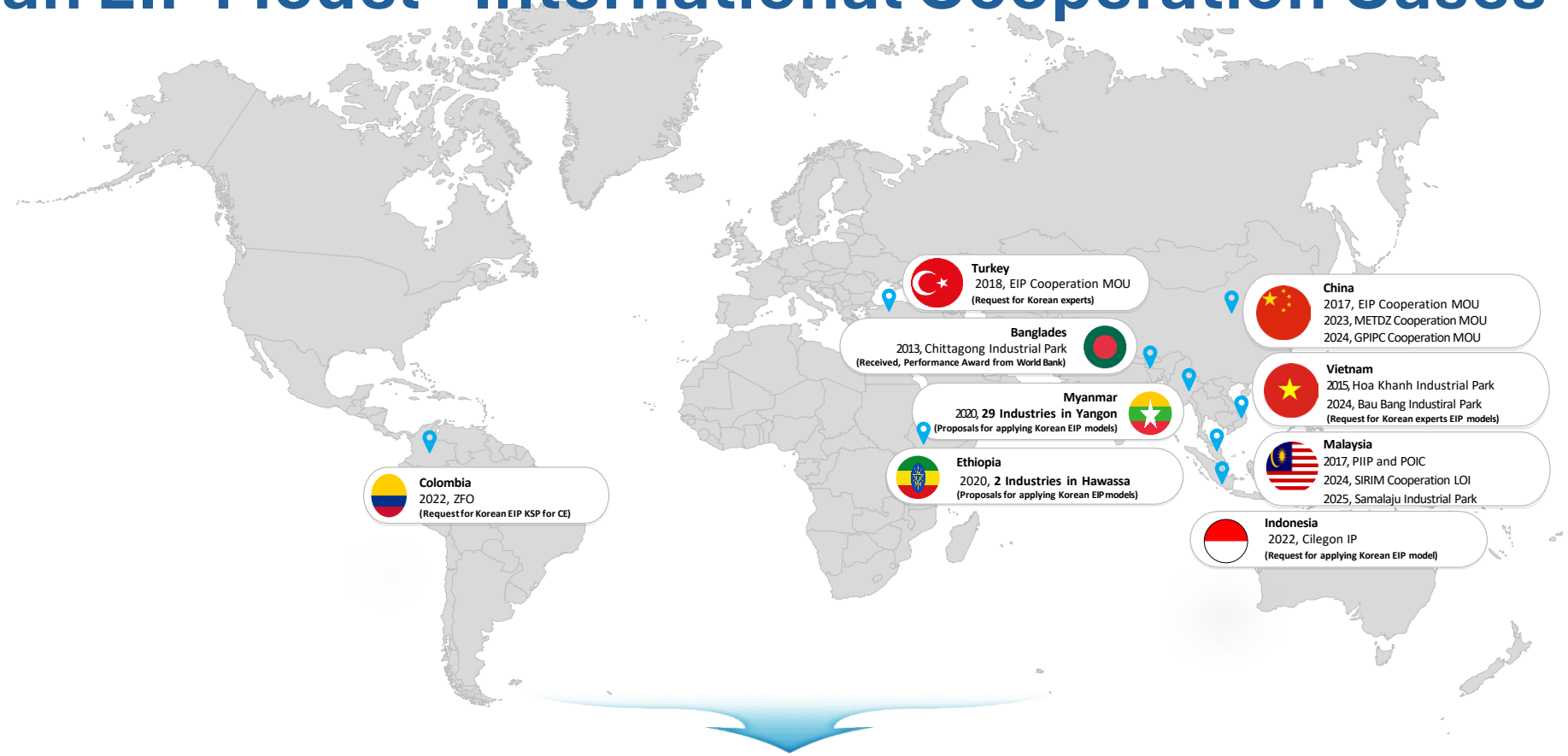
Korean EIP Model - International Cooperation Cases



K-EIP application projects with Korean Government and IO for EIPs in developing countries

UNIDO UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION WORLD BANK GROUP

Diagnosis	Analysis	Mater Plan	Promotion
Energy consumption Waste generation	Resource efficiency Regulation&Finance	Roadmap Application of K-EIP model	Attraction of Investors For Target countries

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Enabling Conditions for Replication

Four critical prerequisites for successful EIP implementation in developing economies

1. Governance Structure
Lead ministry + industrial park authority

Role: Policy coordination & oversight

Key: Dedicated EIP center

2. Anchor Firms/Utilities
Offtake & supply infrastructure

Requirement: Steam, water, power

Benefit: Stable demand base

3. Data Platform for Flow Mapping
Material/energy flow tracking

Function: Opportunity screening

Tool: GIS-based mapping

4. Feasibility Funding & Policy Coordination
Financial support & regulatory framework

Source: Govt + MDB financing

Support: Technical assistance

Critical Success Factor: All four elements must be present for successful EIP implementation, with government coordination as the primary enabler

Korea EIP Model: 235 projects | 66.2% commercialization rate | $376.9M annual revenue 9+ countries successfully implemented

Barriers We Faced—and How We Solved Them

Four key challenges and practical solutions from 15 years of EIP implementation in Korea

Data Gaps
Lack of material/energy flow data

Challenge: Insufficient baseline data for opportunity identification

Systematic Audits
Data collection & mapping

Solution: Systematic audits and symbiosis opportunity database

Inter-firm Trust
Reluctance to share resources

Challenge: Low trust between companies for collaboration

Convening Platforms
Trust-building & coordination

Solution: Convening platforms and quick-win pilots

Regulatory Hurdles
Complex waste classification rules

Challenge: Regulatory barriers to by-product exchange

Classification Facilitation
Regulatory support

Solution: By-product classification and permitting facilitation

Upfront CAPEX
High initial investment costs

Challenge: Significant capital requirements for infrastructure

Blended Finance
Financial structuring

Solution: Blended finance and bankable offtake contracts

Key Lesson: Addressing barriers requires systematic approach combining technical, institutional, and financial solutions

Korea EIP: 235 projects | 66.2% commercialization | $376.9M annual revenue

66.2% success rate (355 → 235 projects)

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Korean EIP Model can be Replicated by Partnership Framework

Three-phase cooperation roadmap for sustainable industrial development

1 Phase 1: Diagnosis
3-6 months

- ✓ Map material/energy flows
- ✓ Shortlist 10-15 symbiosis options

2 Phase 2: Pilot Portfolio
6-12 months

- ✓ Implement 3-5 projects
- ✓ ROI & GHG tracking

3 Phase 3: Scale-up
12-24 months

- ✓ Policy & financing
- ✓ National replication

Government
Policy & coordination

- Lead ministry oversight
- Industrial park authority
- Regulatory facilitation

MDBs
Finance & TA

- Project financing
- Technical assistance
- Capacity building

Korea EIP Experts
Knowledge transfer

- Methodology transfer
- Best practices sharing
- Training & capacity building

Concrete Cooperation Offer

We propose a structured partnership approach with clear deliverables, milestones, and shared responsibilities for successful EIP implementation

Contact: parkhs@ulsan.ac.kr

KGGTF Korea Team
Ulsan EID Center: https://useco.cafe24.com/#section-1

Korea EIP Model: 235 projects | 66.2% commercialization | $376.9M annual revenue

Ready for partnership implementation

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Thank you for your attention

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