



6-8 May 2015, Regional Workshop
Fostering the Green FDI Opportunity in Asia & the Pacific Seoul, Republic of Korea

Eco-industrial Park Best Practices in Korea: Case of Ulsan

Hung-Suck Park

Professor, Department of Civil and Environmental Engineering, University of Ulsan, Ulsan, South Korea
Co-Chair, Green Growth Committee of Ulsan Metropolitan City, Ulsan, South Korea

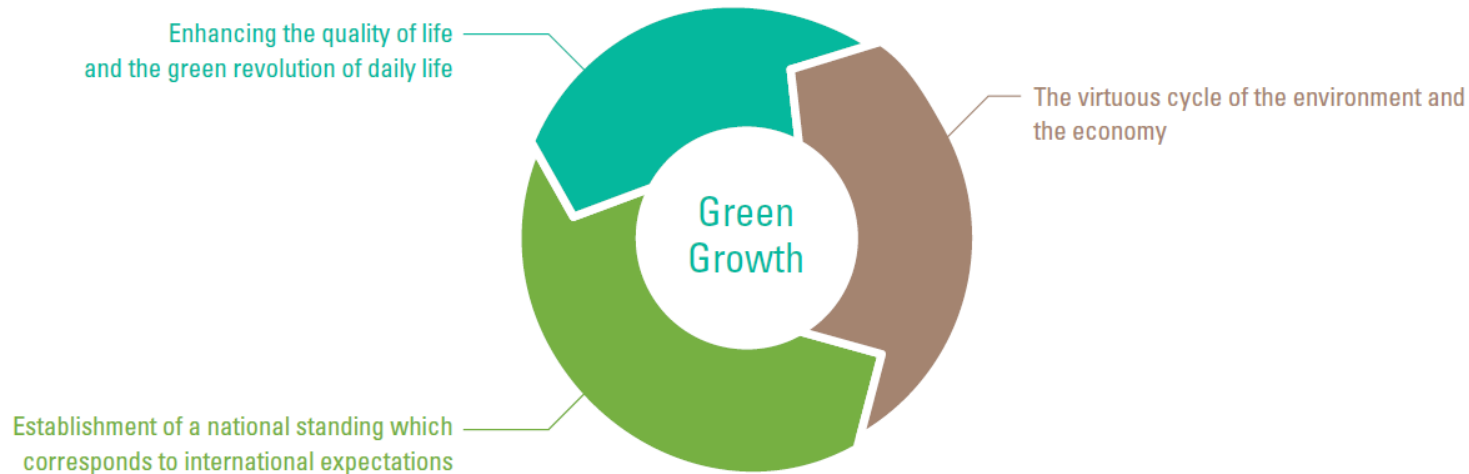
In this presentation....

1. **Korea Green Growth Strategy**
2. **Korea Eco-Industrial Park Initiative**
3. **Ulsan Eco-industrial park**
4. **Challenges to sustainability**



The Korea Green growth policy

The concept of Green Growth



Comparison of the 1st and 2nd plans for Green growth



Vision and Goal of the 2nd Plan for Green Growth

Vision

*Realization of People's Happiness through the Harmonious Development between
Economy and Environment*

3 Strategies

Establishing a Low-carbon
Socioeconomic Infrastructure

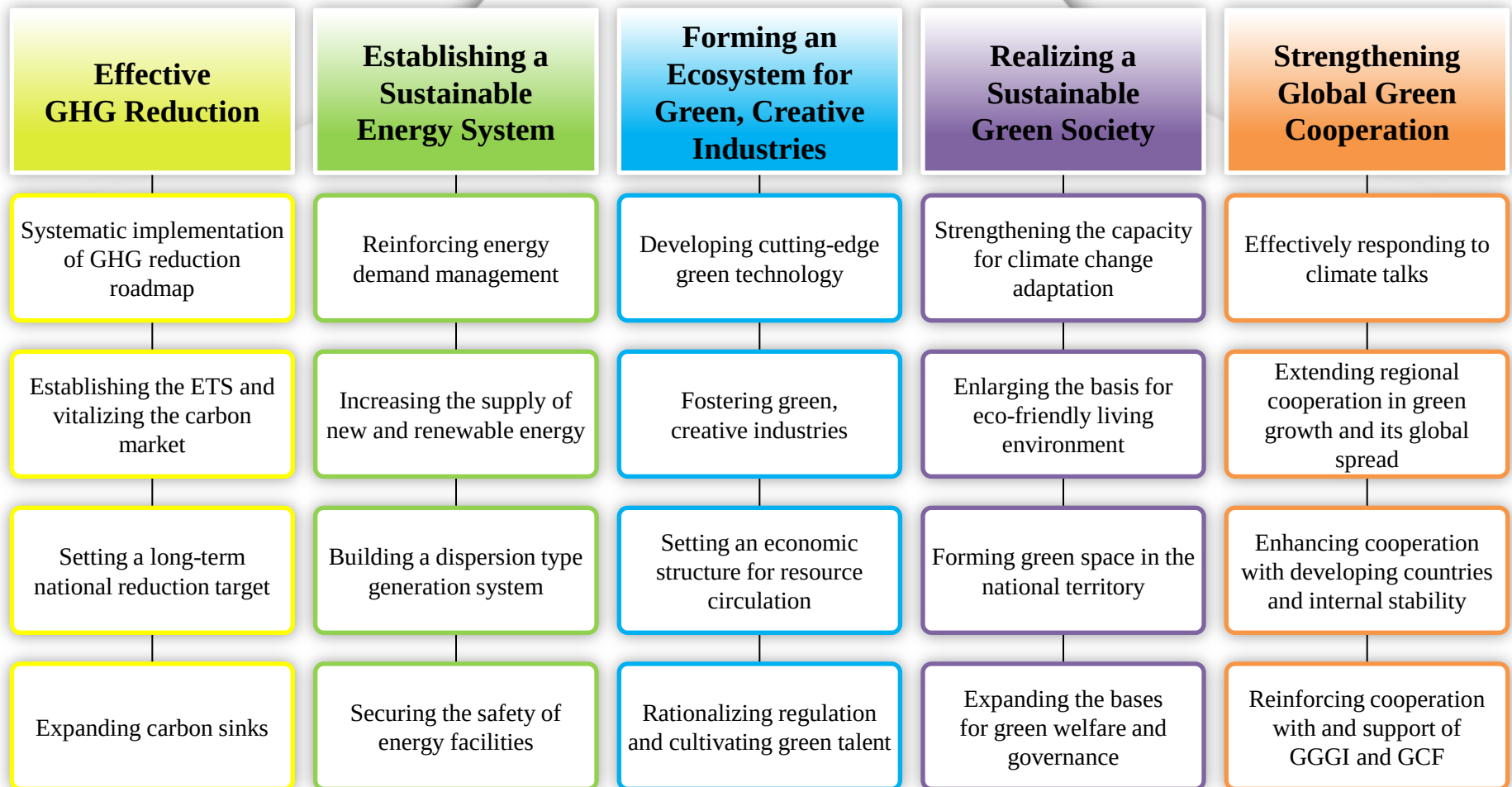
Achieving a Creative
Economy through the
Convergence of Green
Technology and ICT

Building a Pleasant Living
Environment Safe from the
Harms of Climate Change

⇒ 5 Directions and 20 Core Tasks plan to materialize the Presidential Vision for
“Low Carbon Green Growth”

5 Direction 20 Core tasks of 2nd plan for Green Growth

“Low Carbon Green Growth”



GHG reduction target for Green Growth

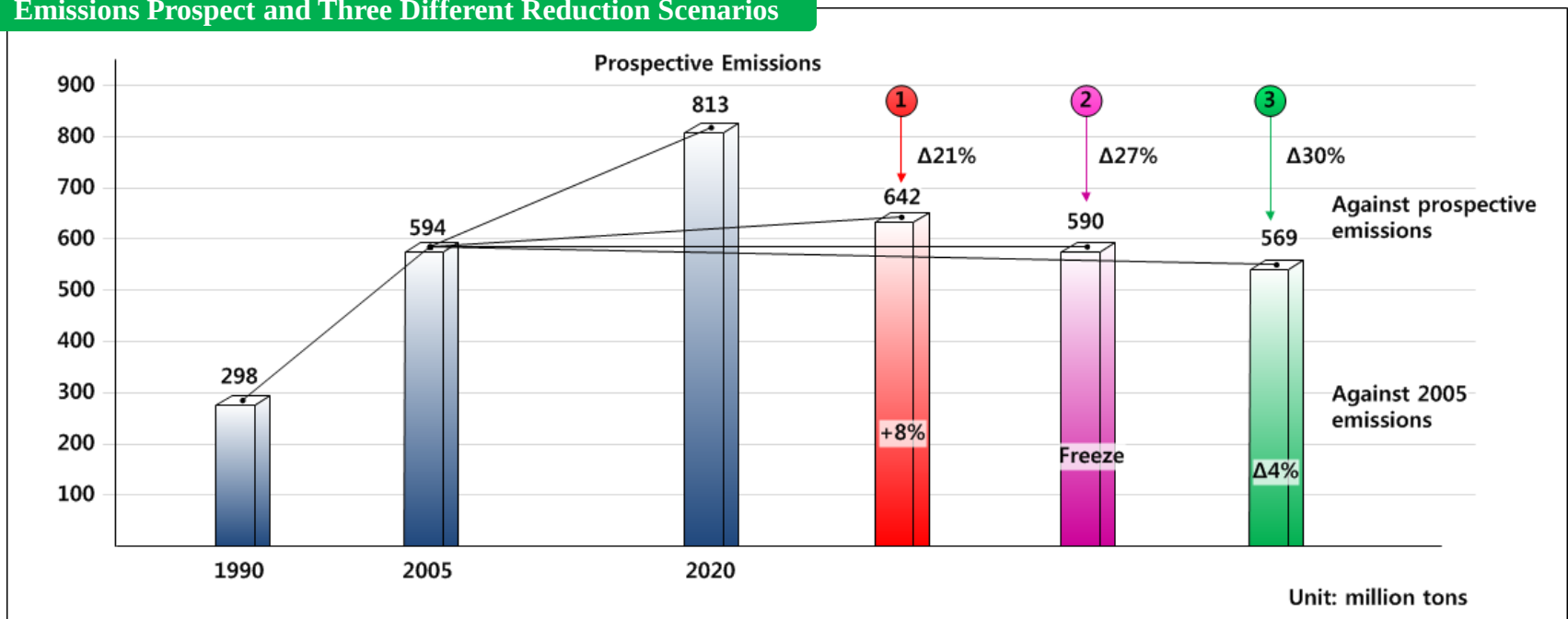
4% reduction by 2020 from the 2005 levels (30% reduction of the 2020 BAU levels), announcement on 17 November 2009.

Unit : million ton CO₂e

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Business as usual (BAU)	-	-	694.5	709.0	720.9	733.4	747.1	761.4	776.1
Emission targets	-	-	659.1	637.8	621.2	614.3	604.4	585.3	543.0
Reduction	1.6%	3.3%	5.1%	10.0%	13.8%	16.2%	19.1%	23.1%	30.0%

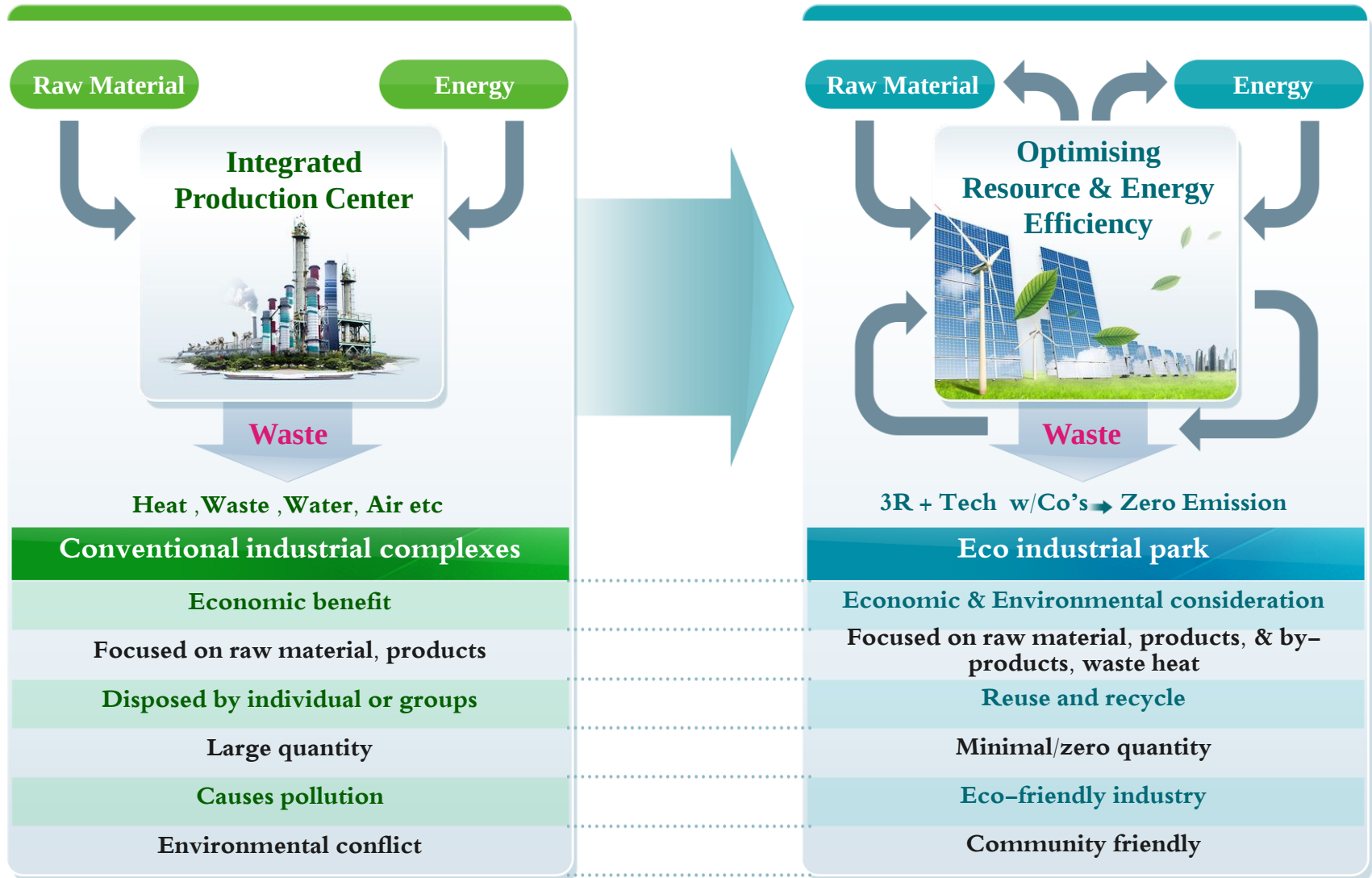
Source : 2nd plan of Green Growth plan, PCGG, 2014.06

Emissions Prospect and Three Different Reduction Scenarios



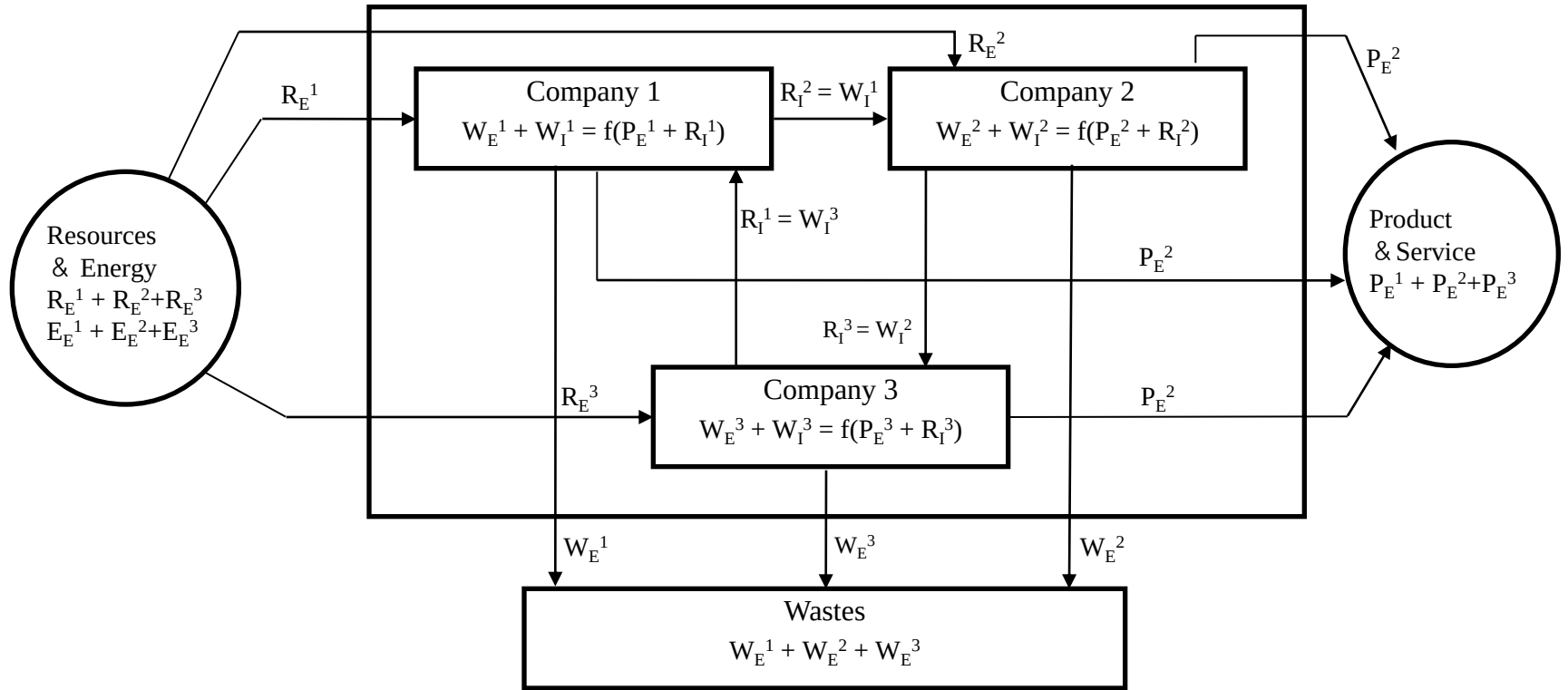
- 
1. **Korea Green Growth Strategy**
 2. **Korea Eco-Industrial Park Initiative**
 3. **Ulsan Eco-industrial park**
 4. **Challenges to sustainability**

What is EIP's ?



Concept of Eco-Industrial Park

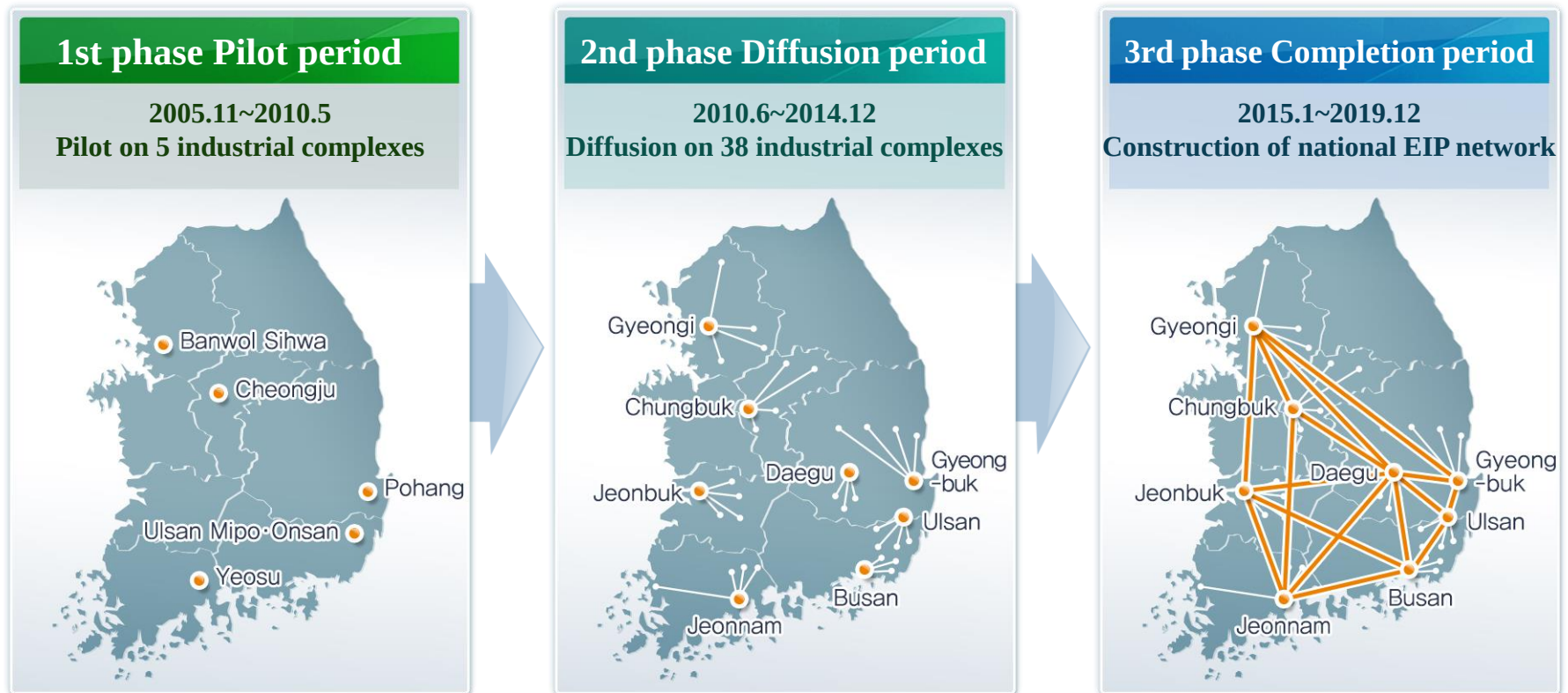
Max Σ Product & Service ; Min Σ Resources & Energy ; Min Σ Waste



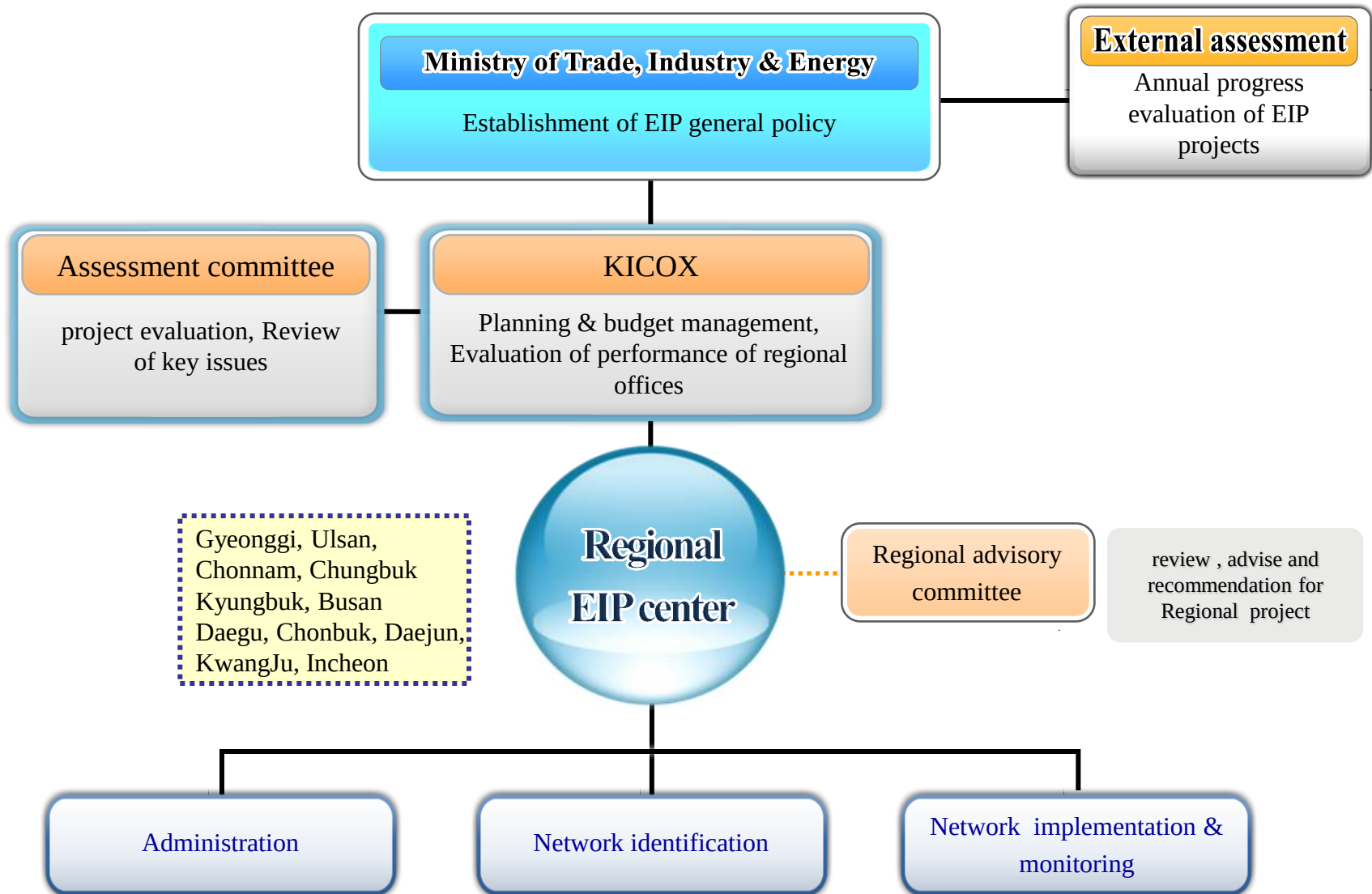
Synergies identified to exchange wastes, resources, GHG gases & byproducts

EIP Initiative 3 Stage Master Plan : ('05~'19)

- 2005. 11 : 1st Phase **Pilot** EIP with 5 industrial complexes
- 2010. 06 : 2nd Phase **Diffusion** on 46 industrial complexes with a Standard EIP model
(EIP design project for Bangladesh Chittagong Economy Processing Zone : '12)
- 2015. 01 : 3rd Phase **EIN.** EIP Model including all industrial complexes



KICOX Administration Hierarchy



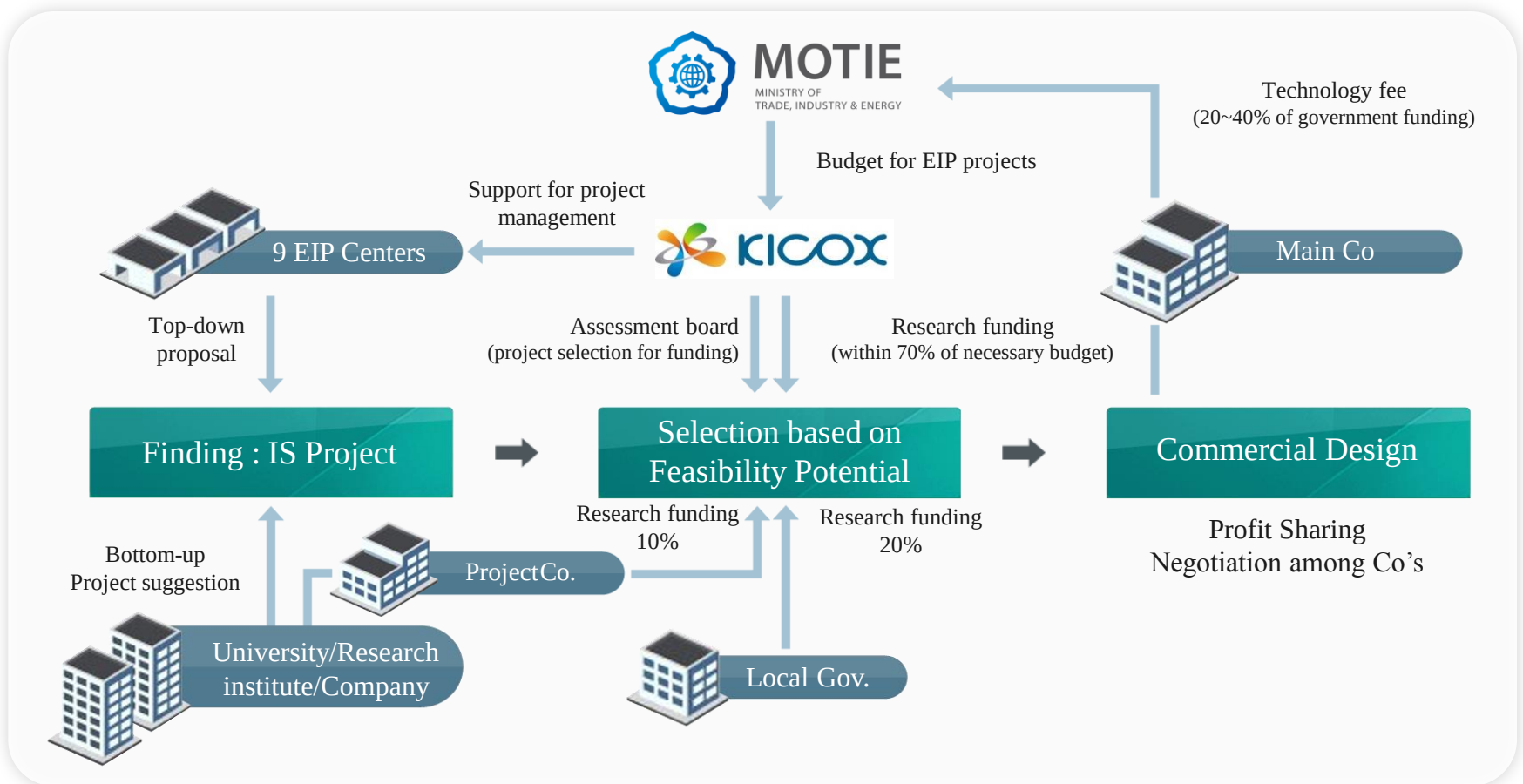
How the Funding System is Enabled?

✓ Project Financing Source

Main Gov.(70%) & Local Gov.(20% : matching), Private Co.(10% : participation fee)

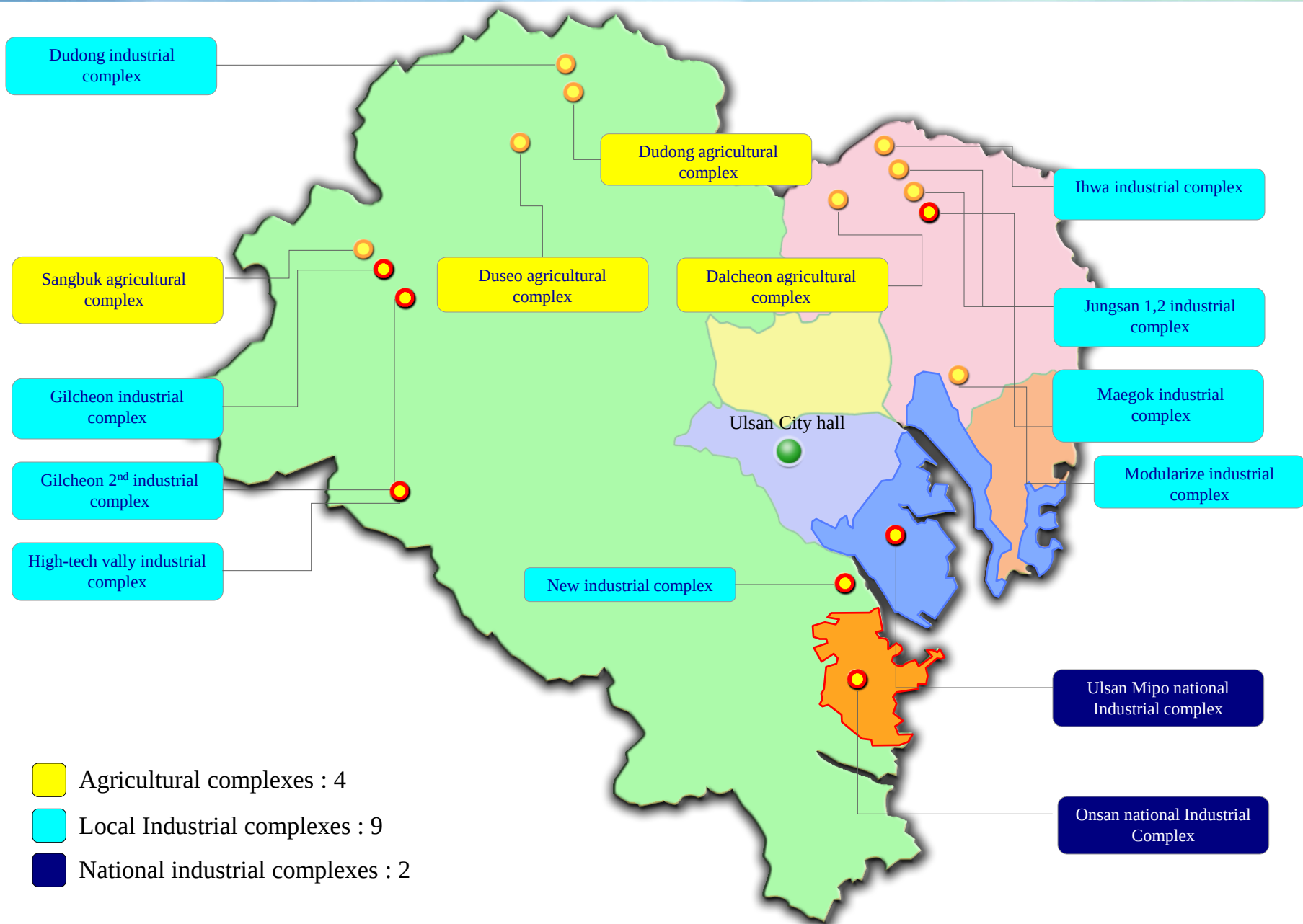
✓ Process

Identification Feasibility study Commercialization



- 
1. **Korea Green Growth Strategy**
 2. **Korea Eco-Industrial Park Initiative**
 3. **Ulsan Eco-industrial park**
 4. **Challenges to sustainability**

Overview of Ulsan Industrial Park



Overview of Ulsan National industrial Parks

Ulsan Mipo industrial complex



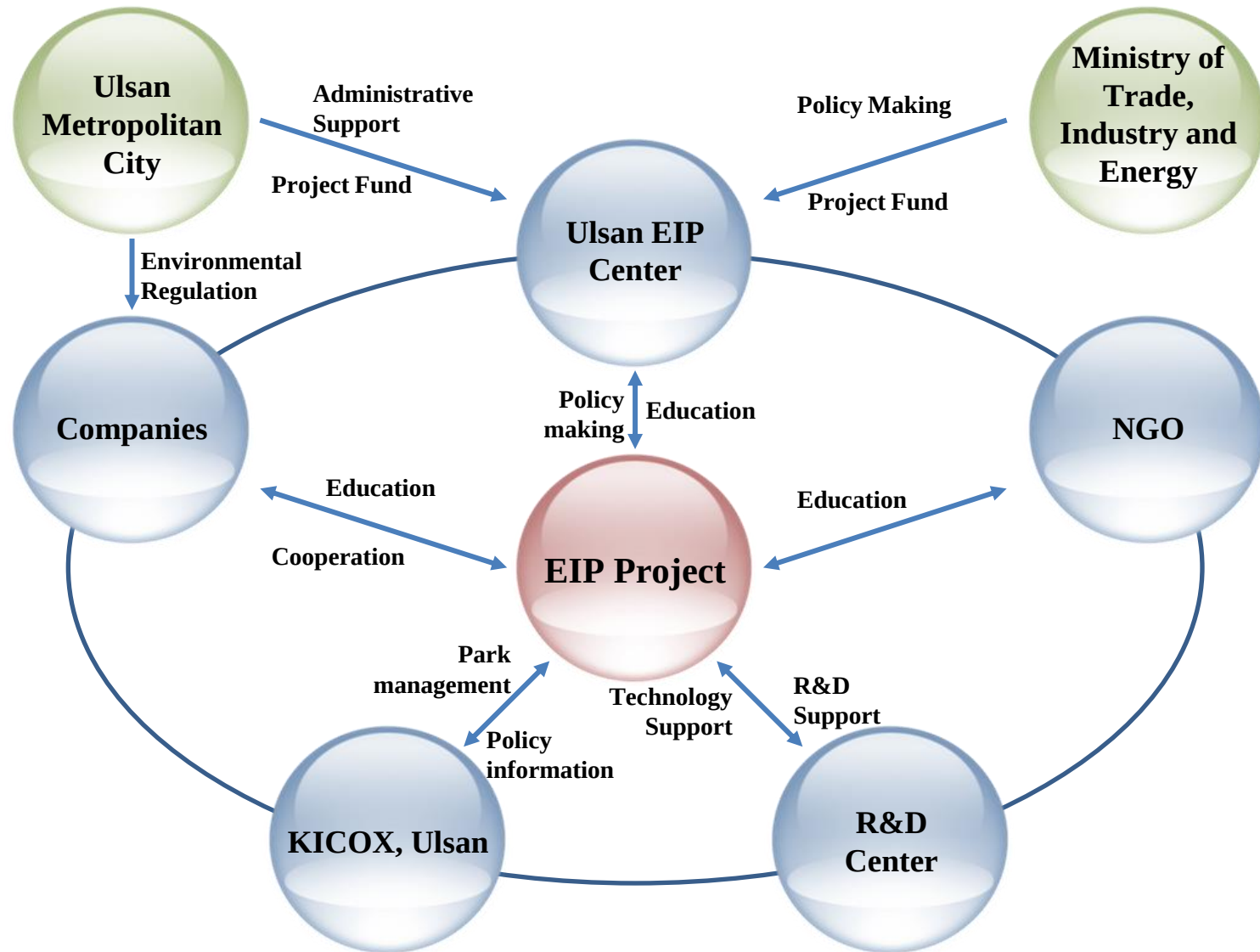
Onsan industrial complex



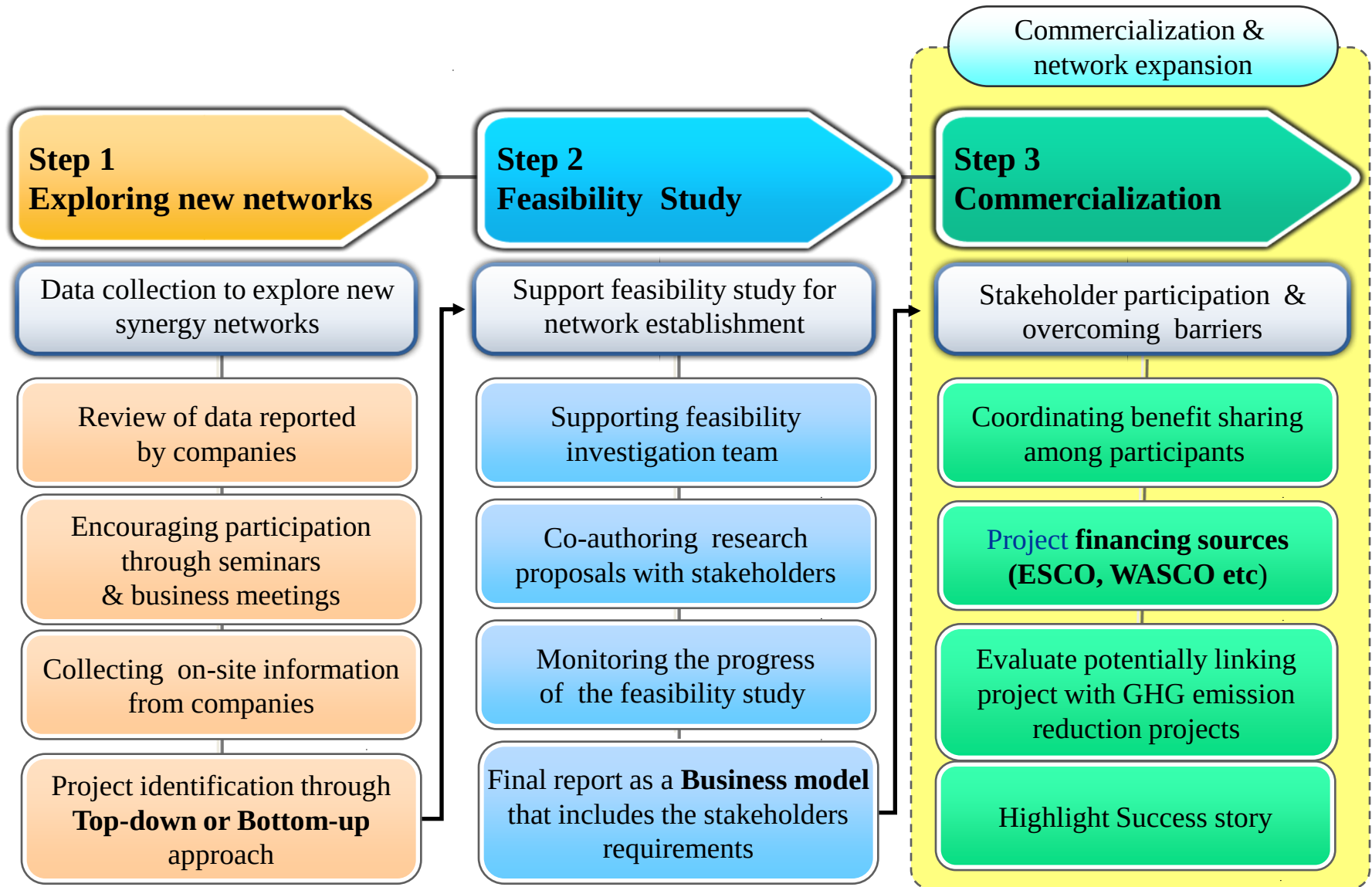
Area(km ²)	45.653
Number of companies	854
Production (Billion USD\$)	137.2
Export (Billion USD\$)	68.01
Number of Employees	103,911
Type of industry	Petrochemical, Automobile, Heavy industry, etc

Area(km ²)	19.765
Number of companies	337
Production (Billion USD\$)	45.34
Export (Billion USD\$)	21.81
Number of Employees	16,892
Type of industry	Petrochemical, chemical, pulp, Metal, etc

Ulsan EIP Project - Governance Structure

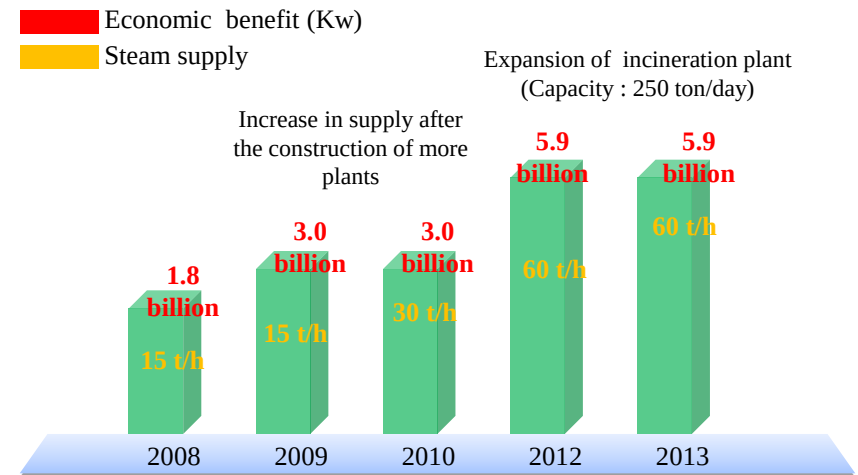
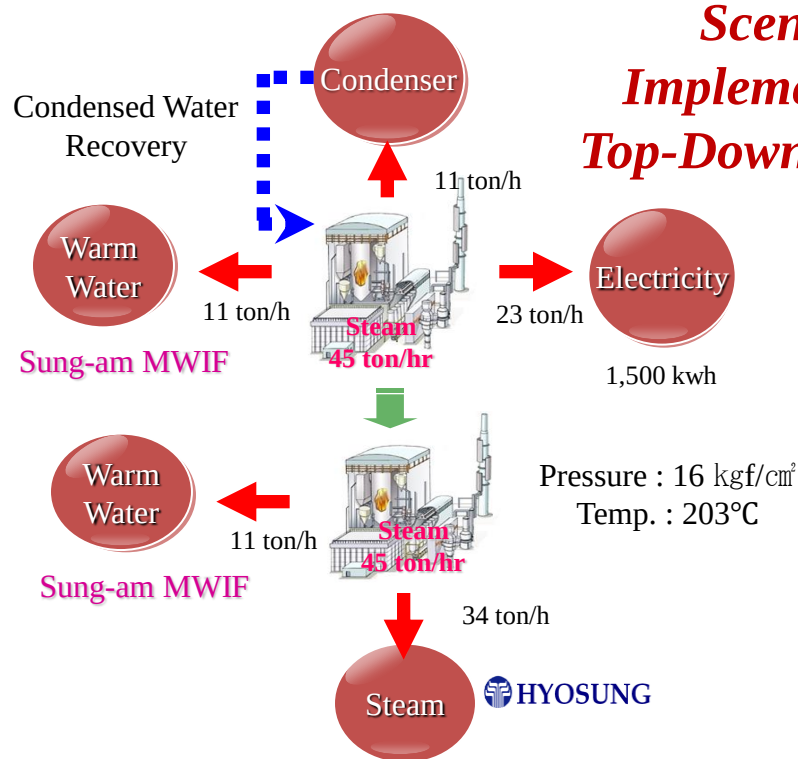


IS Development - Role of Ulsan EIP Center



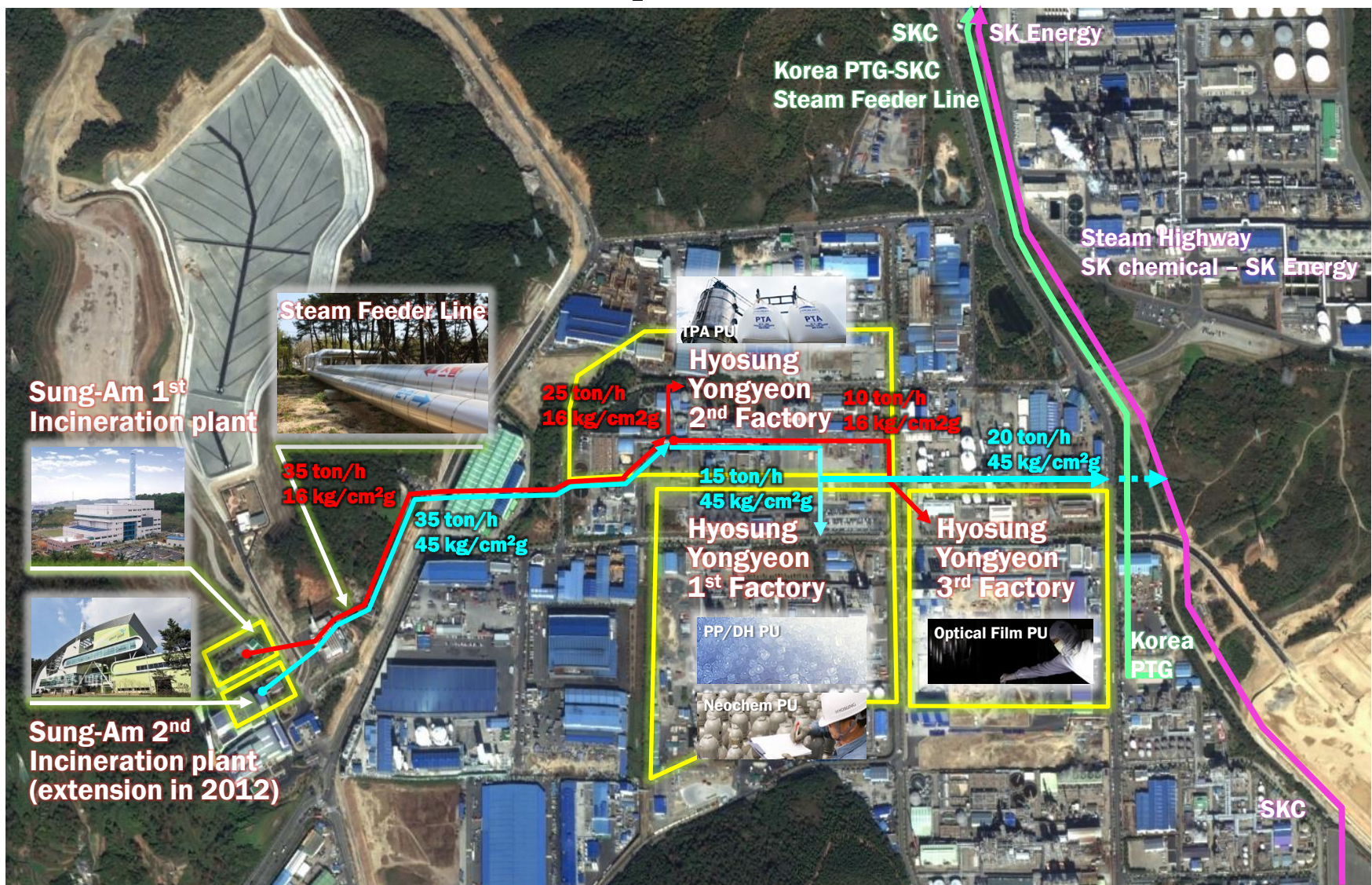
Sample Outcomes of EIP Project

Sungam MWIF – Hyosung Company steam network (2008, 2012)



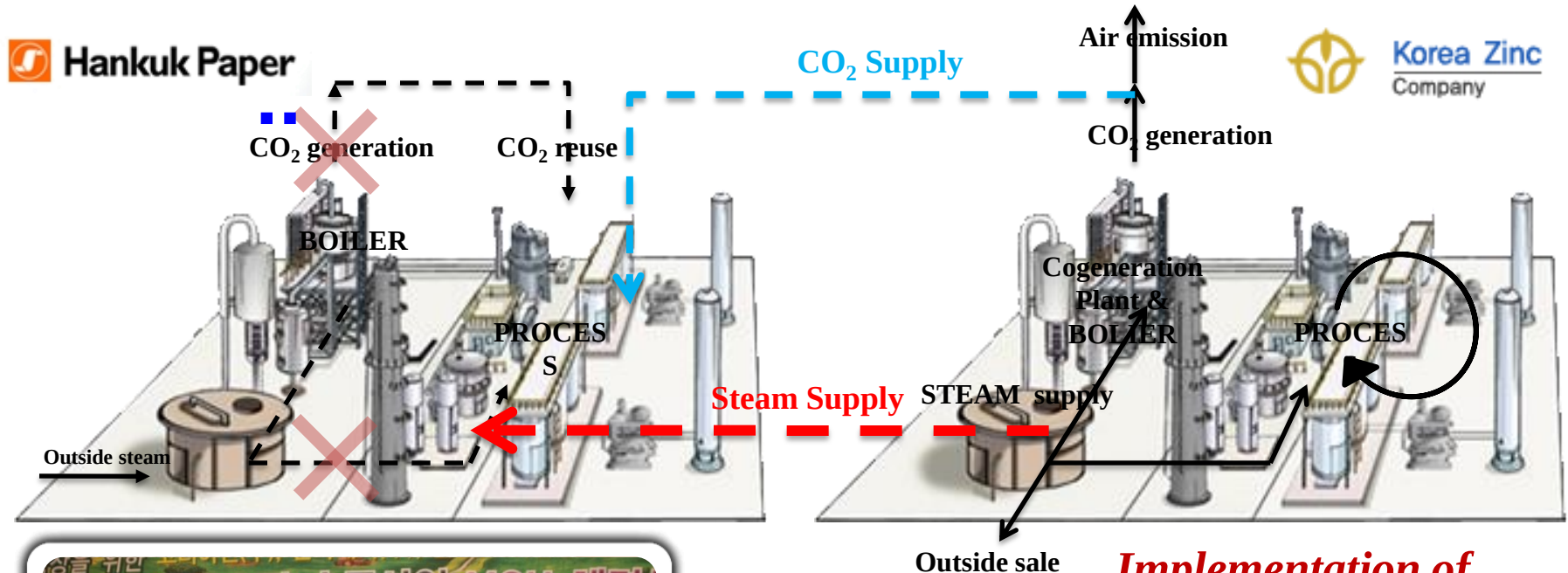
- 1 phase
- Investment: 5.0 million US \$
- Economic benefit: 7.1 million US\$/yr (steam selling and B-C replacement)
- Environmental benefit: 55,500 ton CO₂/yr, 176.8 ton air pollutants/yr
- Establishment of new factories (Employment for 140 people)

- 2nd Phase (2012)
- Investment: 8.2 million US \$
- Economic benefit: 14.7 million US\$/yr (steam selling and LNG replacement)
- Environmental benefit: 39,427 ton CO₂/yr



Sample Outcomes of EIP Project

Carbon dioxide and steam network (2010)



Implementation of Top-Down IS Network

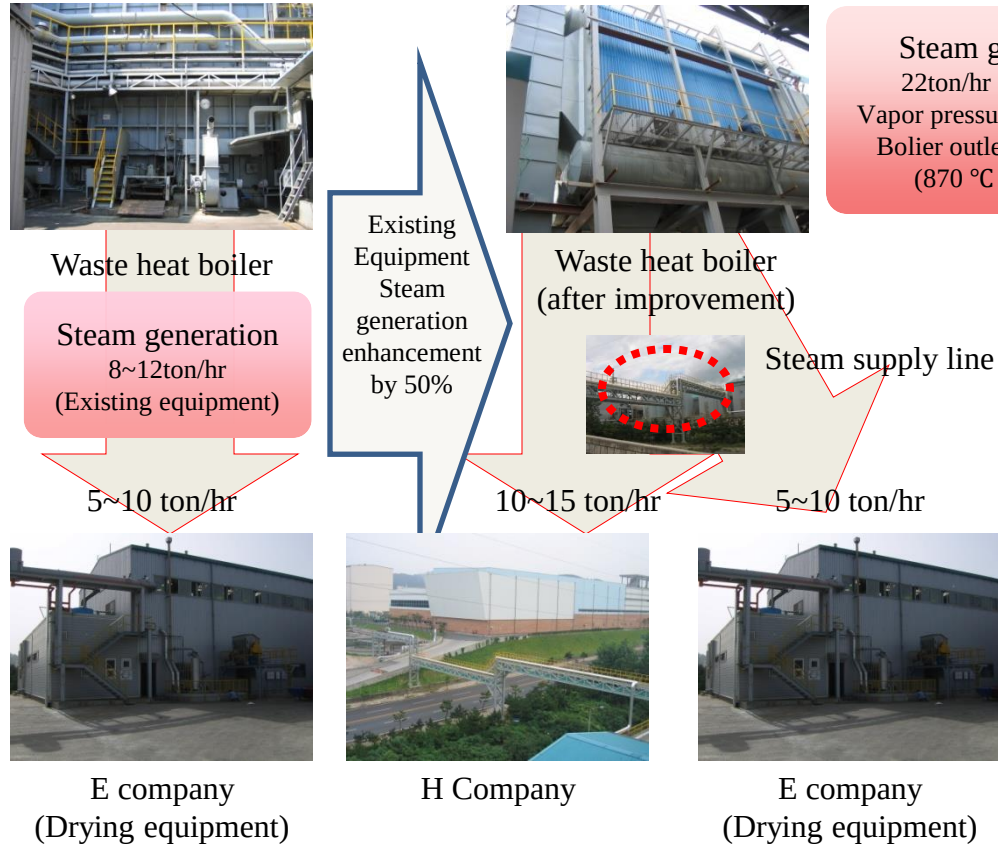
- Economic benefit : 6.6 million US\$/yr (Steam selling and B-C replacement)
- Environmental benefit: Reduction of 63,643 ton CO₂/yr, 1,691.5 ton /yr air pollutants



Sample Outcomes of EIP Project



Yoosung – Hankook Paper steam network (2007)



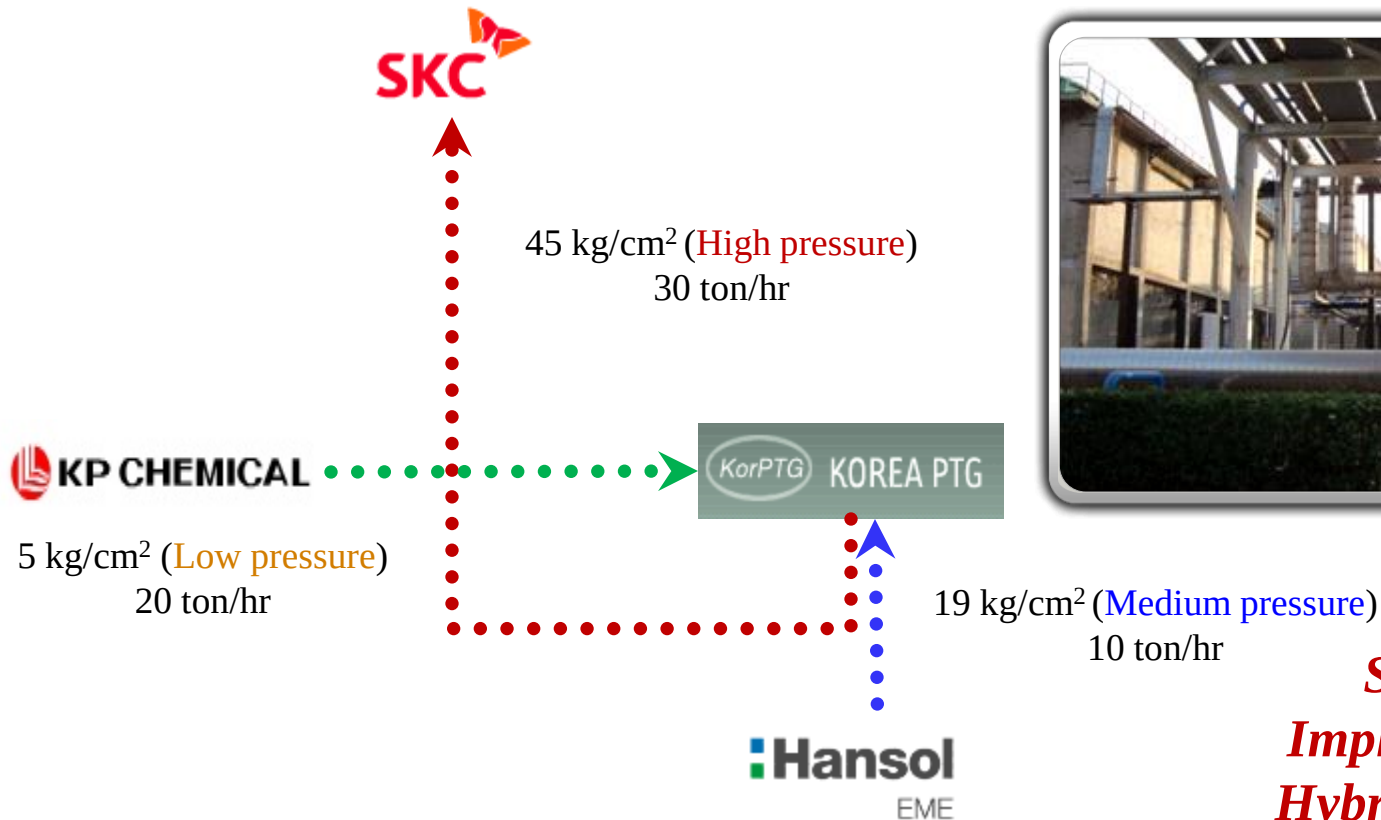
Scenario 2: Implementation of Bottom-Up IS Network



- Initial investment for the waste-heat recovery : 0.85 million US\$ (Boiler complement and piping new installation)
- Economic benefit : 2.32 million US\$/yr (Steam selling and B-C replacement)
- Environmental benefit: Reduction of 14,810 ton CO₂/yr, 20 ton SO_x/yr, 3 ton NO_x/yr

Sample Outcomes of EIP Project

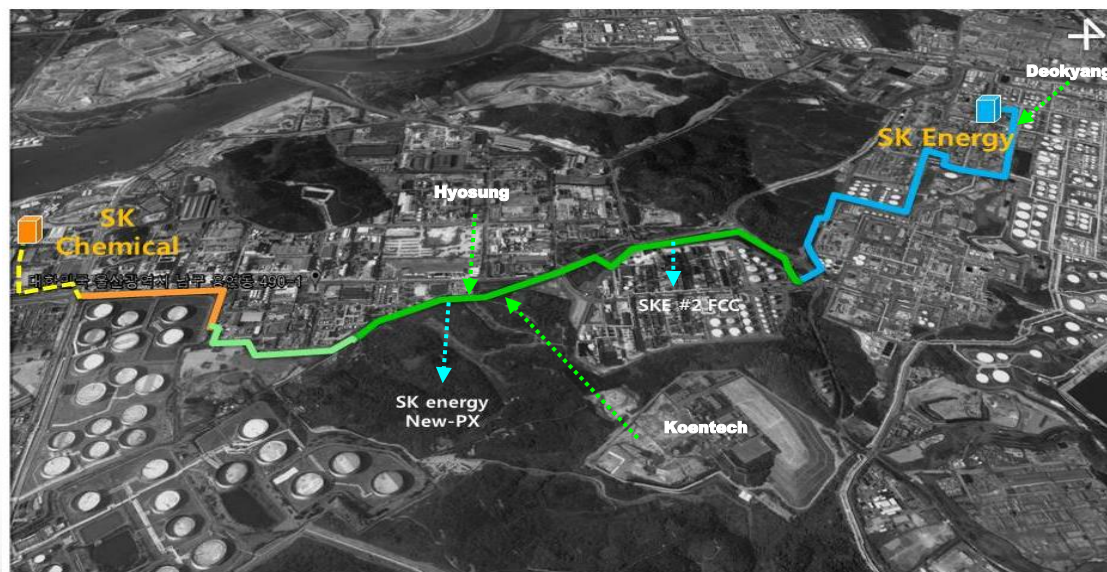
Steam Network project (2009)



Scenario 3: Implementation of Hybrid IS Network

- Economic benefit : 6.4 million US\$/yr (Steam selling and B-C replacement)
- Environmental benefit: Reduction of 44,468 ton CO₂/yr, 314.1 ton /yr air pollutants

Steam Networks by Public-Private Partnership(2013.11)



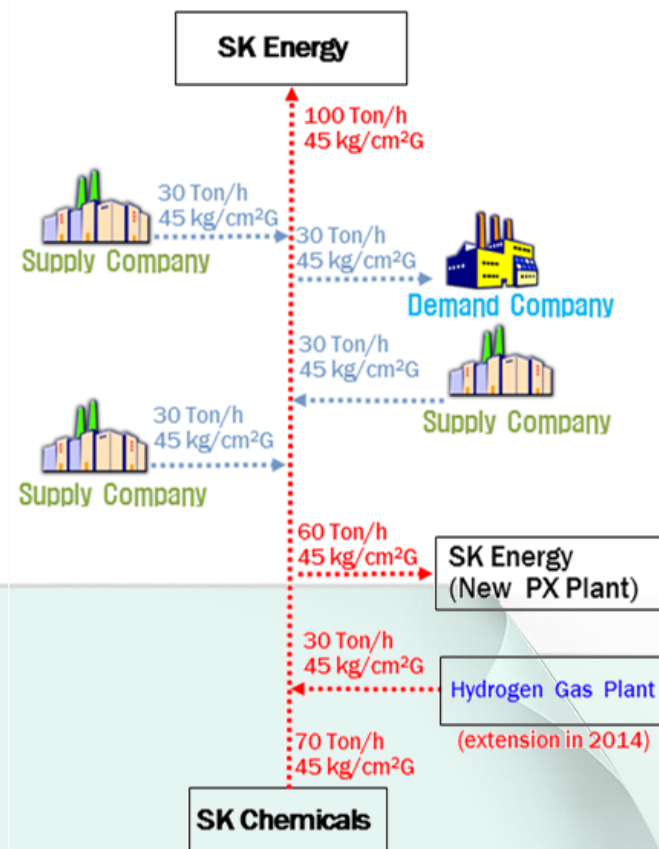
Steam Highway for industrial competitiveness and energy efficiency

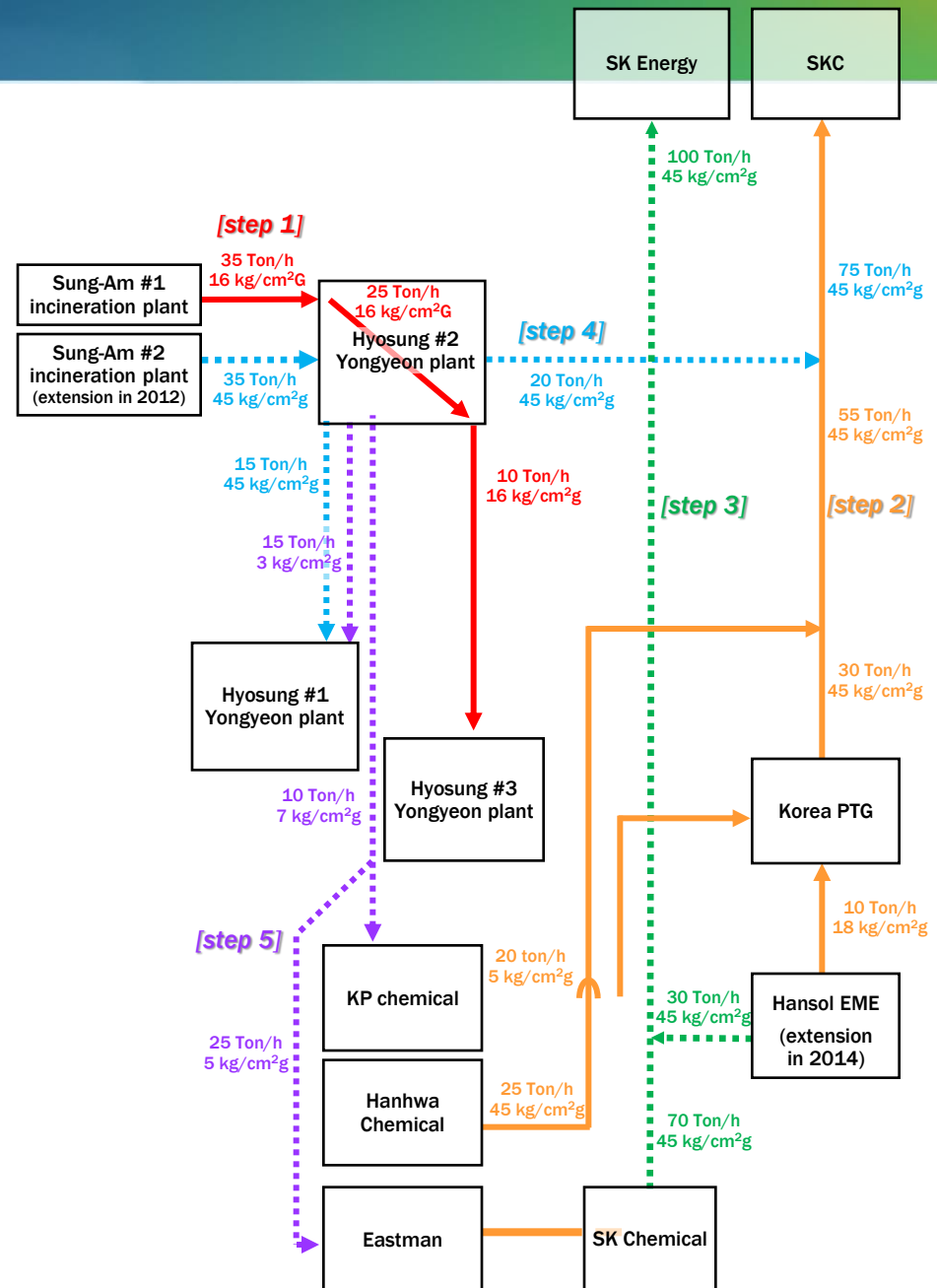
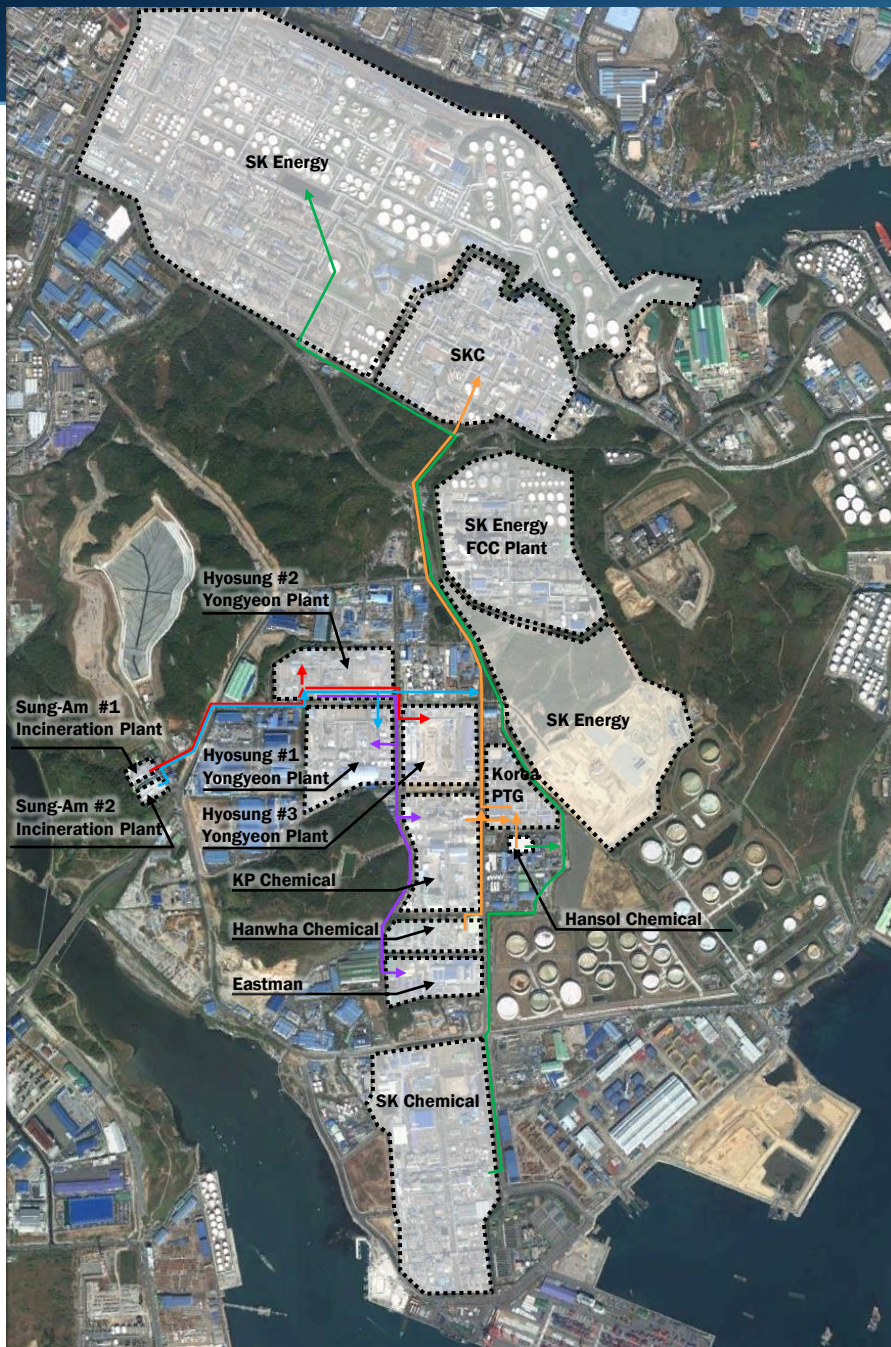
●Expectation:

- **(Economy)** \$19.7million/year energy supply & cost cut
- **(Environment)** 100,000 ton GHG (CO₂) Reduction /year

● IS PPP:

- **(Public sector)** invested a steam pipeline(highway) with several entrances and exists, to facilitate steam networking among companies in the area(25.7 million \$ for Steam distributes, Steam condensate Pipe facility at 6 km)
- **(Private sector)** participated in the network development to reach their own facility





EIP Project Benefits in Ulsan (by 2014)

(Operating 31 Projects)

From	Intermediate processing	To	Research/ Negotiation Period (month)	R&D Fund (million US\$)	Economic benefit		Environmental benefit	
					Investment (million US\$)	Profit (million US\$/y)	CO ₂ reduction (ton/y)	Air pollutant reduction (ton/y)
Yoosung Corp.	-	Hankuk Paper	07/04	0.04	0.85	3.85	12,491	88.2
Sung-am MWIF	-	Hyosung Yongyeon 2 nd plant	04/21	0.01	5	7.1	60,476	427.1
KP Chemical, Hansol EME	Korea PTG	SKC	12/12	0.10	14	4.0	34,906.7	246.6
SK energy	EnvironSoft	Noksan MWWTF	07/02	0.04	0.13	1.99	NA	NA
Dau metal	Sunkyuong Watech	Teakwang industry(I)	12/NR	0.06	0.1	3.69	NA	NA
POSCO	Ilsin Polytech	LS-Nikko	12/ NR	0.15	0.05	1.15	NA	NA
Dongnam fine, Hanjoo metal	Ajin Metal	Dongnam fine, Hanjoo metal	12/ NR	0.20	0.1	3.30	NA	1,325
Petrochemical cluster	Sinheung	Teawon Mulsan	12/ NR	0.06	0.5	1.67	NA	NA
Poongsan metal, GB metal, TNC	TNC	Kunsul chemical industry, Sigma Samsung	12/ NR	0.19	2	5.43	315.7	NA
Hyundai Heavy Industry	-	Hyundai Motor, Hyundai Hysco	12/34	0.08	6	3.20	10,188	273.2
Korea Zinc	-	Hankuk Paper	12/06	0.12	21	6.60	63643	1,692.0
SK Energy	SGR Tech	Oil Spill Restoration Company	24/ NR	0.31	0.2	0.12	NA	NA
Aekyung petrochemical	Hanju	Evonik Headwaters Korea	12/06	0.1	1.5	2.82	33,094	NA
SK petrochemical Sam Nam Petrochemical	Dong-shin chemical	CNT, Hansol Chemical	12/	0.15	0.8	1.19	NA	NA
ISU chemical	Encore networks	Korea Zinc, LS-Nikko	14/03	0.23	0.6	5.97	NA	NA

EIP Project Benefits in Ulsan (by 2014)

(Operating 31 Projects)

From	Intermediate processing	To	Research/ Negotiation Period (month)	R&D Fund (million US\$)	Economic benefit		Environmental benefit	
					Investment (million US\$)	Profit (million US\$/y)	CO ₂ reduction (ton/y)	Air pollutant reduction (ton/y)
Bumwoo		Korea petrochemical	12/NR	0.09	10.0	5.56	25,084	NA
Hyosung Ulsan plant		Hyosung Ulsan plant	12/NR	0.21	1.0	0.52		
Taekwang petrochemical 1 st plant	SK energy	Hyosung Ulsan plant	15/	0.15	6.0	9.2	50,396	
Korean styrolution, Kumho petrochemical	KMT	Sinwha chem, Youngwon tech	12/NR	0.08	0.52	1.28		
Yongsan chemical	Bomyung	Corinox	14/NR	0.04	-	0.40		
Seong-am MWIF #2	Hyosung Yongyeon 2 nd Plant Korea PTG	Hyosung Yongyeon 1 st Plant SKC	1/NR	0.01	8.2	14.7	39,427	
S-Oil	Su engineering	Bangeojin sewage treatment plant	12/	0.11	0.25	0.65	949.0	
Sinheung, Busung Chemical	Serim	Jokang Paint, Samhwa Paint, Buksan Paint	12/NR	0.06	-	0.25		NA
Ulsan Onsan WWTF		Hankuk paper	15/6	0.04	1.2	0.9	4,756	NA
Korea Zinc		GS Ecometal, Hanwan chemical	12/NR	0.04	2.11	1.34	15,242	NA
LG Chemical	Hangil	Jinyang Chemical	12/51	0.10	0.16	1.0	NA	NA
SK Chemcial		SK Energy, Taekwang petrochemical 1 st Plant, Hyosung	19/31	0.47	33.0	21.0	100,000	NA
Poongsan		LS Nikko	26/41	0.21	NA	0.24	NA	NA
Kumho P&B	Neo	Kumho P&B	32/17	0.19	3.0	1.7	NA	NA
SK Energy, S-Oil	Dongyang, Taesung Environmental institute	Dong-A hwasung	17/6	0.10	5.6	0.75	NA	NA
Lotte Chemical		Eastman	12/11	0.04	2.86	2.43	NA	NA
Total				3.74	160.1	11.8	487,626	4,052.6

EIP Project Benefits in Ulsan (by 2014)

- Economic Benefits**

* Currency Exchange Rate(₩1,000=\$1) was applied

Business (by project)	Cost cut (million US\$/yr)	Revenue (million US\$/yr)	Total (million US\$/yr)
31	73.76	44.55	118.31

- Environmental Benefits**

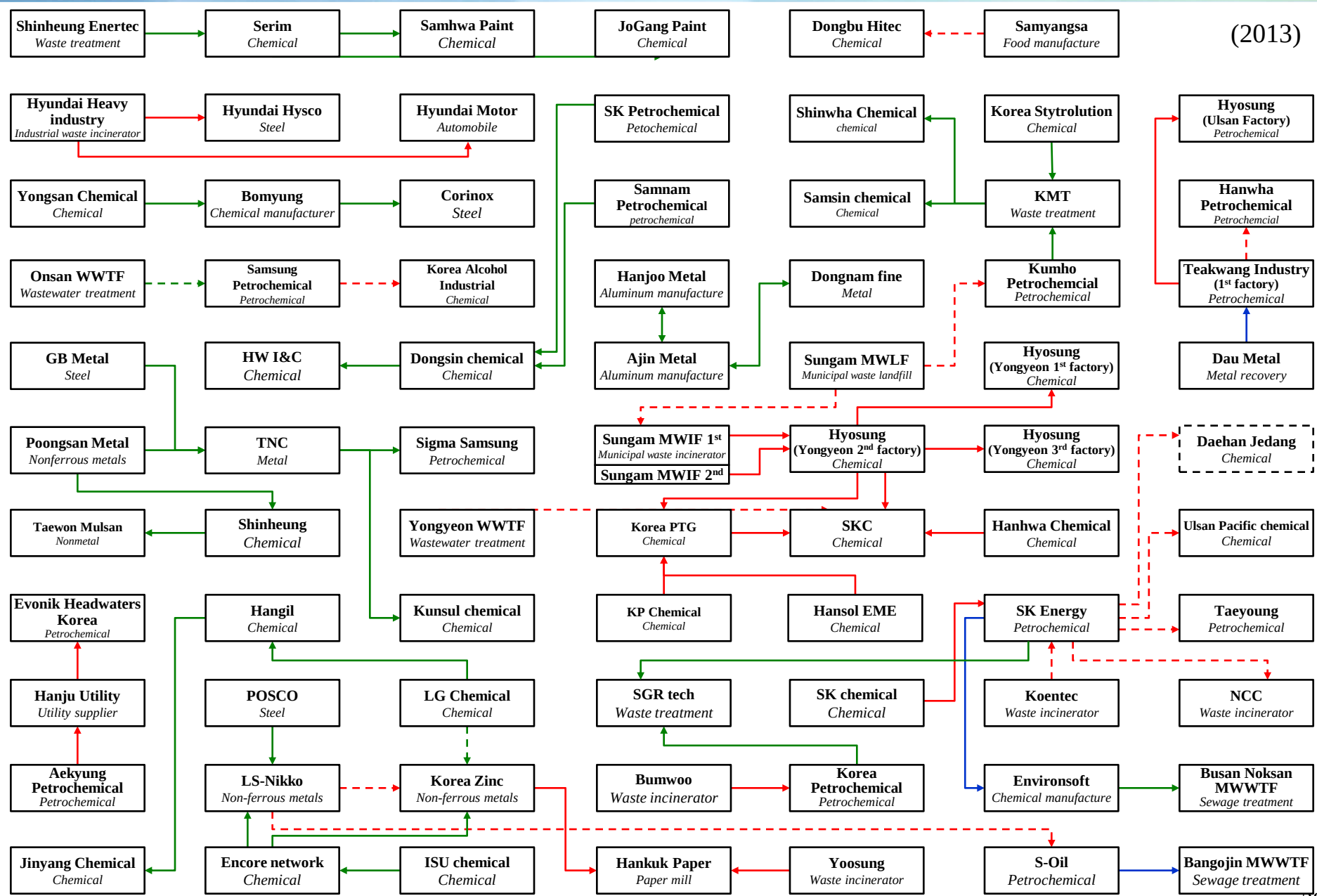
By-Product (ton/yr)	Wastewater (ton/yr)	Energy (toe/yr)	Air pollution (ton/yr)	CO ₂ (tonCO ₂ /yr)
38,544.0	79,007.0	196,102.4	4,052.1	487,626.2

- Social Benefits**

Investment (million US\$)	Job Creation (person)
160.15	184

Symbioses existing in Ulsan EIP

Energy Waste Water --> Before EIP initiative
— — — — — After EIP initiative



Contribution to Environmental Quality by Ulsan EIP project

	Industrial Waste (ton/day, 2013)	Industrial Wastewater (m³/day, 2012)	Industrial Energy (toe/yr, 2013)	Industrial Greenhouse Gas (ton CO₂-eq/yr, 2011)
Emission or Consumption (Energy) in Ulsan	5,482.2	432,000	23,332,000	38,677,000
Outcomes from 1st Stage EIP Project in Ulsan	86.9	101.5	51,767	118,378
Outcomes from 2nd Stage EIP Project in Ulsan	18.7	115.0	144,788	369,249
Outcomes from Total EIP project in Ulsan	105.6	216.5	196,515	487,627
Contribution (%)	1.9%	0.05%	0.8%	1.3%

- 
- 1. Korea Green Growth Strategy**
 - 2. Korea Eco-Industrial Park Initiative**
 - 3. Ulsan Eco-industrial park**
 - 4. Challenges to sustainability**

Challenges to Sustainability

- **Consensus on Low Carbon City**
- **Institutional Challenges**
- **Technological Challenges**
- **Financial Challenges**
- **Customized Green Investment Strategies**
- **International collaboration**

Welcome to the 4th Green Industry Conference (2016GIC) in Ulsan

Thank you

Co-Chair , Green Growth Committee of Ulsan Metropolitan City, Ulsan, South Korea
Professor, Dept Civil & Environmental Engg.

University of Ulsan

93 Dehakro, Nam-Gu, Ulsan, Korea 680-749

Tel: 052-259-1050

Fax: 052-221-0152

E-mail: parkhs@ulsan.ac.kr