Ninth Asia Pacific Eco-Business Forum
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Ulsan for you

Green Growth Strategy in Ulsan Eco-industrial Park

January 31, 2013

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In this presentation…

1. Ulsan Metropolitan City
2. Green Growth Strategy of Ulsan City
3. Ulsan Eco-Industrial Park Program
4. Implications

1. Ulsan Metropolitan City

Ulsan Metropolitan City

- Population : 1.16Miilion(2.2%)
- Area : 1,064㎢(1.1%)
- Adm. Dist. : 4 Gu 1 Gun

Ulsan Metropolitan City

Development of Ulsan city

Population by year (persons)

85,000 → 1,142,341

1962 — 2010

Automobile by year (cars)

274 → 440,735

1962 — 2010

GRDP by year (million $)

24 → 591,000

1962 — 2010

Exports by year (million $)

26 → 7,138,400

1962 — 2010

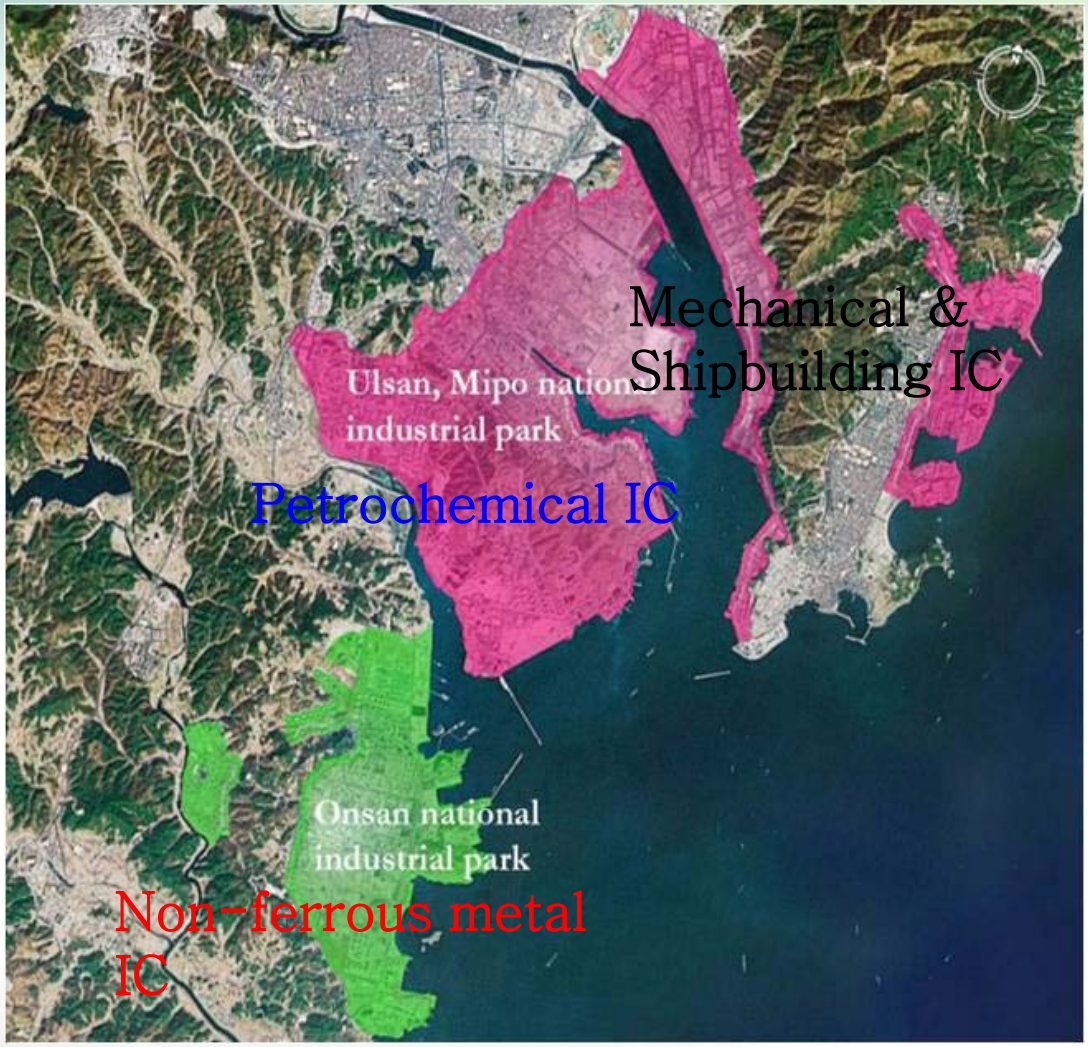
Photographs of Petrochemical IC b/w 1965 and 2008

Photographs of Downtown in Ulsan b/w 1972 and 2008

1972

2008

National Scale Industrial Complexes in Ulsan



2. Green Growth Strategy of Ulsan City

Ulsan Metropolitan City is evolving …

1960’s Fishery village

Industrial Capital of Korea

1980’s Most Polluted City

Eco-Polis Ulsan

Status of Ulsan Metropolitan City

Area : **1,058 km²**

Population : **1,142,341**

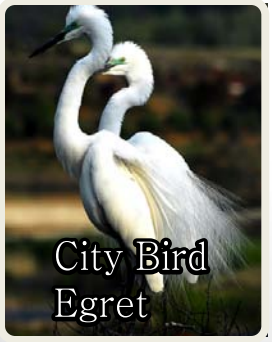
Annual temperature : **14.3**℃
(High **34.2**℃**,** Low **-9.2**℃**)**

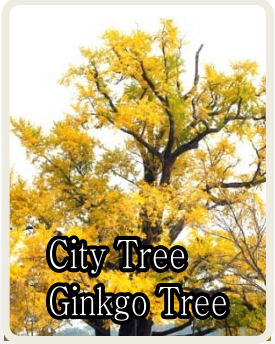
GRDP per person : $54,001
(Top in Korea)

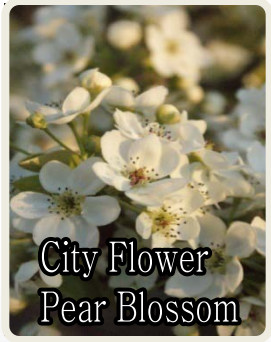
1962.06 Promoted to Ulsan City

1995.01 Ulsan city and Ulsan-gun were integrated

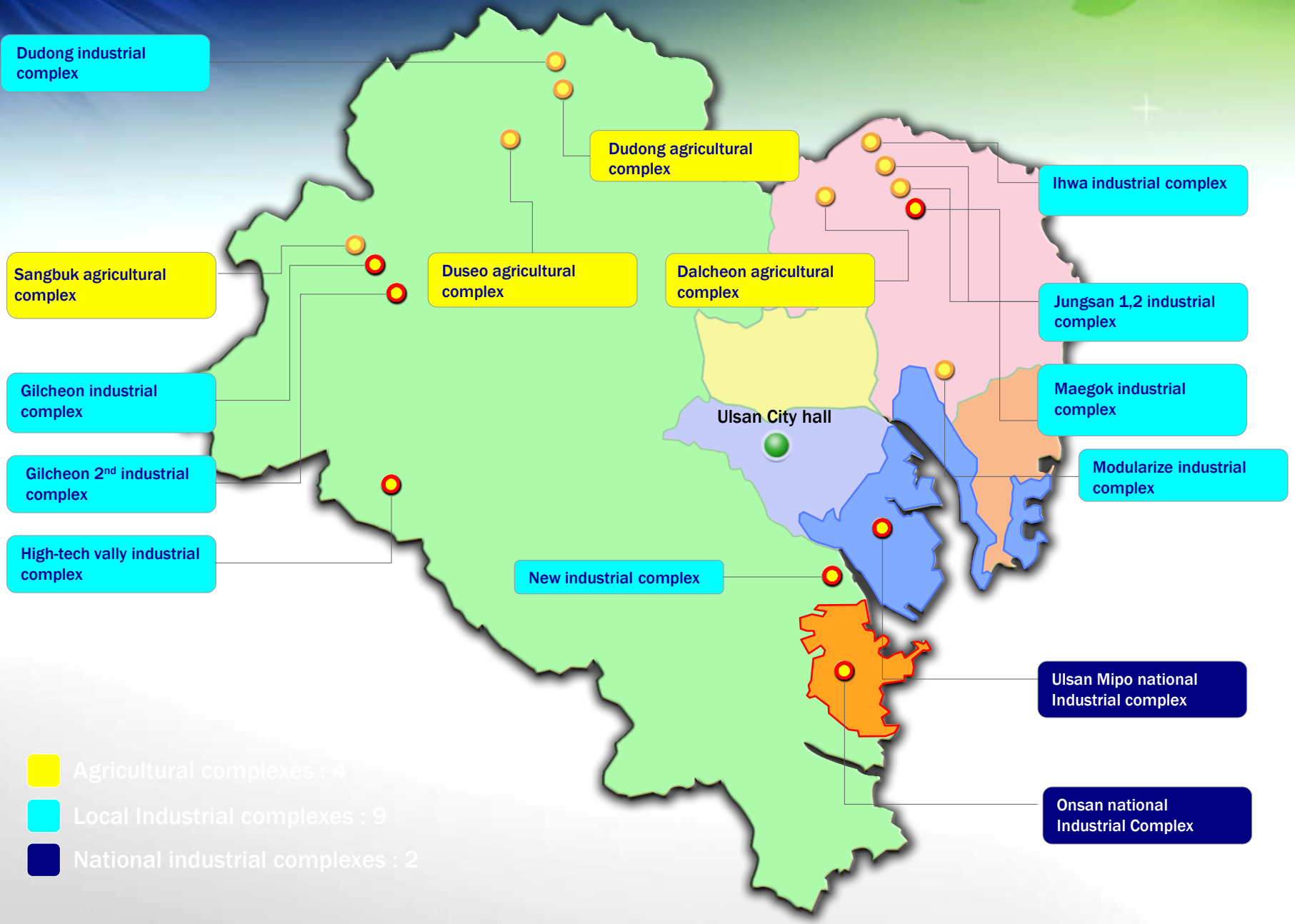
1997.07 Promoted to Ulsan Metropolitan City







Is industrial capital of Korea good or bad ?



Overview of Ulsan National industrial Parks

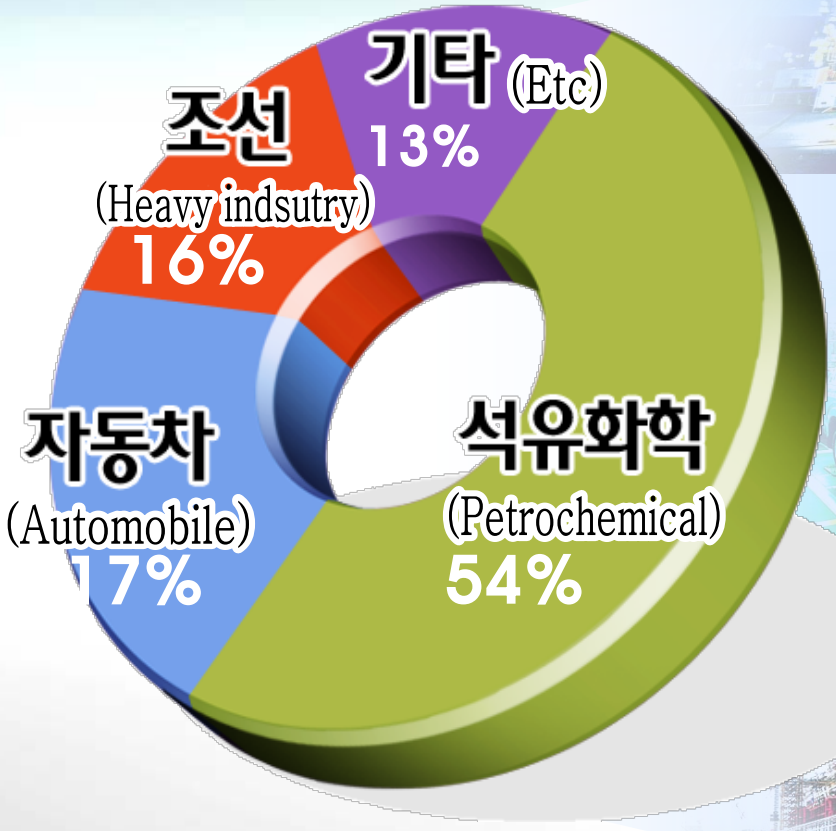
Ulsan Mipo industrial complex

Onsan industrial complex

Area	48,111,000 ㎡
Number of companies	869
Cumulative production (1,000 USD$)	99,722,200
Cumulative export (1,000 USD$)	54,844,675
Number of Employees	80,063
Type of industry	Petrochemical, Automobile, Heavy industry, etc

Area	25,939,000 ㎡
Number of companies	321
Production (1,000 USD$)	35,959,532
Export (1,000 USD$)	18,949,934
Number of Employees	14,850
Type of industry	Petrochemical, chemical, pulp, Metal, etc

Major industries in Ulsan national industrial complexes



Petrochemical

Automobile

Heavy industry

: World Scale Industrial Facilities in Ulsan


SK Energy-Refineries

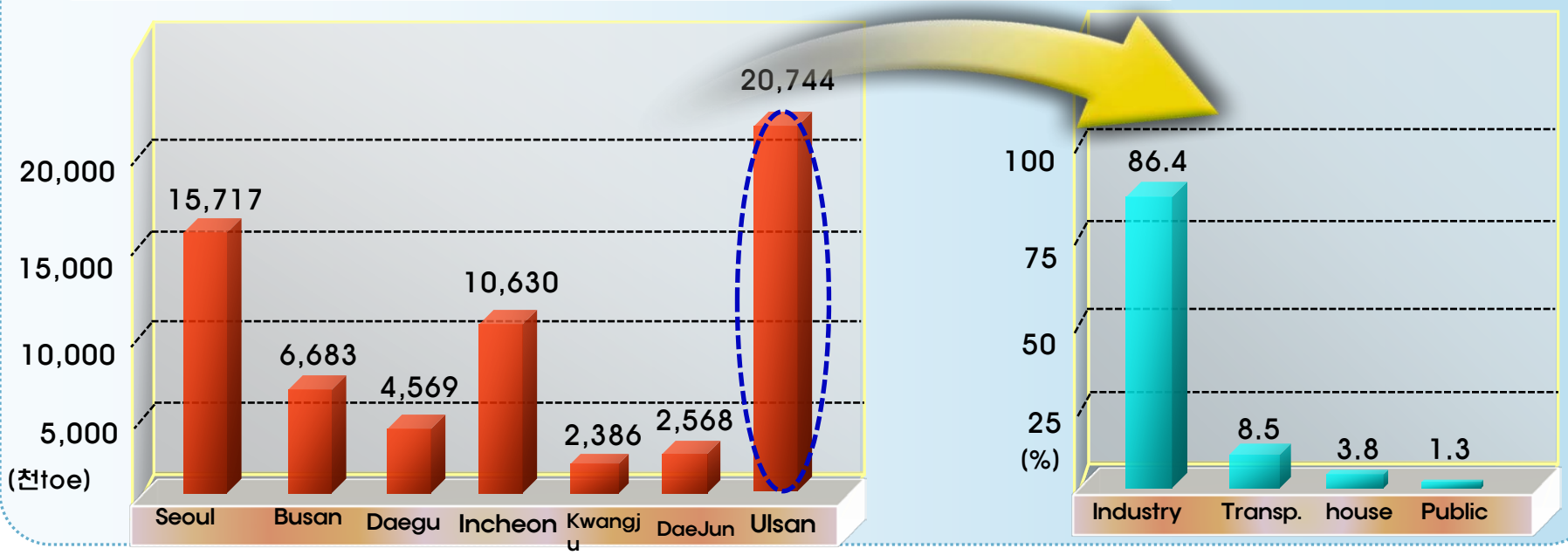
Hyundai Heavy Industry


Samsung Petrochemical


Hyundai Automobile

Energy Consumption in Ulsan (2010)

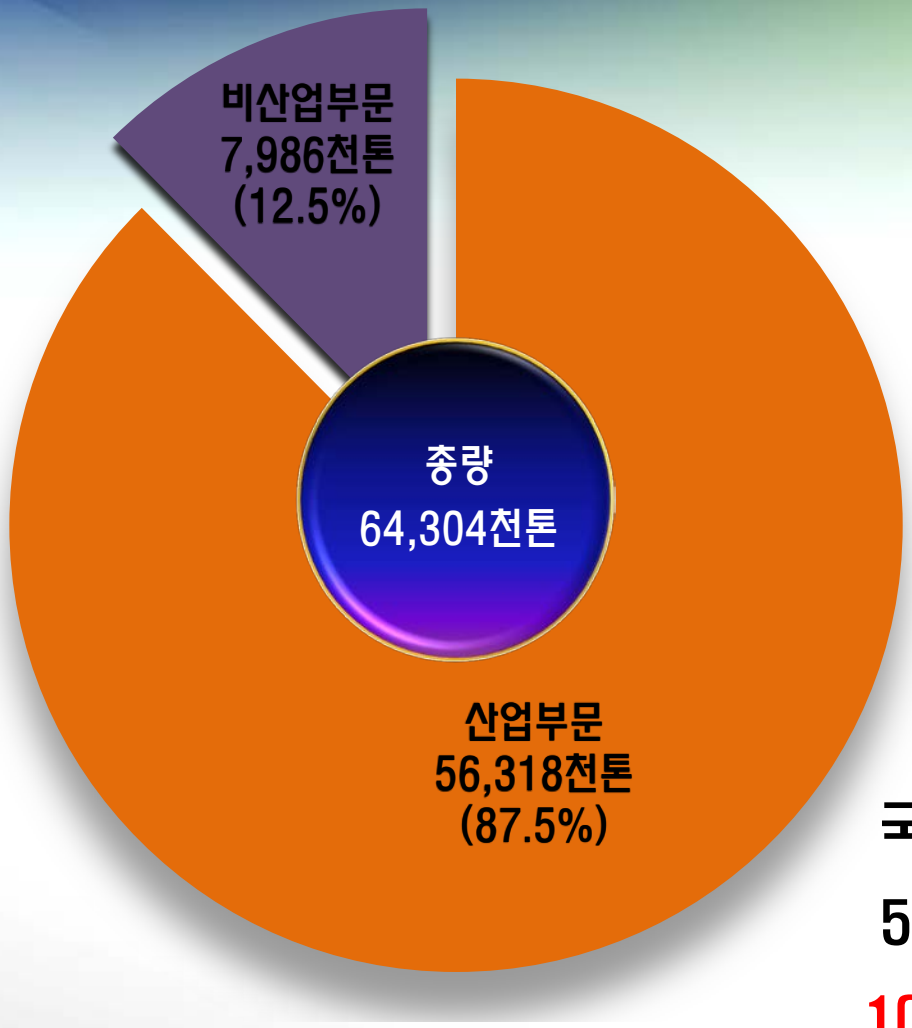
Final Energy Consumption(7 Metr. City)



- 10.7%의 National Energy Consumption 193,832toe
- High energy consumption industry(Perto. Chem./shipbuid./Auto.)

* Indusrty sector consume 86.4% (115,155toe) of total

GHG emmsions(2005)



국가 온실가스 배출량

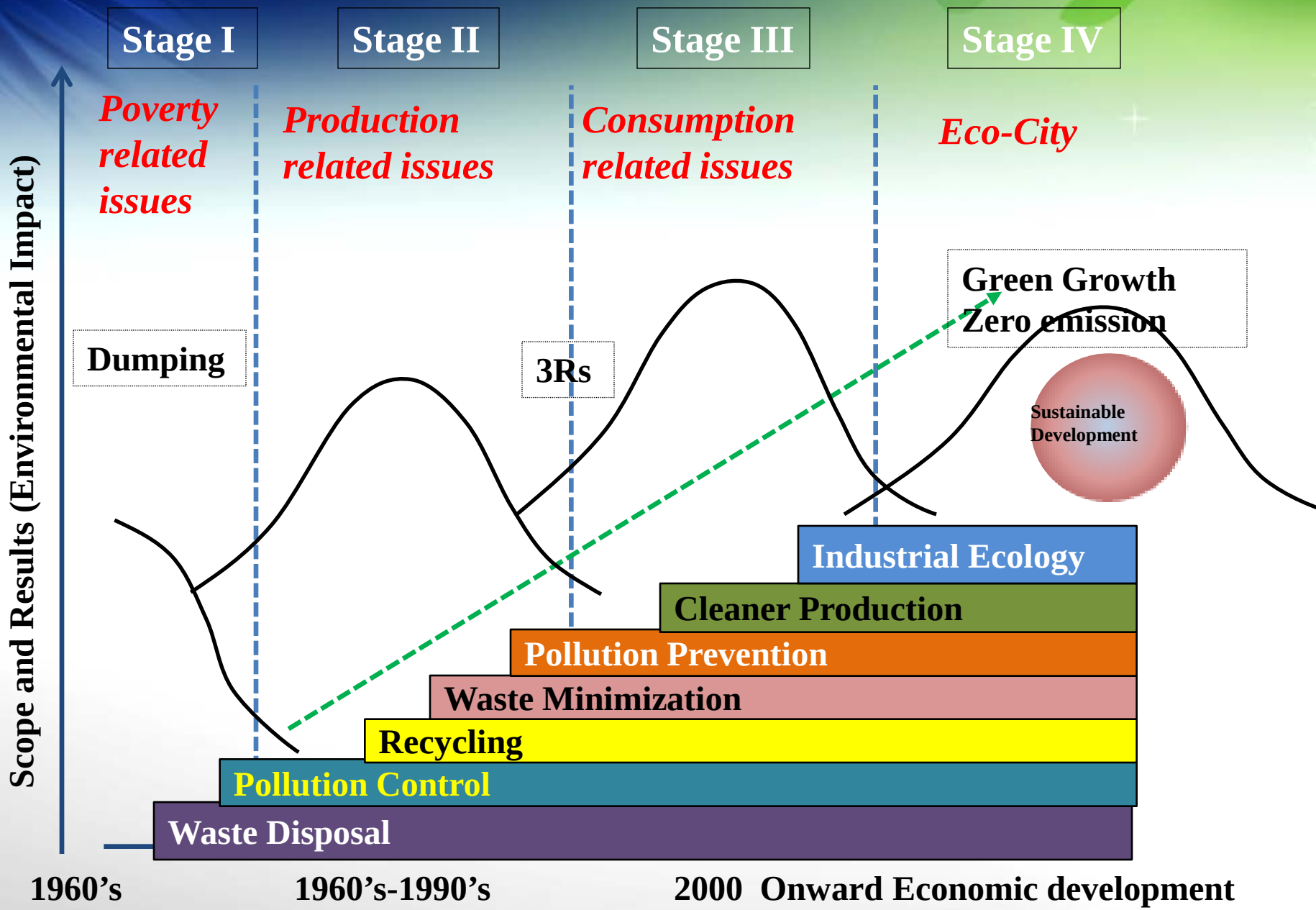
5.94 억톤CO_2('05년 기준)의

10.8%를 울산에서 배출

Challengies of Sustainability of Ulsan City

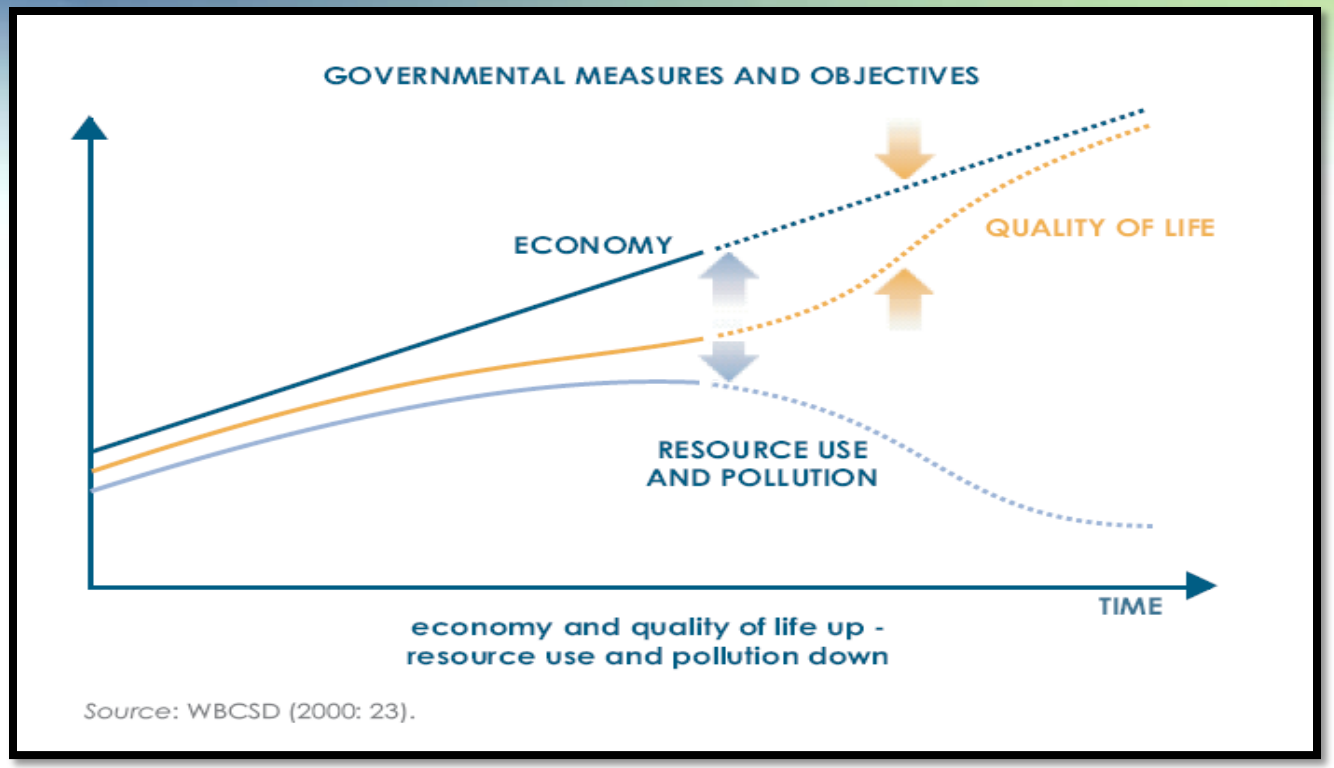
- The largest industrial city with national-scale ICs in Korea
- Population: 1.16 M (2.2% of Korea)
- Energy consumption: 20,891 TOE/yr (12.5% of Korea)
- 1st ranked energy consumption per capita in Korea
- Most energy is consumed for industrial activities
- Large emissions of Air Pollutants and Greenhouse Gases from combustion of fossil fuel.

Where we have to go ?



Solution for Sustainable Development

Green Growth Strategy (A Win-Win Solution)



while improving sustainability.

- **Decouple economic "goods" from environmental "bads"**
- **Environmental protection as growth engine**

Green Growth Strategy of Ulsan City

01 GHG Reduction City

- Emission Reduction('20 BAU 30%)
- New and Renewable Energy Propagation
- Climate Change Adaptation

02 Global Green Industry Showcase

- Greening Strategic Industry
- Transformation to Low Carbon Industrial Structure
- Center for Green Tech R&D

3. Major Green Growth Policies

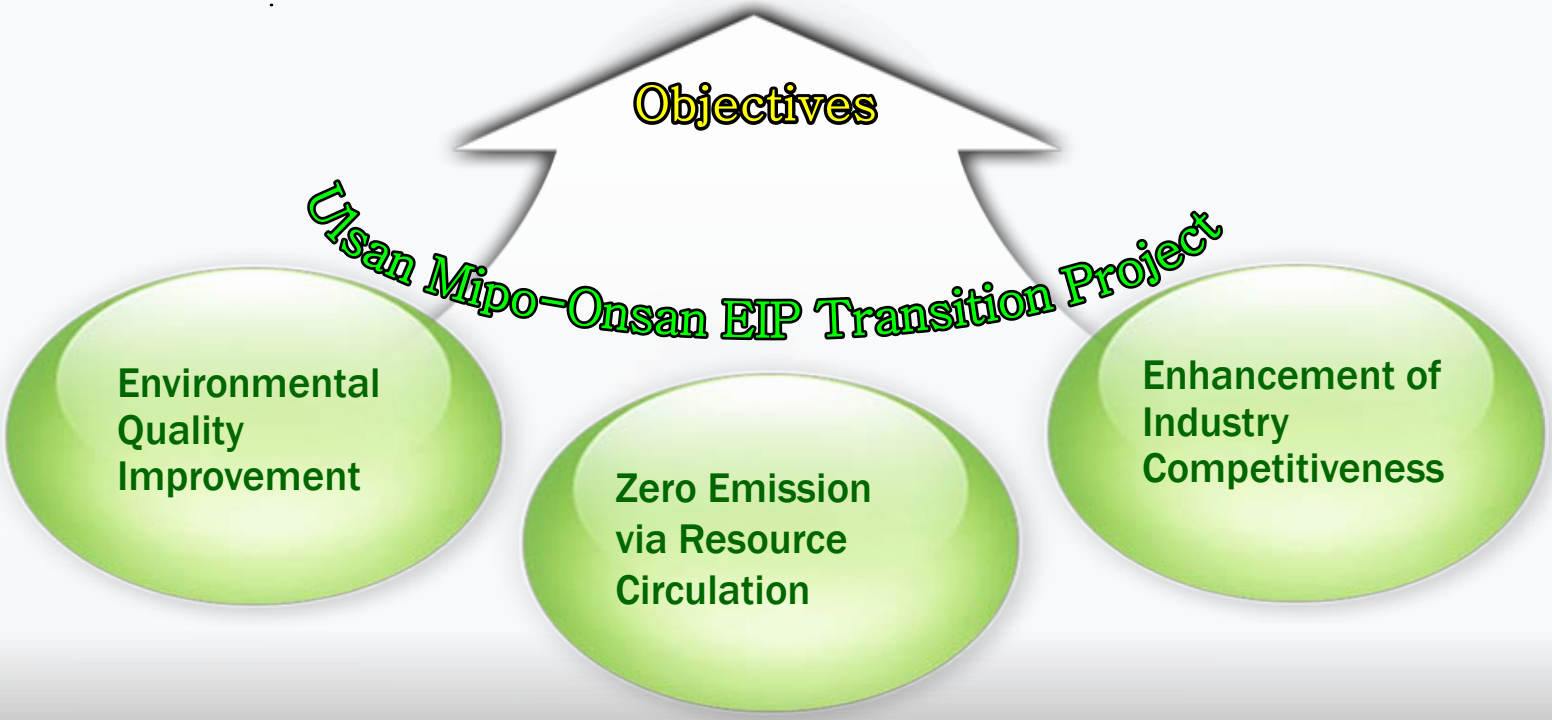
Direction of Green Growth Policies

Major Policies = EIP projects

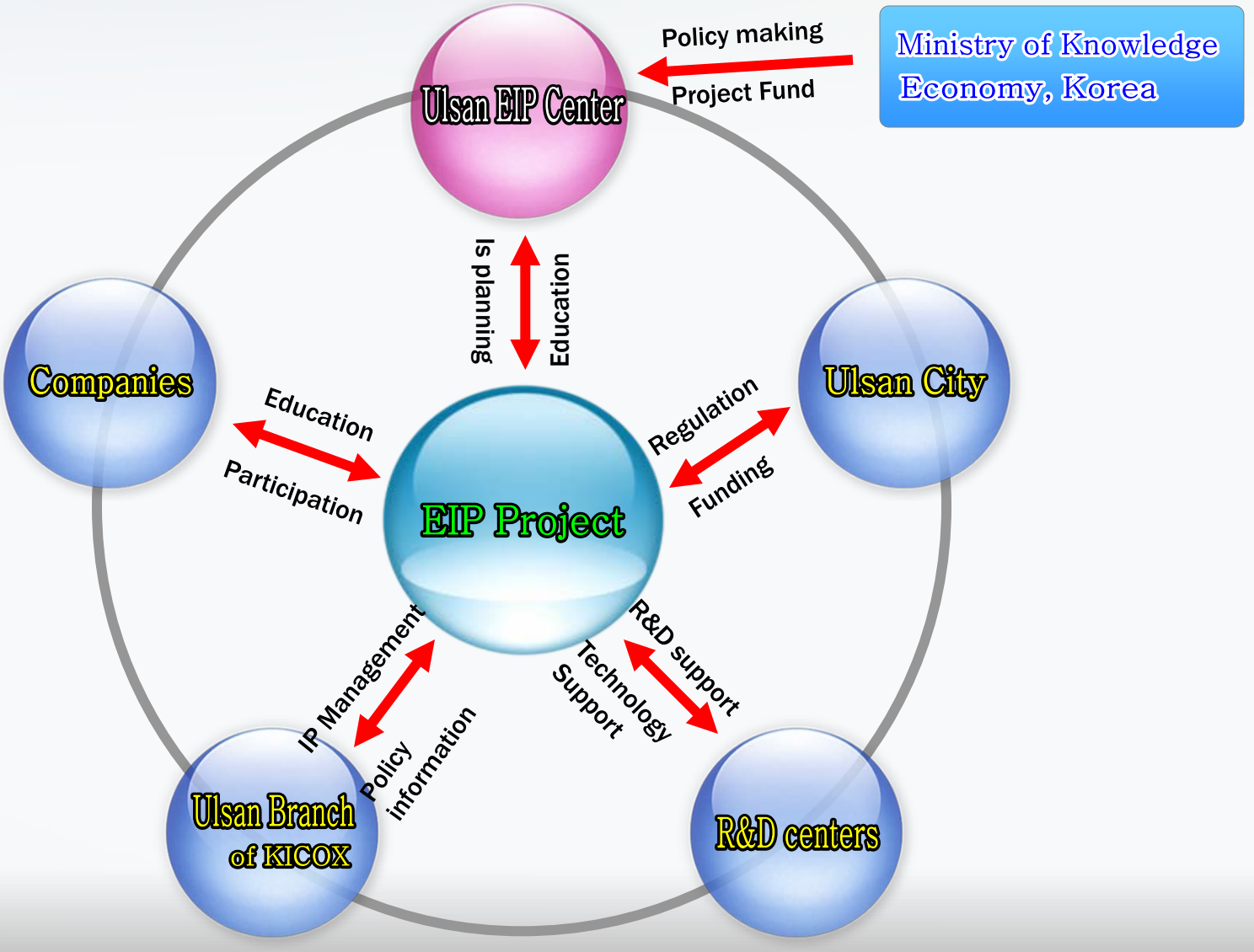
- Waste-to Energy Project
- Industry to Community energy network project
- Green Business incubation
- Foster Green Governance

Overall objective of EIP

Environmental	Industrial	Social
Pollution reduction	Cost Reduction and Enhanced competitiveness	Harmony with Community
Cascading Zero-Emission via Resource recycle	New business	Eco-Polis Ulsan
		Sustainable Society

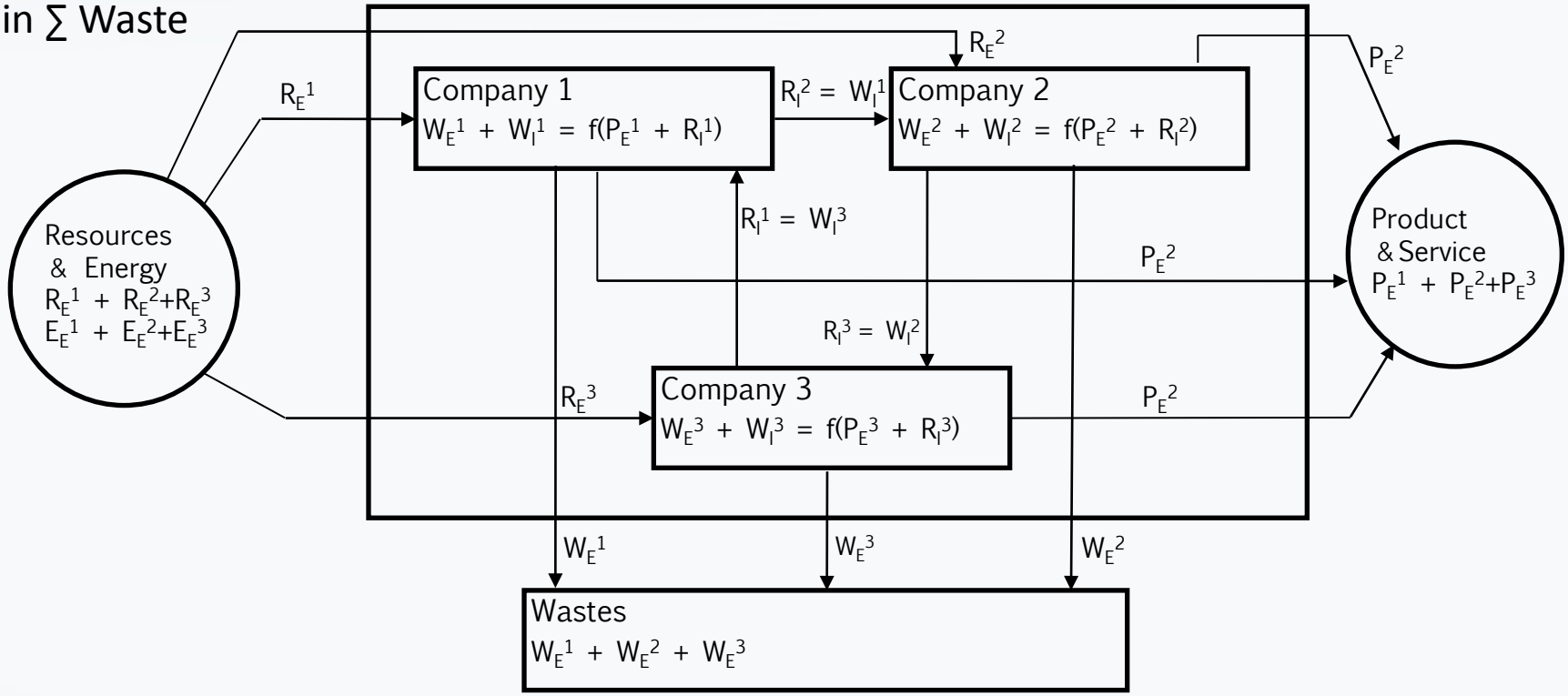


Organization hierarchy



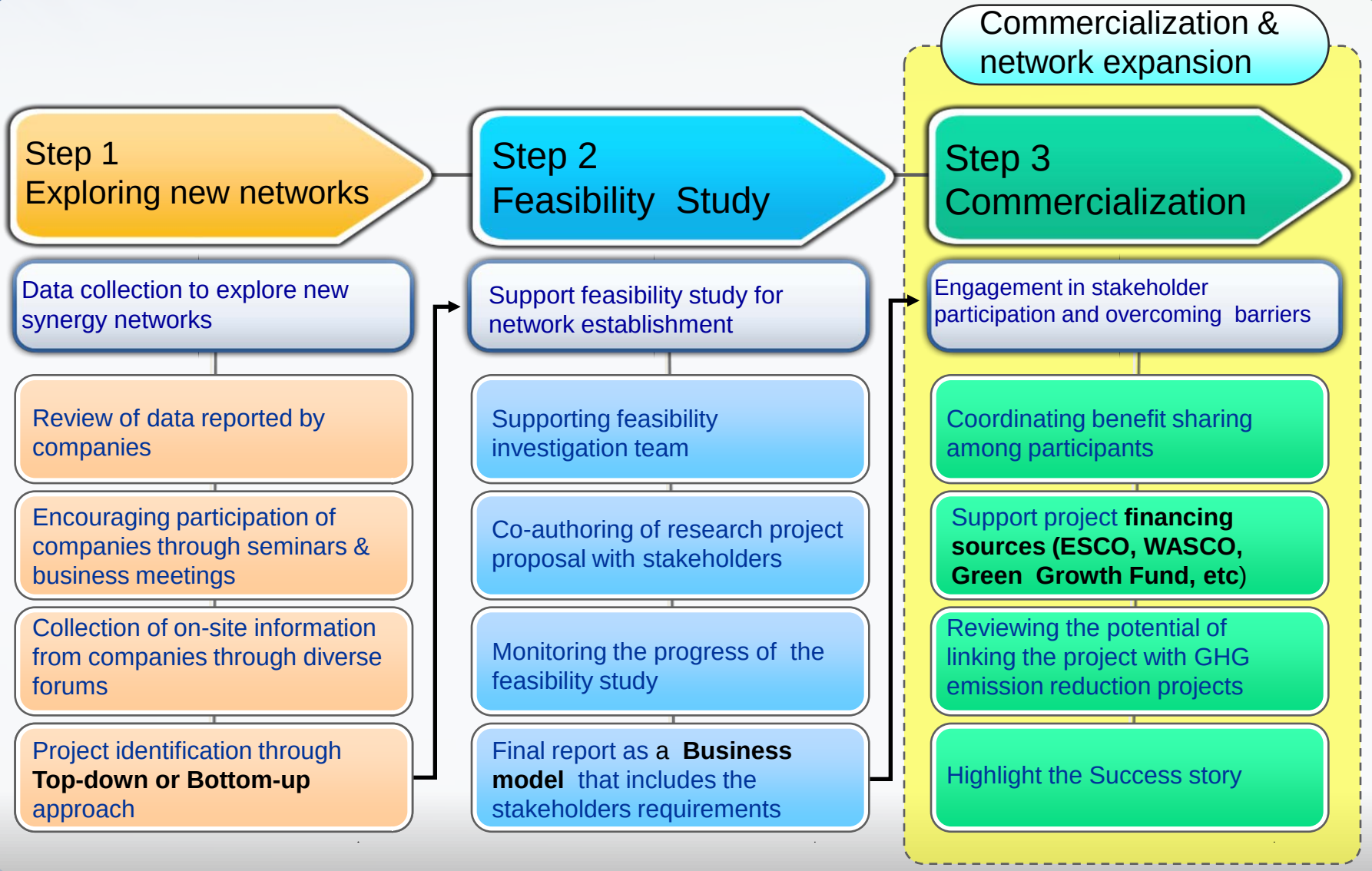
Conceptual diagram of an EIP

Max ∑ Product & Service
Min ∑ Resources & Energy
Min ∑ Waste



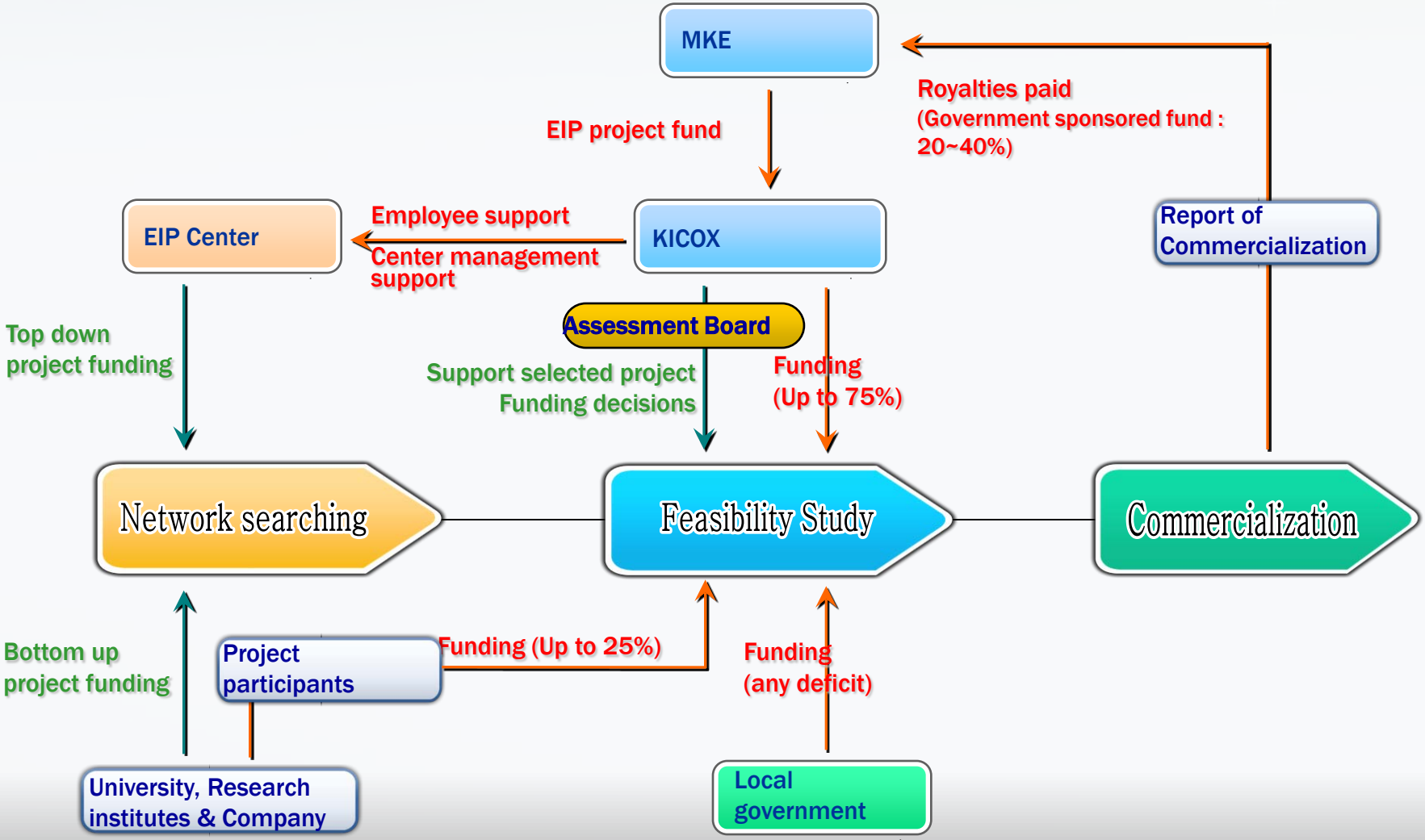
$$\text{Eco-efficiency} = \frac{\sum \text{Product \& Service}}{\sum \text{Resources \& Energy}}$$

Role of EIP Center in IS Development



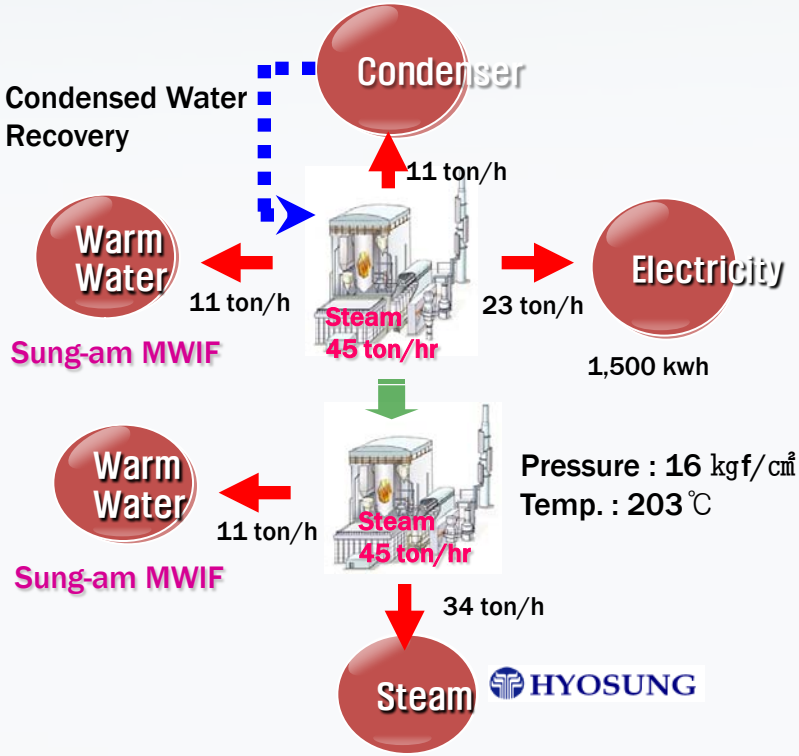
Enabling system

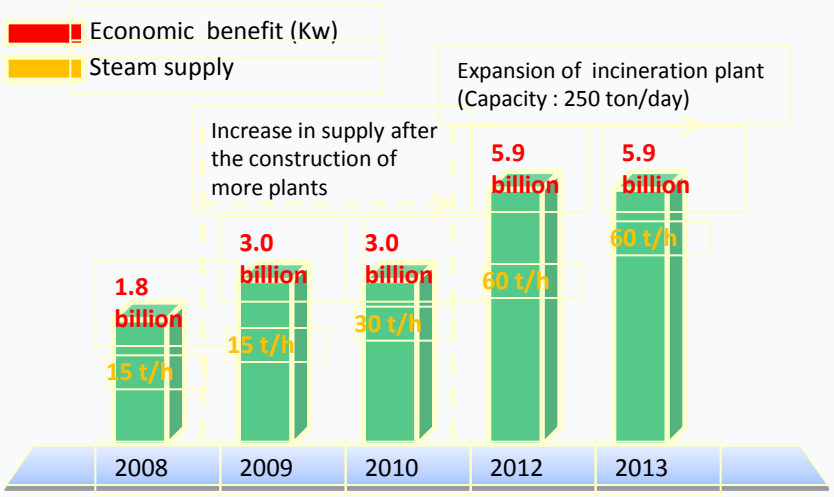
Steps and procedures of project funding



Implementation: Top-down IS network

Sungam MWIF – Hyosung Company steam network (2008)





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

Implementation: Bottom-up IS network

Yoosung – Hankook Paper steam network (2007)

Waste heat boiler

Steam generation
8~12ton/hr
(Existing equipment)

Existing Equipment Steam generation enhancement by 50%

Waste heat boiler
(after improvement)

Steam generation
22ton/hr (Improved)
Vapor pressure (12kg/cm2g)
Bolier outlet temperature
(870 ℃ →220 ℃)

Steam supply line

5~10 ton/hr

10~15 ton/hr

5~10 ton/hr

E company
(Drying equipment)

H Company

E company
(Drying equipment)

- 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 CO_2/yr, 20 ton SO_x/yr, 3 ton NO_x/yr

Implementation: Hybrid IS network

Steam Network project (2009)

SKC

45 kg/cm^2 (High pressure)
30 ton/hr

KP CHEMICAL

KorPTG KOREA PTG

5 kg/cm^2 (Low pressure)
20 ton/hr

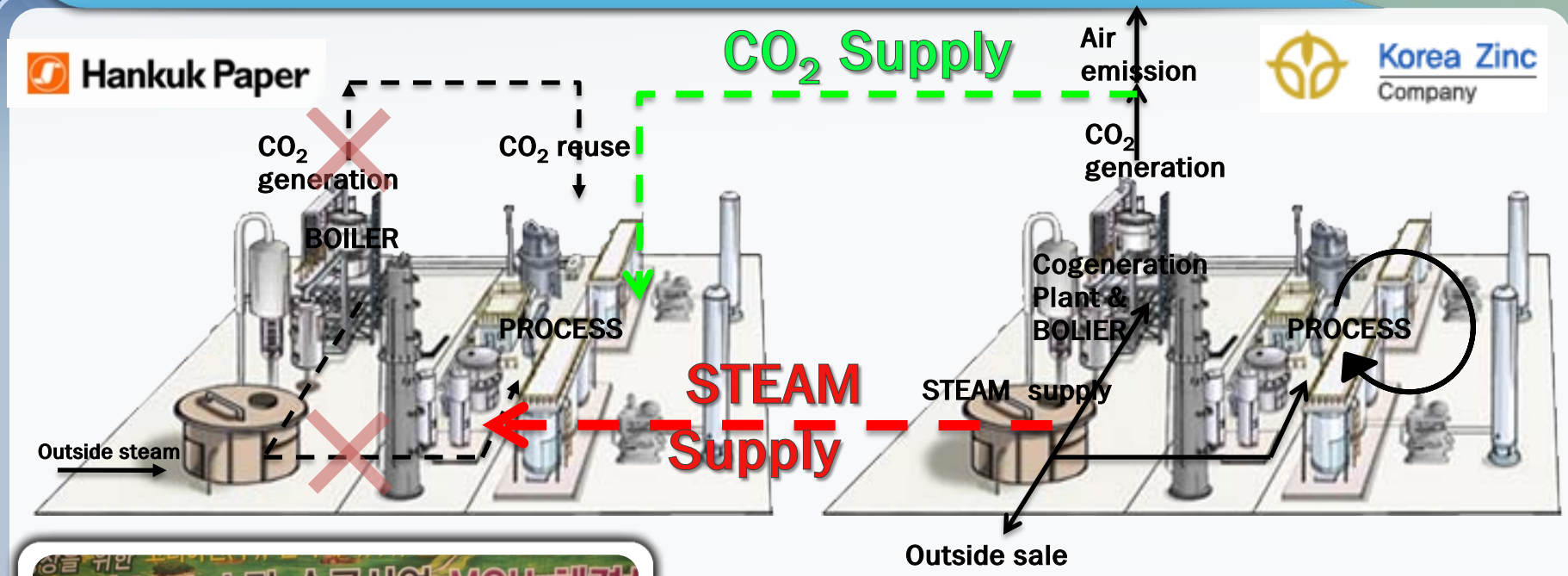
19 kg/cm^2 (Medium pressure)
10 ton/hr

Hansol EME

- **Economic benefit : 6.4 million US$/yr (Steam selling and B-C replacement)**
- **Environmental benefit: Reduction of 44468 ton CO_2/yr, 314.1 ton /yr air pollutants**

Implementation: Top-down IS network

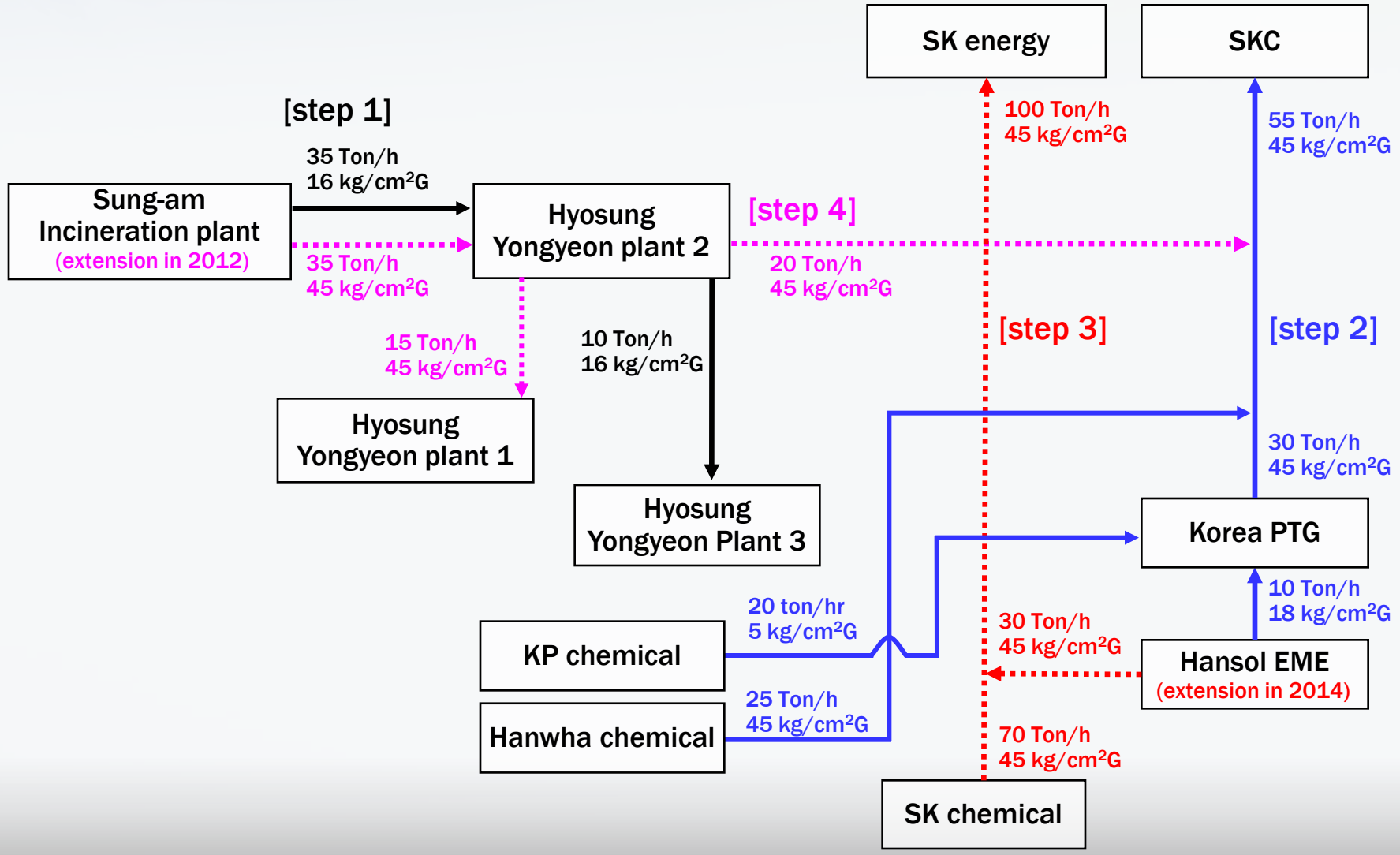
Carbon dioxide and steam network (2010)



- Economic benefit : 6.6 million US$/yr (Steam selling and B-C replacement)
- Environmental benefit: Reduction of 63643 ton CO_2/yr, 1691.5 ton /yr air pollutants

Step-wise Implementation

Hybrid IS Network

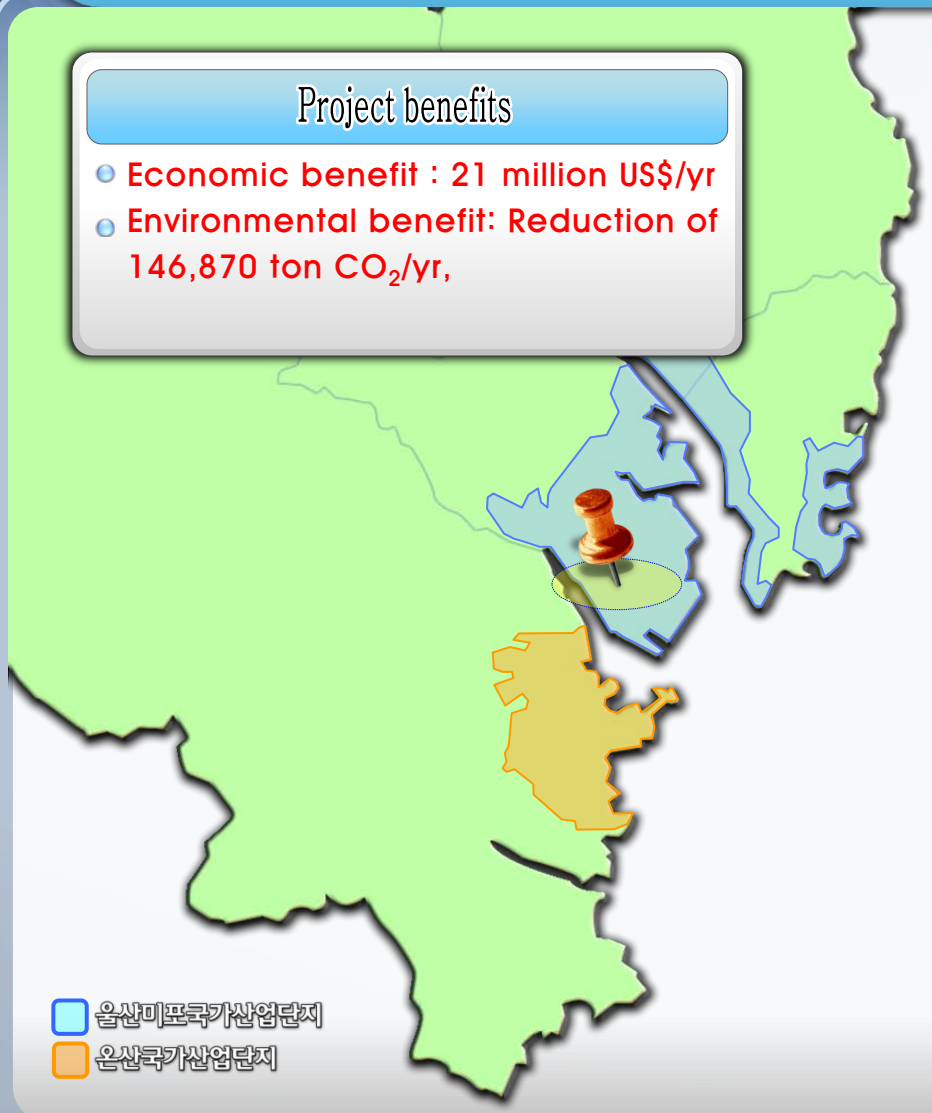


Step-wise Implementation

Steam Highway project

Project benefits

- Economic benefit : 21 million US$/yr
- Environmental benefit: Reduction of 146,870 ton CO_2/yr,



The outcomes of EIP project

SK energy – Noksan MWWTF

Supply of 16.8ton/yr
Aldehyde wastewater with
removed toxicity

Use for carbon soruce

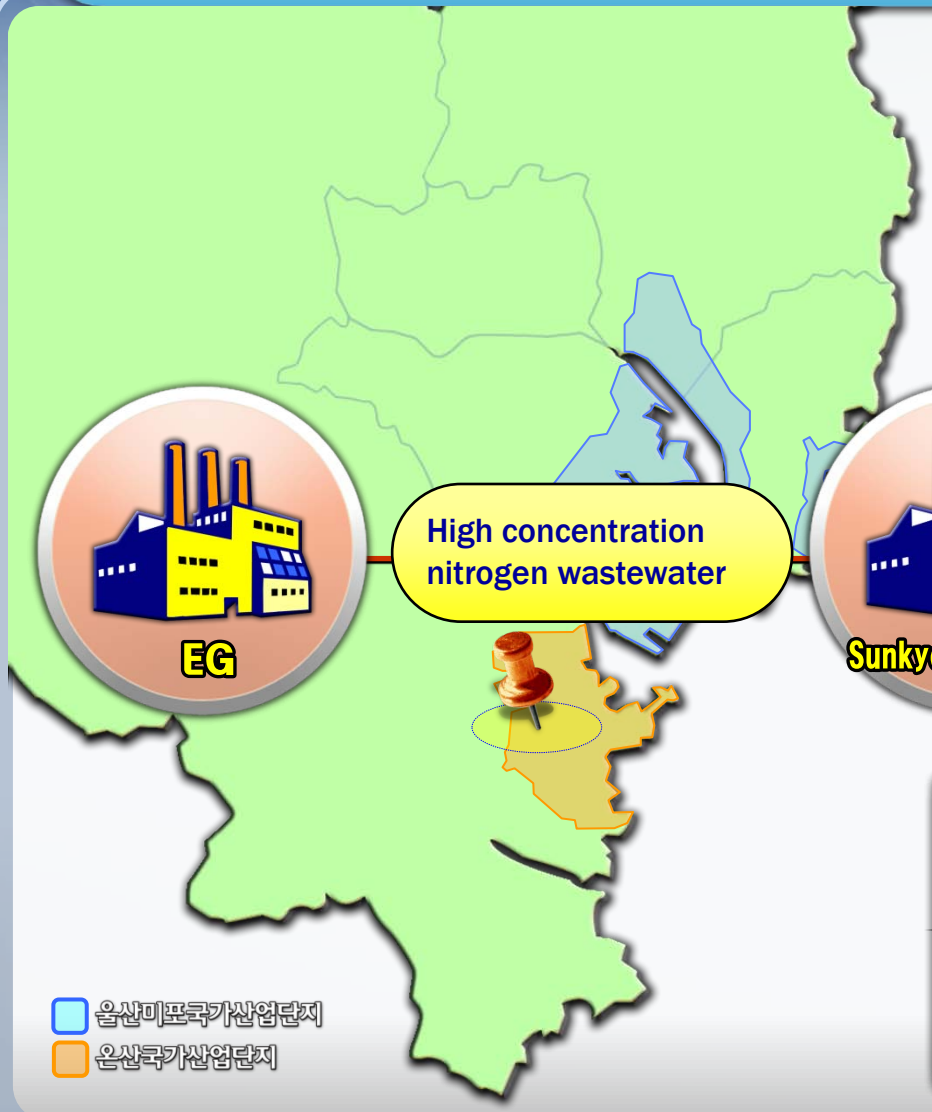
Project benefits

- Resource replacement and Treatment cost 1.98 million US$/yr reduction
- Wastewater 6,000ton/yr reuse

울산미포국가산업단지
온산국가산업단지

The outcomes of EIP project

Sunkyung Watech – Petrochemical company WWTF



Project benefits

- Resource replacement and Treatment cost
  3.69 million US$/yr reduction
- High concentration nitrogen wastewater
  2,000ton/yr recycle

The outcomes of EIP project

Dongnam precision, Hanjoo metal – Ajin Metal

Project benefits

- Resource replacement and Treatment cost 4.44 million US$/yr reduction
- Dust and VOC 1,325ton/yr recycle

The outcomes of EIP project

Ilsin polytech – LS Nikko

Dolomite mine

Dolomite
Magnesite

POSCO

Waste of
Steel process

LS-Nikko copper

울산미포국가산업단지
온산국가산업단지

Project benefits

- Resource replacement and Treatment cost 1.15 million US$/yr reduction
- Gypsum sludge 390,000ton/yr reduction

The outcomes of EIP project

Industrial Comp, Poonsan – Shinheung oil company – Taewon mulsan

Poongsan

Grease removing waste

POONGSAN

Shinheung oil company

Emulsion fuel oil 13,635ton/yr

Taewon mulsan

Waste oil generated from industrial complex

Shinheung Enertec

울산미포국가산업단지

온산국가산업단지

Project benefits

- Emulsion fuel oil product and supply 2.67 million US$/yr
- Sludge 300ton/yr, Wastewater 900ton/yr reduction

The outcomes of EIP project

Poongsan – TNC – Sigmasamsung Coatings

Poongsan

TNC

TNC

Zinc ash 456ton/yr

POONGSAN

Zinc scrap 600ton/yr

TNC 2 factory

Zinc dust 100ton/yr
& Zinc flake 458ton/yr

Hyundai motor
Hyundai havey industrial
Hyundai mipo dockyard

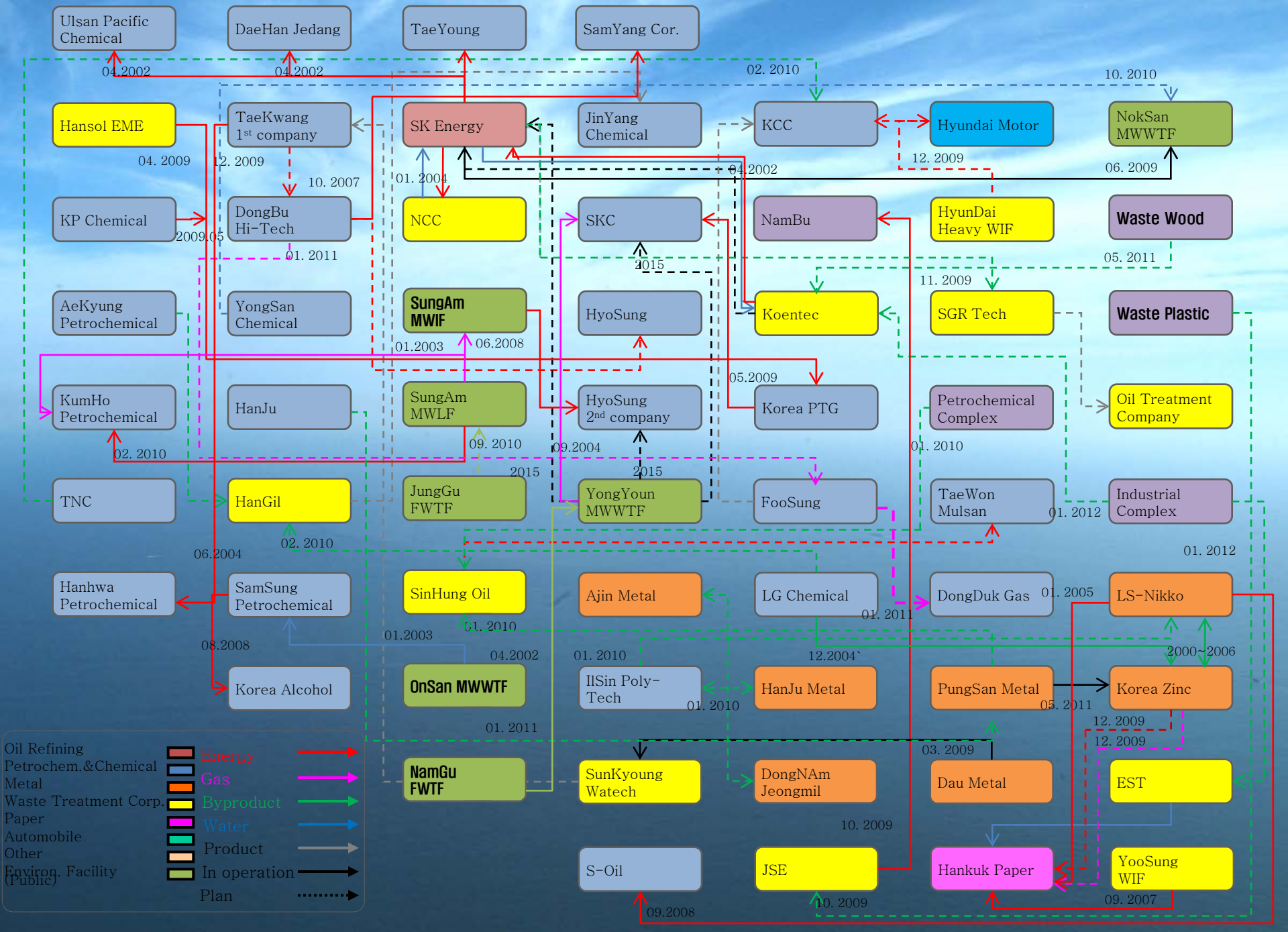
Sigmasamsung Coatings
Kunsul chemical industrial

TNC 1 factory
GB Metal

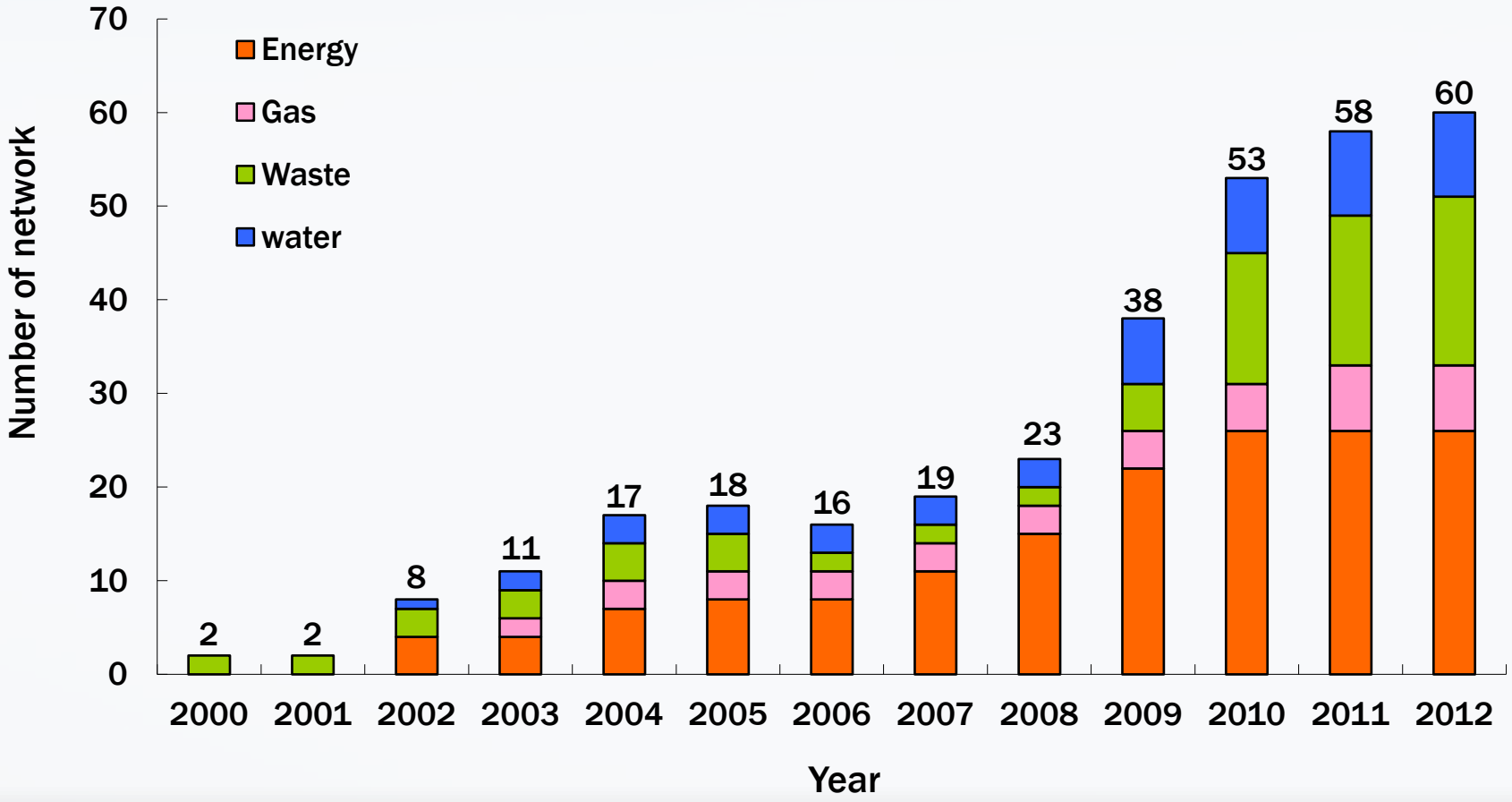
울산미
온산국가산

Project benefits

- Resource reduction and Production selling 4.4 million US$/yr
- CO_2 315ton/yr, Waste 620ton/yr reduction
- Employment for 4 people


Ulsan Pacific Chemical
DaeHan Jedang
TaeYoung
SamYang Cor.
04.2002
04.2002
02. 2010
10. 2010
Hansol EME
TaeKwang 1st company
SK Energy
JinYang Chemical
KCC
Hyundai Motor
NokSan MWWTF
04. 2009
12. 2009
10. 2007
01. 2004
04.2002
12. 2009
06. 2009
KP Chemical
DongBu Hi-Tech
NCC
SKC
NamBu
HyunDai Heavy WIF
Waste Wood
2009.05
01. 2011
2015
05. 2011
11. 2009
AeKyung Petrochemical
YongSan Chemical
SungAm MWIF
HyoSung
Koentec
SGR Tech
Waste Plastic
01.2003
06.2008
05.2009
KumHo Petrochemical
HanJu
SungAm MWLF
HyoSung 2nd company
Korea PTG
Petrochemical Complex
Oil Treatment Company
02. 2010
09. 2010
09.2004
01. 2010
2015
2015
TNC
HanGil
JungGu FWTF
YongYoun MWWTF
FooSung
TaeWon Mulsan
01. 2012
Industrial Complex
02. 2010
06.2004
01. 2012
Hanhwa Petrochemical
SamSung Petrochemical
SinHung Oil
Ajin Metal
LG Chemical
DongDuk Gas
01. 2005
LS-Nikko
01. 2010
01. 2011
01.2003
08.2008
04.2002
01. 2010
12.2004`
2000~2006
Korea Alcohol
OnSan MWWTF
IlSin Poly-Tech
HanJu Metal
PungSan Metal
Korea Zinc
01. 2010
05. 2011
12. 2009
12. 2009
01. 2011
03. 2009
NamGu FWTF
SunKyoung Watech
DongNAm Jeongmil
Dau Metal
EST
10. 2009
S-Oil
JSE
Hankuk Paper
YooSung WIF
09.2008
10. 2009
09. 2007
Oil Refining
Petrochem.&Chemical
Metal
Waste Treatment Corp.
Paper
Automobile
Other
Environ. Facility (Public)
Energy
Gas
Byproduct
Water
Product
In operation
Plan

Evolution of IS networks (2000-2012)



EIP project Benefits (in operation)

Material	From	To	Profit (million us$/yr)	Environment benefit (ton/yr, toe/yr)				Social benefit	
				Waste reduction (ton/yr)	Wastewater reuse (ton/yr)	CO_2 reduction (ton/yr)	Air pollutant reduction (ton/yr)	Investment (million us$/yr)	Employment (persons)
Aldehyde waste water	SK energy	Noksan MWWTF	19.9		6,132			1.3	
Steam	Yoosung Corp.	Hankuk Paper	38.5			3,893	12,491	8.5	
Oil degradation material	SK Energy	Oil Spill Restoration Company	1.2	200				2	
Steam	Sung-am MWIF	Hyosung company (II)	73.8			18,850	60,476	50	140
Nutrient for Micro Organisms	Dau metal	Teakwang industry(I)	36.9		30,000			1	
Steam	KP chemical Hansol EME	SKC	40.0			10,880	34,907	140	
Steam	Hyundai Heavy Industry	Hyundai Motor Hyundai Hysco	32.0			6,024	10,188	62	
Neutralizing Agent	POSCO	LS-Nikko	11.5	29,000					
Aluminum Chip	Dongnam fine Hanjoo metal	Ajin Metal	33.0	1,250				1	
Steam, CO2	Korea Zinc	Hankuk Paper	66.0			26,849	63,643	210	
Waste oil	Petrochemical cluster	Teawon Mulsan	16.7	300	900	12,120		5	
Zinc powder	Poongsan metal GB metal TNC	Kunsul chemical industry Sigma Samsung	54.3	1,178			316	20	
Steam	Aekyung petrochemical	Evonik Headwaters Korea	24.0			8,881	30,094	15	
TPA slurry	SK petrochemical Samnam petrochemical	CNT Hansol chemical	11.92	1,200				8	
H_2S Gas	ISU chemical	Korea zinc LS Nikko	59.7	2,800				6	
Steam	Bum woo IF	Korea petrochemical	54.8			8,278	25,084	100	
	21 companies	23 companies	578.42	35,928	37,032	95,775	240,199	629.8	140

[1]Profit is the summation of both supplier and recipient

Assumption:- 1US$ = 1000 Korean Won

Projects in progress

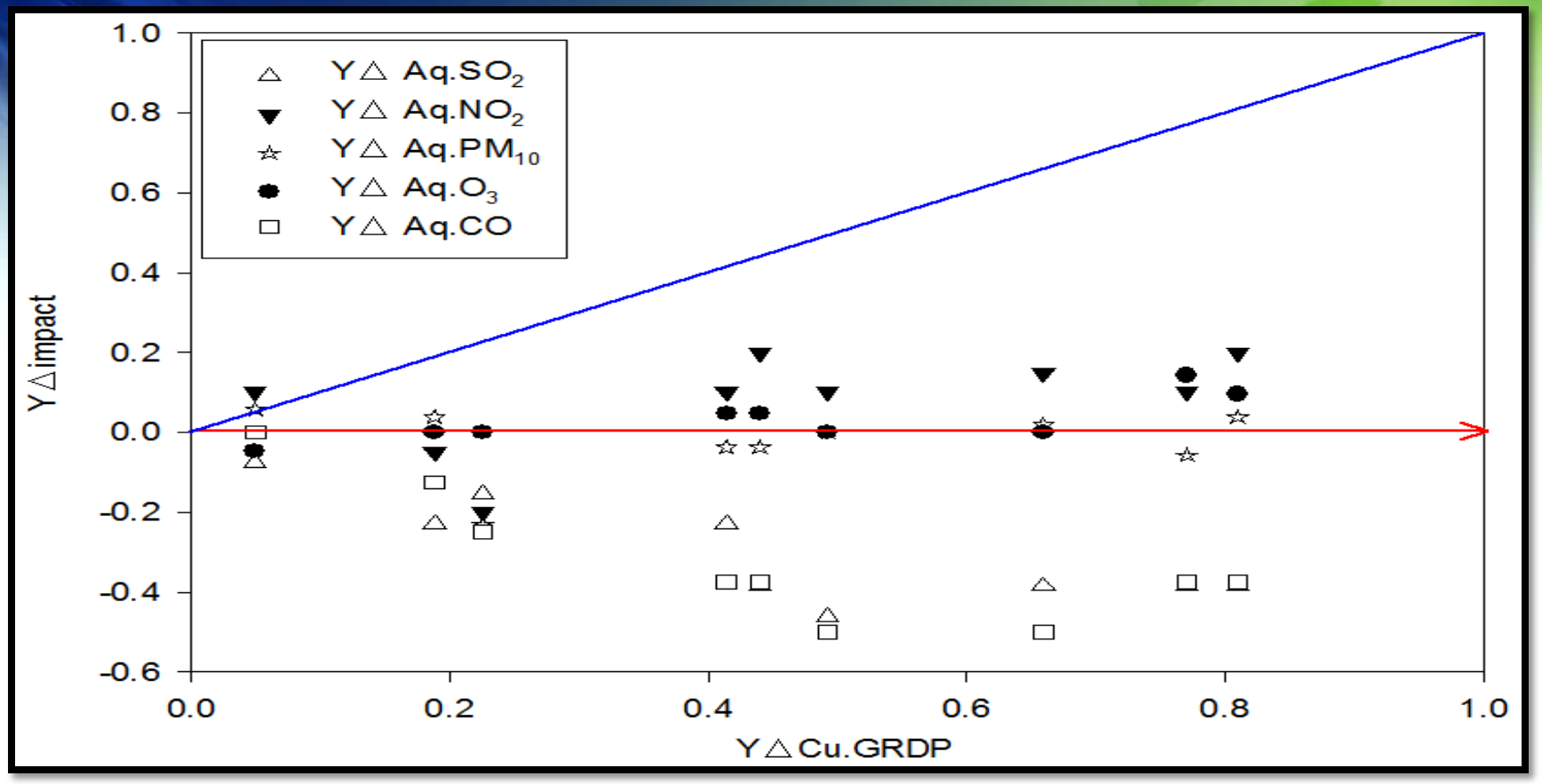
Project Name	Material exchange	From	To	Economic benefit (million US$/yr)	Other benefits (ton/yr)
Establishment of Steam Swap Energy Network in Ulsan·Mipo National Industrial Complex (Mae-Am Area)	Steam	Taekwang industry	Hyosung ulsan	106.0	CO_2 reduction 98,842
Construction of steam network by steam regeneration & distribution in Yongyeon Industrial Area	Steam	Hyosung, Plasma H	SK energy, SKC	270.0	CO_2 reduction 228,304
Network Construction of ethylene recovery in the deform Process of Combustible	Combustible gas	Wacker chemical	Hyosung yongyeon	1.5	CO_2 reduction 500
Supply business with by-product fuel in Naphtha process be connected steam demand project in refining process.	Steam	Korea zinc	KPIC	*	
Construction of a renewable fuel network from development of process for waste synthetic resins pyrolysis	Waste synthetic resins	*	Nambu, Bomyeong	14.6	Waste reduction 6,000
Value improvement network for the recovery waste in DOP process		LG chemical	Jinyang chemical	3.4	Waste reduction 486
Establishment of network for reusing valuables metal and water of a manufacturing process of copper goods using industrial complex wastes	Metal, water	Poongsan	Poongsan	17.8	Water reuse 500
Networking for reusing waste hydrogen generated from electrolysis cell	Hydrogen	*	*	*	CO_2 reduction 3,520

*To be finalized

Contribution to Environmental Quality by Ulsan EIP project

	Industrial Waste (2008, ton/yr)	Industrial Wastewater (2007, ㎥/yr)	Energy (2007, toe/yr)	CO_2 (2007, tCO_2/yr)	Air Pollutant(2007, ton/yr)			
					NO_x	SO_x	VOC	PM10
Emission or Consumption (Energy) in Ulsan	1,998,375	144,626,870	22,525,000	61,829,000	64,198	63,110	96,851	9,797
Outcomes from 1st Step EIP Project in Ulsan	35,168 (132,823)	9,032 (109,911)	90,551 (112,049)	325,262 (765,180)	569 (569)	1,144 (1,224)	75 (75)	1,369 (1,369)
Contribution rate (%)	1.76 (6.65)	0.01 (0.08)	0.40 (0.50)	0.53 (1.24)	0.89 (0.89)	1.81 (1.97)	0.08 (0.08)	13.97 (13.97)

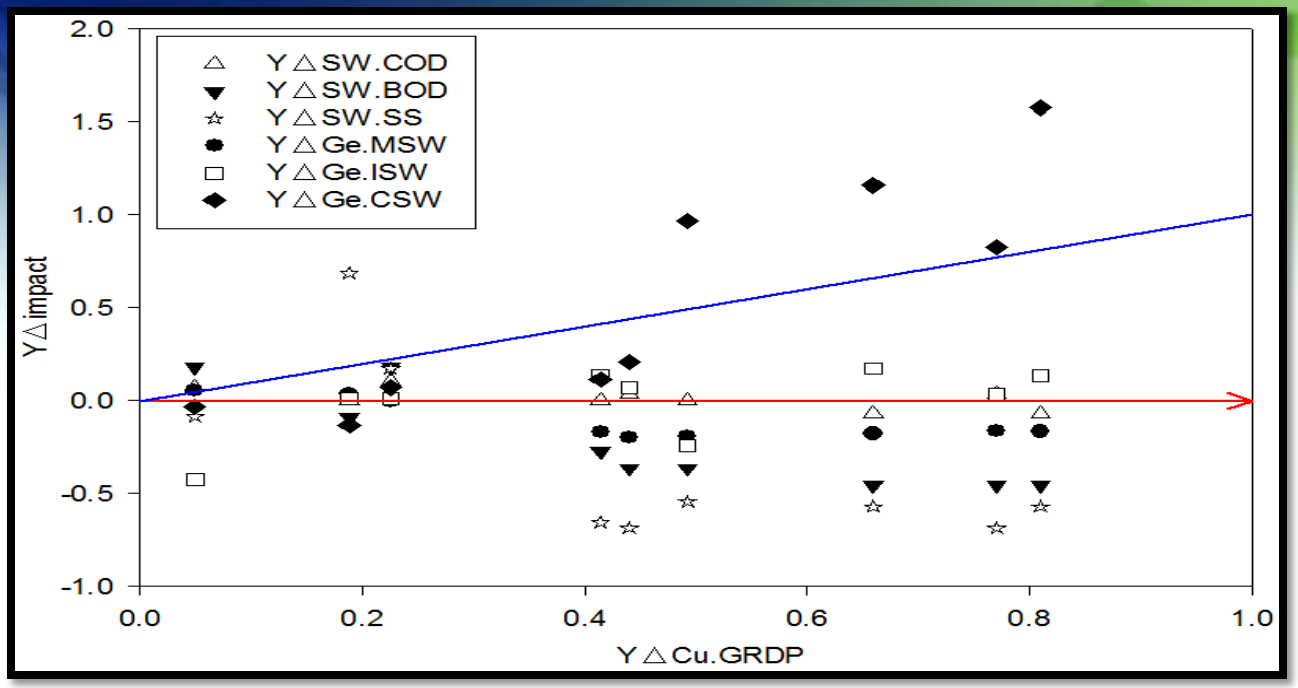
Decoupling: Economic Development & Environmental Pressure



- NO_2, PM_{10} and O_3 emission are in transition between negative and relative decoupling.

- Negative decoupling is observed in terms of SO_2 and CO emission

Decoupling: Economic Development & Environmental Pressure



- Generation of CSW showed transition between relative and absolute decoupling.
- ISW generation is relatively decoupled.

- Surface water quality (in terms of BOD, COD and SS) showed negative decoupling.
- MSW generation is negatively decoupled.

4. Implications

Staged development

Stage 1
2005~2009

Demonstration stage

- Over 200 participating companies
- By-products, Energy & Water exchange network
- Training on CP and EMS

Stage 2
2010~2014

Dissemination stage

- Diffuse to 1000 companies
- Expansion of IS networks
- Development of EIP management system

Stage 3
2015~2019

Realization of sustainable Eco-polis Ulsan

- Share Ulsan EIP model with global society
- Eco-polis Ulsan based on circular economy

- Ulsan's Green Growth strategy targets for the transformation of traditional industrial complexes to eco-industrial park

- Ulsan EIP project aims at the collective innovation of the industrial complexes to enhance economic, environmental and social benefits of Ulsan City.

- Ulsan EIP projects is demonstrating the potential of harmonization of nature and man-made system by socioeconomic and technological symbiosis.

- Sharing the lessons of EIP projects with international society for greening the world.

Ulsan

welcomes you

to

2013 ISIE conference

(jointly organized by China, Japan and Korea)

Thank you

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