

12th Asia-Pacific Eco-Business Forum in Kawasaki

Feb. 18 - 19 2016

Session 1: Towards Establishing an Industry-Academic-Government Cooperation to Promote the Kawasaki Model as an Environmentally Sustainable City in Southeast Asia

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## “Eco-Industrial Network Challenges from Kawasaki Eco-Town”

Prof. FUJITA, Tsuyoshi [fujita77@nies.go.jp](mailto:fujita77@nies.go.jp)

Director of

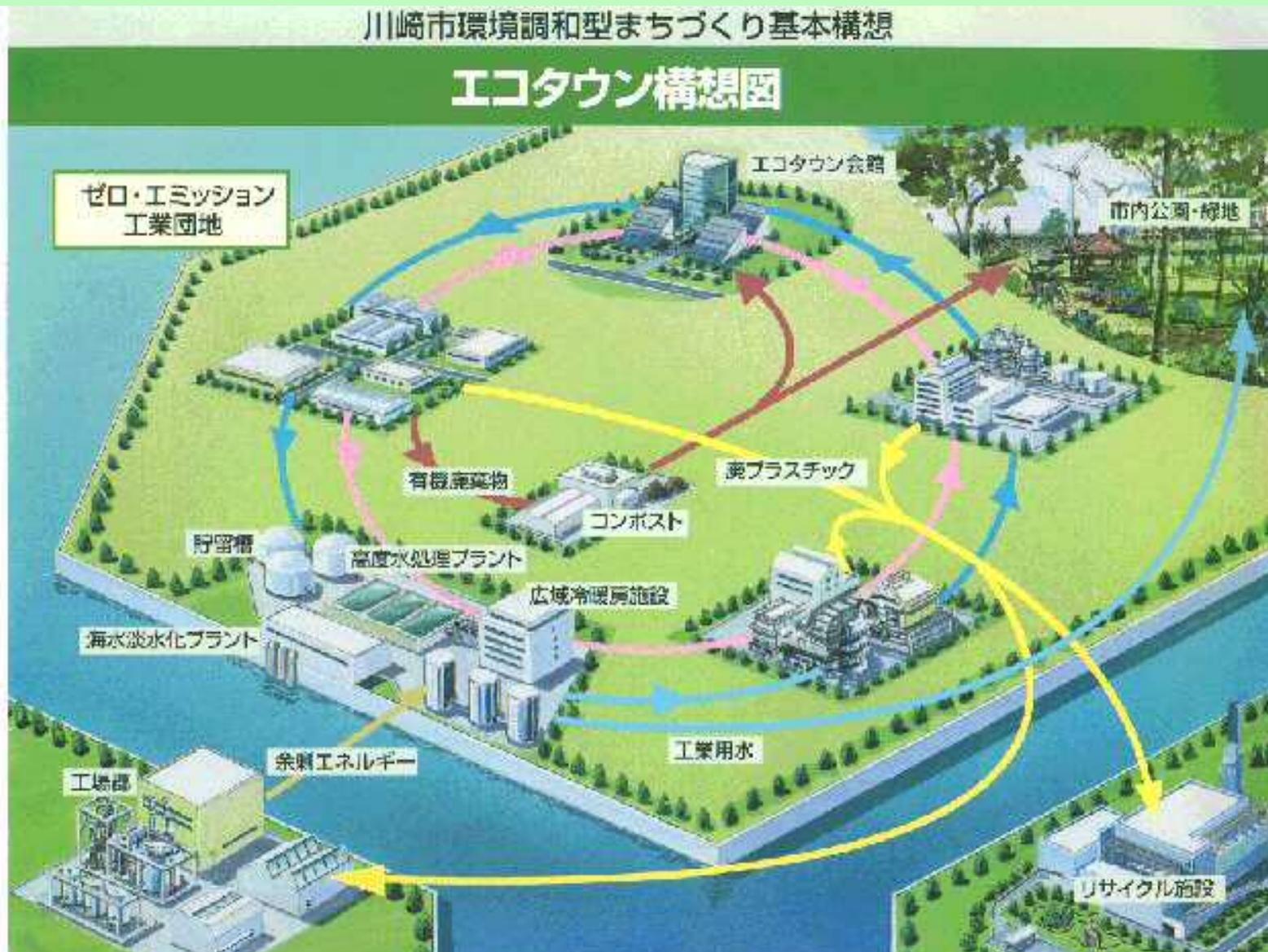
Center for Social and Environmental Systems Research,

National Institute for Environmental Studies, Japan

Alliance Professor of Nagoya University

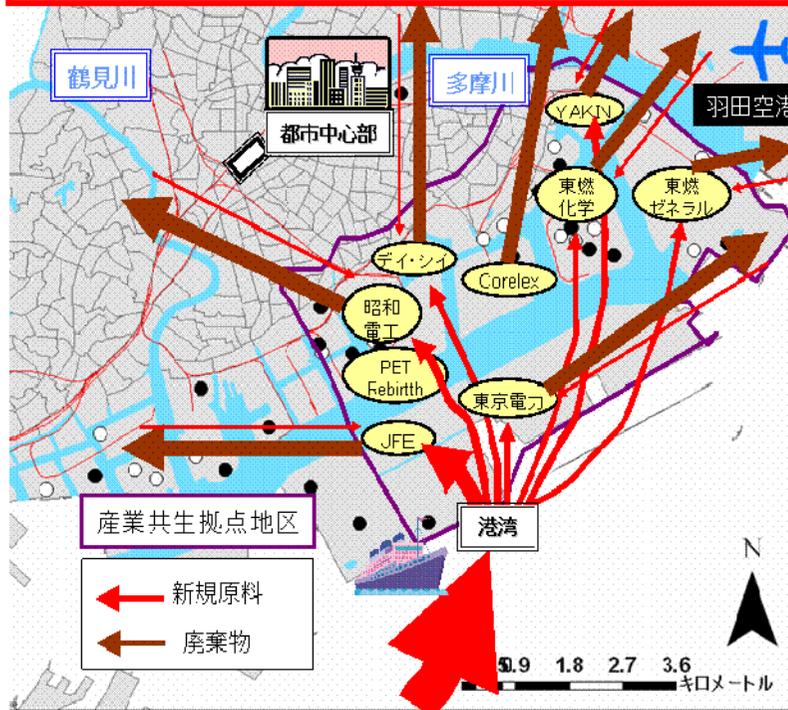
Dr. OHNISHI Satoshi, Dr. FUJII Minoru

# Industrial Symbiosis and Urban Industries to empower cities by circularization (Kawasaki and Kitakyushu are pioneers in 1997→26 cities)

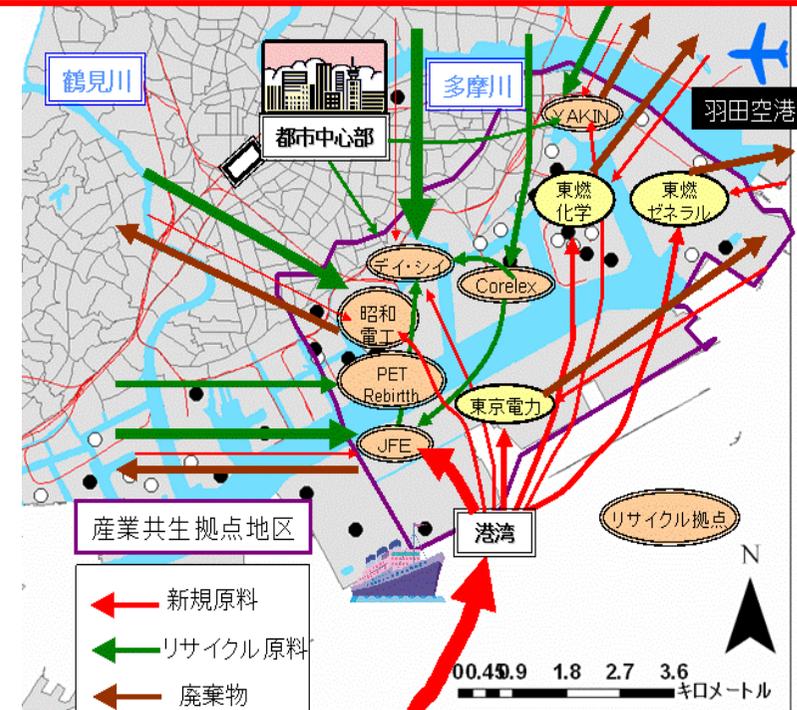


# Target and Accomplishment of Japanese Eco-towns

## Material Flow of Traditional Industrial Parks



## Symbiotic Material Flow in Eco-towns or Eco-Industrial Parks



### Conventional material flow: No-circulation

Virgin materials: largely depends on import  
 Wastes: Disposal based on provisions of the Waste Disposal and Public Cleaning Law  
 Recycle materials: Not used  
 Local material circulation: no use of recycle materials

### Circular material flow of Eco-towns

Virgin materials: part of virgin materials are substituted by recycle materials  
 Wastes: Disposal based on provisions of the Waste Disposal and Public Cleaning Law  
 Recycle materials: Use of recycle materials mainly provided from outside the city  
 Local material circulation: to some extent

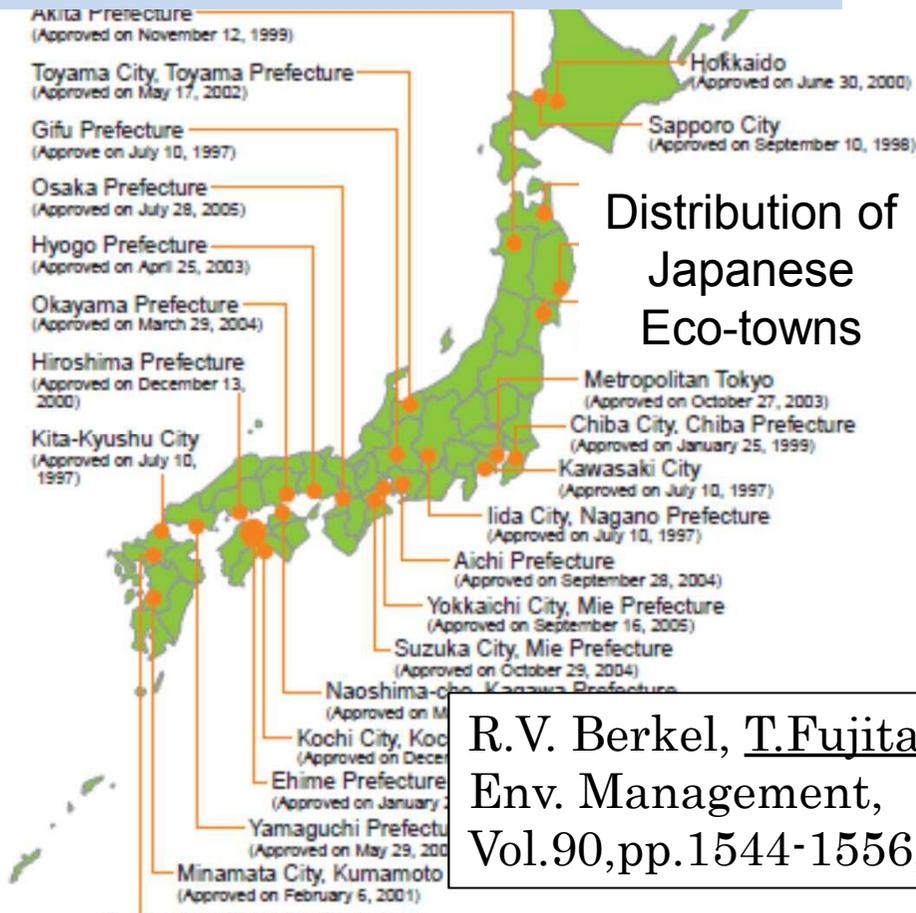
# Eco-town area as demonstration project for Sound material cycle society

METI & MOE approved Eco-Town Plans for 26 areas as of the end of January 2006, and they provided financial support to 62 facilities located within the appropriate areas.

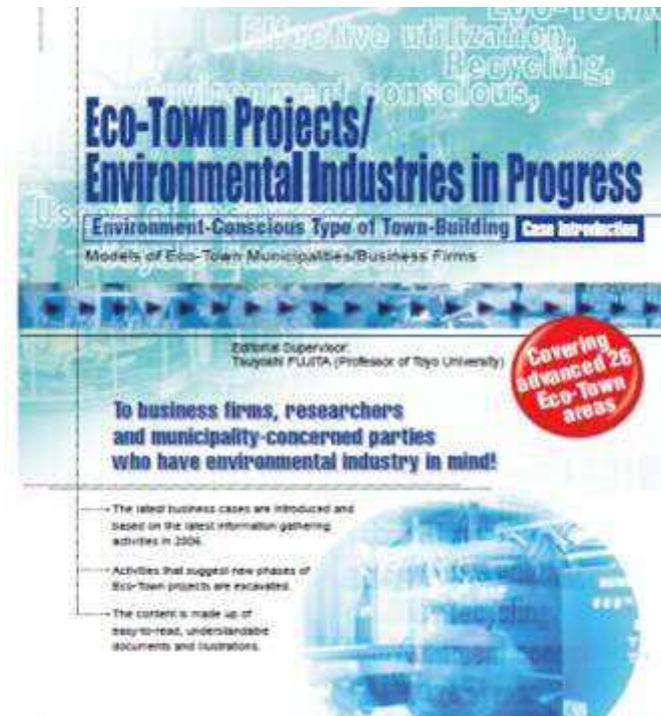


Forming the basis of capacity that totally 2.18 mil t of wastes were treated

Edited by Prof. Fujita, T., Published by METI, 2006



R.V. Berkel, T.Fujita, J. of Env. Management, Vol.90, pp.1544-1556, 2009



Distribution of Total Investment Subsidy projects in 24 Eco-Towns 600mil. US\$

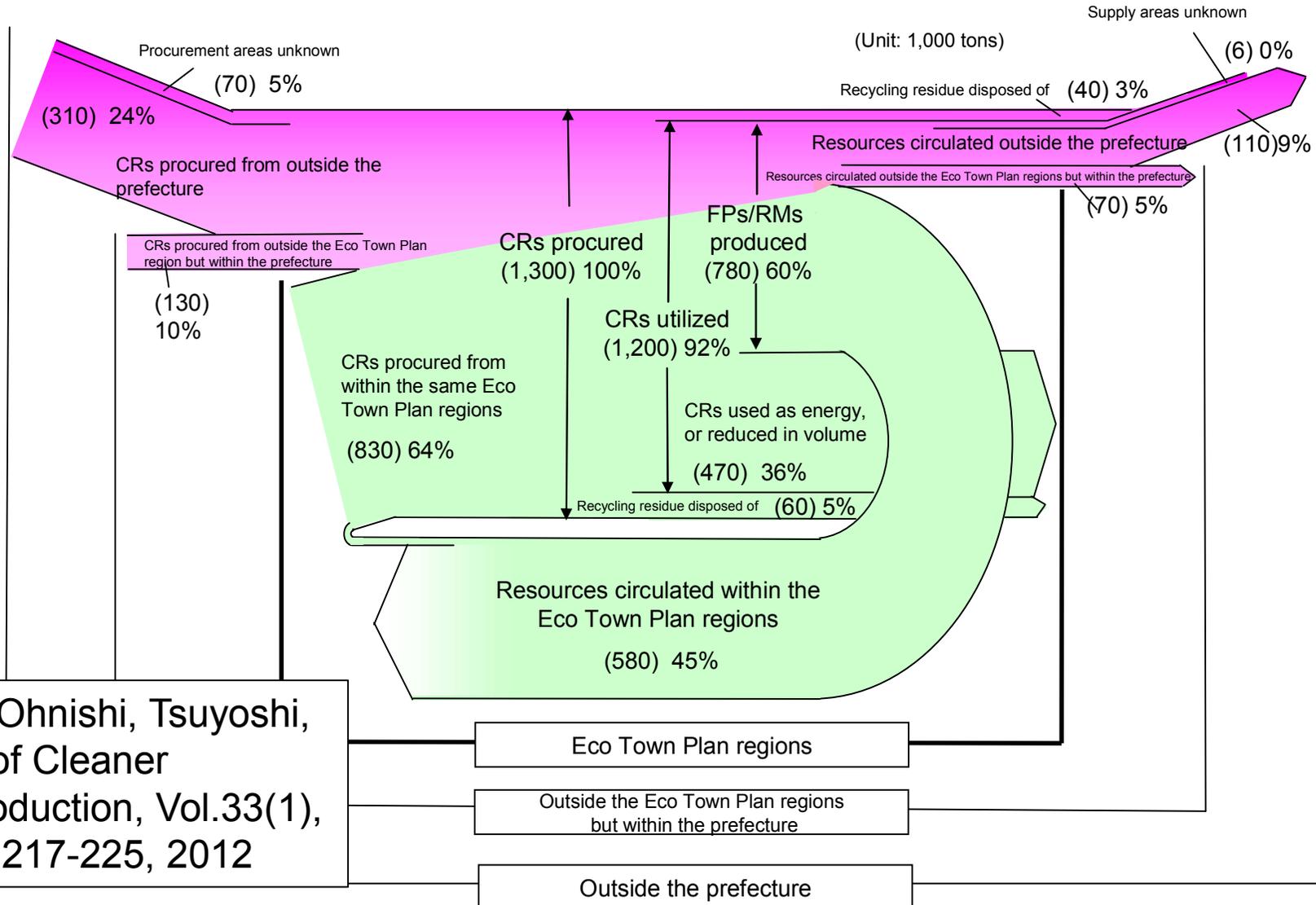
Distribution of Total Investment 60 projects in 24 Eco-Towns 1.6 bil. US\$

# Evaluation of Circular Facilities in 26 Eco-towns

Reduction of Natural Resources; 900,000.ton /yr

CO2 Emission Reduction 480,000 t-CO2/yr

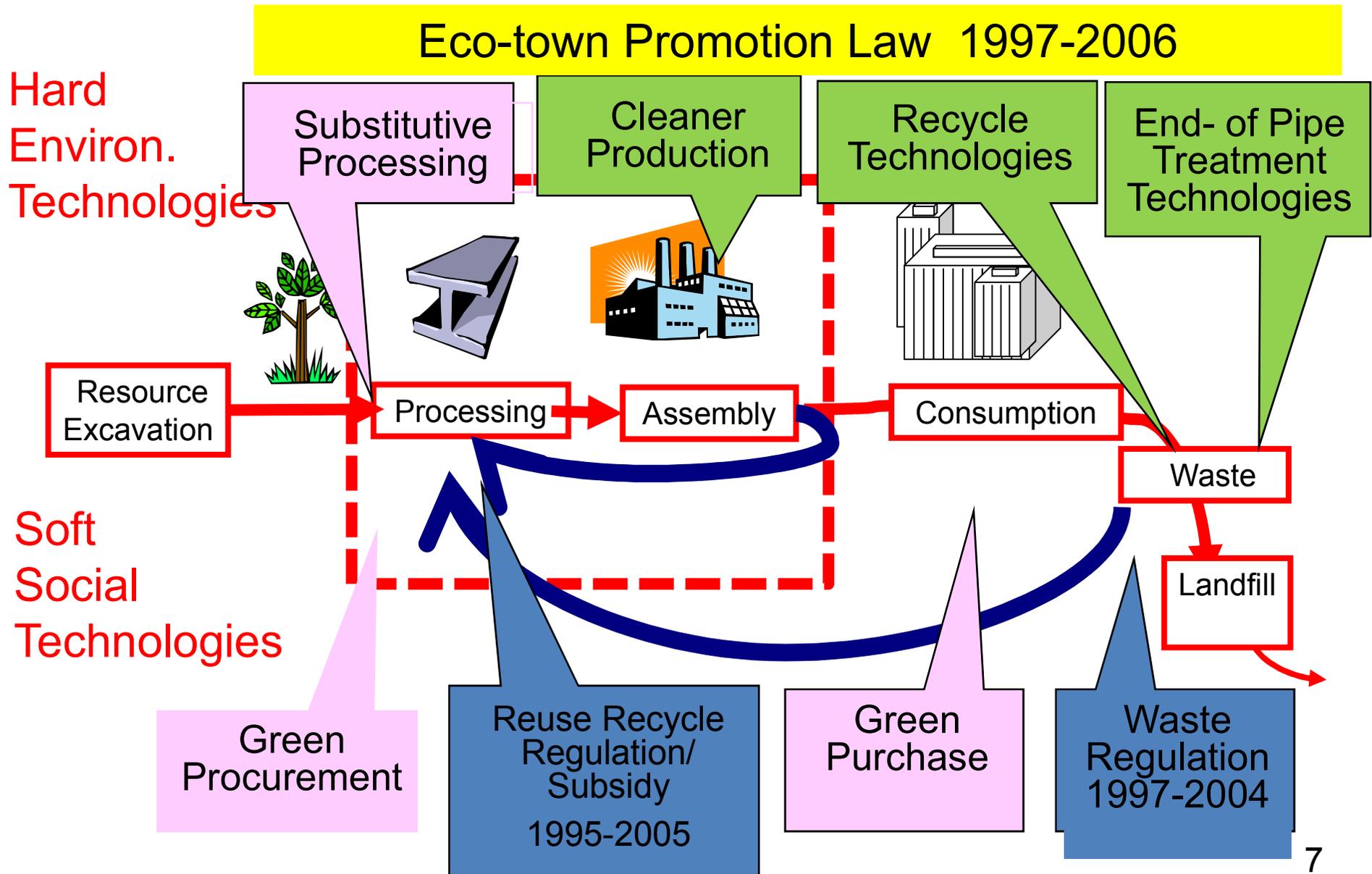
Circular use ratio of by-product 92% Intra-eco-town circulation ratio 61%



# Three Keys for Sustainable Eco-Industrial Conversion from Experiences in Japan

- Societal (regulation / subsidization) system
- Material and Energy network
- Green supply chain management

# Implementation of EIP system into the society

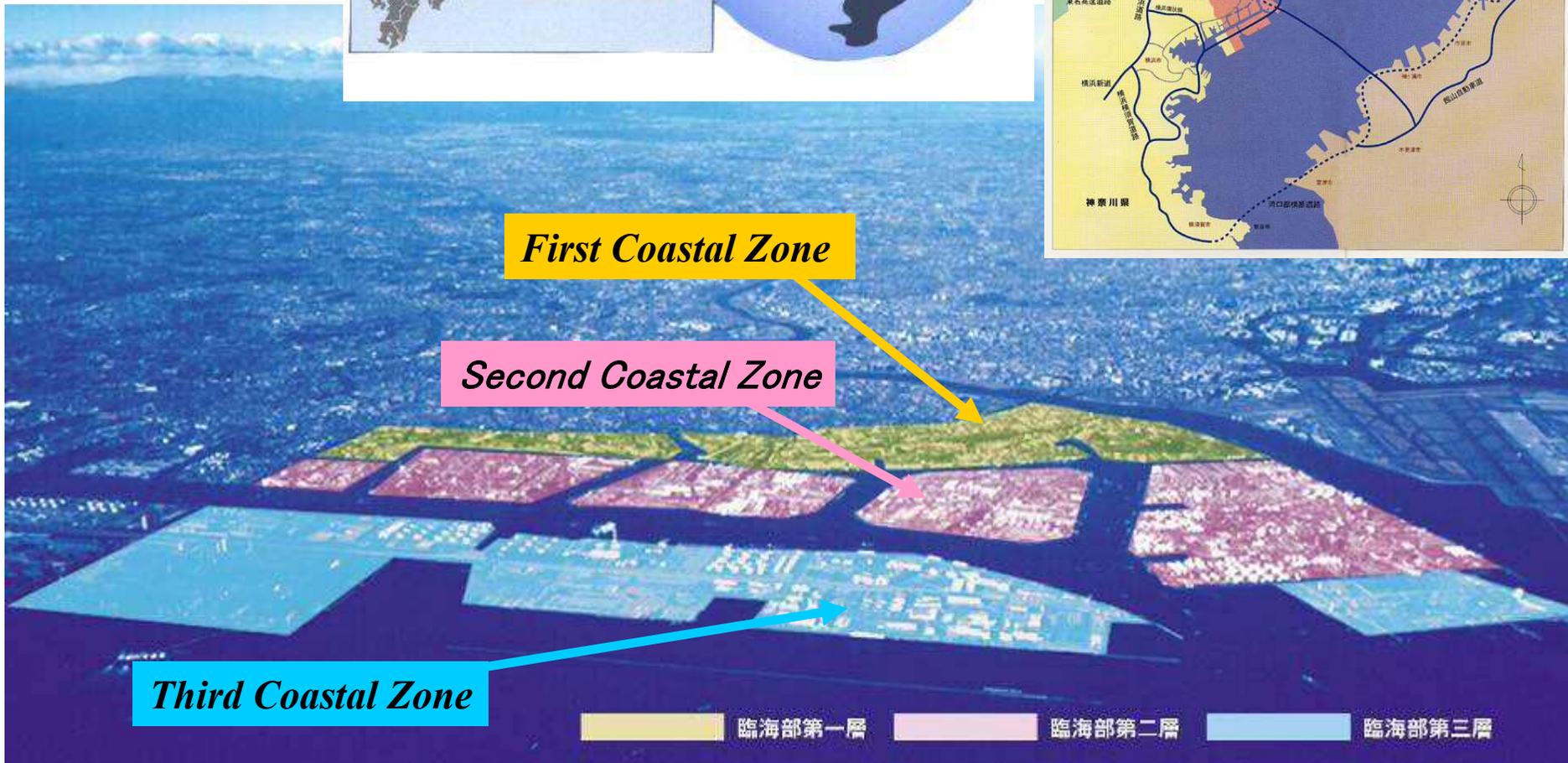
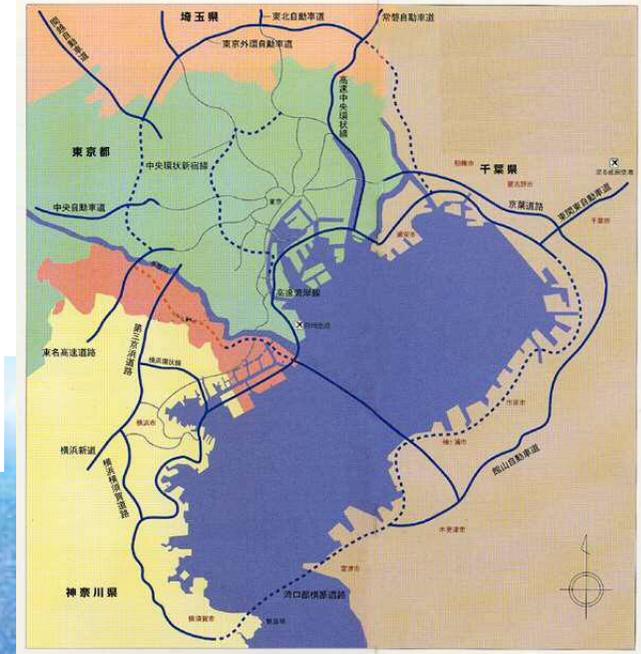


# Key for implementation (1)

- Mosaic type combination of legalization
  - recycle promotion law
  - illegal dumping control law
  - Green consumption and procurement

>>Regional circularization promotion guideline

# Geographical Conditions of Kawasaki Eco-town



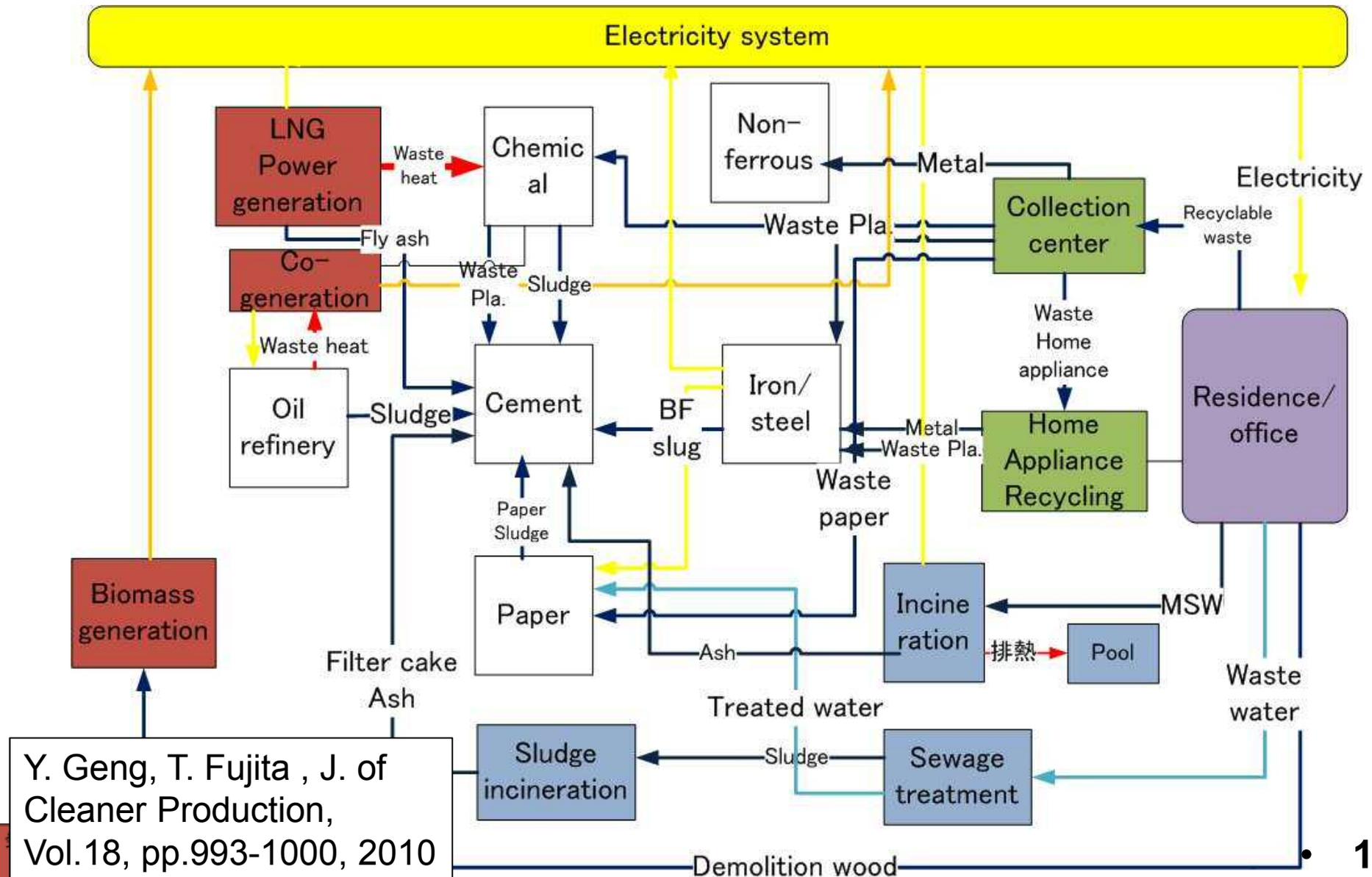
# Kawasaki Synergy Network (current situation)

Bio/life science

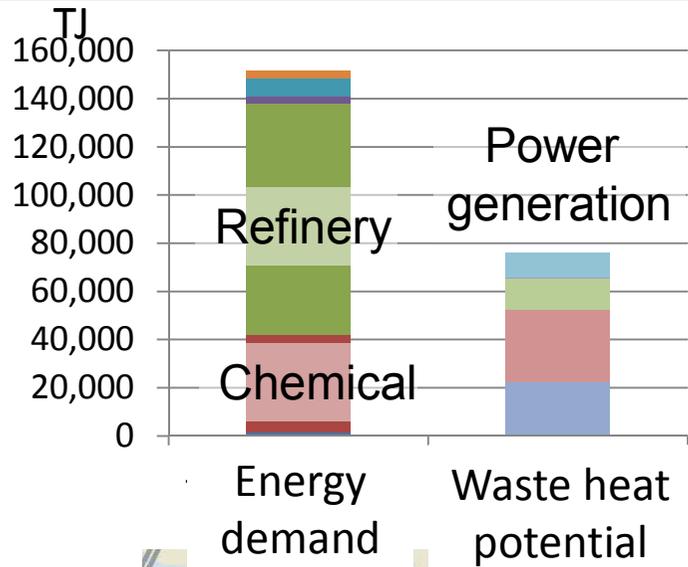
Power generation & material industry

Treatment or recycling facility

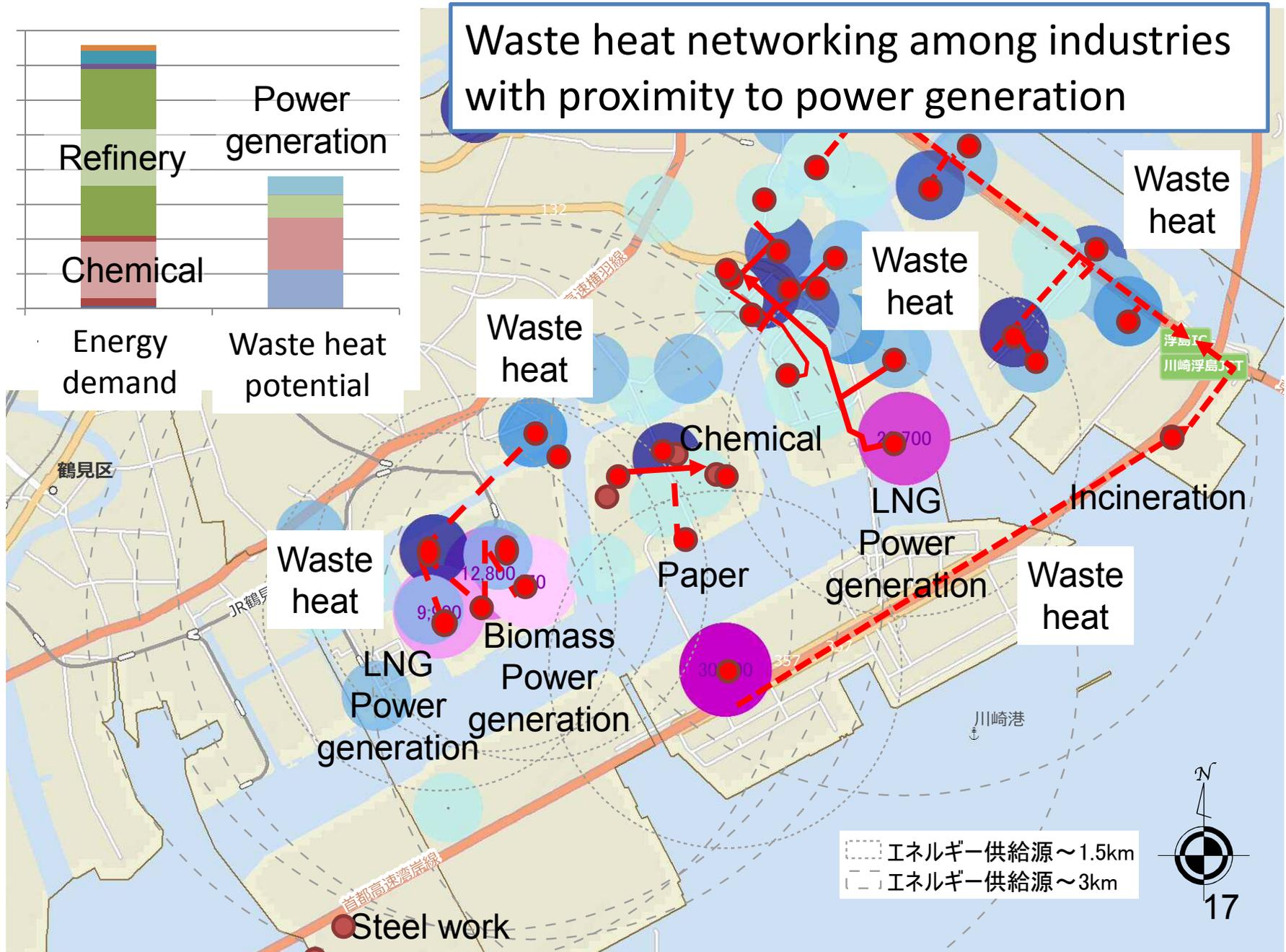
City



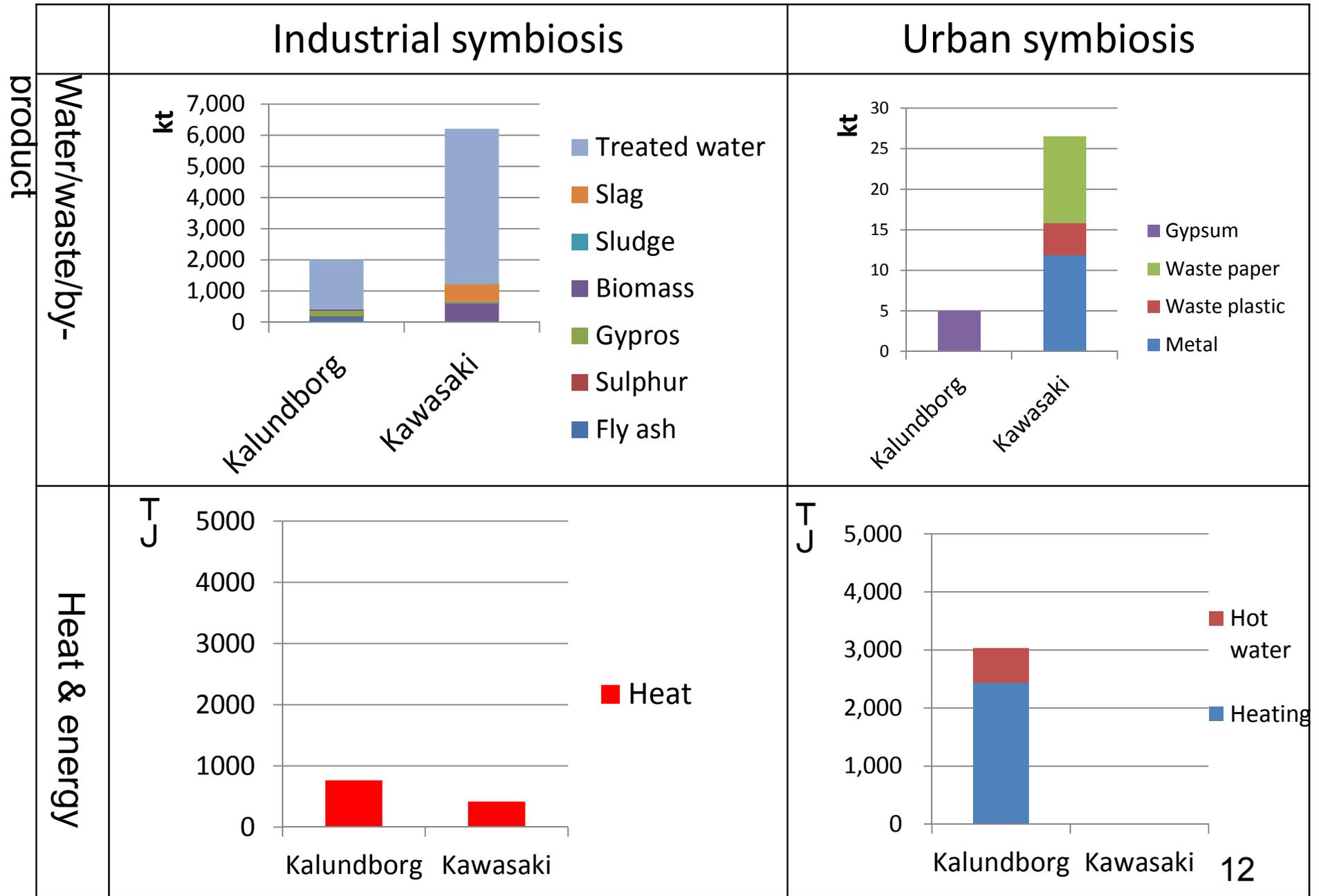
# Kawasaki Synergy Network (Future scenario)



Waste heat networking among industries with proximity to power generation

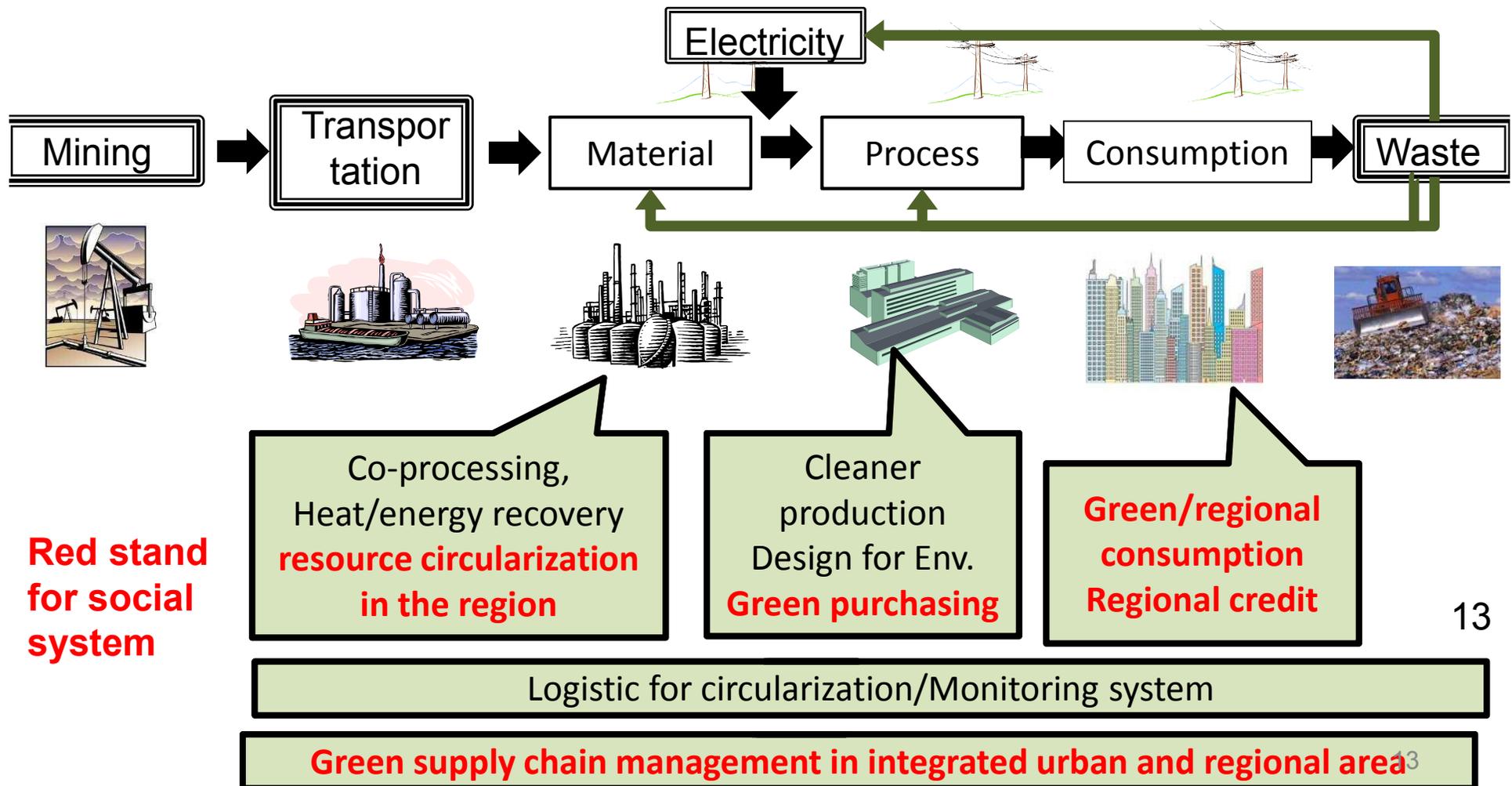


# Comparison between Kawasaki and Kalundborg



# Social system to sustain the circularization in Eco-towns

Establishment of social system and business model along supply chain from mining to waste for low carbon and sound material cycle society



**Red stand for social system**

# Eco-town Innovation Projects by Ministry of Environment, 2011-2013

2010

- Research committee to identify the effects of 26 national eco towns and their projects
  - Evaluation procedure for low carbon and environmental emission reduction effects
  - Extensive key technologies or policies for green supply chain management and regional resource circularization



2011- Eco town innovation projects  
Proposals for Model  
Eco-towns

Eco-town Innovation Projects【2011, 2012, 2013】

Solution and  
Improvement

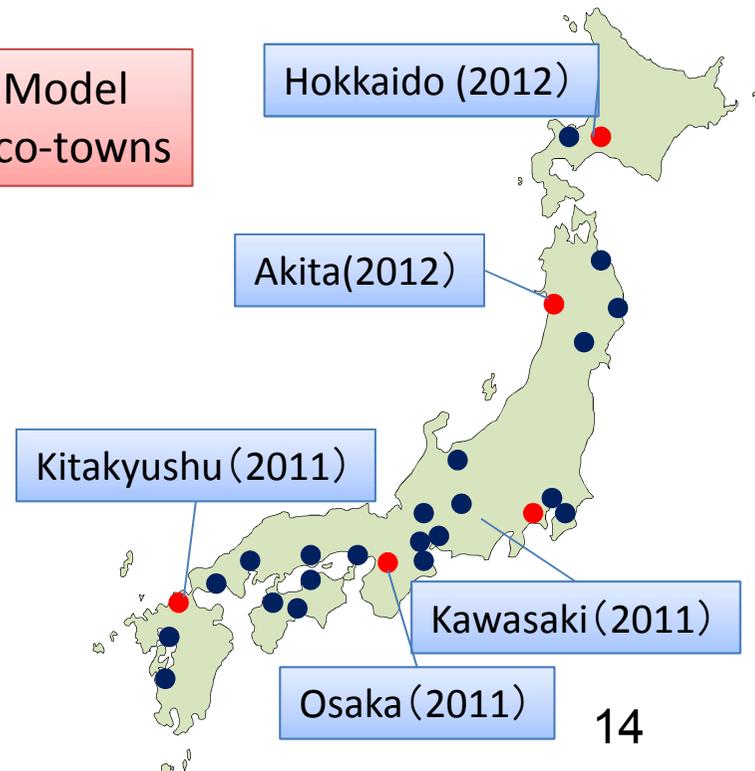
Validation of innovative  
circularization projects

Green  
Innovation

Business scheme design

Extension for national projects

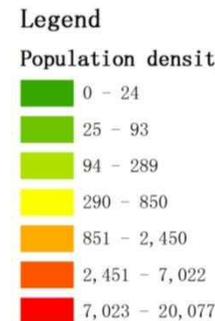
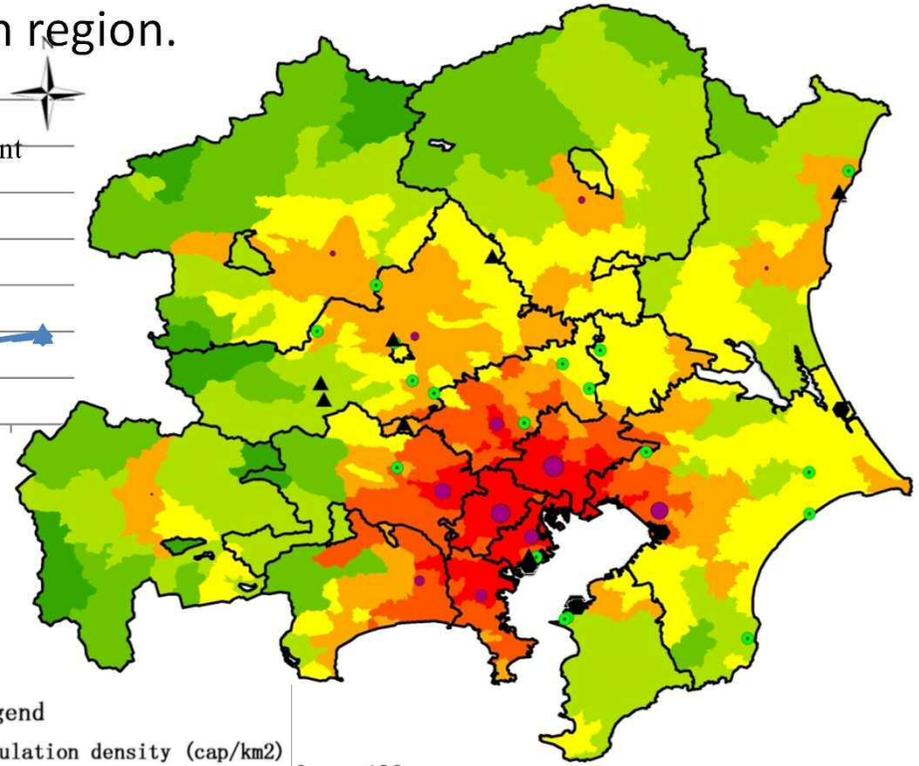
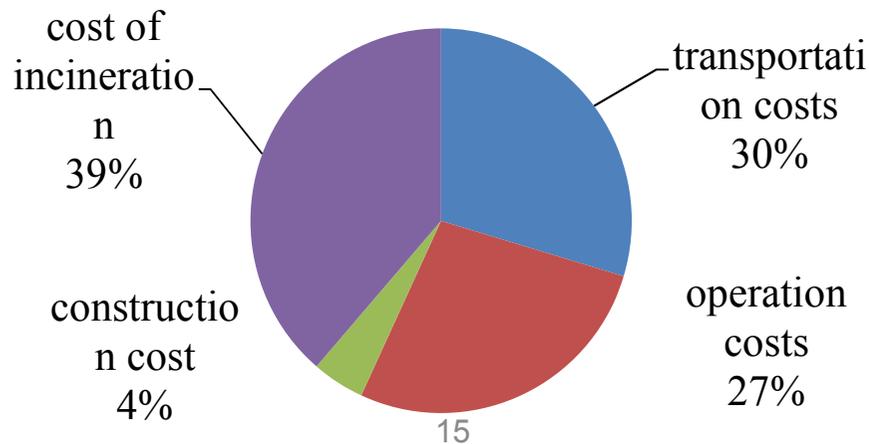
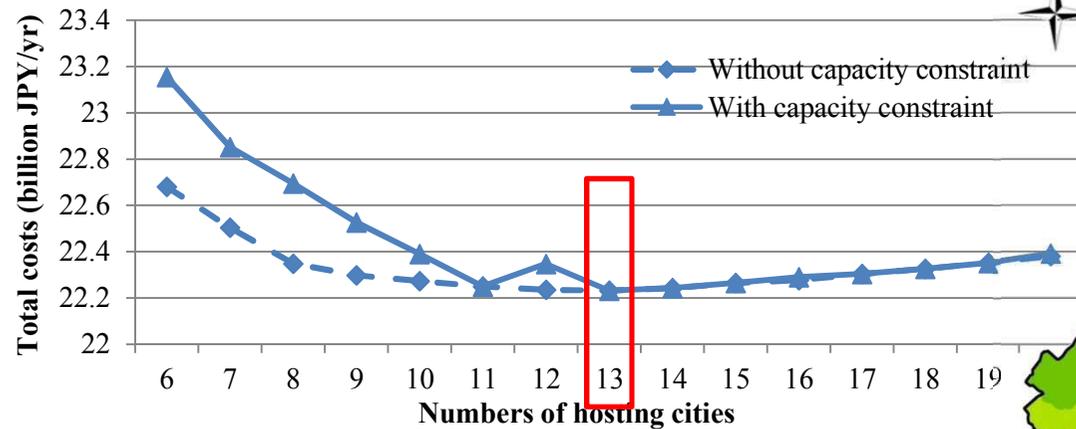
Model  
Eco-towns



# National Guideline for the Circular Region Planning

## Modeling results: Cost and scale

Optimal scales of circularization is also discussed and we made quantitative analysis based on the spatial information of the distribution of solid waste in Tokyo Metropolitan Region with 30 million population. The results are incorporated into the national planning guideline for circularization region.



X. Chen, T. Fujita, et.al,  
J. of Industrial Ecology, Vol.  
16(1), pp.129–141, 2012

# On-going policy and research targets

- **Methodology development**

- to provide optimal network planning as the starting points for stakeholder dialogue

- **Legislative guideline**

- to provide the motivation for local governments and to provide appropriate subsidy by the government

- ***Verification system***

- pilot project for smart eco-industrial parks and eco-cities

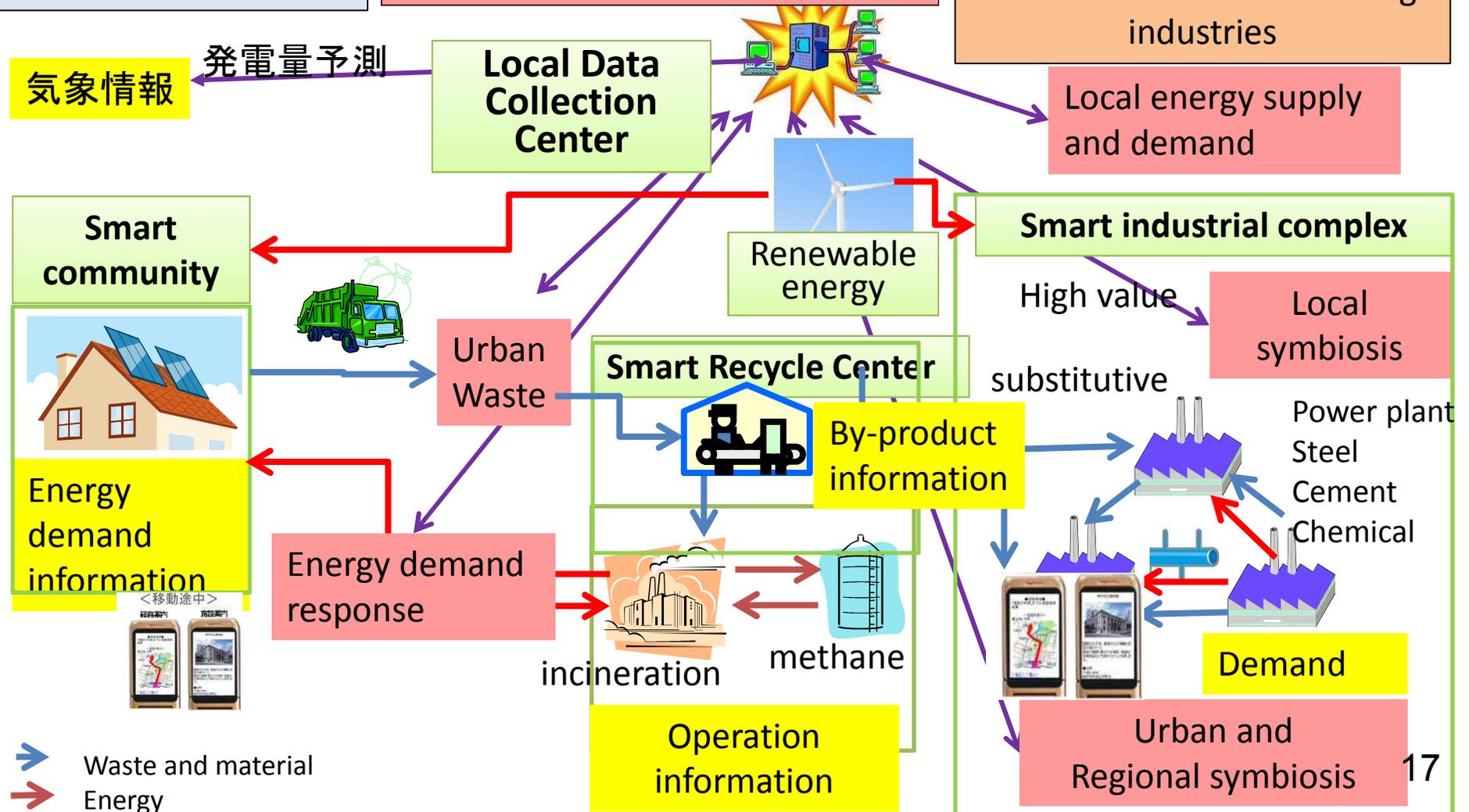
# Smart Symbiosis Initiatives for Eco town Innovation

Smart ICT network will promote and complement the synergetic network functions among stakeholders

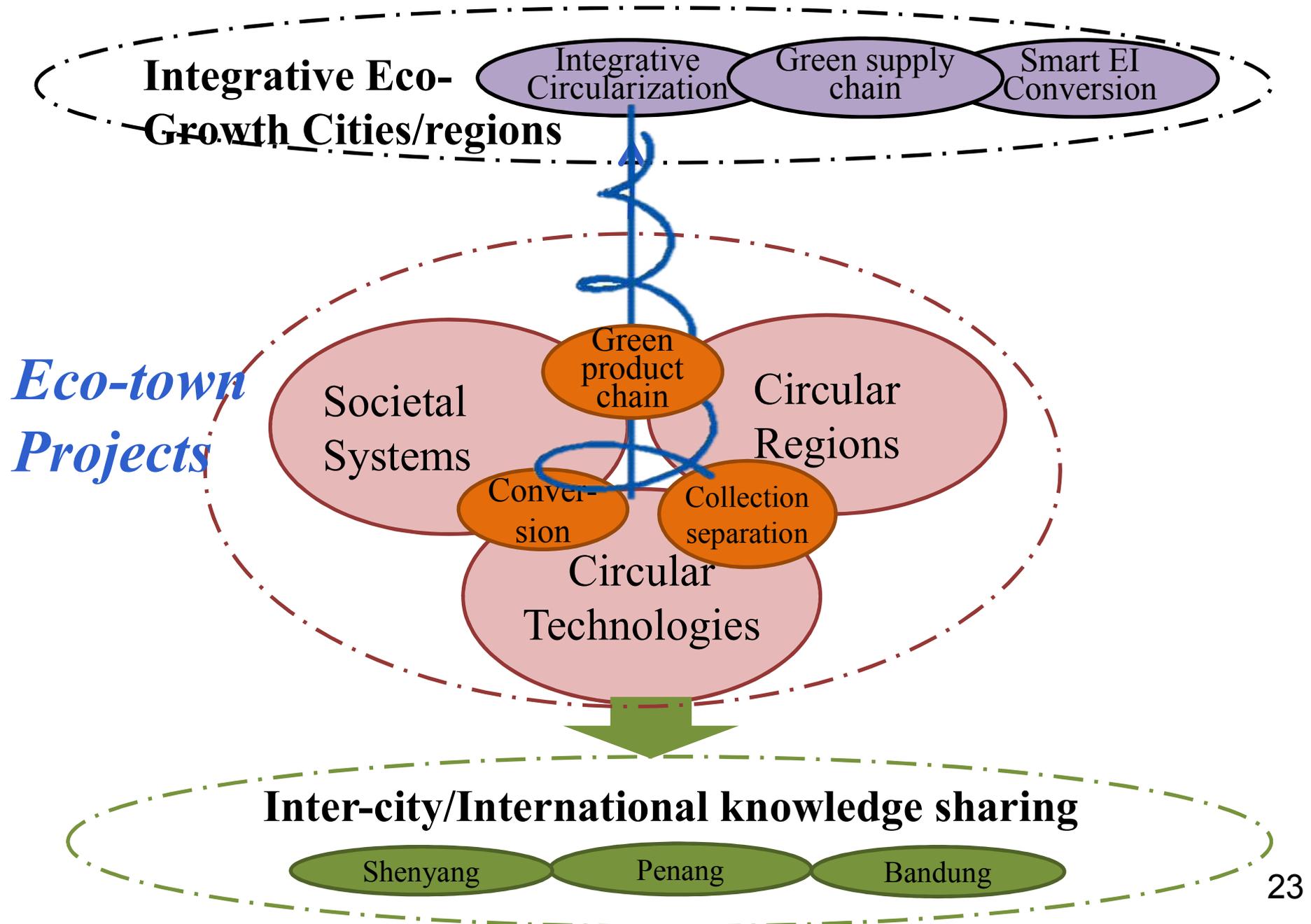
Energy and consumption demand control system for urban sectors

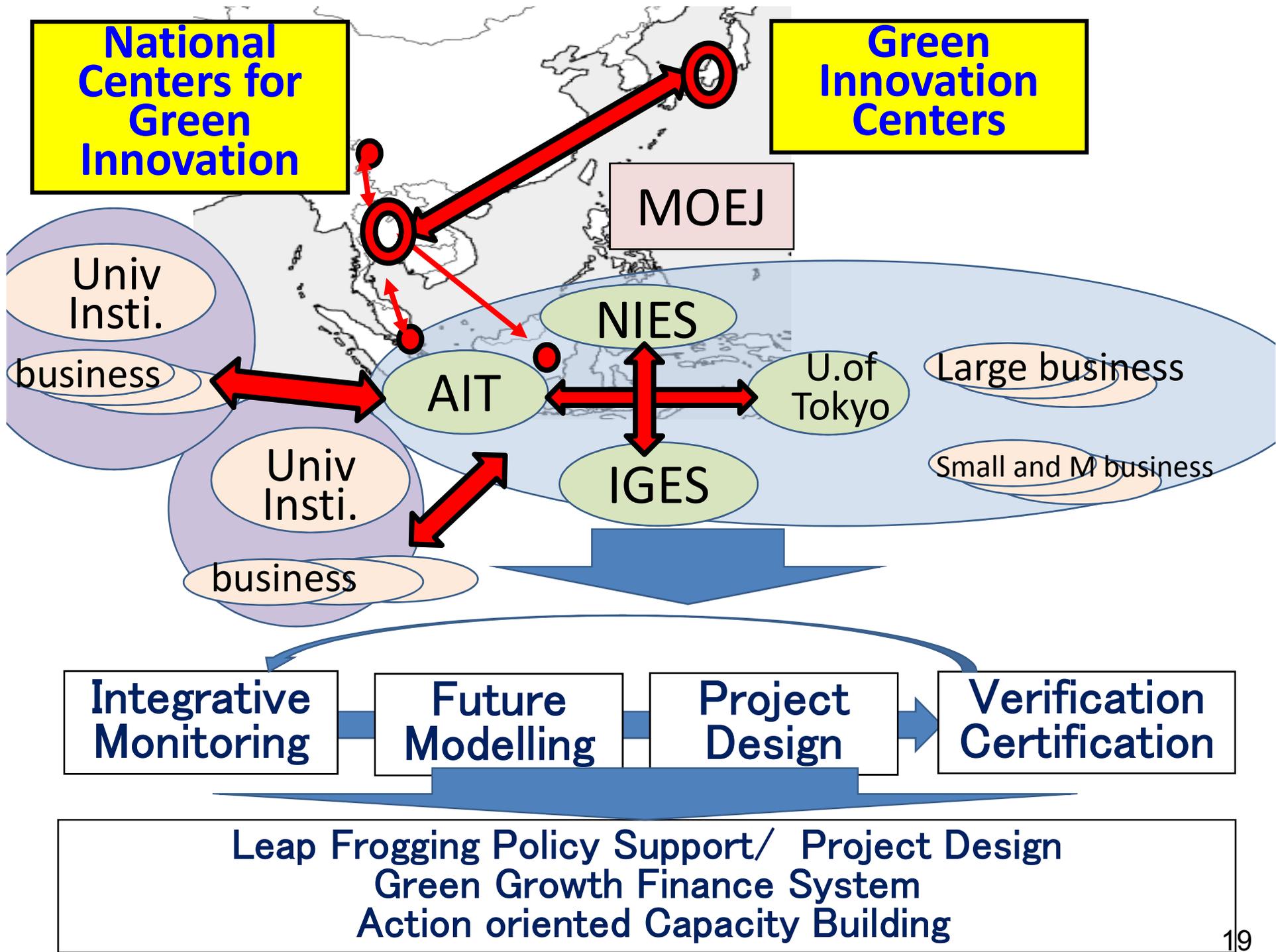
Information support for optimizing local and regional material and energy circularization

Smart industrial complex supported by synergetic information network among industries



# Eco Industrial Innovation





# Related Publication

- Huijuan Dong, Tsuyoshi Fujita, Yong Geng, Liang Dong, Satoshi Ohnishi, Lu Sun, Yi Dou, Minoru Fujii (2016) A review on eco-city evaluation methods and highlights for integration. *Ecological Indicators*, 60, 1184-1191
- Yong Geng, Tsuyoshi Fujita, Hung-suck Park, Anthony S.F. Chiu, Donald Huisingsh (2015) Recent progress on innovative eco-industrial development. *Journal of Cleaner Production*, Available online 25 September 2015, doi:10.1016/j.jclepro.2015.09.051
- Takuya Togawa, Tsuyoshi Fujita, Liang Dong, Satoshi Ohnishi, Minoru Fujii (2015) Integrating GIS databases and ICT applications for the design of energy circulation systems. *Journal of Cleaner Production*, Available online 11 July 2015, doi:10.1016/j.jclepro.2015.07.020
- Liang Dong, Tsuyoshi Fujita, Ming Dai, Yong Geng, Jingzheng Ren, Minoru Fujii, Yi Wang, Satoshi Ohnishi (2015) Towards preventative eco-industrial development: an industrial and urban symbiosis case in one typical industrial city in China. *Journal of Cleaner Production*, Available online 14 May 2015, doi:10.1016/j.jclepro.2015.05.015
- Satoshi Ohnishi, Minoru Fujii, Tsuyoshi Fujita, Toru Matsumoto, Liang Dong, Hiroyuki Akiyama, Dong Huijuan (2015) Comparative analysis of recycling industry development in Japan following the Eco-Town program for eco-industrial development. *Journal of Cleaner Production*, Available online 29 April 2015 , doi:10.1016/j.jclepro.2015.04.088
- Minoru Fujii, Tsuyoshi Fujita, Liang Dong, Chengpeng Lu, Yong Geng, Shishir Kumar Behera, Hung-Suck Park, Anthony Shun Fung Chiu (2015) Possibility of developing low-carbon industries through urban symbiosis in Asian cities. *Journal of Cleaner Production*, Available online 17 April 2015, doi:10.1016/j.jclepro.2015.04.027
- Takuya Togawa, Tsuyoshi Fujita, Liang Dong, Minoru Fujii, Makoto Ooba (2014) Feasibility assessment of the use of power plant-sourced waste heat for plant factory heating considering spatial configuration. *Journal of Cleaner Production*, 81, 60-69
- Minoru Fujii, Tsuyoshi Fujita, Satoshi Ohnishi, Naohisa Yamaguchi, Yong Geng, Hung-Suck Park (2014) Regional and temporal simulation of a smart recycling system for municipal organic solid wastes. *Journal of Cleaner Production*, 78, 208–215
- Xudong Chen, Tsuyoshi Fujita, Yoshitsugu Hayashi, Hirokazu Kato, Yong Geng (2014) Determining optimal resource recycling boundary at regional level: A case study on Tokyo Metropolitan Area in Japan. *European Journal of Operational Research*, 233(2), 337-348
- Xudong Chen, Tsuyoshi Fujita, Satoshi Ohnishi, Minoru Fujii, Yong Geng ; The Impact of Scale, Recycling Boundary, and Type of Waste on Symbiosis and Recycling: An Empirical Study of Japanese Eco-Towns, *Journal of Industrial Ecology*, Vol.16(1), pp.129–141, February, 2012
- Minoru Fujii, Tsuyoshi Fujita, Xudong Chen, Satoshi Ohnishi, Naohisa Yamaguchi ; Smart Recycling of Organic Solid Wastes in an Environmentally Sustainable Society, *Resources, Conservation and Recycling*, Vol.63, pp.1-8, June, 2012
- Xudong Chen, Tsuyoshi Fujita, Yong Geng, Kebin Liu, Minoru Fujii, Junyi Wang, Bing Xue ; Effects of Environmental Education on Waste Separation Performance: Experimental Study in Shenyang University, China, *Journal of Cleaner Productions*, submitted March 28th, 2012
- Satoshi Ohnishi, Tsuyoshi Fujita, Xudong Chen, Minoru Fujii ; Econometric Analysis of the Performance of Recycling Projects in Japanese Eco-Towns, *Journal of Cleaner Production*, Vol.33(1), pp.217-225, September, 2012
- Xudong Chen, Fengming Xi, Yong Geng, Tsuyoshi Fujita ; The Potential Environmental Gains from Recycling Waste Plastics: Simulation of Transferring Recycling and Recovery Technologies to Shenyang, China, *Journal of Waste Management*, Vol.31(1) pp.168-179, January 2011
- Yong Geng, Tsuyoshi Fujita ,Xudong Chen; Evaluation of Innovative Municipal Solid Waste Management through Urban Symbiosis: A Case Study of Kawasaki, *Journal of Cleaner Production*, Vol.18, pp.993-1000, 07,2010
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- Rene Van Berkel, Tsuyoshi Fujita, Shizuka Hashimoto, Minoru Fujii ; Quantitative Assessment of Urban and Industrial Symbiosis in Kawasaki, Japan, *Environmental Science & Technology* , Vol.43, No.5, 2009 ,pp.1271-1281,0129.2009
- Rene van Berkel, Tsuyoshi Fujita, Shizuka Hashimoto, Yong Geng ; Industrial and Urban Symbiosis in Japan : Analysis of the Eco-Town Program 1997-2006 ; *Journal of Environmental Management*, vol.90,pp.1544-1556,2009

*Thank you for attention*