LoCARNet 3rd Annual Meeting Day 2: Nov. 25, 2014

Carbon Monitoring System Innovation

-towards a low carbon campus,

city and region-

3rd LoCARNet Annual Meeting Day2, Session 6
Carbon Monitoring System Innovation
-toward Low Carbon Campus, City and Region-

Nov. 25th, 2014

Innovative Monitoring and Modelling Research toward Low Carbon Society

Prof. Tsuyoshi Fujita,
Director of Social Env. Systems Research Center, NIES
Alliance Professor, Nagoya University, Japan
Guest Professor of United Nations University

(1) Integrative modelling research for low carbon society
(2) Urban and regional eco-city design model and simulation research
(3) Innovative monitoring and regional evaluation system research

PREPARED by Professor MASUI Toshihiko, Dr. FUJII, Minoru,
Dr. ASHINA Shuichi , Dr. GOMI, Kei, Dr. Togawa Takuta

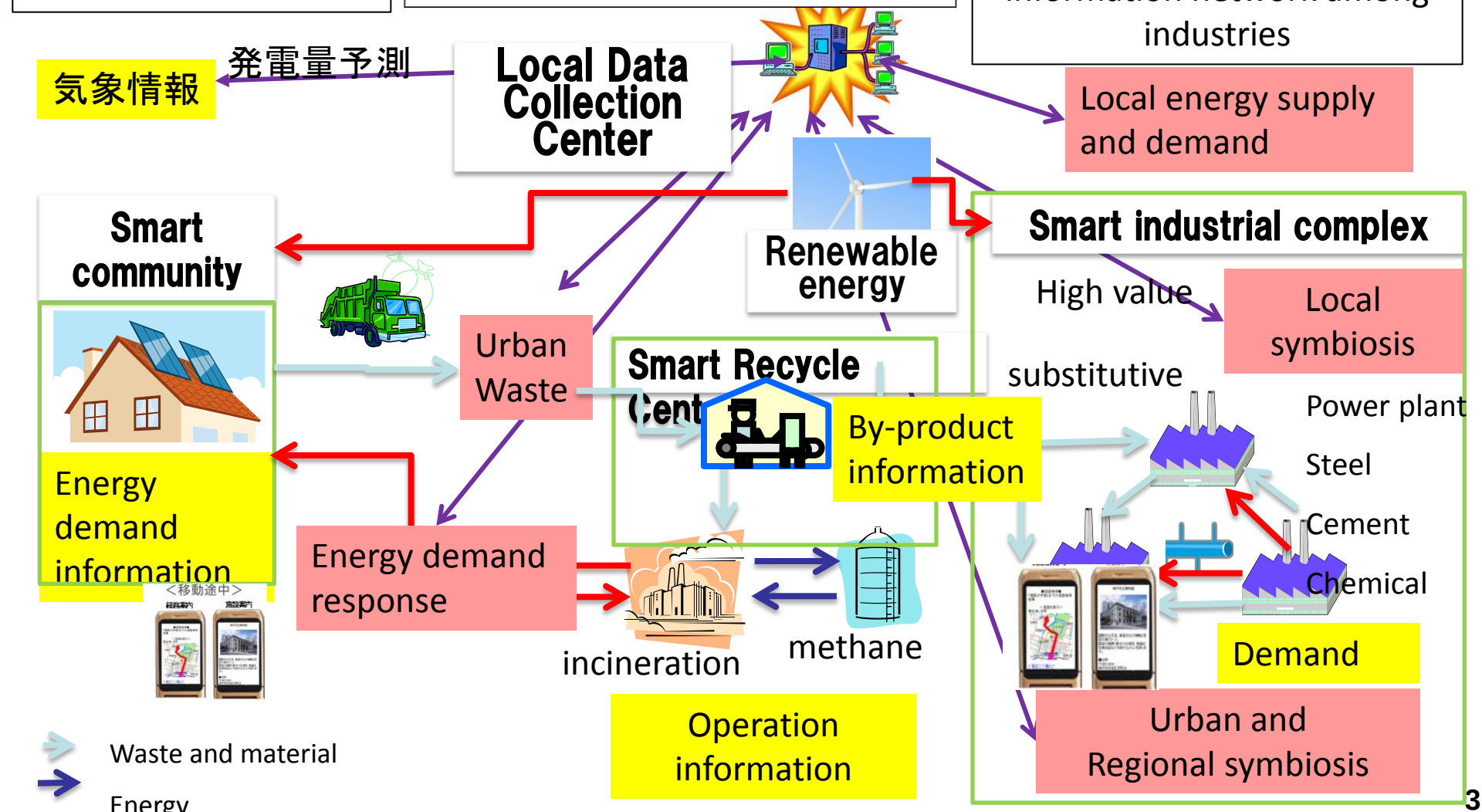
Smart Symbiosis Initiatives for Eco City Innovation

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



CONTENTS

(1)Integrative modelling research for low carbon society

(2) Urban and regional eco-city design model and simulation research

(3) Innovative monitoring and regional evaluation system research

(1) Integrative modelling research for low carbon society

Scenario design assessment of mitigation technologies and financial policies for low carbon development are jointly developed particularly focusing in the fields of agriculture, forestry, and land use sectors in Indonesia

Integrative Model Application toward Low Carbon Cities and Regions
NIES Dr. Gomi

AIM Region Model

Energy Model

$$1-F_{dch}(t,m,hr) \geq \frac{S_{h,tech}(t,m,hr)}{demm}$$

$$FUEL_{tech}(t) = \frac{1}{\eta_{tech}(t)} \times \left(\sum_{m,hr} O_{src,tech}(t,m,hr) \right)$$

$$COST_{fuel,tech}(t) = ucfuel_{tech}(t) \times FUEL_{tech}(t)$$

$$crf_{tech} = \frac{r \times (1+r)^{dpr_{tech}}}{(1+r)^{dpr_{tech}} - 1}$$

Population Model

$$POP\_tot = Pop\_work / \underline{WR\_agg}$$

$$LNtot_{inin} = \sum_{pds} (LHD_{pds} \times AAWH \times \underline{DER_{pds}})$$

$$LNtot_{outin} = \sum_{pds} (LHD_{pds} \times AAWH \times (1 - \underline{DER_{pds}}))$$

Transportation

$$PTD_{ptm} = \sum_{td} \sum_{age} \sum_{hht} Pop_{age,hht} \times Ptg_{age,td} \times Pts_{td,ptm} \times Ptad_{td,ptm} \times 365 \times (1/10^6)$$

$$FTD_{ftm} = \sum_{pss} \sum_{td} PD_{pss} \times Ftg_{pss,td} \times Fts_{td,ftm} \times Ftad_{td,ftm} \times (1/10^6)$$

Local Economy

$$Ainv = \left[\underline{Imat} - (1 - \underline{IMR}) \times \underline{Amat} \right]^{-1}$$

$$X = Ainv(I-(I-Mr)F+Ex)$$

$$Income = LNtot_{inin} \times WagePP + LNtot_{inout} \times \underline{WperL\_inout} + POP\_tot \times \underline{SSget}$$

Policy Options

$$x_{et} = IMP2_{et} \cdot \overline{f}^{MUL} \cdot \overline{f} + IMP1_{et} \cdot \overline{f}$$

$$imp1_{et,et1} \cdot f_{et1} = I^{(0.5)}_{et,et1} \cdot b_{et1} \cdot f_{et1}$$

$$imp2_{et,et2,et1} \cdot f^{MUL}_{et2} \cdot f_{et1} = 0.5 \cdot b_{et1} \cdot \left(\sum_{et3} I^{(1)}_{et,et2} \cdot a_{et2,et3} \cdot I^{(0)}_{et3,et1} \right) \cdot f^{MUL}_{et2} \cdot f_{et1}$$

Land Use Model

$$Area_{lu} = \sum_{lup} LUCM_{lup,lu}$$

$$HA_{crp,cropland} = DP_{crp} \cdot \overline{CRPS}_{crp,cropl} / \overline{YLD}_{crp,cropl}$$

$$LUCM_{lup,lu} = \overline{Area\_prev}_{lup} \cdot LCC_{lup,lu}$$

$$\sum_{lup,lu} \left(\overline{RLCC}_{lup,lu} \cdot \log \frac{LCC_{lup,lu}}{\overline{RLCC}_{lup,lu}} \right) \rightarrow \min$$

Future Scenario インドネシア地域・省・都市

くらし　産業　まちづくり　エネルギー

政策分析

ステークホルダーの合意形成に活用

ステークホルダーのフィードバックや、計画の進展等に対応してモデルとシナリオを改良・更新する。

地域特性に応じた適正技術の選定と効果の推定

将来構想、地域資源、環境回復状況、環境・資源制約、将来の技術開発などを考慮して将来シナリオを構築し、くらし、経済、まちづくり、環境等の地域の目標達成に必要な条件と政策を分析する。

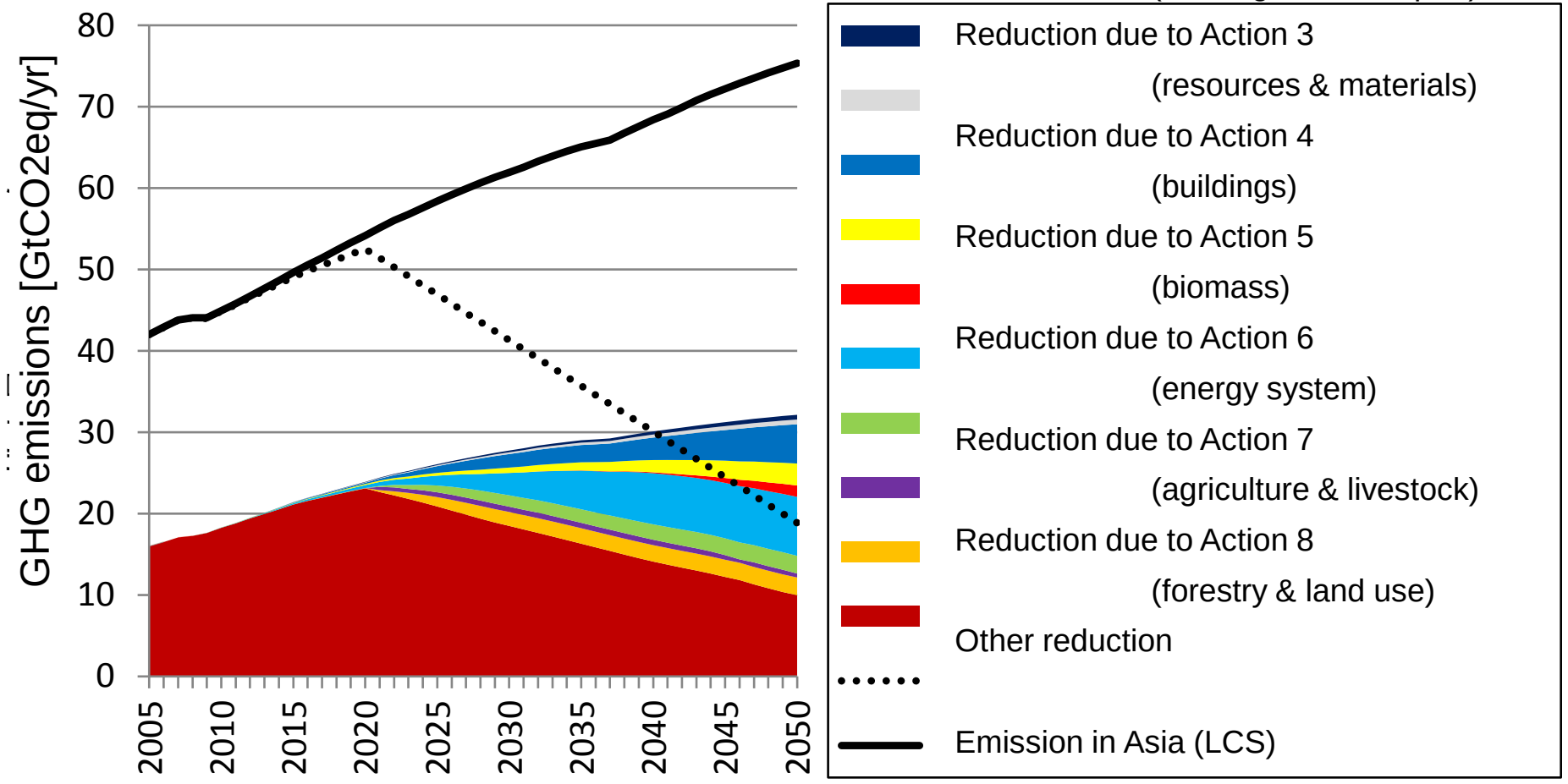
【フェーズ2】開発した手法の汎用化と、内外の地域への展開

復興・再生計画等フォローアップへの情報提供

住民参加型の地域・まちづくり

環境共生型まちづくりの進展

GHG Emissions in Low Carbon Asia



By Dr. S. Fujimori (NIES)

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Macro-scopic Future Scenario Design for Fukushima

	Industrial	Housing	Agriculture
BAU	•Eldery Society •Population out migration •No new indusrial locations		
LNG Base	LNG Base	Local Emplo-yment	•Planned LNG base development •Limited local employment •Limited extensive effects
Industrial Complex	LNG Base, Factories	Local Emplo-yment, Housing	Urban Farm •New factory locatio •Urban housing •limited Farm
Green Growth	LNG基Base, Factories, Green Infra	Local Emplo-yment, Housing	Urban Farm, Product Chain

•Eco-industrial development
•Extensive product chain
•Local housing development

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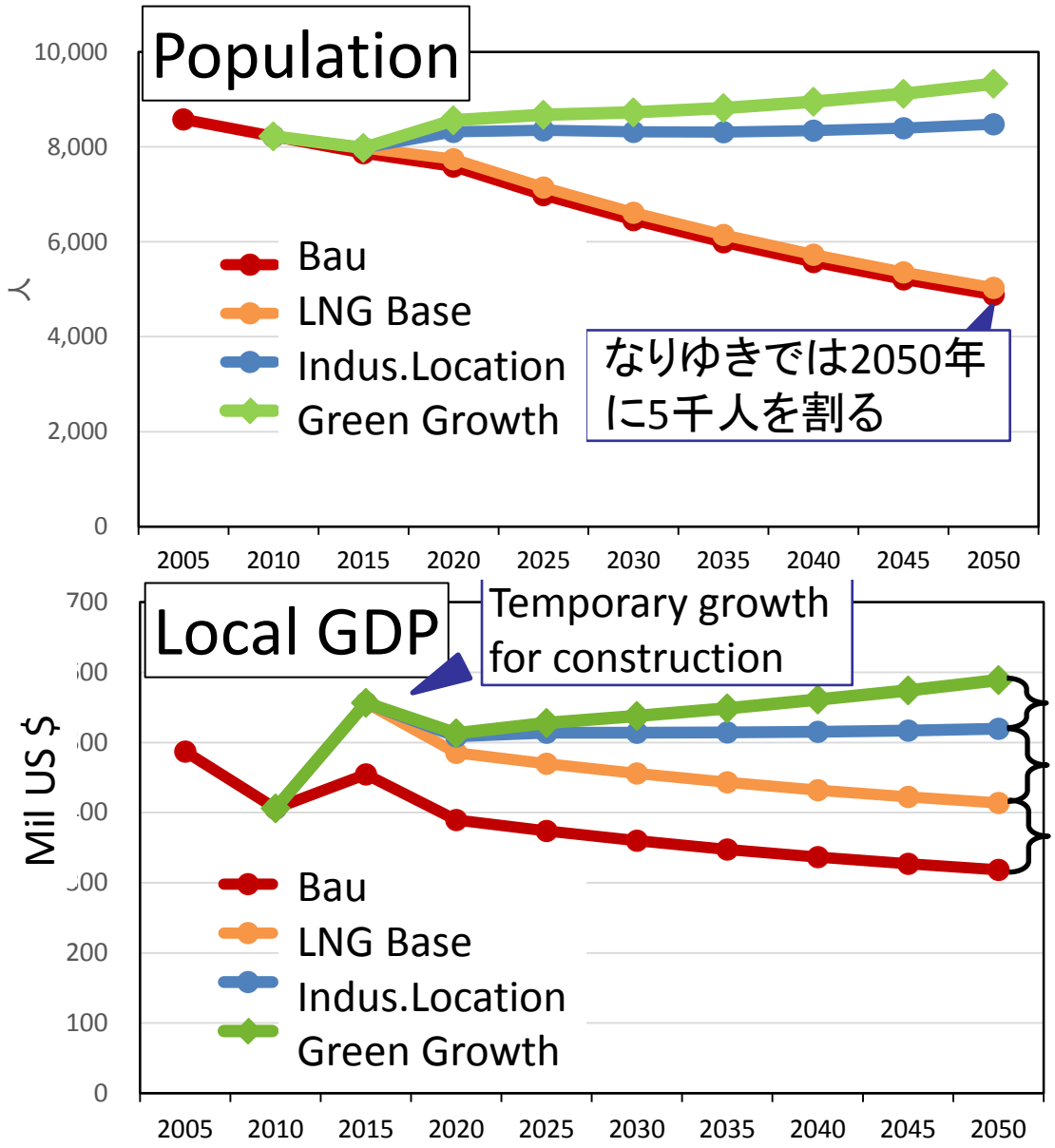
Future Simulation for Alternative Scenarios



Population recovery by green growth

Population keeping with industrial locations

Limited population effects by LNG base

Additional 70 mil US$ effects by green growth

Additional 110 mil US$ by industrial locations

100 mil US$ by LNG base construction and operation

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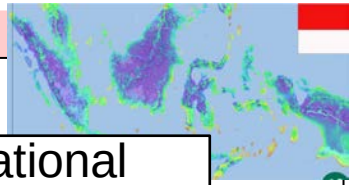
(2)Urban and regional eco-city design model and simulation research

Development of regional scale integrated assessment model for designing low car-bon society in Indonesia, which covers energy sectors as well as non-energy sectors such as forest management and material recycling system will be collaborated re-searched.

By establishing environmental database consisting of urban scale statistical data; monitoring network data as well as spatial GIS and satellite information, strategic district design and urban design will be identified for low carbon society and eco cities.(TBR)

Development of Regional Integrated Models (Regional AIM) and Spatial Planning Model to design sustainable regions and cities

Integrated Model (AIM)



Design of Vision and Road Map for *National Scale*

National End Use Model → *CGE model → National Targets → National Road Maps

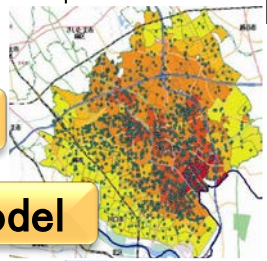
*Computational General Equilibrium

Regional Parame-ters

Analysis for Province Scale

End Use Model → Fukushima CGE Model → Fukushima Targets → Fukushima R. Maps

Low Carbon Urban Design Model



- Strategic Spatial Zoning System
- Forestry Eco System Service Model

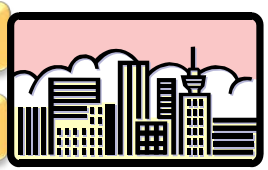
Planning for Local Scale Kabupaten Cota

Snap Shot Models, Policy Support Tools → Local Targets

Kecamatan Kelurahan

Low Carbon District Design Models

- Local Heat/Energy Management
- Low Carbon Industrial System



Spatial Policy/ Tech. Process Packages

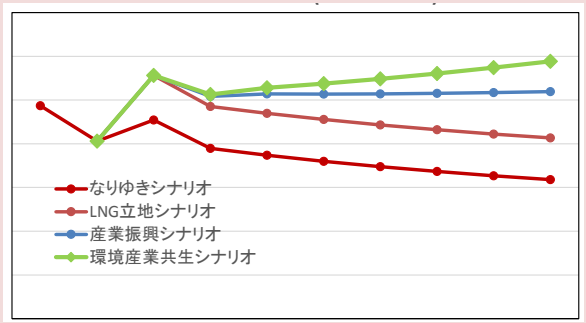
Social Monitoring System & Project Data — Buildings | Industries | Life Style

Multi Stage Approach for Eco-City and EIP Planning

①Macro-scope

Alternative future vision

- population, industries
- core developments
- energy locality



Future frame

②Spatial-scope

Land use zoning /network design

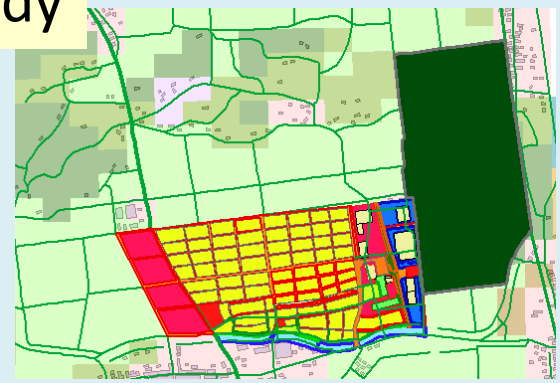
- land use distribution patterns
- local energy network
- location of core developments

Feasibility Study

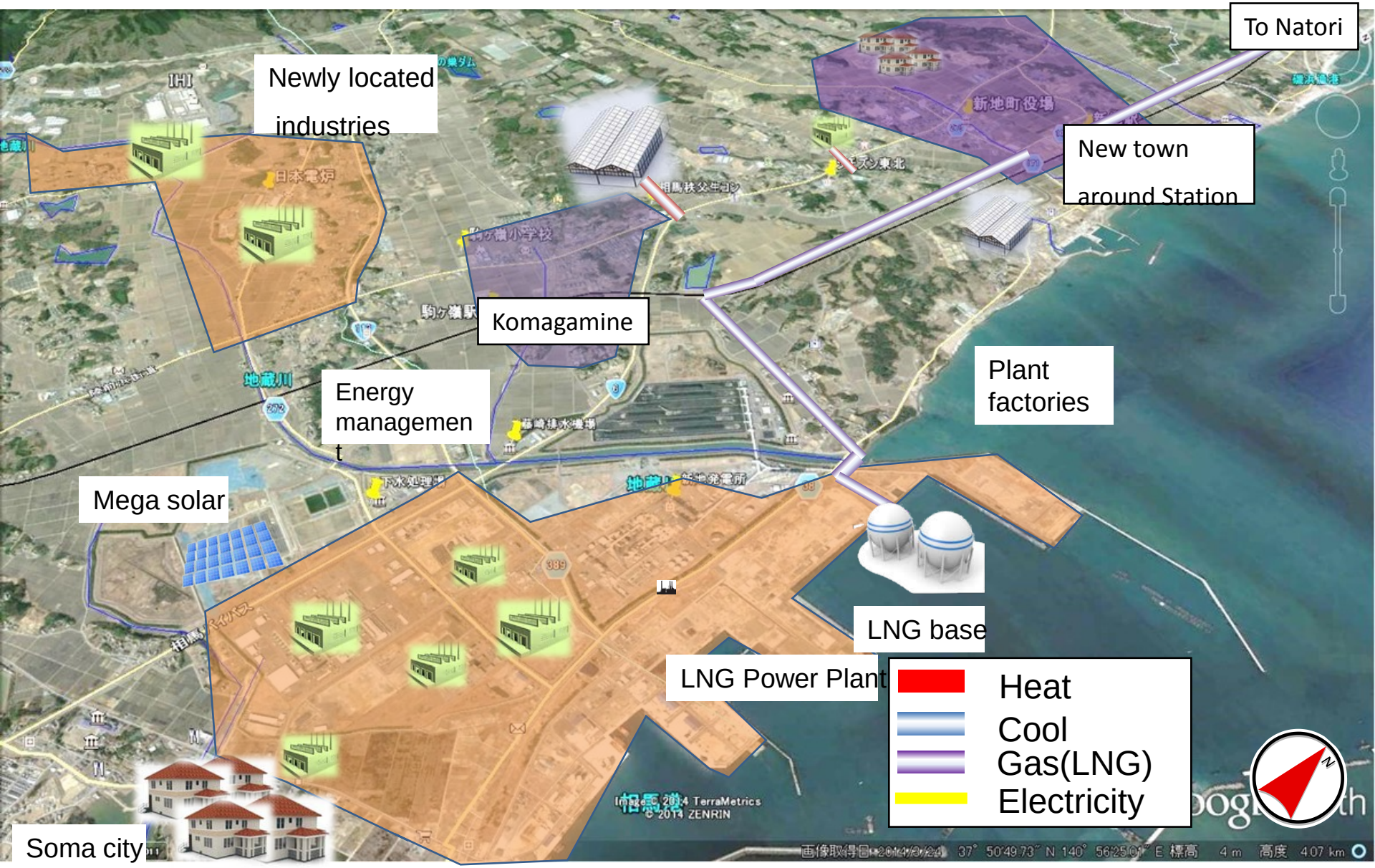
③Project Design

Core projects for revitalization

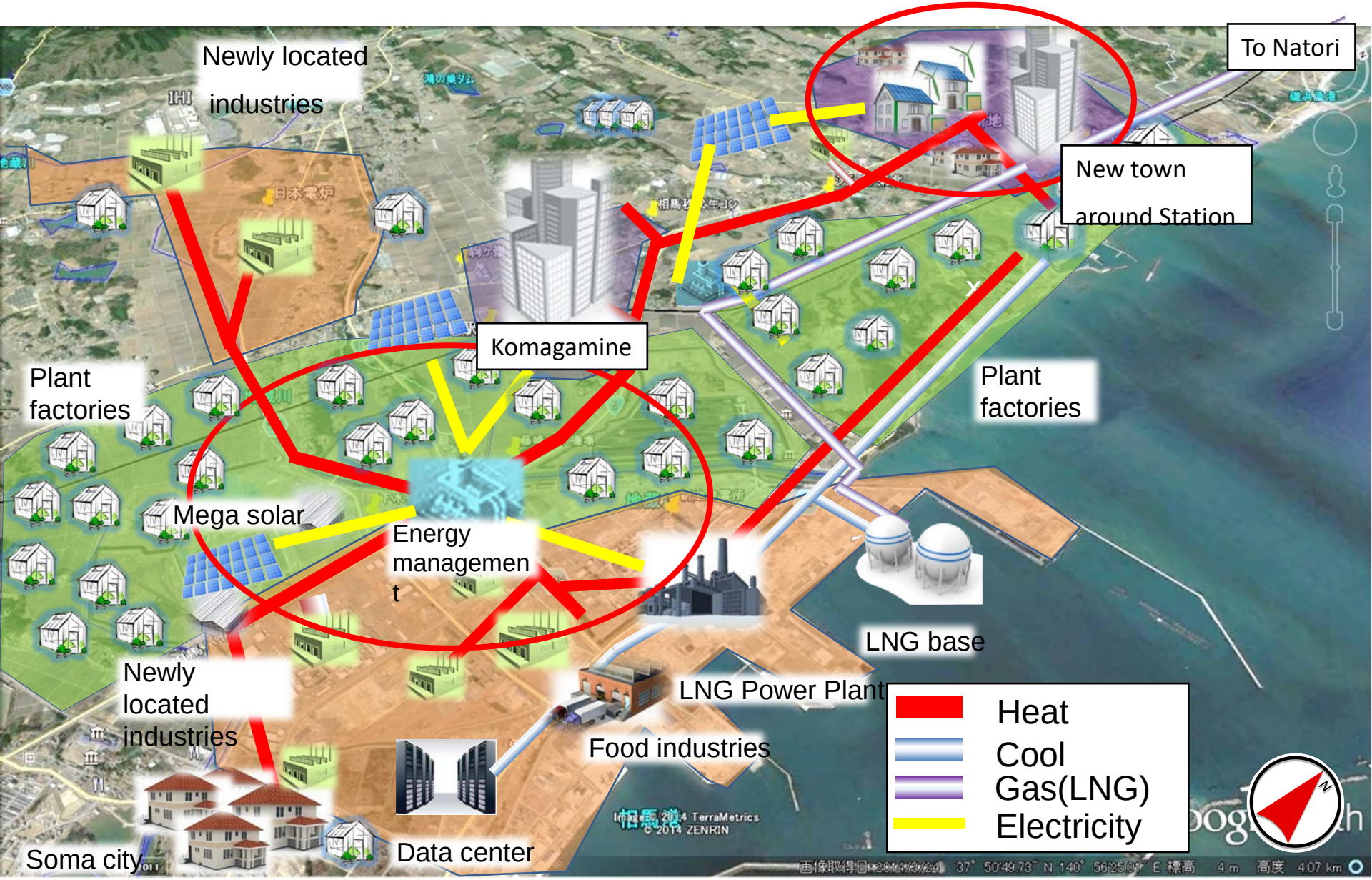
- zoning and regulation
- district planning
- key industries



BaU scenario in Shinchi town in 2030



Integrative Energy System in Fukushima Shinchi town in 2030



Estimation of Alternative Future Recovery Scenarios

Alternative Spatial Scenario

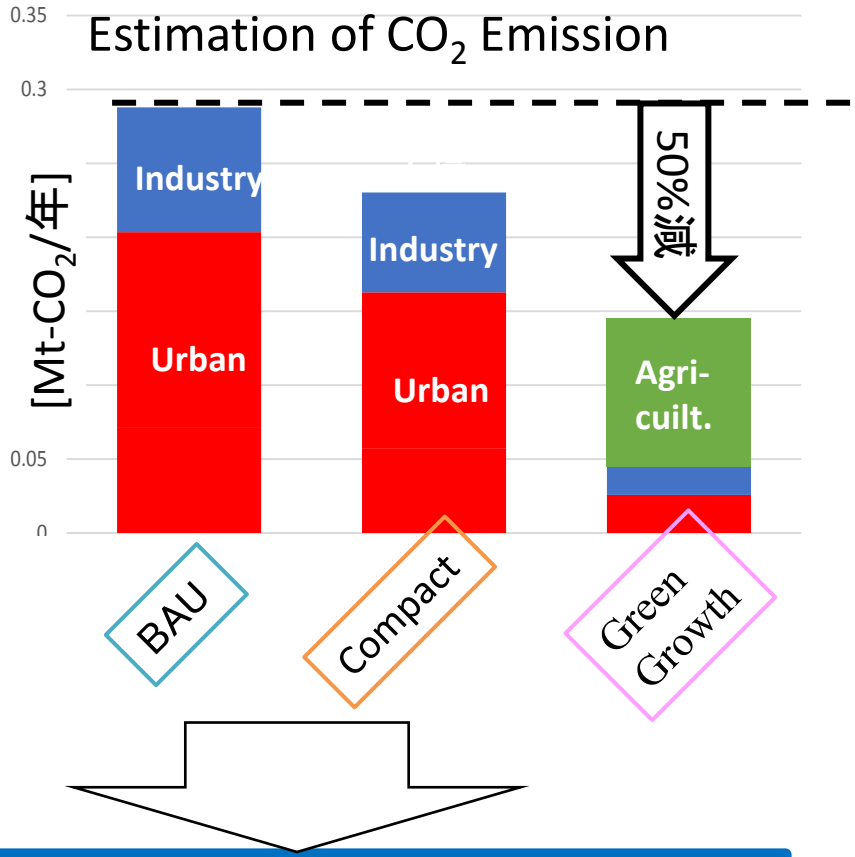
BAU

+Compact City

+Green Growth

Effects of Local Energy Management

Quantification of Impacts and Costs



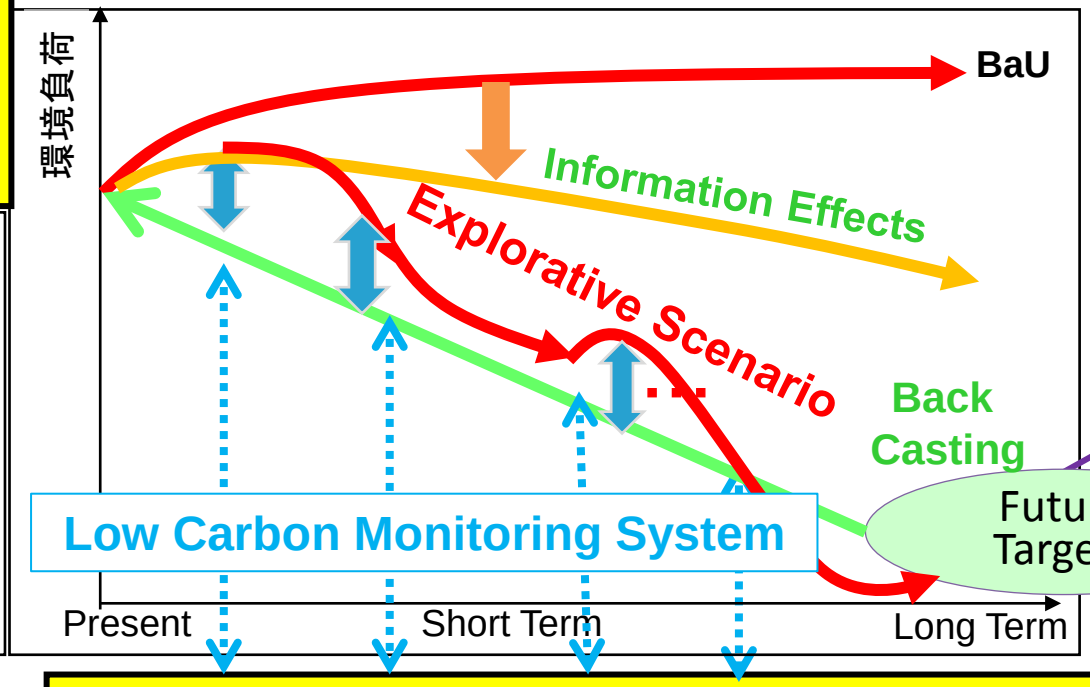
Green growth can double the Carbon Efficiency

将来ビジョン・技術評価・モニタリングの社会実装研究

将来影響・緩和を含む将来ビジョンの統合モデルと、技術・政策アセスメントモデルによる地域ソリューション計画とその検証・評価のモニタリングシステム研究を東南アジアと日本で実装

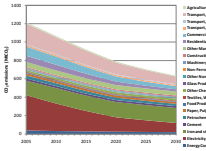
Low Carbon Solutions on Local Contents

Technology and policy Solution Design Adapting to Local Characteristics

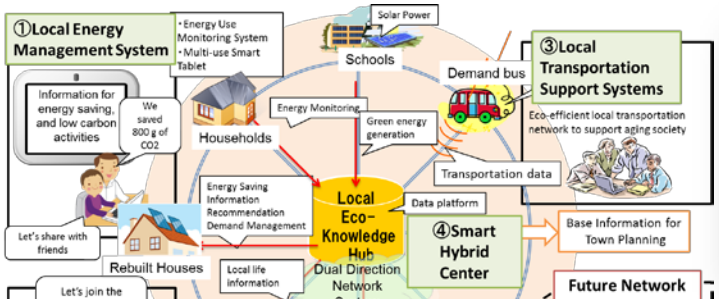


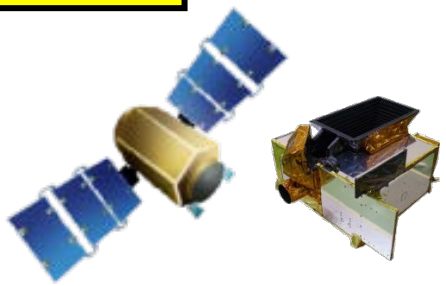
Integrated Model for Future Vision

Normative Targets by General Equilibrium Model



Dual Direction Low Carbon Monitoring Information System





(3) Innovative monitoring and regional evaluation system research

Innovative social monitoring system which includes smart monitoring system for eco-city districts and eco-industrial parks will be developed under the comprehensive collaboration between Indonesia and Japan is discussed. Academic and policy outcome for integrative research challenges are identified such as strategic technology assessment and coordination for sustainable low fossil carbon society strategy planning, innovative monitoring system for the systematic project design and carbon credit certification.

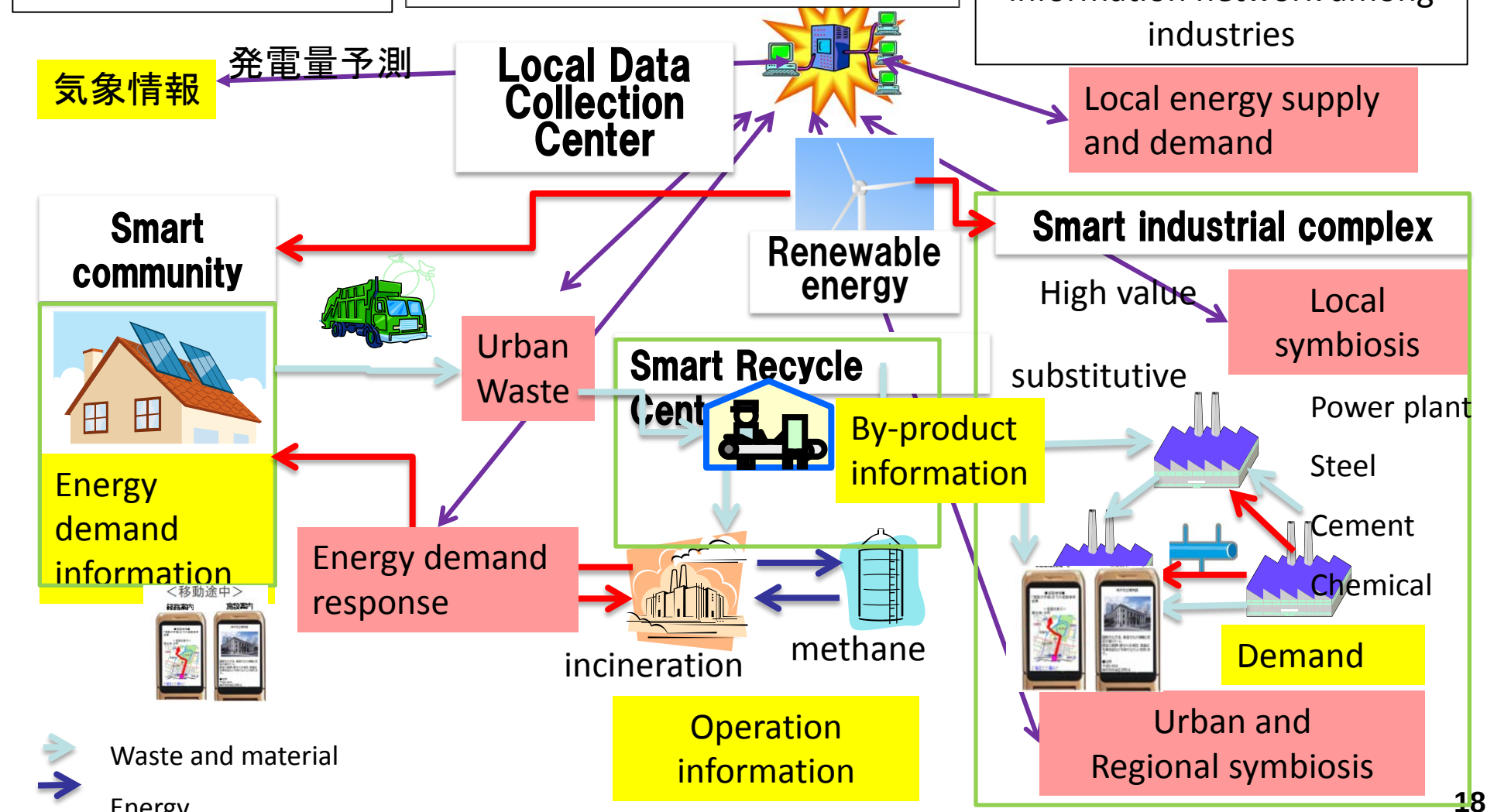
Smart Symbiosis Initiatives for Eco City Innovation

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



Fukushima Shinchi Tablet Network as a Social Monitoring and Activity Support System

Local Energy Assist

Electricity senor: sensor networked with server and tablets

distributer

Real time monitoring

Incentives for efficient energy saving activities

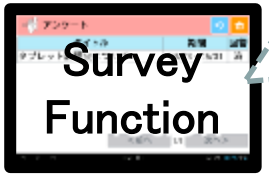
Dual Direction ICT Communication System

Local Life Assist

Dual-direction information sharing system

Community Information Assist

Multi user information sharing system



Frequent questionnaire system

Information sharing among uses

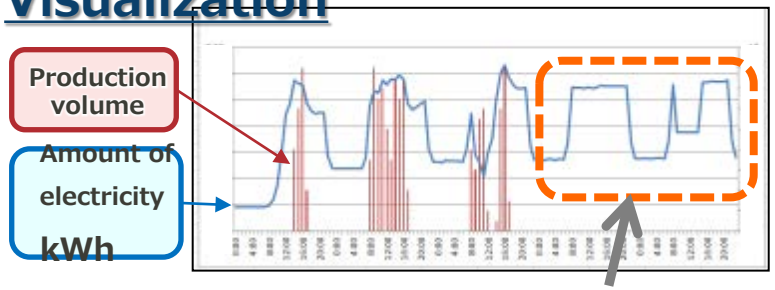
Electric Message Board

Step 1. Visualization of each facility's electricity

1. What we can see from Visualization

Visualize the electricity use of each production process and production line in the factory. Each line will be visualized in one point each

2. What we can support by Visualization



Visualize the electricity amount and production volume shows us the useless point of electricity use.

Analyzing by professional staff, we will be able to advice to save your energy use amount

3. Effect of visualization

1. Enables to save energy in the factory
2. By this activity, it will make a person who bears a responsibility of "saving energy activity"

Data is used only for energy saving and is managed so that only authorized person is seen

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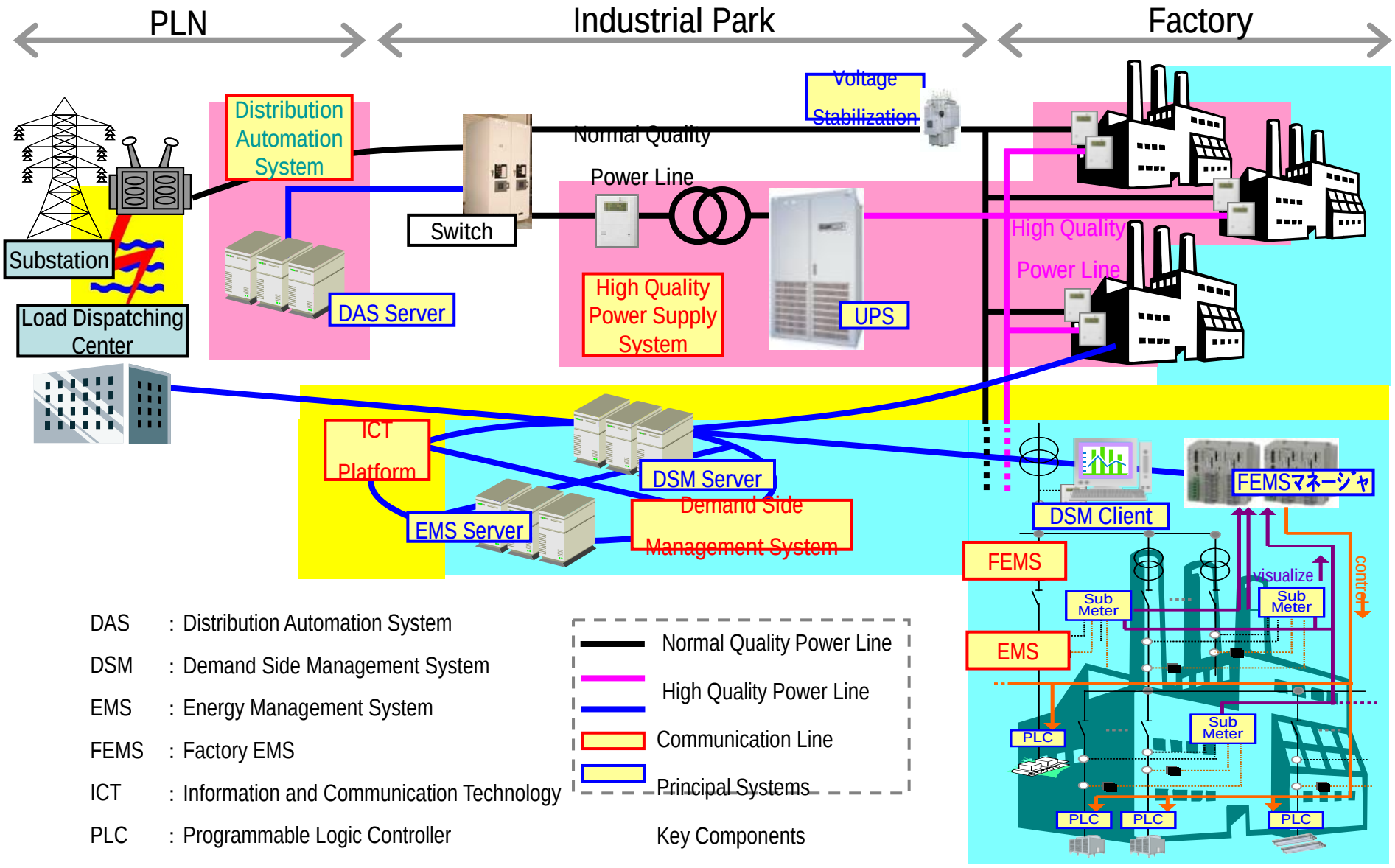
DSM (Demand Side Management)



Steps to realize the goal

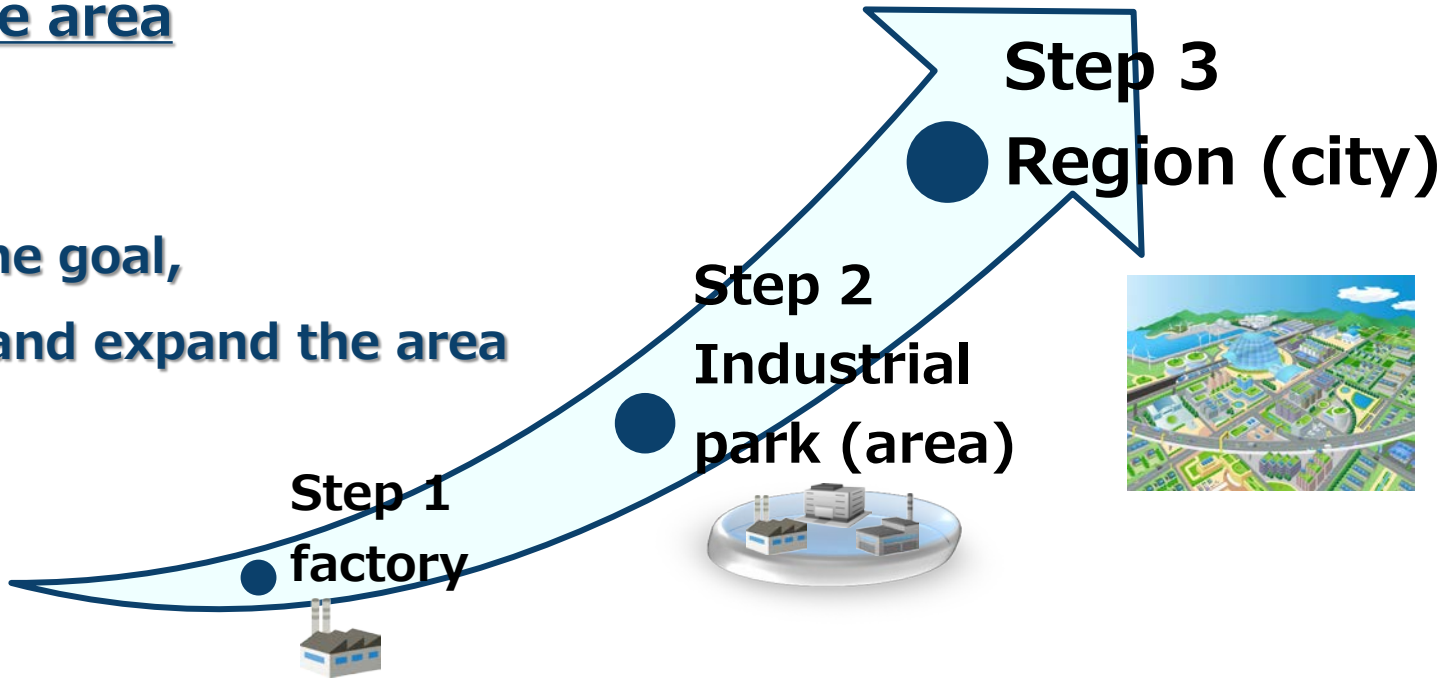
Function for each step

Step 1	Visualization of each factory --> factory
Step 2	Visualization of industrial park (area) electricity -> Shinchi-town
Step 3	Visualization of Region (city) electricity -> Shinchi-town

Expand the area

To realize the goal,

Take steps and expand the area



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Planning System for Fukushima Recovery System through Eco-innovation

Fukushima Shinchi Township

Community Assist Tablet Network

Local Needs

Regional Environment Information

National Institute for Env. Studies

Urban Spatial Analysis

Local environment diagnosis

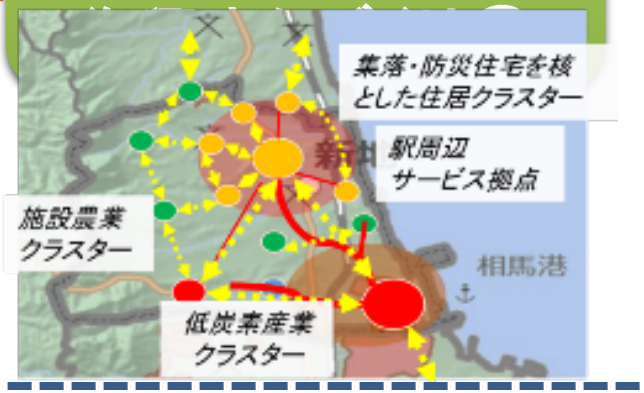
Integrated Modelling

Future scenario assessment

Tech. and policy inventory

- low carbon tech
- circulation tech
- industrial symbiosis
- policy / regulation
- land use control

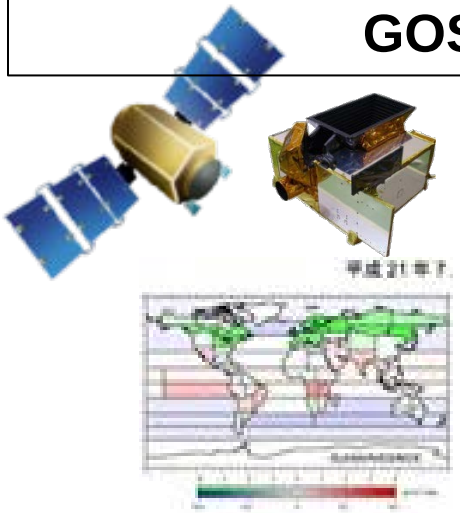
Simulation for recovery roadmap



Planning for Sustainable Future

Innovative Monitoring and Reporting, Verification System in Asian Countries

Greenhouse gas Observing SATellite GOSAT



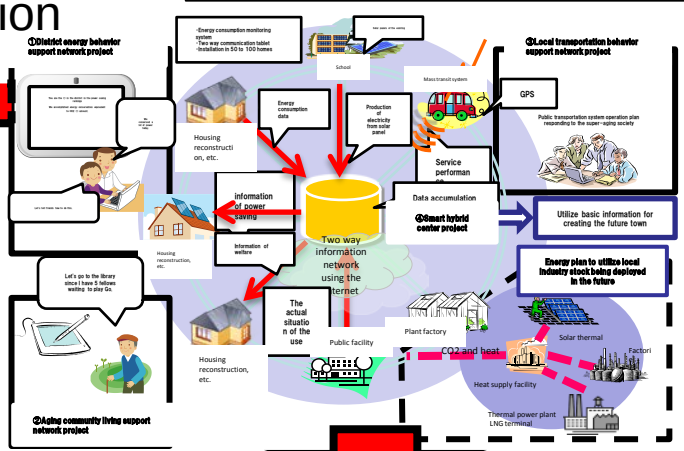
Ground Monitoring System of GHG

Validation

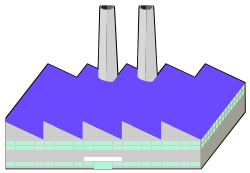
Smart Monitoring Network System for Eco Cities

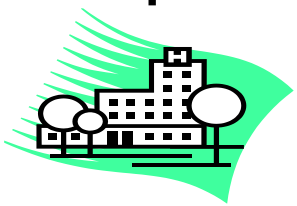
Verification

Joint carbon Credit Mechanism Projects



International Financial System for Low Carbon City Development





Eco-city Evaluation and Validation

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Modelling and Monitorig Approach for the Soft Technology as a Socilal Infrastructure

Quantitative Monitoring approach to seek for better Eco-City system

Pressing research challenges for modelling the Low Carbon Society

Multi-layered monitoring and complementary modelling system for the low carbon policy design and evaluation

List or related publications

- Yong Geng, Fujita Tsuyoshi, Xudong Chen; Evaluation of Innovative Municipal Solid Waste Management through Urban Symbiosis: A Case Study of Kawasaki, Environmental Sci and Tech., 2009 (revised)
- 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
- Shizuka Hashimoto, Tsuyoshi Fujita, Yong Geng, Emiri Nagasawa； Achieving CO2 Emission Reduction through Industrial Symbiosis: A Case of Kawasaki , Journal of Environmental Management, 2008 (submitted)
- Yong Geng, Qinghua Zhu, Brent Doberstein, Tsuyoshi Fujita； Implementing China's Circular Economy Concept at the Regional Level: a review of progress in Dalian, China, Journal of Waste Management, vol.29,pp996-1002,2009
- Yong Geng, Rene Van Berkel , Tsuyoshi Fujita ；Regional Initiatives on Promoting Cleaner Production in China: A Case of Liaoning, Journal of Cleaner Production, 2008 (submitted)
- Zhu Qinghua, Yong Geng, Tsuyoshi Fujita , Shizuka Hashimoto ；Green supply chain management in leading manufacturers: Case studies in Japanese large companies, International Journal of Sustainable Development and World Ecology, 2008 (submitted)
- Yong Geng, Pang Zhang, Raymond P. Cote, Tsuyoshi Fujita；Assessment of the National Eco-industrial Park Standards for Promoting Industrial Symbiosis in China, J. of Industrial Ecology, Vol.13, No.1, pp.15-26, 2008
- Looi-Fang Wong, Tsuyoshi Fujita, Kaiquin Xu； Evaluation of regional bio-energy recovery by local methane fermentation thermal recycling systems, Journal of Waste Management,vol.28, pp.2259-2270, 2008

Thank you for your Attention