

Social Monitoring and Modelling Research for Interactive Solution Design

Jan. 27 -28 , 2016 , AIT, Thailand

Prof. Tsuyoshi Fujita,

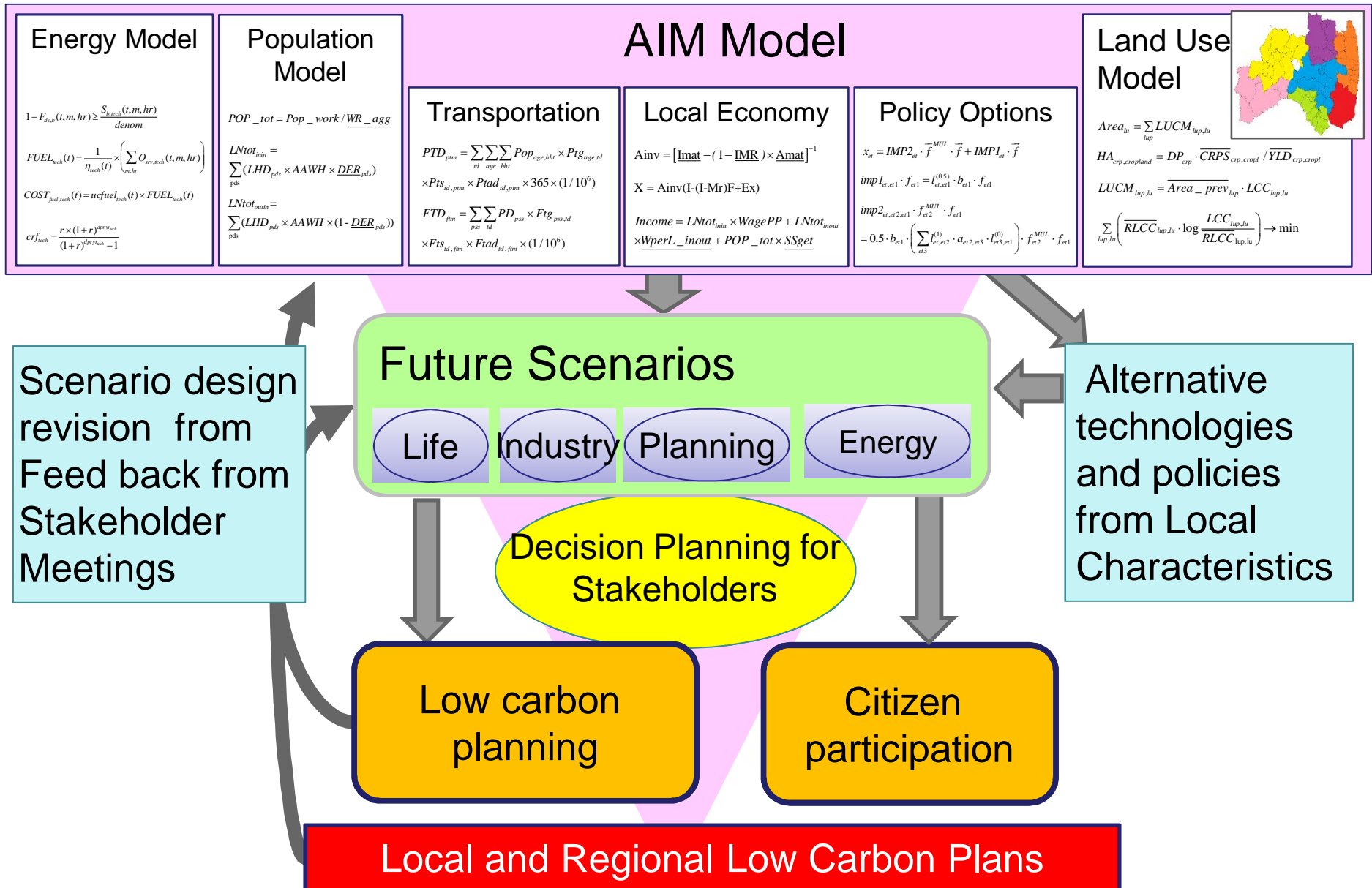
Director of Social Environmental Systems Research Center,
NIES, Japan

Alliance Professor of Nagoya University

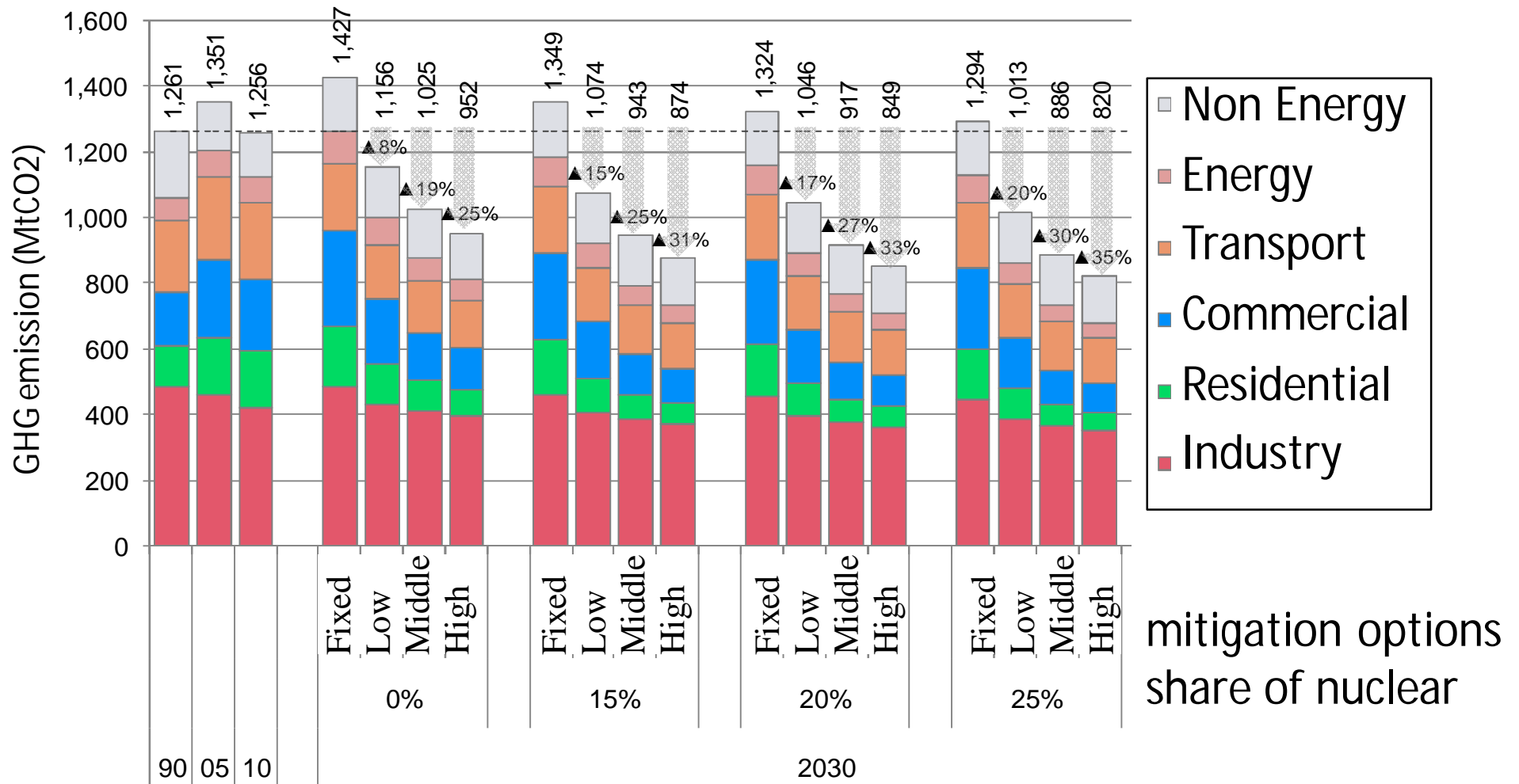
- (1) Integrative modelling research for low carbon society
Multi scale technology and policy simulation system
- (2) Interactive monitoring and regional evaluation system research for
Co design or integrative simulation

PREPARED by
Dr. Toshihiko Masui, Dr. Minoru Fujii Dr. Shuichi Ashina, Dr. Kei Gomi, Dr. Takuya Togawa

Integrative Model Application toward Low Carbon Society by NIES K.Gomi(2015)



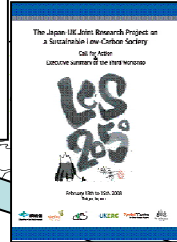
Contribution to Climate Policy in Japan



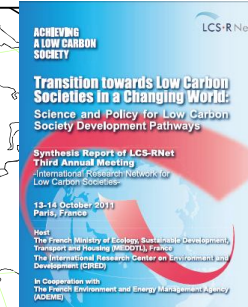
GHG emissions in 2030, Low growth case

International Cooperation toward Low Carbon Society

**Japan-UK Joint
Project on LCS**
2006, 2007, 2008



**LCS-RNet:
endorsed by
G8EMM**



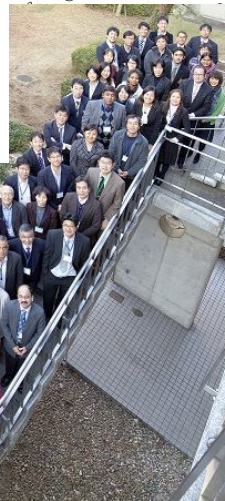
UK

EU

China Korea Japan

**India
Thailand
Malaysia
Indonesia**

**The 18th AIM
International
Workshop, 2012**



AIM Training Workshop at NIES, 2013

**LCS model building
capacity workshop,
Organized by TGO,
SIIT-TU, JGSEE, NIES,
at Bangkok, 2010**

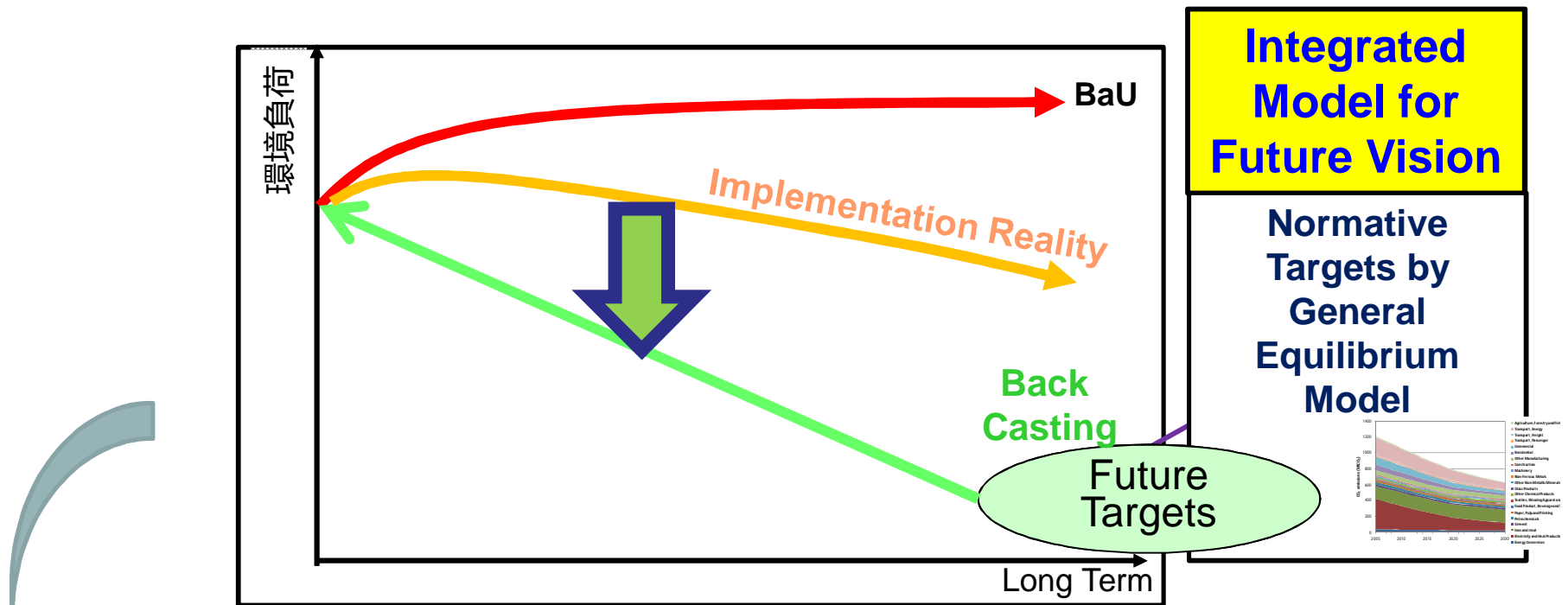


Development of
Low Carbon Society Scenarios for Asian Regions



New Challenges for Modelling and Monitoring Research

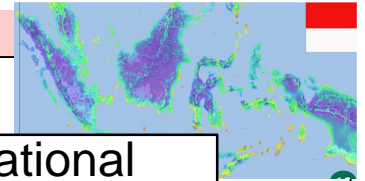
Research challenge to compile innovative modelling and monitoring approach



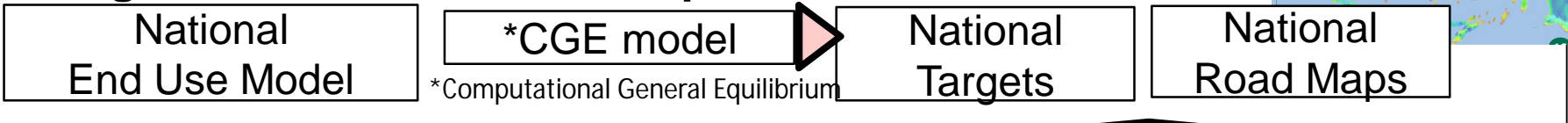
Integrative Approach
Interactive Approach
Innovative Approach

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

Integrated Model (AIM)

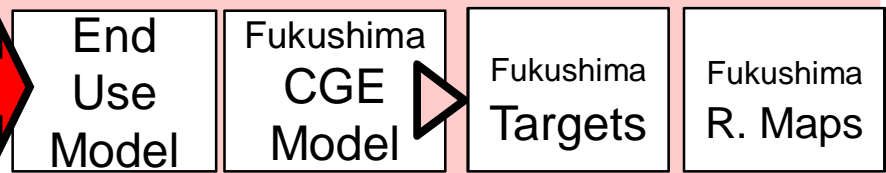


Design of Vision and Road Map for *National Scale*



Regional Parameters

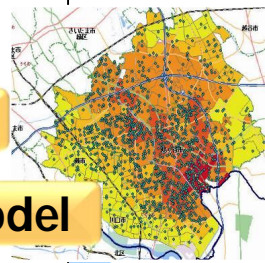
Analysis for Province Scale



Low Carbon Urban Design Model

Strategic Spatial Zoning System

Forestry Eco System Service Model



Low Carbon District Design Models

Local Heat/Energy Management

Low Carbon Industrial System



Planning for Local Scale Kabupaten Kota



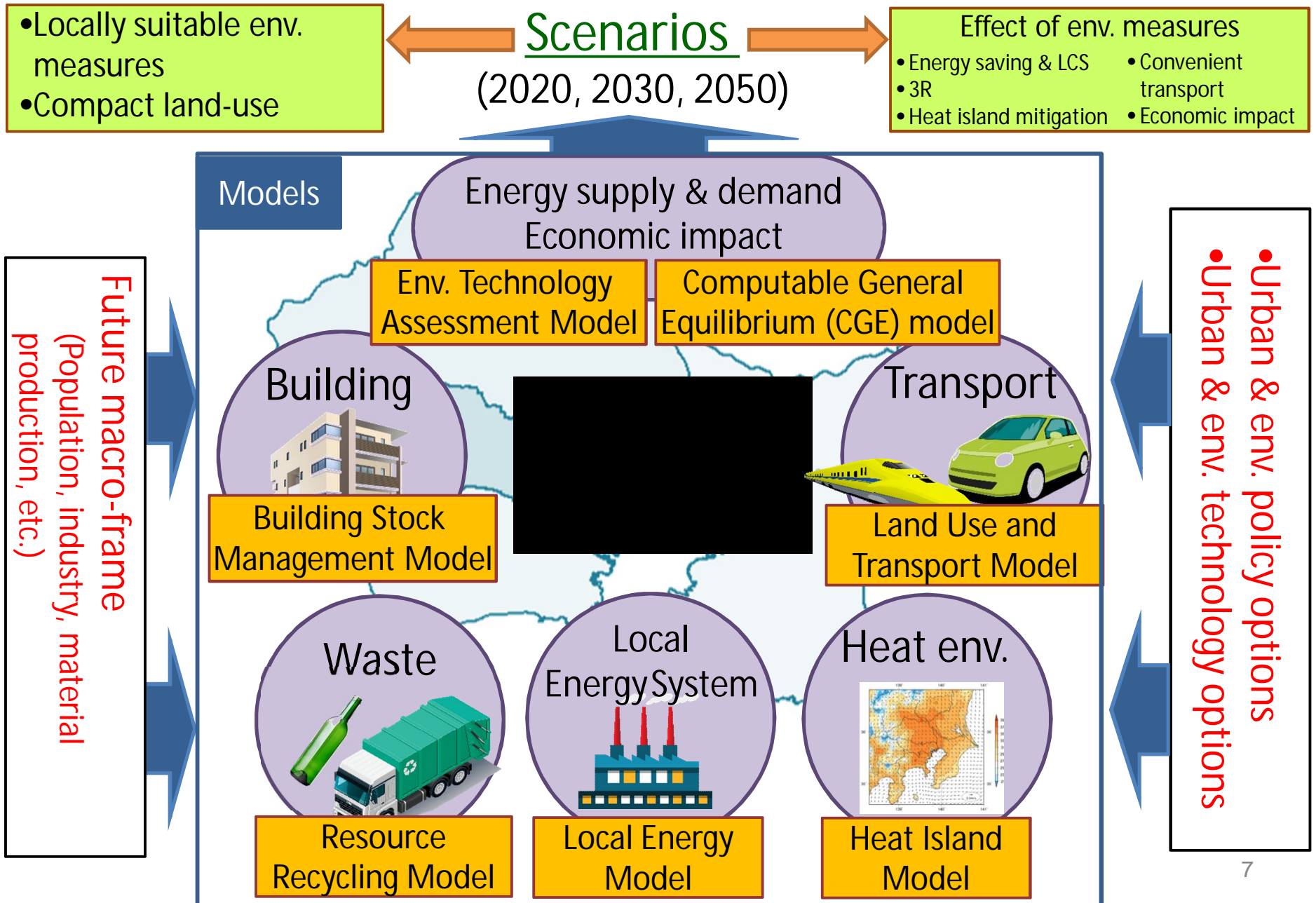
Social Monitoring System & Project Data

Buildings

Industries

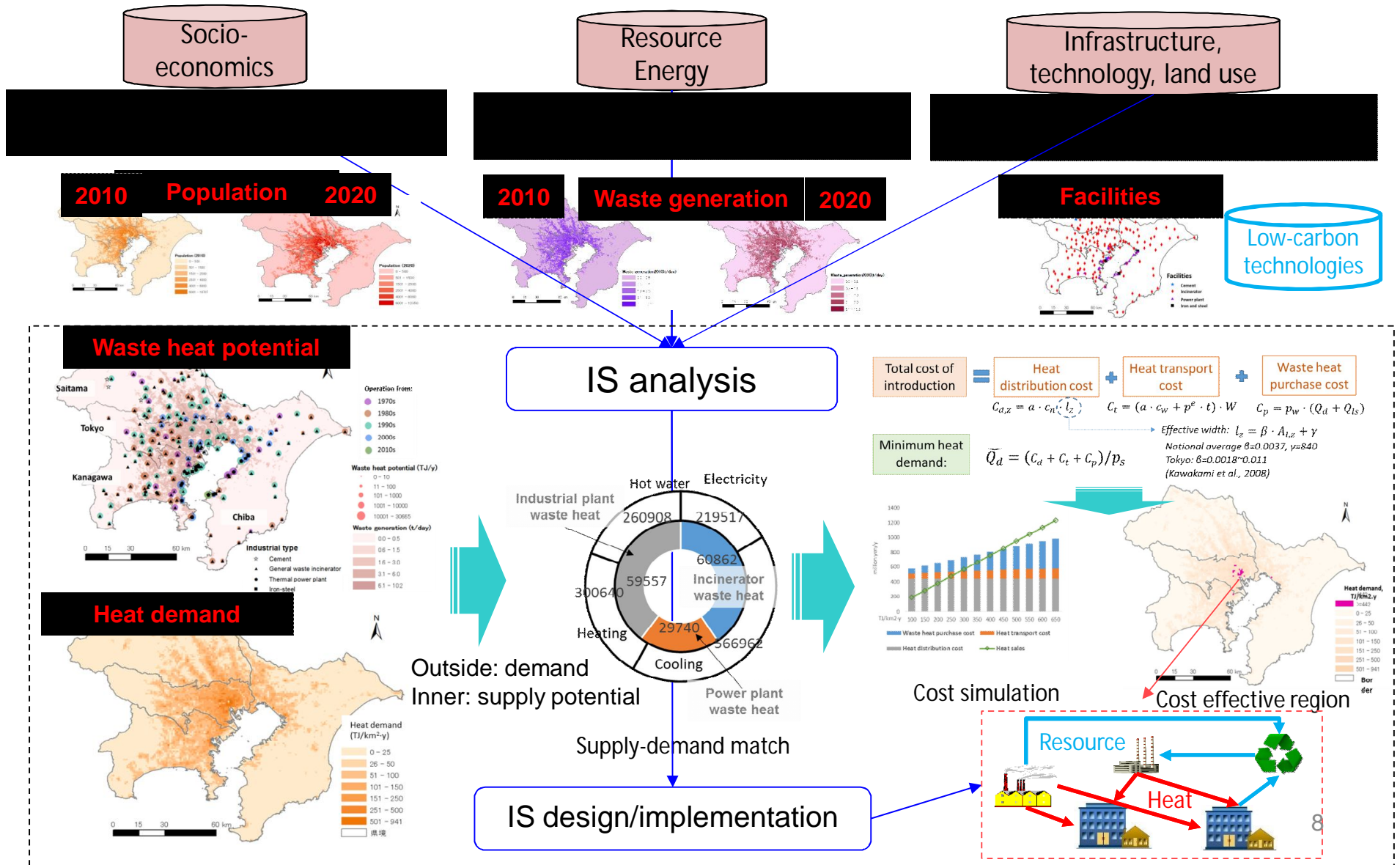
Life Style

Environmental Measures Analysis in Tokyo Metropolitan Region



Primary application case in Tokyo region, Japan

An application case in Tokyo region (macro to spatial scale). Regional condition, resource and energy circulation, and future industrial and urban symbiosis are analyzed.

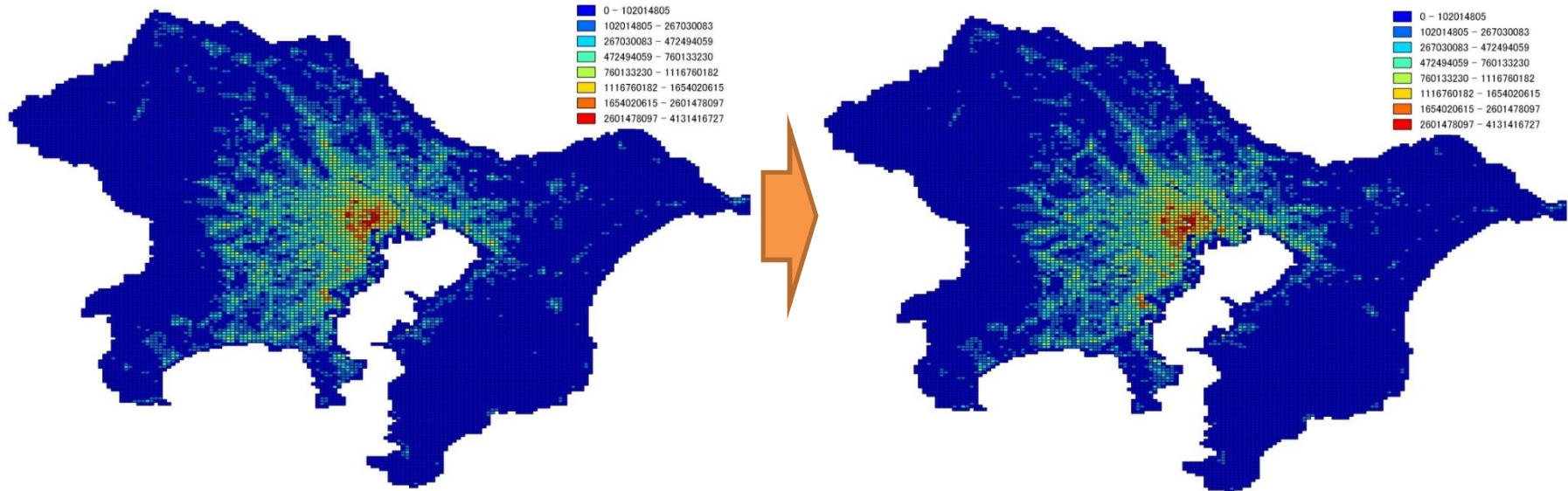


Output of Local Energy Model

Projected energy demand by sector and by service

2014, Total energy demand

2050, total energy demand



Total energy demand in Tokyo Metropolitan Region (PJ/year)

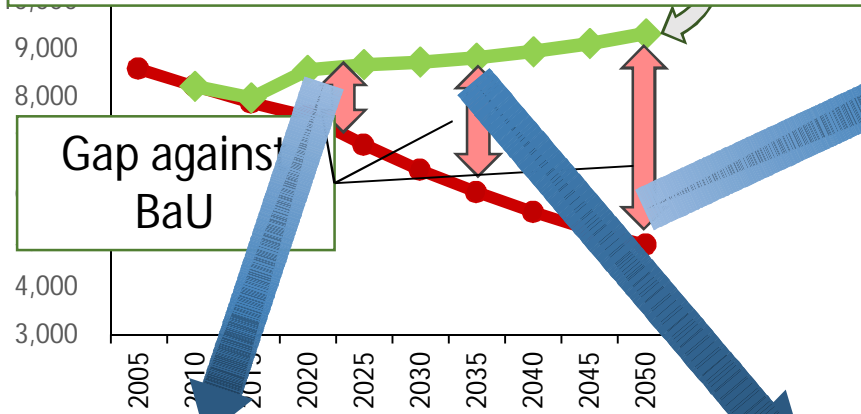
	2014		2050	
	Residential	Commercial	Residential	Commercial
Power	58.4	238.7	47.9	248.2
Cooling	95.2	698.3	78.2	726.2
Heating	90.2	311.9	74.0	324.4
Hot-water	255.2	10.1	209.5	10.5
Sub-total	499.0	1258.9	409.6	1309.3
Total	1758.0		1718.9	

Kei GOMI, Shuichi ASHINA, Tsuyoshi FUJITA, Toshihiko MASUI (2015) :
 Development Of A Methodology For
 Regional Future Scenarios Considering
 Interaction Of Industry And Population
 And Application In So-ma Region In
 Fukushima Prefecture Journal of JSCE
 (Accepted) (In Japanese)

Time-horizon design for technology assessment models

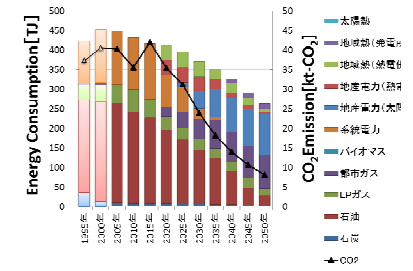
With future targets of demography, economy, and environment in the region, the most suitable technology is chosen in short, mid, and long term. Structure of land use and related industries are describe as well.

Long-term target of the region
[Demography, employment, town-making, low-carbon, etc]



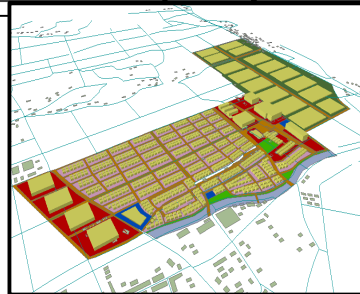
Long-term : Urban-Industry-Agriculture Complex

- Industrial ecology by strategic locations
- Intensive local energy use with IT facilities
- Industrial development center energy business creates employment (~ 3000)



Short term : Pioneering point development project

- Town-planning with local energy
- A show-case of low-carbon system
- Economic impact in several years



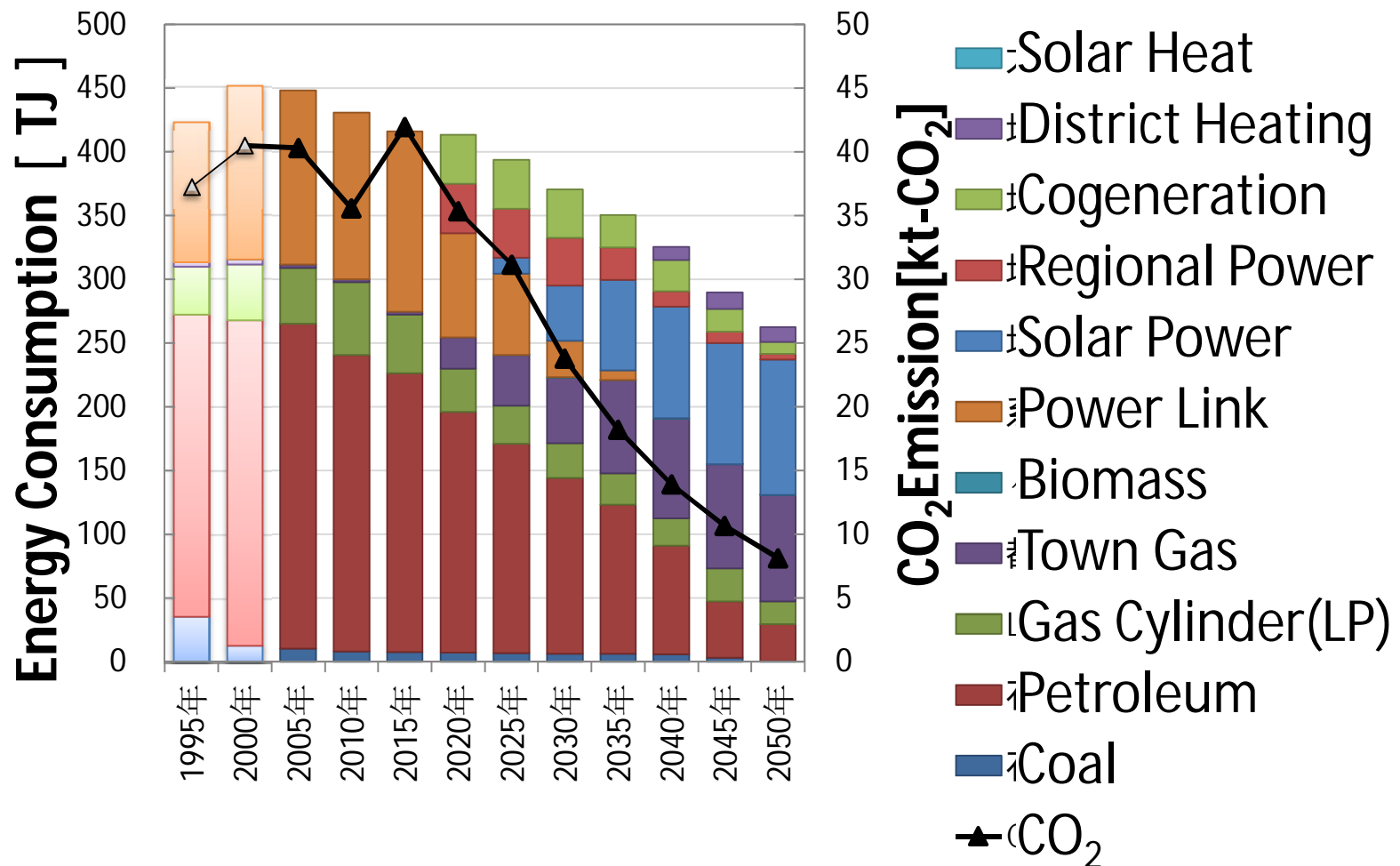
Middle term : Cluster development

- Compact clusters of residents, commerce and industries
- Convenient transport
- Creating employment (~1000) and enhance settlement

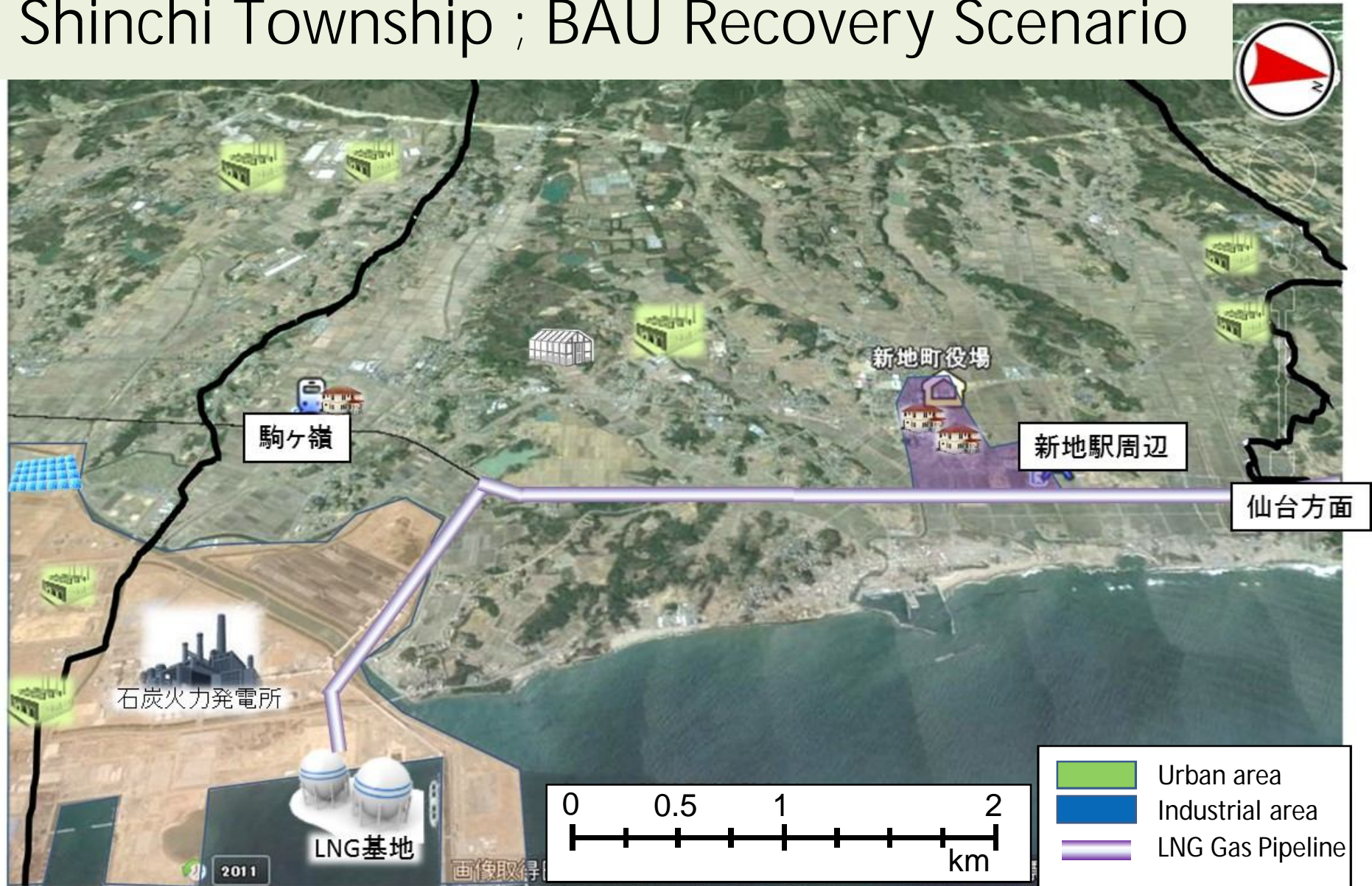


Macro Scope Technology Assessment for Local Government

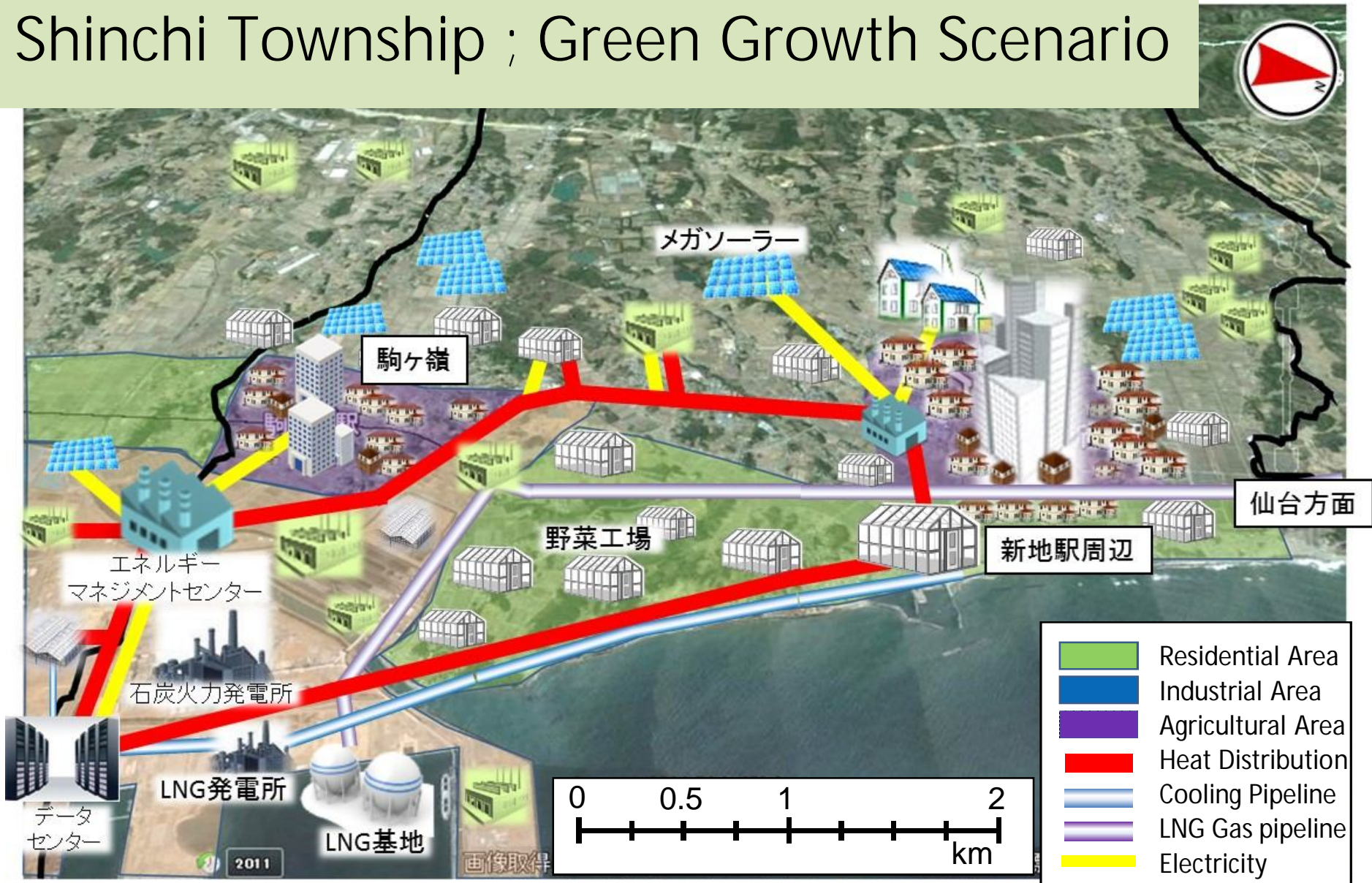
Assessment for Suitable Technology Assessment for the Low Carbon Future (80% Reduction in 2050 from 1990) in Shinchi Town of Fukushima



Future Scenario Simulation for Fukushima Shinchi Township ; BAU Recovery Scenario



Future Scenario Simulation for Fukushima Shinchichi Township ; Green Growth Scenario



Estimation of Alternative Future Recovery Scenarios

Alternative Spatial Scenario

Quantification of Impacts and Costs

BAU



+Compact City

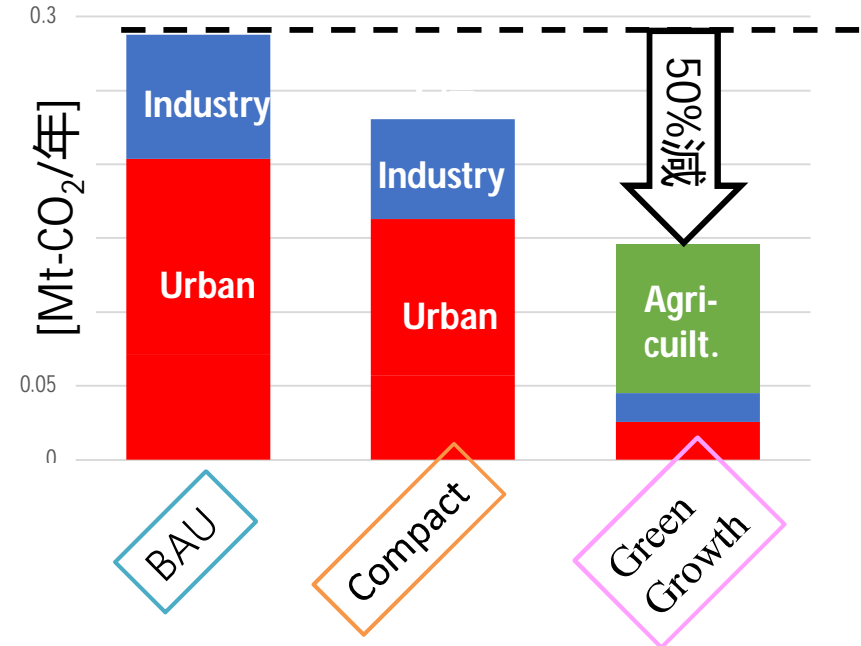


+Green Growth



Effects of Local Energy Management

Estimation of CO₂ Emission



Green growth can double the Carbon Efficiency

Smart City Frontier Project for Fukushima Recovery

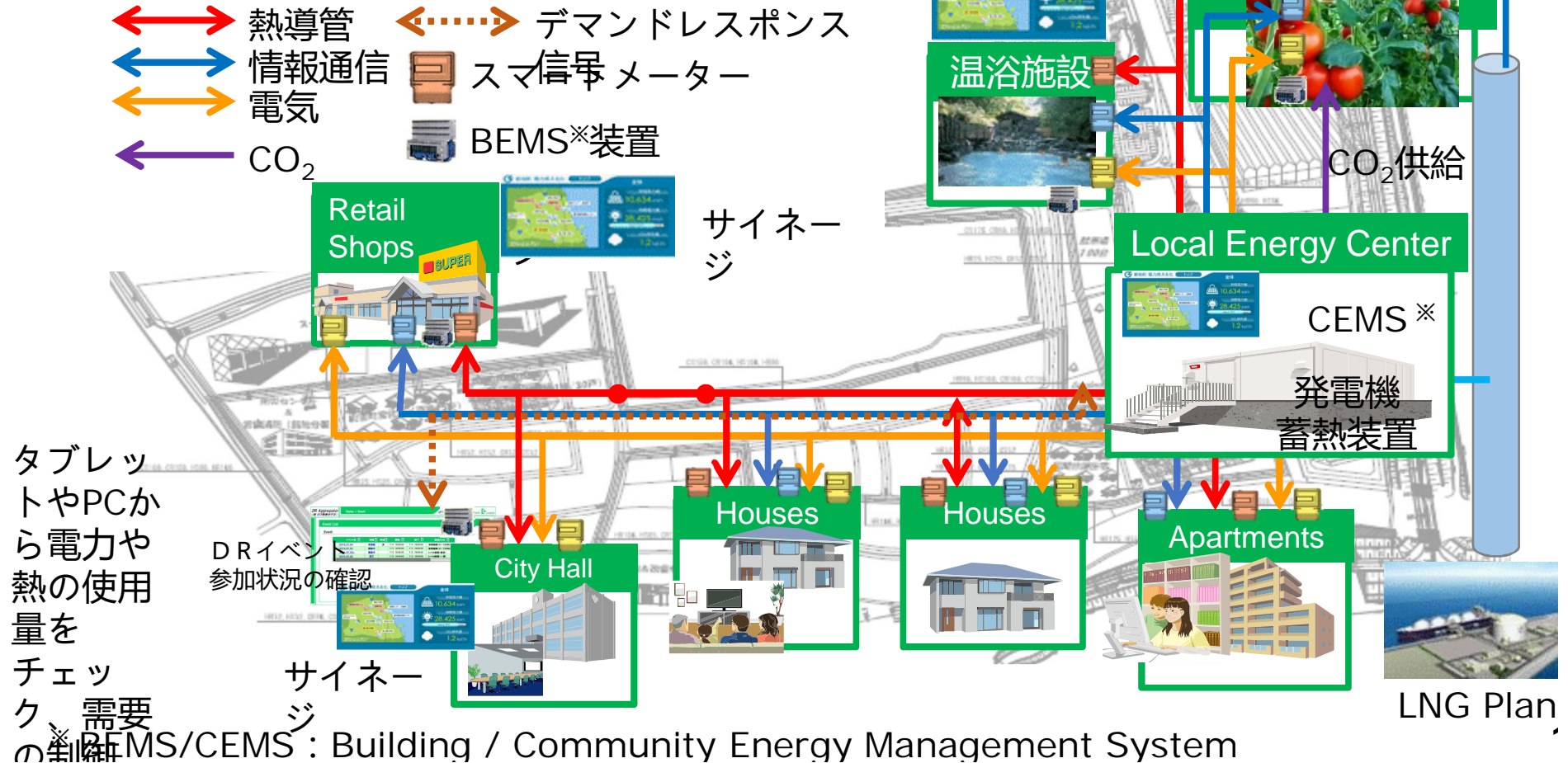
→Subsidization by METI and MOEJ

【Innovativeness】①Local Energy System to Utilize LNG Plant

②Mixed use planning to Realize Optimal Demand Mix、

③Demand Management by ICT or IOT)

【JAPEX, Keiyo Gas Plant, NEC】

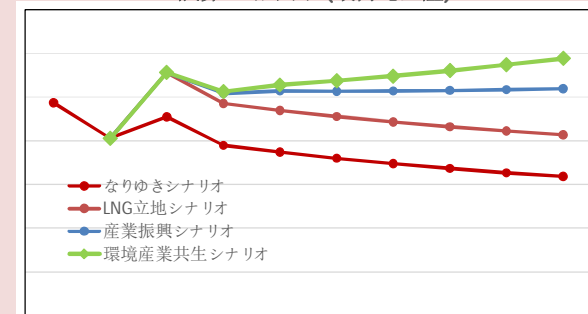


2. Future technology and policy system analysis for eco-cities

① Macro-scope

Alternative
future vision

- population, industries
- core developments



Energy Future frame

② Spatial-scope

Land use zoning
/network design

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

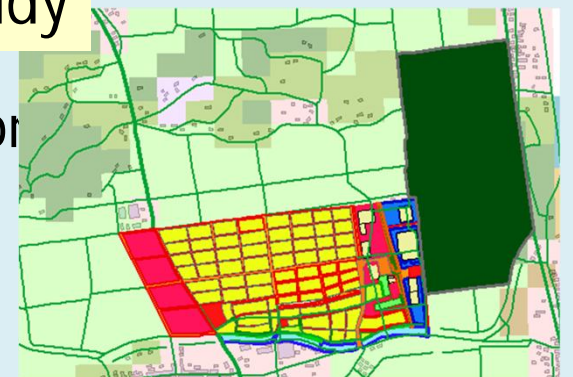


Feasibility Study

③ Project Design

Core projects for
revitalization

- zoning and regulation
- district planning
- key industries



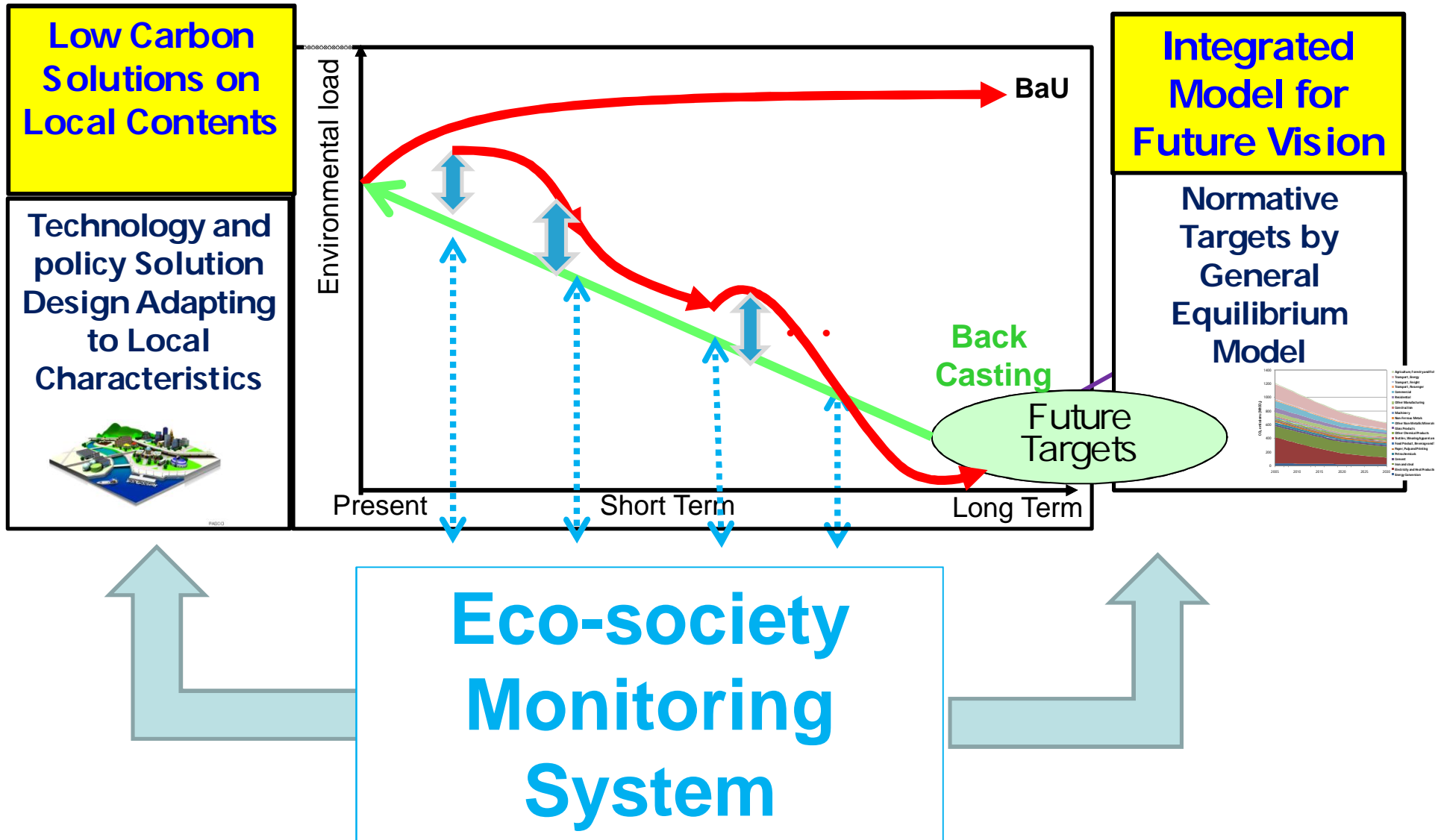
Down Scaling of the Social Model

as an Innovative Approach 1

Social Monitoring and Modelling

as an Innovative Approach 2

Innovative Modelling and Monitoring Research Project



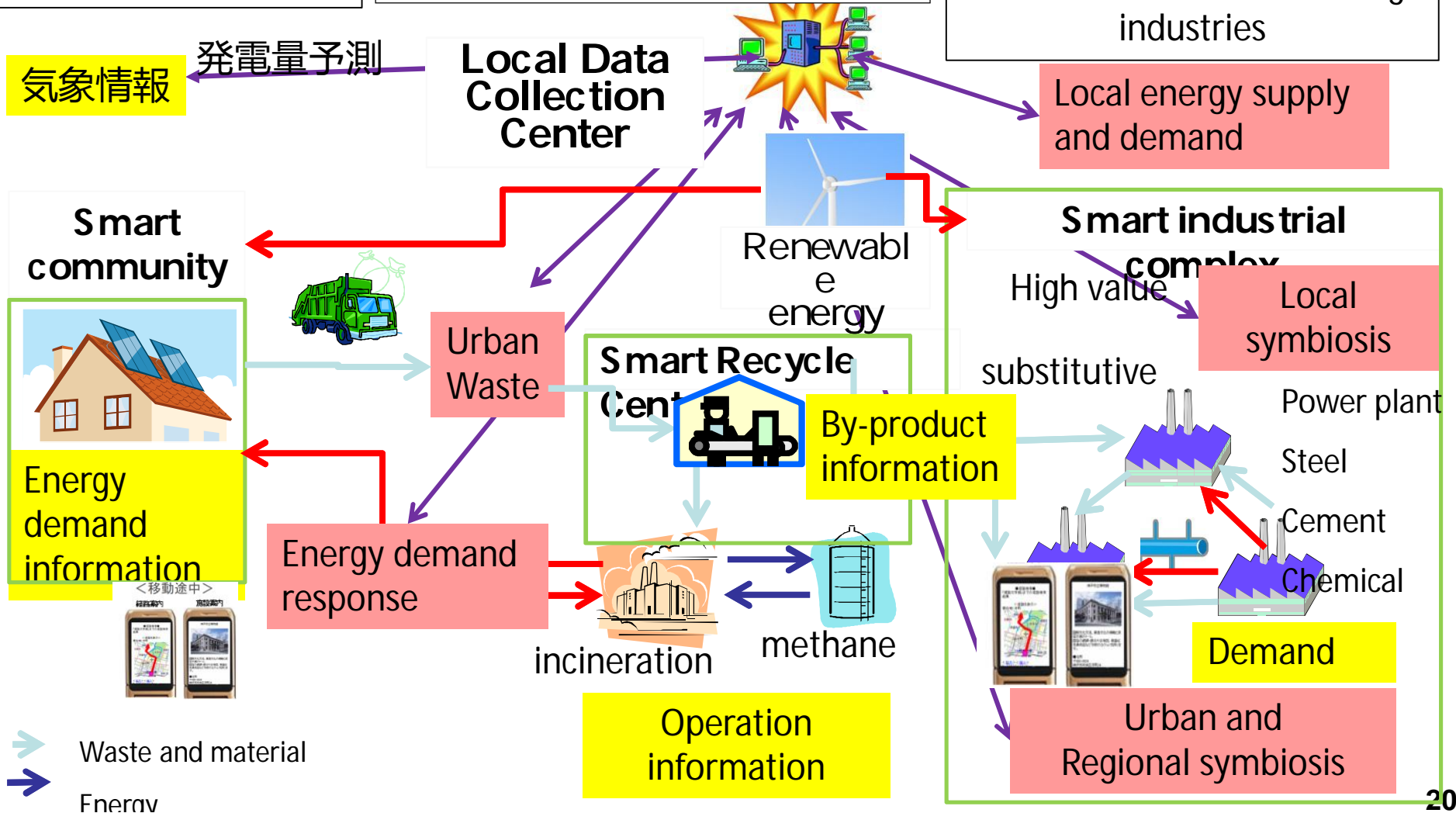
Smart Eco-Monitoring System for Low carbon Society 2014-

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



Social Monitoring Research in Bogor City

2015

2016

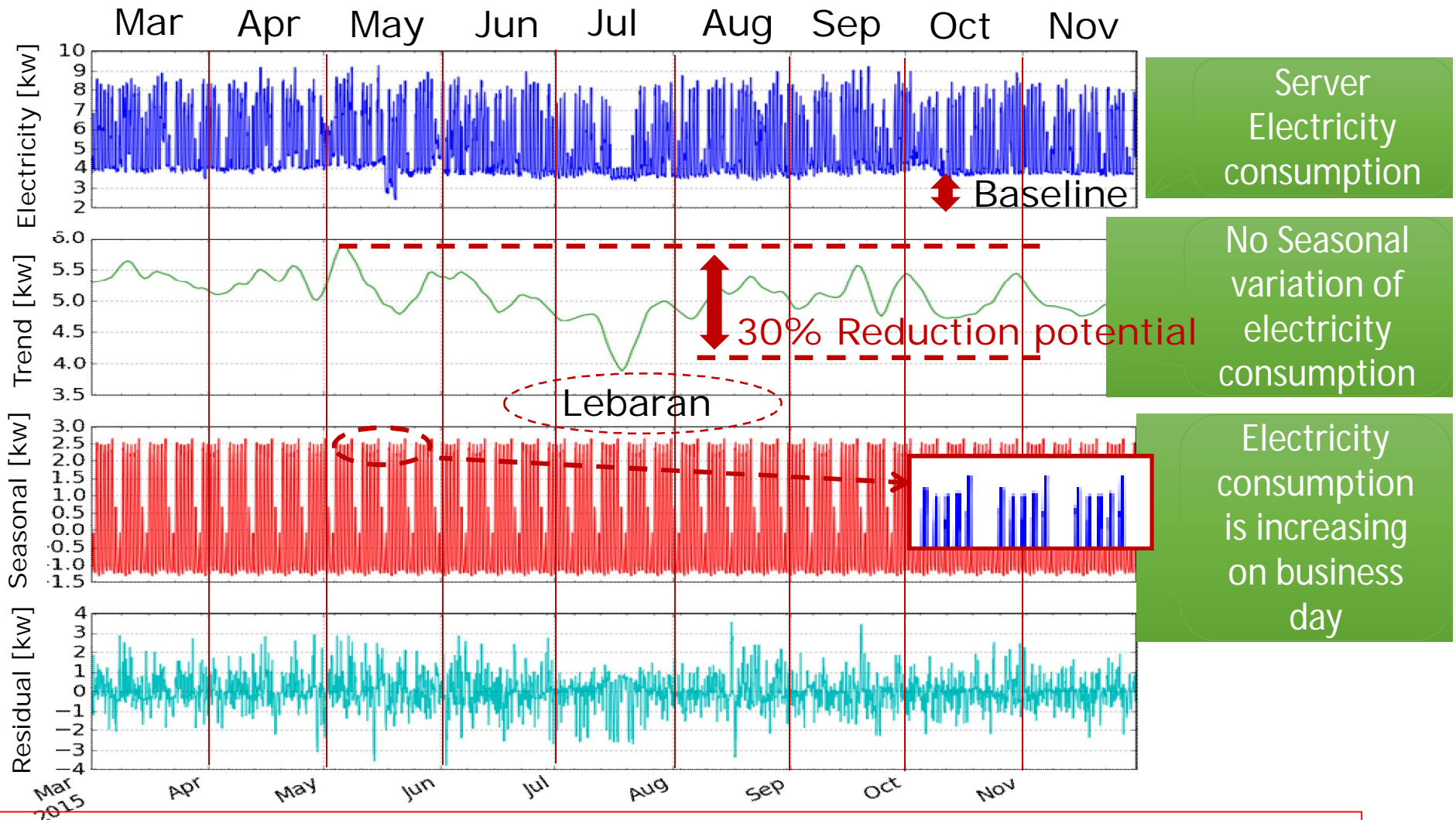


Sector	Number of facilities	Monitoring Start
Office Building	2	2015/03
Households	4	201503
Commercial Area	2 (café/ hotel)	201503

Sector	Number of facilities	Number of point
Government building	3	30
Household	3	10
Shopping Mall	1	10
		21

Time series analysis in Office Building case

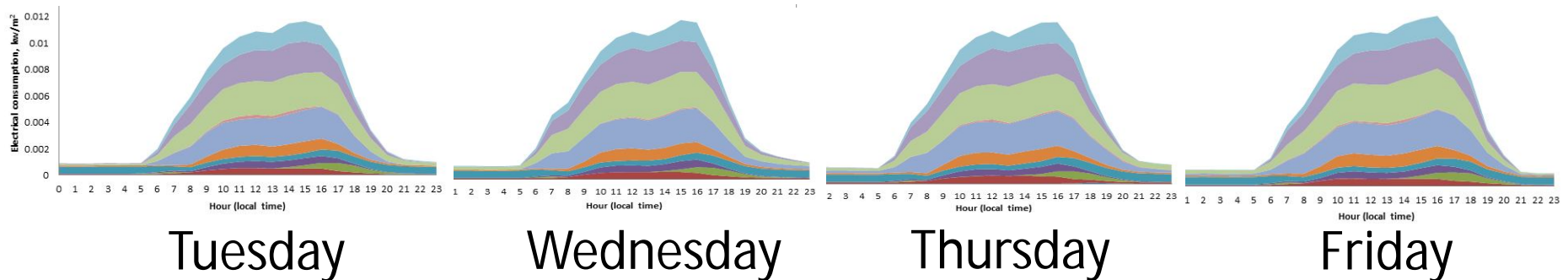
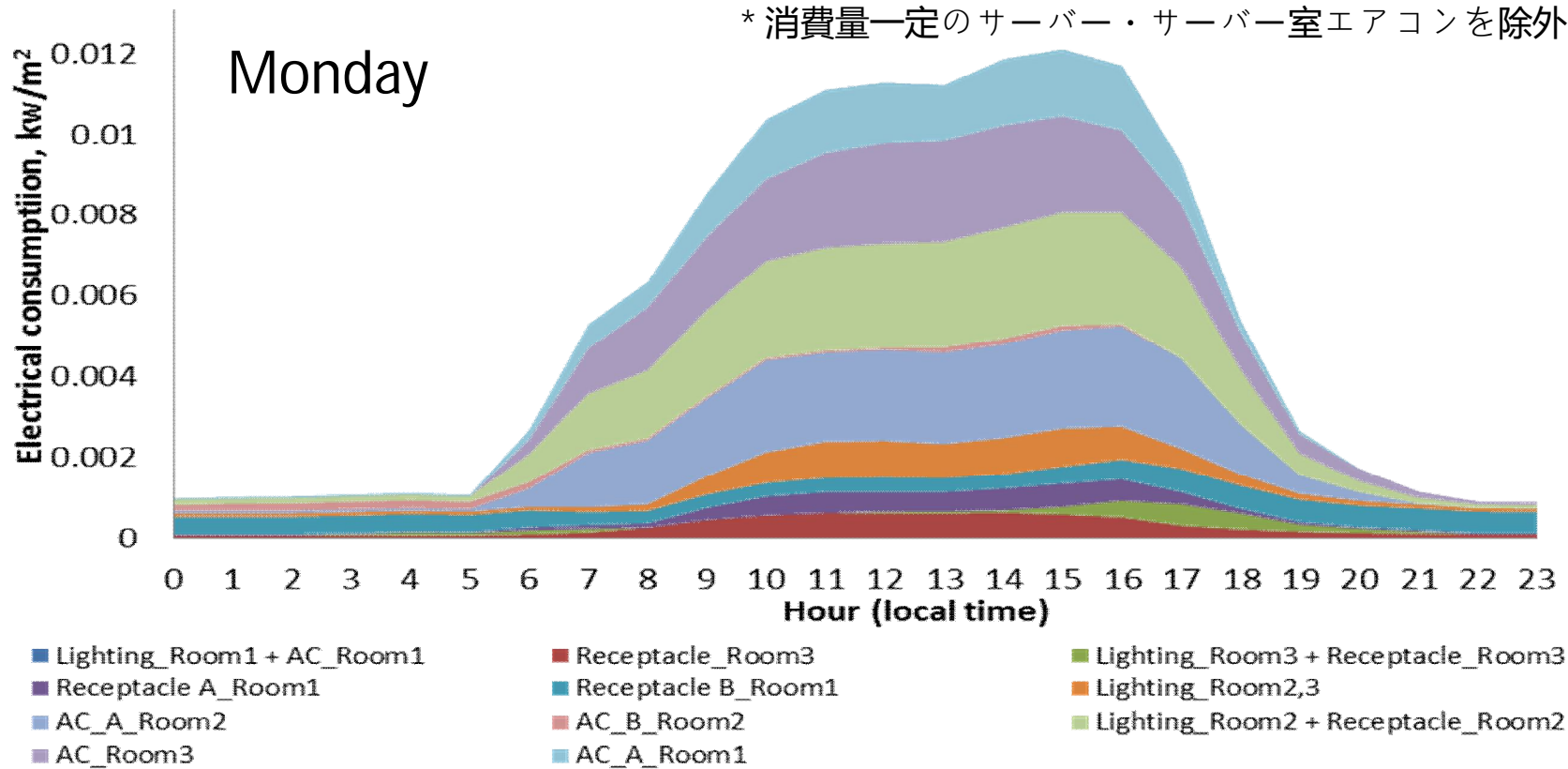
Monitor data every one hour from March to November :kw unit



The reduction potential of about 30% can be expected by turning off Air conditioner by the temperature and humidity.

Electrical consumption patterns for office

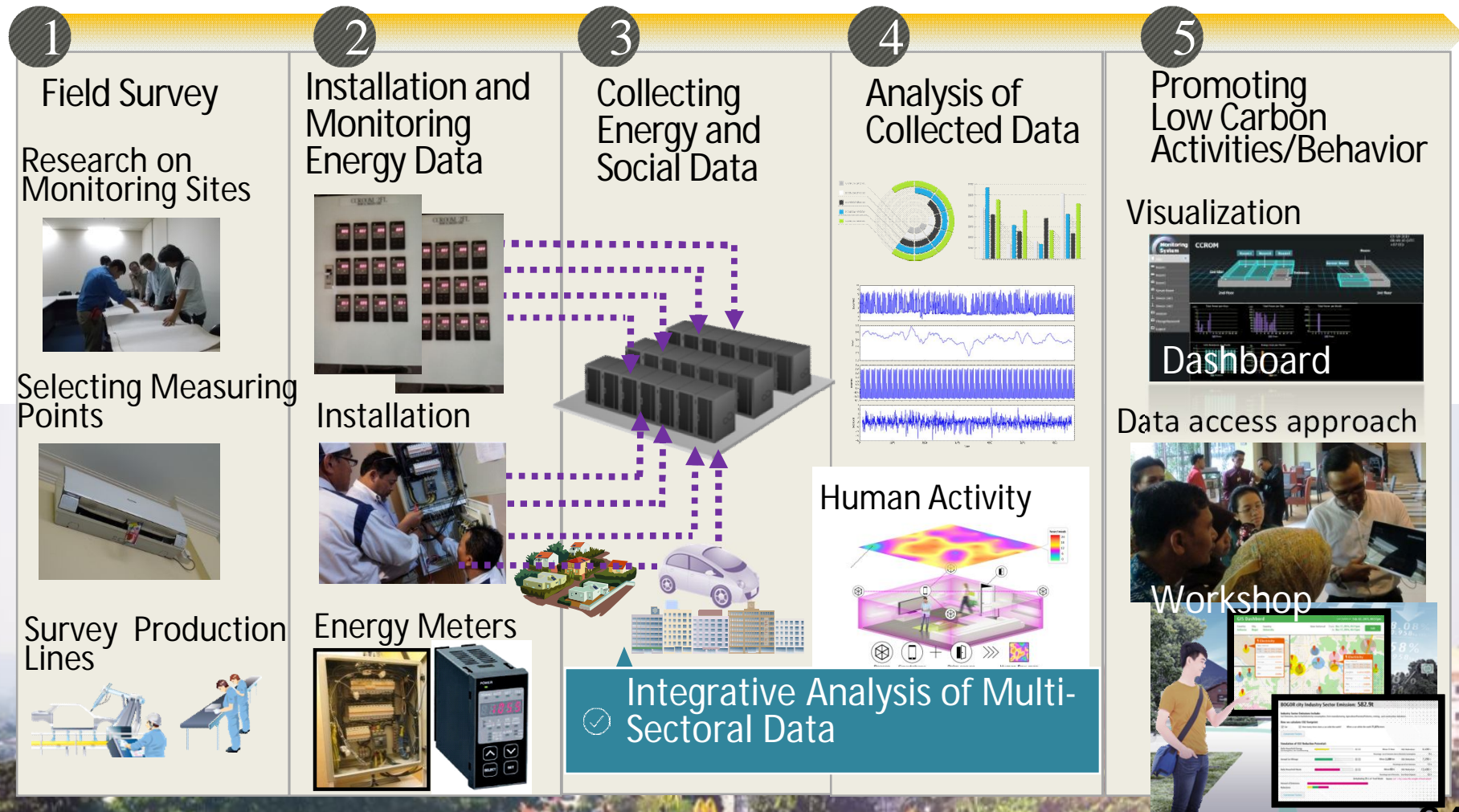
* 消費量一定のサーバー・サーバー室エアコンを除外して表示



Results: (1) The pattern for weekdays from Mar. to Oct. showed **similar trend**.

Framework for Social Monitoring System

1. Visualization of electricity consumption.
2. Supporting demand side management of urban energy consumption for promoting a low carbon society.



25 Traffic monitoring plan

Goal: Eco-friendly and More Comfortable City

Data Oriented
Innovation Center

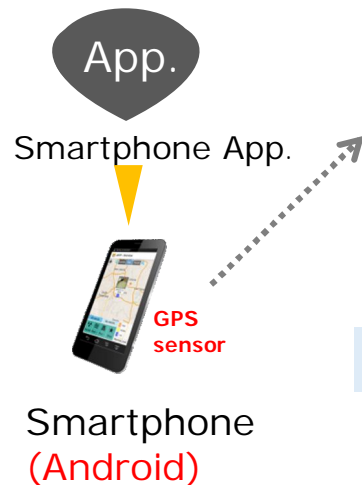
Phase1

Visualize traffic congestion

Visualize traffic congestion and travel time data by using several smart phones as GPS sensor on vehicle.



< Sensing >



< Target Vehicle >

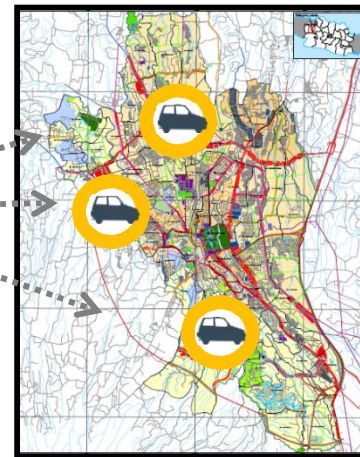


• Public Bus (**TransPakuan**)

The target: 20 vehicles

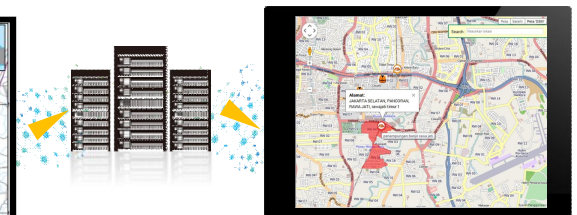
※to be arranged

< Collection and output >



- Positioning info.
- Time and speed

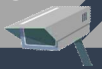
< View >



Traffic data with **GHG info.**

- Schedule (Tentative)
 1. Preparation (~ Feb, 2015)
 2. App. Installation
 3. Monitoring (Mid. of Mar)
 4. 1st Report (End of Mar)

Phase2 : Calculate traffic volume
With CCTV

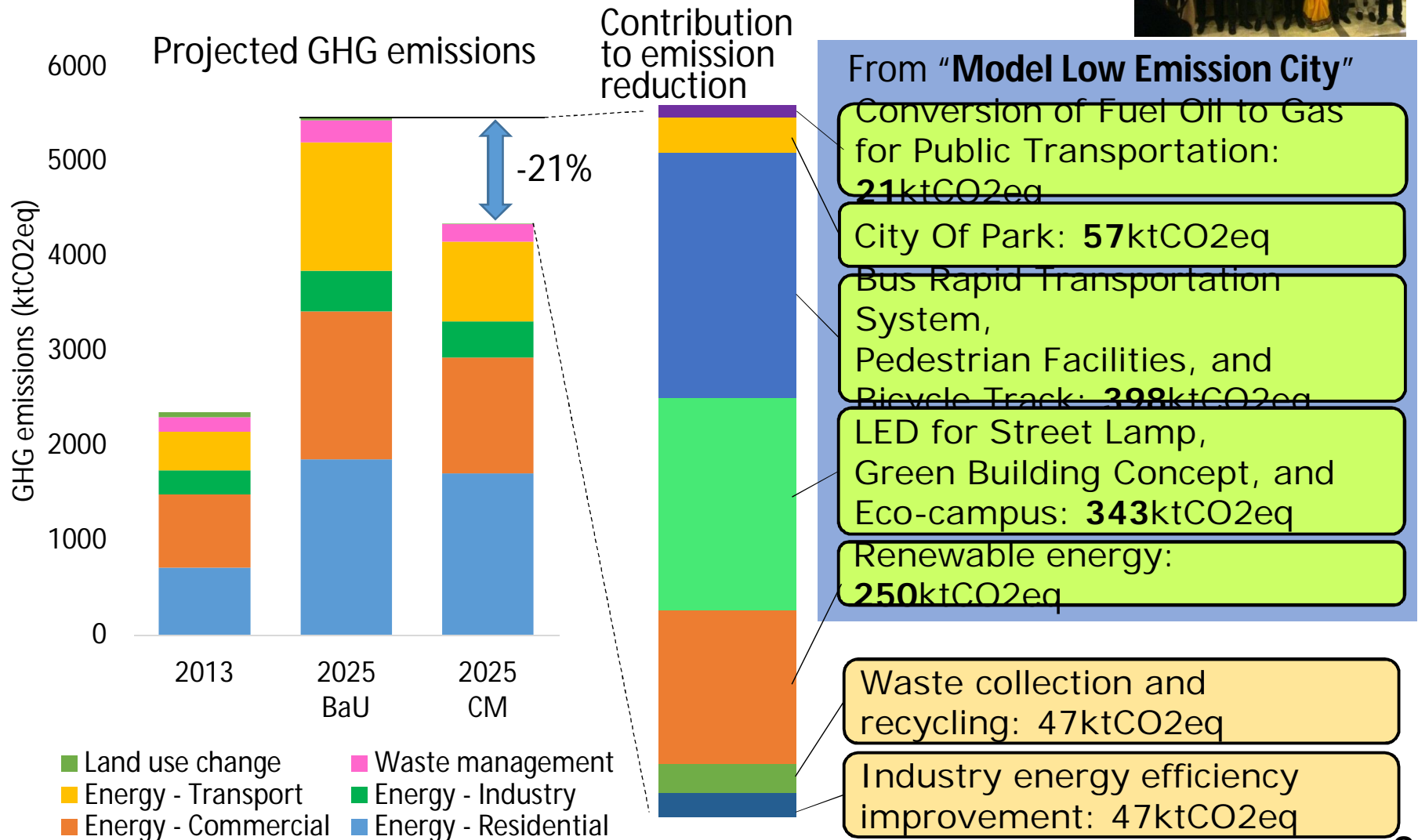


Phase3 : Suggest Environ impact in traffic congestion
With environment sensor



Preliminary Scenario Simulation in Indonesian City for 2025 by Dr.K.Gomi

New scenarios were developed according to "Model Low Emission City" initiatives of Bogor City by IPB and NIES in this August. Emission reduction by the initiatives is projected with some assumptions.



Localized Data and Scenario Modeling

- Conventionally, local scenarios are developed with limited statistical data and “default” parameters from national or international information.
- Our approach combines monitoring of local activity and modeling so that we can propose the most suitable mitigation scenario and Action plans for the city/region.

Statistical information

Current environmental initiative

Transport Monitoring

- Transport structure
- Vehicle speed
- Fuel efficiency etc.

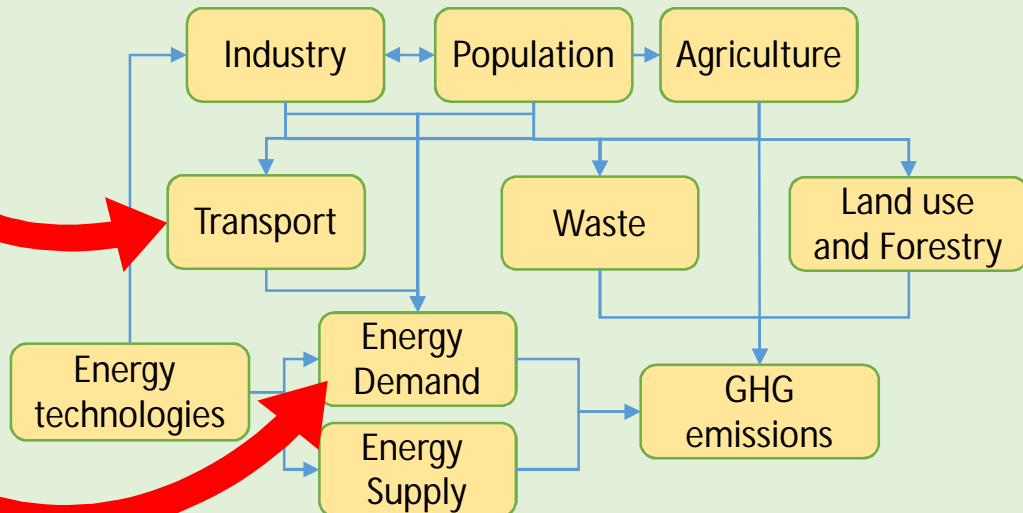


Energy Monitoring

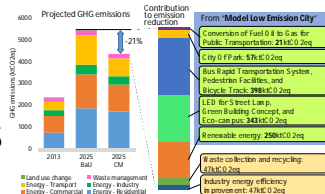
- Current and future energy consumption pattern
- Energy saving potential



The model to project future scenarios: ExSS/AFOLUA



Locally suitable mitigation scenarios



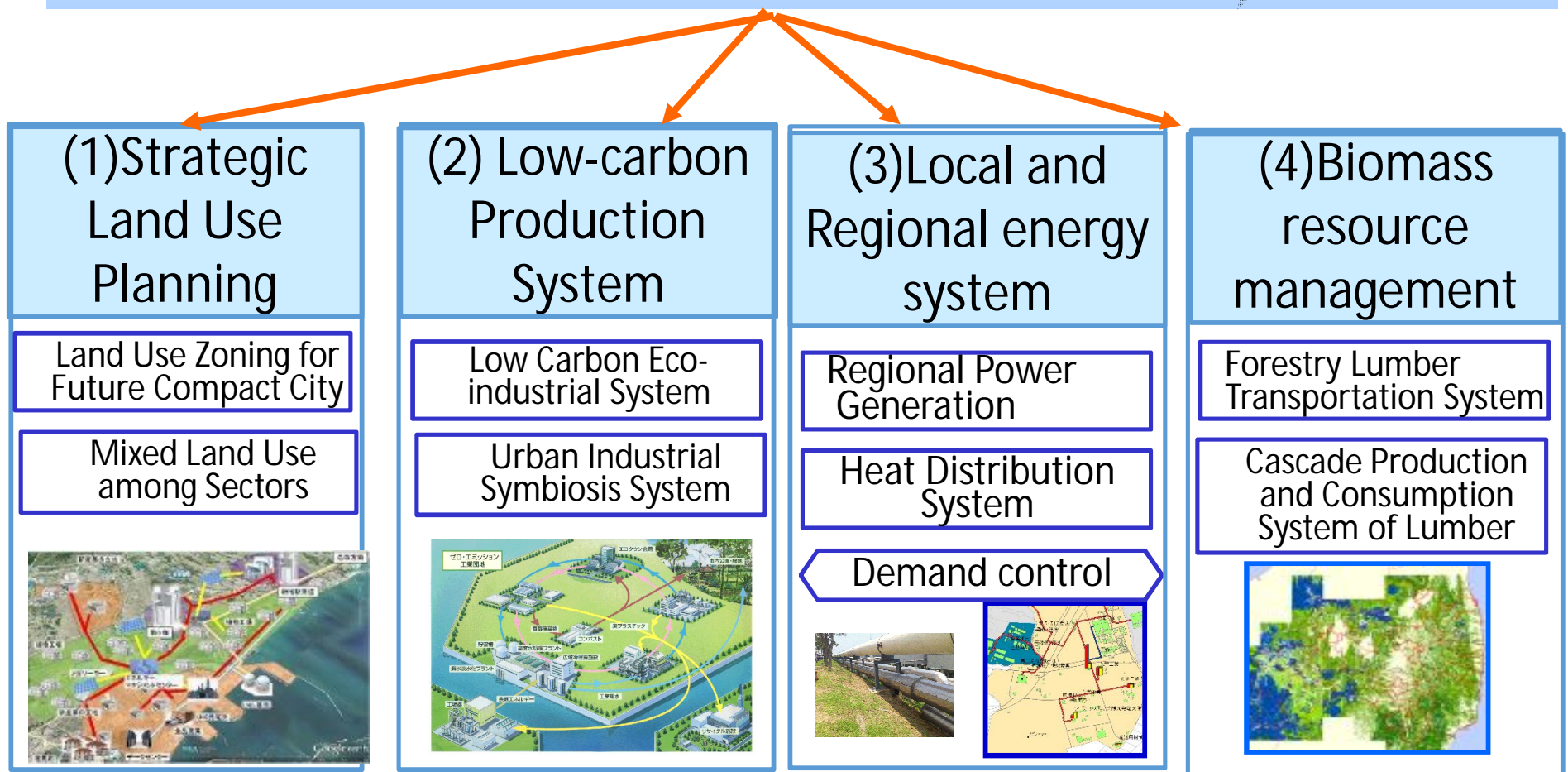
Mitigation potential in 2030

Actions to introduce the measures in 2030

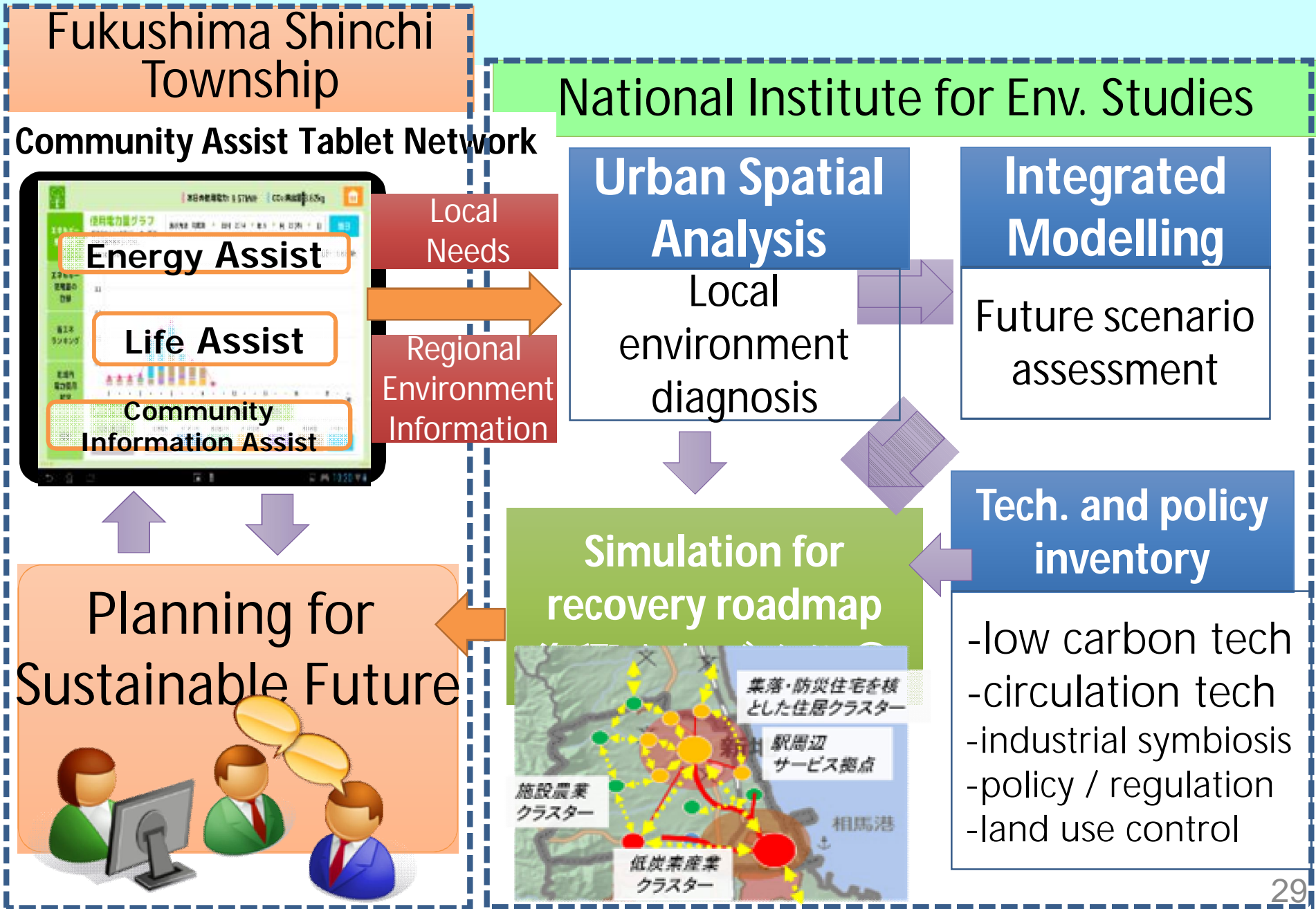
Roadmap and investment towards 2030

Research Targets(1) Strategic future technology assessment system for local technology combining low carbon and environmental technology

Integrated Evaluation Model for Technology Alternatives for the Future Target of the City and Region



Research Target 2; Interactive Eco-policy Planning



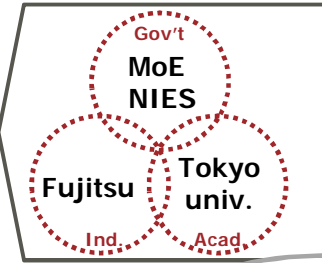
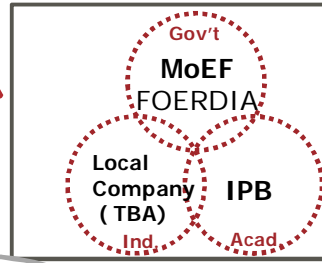
Research proposal for Innovative Eco-Society

Establish Indonesian Eco-Society through Monitoring, Simulation and Innovation

Collaboration of Binational Government-academia-industry for Low Carbon Indonesia and Japan Consortium

Contribution to Indonesia

- Realization of **low carbon society**
- **Urban design** based on solid science and tech
- **Maximize forest value** by cross-sectoral research and activity
- **Effective introduction of Japanese know-how** and effect measurement
- **Improvement of env. research** through collaboration



Contribution to Japan

- **Strengthening of collaboration** of binational government-academia-industry
- **Activation of Low Carbon program** and promotion for reaching CO₂-reduction goal
- Promotion of **Eco-technology transfer**
- Spread Japanese low carbon technologies and products

Scope 1

Scope 2

Environment Monitoring

Living and Natural Environment

- Forestry Monitoring
- Seasonal Fire Early Warning
 - Remote and On-site Monitoring
- Air Pollution Monitoring
- Monitoring and Diffusion Simulation
- Adaptation Forecasting
- Water Quality Monitoring and Hydrological simulation

International Eco-innovation Center

- Functions of center
- 1) Environment Monitoring
 - 2) Social Monitoring
 - 3) Innovative Solution



Social Monitoring

Urban System

- Energy Monitoring
- Monitoring and Management System by ICT
- Transportation Monitoring
- GIS and Sensing Technology
- Solid Waste Monitoring
- Emission Pattern analysis and Simulation

Scope 3

Innovative technologies and Policies

Energy

- Innovative monitoring
- High efficiency equipment

Transport

- HV/PHV/EV
- Optimization

Urban Planning

- Design
- Strategic planning

Forest

- Remote sensing
- Forest land use planning

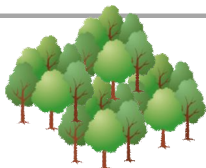
Solid Waste

- Waste to Energy
- Reduction at source

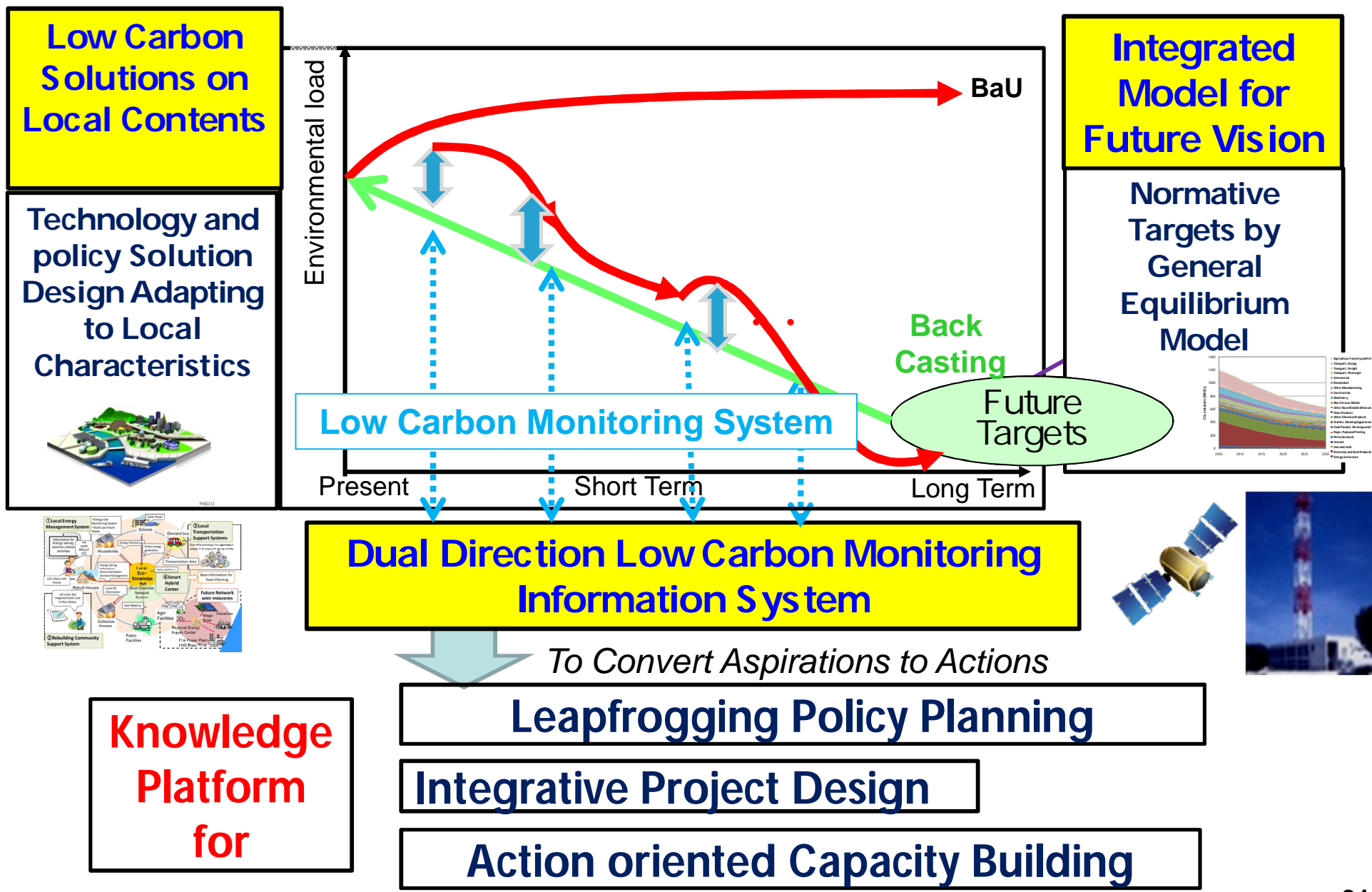
Ecological Solution

Interactive Solution

Urban Solution



Innovative Modelling and Monitoring Research Project



Thank you for your Attention

List of related publications

- 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 Huisingh (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
- Yujiro Hirano, Tsuyoshi Fujita (2015) Simulating the CO2 reduction caused by decreasing the air conditioning load in an urban area. *Energy and Buildings*, Available online 23 June 2015, doi:10.1016/j.enbuild.2015.06.033
- 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
- 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
- Momoe Kanada, Tsuyoshi Fujita, Minoru Fujii, Satoshi Ohnishi (2013) The long-term impacts of air pollution control policy: Historical links between municipal actions and industrial energy efficiency in Kawasaki City Japan. *Journal of Cleaner Production*, 58, 92-101
- Yujiro Hirano, Tsuyoshi Fujita (2012) Evaluation of the impact of the urban heat island on residential and commercial energy consumption in Tokyo. *Energy*, 37(1), 371-383