; Plenary Session: How We Could Promote Evidence-Based Policymaking by Bridging the Gap between Policymakers and Research Communities?

7th LOCARNET Conference November 22th, 2018

SDGs and National Policies in Japan
- Scientific models and Tools for SDGs Cities -

Prof. Tsuyoshi Fujita

Director of Center for Social Environmental Systems Research

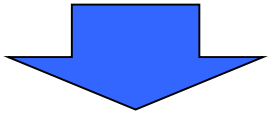
National Institute for Environmental Studies

Appointed Professor of Tokyo Institute for Tech.

Strategy of low-carbon society in Japan since 2008

Mid-to long-term goal for Japan (80% reduction by 2050)

- Draft proposal by Minister of Environment in March 2010: “a cut of 25% in 2020, 80% in 2050”



- Development of innovative technology and wide adoption of existing leading technology
  (Technology development and popularization of renewable energy and energy saving)
- Actions to move the whole country toward decarbonization
  (emissions trading, tax reform, transparency)

- The power of regions: Eco-model cities since 2008
  (United efforts to decarbonize by cities and communities)

Eco-cities, Smart Cities and SDGs Future Cities

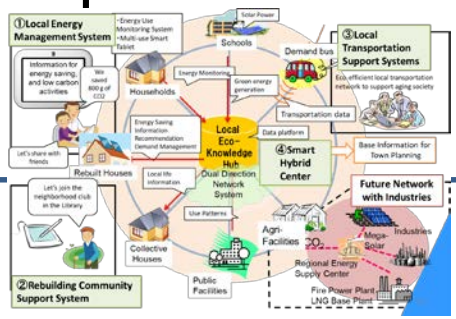
● Eco-Model Cities since 2008; 23cities

Low-carbon Unification Initiatives for Cities/Regions

- Promotion Council for the Low-Carbon Cities
- Best Practices for Planning Low-Carbon Cities

● Future Cities since 2011; 11 cities

The creation of successful examples to be spread throughout Japan and internationally



● Smart Comm-unity Projects since 2011

●SDGs Future Cities since 2018; 30

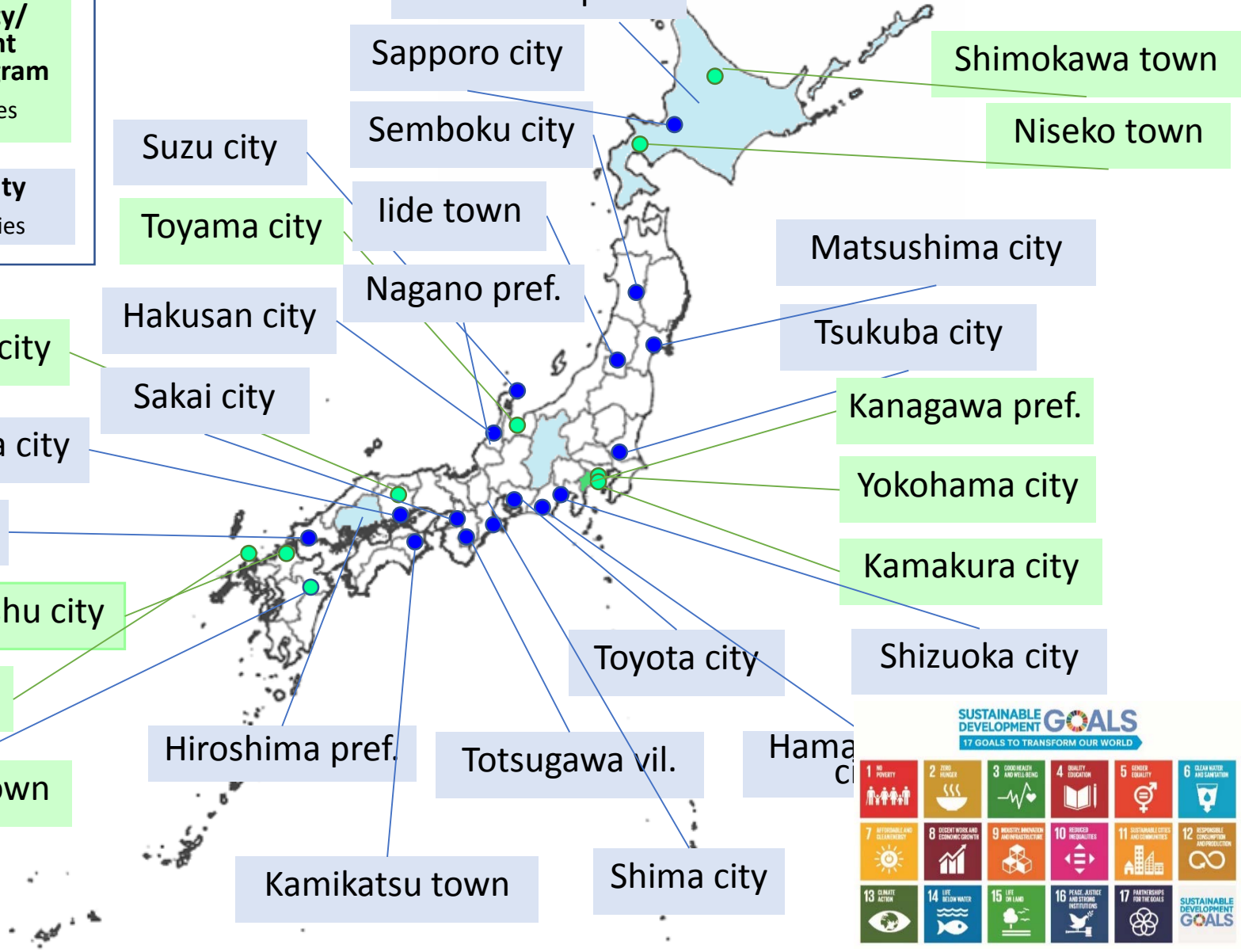
Autonomous SDGs planning and driving Projects, designated on JUNE 14th, 2018

SDGs Future City Initiatives

Announced on June 15, 2018

SDGs Future City/ Local government SDGs mode program
10 municipalities

SDGs Future City
19 municipalities



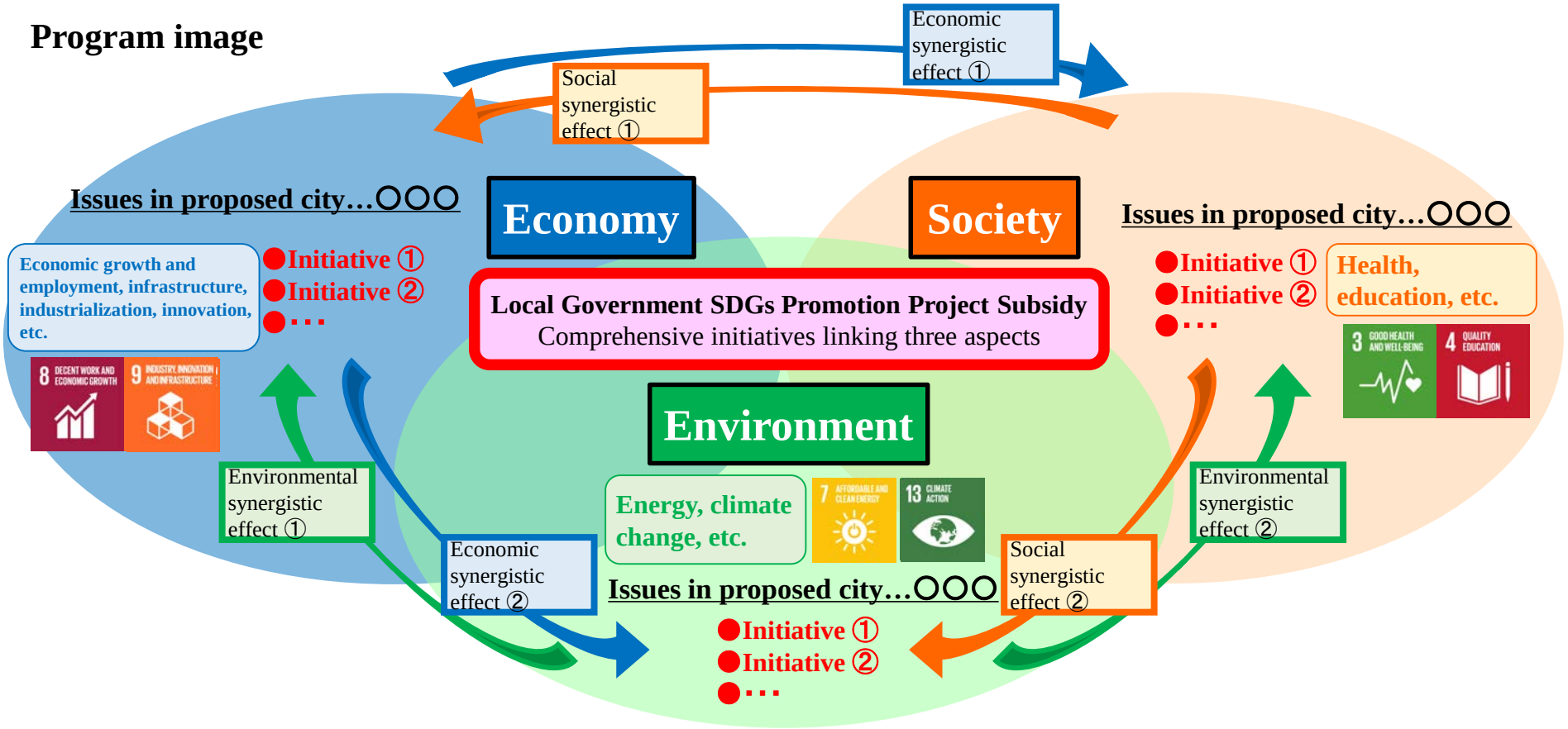
This map is made based on the blank map of Geospatial Information Authority of Japan〔http://www.gsi.go.jp/〕

Local Government SDGs Model Programs

Model Programs

Through comprehensive initiatives that follow the SDGs principles, these pioneering initiatives with strong potential will achieve sustainable development by creating new value in the three aspects of economy, society, and environment, and aim to implement programs expected to produce self-directed virtuous cycles in the region through cooperation with diverse stakeholders.

Program image

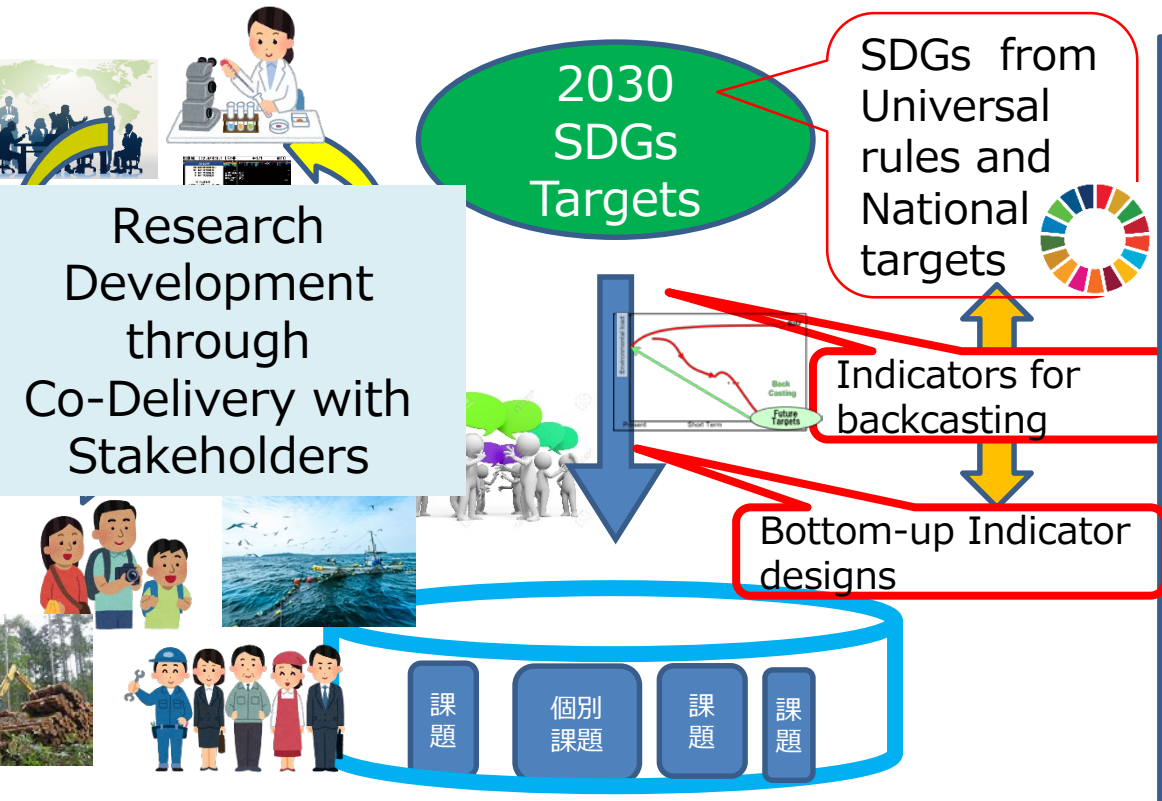


SDGs goal will be chosen according to the issues in the proposed cities

Action Research for SDGs Co-Planning

- Subjective progress evaluation theories and methodologies rather than comparative estimation
- Coordination of Bottom-up Planning and Scientific objectivity

  bottom up goals and indicator setting based on scientific analysis



SDGs and Targets Design

Global and National SDGs Targets

Top-down or Normative SDGs Targets

Logical Integrity and Quantitative Co-relation

SDGs of Localities and Enterprise

Bottom-up or Explorative SDGs targets

Research Perspectives for Evidence-Based Policymaking by Bridging the Gap between Stakeholders and Research Communities

1. *Solution design* and development of green cities and regions by *back-casting from the future*.

2. *Social* monitoring and modelling challenges for sustainable cities

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 Rebuilding Parameter

- 【Population】Policies for aging
- 【Industries】Policies for low carbon
- 【Bio-Sys】Natural habitat restoration
- 【Land Use】Compact city Policies

Regional Parame-ters

Analysis for Fukushima Pref. Scale

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

Spatial Planning Model

Eco Growth Modules

- Local Heat/Energy Management
- Low Carbon Industrial System
- Strategic Spatial Zoning System
- Forestry Eco System Service Model

Spatial Policy/ Tech. Process Packages

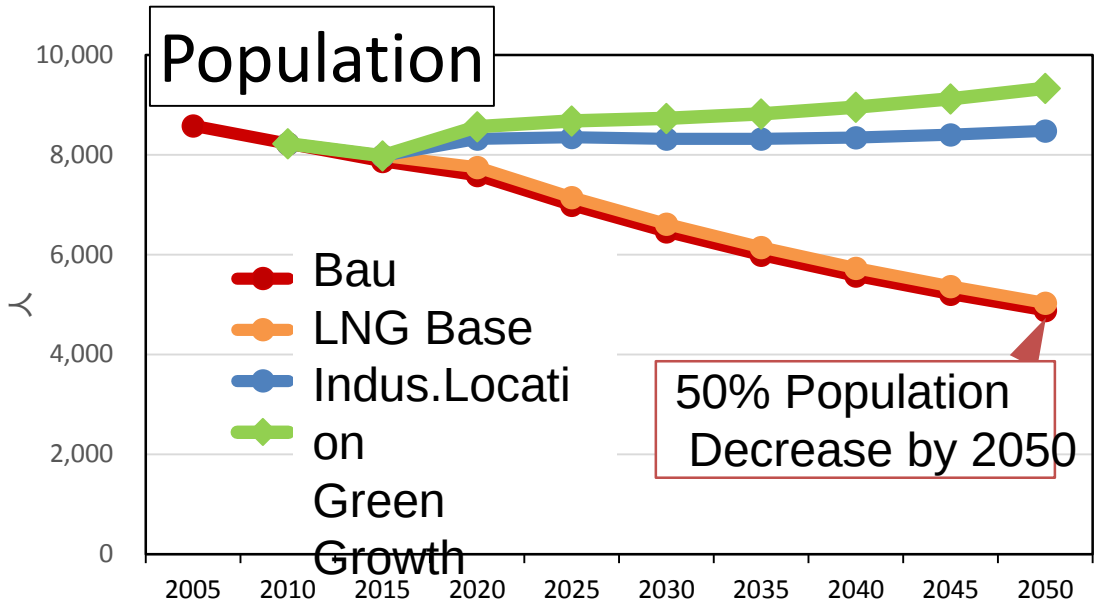
Planning for Local Scale

Snap Shot Models, Policy Support Tools → Local Targets

Local Startistics and Project Data

- Buildings
- Industries
- Agriculture/ Forestory
- Life Style

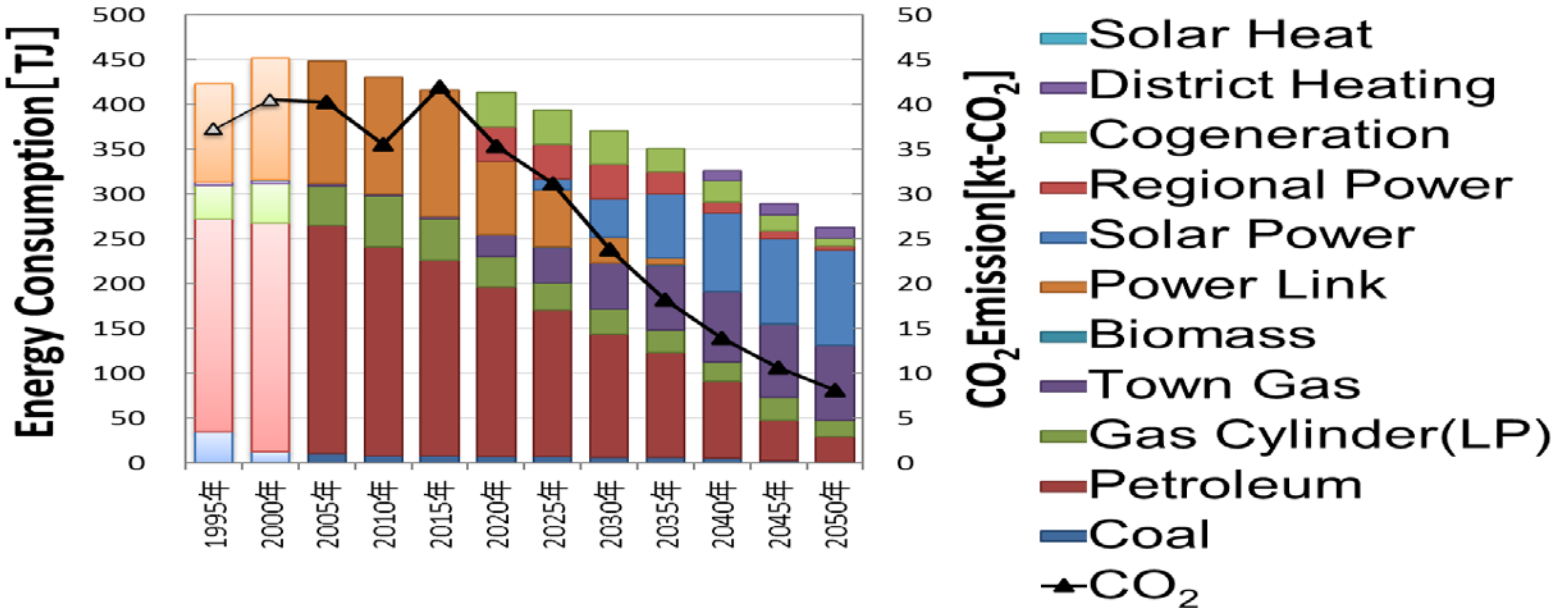
Macro-scope Simulation for the Future Scenario of Population and Prodiction



Population recovery by green growth

Population keeping with industrial locations

Limited population effects by LNG base

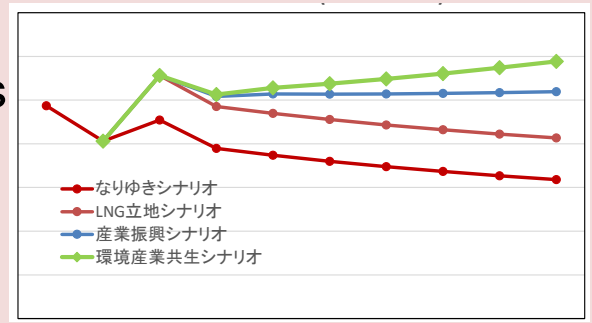


Multi Stage Approach for Eco-City and EIP Planning

①Macro-scope

Alternative future vision

- population, industries
- core developments
- energy locality



Future frame

②Spatial-scope

Land use zoning /network design

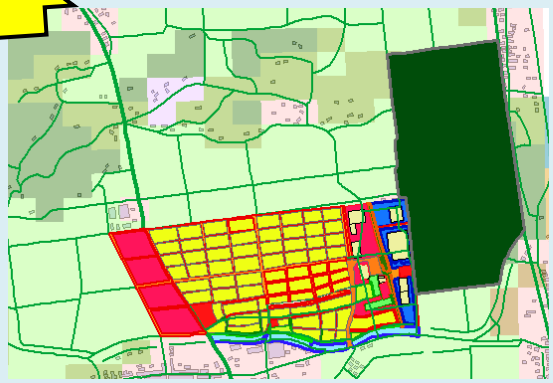
- land use distribution patterns
- local energy network
- location of core developments

Feasibility Study

③Project Design

Core projects for revitalization

- zoning and regulation
- district planning
- key industries



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Snap Shot Models, Policy Support Tools → Local Targets

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- Life Style

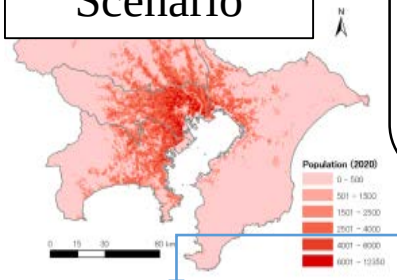
Integrative Eco-city Simulation Model for Municipal Governments

- *Location theory*
- *Regional science (Weber, Alonso, etc.)*

Regional Future Scenario (Local GDP, Population Land area)

- *Multi-Variable Integration Theory*

Land Use Scenario



Spatial Distribution (Residential)

Spatial Distribution (Industrial)

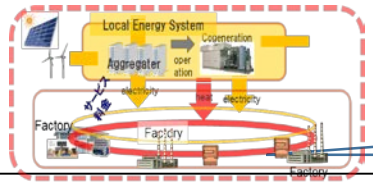
Industrial Location Scenario

Future Spatial Scenario

Built Environment Transition

Local Energy Management System

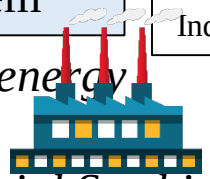
- *CEMS*
- *ADR*



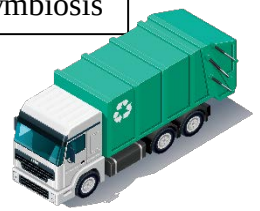
Transportation Management System

Industrial Energy Management System

- *Local energy*
- *FEMS*
- *Industrial Symbiosis*



Waste Management System
Recycle and Industrial symbiosis



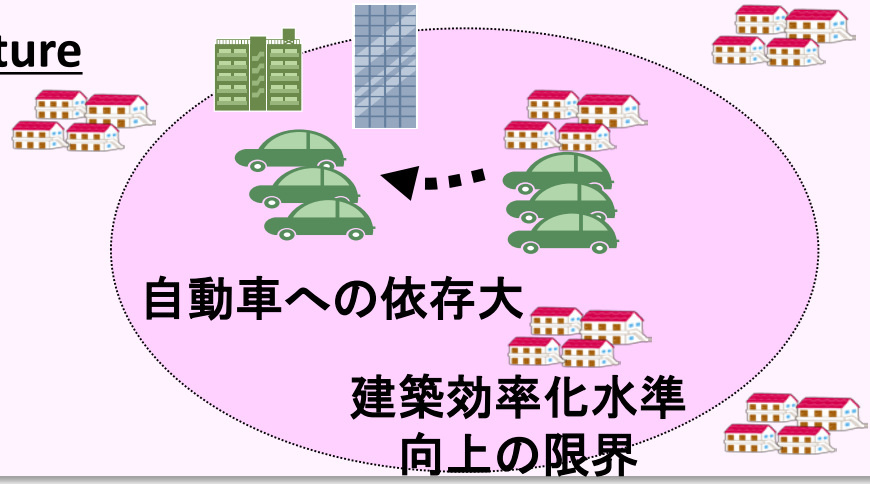
- Eco Finance / Behavior Science

Scenario Design for Strategic Land Use Planning

- 地域交通技術については、都市の集約化を考慮し、カーシェアリング、シェアライド等の地域交通システム導入により低炭素化を促進する。
- 建物環境改善技術については、既築建物の改修（断熱改修等）、建物の新築および街区更新を契機とした技術の導入により、建物内エネルギー消費量を削減する。

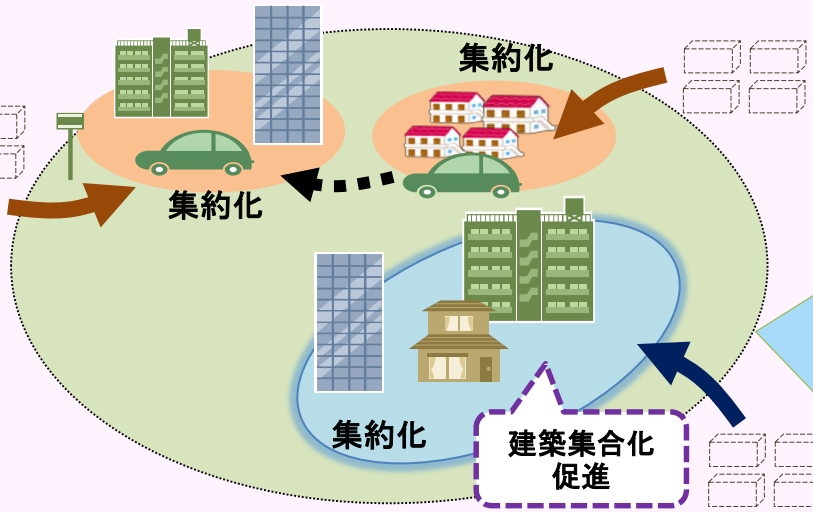
Present（2015）

BAU Future

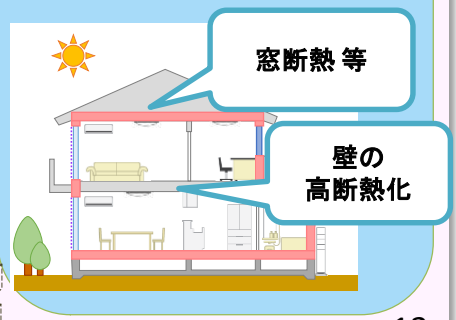


Low Carbon Scenario
技術導入シナリオ
土地利用シナリオ

地域交通技術が普及する地域
・カーシェアリング等の地域交通技術導入によるマイカー依存から脱却

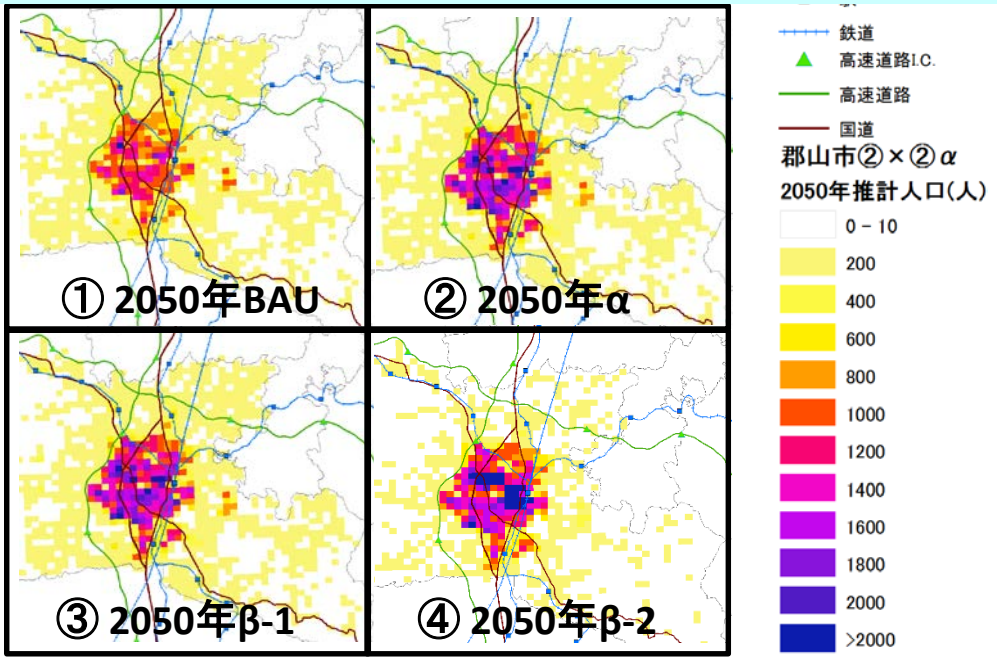


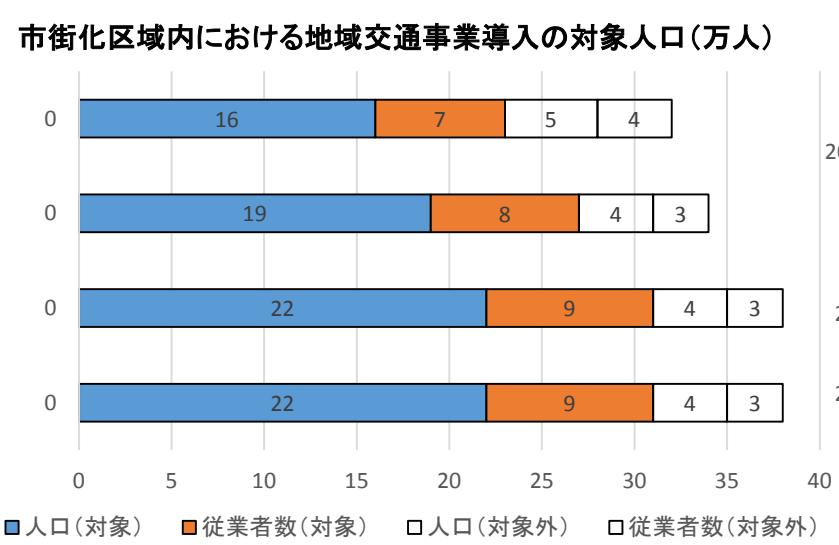
建物環境改善技術の導入が進む地域
例：住宅の対策イメージ

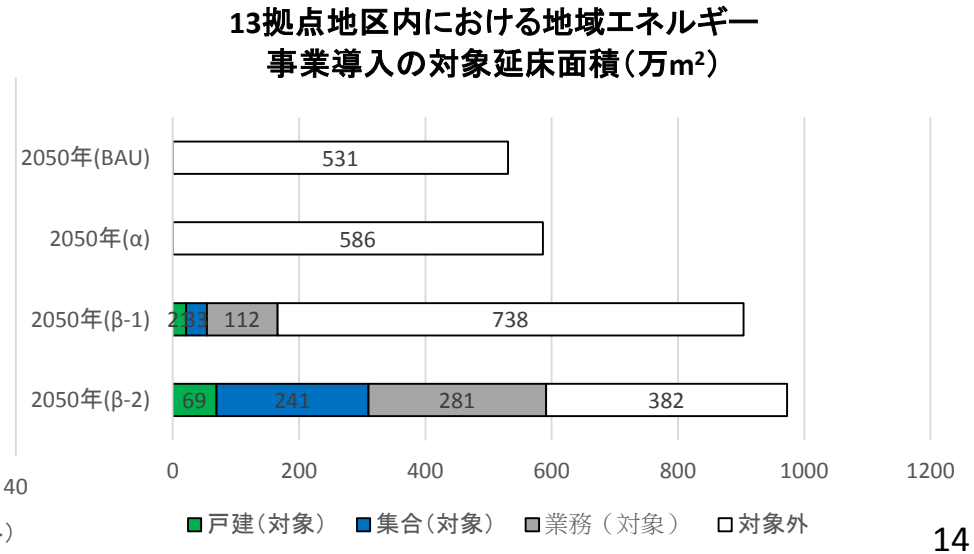


Land Use and Transportation Management Model

- 2010年から2050年を対象に集約化計算を4シナリオを実施。
- 計算の結果、シナリオ β-1 の拠点数は13箇所、シナリオ β-2の拠点数は3箇所と選定。
- 地域交通事業は、αからβ-2にかけて要件を達成するメッシュが増加するとともに対象となる人口・従業者も増加する。
- 地域エネルギー事業は、β-2が事業導入の対象床面積が最も大きい。







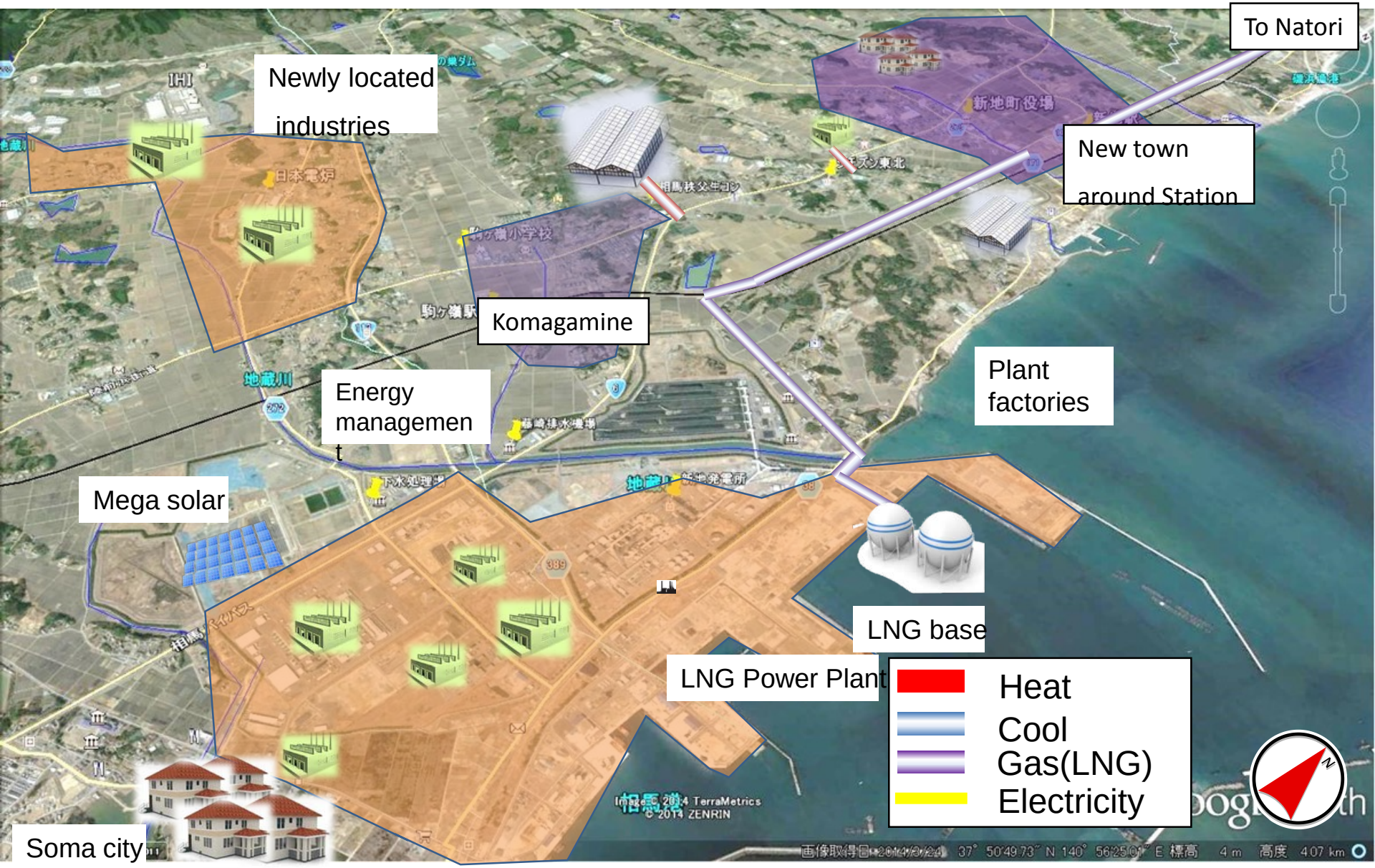
1. Outline of Shinchi Town and Damage by the Earthquake

Shinchi Town, Soma-Futaba Region, Fukushima Prefecture

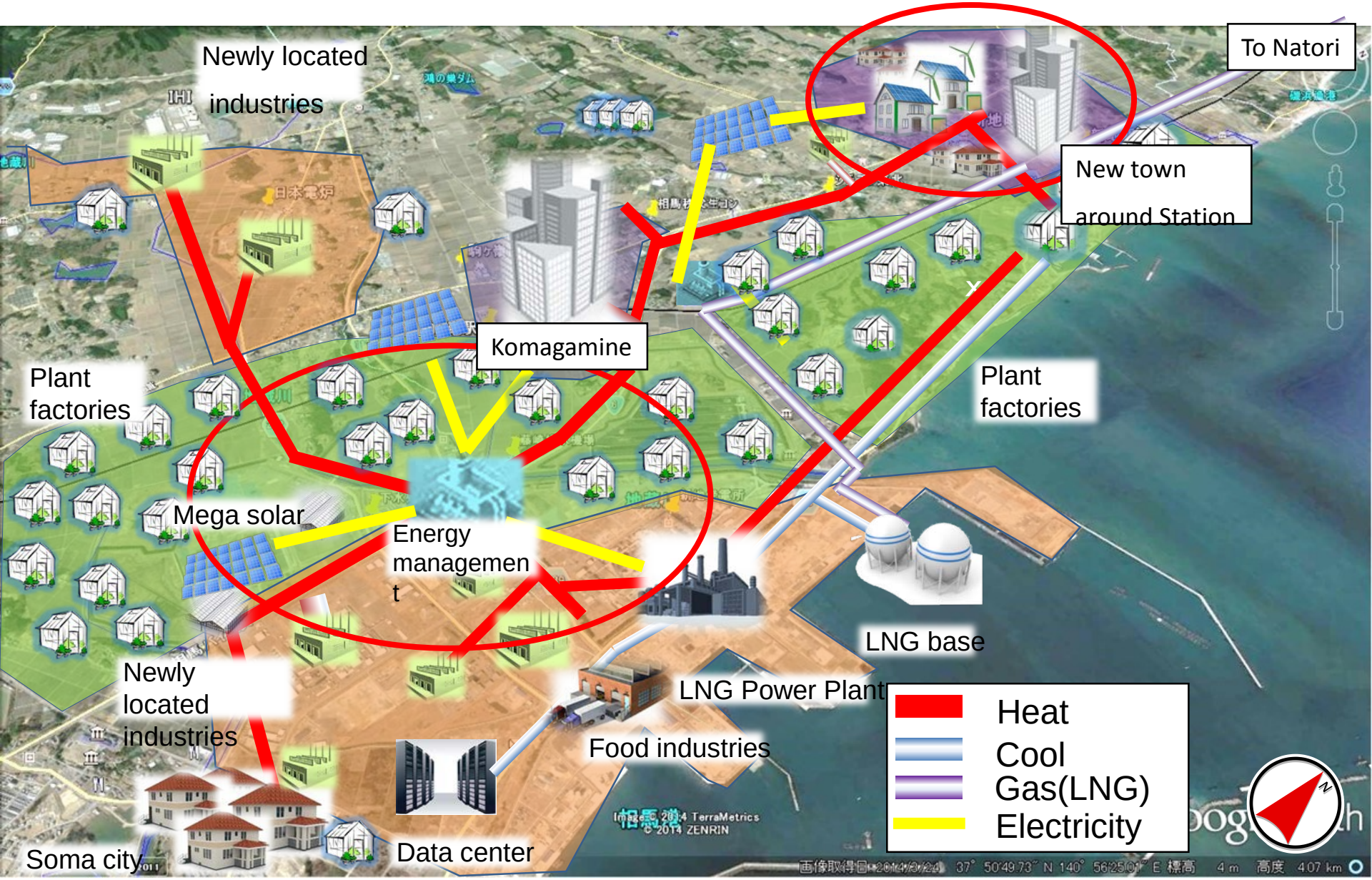
Population: 8,247 / Households: 2,754 / Area: 46.35 km²

(As of Jan. 1st, 2017)

BaU scenario in Shinchi town in 2030



Integrative Energy System in Fukushima Shinchi town in 2030



Estimation of Alternative Future Spatial Scenarios

Alternative Spatial Scenario

BAU

+Compact City

+Green Growth

Effects of Local Energy Management

Quantification of Impacts and Costs

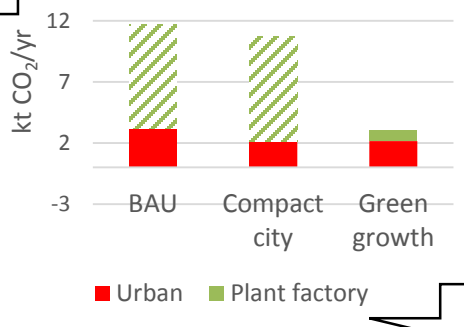
Inventory survey
- Heat supply
- Heat demand

Symbiosis design:
- Heating system design
- Land use design

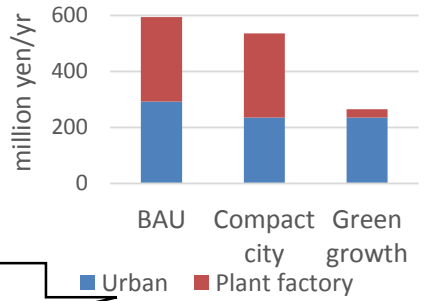
System simulation:
- Networking
- Heat loss
- Pressure loss

Assessment:
- Economic cost-benefits
- Environmental impacts

CO_2 emission comparison:



Fuel cost comparison:



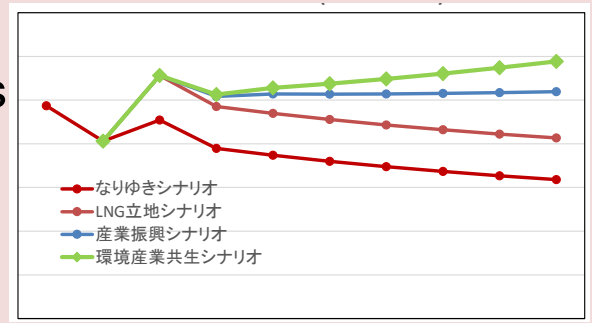
Green growth can bring significant co-benefit of CO2 emission reduction and fuel saving.

Multi Stage Approach for Eco-City and EIP Planning

①Macro-scope

Alternative future vision

- population, industries
- core developments
- energy locality



Future frame

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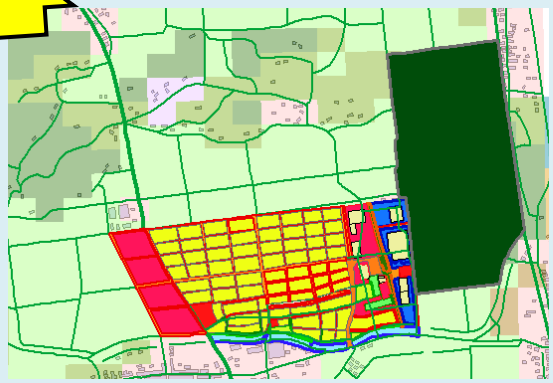


Town planning around Shinchi Station and energy system

Town planning and Local Energy Center (Operation from 2019)

Branch of the Natural Gas line from Soma LNG base to Sendai City. The gas will be used for combined heat, power and CO2 supply to facilities by cogeneration

Local Energy Based Urban Rebuilding Project in Fukushima

Sustainable rebuilding projects through collaborative planning among town planning, industrial development and local energy system

施設農業

Multi sectoral energy management /housing/commertial/agriculture

Strategic land use transition targets

都市

Energy Center

- Smart thermal and electricity management

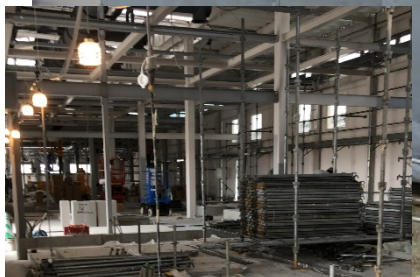
LNG

LNG Plant

熱

電気

Efficient local energy management for a local scale system




Shinchi Energy Center Oct. 2018

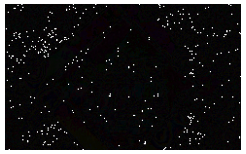
Green Innovation System from Local Energy Center

①Visible Local Energy Center
➡Smart Local Information Center

地域エネループラント、計測装置の見える化による実践教育機会としての活用・エネルギー消費モニター・壁面太陽光パネル、緑化

②Local Infrastructure Innovation ; Pipe, Wire, Fiver

・舗装（ルートライン、サインプレート、ハンドホール、など）

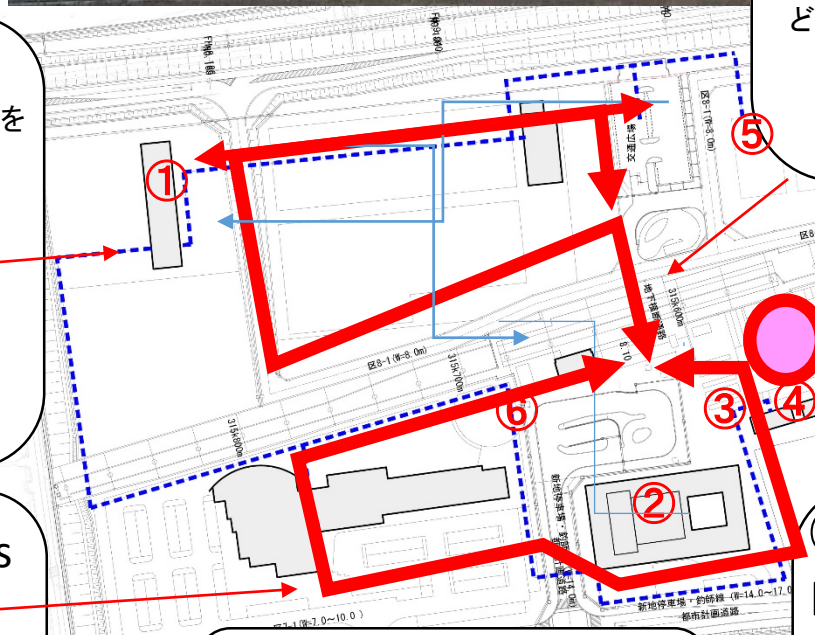


○Signs for Bldgs

・エネルギー供給・消費量や状況を視覚的に分かりやすく説明

○Signs for Networks

・地中の熱導管を見せる



Communication Center

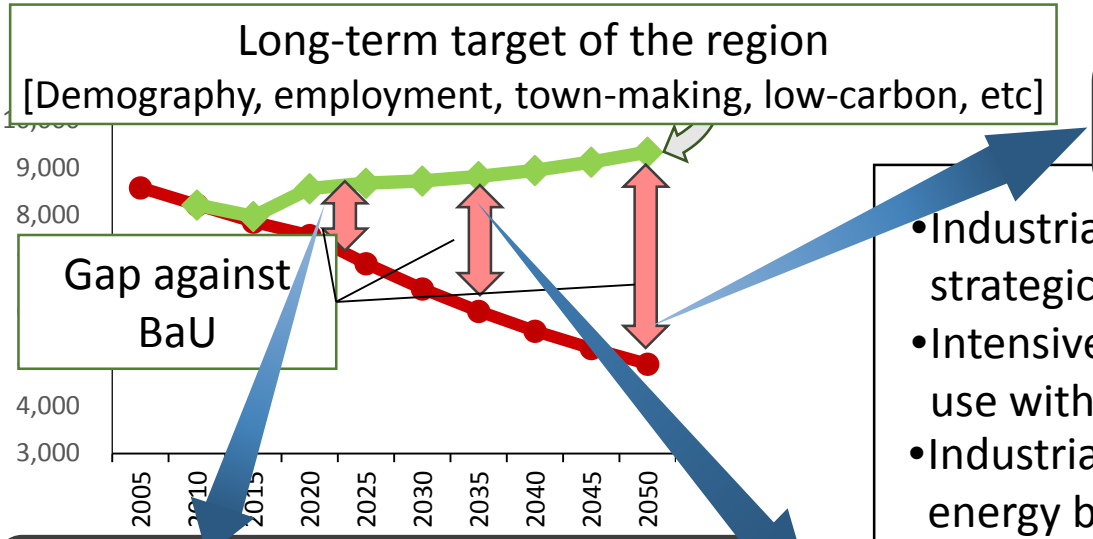
・ガラスの機械室　・サイネージ設備
（イベント情報、まちのPRなども掲載）

熱導管・自営線ルート

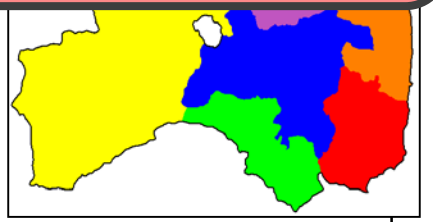
③Eco-City Innovation Research（NIES and Universities

・エネルギーまちづくりの社会イノベーション研究拠点の運営
・模型、パネル・写真展示、環境教育設備等の設置
・サイネージ設備
（商業施設テナント情報なども掲載

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.

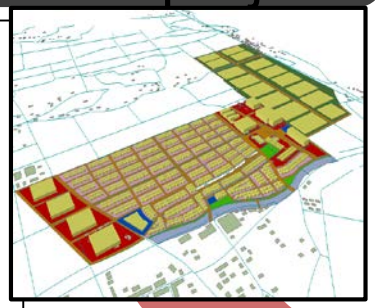


Long-term : Urban-Industry-Agriculture Complex



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

Short term : Pioneering point development project

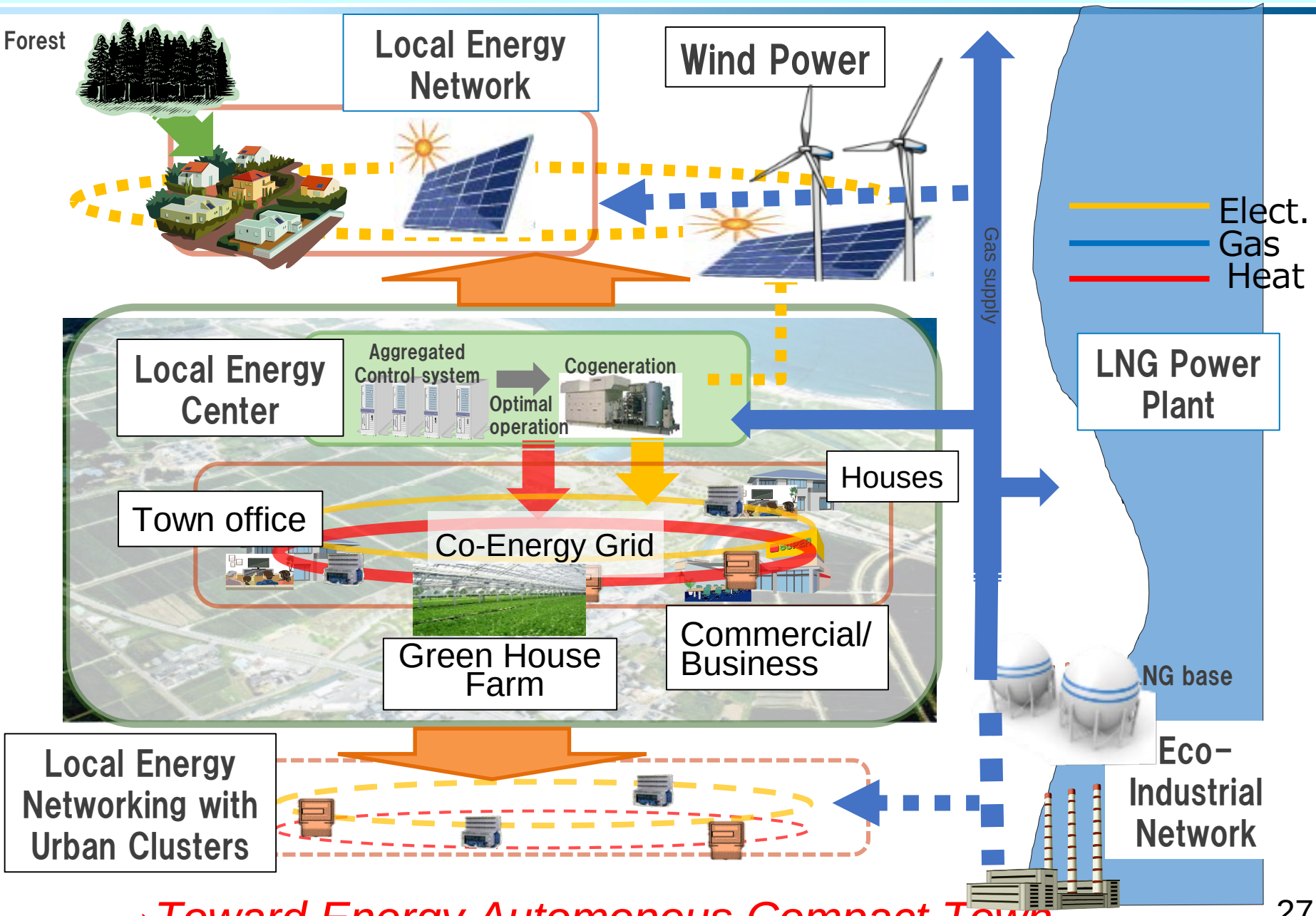


- Town-planning with local energy
- A show-case of low-carbon system
- Economic impact in several years

Short term : Cluster development

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

Future Target 3; Regional Energy Renovation



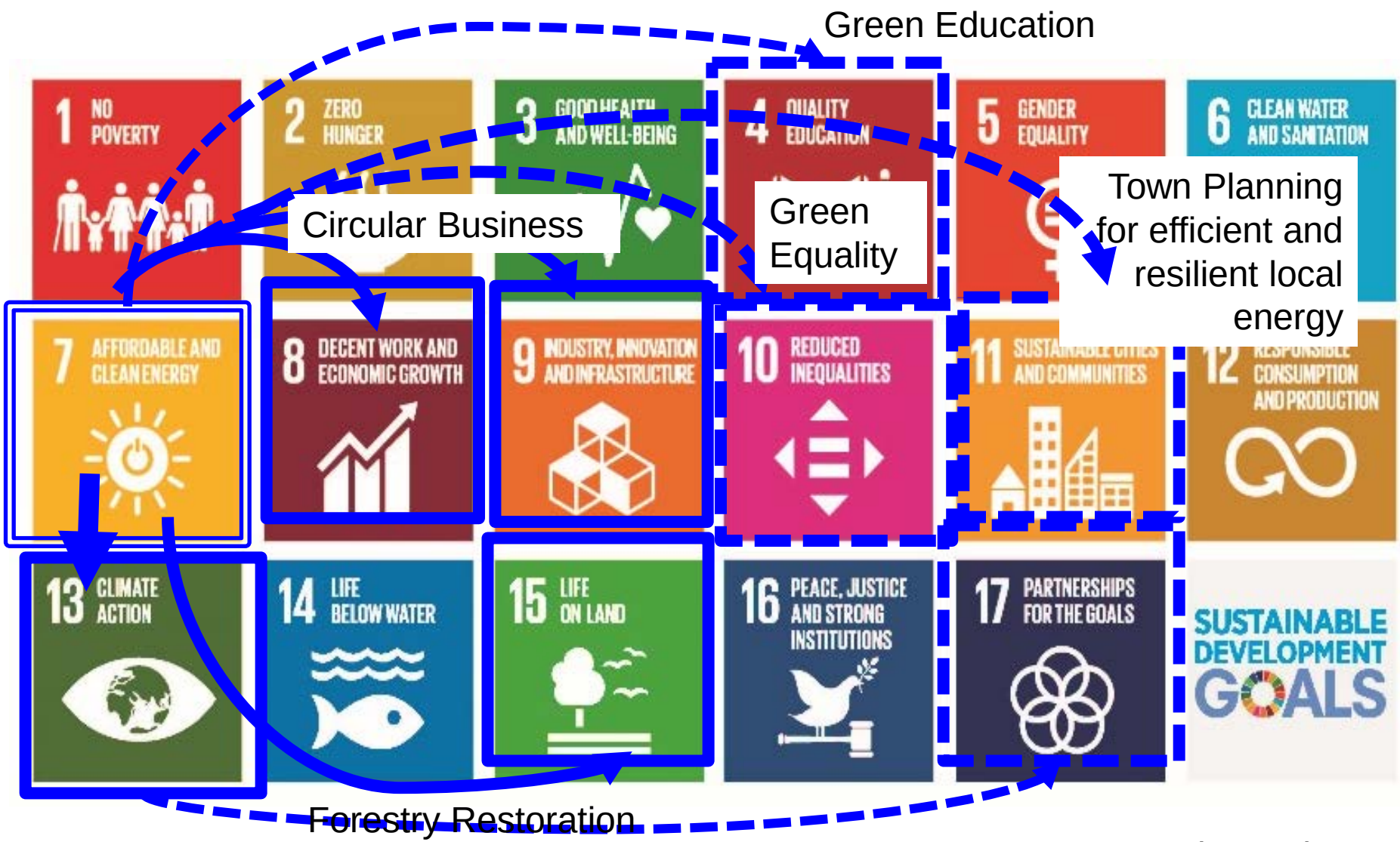
→*Toward Energy Automonous Compact Town*

Energy scenario settings (proposed)

Based on difference of direction in future societal and technological changes, the urban energy model can project various scenarios as following examples. Detailed value of the input parameters should be decided accordingly.

Scenarios	Description	Population	Energy use per capita	Energy use per worker	Device Efficiency	Renewable Energy	CEMS
BaU_fix	Technology and behavior is fixed at present	+	Current	Current	Current	Current	None
BaU_future	Likely future changes without strong policy intervention	+	Increase	Slight Increase	++	Current	None
LCS_tech	Low-carbon devices are introduced No change in use level	+	Current	Current	++	+ Supply under current grid	None
LCS_Social Policies	Strong spatial policy and community energy management	+	Decrease by HEMS	Decrease by BEMS	Current	++ Increase for local supply and use	++
LCS_integrateed	Both low-carbon techs and strong planning for CEMS	Compact distribution	Decrease by HEMS	Decrease by BEMS	++	++	++

Evidence Based Policy Design for Integrative SDGs Policies from Local Energy Projects



German Style Stadt Verg

NIES Solution-Oriented Research Programs and SDGs

Pilot Project

Future Extension

Education

Economy

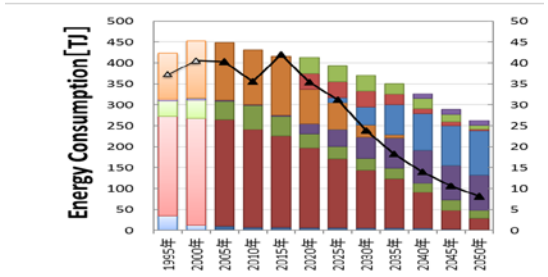
Energy

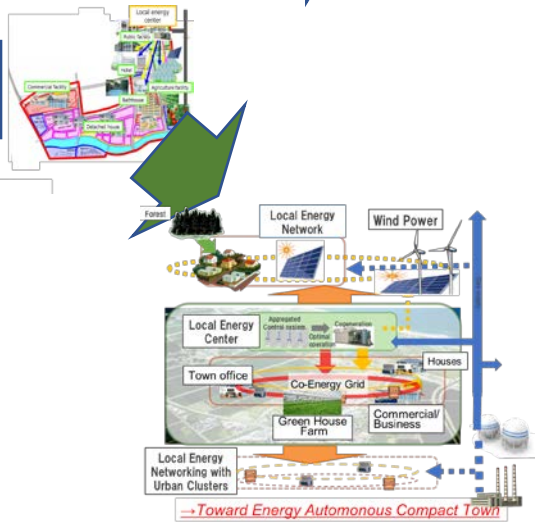
Equity

Cities

Climate

Partnership





Trade off(-)

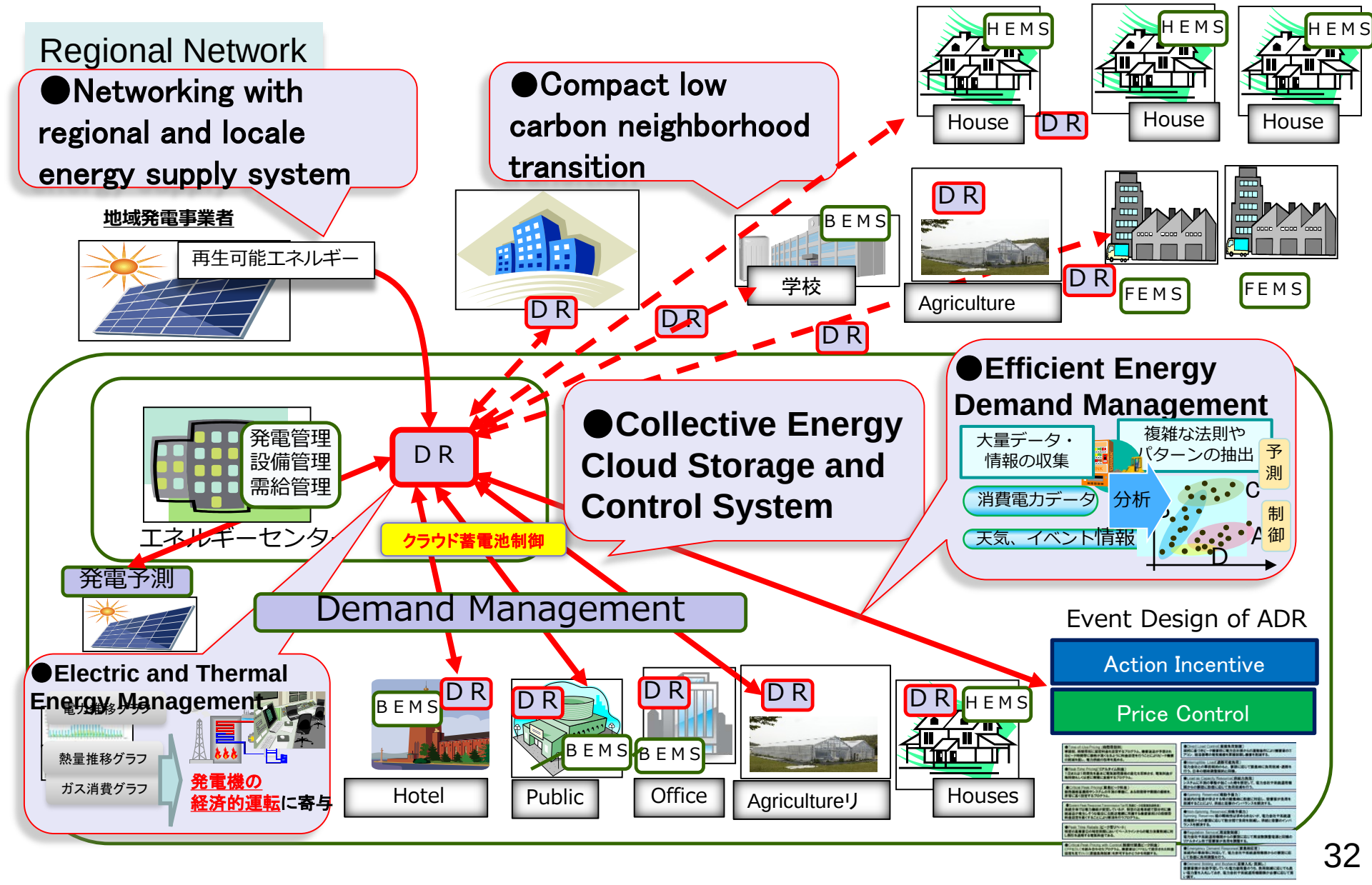
Synergy(+)

Research Strategies for Evidence-Based Policymaking by Bridging the Gap between Stakeholders and Research Communities

1. *Solution design* and development of green cities and regions by *back-casting from the future*.

2. *Social* monitoring and modelling challenges for sustainable cities

Toward Smart Urban and Industrial Energy Management (Smart Electric and Thermal Demand Management System)



Action framework of urban monitoring system in Asia

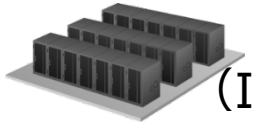
- Advanced internet security technologies effectively manage and protect the data
- Excellent recovery data collection capability
- Relationship analysis between human behavior and energy use

Robust Data Traffic under Uncertain Condition

Integrative Analysis of Multi- Sectoral Data

2 Collecting Electricity Data

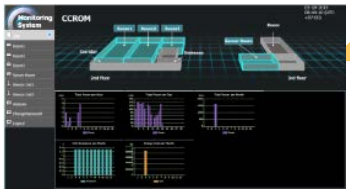
3 Analysis of collected data



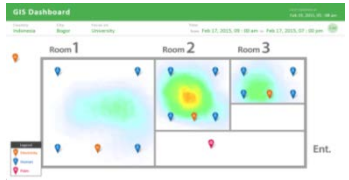
Data Center (Indonesia/ Japan)

1 Monitoring Electricity Data

Visualization



Data access・ Analysis



Sensor for human activity

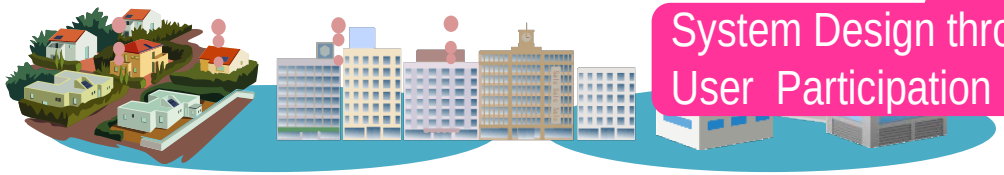
Energy Meters

4 Promoting Low Carbon Activities/Behavior

Lightings AC

Production Line

System Design through User Participation



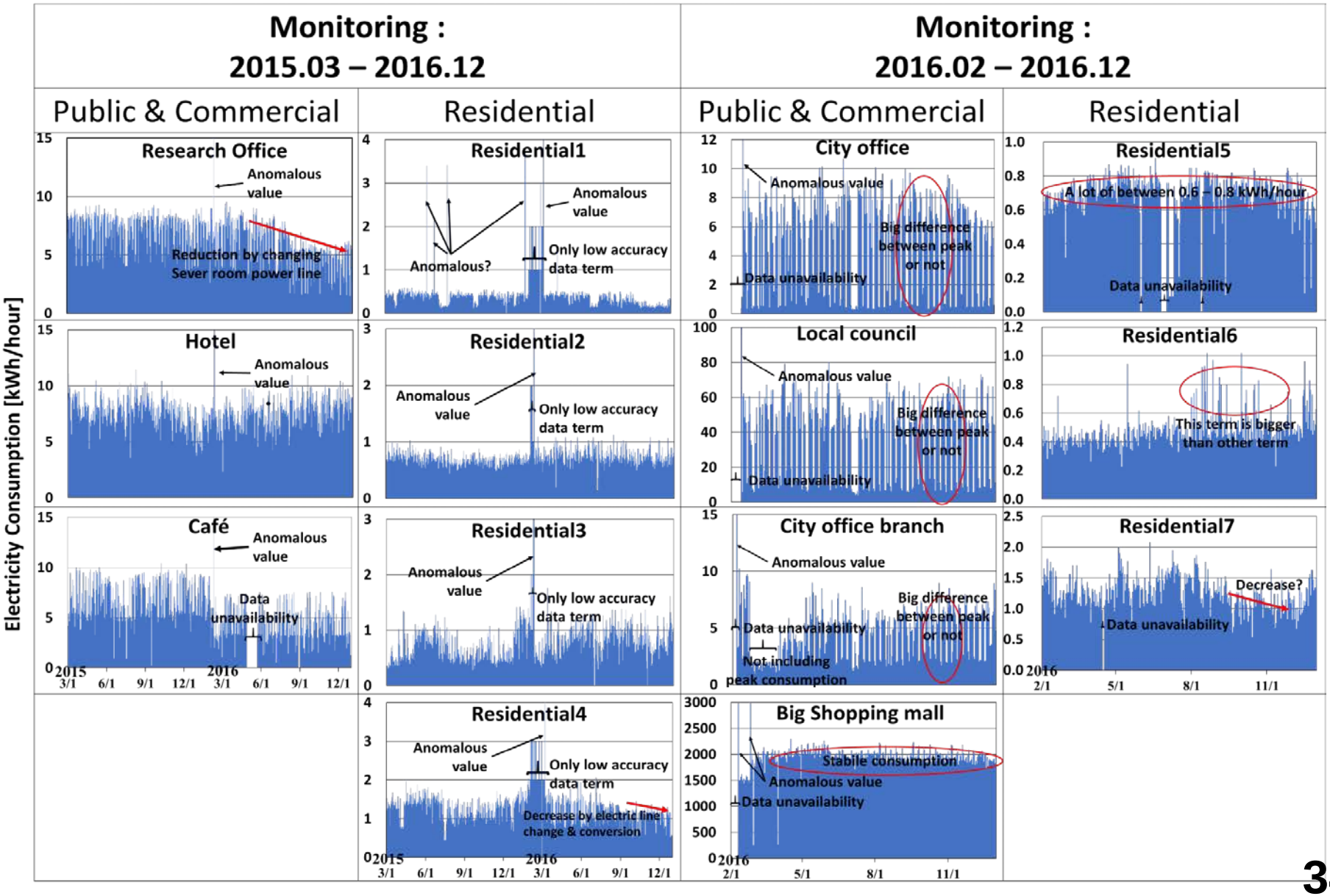
Residential Commercial Industrial

Green Room (Management center)

Tablets

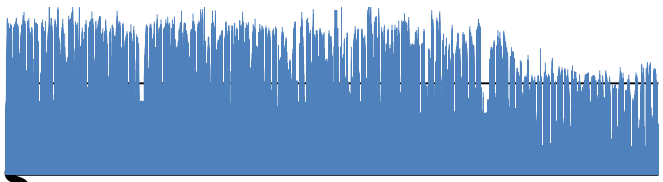
Monitoring results in Bogor

Electricity consumption

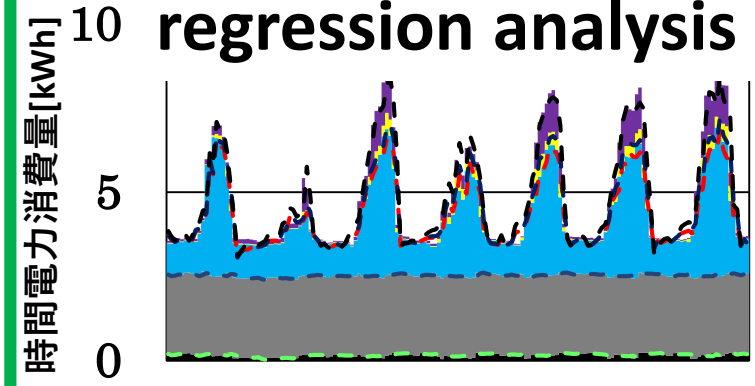


Future Target 2; Data Analysis Aggregation for Urban Energy Transition

Monitoring Data



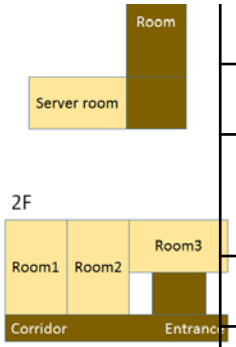
Time series regression analysis



Future energy demand prediction models under climate change impacts

Comple-mentary

Multi sectoral characteristic estimation



Area	○○m2
No of Persons	○○
Type of Activities	○-△
Building Type	○○
Surrounding	○○

Extensive estimation model for Muti-sectoral characteristics; such as building and life stypes

Development of an energy demand prediction model combined with buildings information

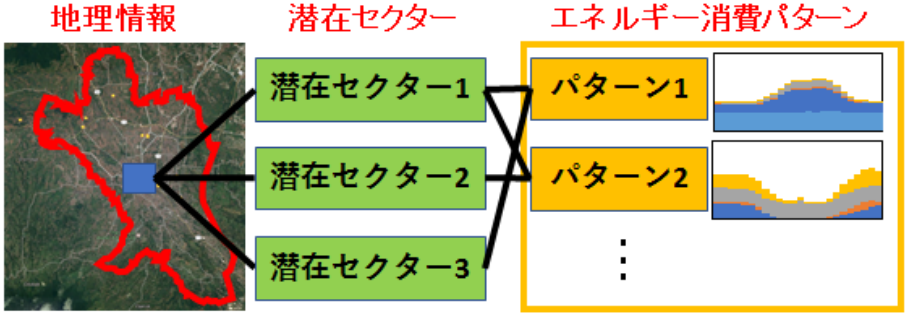
From time series analysis to areal modeling

Time series inventory

- 平均･日変動･期間変動をモデル化
- DRや買い替え効果をモデル化し、検証

空間展開

Model development for Bogor City

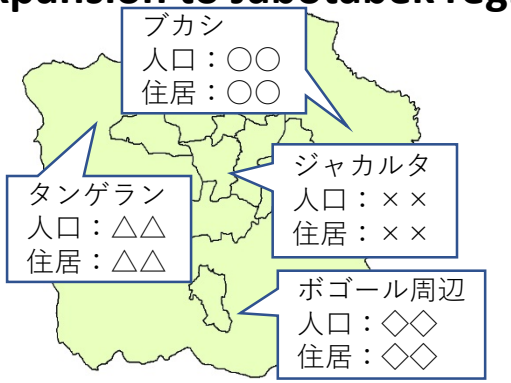


ベイジアンネットによる地理情報からのパターン推定を確率モデル化

- 地理情報やアンケート結果から、潜在セクターを推定し、モニタリング結果を空間に紐づけ
- ベイジアンネットによる確率モデルを開発
- 地理情報からエネルギー消費を変動含め、推計

広域化

Expansion to Jabotabek region

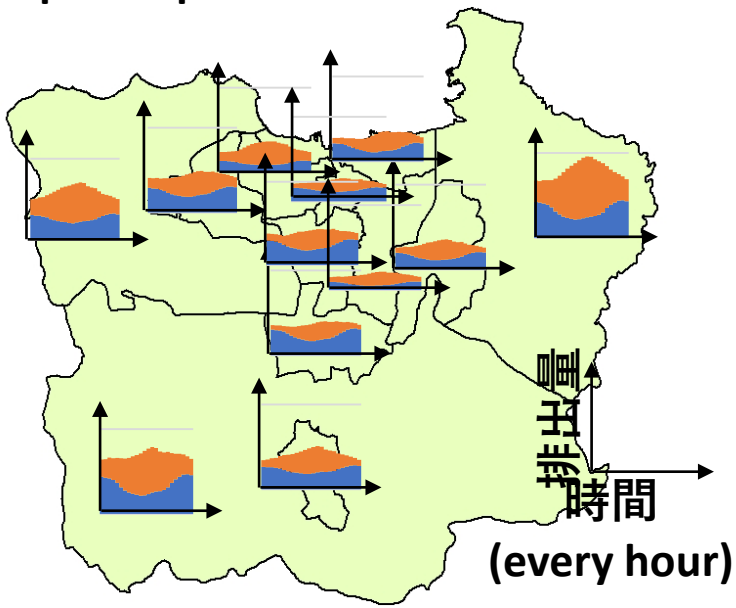


- 開発したモデルに必要な統計等データをジャポダベックで収集
- 得られたデータに開発した確率モデル適用し、ジャポダベック地域全体へ展開

対策効果

地域推計

Temporal-spatial model



- 紐づけするデータは平均、日変化、期間変化とし、組み合わせることで、地域のエネルギー消費を時間単位で可視化
- CO2排出ポテンシャルマップを作成
- 対策の効果は時系列分析でインベントリ化
- 対策の実施率を行動モデルとして確率モデル化
- エネルギー種ごとに排出のポイントをモデル化、GOSAT・サテライトサイトの結果と比較し、補完・原因推定

37Traffic 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>

App.

Smartphone App.

GPS sensor

Smartphone
(Android)

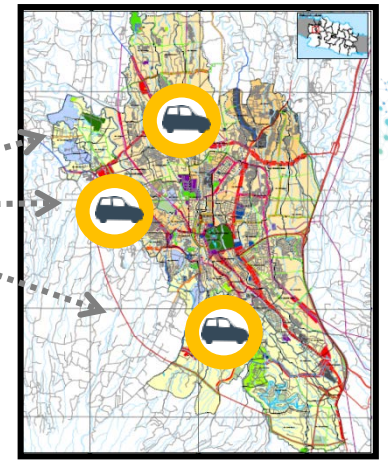
<Target Vehicle>

・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

Locally suitable scenario development

- Many local LCS scenarios have been developed with limited statistics and “default” parameters from national or international information. Such scenarios may not reflect local conditions properly.
- We combines modeling with monitoring of local activity so that we can propose more suitable mitigation scenario and Action plans for a city/region.
- Wider questionnaire survey is also adopted in order to supplement the monitoring.

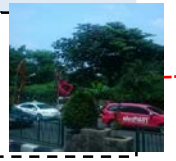
Energy Monitoring

- Current and future energy consumption pattern
- Energy saving potential

+ Questionnaire survey

Transport Monitoring

- Transport structure
- Vehicle speed
- Fuel efficiency etc.



Statistics

Current environmental initiative

The model to project future scenarios: ExSS/AFOLUA

Industry

Population

Agriculture

Transport

Waste

Land use and Forestry

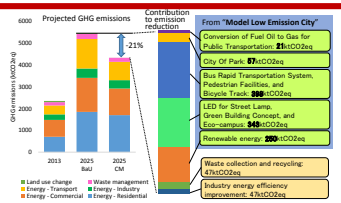
Energy technologies

Energy Demand

Energy Supply

GHG emissions

Locally suitable mitigation scenarios



Mitigation potential

Policy actions

Roadmap and investment

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

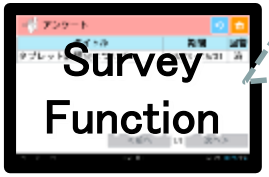
Dual Direction ICT Communication System

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

Interactive Eco-policy Planning System in Asia

Fukushima Shinchi Township

Community Assist Tablet Network

Local Needs

Regional Environment Information

Planning for Sustainable Future

National Institute for Env. Studies

Urban Spatial Analysis

Local environment diagnosis

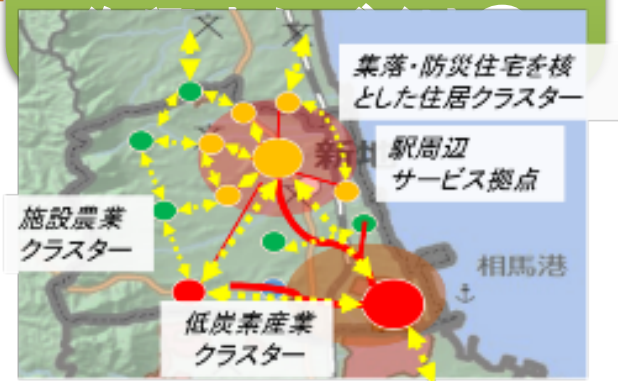
Integrated Modelling

Future scenario assessment

Tech. and policy inventory

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

Simulation for recovery roadmap



Research Scope of Theme 1; Scientific Guidelines for SDGs Future Cities Local Diagnosis, SDGs Design and Solution

④ Inter-sectoral Organiz-ation Systems

①Local Diagnosis For Seventeen SDGs resource and problems

②SDGs Selection and Design; inclusive goal designs

③SDGs solution design and evaluation; integrative projects participation process

⑤ Metho-dolog-ies for Gener-Aliza-toin

-indicators

-theory

-solutions

Strategic research perspectives for sustainable future

1.Solution design and development of green cities and regions by back-casting from the future.

➡Policy Planning and Project Design System to integrate Back-casting Simulation and Fore-casting Policies and Technology Systems

➡Generalization toward Guidelines from Demonstrative Pilot Cases

2. Social monitoring and modelling challenges for sustainable cities

➡Emerging Academic Challenge to utilize IOT Innovation

Selected list of recent publications in the related topics

- Seiya Maki, Shuichi Ashina, Minoru Fujii, Tsuyoshi Fujita, et.al (2018); Energy consumption monitoring system and integrative time series analysis models - case study in the green city demonstration project in Bogor City, Indonesia , Frontiers of Energy
- Remi Chandran, Tsuyoshi Fujita, et.al.(2018); Expert networks as science-policy interlocutors in the Implementation of a Monitoring Reporting and Verification (MRV) system, Frontiers of Energy, in press
- Yi Dou, Takuya Togawa, Liang Dong, Minoru Fujii, Satoshi Ohnishi, Hiroki Tanikawa, Tsuyoshi Fujita (2018) Innovative planning and evaluation system for district heating using waste heat considering spatial configuration: A case in Fukushima, Japan. Resources, Conservation and Recycling, 128, 406-416
- Yujiro Hirano, Kei Gomi, Shogo Nakamura, Yukiko Yoshida, Daisuke Narumi, Tsuyoshi Fujita (2017) Analysis of the impact of regional temperature pattern on the energy consumption in the commercial sector in Japan. Energy and Buildings, 149, 160–170
- Yujiro Hirano, Tsuyoshi Fujita (2016) Simulating the CO2 reduction caused by decreasing the air conditioning load in an urban area. Energy and Buildings, 114, 87-95
- Yong Geng, Tsuyoshi Fujita, et.al. (2016) Recent progress on innovative eco-industrial development. Journal of Cleaner Production, 114, 1-10
- Hiroto Shiraki, Shuichi Ashina, Yasuko Kameyama, Seiji Hashimoto, Tsuyoshi Fujita (2016) Analysis of optimal locations for power stations and their impact on industrial symbiosis planning under transition toward low-carbon power sector in Japan. Journal of Cleaner Production, 114, 81-94
- Satoshi Ohnishi, Minoru Fujii, Tsuyoshi Fujita, et.al. (2016) Comparative analysis of recycling industry development in Japan following the Eco-Town program for eco-industrial development. Journal of Cleaner Production, 114, 95-102
- Takuya Togawa, Tsuyoshi Fujita, et.al. (2016) Integrating GIS databases and ICT applications for the design of energy circulation systems. Journal of Cleaner Production, 114, 224-232
- Minoru Fujii, Tsuyoshi Fujita, et.al. (2016) Possibility of developing low-carbon industries through urban symbiosis in Asian cities. Journal of Cleaner Production, 114, 376-386

Thank you for your Attention