



# Circular economy and GHG mitigation strategies from Japan: Building a Regional Circular and Ecological Sphere to achieve a sustainable society

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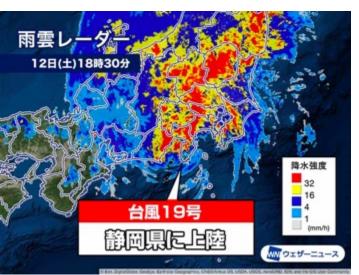
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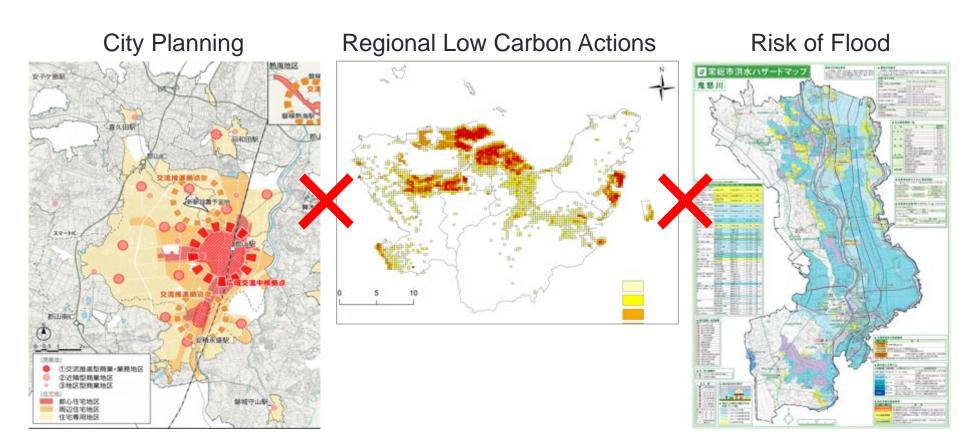
# Typhoon Hagibis hits Japan on 12 Oct, 2019, and still has impacts on the wide area of Japan





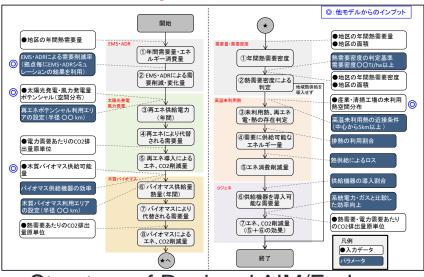
# City Planning in consideration with Climate Change

- City planning may adjust with consideration both for regional climate change mitigation actions and regional climate change risk, such as flood, landslides and tsunami.
- Take risk or avoid risk?



# Regional Low Carbon Scenario: AIM with Spatial Info.

 Developed Regional AIM/Enduse could analyze GHG reductions and mid-/long-term scenarios in region in consideration with spatial distribution of energy demand and supply.



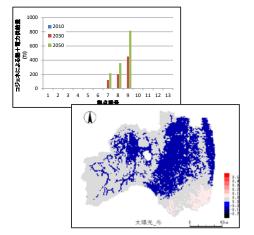
Structure of Regional AIM/Enduse

#### **Energy Demand**

# 

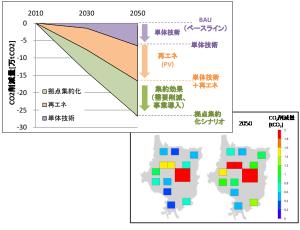
Spatial Distribution of Energy Demand

## **Energy Resource**



Energy Resources (CHPs, Renewables)

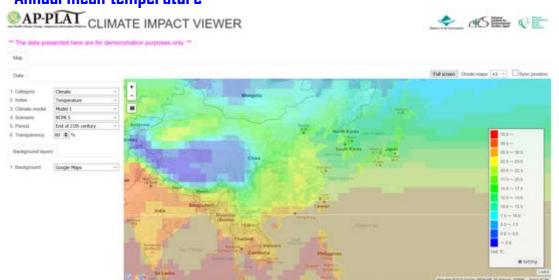
### GHG reductions



GHG reductions in region

# Regional CC Impact/Adaptation: A-PLAT/AP-PLAT

#### Annual mean temperature

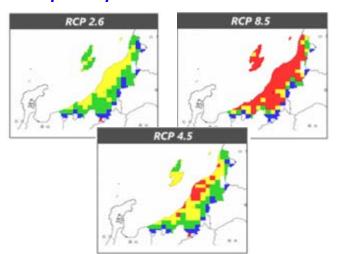


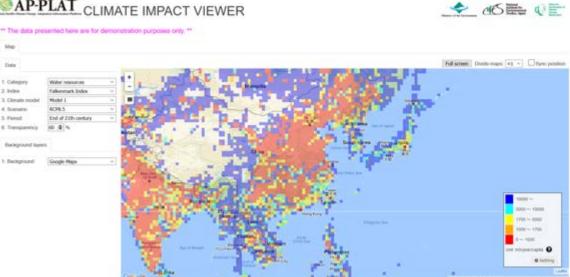




Water-stressed population

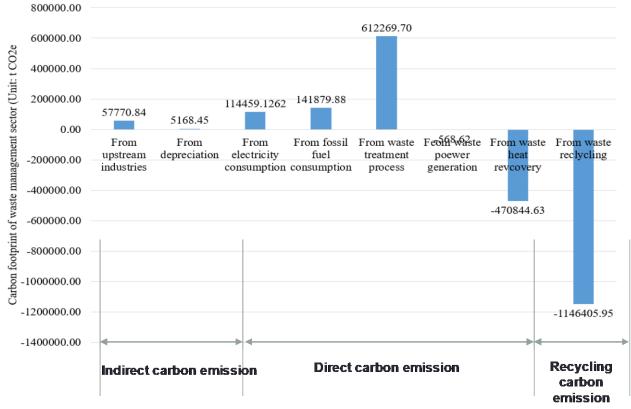
#### **CC Impacts by RCPs**





# Importance of Circular Economy in Japan: Perspectives from Tokyo Metropolis

- From life cycle perspective, waste management sector of Tokyo Metropolis will reduce 6.86 million tons CO<sub>2</sub>e in 2011, 1.12% (61.1 million tons) of total CO<sub>2</sub> emissions.
- Indirect and direct carbon emissions contributed 1.77 million and 2.83 million tons to the carbon footprint, respectively; the carbon emission reduction from waste recycling is enormous, which is 1.15 million ton CO<sub>2</sub>.

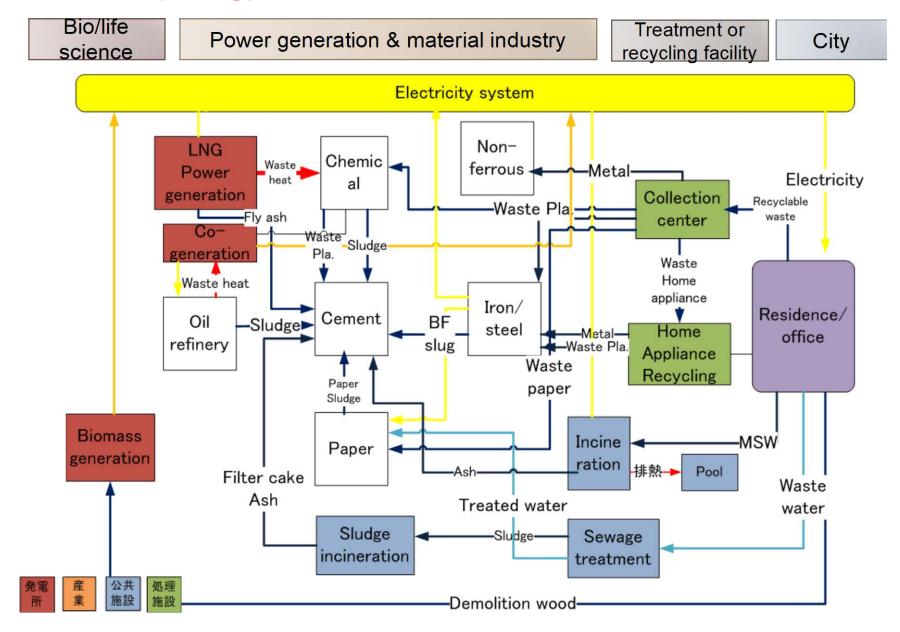


Life cycle carbon footprint of waste management sector, 2011

Industrial Symbiosis and Urban Industries to empower cities by circularization: Case of Kawasaki

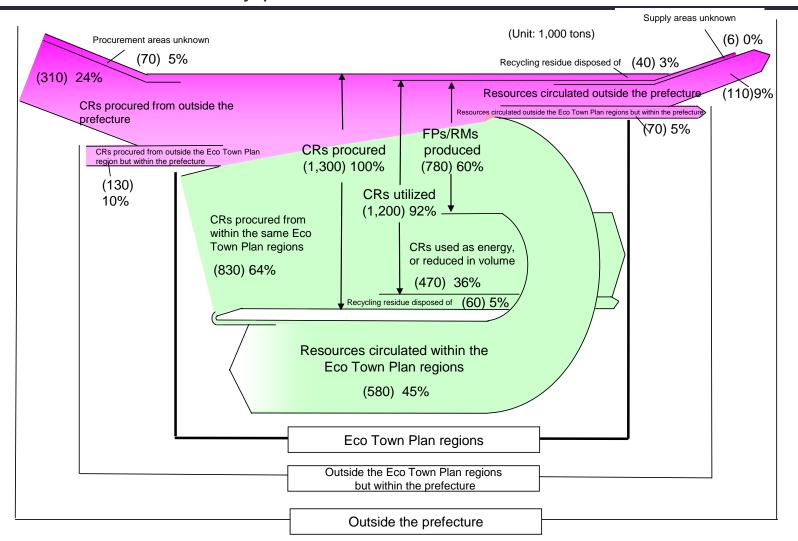


# Kawasaki Synergy Network (current situation)



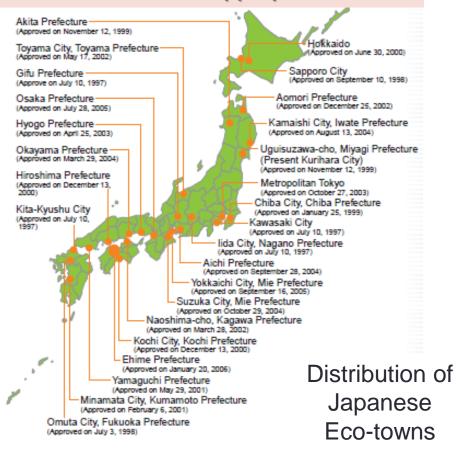
#### Evaluation of 90 Circular Facilities in 26 Eco-towns

Reduction of Virgin Materials; 900,000.ton /yr CO2 Emission Reduction 480,000 t-CO2/yr Circular use ration of by-product 92% Intra-eco-town circulation ratio 61%



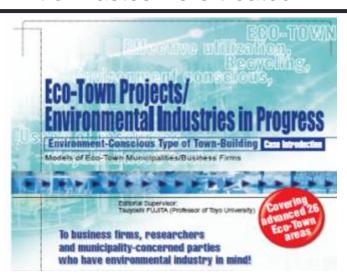
# Eco-town area as demonstration project for Sound material cycle society

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

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

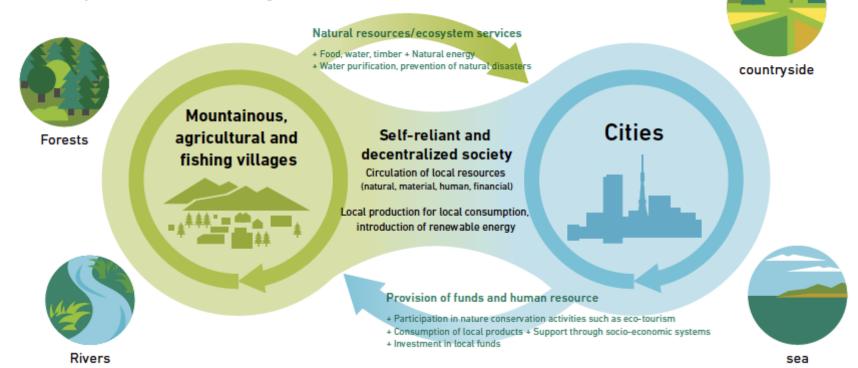
Distribution of Total Investment 60 projects in 24 Eco-Towns 1.6 bil. US\$

# Combining Circular economy and GHG mitigation: Regional Circular and Ecological Sphere (CES)

 Aims to enhance utilization of regional resources for building a sustainable society not only within a region but also with neighboring regions.

Regional resources including energy (solar and wind), social and natural resources (culture, climate and communities)

Conceptual illustration of a Regional CES

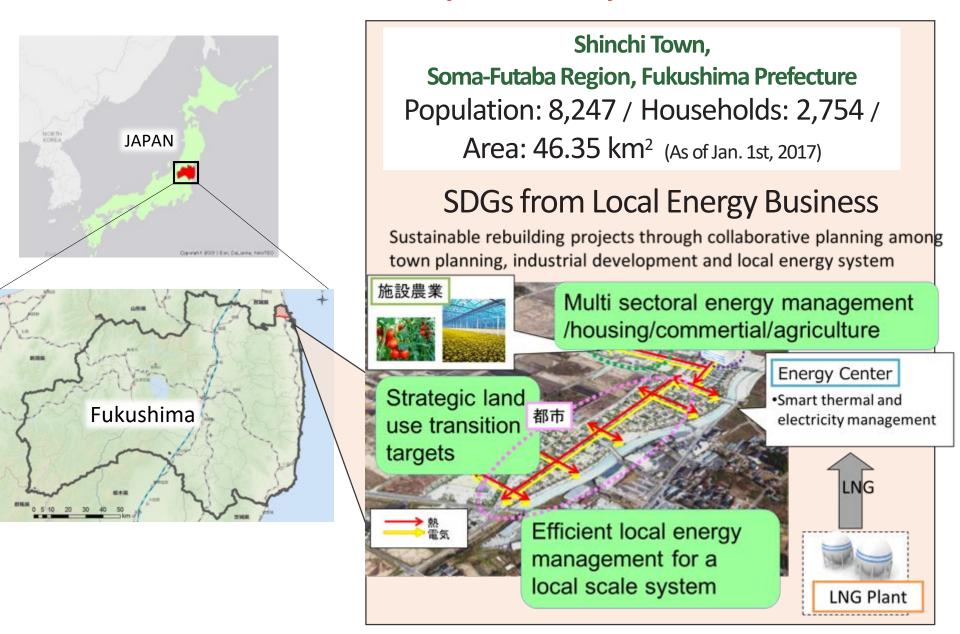


Source: Ministry of the Environment

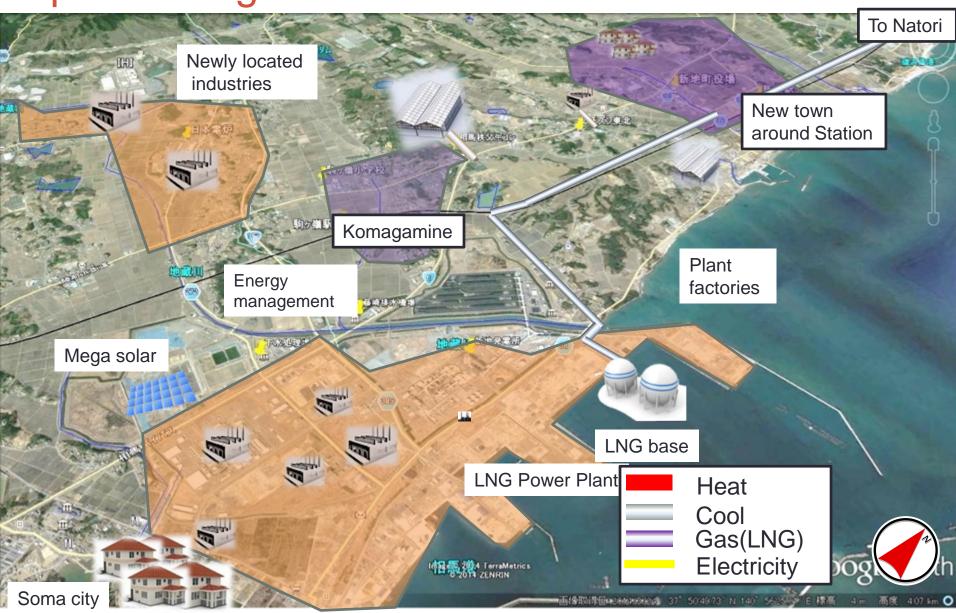
# Schema of The Regional CES: Mandara



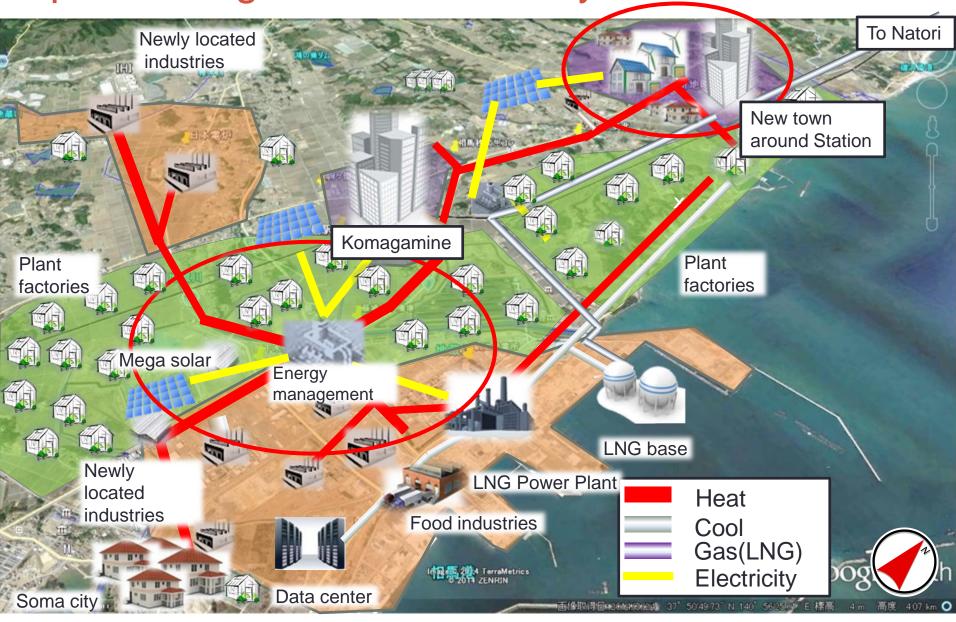
# Newest Smart Community underway in Fukushima



Spatial Design under the BaU scenario in 2030

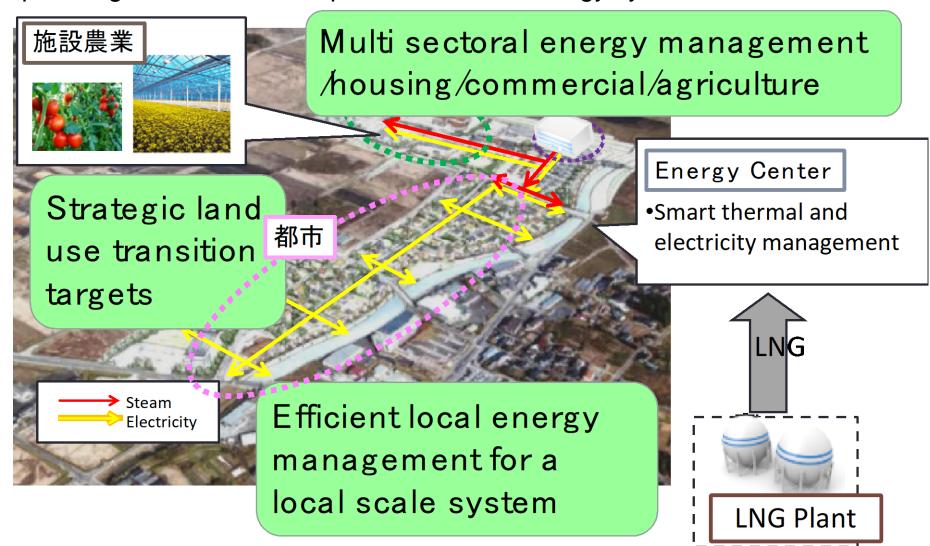


Spatial Design for the Smart City in 2030



# Local Energy Based Urban Rebuilding Project in Fukushima

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

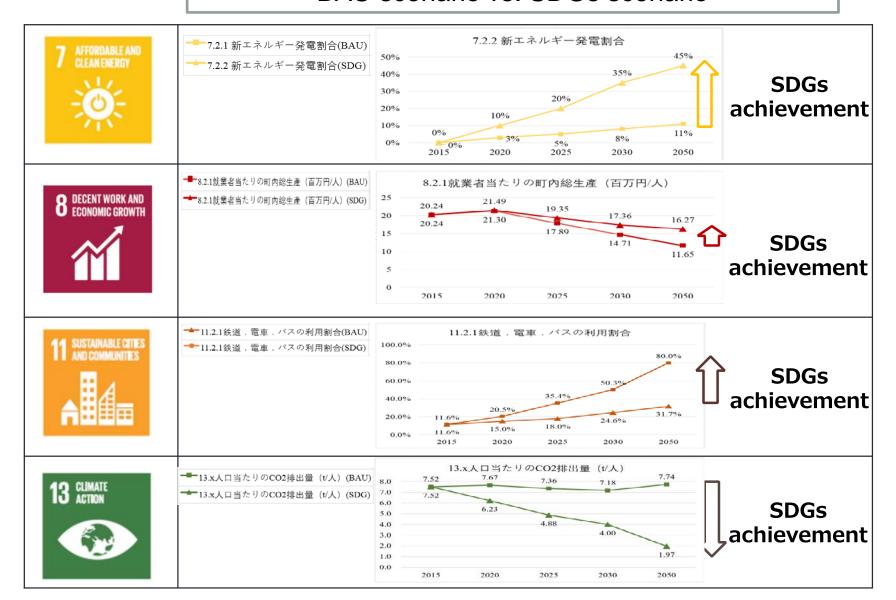


# Local Energy Based Urban Rebuilding Project in Fukushima

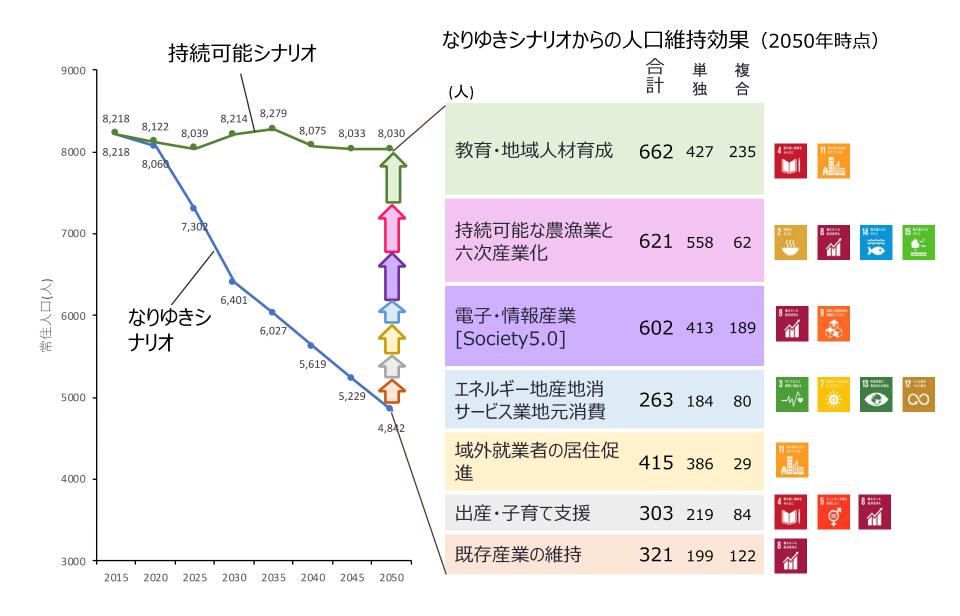


# Impacts of Regional CES in Shinchi – Application of AIM

#### BAU scenario vs. SDGs scenario



# Impacts of Regional CES on Population in Shinchi



## Regional CES Mandara in Shinchi

- ◆Cloud EV city
- · Hydrogen station compact town development
- EV cloud storage
- ◆Hydrogen energy

CO2 free hydrogen production

Hydrogen production base Hydrogen storage etc

◆Large scale

#### Renewable energy

- · Mega, meso solar
- Wind power (land/ocean)
- Biomass (forest, methane, algae) Blue carbon etc.
- ◆ Start based smart city
- · DR, digital grid
- Thermal energy network
- Society 5.0 type regional service
- ◆ Cascade woody society

Wood sorting technology Construction material utilization system (CLT, laminated wood, interior material, craft material) Cogeneration biomass energy Woody compact city

◆ Regional group that utilizes information network

Inter-district communication using CT Public services that utilize ICT Remote Hometown Support System

- ◆ Human resource and education
- · University base office invitation
- SDGs Policy Platform

◆ Hybrid

Transportation

- Automatic
- operation network
- Personal mobility. barrier-free walking network
- ◆Smart mobility
- MAAS (Mobility-as-a-Service)
- Public transport network
- Traffic congestion prediction, traffic control Public car sharing

◆De-fossil type compact network

Compact zoning and network services from a long-term perspective Formation of urban industry symbiosis district

- Regional circulation symbiosis type land conversion that utilizes local resources, materials
- ◆ Reconstruction business. science tourism
- Ecotourism, town development regeneration, network tourism of oporav industrial development base.

Enatural park

◆Climate change Adaptation Strategic urban area downsizing Regional Adaptation Consortium Disaster prevention infrastructure construction

Low carbon complexes in energy intensive industries Wide area base of material type industry

LNG base cold energy business Local production and consumption cogeneration in LNG thermal power

Decompression distributed supply in LNG pipeline

Zero carbonization by highly efficient CCS business

Transportation Town planning

#### Regional energy

#### 2030 2040 2050 Shinchi future revival project

- Future-oriented environment creation recove

#### Zero CO2 emissions due to fossil removal Population recovery by regional innovation Local revitalization

#### Information infrastructure of regional circulation symbiosis Knowledge platform

◆Smart wellness

Smart longevity health service Robot, drone delivery Smart personal monitoring etc

#### ◆Future-oriented green area finance

Commercialization support base TIF bonds etc. FSG investment

Green Bond, Funance Real RE 100 company invitation

- ◆Safe and secure regional environment information sharing network
- Cooperation with environmental information telemeter system etc.
- Risk communication · Environmental awareness improvement information system
- Local circulation symbiosis business real time information sharing

◆Industry symbiosis type smart agri facility and system Circular **Development Risk Information** Network ,Econom v

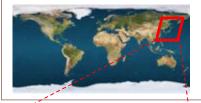
Consumer, distribution real-time information network Thermoelectric carbon dioxide supply by trigeneration Sixth industrialization business including processing sales

- ◆Closed loop recycling High added value recycling Sorting center Solar panel recycling base EV storage battery reuse base etc.
- ◆ Technologies that support the realization of circular economy
- Logistics optimization mainly for venous logistics
- Sharing economy
- Service of goods

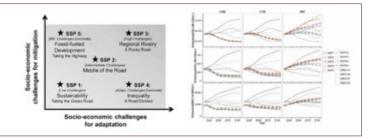
## A Multi-Resolution Approach in AIM

Different scales but interactive approaches are employed in AIM

#### Global



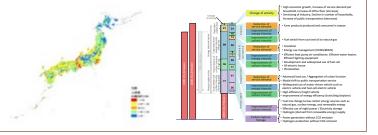
- Representative Concentration Pathways (RCPs)
- Shared Socio-Economic Pathways (SSPs)
- Food hunger risk







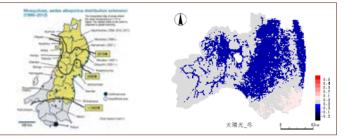
- Low Carbon Scenario
- **Adaptation Strategy**
- **Nationally Determined Targets** (NDC)
- Greenhouse Gas Inventory



Regional



- Low Carbon Development Plan
- Low Carbon Actions
- **Adaptation Strategy**
- Regional Energy Potential



City



- Low Carbon Town Planning
- Compact city
- **Project Design**
- Stakeholders Involvement
- **Social Monitoring**

