

# The study on Sustainable City and its Associated Energy System in Japan to 2030

T a k a s h i F U J I I  
The Japan Gas Association

&

Y u i c h i T A K E U C H I  
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What happens if urban design and energy systems are considered together?

**1 . View points on thinking about Sustainable City**

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**2-3 . Direction of Sustainable City and Energy System**

How do we make these dreams come true?

**3 . Proposal of “Urban and Energy Package”**

**4 . Case Study**

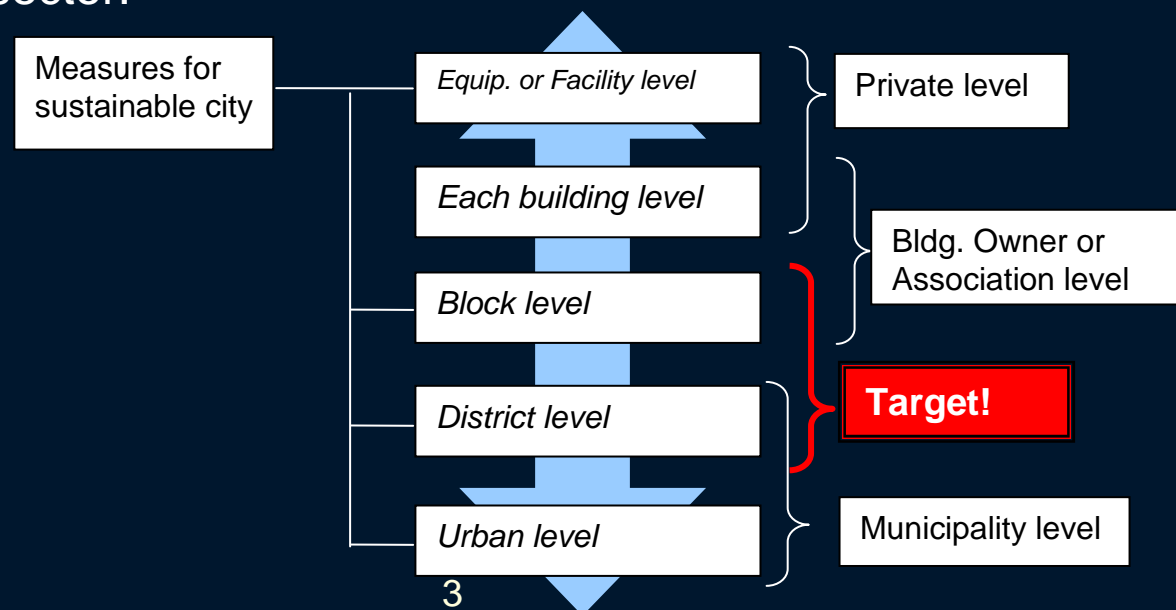
### 3.Suggestion of business solution for Urban and Energy Development Issues “Urban and Energy Package”

#### ◆Methodology of “Urban and Energy Package”

##### The answer to block renovation

★Toward the Sustainable City, urban regeneration can't be obtained only by single urban redevelopment. The various approaches should be done continuously to the each stage between the facility management through the urban redevelopment.

★The approach to facility and each building has been proceeded. However more higher level as the urban regeneration has not well done by the municipality. Medium level as the district regeneration should be addressed by the private sector.



### 3.Suggestion of business solution for Urban and Energy Development Issues “Urban and Energy Package”

#### ◆Methodology of “Urban and Energy Package”

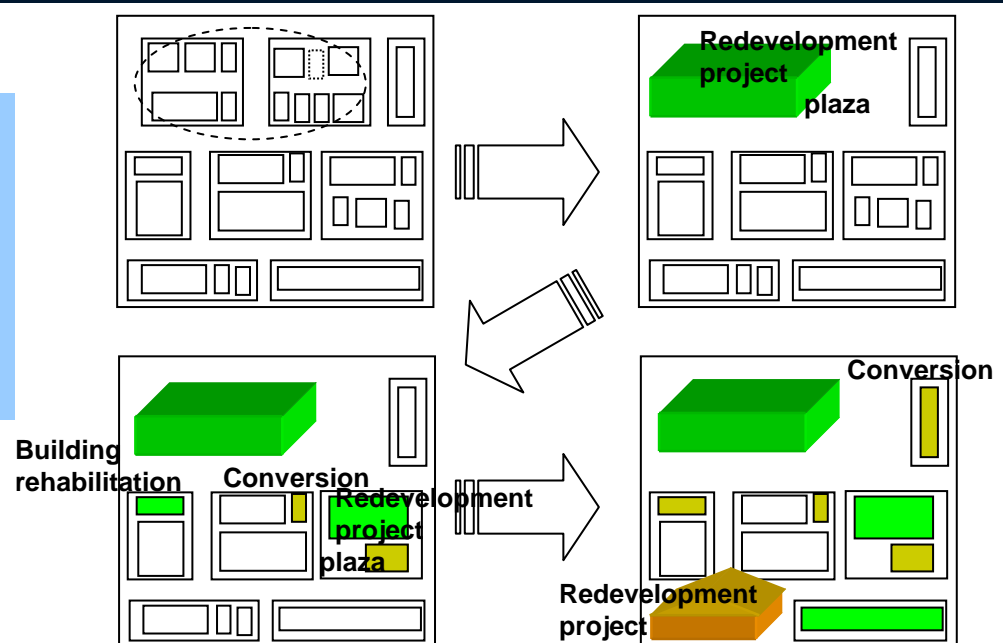
##### Phased urban regeneration and its control

★Urban regeneration has been implemented in several ways such as redevelopment and conversion,etc due to each urban feature. Furthermore it has been escalated step by step.

Thus long-term perspective is highly demanded.

★If no body would undertake to develop the phased urban regeneration, each plan would be commenced independently. Therefore the enough management is a significant issue.

Manage the various district regeneration while imaging the phased urban regeneration!



### 3. Suggestion of business solution for Urban and Energy Development Issues “Urban and Energy Package”

**The method of “ Urban and Energy package” is responsible for developing block renovation.**

- Tie in with the urban regeneration and the energy system renovation toward Sustainable Society
- Design the expected regeneration pattern, urban activities, and urban space
- Coordinate the urban regeneration as well as the energy renovation to manage the district

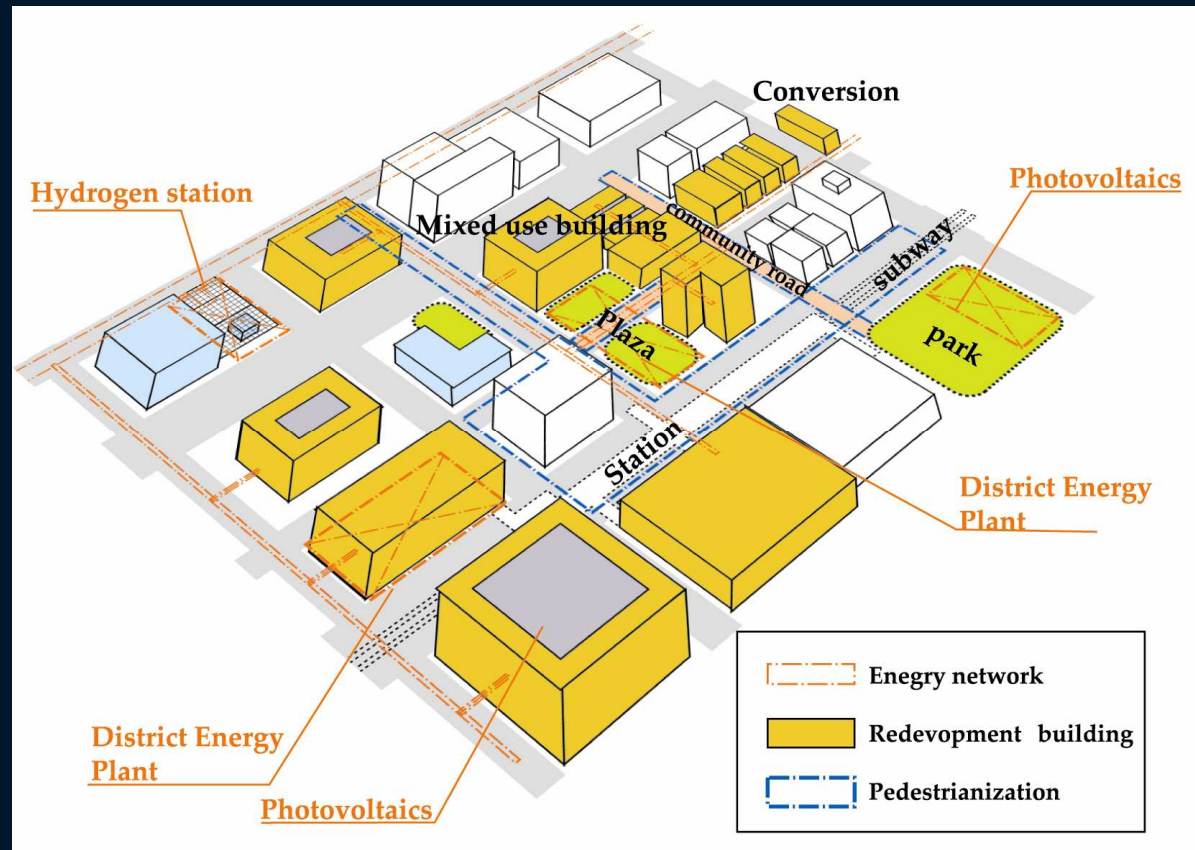
#### ◆ Why do we need “Urban and energy package” ?

- ⇒ Since the construction of a new urban infrastructure requires an enormous amount of money and the involvement of many stakeholders, the planning and construction must be done based on the premise of the long-term utilization
- ⇒ It is necessary to systematically design cities and energy systems while considering how to minimize environmental load and how to advance the progress of the economy and society of the infrastructure.

### 3.Suggestion of business solution for Urban and Energy Development Issues “Urban and Energy Package”

Town planning and design		Energy system design
Mixed use development	↔	CGS (CHP)
Housing		Heat storage
Conversion		Low energy building
Pedestrianization		Renewable energy
Plaza		

Packaging



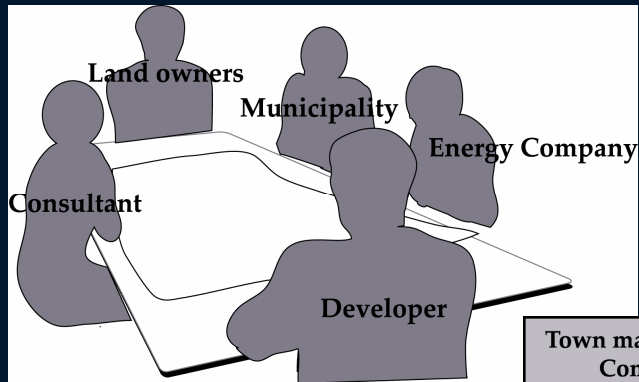
### 3. Suggestion of business solution for Urban and Energy Development Issues

#### “Urban and Energy Package”

#### ◆ Process of the “Urban and energy package”

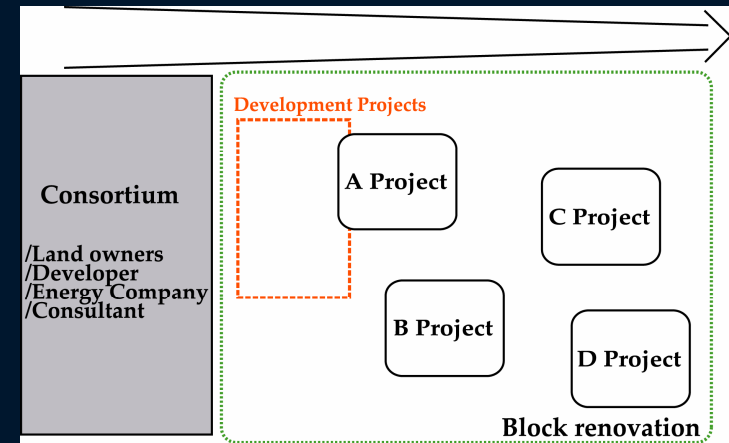
##### Planning Stage:

- /Meeting of mind about town and energy issues
- /Making a vision of town planning and energy system design



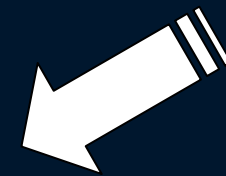
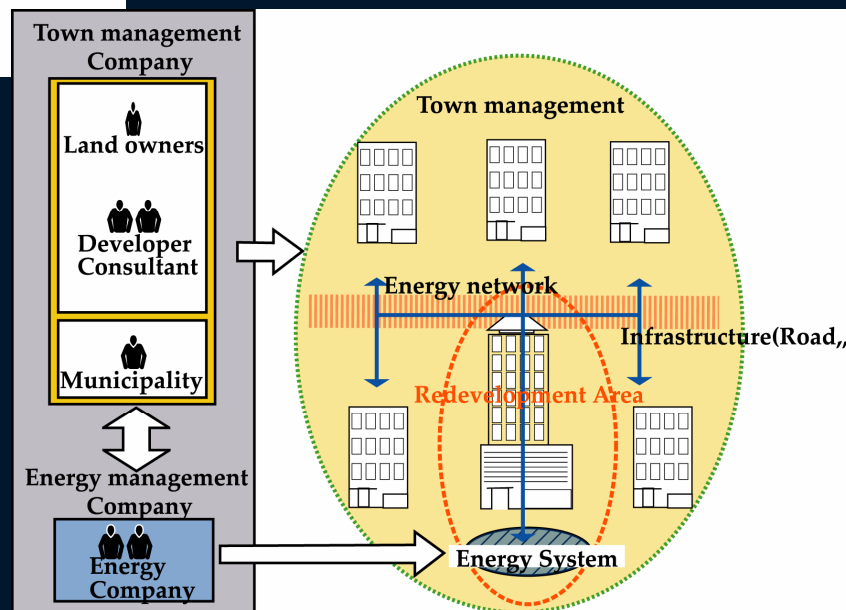
##### Projects coordination Stage:

- /Setting up for Development Consortium
- /Coordinating to entire project



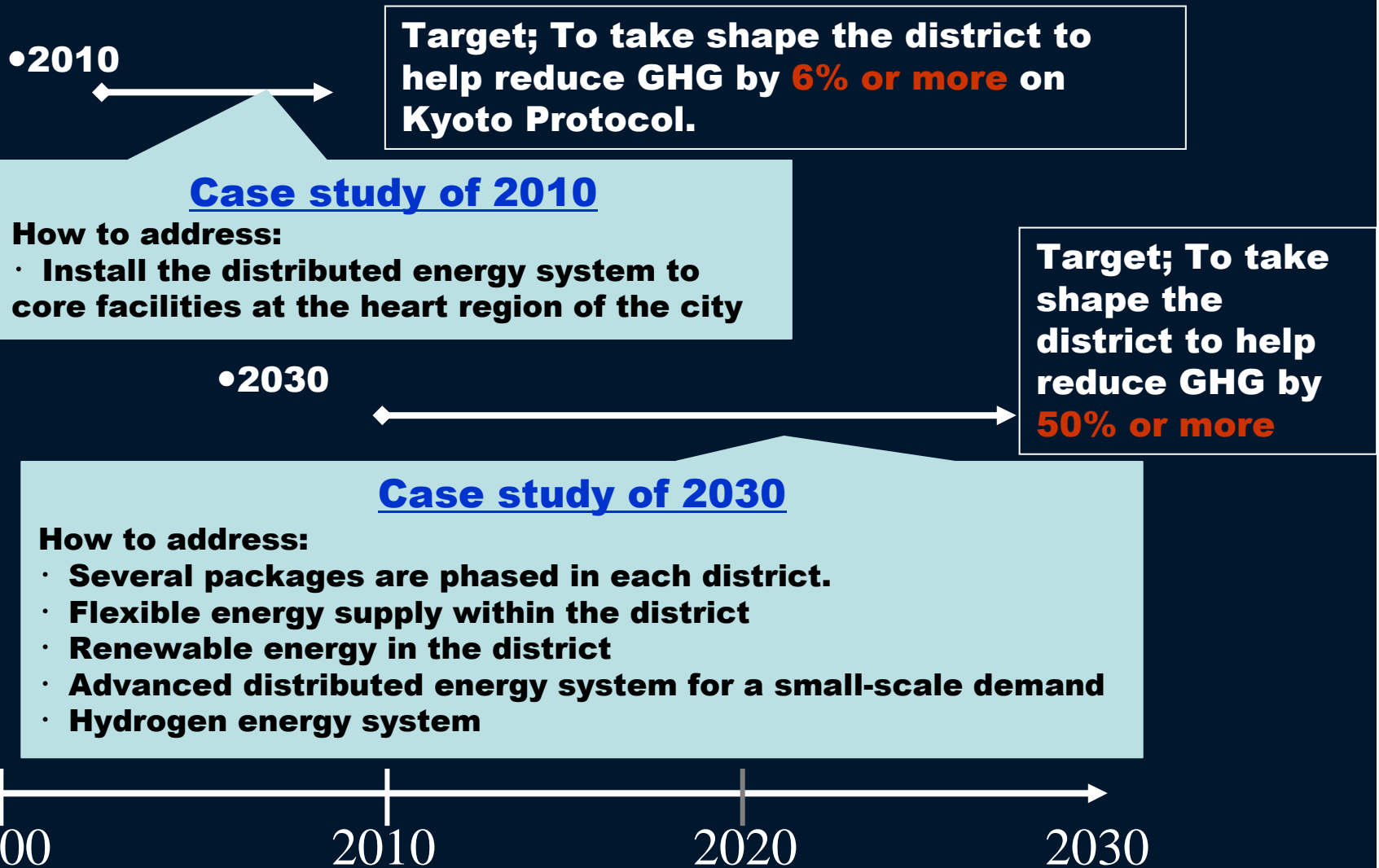
##### Town management Stage:

- /Setting up for town and energy management company
- /collaboration with municipality and citizens



## 4. Case Study

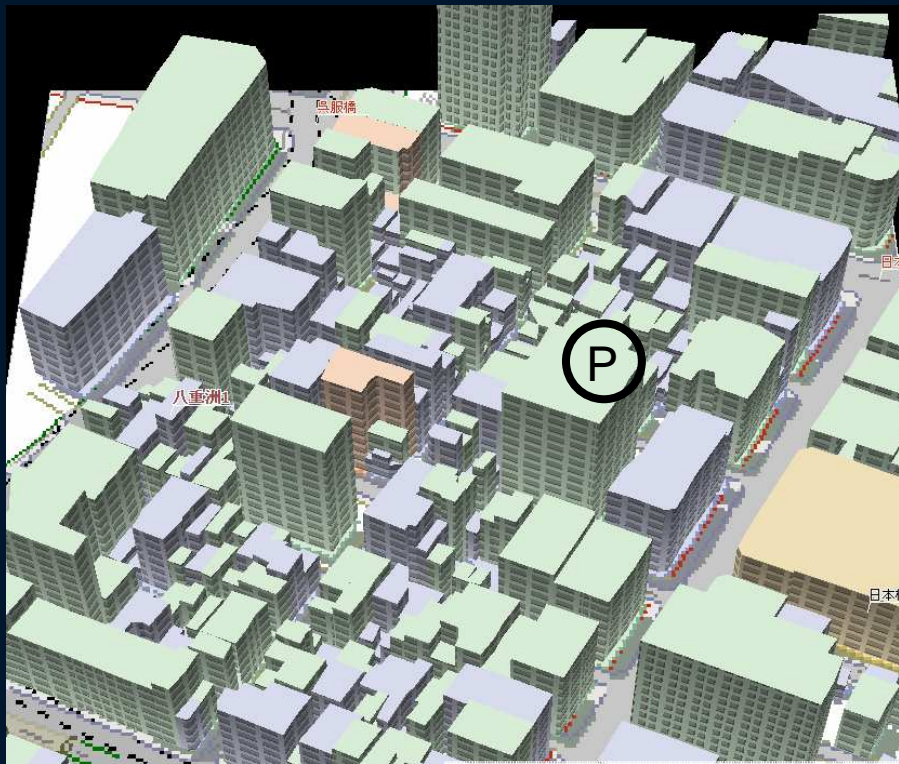
### ◆ Target of Sustainable “Urban and Energy package”










## 4. Case Study

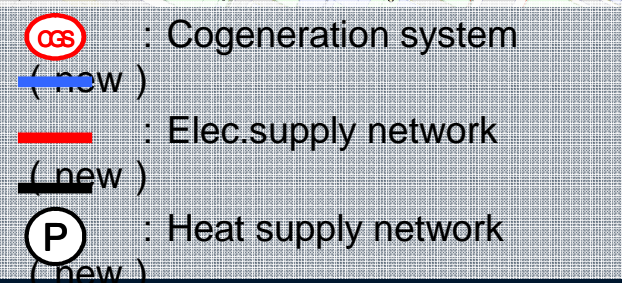
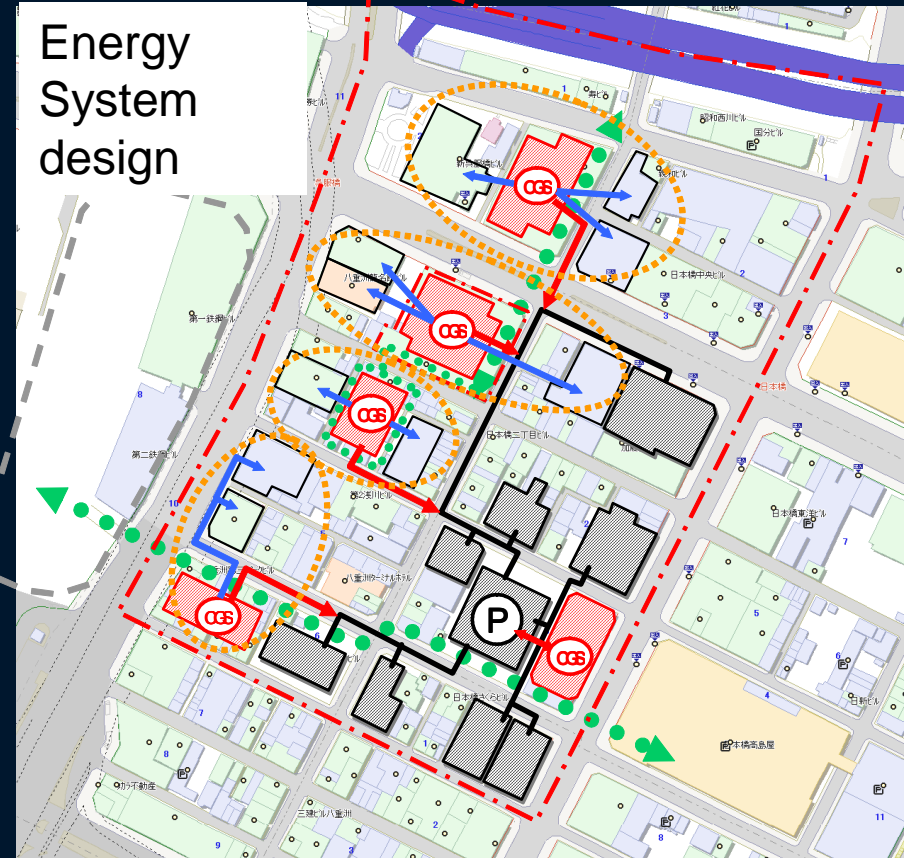
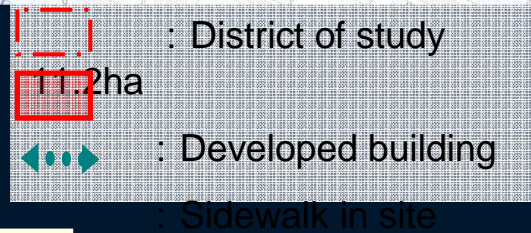
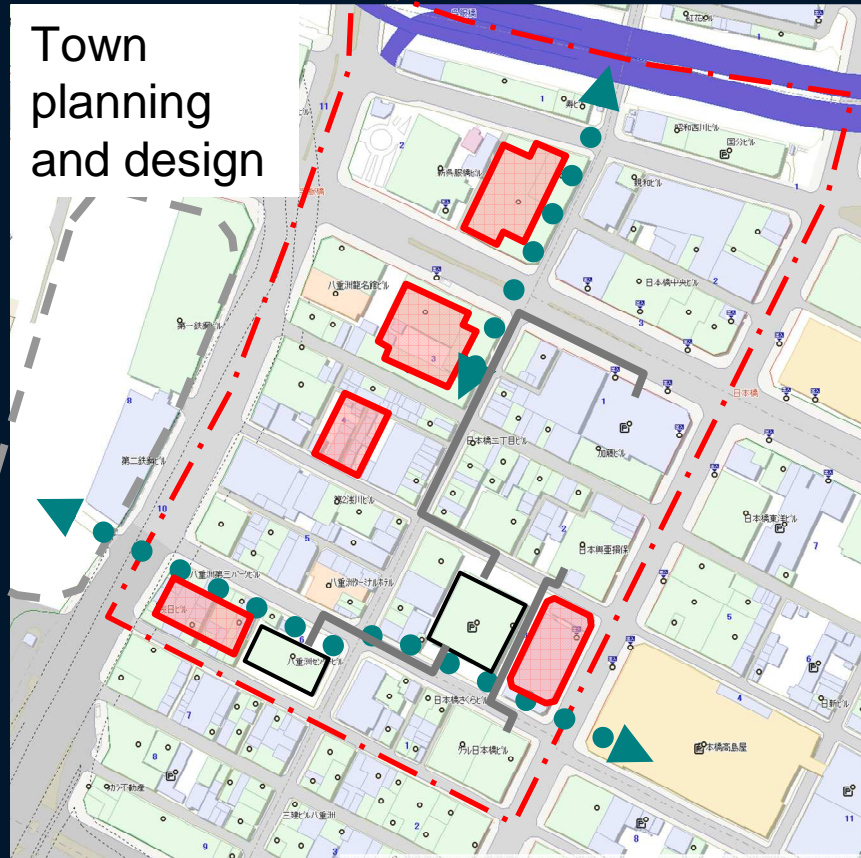
### ◆ Urban districts in central Tokyo at present



-  : District of study
-  : 44.2ha
-  : Heat supply network
-  : District energy plant
-  : service area

# 4. Case Study

## ◆Urban districts in central Tokyo in 2010

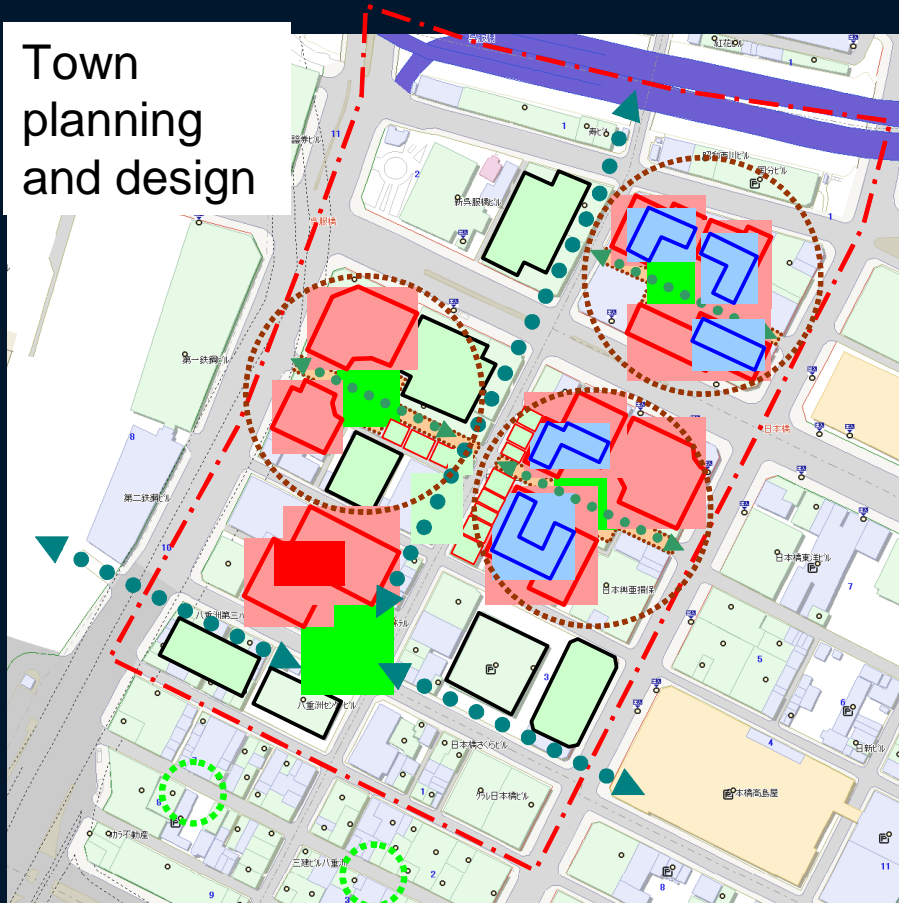




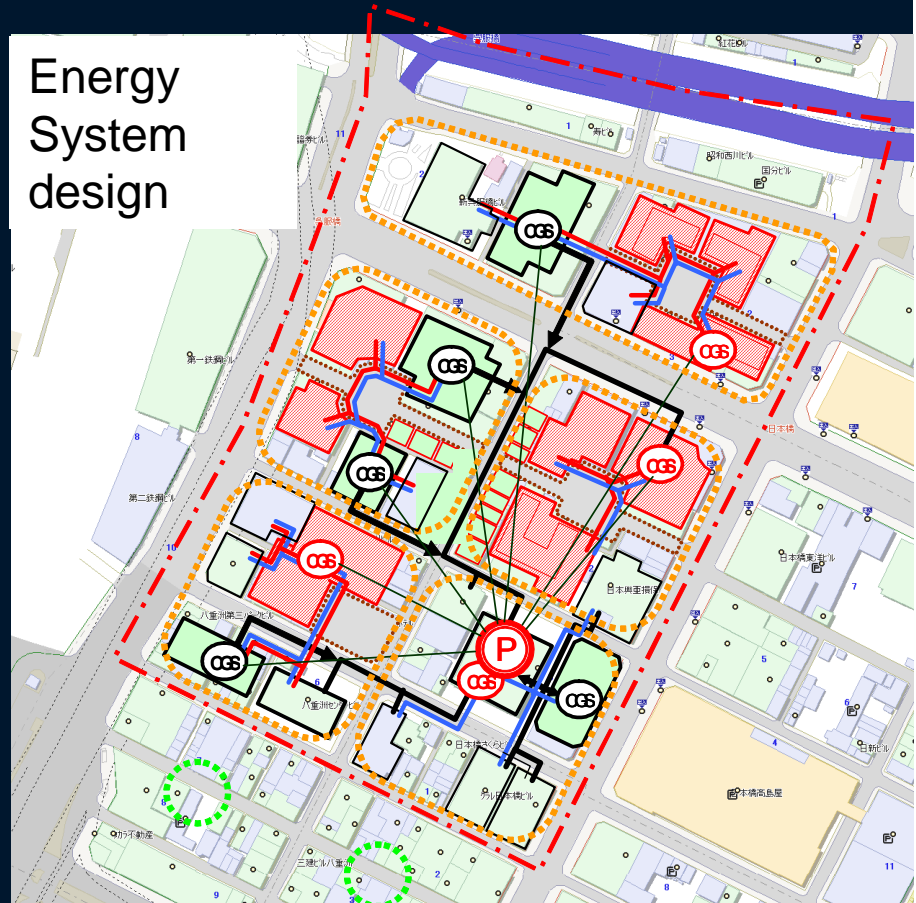
# 4. Case Study












## ◆ Urban districts in central Tokyo in 2030

Town planning and design



Energy System design

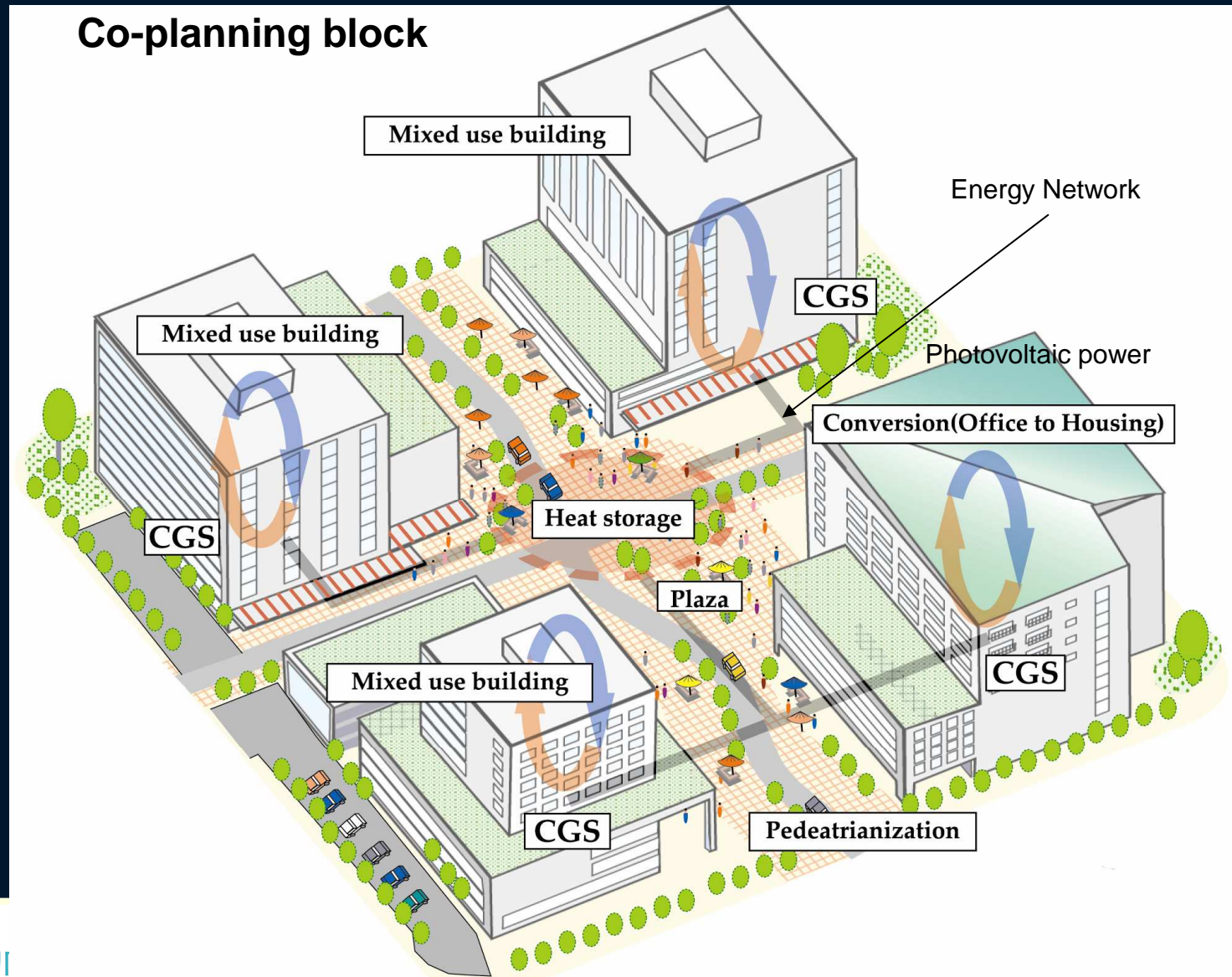


- |   |                       |   |                                    |
|---|-----------------------|---|------------------------------------|
|  | : Developed building  |  | : Cogeneration system              |
|  | : Residential complex |  | : Cogeneration system ( built-up ) |
|  | : Open square         |  | : Elec. supply network ( new )     |
|  | : Sidewalk in site    |  | : Heat supply network ( new )      |
|  | : small city block    |  | : Heat supply network ( built-up ) |
|   |                       |  | : Heat supply network ( built-up ) |



## 4. Case Study

### ◆ Urban districts in central Tokyo in 2030



# Conclusion

- ❑ Sustainable city in 2030 in Japan and its associated energy system means a compact city and a micro-grid system which we call an “energy cluster”.
- ❑ We have proposed the “Urban and energy package” as a city planning tool to integrate the city with the energy system and realize it.
- ❑ Our next step is to apply the proposed energy package to a specific district and cities in Japan.

# 4. Case Study

Points of urban regeneration		Town planning and design	Energy System design
“Multi-purpose space & facilities” (business, commercial, residential, and communication facilities)	<b>Individual regeneration of small and medium-size buildings; improvement of office environment by joint reconstruction</b> ⇒Improvement of information infrastructure and disaster prevention functions	<b>Improvement of mid-to-high-rise office buildings</b> ; Satellite offices, sophisticated Internet cafes, etc.	<b>Integration of energy-intensive facilities within a highly-populated city block, inducement of population density and functions, introduction of decentralized power supplies that contribute to a self-sufficiency of energy sources, auxiliary power supplies for an emergency proved region-wise, extensive introduction of highly-efficient energy systems, and the establishment of an energy interchange network among multi-purpose facilities</b>
	<b>Introduction of business support functions</b> ⇒Introduction of functions responding to the needs arising from various work-styles, including child rearing support and health management.	<b>Improvement of mid-to-high-rise compound facilities by redevelopment</b> ; Nursery schools, day-care centers, etc.	
	<b>Introduction of new functions to increase urban attractiveness</b> ⇒Advanced business support-type commercial, residential and communication functions	<b>Improvement of full-scale urban-type fitness facilities, hotels and commercial facilities for business workers</b>	
Public space (disaster prevention space)	<b>Creation of a core common space for the community</b>	<b>Provision of public space where many functions are incorporated in one single capability (disaster prevention space)</b>	<b>Installation of a decentralized energy source within a space under a plaza (also to be used for power generation in an emergency) and district-based energy supply</b>



## 4. Case Study

<p>Ground level semi-public space</p>	<p><b>Reorganization of semi-public space to create diverse flows at ground level</b></p>	<p><b>Establishment of a communication and green zone by connecting open spaces created as the result of reconstructing individual buildings</b>          ; Outdoor MTG space for lunch time, out-of-school experiences, bars for business people, open jazz bar, barrier-free space showing consideration for child-rearing and care for elderly people, secured evacuation traffic line, healthy-food restaurants, etc.</p>	<p><b>Construction of conduits for decentralized energy-supply infrastructures also used as an emergency power supply</b></p>
<p>District management</p>	<p><b>Formation of town management organization</b></p>	<p><b>Establishment of activity bases for town management organization at every turn</b>          ; Organization activity base facility, activity base in semi-public spaces (meeting places, etc.), activity base in public spaces (lodges, etc.), advanced urban space management (inter-facility information network using ICT and WEB technologies), environment monitoring system (purchase history of eco-goods, the amount of reuse of waste water and rain water), etc.</p>	<p><b>Management of optimal energy interchange using existing regional air-conditioning network</b>          ⇒local ESCO and local BEMS utilizing as a core element an advanced, highly-efficient decentralized energy-supply system</p>

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# 1. View points for Sustainable City

~ Issues of the Japanese future city ~

- Declining birthrate and growing of elderly people
- Adverse effect of suburbanization ( Decrease of green space, Heat island phenomenon )
- Lack of safety and security
- Chronic traffic problem
- Global warming trends

★ Urban regeneration to keep its vitality

★ Reduction of environmental load

**The fulfillment of Sustainable City is significant!**

# 1. View points for Sustainable City

~ Trends and Challenges of energy consumption for the future ~

- **Significant growth in demand for private and transportation sector**
- **Progress toward the energy consuming type life style**
- **Commitment of automotive issues**
- **Slight change of energy supply structure**

★ **Review of energy consuming life style**

★ **Review of excessive dependence on automotive**

★ **Proper energy supply and demand control**

**The feasible energy system to address these issues should be fulfilled while the urban regeneration is forwarded to Sustainable City.**

## 2-1. Sustainable Urban Image in 2030

### ~ The concept of a targeted sustainable urban image in 2030 ~

#### ○High density

→Effective use of resources and reinforcement of the community should be pursued, which will make the city more high densely populated. This doesn't mean to make the whole district highly populated but the different populated districts from medium to high should be located according to each district feature.

#### ○Mix of use

→Each district should be reorganized with the advanced life support function such as an adjacency of residence and workplace, a help for parenting, and a welfare for elderly people within the walking area.

#### ○Cluster composition

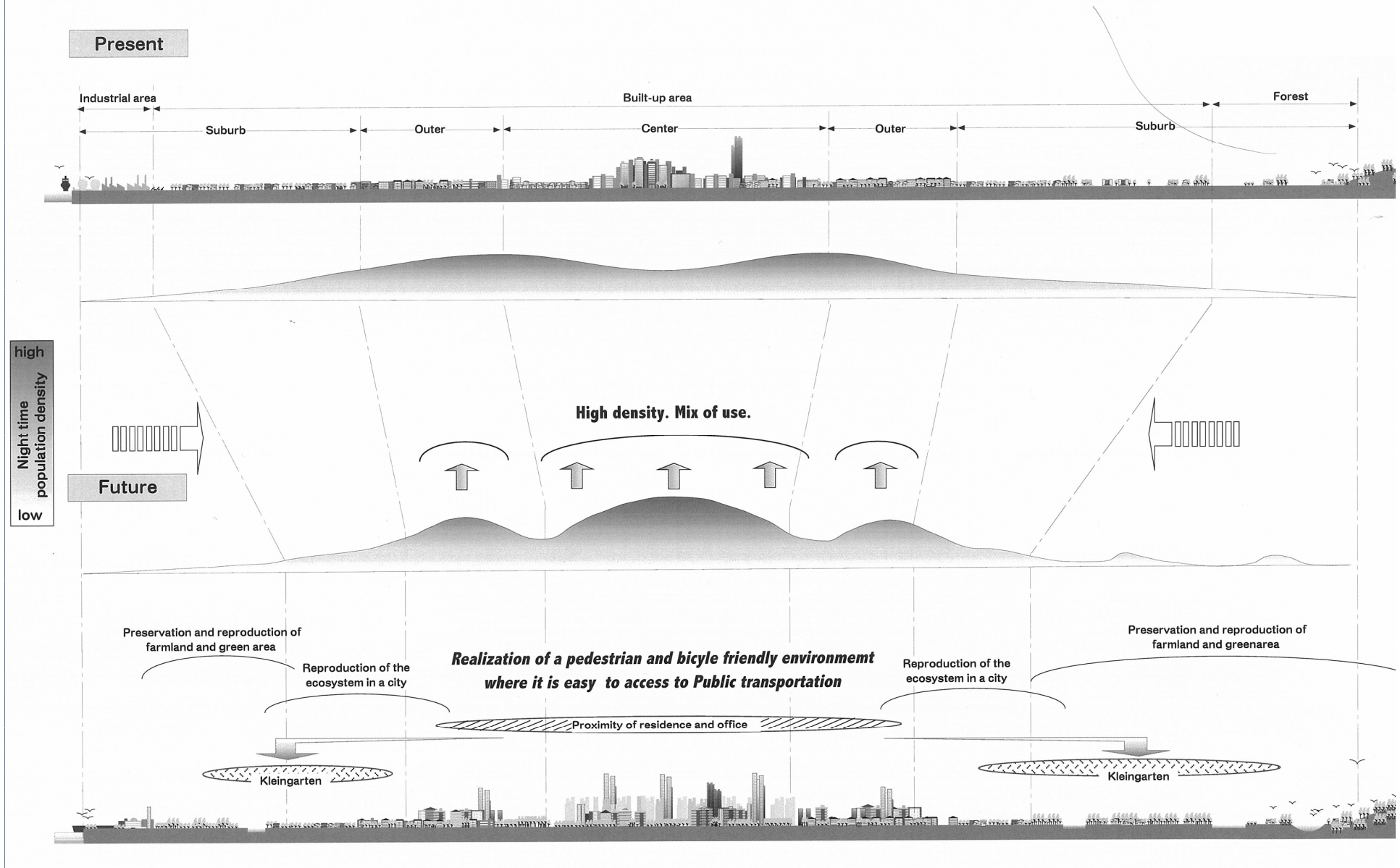
Even in the present urban area, the different featured districts exist. To enhance these features more clearly, the districts should be divided into the well-defined boundary.



“Compact city” should be identified as high densely populated, multiple functioned, and scattered area.

# 2-1. Sustainable Urban Image in 2030

## ~ Image of "Compact City" ~



## 2-1. Sustainable Urban Image in 2030

~ Proposal Urban Structure consisting of “several Compact Cities” ~

- 1 . Dynamic urban structure with the intensive multi functioned and scattered area
- 2 . District formation based on public transportation and walking
- 3 . Humane urban space on the basis of middle to high population density
- 4 . Securing of urban area with the attention to symbiosis with nature

## 2-2. Energy System in 2030

### ~ Major features of future energy system ~

#### **Introduction of renewable energy in a big way**

- ① Photovoltaic, biomass, unutilized city waste heat should be positively utilized on site for saving energy and GHG reduction.
- ② Waste heat from industrial firm, garbage incinerator, etc., should be integrated and normally used.

#### **Micro grid construction**

- ③ Micro grid should be well installed to make use of the power from renewable energy.
- ④ SOFC will be connected to micro grid.

#### **Development of hydrogen supply infrastructure**

- ⑤ FC and hydrogen filling station should be organized for the large scale apartment and FCV.
- ⑥ Hydrogen will be produced from city gas as well as by product hydrogen gas from firm.

#### **Upgrading of supply and demand control network system**

- ⑦ TEMS (Town Energy Management System) should be developed with IT.

## 3-2. Energy System in 2030



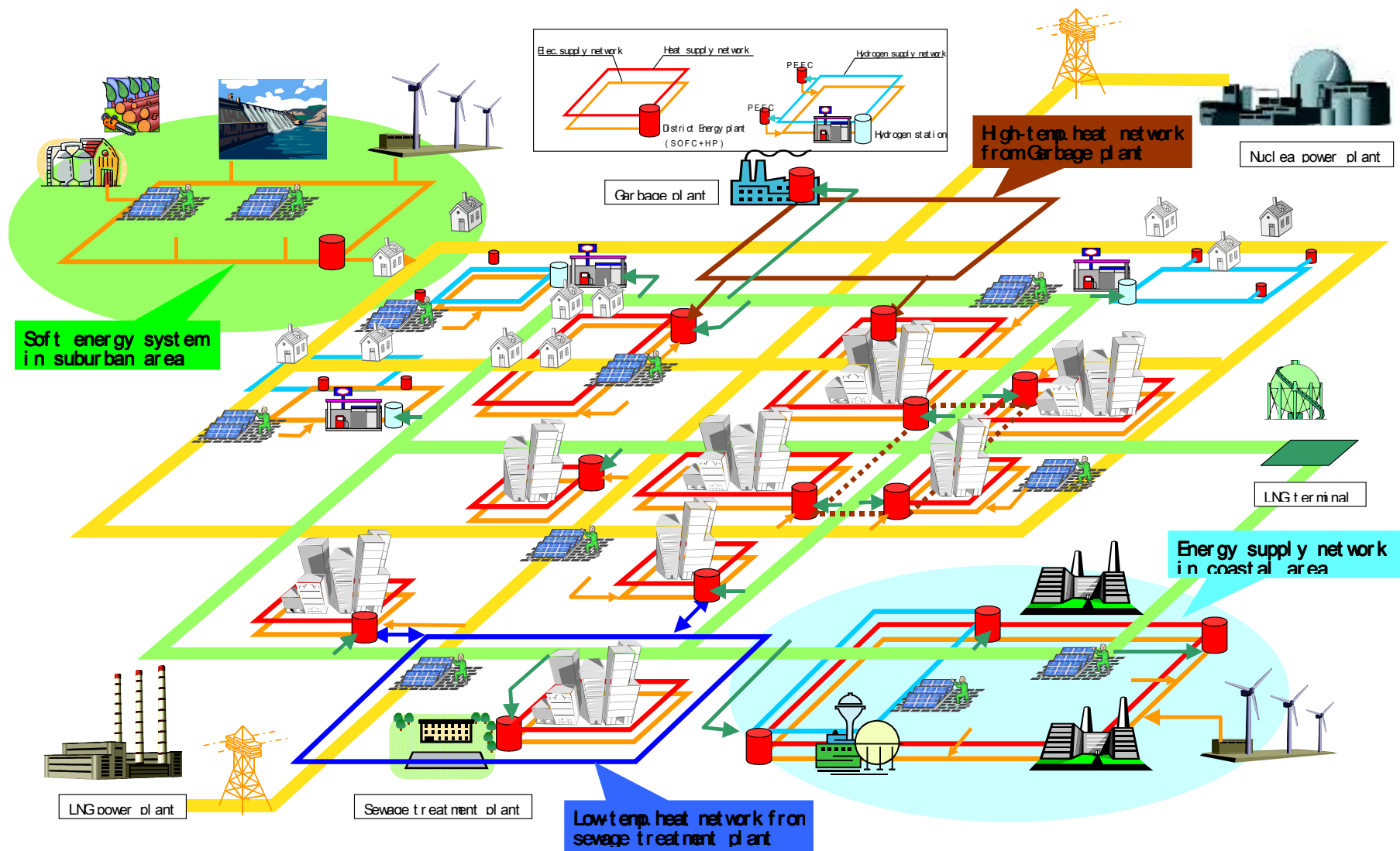
### **Development of “Energy Cluster” at each district**

**“Energy Cluster” should be defined as the micro grid which provide electricity, heat, and hydrogen as a rule.**

# 3-2. Energy System in 2030

~ Outline of Energy System in 2030 ~

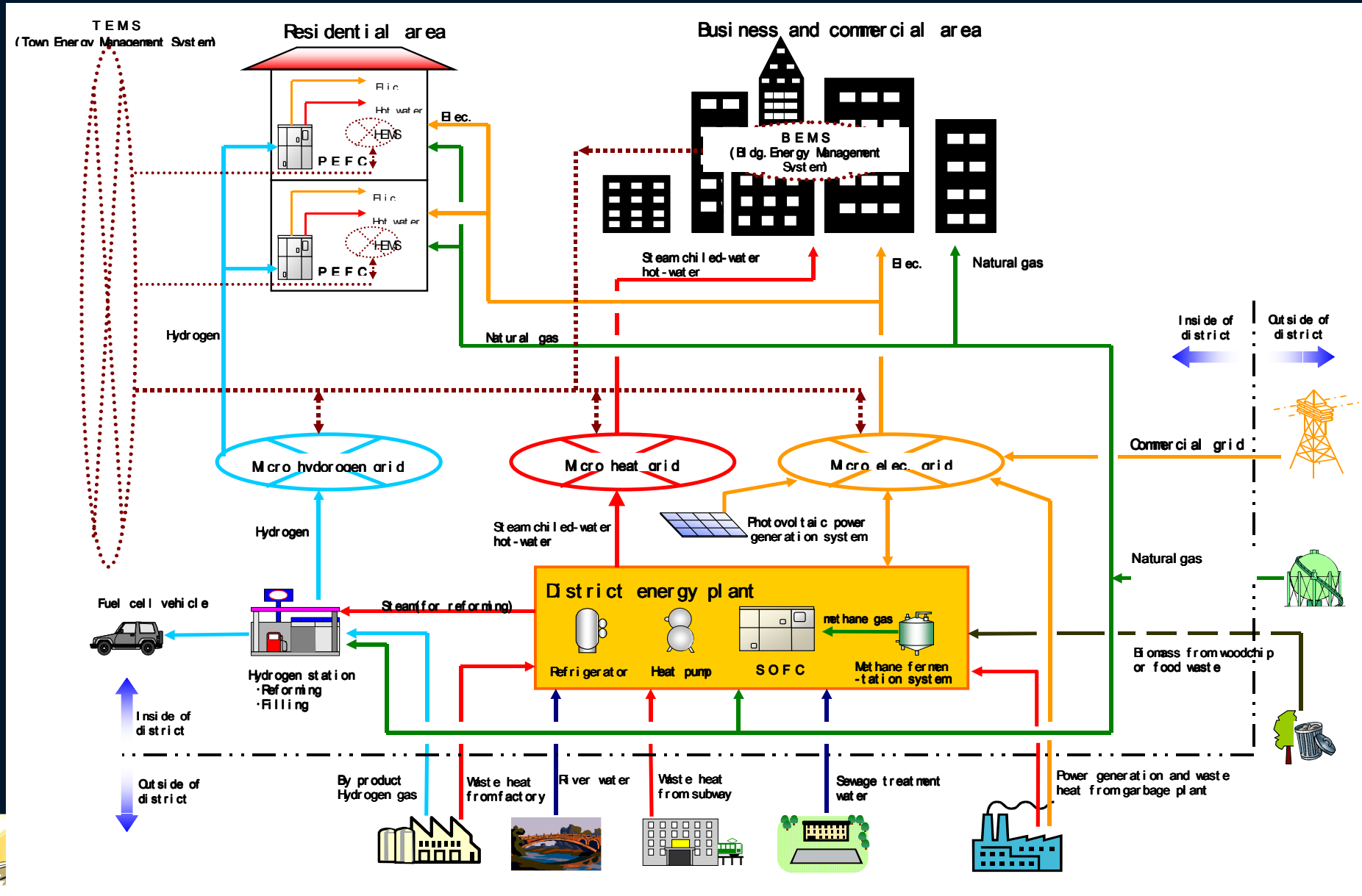
Development of different scale energy network systems and their interconnections





# 3-2. Energy System in 2030

Outline of Energy System in 2030



### 3-3.Future Direction of Sustainable City and its Associated Energy System

**“Compact City”** where self-sustained district with well-defined boundary is located widely.

**Phase-in of “Energy Cluster”** which makes sure the best way of energy consumption

**Features of “Compact City”**

- Intensive activity with high density and mix of use
- Various districts with well-defined boundary

**Features of “Energy Cluster”**

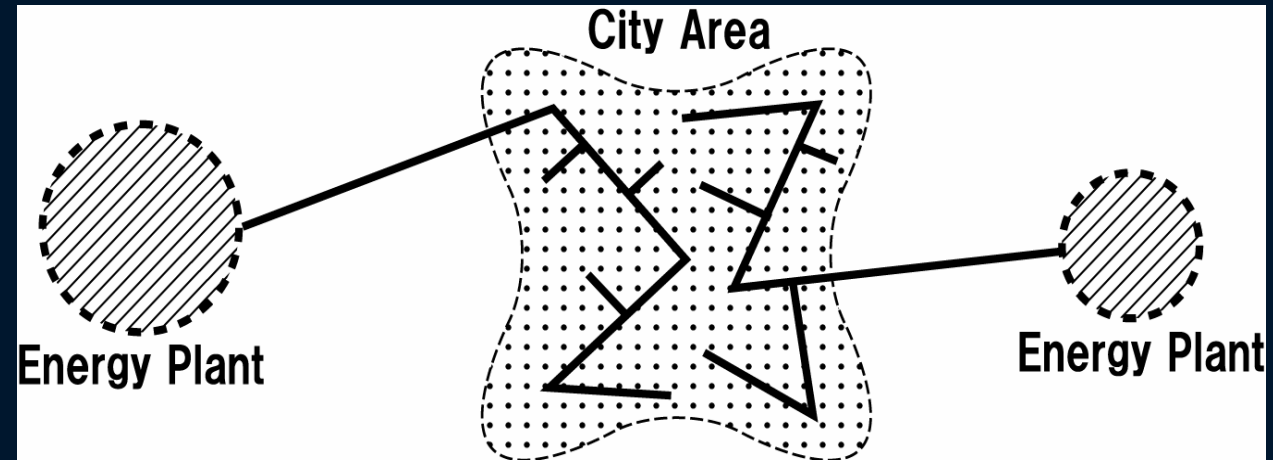
- Energy supplies on demand site
- Various energy source
- Well-managed supply and demand control

**Set up the energy source in the city!**

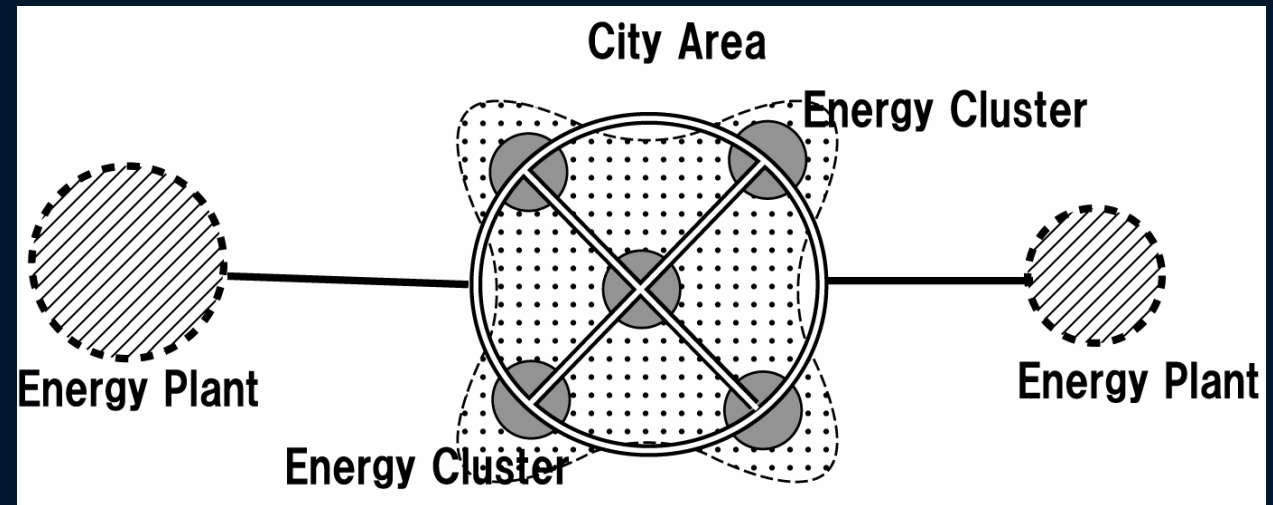
## 2-3.Future Direction of Sustainable City and its Associated Energy System

### ~ Comparison between conventional and new energy system ~

◆ Conventional system



◆ New energy system



### 3-3.Future Direction of Sustainable City and its Associated Energy System

**Set up the energy source in the city!**



- **Reduction of CO2 emission in the whole city by effective use of energy**
- **Dedication to the Sustainable Urban Structure with the association of urban regeneration and energy renovation**
- **Creation of environmentally friendly community by the on demand energy control system and the enhancement of people's conscious for energy**
- **Upgrading of energy security in case of emergency by self-reliant type energy sources**