Appendix 2

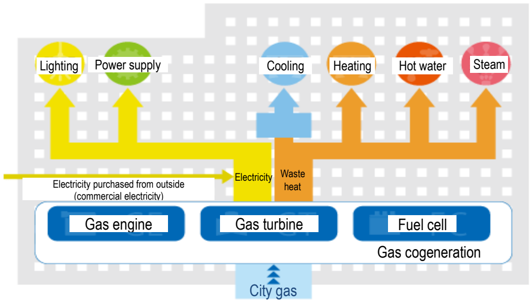
Low Carbon Measures Along With Case Examples

(1) Cogeneration System

Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication	Minor Classi-fication		I	II	III	IV
Supply side	Generating/ distributing power	Infrastructures for generating/ storing Power	Cogene-ration System	H	H	L	L

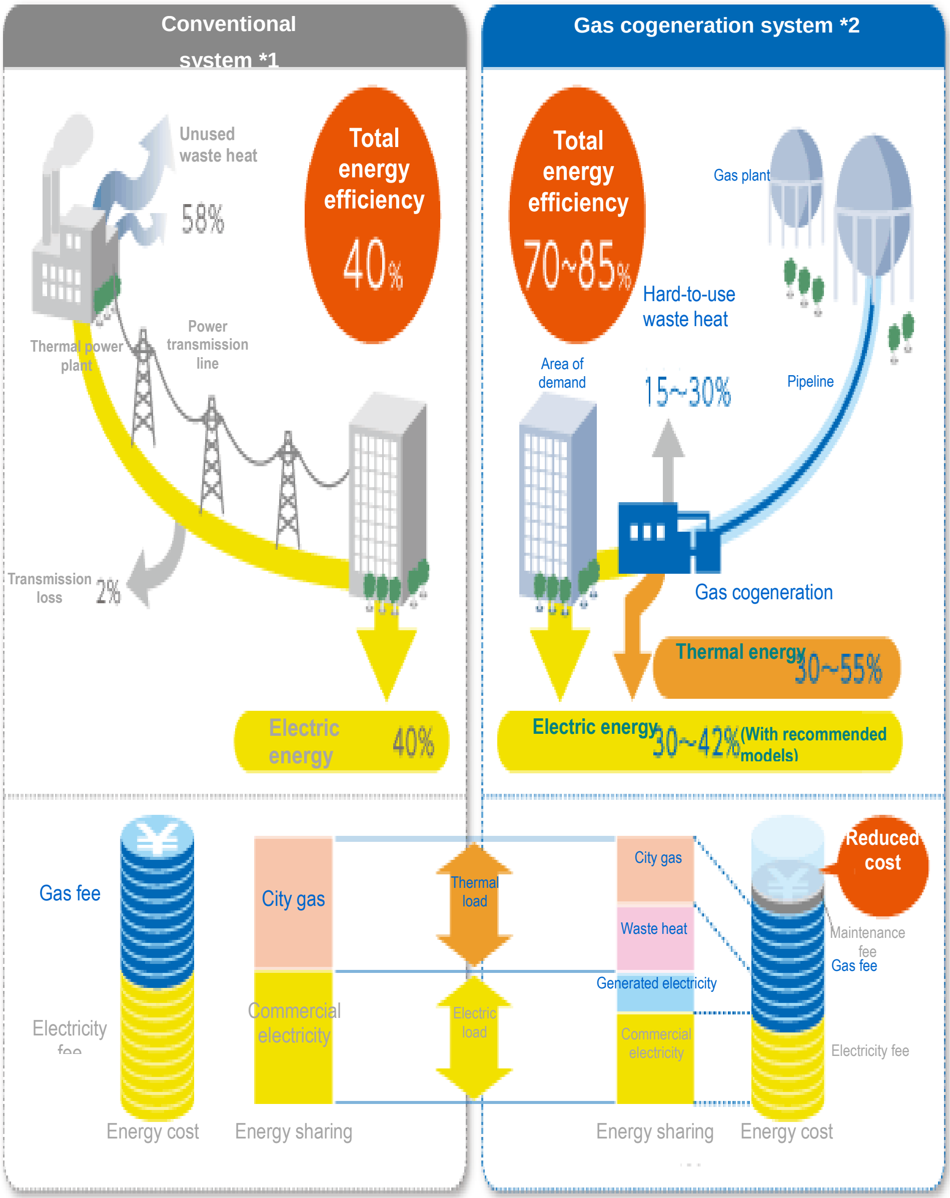
Overview of Measures and Applicability
• Cogeneration is a system that generates electricity where needed using city gas for fuel, and at the same time makes efficient use of generated heat for cooling, heating, hot-water supply, steam etc. • Cogeneration has a wide range of application for a variety of areas and systems that use heat, including those for households/businesses, large cities, middle cities and farming villages etc., as well as district cooling/heating (district-scale use) and smart energy systems etc. • As for its application in farming villages, there are cases where this system is used as a tri-generation using electricity, heat and CO_2 for greenhouse cultivation. •
Expected CO_2 Reducing Effect
• Compared with conventional systems (thermal power + boilers), it can reduce CO_2 emissions by about 30-40%.
Examples of Application
• Around 5 million kW in total has been introduced in Japan (in stock).
Schematic Diagram of the System etc.

- A schematic diagram of the system



The generated electricity is combined with that purchased from outside and is supplied into the building.

- The energy/cost-saving performance of gas cogeneration



*1 LHV standard. The thermal efficiency and total loss of thermal power plants were calculated on the basis of the operation performance of nine (9) power utilities and wholesale power utilities in 2003FY (The Working Group on Energy-Saving Standards, September 2005).

*2 The efficiency of gas cogeneration system is an example based on LHV standard.

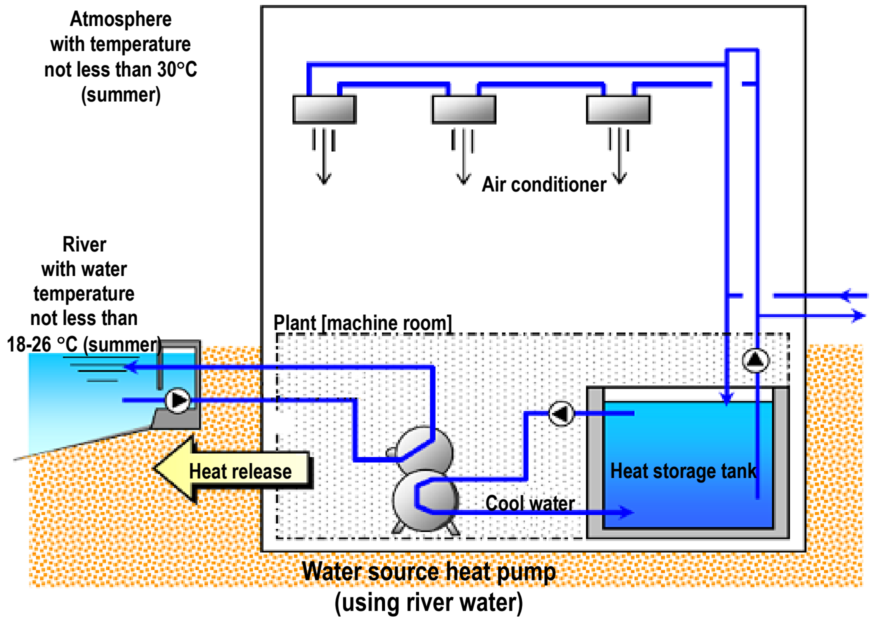
(2) Using sea/river water

Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication	Minor Classi-fication		I	II	III	IV
Supply side	Untapped energy		Using sea/ river water		H	M	L

Overview of Measures and Applicability
• As sea/river water temperature is stable and is lower in summer and higher in winter than the atmospheric temperature, it will contribute to improving energy efficiency both as a coolant of heat pumps used in heat source equipment for cooling and as a heat source water of heat pumps for heating/hot-water supply. • As the use of seawater requires countermeasures for salt damage to equipment and for marine organisms, and the use of river water requires drought management measures etc., it is a common practice to combine the use of sea/river water with large-scale facilities such as district heat supply systems.

Expected CO_2 Reducing Effect
• It is expected that CO_2 will be reduced through improving energy efficiency in cooling/heating and hot-water supply in the relevant communities. •

Examples of Application

Schematic Diagram of the System etc.	
	 A system making use of the temperature difference from river water Source : "An Investigative Report on District-Scale Energy Use", March 2005

(3) District heating and cooling (DHC)

Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication	Minor Classi-fication		I	II	III	IV
Supply side	District energy (heat supply)		District heating and cooling (DHC)		H	M	L

Overview of Measures and Applicability

- It connects multi-purpose buildings in certain regions via regional conduits, and supplies cooling/heating media from regional energy supply plants in an efficient manner.
- By means of this system, not only energy-saving but also energy security and urban aesthetic can be promoted, which include labor-saving, efficient use of building spaces, pollution-abatement, heat-island countermeasures, prevention of urban disasters etc.

Expected CO2 Reducing Effect

- Compared with individual (heat source) systems, primary energy consumption can be reduced by 10%-14%*. Further reduction of energy consumption (by not less than 20%) can be realized by utilizing unused energy, contributing to a significant reduction of CO2.

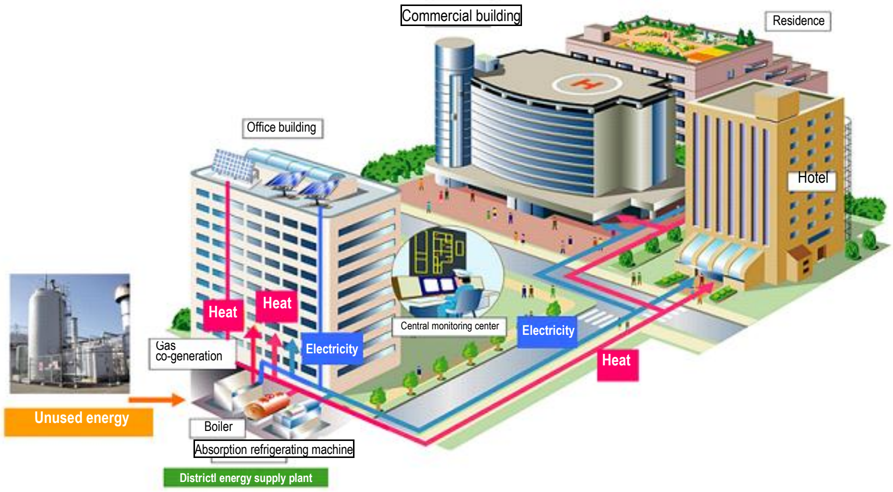
* "District-Scale Utilization of Unused Energy - the Current Status of Heat Supply and the Direction towards the Next Generation", Ministry of Economy, Trade and Industry (March 2008)

Examples of Application

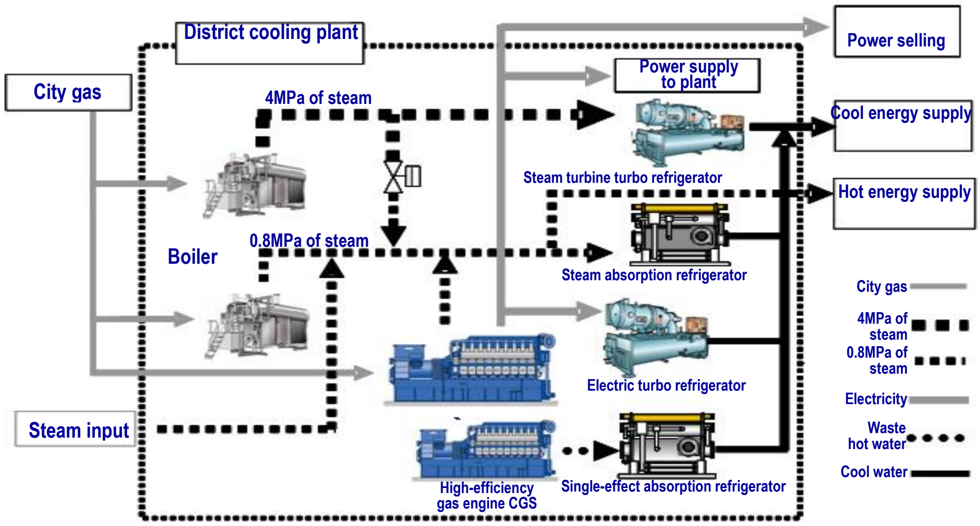
Shinjuku Sub-center, Marunouchi District, Osaka Senri New Town Chuo District etc.

Schematic Diagram of the System etc.

- Schematic Diagram of the System



- An Example of a Regional Cooling/Heating Plant



(4) Sunlight shading and thermal insulation

Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication	Minor Classi-fication		I	II	III	IV
Demand side	Building	Reducing load (Thermal)	Sunlight shading and thermal insulation				

Overview of Measures and Applicability

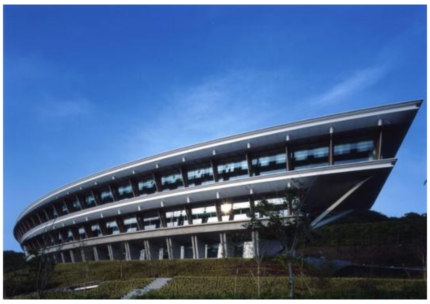
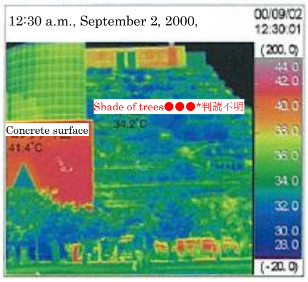
- Sunlight shading is very effective in reducing thermal load put into a building from outside. As the solar elevation changes according to its bearing, the type of suitable eaves or blinds also varies. In planning sunlight shading, it is necessary to take the building exterior into account so that the sunlight would be effectively shaded.
- Shutting off sunlight on the outer side of a building is more effective. External blinds installed on the outer side of a building would help reduce the thermal load in the rooms. They also play the role of adjusting natural lighting when the blinds are designed to change their angles automatically according to the solar elevation.
- Planting vegetation around a building cuts direct sunlight off the concrete surface and takes effect on controlling the rise in the air temperature around the building because of evapo-transpiration effect.

Expected CO2 Reducing Effect

- Power consumption cut is expected due to the reduction of air conditioning load thanks to the lowered temperature inside the building and natural lighting. As a result, it takes effect on the reduction of CO2 emission.

Examples of Application

Itoman city Municipal Office, Institute for Global Environmental Strategies (IGES) Main office Building, Across Fukuoka (Commercial-Office-Cultural Complex)

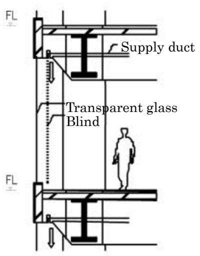
Schematic Diagram of the System etc.	
	●Itoman city Municipal Office   ●Institute for Global Environmental Strategies (IGES)   ●Across Fukuoka  

(5) Façade engineering

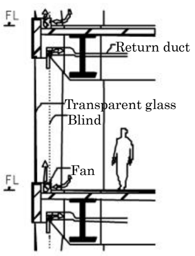
Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication	Minor Classi-fication		I	II	III	IV
Demand side	**Buildings**	**Reducing load (Thermal)**	**Façade engineering**				

Overview of Measures and Applicability
• The façade engineering refers to the technology of reducing thermal load from outside by applying high heat characteristics to the window and outer wall which constitute a façade. • The important component is high performance glass, such as the duplex glass containing air space between two pieces of glass and low-e glass with specific coating for blocking the radiation heat from traveling through. These types of glass also enhance indoor environmental performance around the windows. • One possible approach is the "Air flow windows". They improve the thermal insulation properties and sunlight shading around a bow window by creating a kind of air curtain by ventilating inside the double-layered glass equipped with a built-in blind. Ordinarily, room air is sucked from beneath the glass window and the air inside the double-layered glass is led to under the ceiling with a ventilation fan mounted under the ceiling.
Expected CO2 Reducing Effect
• Diagrams below show the simulation examples of PMV when using ordinary glass only and using low-e glass plus eaves, the peak load of the perimeter, and annual thermal load. The result shows that the employment of eaves plus low-e glass cuts the peak load by 43%, indicating that approximately 16% of thermal load will be slashed annually.
Examples of Application
Iidabashi First Building, etc.

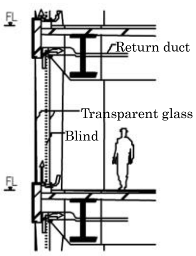
Schematic Diagram of the System etc.



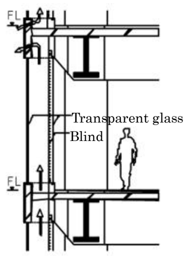
The load around the window is handled by the air conditioner. In winter, some devices such as a panel heater is required because cold draft is generated.



By creating an air curtain barrier between the glass and the blind by a fan, the thermal load generated around the window is collected in order to cut in-room load.



The thermal load around the window is contained inside the Air Flow, and then collected by the air taken from the slits of sashes in the room in order to cut in-room load.



In summer, open air is taken in from the slits on the outer wall to naturally ventilate thermal load accumulated inside the double skin. In winter, open air is shielded off to collect heat.

Iidabashi First Bldg.

PCP Marunouchi

JR East Japan Head Office

Chiba Prefecture Autonomous Hall

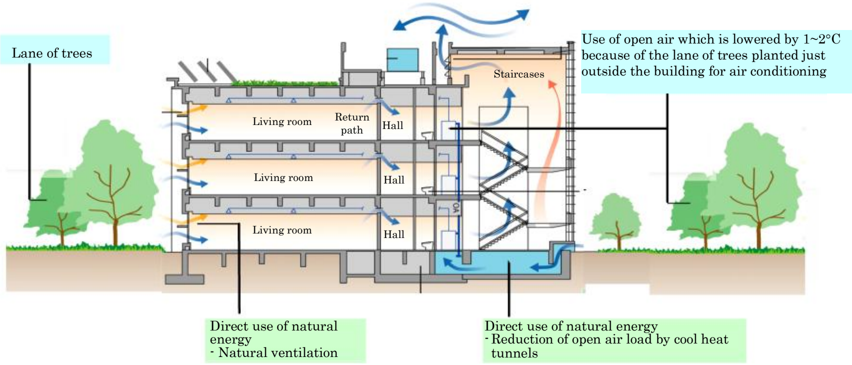
(6) Natural ventilation

Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication	Minor Classi-fication		I	II	III	IV
Demand side	**Buildings**	**Reducing Load (Thermal)**	**Natural ventilation**				

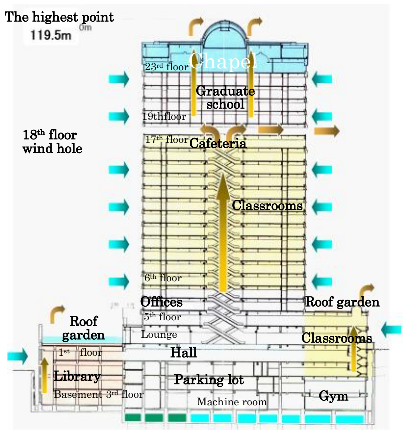
Overview of Measures and Applicability
• The mid-term air-conditioning energy can be reduced by planning to take natural wind into rooms, for instance by installing apertures or opening-closing windows effectively or natural ventilation voids inside the building. • The void enables natural air flow even when it is calm. (The natural ventilation by the difference in temperatures between tops and bottoms.) Moreover, natural ventilation can be effectively obtained no matter which direction the wind blows. (The wind shielding board prompts natural ventilation as negative pressure zone is created when the wind flows through the upper part). Example: Meiji University Liberty Tower (Top figure) • Natural ventilation using the staircases can also produce the same effect as installing natural ventilation voids and wind shielding boards. (When air is calm, ventilation is enabled naturally by the difference in temperatures between upper and lower part of the staircases. When a wind shielding board is mounted on the top, a negative pressure zone is created as the wind passes through the upper part, thereby allowing natural ventilation free of the wind direction. (Bottom figure)
Expected CO2 Reducing Effect
• Reduction of CO_2 as a result of reduced air conditioning load
Examples of Application
Meiji University Liberty Tower

Schematic Diagram of the System etc

● Natural ventilation using the staircases



● Meiji University Liberty Tower



(7) Daylight use plus lighting system

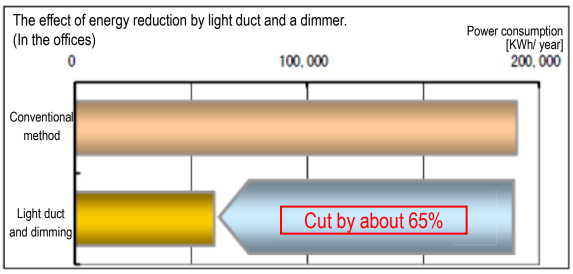
Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication	Minor Classi-fication		I	II	III	IV
Supply side	**Building**	**Reducing load**	**Daylight use plus lighting system**				

Overview of Measures and Applicability

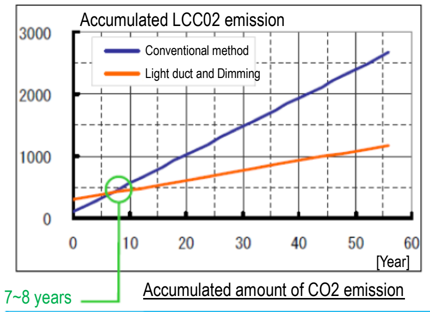
- The light from the window is limited in its reach, or no lighting is available if there is no window in the room. However, natural light can be reached to the darker areas in the building by using a light duct. The illustrations given below show the system of a light duct using aluminum mirror with 95% reflectivity of visible light for its inside in order to get the light transported from the light collection part to the light-releasing part.

Expected CO2 Reducing Effect

- The system of using light ducts shown below is effective in cutting the annual electricity consumption by approximately 65% over the conventional systems. It is noted that the Life Cycle (LC) CO2 can be recovered in 7 to 8 years.



Amount of annual electricity consumption for illumination



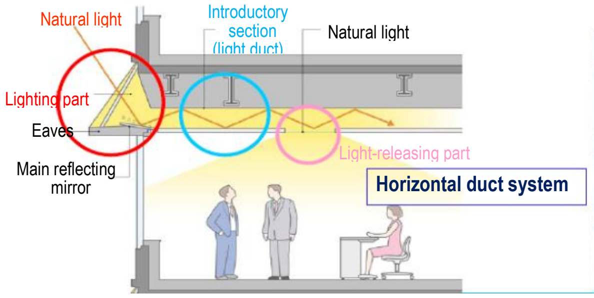
Accumulated amount of CO2 emission

Examples of Application

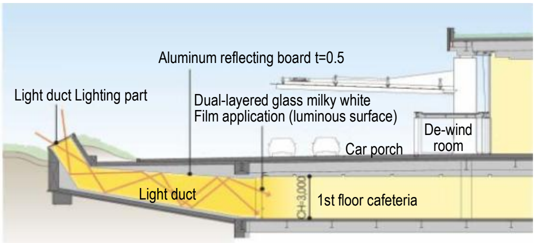
Japan Aerospace Exploration Agency (JAXA), Tsukuba Space Center (TSC), Toyota Motor Corporation Office Main Building

Schematic Diagram of the System etc.

- Example of using light duct in offices (JAXA, TSC)



- Using example in the basement cafeteria (Toyota Motor Office Main Building)

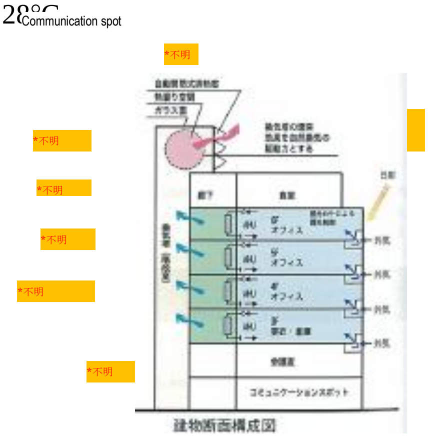


(8) Hybrid of natural ventilation plus air conditioning

Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi- fication	Minor Classi- fication		I	II	III	IV
Supply side	**Building**	**Reducing load (Thermal)**	**Hybrid of natural ventilation plus air conditioning**				

Overview of Measures and Applicability

- As an air conditioning facility system incorporated into a building, it is a hybrid air conditioning system which combines three types of air conditioning systems, air current feeding by the ceiling fan, floor blow-out air conditioning as well as the natural ventilation.
- A ceiling fan generates gentle air current by stirring a large amount of wind with less electricity. It can realize a comfortable space at 28°C even in summer.



Cross-sectional view of building

Expected CO2 Reducing Effect

- Air conditioning load can be reduced by making natural ventilation as the principal approach. Further CO_2 reduction can be expected by employing a human sensor or an automatic light dimmer for making the best of daytime light along with natural ventilation.

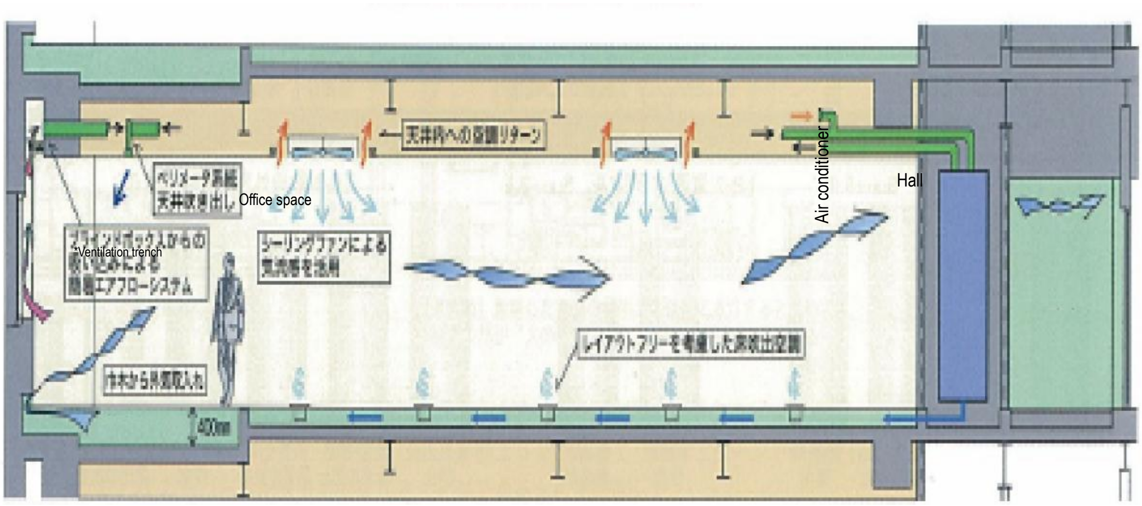
Examples of Application

Sakai Gas Building

Schematic Diagram of the System etc.

- Sakai Glass Building

- Hybrid AC ventilation system using natural ventilation and ceiling fans



Source) CASBEE Studies on Actual Examples, JSBC, 2005

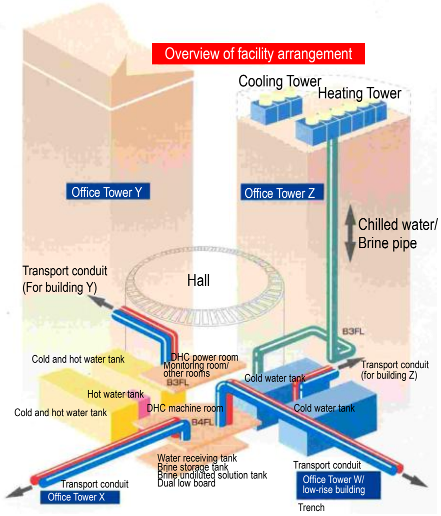
(9) High-efficient heat source plus heat storage

Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication	Minor Classi-fication		I	II	III	IV
Supply side	**Building**	**High-efficient Facility systems**	**High-efficient heat source plus heat storage**				

Overview of Measures and Applicability
• In an intensive and high density district development on a large scale, a system of generating cold/hot water and steam at the central plant in the district and supplying them to individual buildings can better contribute to the realization of a low-carbon society by making the best of scale merit. • The central plant in the district is divided into three categories. 1) Electricity system: a system of generating cold and hot water by using turbo chillers, heat pump chiller, etc. 2) Gas system: a system of generating cold water and steam by gas-absorption chillers or steam absorption chillers using the co-generated (CHP) steam exhaust heat. 3) Electricity/gas combination system: a system of generating cold water, steam (hot water) by combining 1) electric heat source and 2) gas heat source. • There are systems which combine one of the above-mentioned systems with unused energies such as river water, sewage heat, exhaust heat from waste incineration plants, and so on.
Expected CO2 Reducing Effect
• The use of highly efficient district air conditioning and heating allows the reduction of air conditioning load, which is expected to reduce CO2 emission significantly. • Furthermore, the reduction of CO2 emission in per unit can be expected by storing heat energy in thermal storage tanks with the use of night time electricity.
Examples of Application
Harumi Island, Triton Square

<table>
<tr><th colspan="2">Schematic Diagram of the System etc.</th></tr>
<tr><td></td><td>

- Harumi Island area



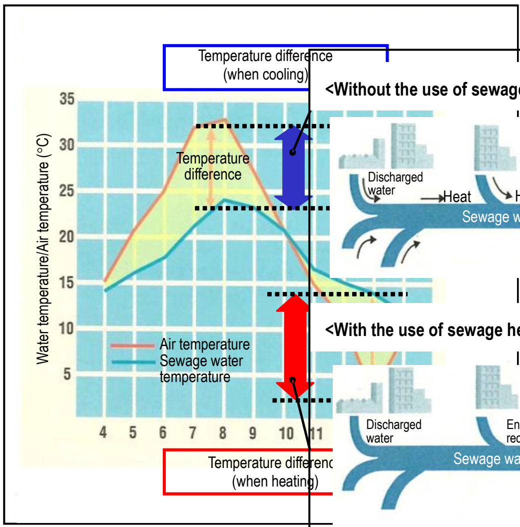
</td></tr>
</table>

(10) Waste heat from sewage treatment plant

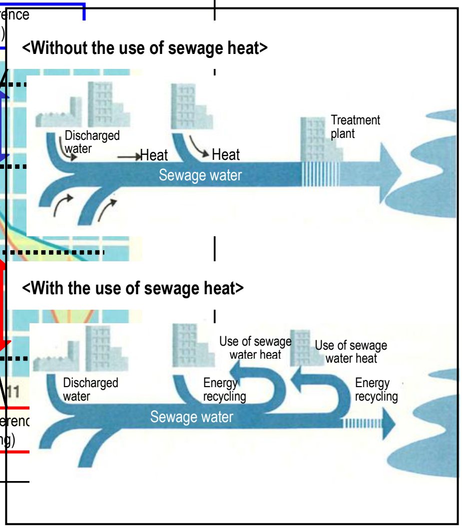
Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication	Minor Classi-fication		I	II	III	IV
Supply side	Untapped energy		Using Waste heat from sewage treatment plant		H	M	L

Overview of Measures and Applicability
• As sewage water temperature is lower in summer and higher in winter than the atmospheric temperature, it will contribute to improving energy efficiency both as a coolant of heat pumps used in heat source equipment for cooling and as a heat source water of heat pumps for heating/hot-water supply. • Using sewage water heat means the reuse of city waste heat, and it may be regarded as a recycling-oriented city energy system. • It is necessary to pay attention to the balance between the heat supply source and the heat load from cooling/heating as well as hot-water supply, considering such regional conditions as the amount of sewage water, daily/seasonal variations in temperature and interfusion of snow-melt water. In addition, as heat demand also varies in terms of time period and season, this variation should be reduced by installing heat storage tanks. • Moreover, it requires corrosion-resistant treatment of the related equipment based on the water quality, as well as strainers for removing foreign matters contained in the sewage water.
Expected CO2 Reducing Effect
• It is expected that CO2 will be reduced by means of improving energy efficiency in cooling/heating and hot-water supply in the relevant communities.

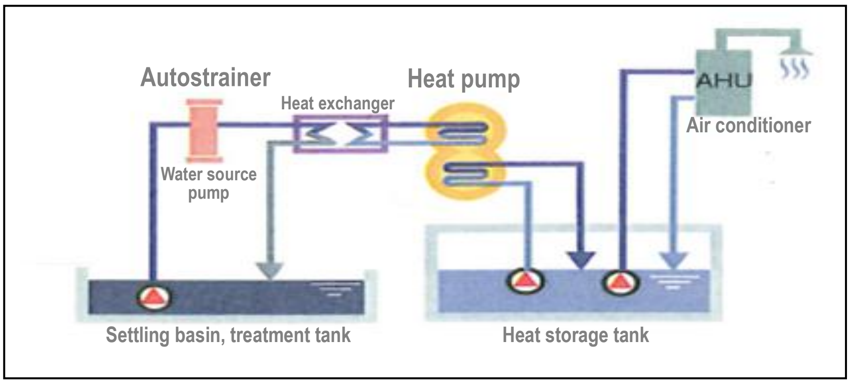
Examples of Application
Schematic Diagram of the System etc.



<An image of temperature variation in sewage water and atmosphere>



<A heat cycle using sewage water heat>



<A schematic diagram of a heat pump system using sewage water heat>

(11) Hydroelectric power generation

<table>
<tr><th colspan="3">Classification of Measures</th><th rowspan="2">Low Carbon Measure</th><th colspan="4">Applicability as per Type of Town</th></tr>
<tr><th>Supply/ Demand</th><th>Major Classi-fication</th><th>Minor Classi-fication</th><th>I</th><th>II</th><th>III</th><th>IV</th></tr>
<tr><td>Supply side</td><td>Renewable energy</td><td></td><td>Hydroelectric power generation (Small and middle scale)</td><td></td><td>L</td><td>L</td><td>M</td></tr>
<tr><th colspan="8">Overview of Measures and Applicability</th></tr>
<tr><td colspan="8">• In principle, introduction of renewable energy power generation systems will lead to the reduction of carbon dioxide emissions etc. However, because of the fact that the cost and efficiency are dependent on such factors as the climate condition and administrative support measures in the relevant regions, and the generated amount of electricity is highly variable, it is a common practice to combine hydroelectric power with large-scale power generation and energy storage systems.
• Small and middle scale hydroelectric power generation generally makes use of water without storing it. Depending on the method of water use and the structure for gaining a head of water, several forms exist.
• Small and middle scale hydro power generation carries a heavy burden of electrical equipment costs. It takes a greater share of the total construction cost in comparison to large scale hydro power generation.
• In addition to the systems utilizing the nearby rivers, the cases can be assumed where hydroelectric power generation systems are installed as a form of agricultural drainage facility in farming villages.</td></tr>
<tr><th colspan="8">Expected CO2 Reducing Effect</th></tr>
<tr><td colspan="8">• It is expected that CO2 will be reduced by means of increasing electricity generation from renewable source.</td></tr>
</table>

Examples of Application
Schematic Diagram of the System etc.

■A run-of-river type power station
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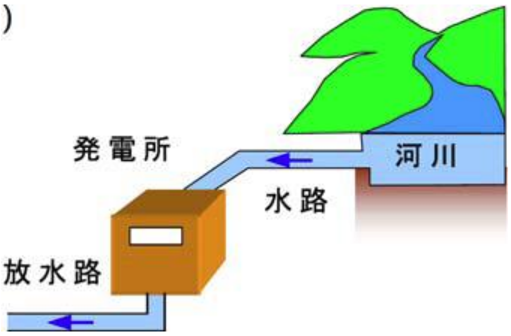
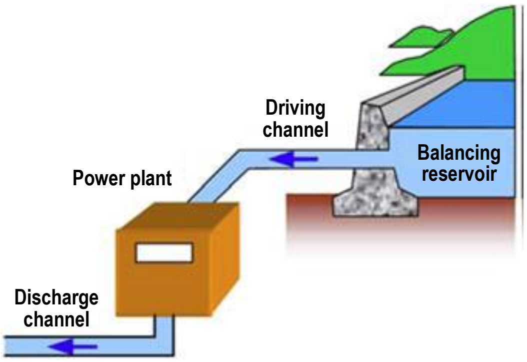


■A reservoir type power station



(NEDO's White Paper on Renewable Energy Technologies)

(12) Waste heat from incineration plants

Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication	Minor Classi-fication		I	II	III	IV
Supply side	Untapped energy		Using Waste heat from incineration plants		H	M	M

Overview of Measures and Applicability

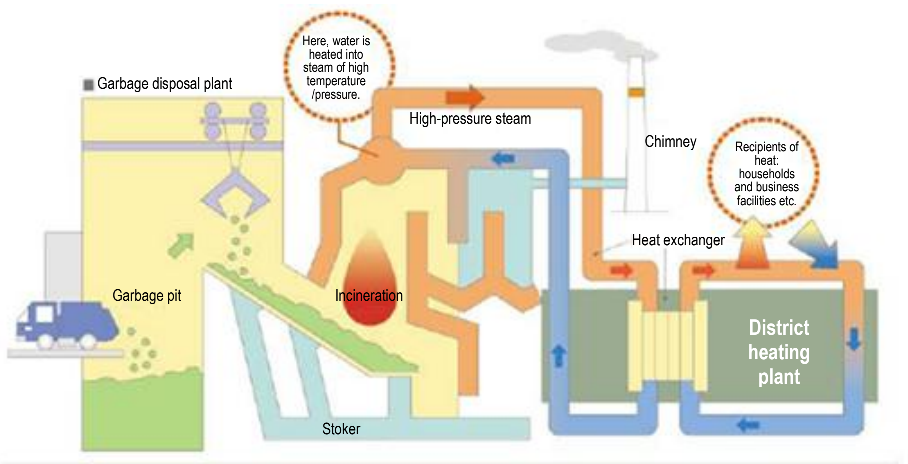
- The exhaust gas from refuse incineration at garbage disposal facilities has a high temperature and it can be utilized for power generation and as an infrastructure for heat supply.
- As garbage disposal facilities are often built away from residential areas, it is necessary to develop a sitting plan which facilitates heat use, on the basis of garbage disposal facilities as an infrastructure for energy supply.

Expected CO2 Reducing Effect

- It is expected that CO2 will be reduced by means of improving energy efficiency in each region through power generation from unused energy and utilization of surplus waste heat.

Examples of Application

Schematic Diagram of the System etc.



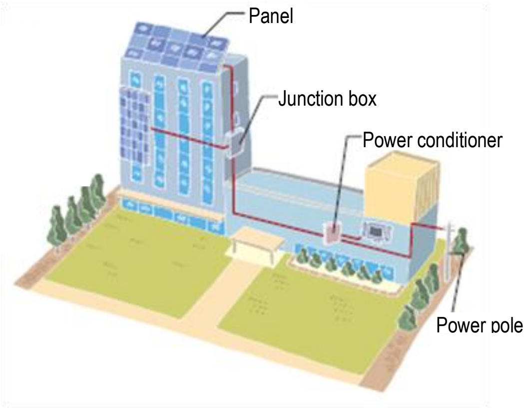
(13) Solar power generation

<table>
<tr><td colspan="3">Classification of Measures</td><td rowspan="2">Low Carbon Measure</td><td colspan="4">Applicability as per Type of Town</td></tr>
<tr><td>Supply/ Demand</td><td>Major Classi-fication</td><td>Minor Classi-fication</td><td>I</td><td>II</td><td>III</td><td>IV</td></tr>
<tr><td>Supply side</td><td>Renewable energy</td><td></td><td>Solar power generation</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td colspan="8">Overview of Measures and Applicability</td></tr>
<tr><td colspan="8">• In principle, the cost and efficiency of renewable energy power generation depend on such factors as the climate condition and administrative support measures in the relevant regions. Since the generated amount of electricity is highly variable, it is a common practice to combine the renewable power generation systems with conventional power generation and energy storage systems.
• Solar photovoltaic power generation is a collective term for technologies using semiconductors to convert light energy into electricity. Semiconductors (solar cells) can be classified into the types using multi-crystalline silicon, thin film silicon, chemical compound/organic etc. Solar power generation ranges from large-scale power generation systems to middle- and small-sized power generation systems for industry and household use.
• Compared with other renewable energy power generation systems, this system has an advantage in terms of the ease of installation and maintenance, and no conditions for installation. On the other hand, it has the highest introduction cost per unit of electricity generated.
• A certain amount of energy output can be expected where solar insolation is obtained, and this system has a wider applicability than solar heat power generation or wind power generation systems.</td></tr>
<tr><td colspan="8">Expected CO2 Reducing Effect</td></tr>
<tr><td colspan="8">• It is expected that CO2 will be reduced by means of improving energy efficiency in electricity/heat generation in the relevant communities.</td></tr>
</table>

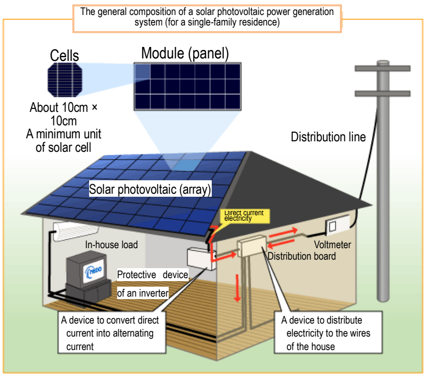
Examples of Application

Schematic Diagram of the System etc.

■A middle-sized power generation system



■A small-sized power generation system



(14) Solar heat

Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication	Minor Classi-fication		I	II	III	IV
Supply side	Renewable energy		Using Solar heat	M	M	M	M

Overview of Measures and Applicability

- Utilizing the natural energy of solar heat for hot-water supply and cooling/ heating makes it possible to promote energy saving and CO2 reduction in buildings.
- Solar heat can be utilized for household and commercial use.

Expected CO2 Reducing Effect

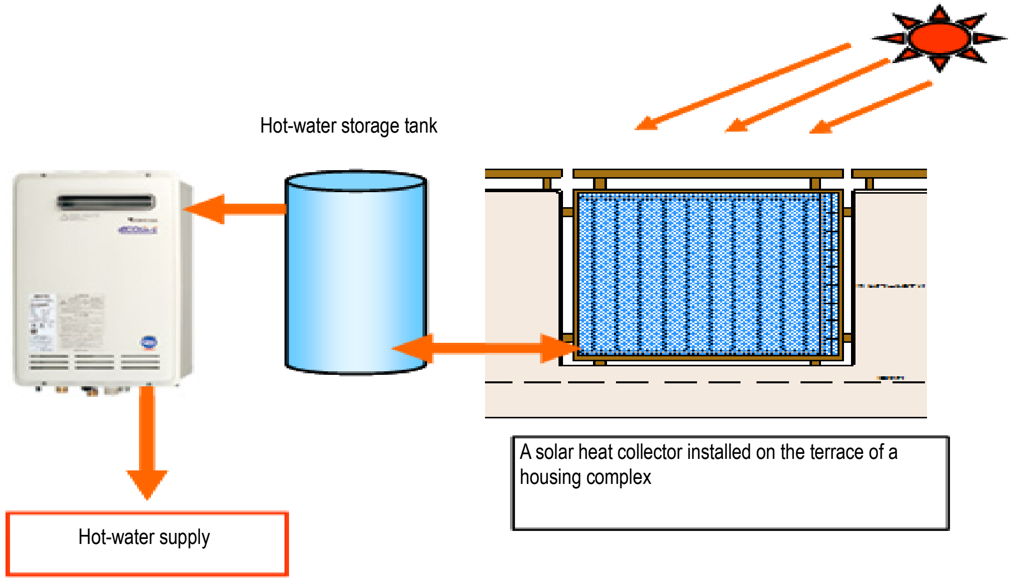
- Yearly gas consumption and CO2 emissions can be reduced by about 30% by using solar heat.

(Based on an average household of three family members in a housing complex; a trial calculation for a solar heat system with a heat collection area of $3m^2$, installed facing south.)

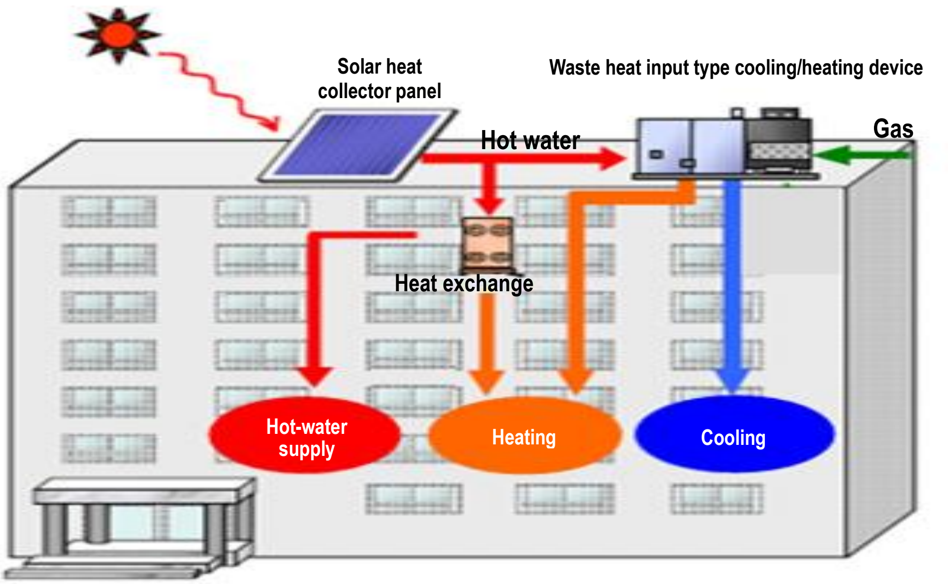
Examples of Application

A housing complex in Kawasaki, A office building in Kumagaya, Japan

Schematic Diagram of the System etc.
A combination of solar heat and gas hot-water heater systems (for household use)



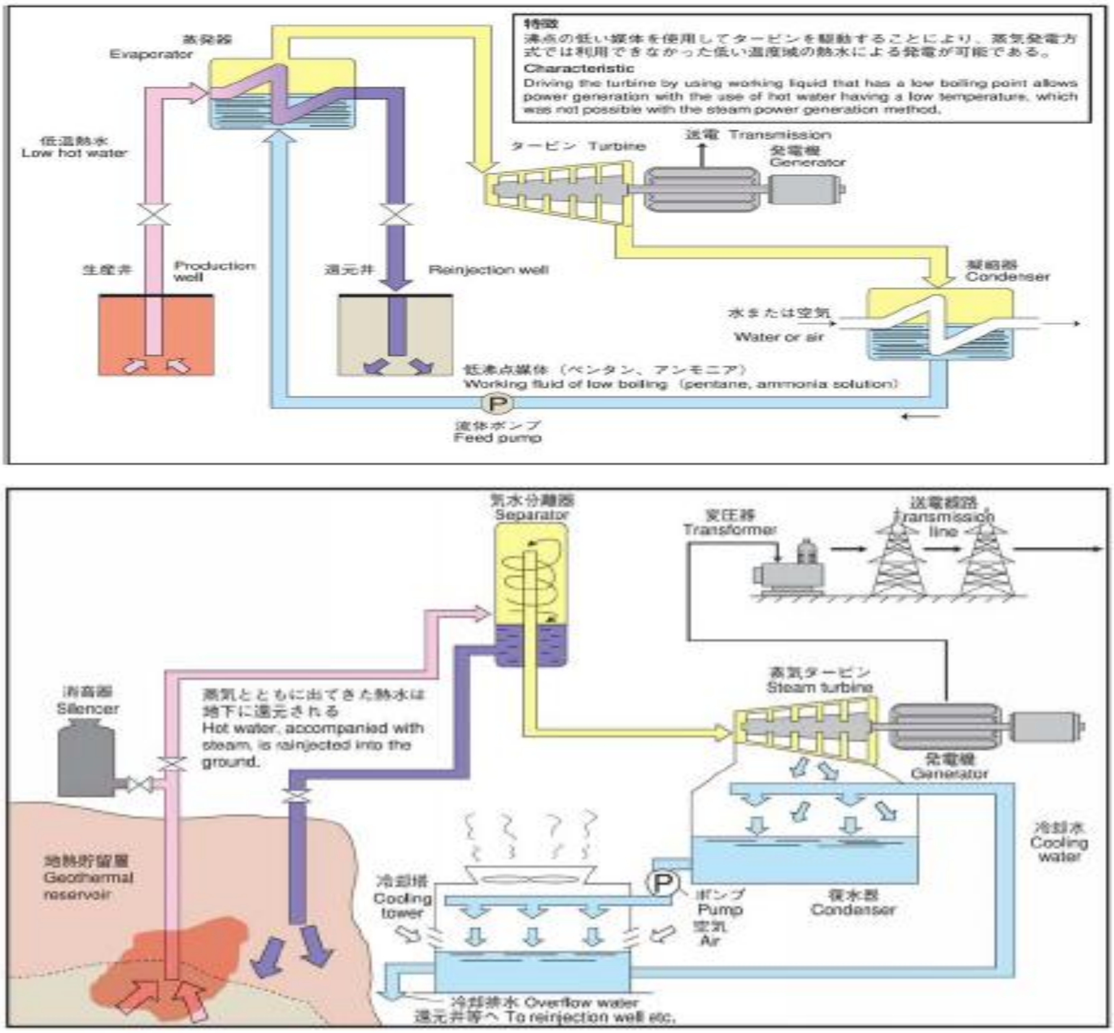
Use of solar heat for gas air-conditioning (for buildings)



(15) Geo-thermal power generation

Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication	Minor Classi-fication		I	II	III	IV
Supply side	Renewable energy		Geo-thermal power generation		L	L	M

Overview of Measures and Applicability
・Geo-thermal power generation is a collective term for power generation using geo-thermal energy. There are two different systems to convert thermal energy into electrical energy via steam turbines; a flash and binary system. ・Compared with other renewable energy generation systems, this system has an advantage in terms of energy stability, but it is necessary to take account of environmental risks (air pollution caused by releases of hydrogen sulfide etc.). ・The regions where this system can be applied are limited to those which can meet the criteria, namely, a specified amount of geo-thermal energy resource existing under the ground which can be developed at a reasonable cost.
Expected CO2 Reducing Effect
・It is expected that CO_2 will be reduced by means of using clean energy for electricity/heat generation in the relevant communities.
Examples of Application

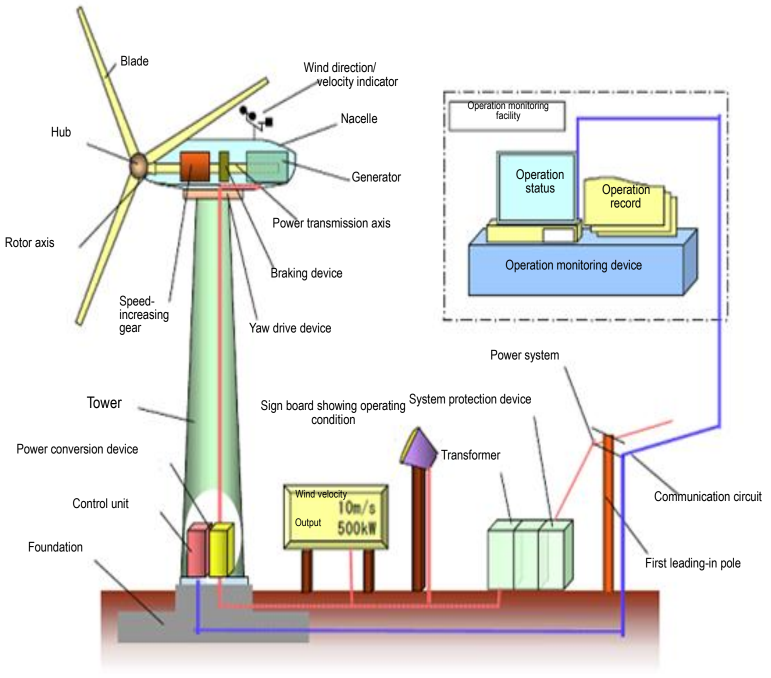
Schematic Diagram of the System etc.
■A geo-thermal power generation system (A binary system (upper) vs. a flush system (lower) – "White Paper on Renewable Energy", NEDO) 

(16) Wind power generation

<table>
<tr><th colspan="3">Classification of Measures</th><th rowspan="2">Low Carbon Measure</th><th colspan="4">Applicability as per Type of Town</th></tr>
<tr><th>Supply/ Demand</th><th>Major Classi-fication</th><th>Minor Classi-fication</th><th>I</th><th>II</th><th>III</th><th>IV</th></tr>
<tr><td>Supply side</td><td>Renewable energy</td><td></td><td>Wind power generation</td><td></td><td>L</td><td>L</td><td>M</td></tr>
<tr><th colspan="8">Overview of Measures and Applicability</th></tr>
<tr><td colspan="8">• Wind power generation is a collective term for technologies used to generate electricity by means of capturing wind energy with rotor blades and transferring the rotational energy to generators. This power generating system has various types depending on the structure of blades and size, but it can be roughly classified into large-scale wind power generation linked to the grid and middle- or small-scale wind power generation intended to be used within each region.
• Compared with other renewable energy generation systems, this system has an advantage in terms of low introduction cost per unit of electricity generated. On the other hand, it has a disadvantage of low energy efficiency in case of limited geographical conditions (dependent on wind conditions) or small-scale power generation.
• As wind energy increases in proportion to the wind velocity, it is highly probable that this system can be applied in regions with favorable wind conditions.</td></tr>
<tr><th colspan="8">Expected CO2 Reducing Effect</th></tr>
<tr><td colspan="8">• It is expected that CO2 will be reduced by means of using clean energy in electricity generation in the relevant communities.</td></tr>
</table>

Examples of Application

Schematic Diagram of the System etc.	
	■A wind power generation system (NEDO - "White Paper on Renewable Energy")



(17) Biomass Power Generation

Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication			I	II	III	IV
Supply Side	Renewable Energy		Biomass Power Generation		L	L	M

Overview of Measures and Applicability

- Biomass power generation is a collective term for power generation technologies using biomass (animal/plant resources and organic wastes from these resources) for direct incineration, heat decomposition, fermentation etc. The form of biomass can be roughly classified into unused resources (forest resources, agricultural residues etc.), waste resources (building materials, paper manufacturing materials, livestock manure, food residues etc.) and production resources (pasture grass, water plant, vegetable oil etc.).
- Suitable locations vary with the type of resources because biomass needs stable supply.

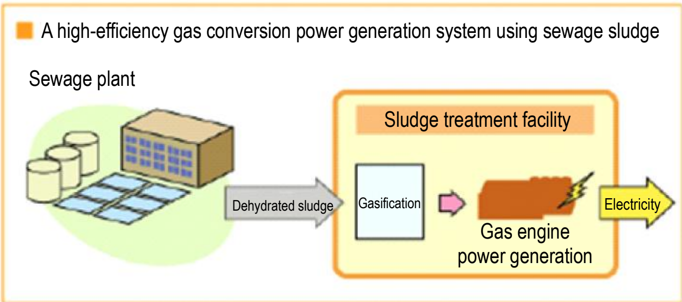
Expected CO2 Reducing Effect

- CO2 will be reduced through renewable power generation.

Examples of Application

Schematic Diagram of the System etc.

■A biomass power generation system (NEDO)



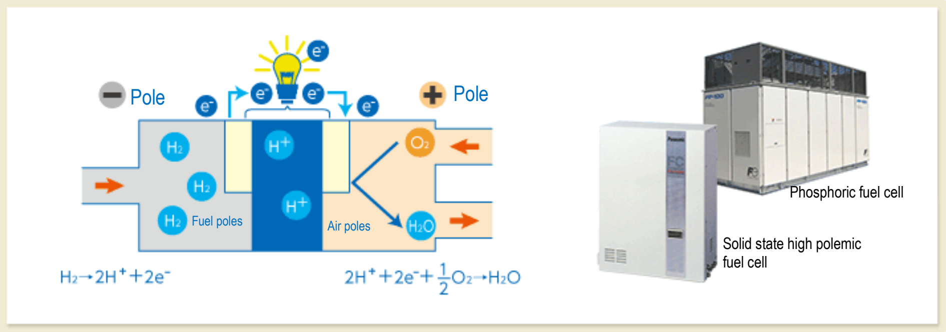
(18) Fuel cell

Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication	Minor Classi-fication		I	II	III	IV
Supply side	**Buildings**	**Equipment installed At facilities**	**Fuel cell**	**H**	**H**	**M**	**M**

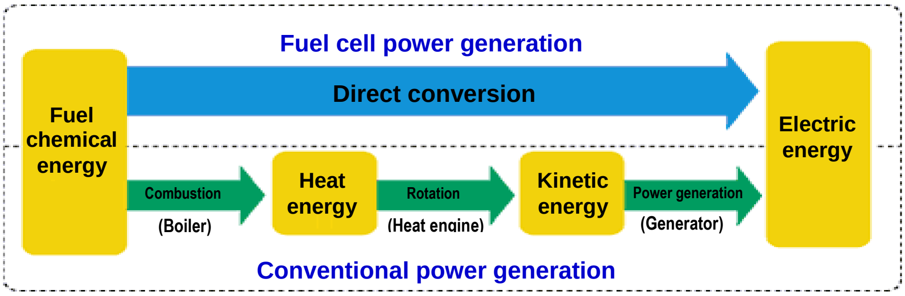
Overview of Measures and Applicability
• Electricity is generated by hydrogen taken out of natural gas, methanol, etc. and oxygen from air, while the heat concurrently generated is collected as steam or hot water. This is a highly efficient power generation because electricity is generated directly from hydrogen using an electrochemical reaction. • Fuel cell can be used for various uses and systems with different scales. • It also contributes to the reduction of peak time power consumption and the improvement of energy security.
Expected CO2 Reducing Effect
• Because power is generated as hydrogen and oxygen react to each other, water is the only substance that is formed. Although carbon dioxide (CO2) is generated while hydrogen is being produced, its generated amount is less while using the identical volume of electricity and heat, thanks to the high overall efficiency. • For an ordinary household of four people living in a house, CO2 can be reduced by approximately 40% per year compared to the conventional system (thermal power generation +boiler).
Examples of Application
• For buildings, automobiles, personal computers, etc.

Schematic Diagram of the System etc.

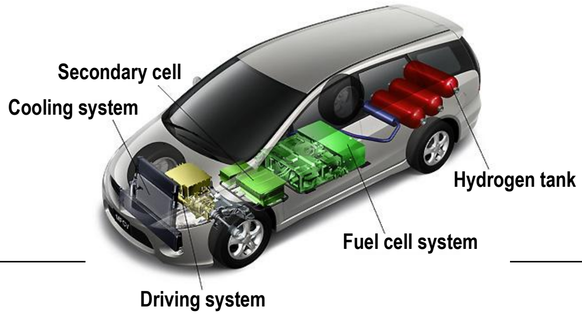
●Fuel cell system



●Power generation with fuel cell



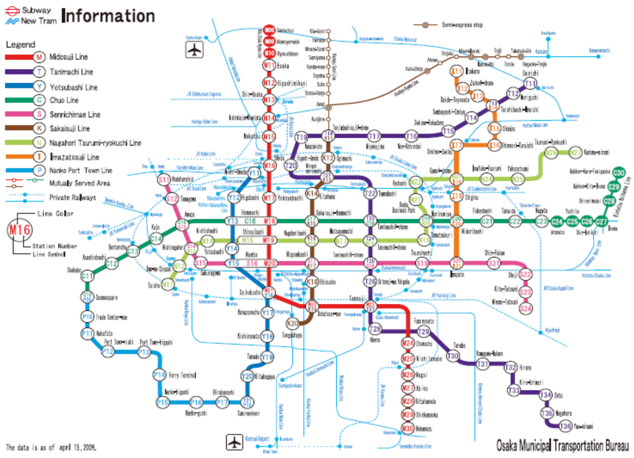
●Fuel cell cars



(19) Transportation (Establishment of public transportation network)

<table>
<tr><th colspan="3">Classification of Measures</th><th rowspan="2">Low Carbon Measure</th><th colspan="4">Applicability as per Type of Town</th></tr>
<tr><th>Supply/ Demand</th><th>Major Classification</th><th>Minor Classification</th><th>I</th><th>II</th><th>III</th><th>IV</th></tr>
<tr><td>Demand</td><td>Transportation system</td><td>Public transportation systems</td><td>Well developed Public Transportation Network</td><td>M</td><td>M</td><td>M</td><td>X</td></tr>
<tr><th colspan="8">Overview of Measures and Applicability</th></tr>
<tr><td colspan="8">• There are a variety of public transportation systems in cities. Typical transportation systems are subways, LRT, BRT, route buses, etc.
• By establishing a public transportation network which combines optimal public transportation systems based on the city size and the demand for transportation, low carbon urban life and sustainable cities must be realized through the use of public transportation with less CO2 emission.</td></tr>
<tr><th colspan="8">Expected CO2 Reducing Effect</th></tr>
<tr><td colspan="8">• As people use public transportation systems which emit less CO2 than automobiles do, its development contributes to curbing the amount of CO2 emission in cities.</td></tr>
<tr><th colspan="8">Examples of Application</th></tr>
<tr><td colspan="8">• There are a number of examples of well developed public transportation network in cities in the APEC region.</td></tr>
</table>

Schematic Diagram of the System etc.



Subway network of Osaka City, Japan

(BRT)

(UMRT)

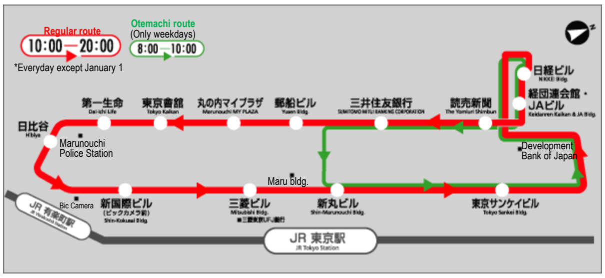
(BUS)

(LRT)

(20) Local Transportation System (Bus, LRT, etc.)

<table>
<tr><th colspan="3">Classification of Measures</th><th rowspan="2">Low Carbon Measure</th><th colspan="4">Applicability as per Type of Town</th></tr>
<tr><th>Supply/ Demand</th><th>Major Classi-fication</th><th>Minor Classi-fication</th><th>I</th><th>II</th><th>III</th><th>IV</th></tr>
<tr><td>Demand</td><td>Transportation system</td><td>Public Transportation System (Bus, LRT)</td><td>Intra-district Transportation system</td><td>H</td><td>H</td><td>H</td><td>L</td></tr>
<tr><th colspan="8">Overview of Measures and Applicability</th></tr>
<tr><td colspan="8">• The LRT, BRT, and buses are the public transportation systems that offer services in a part of city area such as CBD (Central Business District). The establishment of those systems would serve to improve convenience for the people who travel in the area.
• Although the carrying capacity is smaller than that of mass transportation systems such as subways, they can be established with less cost and the distance between stops can be set shorter as well, compared to subways.</td></tr>
<tr><th colspan="8">Expected CO2 Reducing Effect</th></tr>
<tr><td colspan="8">• As traveling by local public transportation becomes more convenient, people begin to use public transportation systems which emit less CO2 compared to cars. Therefore these measures are effective in curbing the amount of CO2 emission from inside cities.</td></tr>
<tr><th colspan="8">Examples of Application</th></tr>
<tr><td colspan="8">• There are a number of examples in cities in the APEC region.</td></tr>
</table>

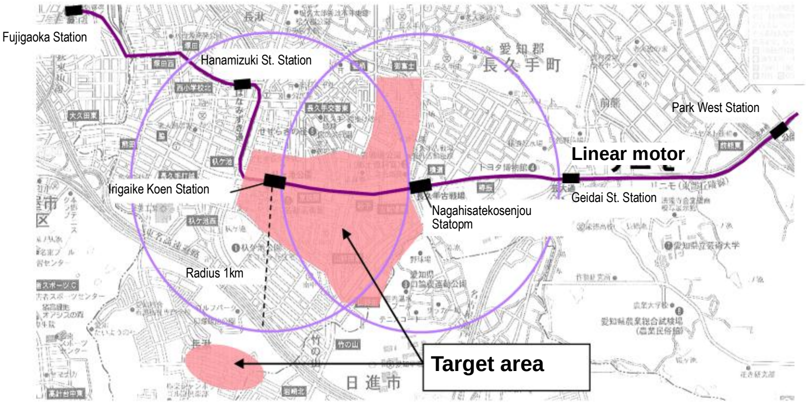
Schematic Diagram of the System etc.



(http://www.hinomaru.co.jp/metrolink/marunouchi/index.html)

FigBus Service Route & Vhechles in Tokyo CBD (Marunouchi)



http://www.linimo.jp/sonota/index.html#02

Fig　Light Rail System(Linimo) in Nagoya,Japan

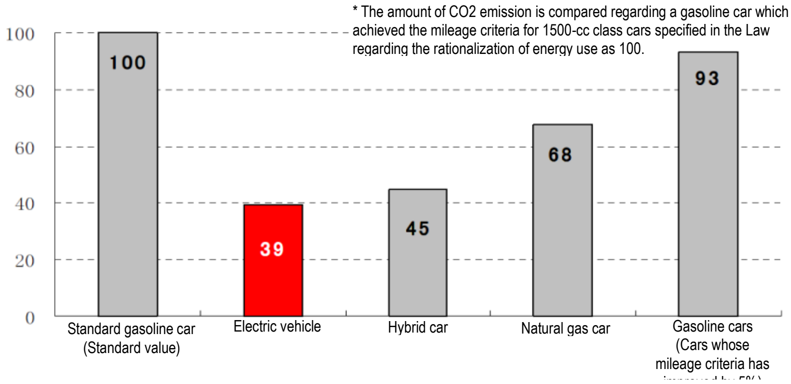
(21) Electric Vehicle

Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication	Minor Classi-fication		I	II	III	IV
Demand Side	**Transportation system**	**Vehicles**	**Electric Vehicle (EV)**	**M**	**M**	**M**	**M**

Overview of Measures and Applicability
• The wide use of electric vehicles will be promoted through improving the environment for the usage such as installing fast-chargers, and public relations activity for the EVs environmental performance over conventional cars, etc.
Expected CO2 Reducing Effect
• EVs don't run on fossil fuel such as gasoline unlike existing automobiles, and therefore, they serve to reduce the amount of CO_2 emission from traffic.
Examples of Application
• Introduction of EVs has already started in some economies in the APEC, even though it is in a small scale and for the experimental purposes. Recently, commercial production of EV has started for the use of general public.

Schematic Diagram of the System etc.

Electric Vehicle



Source: Information from Kanagawa Prefectural Government, Japan

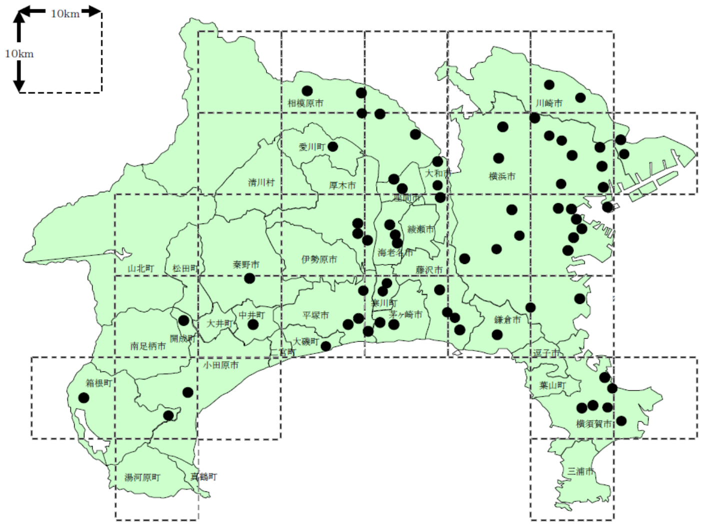
Comparison of CO_2 emission between gasoline cars and EVs (Comparison of 1500cc-class vehicles)

(22) Fast charger, Small-size storage battery

Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication	Minor Classi-fication		I	II	III	IV
Demand	**Transportation system**	**EV-related hardware**	**Fast charger, Small-size storage battery**	**M**	**M**	**M**	**M**

Overview of Measures and Applicability
• Fast chargers for electric vehicles will be installed taking their usage scenes and driving ranges into account. • The introduction of fast chargers will be promoted by grasping business opportunities such as city redevelopment projects, etc.
Expected CO2 Reducing Effect
• Compared to gasoline cars, the driving range of EVs is limited (approximately 160km with one full-charge), which exerts a significant influence on the sales of EVs. As fast chargers spread and small-size storage batteries are improved, the diffusion of EV will be boosted, which will, in turn, contribute to the reduction of CO_2 emission from traffic.
Examples of Application
• Installation has already started at parking lots, gasoline stations, and shopping malls, etc.

Schematic Diagram of the System, etc.

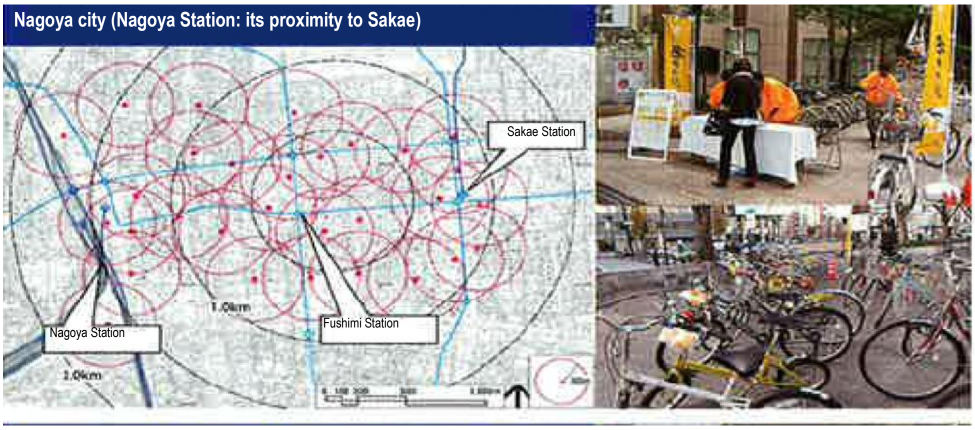


Source: Information Kanagawa Prefectural Government

Installation points of fast chargers in Kanagawa Prefecture

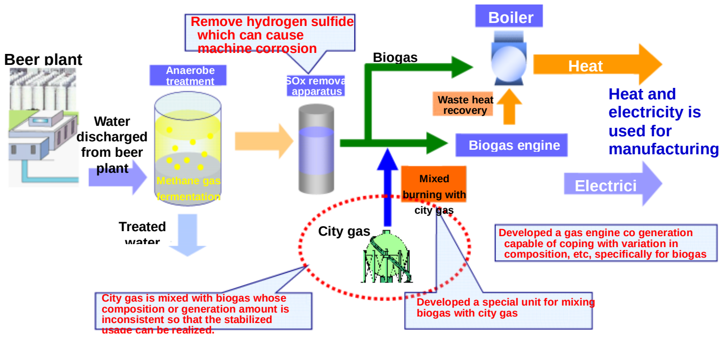
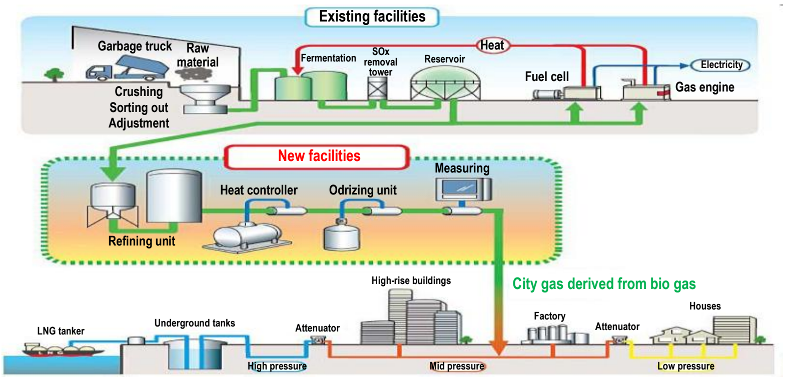
(23) Community Cycle Sharing

<table>
<tr><th colspan="3">Classification of Measures</th><th rowspan="2">Low Carbon Measure</th><th colspan="4">Applicability as per Type of Town</th></tr>
<tr><th>Supply/ Demand</th><th>Major Classi-fication</th><th>Minor Classi-fication</th><th>I</th><th>II</th><th>III</th><th>IV</th></tr>
<tr><td>Demand side</td><td>Transportation system</td><td>Public transportation systems</td><td>Community Cycle Sharing</td><td>H</td><td>H</td><td>H</td><td>L</td></tr>
<tr><th colspan="8">Overview of Measures and Applicability</th></tr>
<tr><td colspan="8">• The community cycle or bike-sharing (hereinafter, the CCS) refers to a system of sharing bicycles where users can pick-drop a bicycle at their convenience. This system aims at improving the use of bicycles as an alternative to cars, and addressing the problems of illegal parking or abandoned bicycles.
• By installing CCS ports mainly around railroad stations and public facilities, this system is expected to take effects in making up for the unavailability of public transportation infrastructure and improving accessibility.</td></tr>
<tr><th colspan="8">Expected CO2 Reducing Effect</th></tr>
<tr><td colspan="8">With respect to the NUBIJA (the CCS of Changwon city, South Korea), about 45% of users in their 30s and older have reportedly switched from cars to bicycles for commuting, after one year of the CCS introduction (source: NUBIJA HP). The appropriately introduced CCS will prompt people to switch from automobiles to bicycles, and it is expected to take effect in reducing CO2 emission in the transportation sector.</td></tr>
<tr><th colspan="8">Examples of Application</th></tr>
<tr><td colspan="8">The CCS ports will be installed at railroad stations, public facilities, parks, commercial facilities, office buildings, apartment complexes, and so on. Users can pick-drop a bicycle freely. Registration required. IC cards will be introduced for payment.</td></tr>
</table>

Schematic Diagram of the System etc.
 CCS Port arrangement (Source: JTPA Report, City and Transportation, Japan Transportation Planning Association、2011)

(24) Garbage

<table>
<tr><td colspan="3">Classification of Measures</td><td rowspan="2">Low Carbon Measure</td><td colspan="4">Applicability as per Type of Town</td></tr>
<tr><td>Supply/ Demand</td><td>Major Classi-fication</td><td>Minor Classi-fication</td><td>I</td><td>II</td><td>III</td><td>IV</td></tr>
<tr><td>Supply side</td><td>Renewable energy</td><td></td><td>Biogas injection into City gas combustion</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="8">Overview of Measures and Applicability</td></tr>
<tr><td colspan="8">• Excessive biogas generated from sewage sludge or food waste, etc. is put to an effective onsite use as the fuel for power generation or automobiles. If generated biogas or electricity still remains after onsite use, it would be possible to supply energy (biogas, co-generation power) to outside.
• Not only these measures contribute to energy conservation and CO2 reduction, but also they help make the best use of and recycle the local biogas resources, such as sewage sludge or kitchen garbage, for a long-term in a stable manner. .</td></tr>
<tr><td colspan="8">Expected CO2 Reducing Effect</td></tr>
<tr><td colspan="8">• CO2 can be drastically reduced by using carbon-neutral biogas.
• (Example) Injection of biogas into city gas conduits: Approx. 1,830 tons/year
• (outlined in below: case example of Tokyo metropolitan)</td></tr>
<tr><td colspan="8">Examples of Application (In Japan)</td></tr>
<tr><td colspan="8">• Biogas generation… Tokyo metropolitan, Yokohama city, etc. (About 30 sewage treatment facilities, etc.)
• Biogas automobiles… Kobe city, Ueda city
• Injection of biogas into city gas conduits … Kobe city, Tokyo metropolitan</td></tr>
</table>

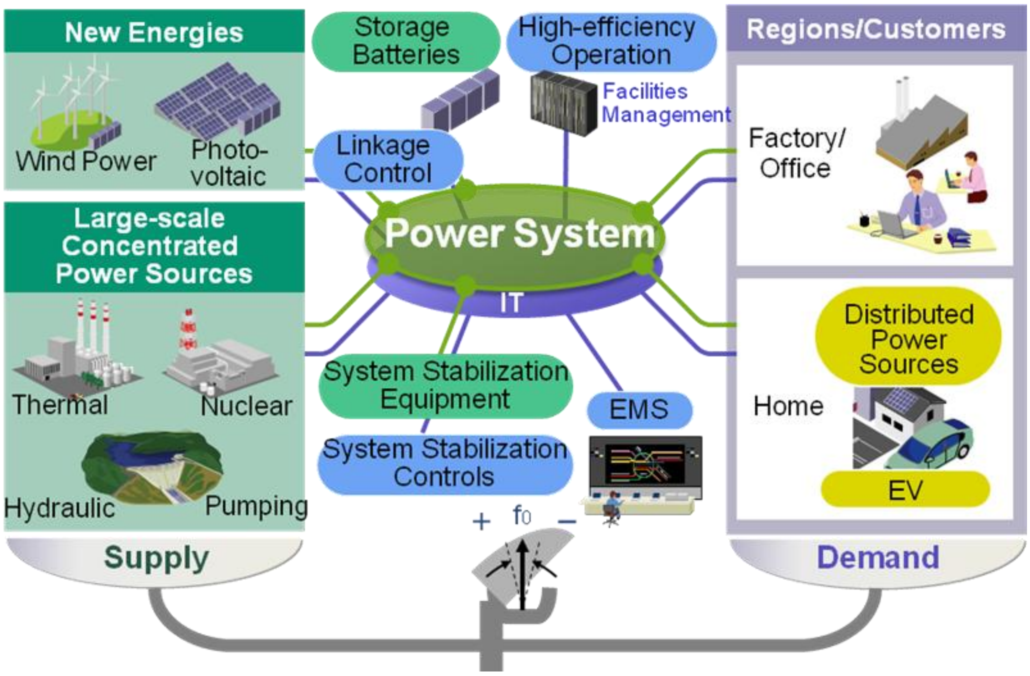
Schematic Diagram of the System etc.
(1) Example of onsite biogas use (Beer plant)  (2) Injection of biogas derived from food residual (Tokyo metropolitan) 

(25)Smart Grid

Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication	Minor Classi-fication		I	II	III	IV
Supply/ Demand	**Electric Power System**	**Smart Grid**	**Smart Grid**	**H**	**H**	**H**	**H**

Overview of Measures and Applicability
・The supply side of electricity comprises large-scale power station and renewable energy sources such as wind and solar, which are unstable in nature. The demand side is equiped with solar cells and electric vehicle which act as distributed power sources, and the consumers are linked to the electricity supply system with the options on the selection of energy consumption structures. ・The electricity system is equiped with power stabilization facilities, which balance the demand and supply on the realtime basis to maitain the high quality of electricity supply.
Expected CO2 Reducing Effect
• Expansion of the use of the renewable energy sources and distributed power supply through the system stabilization control • Reduction of the overall emission of CO2 from electric power generation
Examples of Application (In Japan)

Schematic Diagram of the System etc.



(26)

Classification of Measures			Low Carbon Measure	Applicability as per Type of Town			
Supply/ Demand	Major Classi-fication	Minor Classi-fication		I	II	III	IV
Demand	**Energy Management System**	**Community Energy Management System (CEMS)**	**Community Energy Management System (CEMS)**	**H**	**H**	**H**	**H**

Overview of Measures and Applicability

- Community energy management system (CEMS) collects information from the demand-side energy management systems such as home energy management systems and building energy management systems, in a neighborhood, and optimizes the use of energy in the neighborhood.
- CEMS also provide the supply side of electricity with such information as the configuration and state of devices and facilities in the neighborhood.

Expected CO2 Reducing Effect

- Reduction of CO2 emission in a neighborhood
- Reduction of CO2 emission from the concentrated power supply through the total optimization of energy consumption in a neighborhood

Examples of Application (In Japan)

Schematic Diagram of the System etc.