



Sustainable Energy for Japanese Cities with District Heating and Cooling

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Sustainable Energy for Japanese Cities with District Heating and Cooling

Topics

(1) Japanese Government Policies

- *Kyoto Protocol Target Achievement Plan*
- *Long-term Target of GHG Emissions*

(2) DHC and Area Energy Network

- *Outline of Japanese DHC*
- *Future vision of DHC*

(3) Actual example of the improvement of DHC

- *Improvement of plant efficiency, CO₂ reduction, etc.*

(4) Further Effort to Achieve a Low-Carbon Society

- *Renewable Energy Promotion*
- *Environmental Model Cities*

(1) Japanese Government Policies

Kyoto Protocol and Long-term Target of Greenhouse Gas Emissions

(1) Target of Kyoto Protocol

- **6%** below 1990 levels by the period of 2008-2012

(2) Shared understanding in G8 Toyako Summit in 2008

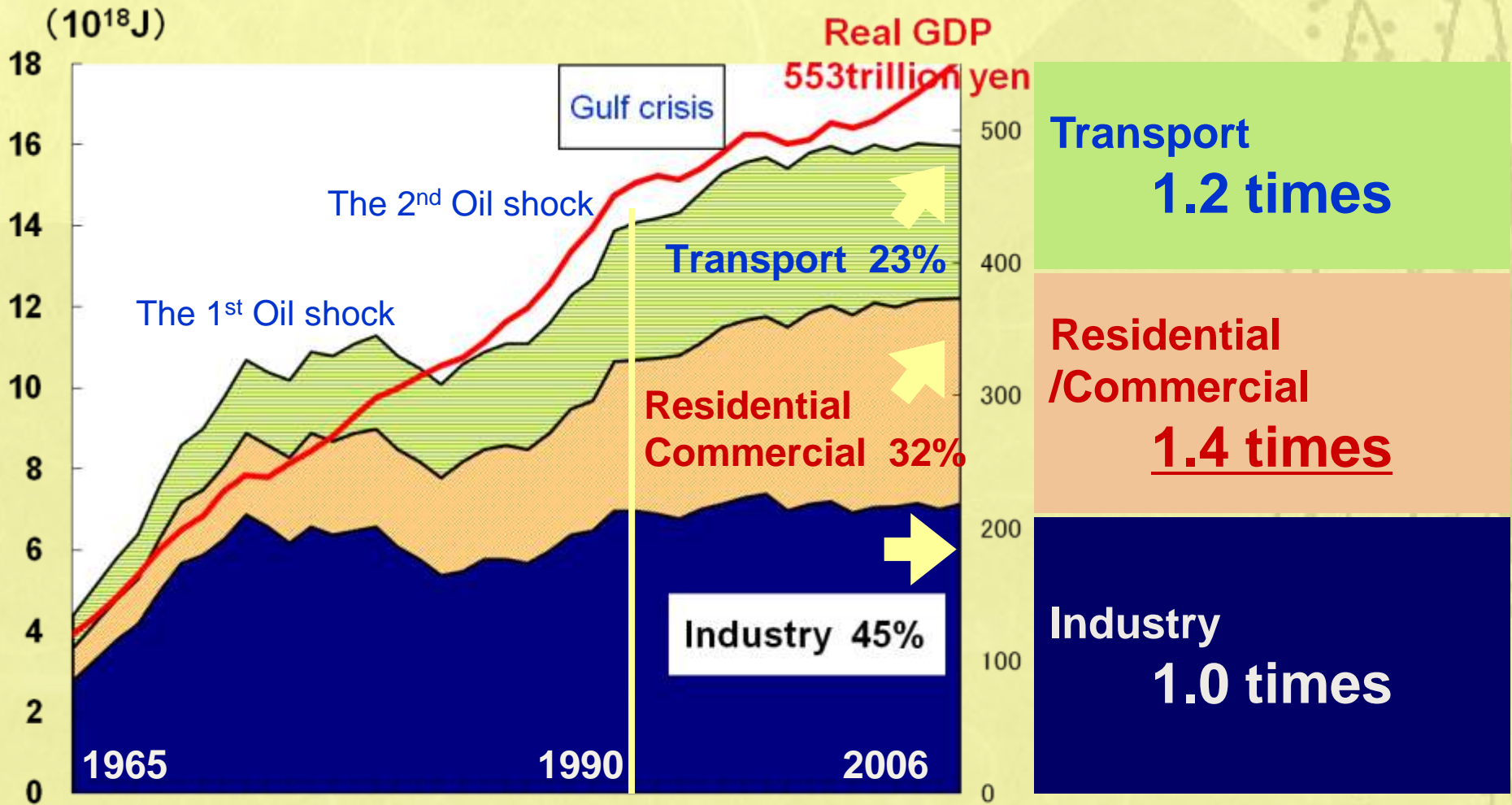
- to seek the goal of reducing GHG emissions by **50%** by 2050

(3) Japan's long-term target for a Low-Carbon Society

- reducing GHG emissions by **60 to 80%** from the present level by 2050

(1) Japanese Government Policies

Residential / Commercial and Transport are mainly to be improved.



Final Energy Consumption vs. GDP

Difference from 1990 to 2006

Kyoto Protocol Target Achievement Plan

For the Improvement of the Residential/Commercial field

1) Change of energy management for urban area:

Shift from **patchwork** measures to an **integrated** approach

➔ Promotion of the **Area Energy Network**

➔ **Efficient Area Energy Network**

(1-Building / Spot ➔ Multiple Buildings / Area)

Specifically:

- Supply of efficient energy to multiple buildings,
- Energy interchange between facilities and buildings,
- Utilization of underutilized energy, etc.

(1) Japanese Government Policies

Kyoto Protocol Target Achievement Plan

➔ For these purposes,
the Government of Japan actively introduced and disseminated
“District Heating and Cooling”,
as an **environmentally outstanding** measure
to produce **large CO₂-saving benefits** in regions.

2) Other countermeasures

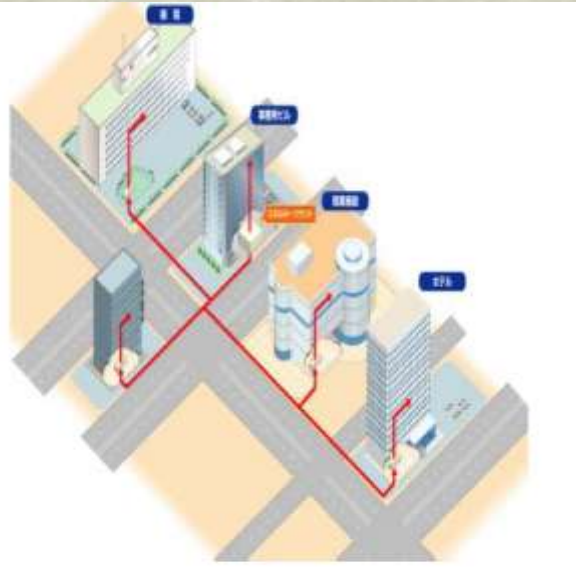
- Revolution of the **people’s entire lifestyles**
- Approaches on **improvement of equipment efficiency**

All types can contribute to energy and CO2 Saving.

Type 1

DHC type

Large scale
Urban district
Multiple buildings



Type 2

HC Supply

Not covered in Law
Small scale
Urban or residential



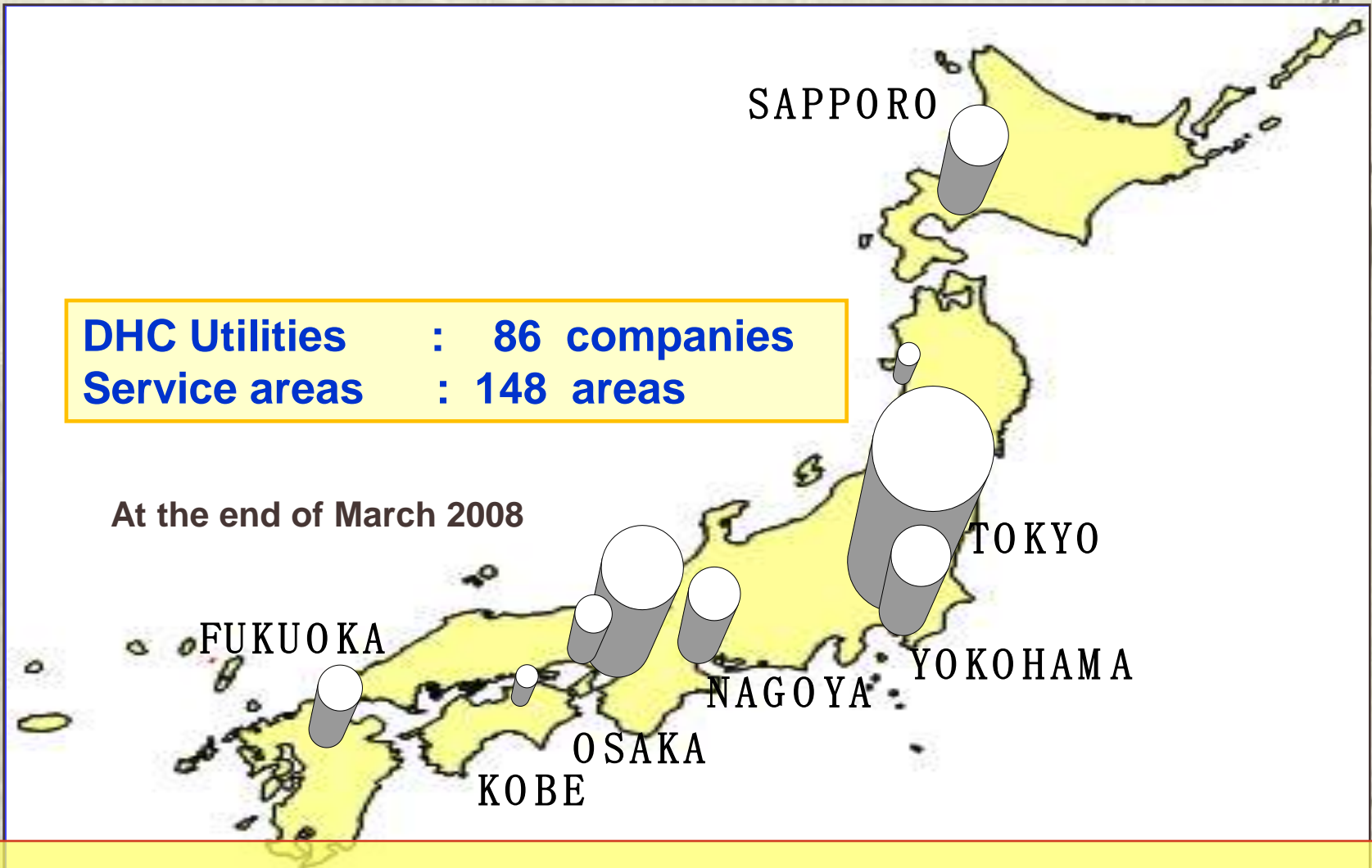
Type 3

Combined or exchange type

Urban district
Adjacent buildings



(2) DHC and Area Energy Network



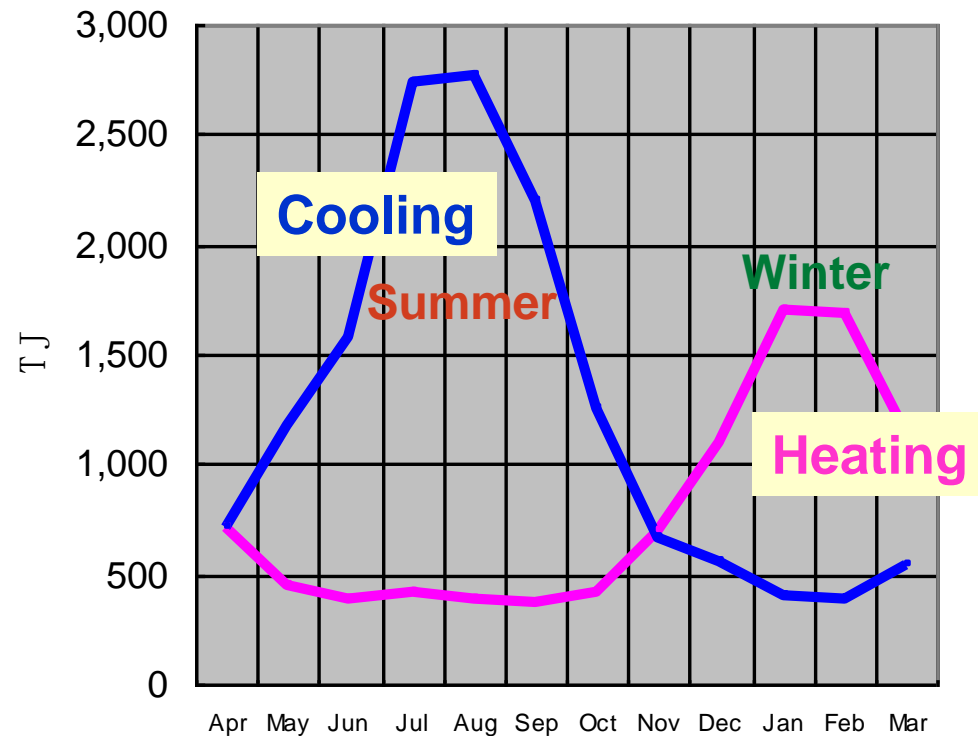
DHC is concentrated mainly in metropolises.

The records of F.Y.2007

- 1. Customers :
 - Private dwellings --- approx. 43,400
 - Public building --- approx. 1,400
- 2. Floor space covered: 48.7 Mil. sq.m
- 3. Service area licensed: 44.2 Mil. sq.m
- 4. Pipeline length: 710 km

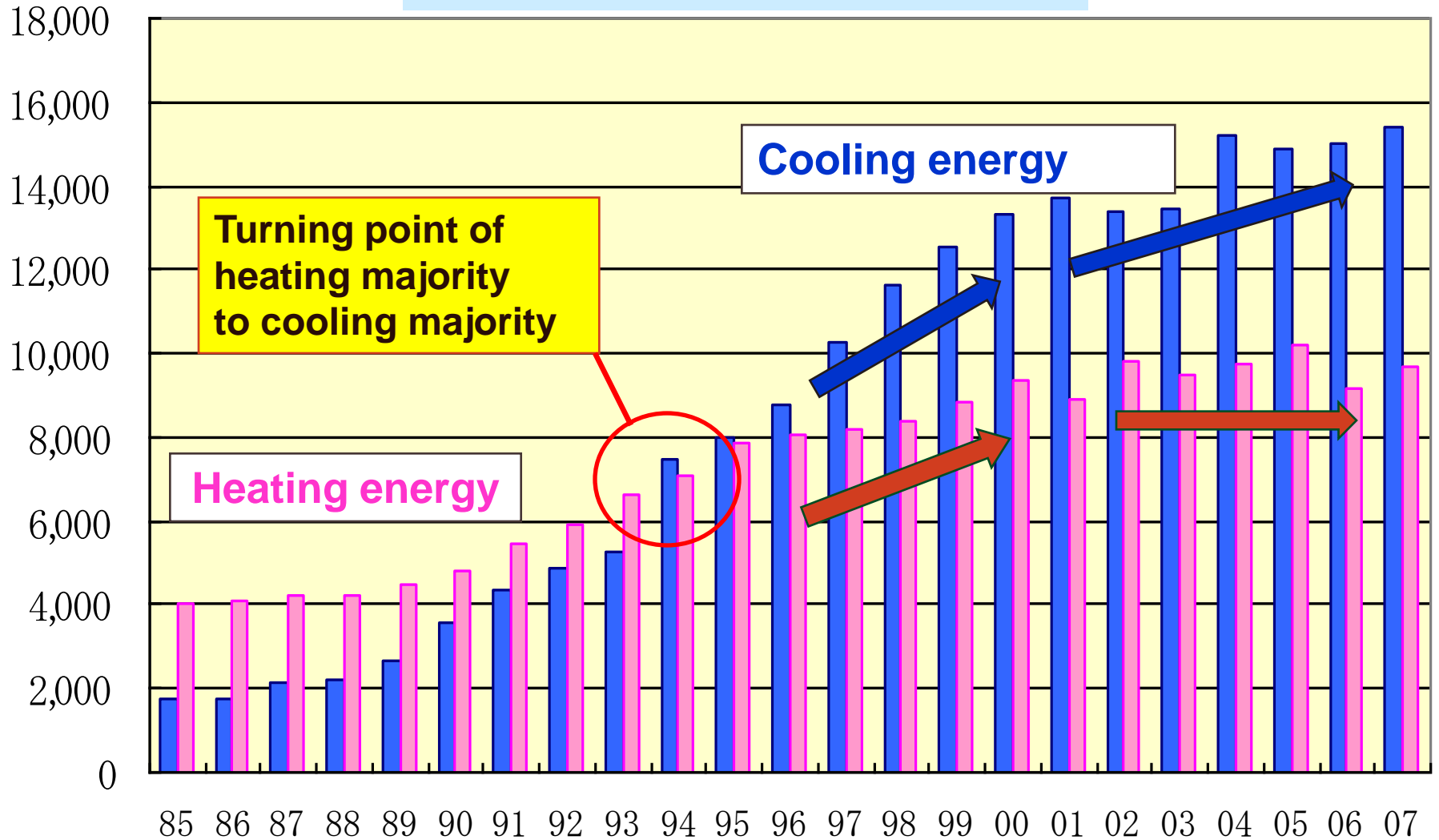
- 5. Heat sales volume :
 - Cooling 15,400 TJ / yr
 - Heating 9,600 TJ / yr
 - (Total) 25,000 TJ / yr
- 6. Annual turnover :
153,000 Mil. JPY / yr
(ca. 1.53 Bill. USD / yr)

Heat Sales Volume



(TJ/Year)

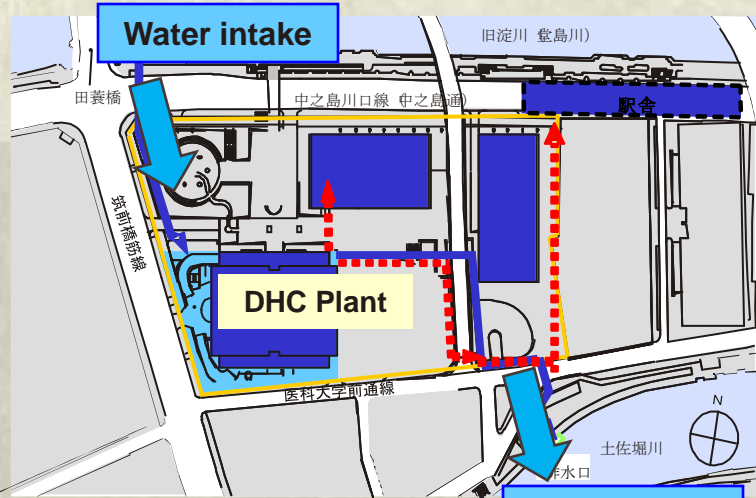
Heat Sales Volume



Future Vision of DHC

1. Effective use of **unutilized energy sourcing**
 - river water, sea water, geothermal, sewage
 - snow, ice
 - waste incineration, underground rail, etc.
2. To promote the use of **renewable energy and biomass**
 - solar power, wind power, thinned wood, etc.
3. Improvement of **energy efficiency and energy flexibility**
 - high efficiency of equipment and systems, etc.
 - sharing exhaust heat from industrial facilities, CGS, etc.

30% CO₂ reduction compared with the individual heat source system



--- Heat supply pipeline
— River water pipeline



Water intake

Use of underutilized energy (river water), exhaust heat from Substation and electric-load leveling (large-scale ice thermal storage)

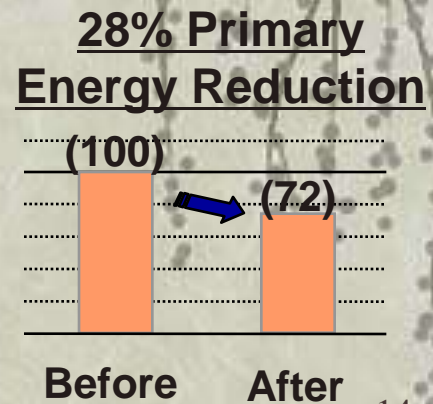
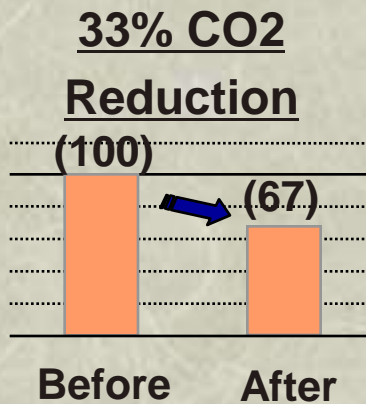
33% CO₂ reduction
 compared with the previous plant
By replacing aged equipment with high-efficiency equipment



Improvement of COP
 Previous System ; (Coefficient of Performance)
 Turbo-refrigerator COP=3.92,
 Absorption type refrigerator, COP=0.80

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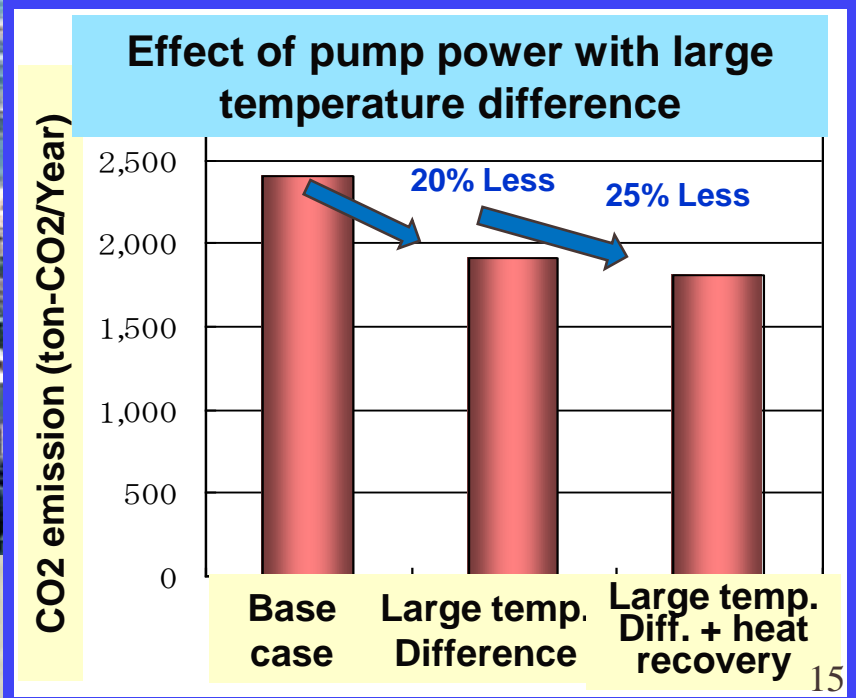
New System ;
 Turbo-refrigerator COP=5.44,
 Absorption type refrigerator, COP=1.48
 Brine turbo-refrigerator, ice-thermal storage



High-efficiency equipment,
 the best mix of gas and electric power, and
 the best operation according to heat load.

60% CO₂ Reduction 44% Energy conservation

By high-efficiency heat pump, electric power reduction of water supply pump and large-scale thermal storage



Water-discharge demonstration for fire-fighting using thermal storage water basin in DHC Plant

***Enhancement of
disaster prevention,
safety and urban
function***



(3) Actual example-5; Tokyo Sky Tree District, Tokyo

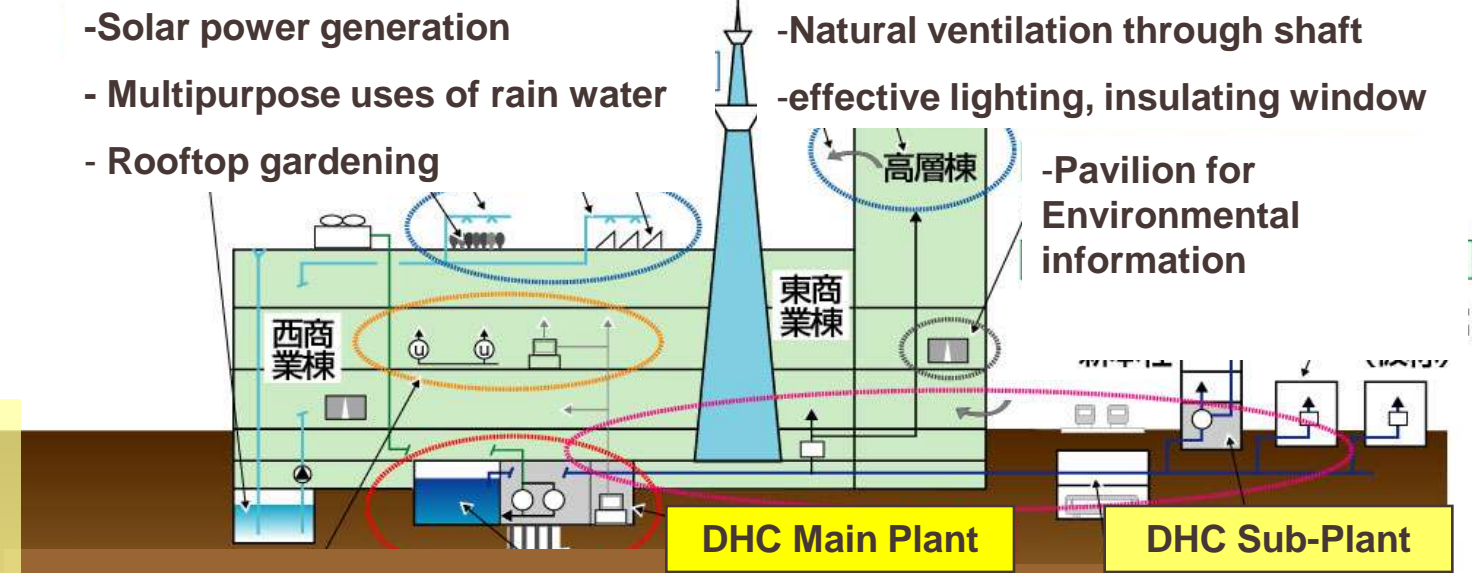
50% CO2 reduction expected
 compared with the conventional system

(4) CO2 reduction by renewable energy (solar)

- Solar power generation
- Multipurpose uses of rain water
- Rooftop gardening

(5) Environmental information transmission station

- Natural ventilation through shaft
- effective lighting, insulating window
- Pavilion for Environmental information



Broadcasting Tower
 610m in height
 Completion in 2011

(3) New Life-cycle toward CO2 reduction with DHC

- Geothermal utilization
- Thermal storage tank
- Effective heat supply

(2) Highest level of Efficiency in DHC Plant

Approach on environmental protection

(1) Energy Network with 2-DHC Plants

(4) Further Effort to Achieve a Low-Carbon Society

1. Proposal of a Renewable Energy Promotion Policy

=== Lofty targets are indispensable ===

- Renewable energy has been low overall Japan;

2% of annual primary energy output in 2005

10% in DHC industries

2. Environmental Model Cities for a Low-Carbon Society

=== Program of Environmental Model Cities is starting ===

- Pioneers to transform Japan into a Low-Carbon Society

- Selection of model cities;

Setting the goals of a significant reduction of GHG, pioneering efforts, feasibility and sustainability.

The Action Plan for Establishing Low-Carbon Society

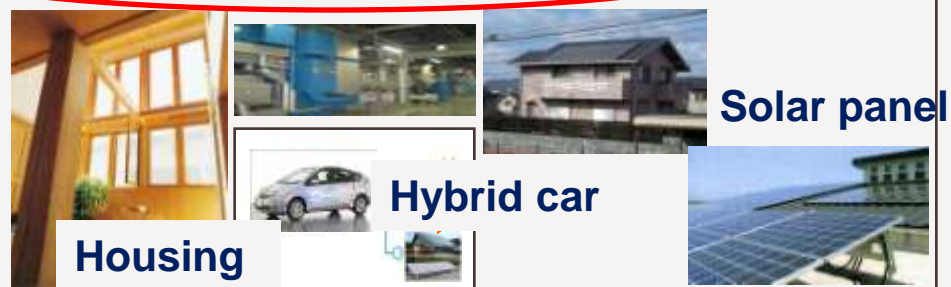
(1) Examination of city planning by bold revolution

Compact city, barrier-free, car sharing, mobility management, LRT from car, etc.



(2) Evaluation of efficiency with Area Energy Network

Energy conservation house, electric vehicle, hybrid car, solar power house, **DHC using unutilized energy.**



(3) Environmental model city evaluation

Action plan of the city
Max. DHC application



(4) Carbon offset in urban and rural regions

Wood pellet made in rural and used in urban area



Thinned wood
Rural



Pellet stove
Urban



(5) Effective use of biomass resources

Waste oil, garbage, cow cake
DHC using Eco Fuel



Cow cake compost



Biomass boiler



- 1. Japan has a long-term target of reducing GHG emissions by 60 to 80% by 2050.**
- 2. Japan is promoting DHC with Area Energy Networks for improving urban energy efficiency.**
- 3. DHC are located mainly in metropolises. DC demand is higher than DH and still increasing.**
- 4. Actual examples show 30 to 60% CO₂ reduction. DHC also plays a role in disaster prevention, safety and urban function.**
- 5. For further effort to achieve a Low-Carbon Society, a program of Environmental Model Cities is starting.**

For the future

***Japan Heat Service Utilities Association
Tokyo, Japan***

Thank you for your attention!

Japan Heat Service Utilities Association
Tokyo, Japan

District Heating and Cooling in Japan

❖ “Heat Supply Business Law” enacted in 1972

Definition:

- Demand: General demand (heating, cooling or production)
- Supply : Hot water, cool water or steam
to two or more buildings by pipeline
- Capacity: Heating capacity of 21GJ/h or more

❖ Japan Heat Service Utilities Association, Japan

consists of 86 companies which are corporations or individuals licensed to operate DHC systems under the Heat Supply Business Law, and 14 associate members as of March, 2008.