

Energy Efficiency Technology for Industrial, Commercial and Residential Sectors

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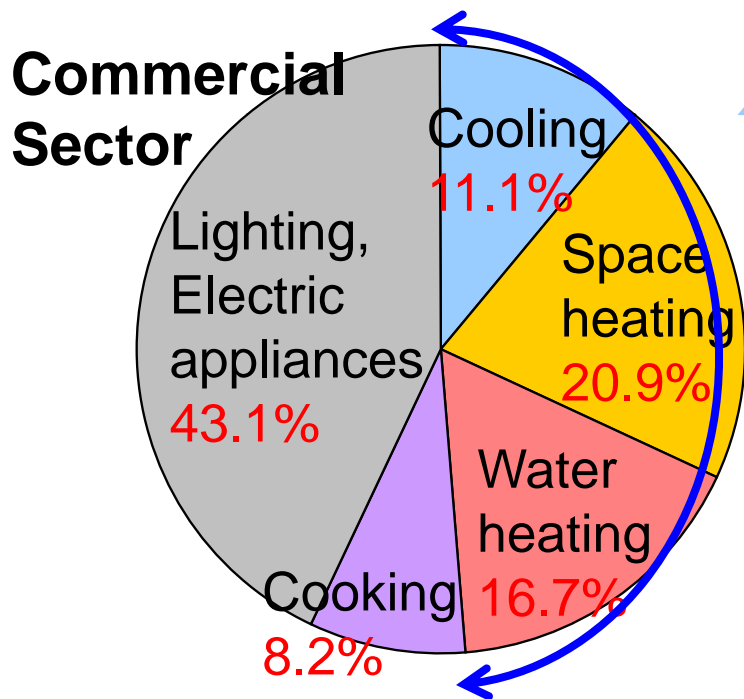
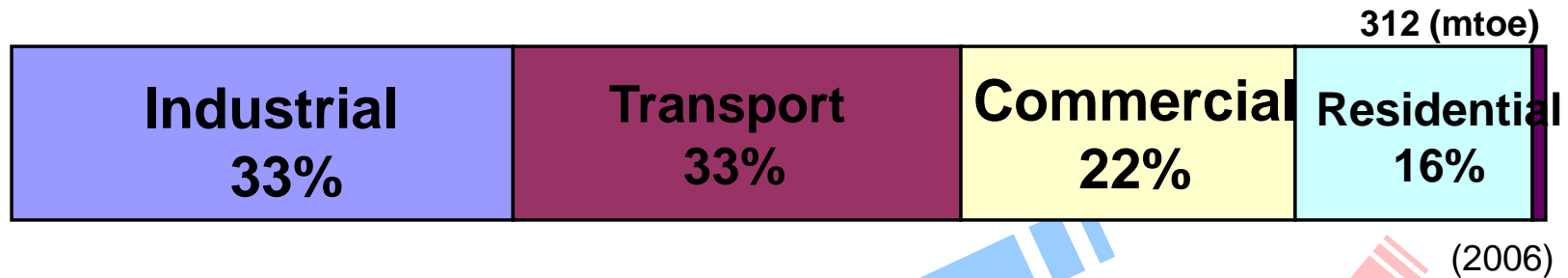
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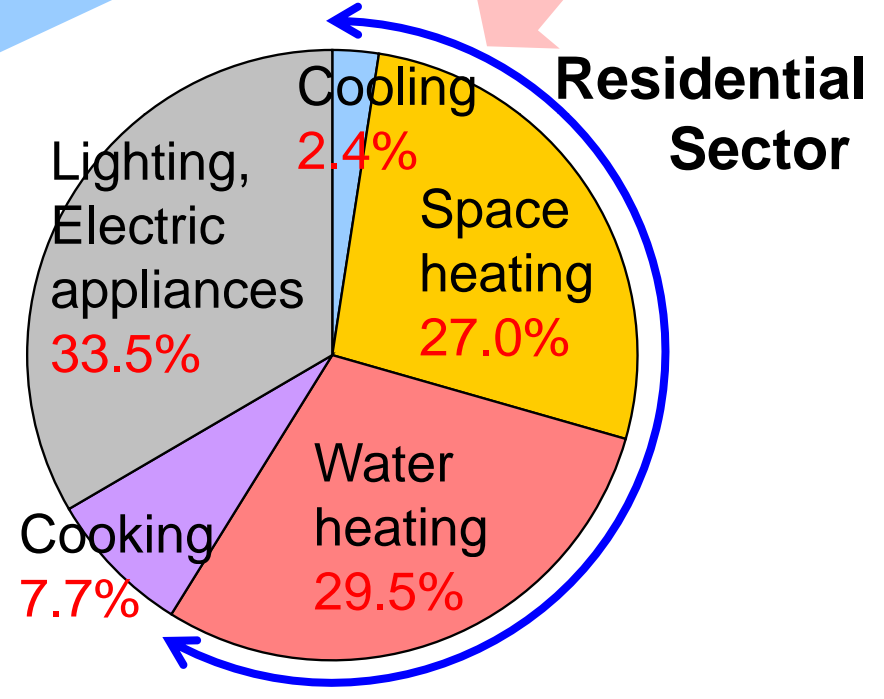
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Energy Consumption Breakdown in Japan



Heat Demand : about 50%



Heat Demand : about 60%

Source: Comprehensive Energy Statistics

Why Heat Pumps?

Heat Demand and High Efficiency

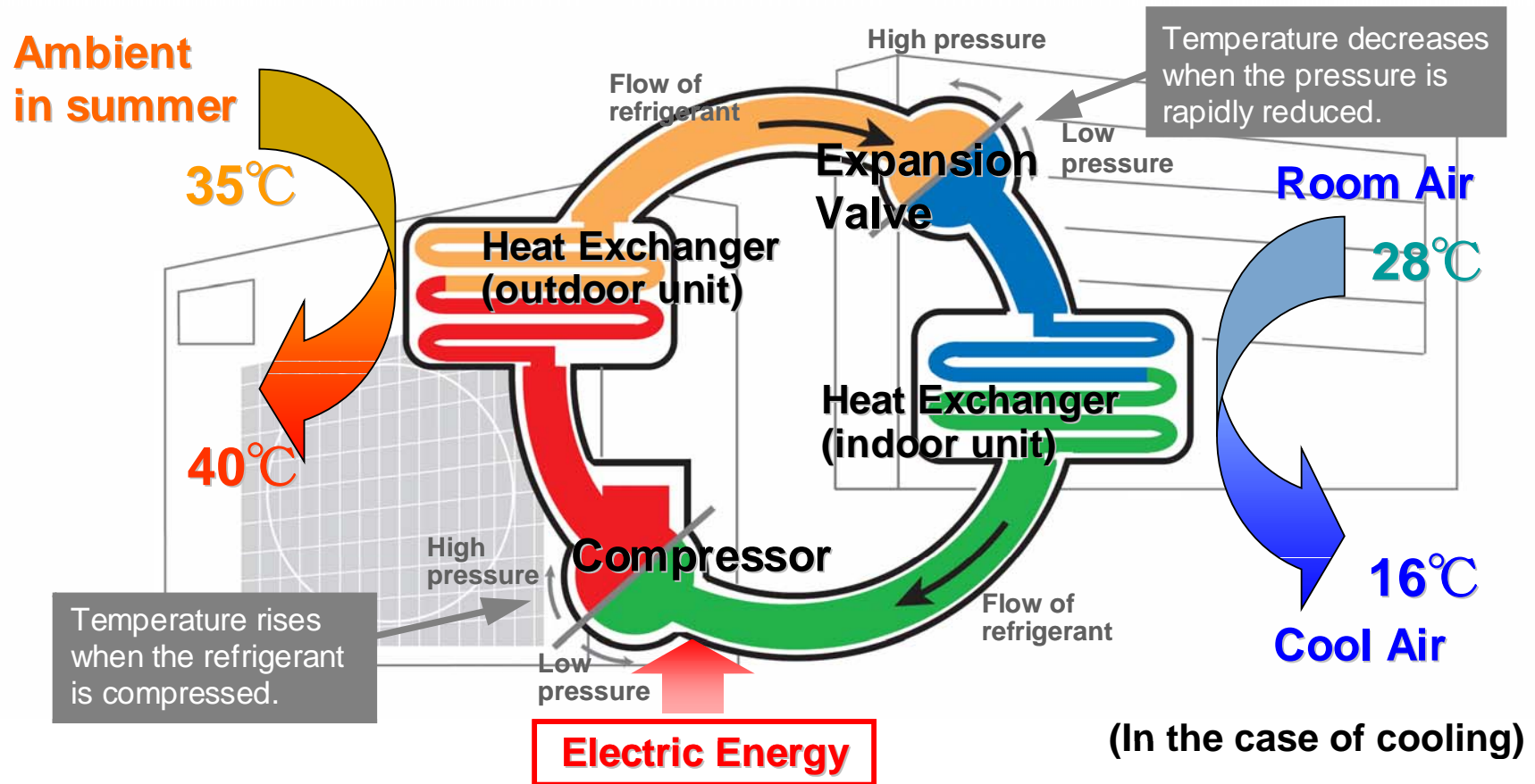
- Large **heat demand** in commercial (50%) and residential sectors (60%) in Japan
 - Home AC, Water heater
 - Heat generating equipment for industrial and commercial sectors
- **High Efficiency**

Europe and IEA

- (Aerothermal, geothermal and hydrothermal) energy pumped by heat pumps is counted as **renewable energy** in Europe
- Heat pump is identified as one of the **key technologies** and measures to reduce CO₂ emissions in the IEA book “Energy Technology Perspectives 2008.”

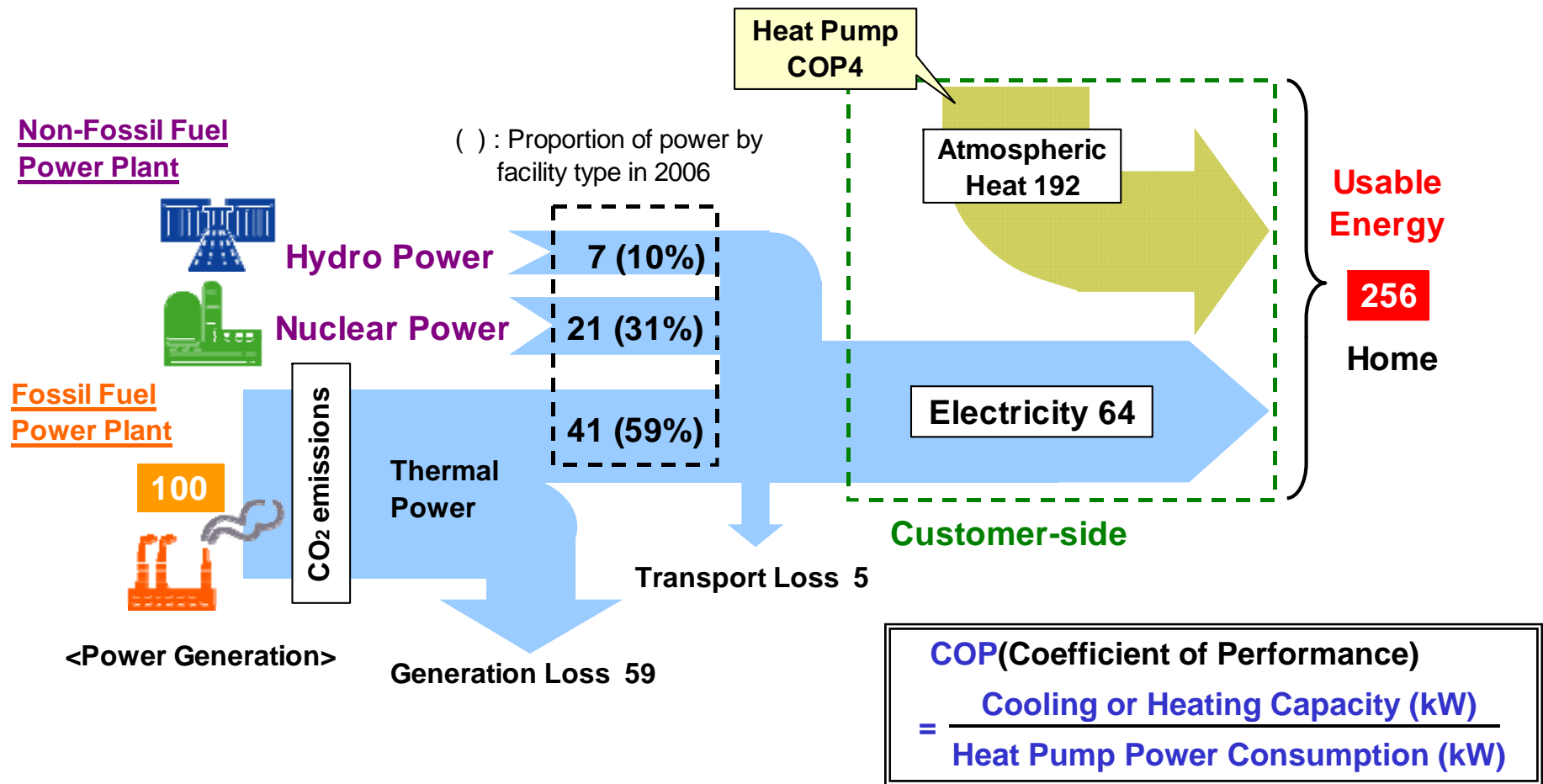


Heat Pump's Mechanism to Pump up Heat



- When this cycle is reversed, heat pumps can heat rooms and supply hot water.
- Pumping up consumes electricity as the power to compress a refrigerant.
- **A great advantage of heat pump is that it needs very small amount of electricity compared to the heat which is generated.**

An Estimation of Energy Utilization by Heat Pump



- **256 units of energy can be used with 100 units of fossil fuels.**

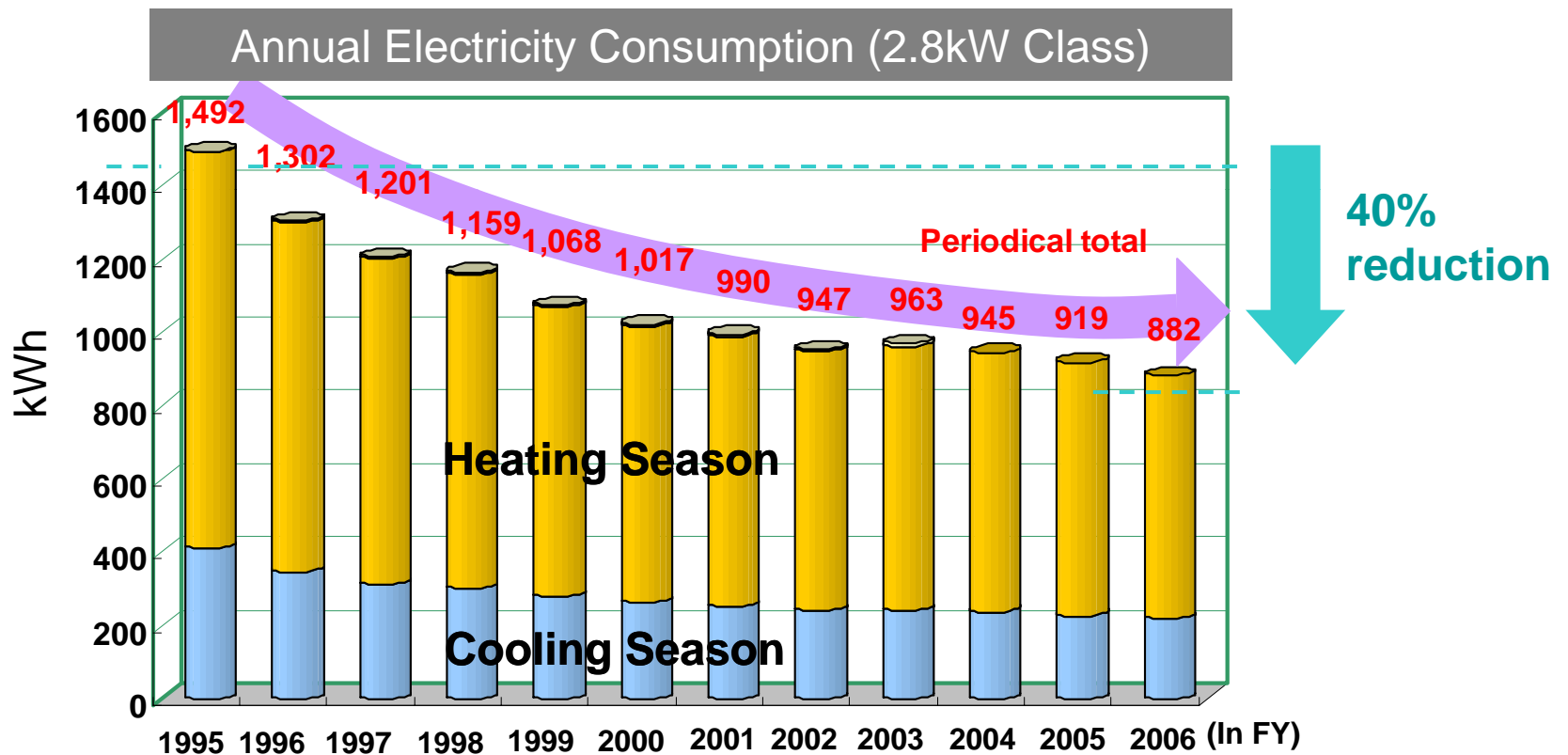
(Source: "Environmental Action Plan by the Japanese Electric Utility Industry," the Federation of Electric Power Companies, September 2006)



Efficient Air Conditioner (AC)

Efficiency Improvement of House AC

- The annual electricity consumption for heating and cooling **decreased** by about **40%** in past ten years.
- Recently, air conditioners with close to **COP 7** have made their debut.

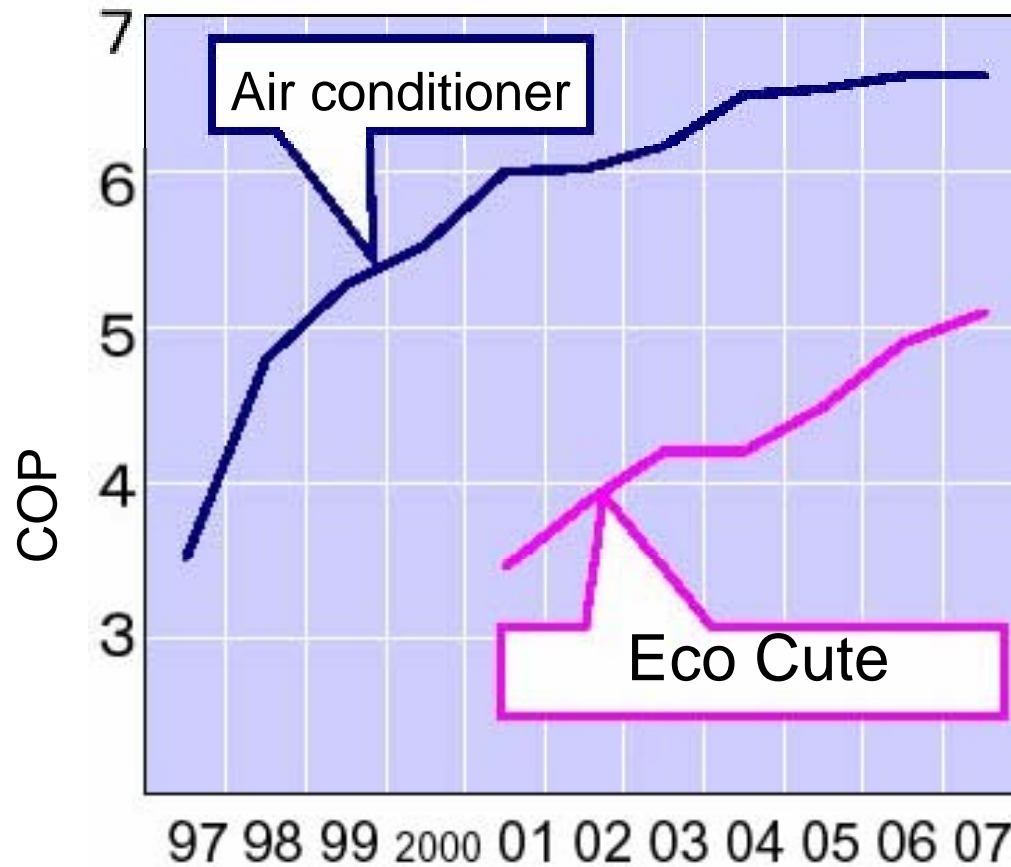


※Cooling and heating AC, 2.8kW cooling capacity, average consumption of high class products.

※Annual electricity consumption is calculated by the standard of "Japan Refrigerator and AC Industry (JRA4046)"

Source: Association of Japan Refrigerator and Industry

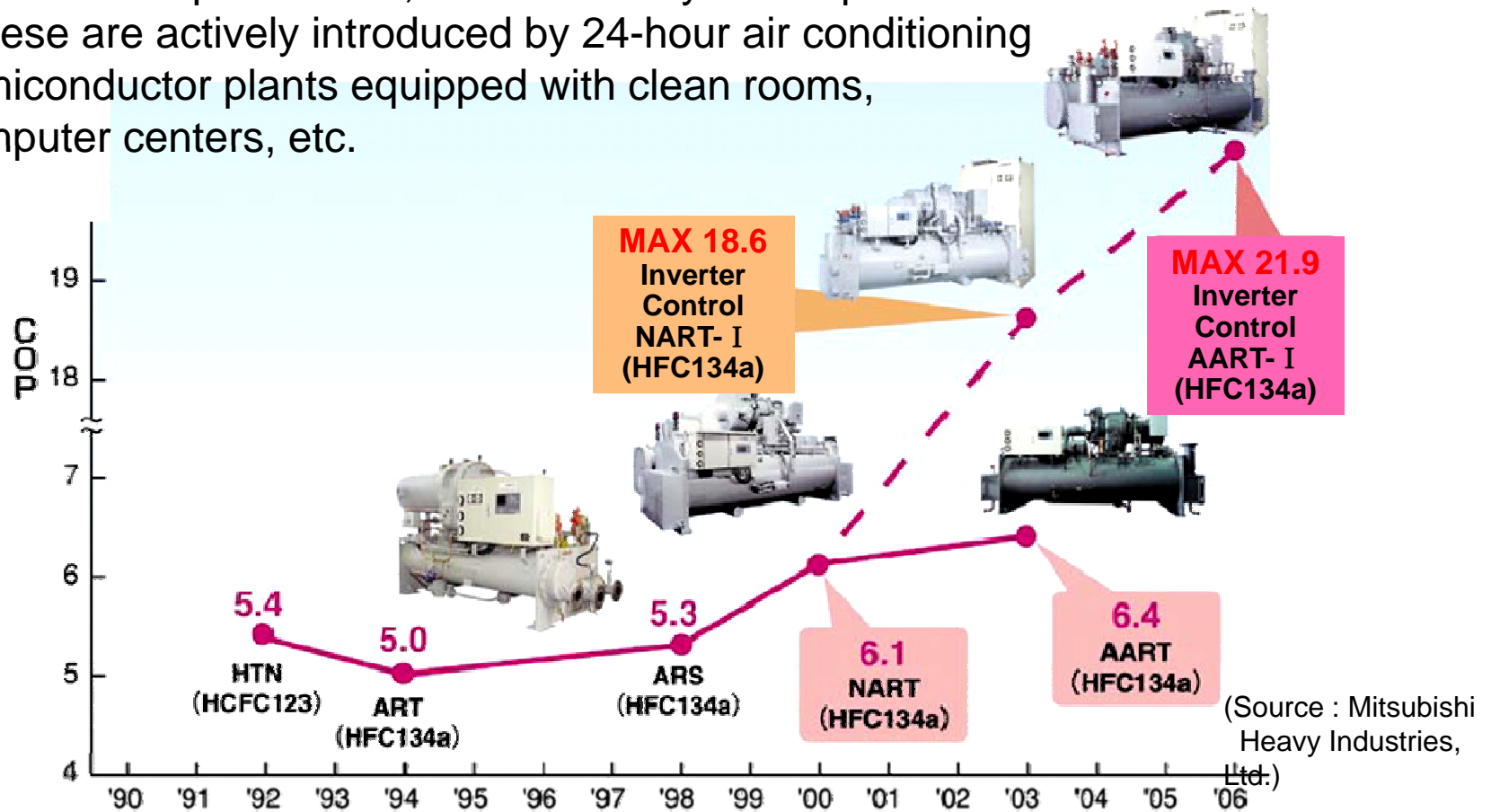
Efficiency Improvement



Efficiency of air conditioners and Eco Cute increased twice as high and 50%, respectively.

Changes in Performance of Centrifugal Chillers

- Centrifugal chillers are mainly used for air conditioning in large facilities such as buildings and factories.
- Advanced centrifugal chillers, of which the efficiency is increased to **COP=20 or higher by inverter-controlled** variable-speed operation at the time of partial load, are also newly developed.
- These are actively introduced by 24-hour air conditioning semiconductor plants equipped with clean rooms, computer centers, etc.

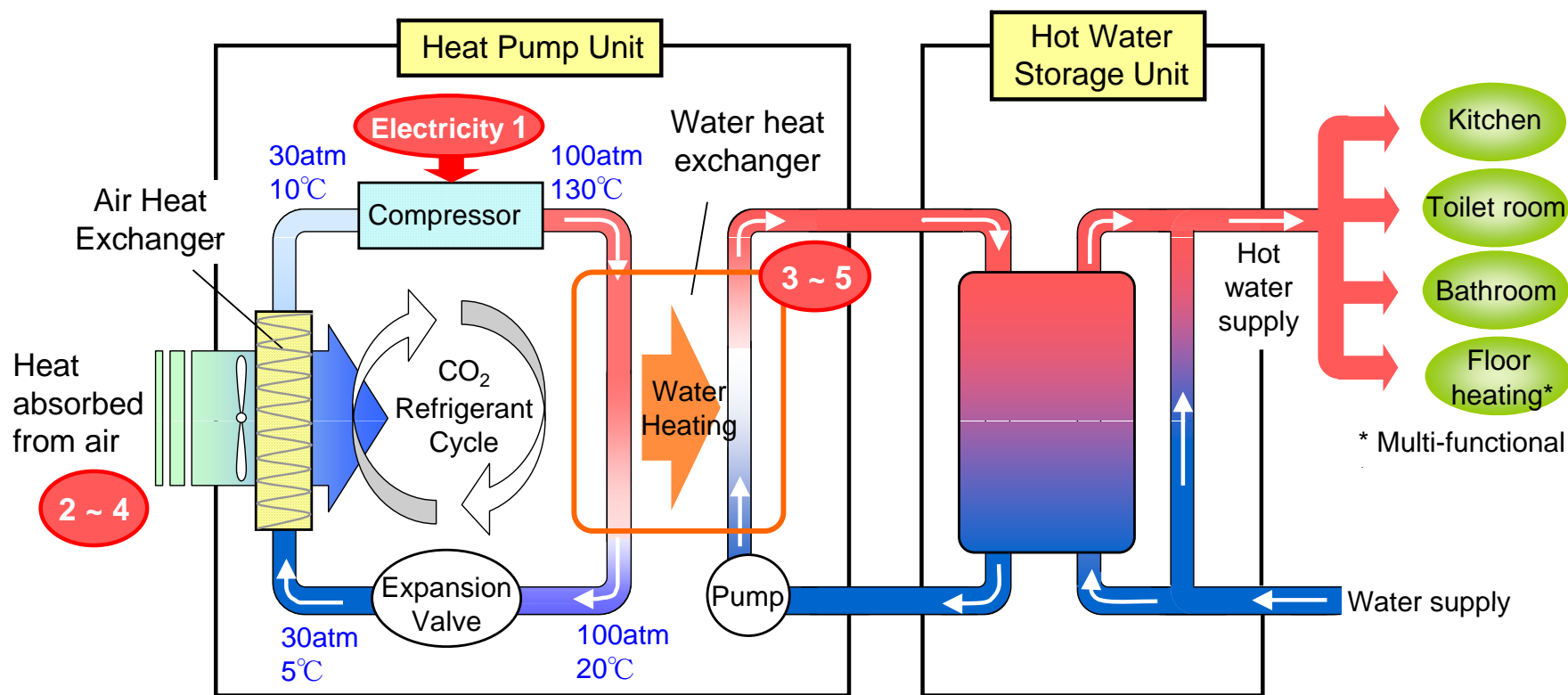




Heat Pump Water Heater

What is “Eco Cute” ?

The natural refrigerant (CO₂) heat pump water heater, “Eco Cute”, is highly efficient.



$$1 \text{ (Electric Energy)} + 2\sim4 \text{ (Atmospheric Heat)} = 3\sim5 \text{ (Available Hot Water Supply)}$$

※“Eco Cute” is the name used by the electric power companies and water heater manufactures when they call the natural refrigerant (CO₂) heat pump water heaters.

Main Features of “Eco Cute”

High Efficiency

- “Eco Cute” pumps up air heat to hot water, so that it can **produce thermal energy 3 to 5 times** more than the energy (electricity) required for running its system.

Natural Refrigerant

- **Natural refrigerant (CO₂)** has very little impact on global warming.
- It can heat water as high as up to a **maximum of 90°C** by solely operating a heat pump due to the physical properties of CO₂ refrigerant.

Low Running Cost

- By combining **inexpensive electricity of the night-only service** with the highly efficient heat pump system, it is able to achieve superior running cost performance.

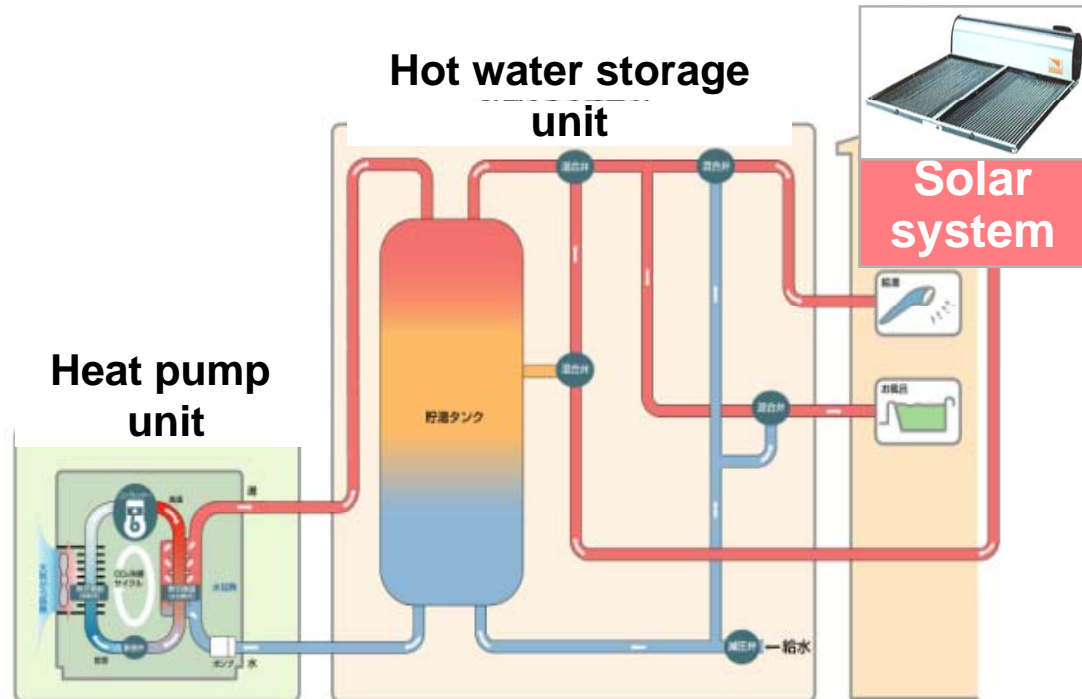
Various Types of “Eco Cute”

Solar Hybrid Type

The hot water heated by the solar water heater is mainly used for daytime, and the running short of hot water is supplied by “Eco Cute”.

“Eco Cute” calculates the quantity of required hot water automatically.

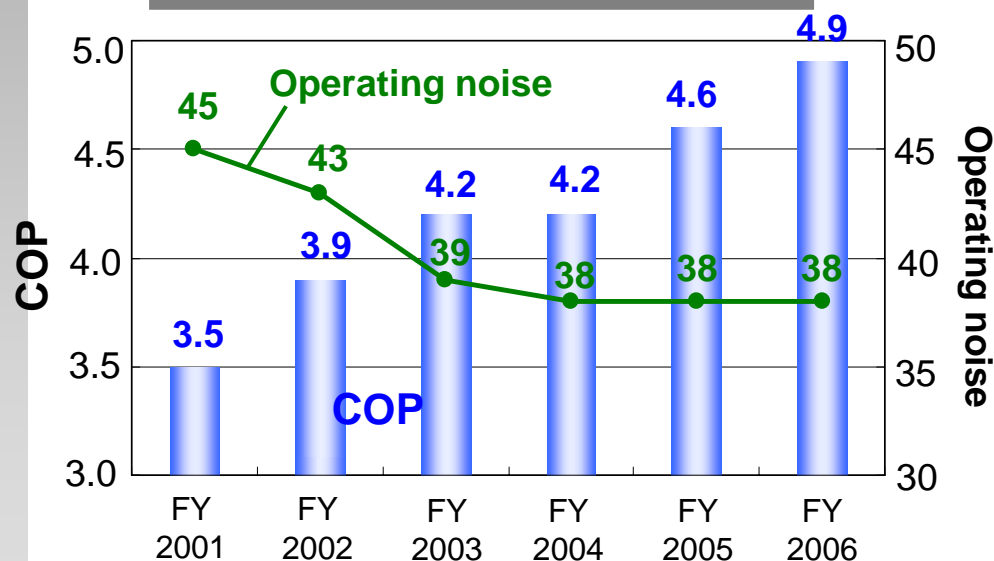
This system achieves **COP6.0** or more.



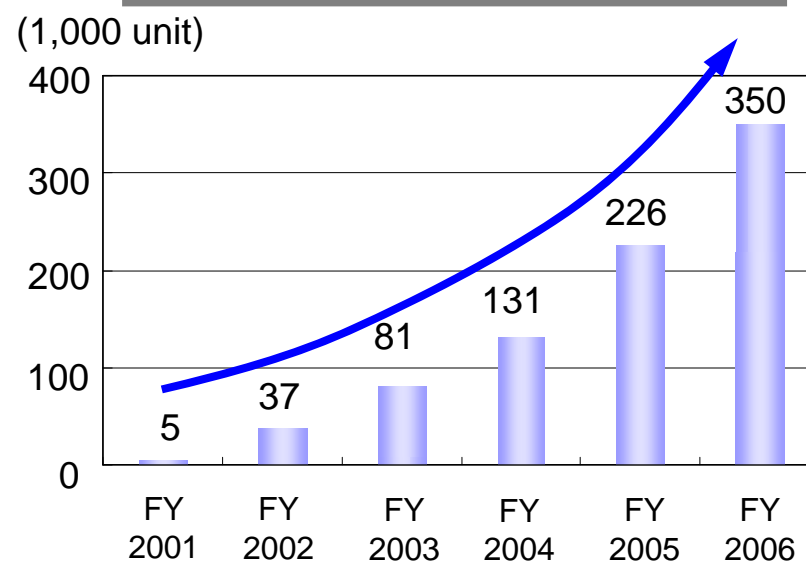
Performance Improvement and Shipments Trend of “Eco Cute” for Residential Use

- **COP** of the first model has been improved **from 3.5 * to 4.9 ***, and the operating noises have decreased from 45dB to 38dB.
(*under the rated heating condition of the JRA(Japan Refrigeration Association))
- In fiscal 2006 only, **about 350,000 units** were shipped throughout the country, and it is now reaching over **1 million** units in total.
- The Japanese government sets a plan to introduce **5.2 million units** by the time of 2010.

Performance Improvement of “Eco Cute” (Top-runner model)

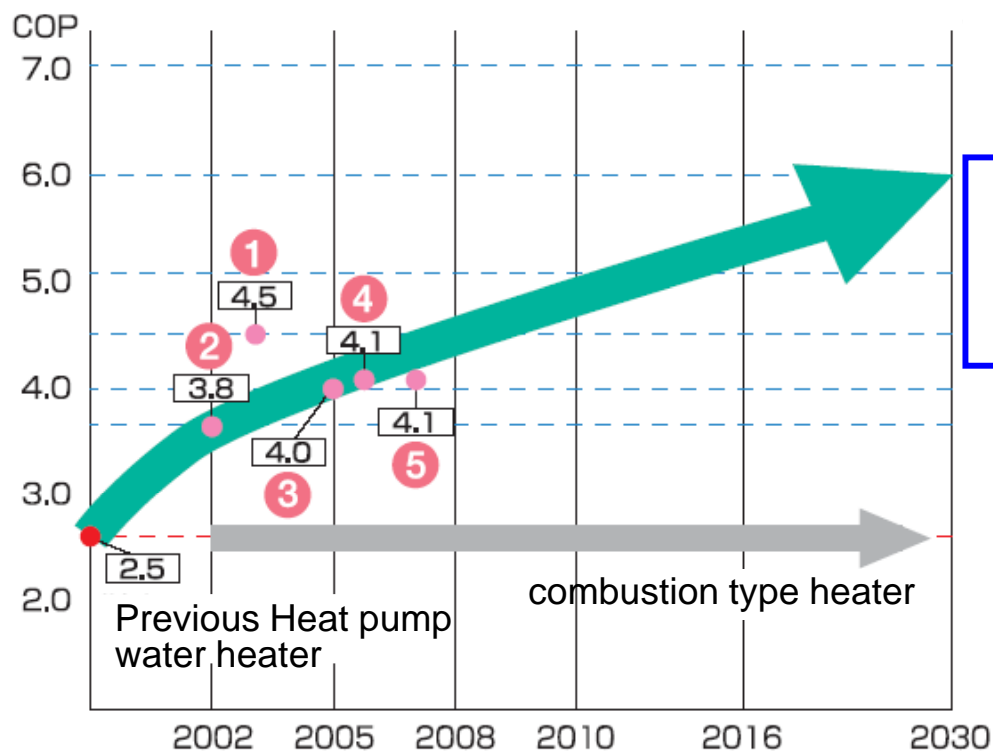


Shipment Trend of “Eco Cute” (Residential Use)



TEPCO's Development of Heat Pump Water Heater for **Business Use**

Various types of Heat Pump Water Heater for **business use** depending on hot water supply loads for hotels, hospitals, sports facilities, stores and restaurants have been placed on the market.



- 1**

“Hot Power Eco BIG”
(Toshiba Carrier)
(28kW) COP4.5


- 2**

“Eco Cute”
(Nihon Itomic Co.)
(26.3 kW) COP3.8


- 3**

“Eco Cute”
(Daikin Industries)
(4.5 - 15.5 kW) COP4.1


- 4**

“Eco Cute”
(Hitachi Appliances)
(15 - 30 kW) COP4.1


- 5**

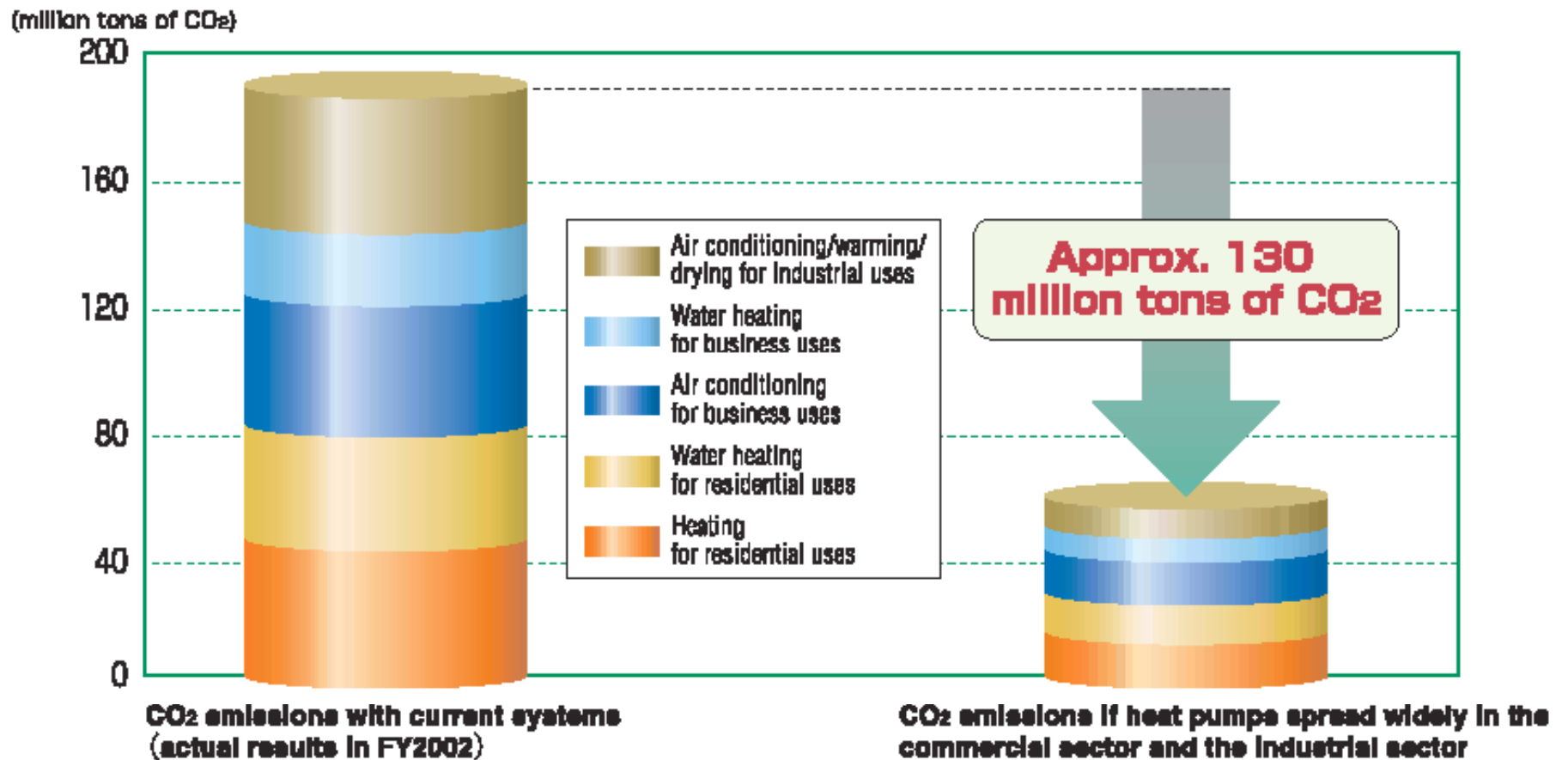
“Eco Cute”
(Mitsubishi Electric Works)
(40 - 320 kW) COP4.1





Potential and Promotion

Potential of Reduction in CO₂ Emissions in Japan



About 130 million tons of reduction in the residential + business + industrial sectors in Japan.

Source: Calculation by HPTCJ

Governmental Policy Support

1. Encourage dissemination of heat pumps as the government's policy

- “Kyoto Protocol Target Achievement Plan” (2005)
- “New National Energy Strategy” (2006)
- “Basic Energy Plan” (2007)

2. Apply subsidies and tax breaks

- Eco Cute
- Highly efficient heat pumps for air conditioning



Thank you for your attention!