

R-03	Keywords	Y2	device	Z2/3	oil/natural gas	S5	renewal energy
						L	Technical Services

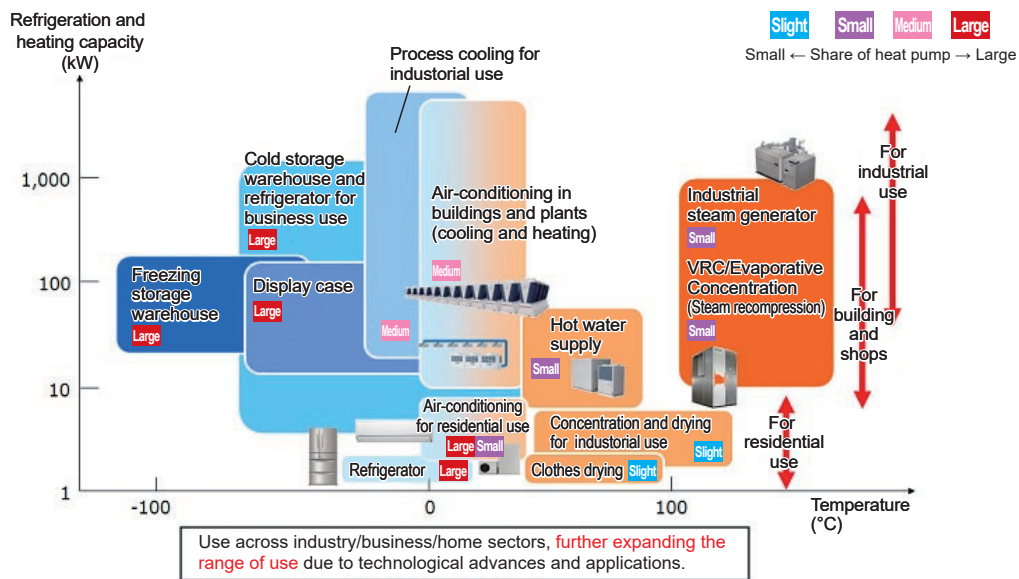
Heat Pump and Thermal Storage Technology Center of Japan

## Heat Pump (General Purpose)

### Features

- ◆ The air, the water, and the ground existing in Nature are full of sun-based energy. The technology in this heat pump makes this heat energy usable and puts it to use for air conditioning, water heating, and drying.
- ◆ Using heat energy from the air and water instead of fossil fuels increases energy efficiency and leads to reduce CO<sub>2</sub> emissions.
- ◆ The use of heat pumps has spread mainly in the household use, e.g. air-conditioners for cooling and heating and water heaters. They can also be used to meet the thermal energy demand for drying and heating (below 120°C) in industrial processes.

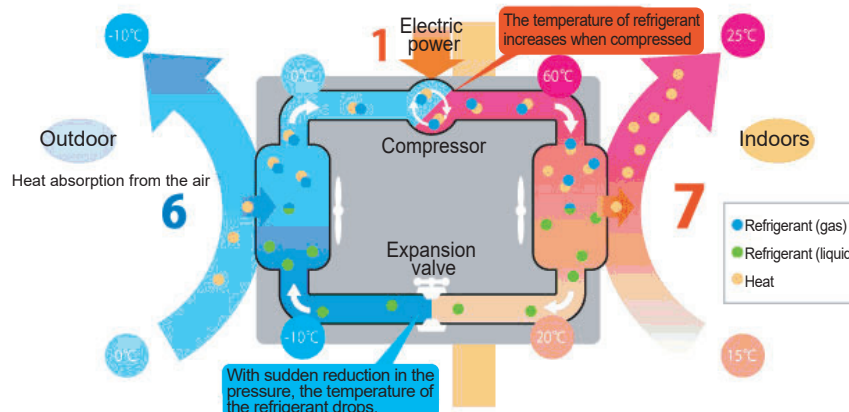
### Applicable Fields of Heat Pump



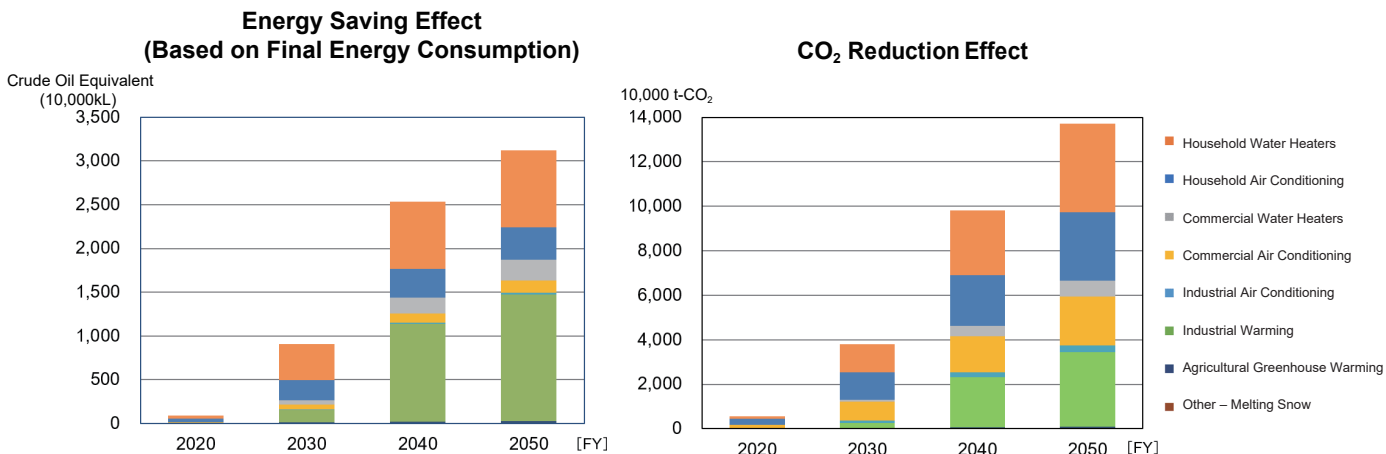
### Basic Concept or Summary

- Heat pumps don't contain on combustion devices or heaters, but are instead equipped with compressors that compress heating transmitter (i.e., refrigerant).
- By compressing and expanding heat-carrying elements (i.e., refrigerants) in a cycle, indoor heat is transferred outdoors or outdoor heat is transferred indoors by an air conditioner, for example, to subsequently cool or heat a room.
- Fluctuations to the temperature of refrigerants is based on the principle that “compressing a gas increases its temperature, while lowering its pressure (i.e., expanding) lowers its temperature.

1 unit electric power + 6 units heat in the air → 7 units thermal energy  
 (an example of heating with a household air conditioner)

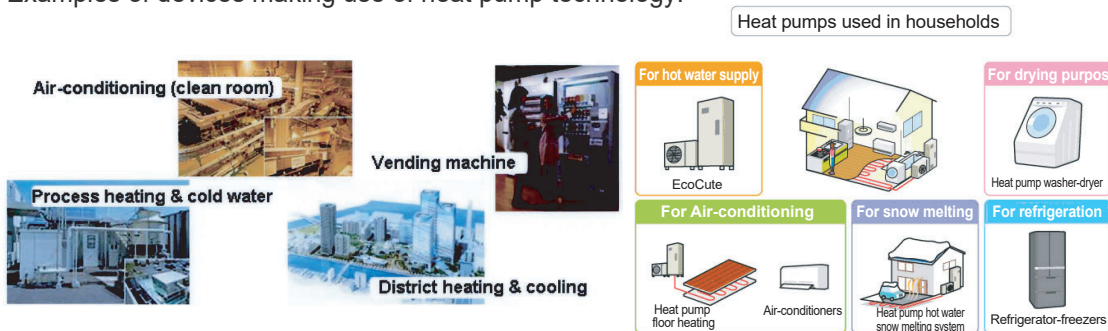


- ◆ The graphs below show the potential amount of primary energy and CO<sub>2</sub> that can be conserved/reduced in each setting (i.e., residential use, office use, industrial use, agricultural use, and other settings) and application (hot water supply, air-conditioning, heating, melting snow, etc.), if the use of heat pump systems becomes widespread with respect to the base year (FY2018) (calculated based on the amount of primary energy and CO<sub>2</sub> used/produced in these settings in FY2020).



## Installation in Practice or Schedule

**Domestic** Examples of devices making use of heat pump technology:



**Overseas** Air conditioners in commercial buildings and district cooling systems around the world use heat pumps with high-efficiency turbo chillers; however, variable-speed turbo chillers with inverter control have also been employed in recent years to achieve even higher standard of energy efficiency.

In Europe, heat pump heaters equipped with geothermal systems are widely used, and Japanese manufacturers have also added their independently-developed heat pumps as heat sources.

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