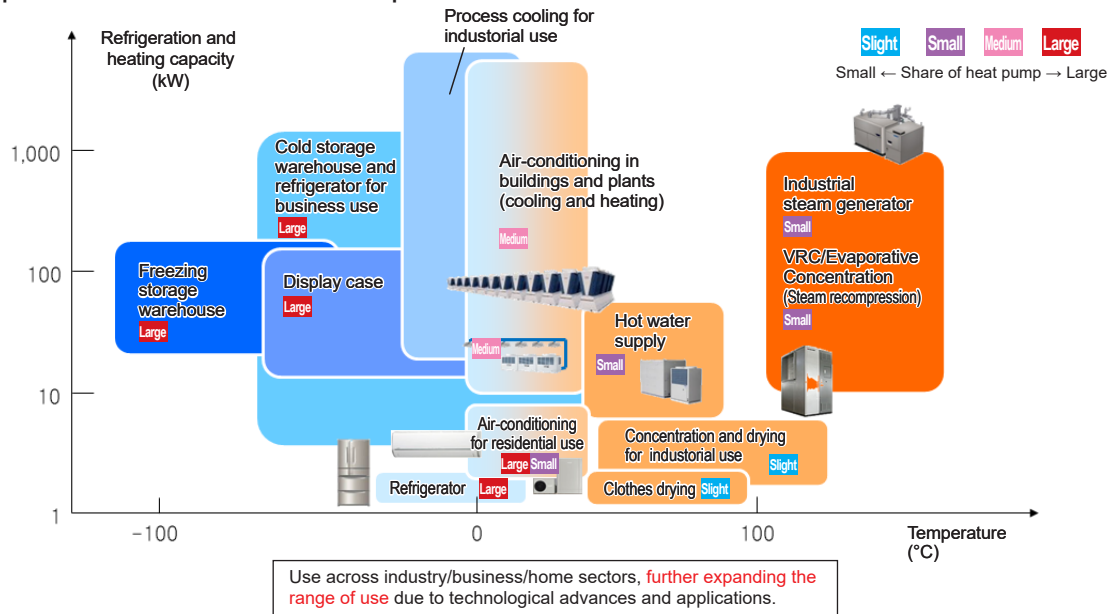


Heat Pump (General Purpose)

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 the reduction of CO₂ 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.

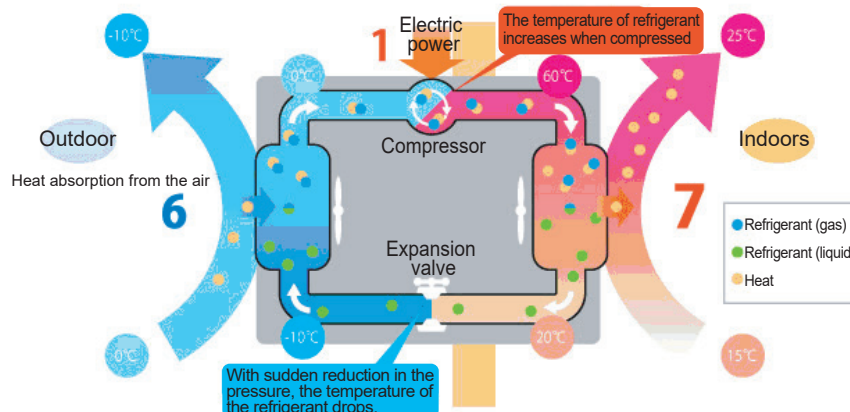
Applicable Fields of Heat Pump



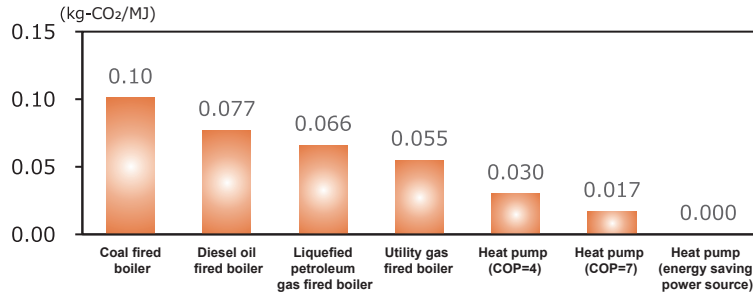
Basic Concept or Summary

- ◆ Heat pumps don't contain 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)

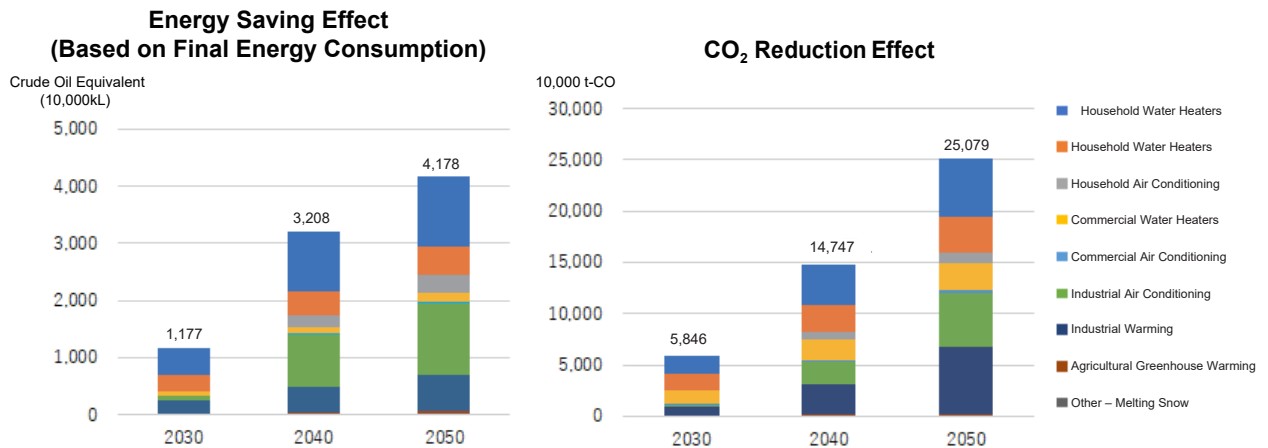


◆ Comparison of CO₂ emissions per 1MJ heating



Type	Heating value	Emission factor
Petroleum	25.7MJ/kg	2.33kg-CO ₂ /kg
Diesel	39.1MJ/L	2.71kg-CO ₂ /L
Liquefied petroleum gas	50.8MJ/kg	3.00kg-CO ₂ /kg
Utility gas	44.8MJ/m ³ N	2.23kg-CO ₂ /m ³ N
Electricity	3.6MJ/kWh	0.435kg-CO ₂ /kWh

◆ The final energy and CO₂ emissions reductions by sectors (home, business, industry, agriculture, etc.) and by use (hot water supply, air conditioning, heating, snow melting, etc.), in the event the use of the heat pump unit and the like becomes more popular, are shown in comparison with the base year (FY2020) below (figures are estimates derived by this center in 2022).



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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