

*Residential heat pump hot water heating
and
Whole house air conditioning system*

MITSUBISHI ELECTRIC CORPORATION
Nakatsugawa Works

Outline

Econucool(Hot water heating)

- Backgrounds of development
- Specifications
- Features



Air resort(Whole house air conditioner)

- Specifications
- Features



Regional difference



Air conditioning is mainly separated and intermitting.
Heating energy accounts for About 20~30% in residential energy consumption.
Air temperature hardly lowers under the freezing point.
Many big cities exist.

Regional difference

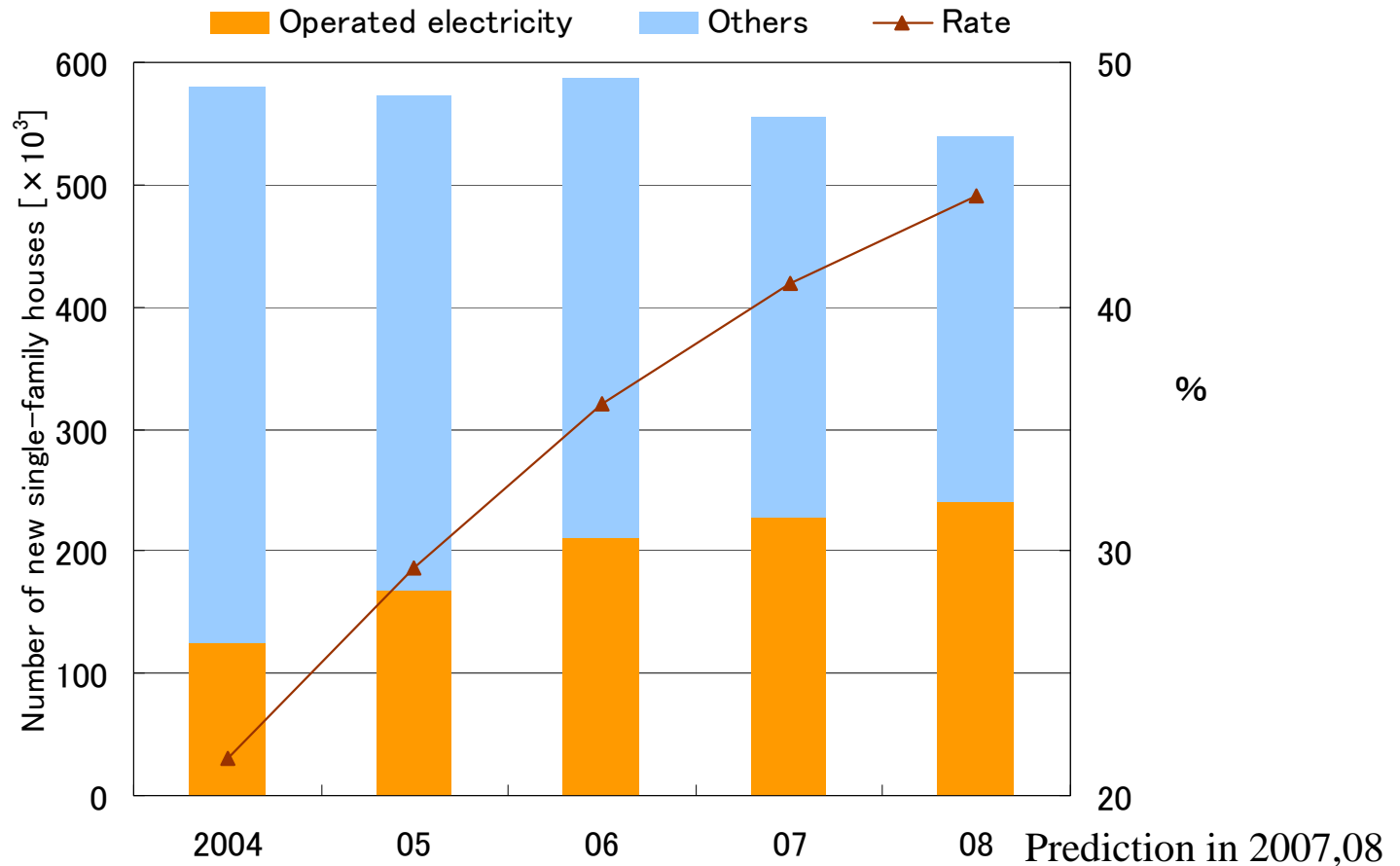


The central heating and 24 hour operating.

Heating energy accounts for over 50% in residential energy consumption.

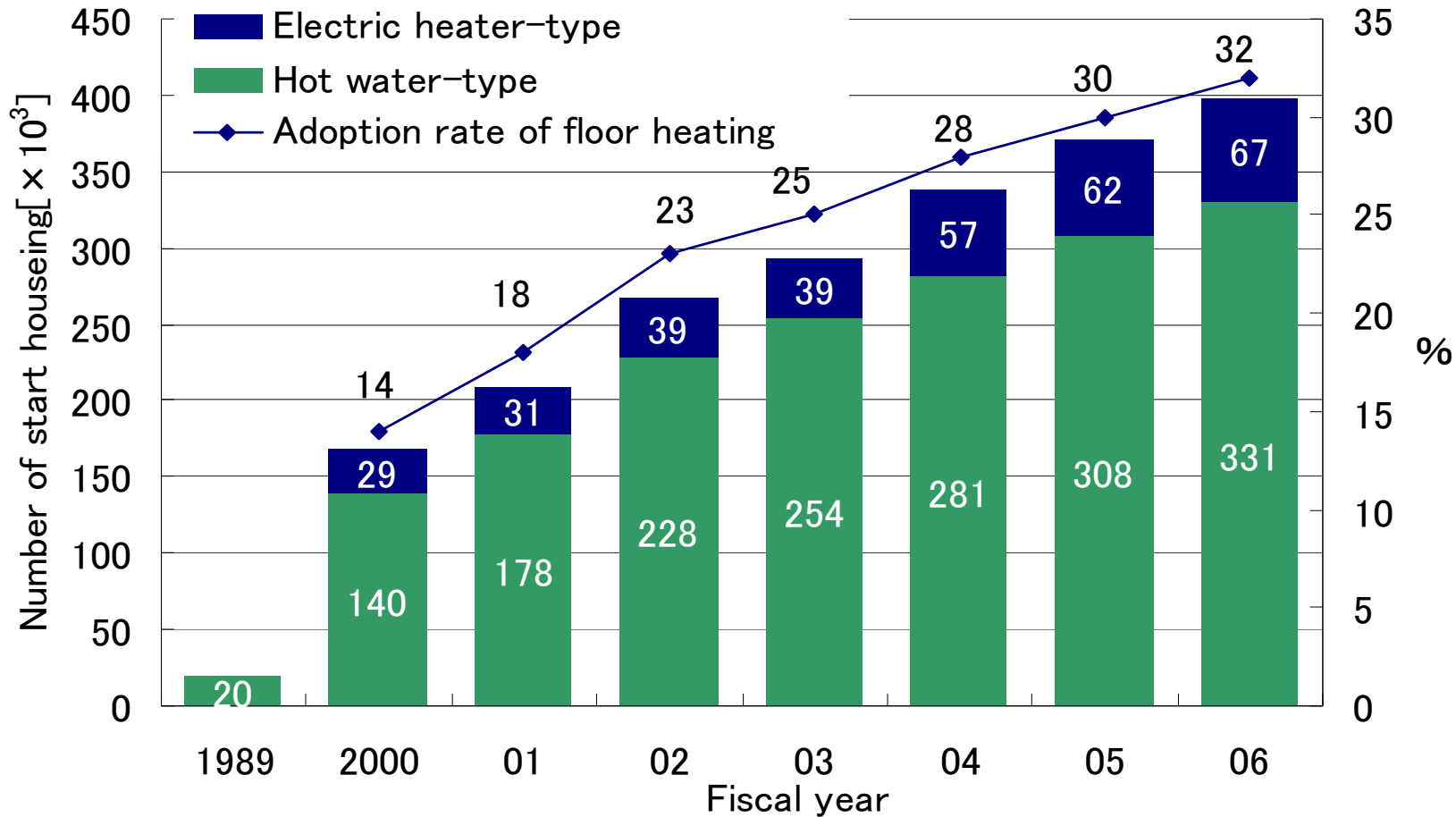
In winter the average temperature through a day often lowers under the freezing point.

Increase in houses operated electricity



- **Development of high efficient products**
- **Progress in insulation level of houses**

Market of residential floor heating



▪ The central heating becomes acceptable.

Comparison floor heating with others

	Floor heating	Air conditioner	Kerosene or gas fan heater	Thermal storage heater
Warmth	☆☆☆ Warm at one's feet	☆ Sending air	☆ Sending air	Uncontrollable temperature
Saving energy	☆☆☆ 16~20°C	☆ 20~24°C	☆ 20~24°C	Uncontrollable temperature
Cleanness & health	☆☆☆ Radiation & natural convection current	☆ Raise the dust	☆ Raise the dust burning	☆☆☆ Radiation & natural convection current
Interior & exterior	☆☆☆ Concealed under floor	☆☆ Set on wall	☆ Put on floor	Put on floor
Safety	☆☆☆ Heat source outside	☆☆☆ Electric heat source	Combustion	Risk of burn

- **Floor heating provides high comfort.**
- **Floor heating is superior to others in many ways.**

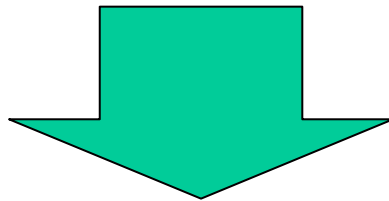
Backgrounds

Necessity of energy reduction in residences

Increase in houses operated electricity

Comfort of floor heating

Progress in the insulation level of houses



Heat pump-type hot water heating

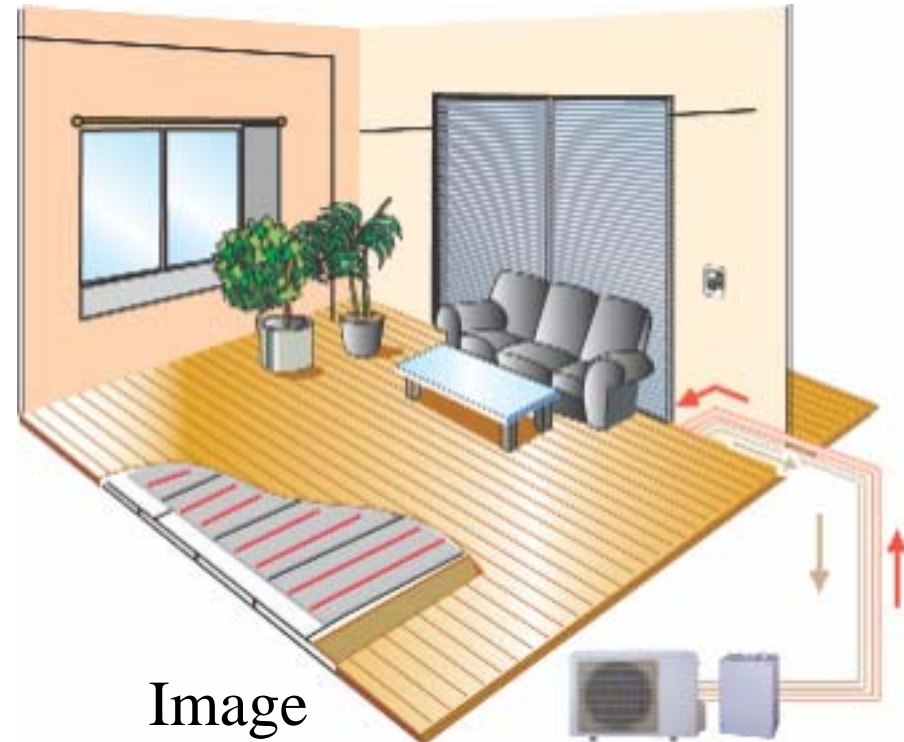
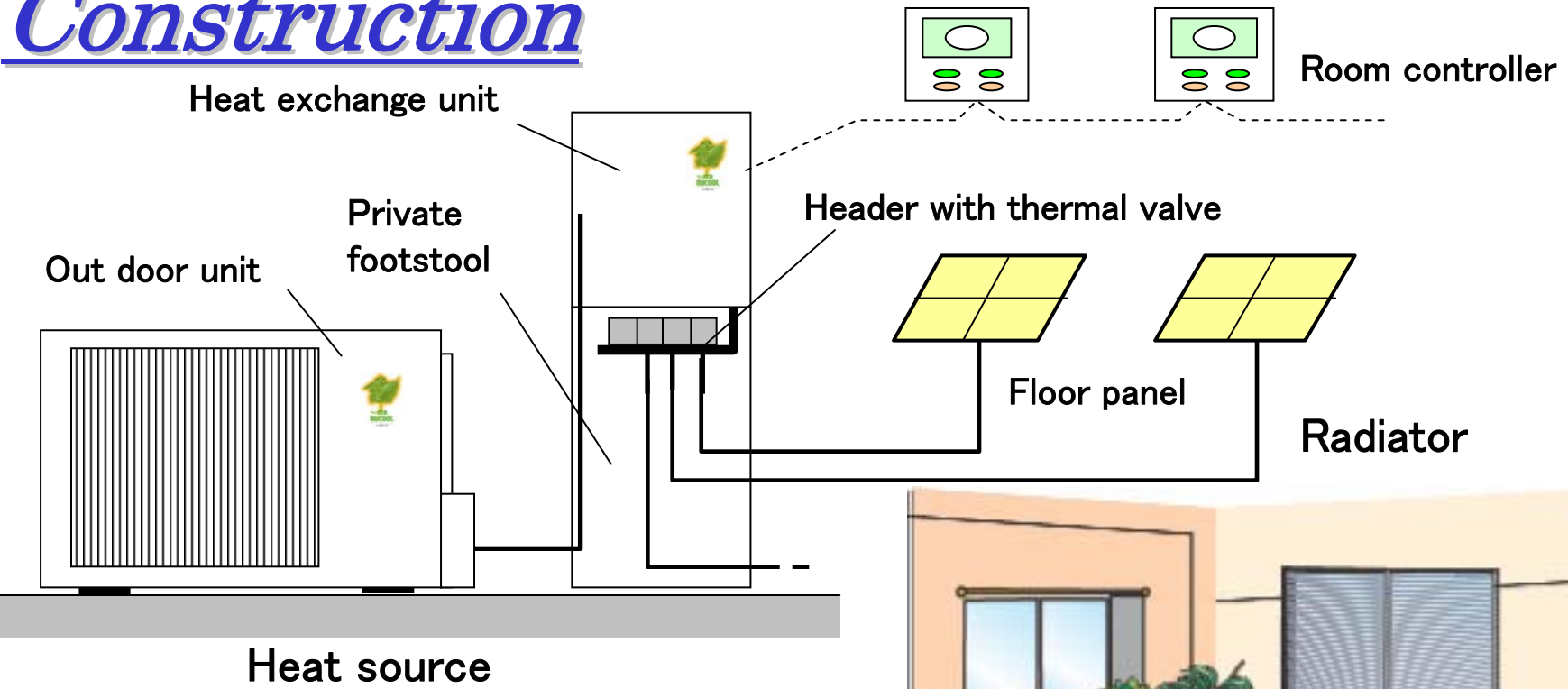
Specifications

Capacity

		Picco (Compact type)	Leo (Powerful type)
Heating	Capacity	6.0kW	11.5kW
	COP	4.00	3.90
Cooling	Capacity	3.5kW	7.0kW
	COP	2.5	2.5
Adaptation area		64m ²	97m ²
Sending water degree		7~20°C (cooling) 25~55°C (heating)	
Adaptation outer temperature		Over -25°C	
Size of H.E. unit		W350 × H480 × D260mm	W580 × H560 × D300mm

- **The Leo is mainly adopted in cold area with wall-mounted panel heaters(radiators).**
- **The Picco is mainly designed for warm area with floor heaters.**

Construction

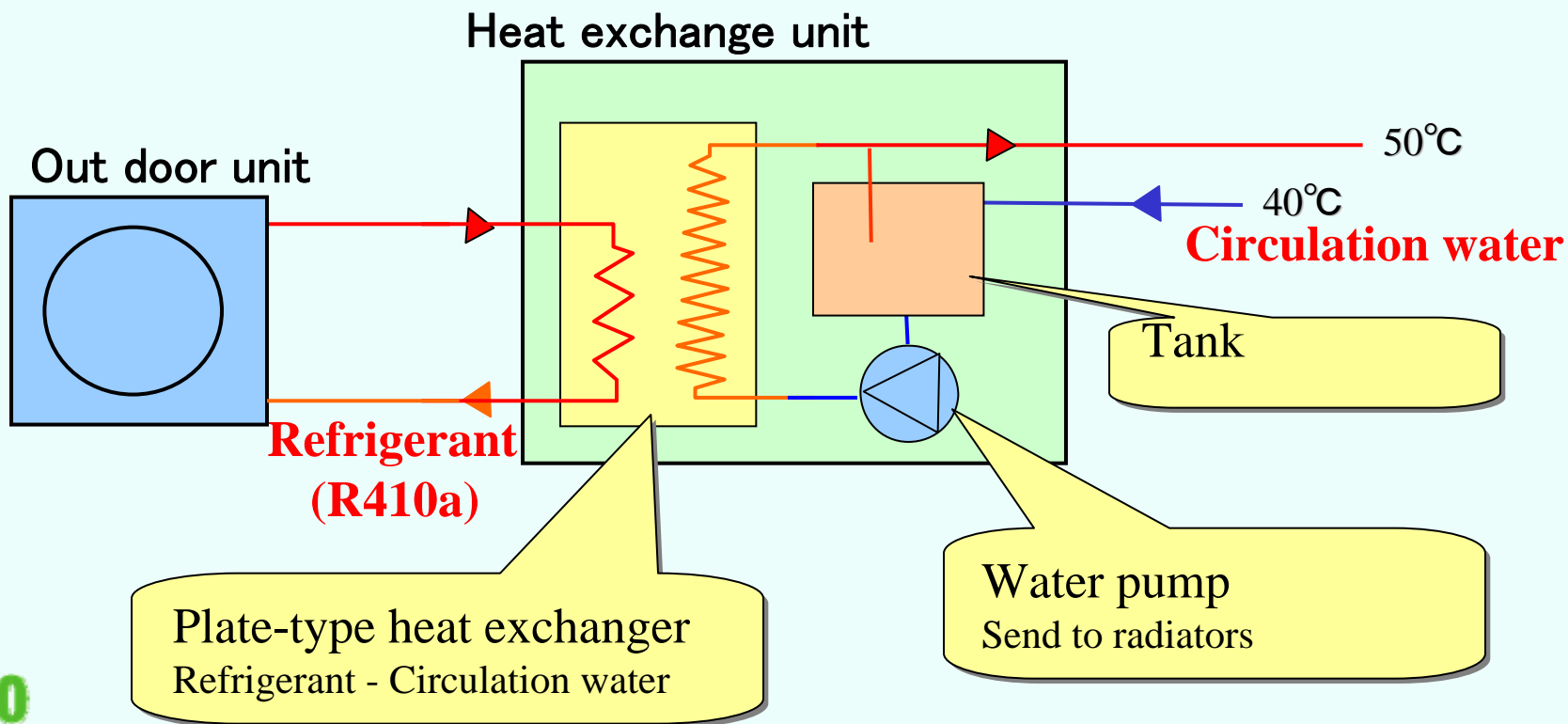


Energy saving

- Adoption of high efficient heat exchanger
- High insulation of outdoor unit & heat exchange unit
- High efficient defrosting
- **Generation of proper temperature water
(Low temperature water supply)**
- Adaptation for air temperature -25°C

Generation of proper temperature water

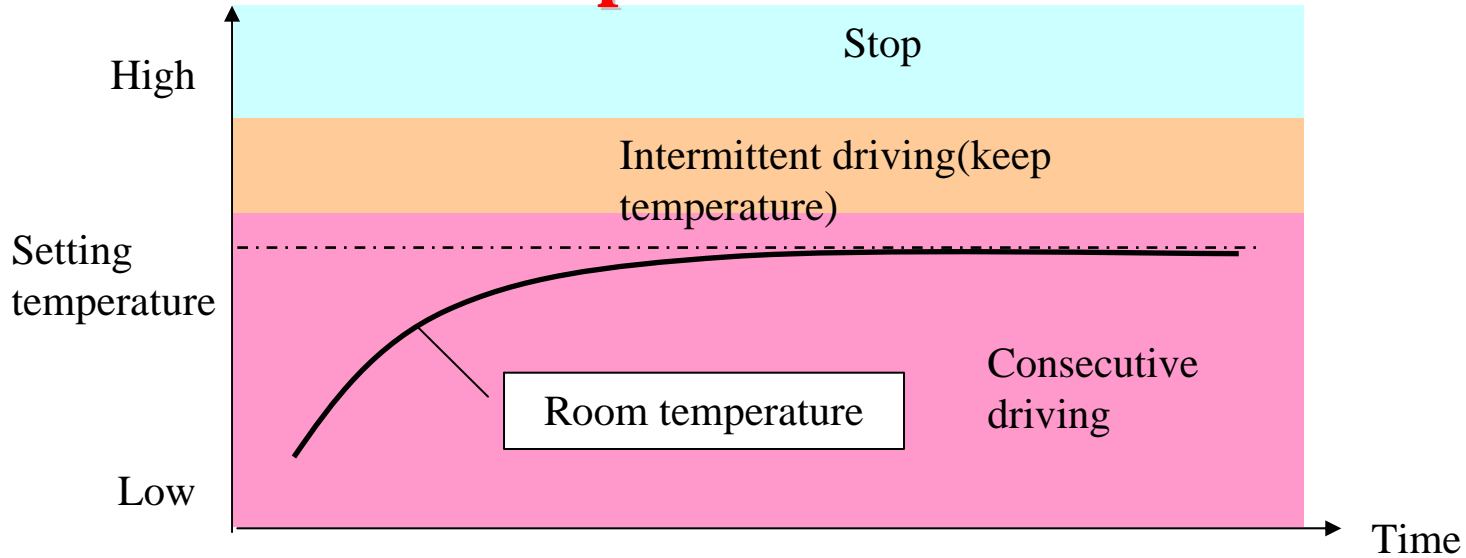
Hot water generation



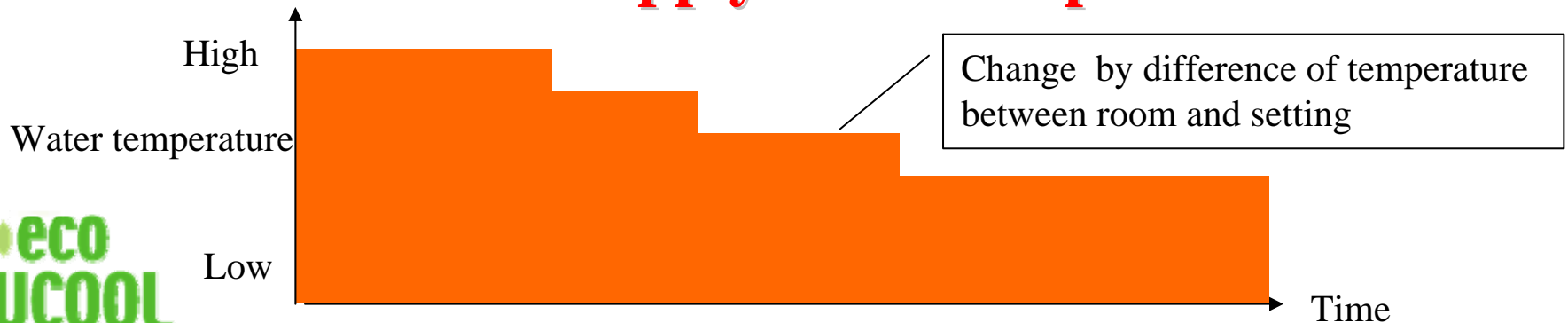
Generation of proper temperature

water

Floor temperature control

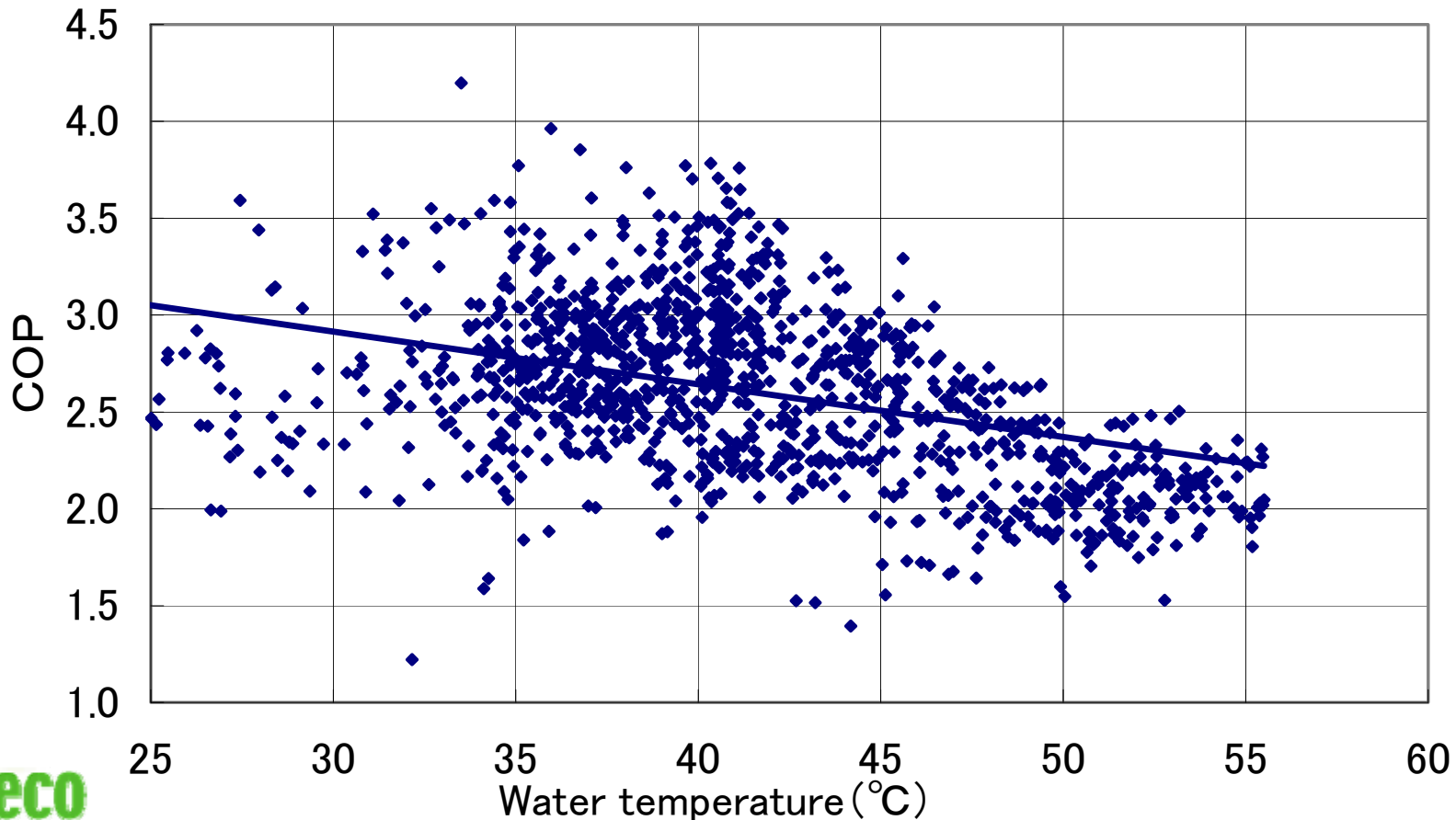


Control of supply water temperature



Generation of proper temperature water

Correlation of generated water temperature and COP



High efficient with low temperature water generation

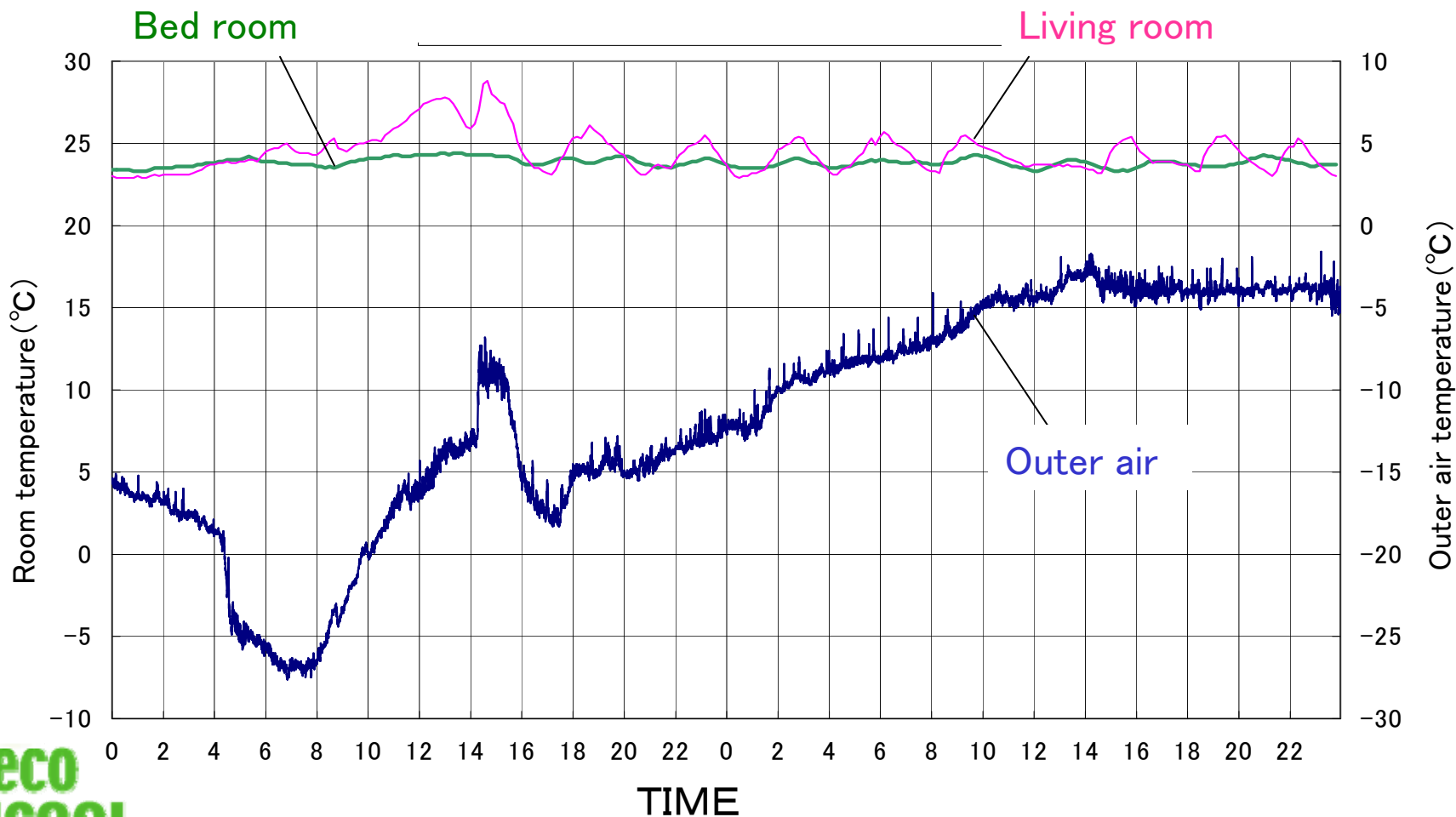
Adaptation to -25°C

Measurement in Asahikawa(Hokkaido)

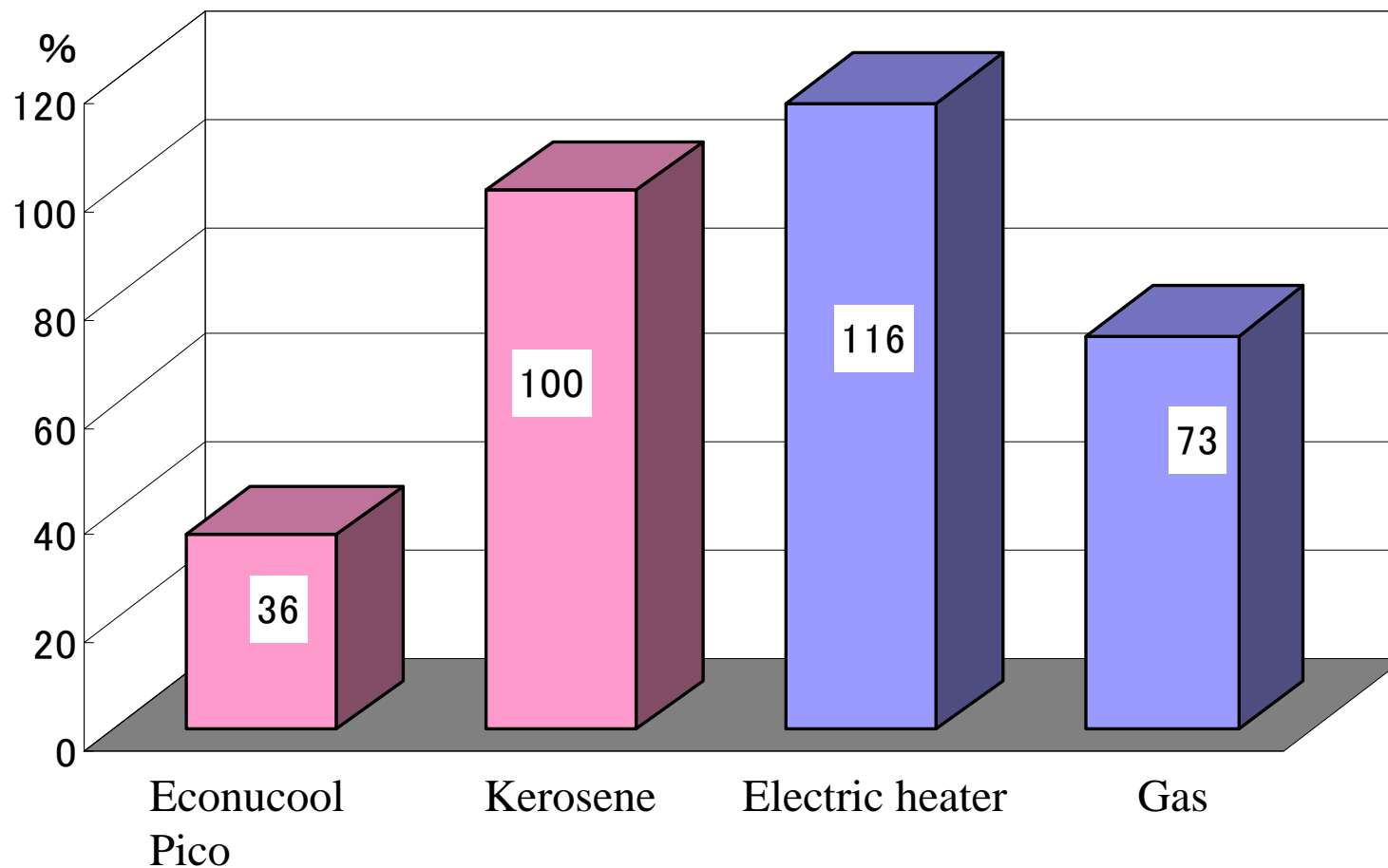
Area:134m²

Insulation level:1.37W/m² K

Total heat load:7203W



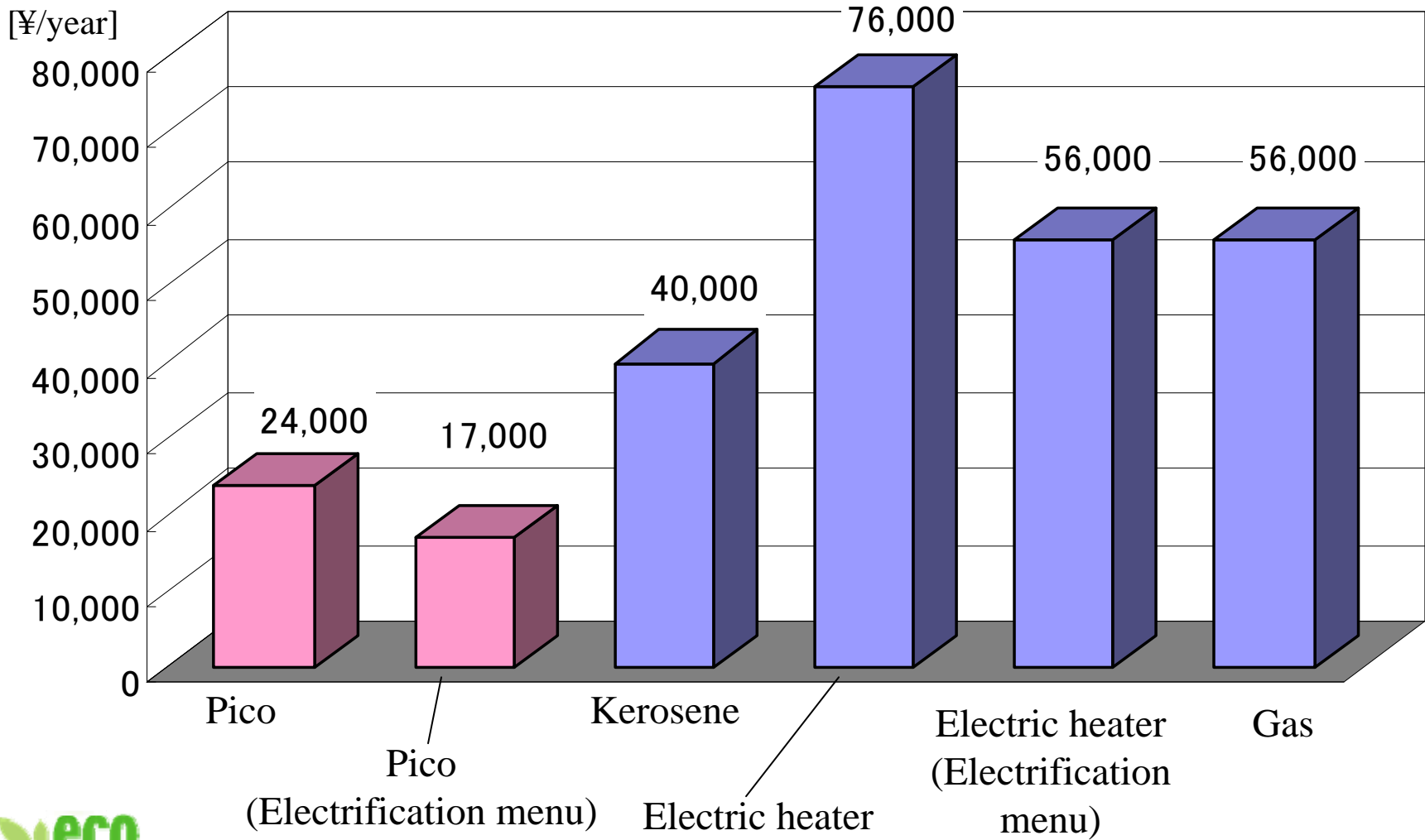
CO₂ footprint

Heating area:33m²
Time:24hrPlace:Tokyo area
Setting temperature:18°C

One third of kerosene, a half of gas

Running cost

Heating area: 33m² Place: Tokyo area
Time: 24hr Setting temperature: 18°C



Conclusion

- Heat pump hot water heating can provide comfort of floor heating.
- It also saves a lot of energy.
- It can run even in extremely cold area of Japan.
- Econucol is advanced heating system.

System construction(1)

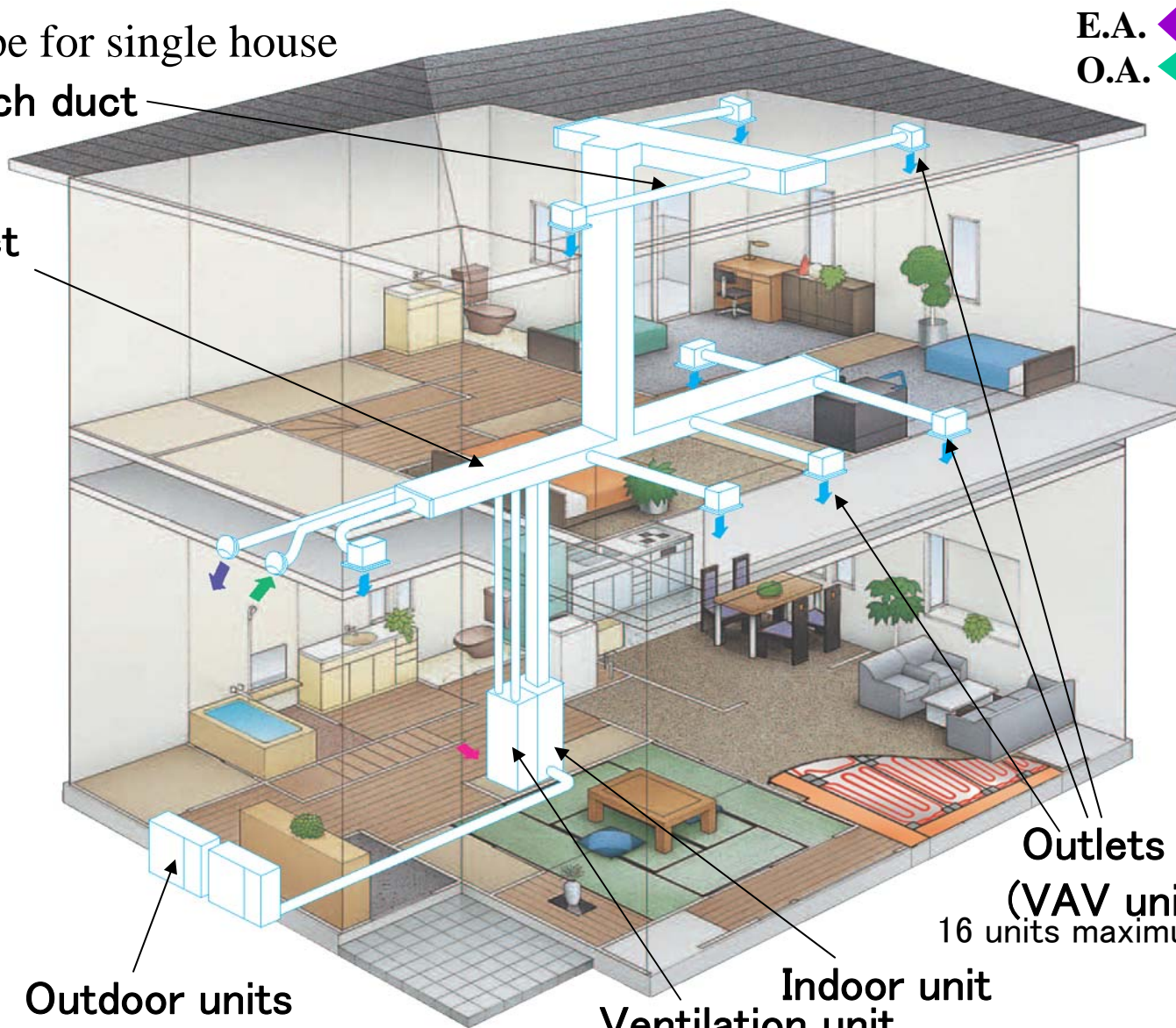
Example of floor type for single house

Branch duct

Main duct

Capacity
Heating :9.5kW
Cooling :8kW
Adaptation area
165m²

S.A. ←
R.A. ←
E.A. ←
O.A. ←



Outlets
(VAV unit)
16 units maximum

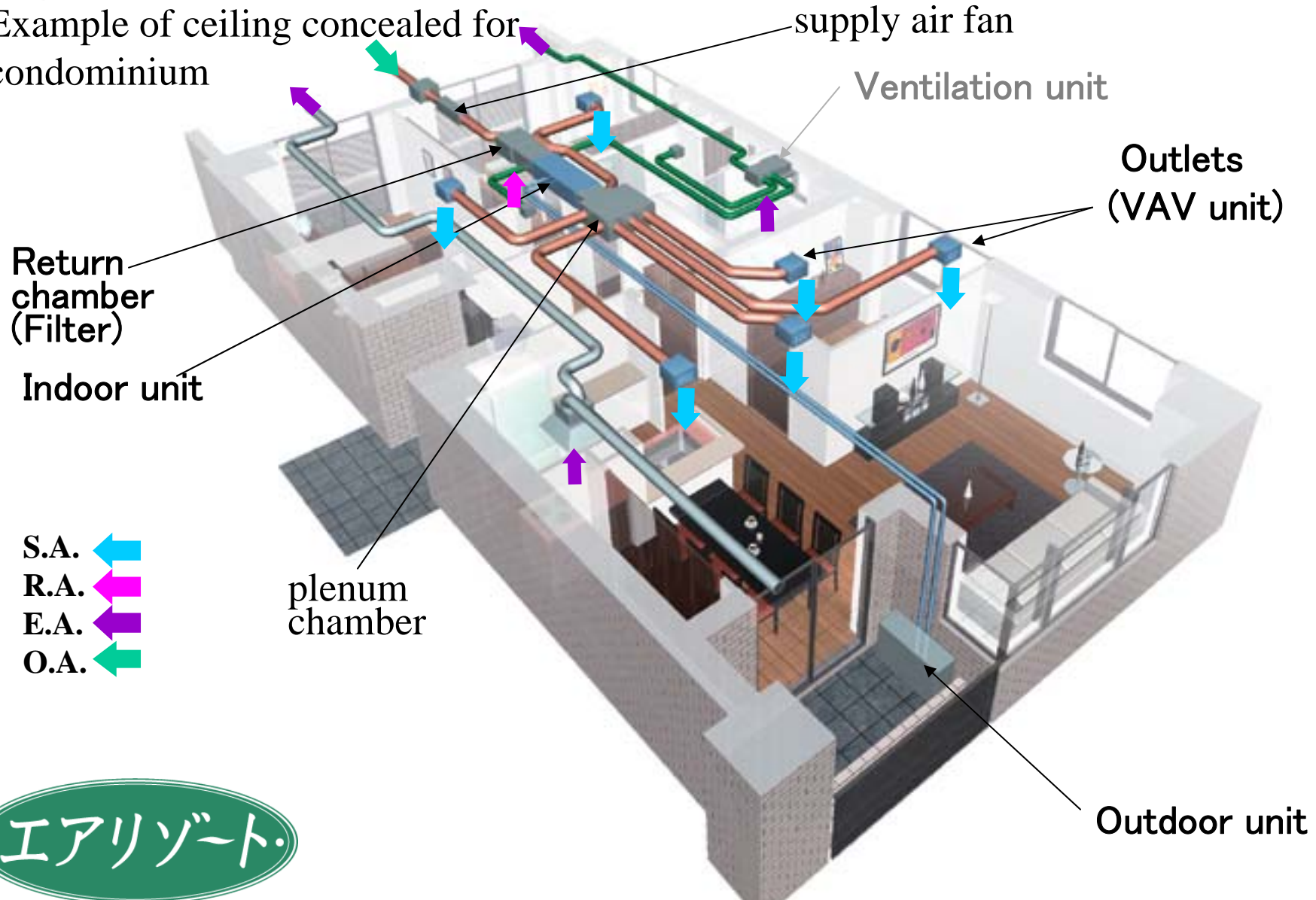


Outdoor units

Indoor unit
Ventilation unit

System construction(2)

Example of ceiling concealed for condominium



Advances of Air-resort

Healthy

No combustion
Fresh air

Saving

Heat recovery ventilation
High airtight & insulation

Maintenance

Periodic inspection
Easy cleaning

Comfort

Uniformity temperature
Individual control

・エアリゾート・

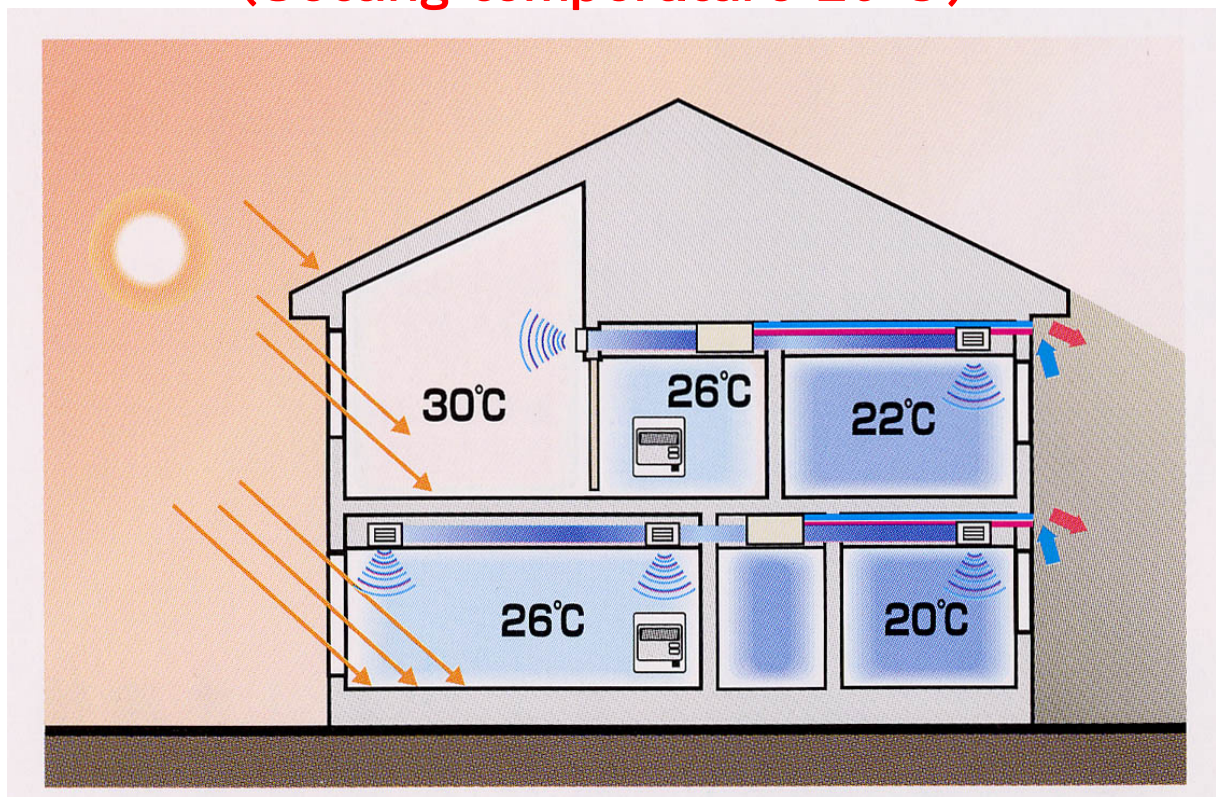
Interior Exterior

Not showy outlet
Save space

VAV system

VAV means Variable Air Volume

Usual whole house air conditioning
(Setting temperature 26°C)



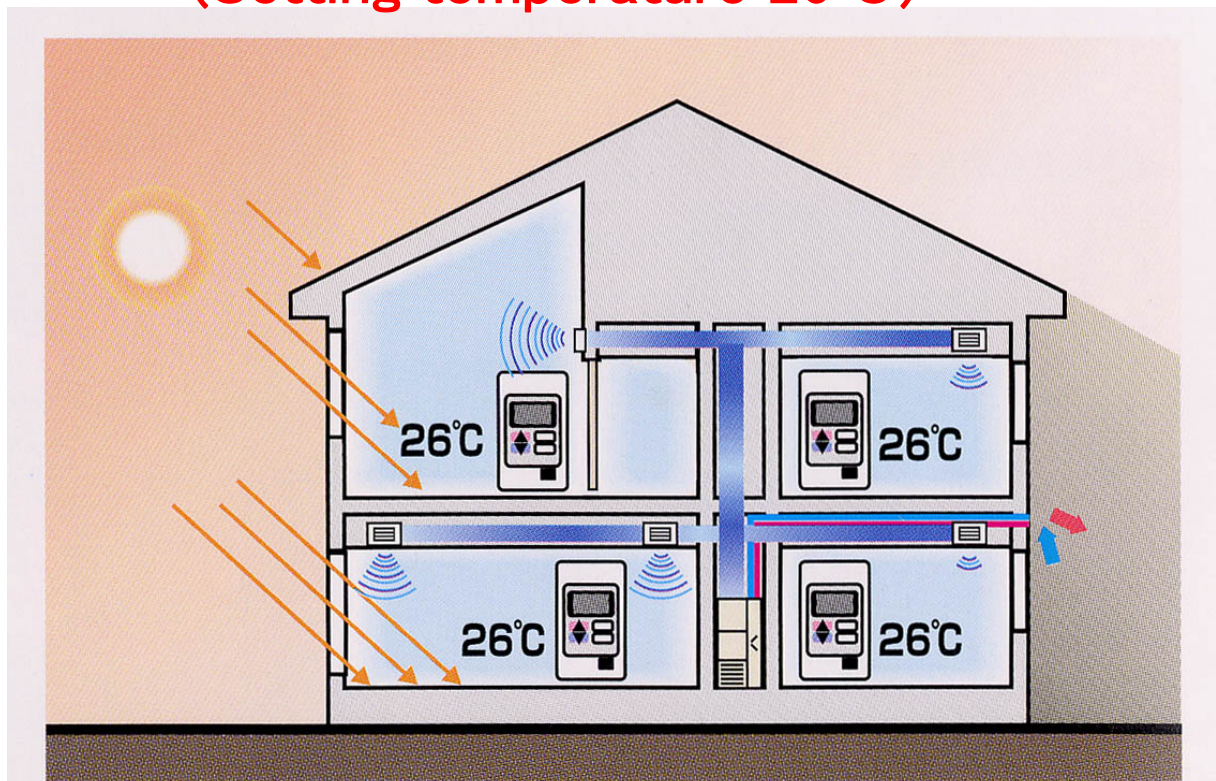
- Fixed air volume
- Temperature changing based on heat load



VAV system

VAV means Variable Air Volume

Air resort
(Setting temperature 26°C)



- Keep the fixed temperature
- Individual control



Control of VAV unit

Test drive: Calculation on resistance each duct

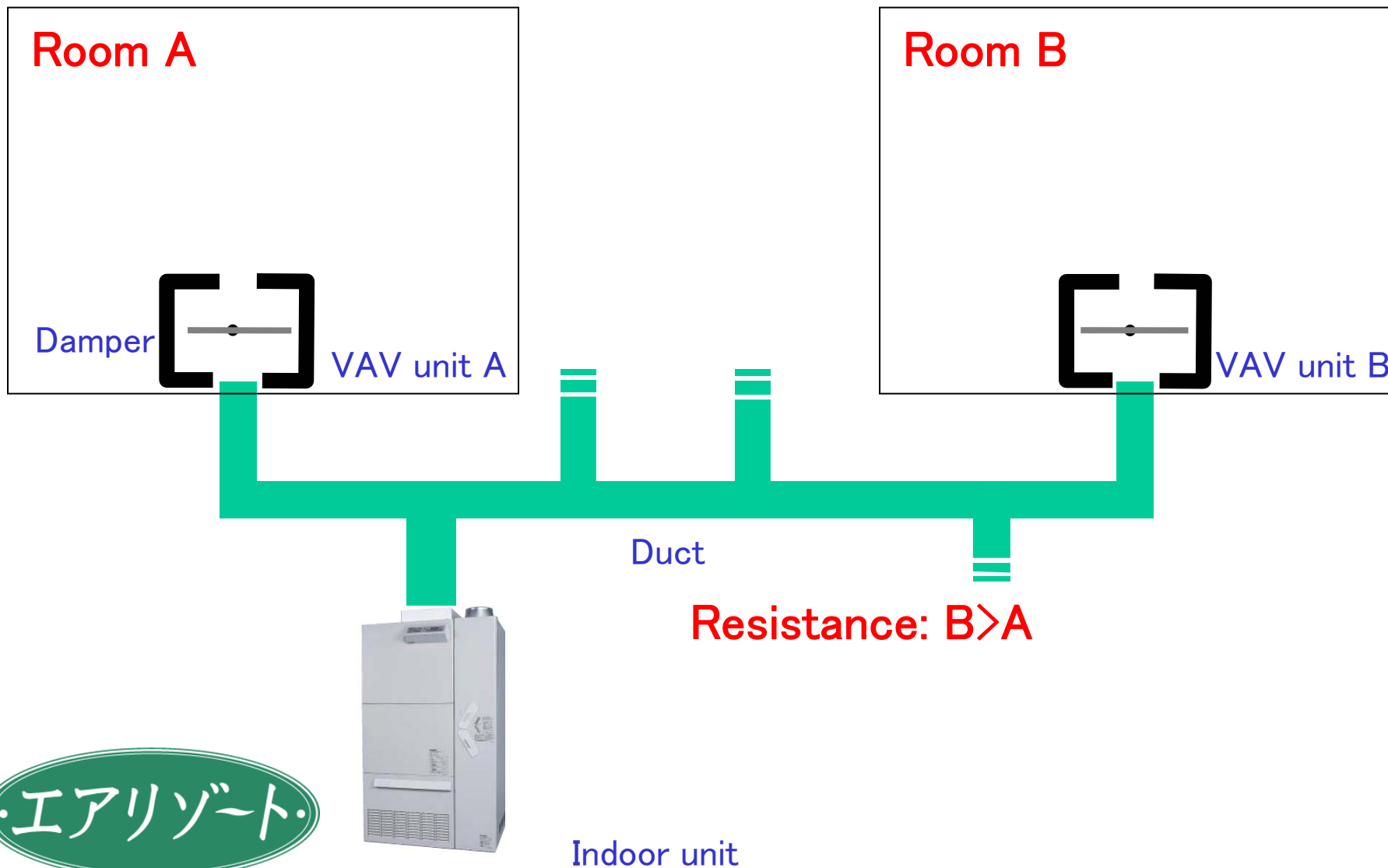
Now & setting temperature

Decide air volume
for each room

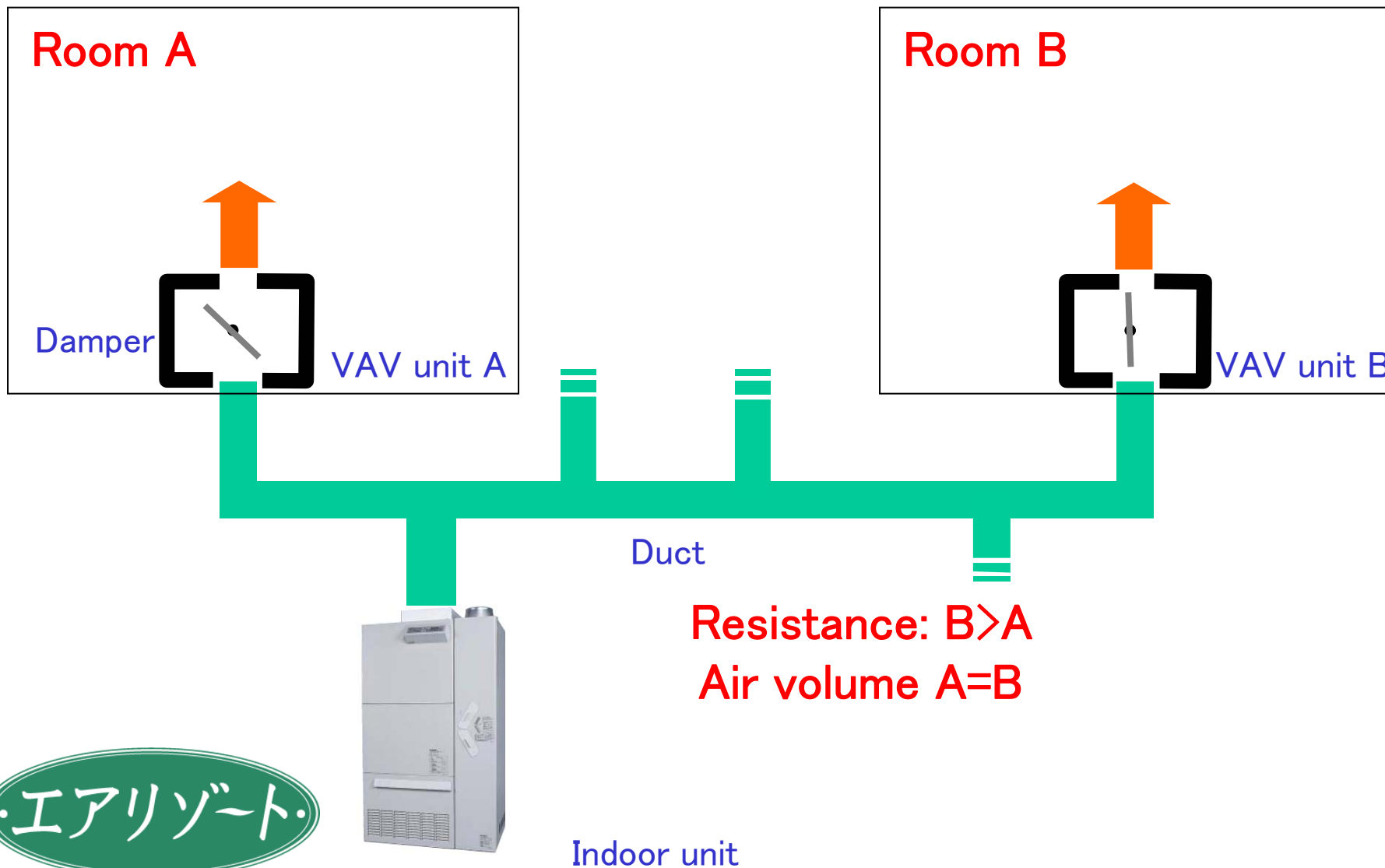
Calculate angle of each damper

Control fan power to suit
the sum of each air volume

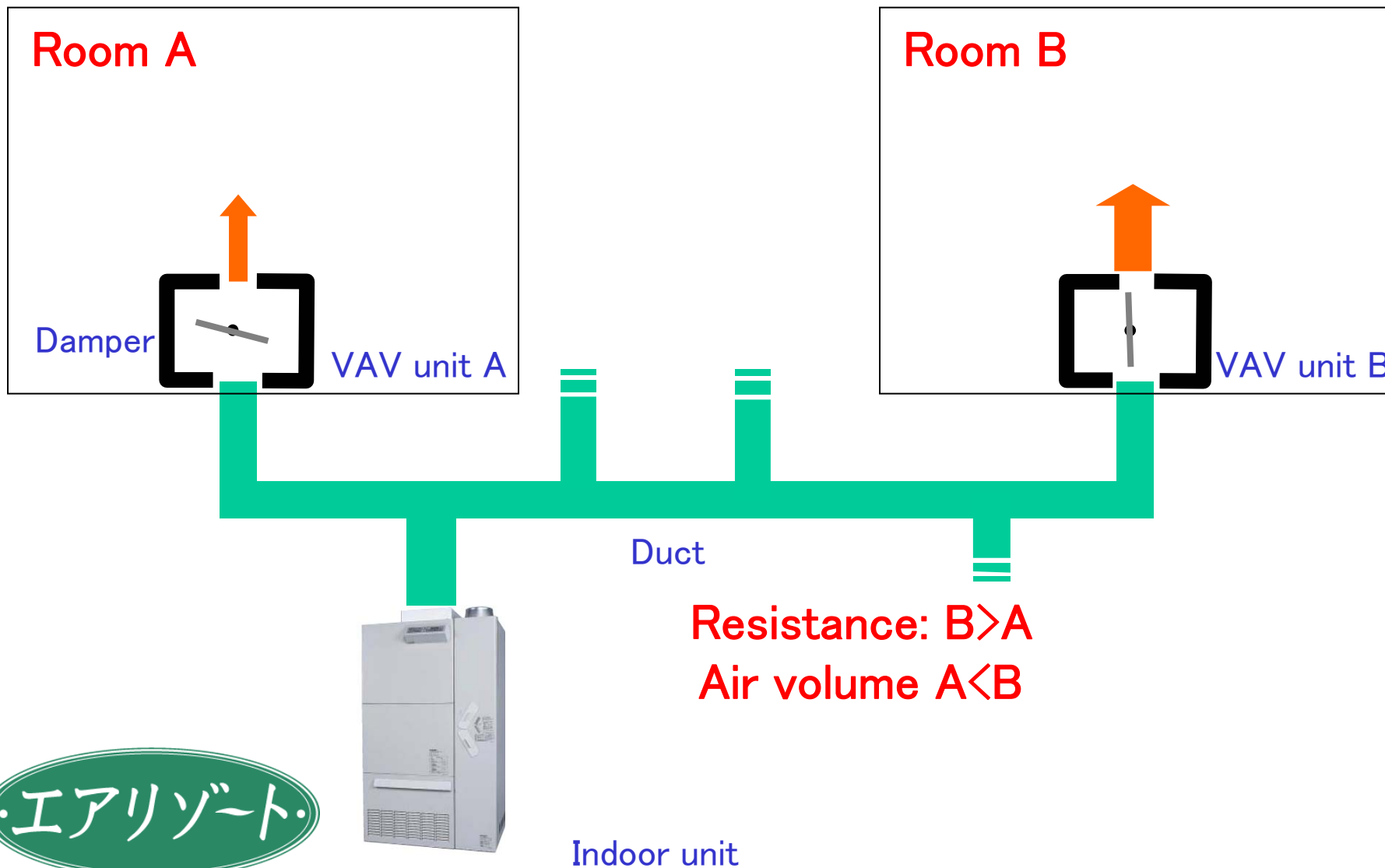
Control of VAV unit



Control of VAV unit



Control of VAV unit



Conclusion

VAV is superior to others in maintaining the fixed temperature and individual control.

Air resort adds flexibility and comfort to usual whole house air conditioning systems.



Thank you for your attention

MITSUBISHI

三菱電機

Changes for the Better

