Personal Environment Comfort System (PECS) for Improving Thermal Comfort and IAQ in a Zero Energy Building

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T Innovation Center

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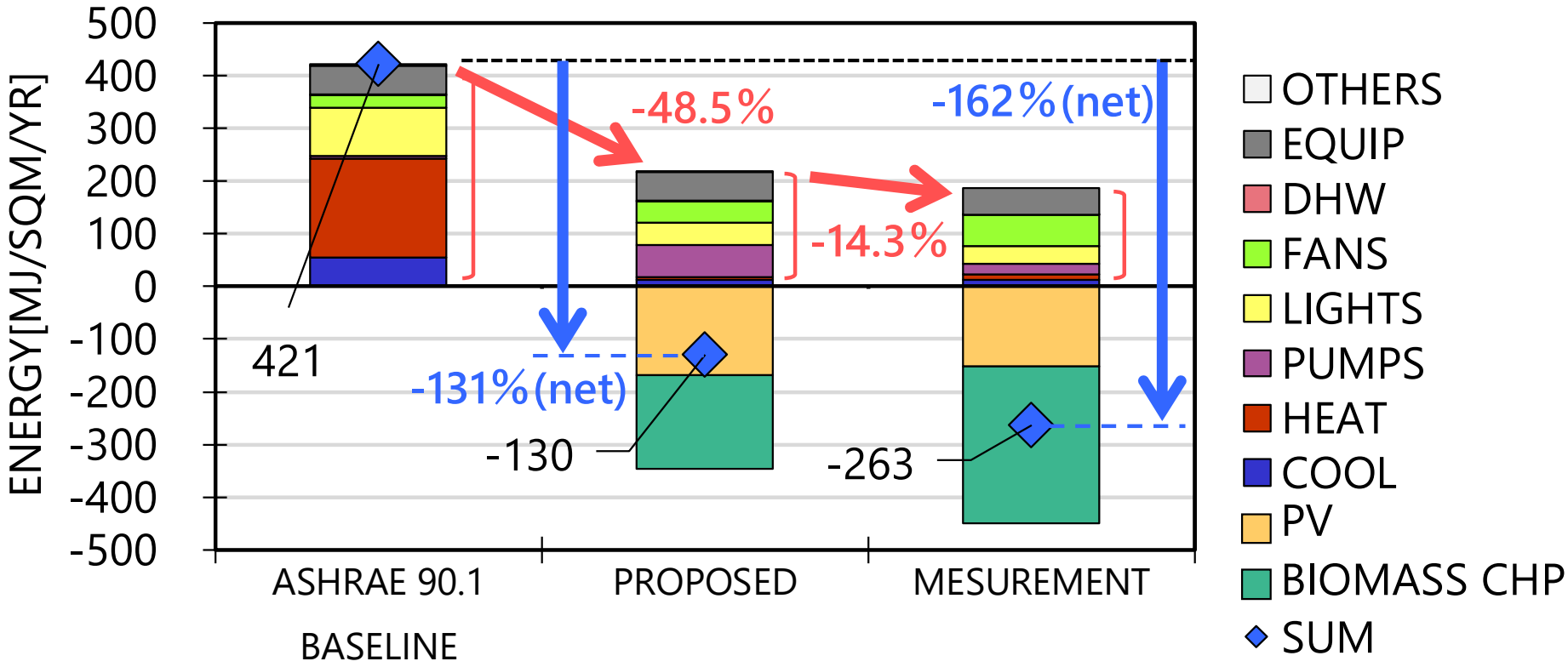
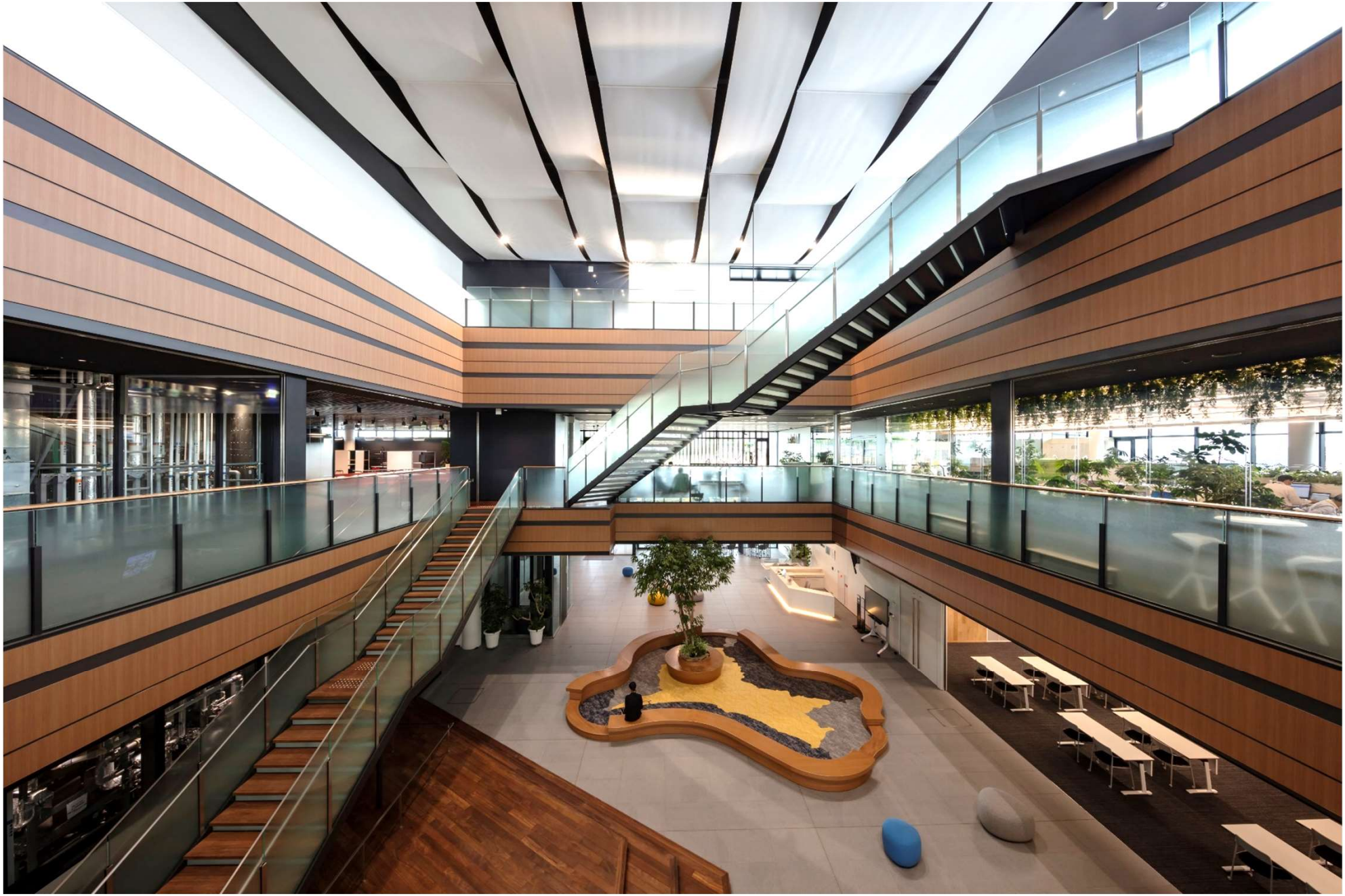
Location	**Tsukubamirai-city, Ibaraki, Japan**
Hight	**2-story building (15.5m)**
Target office	**2nd floor with Activity Based Working (ABW)**
Floor Area	**Office building: 4,750m²** **Laboratory building: 6,050m²**
Energy System	**Groundwater heat exchange** **Wood biomass heat and power supply system (CHP)** **PV panels 200 kW** **Battery power storage 4,600kWh**

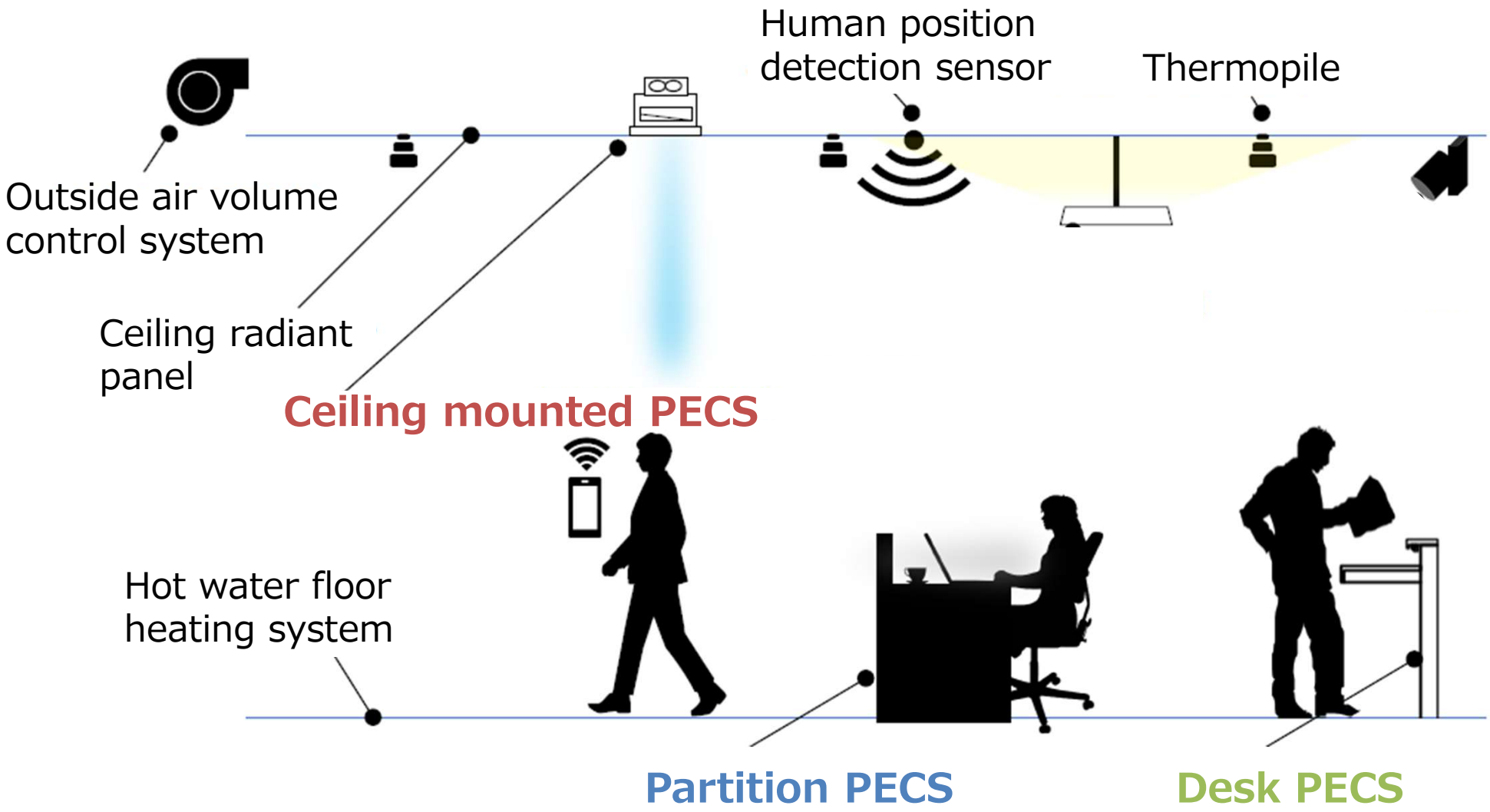
Net Zero Energy



✓ **Net Zero Energy and Emission were achieved during 2021.**



Three Types of PECS



Energy Efficiency: using groundwater as a cold heat source in summer and exhaust heat from biomass CHP as a heat source in winter

Ceiling installed PECS

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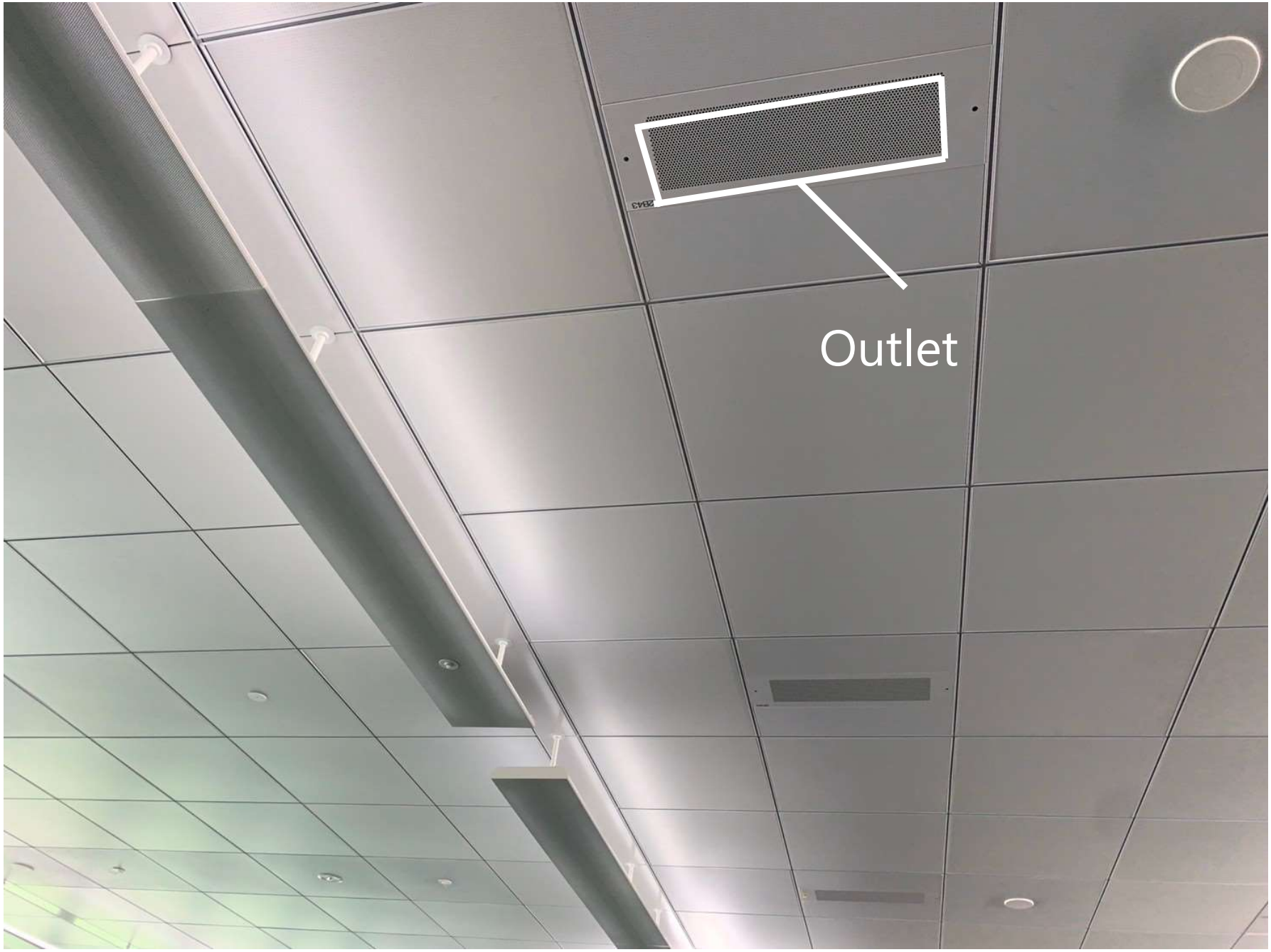

Ceiling installed PECS

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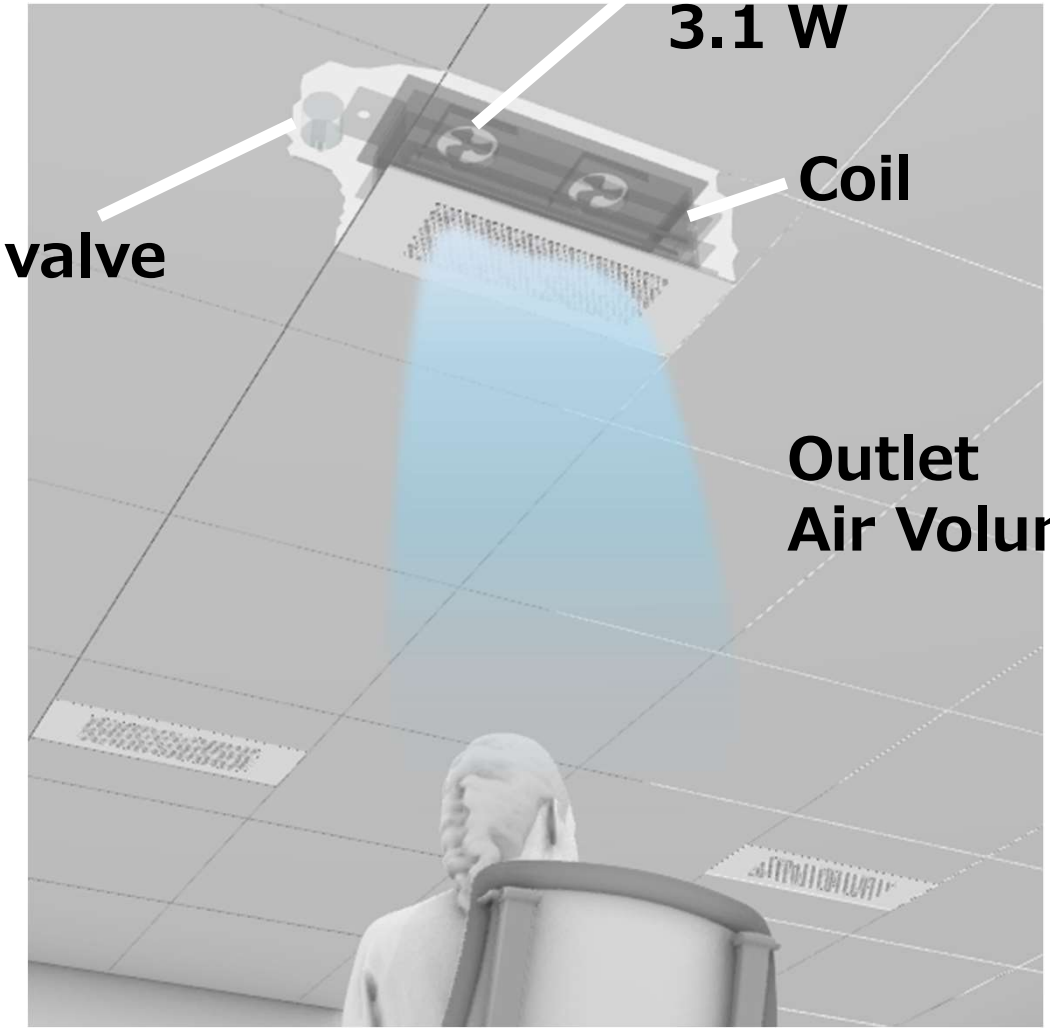

Cooling capacity 470W

Partition PECS

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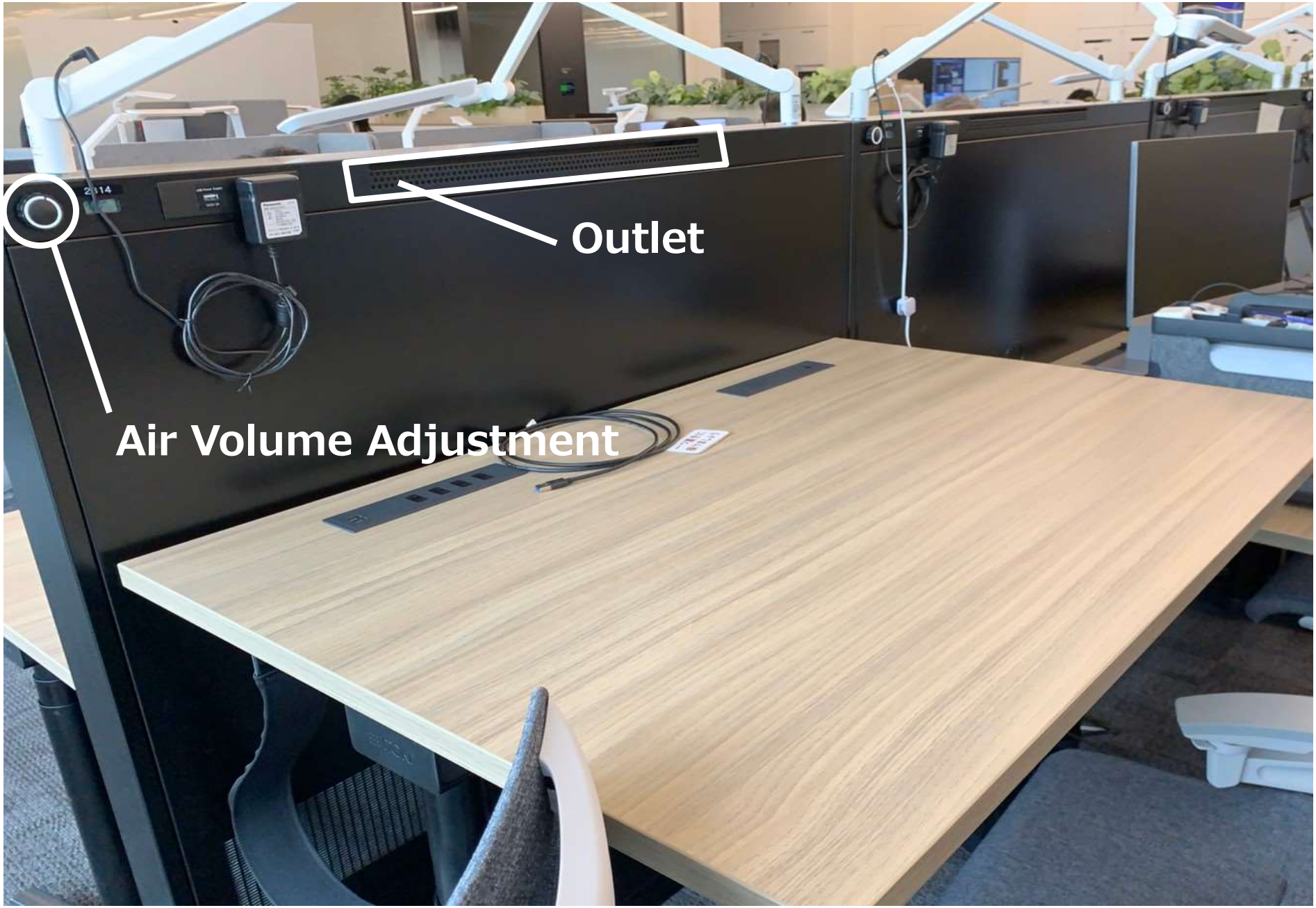

Partition PECS

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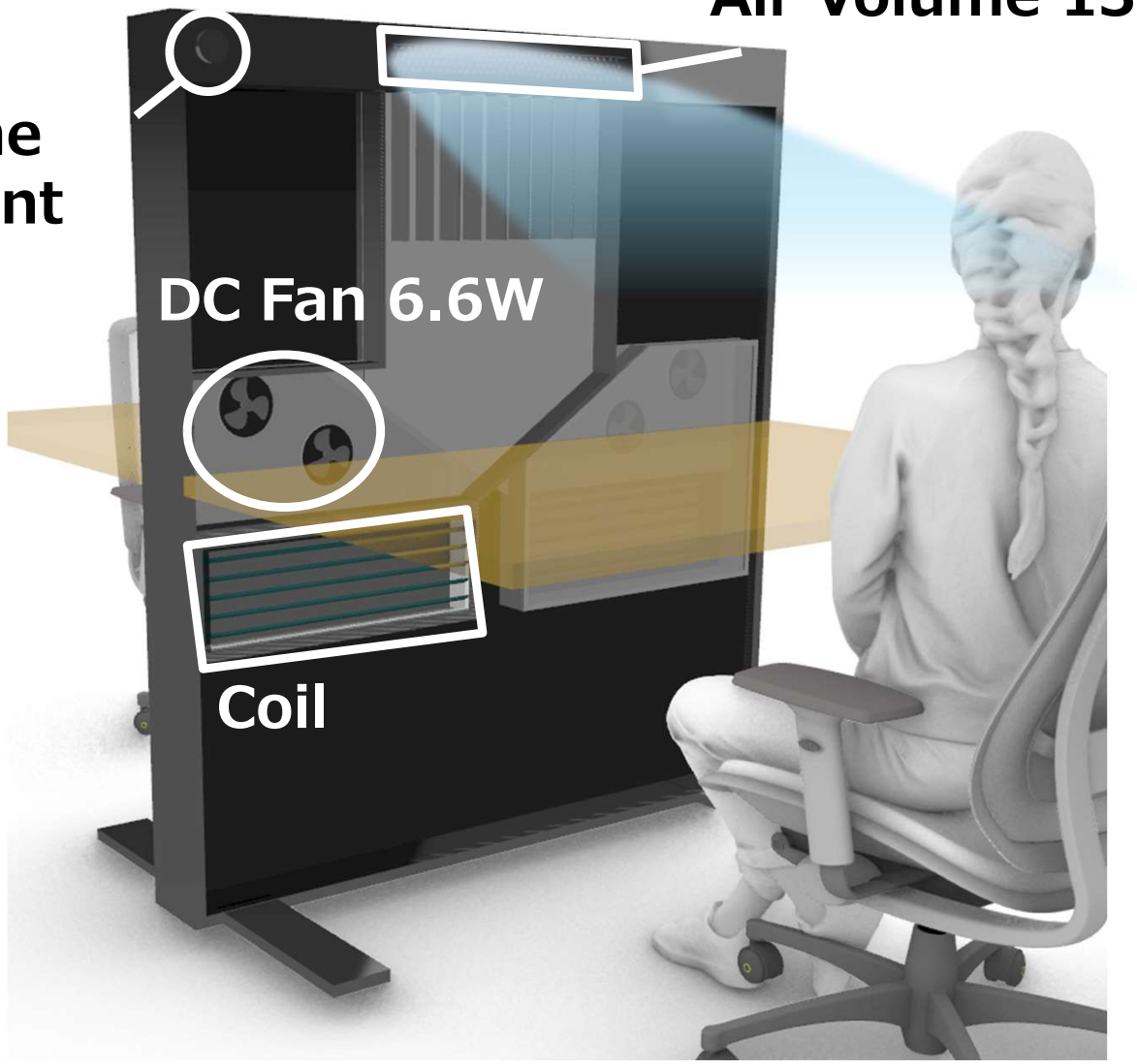

Cooling capacity 150W

Desk PECS

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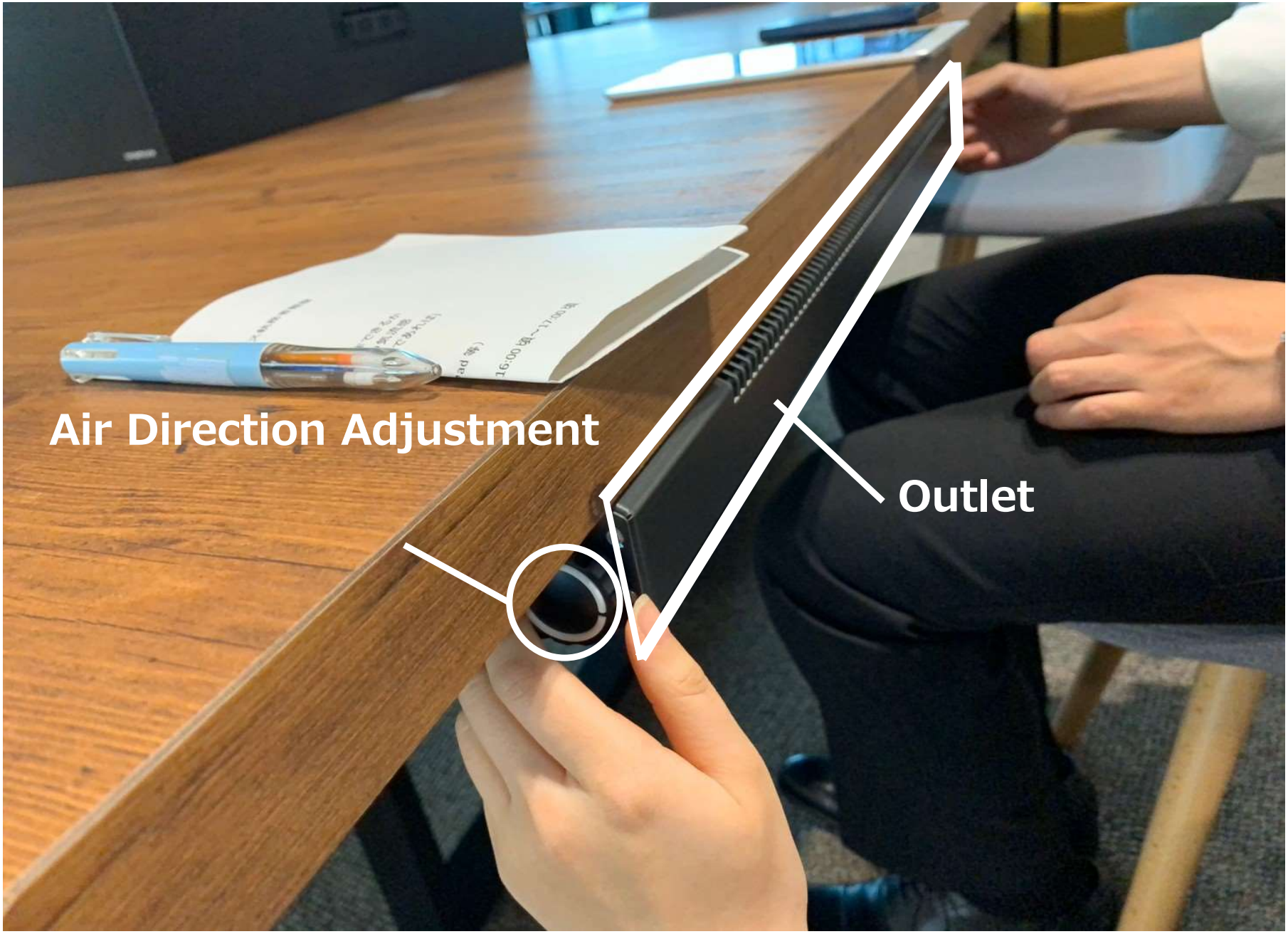

Desk PECS

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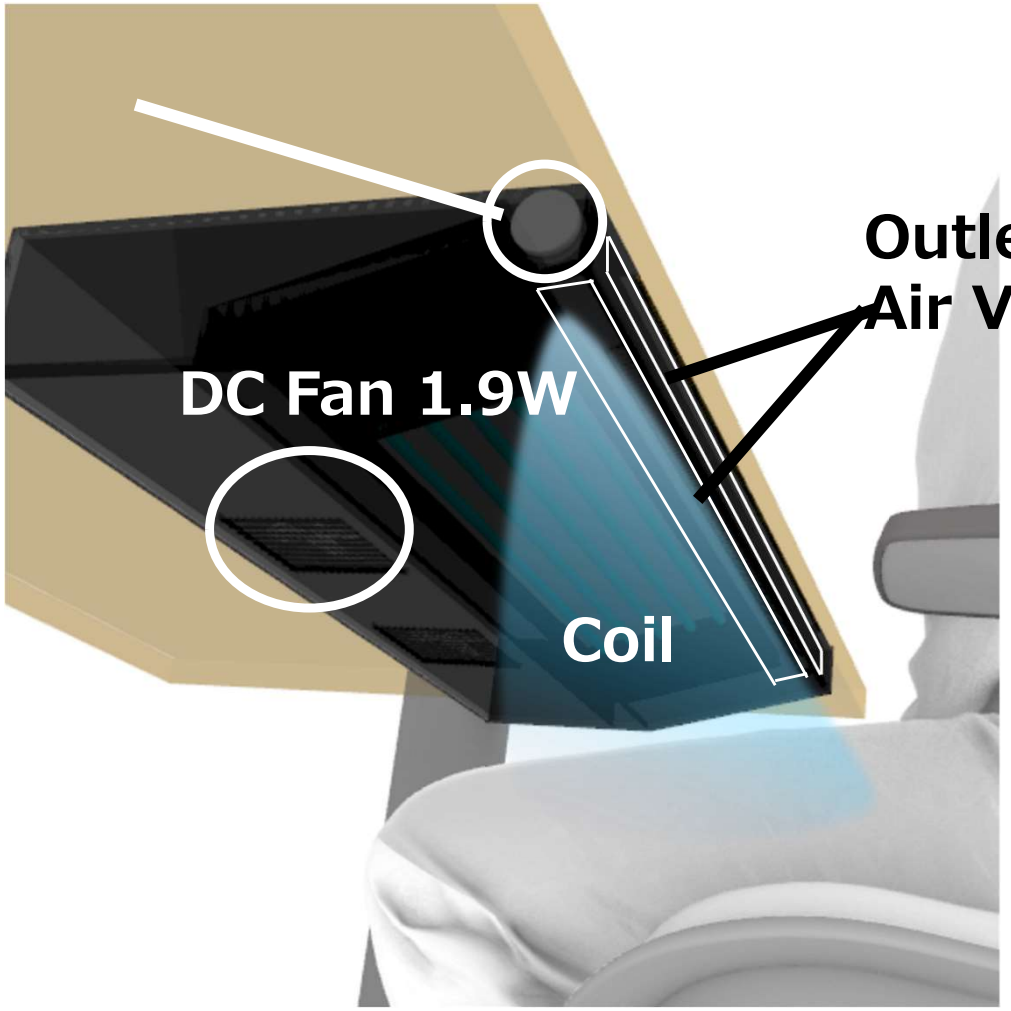
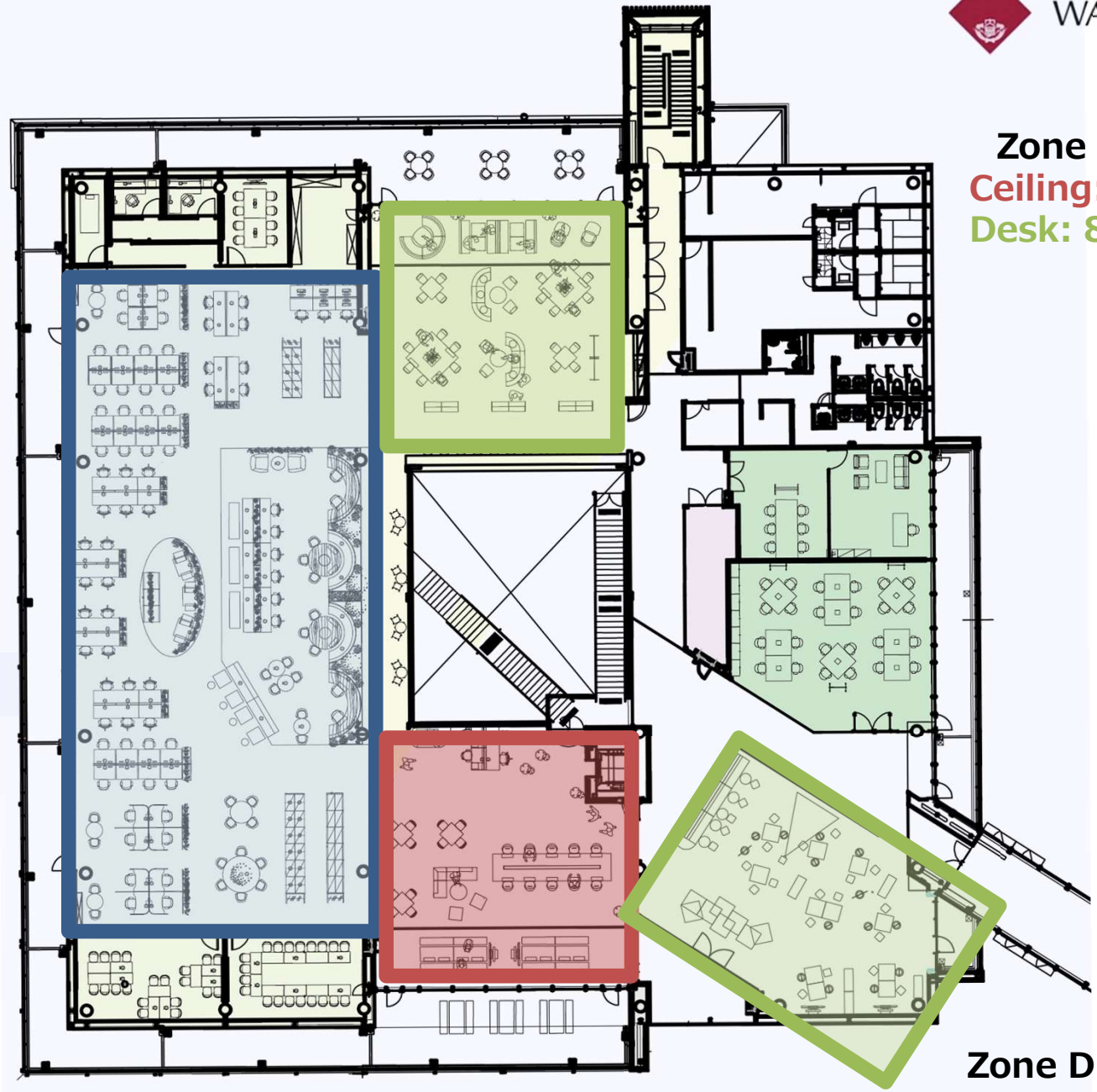
Air Direction Adjustment



Cooling capacity 70W



Zone A (634m²)
Ceiling: 57 units
Partition: 30 units
Desk: 28 units

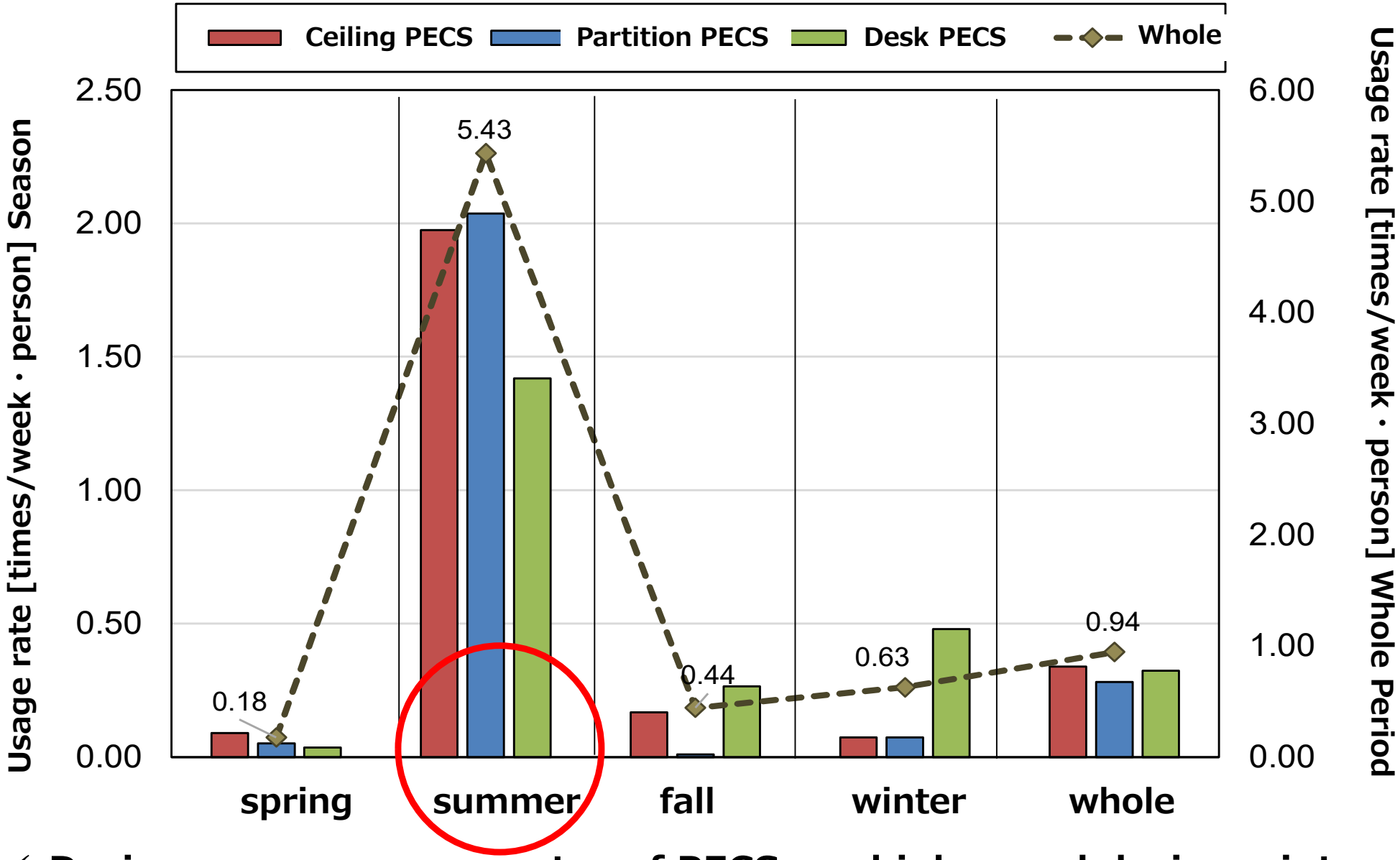
VIEW

Zone B (194m²)
Ceiling: 34 units
Partition: 10 units
Desk: 18 units

Zone C (204m²)
Ceiling: 36 units
Desk: 8 units

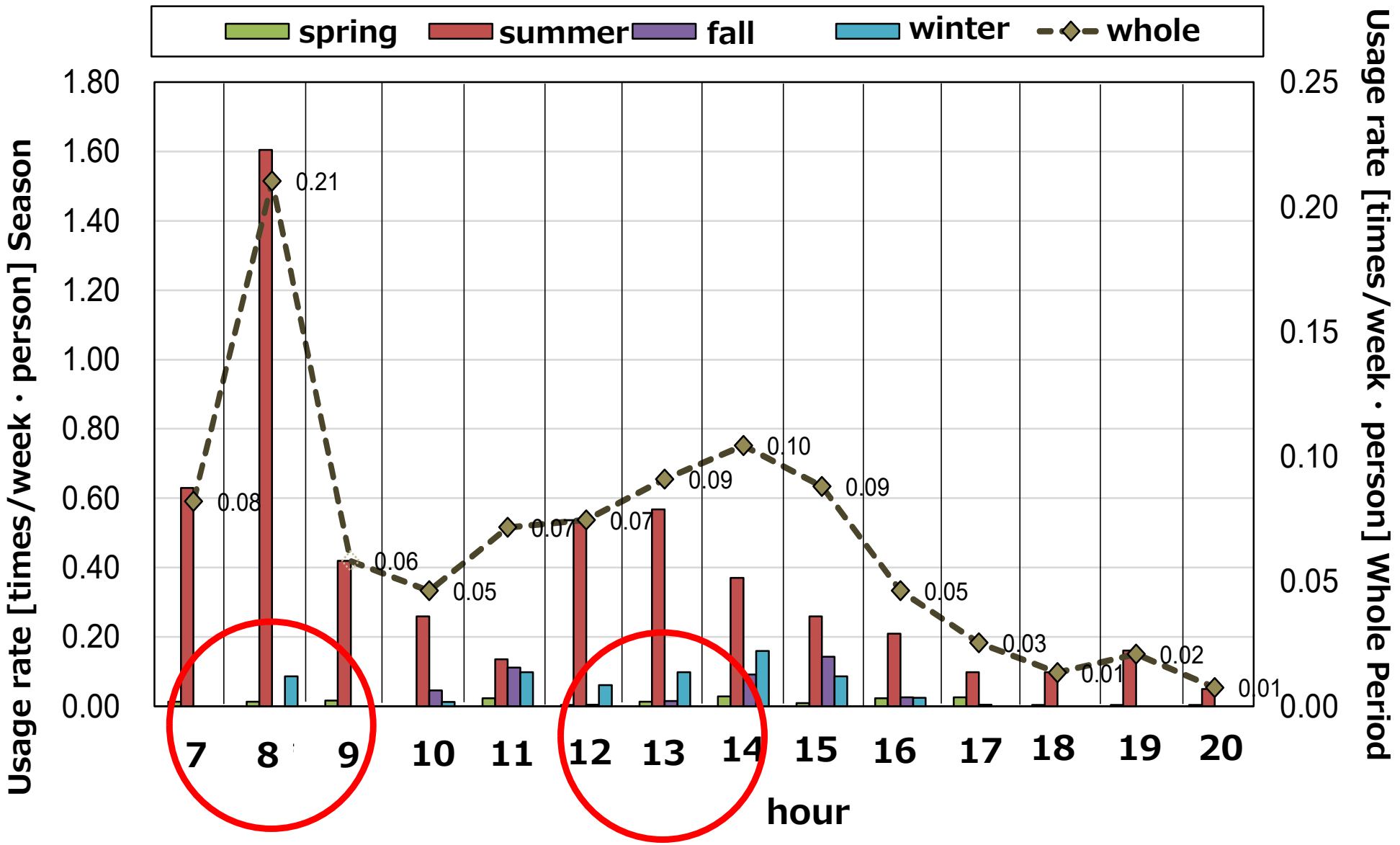
Zone D (274m²)
Ceiling: 38 units

Season Usage Rates of PECS



✓ **During summer usage rates of PECS are higher and during winter they use desk type PECS for warming.**

Daily Usage Rate of PECS



✓ **More use in the morning and after lunch due to high metabolic rate.**

Ambient Thermal Conditions

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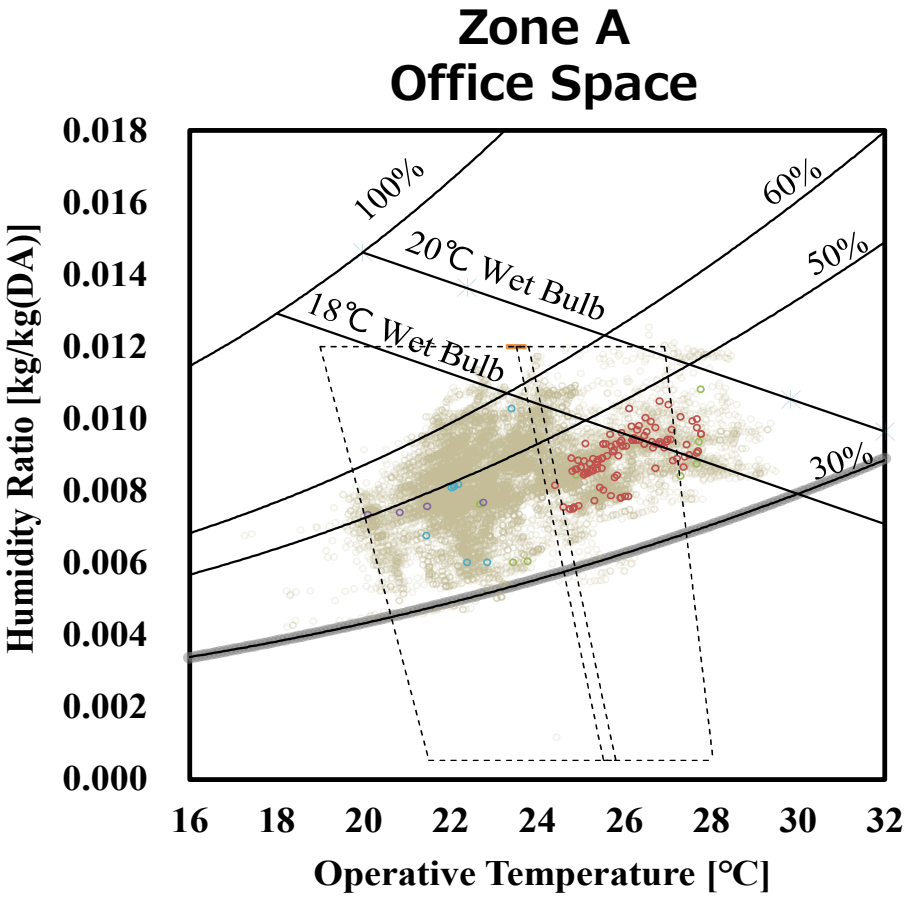
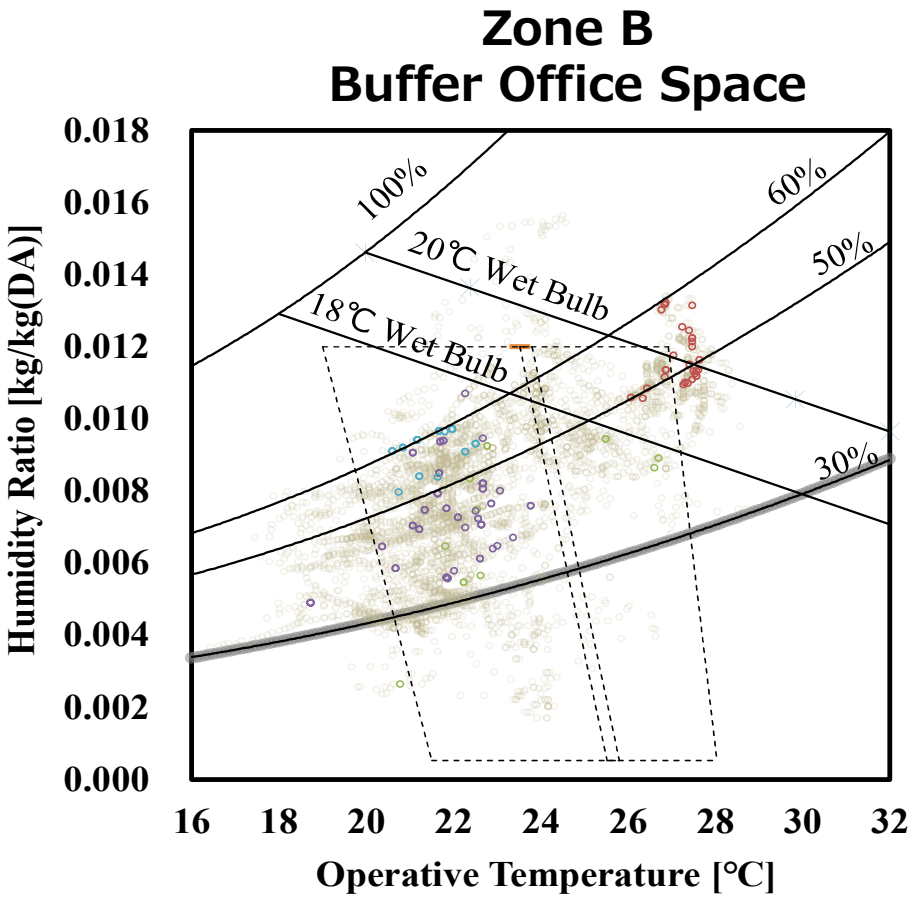
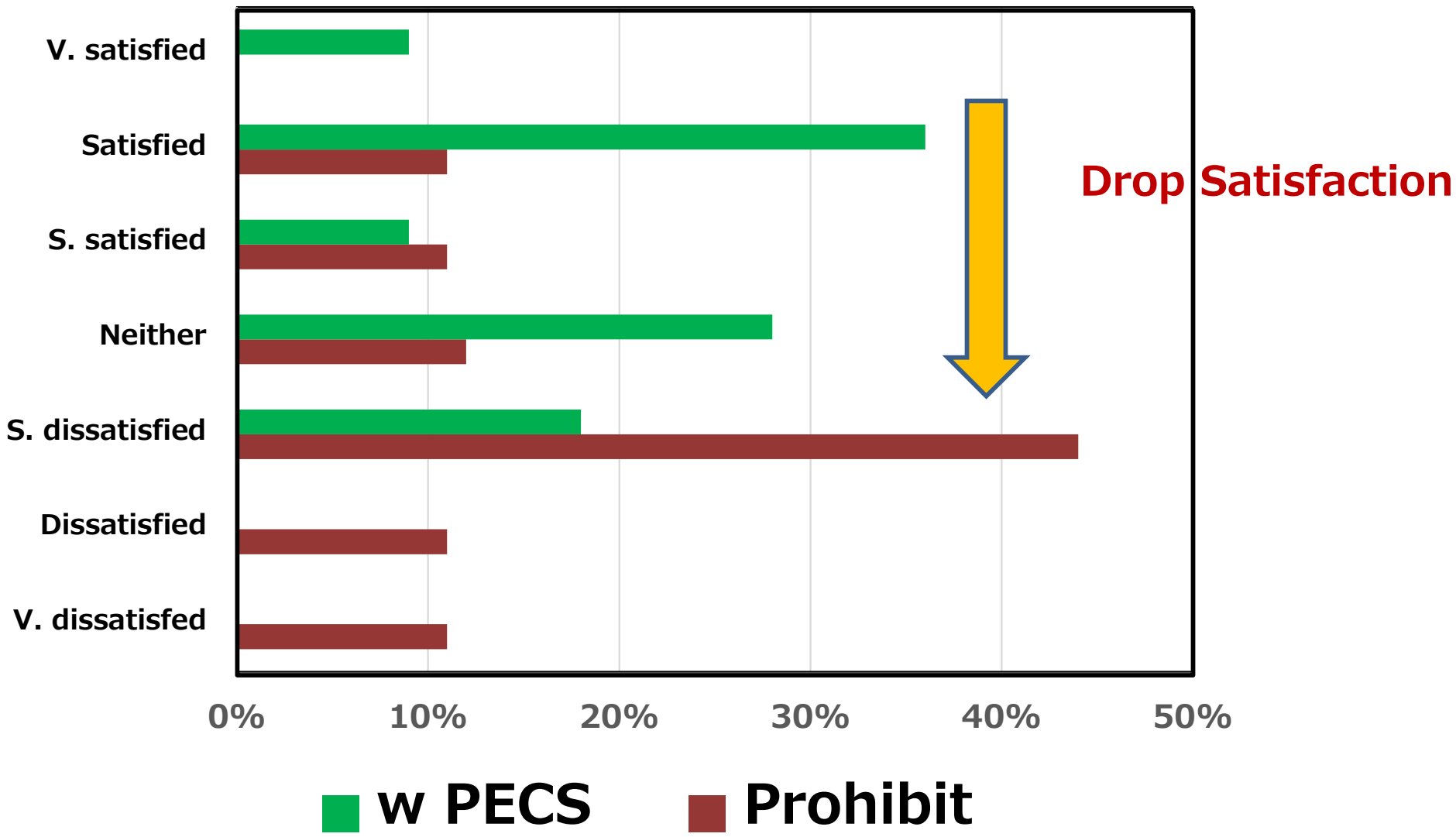




: w/o PECS
: Spring with PECS
: Summer with PECS
: Fall with PECS
: Winter with PECS

- ✓ In office space (Zone A), they use PECS in the morning and after lunch due to high metabolic rate.
- ✓ Buffer office space (Zone B), they use PECS to compensate thermal sensation.

Percentage of Satisfied



We prohibit to use PECS system during certain period.

Conclusions

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T Innovation Center opened in January 2020

- ✓ **In office building unit net Zero Energy and Emission were achieved during 2021.**
- ✓ **Three types of PECS are installed in the different area.**
- ✓ **System specifications are described.**

Usages of PECS are investigated

- ✓ **During summer usage rates of PECS were higher and during winter they use desk type PECS for warming.**
- ✓ **They used PECS more in the morning and after lunch due to high metabolic rate.**
- ✓ **In office space (Zone A), they used PECS in the morning and after lunch.**
- ✓ **Buffer office space (Zone B), they used PECS to compensate thermal sensation.**

We prohibited to use PECS system during a certain period.

- ✓ **Percentage of dissatisfied significantly increased w/o PECS.**

Acknowledgments

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