Building Energy Code Working Group of IEA EBC TCP 3rd June 2026

Evaluation of building performance against overheating

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Japanese climatic conditions

- They range from severely cold to hot humid.
- Profiles of energy consumptions for different uses vary among regions.

Fig. 1 Zone classification by energy conservation standard

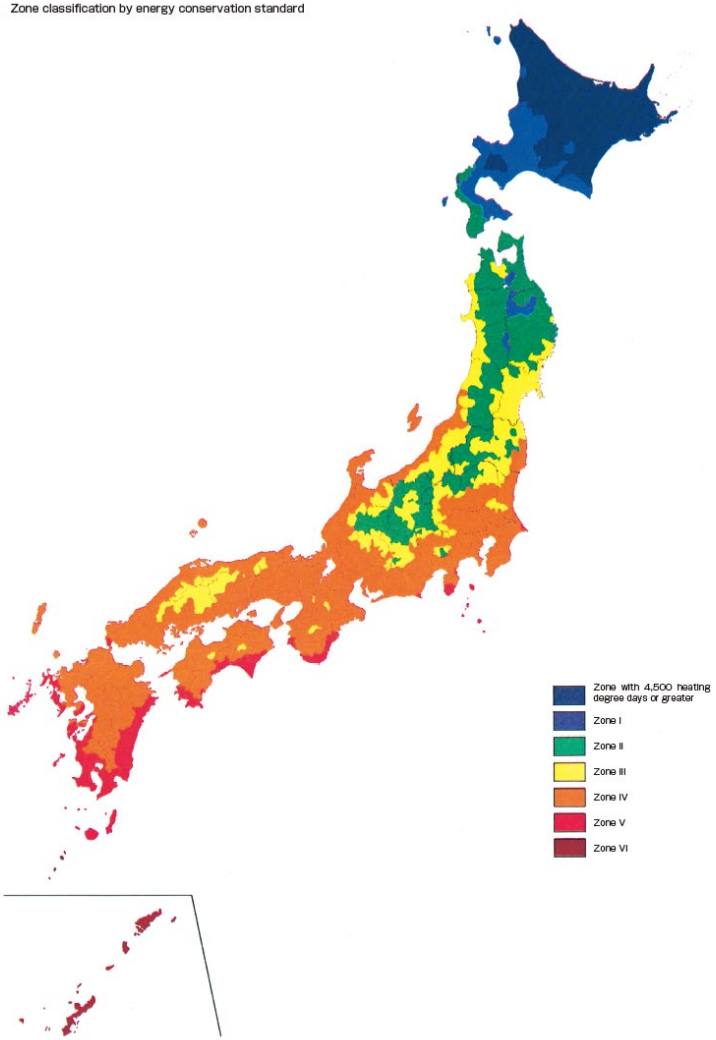
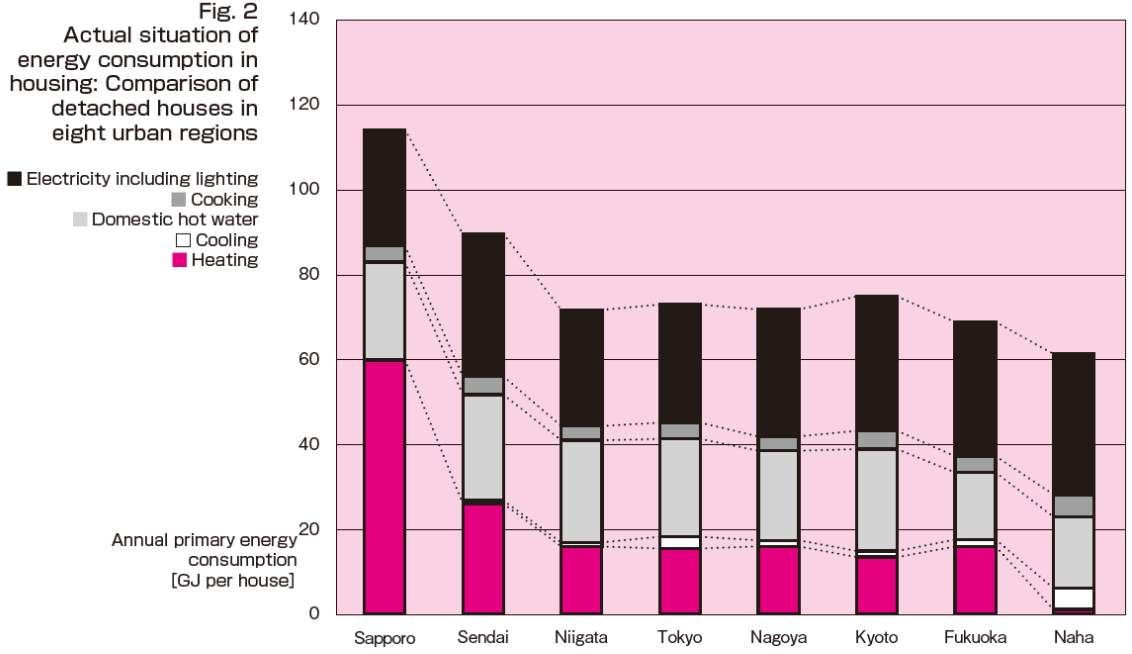


Fig. 2
Actual situation of energy consumption in housing: Comparison of detached houses in eight urban regions



factors of overheating in residential buildings

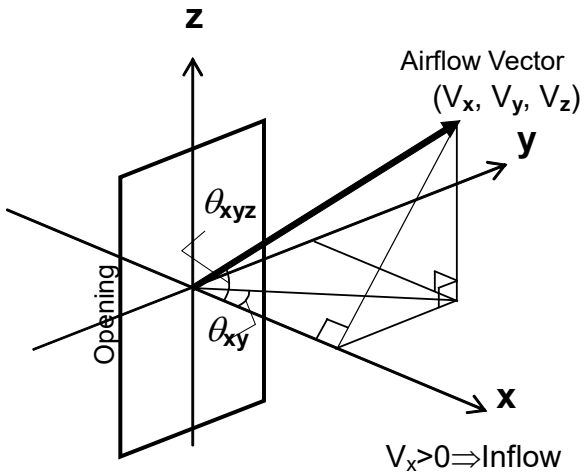
1. Solar heat gain
   - ➢Through windows and other openings (shading)
   - ➢Through roofs (insulation, vented cavity, reflectivity)
2. Thermal mass
3. Internal heat gain
   - ➢Lighting
   - ➢Electric appliances including refrigerators and TV sets
   - ➢Cooking
4. Natural ventilation
   - ➢Wind induced
   - ➢Buoyancy induced
5. Cooling equipment
   - ➢Fans
   - ➢Room air-conditioners

factors evaluated in the Japanese building energy code for residential buildings

Cooling energy use is calculated taking the following factors into consideration:

1. Solar heat gain
   - Through windows and other openings (shading)
   - Through roofs (insulation, vented cavity, reflectivity)
2. Thermal mass
3. Internal heat gain
   - Lighting
   - Electric appliances including refrigerators and TV sets
   - Cooking
4. Natural ventilation
   - Wind induced
5. Cooling equipment
   - Room air-conditioners

Discharge coefficient of windows

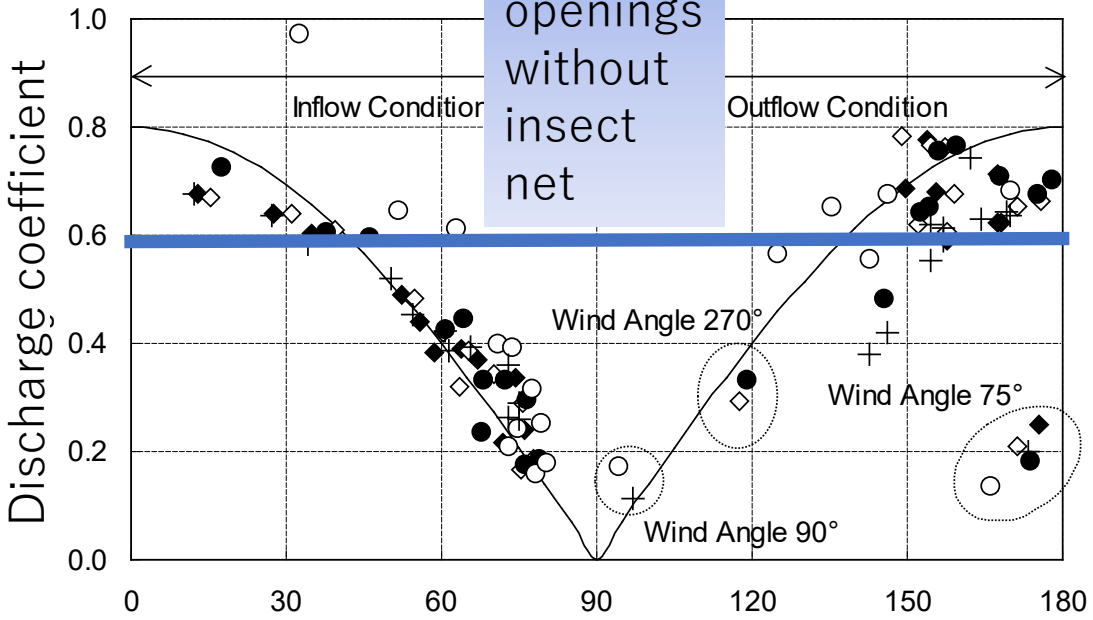


$V_x>0 \Rightarrow$ Inflow

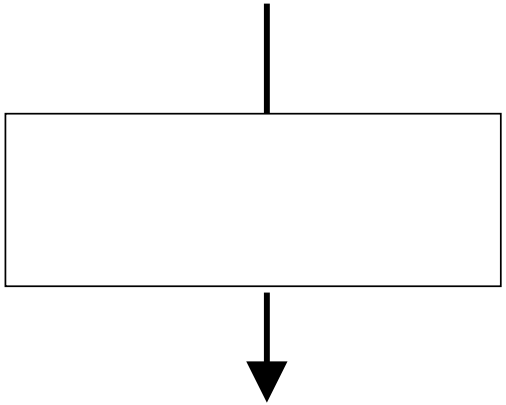
$V_x<0 \Rightarrow$ Outflow

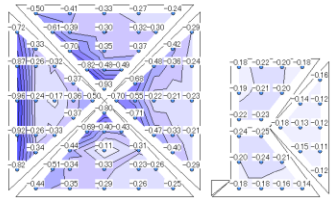
$$\theta_{xyz} = \tan^{-1} \frac{\sqrt{V_y^{\,2} + V_z^{\,2}}}{V_x} \qquad 0 \le \theta_{xyz} \le 180$$

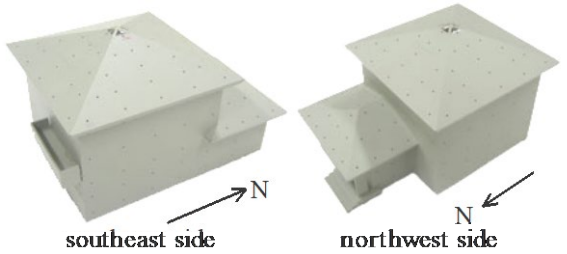
0.6 for openings without insect net



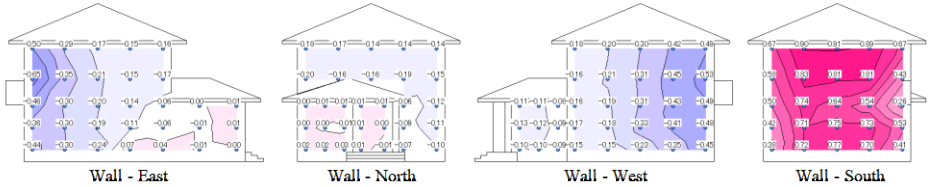
Wind pressure coefficient



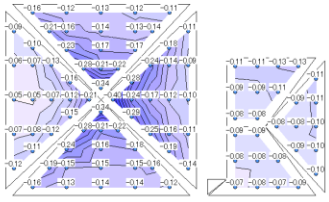


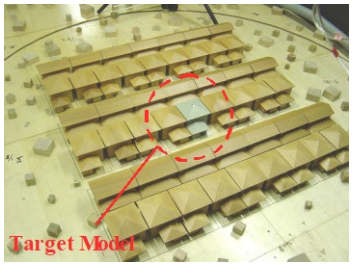


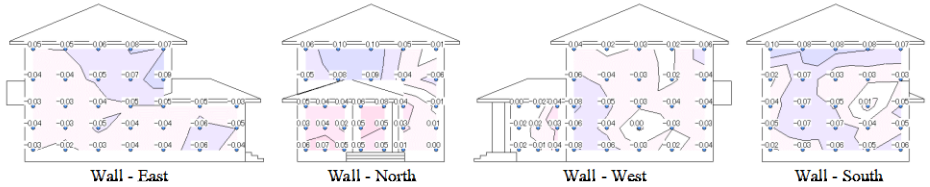
Building Model



1) Isolated setting

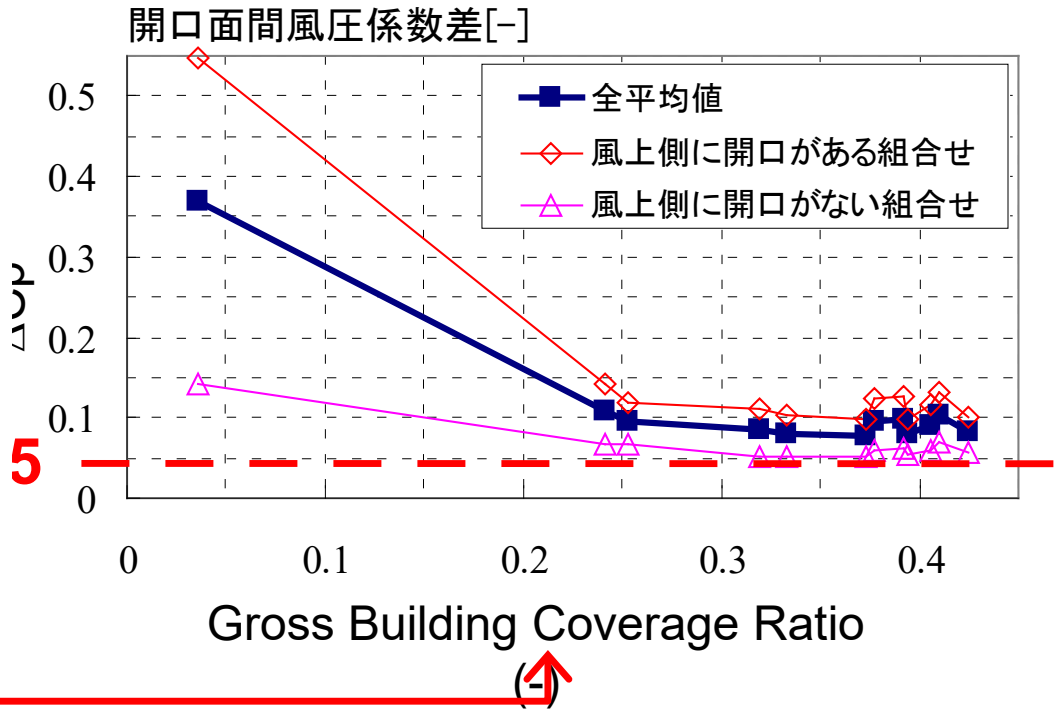




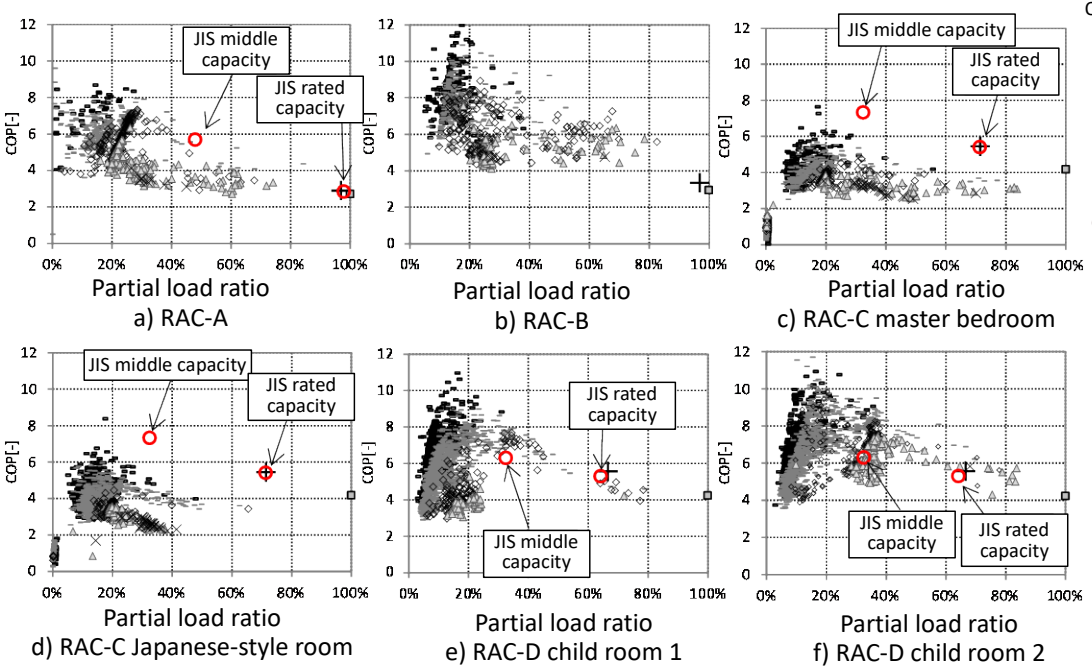


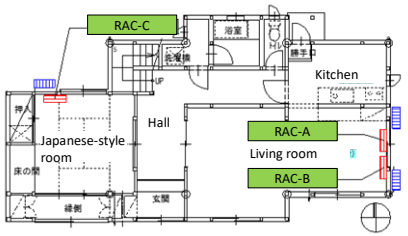
2) Residential District setting

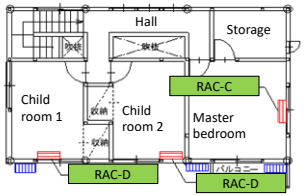
istribution of Wind Pressure Coefficient



立地条件	開口位置と風向の関係	想定した通風経路 A. 1階隅角	B. 2階隅角	C. 1階対面	D. 2階対面	E. 2階壁面−屋根面		採用した値
密集住宅地	開口部が風上側にある場合	0.1～0.14	0.08～0.21	0.08～0.15	0.08～0.23	天窓が風下側屋根面にある場合	0.15～0.22	0.05
	開口部が風上側にない場合	0.05～0.07	0.06～0.08	0.08～0.13	0.08～0.14			

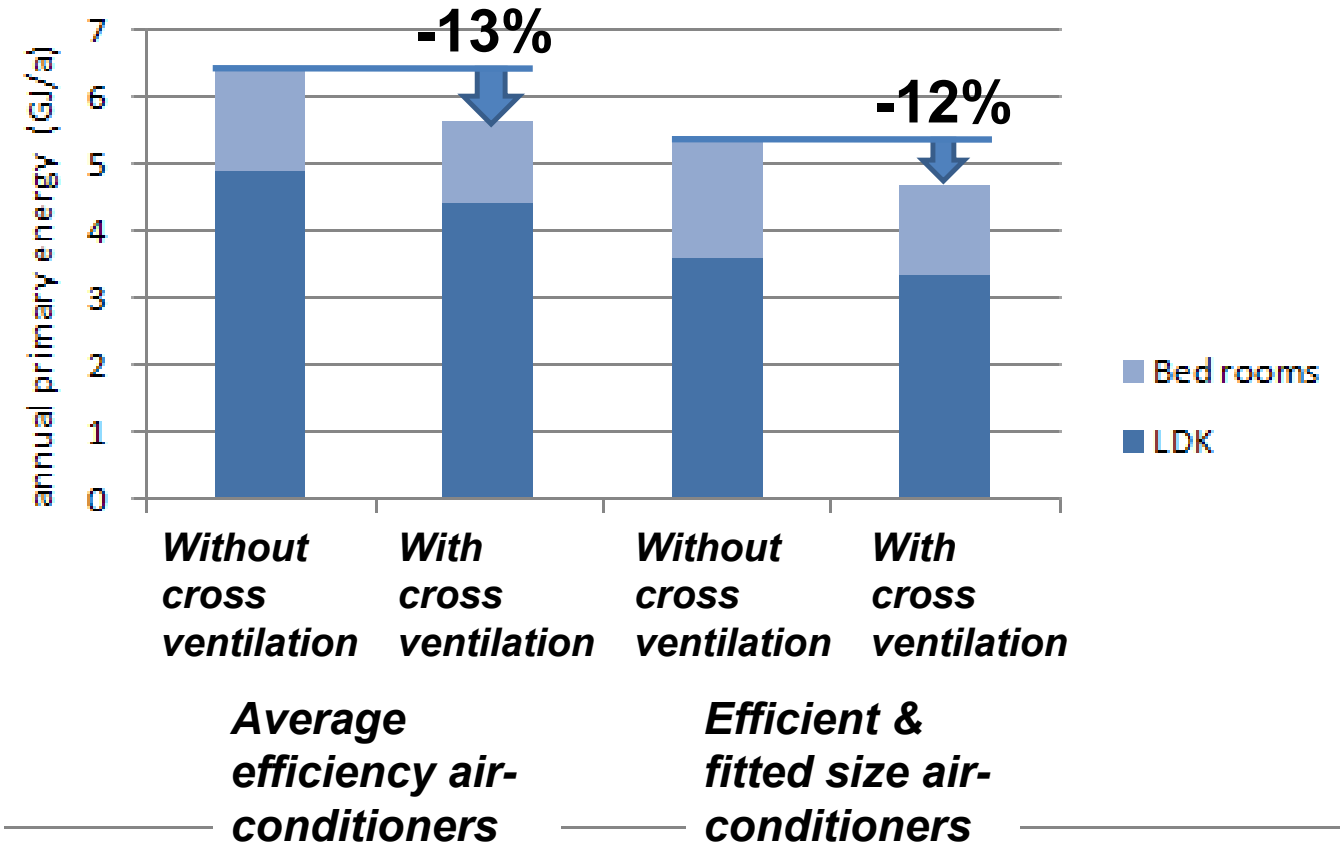

JIS middle capacity
JIS rated capacity
COP[-]
Partial load ratio
a) RAC-A
b) RAC-B
c) RAC-C master bedroom
d) RAC-C Japanese-style room
e) RAC-D child room 1
f) RAC-D child room 2
Outdoor temp. ranges
24 ± 1.5℃
27 ± 1.5℃
30 ± 1.5℃
33 ± 1.5℃
36 ± 1.5℃
Full capacity catalogue value
Rated capacity catalogue value
JIS B 8615 Test for this project


RAC-C
Kitchen
Hall
Japanese-style room
RAC-A
Living room
RAC-B


Hall
Storage
Child room 1
Child room 2
RAC-C
Master bedroom
RAC-D
RAC-D

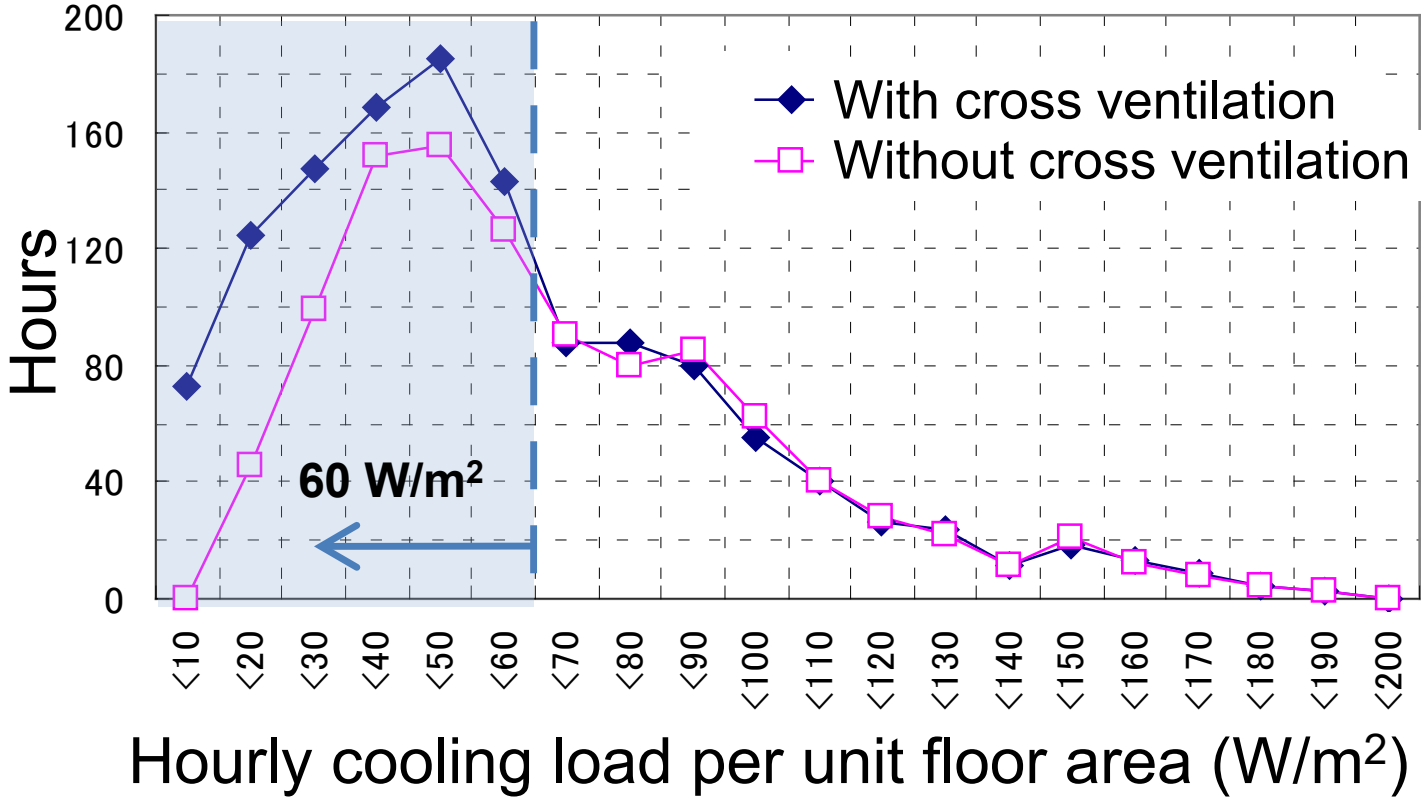
f the paper.

Examples of cooling energy calculation



Assumptions on the specifications of air-conditioners are;
Average: (LDK) Max output **5.8kW** Rated output **5.6kW** COP **2.91**
(Bed rooms) Max output **3.05kW** Rated output **2.5kW** COP **5.09**
Efficient & fitted size: (LDK) Max output **3.3kW** Rated output **2.2kW** COP **5.57**
(Bed rooms) Max output **3.3kW** Rated output **2.2kW** COP **5.57**

Influence on the cooling load when the cross ventilation is taken into account



ooling load less than 60 W/m² decreases significantly

Thank you for your attention.