VENTILATIVE COOLING: EXAMPLES OF APPLICATIONS IN NON RESIDENTIAL BUILDINGS

Flourentzos Flourentzou:
Innovation park EPFL
Lausanne, Switzerland
Why ventilative cooling in non residential buildings?
because according to the Swiss low mechanical cooling is practically prohibited
Solar control
Solar control
one of the first eco-buildings labeled Minergie in Geneva
solar shading, color selection, external environment design
Nicosia municipal building passive design

Permanent solar protection and glazing g-39%, TL-70%
100% glazing in the East and in the South facades, with no visible opening.
100% glazing in the East and in the South with no visible opening.
Opening design and ventilation strategy
architectural elements act like air ducts, inlet and exhaust devices
\[ Q_1 = 2 \times 12'237 \text{ m}^3/\text{h at } \Delta T = 6^\circ \text{C, 50\% ach in 9 minutes} \]
flash ventilation when CO2 > 800 ppm / night ventilation during summer
local heat discharge when sun is striking the facade
Nighting ventilation cooling strategy
DIAL+ simulation: EN 15251 thermal comfort

No ventilation cooling strategy
DIAL+ simulation: EN 15251 thermal comfort

overheating: night ventilation cooling strategy - 55 h / no strategy 1099 h
overheating: night ventilation cooling strategy - 55 h / no strategy 1099 h
• Hybrid ventilation of the hall – natural ventilation path

Cooling storing under the plenum, stratification, intelligent strategy
• Hybrid ventilation of the hall – mechanical with heat recovery

➔ Use only when it is needed
office night ventilation design

safe, protected, flexible openings, dissociation of air from light path
- natural ventilation design

<table>
<thead>
<tr>
<th>Opening possibilities</th>
<th>m³/h</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>40X300</td>
<td>610</td>
<td>100</td>
</tr>
<tr>
<td>40X300 grille</td>
<td>366</td>
<td>60%</td>
</tr>
<tr>
<td>40X122</td>
<td>158</td>
<td>26%</td>
</tr>
<tr>
<td>40X122+40X122</td>
<td>499</td>
<td>82%</td>
</tr>
<tr>
<td>15X122 à la française</td>
<td>59</td>
<td>10%</td>
</tr>
<tr>
<td>7X122</td>
<td>28</td>
<td>5%</td>
</tr>
<tr>
<td>15X122+15X122 à la Fr</td>
<td>187</td>
<td>31%</td>
</tr>
<tr>
<td>15 cm à l’italienne (6°)</td>
<td>49</td>
<td>8%</td>
</tr>
<tr>
<td>10 cm à l’italienne (4°)</td>
<td>30</td>
<td>5%</td>
</tr>
</tbody>
</table>

A window offering 30 to 366 m³/h stack effect single sided airflow at ΔT 5° C
La fenêtre n’est pas une contrainte et on peut compter sur l'utilisateur.
La fenêtre n'est pas une contrainte et on peut compter sur l'utilisateur.
La fenêtre n'est pas une contrainte et on peut compter sur l'utilisateur.
Thermal mass
• apparent thermal mass and stratification strategy

→ Unhydrid screed for the floor, apparent claded concrete slab.
• apparent thermal mass

➔ Without thermal mass temperature rises to 37° C instead of 30
stratification strategy: cool the occupied area, avoid ceiling heat trap
during the hottest days of June, internal temperature < 27/25°C
• 10 passive technics

- Almost perfect solar shading
- Thermal insulation, high performance glazing, no thermal bridges
- High apparent thermal mass
- Optimal dimensioning of glazing for passive lighting, heating, solar protection
- 70% of natural light autonomy and high efficiency artificial lighting
- Opening design for optimal night ventilation (summer passive cooling)
- Controlled natural ventilation.
- Use of ceiling fans
- Ventilation strategy for automatic windows and user manual for manual ones.