# Contents

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:30</td>
<td>INTRODUCTION: Peter Wouters, INVE, Belgium</td>
</tr>
<tr>
<td>10:40</td>
<td>ASSESSMENT OF THERMAL AND COMFORT PERFORMANCE: Audres Lifak, Apehat, France</td>
</tr>
<tr>
<td>10:55</td>
<td>Questions and answers</td>
</tr>
<tr>
<td>11:05</td>
<td>ON SITE MEASUREMENTS AND FEEDBACK: Anne Marie Bernard, Allbr'Air, France</td>
</tr>
<tr>
<td>11:20</td>
<td>Questions and answers</td>
</tr>
<tr>
<td>11:30</td>
<td>GUIDELINES TO ACHIEVE AN EFFECTIVE VENTILATIVE COOLING: Nicolas Plot, EGE, France</td>
</tr>
<tr>
<td>11:45</td>
<td>Questions and answers</td>
</tr>
<tr>
<td>12:00</td>
<td>End of the webinar</td>
</tr>
</tbody>
</table>

**FREEVENT Guide is online (in french)**

[Downloadable on Construction21.fr](https://www.construction21.org/france/community/pg/groups/19939/)
Guidelines to achieve an effective ventilative cooling (FREEVENT Guide)

- Definitions:
  - Mechanical / natural / hybrid ventilative cooling
  - Thermal Potential, Energy Evacuation
- The expected requirements
- Site analysis
- Building analysis
- Choice of ventilative cooling system
- Examples and figures (orders of magnitude)

CONCEPTS AND DEFINITIONS

Mechanical ventilative cooling

- Single flow ventilation (blowing ventilation)
- Single flow ventilation (exhaust ventilation)
- Balanced ventilation (heat recovery)
- Air handling
Natural and hybrid, mixed ventilative cooling

Cross ventilation

Single side

Stack effect

Hybrid

Thermal Potential and Energy Evacuation
2. Site Analysis

Wind exposure

<table>
<thead>
<tr>
<th>Optimal</th>
<th>Appropriate</th>
<th>Ineffective</th>
<th>Ineffective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening on the same façade</td>
<td>Opening on adjacent façades</td>
<td>Ideallly oriented openings</td>
<td>Poorly oriented openings</td>
</tr>
</tbody>
</table>

Read specialized guides and handbooks (AIVC)

Evaluation of the natural ventilative cooling driving force

**Stack Effect alone**

\[ Pr = 0.044 H (T_e - T_i) \]

\[ Pr = 0.63 P_s \]  

\[ T_{i0} = 38^\circ C \]  

\[ T_{ei} = 20^\circ C \]

\[ Q = C_s \left( \frac{T_i - T_e}{T_i} \right) \]

Wind+stack effect combined

Ideally oriented openings

Wind+stack effect combined

Poorly oriented openings

Wind+stack effect combined

Mono-façade openings (wind effect cancelled)

**Wind Speed**

\[ Pr = p C_s v^2 / 2 \]

\[ Pr < 0.01 \]

\[ Pr = 0.01 \]

\[ Pr > 0.01 \]

For natural ventilation, driving forces create few pascal pressure available
3. Building characteristics analysis

Dynamic Thermal Simulation

<table>
<thead>
<tr>
<th>PROGRAMME</th>
<th>SITE</th>
<th>BATIMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong>: maximum allowed number of hours of discomfort or air-conditioning energy consumption reduction</td>
<td>- Thermal potential</td>
<td>- External loads (solar shadings optimized design)</td>
</tr>
<tr>
<td>- Classification of premises</td>
<td>- Distance obstacles providing natural shading</td>
<td>- Internal loads</td>
</tr>
<tr>
<td>- Occupancy scenario</td>
<td>- Ventilation, infiltrations</td>
<td>- Thermal inertia: internal thermal insulation / external thermal insulation</td>
</tr>
<tr>
<td>- Internal loads</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dynamic Thermal Simulation

Calculate the Air Change Rate necessary to achieve the programme requirement

SYSTEMS COMPARISON

- Natural ventilative cooling
  - No electrical consumption
  - Energy evacuation uncertain, mainly if the potential is low, energy balance.
  - More design parameters to deal with (site, building)

- Mechanical ventilative cooling
  - Better controled evacuation
  - Auxiliary equipment consumption, EER
  - Acoustic awareness
  - Balancing,
  - Ducts sizing

The FREEVENT Guide documents for each of them:
- Pro arguments for each system
- Constraints to be checked
- Alertness Critical points to be studied
Coefficient of Performance:
Use of EER for controls settings

EER = kWh thermal energy evacuated / kWh fan

kWh thermal evacuation = 1.22 x Q (L/s) x (T_{ext} - T_{int}), over the duration of ventilative cooling
kWh fan = SFP x Q   (Specific Fan Power x Flow Rate)
EER = 1.22 x ΔT / SFP

Example: determination of a control rule for ventilative cooling activation:
SFP = 0.9 W / (L/s), let’s set EER > 4,
One should get ΔT > 3°C between inside and outside before activating ventilative cooling

DESIGN EXAMPLES
School / Educational Building
Office buildings with balanced heat recovery ventilation

Office buildings with single flow ventilation

Hygienic mode aeration

Ventilative cooling mode aeration
Residential buildings with balanced heat recovery ventilation

FEEDBACK FROM MONITORING

Buildings with good results for ventilative cooling show:
- Good upstream programme design
- Commissioning with extended monitoring
- Raising of the user’s awareness with operating principles.

Avoid occupants discomfort:
- Acoustics
- Residual air velocity if ventilation occurs during building occupancy hours
- Cold sensation in the morning if ventilative cooling is not set off
- Unwanted moisture generation in air-conditioned buildings (enthalpy control to be planned)
FEEDBACK FROM MONITORING

Commissioning, in particular for controls
• Checkin of planned operation for every mode, in particular in the absence of supervision (Building Management System)
• Calibration of threshold limits, position and calibration of temperature probes
• Multizone regulation in order to avoid discomfort

Further maintenance
• Operating manual for users and the owner
• Limitation of motorized equipments and associated regulation
• Facilitated access for equipements

FEEDBACK FROM MONITORING

Provide air transfer and effective transfer of premises
• Management by occupants of manually operated openings (windows and doors)
• Air transfer grilles and acoustics isolation of premises

Caution for undersizing
• Lack of stack effect and driving forces for natural ventilation
• Excessive pressure losses in mechanical ventilation
• Undersized ground-coupled heat exchanger, to be designed for summer ventilative cooling air-flow rates.

Degradation of buildings thermal performances
• Infiltration occurrences in air inlet or exhaust when ventilative cooling is off
• Creation of thermal bridges
PERSPECTIVES...

Development of devices specifically dedicated to ventilative cooling

Development of integrated standard control modules dedicated to ventilative cooling

Main difficulty: to design a double air flow-rate without adding multiples motorized damper, with all the associated regulation equipments. Limit of use of self-regulating dampers.

Guide FREEVENT (in French)

Questions?

Downloadable on Construction21.fr:
https://www.construction21.org/france/community/pg/groups/19939/