Resilient Ventilative Cooling in practice
- VENTILATIVE COOLING INTEGRATED DESIGN

Our business areas
Stand-alone solutions or full integration with BMS

Provide and control
- Natural ventilation
- Mixed mode ventilation
- Smoke ventilation

Additional control of
- Sun screening
- Cooling
- Heating
- Light
- Mechanical ventilation
Cloud-based control system

How does it works?

App and dashboard

Cases

Municipality building
- 0-energy office building utilising Hybrid ventilation.

Court building
- Mechanical- and natural ventilation depending on the area.

PNC Tower
- Hybrid ventilated office building.
Office building in Denmark

Solution

Hybrid ventilation  Solar shading

Buildings

01-06-2021  5

IEA Annex 62 – tool to analyse the VC climate potential


User guide

Results from tool

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<tr>
<th>Year</th>
<th>Jan</th>
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<td>VC mode [0]: ventilation cooling not required</td>
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<td>VC mode [1]: potential comfort hrs by direct ventilation cooling with minimum airflow rates</td>
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<td>VC mode [2]: potential comfort hrs by direct ventilation cooling with increased airflow rates</td>
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<td>VC mode [3]: potential comfort hrs with evaporative cooling</td>
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<td>VC mode [4]: residual discomfort</td>
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Average airflow rate

- 2.41  3.22  3.53  3.49  3.56  2.85  2.46  -  -

Maximum

- 6.76  11.11  11.22  1.38  0.33  0.21  -  -

Table 3: Required ventilation rates (average and maximum values over each month in cfm) for heating during occupied hours when direct ventilation cooling with increased airflow rates is required (VC mode [2]).

Note: rates are in example 7. office building in Copenhagen.
Hybrid ventilation
Lowered; capital cost, energy consumption and solar panels.

One year temperature data

Worst performing rooms

Requirements (DK)

Indoor temperature:
- Not more than 100 hours above 26°C
- Not more than 25 hours above 27°C
Night time cooling

External vs. internal temperatures

External vs. internal temperatures and opening degree

Court House (Retten på Frederiksberg)
Copenhagen, Denmark
Court House (Retten på Frederiksberg)
Copenhagen, Denmark

Solution and control of

- Natural ventilation
- Mechanical ventilation
- Hybrid ventilation
- Smoke ventilation
- Solar shading
- Heating

Layout

Court rooms at ground floor level
are mechanical ventilated
Ventilation overview

Plan drawing

Illustration of the ventilation principle

Office Corridor Atrium

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Ventilation walk-through

Façade Corridor

Office Corridor Atrium

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Ventilation walk-through

In line with thermal requirements

Measured indoor climate during 1 year

Requirements (DK)

Indoor temperature:

- Not more than 100 hours above 26°C
- Not more than 25 hours above 27°C
Statement from the Head of Administration

Jesper Christiansen:

“The natural ventilation works well. It is possible to control the air temperature and the employees are satisfied.”

The Tower at PNC Plaza, Pittsburgh, US

“45% of the time we would be able to open our windows for fresh air…”
Ventilation principle

The Tower’s façade delivers fresh air at low velocity

The Tower’s solar chimney pulls cooler air into the building

6300 MotorLink actuators to control:
- synchronization of 4 actuators on 1 parallel window, 700 parallel windows in the outer DSF
- 1450 automated air vents in the inner facade.
- Feedback & control position via BMS.

During the summer, spring and fall, the heat at root level pulls air from the building up and out through the solar chimney. This facilitates natural ventilation and helps PNC maintain a comfortable indoor temperature within The Tower.

“The research told us that 45% of the time we would be able to open our windows for fresh air and essentially turn off the mechanical ventilation in the building.”
Sophisticated control of the openings
...based on external CFD simulation

Animation of wind and pressure distribution

Elevated wind speeds at higher levels

IEA Annex 62 - Deliverables
Ventilative cooling case studies

Case studies - book

Ventilative Cooling Application - buildings incl. ventilative cooling from several countries

Questions

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