



venticool
the platform for resilient ventilative cooling

Tight Vent
Europe
BUILDING AND DUCTWORK AIRTIGHTNESS PLATFORM

42nd AIVC

10th TightVent
& 8th venticool
Conference

Ventilation challenges
in a changing world

October 5-6,
2022

Rotterdam

The Netherlands
Hilton Hotel

www.aivc2022conference.org

FINAL
PROGRAMME



42nd AIVC 10th TightVent & 8th venticool Conference



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Congress Venue

Hilton Rotterdam, Weena 10, Rotterdam, 3012 C, Netherlands

Registration Desk Hours

Registration Desk will be open during the following dates and times:

Tuesday 4 October, 2022 / 19:00 – 20:00

Wednesday 5 October, 2022 / 08:00 – 18:30

Thursday 6 October, 2022 / 08:30 – 17:00

Poster display information

- Posters should be set up on Wednesday 5 October, 2022 from 09:30
 - Dismantling of posters should be finished by **Thursday 6 October 2019 at 17:00**
- Professional Congress Organizer and Organizers have no liability for posters left behind

Poster dimensions

(A0) size, 120CM Height x 80CM Width

Poster presentation session

Authors are expected to be in front of their poster in order to reply to any questions as per schedule below:

Wednesday 5 October 2022, at 18:30 - 20:00

Long & Short Oral Presentations information

- Long Oral Presentations (indicated within the programme) are expected to last 12 minutes; another 3 minutes are foreseen for questions and answers (15 minutes in total)
- Short Oral Presentations (indicated within the programme) are expected to last 3 minutes; another 2 minutes are foreseen for questions and answers (5 minutes in total)

Social Events

Welcome Reception

Tuesday 4 October, 2022

19:00 – 20:00

Hilton Rotterdam Hotel

*(*all registered delegates are welcome to participate)*

Gala Dinner

Thursday 6 October, 2022

19:00 – 22:00

Hotel New York, Koninginnenhoofd 1,
3072 AD Rotterdam

(Dinner is not included in the conference registration fees)

Tickets are available at the registration desk at the cost of € 79 per ticket



Tuesday October 4th, 2022

19:00-20:00 Registration & Welcome reception



ROOM A / LE JARDIN

Wednesday October 5th, 2022

08:00-09:00 Registration

09:00-10:30 Opening - Plenary session

Chairs: Arnold Janssens, Peter Wouters

Welcome on behalf of AIVC, venticool, TightVent

Arnold Janssens, *INIVE, Ghent University*
& Peter Wouters, *INIVE*

Welcome on behalf of TNO

Machteld de Kroon, *Director of Unit Buildings, Infrastructure and Maritime*

**Challenges in transition towards a sustainable built environment
from a European and National perspective**

Robert Dijksterhuis, *Ministry of the Interior and Kingdom Relations*

Ventilation & IAQ in the Energy Performance of Buildings Directive (EPBD)

Pau Garcia Audi, *European Commission*

What we know and should know about air cleaning

Pawel Wargocki, *DTU*

In memory of François Rémi Carrié

Valerie Leprince, *Cerema*

10:30-11:00

Coffee Break

**11:00-12:30 Session 1A - Topical Session
(Post-pandemic building ventilation: what have we learned and what is next?)**

Chairs: Arnold Janssens, Wouter Borsboom

Understanding and controlling building ventilation can improve the quality of the air we breathe and reduce the risk of indoor health concerns including prevent viruses spreading indoors. The COVID-19 pandemic showed that many buildings are not equipped to achieve adequate ventilation and limit exposure to infected aerosols in occupied spaces.

During the pandemic, various societies and countries have established taskforces to develop COVID-19 ventilation guidance and tools, including on complementing ventilation with air cleaning, and monitoring indoor air quality. Also new research, standardization and regulatory programmes have been initiated to make sure cross contamination in indoor environments is better controlled in the future.

Looking back at these experiences, this workshop discusses the role of ventilation systems in pandemic control, the lack of well-performing ventilation systems in the building stock, and the actions needed to reduce the risk of contamination, now and in the future. The workshop will give a better understanding of recent and on-going initiatives, and of knowledge gaps needed to be filled to come to more resilient building ventilation.

The session is part of the AIVC-project "Ventilation, airtightness and COVID-19" which aims to collect, discuss and disseminate information about COVID-19 in relation to ventilation and airtightness. It was prepared in collaboration with the Indoor Environmental Quality Global Alliance (IEQ-GA) COVID-19 Task force. The mission of IEQ-GA is to provide an acceptable indoor environmental quality to occupants in buildings and places of work around the world and to make sure the knowledge from research on IEQ get to be implemented in practice.

The objective of this session is to present ongoing developments in ventilation and indoor air quality research, design, standardisation and regulation in response to the COVID-19 pandemic, to define knowledge gaps and challenges for the research community.

Introduction and problem statement

Arnold Janssens, Ghent University, Belgium

Infection risk-based ventilation design method

Jarek Kurniowski, Tallinn University of Technology, Estonia

AIRBODS: Airborne Infection Reduction through Building Operation and Design for SARS-CoV-2

Benjamin Jones, University of Nottingham, UK

Indoor Carbon Dioxide Position Document: What's Next?

Andy Persily, NIST, USA

Start of the Pandemic Preparedness Program through Ventilation - Knowledge Gaps and application of the results

Roberto Traversari, TNO, the Netherlands

Revision of the ventilation part of EN16798-1 and -2

Bjarne Olesen, DTU, Denmark



Wednesday October 5th, 2022



ROOM B / ROTTERDAM

11:00-12:30 Session 1B-Long & Short Oral Presentation Session
(Airtightness measurements)

Chairs: Ian Walker, Laure Mouradian

Air Leakage Detection in Building Façades by Combining Lock-In Thermography with Blower Excitation (Long Oral Presentation)
Benedikt Kölsch, German Aerospace Center (DLR), Germany

Determining infiltration from the Pulse tests - the establishment of an evidence base of utilising a low-pressure approach for measuring building airtightness and energy modelling (Long Oral Presentation)
Xiaofeng Zheng, University of Nottingham, UK

Measuring airtightness of 100-meter high-rise buildings (lessons learned) (Long Oral Presentation)
Stephanie Rolfsmeier, Blowerdoor Gmbh, Germany

French building airtightness database after 10 years of operation: statistical analyses of about 500,000 measurements (Long Oral Presentation)
Bassam Moujalled, Cerema, France

Air Leakage and the Building Enclosure - Energy Codes, Testing, and Practical Limitations (Long Oral Presentation)
Sean Obrien, Simpson Gumpertz & Heger, Inc., USA

Empirical validation of infiltration models based on different wind data (Short Oral Presentation)
Gabriela Bastos Porsani, University of Navarra, Spain

Computational analysis of room pressure control in airtight cleanrooms (Short Oral Presentation)
Rick Kramer, Eindhoven University of Technology, Netherlands

RENOVAIR: A study of the evolution of airtightness, ventilation, comfort and indoor air quality in 7 energy efficient refurbishment operations of social housing in France (Short Oral Presentation)
Andrés Litvak, Cerema, France



ROOM C / COOLSINGEL

11:00-12:30 Session 1C-Long Oral Presentation Session
(Ventilative cooling & climate change)

Chairs: Hilde Breesch, Regina Bokel

Methodology for the constitution of a restricted set of heatwaves, derived from climate projections, that can be used for building performance simulations
Adrien Toesca, UCB Lyon 1 - CETHIL, France

11:00-12:30

Assessing natural ventilation strategies to improve thermal resilience to extreme temperatures of the residential buildings in Barcelona

Elisenda Clèries Tardío, *IREC, Spain*

Climate correlation model to forecast thermal comfort and IAQ in naturally ventilated residential buildings

Maria Kolokotroni, *Brunel University London, UK*



The effect of airflow guiding components on effective ventilation rates in single-sided ventilation applications

Nima Najafi Ziarani, *Munster Technological University, Ireland*

Assessing the "sufficient ventilation" requirement for Austrian buildings - Development of a Monte Carlo based spreadsheet calculation to estimate airing intervals and mould risk in window ventilated buildings

Gabriel Rojas, *University of Innsbruck, Austria*

Better Estimation of Cross-ventilation through Roof Windows in an Attic - Possible Improvement for EN 16798-7:2017

Valerie Leprince, *Cerema, France*

12:30-13:30

Lunch Break



ROOM A / LE JARDIN

13:30-14:45

Session 2A-Topical Session

(Designing buildings ventilation to reduce the risk of airborne pathogens)

Chairs: Jesica Fernández-Agüera

The change of paradigm ushered in by COVID 19, along with similar challenges that may arise in the future, has highlighted the importance of designing safe and healthy buildings, deploying (occupancy, ventilation, filtering ...) strategies that lower the risk of disease caused by air-borne pathogens.

The change in paradigm necessitates changes in buildings if occupants are to continue to be able to use them safely for the purposes for which they were built education, work and domestic life. The primary objectives of this session are therefore to identify future trends for designing safe and healthy buildings and to create a platform for debating measures to mitigate the spread of virus aerosols in buildings.

The session is organised around four lectures and an open panel discussion in which brainstorming is welcome.

The lectures will be followed by a Wooclap-mediated online panel discussion to conceptually map session participants' proposals for measures to mitigate the spread of virus aerosols, including: event duration (exposure time); occupancy (proportion of allowable); facemasks: use and type; ventilation; impact of purifying the air.



Wednesday October 5th, 2022

13:30-14:45 **Minimising Hospital Acquired Infections using Good Design: Future Trends**

Susan Roaf, *Heriot Watt University, UK*

Covid airborne risk: online tool to develop healthy buildings

Miguel Ángel Campano, *University of Seville, Spain*

Design and Indoor Air Quality in kindergartens in Italy

Samuel Domínguez-Amarillo, *University of Seville, Spain*

Panel Discussion



ROOM B / ROTTERDAM

13:30-14:45 **Session 2B-Topical Session**
("Towards Smart Ventilation" in Mid-sized buildings)

Chairs: Hilde Breesch, Jelle Laverge

This interactive session is an outcome of the collaborative work of the Flemish VLAIO Flux50 strategic basic research (SBO) project "Towards Smart Ventilation in mid-sized buildings" and the International Energy Agency (IEA) Energy in Buildings and Communities Programme (EBC)'s Annex 86 for energy efficient IAQ management strategies. The objective of this seminar is to have an interactive discussion between HVAC experts and building designers on the requirements of highly energy-efficient "Smart Ventilation" systems in mid-sized buildings. Such systems can continually adjust their operation to provide the desired indoor air quality (IAQ) while minimizing energy use, utility bills, thermal discomfort and noise. They should also be responsive to e.g., occupancy shifts, dynamic outdoor conditions, contaminants' sources and can provide information about e.g., IAQ, energy use.

For mid-sized buildings, where the system complexity exceeds the typical 'all-in-one-box' solutions that are available for single-family dwellings, the design of ventilation systems is very conservative and inefficient. Moreover, no method exists today to select the most optimal system and room layout in a specific building based on a coherent set of indicators. This interactive session will aim to address the knowledge gap by presenting a performance assessment framework consisting of a general economic indicator. The indicator can be integrated as an objective function in the design optimization of air distribution networks. The indicator is tailored for different room types, and IEQ parameters (acoustics, resilience, occupant behaviour, sleep).

The use of a global economic indicator is an improvement on the current ventilation design methods, which are driven by minimum requirements for IAQ, energy consumption and/or investment costs. The key takeaway from this seminar is to acknowledge the importance of establishing such an assessment framework for ventilation systems in mid-sized buildings. This seminar will allow participants to interact, through polls and room discussions on the research objectives, methods as well as the possible outcomes and valorization paths.

Wednesday October 5th, 2022

13:30-14:45 **Project contents, objectives and structure, organization and work plan**

Hilde Breesch, *KU Leuven, Belgium*

General economic indicator for performance assessment of smart ventilation systems

Jelle Laverge, *Ghent University, Belgium*

Occupant-centric control in non-residential buildings

Quinten Carton, *KU Leuven, Belgium*

Discussion with the attendees



ROOM C / COOLSINGEL

13:30-14:45 **Session 2C-Topical Session**

(Resilient Cooling in a Changing Climate)

Chairs: Maria Kolokotroni, Peter Holzer

This topical session provides insights into the challenges of resilient cooling in a changing climate. Research outcomes from the EBC Annex 80 as well as findings from topical related research work will be presented. Annex 80 sought to provide a sound basis for the assessment of cooling technologies by creating concise sets of future weather data and heat waves. Agnese Salvati together with Maria Kolokotroni are taking this approach further by assessing the impact of urban microclimate on ventilation and thermal performance of multi-family residential buildings. The definition of Key Performance Indicators (KPI) for resilient cooling has been an important task of Annex 80 since its start in 2019. Abantika Sengupta and Adam O'Donovan present two papers where these definitions are applied in the evaluation of case study buildings in Ireland and Belgium.

Introduction to EBC Annex 80 Resilient Cooling

Peter Holzer, *Institute of Building Research & Innovation, Austria*

Urban microclimate impact on ventilation and thermal performance of multi-family residential buildings: two case studies in different climates and urban settings.

Maria Kolokotroni, *Brunel University London, UK*

Evaluating the present day ambient warming resilience of passively cooled dwellings in Ireland: A data-driven approach

Adam O'Donovan, *Munster Technological University, Ireland*

Evaluation of thermal resilience to overheating for an educational building in future heatwave scenarios

Abantika Sengupta, *KU Leuven, Belgium*



14:45-15:00 **Room Change**



Wednesday October 5th, 2022



ROOM A / LE JARDIN

15:00-16:30 Session 3A-Long Oral Presentation Session
(Air filtering, cleaning and control)

Chairs: Bjarne Olesen, Alireza Afshari

The role of ventilation in the penetration of outdoor air pollutants
Sara Verheyleweghen, *BBRI, Belgium*

Real-life ventilation filter performance: final results of an in-depth study
Joris Van Herreweghe, *BBRI, Belgium*

Improved performance efficiency and reduced heat loss of centralized air handling units through gas-phase air cleaning technology
Amirmohammad Behzadi, *KTH Royal Institute of Technology, Sweden*

Supply air filtration and fine particle levels in indoor air of occupied dwellings
Benoit Golaz, *CETIAT, France*

Tracing of Sars-CoV-2 aerosols with tracer gases in an occupied classroom with mobile air cleaners
Willigert Raatschen, *Tracertech GmbH, Germany*

A novel model based approach of an integrated ventilation and heating model for monitoring and control
Wouter Borsboom, *TNO, Netherlands*



ROOM B / ROTTERDAM

15:00-16:30 Session 3B-Long Oral Presentation Session
(Inspection of ventilation systems, including ductwork airtightness)

Chairs: Samuel Caillou, Valérie Leprince

Ductwork leakage: practical estimation of the impact on the energy overconsumption and IAQ
Nolwenn Hurel, *INIVE/PLEIAQ, France*

Air leakage and pressure loss measurements on calcium silicate ductwork
Wolf Bracke, *Ghent University, Belgium*

Field experience with ductwork airtightness improvement after installation in Europe
Nolwenn Hurel, *INIVE/PLEIAQ, France*

Improving Design, Commissioning, Operation and Maintenance in New Residential Ventilation Systems
Michael Lubliner, *Oak Ridge National Labs, USA*

Impact of ventilation non conformities: calculation methodology and on-site examples
Nolwenn Hurel, *INIVE/PLEIAQ, France*

Inspection of ventilation systems - Summary of existing protocols and technical survey
Nolwenn Hurel, *INIVE/PLEIAQ, France*

Wednesday October 5th, 2022



ROOM C / COOLINGEL

15:00-16:30

Session 3C-Long Oral Presentation Session
(Ventilation performance assessment)

Chairs: Jelle Laverge, Marcel Loomans

The monitored performance of the combination of balanced ventilation with post-conditioning by an air-to-air heat pump

Bart Cremers, *Zehnder Group, Netherlands*

Quantification of the Impact of Indoor Temperature Gradients in Dwellings on Useful Recovered Heat of Ventilation Systems

Josué Borrajo Bastero, *Ghent University, Belgium*

Multi-nodal model for predicting vertical temperature profile in the stratum-ventilated large retail facility

Natalia Lastovets, *Tampere University, Finland*

Prediction of Temperature and Contaminant Concentration Profiles in a Room with Impinging Jet Ventilation System by Zonal Model

Haruna Yamasawa, *Kyushu University, Japan*

Sensitivity analysis on the effects of inhabitant behaviour on the performance of ventilation systems

Axel Deturck, *Vero Duco, Belgium*

16:30-17:00

Coffee Break



Thursday, October 6th, 2022



ROOM B / ROTTERDAM

13:30-15:00 Session 7B-Long Oral Presentation Session
(IEQ evaluation)

Chairs: Andy Persily, Simon Jones

Health impacts of indoor air contaminants determined using the DALY metric
Gioberti Morantes, *University of Nottingham, UK*

Indoor environmental quality rating using the TAIL scheme
Pawel Wargocki, *DTU, Denmark*

**The challenge of rating energy efficient IAQ management strategies:
welcome to IEA-EBC Annex 86**
Jelle Laverge, *Ghent University, Belgium*

Hemp concrete walls: evaluation of the relationship between CO2 and TVOC
Irene Lara-Ibeas, *Eurac Research, Italy*

**Archetypes of public secondary schools in Mediterranean climate.
Indoor air quality and comfort field studies**
Jesús Llanos Jiménez, *University of Seville, Spain*

**How to collect reliable information regarding occupants' behavior
during IAQ campaigns? Performance 2 project first feedbacks**
Adeline Mélois, *Cerema, France*



ROOM C / COOLSINGEL

13:30-15:00 Session 7C-Topical Session
(Ventilative cooling to reduce overheating in buildings in ventilation related
standards and legislation in the context of well-being, sustainability and
energy)

Chairs: Christoffer Plesner, Jannick K. Roth

Ventilative cooling (VC) is widely used as a key element when designing a building to cope with overheating. This part focuses on the indoor climate aspects. However, the focus towards well-being, sustainability and energy use are now on the agenda in many countries. VC can, when designed correctly, tap into these three aspects and promote buildings with higher degree of well-being, be a part of the sustainability agenda and result in a reduced energy use. It should be noted that there to some extent is an overlap of the three mentioned aspects; well-being, sustainability and energy use.

VC can under the right conditions be a very good main alternative, supplementary solution to mechanical cooling systems.

13:30-15:00 *Low energy buildings are highly insulated and airtight and therefore subject to overheating risks, where VC might be a relevant solution. VC is an application (distribution in time and space) of air flow rates to reduce cooling loads and overheating in spaces using outside air driven by natural, mechanical or hybrid ventilation strategies. Ventilative cooling reduces overheating in both existing and new buildings - being both a sustainable and energy efficient solution to improve indoor well-being, hereunder thermal comfort. VC is further an important topic supported by the International Energy Agency (IEA) - where the project, IEA Annex 62 Ventilative cooling had a special focus on this area finishing the project in 2018.*

The purpose of this workshop is to evaluate and discuss how ventilative cooling is a mean to reduce overheating in buildings to achieve good well-being in ventilation related standards and legislation in the context of well-being, sustainability and energy.

13:30-15:00 **Introduction**

Christoffer Plesner, VELUX A/S, Denmark & **Jannick Roth**, WindowMaster International A/S, Denmark

Upcoming European and International technical documents on "Ventilative cooling systems - Design" in CEN/ISO

Christoffer Plesner, VELUX A/S, Denmark & **Jannick Roth**, WindowMaster International A/S, Denmark

How is VC a part of resilient cooling strategy and what to be aware of in the early-stage design?

Paul O'Sullivan, Munster Technological University, Ireland

How does well-being and the revision of EN 16798-1 fits into VC?

Bjarne W. Olesen, DTU, Denmark

Is VC a renewable energy solution and how does it fit into the sustainability agenda?

Ivan Pollet, Renson, Belgium

Is VC a relevant and future proof cooling solution?

Peter Holzer, Operating Agent EBC Annex 80, Institute of Building Research & Innovation. Austria

Why choose hourly calculation procedures - and the relation to the VC potential tool?

Dick van Dijk, EPB Center, Netherlands

Questions and open Discussion

Facilitated by **Christoffer Plesner**, VELUX A/S, Denmark & **Jannick Roth**, WindowMaster International A/S, Denmark

15:00-15:15 **Room Change**



Thursday, October 6th, 2022



ROOM A / LE JARDIN

15:15-16:45 Closing Session

Chairs: Arnold Janssens, Peter Wouters

Digital tranformation for energy neutral building with a healthy environment

Lieve Declercq, *SPIE Nederland B.V., Netherlands*

Summing up of the "Smart ventilation, IAQ & Health" track

Benjamin Jones, *University of Nottingham, UK*

Summing up of the "Airtightness" track

Valerie Leprince, *Cerema, France*

Summing up of the "resilient ventilative cooling" track

Hilde Breesch, *KU Leuven, Belgium*

Best paper/poster award & Student Competition awards

Announcement of 2023 conference

Closing

17:00

End of Conference



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