

# 36th AIVC Conference

Effective ventilation in high performance buildings



23 - 24 September 2015  
Madrid, Spain

5<sup>th</sup> TightVent Conference

3<sup>rd</sup> venticool Conference



FINAL PROGRAMME

Salón de Actos

09:00-10:45

**Opening - Plenary Session (Part 1)**

*Chairpersons: Peter Wouters, José Antonio Tenorio*

- **Welcome on behalf of AIVC, venticool, TightVent**  
Peter Wouters, Manager, INIVE EEIG, Belgium
- **Welcome by Eduardo Torroja Institute for Construction Science - IETcc-CSIC**  
Marta Castellote, Director, IETcc-CSIC, Spain
- **Indoor Air Quality regulations. The Spanish case**  
José Antonio Tenorio & Pilar Linares, Building Quality Department, IETcc-CSIC, Spain (*p. 1*)
- **Energy efficient ventilation for NZEB in Mediterranean countries**  
Servando Alvarez Dominguez, Professor, University of Seville, Spain  
(Invited speaker) (*p. 3*)

10:45-11:15

**Coffee break**

11:15-12:45

**Plenary Session (Part 2)**

*Chairpersons: Yun Gyu Lee, Max Sherman*

- **Is ventilation necessary and sufficient for acceptable indoor air quality?**  
Kwok Wai Tham, Professor, National University of Singapore, Singapore (Invited speaker) (*p. 5*)
- **Ventilation projects within the International Energy Agency: objectives, approaches and expected results**  
Per Heiselberg, Professor, Aalborg University, Denmark  
(Invited speaker) (*p. 12*)
- **BIMs, sustainable buildings and effective ventilation**  
Frank Hovorka, Head of real estate sustainable policy, Caisse des Dépôts, France (Invited speaker) (*p. 14*)

12:45-13:45

**Lunch break**

**A3 Aula de Formación**

13:45-15:15

**Parallel Session 1A - Topical session: Building airtightness testing: ground status from various countries**

*Chairpersons: Arnold Janssens, Paula Wahlgren*

- **Analysis of results from ATTMA lodgement - what are the realistic air permeability characteristics of UK housing**  
Barry Cope, UK (Invited speaker) (p. 19)
- **Building airtightness in Germany - what are the driving forces?**  
Oliver Solcher, Germany (Invited speaker) (p. 21)
- **6 years of envelope airtightness measurements performed by French certified operators: analysis of about 65.000 tests**  
Adeline Bailly, France (Invited speaker) (p. 22)
- **Airtightness Data and Characteristics of 752 Residential Units of Reinforced Concrete Buildings in Korea**  
Jo Jae-Hun, South Korea (p. 33)
- **Airtightness and indoor air quality in subsidised housing in Spain**  
Jessica Fernandez - Aguera, Spain (p. 43)

**Auditorio**

13:45-15:15

**Parallel Session 1B - Topical Session: Ventilative cooling and Annex 62 (Part 1)**

*Chairperson: Per Heiselberg*

- **Evaluation tool of climate potential for ventilative cooling**  
Annamaria Belleri, Italy (p. 53)
- **Night time cooling by ventilation or night sky radiation combined with in-room radiant cooling panels including Phase Change Materials**  
Bjarne W. Olesen, Denmark (p. 67)
- **Stack driven ventilative cooling for schools in mild climates: analysis of two case studies**  
G. Carrilho da Graca, Portugal (p. 78)
- **Ventilative Cooling and energy use in supermarkets**  
Zoi Mylona, London (p. 89)

Salon de Actos

13:45-15:15

**Parallel Session 1C - Long Oral Presentation Session: Ventilation in relation to IAQ and health**

*Chairpersons: Pilar Linares, Pawel Wargocki*

- **Effect of building and installation design on PM<sub>2,5</sub>**  
Wouter Borsboom, Netherlands (*p. 101*)
- **Experimental characterization of the efficiency and energy consumption of various central ventilation air cleaning systems**  
Alain Ginestet, France (*p. 107*)
- **CO<sub>2</sub> and volatile organic compounds as indicators of IAQ**  
Andrzej Szczurek, Poland (*p. 118*)
- **Impact of ventilation and recirculation rates on exposure to and intake of ozone and its initiated chemistry products: Mass balance model evaluation**  
Fadeyi Moshood Olawale, Singapore (*p. 128*)
- **Assessment of ventilation systems efficiency in office buildings, related to indoor volatile organic compound concentrations**  
Teodosiu Catalin, Romania (*p. 139*)
- **Influence of moving objects on ventilation plan for smoking room**  
Sihwan Lee, Japan (*p. 149*)

15:15-15:30

**Room change**

A3 Aula de Formación

15:30-16:30

**Parallel Session 2A - Topical Session: Ventilation and energy use**

*Chairpersons: François Durier, Claus Haendel*

- **Ecodesign Directive for Ventilation Units**  
Claus Haendel, Germany (Invited speaker) (*p. 194*)
- **Primary energy used in centralized and decentralized ventilation systems measured in field tests in residential buildings**  
Frank Scholzen, Luxembourg (*p. 197*)
- **Spread in energy use in buildings dependent on choice of heating and ventilation system**  
Par Johansson, Sweden (*p. 204*)
- **Development of a compact single room ventilation unit with heat recovery dedicated to tertiary building**  
Samuel Gendebien, Belgium (*p. 213*)

## Auditorio

15:30-16:30

### Parallel Session 2B - Long Oral Presentation Session: Ventilative cooling and thermal comfort

*Chairpersons: Bjarne Olesen, Wouter Borsboom*

- **Model Home 2020 – full-year measurements of daylight, energy and indoor climate in five single-family houses occupied by typical families: what has been learned**  
Peter Foldbjerg, Denmark (*p. 158*)
- **Optimization of indoor air quality through controlled cross ventilation in the retrofitting of residential buildings**  
Miguel A. Padilla - Marcos, Spain (*p. 167*)
- **Wind-induced pressure coefficients on buildings dedicated to air change rate assessment with CFD tool in complex urban areas**  
Guillaume Caniot, France (*p. 179*)
- **Field application of enhanced displacement ventilation system in an office of a Zero Energy Building in the Tropics**  
David K.W. Cheong, Singapore (*p. 188*)

## Salón de Actos

15:30-16:30

### Parallel Session 2C - Topical Session: Annex 68: Design and Operational Strategies for Low Energy and High IEQ Buildings

*Chairperson: Carsten Rode*

- **IEA EBC Annex 68 – Indoor Air Quality Design and Control in Low Energy Residential Buildings**  
Carsten Rode, Denmark (Invited speaker) (*p. 223*)
- **IEA EBC Annex 68 – Subtask 1: Defining the metrics**  
Marc Abadie, France (*p. 226*)
- **IEA EBC Annex 68 – Subtask 2: Pollutant Loads in Buildings**  
Marc Abadie, France (*p. 229*)
- **IEA EBC Annex 68 – Subtask 3: Modelling**  
Gabriel Rojas, Austria (*p. 232*)
- **IEA EBC Annex 68 – Subtask 4: Strategies for design and control of buildings**  
Jakub Kolarik, Denmark (*p. 235*)
- **IEA EBC Annex 68 – Subtask 5: Field Measurements and Case Studies**  
Kristine Nore, Norway (*p. 237*)
- **Discussion**

16:30-17:00

Coffee break

A3 Aula de Formación

17:00-18:30

**Parallel Session 3A - Long & Short Oral Presentation Session:  
Airtightness - Airflow measurements**

*Chairpersons: Andrew Persily, Andrzej Gorka*

- **rCloud - Capturing the moment, a new era in automated testing**  
Colin Genge, Canada (*p. 239*)
- **Uncertainty in airflow rate estimation of daytime ventilation associated with atmospheric stability**  
Lim Jongyeon, Japan (*p. 241*)
- **Airtightness Quality Management Approaches in France: end and birth of a scheme. Previous and new schemes, overview and analysis**  
Sandrine Charrier, France (*p. 250*)
- **Thermal envelope quality versus nZEB parameters and long-term economics: the Eco-Silver House case in Ljubljana**  
Luka Zupancic, Slovenia (*p. 261*)
- **The zero pressure paradox**  
Bink Niek-Jan, Netherlands (*p. 272*)
- **Airtight duct systems [a simple way of improving a building's energy efficiency without increased investment]**  
Santiago Pascual, Spain (*p. 293*)
- **Estimating the average Air Change Rate for the heating season**  
Laszlo Fulop, Hungary (*p. 300*)

Auditorio

17:00-18:30

**Parallel Session 3B - Short Oral Presentation Session: Ventilative cooling and thermal comfort**

*Chairpersons: Maria Kolokotroni, Lorenzo Pagliano*

- **Experimental Analysis of Microscale Trigeneration Systems to Achieve Thermal Comfort in Smart Buildings**  
Sawant Parantapa, Germany (*p. 309*)
- **Impact of natural ventilation in energy demand and thermal comfort of residential buildings in Catalonia**  
Jaume Salom, Spain (*p. 320*)
- **Thermal comfort assessment in a sustainable designed office building**  
Maria Nuria Sanchez Ejido, Spain (*p. 331*)
- **Improvement of comfort and energy efficiency in existing buildings using Adaptive Thermal Comfort Algorithm**  
Javier Garcia Ramos, Spain (*p. 342*)

- **Electrothermal actuators with PWM control**  
Michal Szymanski, Poland (*p. 352*)
- **Assessment of spatial and temporal distribution of thermal comfort and IAQ in low energy houses**  
Maria del Carmen Bocanegra-Yanez, UK (*p. 358*)
- **Model Predictive Control (MPC) of hybrid ventilation systems in office buildings with dynamic glass facades**  
Christian Drivsholm, Denmark (*p. 369*)
- **Thermal performance analysis of a solar chimney, based on the experimental study of the main driving variables in a physical prototype**  
Ricardo Enríquez, Spain (*p. 385*)
- **Control Strategies of the Natural Ventilation for Passive Cooling for an Existing Residential Building in Mediterranean Climate**  
Alessandro Rinaldi, Italy (*p. 396*)
- **Evaporative Cooling and Ventilation Control Strategies for a Kindergarten in Mediterranean Climate**  
Alessandro Rinaldi, Italy (*p. 406*)
- **A modular, open system for testing ventilation and cooling strategies in extremely low energy lecture rooms**  
Ralf Klein, Belgium (*p. 416*)
- **Cold storage in the thermal mass of buildings using night ventilation. Experimental analysis**  
Rafael Salmeron Lissen, Spain (*p. 426*)
- **How safe is it to neglect thermal radiation in indoor environment modeling with high ventilation rates?**  
Sasan Sadrizadeh, Sweden (*p. 436*)
- **3D Fluid dynamic analyses of open joint ventilated facades applying experimental Stereo-PIV techniques**  
Maria Nuria Sanchez Egido, Spain (*p. 441*)
- **A Study on the Reduction Effect of Ventilation and Heating Load by Installing Air-based Solar System in the Detached Houses**  
Choi Youngjin, Japan (*p. 450*)
- **Implementation of Multi-zone Ventilation Methodology in the Spanish Energy Performance Certificate Tool**  
Javier Garcia Ramos, Spain (*p. 460*)

17:00-18:30

**Parallel Session 3C - Short Oral Presentation Session: Ventilation in relation to IAQ and health**

*Chairpersons: Willem de Gids, Samuel Caillou*

- **Ventilation and health – a review**  
Peter Foldbjerg, Denmark (p. 474)
- **Evaluation of Ventilation and IAQ Parameters Measured in Social Housing in Madrid**  
Sergio Rodriguez - Trejo, Spain (p. 482)
- **Influence of air quality performance requirements on the demand of energy**  
Jose Manuel Salmeron Lissen, Spain (p. 495)
- **Radon concentration control by ventilation and energy efficiency improvement**  
Borja Frutos, Spain (p. 508)
- **How the filtration of the incoming air decreases the particle concentration within a school equipped with a balanced ventilation system**  
Alain Ginestet, France (p. 518)
- **Energy performance of active polarization filters vs. conventional filters in HVAC systems**  
Eduardo Theirs, Spain (p. 527)
- **The effect of CO<sub>2</sub> on the nocturnal restlessness of an Alzheimer patient**  
Bart Cremers, Netherlands (p. 534)
- **Air change rate measurements using indoor/outdoor ratio of PM2.5**  
Li Lingshan, China (p. 540)
- **Mitigating Occupant Exposure to PM2.5s Emitted by Cooking in High Occupancy Dwellings Using Natural Ventilation Strategies**  
Benjamin Jones, UK (p. 549)
- **Ventilation effectiveness comparison between extract ventilation and balanced ventilation in a scale model**  
Bart Cremers, Netherlands (p. 559)
- **Numerical evaluation of the impact of hemp lime concrete moisture-buffering capacity on the behaviour of relative humidity sensitive ventilation system**  
Bassam Moujalled, France (p. 566)
- **Optimal window opening based on natural ventilation measurements**  
Yue Zhang, China (p. 575)
- **Evaluation of the refurbishment potential of Mediterranean schools towards nZEB**  
Niki Gaitani, Greece (p. 584)

18:30

**Welcome Reception**



A3 Aula de Formación

08:45-10:15

**Parallel Session 4A - Topical Session: Solutions and future developments for airtight envelopes and ductwork in new and renovated buildings**

*Chairpersons: François Rémi Carrié, Edward Cooper*

- **How to construct a domestic pitched roof with high thermal quality?**  
Staf Roels, Belgium (Invited speaker) (p. 593)
- **Detailed numerical modelling of moist air flow through a complex airtightness defect**  
Clement Belleudy, France (p. 601)
- **Characterization of sealants and expanding foams**  
Filip Van Mieghem, Belgium (p. 612)
- **Laboratory investigation on the durability of taped joints in exterior air barrier applications**  
Jelle Langmans, Belgium (p. 615)

Auditorio

08:45-10:15

**Parallel Session 4B - Topical Session: Ventilative cooling and Annex 62 (Part 2)**

*Chairperson: Guilherme Carrilho da Graça*

- **Energy use consequences of ventilative cooling in a ZEB residential building**  
Maria Justo Alonso, Norway (p. 624)
- **Ventilative cooling strategies to reduce cooling and ventilation needs in shopping centres**  
Marta Avantaggiato, Italy (p. 633)
- **Overheating Assessment of a Passive House Case Study in Spain**  
Juan Maria Hidalgo Betanzos, Spain (p. 645)
- **Automatic natural ventilation in large spaces: a passive ventilation technology for passive buildings**  
Flourentzos Flourentzou, Switzerland (p. 656)

Salón de Actos

08:45-10:15

**Parallel Session 4C - Topical Session: IAQ and ventilation in the Spanish regulation**

*Chairpersons: José Antonio Tenorio, Pilar Linares*

- **Energy and IAQ friendly variable ventilation rates, according with the proposed indoor air quality regulations included in the Spanish building code**  
Sonia Garcia-Ortega, Spain (p. 677)
- **Energy saving as a consequence of the proposed change in Spanish regulations relating to indoor air quality**  
Pilar Linares, Spain (p. 687)
- **Impact on the formation of mould in the period of summer, that indicates change in existing housing ach. Climate zone D1**  
Enrique Larrumbide Gomez-Rubiera, Spain (p. 695)
- **Ventilation tool for improving the usability of ventilation levels related to Spanish regulations**  
Rafael Villar Burke, Spain (p. 702)
- **Impact of the new rite 2013 (regulation on thermal installation) on indoor air quality**  
Paulino Pastor Perez, Spain (p. 709)

10:15-10:35

Coffee break

A3 Aula de Formación

10:35-11:35

**Parallel Session 5A - Long Oral Presentation Session: Air infiltration modelling**

*Chairpersons: Peter McDowall, Jelle Lagmans*

- **Infiltration and Ventilation in a Very Tight, High Performance Home**  
Andrew Persily, USA (p. 719)
- **Impact of air infiltration rates on moisture buffering effect of wooden surfaces**  
Dimitrios Kraniotis, Norway (p. 727)
- **Numerical evaluation of the airtightness impact on airflow pattern in mechanically ventilated dwellings in France**  
Fabrice Richieri, France (p. 738)
- **Characterization of high performance ductwork**  
Lars-Ake Mattsson, Sweden

Auditorio

10:35-11:35 **Parallel Session 5B - Topical Session: Natural free cooling using PCM and thermal mass**

*Chairpersons: Servando Alvarez, José Antonio Tenorio*

• **Concrete in ventilated facades for natural cooling of buildings. SINHOR project**

Servando Alvarez & Cesar Bartolomé, Spain (p. 750)

• **PCMs as a tool increasing thermal inertia in Buildings**

Luisa Cabeza, Spain (p. 1002)

• **Advanced Materials to fight Urban Climate Change**

Theoni Karlessi, Greece (p. 752)

• **How cool roofs interact with PCMs: Investigating thermal-energy behaviour of a cool roof membrane with paraffin based PCM inclusion**

Anna Laura Pisello, Italy (p. 753)

Salón de Actos

10:35-11:35 **Parallel Session 5C - Topical Session: Indoor Environmental Quality- Ventilation and Health**

*Chairpersons: Bjarne Olesen, Wouter Borsboom*

• **The Indoor Environmental Quality Alliance. Occupants behaviour and its impact on ventilation**

Bjarne Olesen, Denmark (Invited speaker)

• **Are women feeling colder than men in air-conditioning buildings?**

Bjarne Olesen, Denmark (p. 756)

• **A new AIVC Technical Note on Residential Ventilation and Health**

Wouter Borsboom, Netherlands (Invited speaker)

11:35-11:50 **Room change**

## A3 Aula de Formación

**11:50-12:50**      **Parallel Session 6A - Long Oral Presentation Session: Airflow and airtightness measurements**

*Chairpersons: Benjamin Jones, Paula Walhgren*

- **Field trialling of a new airtightness tester in a range of UK homes**  
Edward Cooper, UK (*p. 759*)
- **Calibrating measurement gauges – expense and findings**  
Paul Simons, Germany (*p. 768*)
- **Multivariant measurements of airtightness of multifamily building**  
Radoslaw Gorzenski, Poland (*p. 778*)

## Auditorio

**11:50-12:50**      **Parallel Session 6B - Topical Session: Demand - Controlled Ventilation**

*Chairpersons: François Durier, Jelle Laverge*

- **Demand controlled ventilation in practice: Case study**  
Bart Merema, Belgium (*p. 820*)
- **Residential demand controlled extract ventilation combined with heat recovery via a heat pump**  
Ivan Pollet, Belgium (*p. 830*)
- **Theoretical and real ventilation heat losses and energy performance in low energy buildings**  
Flourentzos Flourentzou, Switzerland (*p. 666*)
- **Discussion**

## Salón de Actos

**11:50-12:50**      **Parallel Session 6C - Long Oral Presentation Session: IAQ and ventilation in standards and regulations**

*Chairpersons: William Bahnfleth, José Manuel Salmeron*

- **Status of the development of the CEN and ISO standards on energy performance of buildings assessment procedures**  
Jaap Hogeling, Netherlands (Invited speaker) (*p. 789*)
- **Analysis of indoor air quality & thermal comfort parameters in building regulations in 8 member states**  
Eleni Kontonasiou, Belgium (*p. 799*)
- **Indoor Carbon Dioxide Concentrations in Ventilation and Indoor Air Quality Standards**  
Andrew Persily, USA (*p. 810*)

**12:50-13:50**      **Lunch break**

A3 Aula de Formación

13:50-15:20

**Parallel Session 7A - Topical Session: Winning concepts and examples for high indoor air quality in renovated school buildings**

*Chairperson: Lorenzo Pagliano*

- **The Renew-School project: introduction and overview**  
Lorenzo Pagliano, Italy (Invited speaker)
- **Ventilation, indoor air quality and learning in schools**  
Pawel Wargocki, Denmark (p. 949)
- **Evaluation of ventilation solutions for retrofitting of schools**  
Christian A. Hviid, Denmark (p. 959)
- **Minimal Invasive Ventilation Systems with Heat Recovery for School Buildings**  
Gabriel Rojas, Austria (p. 968)
- **Indoor climate assessment of a classroom with mechanical ventilation and operable windows**  
Yacine Allab, France (p. 980)
- **Ventilation strategies for the deep energy retrofit of a kindergarten**  
Francesco Causone, Italy (p. 991)

Auditorio

13:50-15:20

**Parallel Session 7B - Long Oral Presentation Session: Ventilation performance and comfort**

*Chairpersons: José Manuel Salmeron, Max Sherman*

- **Simplified Methods for Combining Natural and Mechanical Ventilation**  
Nolwenn Hurel, France (p. 840)
- **Development of a Seasonal Smart Ventilation Controller to Reduce Indoor Humidity in Hot-Humid Climate Homes**  
Sara Ticci, Italy (p. 851)
- **Thermodynamic analysis of buildings with natural ventilation and indoor air quality**  
Víctor Moreno Solana, Spain (p. 862)
- **Performances of a simple exhaust mechanical ventilation coupled to a mini heat pump: modeling and experimental investigations**  
Frederic Ransy, Belgium (p. 872)
- **Ventilation performance and indoor air pollutants diagnosis in 20 French low energy homes**  
Gaëlle Guyot, France (p. 885)

13:50-15:20

**Parallel Session 7C - Long Oral Presentation Session: Ventilation and Indoor Air Quality**

*Chairpersons: Jaap Hogeling, Yun Gyu Lee*

- **Recommendable supply air rates for residential housing - A simulation study considering CO<sub>2</sub> concentration, relative humidity, TVOC emissions and mould risk**  
Gabriel Rojas, Austria (p. 937)
- **Reviewing legal framework and performance assessment tools for residential ventilation systems**  
Rob van Holsteijn, Netherlands (p. 895)
- **Capture efficiency of air curtain assisted residential range hoods**  
Jelle Laverge, Belgium (p. 913)
- **Impact of staff posture on airborne particle distribution in an operating theatre equipped with ultraclean-zoned ventilation**  
Sasan Sadrizadeh, Sweden (p. 919)
- **Mechanical ventilation performance assessment in several office buildings by means of Big Data techniques**  
Ricardo Enriquez Miranda, Spain (p. 926)
- **Effects of Carbon Dioxide With and Without Bioeffluents on humans**  
Pawel Wargocki, Denmark (p. 904)

15:20-15:35

**Coffee break**

Thursday 24 September 2015

## Salón de Actos

15:35-17:15

### Closing session

#### **Best paper & poster award**

Max Sherman, USA

#### **Summing up of ventilative cooling track**

Maria Kolokotroni, Professor, Brunel University London, London  
(Invited Speaker)

#### **Summing up of IAQ & health track**

Willem de Gids, VentGuide, The Netherlands (Invited Speaker)

#### **Summing up of airtightness track**

Arnold Janssens, Professor, University of Ghent, Belgium  
(Invited Speaker)

#### **Shifting the IEQ Paradigm from Comfort Silos to Holistic Health and Performance**

William Bahnfleth, Professor and Director, Indoor Environment Centre Department of Architectural Engineering, The Pennsylvania State University, USA (Invited Speaker) (*p. 1006*)

**Announcement of 2016 conference - IAQ 2016 "Defining Indoor Air Quality: Policy, Standards and Best Practices", co-organized by ASHRAE and AIVC**

### Announcement of other events

17:15

### End of conference



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