AIR INFORMATION REVIEW

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Building Ventilation - The State of the Art

A new publication by Earthscan/James & James, UK

- Prepared in association with the Air Infiltration and Ventilation Centre (AIVC);
- Written by recognized experts from Europe and the US, this work provides organized, classified and evaluated information on the progress of the key topics in building ventilation, relevant to all building types
- Outlining the state of the art, the book is an invaluable reference for building professionals on strategies and technologies for optimizing ventilation performance

Designing for optimum ventilation performance is a vital part of building design. This book reviews the main research and industrial achievements in the field of building ventilation, offering professionals an up-to-date framework for further development. Selecting the most appropriate ventilation strategy is made especially difficult by the complexities of airflow behaviour, climatic influences, occupancy patterns and pollutant emission characteristics. Recognizing such complexities, the editors bring together expertise on each key issue, providing an authoritative reference work relevant for all those interested in energy-efficient building design. From components to computer tools, this book offers detailed coverage on design, analysis and performance, and is an important and comprehensive publication in this field.

Edited by **Mat Santamouris and Peter Wouters**
Mat Santamouris is Associate Professor in the Physics Department, University of Athens, Greece.
Peter Wouters is with BBRI, Belgium and he is the manager of INIVE EEIG and Operating Agent of the Air Infiltration and Ventilation Centre

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AIVC Conference 2006

Technologies & Sustainable Policies for a Radical Decrease of the Energy Consumption in Buildings
20 - 22 November 2006 - Lyon – France

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AIR INFORMATION REVIEW

The newsletter of the AIVC, the Air Infiltration and Ventilation Centre. This newsletter reports on air infiltration and ventilation related aspects of buildings, paying particular attention to energy issues. An important role of the AIVC and of this newsletter is to encourage and increase information exchange among ventilation researchers and practitioners worldwide.

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Natural Ventilation in the Urban Environment.
Authors: F. Allard and C. Ghiaus, University of La Rochelle, France.
This article presents the physics of natural ventilation, the strategies to be followed to achieve an effective natural ventilation, the cooling potential of ventilation, and the major alteration of the cooling potential of natural ventilation in the urban environment.

Analytical Methods and Computing Tools for Ventilation.
Author: J. Axley. Yale University US.
This article presents new modern calculation methods like : Multi-zone Nodal Methods, Multi-zone Loop Methods, Sub-zone and Embedded Modelling Methods and Multi-zone Multi-physics Analysis.

Ductwork, Hygiene and Energy
Authors: F. R. Carrie, CERTU, France and P. Passanen, University of Kuopio, Finland.
This article examines aspects related to duct hygiene and health, energy performance and duct design, maintenance of ducts, performance checks and finally it presents some future challenges on the topic.

Building Airtightness
Authors: M.H. Sherman and W.R. Chan, LBL, USA.
This article presents initially the hydrodynamics of leaks and then fan pressurisation and measurement techniques, air tightness metrics and data and finally aspects of dynamic air flow.

Ventilation Performance Indicators and Targets
Author: P. Schild, NBI, Norway.
This article presents initially the hierarchy of ventilation principles, and then the application of the hierarchy ventilation performance indicators and finally it presents the available data and the suggested targets.

Heat Recovery
Authors: P. Schild, NBI, Norway.
The article presents the types and the areas of heat recovery use, aspects related to moisture recovery and frost protection and heat recovery performance. Then, it includes data on the calculation of the energy savings and profitability, the choise of heat recovery for different building types, and finally it presents aspects of commissioning, operation and maintenance.

Hybrid Ventilation
Authors: P. Heiselberg, University of Aalborg, Denmark.
The article presents the various hybrid ventilation strategies, the design of hybrid ventilation systems, some practical solutions, aspects of control of hybrid ventilation systems, processes of hybrid ventilation airflow, and finally, some future challenges and trends in research and development.

Ventilation for Comfort and Cooling
Author: M. Santamouris, University of Athens, Greece.
This article presents the recent trends on the cooling of buildings, the basic principles of ventilation for cooling, then aspects related to ventilation and thermal comfort, while it includes information of the design processes to achieve cooling through ventilation. It discusses constraints and limitations of ventilative cooling techniques, and presents the state of the art on the use of fans and mechanical ventilation systems to provide thermal comfort. Finally, it shows how hybrid ventilation systems may be used to provide cooling.

Effect of Ventilation on Health and Other Human Responses
Author: O. Seppanen, Technical University of Helsinki, Finland.
This article presents the relation between ventilation and indoor air quality, the role of ventilation in controlling pollutants in the indoor environment followed by aspects of ventilation for residences, ventilation and temperature control, cleaning with recirculating and filtering air, the association of heating, ventilating and air conditioning system types with SBS symptoms. It concludes with the presentation of aspects considering pollutants in air handling equipment and systems, operation and maintenance, ventilation and pressure differences and some ideas about future research needs.

Advanced Components for Ventilation
Author: W.F. de Gids, TNO, The Netherlands.
This article includes specific information on the role of infiltration, air inlets, windows, vents, inlet grilles, pressure controlled air inlets, passive and active air inlets, humidity controlled inlets and pollutant controlled inlets.

Then it discusses the integration within the ventilation system, the integration within the heating system, the mechanical supply units per room, mechanical supply, extract and pressure controlled valves, ductwork, fans, heat recovery units, roof outlets and PV applications.

Ventilation Standards and Regulations
Authors: P. Wouters, C. Delmotte and N. Heijmans, BBRI, Belgium.
This article presents the policy in standards and regulations related to ventilation, the standards in European Union, the types and levels in requirements to standards and regulations, the North American ventilation standards for residences, and finally some ideas about the new challenges in the context of ventilation standards.

Air-tightness measurements of residential houses in Athens, Greece

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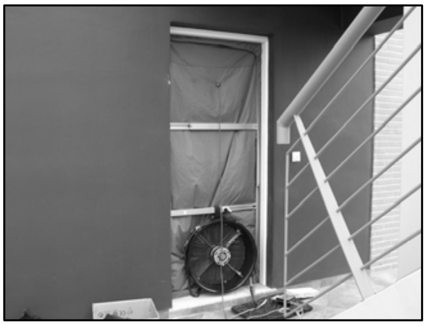
Infiltration is defined as the movement of air through leaks, cracks or other openings of the building envelope. This phenomenon affects the energy use of the building and impacts the transport of pollutants so affecting indoor air quality.

Infiltration rates are affected from the buildings' construction characteristics, the surroundings and the buildings' age. Wind speed, wind direction and secondary indoor – outdoor temperature difference affect them too, so air exchange can vary substantially during the year. Air tightness is the fundamental building property that impacts infiltration and it is measured as a function of the pressure across the building envelope with pressurisation tests.

Very few information is available regarding infiltration of buildings in the Mediterranean area. Mediterranean buildings are characterised by large openings and natural ventilation is a very common procedure to achieve cooling, fresh air and comfort.

Given the increase of urban temperatures because of heat island phenomenon, and the serious reduction of the wind speed in urban canyons, the cooling potential of natural ventilation techniques is seriously decreased and as a consequence the number of air conditioned buildings increases considerably.
Good air tightness in air conditioned buildings is a strong requirement and thus, knowledge of the airtghtness levels and infiltration rates is necessary. A recent Greek study aims to offer the necessary information to better estimate natural infiltration rates in residential buildings in the South of Europe.



Blower Door equipement

During the summer of 2005, air tightness and infiltration measurements were performed in twenty houses, in the area of Attica, Greece. All tested houses were single-family buildings that had more than one exposed facade. Two measurement methods were used, i.e. the tracer gas decay method and the Blower Door tests method. Ambient conditions and temperature fluctuations inside the houses were measured as well, using the mobile meteorological station of Group of Environmental Studies of University of Athens.

Mobile meteorological station

Infiltration rates were determined by using the "tracer gas – decay" method. The tracer gas equipment consists of a central unit that controls the gas injection and sampling, an infrared radiation detector, a gas bottle and several fans that were used in order to ensure that the gases (indoor air – inert gas) were well mixed. The (inert) gas indicator that was used was N_2O. An amount of gas was then released into four different building zones through four separate tubes - channels, while all house openings remained closed. As soon as the inert gas – indoor air mixing was complete and the N_2O concentration target value was reached, gas release was cut off while N_2O gas concentration tracing went on. The infiltration rate, in air changes per hour (ACH), for each of the four building zones that were tested as well as for the entire building (ACHav), was calculated by using the traced concentration values.
Each building's air tightness was measured using a Blower Door in accordance with EN ISO 13829. Measurements were carried out following "method A – common building use" of EN ISO 13829 while also applying a pressure difference of 50 Pa in order to fulfil the requirements of EN ISO 13790 (former EN ISO 832).

All blower door experiments' results are acceptable as they fulfil EN ISO 13829 criteria.
The average number of air changes per hour was approximately 0.6 ACH, when the tracer gas method was used, while the average number of air changes per hour at a 50 Pa pressure was 7 ACH, when the Blower Door tests method was used. A classification of houses examined, based on experimental results, was done in accordance with EN ISO 13790. The houses were classified into three air tightness categories, in regard to their air tightness in natural conditions and at a pressure difference of 50 Pa. The majority of buildings belong to "medium air tightness category".

A statistical homogeneity test between regression coefficients of blower door measurements is performed for each category of air tightness. The sample of buildings that belong to the "low air tightness level" category is statistically homogeneous, while the samples of buildings that belong to the "medium" and "high" air tightness level are statistically uneven.

Different construction characteristics or variations on ambient conditions between buildings of the same category possibly contribute to this unevenness. Given that "medium/high air-tightness level" buildings are uneven, it becomes necessary to either redefine the values' range of each category or to create a new category that would fall between the two already existing ones. Both actions require a large number of experiments.

An important factor associated with air tightness of a building is the total window frame length divided by the building's net volume. This parameter was estimated for each building and was defined as "frame length factor (FLF)". There is no significant correlation between the air tightness measurements at natural conditions and the "frame length factor (FLF)", while a linear correlation between the air tightness measurements at a 50 Pa pressure difference and the FLF is noticed.
At first sight, it seems the low R^2 values are probably due to substantial affects associated with climatic conditions and the fact that there might be other causes for building leakages.

Linear correlation between the blower door measurements and the total frame length was further checked for each one of three air tightness levels (high, medium, low). The linear correlation for the "high" and the "medium" air tightness levels give lower R^2 values compared with the high value of R^2 = 0.93 of "low" air tightness buildings. In the case of "low air tightness" houses, the most important linear correlation between FLF and air tightness measurements is observed, while this category is mostly affected by the total window frame length.

Progress in air-tightness of Norwegian dwellings

Tormod Aurlien
SINTEF Building & Infrastructure, Norway

The last few years have seen a revival of interest in the importance of building airtightness on the energy consumption of Norwegian dwellings (see AIR December 2004, p.3). It is traditionally popular to build detached houses, very often with a timber frame construction.

House with leakage number n_{50} < 0.1 ach/h, measured in early wind tight stage. (Photo: Torstein Fjogstad)

Good airtightness has customarily been sought by focusing on the inner parts of the external façade, i.e. the cladding and plastic vapor barrier.
Common leakage numbers for these constructions have been around n_{50} = 4 ach/h at 50 Pa, which is the national building regulation for airtightness of such houses.

In an effort to further reduce energy consumption, the Norwegian government has just proposed to significantly tighten the building regulations from 2007, making "low energy" houses standard. One of the proposed measures is to restrict leakage numbers to n_{50} < 1.5 for all buildings. To reach this goal, focus must now be redirected to the external wind barrier and corresponding details, in addition to the traditional inner-layer focus. One effect of this has been that leakage measurements are now performed at an early stage of the construction process, when only the outer layer is present, such that remedial work can be done to improve airtightness as little extra cost.

There are many ongoing projects documenting results from this national effort to improve airtightness in low energy housing. These show that the goal is possible to achieve. Typical leakage number values seem to be around n_{50} = 1.5 ach/h for these new houses. An evaluation project has also started to try to pinpoint which details and building practices guarantee low leakages.

What has been especially inspiring is the ongoing adaptation process in many small and larger house building firms:
The present gold medal for airtightness is held by Fjogstad-Hus Sandnes AS, situated in the South West of Norway; an area famous for its windiness.

Some years back they had a building project with large air leakages, resulting in large costs for remediation. As a result, the firm embarked on a quality improvement plan. They have recently built three low energy houses. These have all been measured with a leakage number around n_{50}=0.3 ach/h, measured in early wind tight stage and around n_{50}=0.2 measured in finished stage with insulation, vapor barrier and inside cladding in place. These impressive results inspired the firm to try out their new practices on a slightly more challenging geometry (see the following photo), and the results were even better, with n_{50}<0.1 ach/h.

These results have a great importance in the nationwide debate on new building regulations, when parts of the local building industry have been complaining about airtightness with leakage numbers as low as 1.5 ach/h being "impossible to reach". It is possible with practical measures!

ASHRAE May Reduce Ventilation Rates for Dwellings

Max Sherman
Lawrence Berkeley National Laboratory, USA

In the 18th Century the English Parliament was declared foul, odorous and pestiferous. When Parliament burned (or was burned) down later, a commission was given to figure out how much outdoor air parliament should have.

Thus the first numerical and mechanical ventilation rate was specified in the early nineteenth century with a value of about 4 cfm/person (7 m³/h.pers) based on the metabolic requirements of legislators. The philosophy of treating the occupants as the prime contaminant source led to ever increasing rates as research on health and comfort continued.

At the turn of the 20th century, ASHRAE (or more properly is predecessor the American Society of Ventilation Engineers, ASVE) recommended 30 cfm/person (51 m³/h.pers). Many in the medical community recommended twice that, but by the 1930s many states and localities had adopted 30 cfm/person (51 m³/h.pers) as the requirement. In the latter half of the century, ASHRAE Standards varied in the range of 5-20 cfm/person (8.5-34 m³/h.pers) as issues of odor, energy use and changes in indoor sources were reconsidered.

Janssen (1999) has reviewed the first century of conditioning in some detail.

The lower rates that were employed after the first oil shock of 1973 provided a research opportunity to investigate sources other than the occupants and their direct activities. In the 80s it began to be recognized that the building structure and its contents were substantial contributors to indoor pollution and that the metric of cfm/person was not appropriate for spaces with low occupant densities. The metric of Air Changes per Hour (ACH) was considered much more appropriate.

This philosophy was implemented for houses in ASHRAE Standard 62-89, which had a requirement of 15 cfm/person, (25.5 m^3/h.pers) but not less than 0.35 ACH. This could lead to rates anywhere from 15 to 50 cfm/person (25.5 - 85 m^3/h.pers). For all but the smallest densest homes, it is the 0.35 ACH that mattered.
The 0.35 ACH was very successful as a target for design, for retrofit programs, and for setting base cases. Although higher rates are commonly used in Western Europe, the 0.35 ACH is the most generally accepted residential rate in North America. Despite that acceptance the standard was not very successful at effecting mechanical ventilation because of the way it treated windows and infiltration.

62-89 allowed the 0.35 ACH to be met through any combination of mechanical or natural ventilation desired. Someone could claim to meet this level by infiltration alone. The standard was not written in a way that would allow any unambiguous means of compliance. In 1997 ASHRAE decided to write a completely separate standard, 62.2, to just focus on houses and deal with issues such as this. This effort was completed in 2003 and the current version is 62.2-2004.

62.2-2004 takes an intermediate approach of using a target that is the sum of a building part and a per person part that usually winds up a bit lower and a lot less variable than the 62-89 values, but generally about the same. A big difference in the standard, however, is that in its main compliance path it specifically states how much of this must be supplied by mechanical ventilation and how much is assumed to be supplied by infiltration.

ASHRAE will soon have an addendum out for public review that would delete the section that describes how infiltration is treated and what is assumed. This change lowers the target value of ventilation to about half of the 0.35 ACH. For those following the mechanical ventilation sizing table in the standard there is little real impact of this change, but for those using alternative methods or for those looking to ASHRAE to provide guidance on minimum rates, it has a substantial impact by cutting the ventilation rate in half.

Interestingly enough, deleting the section on infiltration makes it easier to comply with the standard using infiltration alone. Not only is the target rate now lower, but it removes the prescriptive method for taking (or limiting) infiltration credit. Without this limitation and with the now lower target, a tight home could now meet the proposed requirement by infiltration alone using the "Alternative Ventilation" path in the standard.
This brings the standard full-circle to be similar to 62-89 in that almost any house can be shown to meet it with or without actually having any ventilation - but now at half the 62-89 nominal rate.

This proposed change is out for public review from 22 September through 6 November . Is it time to reduce rates and reduce restrictions on infiltration? If you have an opinion on this controversial issue, I would encourage you to share it with the project committee by filing a public review comment. Information can be found on the new ASHRAE website (*http://www.ashrae.org*) under "Standards for Public Review" or by contacting the ASHRAE Manager of Standards at *cramspeck@ashrae.org*.

Janssen J. E., "The History of Ventilation and Temperature Control," *ASHRAE J*. pp 47-52; October 1999.

Implementation of CEN ventilation standards in Dutch Building Regulations and Standards

Willem de Gids
TNO Building Environment and Geosciences, The Netherlands

CEN has produced a large number of standards on ventilation. Most of these standards are so called product standards. Each national standards institute has now the obligation to reject, modify existing standards or just replace them by the CEN equivalent standard.
In the Netherlands this process has now started. TNO has carried out an analysis and approach on how to achieve the application of European ventilation standards. A proposal is now at the Dutch Standard Institute (NEN) and the Ministry of Housing (VROM) for decision of real implementation.

Tests for a number of ventilation components are now covered with CEN standards. See table hereafter. These standards all concern the Construction Product Directive of the EU.(89/106 EEC).

There are a number of ventilation or ventilation related standards produced with regard to the Energy Performance Buildings Directive (EPBD). Most of the EPBD standards are mandatory.
The analysis carried out by TNO has taken into account 64 CEN documents:
- 2 CEN reports
- 37 CEN standards
- 25 CEN work items shortly leading to CEN standards

From these documents:
- 31 product standards did not have a direct relation with the Dutch Building Regulation or relating standards
- 10 standards of which there are no equivalent in the Netherlands
- 3 standards relating to Dutch standards which cover about the same as the Dutch situation (NEN 1087/ NEN 8087 Ventilation of buildings, Test methods)
- 4 standards which have a direct relation to the Dutch Energy Performance Standard (NEN 5128)
- 1 standard which requires a change in the Dutch Building Regulation
- 5 standards which can be used in or referenced to in the existing code of practice for ventilation of dwellings (NPR 1088)

- 2 standards which can be seen more as a recommendation or guideline.

The main problem TNO has encountered during their analysis is that the Dutch ventilation standards which are directly coupled to the Building Regulations are so called "standards" covering test methods for a building as a whole. This means that the Dutch standards are not the product of component standards but standards covering the performance of the total ventilation system. The ventilation standards nevertheless have test methods almost similar to the CEN standards for components. Therefore the final choice was not to adopt the integral text of the CEN standards on component testing but modify the existing standard in a way that the new Dutch standard is in compliance with the concerning CEN standards.
Most of the principles of the test methods in the CEN standards (EN 13141-1/ EN 13141-2) were almost equal to the principles in Dutch Standards (NEN 1087/NEN 8087).
The modification of the Dutch ventilation standards concerns mainly the determination of the capacity of a ventilation component for air supply and exhaust. The minor changes in the Dutch ventilation standard will concern:

- Some definitions will be changed in accordance of the CEN standards
- The number of measurement points in flow/pressure relation
- The required pressure differences
- A correction for atmospheric pressure and outside temperature
- The accuracy to determine air flow rates and pressure differences

EN 13141-1:2004	Ventilation for buildings - Performance testing of components/products for residential ventilation - Part 1: Externally and internally mounted air transfer devices
EN 13141-2:2004	Ventilation for buildings - Performance testing of components/products for residential ventilation - Part 2: Exhaust and supply air terminal devices
EN 13141-3:2004	Ventilation for buildings - Performance testing of components/products for residential ventilation - Part 3: Range hoods for residential use
EN 13141-4:2004	Ventilation for buildings - Performance testing of components/products for residential ventilation - Part 4: Fans used in residential ventilation systems
EN 13141-5-2006	Ventilation for buildings - Performance testing of components/products for residential ventilation - Part 5: Cowls and roof outlet terminal devices
EN 13141-6:2004	Ventilation for buildings - Performance testing of components/products for residential ventilation - Part 6: Exhaust ventilation system packages used in a single dwelling
EN 13141-7:2004	Ventilation for buildings - Performance testing of components/products for residential ventilation - Part 7: Performance testing of a mechanical supply and exhaust ventilation units (including heat recovery) for mechanical ventilation systems intended for single family dwellings

A number of European ventilation standards for testing components or products

A real problem exists in the application of the flow field behind an air inlet (EN 13141-1) expressed in temperature and air velocity. The conditions chosen in the CEN standards are only extreme conditions, while in the Dutch ventilation standards the comfort behind an air inlet is considered in the occupation zone of a total room under certain conditions.
The CEN standards data result in an air flow field behind an air inlet on which one might see the difference in performance of several different inlets related to comfort. In fact the Dutch requirement considers the real comfort in the occupation zone of each room. In the revised Dutch ventilation standard this will be explained.

A number of changes in the Dutch Energy Performance Standard will be necessary as soon as the EPBD mandated standards are enforced. This requires much more effort than the relatively modest modification of the Dutch ventilation standards.

Although not yet planned, the first revision of the Dutch code of practice for ventilation of dwellings will have a lot of references to the existing CEN standard for ventilation.

The proposed change in the Dutch Building Regulation concern the way a cowl or roof outlet may influence the performance of a passive duct for extraction of air from inside to outside. In the Dutch ventilation standards there are very strict requirements on the position of the roof outlet above roof level, depending on the pitch of the roof and the distance to the roof pitch. Until now there was no test standard for the performance of cowls and the roof outlet. In the Dutch Building regulations therefore there is a so called functional requirement. This functional requirement states that a cowl drafting must stabilize the pressure in the passive duct to prevent from flow reversal or back drafting and may not have a negative effect on the extracted air flow.

The Dutch Building Regulations will take into account the test method of the new CEN standard EN 13141-5 and set a performance requirement. The ventilation standards NEN 1087/ and NEN 8087 will reference the test method of the cowl simply to EN 13141-5.

ASHRAE Position on ETS Cited in Newly Released Government Report

ATLANTA – A newly released report from the U.S. Surgeon General echoes ASHRAE's position that adverse health effects related to tobacco smoke cannot be eliminated through filtration or ventilation.

In its position document published last year, ASHRAE determined that although complete separation and isolation of smoking rooms can control environmental tobacco smoke exposure in non-smoking spaces in the same building, adverse health effects for the occupants of smoking areas cannot be controlled by ventilation.

"ASHRAE's position is that the only way to effectively eliminate health risk associated with indoor exposure is to ban smoking activity," Terry Townsend, P.E., ASHRAE president, said. "ASHRAE is pleased that our position was recognized by the U.S. government."

Findings from ASHRAE's Environmental Tobacco Smoke Position Document as well as guidance from ASHRAE's indoor air quality standard and ASHRAE Journal and Transactions articles are referenced in the report, The Health Consequences of Involuntary Exposure to Tobacco Smoke.

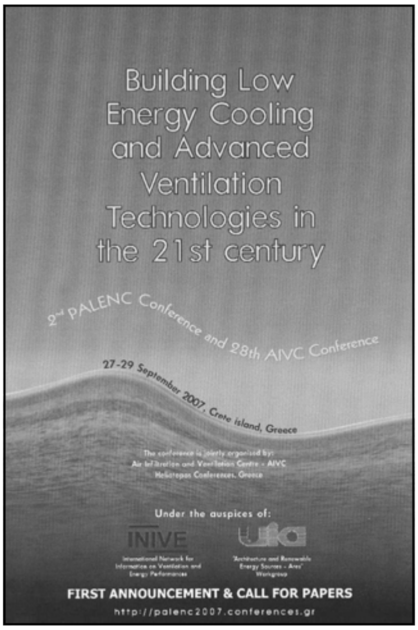
The U.S. Surgeon General report reaches six conclusions, including the fact "that eliminating smoking in indoor spaces fully protects nonsmokers from exposures to secondhand smoke. Separating smokers from nonsmokers, cleaning the air, and ventilating buildings cannot eliminate exposures of nonsmokers to secondhand smoke."

The supporting evidence for that conclusion notes that "ASHRAE, the preeminent U.S. body on ventilation issues, has concluded that ventilation technology cannot be relied on to control health risk from secondhand smoke exposure".

To obtain a free copy of the ASHRAE position document, visit http://www.ashrae.org/positiondocuments.

AIVC Conference 2007

Building Low Energy Cooling and Advanced Ventilation Technologies in the 21st Century
27-29 September 2007,
Crete Island, Greece



The joint 2nd Palenc and the **28th AIVC Conference** aims to focus on the advanced low energy cooling and ventilation technologies for buildings.

Increase of the living standards, deterioration of the thermal conditions in the urban environment and non-appropriate architecture design, has caused huge penetration of air conditioning in many parts of the world and not only in hot climates. Such a condition has a very serious impact on the peak electricity demand of the countries and the corresponding energy consumption. Intensive research carried out during the last years has permitted to develop new technologies, components, materials and techniques that permit to decrease seriously or even eliminate the cooling demand of buildings. In parallel, very low energy consumption for cooling new generation buildings have been realized and monitored.

Ventilation in buildings permits to decrease the cooling demand, improve comfort conditions and decrease indoor pollution.
A wide range of research activities carried out over the last years has permitted to develop advanced ventilation systems that highly satisfy the above requirements.

There is in many countries increased interest in regulations to cover the issue of summer comfort, air conditioning and peak power control, e.g. the European Energy Performance of Buildings Directive asks from the Member States to undertake all the necessary measures in order to decrease the energy consumption caused by air conditioning and improve indoor environmental conditions (air quality, summer comfort, ...). Passive and low energy cooling strategies provide interesting options.

The scope of this conference includes all aspects of technology and building design dealing with ventilation and passive cooling techniques able to improve the environmental performance of buildings.
Papers related on ventilation, solar control, thermal mass, thermal comfort, urban microclimate landscaping, low energy architecture, innovative components and materials, standardization and legislation, advanced and alternative air conditioners, demand side management, etc. are welcomed. The main aims are to present and discuss the state of the art of research and applications dealing with ventilation and cooling and also to assess the results achieved almost two years after the application of the European Energy Performance of Buildings Directive.

Topics
Passive Cooling Techniques
Ventilation for Cooling
Solar Control
Thermal Mass
Natural Ventilation
Hybrid Ventilation
Heat Protection Techniques
Advanced Control Systems and Techniques
Innovative Material and Components
Ground Cooling
Evaporative Cooling
Radiative Cooling
Microclimate
Heat Island
Canyon Effect
Applications in social housing
Demand Side Management

Legislation and in particular results from the application of the European Directive
Education & distance learning
Climatic Responsive Architecture
Thermal Comfort
Indoor Environmental Quality
High Efficiency Air Conditioners

Call for papers
Oral or poster presentations are welcome on the above mentioned topics.

Interested contributors are kindly asked to submit their abstracts electronically by **15 December 2006.**

An abstract of up to 300 words should be submitted, stating clearly the scope of the paper to be presented, the scientific methodology applied and the results obtained.

All abstracts will be reviewed and the authors will be notified about acceptance of their abstract by 15 February 2007.

A book (or CD) of the conference proceedings will be published and will be available to the participants during the conference. Detailed instructions on paper submission will be given in a later stage.

Note: All deadlines are provisional at this stage and subject to change

Venue
The conference will take place at **Capsis Beach Hotel & Sofitel Capsis Palace Conference Center**. The hotel is located in Aghia Pelaghia on a private peninsula of 150 acres, 25 km from the city of Heraklion in Crete. It consists of two main buildings and three bungalows sets with a total of 650 air-conditioned rooms, suites and bungalows & two Conference Centers and one Exhibition Center with a maximum conference capacity of up to 4.800 delegates.

Website
http://palenc2007.conferences.gr

EPIC 2006 AIVC

Palais des Congrès - Lyon, France - 20-22 November 2006

Scope of the conference
Given the oil crisis and the huge increase of the energy consumption (and its environmental impact), the theme of the conference focuses on the sustainability principles to be applied in the built environment.

In order to achieve a sustainable development with respect to the energy use and indoor climate in buildings, significant actions are required in the short and long term. The conference will pay attention to both aspects. Practical HVAC aspects are covered during the conference.

The 3-day conference is organised in the framework of the 4th European Conference on Energy Performance and Indoor Climate in buildings (EPIC), the **27th Conference of the Air Infiltration and Ventilation Centre** (AIVC – http://www.aivc.org) and the 1st conference of the International Energy Agency - Programme on Energy Conservation in Building and Community Systems) http://www.ecbcs.org.

Topics
1. Extreme Low Energy Buildings and Buildings with Positive Energy
2. Energy Performance Regulations and Certification: where are we and where to go?
3. The Existing Building Stock: Technical, Economical and Social Aspects for a Wide Scale Upgrading
4. Performance Assessment of Building Components and Installations
5. Sustainable Urban Planning
6. Advanced Glazing, Façade and HVAC Technologies
7. Natural Ventilation in Urban Settlements
8. Design of Buildings of High Architectural and Environmental Quality
9. Contributions & Challenges of the Information Society in relation to achieving Environmental Quality
10. Indoor Climate Criteria in relation to Sustainable Building
11. Indoor Climate, Energy & Economy, i.e. the Economic Value of Indoor Climate, the Overall Cost of Low Energy Concepts
12. Opportunities & Barriers for the integration of Renewables in the Built Environment
13. International and National Policies for medium and long term Energy Management – Post-Kyoto
14. Innovative Concepts for Education and Training

Conference Programme
There will be 4 parallel sessions during the whole duration of the conference (with the exception of the opening and closing session).

Each of the parallel sessions covers a specific topic:

1. AIVC track organised by the Air Infiltration and Ventilation Centre
A total of 8 sessions will cover a wide range of topics dealing with ventilation, e.g. development of new ventilation systems, ventilation and thermal comfort, indoor air quality, energy performance of ventilation systems, airtightness of buildings

2. EPBD and SAVE track organised by the EPBD Buildings Platform
Also this track contains 8 sessions during which the focus is primarily on the implementation of the European Energy Performance of Buildings Directive.
Information will be provided about the relevant projects of the SAVE programme, the activities in the EPBD concerted Action and the EPBD Buildings Platform, the mandate given by the EC to CEN for developing a whole range of standards facilitating the implementation of the EPBD. Moreover, a wider view on the EC policy regarding energy in buildings as well as the long term challenges will be presented.

3. IEA track organised by the International Energy Agency
For more than 30 years, the International Energy Agency (IEA) has been running a whole range of projects focusing on the energy performance of buildings. Many of these projects are managed by the IEA Programme on Energy conservation in buildings and community systems (ECBCS).
In total, 8 of these so-called annexes will lead a session covering topics as low exergy systems, high performance thermal insulation, commissioning of buildings and HVAC, testing and validation of energy simulation tools, integrating environmentally responsive elements in buildings, energy efficient lighting, energy efficient retrofit buildings for governmental buildings, energy efficient retrofits of schools.

4. EPIC track
During these sessions, there will be a wide range of presentations in relation to the conference topics.

Monday 20/11/2006				
09:30 – 13:00	Opening Session			
14:00 – 15:45	**AIVC** EOP	EP European Directives	ECBCS Annex 39	EPIC EOP
16:15 – 18:15	**AIVC** SOP	EP ENPER Exist	ECBCS Annexes 40-47	EPIC SOP
18:30	Wine tasting and conference dinner			
Tuesday 21/11/2006				
09:00 – 10:45	**AIVC** EOP	EP Certification	ECBCS Annex 46	EPIC EOP
11:15 – 13:00	**AIVC** RHEVA	EP European Standardisation CEN	ECBCS Annex 43 – T34	EPIC EOP
14:00 – 15:45	**AIVC** EOP	EP Educational Aspects	ECBCS Annex 44	EPIC EOP
16:15 – 18:15	**AIVC** EOP	EPIC EOP	ECBCS Annex 45	EPIC EOP
Wednesday 22/11/2006				
09:00 – 10:45	**AIVC** EOP	EP Green Buildings	ECBCS Annex 37	EPIC EOP
11:15 – 13:00	**AIVC** EOP	EP Bestfaçade	EPIC EOP	EPIC EOP
14:00 – 15:45	**AIVC** EOP	EP EE measures in the existing sector	EPIC	EPIC
16:15 – 18:00	Closing session			

Preliminary program subject to modifications – EOP: Extended Oral Presentations – SOP: Short Oral Presentations

Venue

The EPIC 2006 AIVC Conference will be held at the "Palais des Congrès", the Convention Centre, Lyon, in the heart of the Cité Internationale.
SECIL, Cité Internationale,
50 Quai Charles de Gaulle,
69463 Lyon Cedex 06, France,
phone: +33.4.72.82.26.26,
fax: +33.4.72.82.26.27,
http://www.palais-des-congres.com.

Language

English will be the official language.
Simultaneous translation in English and French will be provided for the opening and closing sessions.

Conference Secretariat

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epic2006aivc@entpe.fr,
http://epic.entpe.org

Conference Dinner

The Conference Dinner will be organized on Thursday evening at a cost of 50 €uros per guest.

Hotel information

The EPIC 2006 AIVC organizing committee made special arrangements for accommodation in Lyon during the conference. You will find at http://epic.entpe.org the list of the hotels by category with contact for reservation.

Please book your room directly with the hotel you choose and mention allotment reference **"EPIC 2006"** to obtain special prices as arranged by us. Please book as soon as possible. Due to various events in Lyon at this period of the year, there will be a high demand for rooms, so if you wish to benefit from allotment prices, make sure to book your room early.

For further information on other categories of hotels, please refer to web site http://epic.entpe.org.

Register at http://epic.entpe.org

Many ventilation related IEA ECBCS publications are now freely available!

The AIVC is one of the Annexes of the Implementing Agreement on Energy Conservation in Buildings and Community systems (ECBCS – http://www.ecbcs.org). Since almost 30 years ago, ECBCS has initiated some 50 research projects (so-called 'Annexes'), whereby many of these Annexes have a direct or indirect link with ventilation.

For a large number of Annexes some or all of the reports are now available free of charge as pdf-files. The list below gives an overview of the available reports as well as the title of the Annex.

Annex 1: load energy determination of buildings (1977-1980)

- Annex 1 Results and Analyses of Avonbank Building Simulation Level 1
- Annex 1 Results and Analyses of Avonbank Building Simulation Level 2

Annex 3: Energy conservation in residential buildings (1979-1982)

- Annex 3 Calculation Methods to Predict Energy Savings in Buildings
- Annex 3 Guiding Principles Concerning Design

Annex 6: Energy systems and design of components (1979-1981)

- Annex 6 Program for Community Systems Swedish Report

Annex 11: Energy auditing (1982-1987)

- Annex 11 Source Book for Energy Auditors
- Annex 11 Source Book for Energy Auditors Vol 2

Annex 12: Windows and fenestration (1982-1986)

- Annex 12 Calc of Seasonal Heat Loss and Gain Through Windows
- Annex 12 Thermal and Solar Properties of Windows
- Annex 12 The State of The Art in Existing and New Windows
- Annex 12 Building Regulations, Standards and Codes
- Annex 12 Comparison of Six Simulation Codes
- Annex 12 Windows and Space Heating Requirements

Annex 13: Energy management in hospitals (1985-1989)

- Annex 13 Booklet I Introduction and Management Perspective
- Annex 13 Booklet II Heat and Cold Generation and Distribution
- Annex 13 Booklet III Heating, Ventilating, Air Conditioning, Domestic Hot Water
- Annex 13 Booklet IV Electrical System
- Annex 13 Booklet V Services
- Annex 13 Booklet VI Building Envelope

***Annex 14:* Condensation and energy (1987-1990)**

- Annex 14 Catalogue of Materials Properties
- Annex 14 Condensation and Energy Case Studies
- Annex 14 Guidelines and Practice Vol2
- Annex 14 Source Book

Annex 15: energy efficiency in schools (1988-1990)

- Annex 15 Energy Efficiency in Schools Final Report Part1
- Annex 15 Energy Efficiency in Schools Final Report Part2
- Annex 15 Working Group: Energy Efficiency in Educational Buildings Working Group Final Report

Annex 16: Building Energy Management Systems – User interfaces and system integration (1987-1991)

- Annex 16 A Guide to Sensors for Bems

Annex 17: Building Energy Management Systems – Evaluation and emulation techniques (1988-1992)

- Annex 16-17 Technical Synthesis Report

Annex 18: Demand controlled ventilating systems (1987-1992)

- Annex 18 Technical Synthesis Report: Demand Controlled Ventilating Systems
- Annex 18 Demand Controlled Ventilating Systems Case Studies
- Annex 18 Demand Controlled Ventilating Systems Market Survey
- Annex 18 Demand Controlled Ventilating Systems Sensor Tests
- Annex 18 Demand Controlled Ventilating Systems Source Book
- Annex 18 Demand Controlled Ventilating System State of the Art Review

Annex 19: Low slope roof systems (1987-1993)

- Annex 19 Technical Synthesis Report: Low-Slope Roof Systems

Annex 20: Air flow patterns within buildings (1988-1991)

- Annex 20 Air Flow Through Large Openings in Buildings
- Annex 20 Room Air and Contaminant Flow
- Annex 20 Stochastic Model of inhabitant Behaviour

Annex 21: Environmental performance of buildings (1988-1993)

- Annex 21 Appropriate Use of Programs Volume 1
- Annex 21 Appropriate Use of Programs Volume 2
- Annex 21 Energy Analysis Tests for Commercial Buildings (Commercial Benchmarks)
- Annex 21 Technical Synthesis Report: Calculation of Energy and Environmental Performance

Annex 23: Multizone air flow Modelling (1990-1996)

- Annex 23 Evaluation of COMIS
- Annex 23 Evaluation of COMIS Appendices
- Annex 23 Technical Synthesis Report: Multizone Air Flow Modelling COMIS

Annex 24: Heat, air and moisture transport in insulated envelope parts (1991-1995)

- Annex 24 Technical Synthesis Report: Heat Air and Moisture Transfer in Highly insulated Buildings

Annex 25: Real-time HEVAC simulation (1991-1995)

- Annex 25 Building Optimization and Fault Diagnosis Source Book
- Annex 25 Real Time Simulation of HVAC Systems Fault Detection
- Annex 25 Technical Synthesis Report: Real Time Simulation of HVAC Systems

Annex 26: Energy efficient ventilation of large enclosures (1993-1996)

- Annex 26 Technical Synthesis Report: Energy Efficient Ventilation of Large Enclosures
- Annex 26 Ventilation of Large Spaces in Buildings Case Study Report
- Annex 26 Ventilation of Large Spaces in Buildings Analysis and Prediction

Annex 27: Evaluation and demonstration of domestic ventilation systems (1993-2002)

- Annex 27 Evaluation and Demonstration of Domestic Ventilation Systems
- Annex 27 Handbook
- Annex 27 Technical Synthesis Report: Simplified tools for Evaluation of Domestic Ventilation Systems

Annex 28: Low energy cooling systems (1993-1997)

- Annex 28 Low Energy Cooling Case Study Buildings
- Annex 28 Low Energy Cooling Detailed Design tools
- Annex 28 Review of Low Energy Cooling Technologies
- Annex 28 Technology Selection and Early Design Guidance
- Annex 28 Technical Synthesis Report: Low Energy Cooling

Annex 30: Bringing simulation to application (1995-1998)

- Annex 30 Technical Synthesis Report: Bringing Simulation to Application

Annex 31: Energy related environmental impact of buildings (1996-1999)

- Annex 31 Technical Synthesis Report

Annex 32: Integrated building envelope performance assessment (1996-1999)

- Annex 32 Technical Synthesis Report: Integral Building Envelope Performance Assessment

Annex 34: Computer aided evaluation of HVAC system performance

- Annex 34 Technical Synthesis Report: Computer-Aided Evaluation of HVAC System Performance

Annex 35: Control Strategies for Hybrid Ventilation in New and Retorfitted Office Buildings (HybVent) (1998-2002)

- Annex 35 Technical Synthesis Report: Control Strategies for Hybrid Ventilation in New and Retrofitted Office Buildings (HybVent)

1st European BlowerDoor Symposium

Tight Building Envelope and Dwelling Ventilation

On June 23 and 24, 2006, the 1st European BlowerDoor Symposium took place in Fulda, Germany. Out of 150 participants, nearly one third had joined the venue from abroad. The symposium had been organized by the Energy and Environment Centre in cooperation with the German Dwelling Ventilation Association. The programme featured a total of 28 presentations.

From left: Ulf Köpcke, Dr. Henk Kaan, Dr. Anton Maas, and Peter Rathert presented papers on air-tightness and dwelling ventilation

Peter Rathert from the German Ministry of Transport, Construction and Urban Development elaborated on the procedure adopted by the German federal government regarding the amendment to the Energy Saving Ordinance. He mentioned the current timetable according to which an introduction of the energy passport is foreseen “at the earliest possible date” and explained the parallel process for introducing a demand-based as well as consumption-based energy certification.

Lawyer Ulf Köpcke expressed doubts about the legality of admitting such a certification because of the stipulations in Article 7 of the European Directive on Energy Performance of Buildings (EPBD). He also held the view that the passage in the German Energy Saving Act which attributes a purely informative function to energy passports might lead to an underestimation of potentially ensuing civil liability problems. The energy passport is, in fact, an expertise and must be faultless, Köpcke said. Its legally binding character is corroborated by the fact that non-issuing of the certification will result in a fine.

Air-tight Construction:
Past and Present Developments

According to Thorsten Bolender, the German era of air-tight construction began in 1974 with the entering into force of the supplementary provisions to the DIN 4108 standard. A draft standard for measuring building air-tightness (ISO/DIS 9972) was introduced only in 1990. The year 2001 saw the introduction of the measuring standard DIN 13829.
As Günther Gantioler reported, this standard was also introduced in Italy in 2003. However, building air-tightness is not a major concern in Italy yet, Gantioler added. In the Czech Republic, the introduction of the standard CSN 73 0540-2 “Thermal Insulation of Buildings” in 2002 has established the link with air-tightness and its measurability under CSN EN 13829. The implementation of air-tightness concepts, however, was said to be still in its infancy. In the Netherlands, the sealing of building joints had already begun in the 1960s.
The first regulation governing dwelling ventilation in new buildings was therefore issued as early as 1975. In France, the issue of air-tight building envelopes has been studied for a number of years now, as Andres Litvak pointed out. Since the beginning of 2006, air-tightness of buildings has also been incorporated into the EPBD.

The organisers hope for another large turnout at the 2nd European BlowerDoor Symposium in Kassel, Germany, on March 16 and 17, 2007. The call for papers is available at *http://www.e-u-z.de/htm/ebds.htm*. There you also can order the proceeding of the 1st European BlowerDoor Symposium.

IAQ 2007: Healthy & Sustainable Buildings

Baltimore's Inner Harbor,
15-17 October 2007, Maryland

Healthy and sustainable buildings provide indoor environments where people are healthy and productive while simultaneously minimizing adverse impacts on the regional and global environment. IAQ 2007 will review the state of knowledge about healthy and sustainable buildings and help define future directions. Criteria for healthy and sustainable buildings, measured performance of such buildings, and practical methods for their design, construction, operation and maintenance will be the key themes.

The conference program will include internationally acclaimed keynote speakers, original peer reviewed papers, the latest in sustainable building practices, plus workshops with panel discussions.

More information and call for paper: http://www.IAQ2007.org/.

WellBeing Indoors - Clima 2007

10-14 June 2007, Helsinki, Finland

The 9th REHVA World Congress will offer scientists, industry, building owners, consultants, engineers, architects and policy-makers a platform for the exchange of scientific knowledge and technical solutions. The congress will cover all the aspects of HVAC technology including building automation in all types of buildings.

The programme will contain:

- Key note sessions with eminent speakers from the academic community and the HVAC industry
- Scientific sessions with full technical papers and oral and poster presentations on recent research results.
- Practical sessions with short technical communications and poster presentations on practical applications of HVAC technology
- Pre-planned REHVA-workshops on concurrent problems and international possibilities on their solution

An exhibition will be arranged in conjunction of the conference.

The organizers invite abstracts of scientific papers and technical communications by 15 Oct 2006. The abstract should not exceed 300 words and it should not contain illustrations.

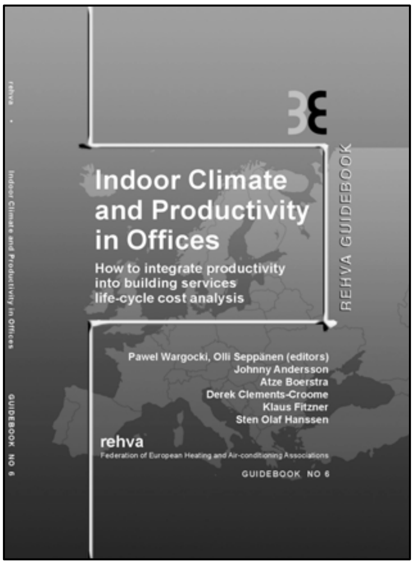
More information and call for papers: http://www.clima2007.org.

AIVC Online Call for papers

Indoor Climate and Productivity in Offices

This REHVA guidebook N°6 « Indoor Climate and Productivity in Offices - *How to integrate productivity in life–cycle cost analysis of building services* » shows for the first time how to quantify the effects of indoor environment on office work, and also how to include these effects in the calculation of building costs.

In recent years, more and more information has become available on the relationship between indoor climate and productivity. This information has been reviewed during the present work to find out whether there is solid scientific evidence that the indoor environmental quality affects office work.



The quantitative relationships presented in this guidebook can be used to calculate the costs and benefits of running and operating the building, as illustrated by several examples. One of the aims of these examples is to emphasize that the costs of running the building are much lower than the benefits from improved office work obtained by reducing temperatures or improving of indoor air quality. This is further presented in the guidebook by comparing the typical costs of wages, and typical energy and operation costs.

The main purpose of the guidebook is to increase the awareness of building owners and practitioners to indoor environmental quality and its importance for office work.

REHVA, the Federation of European Heating and Air-conditioning industries, founded in 1963, is a European organization connecting European professionals in the area of Building Engineering Services. REHVA represents more than 110.000 building engineers from 30 European countries. Its mission is to develop and disseminate economical, energy efficient and healthy technology for mechanical services of building; to serve its members and the field of building engineering (heating, ventilating and air-conditioning).
http://www.rehva.com

Natural night ventilation in office buildings

Performance evaluation based on simulation, uncertainty and sensitivity analysis

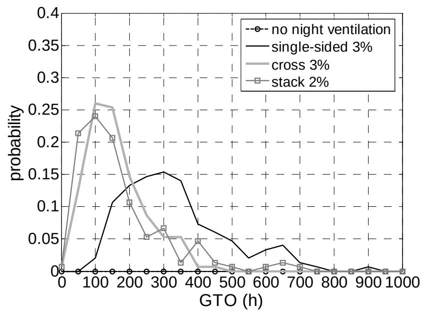
Hilde Breesch
Ghent University, Belgium

Natural night ventilation is often an interesting passive cooling method in moderate climates. Driven by wind and stack generated pressures, natural night ventilation cools down the exposed building structure at night, in which the heat of the previous day is accumulated. Building simulation can predict the performances of this cooling technique. Nevertheless, the reliability of these simulation results depends on the accuracy of the input data. The uncertainty on these data can be very important in the decision process.

Therefore, the objective of this PhD was to develop a methodology to predict the performances of natural night ventilation with building simulation taking into account the uncertainties in the input.

To evaluate the performances of natural night ventilation, thermal comfort and the reduction in cooling demand were determined, whereby the case without natural night ventilation served as reference. To predict these performances, the existing coupling between the multi-zone thermal simulation software TRNSYS and the infiltration and ventilation simulation software COMIS was chosen. Uncertainty and sensitivity analysis were used to take into account the uncertainties in the input. The variation on the reached thermal comfort as well as the input parameters causing this uncertainty was determined.

From the analysis on a specific office building, it was concluded that the following list of input parameters has the most important impact on the uncertainty interval of thermal comfort when natural night ventilation is applied: the internal heat gains, the building airtightness, the solar heat gain coefficient of the sunblinds, the setpoint for incident the solar radiation controlling the sunblinds, the internal convective heat transfer coefficient, the temperatures controlling the natural night ventilation at night, the wind pressure coefficients Cp and the discharge coefficient C_d of the night ventilation opening.



Practical guidelines are derived from this methodology to ensure a reliable design of natural night ventilation and, subsequently, to evaluate this design.

Natural night ventilation is applicable in a low energy office building with restricted fenestration and internal heat gains and sufficiently exposed thermal mass where an exposed ceiling is preferred to an exposed floor. Natural night ventilation can be combined with additional cooling techniques like top cooling, increased ventilation flow by day or window opening by the users by day. Furthermore, the combination of a normal and extremely warm weather data is advised to evaluate the performances properly. In addition, it is recommended to analyse the uncertainty interval of thermal comfort instead of one single value. For this purpose, an easy-to-use method is developed, which predicts this uncertainty interval based on three discrete simulations, in which only the most influencing input parameters are varied. This method has been applied to evaluate the thermal comfort in two Belgian office buildings.

AIVC Online Natural night ventilation in office buildings - Performance evaluation based on simulation, uncertainty and sensitivity analysis – 211 pp.

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The bibliographic database Airbase is also available on-line (about 17000 references from 1979 to present day). The access code gives access to 1800 full documents already linked to Airbase.

Since the March 2005 issue of the Air Information Review, all the documents linked to the newsletter are available on-line. They are only available with the access code.

The cost of the subscription for the year 2006 is given on the order form.

Subscribe now and take advantage of the temporary special offer!

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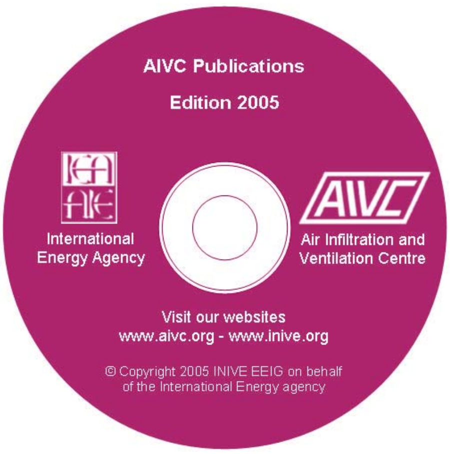
AIVC publications are also available on CD-Rom

A CD-Rom is available with all the guides (6), annotated bibliographies (12), ventilation information papers (10) and technical notes (47 - only some old superseded ones are not included) published by the AIVC between 1979 and 2005.

A CD-Rom is also available with the proceedings of the AIVC conferences from 1998 to 2004.

There is also another CD-Rom with the proceedings of the AIVC conference 2005.



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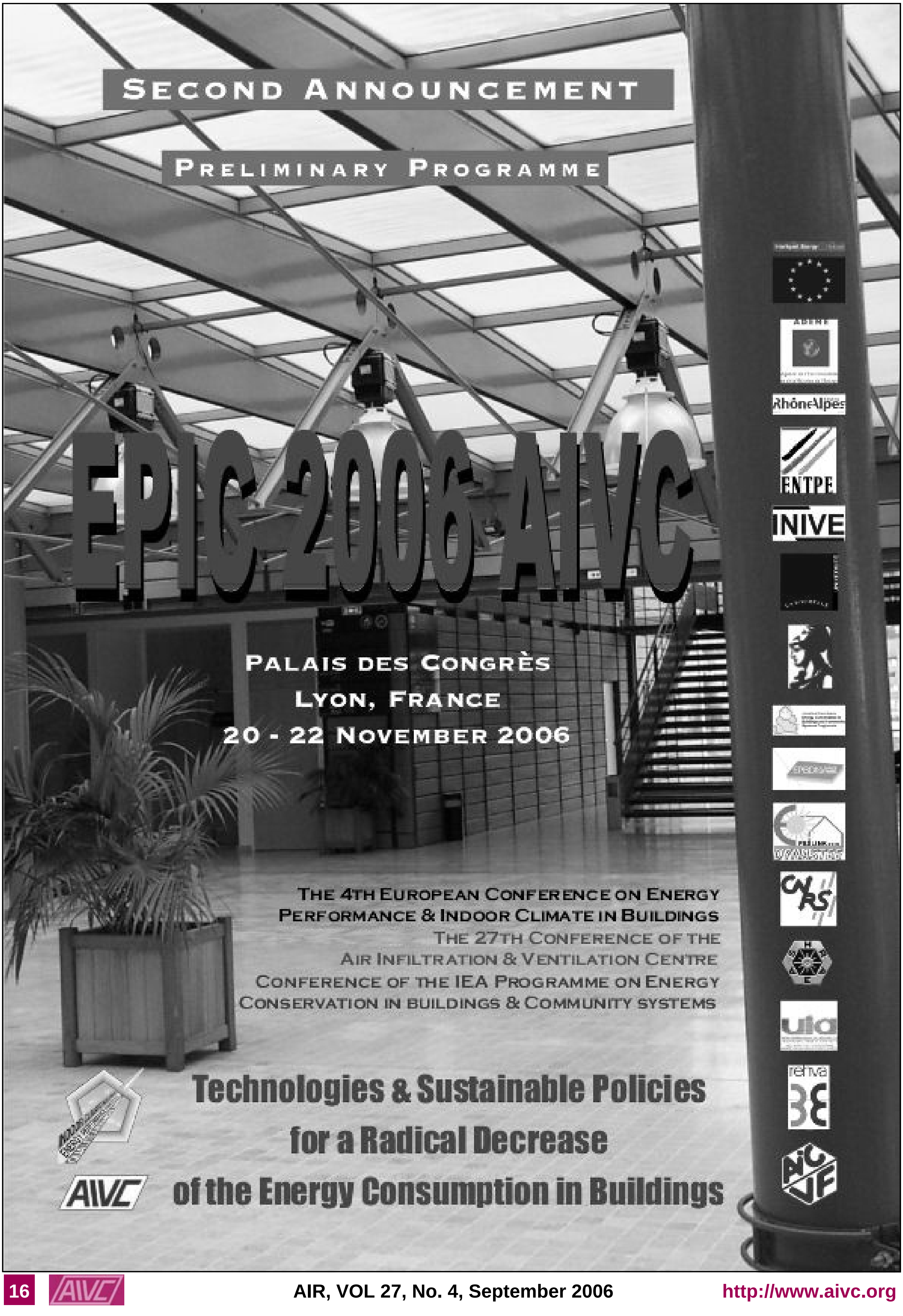
SECOND ANNOUNCEMENT
PRELIMINARY PROGRAMME
EPIC 2006 AIVC
PALAIS DES CONGRÈS
LYON, FRANCE
20 - 22 NOVEMBER 2006
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