AIR

AIR INFORMATION REVIEW

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A quarterly newsletter from Air Infiltration and Ventilation Centre

Ventilation in the Czech Republic
- A new AIVC Technote -

Pavel Charvat, Brno University of Technology

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The Czech Republic is located in the centre of Europe. The area of the Czech Republic is 78 866 km^2 and its population is 10.3 million people. The Czech Republic has a moderate climate with the annual mean air temperature around 8 °C. Therefore, heating accounts for most of the energy consumption of buildings. The Czech Republic was part of former Czechoslovakia until 1993 and it has been a member state of the European Union since 2004.

The Czech Standards Institute (CNI) is the national institution for standardization. Original Czech standards are only produced in the areas where European or international standards do not exist. The Czech standards are designated CSN (e.g. CSN 73 0540) and represent only 10% of the technical standards issued in the Czech Republic annually. The rest of the issued standards are adopted European and international standards.

The technical standards in the Czech Republic (including the adopted European and International standards) are generally not mandatory. The standards are mostly used as guidelines. A standard becomes mandatory when a law or decree refers to it for further specifications. The mandatory standards usually deal with occupational safety and health or other safety issues e.g. fire protection of buildings.

The Czech Republic, as a member state of the EU, has adopted the requirements and recommendations of the European directive 2002/91 (EPBD) in its legislation. The Energy Management Act 406/2006 (adopted by the Czech Parliament in 2006) sets the framework for energy use not only in the building sector but also in some other areas. The energy certification of buildings will be obligatory (from January 1, 2009) for newly built buildings and buildings with a floor area of more than 1000 m^2 undergoing a renovation that has an impact on their energy consumption.

At present the Czech Republic has binding regulations for ventilation of work spaces, schools, and some other indoor environments with public access. The standards dealing with residential ventilation exist but they are not binding (the exception is ventilation of protected escape routes in residential buildings required by fire protection codes).

Masonry and reinforced concrete are the main construction materials for load-bearing structures of the buildings in the Czech Republic. Former Czechoslovakia was a socialist country between 1948 and 1989 and the socialist regime promoted central planning, unification, and standardisation in different areas including the building sector. Prefabricated reinforced-concrete buildings became a symbol of standardisation in building design under socialism. There currently are more than 62 000 prefabricated reinforced-concrete apartment buildings with 1.2 million apartments in the Czech Republic.

Natural ventilation by opening windows is used in the vast majority of buildings in the Czech Republic in spite of the fact that most buildings have mechanical exhausts in the kitchens, bathrooms, and toilets. The mechanical exhausts are usually manually controlled and they are not used as whole-house or whole-apartment ventilation systems.

Moreover, buildings lack purpose provided air supply openings and outdoor air enters the buildings only through the cracks in the envelope when the exhaust fans are running.

Balanced mechanical ventilation is mostly used in commercial types of buildings (office buildings, shopping centres, restaurants, banks, etc.) and spaces with high people density (lecture halls, movie theatres, gyms, etc.). A combination of balanced ventilation with warm air heating is becoming popular in low-energy houses.

The new AIVC Technote on "Ventilation in the Czech Republic" will be available soon at http://www.aivc.org.

Building airtightness in the Czech Republic

J. Novak, Czech Technical University
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Until recently, the airtightness of the building envelope has not been considered as an important issue in the Czech building industry. The character of Czech building stock could explain this situation – more than 50% consists of either prefabricated concrete block of flats constructed before 1990 or other traditional massive structures (masonry walls, concrete slabs). Therefore, the airtightness has been generally perceived as a problem related mainly to window gaps and joints in concrete panel structures.

Since the 1990s, the character of building technologies has been changing and diversifying considerably in the Czech Republic. The following new tendencies have had a special impact on airtightness of new building stock:

- more frequent use of lightweight assembled structures
- progressive substitution of single-layer walls by multi-layer structures with air permeable layers (mineral wool thermal insulation, etc.)
- effort to reduce energy use for heating and a growing popularity of low-energy buildings and passive houses

In the context of these changes, an increasing number of defects or other problems caused by excessive air leakage was been recorded during the last decade. Therefore, the airtightness is becoming a pressing issue, especially in the low-energy sector.

In 2002, the amendment of the national standard CSN 73 0540-2 [1] brought significant changes concerning the requirements of the airtightness of buildings and building elements.

Besides the traditional requirements concerning the airtightness of window gaps, the following new topics were introduced:

- airtightness of gaps in other building components than windows and doors and airtightness of joints between different building components
- protection of thermal insulation layers against the impact of wind
- overall airtightness of the building envelope
- airtightness of rooms equipped with mechanical ventilation or air conditioning system

The aim is to limit the air leakage which could result in either excessive energy losses, a risk of deterioration of building fabrics or the dysfunction of ventilation systems.

In [1] the overall airtightness of the building envelope is expressed in terms of n_{50} value. The n_{50} value of the assessed building (determined experimentally by means of the fan pressurization method [2]) should not exceed the values given in the table below.

Ventilation in the building	**$n_{50,N}$ [h^{-1}]**
Natural	**4.5**
Forced	**1.5**
Forced with heat recovery	**1.0**
Forced with heat recovery in buildings with especially low heat use for heating (passive buildings)	**0.6**

The recommended values of the total air change rate $n_{50,N}$ according to [1]

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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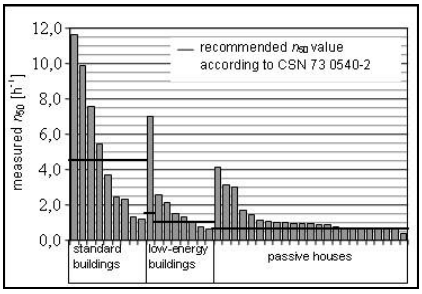
INIVE EEIG - Lozenberg 7 - BE-1932 Sint-Stevens-Woluwe - Belgium
Tel: +32.2.655.77.11 - Fax: +32.2.653.07.29 - *inive@bbri.be* - *http://www.inive.org*

Preparation: Christophe Delmotte & Peter Wouters - Editing: Erika Malu

As the use of appropriate test methods is not widely spread in contemporary Czech building practice, the fulfilment of these values is only recommended, not required.

The results of first blower door tests performed between 2000 and 2006 have shown that the level of airtightness commonly achieved in Czech building practice can vary in a wide range (see figure). The low-energy and passive houses were found to be significantly tighter than standard production, but the airtightness was insufficient in general terms for both categories of buildings. Only a minority (less than 40 %) of tested buildings have fulfilled the recommended n_{50} values according to [1].

However, significant improvements can be observed since 2006, particularly in low-energy construction. In this construction sector, the blower door test is becoming an integral part of quality control during the building process. While the n_{50} values closer to 0,6 h^{-1} have been achieved only exceptionally before 2006, nowadays, n_{50} values lower than 0,6 h^{-1} are observed more and more frequently.



Overview of a part of database records

Thanks to a close cooperation of several blower door test providers with experts of the Czech Technical University, the results of airtightness measurements are collected together with a detailed description of the buildings tested in order to build up a database (see figure). This database allows monitoring of the time progress of the airtightness level commonly achieved in the practice. Further analyses are performed and updated as the database is growing. Based on these outcomes, simple tools are developed, intended to support the design of an efficient air barrier system.

The results of this work will be progressively presented at a website, exclusively dedicated to the airtightness of buildings (http://www____).

References

1 CSN 73 0540-2 Thermal protection of buildings Part 2: Requirements (Czech national standard)

2 CSN EN 13829 Thermal performance of buildings - Determination of air permeability of buildings - Fan pressurization method

EC ADVENT project has started!

The EC SAVE Building AdVent project (http://www________) started in the beginning of 2007 and will disseminate information to designers on 18 non-domestic buildings that are examples of successfully implemented low energy ventilation systems. The buildings are spread throughout the various climates of Europe. The project is coordinated by Dr. Andrew Cripps from Buro Happold.

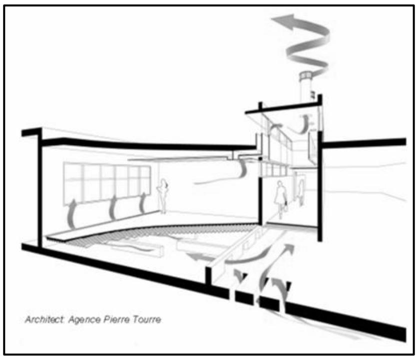
This project intends to contribute to the use of low energy ventilation systems by disseminating information on actual buildings that incorporate low energy techniques, thereby helping to overcome a general lack of knowledge and confidence amongst engineers and architects.

The main objective of this project is to support a reduction in the energy required to deliver ventilation effectively in non-domestic buildings by capturing good ventilation practice and disseminating it widely.

The main outputs will be based around 18 case studies of buildings that have been monitored for energy and air quality, including contemporary examples of buildings constructed in the new Millennium. This will be supplemented by additional analysis of their effectiveness and guidance on how to apply them in other situations.

The project has the following development objectives:

1. Classification of existing building ventilation technologies as applied in built examples and collection of additional information on building performance.
2. Identification of barriers for future application.
3. Preparing the case-studies in a common format together with training material.



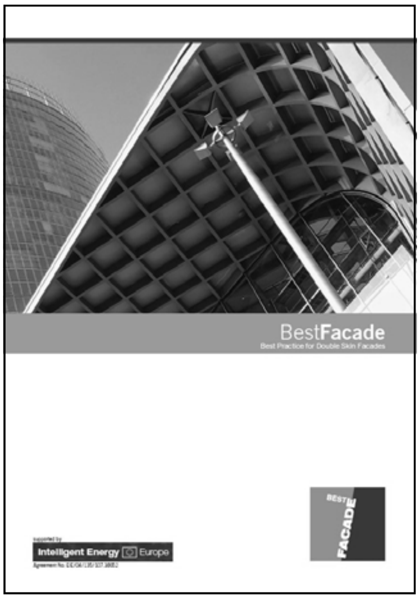
Promotion objectives include seminars in professional conferences, incorporation of training material in university curricula and dissemination of case-studies to architects, engineers and ventilation professionals through UIA (International Union of Architects), REHVA and the AIVC.

The project will regularly produce newsletters. A first newsletter was published in September 2007 for more information, contact Dr. Andrew Cripps Sustainability and alternative technologies, Buro Happold.

The BestFacade project has come to an end

Commercial buildings with integrated Double Skin Facades (DSF) can have very good qualities and can be energy efficient buildings. However not all DSF built in the last years perform well. Far from it in most cases large air conditioning systems have to compensate for summer overheating problems and the energy consumption badly exceeds the intended heating energy savings.

Therefore the BestFacade project, ending in December 2007, has aimed to create a best practice guideline to actively promote the energy efficient concepts of DSF.



It is based on a comprehensive survey of DSF in Europe.

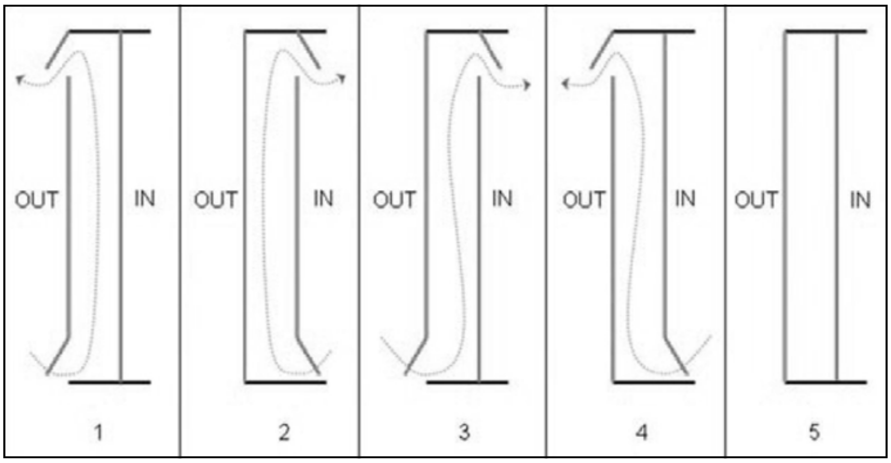
The outcomes of the BestFacade project are miscellaneous. A project database of DSF in the European Union has been established. Best practice guidelines have been compiled providing common basic scientific, technical and economic knowledge supporting the design, choice, implementation and management of DSF. The guidelines include information on the different ventilation strategies that can be applied with DSF.

An assessment method has been developed which offers sufficient accuracy of the thermal behaviour and the energy performance of the system and that is harmonised with the currently developed CEN-Standards for the implementation of the EPBD.

Benchmarks have been made available allowing users and operators to compare their energy consumption levels with others in the same group, set future targets and identify measures to reduce energy consumption. Non-technological barriers and solutions to overcome them have been identified.

The dissemination strategy of the deliverables consists of a website, CD-Roms, workshops and presentations at conferences.

More information can be found at http://www_____________.



The different ventilation modes of a ventilated double skin facade

Database of Building, Equipment Owning, Operating Costs Provided by ASHRAE

Every day, engineers are asked to advise building owners and managers on strategic decisions involving the life cycle and functionally of buildings. In the past, lack of valid data has left engineers without a solid basis for making these decisions.

A new free online database from ASHRAE provides engineers with equipment service life and annual maintenance costs for a variety of building types and HVAC systems. The database can be accessed at http://www_______.

It contains more than 300 building types and more than 38,000 pieces of equipment with service life data.
The database allows users to access up-to-date information to determine a range of statistical values for equipment owning and operating costs. With this, ASHRAE is providing the necessary methods and information to assist in using life-cycle analysis techniques to help select the most appropriate HVAC system for a specific application.

“Life-cycle evaluations provide the most effective method for determining the best value of HVAC system alternatives,” said Lynn Bellenger, chair of ASHRAE’s Technology Council. “In order to facilitate the use of life-cycle analysis techniques by decision makers, the necessary data must be available, current and correctly applied. This database provides that needed data.”

As part of the project, users are encouraged to contribute their own service life and maintenance cost data, further expanding the utility of this tool. Over a period of time, this input will provide sufficient service life and maintenance cost data to allow the comparative analysis of many different HVAC systems types in a broad variety of applications. Data can be entered by logging into the database and registering, which is free.

Information from the database is also to update the ASHRAE Handbook. Chapter 36, Owning and Operating Costs, of the 2007 ASHRAE Handbook, HVAC Applications, contains median equipment service life data from the first 163 commercial buildings that were used to seed the database, with updates to come as the database grows.

The database is the result of ASHRAE research project 1237, Interactive Web-based Owning and Operating Cost Database, sponsored by ASHRAE’s technical committee 7.8, Owning and Operating Costs.

Results of the REHVA Workshops at Clima 2007 congress now available

Clima 2007, the 9th REHVA world Congress, was organized in Helsinki, 10-14 June 2007, under the motto "WellBeing Indoors", by the Finnish Association FINVAC in co-operation with the Finnish Association of Mechanical Building Services Industries (FAMBSI) and the Finnish Society of Indoor Air Quality and Climate. The Conference was comprised of daily plenary sessions, sessions for oral presentations of accepted papers, poster sessions with short oral introductions, and summary sessions, arranged around four main themes. It gathered more than 1000 participants from over 60 different countries in six continents, who presented 480 papers in 30 sessions during the week.

As a satellite part of the conference REHVA organized 19 Technical Workshops. The objective of the workshops was to provide an opportunity for two-way communication between the expert speakers and their audiences on the selected subjects. The red thread throughout the workshops was the required efforts towards the successful implementation of the European Directive on the Energy Performance of Buildings (EPBD).

Each workshop was organized and chaired by a recognised expert. The workshops were closely connected to the topics of the permanent REHVA Task Forces, which will further use the workshop results to develop European guidelines for improving the energy efficiency of buildings.

The 19 Technical Workshops were organized by internationally known experts in the specific topic areas of the workshops, of which the vast majority had a direct focus on energy issues, such as:

- Web based learning for the Energy Performance of Buildings Directive
- Inspection methods of air conditioning and ventilation systems according to the EPBD
- How to Evaluate the Impact of Inspections and Advice Programmes for Boilers
- Micro-CHP and Fuel Cell Technologies for Buildings
- Enhanced Use of Weather Data and Forecasts to Improve the Energy Efficiency and Indoor Environment in Buildings
- Advanced Sustainable Energy Technologies for Cooling and Heating Applications
- Low Temperature Heating and High Temperature Cooling Systems for High/Performance Built Environments
- Effects of product certification on energy efficiency
- Economics of Indoor Climate
- Resource Savings by Polygeneration (heating, cooling and electricity)
- How to Develop Cost Effective Methods, Programs and Technology to reduce Energy Use of Existing Residential Buildings in Europe

Each workshop produced a summary of the results, and these are presented in the report "Energy Efficiency In-Focus" and its companion CD-ROM. The report is available from http://www________. And in addition to an electronic version of the workshop report, all the Workshop Summaries and the complete original presentations used in the Workshops are included on the CD-ROM accompanying the report. They are also available for download at the REHVA website http://www________. The report also offers a summary of the Clima 2007 Congress and Workshops in the form of a selection of the most Energy Efficiency "in-focus" material presented at both the Conference and during REHVA Workshops, often concerned with EPBD issues, but not only.

Complete Conference papers can be found on the Clima Proceedings CD-ROM set which is available from http://www_______ or ____@_____. The abstracts of all papers can be found through AIRBASE (http://www.aivc.org).

The REHVA Technical Workshops and the "Energy Efficiency In-Focus" publication were supported by the Intelligent Energy Europe Programme of the European Commission.

Computational Fluid Dynamics in Ventilation – a new REHVA Guidebook

P. V. Nielsen, F. Allard,
H. B. Awbi, L. Davidson & A. Schälin

Computational Fluid Dynamics in Ventilation Design is a new title in the REHVA guidebook series. The guidebook is written for people who need to use and discuss results based on CFD predictions, and it gives an insight into the subject for those who are not used to working with CFD. The guidebook is also written for people working with CFD which have to be more aware of how this numerical method is applied in the area of ventilation. The guidebook has, for example, chapters that are very important for CFD quality control in general and for the quality control of ventilation related problems in particular.

A large number of CFD predictions are made nowadays, and it is often difficult to judge the quality level of these predictions. The guidebook introduces rules for good quality prediction work, in order to improve the technical level of CFD work in ventilation.

The book contains the following main chapters:

- Mathematical background
- Turbulence models
- Numerical methods
- Boundary conditions
- Quality control
- CFD combined with other prediction models
- Application of CFD codes in building design
- Case studies
- Benchmark tests

The chapters Mathematical background and Turbulence models give a short introduction to the theory behind the methods used in CFD modelling. The fundamental transport equations are discussed with emphasis on ventilation applications, and descriptions are given for two-dimensional geometry to simplify the concepts. A user of CFD predictions must have some knowledge of fluid mechanics.

It is important to understand conditions such as: laminar flow, turbulent flow, steady flow, time dependent flow etc. both in connection with CFD and also with measurements in rooms for validating the predictions.

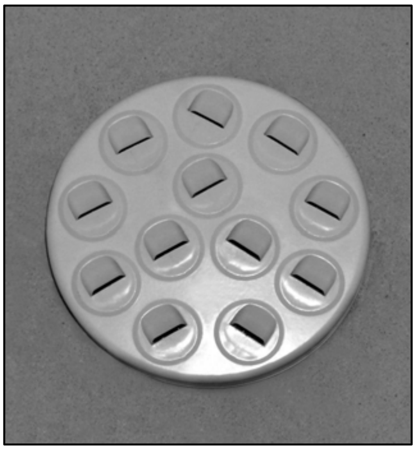
The two chapters give some insight into all of these conditions.

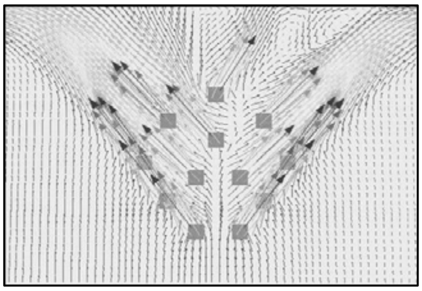
The turbulence model is a very important aspect of CFD. It is obvious that room air flow will be turbulent because of geometry and practical velocity levels, but it will not always be a fully developed turbulent flow. Some of the widely used models are discussed such as the k-ε model, the SST model, and the Reynolds Stress model. The Large eddy simulation is also shortly mentioned.

The chapter on Numerical method illustrates the structure of a CFD programme, and it demonstrates much of the experience a user will have in using a commercial program. Most of this chapter is based on a one-dimensional theory. The use of a one-dimensional analysis made it possible to understand, by hand calculation, many concepts and issues such as: order of accuracy, necessary number of grid points, wiggles in the solution, iterations, divergence, etc. This is demonstrated with a convection-diffusion equation which is solved with the use of different schemes at different velocity levels.

The chapter on Boundary conditions is especially important in the ventilation area. Often the flow in a room is determined by small details in the diffuser design. This means that a numerical prediction method should be able to handle small details in dimensions of one or two millimetres, as well as dimensions of several metres. This wide range of the geometry necessitates a large number of cells in the numerical scheme, which increases the prediction cost and computing time to a rather high level. The problem is overcome by applying different simplifications such as simplified boundary conditions, box method, prescribed velocity method or the momentum method. Continuous development of computational capacity and speed will undoubtedly make the direct methods with local grid refinements or the multigrid solution possible.

This is illustrated in the following with a diffuser consisting of 12 small slots which can be adjusted to different flow directions.



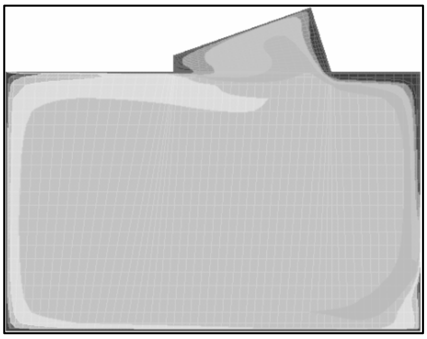


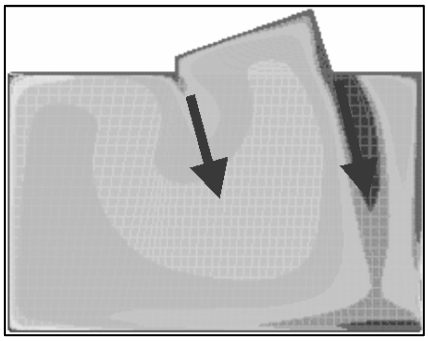
A direct simulation if a diffuser consists of 12 small slots which can be adjusted to different flow directions. Development of computer capacity will make direct simulations of diffusers possible in the future

The chapter does also discuss other boundary conditions such as surface boundary which is important for heat transfer predictions, free boundary, plane of symmetry, air exit opening and obstacle boundary.

The chapter on Quality Control is one of the more important chapters in the guide book. Quality control consists of four major steps: to recognize possible error sources, to check for them in the simulation, to estimate the accuracy of the simulations, and to improve the simulation whenever possible. Two of the many examples given in the guidebook will be shown here.

There is a strong reduction in computing cost working with two-dimensional flow instead of three-dimensional flow, but is it possible in all situations where the boundary conditions are "two-dimensional"? The figure shows a long hall with a shed roof. There are some complaints about a strong downdraught, but a two-dimensional prediction is not able to show this effect. It is necessary to use a three-dimensional transient approach to predict the downdraught.





Hall with shed roof, two-dimensional prediction and transient three-dimensional prediction

The information on this page is provided in collaboration with REHVA, the federation of European heating and air-conditioning associations.

For each set of problems a grid independence study should be performed. The following figure shows an example of such a study, where the same case (a transient fire simulation) is run for various grids from coarse to fine, and with homogeneous grids and other grids with mixtures of prisms, tetra- and hexahedral cells. The latter performs best. The figure shows the temperature distribution for 50 000 cells and 20 000 cells.

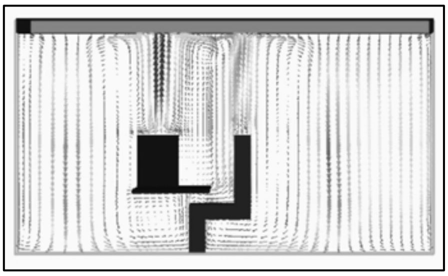
The use of a CFD program in connection with other programmes is discussed in the chapter CFD combined with other prediction models. Of highest interest and importance to ventilation design are the following: coupling of air flow and multi-zone dynamic thermal simulation, where especially energy storage is an important issue; coupling of air flow, moisture and energy transport through walls; coupling of air flow and multi-zone flow simulation, where the zonal flow simulation also handles the transport of additional components such as contaminants (e.g. smoke, CO_2, odours, moisture); and lastly coupling of the air flow and emission from building materials.

The possibilities for applying CFD for simulating the air flow in a building are discussed in the chapter Application of CFD codes in building design. A number of areas such as: room air movement, concentration distribution, emission from materials, thermal comfort assessment, ventilation effectiveness prediction and smoke management can be evaluated by a CFD program from the conceptual design to the preliminary design and right through to the final detail design stages.

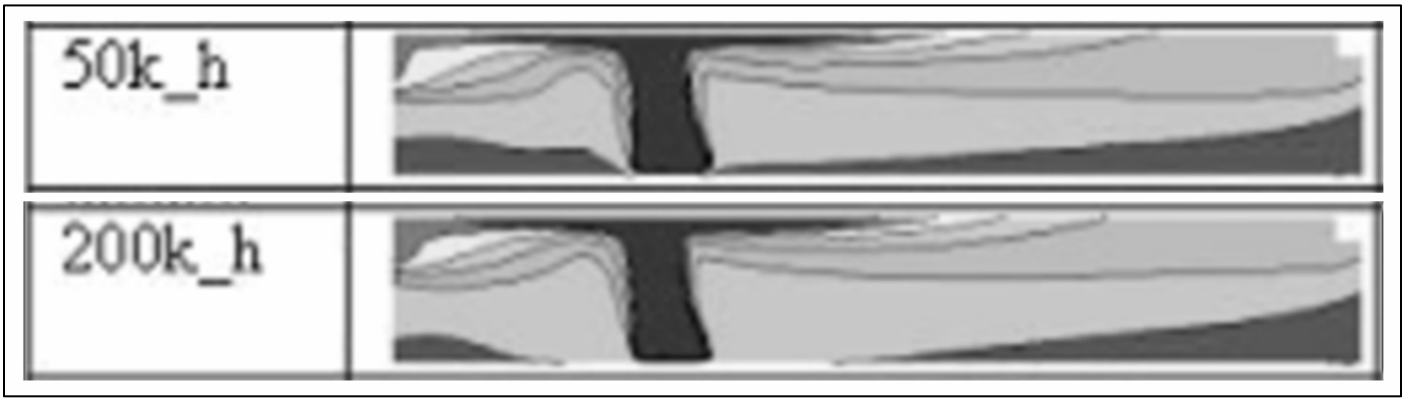
The chapter Case studies, shows different practical application of predictions made at different stages in the initial design, detail design and commissioning phases. In particular, four different air distribution systems are studied by CFD and compared by measurements.

The four systems are mixing ventilation with a wall-mounted diffuser, vertical ventilation, displacement ventilation and mixing ventilation generated by a ceiling mounted radial diffuser. All systems are designed to handle the same load in the same room. The following figure shows the result for vertical ventilation.

The final chapter is a small chapter discussing different types of benchmark tests. A benchmark test can be used for new beginners in CFD to obtain a fast insight into different problems for the predictions of ventilation and to obtain an initial experience by comparing CFD outputs.



Velocity distribution in the centre plane of an office room ventilated by a ceiling mounted textile terminal giving vertical ventilation



Simulation of a transient fire with 50,000 and 200,000 cells in the solution domain

The information on this page is provided in collaboration with REHVA,
the federation of European heating and air-conditioning associations.

An new book on Indoor Environment Quality in Greece

A new book on Indoor Environment Quality has been produced in Greece. The book is aimed as training material for building experts and users. It covers all parameters that influence the environmental indoor quality as well as solutions to recover relevant problems, including aspects related to the design, construction, use and maintenance of healthy buildings. The book (ISBN: 978-960-8257-52-8) titled "Pollution and Quality of Indoor Environment in Buildings" is currently available in Greek.

The book is the result of the cooperation between 5 Greek institutions - the Aristotle University of Thessaloniki, the University of Ioannina, the Technical University of Crete, the Technological Educational Institute of Crete and the National and Kapodistrian University of Athens - with the Institute for Health & Consumer Protection, Joint Research Centre of the European Commission and the publishing company Tekdotiki-4M-Selka, carried out under the supervision of the National and Kapodistrian University of Athens.

The need to provide an educational book in this specific sector came from the reported deterioration of the indoor environment, as well as from the lack of relevant education, knowledge and awareness in the Greek.

Low ventilation levels, combined with the use of many modern building materials, lead to a significant decline in the indoor environment quality, aggravated by pollutant emissions that can harm the health of building occupants. Relevant problems with indoor pollution are shown in many Greek buildings. Measurements carried out in residential buildings have shown VOC's concentrations which exceeded the limits in as much as 95 % of cases, while particle pollution was measured in more than 80 % of the buildings (Santamouris et al, 2006). Similar results were extracted from measurements carried out in schools (Synnefa et al, 2003), hospitals, office buildings etc. The CO_2 values measured in Greek school buildings are not considered to impose severe health risk. However, they can be responsible for a serious reduction of productivity and mental activity.

In parallel, the maximum VOC concentration levels fluctuated between 0.21 and 5.34 ppm, whereas concentration levels between 0.80 and 6.64 ppm could be responsible for health problems.

A study that was carried out by means of a questionnaire to a broad range of building experts, owners and users, as well as national institutions, chambers, agencies, universities, associations and offices in various areas of the country, showed a high level of ignorance around the subject of indoor quality, along with a lack of means and knowledge for the assessment and control of the indoor environment quality and a significant deficiency in relevant communication and reporting skills.

Given the fact that the use of air conditioning in Greece is rising exponentially, whereas the knowledge of proper design, installation, use and control is lacking, the indoor conditions are expected to worsen rapidly, forming an important issue for the Greek population.

As such, the book "Pollution and Quality of Indoor Environment in Buildings" aimed to educate not only scientists, architects, building designers and engineers but also the broader Greek public to understand indoor environment and raise awareness on how to create and maintain healthy, comfortable, functional and energy-efficient buildings. The scope was to define and study all the parameters that constitute the national body of knowledge on indoor environment issues, in order to develop a market driven educational material.

The result is a book consisting of these issues in the following 13 chapters:

The first chapter is a general introduction on the issue of indoor environmental quality and the parameters that define the indoor environment, while specific attention is paid to terms and facts such as the "Sick Building Syndrome" and the "Building Related Illnesses" that are faced by building users nowadays especially in rural areas.

Then in chapter 2, the physical parameters (temperature, humidity, ventilation, noise) that define the indoor quality are described and the correlation between those is studied.

Chapter 3 is about radioactive components found indoors which determine the quality of the buildings. It describes the impact of those components on the biological functions of the human being and studies more in detail the sources and effects of radon and polonium.

Chapter 4 focuses on the chemical pollutants affecting the indoor quality. It describes the problem of chemical pollution indoors, its effect on human health, acceptable exposure limits, assessment methodologies and possible solutions.

In the 5th chapter the focus is on indoor pollution by particulate matter, how those affect the human organism and ways to prevent such pollution.

The following chapter, chapter 6, describes indoor pollution by biological parameters. It first explains why biological pollutants are as important in the indoor environment as any others and how they differ from other pollutants. Then it studies their characteristics in terms of development, multiplication and transfer mechanisms.

The effect of Heating, Ventilation and Air Conditioning Systems in the indoor environment is analysed in chapter 7. This chapter describes how HVAC systems can degrade the quality of the indoor environment and human comfort and how they can be properly designed, installed and used to improve the thermal comfort and indoor environment.

Chapter 8 defines techniques to prevent indoor pollution and describes specific solutions to indoor environment quality problems during design, construction, function and use of the buildings.

Chapter 9 unfolds the different exposure and impact mechanisms of indoor pollutants to the human body. It refers to all those parameters defining the well being of humans and analyses per pollutant and exposure level the specific health effects.

In chapter 10, analysed and compared against one another, the most recent methodologies of product labeling are presented, analysed and compared against one another developed to assess indoor products based on their emissions.

The specific national and international standards and regulations on indoor quality as well as proposed exposure limits for pollutants and desirable conditions of thermal comfort and noise, are summarized in chapter 11.

Chapter 12 analyses the different tools and methodologies to assess and quantify indoor quality.

Finally, in chapter 13 a review is given of the results of all studies and measurements in indoor air and environmental quality that have been carried out until today in Greece and abroad.

The book, consisting of this important educational material, is considered to be a prototype of its kind in the country and it is expected to contribute considerably in the improvement of the indoor quality and the maximization of the well-being of building users.

EPA's IAQ tools for school Programme

In the USA, The Environmental Protection Agency (EPA) developed the Indoor Air Quality (IAQ) Tools for Schools (TfS) Program to reduce exposures to indoor environmental contaminants in schools through the voluntary adoption of sound indoor air quality management practices.

The IAQ Tools for Schools Program is a comprehensive resource to help schools maintain a healthy environment in school buildings by identifying, correcting, and preventing IAQ problems. Poor indoor air quality can impact the comfort and health of students and staff, which, in turn, can affect concentration, attendance, and student performance. In addition, if schools fail to respond promptly to poor IAQ, students and staff are at an increased risk of short-term health problems, such as fatigue and nausea, as well as long-term problems like asthma.

Since its release in 1995, the IAQ TfS Action Kit has been implemented in hundreds of schools across the country. School districts that have implemented IAQ TfS find that there are common elements to successfully implementing the program.

A lot of information can be found on http://www_______________.

All of the Indoor Air Quality Tools for Schools (IAQ TfS) Publications listed below are available at no-cost.

- IAQ Tools for Schools Action Kit
- IAQ TfS Roadmap
- IAQ TfS Problem Solving Wheel
- IAQ TfS Advantage Video
- IAQ TfS Fact Sheet
- IAQ Design Tools for Schools Fact Sheet
- IAQ TfS Mentor Network Fact Sheet
- IAQ and Student Performance Fact Sheet
- IAQ Practices in Schools Survey Fact Sheet How to Implement a District-Wide IAQ Tools for Schools Program Fact Sheet
- Find Information on Healthy School Environments Faster Fact Sheet
- Benefits of Improving Air Quality in the Indoor Environment
- Managing Asthma in the School Environment
- IAQ TfS Communications Guide
- IAQ TfS - Actions to Improve IAQ
- IAQ TfS Case Studies
- IAQ TfS Bulletins
- Government Accountability Office Reports on Schools
- Help Your Child Gain Control Over Asthma
- Dusty the Asthma Goldfish and His Asthma Triggers Funbook
- Dusty the Asthma Goldfish and His Asthma Triggers Bookmark
- Mold in Schools Fact Sheet
- Mold Remediation in Schools and Commercial Buildings
- Mold Magnet
- Radon in Schools
- IAQ Building Education and Assessment Module (I-BEAM)
- School Advanced Ventilation Engineering Software (SAVES)

AIVC Conference 2008

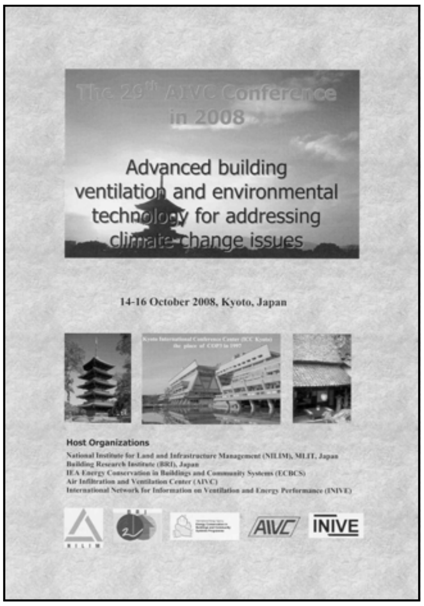
Kyoto, Japan, 14-16 October 2008

In 2008, when the target period of the Kyoto Protocol begins, the 29th AIVC Conference will be held at Kyoto International Conference Centre, Kyoto, Japan, where the protocol was negotiated in December 1997.

The conference will provide a valuable best opportunity for researchers and engineers worldwide to convene for 'Advanced building ventilation and environmental technology for addressing climate change issues'.

The increase in Carbon Dioxide due to energy use in buildings is a common issue for most countries in the world.

Above all, it is expected that the energy use for indoor environmental control including ventilation, heating and air-conditioning must be substantially reduced to mitigate the global warming issue, while there are increasing demand for better indoor health and comfort.



For the 29th AIVC Conference, in collaboration with ECBCS, papers are invited for the following research and development topics:

- Natural Ventilation
- Mechanical Ventilation
- Hybrid Ventilation
- Air Filtering
- HVAC System for Non-residential building
- Heating and Air-conditioning for residential building
- Thermal Environment
- Standard and Regulation for Ventilation and HVAC
- Control Technology
- Commissioning
- Integration of Building Envelope and Services
- Envelope Air Tightness
- Condensation Prevention
- Energy Retrofitting
- Computer Simulation
- Post Occupancy Evaluation and Surveys
- Case Study Building
- Air distribution

Interested contributors are kindly asked to submit their abstracts electronically by 18 January 2008.

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 22 February 2008.

A book of the conference proceedings will be published and will be available to the participants during the conference.
Final papers due: 31 May 2008.

http://www.aivc2008.jp/
info@AIVC2008.jp

AIVC Online Second announcement

International workshop “Trends in national building ventilation markets and drivers for change”
Ghent, Belgium, 18-19 March 2008

The 2 day workshop will take place on March 18th and 19th 2008 in the Novotel, Ghent. The first day is primarily dedicated to around 12 country presentations, whereas the second day is focused on a synthesis and discussions. The country presentations will cover the following topics: IAQ issues, energy issues, airtightness issues and innovative systems issues.

The expected outcome of this workshop is a very clear picture of the trends in national ventilation markets, the drivers for change and an indication of potential bottlenecks and opportunities.

The preliminary programme is given below. A workshop flyer with more detailed information will be available soon at http://www.aivc.org. You may also contact Stéphane Degauquier (stephane.degauquier@bbri.be).

The international workshop is an initiative of AIVC with support of the EU SAVE projects ADVENT and ASIEPI and is sponsored by REHVA. The conference is organised by INIVE EEIG. Ghent is a Belgian city with a rich history and is located 50 km away from Brussels. There are very good train connections from Brussels airport.

Day 1 - Tuesday 18 March 2008	
9:00 – 9:40	Introductory presentations
9:40 – 11:10	3 country presentations
11:10 – 11:30	Break
11:30 – 13:00	3 country presentations
13:00 – 14:00	Lunch
14:00 – 15:30	3 country presentations
15:30 – 16:00	Break
16:00 – 17:30	3 country presentations
19:00	Walking dinner in Ghent
Day 2 – Wednesday 19 March 2008	
9:00 – 10:30	3 country presentations
10:30 – 11:00	Break
11:00 – 12:00	Synthesis and discussion on national trends in IAQ issues
11:00 – 12:00	Synthesis and discussion on national trends in energy issues
13:00 – 14:00	Lunch
14:00 – 14:45	Synthesis and discussion on national trends in airtightness issues
14:45 – 15:30	Synthesis and discussion on national trends in innovative systems
15:30 – 16:15	Round table with industry representatives
16:15 – 16:30	Conclusions and next steps

Network for comfort and energy use in buildings autumn 2007 meeting

Three years of the NCEUB

This is a network of researchers, consultancies, designers and manufacturers concerned with building-related energy issues and the requirements for human thermal comfort. The aim of the network is to define and promote the research effort needed to understand and enhance the thermal comfort of building occupants whilst also minimising the energy use of buildings, in particular those without year-round mechanical heating and cooling. You can join the Network on their website http://_______

On the 20th September 2007 a one day conference was held to celebrate the first three years of NCEUB and mark the end of its funding by the UK Engineering and Physical Sciences Research Council (EPSRC). The meeting opened at the offices of Engineers Arups in Fitzroy Street, London and ended at the Building Centre in Store Street.

The full list of speakers and summary of many of their talks can be viewed at http://_____.

Speakers included many who readers may be familiar with. In the evening Eduardo Maldonado of the University of Porto, and one of the architects of the EPBD gave a lively talk on "Understanding the Energy Performance of Buildings Directive". Peter Clegg of well-known low energy Architectural firm Feilden Clegg Bradley gave a stimulating talk on "Research into Practice" showing how architects can use research findings in their designs.

Another feature of the meeting was a special workshop on outdoor comfort which had been specifically requested by Arups. Speakers included Professor Gerd Jendritsky of Freiburg University (formally of the German Meteorological Service) who is leading a European project to develop a Universal Thermal Climate Index (http://www_______) which will supplant existing indices such as the Wind Stress Index.

Other speakers in this workshop were Marialena Nikolopoulou who headed the international outdoor comfort project RUROS and Becci Taylor of Arups who framed the needs of industry for information about the outdoor climate.

In the UK there is an increasing demand from Government for new educational and health buildings to be provided using PFI (Private Finance Initiative). This has encouraged the provision of fast-build and generally light-weight buildings. Two presentations put ventilation on the frontline of better provision in the specialist areas of schools and hospitals. Below we present a synopsis of the arguments, the full presentations are available on the NCEUB website (http://______).

Schools

Andy Ford of Fulcrum consulting described the difficulties for engineers in designing schools to the official 'Building Bulletin' specifications for ventilation, temperature and lighting. Emphasising the importance of good environment (especially fresh air and cool temperatures) on education, he laid out the problem facing environmental consults.

Building Bulletin 101 – Ventilation

- A minimum of 3 l/s/person
- A minimum daily average of 5 l/s/person
- Capability to increase to 8 l/s/person

Overheating (1st May to 30th September) - Only 2 of these criteria need be achieved

- No more than 120 hours above 28 deg C
- Average internal to external temperature difference not to exceed 5 degC
- Internal space not to exceed 32 degC

Building Bulletin 87 - Daylighting

- Daylit spaces average factor of 4-5%
- With artificial light assistance minimum average daylight factor 2%
- Uniformity (ratio of minimum to average daylight factors) 0.3 to 0.4

The typical new classroom (figure) has been found to supply unacceptably low levels of ventilation without mechanical backup, but do the BB101 ventilation levels allow classrooms to comply with both the daylighting and the overheating criteria? Conflicts will arise if the required daylighting level precludes the use of shading to keep temperatures within acceptable limits.

Specifications for daylighting require that school classrooms have large windows but this will often result in overheating on sunny days. (picture Andy Ford)

The information on this page is provided in collaboration with NCEUB,
the Network for Comfort and Energy Use in Buildings. For more information, visit http://www_________

Simulation analysis by Fulcrum suggests that only by using shallow-plan classrooms and providing day ventilation of 16l/s.p and night ventilation of 8l/s.p can overheating be kept within prescribed limits, and even then the maximum temperature will exceed the recommended value. Andy Ford ended by asking "is this good enough?"

Hospitals

Prof Susan Roaf of Heriot Watt University in Edinburgh made an impassioned plea for environmentally robust, naturally ventilated, hospital buildings which will provide medically and thermally safe environments through the coming decades of climate change and rapidly rising energy prices. Below is a part of her argument.

Many old hospitals were built with high ceilings and large windows to ensure the removal of infectious pathogens away from the environs of the patient and their expulsion through open windows via high ventilations rates. Such systems have been shown to still provide lower cross-infection rates than those in mechanically ventilated wards for tubercular patients (Escombe, 2007).

Sunshine is highly effective at killing a range of pathogens. TB bacilli are killed by only a few hours in direct sunlight, by the UV component specifically. This is relevant to design, as natural light needs to be maximised to contribute to surface disinfection in ambient working conditions. There is a strong case to be made for the use of opening windows in sunny wards for such patients to encourage rapid recovery.

Conversely concerns are growing about the healthiness of many mechanical ventilation systems in general. The design and maintenance of mechanical plant, filter and duct systems is obviously critical in hospitals. Poor indoor air quality, and unhygienic air supply conditions that can be directly associated with poorly maintained air conditioning systems (Mauderly, 2002; Clausen et al., 2002; Bjorkroth et. al., 2002). The age and maintenance status of a system is patently critical.

Early twentieth Century Tuberculosis ward limiting the spread of infection using plenty of sunshine and fresh air

A range of scientifically robust studies have also shown that pressurised mechanical ventilation systems have been linked to the spread of a range of infectious diseases including MRSA, MDRBT, SARS, TB, Influenza, Varicella (chicken pox) and measles (Cotterill et al., 1996; Kumari et al., 1998). In some of the cases cited on the subject by Li et al. (2007) the infections were the result of faulty mechanical systems. Clearly ducts, filters and fans must be easily accessible for maintenance, cleaning and inspection. A wide range of physical and managerial factors influence the rates of spread and transmission pathways of infections (Beggs, 2003a; Beggs et al. 2003b; Tang et al., 2006).

Hospitals are also in the front line of the 21st century battles to cope with more extreme weather events, increasing insecurity of energy supply and concerns about the rise and spread of infectious diseases.

It is imperative that of all buildings hospitals should be resilient enough not to fail during related catastrophic events in order to reinforce our Social Resilience to un-predictable future conditions.

To do this hospital buildings must be robust, passive buildings with the capacity to run vital services from embedded renewable energy systems. There is some evidence that naturally ventilated wards need pose no more threat to health than mechanically ventilated wards for many patients and for some pathogens may reduce the cross-infection rates of nosocomial infection.

More work is urgently needed in the field of Resilient Hospital design in light of the increasing frequency and severity of extreme weather and energy failure events experienced around the world since the turn of the 21st century.

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the Network for Comfort and Energy Use in Buildings. For more information, visit http://www________

AIVC Contacts

Belgium
P. Wouters & Ch. Delmotte
Belgian Building Research Institute
Lozenberg 7
1932 Sint-Stevens-Woluwe - Belgium
Tel: +32.2.655.77.11
Fax: +32.2.653.07.29
aivc@bbri.be
http://www.bbri.be

Czech Republic
M. Jicha
Technicka 2
61669 Brno - Czech Republic
Tel: +42.541.14.32.71
Fax: +42.541.14.33.65
jicha@fme.vutbr.cz

I. Plockova
Ministry of Industry and Trade
Construction dept.
Na Františku 32
110 00 Praha 1
Czech Republic
Tel: +420.224.85.22.11
Fax: +420.224.85.32.16
plockova@mpo.cz

Denmark
P. Heiselberg
Aalborg University
Indoor Environmental Engineering
Sohngaardsholmsvej 57
DK-9000 Aalborg
Denmark
Tel: +45.9.635.85.41
Fax: +45.9.814.82.43
ph@civil.auc.dk

B. W. Olesen
Technical University of Denmark
Building 402
DK-2800 Lyngby
Denmark
bwo@mek.dtu.dk

France
P. Deroubaix
ADEME
Département Bâtiment et Collectivités
500 Route des Lucioles
Sophia Antipolis
06560 Valbonne - France
Tel: +33.4.93.95.79.56
Fax: +33.4.93.65.31.96
pierre.deroubaix@ademe.fr
http://www.ademe.fr

Contact for the diffusion of AIR in France:
francois.durier@cetiat.fr

Greece
M. Santamouris
Building Environmental Studies
Applied Physics Section
Department of Physics
University of Athens
University Campus, Building Physics 5
15784 Athens - Greece
Tel: +30.210.727.68.47
Fax: +30.210.729.52.82
msantam@phys.uoa.gr
http://grbes.phys.uoa.gr

Japan
T. Sawachi
National Institute for Land and Infrastructure Management - NILIM
1 Tachihara Tsukuba
305-0802 Japan
Tel: +81.29.864.43.56
Fax: +81.29.864.67.74
sawachi-t92ta@nilim.go.jp
http://www.nilim.go.jp/english/eindex.htm

H. Osawa
Building Research Institute
1 Tachihara Tsukuba
305-0802 Japan
Tel: +81.29.864.6667
Fax: +81.29.864.6775
osawa@kenken.go.jp
http://www.kenken.go.jp/english/index.html

Republic of Korea
Yun-Gyu Lee
Building & Urban Research Department
Korea Institute of Construction Technology - KICT
2311 Daehwa-Dong, Ilsan-Gu, Goyang-Si Gyeonggi-Do, 411-712 Republic of Korea
Tel: +81.31.91.00.351
Fax: +81.31.91.00.361
yglee@kict.re.kr
http://www.kict.re.kr

Norway
P. Schild
SINTEF Building Research
Forskningsveien 3b
PO Box 124, Blindern
0314 Oslo - Norway
Tel: +47.22.96.58.54
Fax: +47.22.96.57.25
aivc@sintef.no
http://www.sintef.no/byggforsk

Netherlands
W. F. de Gids
TNO Built Environment and Geosciences
Division of Building and Systems
PO Box 49
2600 AA Delft - Netherlands
Tel: +31.15.26.95.300
Tel direct: +31.15.269.52.80
Fax: +31.15.269.52.99
wil.degids@bouw.tno.nl
http://www.bouw.tno.nl

USA
M. Sherman
Lawrence Berkeley
National Laboratory
1 Cyclotron Rd
MS 90-3074
Berkeley, California
CA 94720
United States of America
Tel: +1.510.486.40.22
Fax: +1.510.486.66.58
mhsherman@lbl.gov
http://www.lbl.gov

Operating Agent
INIVE eeig
P. Wouters & Ch. Delmotte
Lozenberg 7
1932 Sint-Stevens-Woluwe - Belgium
Tel: +32.2.655.77.11
Fax: +32.2.653.07.29
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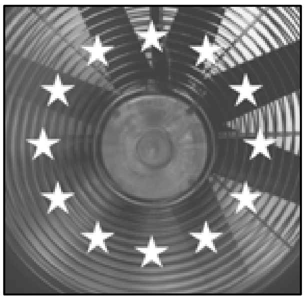
Information on AIVC supported conferences and events

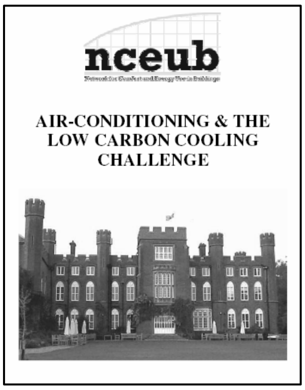
The 2 day international workshop on “Trends in national building ventilation markets and drivers for change” will take place on March 18th and 19th 2008 in the Novotel, Ghent. The first day is primarily dedicated to around 12 country presentations, whereas the second day is focused on a synthesis and discussions. The country presentations will cover the following topics: IAQ issues, energy issues, airtightness issues and innovative systems issues. The expected outcome of this workshop is a very clear picture of the trends in national ventilation markets, the drivers for change and an indication of potential bottlenecks and opportunities.

More information: http://www.aivc.org & page 11.



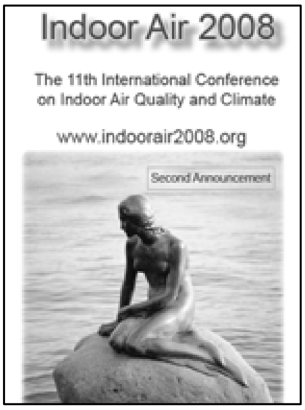
The 3rd European Blower-Door-Symposium is held in Kassel (Germany) on May 30 and 31 2008. The symposium will focus on air-tightness, ventilation and mould. Topics include e.g. : Airtightness examination methods, Airtightness in the building process: planning, design, construction; Airtightness concepts and durable links in new and existing buildings; Effects of unsufficiant airtightness; Airtightness and economy; Mechanical ventilation in residential buildings; mould - causes and prevention; Training and education, qualification, and quality assurance; Current standards and directives, technical regulations, legal aspects.

More information : http://www_______



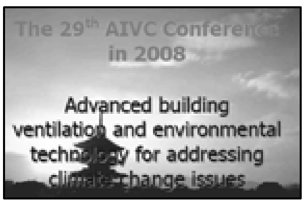
This is the 5th Windsor thermal comfort conference and held in Windsor (UK) from July 27-29 2008. The kind of questions addressed by this conference include: • When is AC essential? • Are there ways to make it more efficient? • What conditions should it provide? • Can controls improve energy efficiency? • What will be the effect of climate change and rising energy prices? • How can thermal comfort standards reflect concerns for sustainable buildings? • What are the cultural consequences of reliance on AC? • How can we achieve Low Carbon Cooling ?

More information : http://www________



The 11th International Indoor Air Conference on Indoor Air Quality and Climate will be held in Copenhagen (Denmark) August 17-22 2008. It is a multidisciplinary event involving participants from medicine, engineering, architecture and related fields. The congress covers all aspects of Indoor Air and Climate and the effects on human health, comfort and productivity. Cutting-edge research results will be presented, including ways to achieve an optimal indoor environment in a sustainable manner. The congress addresses a variety of indoor environments – residential, office, school, industrial, commercial and transport.

More information : http://www________



The 29th AIVC conference will be held in Kyoto (Japan) October 14-16 2008.

The conference will cover a wide range of ventilation related topics whereby specific attention will be given to building ventilation and environmental technologies addressing climate change issues.

More information : http://www.aivc2008.jp & page 10.