

Air Infiltration Review

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International Energy Agency - AIVC

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AIVC Welcomes New Member Country - Greece

The AIVC looks forward to extending its full range of services to Greek participants, and to facilitating the dissemination of Greek ventilation research to all member countries on the occasion of Greece's new membership status. Greece is the thirteenth participating country, following Belgium, Canada, Denmark, Finland, France, Germany, Netherlands, Norway, New Zealand, Sweden, UK and the USA, all of whom have been members since inception in 1979. Several other countries are currently considering membership.

To mark the event, this year's AIVC conference took place in Athens, Greece, and was as usual very well attended, attracting delegates from all member countries, many interested parties from other countries, and a strong local contingent.

AIVC Conference Keynote Address Announces Greek Participation

The opening Keynote Speech was delivered by Dr Dimitrios Nomidis, the IEA Energy Conservation in Buildings and Community Systems (ECBCS) Programme Executive Committee Member for Greece. His address contained the official announcement that, with effect immediately, Greece will participate as a full member country of the AIVC.

Building Energy Consumption and Conservation in Greece

Setting the framework for the conference, Dr Nomidis examined the contribution of buildings to energy consumption in Greece, and the energy conservation measures being implemented there. The building sector in Greece accounts for 30% of the total primary energy consumption of the country, and Dr Nomidis stressed that a current major trend is for increased use of air-conditioning equipment. The impact of this on electricity demand is becoming a serious problem, especially in regions with limited generation capacity, such as the Greek islands. In addition, the urban heat island effect, which results in much higher summer air temperatures in the central regions of cities, compared to other areas, is further adding to this problem.

Dr Nomidis went on to explain important energy conservation measures which have been adopted in Greece for the building sector, covering among others, energy certification of new and existing buildings, incentives for the realisation of energy conservation in existing buildings, and subsidies for energy conservation investments in the industrial and tertiary sectors. These measures are discussed further in the following conference report.

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Ventilation and Cooling

Conference Report by Malcolm Orme

This year the 18th Annual AIVC Conference was held in Greece, from 23rd - 26th September, at the Astir Palace Vouliagmeni Complex south of Athens. More than 100 delegates from 16 different countries attended the various sessions featuring 65 presentations on the conference theme.

Energy Conservation Measures in Greece

The keynote speaker, Dr Nomidis, explained the energy conservation measures which have been adopted in Greece for the building sector, summarised as follows:

- A law concerning the insulation of buildings.
- The preparation of another law, which will provide for:
 - * the submission of an integrated energy study for each building,
 - * energy certification of new and existing buildings,
 - * energy auditing of buildings in the industrial and tertiary sectors,
 - * improvement of the existing law for insulation by setting stricter standards and enforcing the actual implementation of the law, and
 - * incentives for the realisation of energy conservation in existing buildings (mainly by tax reduction).
- High rates of subsidies (40% - 55%) for energy conservation investments in the industrial and tertiary sectors, according to the criteria that:
 - * renewable energy sources (RES) are promoted,
 - * substitution of electricity or fuel oil by fuel gases, treated waste products, RES, or waste

heat recovery, and

- * energy savings are higher than 10%.
- The Operational Energy Programme, jointly funded by the European Community and the Greek Government, including a sub-programme for RES investments. Examples of applications include:
 - * co-generation of heat and power,
 - * substitution of electricity or conventional fuels by natural or liquefied petroleum gas,
 - * active or passive solar systems, and
 - * passive systems for heating, cooling and lighting and bioclimatic systems.
- European energy efficiency legislation (from the SAVE programme), in particular minimum energy efficiency standards for non-industrial boilers.
- European directives for energy labelling of domestic appliances, in particular labelling for packaged air-conditioners is under preparation.

Ventilation and Energy Efficient Cooling

A large number of presentations strongly reflected the Conference theme, "Ventilation and Cooling". Topics covered included night cooling, minimising heat gains and non-refrigerative cooling and dehumidification technologies. In fact, the subject of the Best Paper at the Conference, by Gary Hunt (University of Cambridge, UK), was an examination of passive cooling by natural ventilation, investigated using salt bath modelling of combined wind and buoyancy forces.

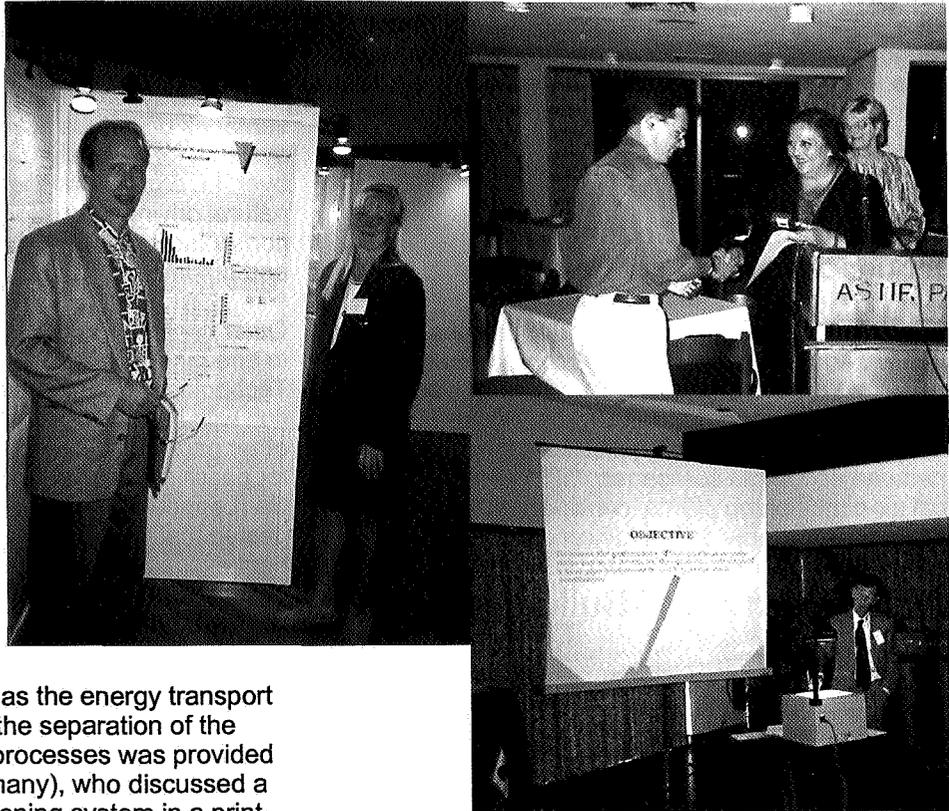
Session one opened with an explanation from Fritz Steimle (University of Essen, Germany) of how re-

Air Infiltration Review

Editor: Janet Blacknell

Air Infiltration Review has a quarterly circulation of 3,500 copies and is currently distributed to organisations in 40 countries. Short articles or correspondence of a general technical nature related to the subject of air infiltration and ventilation are welcome for possible inclusion in AIR. Articles intended for publication must be written in English and should not exceed 1,500 words in length. If you wish to contribute to AIR, please contact the Air Infiltration and Ventilation Centre. Please note that all submitted papers should use SI units.

quirements for cooling and dehumidification of ventilation air depend on human thermal comfort. This, in turn, is fixed by activity level, clothing, air temperature, humidity and velocity, and wall temperature. He continued by giving the advantages for the separation of cooling and ventilation air, in air conditioning systems. The principal reason for this separation is that it is more effective to transport cooling energy by using water systems than to use only air. Ventilation rates can then be reduced, ensuring dehumidification needs are also minimised. Sensible cooling of the conditioned space can then be achieved using water as the energy transport medium. Another example of the separation of the cooling and dehumidification processes was provided by Gunther Mertz (FGK, Germany), who discussed a sorption-supported air conditioning system in a printing-office. (In this instance, evaporative air cooling was used.)



Night Cooling

There is currently much interest in using night-time ventilation to achieve air cooling during the daytime (particularly in office buildings). The key to the technique is to use external air to cool the building structure at night, which subsequently re-absorbs heat during the day, thus cooling the internal air. Vassilis Geros (University of Athens, Greece) gave the results of measurements made in three real office buildings, in which night ventilation had been in use. Both 'free floating' (i.e. no additional temperature control) and air conditioned operation were studied. It was found that night ventilation had a particularly significant impact in the building of highest thermal mass, with a daytime temperature reduction up to 2.5 °C under free floating conditions, and 1 °C under air conditioned operation.

The design of low energy office buildings combining mechanical ventilation for indoor air quality (IAQ) control and night time natural ventilation for thermal comfort was commented upon by Peter Wouters (BBRI, Belgium). Amongst other things, his conclusions took the view that natural ventilation for IAQ control requires completely different provisions than natural ventilation for thermal comfort control in summer. Furthermore, he proposed that the attainment of an optimum balance between IAQ and energy use is not evident with the natural ventilation devices presently available, although self-regulating devices may in future remedy this situation.

Two papers from French authors were also concerned with night cooling of office buildings. One of these extended the theme to consider the effect of increased ventilation air flow rate during the daytime for cooling purposes, while the other additionally described tools dealing with evaporative cooling. Also, Maria Kolokotroni (BRE, UK) provided an introduction to her pre-design tool for night ventilation of office buildings. This tool allows the prediction of a weekly internal temperature profile for an office space. It also allows energy consumption and peak cooling capacity requirements (i.e. relative to a reference system without night cooling) to be assessed.

Nien-Tzu Chao (Chung-Hua Polytechnic, Taiwan) presented a study, conducted with flow simulations, of window location and furniture layout to maximise cooling effect for an urban apartment by night ventilation. This was also the theme of experimental work conducted in Greece (with natural cross ventilation) that was reported at the Conference.

Minimising Heat Gains

One method of lowering cooling-related energy use is to reduce the heat gains to the conditioned space. Aris Tsangrassoulis (University of Athens, Greece) gave clarification of the ventilation and daylight efficiency of various solar shading devices, which are installed to prevent solar heat gains. Under-roof air cavities are often used in large enclosures such as atria and auditoria, because they allow an effective in-

crease of the thermal insulation of the building, without a great increase of the structure weight. Marco Perino (Politecnico di Torino, Italy) reported that solar gains (and hence cooling loads) may be reduced by means of such constructions, especially with ventilated roof cavities, which may lower solar gains by up to 50% compared with closed cavities.

Non-Refrigerative Cooling and Dehumidification Technologies

An account of the possibilities and limitations for evaporative and desiccant cooling technologies was made by Torbjörn Lindholm (Chalmers University of Technology, Sweden). Furthermore, Sönke Biel (University of Essen, Germany) discussed how he has made an economic comparison of three non-industrial air-conditioning plants, principally to investigate the pricing of a new dehumidification unit.

Retrofit of Buildings

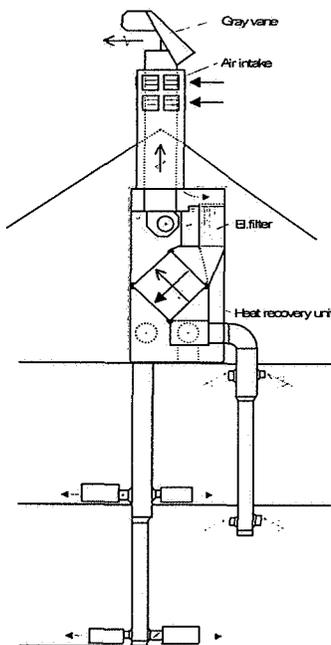


Figure 1 Example of natural ventilation with heat recovery

It is sometimes more economic, or otherwise desirable, to retrofit or refurbish existing buildings, rather than to construct new ones, so extending their useful lives. In the future, this may become an increasingly important course of action. Two poster presentations at this year's Conference were specifically concerned with this activity. The first, describing work undertaken in Finland, involved measurements of the airtightness of apartments before and after renovation. In this, Keijo Kovanen (VTT) concluded that renovation measures (in this case including changing the windows and refurbishing the interior surfaces) usually led to an increase in the airtightness. Exceptions were observed to occur under conditions of poor workmanship in the renovation work. The second poster, presented by Peter Op't Veld (Cauberg-Huygen Consulting Engineers, The Netherlands), gave an insight into how multi-functional appliances can be installed beneficially when retrofitting certain residential buildings. These appliances combine the provision of ventilation air, hot water and heating, and include a heat recovery heat exchanger.

Energy Recovery

Jørn Brunzell (Norwegian Building Research Institute, Norway) explained the advantages and disadvantages of various approaches to heat recovery systems for naturally ventilated office buildings. Moreover, he argued that the frequency distribution of natural driving forces for a range of European locations indicated a need for assisting fans in the spring and autumn.

Other contributions were made from Finland relating to energy recovery. Kai Sirén (Helsinki University of Technology) examined solar assisted natural ventilation with heat pipe heat recovery, complementing another paper that investigated heat pipe heat recovery for passive stack ventilation. Furthermore, Esa Marttila (Lappeenranta University of Technology) suggested that the performance of series connected heat exchangers with a looped liquid circuit could be optimised by following a given procedure.

IEA Project - "Evaluation and Demonstration of Domestic Ventilation Systems"

The International Energy Agency's ECBCS Annex 27, "Evaluation and Demonstration of Domestic Ventilation Systems" is a collaborative project, closely associated with the work of the AIVC. A number of presentations were made by Annex 27 participants, who discussed the progress of certain aspects of the Annex work, now entering the last few months of its programme. Lars-Göran Månsson (LGM Consult AB, Sweden) gave an introduction to the simplified tools, which are being developed to evaluate domestic ventilation systems. In order to assist with the development of a thermal comfort tool, Takao Sawachi (Building Research Institute, Japan) has been undertaking experiments to assess the thermal comfort impact of direct fresh air supply in winter, making a comparison of different air supply inlets for exhaust only ventilation. His poster illustrated the measurement results and also introduced the simplified thermal comfort tool.

Johnny Kronvall (AB Jacobson and Widmark, Sweden) outlined the quantitative approach to system safety analysis of the performance of mechanical ventilation systems, on which a reliability tool has been established. Also presented was a simplified tool for the assessment of life cycle costing (LCC), by Peter Op't Veld (Cauberg-Huygen Consulting Engineers, The Netherlands). An indoor air quality simplified tool is currently being finalised. Work carried out for this purpose, relating to numerical simulations (by the COMIS model) of IAQ and energy need was presented. In addition, Willem de Gids (TNO, The Netherlands) has made a comparison of the performance of different ventilation systems in similar dwellings. These results will be used to evaluate the IAQ tool at a later stage.

Although not part of the Annex 27 programme, a paper from the USA was concerned with a strongly related topic, in which ventilation strategies for new energy-efficient production homes were assessed and recommendations made about the choice of systems, for cold, hot humid, mixed and hot arid climatic regions of the USA.

Building Airtightness

Karin Adalberth (AB Jacobson and Widmark, Sweden) summarised practical guidance she has produced in the form of a manual for designers and contractors for constructing airtight buildings. During his presentation, Earle Perera (BRE, UK) demonstrated a spreadsheet-based tool for predicting envelope air leakage in large commercial buildings before construction (which uses data from the AIVC's Numerical Database, summarised in AIVC Technical Note 44). In addition, building airtightness and ventilation in 20 recently constructed Belgian dwellings were the subject of a further contribution.

Duct Leakage

There appears to be a lack of duct leakage measurements in Europe (apart from in Sweden), according to Francois Rémi Carrié (Ecole Nationale des Travaux Publics de l'Etat, France) in his account of the impact of air distribution system leakage in Europe. However, on the basis of existing data, he judged that the ventilation and energy use implications of leaky ducts are large. Continuing this topic, Johnny Andersson (Scandiaconsult, Sweden) summarised the status of Swedish duct leakage.

Tracer Gas Techniques

Effective ventilation rate measurements have been made in real time for entire floors of buildings by Mark Bassett (BRANZ, New Zealand). His measurements were made in five separate mechanically ventilated buildings. (An example is shown in Figure 2.) He explained how the equipment measures tracer gas concentrations at a large number of locations (30 to 50 positions, using a gas chromatograph working in real time) while the tracer gas itself is released constantly and uniformly within the ventilated space. Also, Hans Stymne (Royal Institute of Technology, Sweden) related how he has found the homogeneous emission tracer gas technique using passive tracer gas sources and integrating diffusive samplers to be a convenient and satisfactory method for measuring the average local mean ages and their distribution. (However, care must be taken when mechanical ventilation is intermittent or varied.)

Natural Ventilation Design

Delegates from both Sweden and the UK have produced tools for natural ventilation design. David Etheridge (University of Nottingham, UK) explained his non-dimensional graphs for natural ventilation de-

sign. These allow manual calculation of both buoyancy, including stack, and wind driven ventilation rates for summer and winter conditions. From Sweden, Charlotte Svensson (AB Jacobson and Widmark) displayed a computer based design tool for natural ventilation.

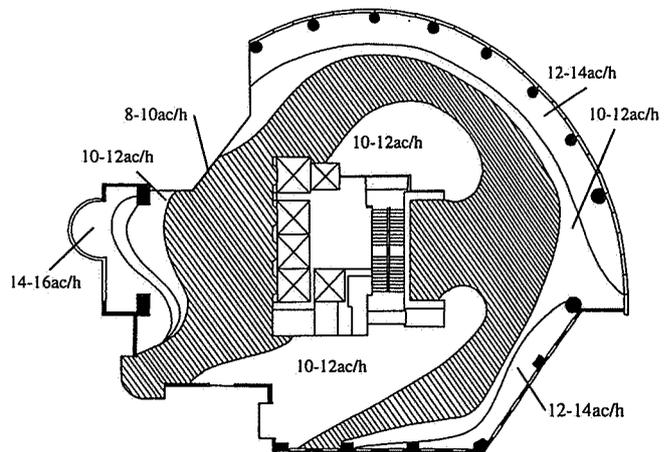


Figure 2 Approximate contours of effective ventilation rate in the breathing zones of a building

Søren Aggerholm (SBI, Denmark) discussed the barriers that exist to natural ventilation design of office buildings. He put forward the view that general knowledge about natural ventilation has to be improved and that standards and guidelines must also be refined to provide a better technical and legal background for the design of naturally ventilated office buildings. By a macroscopic formulation and solution of ventilation design problems, Jim Axley (Yale University, USA) offered feasible combinations of design criteria in order to achieve thermal comfort objectives.

Awards for Best Paper and Best Poster Presented at the Conference Dinner

Delegates at the Conference Dinner enjoyed an after-dinner speech by Professor D. N. Asimakopoulos, Director of the Group Building Environmental Studies at the University of Athens, closely followed by the presentation of the Best Paper and Poster Awards by Ms. Elsa Papadimitriou, Member of the Greek Parliament. The Best Written Paper Award went to Gary Hunt (University of Cambridge, UK) for his description of his salt bath modelling work, and Best Poster was awarded to Kai Sirén (Helsinki University of Technology, Finland) for his modification of the power-law equation to account for large scale wind turbulence. The Conference was summed up and closed by Martin Liddament, Head of the AIVC.

The 18th AIVC Conference Proceedings can be purchased from the AIVC, priced £65. (Please see publications pages for more details.)

Indoor Climate Monitoring at Schloß Schönbrunn, Austria

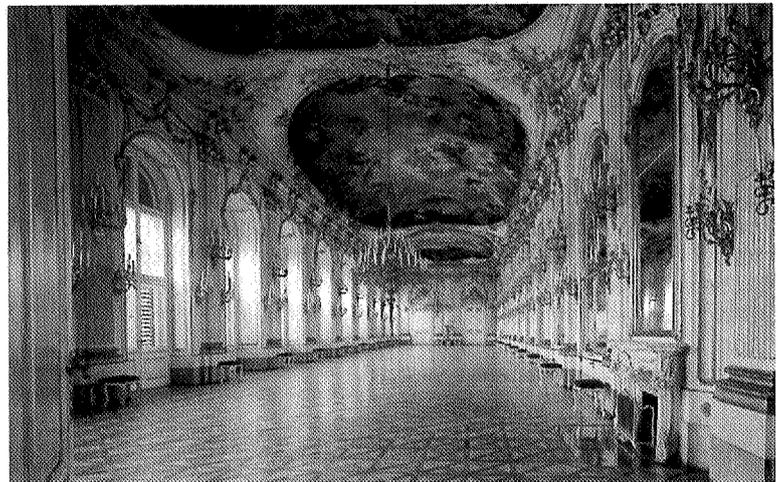
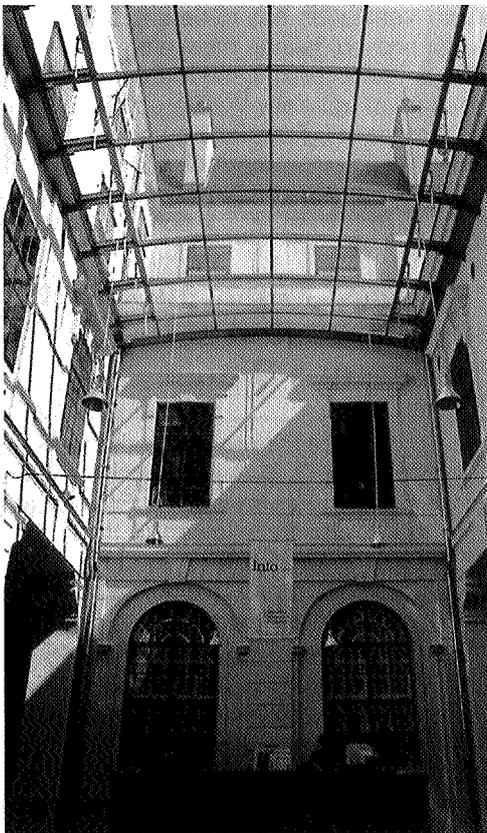
Schloß Schönbrunn is Austria's principal heritage site, and was once the Summer Palace of the Austrian Royal Family. Now open to the public, there is a special need to preserve its artifacts and maintain its authenticity. One of the recent concerns has been damage to many of the Chinese lacquer paintings that decorate much of the interior wall panelling. These were imported from the Imperial Palace of Beijing in the 16th Century, and now suffer from cracking through a combination of age and environmental conditions. Solutions to halt deterioration are urgently being sought.

As part of the effort to maintain the Palace, research into the indoor environment is taking place. Prior to 1992, no climate measurements had been made but, starting in 1993, a monitoring exercise commenced which concentrated on indoor temperature and humidity conditions. This was followed with the measurement of local outdoor climate including outside temperature, wind velocity, precipitation and solar radiation. By 1995 further IAQ monitoring commenced,

including the measurement of ventilation using tracer gas. Heat and humidity flux through the walls also started to be evaluated.

A prime concern has been uncontrolled air flow behaviour which, at busy times, is largely dominated by window opening. There is also cold draughting. Local air fluxes and their impact on dust settling on artifacts is also of concern. To improve conditions, the immediate intention is to provide more uniformity to the rate of ventilation. However, there are constraints on what can be achieved because it is not appropriate to install a modern mechanical system with all the associated ductwork. Instead it is intended to make use of existing warm air ducts, waste heat and the thermal mass of the structure. This will be combined with the selective sealing of parts of the structure to minimise infiltration. A displacement ventilation approach is planned in which incoming air will be ducted underground to ensure a more constant supply temperature. Air will be mechanically extracted through existing chimney openings. This will involve carefully controlling the rate of air flow through between thirty and forty chimneys. All changes are intended to be gradual or "transitional" to avoid step changes in present conditions.

For more information, please contact Martin W. Liddament



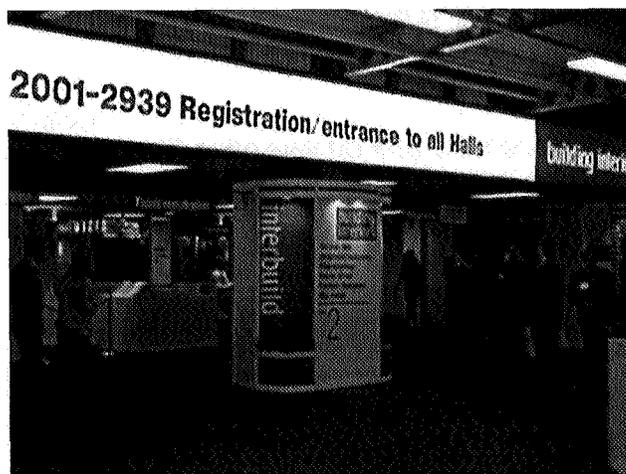
Schloß Schönbrunn - aiming for modern environmental quality while retaining ancient splendour

Interbuild 97

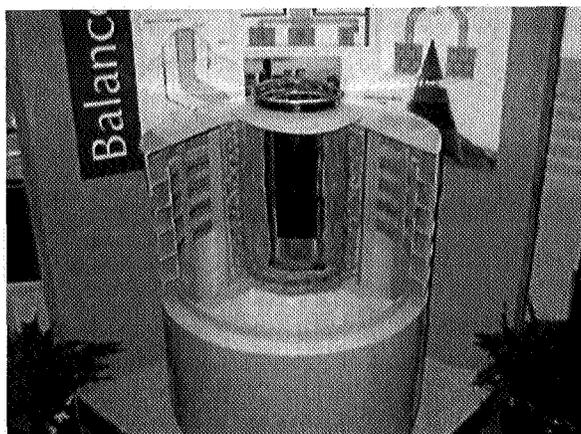
The National Exhibition Centre, Birmingham, UK

23rd - 28th November 1997

Promoted as "Exciting, Exotic and Exhilarating", Interbuild 97 contains 1200 exhibiting companies from the United Kingdom and overseas, offering everything new and innovative for building design and construction. The show expands every year, with Interbuild 97 taking over eight large exhibition halls, where all aspects of building design and installation are showcased, including kitchens and bathrooms, floor coverings, heating systems, building controls and ventilation systems, as well as displays focusing on structural building materials, windows, doors and building machinery. The show has also expanded more recently to include specific showcases, demonstrations and seminars on a wide variety of construction based issues.



Out of the 1200 exhibiting companies, 38 focus primarily on ventilation, falling into three main areas; ventilation ducting, ventilation systems and room ven-



Monodraught balanced chimney system - exhibited at Interbuild '97

tilator units and systems. Exhibitions included both natural and mechanical design solutions, from simple passive trickle vents, to more complex automatic trickle vents such as the AERECO system on display. All of these devices comply with the current UK building regulations and can be fitted to a wide variety of window units before or after installation. On the mechanical side, simple extract fans as well as complicated heat recovery ventilation units were also on display. Although most of these products are based on familiar designs, many have been redesigned to be more discreet and some have also incorporated automatic control systems, such as PIR's and remote wireless control, such as the new system by Vent Axia. It represented one of the most interesting design configurations, consisting of a series of fans which could all be controlled remotely by a portable hand set. The system is designed primarily for use in pubs and clubs, where the owners can automatically control the position and setting of individual fans automatically from anywhere within the building. The remote uses radio waves and therefore is not subject to the obvious restrictions of infrared signals. Any number of fans can be operated by one handset, allowing individual fans to be turned on, off and reversed by the user, without fear that once he has left the location they will be manually altered.

Although "Exciting, Exotic and Exhilarating" was perhaps an exaggeration, interesting, informative and well worth attending could definitely be applied to this exhibition .



First Announcement
International Energy Agency Air Infiltration & Ventilation Centre's 19th Annual Conference

Ventilation Technologies in Urban Areas

Call For Papers

To be held at Holmenkollen Park Hotel Rica, Oslo, Norway, September, 28-30 1998

Theme of the Conference

Urban areas present particular problems to ventilation design and implementation. These arise from factors such as: *poor outdoor air quality; excessive noise and heat island effects*. The purpose of this Conference is to clarify the solutions needed to overcome these difficulties. The programme will include full sessions and poster displays preceded by 5 minute oral presentations. Both research and case study papers are welcome.

utes from the centre of Oslo and Fornebu Airport. It's location, 350 metres above the city and the fjord, provides stunning views of the surrounding countryside and the neighbouring Holmenkoll ski jump. The hotel is built in the distinctive Norwegian "dragon style" and contains excellent conference facilities and accommodation.

Contributions

Abstracts of approximately **300-500 words** are invited from authors of AIVC* and Non-AIVC countries, on the following, or related, topics:

- *Outdoor air pollutant characteristics*
- *Air intake location*
- *Air quality control strategies*
- *Cooling technologies*
- *Acoustic control*
- *Filtration*
- *Solution for offices, retail stores*
- *Solution for light industrial building*
- *Solution for dwellings*
- *Case studies*

Deadlines for abstract(s) and papers: Receipt of abstracts: 27th February 1998
Notification of acceptance: 10th April 1998
Deadline for final papers: 31st July 1998

Conference Venue

The conference will be held at the Holmenkollen Park Hotel Rica which is situated approximately 15 min-



Fees

The conference will be held over 3 full days and the overall cost (*inclusive of 3 nights bed/breakfast, 3 lunches, conference attendance, proceedings and Gala Dinner*) will be **650 pounds sterling** for delegates from AIVC member countries* and **675 pounds sterling** for non-AIVC country delegates. A conference brochure with full details will be circulated shortly.

For further information please contact the Conference Secretariat:

AIVC, Sovereign Court, Univ of Warwick Science Park, Coventry, CV4 7EZ, United Kingdom,
Tel: +44 (0)1203 692050, Fax: +44 (0)1203 416306
e-mail: airvent@aivc.org

Visit our WWW Home Page for up to date conference information and other AIVC activities:
<http://www.aivc.org/>



AIVC Ventilation Research - Update '98

An invitation to contribute to the AIVC's triennial survey of current research into air infiltration, ventilation and related indoor environmental problems in buildings

New Review of Ventilation Research Programmes

The AIVC is currently launching its new review of ventilation research programs, to assess the current trends and focus of specific research into ventilation, indoor air quality and energy use within buildings. This three yearly survey plays a major and vital role in the AIVC's work programme, providing a platform from which researchers and engineers from organisations worldwide can publicise and share their research expertise. The combined results of the survey provide a state-of-the-art compendium of ventilation research, invaluable for identifying current and future trends, reducing research duplication effort and in linking world experts. This is why the AIVC's Research Update has continued to be one of our most successful publications over the last eighteen years.

Past Surveys a Valuable Source of Information

It has been three years since the last update, which contained detailed information on over 250 research projects from seventeen different countries. The main focus of attention during the last survey was on indoor air quality and ventilation systems and strategies, which had shown an increase in research effort from the last survey. There was also much interest in indoor air movement, energy impact of ventilation and air leakage studies, while the number of projects relating to tracer gas and air flow modelling were reduced. Research in occupied buildings remained popular, while greater interest was being shown towards simulated occupancy and unoccupied studies. Research remained fairly constant in dwellings, commercial/office and industrial buildings, although most notably the use of test chambers rose by 32%. Dwellings represented the largest area of study, with over 100 ongoing projects registered, and was closely followed by the commercial office sector. Studies focusing on HVAC systems and their associated components also increased. Building components identified by the 1994 survey showed that walls, windows, doors, floors and cracks were all well represented. The miscellaneous category identified seventeen other components which featured in research projects, including building materials, passive stack ventilation systems and carpets.

Invitation to Register Your Research Activities

The current survey form remains simple and concise taking only a few moments to complete. It is divided into four main sections. The first starts by identifying the project title, and the principal researcher's contact details.

The second section attempts to classify the general area of focus, for example is the project indoor air quality, or energy related? Is it specifically aimed at occupied, or unoccupied buildings, and if so are they dwellings, commercial or industrial. Or does the study concentrate more on a particular building element, such as windows or doors? The third section of the survey allows the respondent to briefly outline the more general details of the project, such as the aims and objectives, the way the research program is structured, any problems, and any results that have been collected to date. The final section leaves space to enter the details of any important publications, including associated papers, articles or research projects that provide important background reading to the specific project.

Publication in Database Format

The final publication will be available in 1998, containing the entire list of replies, fully indexed, in terms of research topic, author and country of origin. It will be published in both hard copy and database format, and run alongside our bibliographic database, AIRBASE.

To contribute your project to this authoritative and comprehensive list of ventilation based research projects, please complete the Survey Form (located on the Web), or send your own word processed version on diskette to the AIVC, via surface mail, fax or email (survey@aivc.org). The Web online survey form can be found on <http://www.aivc.org/survey.html>. All researchers who contribute will receive a complimentary database version of the entire survey as soon as it is complete.

Please take a few minutes of your time to complete the form and register your own project. Greater awareness can only lead to better results!

All replies must be received by Friday 27th February 1998.

Two New Technical Notes from the AIVC

AIVC Technical Note 49

Energy Impact of Ventilation: Estimates for the Service and Residential Sectors

by Malcolm Orme

Available from AIVC Bookshop price £20.00

Analyses air change energy use in thirteen major industrialised countries, and the effect that air change energy use has on carbon dioxide emissions due to the use of fossil fuels, both directly in combustion appliances, and indirectly as electricity.

It can be seen that total building energy demand in the non-industrial sector is of comparable significance to that of transport, and more than twice that of the industrial sector. Therefore it is important to understand why the building sector uses such a significant quantity of energy, and in particular, the impact of ventilation and air infiltration (i.e., air change) on this demand.

Though ventilation is essential to ensure good indoor air quality, there is nevertheless much evidence to suggest that a great deal of energy is wasted due to uncontrolled or unnecessary air infiltration. Losses may also be associated with ventilating pollutants, more effectively controlled by their elimination at source.

To quantify the energy impact of air change on total energy use, the AIVC has been undertaking a study of current estimates for non-industrial buildings. The potential for reduced energy use by improved ventilation control is also considered. It is found that air infiltration and ventilation together account for a significant proportion of energy use in buildings.

The report finds that the total annual loss of heating energy due to air change in the thirteen countries is estimated to amount to 48% of delivered space conditioning energy (including heating equipment losses). Stated in terms of delivered space heating energy alone (i.e., excluding space cooling), this rises to 53%. If the outdoor air supply rate per occupant were to be universally reduced to a minimum level, taking into account metabolic needs and pollutant loads, then it is conceivable that the heating air change energy loss could be reduced to approximately a third of the current level. The consequent reduction in the total carbon dioxide emissions from the service and residential sectors (for all end uses) would be in the region of 20% per year.

These results emphasise that air change related energy losses are as important as conduction and equipment losses (including "flue" losses) in dissipating delivered space conditioning energy from build-

ings. In fact, as national standards, regulations or codes of practice improve the thermal integrity of buildings and increase equipment efficiency, it is expected that ventilation and air movement will become the dominant loss mechanism.

AIVC Technical Note 50

Introduction to Ventilation Technology in Large Non-Domestic Buildings.

by Don Dickson

Available from AIVC Bookshop price £20.00

Describes current ventilation practice and also looks into the future. Designers, building owners and policy makers will be told what is done and why, while researchers are provided with a framework on which to hang future projects.

Atria, auditoria, sports halls, enclosed shopping malls and offices are examples of the type of space considered. A characteristic of many of these spaces, other than offices, is that they are so large, and the occupied part is so small in comparison, that avoiding draughts and limiting energy use may be as important a consideration as supplying sufficient fresh air for health and comfort. Buoyancy effects, driven by insulation and heat sources relating to people and their activities, frequently result in significant vertical air streams especially where there are large expanses of cold glazed facade.

The report aims to provide an introduction to the way in which large buildings are ventilated in order to provide a starting point for useful dialogue between those who design buildings and those who use them. Ten sections cover the following topics:

- Relating ventilation to the removal of pollution from occupied spaces in buildings
- Showing how the choice between mechanical or natural ventilation affects the whole character of the building, but also that a mixed-mode approach may make it possible to combine the best of both methods
- Showing how these ventilation options translate when applied to different types of building
- Considering how to make the ventilating process "efficient" - the art of good air distribution
- Considering the needs and expectations of the user of the building; is the person in the building comfortable, and is the ventilation system user-friendly?
- Considering the energy implications of ventilation decisions

- Showing how these decisions are arrived at and which are out of the decision makers' control
- Relating these decisions to a design process which is controlled by needs and constraints. Ways of checking design proposals by calculation ("modelling") are briefly reviewed.
- Exploring how the system can be checked after it has been built and commissioned
- Finally summarises the present status of ventilation strategies for large buildings and tries to indicate where the most likely changes may occur.

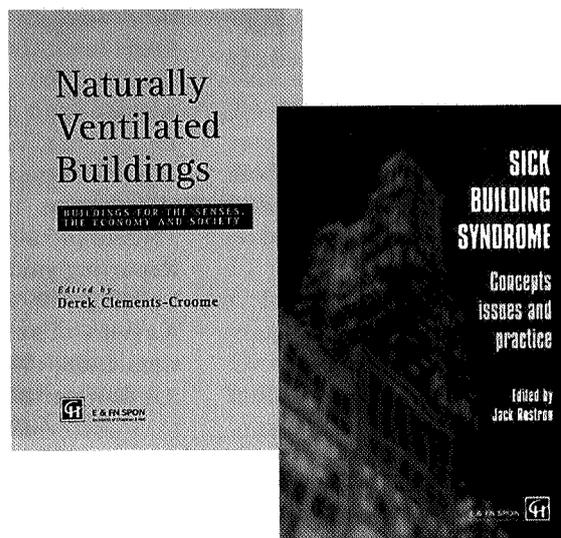
New Books

Sick Building Syndrome: Concepts, Issues and Practice, by Jack Rostron (ed.)

A new collection of expert writing which aims to unravel the complex issues involved in the analysis of sick building syndrome. The book explores sick building syndrome from a range of perspectives including: architectural, psychological, medical and legal. Each chapter offers detailed insights into the condition - taken together they highlight the need for collaboration in addressing it. It is thought that up to 30% of refurbished buildings may suffer from the condition, leading to increased absenteeism among employees, reduction of performance and ultimately building closure. Outlines possible techniques for diagnosing the condition; offers guidance on eliminating sick building syndrome; discusses the legal implications of not tackling the issue. **E&FN Spon, 1997, price £27.50 from the AIVC Bookshop**

Naturally Ventilated Buildings - Buildings for the Senses, the Economy and Society, by Derek Clements-Croome (ed.)

With changing working and living habits we increas-



ingly need low energy, low pollution, low waste, healthy buildings. Naturally responsive buildings are more likely to achieve these criteria. Knowledge about the performance of naturally ventilated buildings has remained comparatively sparse. With ten key research papers this book seeks to address this lack of information. The book is written with both the professional and the client in mind. **E&FN Spon, 1977, price £65.00 from the AIVC Bookshop**

Invitation to Tender - "Ventilation and Acoustics" Report

This call for tender to produce a Technical Note on "Ventilation and Acoustics" is open to individual persons, organisations or a group of organisations and/or individuals with one leading organisation. Proposers must be from one of the following AIVC participating countries: Belgium, Canada, Denmark, Finland, France Germany, Greece, Netherlands, New Zealand, Norway, Sweden, UK or USA.

The target audience will be those with a good knowledge of ventilation, and ventilation systems, but with little or no knowledge of acoustics in buildings.

A suggested table of contents is given below:

- *Basics of acoustics*
- *Acoustics and mechanical ventilation*
- *Acoustics and natural ventilation*
- *Standards and building regulations*

Full details can be found at Web address . <http://www.aivc.org/actender.html>. Please contact Dr Martin W Liddament at AIVC for further advice.

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The AIVC's home page holds Air Infiltration Review, publications and conference details and a list of papers based on the current edition of Recent Additions. The address is <http://www.aivc.org/>

GUIDES

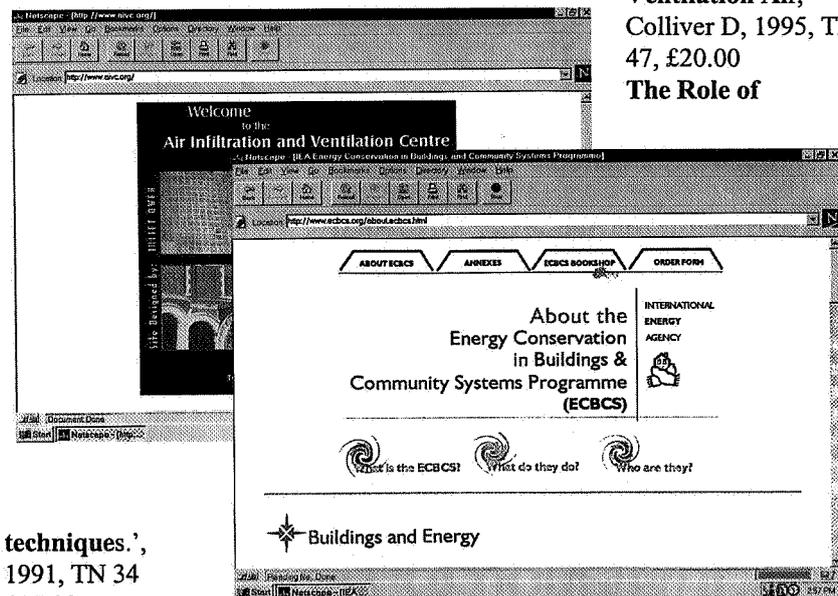
- Guide to Energy Efficient Ventilation,** Liddament M W, 1996 GV £50.00
- Air Infiltration Calculation Techniques: an Applications Guide,** 1986, CT £15.00
- Air infiltration control in housing: Handbook,** 1983 HNBK £15.00

TECHNICAL NOTES

- Validation and comparison of mathematical models,** 1983 TN 11 £15.00
- Wind pressure data requirements,** 1984, TN 13 £15.00
- Wind Pressure Workshop Proceedings,** 1984, TN 13.1 £15.00
- Leakage Distribution in Buildings,** 1985, TN 16 £15.00
- Ventilation Strategy - A Selected Bibliography,** 1985, TN 17 £15.00
- Airborne moisture transfer: workshop proceedings,** 1987, TN 20 £15.00

- Review and bibliography of ventilation effectiveness,** 1987, TN 21 £15.00
- Inhabitants' behaviour with regard to ventilation,** 1988, TN 23 £15.00
- AIVC Measurement Techniques Workshop,** 1988, TN 24 £15.00
- Minimum ventilation rates, IEA Annex IX** 1989, TN 26 £15.00
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- A guide to air change efficiency,** 1990, TN 28 £15.00
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- Reporting guidelines for airflows in buildings,** 1991, TN 32 £15.00
- A review of building air flow simulation,** 1991, TN33 £15.00
- Air flow patterns: measurement**

- Infiltration Data from the Alberta Home Heating Research Facility,** Wilson D and Walker I, 1993, TN 41, £20.00
- Current Ventilation and Air Conditioning Systems and Strategies,** Limb M J, .1994, TN 42, £20.00
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- Air-to-Air Heat Recovery in Ventilation,** Irving S, 1994, TN45, £20.00
- 1994 Survey of Current Research,** Limb M J, 1995, TN 46, £20.00
- Energy Requirements for Conditioning of Ventilation Air,** Colliver D, 1995, TN 47, £20.00
- The Role of**

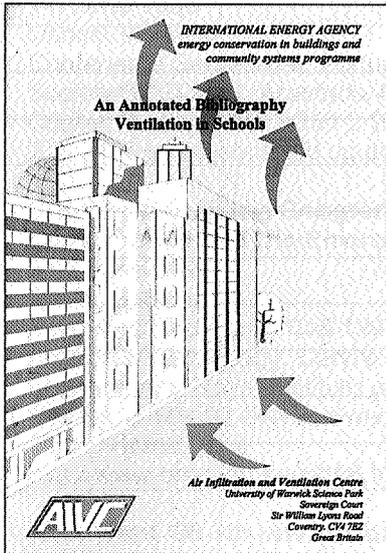


- techniques,** 1991, TN 34 £15.00
- Advanced ventilation systems,** 1992, TN35 £15.00
- Airgloss Air Infiltration Glossary,** Limb M J, 1992, TN 36 £15.00
- A Strategy for Future Ventilation Research and Applications,** Liddament M W, 1992, TN 37 £15.00
- A Review of Ventilation Efficiency,** Liddament M W, 1993, TN 39, £20.00
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- Ventilation in Cooling Non-Domestic Buildings,** Irving S J, 1997, TN 48, £20.00
- Energy Impact of Ventilation: Estimates for the Service and Residential Sectors,** Orme M S, 1998, TN 49, £20.00
- Introduction to Ventilation Technology in Large Non-Domestic Buildings,** Dickson D, 1998, TN 50, £20.00

**ANNOTATED
BIBLIOGRAPHIES**

Ventilation and infiltration characteristics of lift shafts and stair wells, 1993, BIB1 £15.00
Garage Ventilation, 1994, BIB2 £15.00
Natural ventilation, 1994, BIB3 £15.00
Air intake positioning to avoid contamination of ventilation air, 1995, BIB4 £15.00
Heat pumps for ventilation exhaust



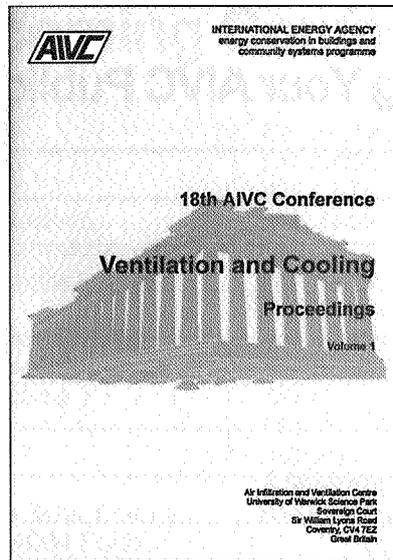
**air heat recovery, 1996, BIB5
£15.00**
**Ventilation in Schools, 1997, BIB 6
£15.00**
**Ventilation and Acoustics in
Buildings, 1997, BIB 7 £15.00**
**Passive Cooling, 1998, BIB 8,
£15.00 (Available soon)**

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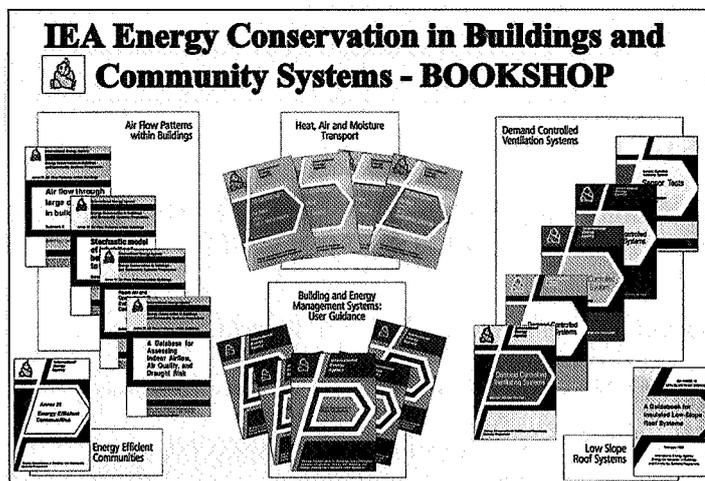


Contents pages can be forwarded on
request.
'Ventilation System Performance'
Belgirate, Italy, 1990, CP 11 £35.00
**'Air Movement and Ventilation
Control within Buildings'**, Ottawa,
Canada, 1991, 3 volumes, CP 12
£50.00
**'Ventilation for Energy Efficiency
and Optimum Indoor Air Quality'**,
France, 1992, CP 13 £50.00
**'Energy Impact of Air Infiltration
and Ventilation'**, Denmark, 1993,

**'Ventilation and Cooling', Athens,
Greece, 1997, CP 18 £65.00**

LITERATURE LISTS

- Pressurisation - infiltration correlation: 1. Models, LL 1
- Pressurisation - infiltration correlation: 2. Measurements, LL 2
- Weatherstripping windows and doors, LL 3
- Caulks and sealants, LL 4 Domestic air-to-air heat exchangers, LL 5
- Air infiltration in industrial buildings, LL 6
- Air flow through building entrances, LL 7
- Air infiltration in commercial buildings, LL 8
- Air infiltration in public buildings, LL 9
- Carbon dioxide controlled ventilation, LL 10
- Occupancy effects on air infiltration, LL 11
- Windbreaks and shelterbelts, LL 12
- Air infiltration measurement techniques, LL 13
- Roofs and attics, LL 14
- Identification of air leakage paths, LL 15



CP 14 £50.00
'The Role of Ventilation', Buxton,
UK, 1994, CP 15 £50.00
**'Implementing the Results of
Ventilation Research'**, Palm
Springs, USA, 1995, CP 16 £50.00
**'Optimum Ventilation and Air
Flow Control in Buildings'**,
Gothenburg, Sweden, 1996,
CP 17 £50.00

- Sick buildings, LL 16
- Flow through large openings, LL 17
- Control of cross contamination from smokers, LL 18
- Location of exhausts and inlets, LL 19

Forthcoming Conferences

World Energy Efficiency Day

5th March 1998
Wels, Austria
O.O. Energiesparverband, Landstrasse 45,
A-4020 Linz, Austria, Tel +43 732 6584 4380,
Fax: +43 732 6584 4383, email esv1@esv.or.at

PLEA 1998 Lisbon Passive and Low Energy Architecture 15th International Conference on Passive and Low Energy Architecture Environmentally Friendly Cities

1-3 June 1998
Lisbon, Portugal
Conference Secretariat, Portuguese Solar Energy Society/SPEC-RN, Apartado 4076, 4004 Porto Codex, Portugal Tel: +351 2 2007455 Fax: +351 2 312476 email ebm@fe.up.pt

CIB World Building Congress 1998 Construction and the Environment

7-12 June 1998
Gävle, Sweden
Executive Secretariat CIB 1998, Division of Materials Technology, Centre of Built Environment, Royal Institute of Technology, PO Box 88, S-801 02 Gävle, Sweden, Fax: +46 26 14 78 01, Home Page <http://www.bmg.kth.se/cib98.htm>

Roomvent '98 6th International Conference on Air Distribution in Rooms

June 15-17, 1998
KTH, Stockholm, Sweden
Conference Secretariat, Roomvent '98, KTH, Building Services Engineering, Birnellvagen 34, S-100 44 Stockholm, Sweden Fax: +46 8 411 84 32 email roomvent98@ce.kth.se

Energy Efficiency in a Competitive Environment ACEE 1998 Summer Study on Energy Efficiency in Buildings

23-28 August 1998
Asilomar Conference Center, Pacific Grove, California, USA
American Council for an Energy-Efficient Economy, Summer Study Office, 1001

Connecticut Avenue NW, Suite 801, Washington, DC 20036, USA +1 202 429 8873, Fax: +1 202 429 0193, email ace3-conf@ccmail.pnl.gov, <http://aceee.org>

World Renewable Energy Congress V Renewable energy climate change and the environment

20-25 September 1998
Florence, Italy
Prof A A M Sayigh, World Renewable Energy Network, 147 Hilmanton, Lower Earley, Reading RG6 4 HN, UK, Tel: +44 0118 961 1364, Fax: +44 0118 961 1365

GBC '98 Green Building Challenge '98

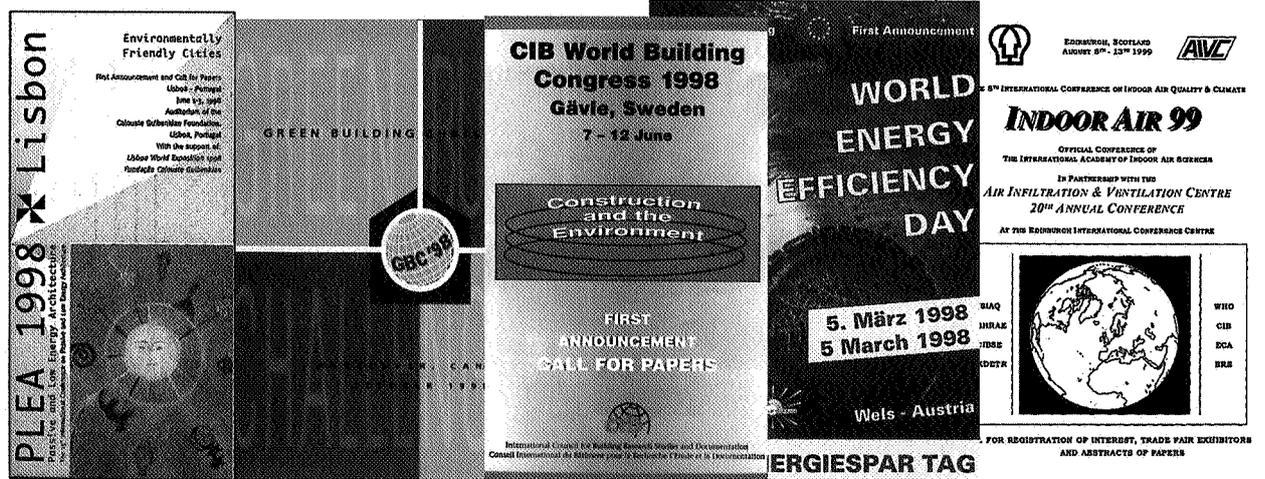
26-28 October 1998
Hyatt Regency Hotel, Vancouver, Canada
Darinka Tolot, GBC '98 Conference Secretariat, CANMET Energy Technology Centre, NRCan 13/F, 580 Booth Street, Ottawa ON K1A 0E4, Canada, Fax: 613 996 9909, email darinka.tolot@nrcan.gc.ca

EPIC '98 2nd European Conference on Energy Performance and Indoor Climate in Buildings and 3rd International Conference on Indoor Air Quality, Ventilation and Energy Conservation in Buildings

19-21 November 1998
Eurexpo Congress Centre, Lyon, France
Conference Secretariat, Laboratoire des Sciences de l'Habitat, Departement Genie-Civil et Batiment, CNRS D 1652, Ecole nationale des Travaux Publics de l'Etat, Rue Maurice Audin, F-69518 Vaulx-en-Velin, France Tel: +33 4 72 04 70 27 Fax: +33 4 72 04 70 41 email secretariat.lash@entpe.fr <http://epic.entpe.fr>

Indoor Air 99 The 8th International Congress on Indoor Air Quality and Climate

8-13 August 1999
Edinburgh, UK
Prof G J Raw (Indoor Air 99) Building Research Establishment, Watford WD2 7JR, UK Fax: +44 1923 664088 email aizlewoodc@bre.co.uk



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