AIR INFORMATION REVIEW

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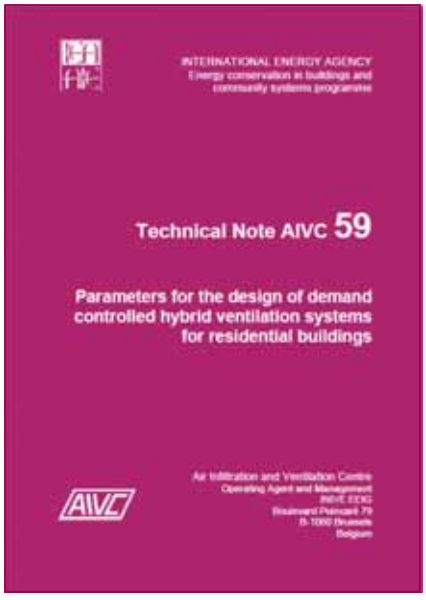
Parameters for the design of demand controlled hybrid ventilation systems for residential buildings

Viktor Dorer, Andreas Pfeiffer, Andreas Weber
AIVC Technical Note 59, 2005, 120 pp, Code TN 59

This AIVC Technical Note has been produced in the framework of the EU RESHYVENT project, conducted from January 2002 to December 2004. An outline of this project is given in the introduction of this report. The report initially was aimed at the project participants; however, a lot of the information may also be of general interest to manufacturers and designers of hybrid residential ventilation systems. Therefore it has been made available to a wider audience by publication as an AIVC TN.



For the design of demand controlled hybrid ventilation systems for residential buildings, the report gives detailed background information on topics which are not sufficiently covered by existing literature (e.g. wind pressures or thermal comfort evaluation by CFD simulation). The report also gives detailed information on input data necessary to perform computer simulations for the performance analysis of systems.

Within RESHYVENT, the information and data given in this report were aimed at the industrial consortia for the development and analysis of their systems and performance assessment simulations. Parts of this report were also used for the preparation of the RESHYVENT source book on residential hybrid ventilation.

2005 AIVC Conference

Brussels - Belgium - 21-23 September 2005
«Ventilation in relation to the Energy Performance of buildings»

More information on pages 8, 9 and 10

AIR
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 and CD is to encourage and increase information exchange among ventilation researchers and practitioners worldwide.

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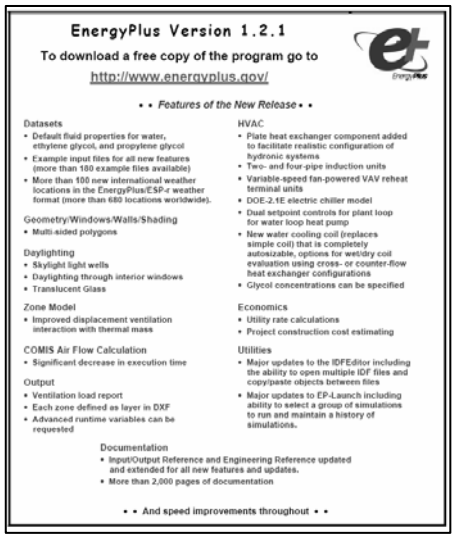
Building Energy Simulation User News

Published bi-monthly, the Building Energy Simulation User News is a newsletter for users of the EnergyPlus, DOE-2, BLAST, SPARK, GenOpt, the Building Design Advisor and ENERGY-10 programs. The newsletter provides documentation updates, bug fixes, inside tips on using the programs more effectively, and articles of special interest to program users. Ventilation related topics are frequently discussed.

Current issues of the newsletter are available electronically; all back issues are available, via regular mail, by request. The newsletter and more information is available on *http://SimulationResearch.lbl.gov*

A free copy of Energy Plus version 1.2.1 can be downloaded on *http://www.energyplus.gov*.



BestFacade - Best practice for double skin facades

Gilles Flamant, BBRI
http://www.bestfacade.com/

Innovative façade concepts are today more relevant than ever. The demand for natural ventilation in commercial buildings is increasing due to growing environmental consciousness while at the same time energy consumption for buildings has to be reduced. An advanced façade should allow for a comfortable indoor climate, sound protection and good lighting, thus minimising the demand for auxiliary energy input.

Double skin facades (DSF) have become a major architectural element in office buildings over the last 15 years. The double skin façade can provide a lot of positive effects: thermal buffer zone, solar preheating of ventilation air, wind protection with open windows, sound protection, nocturnal cooling, etc. Commercial buildings with integrated DSF can be very energy efficient buildings with all the good qualities mentioned above. However not all double skin facades built in the last few years perform well. In many 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 architectural trend has in many cases unnecessarily resulted in a step backwards regarding energy efficiency and the possible use of passive solar energy.

The **BESTFACADE** project will actively promote the concept of double skin facades. A best practice guideline of double skin facades will be created. It will be based on a comprehensive survey of double skin facades in Europe. Information on built examples of double skin facades in European office buildings will be collected, investigated and assessed. Using this guideline designers and investors can avoid application of non relevant concepts of DSF performing worse than traditional facades. The investor confidence concerning operating performance, investment and maintenance costs will be increased.

A simple calculation method for national guidelines to estimate the energy demand and comfort parameters will be developed. This method will be evaluated using measured and simulated data sets. It will be presented to the relevant CEN committees and could be integrated into assessment methods of the Energy Performance of Buildings Directive (EPBD).
Benchmarks will be made available to allow users and operators to compare their energy consumption levels with others, set future targets and identify measures to reduce energy consumption.

Non-technological barriers will be identified, solutions to overcome them will be presented and the results will be incorporated in the dissemination strategy. The analyses will comprise the following non-technological barriers: legal, financial, institutional, standardisation and cultural.
The project results will be disseminated by different strategies, like website, CD-Roms, workshops and presentation at conferences.

BESTFACADE is a SAVE project (01.01.2005 – 31.12.2007) financed by the European Commission. It comprises 12 partners (engineers, industry, architects and designers …) from 7 European countries.

A network for comfort and energy use in buildings

Nicol Fergus
http://www.nceub.org.uk

A group of UK Universities and practitioners have got together set up a 'Network for Comfort and Energy Use in Buildings' (NCEUB) with backing for three years from the Engineering and Physical Sciences Research Council. The Network is being coordinated by the Low Energy Architecture Research Unit (LEARN) at London Metropolitan University. The aim of NCEUB is to bring together researchers, consultancies, designers, manufacturers and end-users concerned with building-related energy issues and the requirements for human thermal comfort.
One major aim is to influence the direction of research and to present evidence of research need to the bodies that fund buildings-related research.

NCEUB has initiated workgroups to review the research in specific areas such as simulation, Standards and occupant expectation which will define and promote the research effort needed to promote the comfort of building occupants whilst minimising the energy use of buildings, in particular those using natural ventilation. Whilst there is no workgroup specifically dealing with ventilation and IAQ at present, both will clearly play a central role in the study of both comfort and energy use. Perhaps this is a cue for members of AIVC to play an active role. The Network has regular open meetings (the next is in September in Bath) at which papers are presented and projects discussed. There are plans afoot for an international conference in 2006 and an International Network is a longer-term aim.

Founding members of NCEUB come from Engineers and environmental consultants such as Arups, and Buro Happold, National Laboratories such as the Building Research Establishment and manufacturers such as Colt International. Academic members include those from energy-related research institutes such as the Energy Systems Research Unit at Strathclyde University and Institute for Energy and Sustainability at DeMontfort University, but also include others with an interest in the occupants of buildings such as the Department of Sociology at the University of Lancaster, the Human Environments Research Laboratory at Loughborough and the Thermal Comfort Unit at Oxford Brookes University.

The Network has a website at *http://www.nceub.org.uk* includes information on the membership and the work of the Network, with downloadable papers and other information and space for dialogue between members and other visitors. There is a member's area where researchers can find each people who can provide advice or look for research partners. Non-members can join online. The network will be a centre for information in this field of research and advice on the implications for the building industry and the training of building professionals.
Outputs will include a detailed analysis of current research related to comfort and building energy use and recommendations for the best directions for future research. The network will also advise on new norms and standards for indoor climate and design guidance for building controls.

Please consider joining and taking an active part in its work you can learn more from the website (*http://www.nceub.org.uk*) or contact Dr Janet Rudge, Network administrator (*j.rudge@londonmet.ac.uk*) or +44(0)20.77.53.70.13.

Development of hybrid ventilation system for residential building

Within the Reshyvent project, a concept of demand controlled hybrid ventilation system has been developed for mild and warm climates. The evaluation of the ventilation needs is realised via sensors. The summer comfort issue is specially handled by the integration of an intensive ventilation mode and solar shading. A first version of this system has been developed during the EU project Photovent. This system was not yet a two modes (hybrid) system at that time and the aspect of summer comfort was not yet integrated. It has been further developed into a hybrid system during the Reshyvent project, among other thanks to the development of the fan.

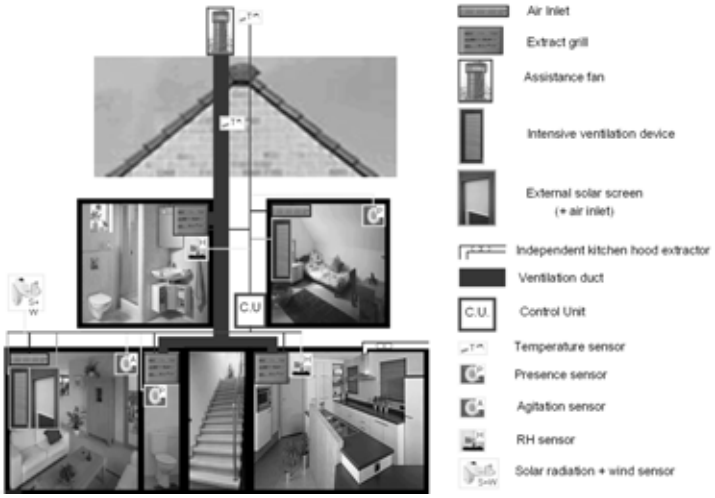
All the ventilation devices such as air inlets, outlets and intensive ventilation devices, as well as solar shading are motorised. These devices such as the fan are piloted by a central control unit. This unit receives all the information coming from the sensors, determines the airflow to realise in each room, the speed of the fan and the opening of some motorised windows. A scheme of the whole concept is presented in the following picture.

Sensors detecting presence, agitation, relative humidity, temperature, solar radiation and wind speed are used into the system. All 10 minutes, the status of the different sensors is communicated to the central control unit which determines the opening position of the inlets, outlets and the rotation speed of the fan.

The balance between supply and exhaust is continuously guaranteed by the central control unit which makes the needed adjustment to the system.
The ventilation system has been conceived to maintain a given under pressure into the dwelling. The motorised inlets and outlets can each adopt 8 opening positions.

The central control unit determines which position these ventilation devices have to adopt. Adaptation to the opening position of inlets or outlets can be necessary in order to guarantee the balance of the airflows. An opening procedure of the different inlets and outlets has been defined into the system. Rules have also been foreseen into the system to avoid significant modifications of the opening status of the different ventilation devices between consecutive time steps. Derogation by the user of the automatic control is possible at the level of each ventilation devices. The derogation mode is maintained for a maximum of 6 hours.

a. The first one is the compensation for the lack of stack effect. The rotation of the fan will be more important when the temperature difference between the interior and the exterior is lower or even inversed. Therefore temperature sensors are installed in the building and outside.
b. The second one is the need for intensive ventilation. Based on the indoor temperature of the last 24 hours, the need for intensive ventilation is evaluated. When the need for intensive ventilation is confirmed, the fan will be used in its maximum speed (corresponding to a power consumption of 16 W).



Scheme of the IC3 ventilation system

The fan developed during the Reshyvent project is specifically adapted for fan-assisted ventilation. The development of this fan is described in the proceedings of the 2001 AIVC conference. The pressure resistance is very limited (lower than 1 Pa for air flow rates of 70 dm³/s).
The fan can be switched off or be run for several power consumptions (2W, 4W or 16W). The shape of the fan has been improved (a.o. via wind tunnel testing) in order to act as roof cowl. Given the very low power consumption, a PV supplied version of the fan has been developed.

The fan speed (corresponding to different power consumptions) can be adapted to take two effects into account:

Air supply is provided by naturally dimensioned motorised inlets placed upon the window frame. An inlet is composed of two parts, a motorised active length adopting always a fixed dimension and, possibly, a manually controlled part allowing adapting the length of the inlet to any window dimension. Air exhaust is provided by naturally dimensioned motorised outlets. The exhaust is a fan-assisted low resistance air duct (160 mm square duct) equipped with low resistance connection fittings.

Ventilation demands for the kitchen and bathroom areas is evaluated by relative humidity when no presence is detected and by the presence detection otherwise. In the bedrooms and toilet, the needs are evaluated by presence detection and by agitation detection (evaluating the number of persons) in the living room. Minimal airflows are realised when no presence is detected.

The system has been optimised to insure a good thermal comfort during summer conditions. The first element contributing to this objective is using the maximal capacity of the ventilation system.

Secondly, motorised windows equipped with louvers for intensive natural ventilation are part of the system. The louvers allow protection against insect penetration, burglary and offer weather tightness. As an option, motorised inlets integrating external solar shading have been developed. The control of the solar shading can be based on measurement of the solar radiation, wind speed and outside temperature.

The hybrid character of the system comes from the fact that the totally fan is switched off (0 W) when the outdoor conditions are favourable which makes this system a two-mode system and not only a low-consuming mechanical system. The integration of the night-cooling mode into the system could be considered as a third mode-system.

The communication between the components of the system can occur via wires or via a wireless solution. The wireless solution (433 MHz radio-commanded) makes this system particularly convenient for refurbishment applications. The developed ventilation system is a highly intelligent system. It may be clear that particular elements of the system can be replaced by less intelligent components, if desired.

Controlled air inlets and hybrid exhaust fan with possibilities for solar shading, intensive ventilation and fan PV supply

Development of Distance Learning Vocational Training Material for the Promotion of Best Practice Ventilation Energy Performance in Buildings VENT DIS COURSE

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http://dea.brunel.ac.uk/ventdiscourse/

This project is funded by the Intelligent Energy – Europe Programme. Its main objective is to accelerate implementation of a core area (ventilation) within the Energy Performance of Buildings Directive (EPBD) at European and national levels and thus improve energy efficiency in buildings by directly transferring existing knowledge to appropriate actors in a suitable format. This will be achieved by developing and promoting vocational training material in a multi-lingual distance-learning format for building professionals to facilitate the implementation of best practice ventilation energy performance (both for indoor environmental quality and thermal comfort) in large new and retrofitted buildings of various types.

This project targets the demand side where users of energy play an important role. However, the degree energy use can be determined to a large extent during the design (or major refurbishment) of a building. To this end, the market actors are not the actual users but the designers and operators of buildings. These actors are usually reluctant (mainly due to financial and job demand reasons) to devote large percentage of their professional time to undertake additional training. However, they could always find small chunks of time that could use to refresh their knowledge, especially if such knowledge will have a direct benefit to carrying out their job (in this case familiarity with one area of EPBD). For this, distance learning methods, used extensively by educational establishments, could be used as opposed to whole day(s) Continued Professional Development (CPD) seminars.

Distance learning methods could range from carefully structured textbooks to 2-3 pages dedicated CPD pages that could appear on professional journals.

The work programme of this project includes seven work packages. The project started in January 2005 and will conclude in December 2007. The work programme includes:

a. Evaluation of educational distance learning methods and application to building ventilation vocational training led by the University of Athens, Greece
http://grbes.phys.uoa.gr/
b. Collection, evaluation and classification of information and material on energy efficient ventilation technologies and design to develop the distance learning training led by ENTPE, France
http://www.entpe.fr/
c. Development of material which will consist of (a) CPD articles in professional journals; (b) textbook and (c) electronic training material using specialised educational software; all to include practical (EPBD based) training exercises and assessment material led by Brunel University, UK
http://www.brunel.ac.uk/sed/

The (tentative) titles and areas to be covered in each module are described below:

- Foundation module: Principles of energy efficient building ventilation and the EPBD
- Module 1: Natural and hybrid ventilation in buildings.
- Module 2: Energy efficient mechanical ventilation
- Module 3: Ventilation for Urban Buildings
- Module 4: Assessment of Building Ventilation
- Common Resource Module: Computerised Tools and Case-studies

d. Establishment of the training methodology including the operational schedule of the material in its various facets and requirements for certification led by BSRIA Ltd, UK
http://www.bsria.co.uk/
e. Transfer of information to training institutes, pilot seminars and CPD articles led by REHVA.
http://www.rehva.com/
f. Testing of the educational package by selected European experts led by REHVA
http://www.rehva.com/

Therefore, the main direct product of the project is distance learning vocational training material for sustainable building ventilation in three formats together with training methodology, operational schedule and requirements for certification. During the project, national seminars, CPD articles (in national languages) and selected training (targeted by professional bodies within participating countries in their national language) would contribute to dissemination.

The main contribution of this project to the energy agenda is that by transferring knowledge on the latest energy efficient ventilation technologies and system design (within EPBD initiatives) to appropriate actors in a systematic but flexible format (distance training) supported by employers and professional institutions in participating countries, it is possible to considerably reduce energy use in buildings. This will be achieved by designers having the know-how (together with calculation methods) on minimising the need for mechanical ventilation (by applying passive ventilation techniques) and specify energy efficient plant where this is necessary.

For more information about the project and access to results are they appear, please visit
http://dea.brunel.ac.uk/ventdiscourse/

Air - for Health and Comfort

An Analysis of HVAC Systems´ Performance in Theory and Practice

Fredrik Engdahl

One part of the objective of this study is to analyze how different ventilation systems perform in practice when it comes to supplying and exhausting designed air flow in different outdoor and indoor conditions. The other part is to analyze the design criteria's and the energy use of a variable air volume system (VAV) based on controlled static pressure at the branch duct level and supplying outdoor air only.

To investigate the technical status of ventilation systems, the result from the compulsory testing and examination of ventilation systems (OVK) is used. A multi-zone model (COMIS) based on the mass balanced equation is used to study the air flow in a multi-family building. Two ventilation systems are analyzed combined with the same building; the mechanical exhaust air and the mechanical supply and exhaust air system. Fundamental pressure loss equations and a computer program (PFS) are used to determine how much the air flow at the air terminals on a branch with controlled static pressure differs compared to the designed air flow depending on duct design.
A model is developed and tested to determine the optimal supply air temperature with respect to heating, ventilation and air conditioning (HVAC) energy use.

The energy use for a VAV system only using outdoor air dependent on control strategies of the supply air temperature and average U-value of the building envelope is analyzed with climate data from northern Europe. An average of 34 % of the studied ventilation systems performed as intended. Both the mechanical exhaust and the mechanical exhaust and supply air system showed sensitiveness to outdoor temperature, building airtightness and wind.

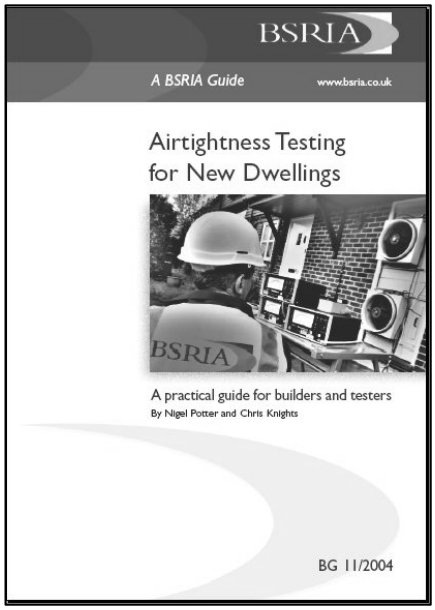
When the static pressure is controlled to be constant at the branch duct level it is possible to vary the air flow to different zones without measuring the individual flow and without significantly influence the air flow to other zones. When using 100 % outdoor air in a VAV system, the indoor air quality will be improved during most of the year.

There is great potential in controlling the supply air temperature optimally to reduce the HVAC energy use. The optimal U-value of the building envelope in an energy use perspective is most often 0 W/(m².°C) for northern European countries.

Air tightness testing for new dwellings

http://www.bsria.co.uk

This BSRIA Guide outlines the requirements of the proposed Building Regulations for 2005 as they apply to new dwellings. The methodology of airtightness testing techniques is presented along with diagnostic methods such as smoke testing and thermographic surveys.



The 2001 Building Regulations required all commercial and industrial buildings with a gross floor area greater than 1000 m² to be tested for airtightness to a minimum standard of
10 m³/h.m² at 50 Pascals (Pa).

Not only will Approved Document Part L2 of the Building Regulations for 2005 extend this requirement to all sizes of commercial and industrial buildings, Approved Document Part L1 will also be extended to include airtightness testing of new dwellings.

The draft Approved Document Part L1 for work in new dwellings will require, with few exceptions, type-testing of all new dwellings to an airtightness standard of 10 m³/h.m² at 50 Pa. For some dwellings where the carbon emission rate is difficult to meet for architectural reasons, then the airtightness target under the SAP calculations may need to be reduced to 7, 5 or even 3 m³/h.m² at 50 Pa to meet the overall carbon emission rate required by the Regulations.

Building contractors who elect to adopt the robust details route to demonstrating compliance with the Regulations will still be required to undertake airtightness testing, albeit with a potentially smaller sample of dwellings.

This guide is available on the Internet at *http://www.bsria.co.uk/content/press-download/index.asp?id=219* and on the AIVC-CD.

External coupling between energy simulation and computational fluid dynamics

Ery Djunaedy, Technische Universiteit Eindhoven

Introduction: the external coupling

Previous research has shown that a building is a complex system whose behaviour can only be understood by taking into account its dynamic interactions. Optimizing the building (and its sub-systems) as a whole is not the same as optimizing the subsystems or components separately, because the latter would miss the dynamic interactions between the subsystems. The research direction in the area of building performance simulation has then moved towards an integrated multi-domain building simulation tools.

This article summarizes the findings of a recently completed thesis (Djunaedy 2005) which shows the viability of the external coupling method in achieving the integrated multi-domain building simulation tools.

Different from the internal coupling method where the domain expansion always means writing new codes into the existing program, the external coupling combines two or more programs during run time.

Using the external coupling method, the code changing can be kept to minimum and the development in any domain can be made available to other domains immediately, provided the communication protocol between the domains has been established.

Considering the importance of building energy simulation (BES) in the building design process and the current trend of wide-spread use of computational fluid dynamics (CFD) simulations, these two domains were selected as the basis of the work.

Implementation

The first objective of the study is to develop a working prototype of external coupling between BES and CFD. The implementation uses ESP-r as the BES program and Fluent as the CFD program. Generic requirements have been formulated for any other BES and CFD packages to be able to use external coupling. Along with the implementation example, the generic requirements allow anybody to replicate the development process and use any other BES or CFD package for the coupled simulation.

The validation study shows that the external coupling works well. From the BES point of view, the coupled simulation can provide a more accurate convective heat transfer coefficient (CHTC) prediction, which directly affects the energy demand prediction. From the CFD point of view, the coupled simulation can provide dynamic boundary conditions so that the changes in airflow patter throughout the simulation period can be observed. The comparison with experimental results showed that the external coupling performed as good as the internal coupling.

From the software development point of view the external coupling has a better chance to improve faster, especially on the developments of CFD packages. With the external coupling, the latest development in CFD packages can be immediately available to the user once the communication protocol between BES and CFD has been implemented.

On the other hand, with internal coupling, the same development in CFD will have to be implemented into the source code, which will take significantly much longer than the relatively simple plug-and-play method offered by the external coupling.

To put everything into perspective, it is important to note that this work shows the advantage of external coupling in terms of solver capability and software maintenance. Other aspects of integrated simulation may (or may not) favour the internal coupling. One example is the control system action. However, this particular aspect is an ongoing research that will be reported in the future (Yahiaoui et al. 2004).

Guideline for BES-CFD coupled simulation

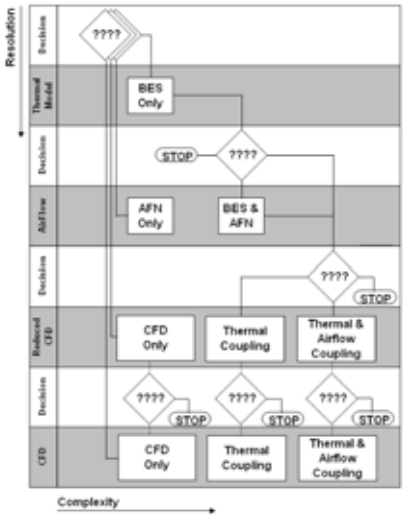
The second line of work is to develop a guideline for the coupled simulation. In the rapid developments of computer technology, many simulation tools are available for use, which falls on a very wide spectrum in terms of sophistication and applicability. It is necessary to develop a guideline to select the appropriate tool(s) for a certain problem. This guideline can also be used as a guideline to assess the necessity of coupled simulation.

Coupling Procedure Decision Methodology (CPDM) as shown in next figure was proposed as the guideline. The main ideas are:

a. A simulation should be consistent with its objective (problem-led), i.e. the designer should not be tool-led. This means that a simulation tool should not be selected simply because it is the only one available, or because it is the most sophisticated tool. The simulation tool should be selected because the problem requires the tool.
b. there should be a problem-led rationale to progress from one level of resolution and complexity to the next.
c. the selection of good design option (among many design options) should be made at the lowest possible resolution and complexity, so that there would be less design option to be simulated at higher resolution level.

In the vertical axis (Figure 1) there are layers of different resolution of building simulation. There are four layers representing the increased level of resolution, i.e. energy simulation, airflow network simulation, and two levels of CFD simulation. Each of the resolution layers is separated by one or more decision layers. The horizontal axis shows the different levels of complexity of building simulation.

How to actually make these decisions is to a large extent still vague as denoted by the question marks in the following figure. In practice the decisions are often made implicitly and depend very much on the skills and experience of a design engineer. With CPDM this implicit process is made explicit and structured. Performance indicators and sensitivity analysis are used for this purpose.



Coupling Procedure Decision Methodology

For CPDM, the sensitivity analysis is used to see the sensitivity of performance indicators towards airflow parameters (i.e. the infiltration and ventilation value) and convective heat transfer coefficient (CHTC). The CPDM uses the sensitivity analysis as the decision making tool to select the appropriate level of resolution for the simulation (do we need CFD simulation or not?) and the appropriate level of complexity (do we need coupled simulation or not? Or should we run BES-only simulation or CFD-only simulation?).

Continued on page 11

26th AIVC Conference
Ventilation in relation to the Energy Performance of Buildings

Brussels, 21-23 September 2005

Parallel session "R&D on ventilation"

Since 1980, the AIVC conferences have been the meeting point for presenting and discussing interesting developments and results regarding ventilation in buildings. At each conference, a specific theme is selected. This year, the conference theme is 'Ventilation in relation to the energy performance of buildings'. There are several reasons for selecting this theme:

- In many countries, buildings represent 30…50% of the total energy and pollution load. As buildings are better insulated, the part played in the ventilation of the overall energy consumption of the buildings might became more and more important if no attention is paid to it.

- In the EU, the deadline for the implementation of the Energy Performance of Buildings Directive (EPBD) is approaching very fast, and there are still many issues to be solved for its correct implementation. This Directive imposes that all 25 EU Member States to have in January 2006 an Energy Performance Regulation in place with e.g. energy performance requirements for ALL new buildings as well as energy performance certification for all buildings when constructed, rent or sold. This conference is an excellent occasion for having a clear picture regarding the status of implementation just a few months before January 2006.

- During the last decade, a lot of attention has been given to the development of innovative ventilation systems. Energy Performance regulations can be a stimulus for the market introduction of innovative systems but also a barrier.

Topics of the session

The 'Current R&D' session is focused on presentations and discussions regarding ventilation related topics for the R&D community, specialised consultants…

The following topics will be discussed during this session:

- Treatment of ventilation aspects in standards and regulations
- Handling of ventilation in energy performance regulations outside Europe
- Air tightness of buildings and ducts
- Energy for transport of air
- Innovative ventilation systems and energy performance regulations
- Impact of regulations on ventilation market
- Good indoor climate and energy performance
- Ventilation in the context of energy certification of buildings
- Commissioning and inspection of ventilation systems
- Ventilation related challenges for the existing building stock
- Ventilation in very low energy buildings
- Ventilation aspects in warm and cold climates
- Economics of indoor climate

In total, some 50 presentations are scheduled.

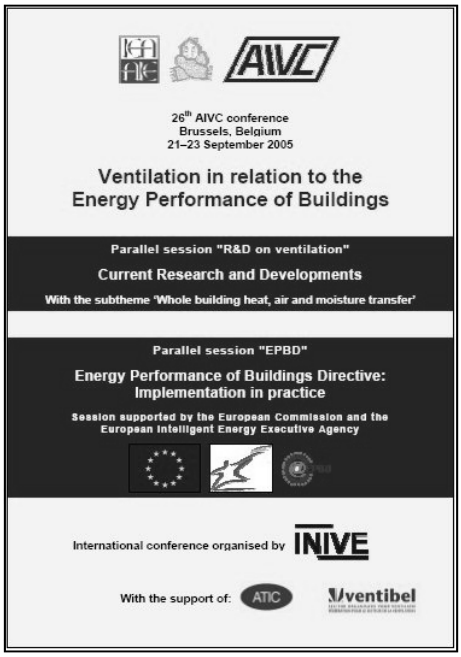
Whole building heat, air and moisture transfer

As during previous conferences, a subtheme has been selected: 'Whole building heat, air and moisture transfer'. This is also the title of IEA ECBCS Annex 41.

For this subtheme, specific attention will be given to the following two topics:

- Coupling, in terms of heat, air and moisture flows, between building and building fabric, consequences for energy consumption and durability

- Combined effect of ventilation and hygric inertia on indoor climate and energy consumption.



Parallel session "EPBD"

The 'Energy Performance of Buildings Directive: Implementation in practice' session can be considered as the 'practice oriented' part of the conference: presentations and discussions focused on information for practitioners whereby all building related aspects are considered: building envelope, HVAC, renewable energies… All presentations are by invitation. The programme presentations have close links with the work carried out in the framework of the EPBD concerted action and the various EPBD related EU SAVE projects.

Session EPBD 1 –
EP standards and calculation procedures

Article 3 of the EPBD requires that EU Member States shall apply a methodology of calculation of the energy performance of buildings on the basis of the general framework set out in the Annex of the Directive. The session should give the participants a clear overview of the status regarding calculation methods.

Session EPBD 2 –
Inspection and commissioning of technical installations

According to articles 8 and 9 of the EPBD, inspection of boilers and air conditioning systems is mandatory. This represents a major challenge, in terms of procedures, number of inspectors, quality of inspectors and quality assurance. The session should give a clear overview of the major issues of concerns and give practical information how the Member States intend to implement these articles. Although ventilation systems which only serve for the control of the IAQ are not bound by article 9, it is important to also pay attention to these systems.

Session EPBD 3 –
Existing buildings: calculation procedures - certification – labelling

Article 7 of the EPBD requires an energy performance certification of all buildings, including existing buildings when sold or rent. Moreover, recommendations for improvements have to be provided.

This is a major challenge, in technical terms (availability of appropriate procedures) as well as in terms of required resources (inspectors, financial means, etc.). The session should give a clear overview of the challenges, existing approaches, and activities in the various ongoing projects, practical feedback of market experiences, etc.

Session EPBD 4 –
Indoor climate considerations and the EPBD

Indoor climate is mentioned several times in the EPBD (e.g. *article 4* and the *annex*). Achieving good indoor climate conditions is not obvious in new and existing buildings. Poor indoor air quality and overheating problems in summer are major issues of concerns. It is essential that energy performance regulations don't contribute to an increase in these problems and preferably lead to a lower occurrence of such problems. The session should give a clear overview of how these problems are handled into the different national regulations.

Session EPBD 5 –
Very low energy buildings and the EPBD

During the last decade, an increased number of very low energy buildings have been built. A major development in Europe is the so-called 'Passive House' concept, whereby the availability of heating systems is no longer a requirement. The session will focus on some major highlights of the Passive House concepts and of the 'Ecobuilding' projects of the 6th framework programme. Specific attention should be given to the application of the EPBD to such kind of buildings.

Session EPBD 6 –
Airtightness and energy for transport

The *annex* of the EPBD mentions that the methodology for calculation may also include airtightness; moreover it specifically refers to the aspects of ventilation and 'natural ventilation'. On the other hand, energy for transport has been receiving increased attention over the last few years.

In practice, there are major developments in fan technology and system design, also new ventilation concepts are emerging, e.g. hybrid ventilation and demand controlled ventilation, whereby there is often a drastic reduction of the energy use for the transport of air. The session will focus on these various issues.

Session EPBD 7 –
Innovative systems and the EPBD

It is logical that buildings which make use of better technologies receive a better assessment in the energy performance certificate. But, some technologies, and in particular innovative systems, may not be covered by agreed calculation procedures. It must be avoided that the non-availability of procedures for such innovative systems becomes a major barrier for the market introduction. The session should give a good understanding of the existing problems. Moreover, there should be a clear information about the way the issue is handled in some countries. Moreover, indications about possible attractive approaches should be given.

Session EPBD 8 –
Dissemination, training and non-technical issues in the EPBD context

Implementing the EPBD requires raising awareness and training of hundred thousands of people in Europe. Several countries already have practical experience and specific projects are running for facilitating the introduction of the EPBD. Moreover, there are also more formal training issues, in particular regarding the certification of buildings and installations (*articles 8 and 9*). The focus will be on the formal aspects of training. Various activities in the field of awareness raising and dissemination will also be discussed.

Practical information

Provisional programme

	Tuesday 20/09	Wednesday 21/09/2005		Thursday 22/09/2005		Friday 23/09/2005	
9:00		Opening session		R&D 4	EPBD 4	R&D 7	EPBD 7
10:45		*Break*		*Break*		*Break*	
11:15		R&D 1	EPBD 1	R&D 5	EPBD 5	R&D 8	EPBD 8
13:00		*Lunch*		Visits EC seminar on invitation		*Lunch*	
14:00		R&D 2	EPBD 2			Closing session	
15:45		*Break*					
16:15		R&D 3	EPBD 3				
18:00		*Break*		R&D 6a	EPBD 6a		
19:00	*Welcome reception* *Desk opening*	*Conference dinner*		*Walking buffet*			
20:00				R&D 6b	EPBD 6b		
21:00							

Conference organizers
The conference is organized by INIVE EEIG (the International Network for Information on Ventilation and Energy - *http://www.inive.org*) on behalf of the AIVC (Air Infiltration and Ventilation Centre – *http://www.aivc.org*) with the support of the EC EPBD Concerted action (*http://www.epbd-ca.org*).

Registration fees

	Before 1st July 2005	*From July 1st 2005*
Conference fee	**726 €** (600 € excl. VAT)	**847 €** (700 € excl. VAT)
Conference fee for students	**423.5 €** (350 € excl. VAT)	**484 €** (400 € excl. VAT)

All prices are without accommodations.

The fee covers: attendance at all conference sessions, conference material, welcome reception, lunches (except on Thursday noon) and breaks throughout the conference, conference proceedings. The fee does not include accommodations and conference dinner.

Venue
The AIVC conference 2005 will be held at the ***Hotel President WTC***
Boulevard du Roi Albert II, 44 -
Koning Albert II-laan, 44
BE-1000 Brussels, Belgium
Tel: +32.2.203.20.20
http://www.presidenthotels.be

Additional information
Additional information will be made available on the AIVC website (e.g. titles of presentations, content of opening and closing sessions, workshop details…): *http://www.aivc.org* > Conferences > AIVC Conference 2005.

Continued from page 7

External coupling between energy simulation and computational fluid dynamics

The main contribution of the guideline is that it tries to make a logical scheme to what is usually an abstract and subjective endeavour. CPDM covers the whole range of simulation tools and proposes a mechanism on how to select the appropriate tool according to the need at a specified time.

References

Djunaedy, E. 2005. External coupling between building energy simulation and computational fluid dynamics, PhD thesis, Technische Universiteit Eindhoven, Netherlands.

Yahiaoui, A., Hensen, J. L. M., Soethout, L. L. 2004. "Developing CORBA-based distributed control and building performance environments by run-time coupling", Proceedings of the 10th International Conference on Computing in Civil and Building Engineering, Weimar, Germany.

Field study on the performance of exhaust-only ventilation in schools with regard to indoor air quality

L.A.H. Joosten, Technische Universiteit Eindhoven (TU/e)

Indoor Air Quality (IAQ) in schools is generally known not to be reaching the basic requirements and should be considered as a top priority because: (1) Children are still developing physically and more likely to suffer from indoor pollutants, (2) An increasing number of children suffers from asthma, (3) IAQ affects student performance. However, not many field studies are conducted on the performance of ventilation systems in schools with regard to ventilation capacity, ventilation efficiency and thermal comfort. Therefore it is unsure when bad thermal comfort (draught) is occurring and if fresh air is sufficiently spread in classrooms. The goal of this study is to evaluate the performance of exhaust-only ventilation systems and to generate suggestions for improvement.

For the evaluation of ventilation systems, in 5 schools a north orientated classroom with exhaust-only ventilation in the Netherlands has been selected, based on expected indoor air quality. Measurements conducted in the heating season for a period of around 7 days included: IAQ (CO2), thermal comfort, airflow and outdoor conditions. Information about use of ventilation facilities and satisfaction of users is obtained by a logbook and questionnaires. As a search for improvements, CFD (Computational Fluid Dynamics) simulation is used to study variants.

Results of the measurements showed that in 4 out of 5 evaluated classrooms the indoor air quality does not meet the requirements for a good indoor air quality. CO2-concentrations are too high indicating that ventilation is not adequate. The realized capacity (as measured) of the ventilation systems without opening doors and windows is not enough for the present number of occupants in the classrooms. Only in one school, where doors were opened most of time the measured flow meets requirements for ventilation. According to measurements of temperature and air velocity no draught occurs. The reason is that flow rates are low in those classrooms. By opening windows and doors more draught occurs at places near air supplies. Ventilation with open doors and windows negatively affects thermal comfort and therefore the use of ventilation facilities of occupants. Temperatures and humidity were measured as well.

In 4 out of 5 schools requirements for thermal comfort are met. Furthermore humidity levels in all schools were sufficiently low to prevent mite growth. Moreover, in dust samples no mites, dead or alive, were found.

The CFD simulations show that thermal discomfort will occur where flow rates increased to higher levels. In the heating season, ventilation with large amounts of outdoor air results in unacceptable cold draught. Therefore, natural air supply in classrooms without any draught prevention is an unacceptable solution. By several variants a draught prevention measure is studied. This draught prevention consists of a lower ceiling where air should warm up in the plenum. A study where dimensions of a lower ceiling were varied showed that the following parameters affect airflow: (1) the height of the lower ceiling relative to the air supply, (2) the distance of the lower ceiling to the air supply, (3) the ceiling length. However, with this lower ceiling still cold draught occurs because air is not sufficiently warming up according to the simulations.

Main conclusions that can be drawn from this study are: IAQ in the evaluated schools does not meet the requirements and more ventilation is essential for better IAQ. The capacity of ventilation systems has to be increased. However air supply limited to vents in the façade results in draught due to high concentration of cold outdoor air. Therefore, a more distributed way of supplying air is recommended.

International Metrology Congress

François Durier, CETIAT
http://www.cfmetrologie.com

The 12th International Metrology Congress takes place in Lyon, France from 20th to 23rd June 2005.
It includes 200 presentations. Among them are several papers or posters related to ventilation and air flows. They concern measurements of air velocities, flow rates or pressures (especially for smaller values), as well as temperature, humidity and air quality measurements. A round table deals with metrological qualification of clean rooms.

Measurements uncertainties are also the topic of several presentations.
The detailed programme of the Congress is available on the AIVC CD.
For more information, see
http://www.cfmetrologie.com

CISBAT 2005 International Conference

http://cisbat.epfl.ch

Renewables in a Changing Climate: Innovations in Building Envelopes and Environmental Systems, Lausanne, Switzerland, **September 28-29, 2005**.
For further information please contact:
Ecole Polytechnique Federale de Lausanne, Solar Energy and Building Physics Laboratory,
Fax: +41.21.693.27.22
e-mail: *cisbat@epfl.ch*
Internet: *http://cisbat.epfl.ch*

Modelling Natural and Hybrid Ventilation

Per Heiselberg, Aalborg University
http://auaw2.aua.auc.dk/fak-tekn/phd/kurser/s6_2.htm

Aalborg University offers a course for PhD students on modelling of natural and hybrid ventilation from
August 15-20, 2005, Aalborg, Denmark

The traditional theory and methods for prediction of air infiltration in buildings are today also used for prediction of the performance of natural and hybrid ventilation. However, a number of the assumptions made in the development of models for predicting air infiltration are not valid for natural ventilation. These assumptions include among others typically:

- **Pressure-Driven Flow** - The model is based on the assumption that airflow is solely pressure-driven. This is not the case for large openings.
- **Velocity and Pressure Distribution** - The model is based on the assumption that both the pressure and the velocity distribution in the opening are constant. This is only the case for a large opening, if it is located in the stagnation zone.
- **Kinetic Energy** - The model is based on the assumption that the kinetic energy is dissipated in the room and that there is no flow contact between the openings.
  This is often not the case in cross ventilation, even if openings are not located opposite to each other.

The characteristics of large openings in the buildings envelope are quite different from the characteristics of cracks, and also the air flow conditions within the building cannot be neglected.

The objective of the course is to introduce the theoretical background for single- and multizone modelling of natural and hybrid ventilation based on state-of-the-art knowledge, to introduce the application of commonly used methods and tools and finally to present current research topics to encourage new developments of natural ventilation theory and modelling.

The course is relevant for all PhD students working in the field of natural and hybrid ventilation. The course will cover the following topics:

- Wind and/or thermal driven flows through single openings
- Air flow through large openings
- Single-zone and multizone models
- Multiple solutions, dynamic phenomena and stochastic modelling
- Prediction of air flow around buildings and building surface pressures

The participants will get the opportunity to apply different software packages for various exercises.

Course lecturers will be: Prof. James Axley, Yale University, USA; Ass. Prof Henrik Brohus, Aalborg University, Denmark; Prof. Per Heiselberg, Aalborg University, Denmark; Ass. Prof. Yuguo Li, The University of Hong Kong, Hong Kong SAR,China and Prof. Mats Sandberg, University of Gävle, Sweden.

More information is available on the AIVC-CD or from the website:
http://auaw2.aua.auc.dk/fak-tekn/phd/kurser/s6_2.htm

Second ClimateWorld Moscow

14 - 17 March 2006
Exhibition Centre CROCUS EXPO, Moscow
http://www.climateworld.info

ClimateWorld is Russia's first specialized trade fair in Russia that is exclusively dedicated to the HVAC industry, including all segments related to it. The exhibition provides an ideal platform for Russian and international key players to present their products and services, to exchange know-how and to establish, build up and expand valuable business contacts.

More information at
http://www.climateworld.info
e-mail: *climateworld@msi-fairs.com*

Dynamic Analysis, Simulation and Testing Applied to the Energy and Environmental Performance of Buildings

DYNASTEE 2005
Athens, 12th – 14th October, 2005
http://www.dynastee.info

Dynamic analysis and modeling techniques, combined with appropriate test methodologies, have been applied for many years to the assessment of the solar and thermal performance of buildings and building components. However, producing accurate results, which inspire confidence throughout the construction sector, can still be a problem.

The specific dynamic analysis and modelling techniques addressed by the conference require a high level of skill to be applied properly. Often statisticians and mathematicians do not have the technical knowledge to correctly apply these dynamic techniques to physical processes, whilst engineers may not have adequate knowledge of the complex statistical and mathematical processes.

Discussions, comparisons, training, guidance tools, and in general, accessible research infrastructures are required to keep the necessary skill at a high level. Due to the wide range of scientific disciplines required for analysing the complexities of the performance of an occupied building in a real outdoor environment, it is difficult and expensive for any one institute, organisation or university to maintain all the required knowledge in-house.
As such, whilst the dynamic analysis and modelling techniques are able to deal with the non-linear processes associated with the energy performance of occupied buildings and are well suited for energy management, it is however necessary to provide an environment which allows direct and effective intercomparison of these techniques and the results of their implementation.

The objective of DYNASTEE 2005 is to provide such an environment, by bringing together the scientific community in the field, to add further momentum to many years of applied research and to identify feasible approaches for the practical implementation of dynamic techniques.

The conference is the meeting ground for the presentation and discussion of the latest scientific developments, presentation of an overview of the activities and strategies to date and the launch of a new informal network on dynamic analysis, simulation and testing. The new grouping -a sustainable informal networking mechanism- is intended for those who are involved in research and applications of thermal analysis of buildings, based on performance data. Possible areas of interest which may benefit from dynamic methods are, for example, energy labelling of buildings, energy retrofit evaluations, performance control in energy management systems, field testing of building components, development of methods for pre-normative research and validation of simulation tools.

DYNASTEE 2005 is the natural progression of a number of previous initiatives in the field, such as the following seminars, workshops and conferences:

- *'Workshop on Parameter identification methods and physical reality',* Joint Research Centre, 1992.
- *'Workshop on the Application of System Identification in Energy Savings in Buildings', Institute for Systems Engineering and Informatics, Joint Research Centre, Ispra, 25-27 October 1993.*
- *'Course on System Identification Applied to Building Performance Data', Institute for Systems Engineering and Informatics, Joint Research Centre, Ispra, 4-7 October 1994.*
- *'Workshop on Advanced System Identification', Informatics and Mathematics Modeling, Danish Technical University, Copenhagen, 30 January-2 February, 2001.*
- *"Conference on Dynamic Analysis and Modelling to Energy Performance Assessment and Prediction of Buildings and Components", Joint Research Centre, Ispra, 13-14 November 2003.*
- *'Workshop on Dynamic Analysis Methods Applied to Energy Performance Assessment of Buildings', Warsaw University of Technology, 13-14 May, 2004.*

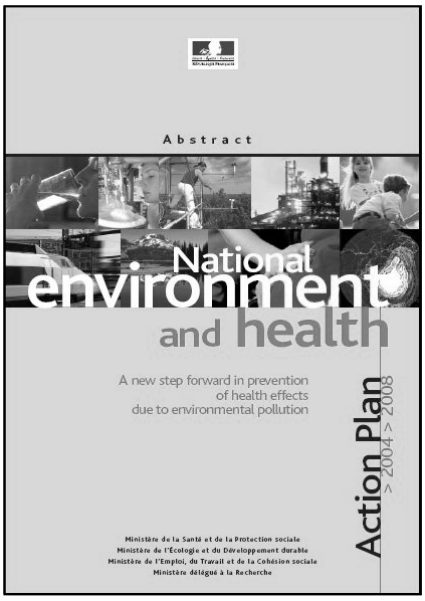
The DYNASTEE 2005 conference is a PASLINK EEIG Action.

For further details visit the DYNASTEE 2005 website: *http://www.dynastee.info* or contact the Conference Secretariat: Gordon Sutherland: *gordon@cres.gr*

French National Environment and Health Action Plan

http://www.afsse.fr

In order to ensure that environmental impacts do not undermine the trend towards higher life expectance, the French government has decided to tackle this problem by developing a National Environment and Health Action Plan (NEHAP). The goal of the plan is to ensure a more favourable environment for health by reducing pollution and the risks it engenders.
The elaboration of the NEHAP relies on a report of experts which was submitted to the French Prime Minister on February 12 2004 and presented an analysis of the exposure of the French people to environmental pollution in their daily lives and made recommendations for action priorities. Inside and outside environments are dealt with in a unified way.



NEHAP defines actions that will structure government action over the next 5 years. The NEHAP includes 45 actions, 12 of which have been set as priorities. There are 3 major goals, one of them being to ensure good quality for air and drinking water.

One of the 12 priority actions is to obtain a better understanding of the determinants of indoor air quality and to strengthen the regulations.

On the AIVC-CD, you can find the report of experts (French), the National action plan (in French) and a summary of the national action plan (in French and English). The files are also available on the Internet at *http://www.afsse.fr*

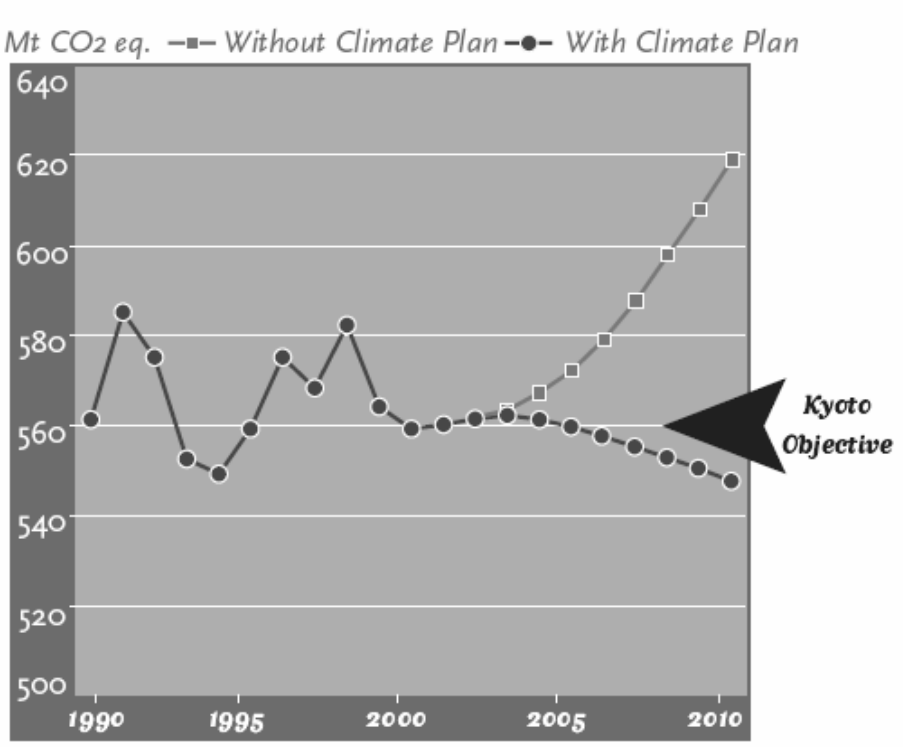
French Climate Plan 2004

The average temperature on Earth rose by 0.6°C during the 20th century – by 0.9°C in France – and is set to rise between 1.4°C and 5.8°C in the coming century. The scale of this significant change has been unprecedented for tens of thousands of years. It is firmly established today that this phenomenon is due to the increase in man-made emissions of greenhouse gases, and particularly carbon dioxide (CO2). CO2 emissions worldwide currently amount to almost 25 billion tonnes. If we continue at our current rate, we will be emitting over 50 billion by the year 2050. Energy consumption in the first half of the twenty-first century would then equal the total energy consumed over the entire history of humankind.
The Climate Plan is an action plan drawn up by the French Government to respond to the climate change challenge, firstly by 2010 (complying with the Kyoto Protocol target), and, secondly, beyond this date.

Projections for France show that national emissions could be 10 % higher than the Kyoto target in 2010 if no measures are taken. This is particularly due to increasing emissions in the sectors affecting daily life (residential-tertiary sectors, transport, etc.).

For this reason, the Climate Plan intends to intensify actions defined by a previous national plan (dated year 2000) which enforcement was considered as insufficient. It contains about 60 measures affecting all sectors of the economy and the daily life of all French citizens with a view to economising the equivalent of 54 million tonnes of CO2 each year by the year 2010, which will help to reverse the trend significantly.

The actions listed by the plan are for some of them not new because they result from the necessary transposition of European Directives (as the Energy Performance of Buildings Directive) while other actions suggest new measures (as for example increased tax allowances).



Beyond 2010, the Climate Plan sets out a strategy for technological research which will enable France to meet a target of reducing greenhouse gas emissions four- or fivefold by 2050.

The French National Climate plan is based on 8 major pillars: national climate change and adaptation campaign - sustainable transport - buildings and eco-homes - industry, energy and waste – sustainable agriculture and forests – sustainable air conditioning – local climate plans and exemplary state action – Research, international action and outlook beyond 2010.

For the pillar 'buildings and eco-homes' the executive summary states:
"The Climate Plan aims to give every French citizen, even the most disadvantaged, the opportunity to live in an ecological home. Using energy efficient equipment (solar water heaters, insulant materials) in home construction or renovation leads to lower energy bills, thereby reducing the economic risk for those who live in them.

Factoring sustainable development criteria into the current plans to boost council housing, i.e. building 80,000 council homes per year, as announced by the French President, will contribute to achieving both a social and environmental objective.

This renovation work will have to be conducted in accordance with specific environmental requirements (using high insulation glass, waste collection, widespread use of solar- powered water heaters).

The energy efficiency certificate system will require energy suppliers to fund energy saving work in the residential-tertiary sectors and in industry.

An energy performance assessment will be made compulsory before any property sale as from 2006 and before any property rental as from 2008. As a result, it will be possible to pinpoint energy investments that are required.

The Energy Label will be made compulsory (with categories from A to G depending on consumption in kWh/m2) in the energy performance assessment.

Property owners who carry out renovation work leading to an improvement in their energy label will be entitled to exemption by local authorities from the property tax for two to six years.
A tax rebate of between 25 and 40 % will target energy efficient equipment. Solar-powered water heaters and other equipment running on renewables will be supported by a 40 % tax rebate.

For the first time, building regulations will be introduced for major renovation of existing buildings. Energy performance thresholds will be established for certain types of renovation work."

It is clear that energy efficient ventilation should receive appropriate attention in such overall approach.

For the pillar 'sustainable air conditioning', the executive summary states:
"There has been a sharp growth in air-conditioning systems which may be linked to the legitimate concern of our citizens for their comfort during periods of extreme heat in summer and to protect themselves and their loved ones against the effects of a possible heat wave.

Unfortunately, air-conditioning apparatuses have negative effects: they consume large quantities of energy and cause greenhouse gas emissions. The "Sustainable Air-conditioning" action will aim to better inform consumers, provide information on ways of avoiding air-conditioning wherever possible, instigate good practice by the private sector, make the State exemplary and see to it that the future EU Regulation on controlling air-conditioning apparatuses is adopted."
Passive cooling strategies, including night ventilation, can contribute to the achievement of sustainable air conditioning.

Among the actions related to HVAC systems are for example the will to extend energy labelling of products, to increase the level of building energy consumption requirements, to eliminate from the market less efficient products, to improve installers training and users information.

The full report in pdf is available on the AIVC-CD.

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