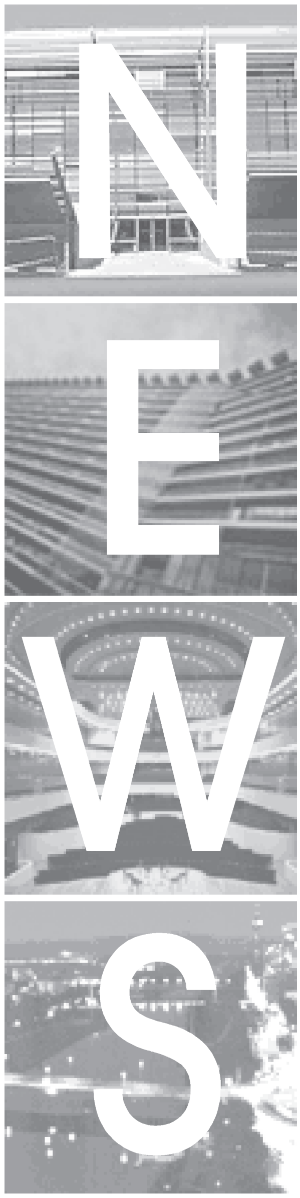
International Energy Agency

ECBCS

Energy Conservation in Buildings and Community Systems Programme



Energy in the Buildings Sector in Portugal

Prof. Eduardo B. Maldonado, Faculdade de Engenharia, Universidade do Porto, Portugal

While buildings represent about 40% of the EU energy consumption, in Portugal, thanks to reasonably mild climatic conditions, buildings represent only slightly more than half that amount. Residential buildings account for 13% of the global energy consumption, while non-residential energy use represents about 9%, for a total of 22%.

In reality, however, recent trends raise the following concerns:

- Energy consumption in the building sector has been growing at a steady pace of about 7%/year for more than a decade;
- The non-residential sector is significantly contributing to this rise with an average increase of 9%/year;
- The buildings sector consumes more than 60% of all the electricity in Portugal, meaning that growth in consumption places a heavy burden upon the electricity grid. It also represents a high share of the global CO2 emissions that Portugal needs to control to meet its commitments within the Kyoto Protocol;
- Out of a total of about 3.5 million buildings, more than 2 million are less than 25 years old and mostly built with little concern for energy efficiency;
- New buildings are being added at a rate of 60,000/year, i.e., an increase of 10%;
- As most buildings are designed to last at least 50 years, the existing building stock shall continue to require high energy consumption for quite some time if no measures are taken to correct the situation;
- While newer buildings (<10 years old) mostly use natural gas for heating, after its introduction in the local market, almost every older building uses electricity or LPG for heating;
- Air-conditioning is becoming more and more common, with an average of more than 100,000 new

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units installed every year in the last 10 years. All the indicators are pointing to a sustained growth of this market in the next few years. Global Warming concerns and a few recent higher than normal temperature spells during the recent past summers have increased sales;

- Recent studies in the largest cities show that building sector is already the largest energy consumer, even larger than transportation: e.g., in Lisbon, energy for buildings ranks highest (46%), above the energy needed for the transport sector (42%).

Current energy regulations for buildings were introduced in 1991 and have not been updated ever since, although the initial plan called for regular updating every 5 years. They require small levels of insulation, usually 2 to 3 cm of most commonly available products for walls and 2 to 4 cm for roofs. Although these are apparently anything but ambitious requirements, they really represented a major step when introduced back in 1990, as insulation was not used at all in buildings until then. Almost every building older than 12 years (about 2.5 million buildings) have no insulation at all in their envelopes. However, thanks to new regulations, recent constructions include insulation. Recent trends show that people now demand insulation for their buildings. A major market has been created for insulation products in building construction.

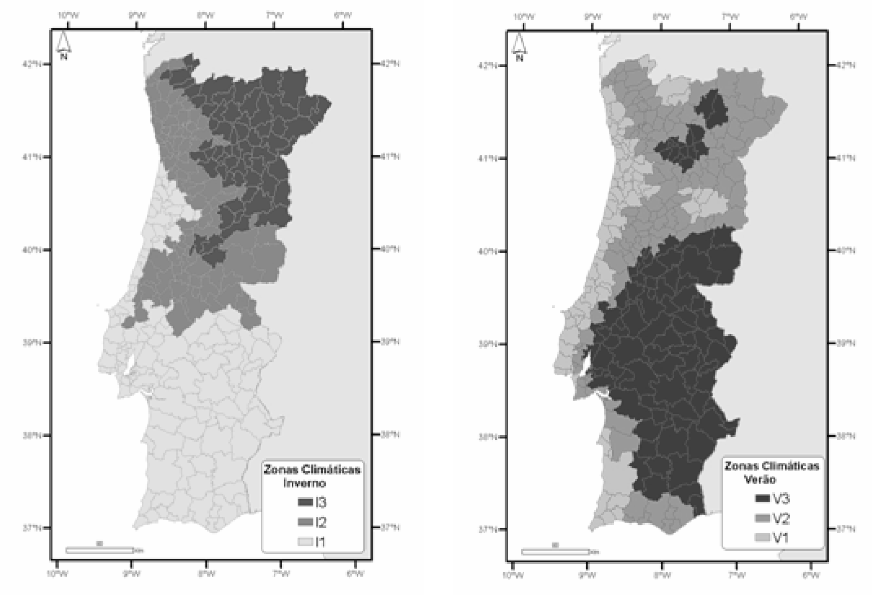
Changing building requirements towards higher insulation levels does not seem to cause major difficulties on the building industry. Current high energy prices easily justify moderate increases in required building insulation levels, commensurate with the mild local climatic conditions (degree days in winter vary from 1000 ºC.days to 3000 ºC.days, on a 20ºC basis for indoor temperature, and cooling design temperatures range from 28ºC to 36ºC in Summer- although Portugal is a small country, the variability in climate is quite significant, ranging from the very mild – most of the country, where most of the population lives – to the relatively severe in the much less populated interior). Heating is required from 5 to 8 months during winter, with 6 months as a typical heating season (November thru April) in most of the country. Cooling is normally needed from June till September.

Portugal is now taking the legal steps needed to update the building regulations, to take effect in 2006. Minimum requirements for insulation will be roughly doubled. Improved requirements will be established for glazings and frames, thermal bridges, boiler and HVAC systems efficiencies, etc. Regular maintenance of HVAC systems will be required and periodically checked along with certification procedures, as the most effective means to ensure a continued high energy efficiency during normal operation of the building. The use of solar collectors for production of hot water will also be required in all cases where there is a roof with an adequate solar exposure.

In line with the requirements of the European Directive on the Energy Performance of Buildings, that must be implemented by the beginning of 2006 in all EU countries, Portugal is also planning the introduction of mandatory Energy Certification of Buildings:

- When applying to a building permit, owners must obtain an energy certificate, later to be checked again after the end of construction;

- The same applies to any building undergoing a major renovation, with the renovated building obliged to meet the new building regulations too;



Winter and Summer climatic zones in Portugal – darker colours mean more severe climates.

ECBCS and the EU Research Programme on Buildings

After a long history of funding research projects in the buildings area, the latest EU Framework Programme (FP6, 2002-2006) is mostly focussed on demonstration projects of energy efficient buildings (ECOBUILDINGS) and of energy efficient communities (CONCERTO). Its responsibility rests with DG TREN (Directorate General for Transport and Energy).

The aim of ECOBUILDINGS projects is *"… a new approach for the design, construction and operation of new and/or refurbished buildings, which is based on the best combination of the double approach: to reduce substantially, and, if possible, to avoid the demand for heating, cooling and lighting and to supply the necessary heating, cooling and lighting in the most efficient way and based as much as possible on renewable energy sources and polygeneration…The projects must go clearly beyond the requirements of existing legislation and thus contribute to a further development of regulatory issues in this sector."*.

The aim of CONCERTO projects is to *"…support research and demonstration focused on optimising the sustainability of energy systems in local communities through the innovative integration of renewable energy technologies directly into eco-buildings, electricity distribution networks, district heating systems, and other energy demanding systems, with advanced thermal and electrical storage and improved energy efficiency, as well as on the measurement (including remote metering), assessment design and management of energy flows…. The results will demonstrate … new "good practices", which can be used in the future as examples to raise the confidence of potential decision-makers, investors and final users"*.

These two topics are well within the aims of ECBCS activities and synergies are certainly possible between both programmes. Mutual contacts have been established, with a visit by the ECBCS chairman, Dr. Morad Atif, to DG TREN, in Brussels, in January 2005, to present ECBCS activities, followed by the presence of a DG TREN representative, Architect Gabrielle Lohr, to the ECBCS meeting in Portugal in June 2005, to hear in more detail about the whole range of activities underway and being planned within ECBCS.

Contacts will continue after details of the new FP7 under preparation by the European Union for 2007-2013 become defined in 2006, namely its buildings component, and ECBCS defines a strategy for its activities in the same topics.

Energy in the Buildings Sector in Portugal (continued)

- An updated Energy Certificate must be presented to a potential buyer or renter whenever a transaction or contract is made;
- Nonresidential buildings will be required to display a valid certificate (maximum validity: 6 years) in a visible location at the main entrance. These certificates will require a periodic energy audit to the building, carried out by an accredited energy expert.

The new regulations also define target benchmarks for the most common types of new and existing non-residential buildings. They have been established on the basis of extensive survey campaigns ordered by the Portuguese Government during the last decade. New buildings will be required to show that they will perform better than the best 40% of the existing stock, while existing buildings above the 60% percentile will be required to implement all improvement measures with a payback of 8 years or better within 3 years. The benchmarks are to be gradually tightened as retrofits and better new buildings improve the overall performance of the sector.

The new policy for the buildings sector is expected to produce measurable results within the medium term. Consumption by the building sector will still grow in the next decade, but a smaller rate of increase is expected. Coupling this policy with a strong emphasis on the use of renewables for production of electricity (mainly wind and biomass), to complement the already high hydro component (total renewable production should be around 40% by 2010), the changes that will come into effect in 2006 should keep the CO_2 emissions from the building sector stable when the new measures are fully implemented, within 3 to 6 years.

Energy efficiency in the building sector has become a major priority for the Portuguese Energy policy, and it should remain there for quite some time.

High Performance Thermal Insulation (Annex 39)

Markus Erb, Operating Agent for Annex 39, Dr H Eicher & Pauli AG, Switzerland

1. Introduction

The motivation for examining the applicability of high performance thermal insulation in buildings (i.e. evacuated insulation in the form of vacuum insulation panels) came from the difficulties involved in renovation – namely severe space limitations and therefore technical constraints, as well as from aesthetic considerations.

The following numbers give an impression on the potential impact vacuum insulation could have on energy consumption:

- In 1997, about 25% of the energy consumption in the EU came from room heating.
- In 1995, there were roughly 150 million dwellings in the EU-15, 32% of this stock was built prior to 1945, 40% between 1945 and 1975 and 28% between 1975 and 1995.

2. Vacuum Insulation Panels (Subtask A)

Vacuum insulation panels (VIP) in general are flat elements consisting of an open porous (and therefore evacuation-capable) core material which has to withstand the external load caused by atmospheric pressure, as well as a sufficiently gas-tight envelope to maintain the required quality of the vacuum. (Figure 1)

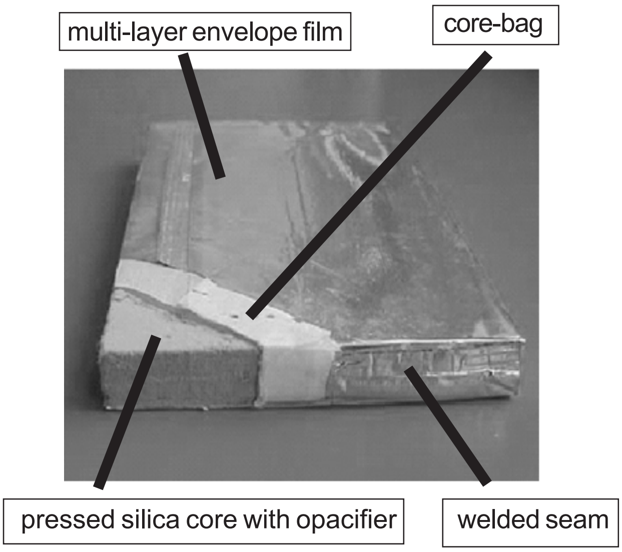


Figure 1: Components of a VIP. The core-bag provides mechanical stability for handling and protects the welding area from being polluted by core-powder (photo: va-Q-tec).

Aging

The thermal conductivity l_{core} of a well evacuated dry VIP with a fumed silica core is typically about 0.004 W/(m·K) after production. As the low internal pressure is not in equilibrium with the environment, pressure gradients are present that act as driving forces for the intrusion of atmospheric gas (essentially N_2, O_2 and H_2O) and by this the thermal performance of VIP is impaired in two ways:

- increasing internal gas pressure and
- increase in the internal water content.

Results

The envelope film with only one metallized layer was clearly proved not to fulfil the requirements. Acceptable pressure increases of about 100 Pa per year can be expected for VIP with an Al-foil and for laminates with three metallized layers.

Air-transmission: edge-effect

The significant contribution of air permeation through the edge-area of the VIP postulates that panels may not be too small in size, (i.e. larger than 50 cm x 50 cm). (Figure 2)

Water vapour transmission

Water vapour uptake in the threefold metallized film was found to be mainly dependent on the size of the panel surface - much smaller edge effect than for air permeation, whereas the panels with Al-film absorbed water vapour at a much lower rate, and this occurred mostly through the edges and seams.

Climatic dependencies of transmission rates

The dependence of air transmission rates on temperature can be described by the Arrhenius law with activation energies that are in the range of 25 to 40 kJ/mol.

Water vapour transmission rates are proportional to the differences in the partial pressures inside and outside, a significant explicit dependence on temperature could not be observed. (Figure 3)

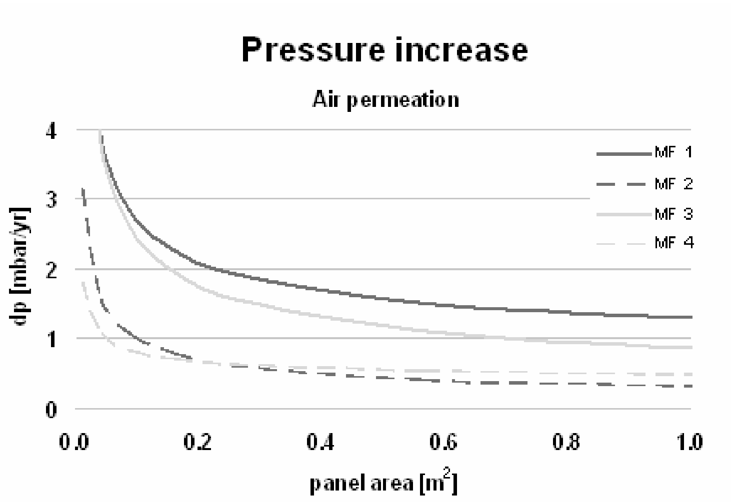


Figure 2: Edge effect on internal pressure increase by air permeation through four different metallized films.

Conclusions

If a time span of 25 years and typical environmental conditions (23 to 25°C and ambient vapour pressure) are taken as a basis for the long-term performance it can be concluded that the pressure increase will be rather linear over the whole period, whereas the moisture content could approach the saturation range (about 4%-mass) within this time period. Moisture equilibrium under normal conditions is basically acceptable, but must be accounted for by a respective increment on the initial thermal conductivity.

Maximum values (approximate) for VIP with actual multi-layer metallized polymer laminate barriers, measured or calculated from laboratory based aging experiments, are given in the table below. Applying known relations for the pressure and moisture impact on the thermal conductivity, maximum values for the thermal conductivity after 25 years are given in the table as well. These values are thought to be on the safe side in applications with VIP surface temperatures and vapour pressures in the range of ambient or indoor air. (Table 1)

Design values

From the results of the aging studies, design values of the thermal conductivity for the center-of-panel ($\lambda_{\chi op}$) can be derived. (Table 2)

In Switzerland a safety increment of 0.004 W/(m·K) is put on the "ideal" initial thermal conductivity value of 0.004 W/(m·K) for VIP with metallized polymer barrier. One part is due to the non-negligible moisture accumulation, which may be around 4%-mass in the long term, corresponding to a thermal conductivity increment of about 0.002 W/(m·K). In addition, a dry air pressure increase of 50 mbar is accounted for, roughly corresponding to another 0.002 W/(m·K) increment. Half increments are taken for VIP with metal foil based barrier. These figures are thought to be on the safe side with respect to both pressure increase and moisture accumulation over a time span of 25 years. It should be noted that this is a preliminary approach. If clearly better barrier quality is proven and proper initial conditions (low pressure, low moisture content) are guaranteed by the manufacturer, lower (individual) design values may be considered by the Swiss thermal insulation standardisation committee.

3. VIP Application (Subtask B)

The core part of the Subtask B report consists of practice reports, showing actual examples where vacuum insulation panels (VIP) have been used, and discussing special issues and open questions. A wide range of built examples, all using VIP, such as floor and ceiling constructions, terrace

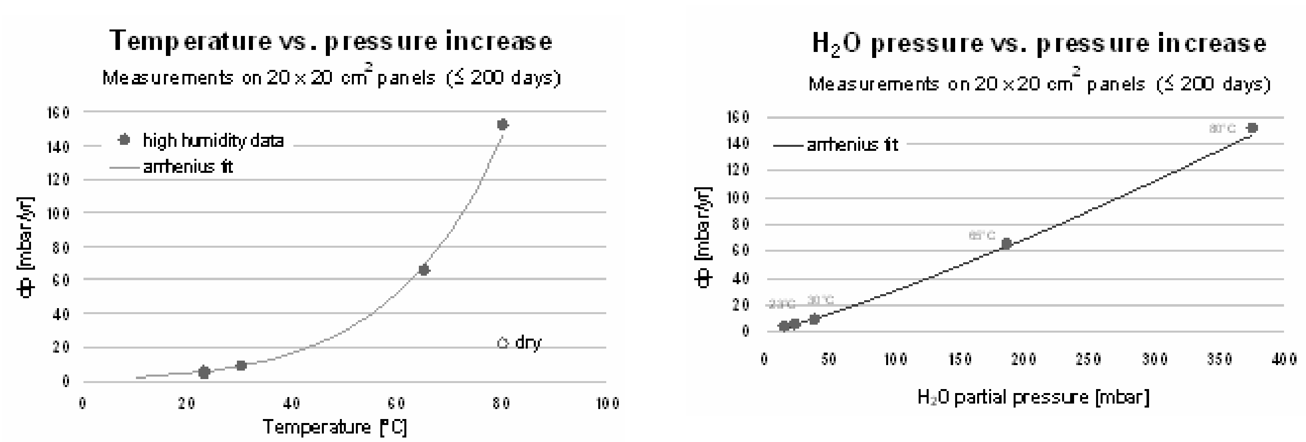


Figure 3: Internal pressure increase caused by water vapour permeation is proportional to the differences in the partial pressures inside and outside the panel. The measurements were done at room temperature after cooling down the samples for some hours.

		50 x 50 x 2 cm3	100 x 100 x 2 cm^3
Pressure increase	[mbar/yr]	< 2.0	< 1.0
Moisture accumulation (initial)	[%-mass/yr]	< 0.2	< 0.2
Thermal conductivity lcore (25 yr)	[W/(m·K)]	< 0.008	< 0.007

Table 1: Aging characteristics for SiO_2-VIP with polymer based multiple metallized barrier (safe values).

insulation, non-loadbearing sandwich elements, parapet insulation, prefabricated façade elements etc. form a rich basis of experience for interested planners and experts as well as manufacturers in search of new products with integrated VIP. Furthermore, the report states the actual knowledge on reliability, thermal bridge effect of the panel envelopes, i.e. the resulting thermal resistance of VIP, and recommended constructions with VIP.

3.1 Thermal bridging

Three different basic levels of thermal bridging can be distinguished:

1. thermal bridging due to the thin film high barrier enveloping the core material
2. thermal bridging due to the small air gap between two adjacent panels
3. thermal bridging due to constructional irregularities (Figure 4)

Due to thermal bridging the effective or overall thermal conductivity, λ_{eff}, of the vacuum insulation panel is higher than the ideal centre-of-panel thermal conductivity λ_{cop}.

This effective thermal conductivity can be calculated as

$\lambda_{eff} = \lambda_{cop} + \psi_{VIP} \cdot d \cdot p / A$ (1)

λ_{cop} centre-of-panel thermal conductivity [W/(m·K)]

d thickness of the VIP (in the heat flux direction) [m]

A surface of the VIP (perpendicular to the heat flux direction) [m^2]

P perimeter of the surface *A* [m]

Swiss center-of-panel conductivity values		λ_{cop}
AF: aluminium foil films	[W/m.K]	0.006
MF: metallized polymer films	[W/m.K]	0.008

Table 2: Swiss design values (safe values) of Center-of-panel thermal conductivities (λ_{cop}) for aluminium andpolymer based multiple metallized barrier envelopes.

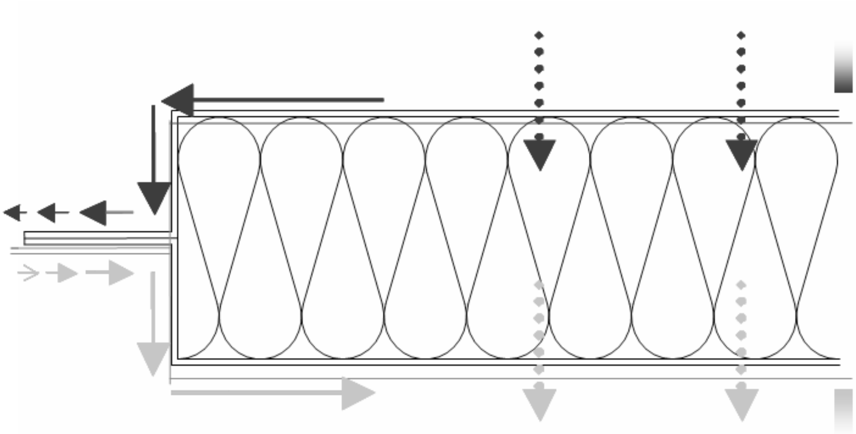


Figure 4: Schematic representation of a cold bridge caused by the VIP envelope.

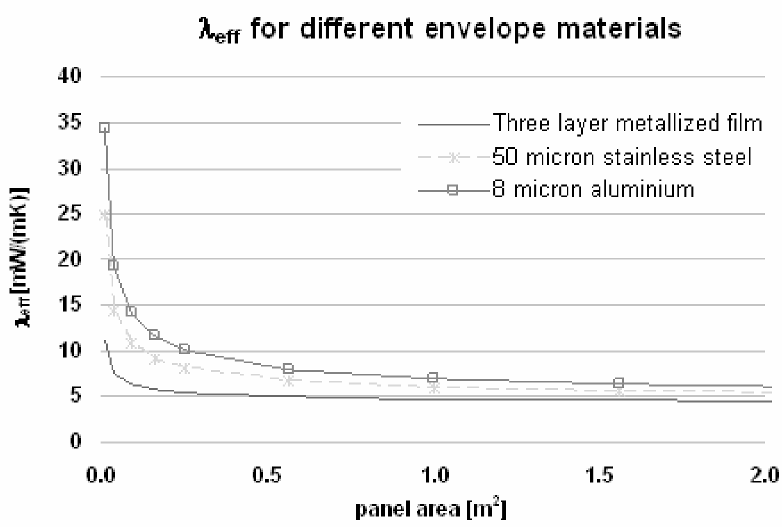


Figure 5:Thermal bridge effect of different envelope materials on overallconductivity (λ_{eff}) of a panel with center-of-panel conductivity ($\lambda_{\chi op}$) of $4 \cdot 10^{-3}$ W/(m•K).

ψ_{VIP} linear thermal transmittance [W/(m·K)]

Envelope materials

Effective thermal conductivities for different envelope materials have been measured and modeled. (Figure 5)

Adjacent materials

As well as the properties of the core material and the envelope, the ψ_{VIP} value is influenced by the material layers immediately surrounding the VIP. At the EMPA the influence of various surrounding materials has been investigated. The calculations were performed for a VIP (20 mm) with metallized enveloping laminate for the adjacent materials metal, glass, wood and insulation, in each case without an air gap between the VIP and with a 5 mm air gap between the panels. Here the design value of λ_{cop} for metallized films of $8 \cdot 10^{-3}$ W/(m•K) was used. (Figure 6)

3.2 VIP in practical use

VIP are today mainly installed directly in the construction on site. By far the most common use is the insulation of flat roof terraces with VIP. This provides a simple method of avoiding unpleasantly high steps between the interior and the terrace. (Figure 7)

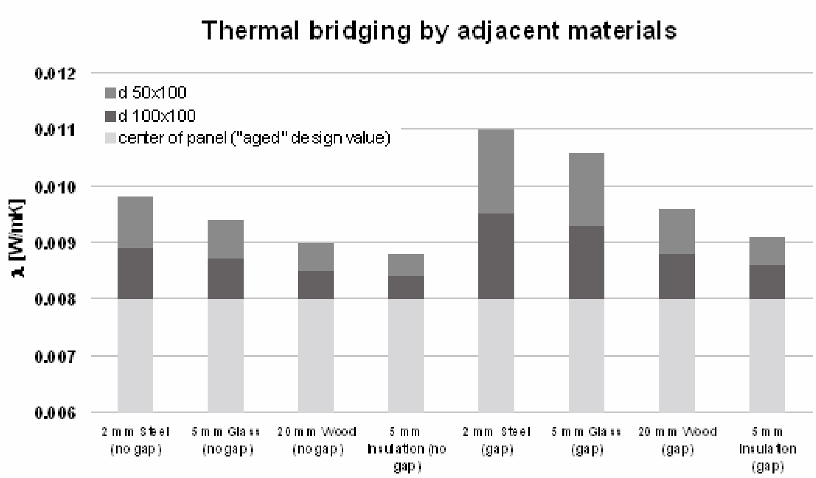


Figure 6: Thermal bridge edge effect of different adjacent materials on overall conductivity (λ_{eff}) of a panel with MF-envelope and a center-of-panel conductivity of $8 \cdot 10^{-3}$ W/(m•K). "d 100x100" is the increase for a panel of 100x100 cm² compared to λ_{cop} and "d 50x100" is the increase for a panel of 50x100 cm² compared to the larger format.

3.3 Use of VIP – Recommendations

Although the processing of VIP under controlled conditions by specially trained personnel in a factory would be highly desirable, only a few prefabricated products and systems are available for the building sector. There are, however, signs that more component and system manufacturers are becoming involved in the development of such products. It can therefore be expected that in the foreseeable future, a wide selection of products such as floor heating systems, outside doors and wall elements with VIP will be offered.

VIP must be handled with care and suitable protective measures and tools employed (protective mats, felt shoes, etc.).

In order to minimize the edge effects of the VIP:

- Select panels that are as square and large as possible (min. 0.5 x 0.5 m²)
- If the envelope of the panel is made of aluminium foil (only rarely nowadays), lay the panels in a double layer, overlapping by at least 5 cm (which, however, is expensive).

VIP must be well protected from mechanical damage. This applies equally to functional loading (e.g. from

Figure 7: Terrace insulation - during installation and the finished terrace.

the floor), inadvertent loading (e.g. dilatation) and subsequent manipulations (e.g. nailing).

VIP are vapour-tight insulation systems, which has to be taken into account in planning the order and thickness of the layers. Furthermore, special attention must be given to the joints between the panels. The joints and edges are usually sealed with a special adhesive aluminium tape, which assures tightness but is relatively brittle. (Figure 8)

Figure 8: Draft sketch for an adhesive warning label to mark VIP panels and building components containing VIP.

The possibility of individual panels or entire areas failing should - at least to date - be included as a risk in the planning and execution. A strategy would be desirable that would aim at being able to replace the VIP in case of failure.

As a rule, one has limited oneself up to now to mitigating the effects of failure, so that a deterioration in the U-value can be accepted and it is assured that on loss of vacuum, there is no risk of loss of comfort or of condensation

4. Outlook: Key-factors for the future success of VIP in buildings

Today we see a very broad interest in the VIP technology from the building branch and the large number buildings in which VIP have been applied. But the quantitative wide use of vacuum insulation is still hindered by mainly two factors:

- high price
- lacking confidence in VIP technology and its use in building applications

Today's cost

The work under the annex has shown that for the design of vacuum insulated constructions one may not use the thermal conductivity of VIP just after production of ~0.004 W/(m·K) but 0.006 to 0.008 W/(m·K). Hereby the already high material cost rises to a level which strongly hinders mass use. Even when gains by space savings and constructional simplifications are considered, the resulting costs are hardly acceptable for standard insulation applications. Unfortunately today little advantage is taken of the regained freedom to develop low U-value building parts with new slim designs. VIP is mainly used in special applications where further advantages are obtained. In renovations by the use of VIP, additional expenses can be avoided, as for instance the lengthening of the roof when insulating the façade. Often VIP is used as a problem solver, e.g. for terrace insulation, VIP is here the only possibility to prevent a step between the heated room and the terrace.

That today the rather crucial direct use of unprotected panels has become the common practice on building sites, has its reason probably also in the high VIP prices. Only very innovative producers of prefabricated insulated building parts (sandwich panels, doors, façade systems etc.) actually invest in the new technology. Many others hesitate because they assess VIP as too expensive to be used in their products.

Cost reduction potentials

It is known that the materials (core and envelope materials) represent quite a high portion of the total cost. With the envelope materials, it can be assumed that it is mainly the production quantity which defines the price. However, fumed silica is already a mass product. Physically it seems to be possible to reduce the portion of fumed silica in the board or to replace it with a cheaper material (e.g. organic foam). In particular the latter requires tighter films to maintain a lower pressure in the panel. Such high barrier films are not only needed for VIP with other core materials but also for (building) applications in more humid / hotter environments. This kind of extreme high barrier film is also developed for other applications (e.g. OLED) which have similar demands. It is therefore quite probable that they will be available soon.

Furthermore the production of VIP is still dominated by expensive manual work. But the portion of the automated production steps has increased in recent years. This development is likely to lead to a price reduction in the near future.

For the next five to ten years, it can be assumed that VIP solutions will remain more expensive than conventional constructions with the same U-value. This is also caused by the fact that conventional insulations are being improved.

Quality assurance

Annex 39 has also contributed to increased confidence in VIP. For instance it was shown that the environment in the main building applications allow a VIP service life of 50 years and more. Actions are needed in the field of quality assurance. It has to be ensured that the VIP applied in a building do not get damaged during the handling and installation processes. Through systematic measurements of the internal pressure of the panels, defective specimens can be tracked down and crucial processes identified. The measurement technology available today is only partially suitable for quality control of the whole process chain. Ongoing developments lead to the conclusion that in the near future a cheaper and more easily applicable measurement device will be available.

ECBCS Annex 39 on the Web

www.ecbcs.org/annexes/annex39.htm

Cost-Effective Commissioning for Existing and Low Energy Buildings – New ECBCS Research Project (Annex 47)

Natascha Castro, National Institute of Standards and Technology, USA

In October 2004 and March 2005, over 40 experts participated in workshops to identify barriers to cost-effective building commissioning. The results of these workshops became the basis for a new annex proposal on "Cost-Effective Commissioning for Existing and Low Energy Buildings" (summarized below), which was approved at the 56th Energy Conservation in Buildings and Community Systems (ECBCS) ExCo meeting in Espinho, Portugal. The first planning-phase meeting will be held on October 24-26, 2005 at the Czech Technical University in Prague.

Background

Commissioning methods and tools are required to ensure that advanced components and systems reach their technical potential and operate energy-efficiently. Likewise, they should strive to improve the energy efficiency of conventional and advanced existing buildings beyond just the design intent.

ECBCS Annex 40 was aimed at developing tools and guidelines for commissioning heating, ventilation and air-conditioning (HVAC) systems. Titled "Commissioning of HVAC Systems for Improved Energy Performance," it clarified the commissioning process on an international basis and developed tools for its implementation in conventional HVAC systems with a focus on functional testing and occupancy. This inter-national effort removed many barriers to commissioning. However, documented commissioning methods are currently only available for conventional HVAC systems and do not address the advanced systems and system combinations that are important for low energy buildings (LEB), such as building scale combined heat and power, integrated control of lighting, blinds and HVAC, and cooling techniques such as evaporative cooling and natural ventilation. Without suitable methods and tools to ensure the correct interaction between components and systems, their performance in the field can be expected to fall significantly short of what is intended.

The current approach for new construction commissioning is to focus on achieving design intent. However, new buildings can often operate using (5 to10) % less energy if they are optimized based on actual use and occupancy rather than using only the information available to the designer. Similarly, retro-commissioning may not have an energy focus if the commissioning provider is called in mainly to solve nagging comfort problems. In the case of existing buildings, the usual practice is to attempt to make the building work as designed. However, the "as-built" and "as-used" building virtually always differs from the original design.

Economic benefits beyond the energy savings include fewer change orders and call-backs for installers, fewer service calls and fewer complaints from occupants. These benefits often exceed \$10/m^2 (\$1/ft^2) in new buildings that are commissioned. Evidence emerging from a study of Leadership in Energy and Environmental Design (LEED) certified buildings performed by the U.S. National Renewable Energy Labboratory and from a number of European studies strongly suggests that commissioning to optimize operation based on actual occupancy and use is even more critical for low energy buildings than for conventional buildings.

There are also a number of environmental benefits associated with reduced energy consumption, including the reduced global warming potential associated with a reduction of carbon emissions, reduced emissions of nitrogen oxides from power plants, and improved comfort and indoor air quality from remedying faults in HVAC systems, although the latter are difficult to quantify.

In order to achieve these benefits, technological and process barriers to greater market penetration must be addressed. It is generally recognized that demonstrating cost-effectiveness, including the persistence of commissioning measures will remove a major barrier to the wider market acceptance of commissioning. Market penetration could be increased through comprehensive development and aggressive deployment of methods and tools that decrease the cost and allow the scaling up of the delivery of commissioning. Additionally, the continuing increase in the fraction of buildings with a Building Energy Management System (BEMS) can also be expected to facilitate market penetration because most of the commissioning methods in use today and most of the automated methods currently under development make use of BEMS.

Work Plan

The Annex will address the following objectives:

- Extend previously developed methods and tools to address advanced systems and low energy buildings, utilizing design data and the buildings' own systems in commissioning
- Automate the commissioning process to the extent practicable
- Develop methodologies and tools to improve operation of buildings in

- use, including identifying the best energy saving opportunities in HVAC system renovations and standard reporting methods for the energy performance of buildings in support of the "European Union Energy Performance of Buildings Directive"
- Quantify and improve the costs and benefits of commissioning, including the persistence of benefits and the role of automated tools in improving persistence and reducing costs without sacrificing other important commissioning considerations

This project will begin by identifying existing barriers to the acceptance of commissioning as standard practice and will develop enabling technologies; for example, methodologies and automated tools to support the "field optimization" approach to commissioning for low energy buildings. The use of automated tools that speed up the process and reduce dependence on scarce and relatively expensive skilled practitioners is expected to further broaden the market for commissioning. Once developed and applied to low energy buildings, these procedures could have substantial impact if eventually applied as standard commissioning practice to all buildings, potentially doubling the energy impact of commissioning in new buildings.

The proposed work focuses on the application of engineering principles to the operation of buildings specifically to achieve energy savings, rather than as a possible side effect. In addition, the commissioning techniques developed through this research will help transition the industry from the intuitive approach that is currently employed in the operation of buildings to more systematic operation that focuses on achieving significant energy savings.

For more information about the Annex and the upcoming planning-phase meeting, please contact the Co-operating agents:

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Scope of Annex	**Subtask**
1) What can be done for future buildings to enable cost-effective commissioning?	**Initial Commissioning of Advanced and Low Energy Building Systems**
The focus is set on the concept, design, construction, acceptance, and early operation phases of buildings.	• Develop information flowchart and information model • Develop general commissioning methodology for advanced & low energy buildings – Functional test procedures – Control strategies for advanced systems – Case studies
2) What can be done for existing buildings and systems to conduct commissioning cost-effectively?	**Commissioning and Optimization of Existing Buildings**
The focus is set on existing buildings where the conditions for commissioning need to be afforded without documentation and limited means for integrated commissioning.	• Develop data visualization, field optimization, and commissioning tools • Perform and disseminate documented case studies be represented?
3) How can the cost-benefit situation of commissioning	**Commissioning Cost-Benefits and Persistence**
Key answers will be provided by developing international consensus methods for evaluating commissioning cost-benefit and persistence, implemented using field data.	• Develop cost-benefit methodology • Develop methodology & tools to enhance persistence • Develop international databases – Cost-benefit, – Persistence

The EU Energy Performance of Buildings Directive

Prof. Eduardo B. Maldonado, Faculdade de Engenharia, Universidade do Porto, Portugal

The buildings sector accounts for 40% of the EU's energy requirements. It offers the largest single potential for energy efficiency. Research shows that more than one-fifth of the present energy consumption and up to 30-45 MTons of CO2/year could be saved by 2010 by applying more ambitious standards to new and when refurbishing buildings, which represents a considerable contribution to meeting the Kyoto targets. It will also make an important contribution towards security of energy supply of the EU because, if nothing is done, the EU will be dependent on 70% from outside sources by 2030.

The aim of improved energy efficiency has been set out in earlier existing legal instruments. Among the main Community legislation for the sector are the Boiler Directive (92/42/EEC), the Construction Products Directive (89/106/EEC) and the buildings provisions in the SAVE Directive (93/76/EEC). The Directive on the energy performance of buildings (2002/91/EC), in force since January 2003, builds on those measures with the aim to provide for an ambitious step-ahead to increase the energy performance of public, commercial and private buildings in all Member States, through cost-effective measures, namely by:

- Setting up a common methodology for integrated buildings energy performance standards, promoting convergence of requirements throughout the EU while accounting for regional climatic and other specific considerations;
- Application of these more demanding standards on new and existing buildings;
- Establishing national or regional Certification schemes for all buildings (new buildings, existing public buildings over 1000 m2 of floor area, and all buildings when sold or rented will be required to get a Certificate), to be issued by independent, accredited experts recognized by Member States;
- Inspection and assessment of boilers/heating and cooling installations.

The common methodology must integrate, among other key factors, insulation, heating, cooling, ventilation, lighting, renewable energy installations, passive systems, CHP, DH/C, position and orientation of the building, natural ventilation and daylighting, etc. CEN has been given a mandate to prepare a new set of Standards to guide EU Member States in the national implementation of building energy calculation procedures. They are already available in draft form, and they should be formally adopted by 2006-2007.

The European Directive on the Energy Performance of Buildings presents a great challenge for the transformation of European building sector towards energy efficiency and the use of renewable energy resources. Governments are required to implement a respective legal framework by January 4, 2006. Certification of buildings and inspections of HVAC systems and equipment can be postponed by up to three years if there is a lack of accredited experts. However, in order to make sustainable energy use happen in real life, local action is essential, such as awareness raising, training and technical support for different professional groups. Towards this end, the European Commission is promoting supporting measures, namely creating a Buildings Platform for central dissemination of information from early 2006, facilitating cooperation between Member States through the Concerted Action for the Transposition of Buildings Directive, where 24 countries are jointly discussing all the practical issues related to Certification, Inspections, Training of experts and implementation of the common methodology since January 2005, funding nearly twenty buildings-related projects through its Intelligent Energy programme (2004-2007), producing videos, brochures and other information materials and supporting numerous conferences and events to pass on the message to the public and professionals throughout Europe.

Annex 39: High Performance Thermal Insulation Systems, and
Annex 40: Commissioning of Building HVAC Systems for Improving Energy Performance

Final Reports Now Available for Free Download at

www.ecbcs.org/annexes/annex39.htm
and www.ecbcs.org/annexes/annex40.htm

First Announcements and Call for Papers

SSB'2006

7th International Conference on System Simulation in Buildings

Thermodynamics Laboratory, PROMETHE Department, 11-13 December 2006, Liège, Belgium

Scope of the Conference

As for the six previous ones, this 7th conference is organized in very close cooperation with the International Energy Agency group "Energy Conservation in Building and Community Systems" (IEA-ECBCS) and with the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).

This conference will be, among others, the occasion to present some final results coming from the IEA-ECBCS Annex 40 " Commissioning of Building HVAC Systems for Improved Building Performance " and to deal with some aspects of the new Annexes 43 " Testing and Validation of Building Energy Simulation Tools ", Annex 47 "Cost Effective Commissioning of Existing and Low-Energy Buildings" and Annex 48 "Heat Pumping and Reversible Air Conditioning".

The following topics will be considered as a priority:

- modeling of HVAC components
- system simulation methods and tools
- application to commissioning
- application to energy management and to maintenance
- application to audit and retrofit

Scientific Committee

Chair : Jean Lebrun (B)

Members: André Ph. (B), Braun J. (USA), Haves Ph. (USA), Holmes M. (U.K.), Jiang Y. (P.R. China), Kummert M. (C), Laret L. (F), Madjidi M. (D), Mitchell J. (USA), Ngendakumana Ph. (B), Peitsman H. (NL), Wang S. (P.R. China).

Language

The official conference language is English.

Abstracts

A one-page abstract must be submitted for every paper. The abstract must include paper title, author's affiliation, address, fax, telephone and e-mail address

Abstracts must be submitted electronically to SSB secretariat.

Calendar

Abstracts due:February 19, 2006

Acceptance of abstracts notified, preliminary program and instructions sent to authors for papers:

April 7, 2006

Paper manuscripts due: June 4, 2006

Notification of paper acceptance and final program:

September 1, 2006

Final form of papers: October 15, 2006

Pre-prints sent to registered participants: November 24, 2006

Conference: December 11-13, 2006

Interest Form

We recommend you to fill in the form via the web on our site http://www.ulg.ac.be/labothap.

Conference Proceedings

Abstracts of the papers will be available on the SSB web site before the conference.

A CD-ROM with the papers will be forwarded to registered participants before the conference.

All papers, along with questions and comments that are generated at the presentation, will be included in the CD-ROM of the conference. This CD-ROM will be forwarded to all participants. A printed version will be also available on request.

Registration fees

before October 30, 2006		after October 30, 2006	
Authors(*)	400 •	Authors(*)	500 •
Participants	500 •	Participants	600 •
Students	150 •	Students	200 •

(*) one per accepted papers

Pre-prints, lunches, coffee breaks, social activities and conference proceedings are included in the registration fees.

Information (registration)

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Papers

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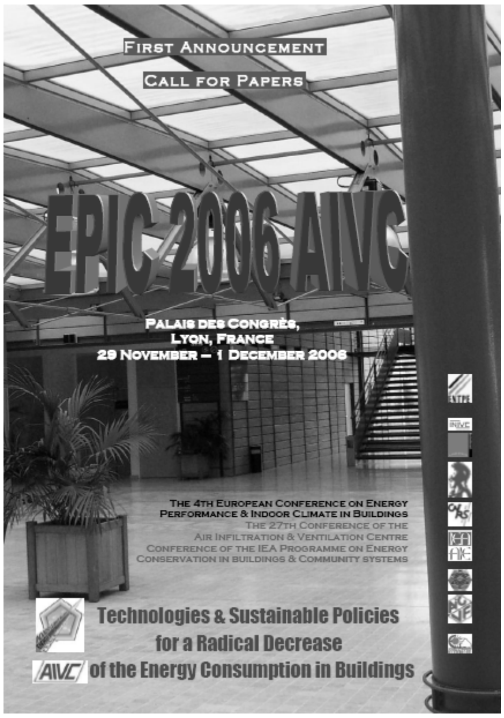
First Announcement EPIC2006AIVC Conference

The 4th EPIC conference and the 27th AIVC conference will be combined and held in Lyon from November 29 till December 1 2006. Moreover, this event will also be an official conference of the IEA programme on energy conservation and community systems.

The title of the conference is "Technologies and Sustainable Policies for a Radical Decrease of the Energy Consumption in Buildings".

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

In order to achieve a sustainable development with respect to the energy use and indoor climate in buildings, significant actions are required on the short and long term. The conference will pay attention to both aspects, whereby technological developments, policies, market implementation, education, … will be discussed. Practical HVAC aspects are covered during the conference but there will be also in parallel and at the same location the CLIMAMED conference.



Presentations on the following topics will be highly appreciated:

1. Extreme low energy buildings and buildings with positive energy
2. Energy Performance Regulations and Certification : where are we and where to go?
3. The existing building stock : technical, economical and social aspects for a wide scale upgrading
4. Performance Assessment of Building Components and Installations
5. Sustainable Urban Planning
6. Advanced glazing, façade and HVAC technologies
7. Natural Ventilation in Urban Settlements
8. Design of Buildings of High architectural and Environmental Quality
9. Contributions & Challenges of the Information Society in relation to achieving Environmental Quality
10. Indoor climate criteria in relation to Sustainable Building
11. Indoor Climate, energy & economy, i.e. the economic value of indoor climate, the overall cost of low energy concepts
12. Opportunities & Barriers for the integration of Renewables in the Built Environment
13. International and National Policies for medium and long term Energy Management – Post-Kyoto
14. Innovative concepts for Education and Training

Deadline for the submission of abstracts is December 1, 2005.

For more information, see http://epic.entpe.org or www.aivc.org

Over 60 ECBCS publications available for free download from www.ecbcs.org/docs

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36 Energy Concept Adviser Working Group Annex Extension (2004-2005)

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38 Solar Sustainable Housing (Solar Heating and Cooling Task 28) (2000-2005)

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39 High Performance Thermal Insulation Systems (2001-)

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40 Commissioning of Building HVAC Systems for Improving Energy Performance (2001-)

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41 Whole Building Heat, Air and Moisture Response (MOIST-ENG)

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42 COGEN-SIM : The Simulation of Building-Integrated Fuel Cell and Other Cogeneration Systems

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43 Testing and Validation of Building Energy Simulation Tools (Solar Heating and Cooling Task 34)

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44 Integrating Environmentally Responsive Elements in Buildings

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45 Energy-Efficient Future Electric Lighting for Buildings

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46 Holistic Assessment Toolkit on Energy Efficient Retrofit Measures for Government Buildings

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47 Cost Effective Commissioning for Low Energy Buildings

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