MARKET OPPORTUNITIES FOR ADVANCED VENTILATION TECHNOLOGY

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'Energy Performance Standardisation and Regulation : status , challenges and ongoing actions

P. Wouters, J. Porrez, D. Van Orshoven, L. Vandaele
BBRI, Belgium

J. C Visier
CSTB, France

Energy Performance standardisation and legislation is receiving an increased interest in many countries. The paper is split up in 3 parts:

- An overview of the present status: which countries have such regulation in force or under preparation, what is the link with European standardisation?
- What are the challenges for achieving an effective EP approach?
- What are important on-going activities?

1. Introduction

Energy Performance (EP) standardisation and regulation is by an increasing number of countries considered as an attractive approach for achieving a more energy efficient built environment. Several countries have already enacted such EP based regulation (the Netherlands, France, ASHRAE approach in North America…), or are preparing one (Germany, Greece, the Flemish Region…).

It is clear that energy performance standardisation and regulation can create '*market opportunities for advanced ventilation technology*'. However, it also can be or become a barrier for such advanced ventilation technologies.

The discussion in this paper is mainly focused on the challenges to be met for creating an environment that really stimulates the design and construction of energy efficient buildings with good indoor climate conditions. Moreover, several on-going international activities are briefly described.

2. Why an EP approach and why now?

There are clearly some remarkable trends in the expression of requirements:

- In the seventies, eighties and the beginning of the nineties, many countries have set up standards and regulations concerning minimum requirements regarding the thermal insulation of buildings. Often, this was combined with requirements regarding the minimum efficiency of heating systems. This approach was quite logical since many buildings were poorly insulated (due to this, transmission losses represented the bulk of the heating losses) and equipped with heating systems with a poor performance;
- In the eighties, several regulations included the so-called passive solar performances of buildings (use of free solar gains in winter time) whereby minimum requirements concerning the net heating demand were imposed;
- Since the beginning of the nineties, there is a strong tendency for setting up requirements whereby attention is paid to the total energy use of buildings. This trend is due to the increased importance of summer comfort and cooling, the potential contribution of renewable energy sources, the relative and sometimes absolute increase in energy use due to ventilation.

3. No Energy Performance without acceptable indoor climate

As far as the authors are concerned, an EP approach that does not pay attention to appropriate indoor climate conditions is not on the right track. Therefore, an EP approach must have as a basic idea the correct assessment of the energy efficiency of a building for an agreed level of indoor climate conditions, whereby particular attention is given to thermal comfort in summer, indoor air quality and visual comfort (figure 1). It implies that a meaningful approach cannot only be based on a procedure that aims to limit the (normalised) energy use (❶) of a building. It should be accompanied by appropriate procedures that guarantee that acceptable indoor climate conditions (❷) can be achieved for given boundary conditions, such as climate, occupancy, etc.

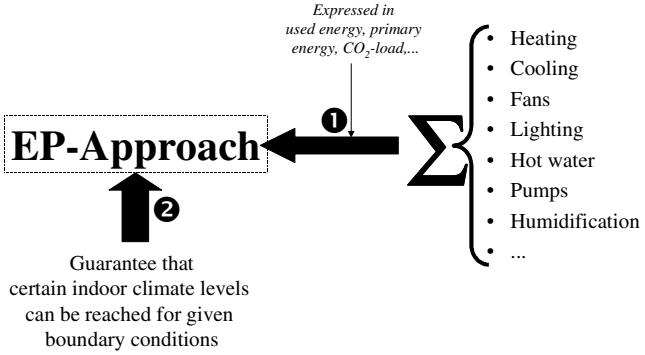

figure 1: The EP level of a building includes all building related energy consumption (under normalised conditions) and assumes appropriate indoor climate conditions

4. Challenges for an Energy Performance standardisation

In order to achieve an EP approach that really achieves environmental and societal quality, a whole range of challenges have to be dealt with (figure 2):

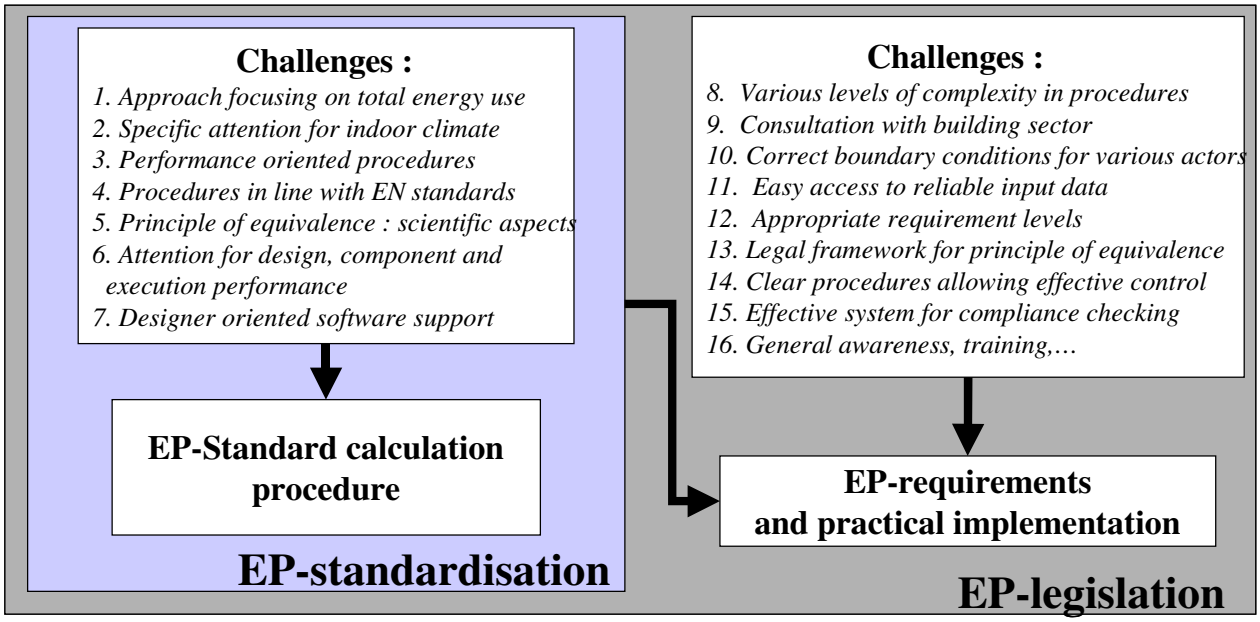

figure 2: Challenges for and interaction between EP standardisation and legislation (Wouters, 2000)

1. *An EP approach must focus on the overall energy consumption*

   The total energy consumption of the building and its installed appliances has to be considered, whereby certain assumptions have to be made with respect to various boundary conditions.

2. *Special attention to indoor climate*

   An EP approach must pay explicit attention to the indoor climate conditions. Of particular interest is the thermal comfort in summer and the indoor air quality.

3. *Performance oriented procedures*

   As much as possible, the whole EP approach must be based on a performance-oriented approach. This does not necessarily mean that the whole calculation procedure must be expressed in performance terms, but that the method is founded on a performance based philosophy. This is especially crucial for allowing the principle of equivalence.

4. *Procedures in line with CEN standards*

   It is clear that EP procedures should be based as much as possible on the CEN standards. A practical problem is the fact that certain procedures are not yet approved as EN-standard.

5. *Open platform for innovation: coherent scientific philosophy with respect to the principle of equivalence*

   A crucial point is that the whole EP philosophy takes from the beginning the principle of equivalence into consideration. It means in practice that one should have a correct philosophy for allowing in a later phase a correct assessment of the principle of equivalence.

6. *Attention for design, component and execution performances*

   It is important to have not only good component performances but also a good design and a correct execution. Therefore, an EP approach should pay attention to these 3 aspects. As

far as legislation is concerned, the execution aspects can only be included in the assessment if proof of compliance is required after construction ('dossier as built').

7. *Support by means of designer oriented software*

5. Challenges for an Energy Performance legislation

An Energy Performance legislation specifies the minimum performance level, whereby the agreed Energy Performance standard has to be used as determination method or, if not fully covered by the standard, use can (partly) be made of the principle of equivalence. In order to have an effective approach, a whole range of requirements has to be met, e.g.:

8. *Various possibilities for proving compliance with required performance level, with specific attention for simplified procedures for simple projects.*

   Especially for small projects and/or projects with very classical techniques and/or in a market which makes little use of specific consultancy on building physics, there may be a need for a simpler procedure than the standard EP calculation. Such approach is in principle almost purely descriptive. The other extreme is the approach that is required for applying the principle of equivalence. It may require detailed calculations going far beyond the standard EP calculation and it is mainly performance based.

9. *The preparation procedure should include consultation with all stakeholders*

   Implementing an EP legislation should be preceded by consultation with the various partners: designers, industry, building contractors, consumer organisations…. This is important for various reasons: to inform, to obtain feedback on the applicability in practice….

10. *Correct boundary conditions for various stakeholders*

    In order to achieve a successful implementation of an EP approach, it is important that the various stakeholders (architects, building contractors, investors, building owners, administration) have appropriate boundary conditions that motivate them to correctly apply the regulations and/or to take actions that increase the probability for a correct application.

11. *Easy access to reliable product data*

    Reliable and well-defined product data are essential inputs for applying an EP procedure. This means that, first of all, there must be appropriate determination procedures. Moreover, industry must make these data available whereby easy access by the users is important. As far as possible, there should be default data for most products and systems, which should be an underestimation of the real performances.

12. *Requirement levels which are performance oriented and achievable by the market*

    An EP regulation can contribute to a better environmental and societal quality if the levels of requirement are on the one hand sufficiently severe for stimulating better building design, technology and execution and if on the other hand these levels are achievable by the market.

    Therefore, an approach as presented in figure 3 may be relevant:

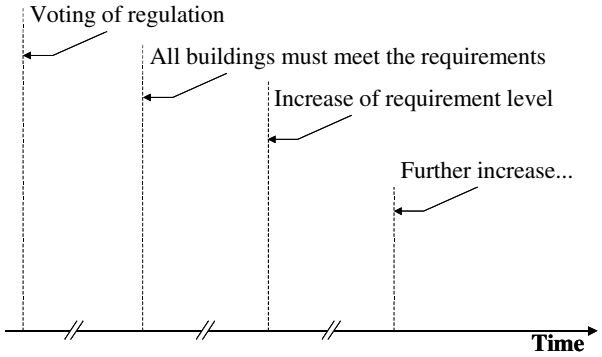

figure 3 : Gradual increase of the requirements

- In a first phase, the building sector must become familiar with the new approach. Therefore, sufficient time should be allowed between the adoption of the new legislation and its effective application on new buildings;
- Later on, the requirements can/should be gradually increased. This has e.g. been done in the Netherlands where the required EP level (based on NEN 5128) was in the beginning 1.40 (1996), then it became 1.2 (1998) and since January 2000, it has become 1.0.

13. Legal framework for the application of the principle of equivalence

Given the importance of the principle of equivalence as a measure for correctly assessing innovative approaches, a legal framework for proof of compliance is needed. The authors believe that it is not realistic to expect from a communal civil servant to correctly assess such approaches and, therefore, an assessment procedure at a higher level is required.

14. Legal framework requiring proof of compliance after construction

Given the building practice in certain countries, it seems for most countries crucial to require proof of compliance with the regulation after construction (and not only when requesting a building permit) and this for the following reasons:

- It allows to pay attention to the execution aspects;
- The motivated architects are in a stronger position to impose the desired performance;
- The motivated builders know quite well the composition of their building. They will have the possibility of checking the conformity between the dossier 'as built' and the reality;
- The material producers and building contractors are in a stronger position;
- As a result, the governmental officials will no longer be the only controllers, since motivated building owners, architects, material producers, building contractors and possible buyers of the building are becoming able to carry out control;
- The risk of non-compliance with the regulations strongly reduces and it will lead to more energy efficient buildings and a better environmental performance of the building stock;
- Finally, a dossier 'as built' is at the same time an ideal basis for energy certification.

15. An effective system for checking compliance with the regulation

A legislation that is based on a proof of compliance after construction strongly enlarges the number and type of persons who can check the works. Nevertheless, there is still a major role for the administration to set up a framework for carrying out random controls and for taking appropriate measures in case of non-compliance.

16. Actions in relation to creating general awareness, training…

It probably is in many cases important to pay sufficient attention to informing the market about the philosophy and advantages of an EP approach. Moreover, appropriate training programmes are crucial.

6. Energy Performance Standardisation: an open platform for innovation and creativity

The availability of cost-effective innovation technologies with respect to indoor climate and energy efficiency is not a guarantee for its large-scale application by the building sector. Many users are not able to correctly assess the benefits of certain innovations. Moreover, creative solutions for improving the indoor climate and/or energy efficiency are not always understood by the decision makers. An EP approach has the potential to stimulate innovation and to promote creative solutions.

In figure 4, various possible actions (all aiming to improve the energy efficiency of a building) are compared with respect to their investment and the energy savings (in EP terms). In principle, an EP approach must allow to assess all relevant technological improvements, therefore a situation as presented for 'measure' E should not occur. As far as the various measures have no other advantages, an EP approach will orient the market to those measures with the best 'investment-energy savings'-ratio, which corresponds in figure 4 to those measures with the steepest slope. A major advantage for governments is that one can focus on a single global requirement; the market forces can determine the most attractive options.

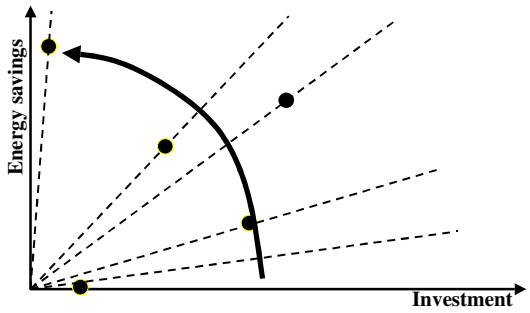

figure 4: An EP approach stimulates the use of cost-effective measures

7. Relevant international activities

At present, there are several activities which directly or indirectly or very relevant for the issue of energy performance standardisation and regulation. Three of these activities are briefly described :

- the EC SAVE-ENPER project (§8);
- the proposed European Directive on energy efficiency (§9);
- the IEA annex 35 'Hybvent' working group on equivalent energy performance targets in standards and regulations (§10).

8. EC SAVE-ENPER project

This European study (2001-2003) deals with the issue of harmonisation in European Building Codes integrating the project proposals 'ENPER' and 'TEBUC' into a single clustered project programme.

A first part of the study concerns the investigation of the possibilities to design harmonised building codes at the European level. Therefore the existing European building regulations are compared, extending existing work in that field. Since within the time horizon of the Kyoto protocol (2008 – 2012), the existing building stock will be responsible of most of the energy consumption and CO_2-emissions, possible measures to foster energy efficiency in this field will be particularly scrutinised. On this basis general principles for a model building code for use in new buildings and - where applicable - renovation will be developed. Furthermore the questions of checking the application and building certification will be investigated, so that this code can serve as a reliable and visible tool for ensuring building energy efficiency.

Since the Energy Performance (EP) standardisation and legislation is in many member states considered to be an attractive tool for increasing the energy efficiency of new buildings and existing buildings, the second part of the study is dealing with this issue in detail. Several countries have already an Energy Performance Regulation (EPR) in place (Netherlands, France, Spain, Sweden, etc.) and/or are preparing a new regulation (Belgium, Denmark, France, Germany, Greece, etc.). Whereas a whole range of European standards are prepared and/or adopted that cover several subdomains of an EP standard, there are major differences in the overall approach used in the different countries for determining the EP level of a building. Setting up a platform for information exchange among the prominent national players, to systematically collect and summarise the different approaches and to develop suggestions for a European ‘model code’ is therefore another main goal of this project.

The project consists of two subprojects ENPER (Working Package B) and TEBUC (Working Package C) focusing on different aspects of building regulations (cf. figure 5). In order to ensure optimal synergies from the two projects the co-ordination is ensured through task A.

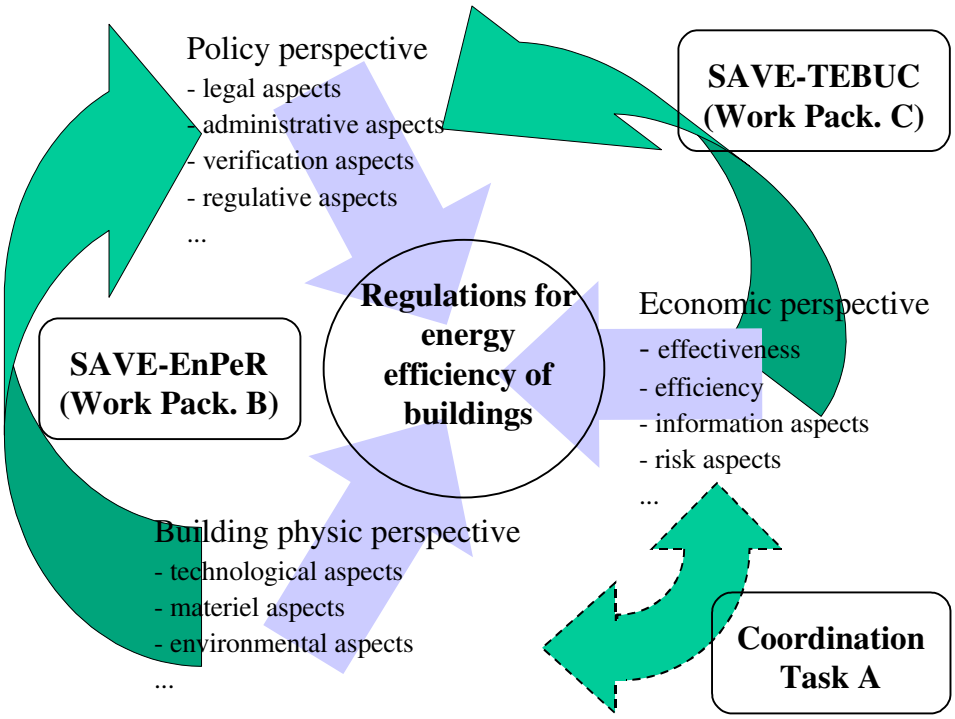

figure 5 : Perspectives on building regulations and corresponding tasks

The main activities are summarised in table 1.

Activity	Task leader
Task A: Project Co-ordination	BBRI
Task B1: EP calculation procedure(s)	CSTB
Task B2: Innovative concepts	BBRI
Task B3: Legal aspects	Un. Athens
Task B4: Applicability on existing buildings	BRE
Task B5: Impact on market	TNO-BOUW
Task B6: Model building code	TNO-BOUW
Task B7: Website	FhG ISI
Task B8: Seminars	UCD & Task leaders
Task B9: Priorities	BBRI
Task C1 – C4: TEBUC	IER

table 1 : Tasks in SAVE ENPER-TEBUC project and task leaders

Information can be found on the website www.enper.org.

8.1 Preliminary results of enquiry among participating countries

In this paper, only a few preliminary results are included. It has to be stressed that the presented results have not been checked. It is envisaged to have at the next project meeting in November 2001 more refined and checked results.

- **Energy aspects considered in the EP procedures**

In table 2, an overview is given of the considered energy flows in the various EP calculations. The table shows that various aspects are considered in many methods and that there are substantial differences between the various methods. According to this table, ventilation is considered in all methods.

	Austria	Belgium	Denmark	Finland	France	Germany	GB	Greece	Ireland	Netherlands	Norway	Portugal	Spain	Sweden	Switzerland	**T Already**	**T-Will be**
Transmission related energy flows	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	**15**	
Ventilation related energy flows	**S**	**S**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**15**	
Internal gains	S	S	A	A	A	A		A	A	A	A	A			A	**12**	
Solar gains	S	S	A	A	A	A	A	A	A	A	A	A	W	A	A	**14**	**15**
Lighting related energy flows		W		A	A	A	A	A	A	A	A	A			A	**11**	
Energy for fan and pumps		W	W	A	A	A				A	A		A		A	**8**	**9**
Heating systems at the building level		W	W	A	A	A	A	A	A	A		A	A		A	**11**	**12**
Heating system at the district level						A				A						**2**	
Losses of heating/cooling distribution		W			A	A		A	A	A			A			**7**	
Domestic hot water		W	W	A	A	A	A	A	A	A		A	A	A	A	**12**	**13**
Cooling systems		W	W		A	A	A	A		A		A	A			**8**	**9**
Renewable energies: thermal		W	W		W			A	A	A					A	**5**	**7**
Renewable energies: electrical		W	W					A		A					A	**4**	**5**
Total A+S	**4**	**4**	**4**	**8**	**10**	**11**	**7**	**11**	**9**	**13**	**6**	**8**	**7**	**4**	**10**		
Total A+S+W if different from A+S		**12**	**10**		**11**								**8**				

table 2 : SAVE-ENPER : preliminary results from enquiry about energy aspects covered by the legislation (A = already included, W = will be included in close future, S = in part of regions) Source : Visier (2001)

- **Comfort related issues**

In table 3, a (preliminary) overview is given of the handling of comfort related issues in the framework of the various EP regulations. It must be stressed that the information has to be checked and that it only concerns aspects directly handled by the EP regulation. As an example, there are in the Netherlands requirements for indoor air quality and ventilation but are not imposed as part of the EP regulation.

	Austria	Belgium	Denmark	Finland	France	Germany	GB	Greece	Ireland	Netherlands	Norway	Portugal	Spain	Sweden	Switzerland	**Total**
Thermal comfort in winter				S				S					S	S	S	**5**
Thermal comfort in summer		E	S	S	S		S	S					S		S	**8**
Indoor air quality		S	S	S									S	S	S	**6**
Visual comfort					E			S		E				S		**4**
Humidity								S					S	S	S	**4**

table 3 : SAVE-ENPER enquiry : preliminary results (S= specific requirement E = Energy penalty) Source: Visier (2001)

- **Execution related aspects**

In table 4, a preliminary analysis is given concerning the attention paid to execution related aspects in the various standards and regulations. Building and ductwork airtightness as well as air flow rates seem to receive attention in many countries.

	Building air tightness	**Air flow rates**	**Lighting levels**	**HVAC TAB**	**Other**	**Handled in the calculation**
Austria						
Belgium	X	X			Also duct air tightness.	E
Denmark						
Finland		X		X		M
France	X				Duct air tightness	E
Germany	X	X		X		
Great Britain	X			X		M
Greece	X		X	X	U-values	M
Ireland						
The Netherlands						
Norway	X	X				E
Portugal		X		X		
Spain		X		X		M
Sweden	X	X				M
Switzerland	X		X			M
Total :	**8**	**7**	**2**	**6**		**6M, 3 E**

table 4 : SAVE-ENPER enquiry : Preliminary results concerning execution related aspects (M=mandatory, E = energy credit) Source : Visier (2001)

9. Proposal for a European Directive on energy efficiency

In the first semester of 2001, the European Commission has approved to submit to the European Parliament and Council a proposal for European Directive on energy efficiency. The basic objective underlying this draft Directive is to promote the improvement of the energy performance of buildings within the EU, ensuring in so far as possible that only such measures as are the most cost-effective are undertaken.
Given the low turn-over rate of buildings (lifetime of 50 to more than 100 years) it is clear that the largest potential for improving energy performance in the short and medium term is in the existing stock of buildings. The proposed Directive lays down a framework that will lead to increased co-ordination between Member States of legislation in this field. The practical application of the framework, however, will remain primarily the responsibility of the individual Member States.
The proposed EC directive covers four main elements:

(a) Establishment of a general framework of a common methodology for calculating the integrated energy performance of buildings.
(b) Application of minimum standards on the energy performance to new buildings and to certain existing buildings when they are renovated.
(c) Certification schemes for new and existing buildings on the basis of the above standards and public display of energy performance certificates and recommended indoor temperatures and other relevant climatic factors in public buildings and buildings frequented by the public.
(d) Specific inspection and assessment of boilers and heating/cooling installations.

In annex, the full text of the proposed directive is included. Article 4 clearly stipulates that indoor climate requirements should receive attention in order 'to avoid possible negative effects such as inadequate ventilation'.

Moreover, the annex to the proposed directive explicitly refers to ventilation.

10. IEA Annex 35 HYBVENT working group

The IEA Annex 35 project 'Hybvent' of the Implementing Agreement on Energy Conservation in Buildings and Community Systems (ECBCS) has set up a specific working group on 'Equivalent energy performance targets in Standards and regulations'.

This working group has as major objective to develop a source book in relation to the handling of advanced ventilation technologies in the framework of energy performance regulations.

11. Conclusions

Energy Performance standardisation and regulation is probably the most effective approach for at the same time improving the indoor climate in buildings (especially thermal comfort in summer and indoor air quality) and increasing the energy efficiency.

In order to achieve success, a whole range of challenges has to be met.

Several European countries are working in a similar way towards an overall Energy Performance regulation. The SAVE-ENPER project is expected to contribute to a better

understanding of the applied approaches and new developments. Moreover it should make a substantial contribution towards the development of a common European approach.

The proposed European Directive on Energy Efficiency can contribute to a better streamlining of the approaches used by the EU member countries.

There is no doubt that the actions in relation to energy performance standardisation and regulation are important for advanced ventilation technologies.

12. References

1. European Commission, Proposal for a Directive of the European Parliament and of the Council on the Energy Performance of buildings (presented by the Commission); Commission of the European Communities; Brussels, 11.5.2001; COM(2001) 226 final; 2001/0098 (COD)
2. J.C. Visier, Enquiry on energy performance regulations, EC SAVE ENPER-TEBUC project, CSTB, June 2001
3. Wouters P. Quality in relation to indoor climate and energy efficiency : an analysis of trends, achievements and remaining challenges, PhD thesis UCL, Louvain-La-Neuve 2000

ANNEX :

Proposal for a
DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
on the energy performance of buildings

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,
Having regard to the Treaty establishing the European Community, and in particular Article 175 thereof,
Having regard to the proposal from the Commission,
Having regard to the opinion of the Economic and Social Committee,
Having regard to the opinion of the Committee of the Regions,
Acting in accordance with the procedure laid down in Article 251 of the Treaty,

Whereas:

(1) Article 6 of the Treaty requires environmental protection requirements to be integrated into the definition and implementation of Community policies and actions.
(2) The natural resources, to whose prudent and rational utilisation Article 174 of the Treaty refers, include oil products, natural gas and solid fuels, which are essential sources of energy but also the leading sources of carbon dioxide emissions.
(3) Increased energy efficiency constitutes an important part of the package of policies and measures needed to comply with the Kyoto Protocol, and should appear in any policy package to meet further commitments.
(4) Demand management of energy is an important tool enabling the Community to influence the global energy market and hence the security of energy supply in the medium and long term.
(5) The Council in its Conclusions of 30 May 2000 and of 5 December 2000 endorsed the Commission's Action Plan on Energy Efficiency and requested specific measures in the building sector.
(6) The residential and tertiary sector, the major part of which is buildings, accounts for more than 40 % of final energy consumption in the Community and is expanding, a trend which is bound to increase its energy consumption and hence also its carbon dioxide emissions.
(7) Directive 93/76/EEC of 13 September 1993 to limit carbon dioxide emissions by improving energy efficiency (SAVE) , which requires Member States to develop, implement and report on programmes in the field of energy efficiency in the building sector, is now starting to show some important benefits. However, a complementary legal instrument is needed to lay down more concrete actions with a view to achieving the great unrealised potential for energy savings and reducing the large differences between Member States' results in this sector.
(8) Directive 89/106/EEC on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products requires that the construction works and its heating, cooling and ventilation installations must be designed and built in such a way that the amount of energy required in use shall be low, having regard to the climatic conditions of the location and the occupants.
(9) The energy performance of buildings should be calculated on the basis of a methodology that integrates, in addition to thermal insulation also other factors that play an increasingly important role such as heating/air-conditioning installations, application of

renewable energy sources and design of the building. A common approach to this process, carried out by qualified personnel, will contribute to a level playing field as regards efforts made in Member States to energy saving in the buildings sector and would introduce transparency for prospective owners or users with regard to the energy performance in the Community property market.

(10) Buildings will have an impact on long-term energy consumption and new buildings should therefore meet minimum energy performance standards tailored to the local climate. As the application of alternative energy supply systems is generally not explored to its full potential, a systematic assessment of the feasibility of such systems for new buildings above a certain size is appropriate.

(11) Major renovations of existing buildings above a certain size should be regarded as an opportunity to take cost effective measures to enhance energy performance.

(12) By providing objective information on the energy performance of buildings when they are constructed, sold or rented out, energy certification will help to improve transparency of the property market and thus encourage investment in energy savings. It should also facilitate the use of incentive systems. Public authority buildings and buildings frequently visited by the public should set an example by taking environmental and energy considerations into account and therefore, should be subject to energy certification on a regular basis. The dissemination to the public of this information on energy performance should be enhanced by clearly displaying these energy certificates. Moreover, the displaying of officially recommended indoor temperatures, together with the actual measured temperature, should discourage the misuse of heating, air-conditioning and ventilation systems. This will contribute to avoiding unnecessary use of energy and to safeguard comfortable indoor climatic conditions (thermal comfort) in relation to the outside temperature.

(13) Regular maintenance of boilers and of central air conditioning systems by qualified personnel contributes to maintaining their correct adjustment in accordance with the product specification and in that way will ensure optimal performance from an environmental, safety and energy point of view. An independent assessment of the total heating installation is appropriate whenever replacement could be considered on the basis of cost effectiveness.

(14) In accordance with the principles of subsidiarity and proportionality as set out in Article 5 of the Treaty, general principles providing for a system of energy performance standards and its objectives should be established at Community level, but the detailed implementation should be left to Member States, thus allowing each Member State to choose the regime which corresponds best to its particular situation. This Directive confines itself to the minimum required in order to achieve those objectives and does not go beyond what is necessary for that purpose.

(15) Provision should be made for the possibility of rapidly adapting the methodology of calculation in the field of energy performance of buildings to technical progress and to future developments in standardisation.

(16) Since the measures necessary for the implementation of this Directive are measures of general scope within the meaning of Article 2 of Council Decision 1999/468/EC of 28 June 1999 laying down the procedures for the exercise of implementing powers conferred on the Commission, they should be adopted by use of the regulatory procedure provided for in Article 5 of that Decision,

HAVE ADOPTED THIS DIRECTIVE:

Article 1

A common framework is hereby created to promote the improvement of the energy performance of buildings within the Community, taking into account climatic and local conditions.

This Directive lays down requirements as regards :

(a) the general framework of a common methodology for calculating the integrated energy performance of buildings,
(b) the application of minimum standards on the energy performance of new buildings,
(c) the application of minimum standards on the energy performance of large existing buildings that are subject to major renovation,
(d) energy certification of buildings, and for public buildings, prominent display of this certification and other relevant information, and
(e) regular inspection, of boilers and of central air-conditioning systems in buildings and in addition an assessment of the heating installation in which the boilers are older than 15 years.

Article 2

For the purpose of this Directive, the following definitions shall apply :

(1) *building*: a building as a whole or, in the residential sector, parts of the building which have been designed to be used separately such as apartments or semi-detached houses;
(2) *energy performance of a building*: the total energy efficiency of a building, reflected in one or more numeric indicators which have been calculated, taking into account insulation, installation characteristics, design and positioning, own energy generation and other factors that influence the net energy demand;
(3) *minimum energy performance standard of a building*: a regulated minimum requirement as regards the energy performance of buildings;
(4) *energy performance certificate of a building*: an officially recognised certificate in which the result of the calculation of the energy performance of a building according to the methodology set out in the Annex has been laid down;
(5) *public buildings*: buildings occupied by public authorities or frequently visited and used by the general public, such as: schools, hospitals, public transport buildings, indoor sports centres, indoor swimming pools and retail trade services buildings larger than 1000 m²;
(6) *CHP (combined heat and power* :the simultaneous conversion of primary fuels into mechanical or electrical energy and heat;
(7) *air conditioning system*: installation designed to cool and condition the ambient air;
(8) *boiler*: the combined boiler body and burner-unit designed to transmit to water the heat released from burning;
(9) *effective rated output (expressed in kW)*: the maximum calorific output laid down and guaranteed by the manufacturer as being deliverable during continuous operation while complying with the useful efficiency indicated by the manufacturer;
(10) *useful efficiency (expressed in %)*: the ratio between the heat output transmitted to the boiler water and the product of the net calorific value at constant fuel pressure and the consumption expressed as a quantity of fuel per unit time;

(11) *heat pump*: installation that extracts heat from the surrounding environment and supplies it to the controlled environment.

Article 3

Member States shall adopt a methodology of calculation of the energy performance of buildings of which the general framework is set out in the Annex. This methodology shall be further developed and defined in accordance with the procedure referred to in article 11(2). The energy performance of a building shall be expressed in a transparent and simple manner and may include a CO_2 emission indicator.

Article 4

Member States shall take the necessary measures to ensure that new buildings which are intended to be regularly used meet minimum energy performance standards, calculated according to the methodology framework set out in the Annex. **These standards should include general indoor climate requirements in order to avoid possible negative effects such as inadequate ventilation**. These energy performance standards shall be updated at least every five years in order to reflect technical progress in the building sector. Member States may exclude historic buildings, temporary buildings, industrial sites, workshops and residential buildings which are not used as normal residences.
For new buildings with a total surface area over 1000 m², Member States shall ensure that the technical, environmental and economic feasibility of installing decentralised energy supply systems based on renewable energy, CHP, district heating or, under certain conditions, heat pumps, is assessed before the building permit is granted. The result of such an assessment shall be available to all stakeholders for consultation.

Article 5

Member States shall take the necessary measures to ensure that the energy performance of existing buildings with a total surface area over 1000 m² which are being renovated, are upgraded in order to meet minimum energy performance standards in so far as these are technically feasible and involve additional costs that can on the basis of the current average mortgage rate be recovered within a period of 8 years by the accrued energy savings.
This principle shall apply in all those cases where the total cost of the renovation is higher than 25 % of the existing insured value of the building.

Article 6

1. Member States shall ensure that, when buildings are constructed, sold or rented out, an energy performance certificate, being not older than 5 years, is made available to the prospective buyer or tenant.

   Member States may exclude historic buildings, temporary buildings, industrial sites, workshops and residential buildings which are not used as normal residences
2. The energy performance certificate for buildings shall provide relevant information for prospective users. It shall include reference values such as current legal standards and best practice in order to make it possible for consumers to compare and assess the energy performance of the building. The certificate shall be accompanied by recommendations for the improvement of the energy performance.

3. Member States shall require for public buildings an energy performance certificate, which is not older than 5 years, to be placed in a prominent place clearly visible to the general public.
   In addition, for public buildings the following information shall be clearly displayed:
   (a) the range of indoor temperatures and, when appropriate, other relevant climatic factors such as relative humidity, that are recommended by the authorities for that specific type of building.
   (b) the current indoor temperature and other relevant climatic factors indicated by means of a reliable device or devices.

Article 7

Member States shall lay down the necessary measures to establish a regular inspection of boilers of an effective output of more than 10 kW of which the requirements are set out in the Annex. These requirements shall be further developed and defined in accordance with the procedure referred to in article 11(2).

Article 8

Member States shall lay down the necessary measures to establish a regular inspection of central air conditioning systems of an effective output of more than 12 kW of which the requirements are set out in the Annex. These requirements shall be further developed and defined in accordance with the procedure referred to in article 11(2).

Article 9

Member States shall ensure that the certification of buildings and inspection of heating and air-conditioning systems are carried out by qualified and independent personnel.

Article 10

Any amendments necessary in order to adapt the Annex to technical progress shall be adopted in accordance with the procedure referred to in Article 11(2).

Article 11

1. The Commission shall be assisted by the committee established by Article 10 of Council Directive 92/75/EEC , hereinafter referred to as the “committee”, composed of representatives of the Member States and chaired by the representative of the Commission.
2. Where reference is made to this paragraph, the regulatory procedure laid down in Article 5 of Decision 1999/468/EC shall apply, in compliance with Article 7 and Article 8 thereof.
3. The period provided for in Article 5(6) of Decision 1999/468/EC shall be three months.

Article 12

1. Member States shall bring into force the laws, regulations and administrative provisions to comply with this Directive by 31 December 2003 at the latest.

When Member States adopt those provisions, they shall contain a reference to this Directive or shall be accompanied by such reference on the occasion of their official publication. Member States shall determine how such reference is to be made.

2. Member States shall communicate to the Commission the provisions of national law which they adopt in the field covered by this Directive.

Article 13

This Directive shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Communities*.

Article 14

This Directive is addressed to the Member States.

Done at Brussels,

For the European Parliament	*For the Council*
The President	*The President*

Proposed European directive on Energy efficiency : Annex

A. Framework for the calculation of energy performances of buildings (Article 3)

1. The methodology of calculation of energy performances of buildings shall integrate the following aspects:
    a. thermal insulation (of building shell and installations)
    b. heating installation and hot water supply
    c. air-conditioning installation
    d. ventilation system
    e. lighting installation
    f. position and orientation of houses and apartments

2. The positive influence of the following aspects shall in this calculation be taken into account:
    a. solar systems and other heating and electricity systems based on renewable energy sources
    b. electricity produced by CHP and/or district heating systems

3. Buildings should for the purpose of this calculation at least be classified into the following categories:
    a. single family houses of different types
    b. apartment blocks
    c. offices
    d. education buildings
    e. hospitals
    f. hotels and restaurants
    g. wholesale and retail trade services buildings
    h. other types of energy consuming buildings

B. Requirements for the inspection of boilers (Article 7)

The inspection of boilers shall have regard to energy consumption and limiting carbon dioxide emissions.

Boilers of an effective output of more than 100 kW shall be inspected at least every 2 years For heating installations with boilers of an effective rated output of more than 10 kW which are older than 15 years, Member States shall lay down the necessary measures to establish a one- off inspection of the whole heating installation. On the basis of this inspection, which shall include an assessment of the boiler efficiency at full and part load and the boiler sizing compared to the heating requirements of the building, the competent authorities shall provide advice to the users on the replacement of the boilers and on alternative solutions.

C. Requirements for the inspection of central air conditioning systems (Article 8)

The inspection of central air conditioning systems shall have regard to energy consumption and limiting carbon dioxide emissions.

On the basis of this inspection, which shall include an assessment of the air-conditioning efficiency at full and part load and the sizing compared to the cooling requirements of the building, the competent authorities shall provide advice to the users on possible improvement or replacement of the air-conditioning system and on alternative solutions.