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An overview of national trends related to innovative ventilation systems

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1 Introduction

This paper summarises presentations and discussions that took place during the workshop entitled “Trends in national building ventilation markets and drivers for change” held in Ghent, Belgium, in March 2008 with a specific focus on innovative (ventilation) systems. Before this workshop, experts were asked to provide information regarding their national situation and the difficulties they experienced to improve the situation in terms of market penetration of innovative systems, indoor air quality and energy use requirements, and compliance check schemes. This has resulted in a set of Ventilation Information Papers published in the same series. This paper summarises the innovation issue.

2 Definition of innovative systems

The word "innovation" is often used to promote new products. And indeed, the usual definition of innovation is "a new method, idea, product, etc" [1].

However, in the context of energy performance of buildings (EPB) regulations, innovative systems are defined as:

- systems which most probably give a better performance in terms of the energy performance of buildings than the usual systems and,
- whose performance cannot be assessed by the standard EPB calculation methods.

According to this definition, some systems may be innovative in some countries and not in other ones.

The discussions during the workshop have reflected these two aspects.

3 Drivers and barriers for innovation in the ventilation industry

Based on the national contributions, the current drivers for innovation in the ventilation industry were identified. It appeared that some drivers were common to the residential and the non-residential ventilation markets, but some drivers were clearly different, and that three main driver types could be identified: the indoor air quality aspects, the thermal comfort aspects and the energy aspects (Table 1).

Historically, the energy aspects were maybe the first drivers for change. Due to the energy crisis, we moved from a situation where ventilation was provided by building leakages and/or window openings only to a situation where simple ventilation systems, like controlled natural ventilation or mechanical exhaust ventilation, were installed.

Market / Driver type	Both residential and non residential	Residential ventilation market	Non-residential ventilation market
Indoor Air Quality	- Commisioning and compliance - Maintenance	- Higher client expectations - Increase in prevalence of asthma and allergies - Health and healthy materials	- Improved productivity
Thermal comfort		- Higher client expectations - Increased need for cooling	- Improved productivity - Increased need for cooling
Energy	- Increasing energy price - Holistic approach (EPBD)		

Table 1 : Drivers for the ventilation market

Different technical solutions were identified to solve the energy issues:

- Reduction of the ventilation need by reducing the emission of pollutants. Finland is certainly a pioneer in this way with the development of a material labelling scheme; Japan also mentioned such a scheme.
- Reduction of the air flow rate, for instance by demand controlled ventilation, or by increasing the ventilation effectiveness.
- Reduction of the heating demand, by using heat recovery, solar walls and ground heat exchangers.
- Reduction of the cooling demand, by using mechanical free cooling and intensive natural night ventilation.
- Reduction of electricity consumption for air transport, by using high efficiency fans, low pressure systems, decentralised systems.

According to the presentations given at the workshop, hybrid ventilation is considered as a potential innovative solution in several countries, including Brazil, Japan, Korea, Poland, even if there is currently a lack of adequate technical solutions (as mentioned in the Brazilian presentation) or if further researches are still necessary.

The role of standards and regulations as barriers or as drivers for change has been highlighted in several contributions. Examples:

- In the UK presentation, it was mentioned that regulations are the main driver for changes.
- Demand controlled ventilation could be a way to save energy without deteriorating the IAQ, but is not allowed in residential buildings in Denmark at the present time.
- In the UK and Finland presentations, it was considered that the ventilation regulations are good drivers for innovative ventilation systems, as they are performance based, as most requirements are related to indoor climate targets and fewer requirements for system specific issues.
- At the same time, the Finnish speaker considers that the Finnish EPB regulation was not a driver until 2007, because it was only based on U-values and not on a holistic approach, as requested in the EU by the EPBD [3].
- In contradiction, Norway considers that the Norwegian EPB regulation is a major driver, as it makes modern energy efficient ventilation compulsory in all type of buildings.
- In any case, the EPB regulation must have a framework to assess the energy performance of innovative ventilation systems, otherwise it becomes at least a lack of driver, or even a barrier. For instance, increased ventilation effectiveness could be a way to save energy without reducing IAQ, but the Belgian EPB regulation does not take this into consideration. The system is not forbidden by the regulation, but is clearly not supported. (See also § 4.)

4 Assessment of innovative ventilation systems in the framework of the national EPB regulations

4.1 Situation in some Member States of the European Union

This issue was addressed in the contributions of Belgium, Denmark, France, Germany, Netherlands and UK [4]. To highlight some characteristics of the framework for the assessment of innovative systems, we will compare the situation in Netherlands, Belgium, France, Denmark and Portugal:

- In The Netherlands, the framework is known as the "principle of equivalence". It exists for more than 10 years and is included in the Dutch building code; it can be applied not only for the assessment of innovative (ventilation) systems in the framework of the EPB regulation, but to any requirement of the building code. The Dutch principle of equivalence is not assessed at national level since the equivalence is evaluated at municipal level. The study can be done by anyone.
- The Dutch experience has strongly influenced the way Belgium has implemented its own principle of equivalence. It was decided to have a centralised approach, at least for products or systems, as the study is carried out by a group of experts nominated by the Belgian Union for the technical approval in the construction (BUtgb – UBAtc) and is evaluated by the Regions[1].
- In France, the situation is in between those of Belgium and the Netherlands, as the study can be done by anyone but its evaluation is done by a central body, namely the Minister for Ecology, Sustainable Development and Spatial Planning.
- In Denmark, the situation is different. There is no framework to assess the energy performance of innovative system, but the standard procedures themselves can be gradually and quite quickly improved, with the direct support of the industry.
- In Portugal, the situation is once again different. Portugal claims not having a need for a principle of equivalence framework, because the energy performance of a building has not to be calculated according to a published comprehensive calculation procedure but, at the design stage, it has to be proved with dynamic simulations and, after a few years, it has to be compared to the actual energy consumption.

Those very different situations show that the need for a principle of equivalence scheme and the way to implement it are strongly influenced by the way the EPB regulation itself is implemented. The fact to have a specific calculation procedures that the assessor has to follow in all details (as it is the case in Belgium, Denmark, France and Netherlands) or not (as in Portugal), and the fact that this calculation procedures can't be adapted quickly (as in Belgium, France and Netherlands) or can be (as in Denmark) will deeply influence the need for a principle of equivalence.

When a principle of equivalence is needed, it can be implemented very differently. Each solution has its own advantages and drawbacks, some of them were identified in the framework of the European ASIEPI project [2]:

- The fact that the procedure was quite open in Netherlands (anyone can make its own evaluation according to its own methodology) has as main advantage the rapidity of the system and the fact that the cost may be lower, but at the same time leads to a lack of confidence in the principle of equivalence system (as all municipalities do not have the resources to evaluate the studies and as different municipalities may come to different assessments) that sometimes reduce the confidence in the EPB regulation itself.
- In opposition, the fact that the procedure is very centralised in Belgium may potentially lead to a longer time for assessing new systems but increase the confidence of the various stakeholders.
- According to the Finnish, German and Dutch participants to ASIEPI, the equivalence studies should not be evaluated at municipal level, whereas the Belgian and French participants estimate that the

[1] Belgium is a federal state, composed of 3 Regions. The EPBD implementation is under the responsibility of the Regions.

evaluation of the studies at national level is an advantage.

4.2 About the IEE SAVE ASIEPI project

As seen here above, the framework for the assessment of innovative systems differs in each Member State, from both the technical and the administrative points of view. The IEE SAVE ASIEPI project is expected to give support to the Member States regarding the setting up or improvement of such a framework; this might lead to more harmonisation.

The project is also addressing other technical aspects of the EPBD implementation, as the evaluation of the thermal bridges, the building airtightness, the duct airtightness, and the summer comfort issue. Finally, ASIEPI intends to make a cross comparison of the national energy requirements across EU.

5 Conclusions

The workshop has shown that there is an increased interest in ventilation systems that deliver good IAQ and good thermal comfort, but that use less energy. Various trends to meet this expectation were identified, i.e. demand controlled ventilation and hybrid ventilation. However, a potential barrier to the application of such system is the EPB regulations, if they do not offer a possibility to evaluate their energy savings potential. The discussions during the workshop have shown that various frameworks for the assessment of innovative systems have been implemented in various countries. The advantages and drawbacks of some of them are summarised in this paper.

6 References

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The Air Infiltration and Ventilation Centre provides technical support in air infiltration and ventilation research and application. The aim is to promote the understanding of the complex behaviour of the air flow in buildings and to advance the effective application of associated energy saving measures in the design of new buildings and the improvement of the existing building stock.