PROMEVENT: IMPROVEMENT OF PROTOCOLS MEASUREMENTS USED TO CHARACTERIZE VENTILATION SYSTEMS PERFORMANCE

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ABSTRACT

For the coming energy-efficient buildings, the guarantee of energy performance becomes a major challenge. It is therefore crucial to implement accurate and reliable measurements, in order to ensure this performance. The in-force French EP-regulation RT2012 already imposes compulsory justification of envelope airtightness. Moreover, the Effinergie+ label requires ventilation systems control and ductwork airleakage performance. This requirements, ventilation control for IAQ concerns and buildings regulatory compulsory controls need reliable diagnostic protocols.
In January 2014, several French partners, led by the CEREMA[1], proposed a new project, PROMEVENT, to improve ventilation systems measurements protocols, through experimental campaign. Several points should be tested through repeatability and reproducibility evaluations. By the end of the PROMEVENT project, recommendations and a first version of a protocol for the measurement of residential buildings ventilation systems should be proposed. Moreover, one of the main objective is to produce a more reliable and optimised protocol which should be written as a proposed draft standard.
This paper presents the context in which the PROMEVENT project has been defined, and expounds its main objectives.

KEYWORDS

Ventilation – Measurements – Airtightness – Airflow - Improvement

[1] A new public scientific organism born from the merging of 11 scientific institutes (including the CETE de Lyon) of the French ministry for ecology, sustainable development and energy (MEDDE).

1 CONTEXT AND OBJECTIVES

The recent French energy performance regulations and labels have resulted in a new buildings generation. Since 2000, airtightness requirements have been gradually implemented in French regulations, leading to a reinforcement of air renewal systems and a need to ensure their reliability. First labels and mostly Effinergie-BBC label have imposed a requirement on building envelope airtightness for residential building. Since January, 2013, the in-force EP-regulation RT2012 imposes airtightness requirements for all new residential buildings.

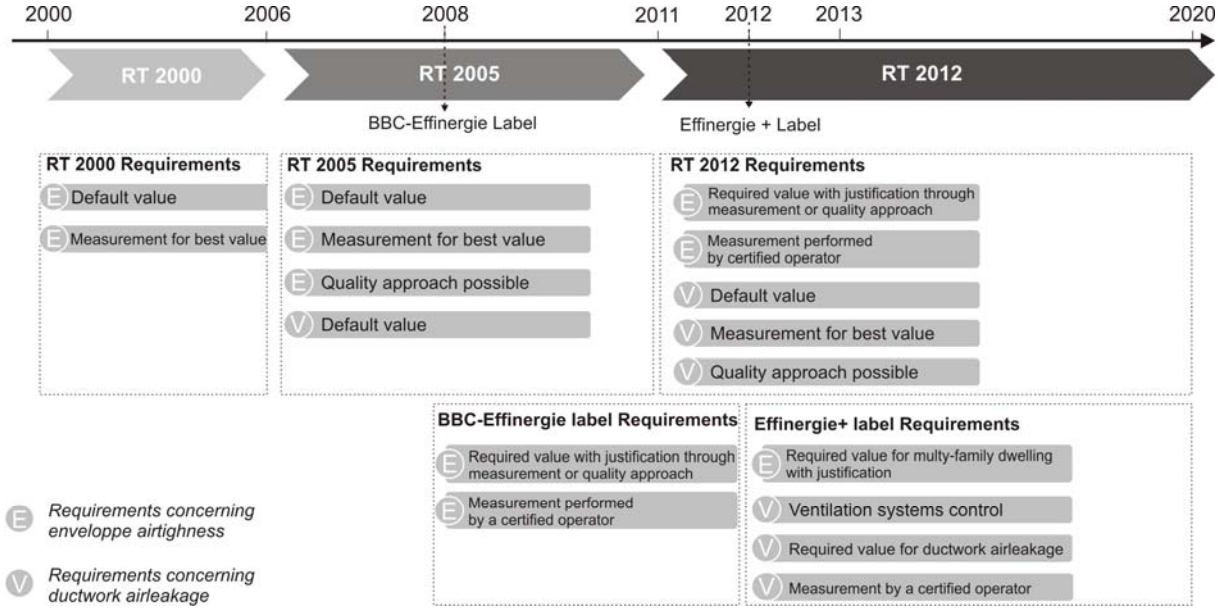

Figure 1: Evolution of French Thermal Regulations

Those highly airtight buildings create an issue for both comfort and indoor air quality. Indeed, in this dwellings, air change rate are provided by ventilation system, which have to be efficient to ensure good indoor air quality, while limiting heat losses due to air change. Several recent studies illustrate this concern. The OQAI (French indoor air quality observatory) performed a national IAQ campaign from 2003 to 2005 (Kirchner, 2008). 567 dwellings (chosen in order to represent the national housing stock) have been investigated through ventilation systems diagnostics and indoor air quality measurements. This national study has concluded that the air change rate and the duration windows are opened are the most important factors of the indoor air quality. Moreover, calculations analysis which have been performed during the project QUAD-BBC have shown some typical evolution of pollutants in highly airtight low consumption buildings (Boulanger, 2012).

The ventilation regulation in force requires a general and permanent ventilation for residential buildings. It also imposes minimal airflow of exhaust air. So as to meet those two seemingly divergent objectives, technically advanced mechanical ventilation systems have been developed. Nevertheless, high quality and technical skills are required during design phase, implementation and maintenance, which are often neglected. Ventilation systems have an influence on the sanitary aspects of the supplied and indoor air, through moisture development for example (Van Herreweghe, 2013). Moreover, inhabitants may have not

understood the functioning of new mechanical systems, especially for balanced ventilation, and might decide to take it down. The OQAI has recently carried out a field survey in seven new built energy-efficient houses in France (Derbez, 2014). All inhabitants have experienced some difficulties with their Mechanical Ventilation with Heat-Recovery systems, because they are difficult to use, the user's manual is complex, high noise levels can be produced or they cause a lack of comfort. But if MVHR systems are turned out or voluntary degraded (airvents closed for example), indoor air quality can become poor and present a risk to human health.

Therefore, in many countries, several studies have been launched to realize a state of the art of ventilation systems in dwellings. In France, a survey (Jobert, 2013) has been carried out through control reports performed between 2008 and 2011 concerning 1287 dwellings (88% are multi-family dwellings). Almost all buildings are equipped by simple exhaust ventilation systems.

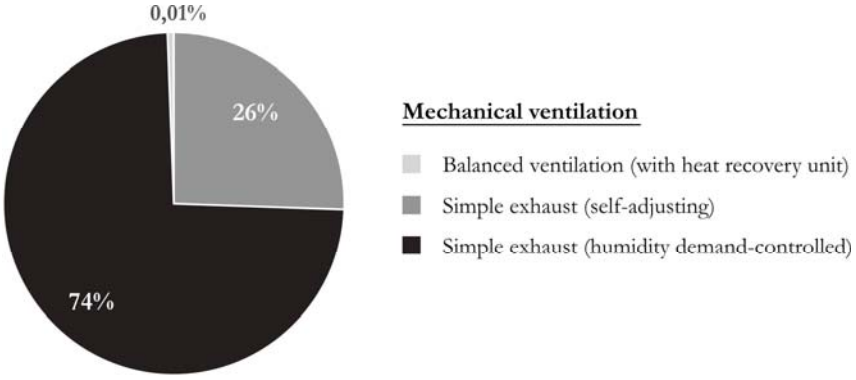

Figure 1: Ventilation system repartition in the analysed sample (Jobert, 2013)

47% of the sample do not comply with the airing regulation, which means that they present at least one non-compliance remark (68% for single-family dwellings, and 44% for multi-family dwellings). Those non-compliances are generally related to design errors, poor implementation and lack of maintenance. Same issues have been observed in many European and American countries (Van Den Bossche, 2013). Two practices could improve the quality of ventilation systems. On one hand, a quality approach could be set up. In France, such approaches have been successfully adopted for building envelope airtightness (Charrier, 2013). Moreover, the VIA-Qualité project is testing the feasibility of such approach for ventilation systems and IAQ (Jobert, 2013). In a second hand, as the French thermal regulation imposed the airtightness level justification, the ventilation system performance could also be controlled, what is already compulsory with a recent label, "Effinergie +". Those controls are in accordance with new approaches, which impose that standards and regulations compliance is ensured by on-site verifications. Those approaches might lead to financial or organizational consequences. Currently, ventilation systems controls are generally performed in France in three cases:

- For buildings applying for new Effinergie label (Effinergie +)
- During regulatory compulsory control (by the technical civil servants network of the Ministry in charge of the Construction's sector)
- When IAQ issues have been set out for a building.

Therefore, control protocols have to be unquestionable. In these cases, several diagnostic protocols are used: either labels reference documents or good practice guide, such as the Effinergie protocol, the DIAGVENT method and the European standard EN12599. The reliability of those protocol may be not sufficient. The next paragraph presents a project,

proposed to ADEME, which main objective is to study and improve the reliability of those protocols.

2 PROMEVENT PROJECT

The PROMEVENT project has been proposed to a call for proposals launched by ADEME within the subject "toward responsible buildings in 2020". The Consortium is constituted of 8 French partners, both private and public sectors: a public institution (CEREMA[2]), a technical center (CETIAT), 5 consultancies (ALLIE'AIR, ICEE, PLEIAQ, CETii, PBC) and an association (Effinergie).
The PROMEVENT project objective is to define a new protocol for controls of ventilation systems performance, based on many existing protocols currently used. Indeed, several protocols are currently used in France and abroad to control ventilation systems performance, including visual diagnostic, proper functioning at air vents control and ductwork airtightness measurement. There are described in label reference documents, campaign protocols, standards or good practice guides. EN12599, DIAGVENT method, Effinergie protocol or OQAI protocol are some of them. The PROMEVENT project proposes to test repeatability, reproducibility and feasibility of those protocols in order to define a more reliable protocol for ventilation system controls. This project may have to deal with such issues as: how can it be representative of all different situations? How can it characterize the equipment use impact? How will it overcome airflow measurement difficulties?
PROMEVENT proposes to carry out several laboratory and in-situ campaigns in order to test repeatability, reproducibility and feasibility of those protocols, including the equipment choice impact. It is expected that conclusions of this project will lead to a new standard which could be imposed in new buildings regulation, in order to impose compulsory check of ventilation systems performance. Discussions on new protocols should focus on several points, such as:

- Ensure sufficient reliability
- Ensure technical and financial feasibility
- Define self-checking equipment conditions
- Define needs and organisation of operators training, qualification and control.

At the end of this project, training and recommendations should be provided to operators through a practical guide, which may be useful for measurements performed for label.

3 ACKNOWLEDGEMENTS

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[2] Centre for expertise and engineering on risks, environment, mobility, urban and country planning - A new public scientific organism born from the merging of 11 scientific institutes (including the CETE de Lyon) of the French ministry for ecology, sustainable development and energy (MEDDE).

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