The quality framework for Air-tightness measurers in France: assessment after 3 years of operation.

Valerie Leprince*[1], Rémi Carrié [2] and Myriam Olivier [1]

1 Centre d'Etudes Techniques de l'Equipement de Lyon.
46 rue Saint Théobald. F – 38081 L'Isle d'Abeau Cedex, France,
**Corresponding author*
valerie.leprince@developpement-durable.gouv.fr

2 INIVE,
Lozenberg 7
BE-1932 Sint-Stevens-Woluwe, Belgium

ABSTRACT
The 2012 French thermal regulation will include a minimum requirement for residential buildings envelope air-tightness, with two options to justify its treatment: a) measurement at commissioning or b) adoption of an approved quality management approach. This paper describes the qualification process for air-tightness measurement authorized technicians when their results are to be used in the EP-calculation method. Our analyses underline the importance of the qualification process to ensure homogeneous measurement practice among technicians. It also shows the limits of the controls that can be implemented if the process is not appropriately sized to absorb a large number of applications. This process highlight nevertheless the great interest of collecting trusted data through a controlled measurers network .

KEYWORDS
air infiltration, envelope, ductwork, leakage, energy use, low-energy buildings, licensed measurer

INTRODUCTION
The objective of the French energy performance regulation revision is to generalize low-energy buildings. The threshold is set to 50 kWh of primary energy per m^2 per year for residences, with some modulation depending on climate zone and altitude; this value includes the primary energy use for heating, cooling, domestic hot water, auxiliary equipment, and lighting. Given the severe impact of envelope leakage in such low energy buildings, a minimum requirement is set for the envelope air-tightness of residential buildings in this 2012 energy performance regulation. Two options are proposed to comply with this minimum requirement : a) measurement at commissioning or b) adoption of an approved quality management approach. The first option raises the question of the measurement quality to ensure homogeneous practice among technicians, and therefore avoid perverse effects that could entail discredit to the whole framework and distort competition. This paper discusses the measurer qualification process, the difficulties to set such a process and the advantages linked to data capitalization.
This paper is based on a former presentation of the process [1].

QUALITY FRAMEWORK FOR MEASURERS

Although there exists a European and an International Standard (EN 13829 and ISO 9972) on the measurement of envelope air-tightness, there remains unanswered questions when the result is to be used as an input in an energy performance calculation method.

One key problem lies in the building preparation, i.e., the openings that have to be sealed or closed during the measurement. One often quoted example is the case of a biomass boiler with a combustion air intake in the living space, for which it could be interpreted that method A requires that the intake remains in its normal condition of use, although it may make sense to seal it if the calculation method appropriately takes into account the energy impact of the additional air drawn into the house.
This is the reason why the BBC-Effinergie label specifies in more detail the openings that can and cannot be sealed or closed during the test [1]. The basic rule is that the building envelope must represent the conditions prevailing during the season when heating or cooling systems are used; however, openings whose contributions are taken into account in the energy calculation method are sealed. This rule is now integrated in an application guide for EN 13829 that was released in February 2010 (GA P 50-784).

A second issue is the estimation of the measured volume. In order to avoid this uncertainty, the French indicator is $Q_{4Pasurf}$, that is to say the flow-rate at 4Pa divided by loss surfaces area (excluding basement floor). This area is automatically calculated in the thermal study, thus a measurer does not evaluate it himself, which avoids any cheating : if the area is over-estimated (to decrease the $Q_{4Pasurf}$), it is also penalizing as it automatically increases conductive losses.

Another major issue lies in the measurer's competences. As it is clearly bringing to light in Rolfsmeier et al.'s paper [6], there can be serious misinterpretations of the measurement protocol and analysis that can of course be intentional but that can also be done in good faith, simply because of a lack of basic knowledge on the energy performance regulation, HVAC systems, or airflow and pressure measurement techniques. This can entail serious errors in the estimations of derived quantities that are used in the calculation method. This is why the ministry decided to require that the measurers be authorized to perform such measurements. The authorization is delivered according to a 3-step approach :
1. The candidate must attend a training programme, based on a state referential, and approved by the ministry. Five trainings bodies are now offering this kind of training.
2. The candidate must pass a theoretical and a practical examination. The theoretical examination is based on a multiple-choice questionnaire. The practical part is divide in two parts:

- Examination of a test performing process (including building preparation, etc.)
- Examination of a test report by the training body.

The training body is given a grid to help in this evaluation process.
3.The candidate must then submit 5 reports to a commission in charge of advising the ministry to deliver authorizations. This commission is constituted of about 20 anonymous experts in the field. The experts can ask for complements if mistakes are not fundamental or if clarification is needed. In this case, the agreement is discussed at the following meeting based on the new materials provided by the candidate. An application cannot be evaluated more than 3 times; over 3 trials, the candidate must submit a new application.

In addition, a “Frequently Asked Question” internet site has been set to deal with questions that are not answered in standards. When a new technical question appears, it is discussed in an expert working group (that meet five times a year) and the consensual answer is published.

On September 2011, more than 230 persons have been authorized (they were merely 50 one year and half ago). Applicants usually have to go through 2 commission meetings to obtain their authorization. The mean elapsed time between the application and the authorization is

about 5.5 months. Figure 1 show the number of authorisation per month and the total from mid 2008 (beginning of the commission), till the end of 2010.

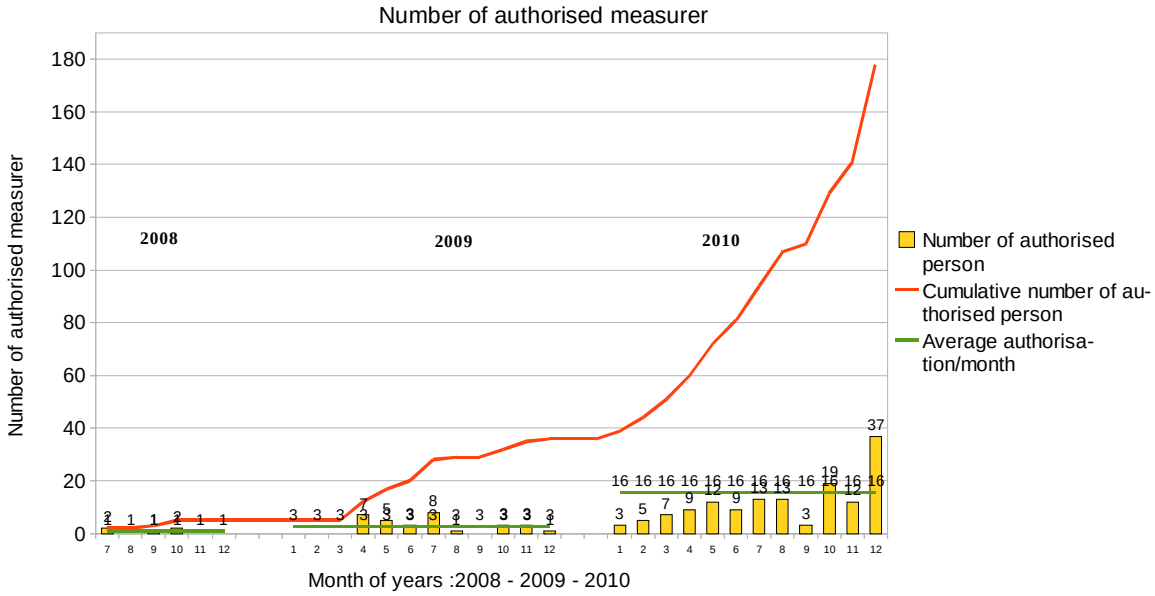

Figure 1: Evolution of number of authorised measurers

There is mostly three profiles for authorised measurer : either they belong to a design office, or to a thermal diagnostician company, or they switch to this new full time measurement activity.
Till December 31th, 2010, the commission was only carried by the sole ministry, and all examinations were performed by unpaid experts. But, by the end of 2010, the number of new applications received per month was over 15. This number should even increase as the 2012 regulation will require this authorization for all measurements when used as proof of compliance to the EP-regulation.
So, in order to prepare the 2012 regulation, a new organisation was set to be able to deal with over 500 applications a year.

DELEGATION TO QUALIBAT

The basic idea was to delegate the process to a private body who will organize the reports examination by pool of experts approved by the ministry.
The “Qualibat” association has been chosen to be in charge of the commission. Qualibat is a qualification and certification body for construction companies. It is a well known organisation in France that has today qualified more than 30 000 companies in the whole construction field. A referential for this new committee has been set in collaboration between the ministry and Qualibat to ensure that former requirements will be maintained and that the authorisation will concern a person authorisation and not a company authorisation. An agreement has been signed between the ministry and Qualibat. Thus, starting January 1st 2011, the ministerial authorisation is delivered through a Qualibat qualification. Qualibat manages the commission and delegates the expertise to ministry approved experts .

Training experts

In January 2011 the function of the ministry was then changed, it is no longer in charge to directly evaluate measurers' competencies, but to “evaluate those who evaluate measurers”. Thus, a two days training is organise twice a year for people willing to become expert for the commission.

On the first half day, the standard analysis grid is detailed. The grid summarizes the NF EN 13-829 and GA P 50-784 key elements, the training consists in explaining what should be consider as reserve, as unconformity or just as recommendation. Then a fictive case is evaluated by trainer and corrected in group. Finally, the trainer is examined on his evaluation of a second fictive case.
Candidates for expertise are experimented measurers, trainers from an approved training center and experts recommended by other members of the commission. It's necessary to dispose of expert from all over France, as an expert should never examine a candidate from his own region. To ensure this dissemination the training is organised along a web conference. At the end of the first training session, 13 candidates out of 15 validated the test and were added to the seven former experts. A new session with ten or so candidates will soon be organised.

During this new commission' s first months, the number of measurer candidates decreased compared to the end of 2010, with an average of only seven qualifications per month, compared to 16 in 2010. In fact, on one hand, in the beginning, the delegation lead to some setting difficulties, and on the other hand, as getting the qualification was no longer free of charge (now around 500€ per candidate), it discouraged some of potential candidates.
Nevertheless, Qualibat has involved itself in promotion and advertisement of the measurer qualification which should arise new applications.

RECOVERING MEASURMENT DATA

A framework has been specified to monitor the authorized measurers' activities. To this end, the measurers must file a standard database for each measurement they perform. This record is a simple spreadsheet table , with pre-defined fields. Each measurer must send this record along with his first application; he must also update it every year to have his authorization extended.
Thus the ministry dispose of a national database with measurements done by all authorised measurers. Mid-2011, when we began to make use of this database, it already gathered almost 2500 measurements, from 25 authorised measurers. This number will exponentially increase as the 2010 authorised measurers will soon send their updated file for annual prolongation.
This database gives us a good view of buildings air-tightness in France, and allowed us to produce interesting statistics on buildings air-tightness according to their localisation, kind of buildings, year of construction, type of construction, etc. [4,5]. Nevertheless, it's necessary to keep in mind that the database is biased towards low-energy buildings: for example 47% of tested detached houses were involved in a BBC-Effinergie certification process, whereas this certification has a market share of only 7% of all new constructions. Since the certification imposes a maximum air-tightness level for houses of $Q_{4Pasurf}$=0.6m^3/h.m², it is foreseen that the average of the database is better than the national average.
Figure 1 gives example of statistic that are done with the database [4,5].

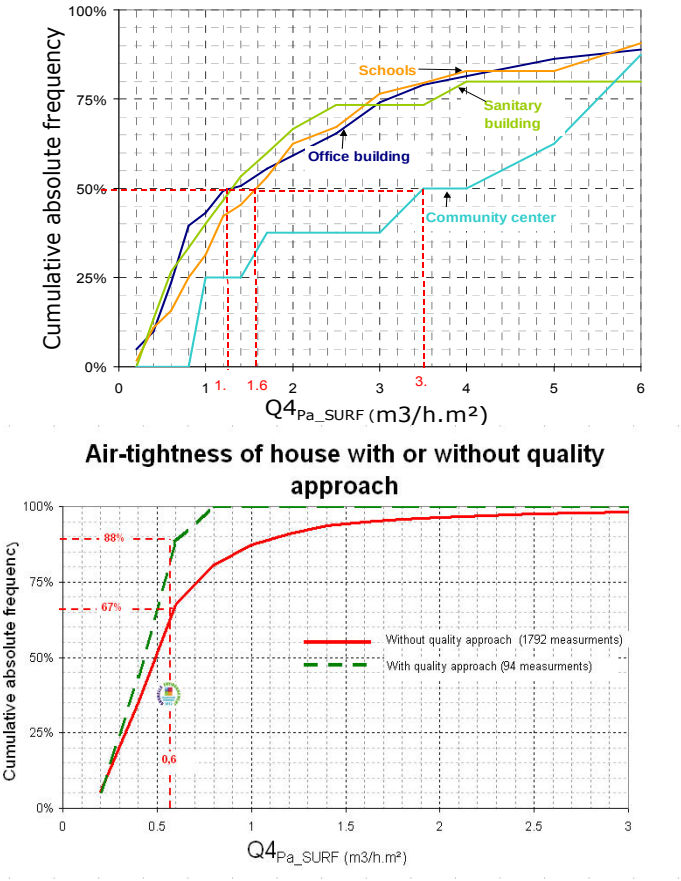

Figure 2: Example of use of the database [4,5]

CONCLUSION

Even if the overall framework for the commission is still under test period, our feeling is that it has greatly helped the measurers' community to keep a positive image. The potential discredit that could fall on a new profession has been avoided so far, even though this subject remains controversial among building professionals.

Moreover, as all measurers are identified, it's easier to disseminate new requirements or adaptations, or to promote potential developments such as ventilation network measurement for example.

Finally the measurer network produce a valuable database for an air-tightness observatory of in France.

ACKNOWLEDGEMENTS

The contribution of CETE de Lyon to the implementation of these quality frameworks is funded by the ministry of ecology, sustainable development, transport and housing (MEDDTL).

The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the Ministry.

REFERENCES

[1] Carrie, F.R., Charrier, S. and Leprince, V. 2010. *Implementation of measurement and quality frameworks in the French regulation for achieving airtight envelopes*, 31th AIVC Conference, 26-28 October 2010, Seoul Korea

[2]*Arrêté du 26 octobre 2010 relatif aux caractéristiques thermiques et aux exigences de performance énergétique des bâtiments nouveaux et des parties nouvelles de bâtiments*, JO 27 octobre 2010
[3]*Arrêté du 24 mai 2006 relatif aux caractéristiques thermiques des bâtiments nouveaux et des parties nouvelles de bâtiments*, JO 25 mai 2006
[4] Leprince, V., Bailly, A., Carrie, F.R., and Olivier, M. 2011. *State of Art of Non-Residential Buildings Air-tightness and Impact on the Energy Consumption*, 32th AIVC Conference, 12-13 October 2011, Bruxelles, Belgium
[5] Leprince, V., Biaunier, J., Carrie, F.R., and Olivier, M. 2011. *Quality Management Approach to Assess Buildings Air-tightness, Requirements and Checking*, 32th AIVC Conference, 12-13 October 2011, Bruxelles, Belgium
[6] Rolfsmeier, S., Vogel, K., Bolender, T., 2010. *Ringversuche zu Luftdurchlässigkeitsmessungen vom Fachverband Luftdichtheit im Bauwesen e.V.*, 5 th International Symposium on Building and Ductwork Air-tightness, October 21-22, 2010, Copenhagen/Lyngby, Denmark