Lessons learnt from the regulatory quality management scheme in France

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ABSTRACT

From January 1st 2013 on, the French energy performance regulation will demand that the airtightness level is justified and that airtightness of a building should be below 0,6m^3/h/m² at 4Pa for single family housing and 1m^3/h/m² for multi-family dwellings, resulting into an important growth in the airtightness market. It is the role of the State to accompany this market evolution and to supervise the quality of airtightness measurements used for the EP calculation. This is why it has been decided that there are two possibilities to justify the airtightness level of a building. Either the constructor makes a systematic measurement of their building or the constructor proves they have a quality management approach so that more than 85% of their production reaches the wanted airtightness.

In order to ensure the quality of the quality management schemes for airtightness, a specific committee has been created. Its goal is to authorize constructors to justify an airtightness level by a quality management scheme. The CETE de Lyon is in charge of this committee.

This paper deals with the role and results of the committee and discusses the advantages and issues raised by such authority, thanks to the experience gained by the CETE de Lyon on these matters. Results show an improvement in the airtightness levels reached by authorized constructors in comparison to levels reached without any quality management approach. Flaws in the control process and biased tests show several possibilities for the State to improve the frame of this authorization.

KEYWORDS

Envelope airtightness, quality management

INTRODUCTION

With the future obligation to prove a certain level of compliance with the French Energy Performance Regulations, airtightness has got a key role in the construction field. Indeed, the application of the 2012 EP regulation demands that buildings comply with an airtightness level below 0,6m^3/h/m² at 4Pa for single family housing and 1m^3/h/m² for multi-family dwellings. To prove the compliance, a constructor has two choices. Either they make a systematic measurement of their buildings or they prove by hand of a quality management scheme for airtightness that more than 85% of their production has the wanted airtightness.

This paper deals with the role of this committee and discusses the advantages and issues raised by such authorities. This paper also presents the results of a state driven control campaign. This paper will hence try to give some answer to the question: is it worth it to implement such a procedure for quality management schemes?

REGULATORY QUALITY MANAGEMENT SCHEME

Context

As described in Leprince 2011, quality management process for airtightness of buildings has been set up in order to improve air tightness treatment during all design and construction stages and in order to spread good practice among professionals.

The French 2005 energy performance regulation introduced the possibility to use an airtightness value lower than the default value in the EP-calculation. This possibility is given only if a measurement proves the lower airtightness value or if the constructor follows a State authorized quality management procedure for airtightness, without systematically performing a test.

Soon, the 2012 energy performance regulation, applicable from January 1st 2013 for housing, makes the airtightness test compulsory. The quality management scheme gives the applicants the possibility to reduce the amount of compulsory tests at commissioning since only a minimum of 5% of the production has to be tested. It gives also the possibility to make energy performance calculations with an airtightness factor lower than the regulatory 0,6 m^3/h/m².

Requirements

Applications are sent to a specific committee dealing with the quality management procedure in airtightness. Any application has to include basic requirements linked to quality management approach, tests on a sample of the production and training documents focusing on airtightness destined to co-workers and craftsmen. Furthermore, some documents have to be submitted to the committee, among others:

-Identification of the chain of liabilities: who does what and when

-Description of the approach applied to the company

-Description of the design characteristics of the buildings on which the quality management approach applies

-Results of tests on a sample of the buildings production proving that more than 85% of the tests are below the target airtightness value

The 2012 quality management process will also require all documents produced in the frame of the quality approach for randomly selected buildings.

Self declared results obtained by approved companies in 2011

So far, the committee received follow ups of a dozen of applicants implementing a 2005 quality approach. The follow ups included bar charts of all measurements performed internally.

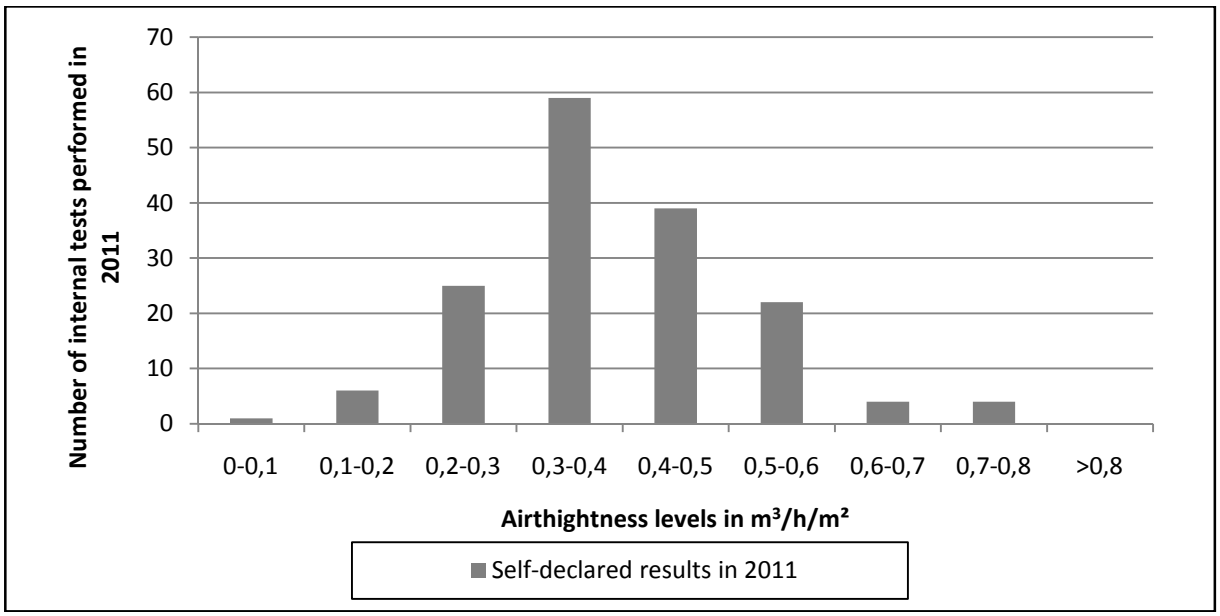

Chart 1: Bar chart of all self-declared results (follow-up 2011) N=160

Chart 1 presents a sum up of all self-declared test results made in 2011 by all constructors that had been authorized in 2010. Obviously, the results in Chart 1 show that every single building tested by these 14 constructers scored below the Q_{4Pa_surf} target of 0,8 $m^3/h/m^2$. The bar chart also shows a normal distribution.

Controls by state technicians

The results presented in Chart 1 are based on measurements performed by State authorized testers. These testers however are not necessary independent of the applicant. Indeed, applicants get advice from ISO9001 bodies working in the field of airtightness that audit the applicants and most likely test the production of the applicant. The independence of the measure is therefore not guaranteed.

To avoid such a bias, the committee started in 2011 a control campaign. Every year, each applicant is asked to hand in a list of all buildings expected to be delivered in the coming year, including date of commissioning, name and address of the client. If the applicant is reluctant to give the demanded information, the applicant might see his agreement suspended.

Then a state technician performs control tests on randomly selected buildings. The amount of buildings tested is supposed to cover more than 5% of all buildings delivered. As of September 2012, 74 control measurements have been performed, whereas 99 had been planned. It represents so far 3,7% of the yearly production of all constructors. Further tests are still expected.

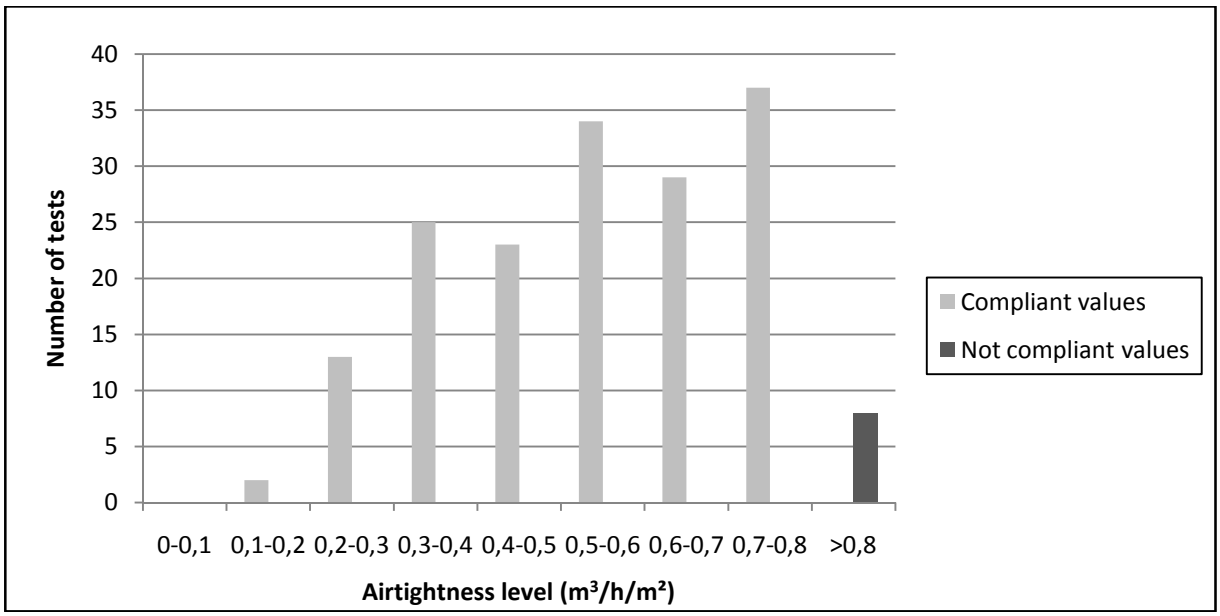

Chart 2: Bar chart of airtightness levels from the control campaign, compliance to the target level

Chart 2 shows a bar chart of all airtightness values measured. From Chart 2 can be inferred that if most of the tests show a result lower than the target airtightness level, a few are above the wished Q_{4Pa_surf} of 0,8m^3/h/m². In the dwellings showing a higher airtightness measure, the leaks are mainly located around water and gas ducts, around boxes integrating roller shutters and window frames. Other leaks are due to a misunderstanding of the constructor of the moment of commissioning. Indeed, some constructors leave the possibility to the client to do a part of the building works themselves, for example installing toilets or a wood-burning stove. So when the dwelling is handed in to the client, these elements are not installed, but they do have an influence on airtightness, which explains part of the high airtightness results obtained.

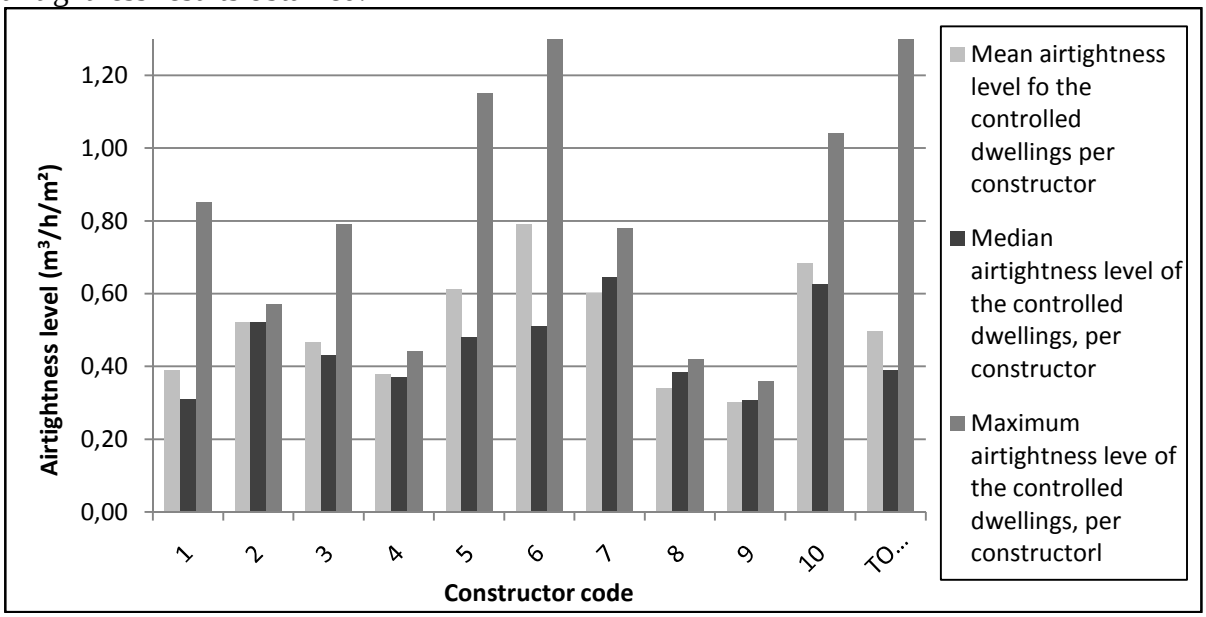

Chart 3: Bar chart of the mean, median and maximum airtightness values from the control campaign, per constructor [Maximum value of constructor 6 is above 1m^3/h/m² and is out of the scale of the chart]

Mean and median values showed in Chart 3 corroborate the results implied from Chart 2. There are all under the 0.8 $m^3/h/m^2$ target level. However, this means that some constructors have been controlled with frequent too high airtightness results, whereas other constructors comply at 100% to the target level. A particularly problematic point in this chart is that one of the constructors showed control results above 1.3$m^3/h/m^2$, which is above the default value of the Energy Performance Regulation and which is a specific requirement to be respected.

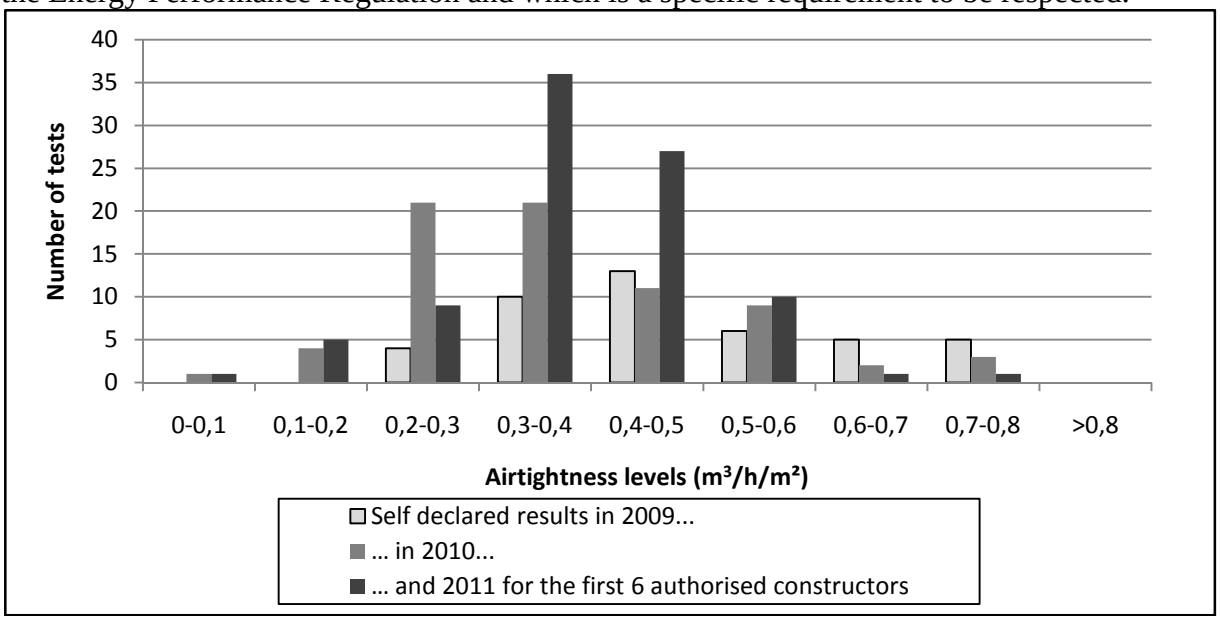

Chart 4: Bar chart of the self-declared results for constructors that have had more than two follow-ups (2009/2010/2011 or 2010/2011)

Chart 4 shows the self-declared results of the constructors that have had more than two follow-ups since beginning. It can be implied that results of 2010 and 2011 are better than results of 2009, but that the latest follow-ups show higher results than in 2010. This means that there is a certain improvement in the general airtightness level, but also that the efforts are probably not being pursued when the target level, 0.8$m^3/h/m^2$ is reached.

Discussion

As already mentioned above, buildings are not always completely finished when the keys are handed to the owner, for example clients take in charge bathrooms or chimney. As a consequence, testers should not seal the holes left because they have to comply to the norm NF EN 13829 and its implementation guide, which demand to leave the holes open, hence there are probably some improper measurements done internally, which gives a bias in the results showed by the constructer.

The committee discussed this point and decided that it is still the liability of the constructor to justify the level of airtightness at commissioning, even when holes are left open. The committee will therefore expect the following requirements to be fulfilled. The first possibility is to reach an airtightness level low enough even if the building is not yet finished. If not and/or if works are to be done in the house by the client, the constructor has to prove that those works are not a threat to the airtightness, and a test is performed after the works by the client. On the contrary, if the works are a threat, the test will still be done after finishing the works. Hence the constructor is expected to give a specific training about air permeability to the client so that they will not deteriorate the airtightness.

As a consequence, the committee advises the constructors to inform in early stages their clients that their house has had a specific airtightness treatment and that there have to be precautious if they do not want to ruin the work done.

Another bias seen in the control tests performed by the state technician is that the controller is given name and address of clients with approximate date of commissioning by

the constructor. The controller randomly selects buildings to test, but still relies on the constructor to visit the construction site. It has been seen that some controlled buildings have been "prepared" for the venue of the controller, with among others fresh foam material filling in vacant spaces for toilets. The test is done in the conditions the building has been delivered, but the real final airtightness value will be higher than what is measured, since the foam material is not meant to stay.

To improve the efficiency of the controls, it has been suggested that they should focus on buildings with sensible spots. We identified among others wooden intermediate floors or mechanical ventilation as quite difficult to apprehend from an airtightness point of view. If the focus is on buildings presenting that type of characteristics, it is to expect that the rest of the buildings production complies with the target airtightness level. Plus, the committee witnesses a growth in the number of applicants and with the application of the 2012 energy performance regulation. In only a few months, the number of applicants for the 2012 version has already exceeded the number of 2005 applicants over three years. It will then be difficult for control testers to measure more than 5% of the production of all these constructors. It is then all the more understandable to focus on sensible construction types.

Seeing that constructors having a quality management process succeed more easily to reach a target airtightness value raises an issue concerning other constructors. Every building will soon have to comply with the Q_{4Pa_surf} of $0{,}6 m^3/h/m^2$ but it is feared that without proper preparation especially in early design stage, it might be difficult for average constructor to obtain such airtightness results.

Finally, let us note that controls are informative. But what if in the future, controls show more applicants that do not comply with their own target? There are still questions here: will the company lose immediately its agreement, will they be warned for a year, or will they have to hand in more documents? The balance between understanding and harsh decisions is yet to be found.

CONCLUSION

With the January 1st 2013 deadline approaching, it is of the greatest importance to prepare the market for lowered requirements in airtightness of buildings.

With the increase of applications the committees receives, it is to be understood that more and more constructors see the importance of treating airtightness by hand of a quality management scheme, which is in a way a success knowing the initial purpose of this authority. Self-declared tests as well as control tests show that in general, constructors gain advantage of such a scheme, for they reach satisfying airtightness levels, even for the 2012 version of the quality management requirements.

At the same time, it is feared that companies that have their authorization for long do not make any effort anymore to continuously improve their scheme, which is the opposite of what was hoped for. Plus, knowing the difficulty of testing the building at the exact moment of commissioning makes the committee doubt about the good faith of certain self-declared tests and makes it a necessity to communicate to all authorized constructors about what is testing at commissioning.

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