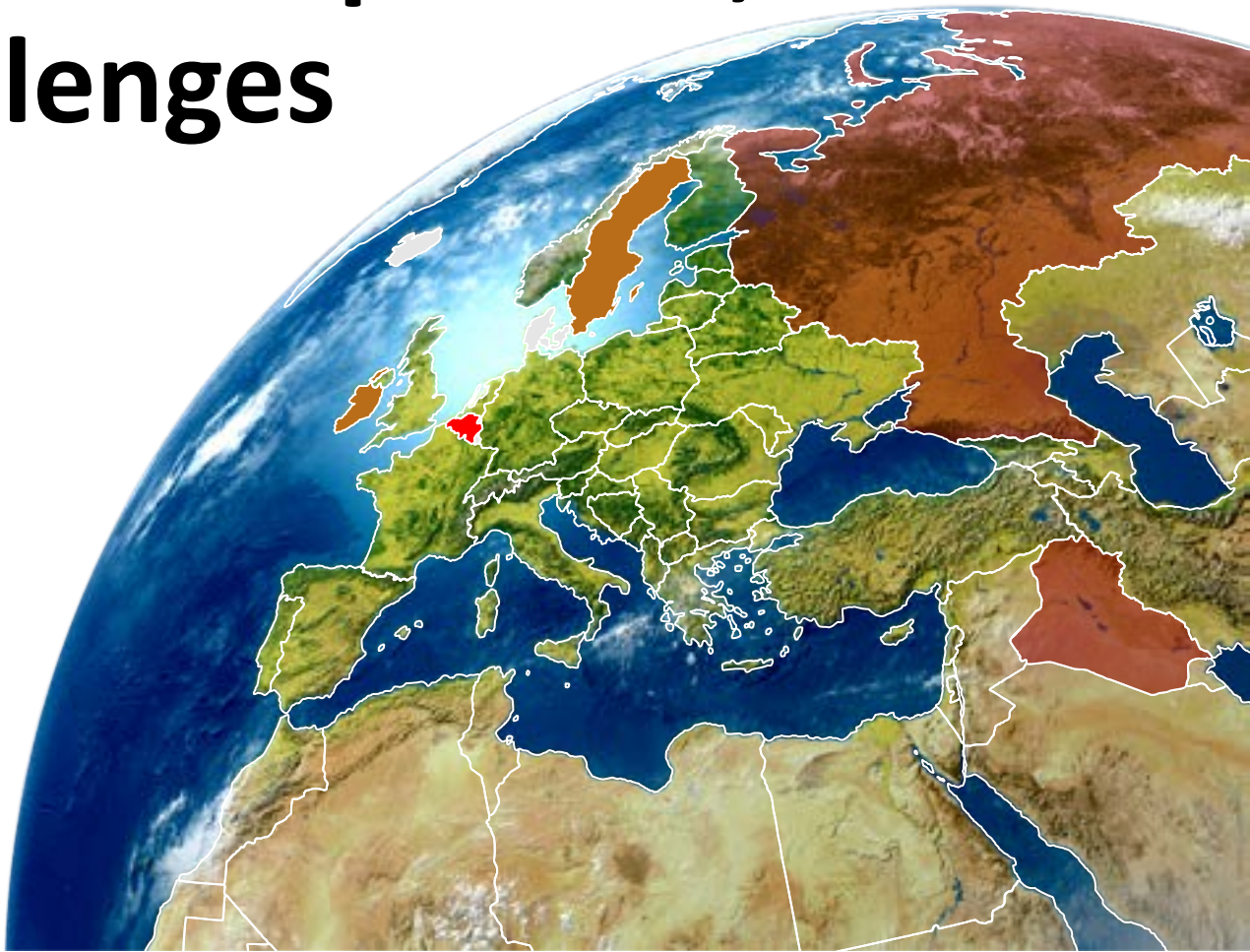
Quality and compliance of ventilation systems: ongoing developments, lessons learnt, future challenges



Peter Wouters

Manager INIVE EEIG

International Network for Information
on Ventilation and Energy Performance

INIVE

You expect a reliable label

… and you expect a good quality

You expect a reliable label

… **and you expect a good quality**

… **and you expect a good quality**

You expect the presence of a ventilation system

… **and you expect good performances (air flow, acoustics, IAQ, energy, …)**

EU QUALICHeCK project (2014-2017)

QUALICHeCK project had 2 objectives…

- *To set up a series of actions which should result in more attention and practical initiatives for* ***actual compliance with the claimed energy performance for new and renovated buildings***

  i.e. 'Boundary conditions which force people to do what they declare';

- *To set up a series of actions, which should result in more attention and practical initiatives for* ***achieving a better quality of the works****,*

  i.e. 'Boundary conditions which stimulate and allow the building sector to deliver good quality of the works'.

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QUALICHeCK products and outcomes

1. About the status on the ground…
2. About interesting approaches…
3. About guidance for improvements

4 focus areas in QUALICHeCK

- Transmission characteristics
- **Ventilation and airtightness**
- Sustainable summer comfort techniques
- Renewables in multi-energy systems

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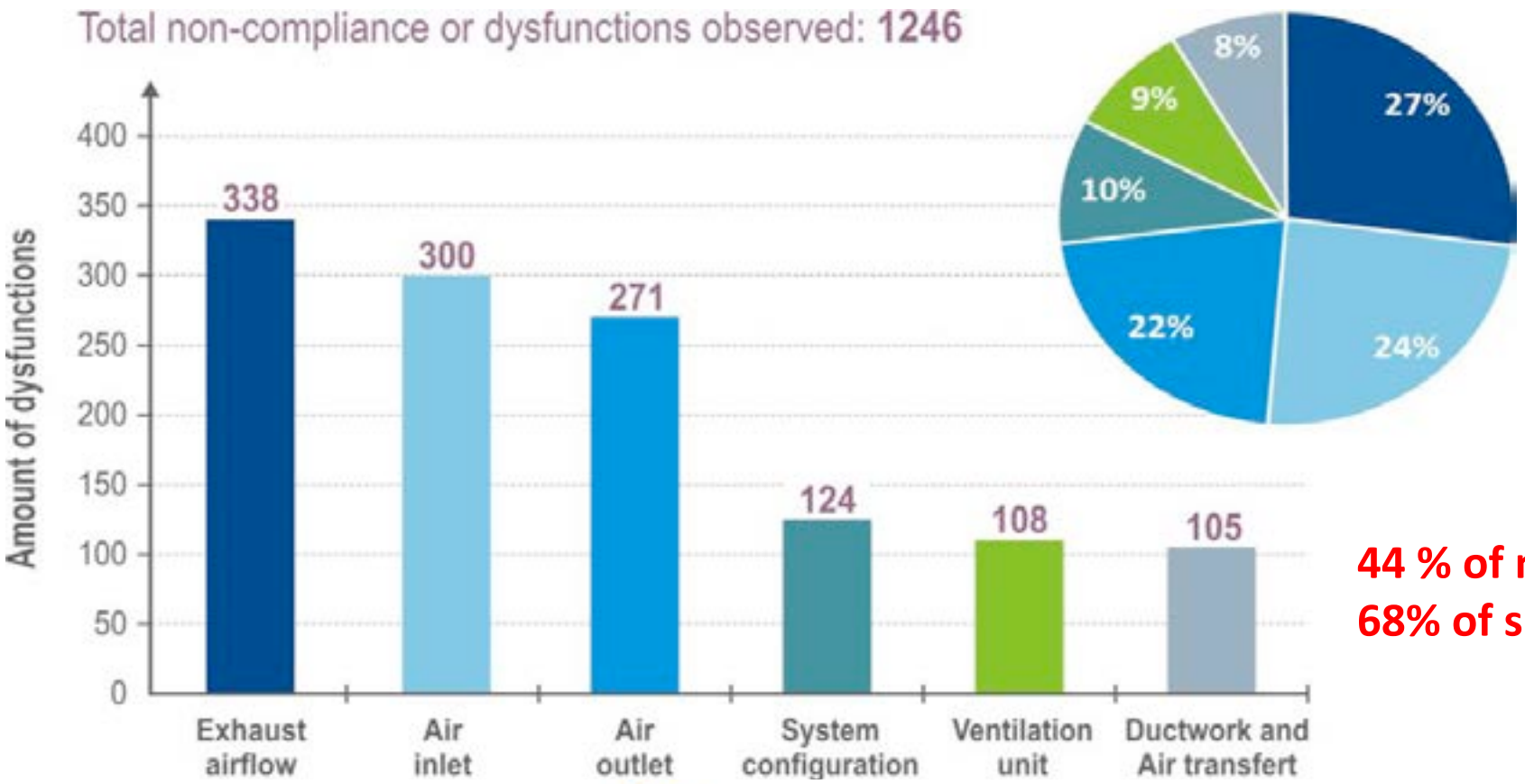
Towards better quality and compliance

Example from FRANCE:
Quality of ventilation systems in 1.287 new dwellings



44 % of multi-family dwellings don't comply
68% of single-family dwellings don't comply

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Example from SWEDEN:
Airtightness of air distribution systems

QUALICHeCK products and outcomes

- 2 booklets
- 3 global reports
- 2 source books
- 9 country reports
- 54 fact sheets
- 6 newsletters
- 16 webinars
- 4 conferences
- 4 focused technology workshops
- 9 national roadshows
- 3 special issues of REHVA Journal
- …

www.qualicheck-platform.eu

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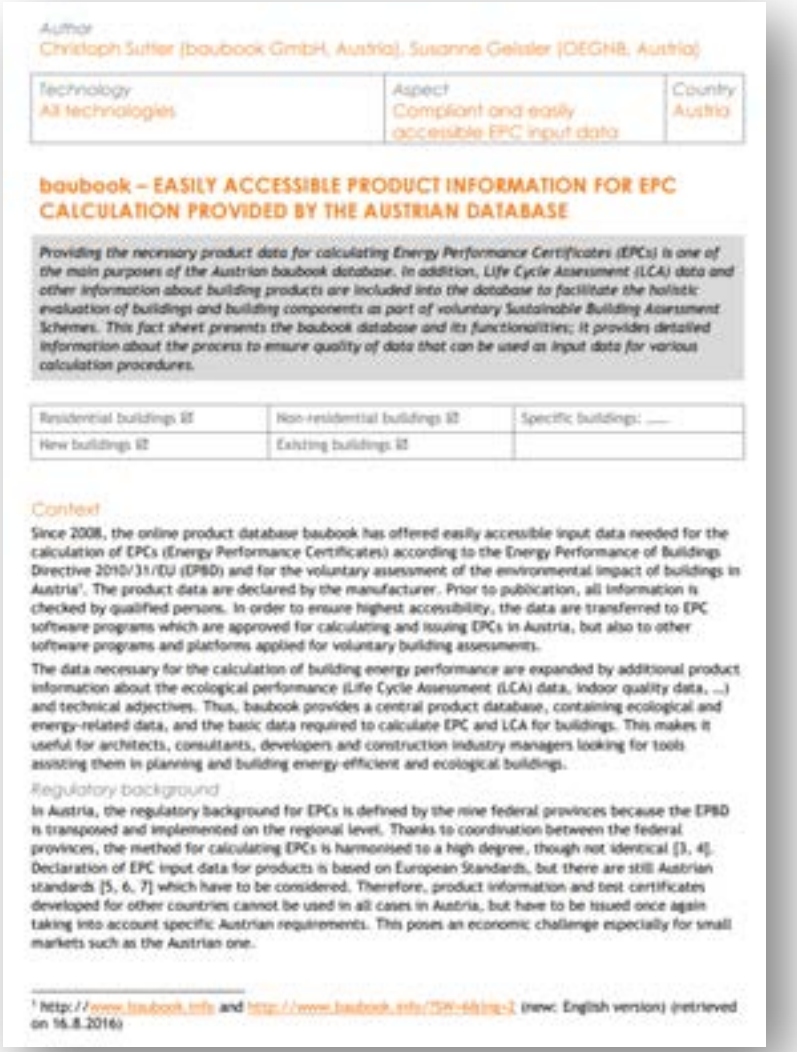
"Status on the Ground"
Overview of existing surveys on energy performance related quality and compliance
Mikk Maivel, Kalle Kuusk, Raimo Simson, Jarek Kurnitski, Targo Kalamees (Tallinn University of Technology, Estonia)
www.qualicheck-platform.eu
Documented examples regarding quality of wor
Keike Erhorn-Kluttig, Hans Erhorn (Fraunhofer Institute for Building
www.qualicheck-platform.eu
"Towards compliant and easily acces
How to get compliant and access for the energy rating calculation
Overview of some existing approache
Finalreport, March 2016
François Durier (CETIAT, France), Susanne
www.qualicheck-platform.eu
Improving the compliance of Energ Certificates and the quality of build
Booklet, April 2016
François Rémi Carlé (ICEE-INIVE)
www.qualicheck-platform.eu

Source book on quality of the works

Aim:

To give guidance towards better frameworks for quality of the works

Factsheets



Author
Christoph Sutter (baubook GmbH, Austria), Susanne Geissler (OEGNB, Austria)

Technology	Aspect	Country
All technologies	Compliant and easily accessible EPC input data	Austria

baubook – EASILY ACCESSIBLE PRODUCT INFORMATION FOR EPC CALCULATION PROVIDED BY THE AUSTRIAN DATABASE

Providing the necessary product data for calculating Energy Performance Certificates (EPCs) is one of the main purposes of the Austrian baubook database. In addition, Life Cycle Assessment (LCA) data and other information about building products are included into the database to facilitate the holistic evaluation of buildings and building components as part of voluntary Sustainable Building Assessment Schemes. This fact sheet presents the baubook database and its functionalities; it provides detailed information about the process to ensure quality of data that can be used as input data for various calculation procedures.

Residential buildings ☒	Non-residential buildings ☒	Specific buildings: ____
New buildings ☒	Existing buildings ☒	

Context

Since 2008, the online product database baubook has offered easily accessible input data needed for the calculation of EPCs (Energy Performance Certificates) according to the Energy Performance of Buildings Directive 2010/31/EU (EPBD) and for the voluntary assessment of the environmental impact of buildings in Austria[1]. The product data are declared by the manufacturer. Prior to publication, all information is checked by qualified persons. In order to ensure highest accessibility, the data are transferred to EPC software programs which are approved for calculating and issuing EPCs in Austria, but also to other software programs and platforms applied for voluntary building assessments.

The data necessary for the calculation of building energy performance are expanded by additional product information about the ecological performance (Life Cycle Assessment (LCA) data, indoor quality data, ...) and technical adjectives. Thus, baubook provides a central product database, containing ecological and energy-related data, and the basic data required to calculate EPC and LCA for buildings. This makes it useful for architects, consultants, developers and construction industry managers looking for tools assisting them in planning and building energy-efficient and ecological buildings.

Regulatory background

In Austria, the regulatory background for EPCs is defined by the nine federal provinces because the EPBD is transposed and implemented on the regional level. Thanks to coordination between the federal provinces, the method for calculating EPCs is harmonised to a high degree, though not identical [3, 4]. Declaration of EPC input data for products is based on European Standards, but there are still Austrian standards [5, 6, 7] which have to be considered. Therefore, product information and test certificates developed for other countries cannot be used in all cases in Austria, but have to be issued once again taking into account specific Austrian requirements. This poses an economic challenge especially for small markets such as the Austrian one.

[1] http://www.baubook.info and http://www.baubook.info/?SW=ebjing=1 (new: English version) (retrieved on 16.8.2016)

What is a factsheet?

Short document on a specific topic

Fact Sheets by topic

TECHNOLOGIES / ASPECTS	Transmission Characteristics	Ventilation and Airtightness	Sustainable Summer Comfort Technologies	Renewables in Multi-Energy Systems
Status on the Ground	X	X	X	X
Compliant and Easily Accessible EPC Input Data	X	X	X	X
Quality of the Works	X	X	X	X
Compliance Frameworks	X	X	X	X

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International Energy Agency

Towards compliant building airtightness and ventilation systems
AIVC Contributed Report 16

Energy in Buildings and Communities Programme
June 2017

This report was produced in collaboration with QUALICHECK

EBC is a programme of the International Energy Agency (IEA)

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fact sheet #07

2015.12

Author
Sandrine Charrier (Cerema), Adeline Bailly (Cerema), François Rémi Carrié (ICEE)

Technology	Aspect	Country
Ventilation and airtightness	Compliance frameworks	France

BUILDING AIRTIGHTNESS IN FRANCE: REGULATORY CONTEXT, CONTROL PROCEDURES, RESULTS

Since 2006, there has been a significant reward in the French energy regulations for good airtightness, which has been combined with a minimum requirement for residential buildings in the 2012 version of the regulation. Airtightness test results show that the average building airtightness performance has improved by nearly 50% in single- and multi-family buildings since 2006 and now stabilises below the minimum requirements around q_{50} = 2.8 m^3/h per m^2 of envelope area, excluding lowest floor (or about n_{50} = 1.8 h^{-1}).

	Minimum requirement	Possible values in case of Quality Management (QM) approach (multiples of 0,1 $m^3/h/m^2$	Default value
Single-family buildings	0.6 (3.2)	0.3-0.6 (1.6-3.2)	
Multi-family buildings	1.0 (5.4)	0.3-1.0 (1.6-5.4)	
Non-residential buildings		0.3-1.7 (1.6-9.2) or 0.3-3.0 (1.6-16.2) depending on building type (QM no longer applicable as of July 2015)	1.7 (9.2) or 3.0 (16.2) depending on building type

Table 1: Airtightness levels in the 2012 French regulation in m^3/h per m^2 of envelope surface area at 4 Pa. Approximate corresponding values at 50 Pa are shown in parenthesis.

OPTION 1: systematic test by certified tester

OPTION 2: Quality management approach (see other factsheet)

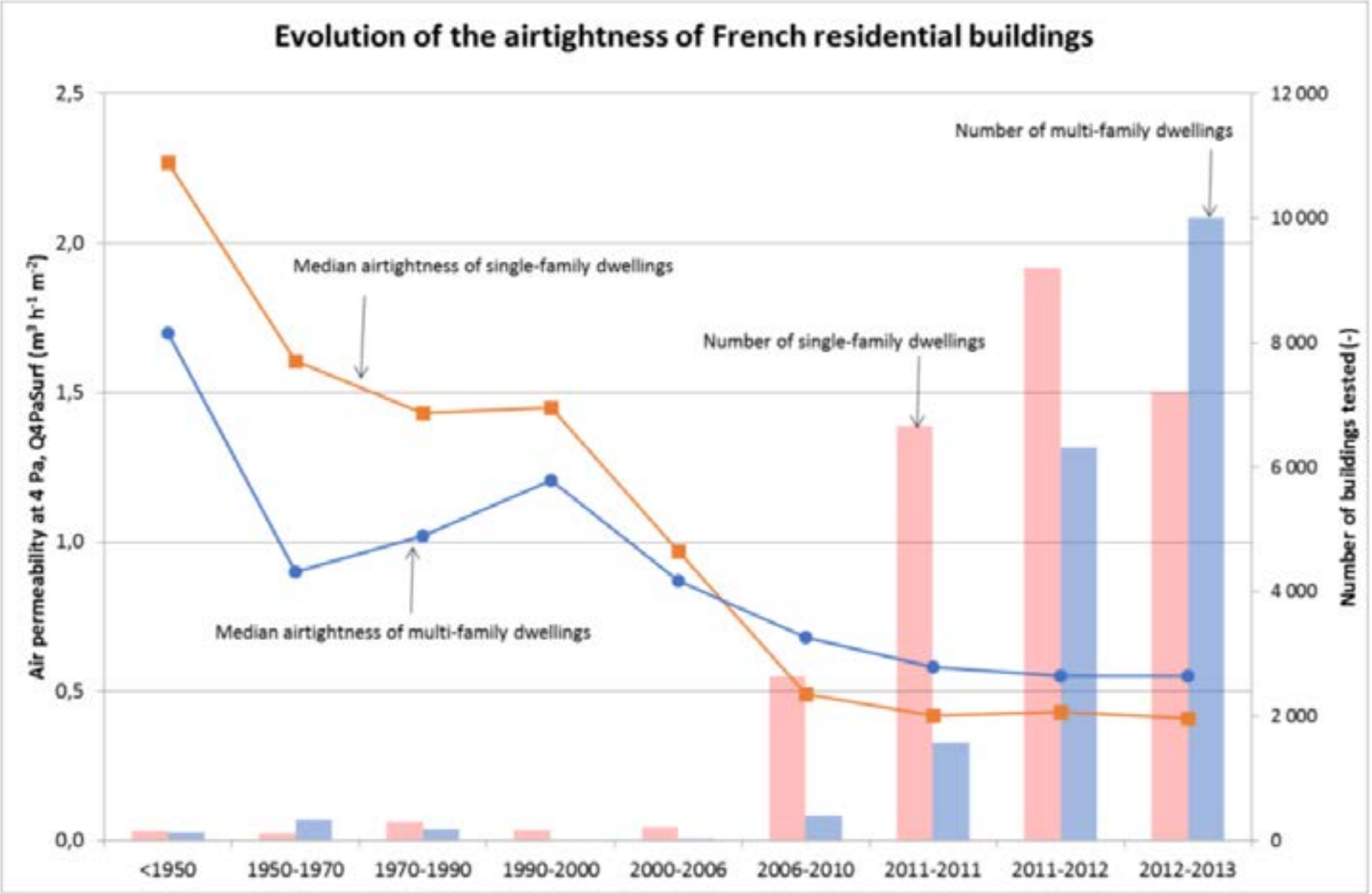

Figure 1: Specific building air leakage rate at 4 Pa performance depending on the construction year of measured buildings

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fact sheet #01

2015.1

Authors
François Rémi Carrié (ICEE) and Sandrine Charrier (CEREMA)

Technology	Aspect	Country
Ventilation and airtightness	Quality of the works	France

BUILDING REGULATIONS CAN FOSTER QUALITY MANAGEMENT: THE FRENCH EXAMPLE ON BUILDING AIRTIGHTNESS

The French regulation includes an alternative route to systematic building airtightness testing to justify for a given airtightness level. This route was developed to push professionals to revisit their methods for implementing building airtightness solutions and to include specific quality requirements. At the end of 2014, 81 such quality management approaches have been approved representing a production of about 15.500 buildings per year.

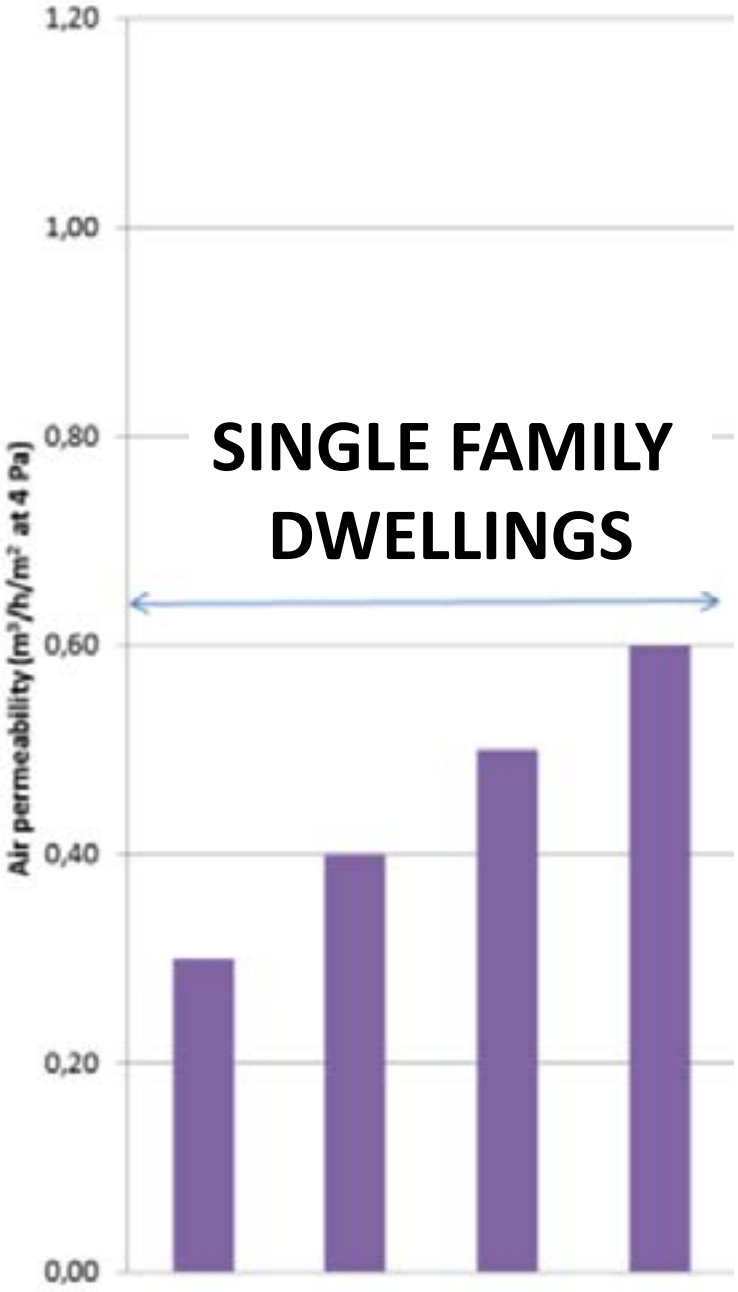


Figure 1: Possible values of maximum air permeability guaranteed by the applicant in single-family dwellings and multi-family buildings.

Type of buildings	Production	Sample size
Single-family dwellings	Nprod ≤ 500 Nprod > 500	Ntests = 5 +10 % Nprod Ntests = 55 + 5 % (Nprod - 500)
Other buildings	Nprod ≤ 50 Nprod > 50	Ntests = 30 % Nprod Ntests = 15 +15 % (Nprod - 50)

Table 2: Minimum sample size for the QM approach in the 2012 French regulation

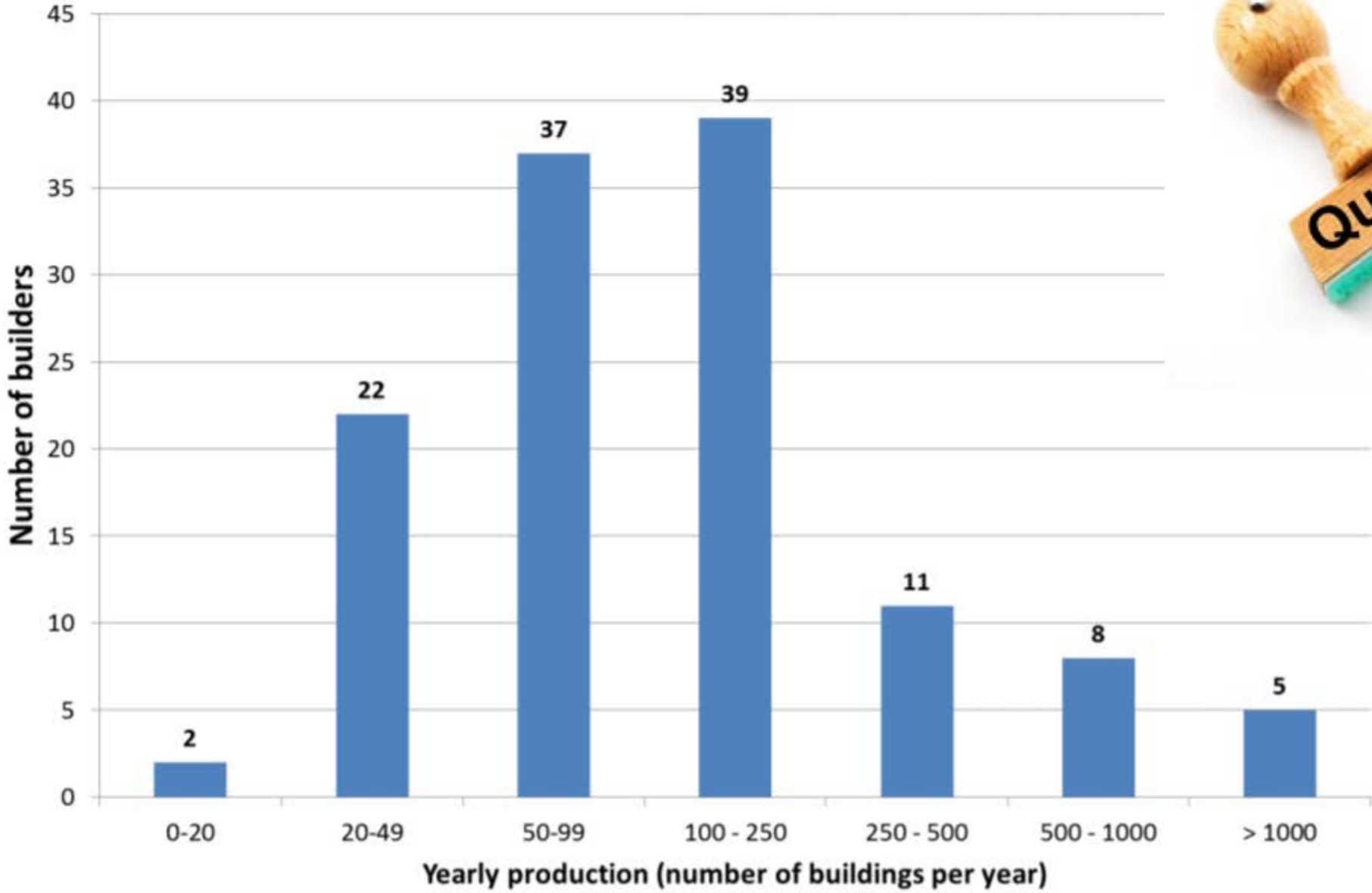


Figure 1: Distribution of builders applying the approach according to their yearly production

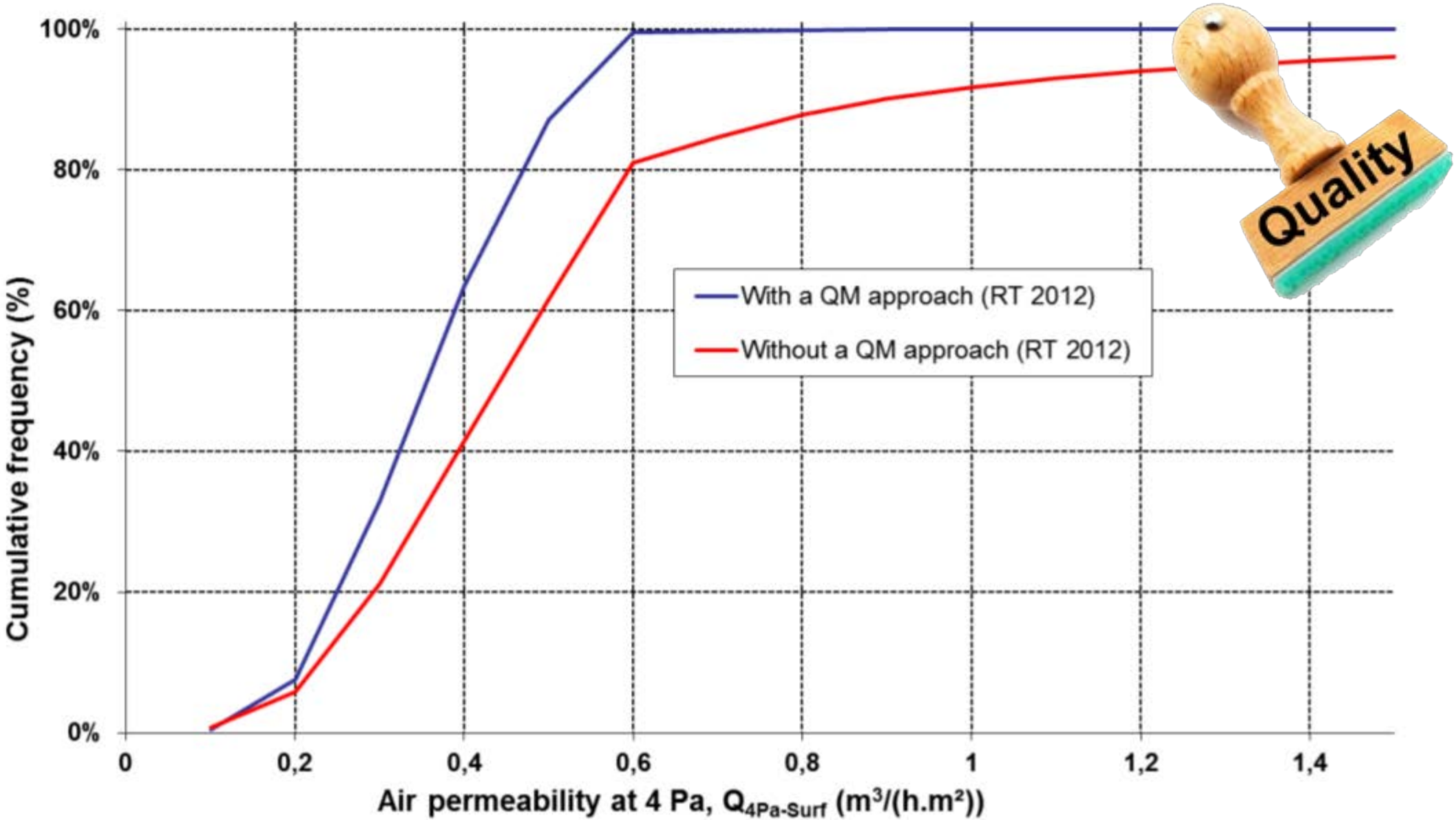


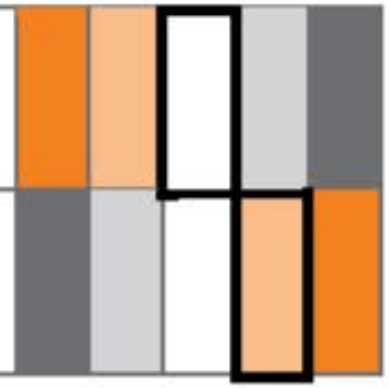
Figure 5: Distribution of measured airtightness of houses with and without implementation of a certified QM approach.

Level of complexity

(dark orange = simplest)

Potential for replication

(dark orange = best)



Prerequisite:

Substantial reward for good airtigh in EP calculation

Hints	Pitfalls
✓ Stress the benefits of QM approaches to secure airtightness level and comply with the regulation among stakeholders ✓ Discuss options with stakeholders ✓ Progressively increase QM requirements ✓ Ensure fair evaluation of the applications ✓ Conduct in situ controls ✓ Carefully estimate the minimum size of the sample to be measured	✓ Resources for examining applications ✓ Proof of application of standard drawings is not sufficient, some measurements must be done

Table 5: Overall hints and pitfalls to avoid when developing such an approach

QUALICHECK Towards better quality and compliance fact DATABASE

Authors
François Durier (CETIAT), Laure Mouradian (CETIAT), Fabrice Lamarre (Uniclima)

Technology	Aspect	Country
Ventilation and air tightness	Compliant and easily accessible EPC input data	France

FRENCH VOLUNTARY SCHEME FOR HARMONISED PUBLICATION OF VENTILATION PRODUCT DATA

A voluntary scheme defining the data to be announced in the product documentation has been launched in 2012 by Uniclima, the French association of ventilation product manufacturers. It ensures that product characteristics are provided under a harmonised form (same physical quantity, unit and assessment method), and facilitates access to relevant input data for the energy performance calculation of a building. The scheme contributes to enhancing the compliance of published data.

QUALICHECK
Towards better quality and compliance

fact DATABASE

Author
Samuel Caillou (BBRI)

Technology	Aspect	Country
Ventilation and airtightness; Transmission characteristics; Sustainable summer comfort	Compliant and easily accessible EPC input data	Belgium

VOLUNTARY SCHEME AND DATABASE FOR COMPLIANT AND EASILY ACCESSIBLE EPC PRODUCT INPUT DATA IN BELGIUM

The "EPB product database" in Belgium is an effective scheme to improve the compliance and easy access to product characteristics used as input data for the Energy Performance Certificate (EPC) calculation. The acceptance of this scheme by the market has been successful for many years. The present factsheet explains this Belgian scheme and tries to identify the reasons for its success and the prerequisites for the implementation of similar schemes in other countries.

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Towards better quality and compliance

fact sheet #06

2015.11

Author
François Rémi Carrié (ICEE), Sandrine Charrier (CEREMA) and Adeline Bailly (CEREMA)

Technology	*Aspect*	*Country*
Ventilation and airtightness	Compliance frameworks	France

REGULATORY COMPLIANCE CHECKS OF RESIDENTIAL VENTILATION SYSTEMS IN FRANCE

Regulatory compliance checks on samples of residential ventilation systems are operational in France. The analysis of their results shows a significant rate of non-compliance with the ventilation regulation (rate on the order of 50%).

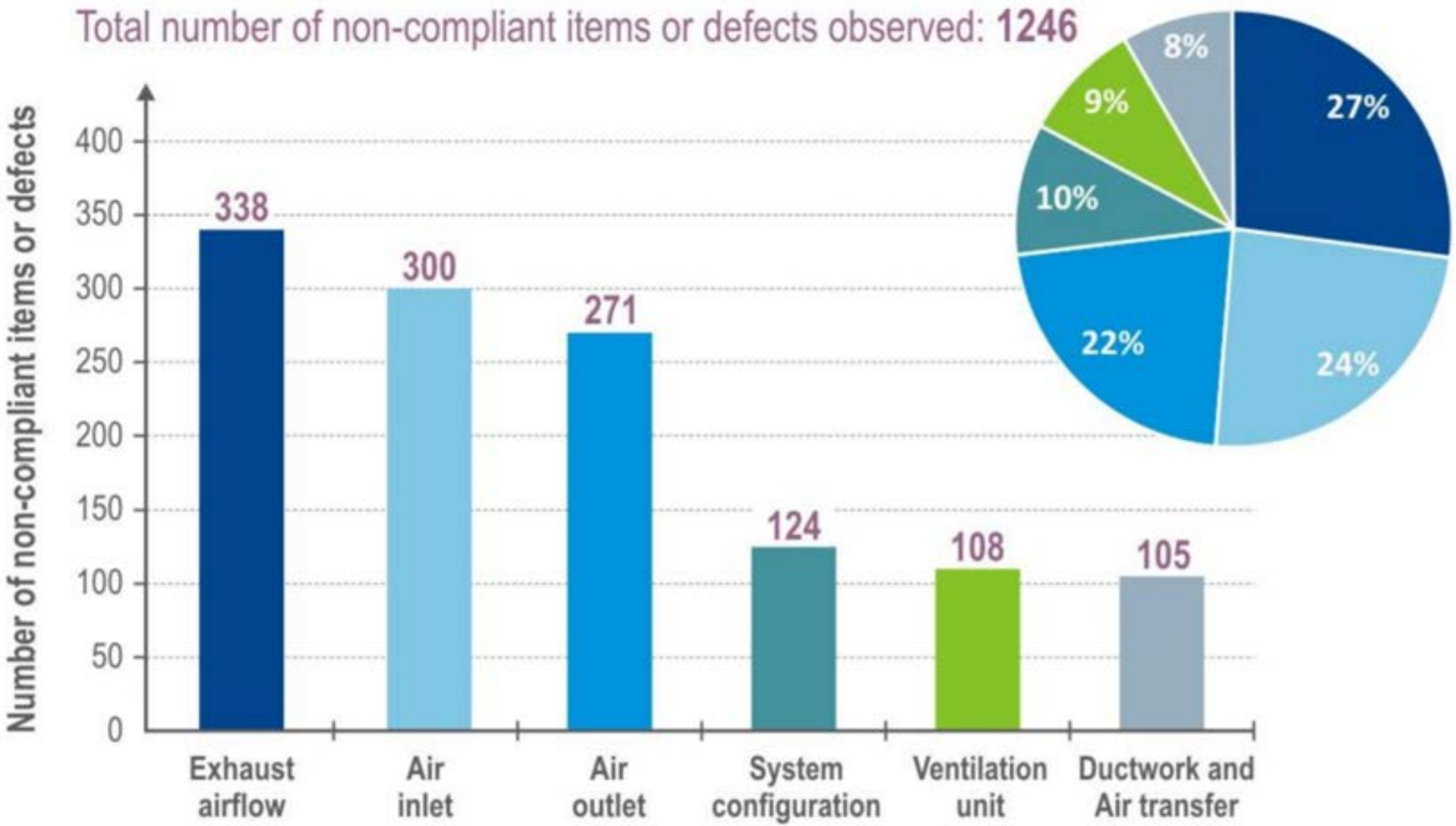

Figure 1: Number of non-compliance or defects per category in a sample of 1287 dwellings, see Jobert and collaborators (2012, 2013)

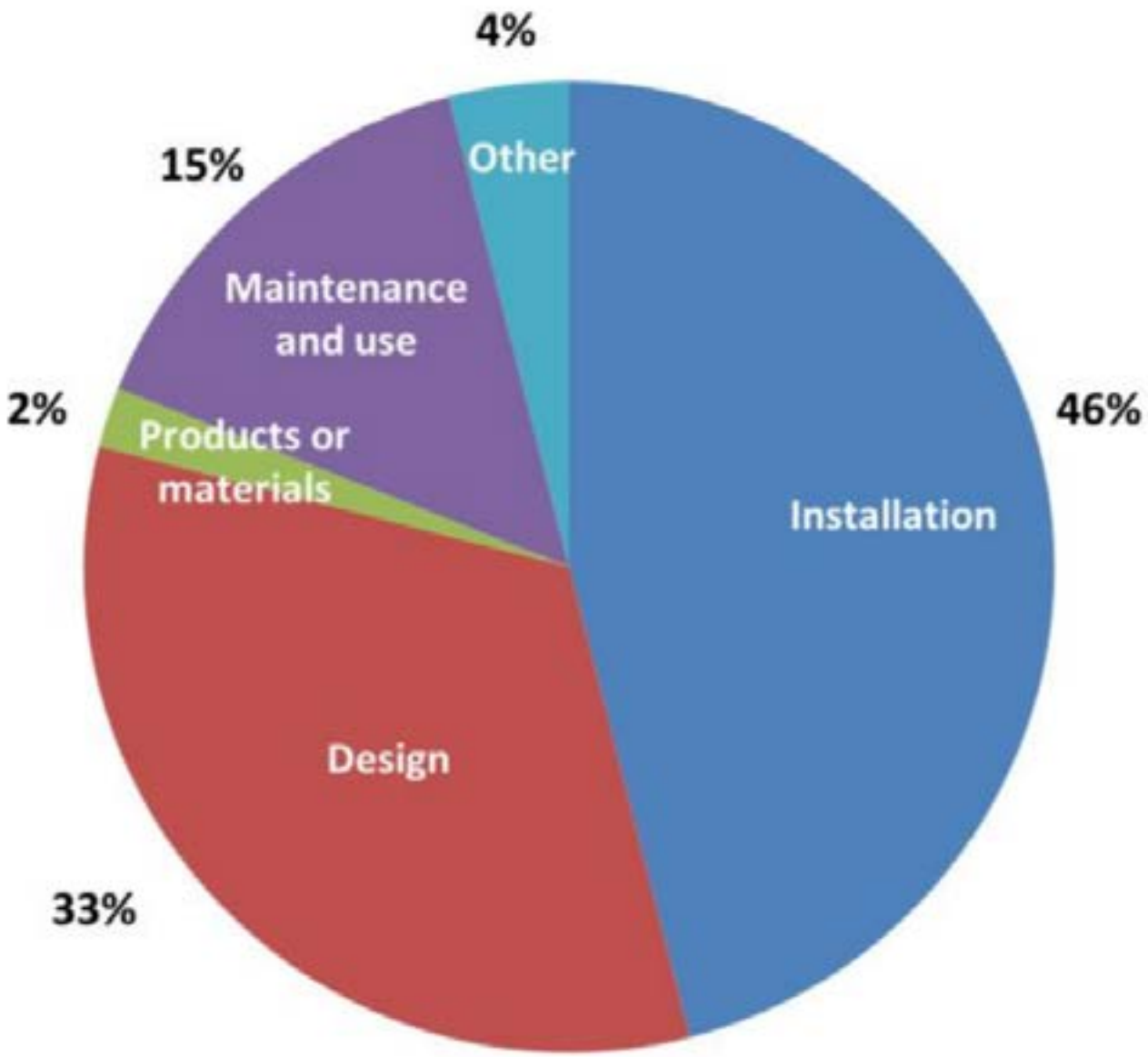

Figure 2: Origin of defects observed in residential ventilation systems in France (Sycodes, 2012)

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Towards better quality and compliance

fact sheet #55

2017.02

Authors
Samuel Caillou, Paul Van den Bossche (BBRI)

Technology	Aspect	Country
Ventilation	Compliance frameworks	Belgium

BELGIAN/FLEMISH EVALUATION SCHEME FOR VENTILATION SYSTEMS

Since many years, several monitoring studies have shown that the quality and compliance of installed ventilation systems can be low. The recently developed Evaluation scheme in Belgium tries to tackle this problem, thanks to the mandatory Ventilation Performance Report of all new ventilation installations, to be delivered by a Ventilation Reporter recognised by a Third-Party control organisation. This factsheet describes the approach of this scheme, including the penalty scheme and the role of the actors involved.

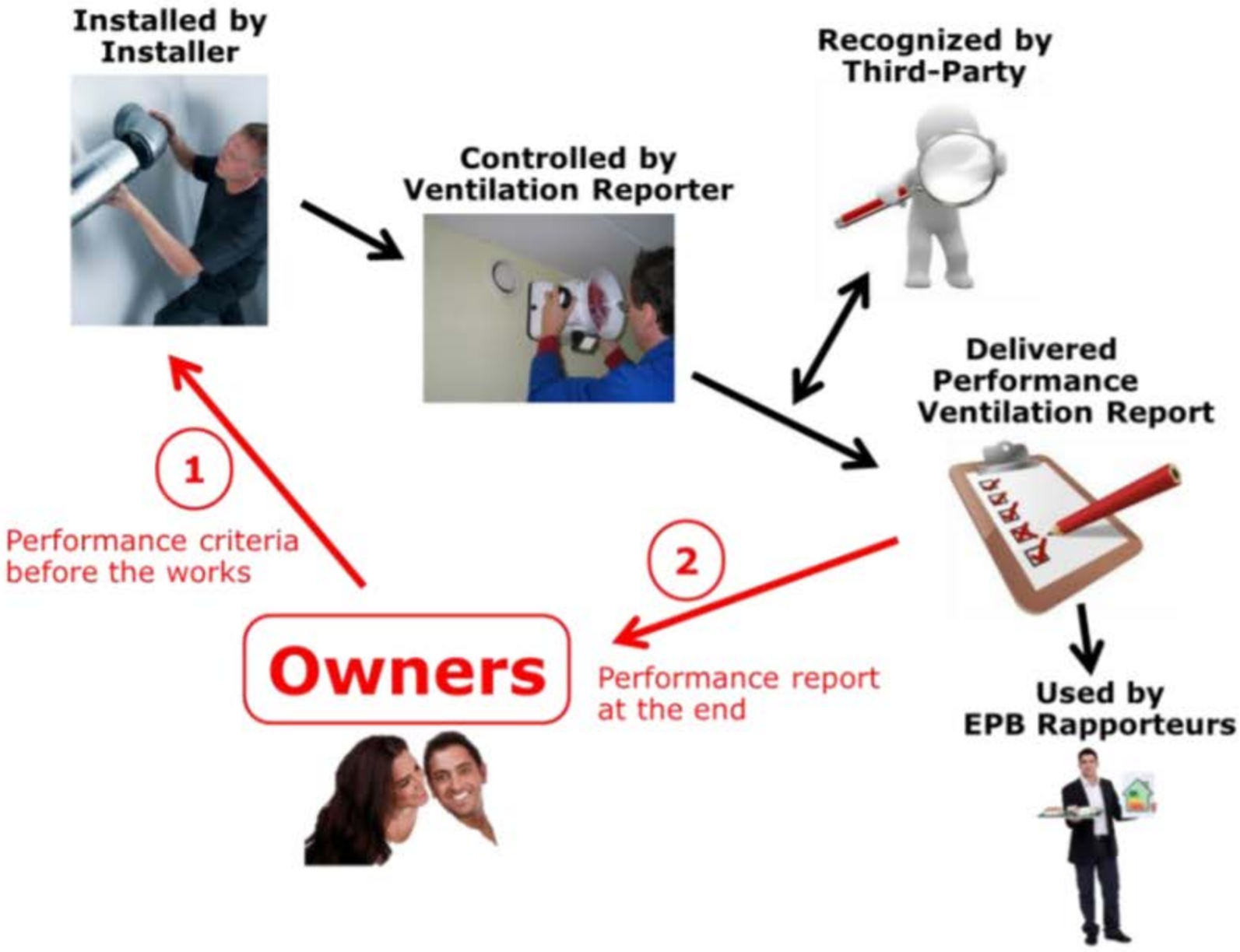


Figure 1: Principles of the evaluation scheme for ventilation in Belgium

Quality frameworks in Flemish Region(Belgium)

- **Insulation of existing cavity walls**
  - Operational since July 2012
  - About 90.000 buildings done since then
- **Internal insulation of external walls**
  - Only by “competent” contractors
- **External insulation**
  - In preparation

DRIVER: SUBSIDIES

- **Building airtightness**
  - For new buildings since January 2015
  - If not done in quality framework: use of default value
- **Residential ventilation**
  - For building permits after January 1 2016
  - If not done in quality framework: air flow rate = 0 m^3/h

DRIVER: ENERGY LEGISLATION

Practical information on airtightness and ventilation quality frameworks

- Quality framework for **<u>building airtightness</u>**:
  - About 3 years of experience

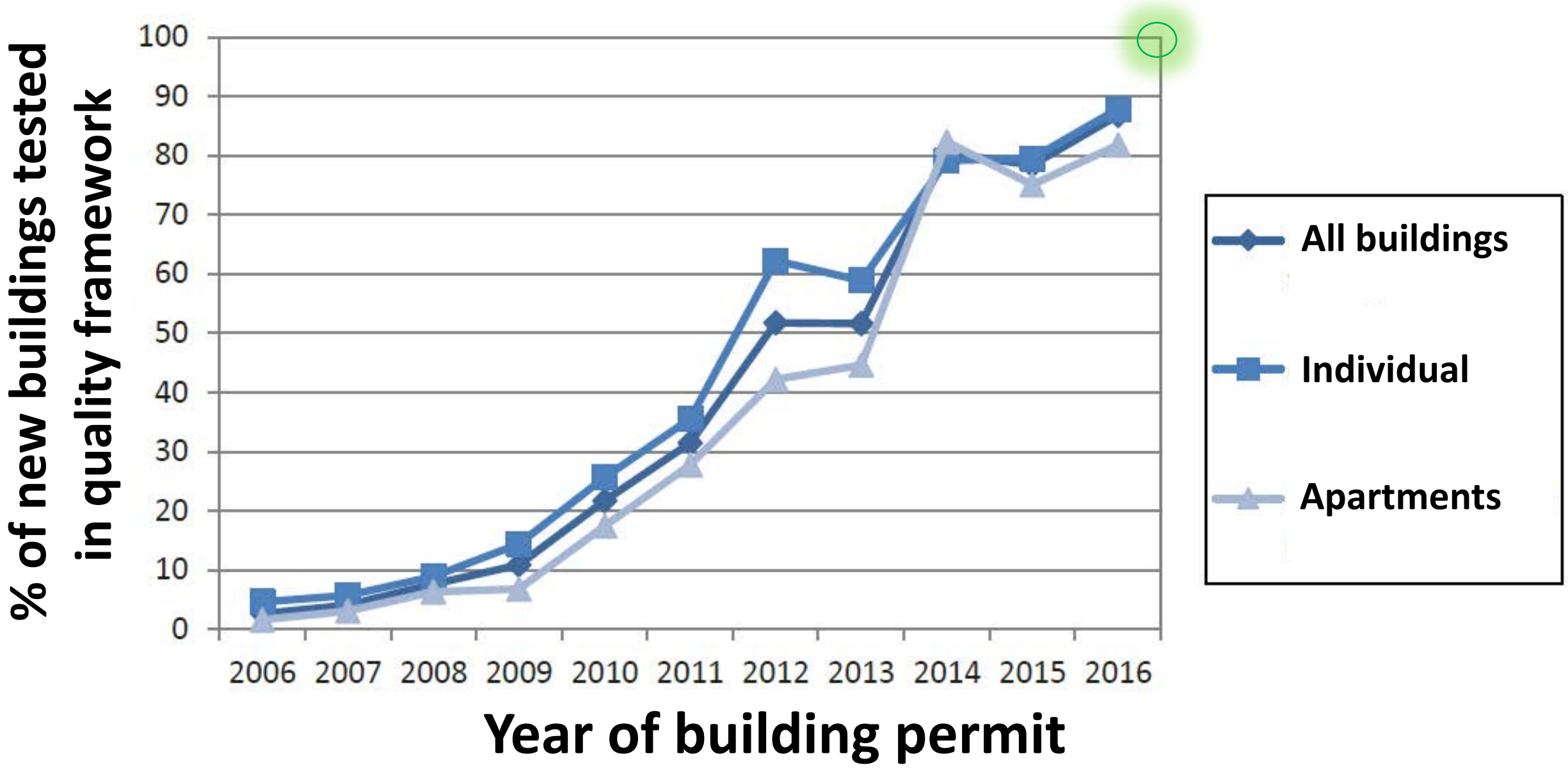
- Quality framework for **<u>residential ventilation:</u>**
  - For new buildings with building permit after January 2016
  - In practice limited number of dossiers

Quality framework for airtightness testing

Context:

- **NOT** mandatory
- BUT if done outside quality framework: use of default value
  - 12 $m^3/h.m^2$ of building envelope
- In practice: will become standard practice with increasing requirements on energy efficiency

  → See next slide


% of new buildings tested in quality framework
100
90
80
70
60
50
40
30
20
10
0
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Year of building permit
All buildings
Individual
Apartments

Who can do a test?

- **No requirement of independence**
  - Contractor can test his own building

- **Proof of competence:**
  - Theoretical exam
  - Practical exam

Control by third party organisation

- **Desktop checks**
  - **10 %** of submitted reports are checked

- **In situ checks**
  - **10 %** of tests are checked on-site
    - Or during the test itself
      - Appropriate equipment? Preparation of building? Testing and reporting
    - Or after test (based on SMS message)
      - Is there a reliable reporting?

SMS procedure

- **SMS 1**: If airtightness tester believes a test is possible:
  - SMS 1: dossier number + estimated time of finishing test
- **SMS 2**: If test is finalised:
  - SMS 2: measured result

- BCCA actions in case on-site check are the requirements:
  - Within 5 minutes: an SMS indicating that an inspector will come on site
  - Within 20 minutes: inspector must be on-site

Desktop checks – BCCA statistics for 2017

- About 6.200 buildings tested
- How many checks: **10,1% of reports** (631 checks)
- At least one check for each testing company : 152 companies were checked **(100%)**

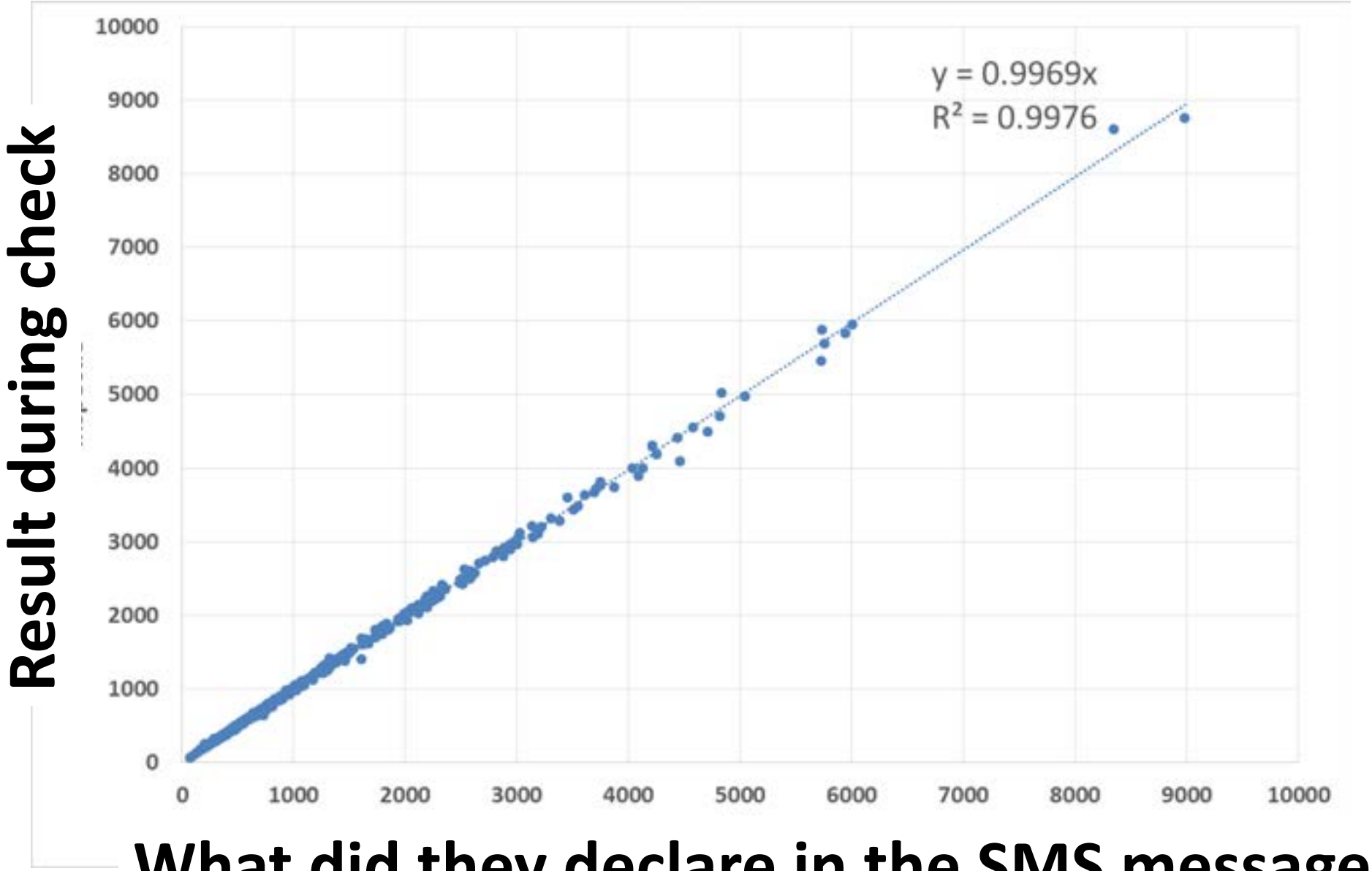
In situ checks – BCCA statistics for 2017

- Checks: **10,2% of reports** (634 inspections)
  - 66% after sending of SMS
  - Also during weekend

- **Duration of inspection?**
  - Average duration of inspection: 21,5 minutes
  - Average waiting time for inspection to arrive: 2,8 min

→ Since 10% of tests are checked: average time 'loss': about 2.5 minutes

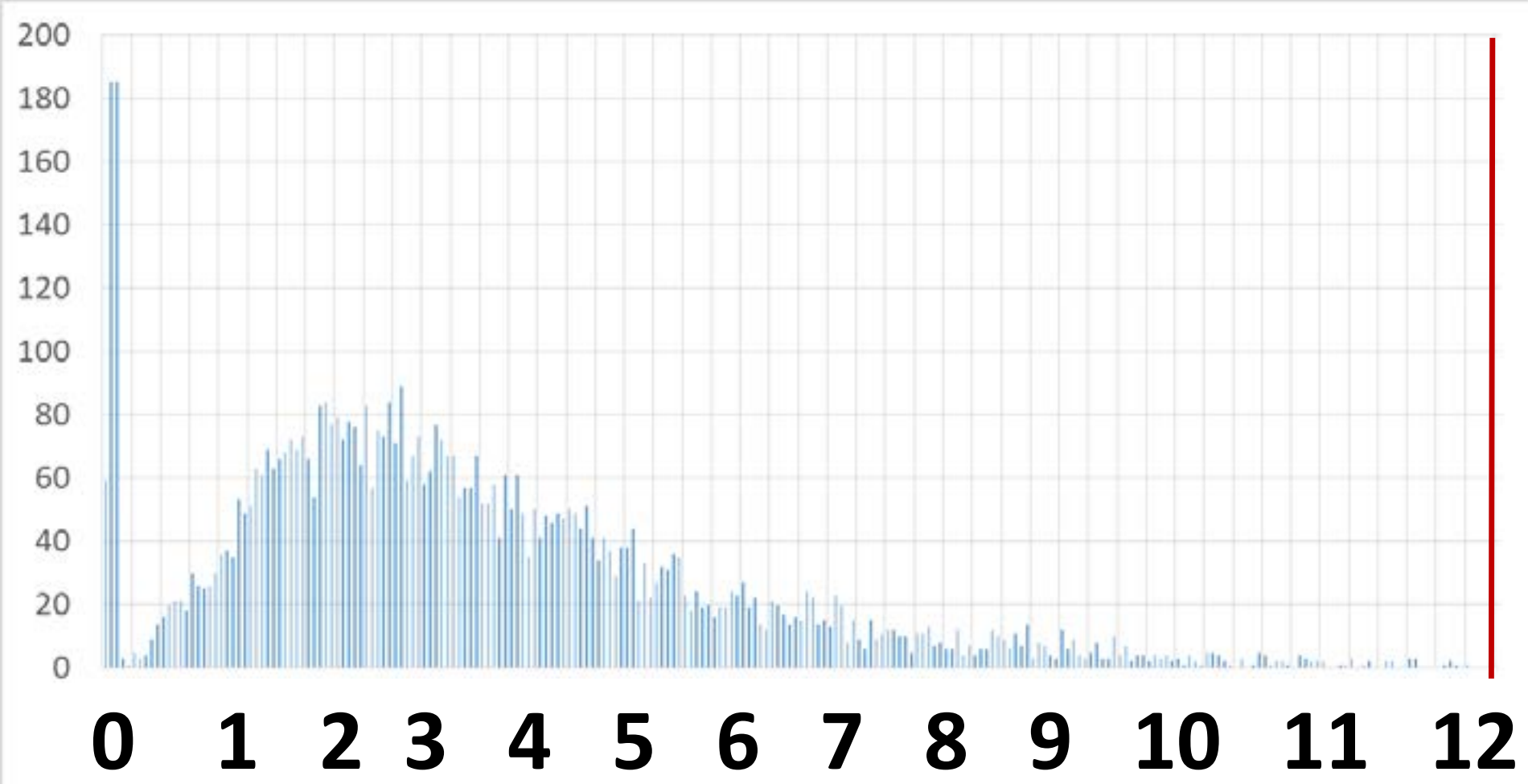
In situ checks– statistics 2017 – 634 inspections



What did they declare in the SMS message?

In situ checks – statistics 2017

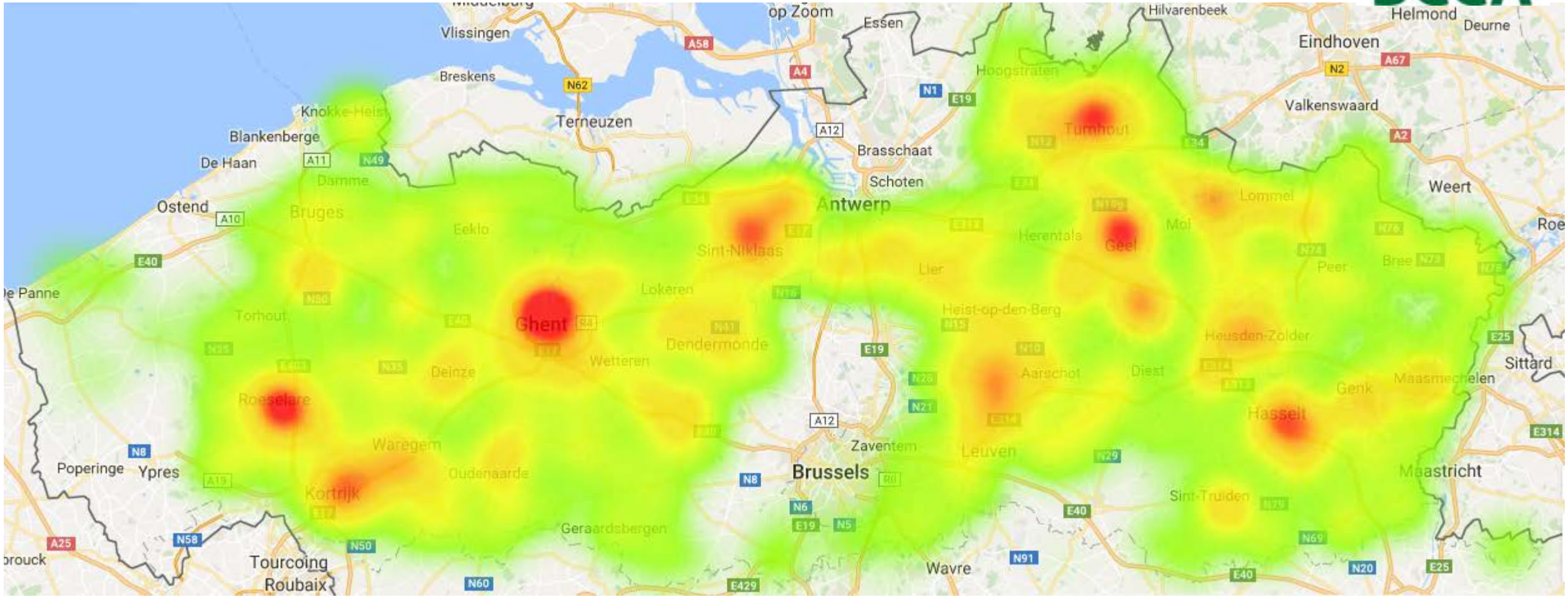
Distribution of results ($m^3/h.m^2$ at 50 Pa)



In situ checks – statistics 2017

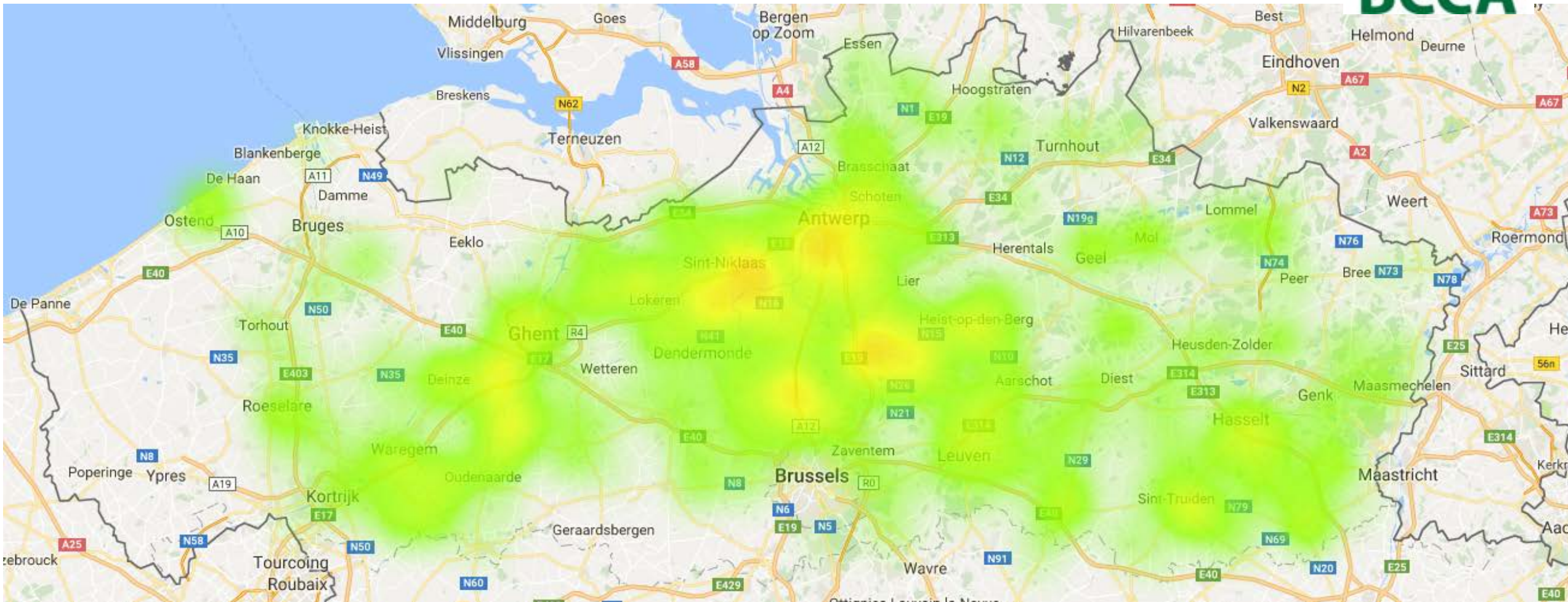
In situ checks – statistics 2017

Location of airtightness testing



In situ checks – statistics 2017

Location of in situ checks



Characteristics Flemish VENTILATION quality framework

- Mandatory scheme in context of requirements for new buildings
- Major elements:
  - **“Competent” person(s)** must execute a number of activities
    - Ventilation pre-design concept
      - Major objective: inform the building owner
    - Ventilation performance report
      - Declaration of performances of ventilation system
  - **Desktop checks** – 10%
  - **In situ tests** – 10%

Competence: Online exams

	# of persons
Coordinator	686
Designer	800
Rapporteur supply openings	737
Rapporteur transfer openings	999
Rapporteur exhaust openings	648
Rapporteur mechanical ventilation	784

Competence: Practical tests

Rapporteur mechanical ventilation: about 350 persons

Conclusions

- Is is not evident to assume that:
  - everybody is following the regulations
  - Everybody reports correctly

- There are various interesting approaches for achieving better compliance