Developing regulations to improve IAQ and ventilation in Belgian buildings

Peter Wouters – Arnold Janssens

Structure of the presentation

- **Introduction**
- 2006 - Ventilation related requirements in the context of the EPBD
- 2015 - On site performance checks of declared building airtightness levels
- 2016 - On site performance checks of residential ventilation systems
- 2019 - Federal regulation regarding wellbeing on workplaces
- 2022 - Federal regulation on indoor air quality
- Conclusions

Introduction

- **1991**: Belgian standard NBN D50-001 with specifications regarding ventilation in residential buildings
  - →In practice very limited impact due to no compliance framework
- **Since 2006**: Starting with the adoption of the EPBD: stepwise evolution in regulatory specifications regarding ventilation in buildings
- **Regulatory context:** Belgium is a federal country
  - Federal government
  - 3 regional governments (Brussels capital – Flemish Region – Walloon Region)
    - In charge of energy policy in buildings

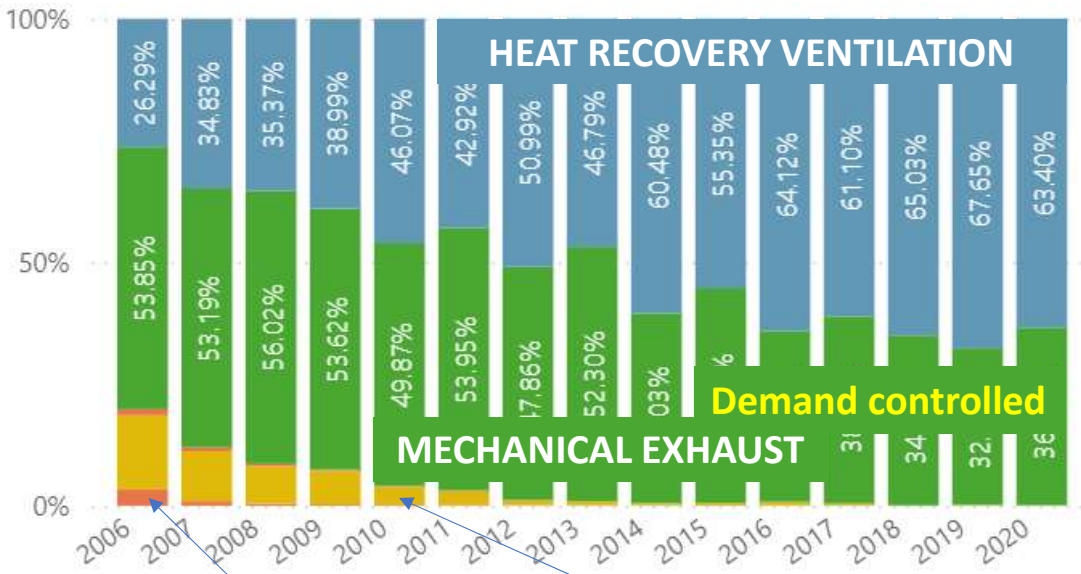

NETHERLANDS
North Sea
GERMANY
FLEMISH REGION
BRUSSELS
WALLOON REGION
FRANCE
LUXEMBOURG

2006 - Ventilation related requirements in the context of the EPBD

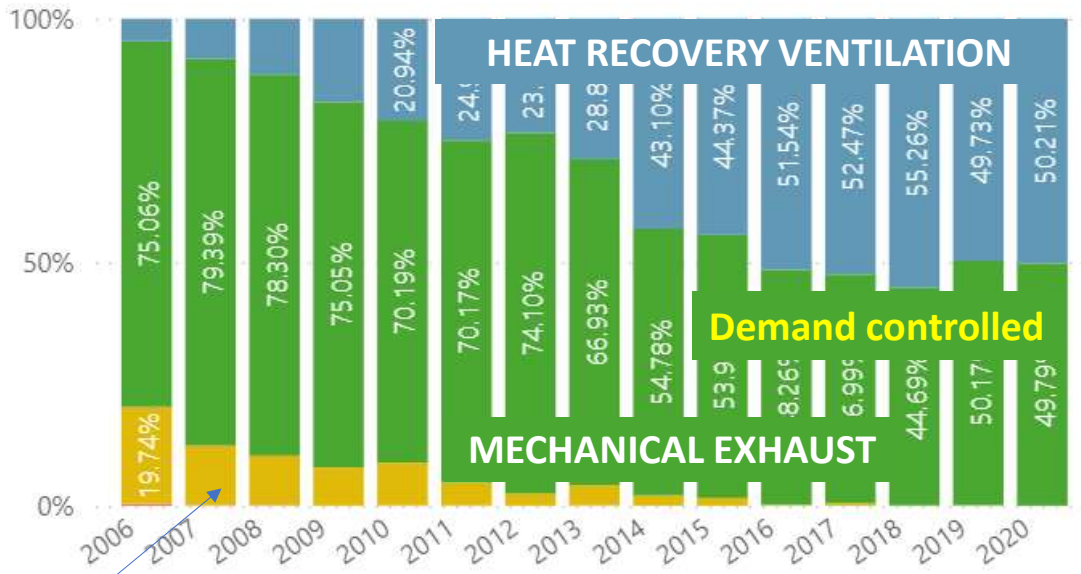
- EPBD? → see presentation by Jaap Hogeling
- EPBD refers since first version in 2003 to indoor air quality
- Belgian context:
  - Transposition of this EPBD directive is the responsibility of the 3 Regions, in practice for new buildings to a large extent a similar approach
- What type of points of attention in Belgian context?
  1. Minimum air flow requirements for all new buildings
  2. Energy efficiencient ventilation is stimulated – see next slides
  3. Legal framework for allowing innovative solutions – see next slides
  4. Database with reliable product data
  5. Energy performance declaration at the end of the works ('as build')
  6. Strict compliance and infringement framework

NEW buildings

Single family dwellings



Apartments in multifamily buildings

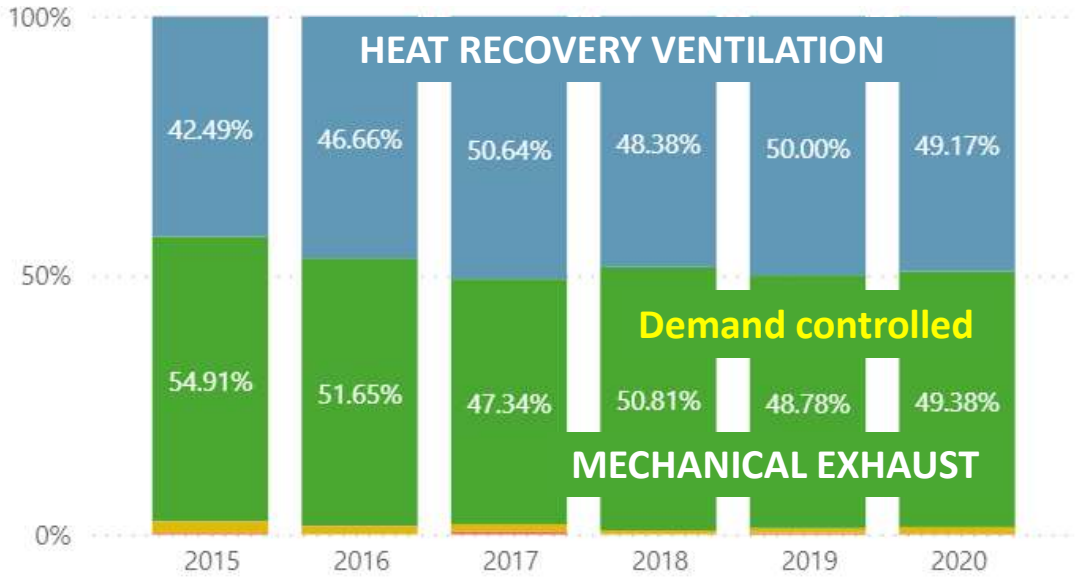


NO VENTILATION

NATURAL VENTILATION

DEEP energy RENOVATIONS

Single family dwellings



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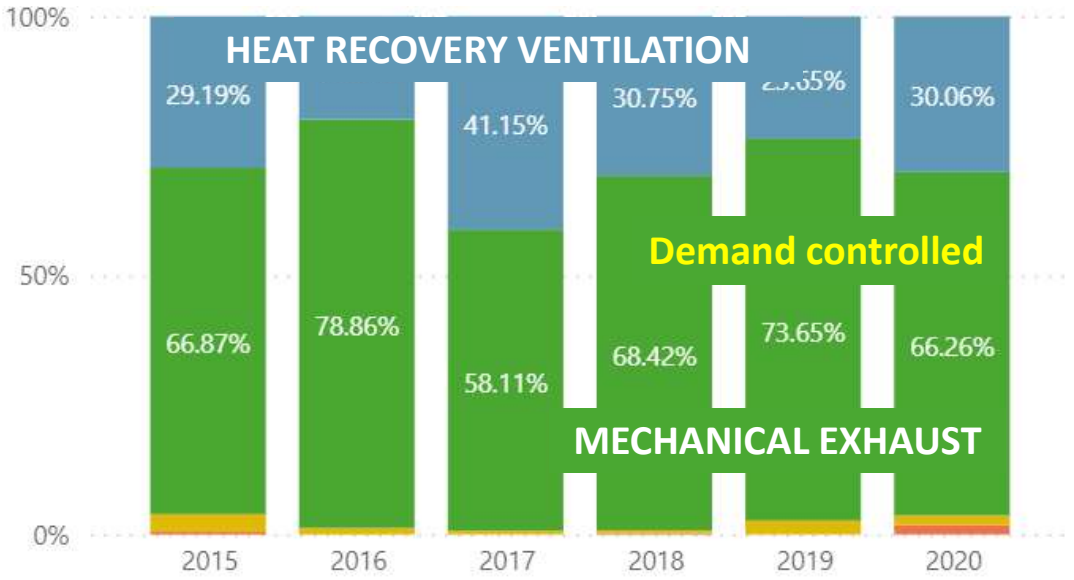

NO VENTILATION

NATURAL VENTILATION

2006- Ventilation related requirements in the context of the EPBD

Belgian energy legislation stimulates energy efficient ventilation by various ways:

- Benefits in case of **heat recovery ventilation**
- Benefits in case of **demand controlled ventilation**
- **Fan power** is taken into account
- **Airtightness of ductwork** can be taken into account
- **Quality of installation** can be taken into account (installed flow rates, balancing of flow rates,…)

Assessment of innovative systems

- **By principle of equivalence**
  - Manufacturers can submit a request
  - Based on the identified performances, a reduction factor is determined based on extensive simulations
- **In practice since 2010:**
  - Regulations allow for the application of residential demand controlled ventilation (DCV)
    - ±30 ventilation systems assessed through equivalence, mainly MEV
  - Generic DCV-classification method with reduction factors in regulatory calculations since 2016
    - ±50 ventilation systems with declared performance on the residential market

Strict compliance framework

- EPB-assessor reports status after completion of works
- Non-compliance with regulations = fines
- Rules are very clear and integrated in software tool:
  - E.g. Ventilation: 4 € per missing m³/h
    - Example:
      - Requirement in bathroom: 50 m³/h
      - If in reality only 10 m³/h: fine = 4*(50-10) = 160 €
- No need to involve judge in decision process

“Reliable” product data

… these data will be accepted by the government in context of this regulation

www.epbd.be

Vlaanderen is energie

bruxelles environnement leefmilieu brussel .brussels

Wallonie

Example: Performance data heat recovery systems

Name	Max. Power FAN 1 (W)	Max. Power FAN 2 (W)	POSITION 1		POSITION 2		POSITION 3	
			EFFICIENCY (%)	m³/h	EFFICIENCY (%)	m³/h	EFFICIENCY (%)	m³/h
AAA	110	110	86%	120	83%	251	81%	310
BBB	121	121	87%	181	85%	229	84%	279
CCC	120	120	87%	179	86%	228	85%	328
DDD	179	179	84%	263	83%	319	80%	400
EEE	178	178	86%	259	85%	320	83%	393

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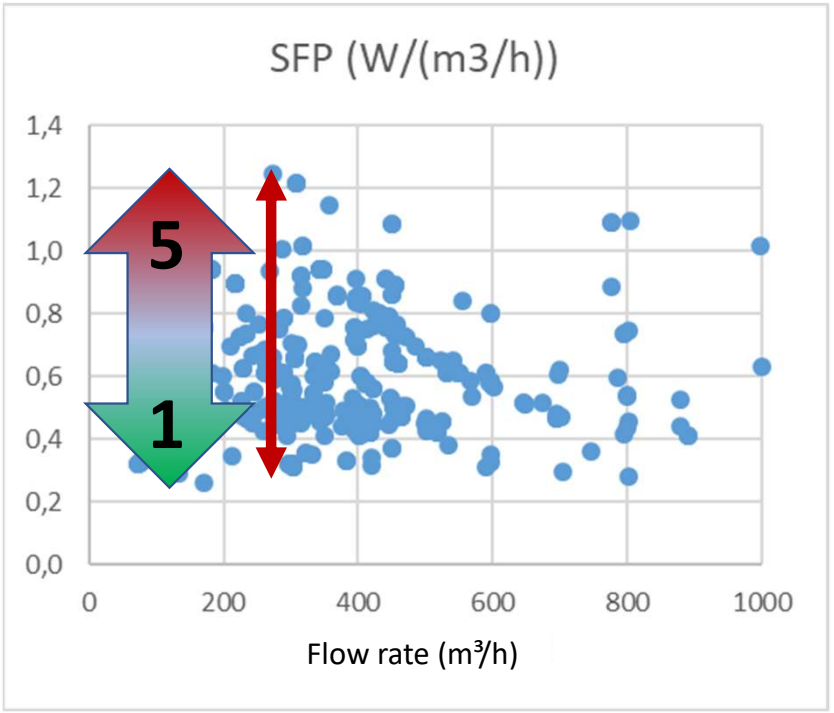
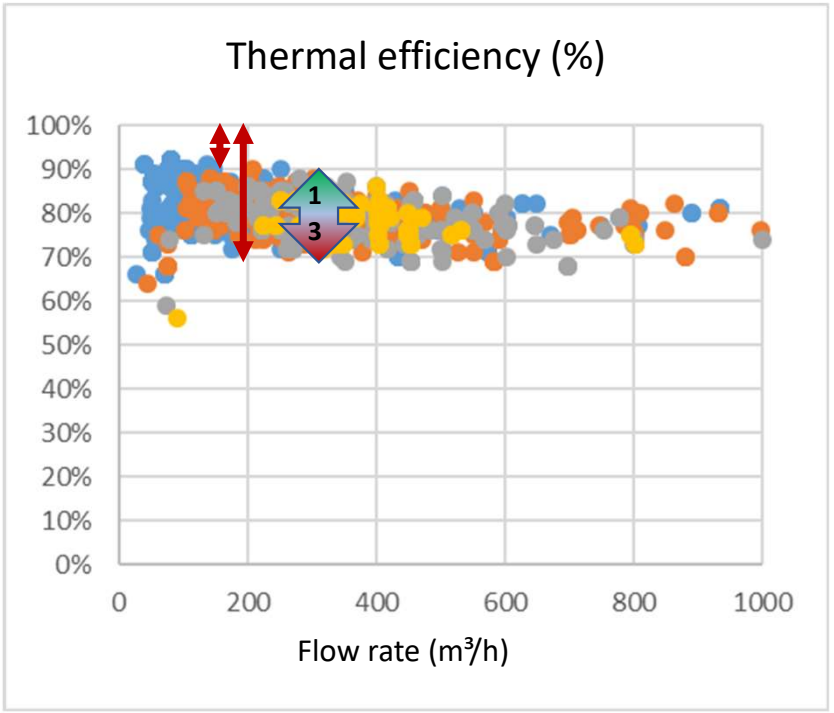
Wallonie

Examples of typical performance data for residential heat recovery units from EPB-productdatabase





Max. power/ max. flow rate

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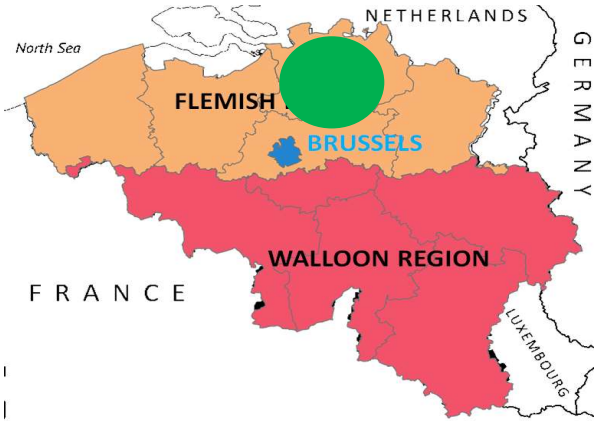
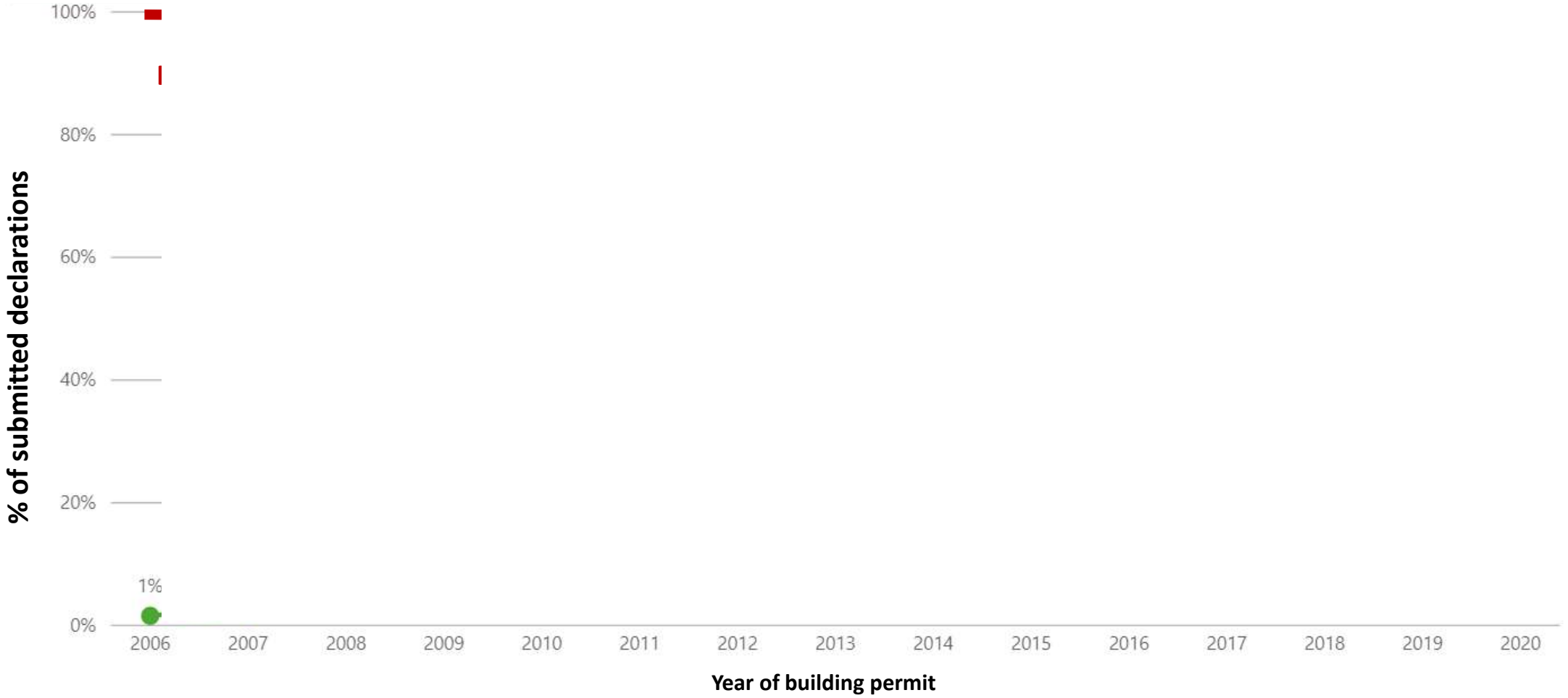
2015 - On site performance checks of declared building airtightness levels

- **Observations:**
  - Energy performance calculations take airtightness into account. If no test results available, default value to be used (12 $m^3/h.m^2$ at 50 Pa)
  - In NZEB buildings, poor building airtightness has a big impact
    - Airtightness testing becomes important (and good results!)
  - Not evident to assume that test results are always reliable
- **Approach:**
  - Quality framework developed by Flemish government (2015)
  - 150 to 190 qualified airtightness tester companies
  - Random onsite audits for min. 10% of tests
  - All measurement data gathered in database
  - More than 100.000 tests done



https://www.aivc.org/resource/vip-454-trends-building-and-ductwork-airtightness-belgium?volume=33977

Evolution of share of residential EPB declarations with air tightness test .



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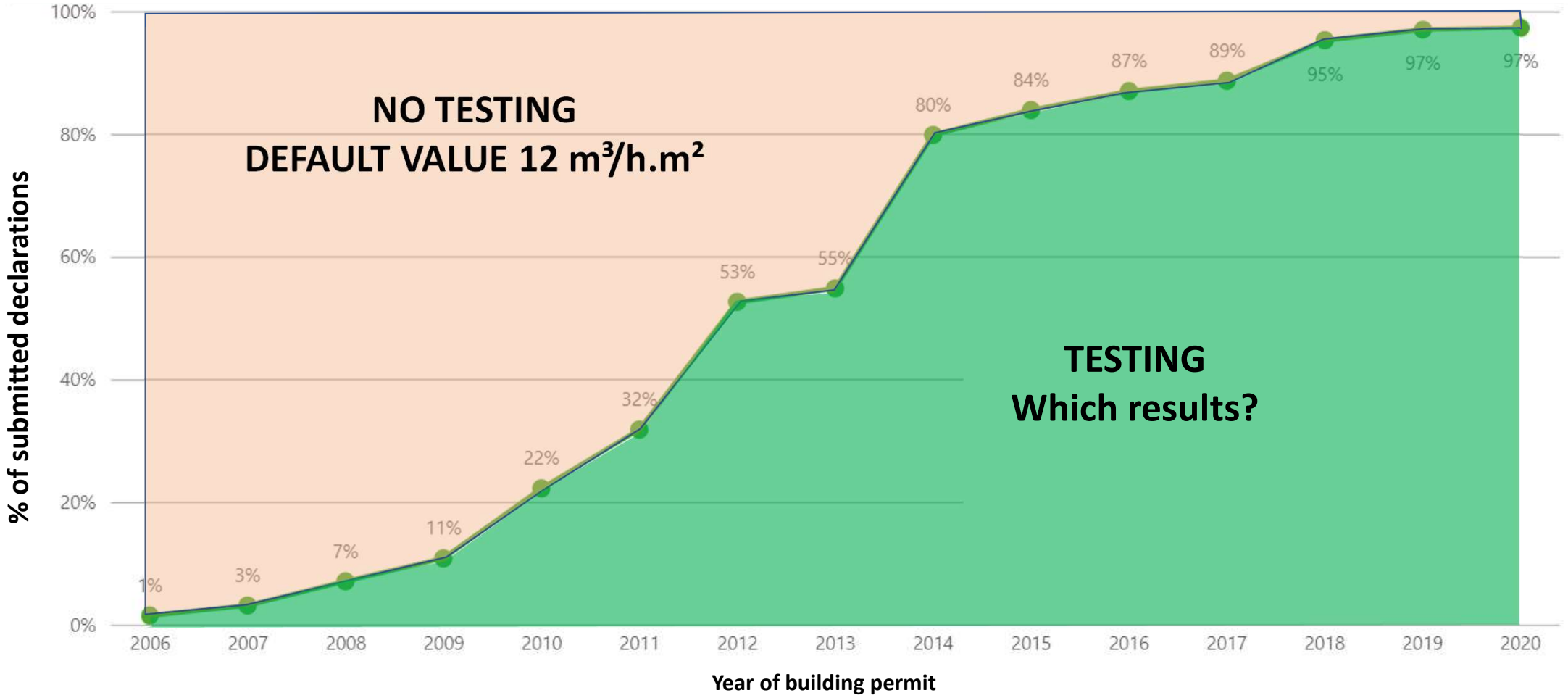
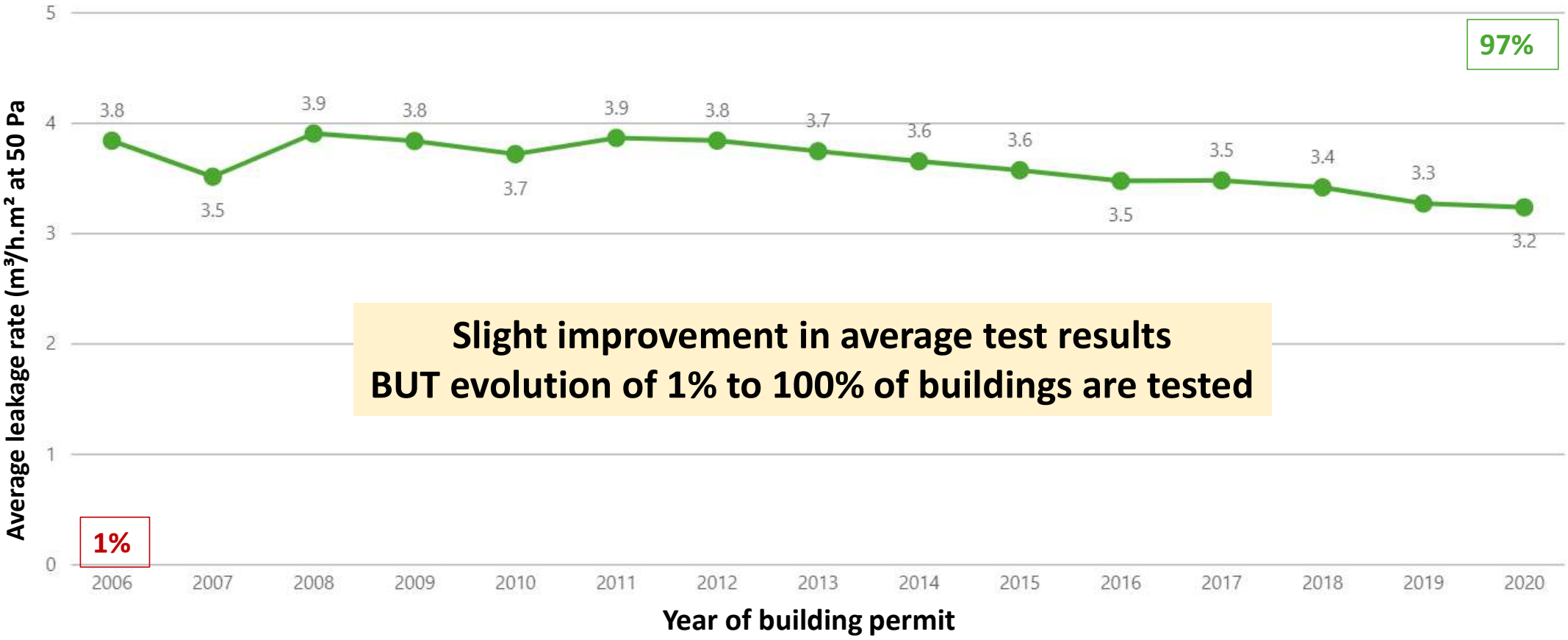
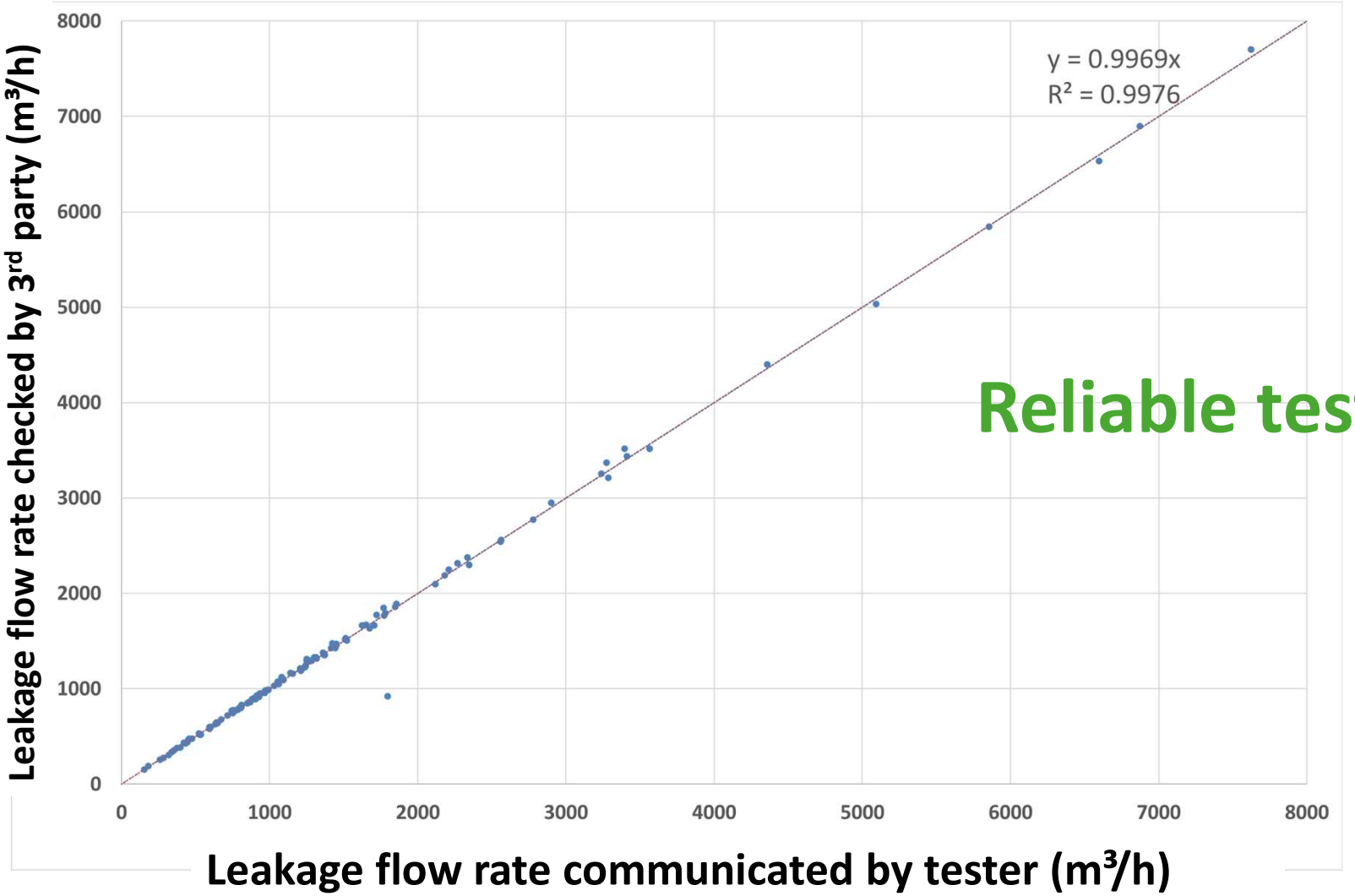


Average air permeability ($m^3/h/m^2$): leakage flow rate @50 Pa divided by heat loss area



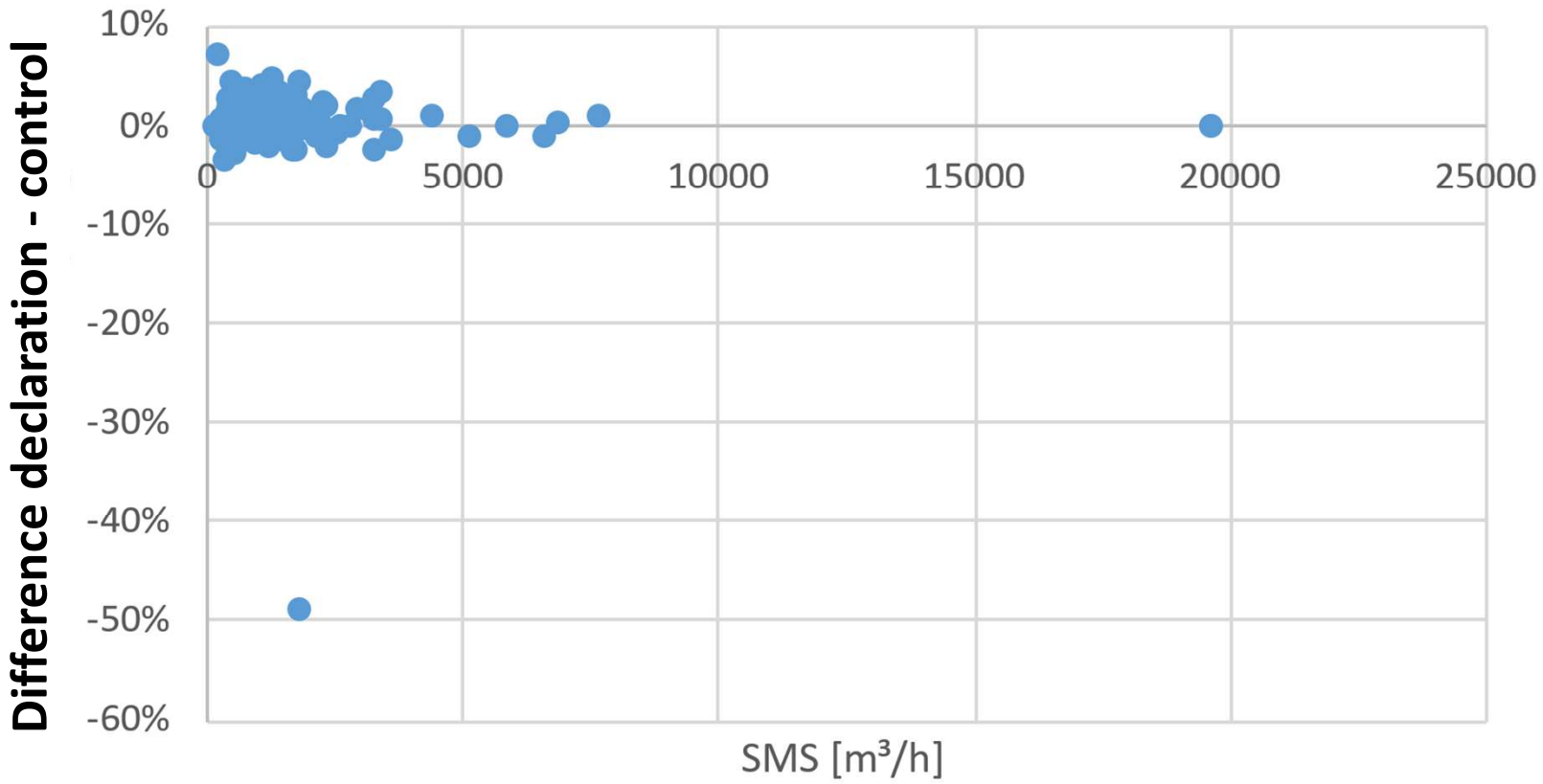
Slight improvement in average test results
BUT evolution of 1% to 100% of buildings are tested

Control of declared airtightness results



Reliable testing!

Control on declared air flow rates



Conclusions regarding airtightness approach

- No requirement to test – no minimum airtightness requirement – default value of 12 $m^3/h.m^2$ building envelope
- In practice testing not needed in the beginning (2006 - no strong energy requirements) but now (2023) in practice necessary with the severe energy requirements
- Quality control framework leads to reliable test results
- Overall large societal acceptance for airtightness testing
- Indirect advantages are important: better design – better execution – better acoustics – less risk of moisture problems
- It has been a major driver for innovation by industry

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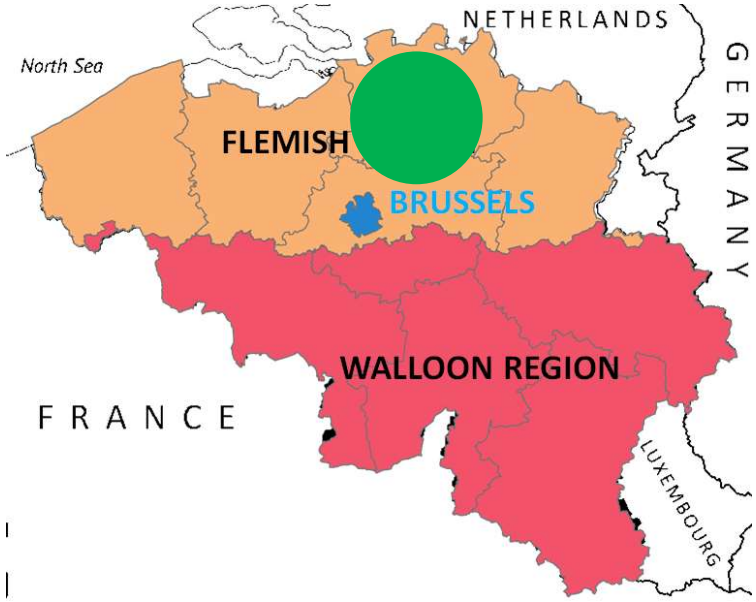

2016 - On site performance checks of residential ventilation systems

- **Observations:**
  - Air flow rates in practice depend to a large extent on the quality of the works
  - Substantial part of installed residential ventilation systems didn't perform in practice as specified in EPB calculations
- **Action:**
  - Implementation of a quality framework with on-site performance checks
  - Main features:
    - Only assessment of air flow rates and fan energy
    - Measurements only after installation
    - To be done by competent person with appropriate measurement equipment
    - It can be done by an independent person or a person involved in the project
    - 10% of systems are checked immediately afterwards by control body

2016 - On site performance checks of residential ventilation systems

- **In practice impact of quality framework residential ventilation:**
  - Very good coherence between declarations and control measures
- **Overall impact of EPB for ventilation systems?**
  - Ventilation systems installed in ALL new buildings
  - Clear tendency towards very energy efficient ventilation systems
  - In more recent years correct air flow rates in residential buildings when installed (FL)
  - Missing: checks on acoustical performances and performances during lifetime

https://www.aivc.org/resource/quality-framework-residential-ventilation-systems-flemish-region-belgium-feedback-after

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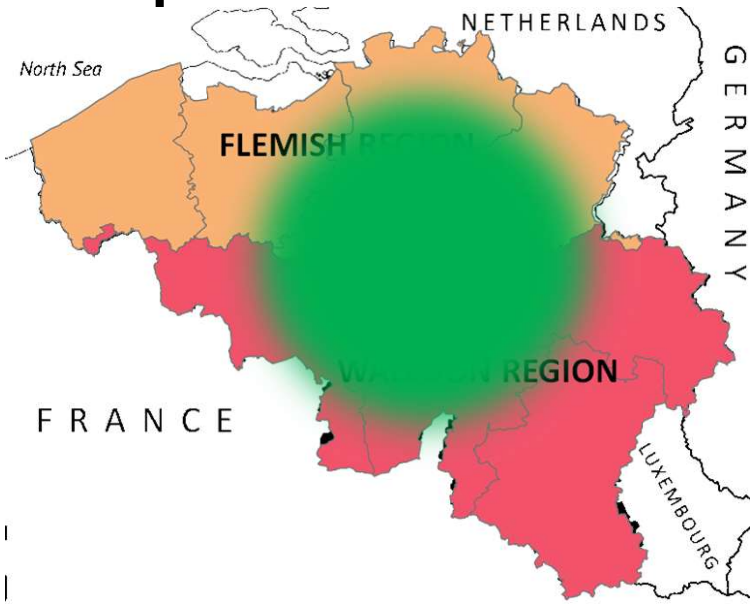
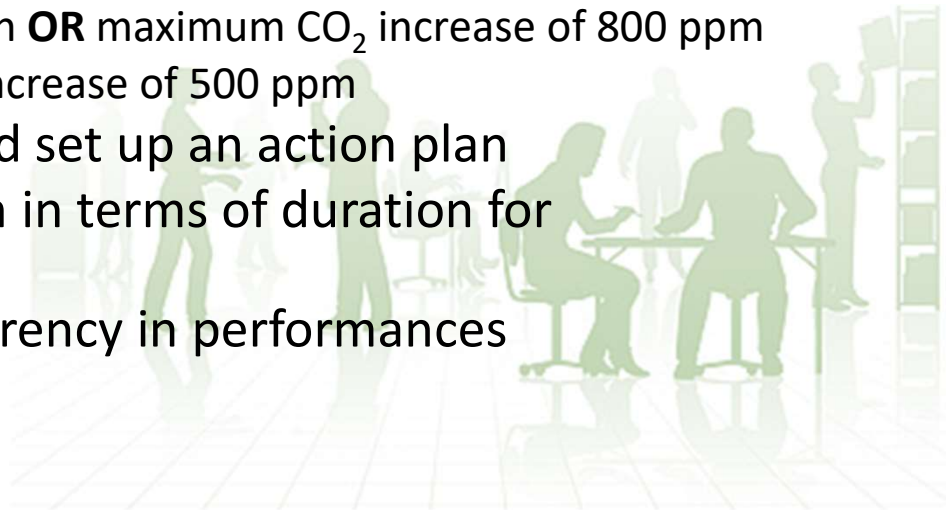


2019 - Federal regulation regarding wellbeing on workplaces

- **Till 2016:**
  - Requirement of 30 m³/h for each employee (not for other persons)
  - In practice often no ventilation or poorly performing ventilation
  - In practice not possible to enforce
- **Since 2019 new regulation**
  - Requirement in terms of minimal air flow rate or maximum increase in CO_2 concentration
  - Requirements depend on other pollutants:
    - If in line with low-polluting building: 25 m³/h.person **OR** maximum CO_2 increase of 800 ppm
    - In other cases: 40 m³/h.person **OR** maximum CO_2 increase of 500 ppm
  - All employers must carry out a risk analysis and set up an action plan
  - For existing buildings in practice large freedom in terms of duration for implementation
  - But potentially very strong incentive if transparency in performances



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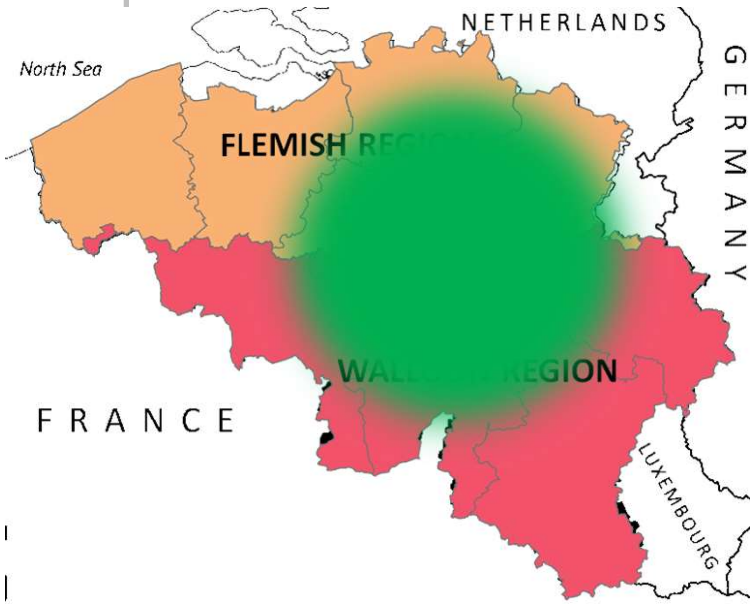

November 2022 - Federal regulation on indoor air quality in public spaces

- In context of COVID (2020-2021)
  - Maximum concentrations of CO_2 concentrations was imposed during certain periods for hotels, restaurants, pubs, cultural sector and sports sector
  - There was a strong increase in awareness of the importance of good indoor air quality
- In October 2022, the federal parliament adopted a law with requirements in terms of indoor air quality in public spaces
  - IAQ-sensors to be installed, at least CO_2 sensors
  - Risk analysis and action plan to be implemented
  - Certification and labelling of these spaces
  - There is a potential role for air cleaning devices
- In practice:
  - Law becomes only effective after adoption of Royal and Ministerial decrees
  - These decrees are expected in 2023 and 2024

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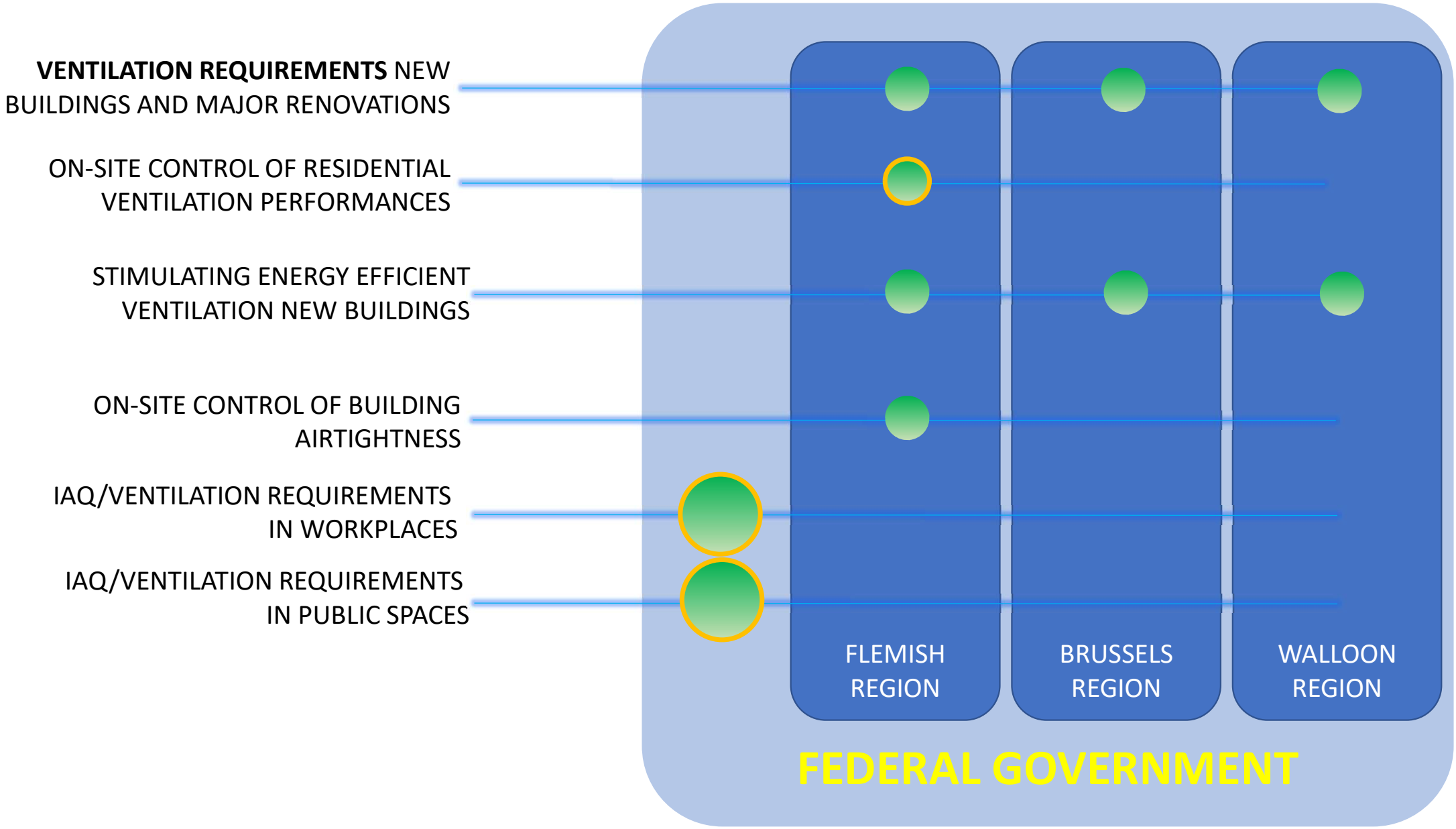
VENTILATION REQUIREMENTS NEW BUILDINGS AND MAJOR RENOVATIONS
ON-SITE CONTROL OF RESIDENTIAL VENTILATION PERFORMANCES
STIMULATING ENERGY EFFICIENT VENTILATION NEW BUILDINGS
ON-SITE CONTROL OF BUILDING AIRTIGHTNESS
IAQ/VENTILATION REQUIREMENTS IN WORKPLACES
IAQ/VENTILATION REQUIREMENTS IN PUBLIC SPACES
FLEMISH REGION
BRUSSELS REGION
WALLOON REGION
FEDERAL GOVERNMENT

Conclusions

- **The role of regulations is crucial** in Belgian context for wide scale uptake of good IAQ and ventilation
- **Since 2006, substantial progress has been achieved**
  - In terms of air flow specifications and compliance
  - In terms of energy efficiency and compliance
  - In terms of stimulating innovative ventilation systems
  - In terms of achieving more airtightness buildings
- **However, still substantial further steps needed**, e.g.:
  - Performances during lifetime of installations, including maintenance
  - Acoustical performances
  - Robust approach for existing buildings