

# Building and ductwork airtightness requirements in Europe

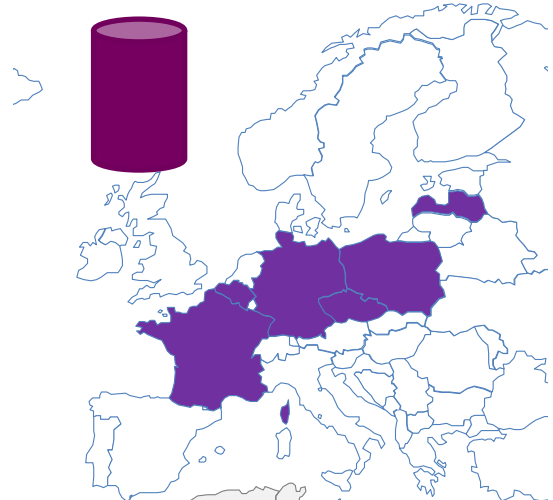
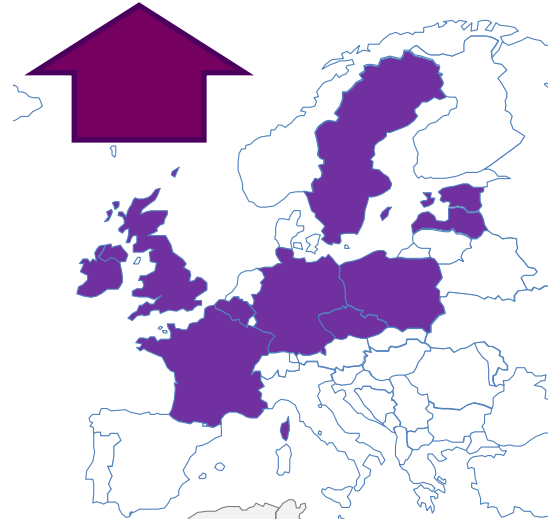
TightVent Airtightness Association  
Committee

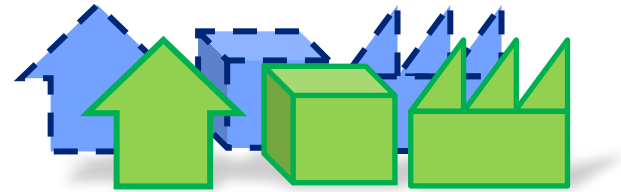
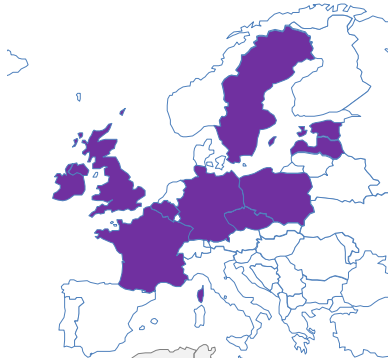
January 12th, 2016

Analysis of answers of airtightness associations  
representatives performed by:  
Valérie Leprince, Maria Kapsalaki, Rémi Carrié

# Presentation

- The objective of this study is to compare approaches for requirements and competent tester schemes for building and ductwork airtightness in various European countries.
- Special thanks to the persons who have kindly answered the questionnaires:
  - Barry Cope (ATTMA), UK
  - Oliver Solcher (FliB), Germany
  - Liesje Van Gelder (BCCA), Belgium- Flemish region
  - Owe Svensson (SP), Sweden
  - Jiri Novak (FSV, CVUT), Czech Republic
  - Radoslaw Gorzenski (PUT), Poland
  - Targo Kalamees (TTU) , Estonia
  - Mark Shirley (2eva), Ireland
  - Adeline Mélois (CEREMA), France
  - Russel Macdonald (iATS), UK
  - Vladislavs Kevišs (Irbest), Latvia
  - Jurgen Luft (Woehler), Germany

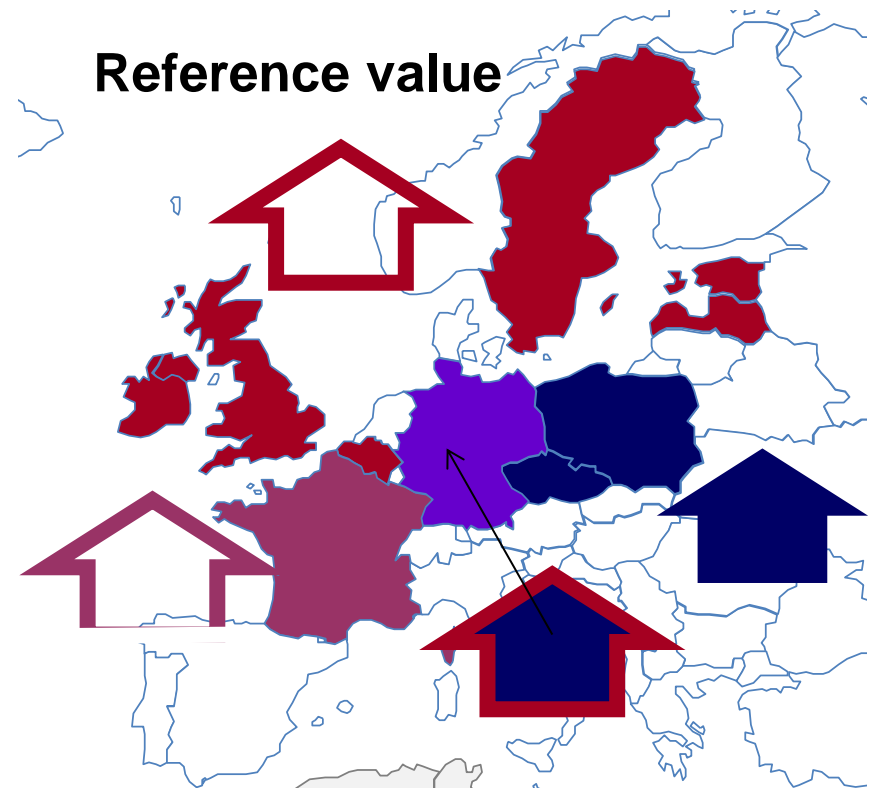
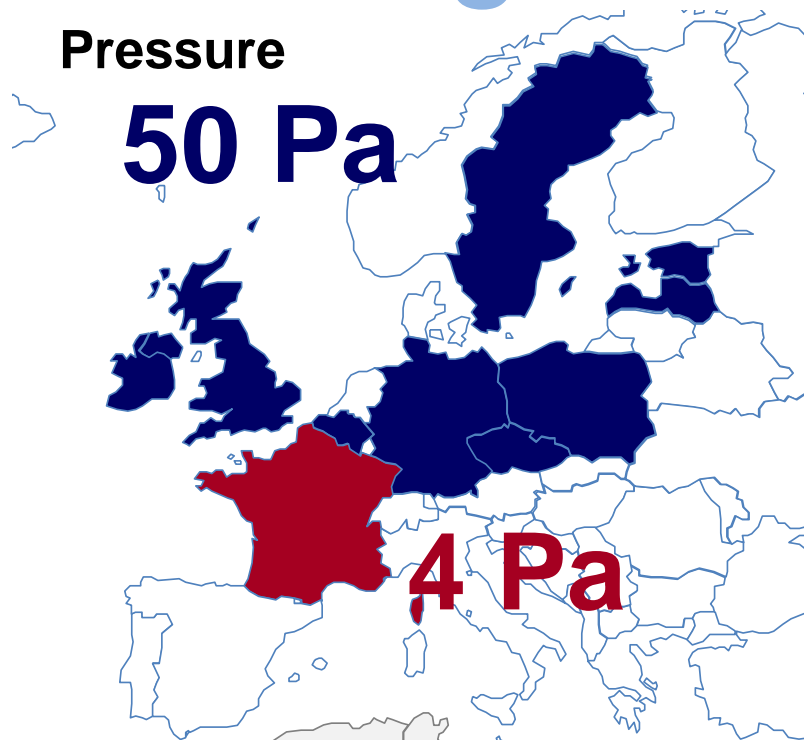




EP-regulation

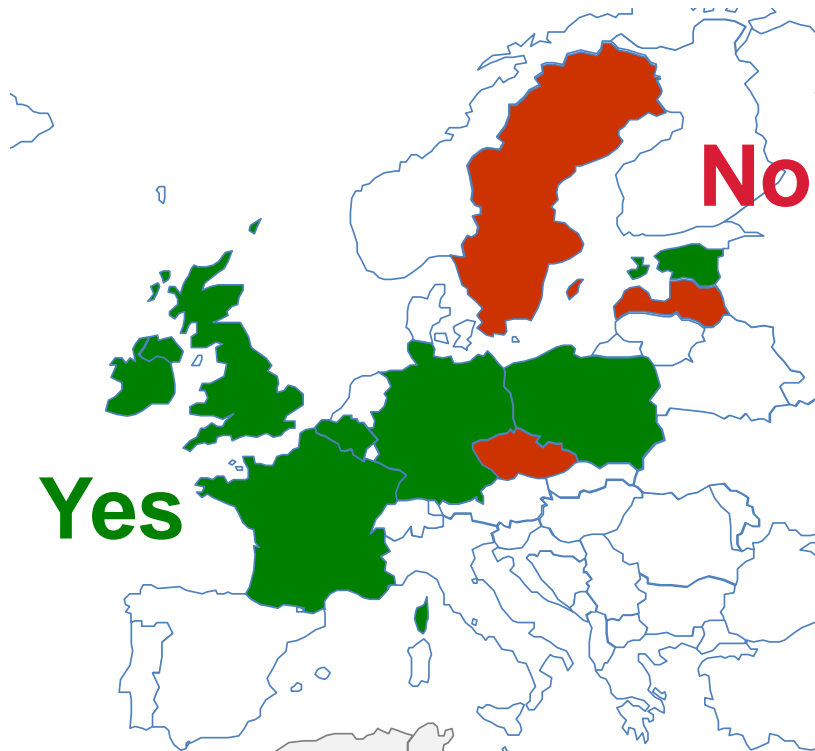
# BUILDING AIRTIGHTNESS

# Airtightness reference



- 8 out of 10 countries have at least one indicator that use the envelope area as reference value
  - Germany use internal volume for buildings below 1500m<sup>3</sup>/h and envelope area for others
  - France use envelope area but without low floor
- 9 out of 10 countries have a reference pressure value at 50 Pa

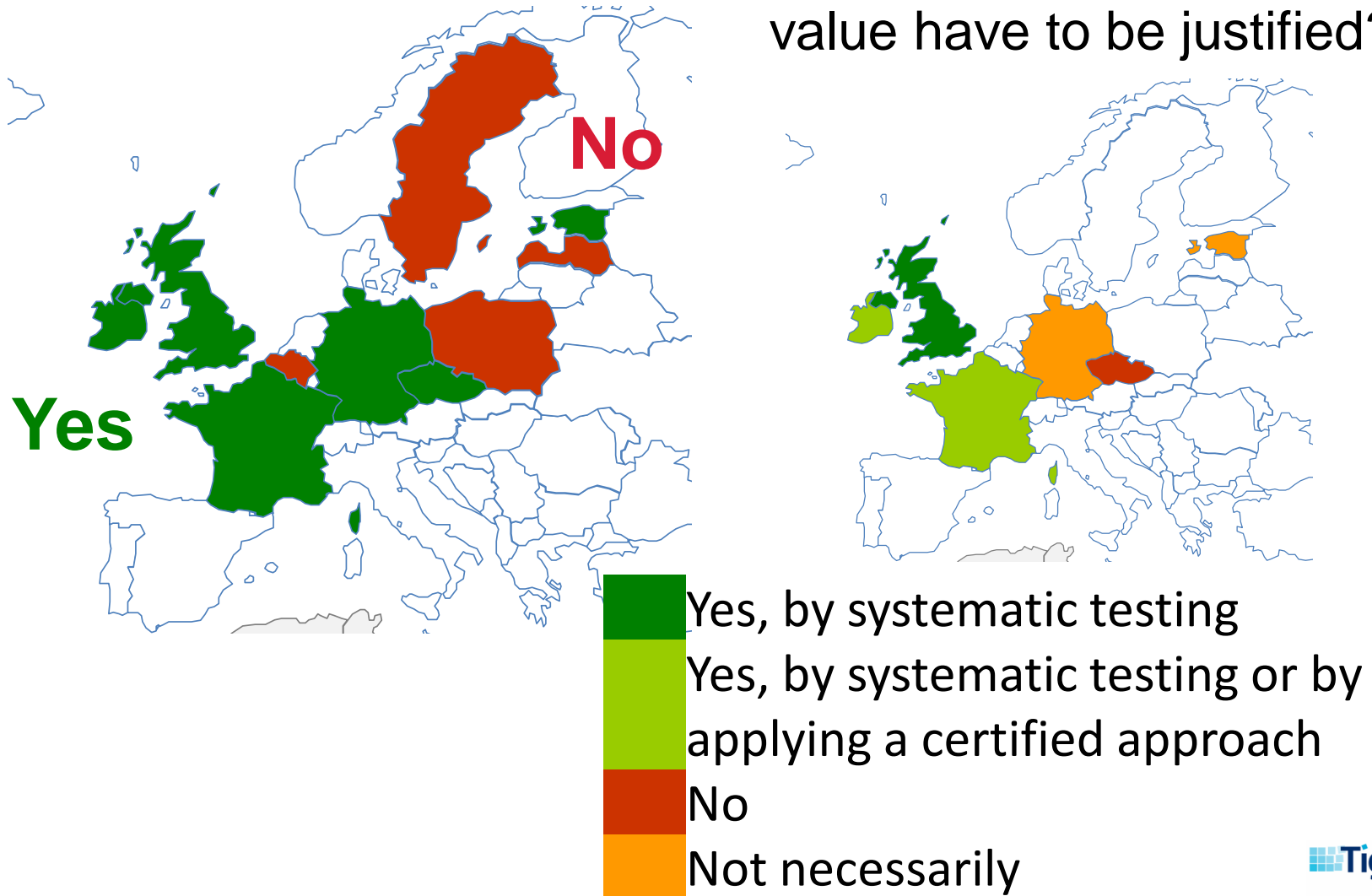
# Regulatory EP-calculation depends on building airtightness ?



- When building airtightness is not taken into account in EP-calculation it may be hard to promote it
  - Building airtightness is not taken into account in 3 out of 10 countries
  - However minimum requirement exist in Czech Republic

# Minimum building airtightness requirements in some cases in EP regulation?









































Does this maximum  
value have to be justified?



# Minimum building airtightness requirements

- Minimum requirements exist in 6 out of 10 countries but do not necessarily need to be systematically justified
  - Only Ireland, UK and France impose systematic justification
- In Belgium there is no minimum requirement but the default value for airtightness is such penalizing therefore 30-50% of new buildings are tested
- In Germany the test is done in most of new buildings
- Two countries propose an alternative to systematic testing: a certified quality approach for building (IE and FR)





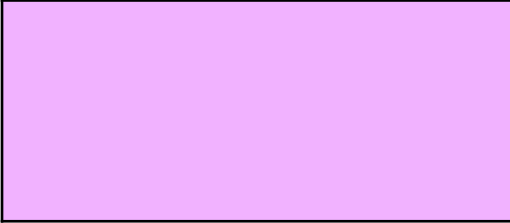
# Minimum requirement value

	  $< 10 \text{ m}^3/\text{h} \cdot \text{m}^2 \text{ @ } 50 \text{ Pa}$			
	 $< 1500 \text{ m}^3: n_{50}$	 $< 3 \text{ 1/h}$		
	 $> 1500 \text{ m}^3: q_{50}$	 $< 4.5 \text{ m}^3/\text{h}/\text{m}^2$	 $< 1.5 \text{ 1/h}$	 $< 2.5 \text{ m}^3/\text{h}/\text{m}^2$
	 $n_{50}$			
	 $4.5 \text{ 1/h}$	 $1.5 \text{ 1/h}$	 $1 \text{ 1/h}$	 $0.6 \text{ 1/h}$
				
	Recommendations: $n_{50}$	 $3 \text{ 1/h}$	 $1.5 \text{ 1/h}$	
	The measured building airtightness should not be higher than the value used in EP-calculation			
	  $q_{50} \leq 7 \text{ m}^3/\text{h}/\text{m}^2$			
				
	$q_{4\text{Pa}_{\text{surf}}}$	 $0.6 \text{ m}^3/\text{h}/\text{m}^2$	 $1 \text{ m}^3/\text{h}/\text{m}^2$	
				
	Recommendations: $q_{50}$	 $3 \text{ m}^3/\text{h}/\text{m}^2$	 $2 \text{ m}^3/\text{h}/\text{m}^2$	 $1.5 \text{ m}^3/\text{h}/\text{m}^2$


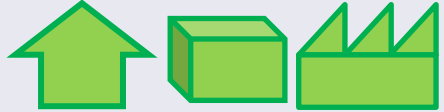





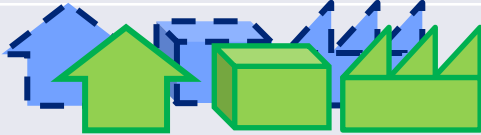








Equivalent area assuming  $V/A = 1.1 \text{ m}$

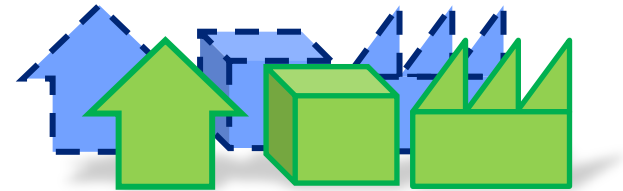
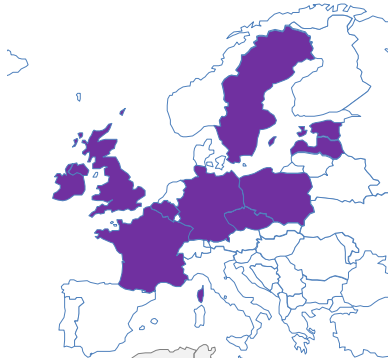


# Keys

	<p>Single-family house/multi-family building/ non-residential building</p> <p>Blue: Retrofitted; Green: New</p>
	<p>Without mechanical ventilation /With mechanical ventilation / With heat recovery</p>
	<p>Passive house</p>
	<p>Relative area. Proportional to the q50 or calculated q50 if the requirement is not expressed in q50 (assuming <math>V/S=1.1m</math>).</p>
	<p>Countries for which EP-regulation require a minimum airtightness level that has to be justified</p>

# Summary of EP-regulation

Country	EP regulation(s)	Minimum requirement applies to:
	Approved Document L of the Building Regulations in England and Wales. Technical Handbook 6 in Scotland.	
	Energieeinsparverordnung EnEV 2014	
	EPB	
	ČSN 73 0540-2 Thermal performance of buildings - Part 2 - Requirements	
	Regulation of the Minister of Infrastructure on the technical conditions that should be met by buildings and their location	
	Methodology for calculating the energy performance of buildings, regulation of Minister of Economic Affairs and Communications. Minimum requirements for energy performance, regulation of Government	
	EPBD --> Ireland 2011 Part (L) --> verified via DEAP software programme from government body SEAI	
	RT2012	



Programmes

# BUILDING AIRTIGHTNESS

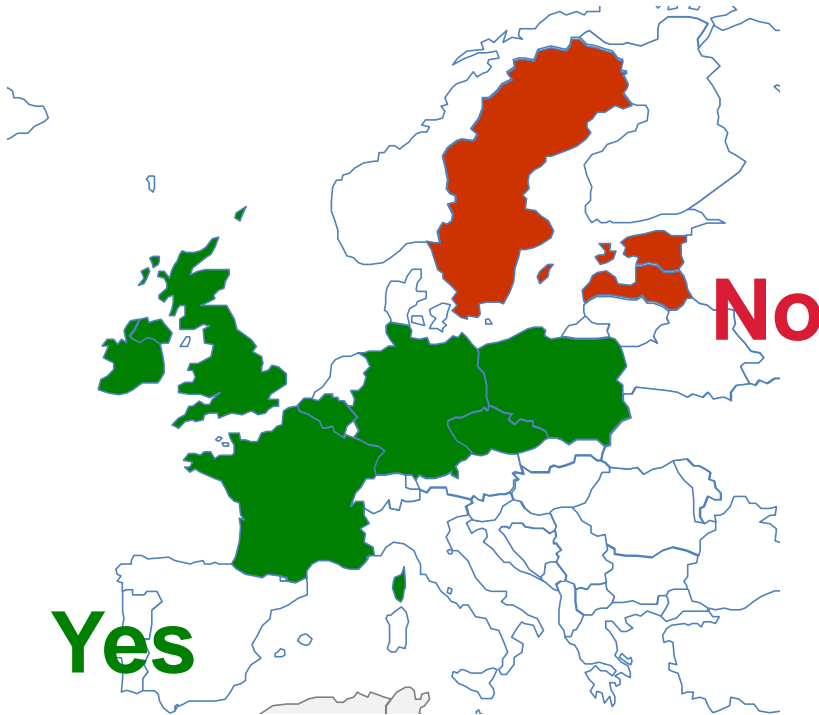
# Programme EP-calculation depend on building airtightness ?



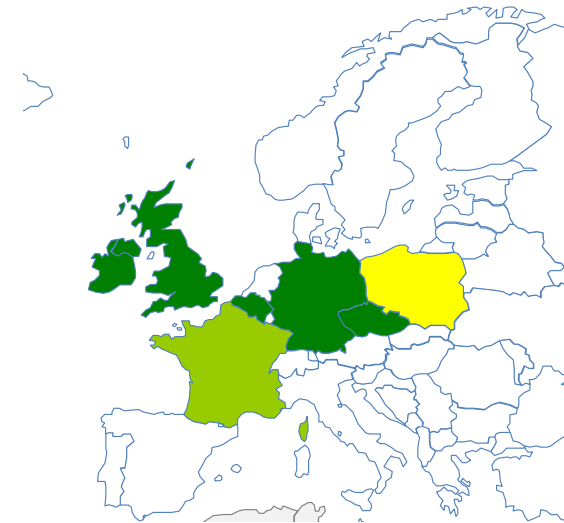
In Czech republic, airtightness is not taken into account in regulatory EP-calculation but is in programme calculation

# Minimum building airtightness requirements in some cases in EP programmes?

- Does this maximum value have to be justified?


































- 7 out of 10 countries have programmes with requirement on airtightness






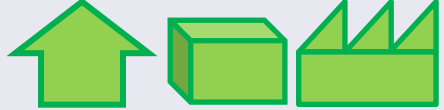

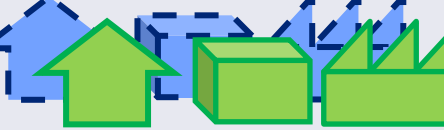








- Yes, by systematic testing
- Yes, by systematic testing or by applying a certified approach
- Yes by testing some buildings selected by a third party

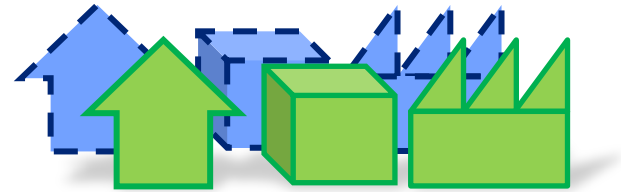
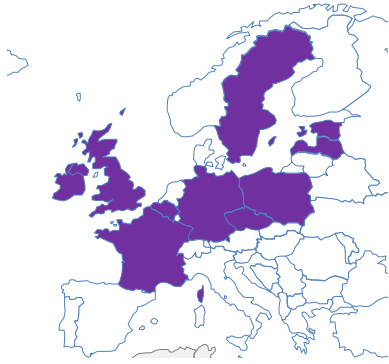
# Minimum requirement value

	  $q_{50} < 10 \text{ m}^3/\text{h} \cdot \text{m}^2$		
			
	 $< 1500 \text{ m}^3$ $n_{50}$	 $< 3 \text{ 1/h}$	 $< 1.5 \text{ 2/h}$
	 $> 1500 \text{ m}^3$ $q_{50}$	 $< 4.5 \text{ m}^3/\text{h}/\text{m}^2$	 $< 2.5 \text{ m}^3/\text{h}/\text{m}^2$
			
	$n_{50}$	 $2.5 \text{ 1/h}$	 $0.6 \text{ 1/h}$
		NF40	NF 15
	$n_{50}$	 $1 \text{ 1/h}$	 $0.6 \text{ 1/h}$
		 $0.6 \text{ 1/h}$	
	 $q_{50} \leq 7 \text{ m}^3/\text{h}/\text{m}^2$		
			
	$q_{4\text{Pa}_{\text{surf}}}$	 $0.4 \text{ m}^3/\text{h}/\text{m}^2$	 $0.8 \text{ m}^3/\text{h}/\text{m}^2$

Equivalent area assuming  $V/A = 1.1 \text{ m}$

# Summary of Programmes

Country	Programme	Minimum requirement applies to:
	SAP - Standard Assessment Procedure	
	DIN V 4108-6/ DIN V 4701-10; DIN V 18599	
	Passiefhuis	
	New Green Savings Programme (state subsidies programme for construction of energy efficient buildings)	
	NF15 and NF40 by National Fund for Environmental Protection and Water Management	
	Irish Building Regulations Technical Guidance Document Part (L) - Conservation of Fuel & Energy	
	Effinergie +, BEPOS Effinergie	

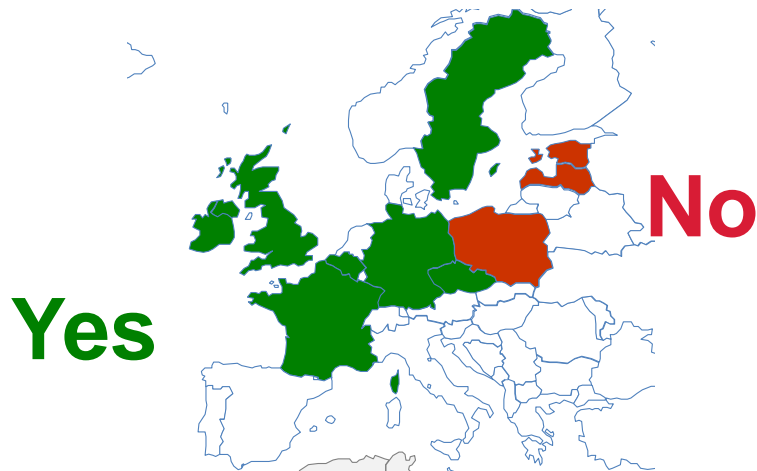


Airtightness tester schemes

# BUILDING AIRTIGHTNESS



# Is there a quality framework for testers in your country?



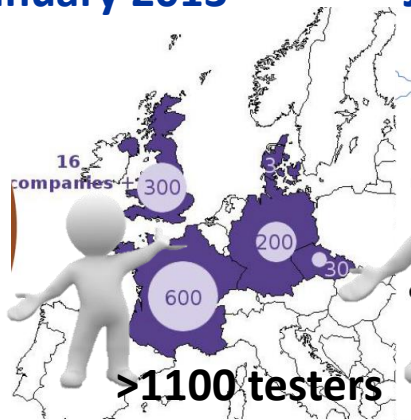
- **7 countries out of 10** now have a quality framework for building airtightness testers
- In 4 countries out of the 7 this qualification is required for testing in the context of the EP-regulation or/and a EP-programme
  - In UK the qualification is not required but if test is performed by a qualified tester a «standardised certificate » is automatically issued (no need for the tester to make a full report)

Is the qualification mandatory for testing in the context of:

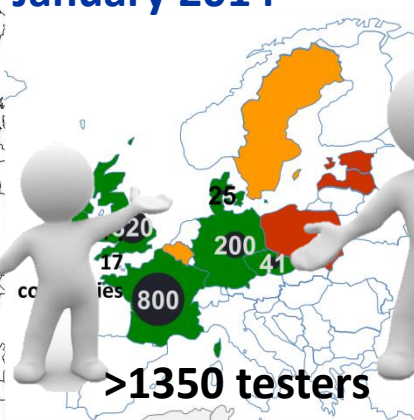


# Qualified tester are increasing in Europe

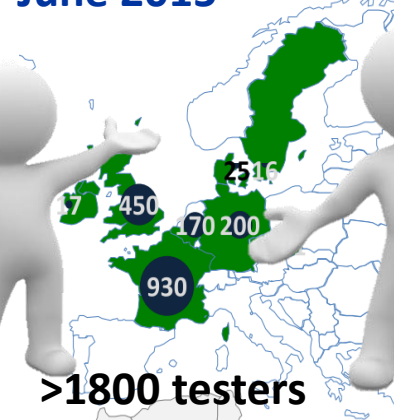
January 2013



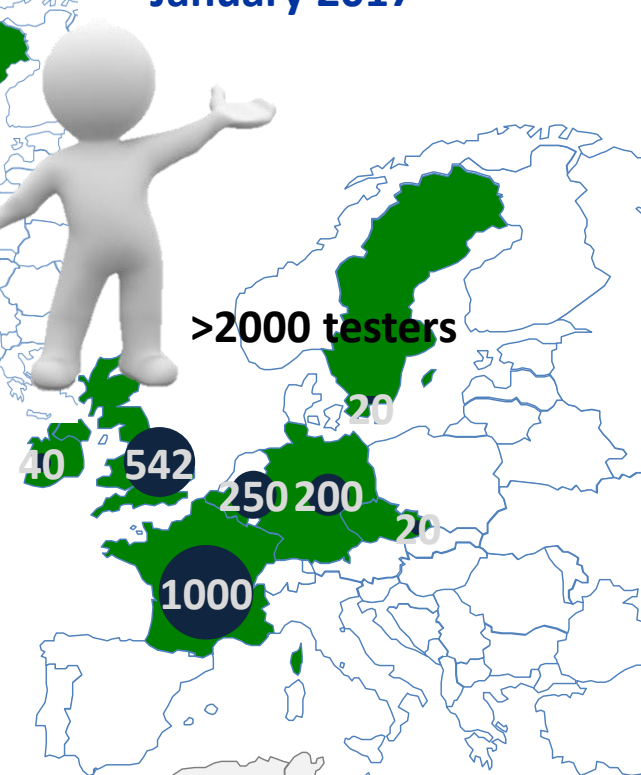
January 2014



June 2015



January 2017










- The number of tester is increasing rapidly in Belgium, Ireland, France and UK
  - Either because they are requiring airtightness testing in regulation (FR, UK, IE)
  - Or because they are promoting airtightness by awarding the EP- calculation if test is performed (BE)
- In Germany this is only Flib figures but other qualifications exist

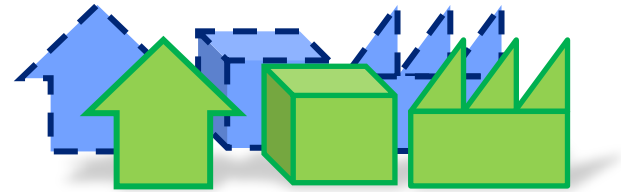
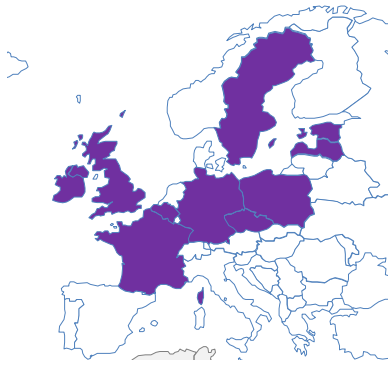
Have guidelines for airtightness testing (apart from ISO 9972) been published or updated in your country in the last 5 year?



- Only 4 countries out of 10 have issued guidelines
- Quality framework does not require guidelines
  - Czech republic, Ireland and Sweden have a quality framework but no specific guidelines
  - No country have guidelines without quality framework

# Qualification tester schemes

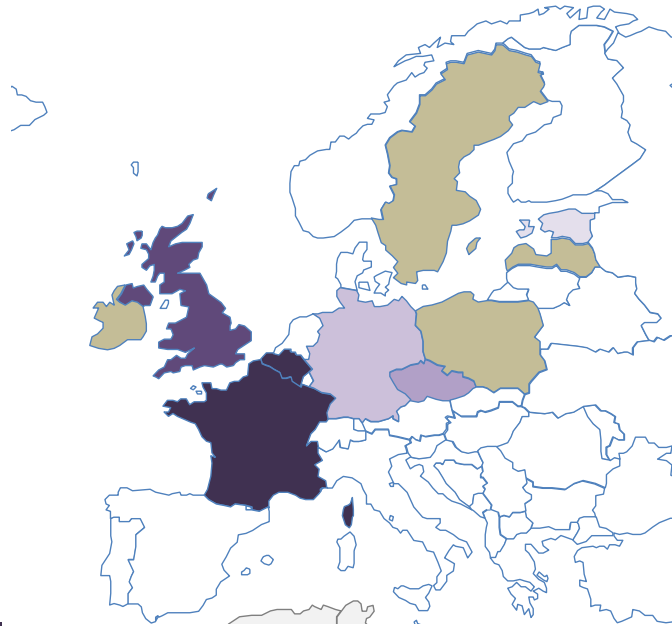
Country	Qualification tester schemes	Guidelines	Previous Guidelines
	Air Tightness Testing & Measurement Associations (ATTMA) The Independent Airtightness Testing Scheme (iATS)	ATTMA TSL1 2016 (Dwellings), ATTMA TSL2 (Non-Dwellings) 2010 (currently under revision)	
	There are some certification schemes. I.e. FLiB- certification.	EnEV 2014	EnEV 2009
	Kwaliteitskader Luchtdichtheid	STS-P 71-3 2014	yes, specification document with additional requirements of government 2013
	Diplomerad luftt��hetsprovare (diplomaed airtightnestester)	Not published yet, but we are working on ByggaL (means "Building airtight") and part of that is a guideline for airtightness testing in Sweden. Hopefully it will be published in this year	
	Membership in the Association Blower Door CZ		
	The National Standards Authority of Ireland- NSAI (95% of testers), The Irish National Accreditation Board - INAB and we also recognise the British ATTMA		
	Qualibat 8711	FD 50-784, 2016	GAP 50-764, 2014



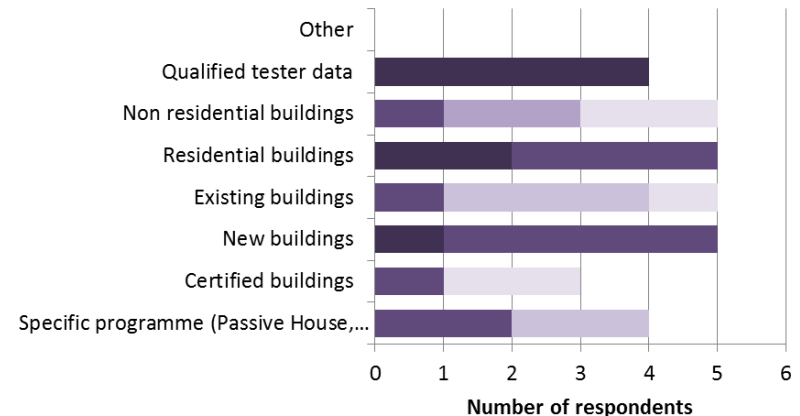
Database

# BUILDING AIRTIGHTNESS

# Is there available field data on building airtightness levels achieved in your country?











What is the specificity of the buildings and/or testers that performed the tests?

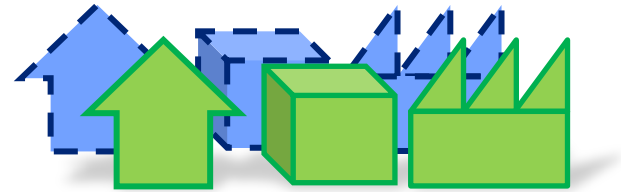
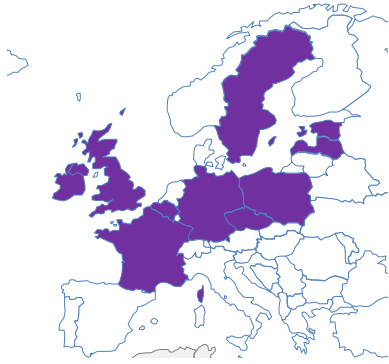


■ Only/Nearly only      ■ A significant fraction of the data  
 ■ A moderate fraction of the data      ■ A small fraction of the data  
 ■ No/Nearly no

- 6 countries out of 10 have a database
  - In Germany this is rough figures from Flib members
- Mainly new residential buildings tested by qualified testers

# Database sources and access

Country	Database source	How to have access to this data or studies:
	Both iATS and ATTMA maintain a lodgement scheme for completion results.	For ATTMA: A case must be made to explain why you want the data, who you are and what you intend to do with it. We would also ask that any publications are run past us first. For iATS: Access would have to be arranged with co-operation from iATS directors. Please contact <a href="mailto:manager@iats-uk.org">manager@iats-uk.org</a>
	Flib asks its members for rough figures (not mandatory)	<a href="http://www.flib.de/presse/2015/05/2015_05_Meld_Statistik15_I.pdf">http://www.flib.de/presse/2015/05/2015_05_Meld_Statistik15_I.pdf</a>
	BCCA database, EPBD database	databases are not public
	Database of test results collected by the members of Association Blower Door CZ	contact person: Jiri Novak, <a href="mailto:jiri.novak.4@fsv.cvut.cz">jiri.novak.4@fsv.cvut.cz</a>
	Overview of measurements, 2008.	<a href="https://www.etis.ee/File/DownloadPublic/3cf0f211-274f-4bcf-a63a-6f01651e48b9?name=Fail_Raport.pdf&amp;type=application/pdf">https://www.etis.ee/File/DownloadPublic/3cf0f211-274f-4bcf-a63a-6f01651e48b9?name=Fail_Raport.pdf&amp;type=application/pdf</a> <a href="http://dx.doi.org/10.1016/j.buildenv.2006.06.001">http://dx.doi.org/10.1016/j.buildenv.2006.06.001</a>
	Only via individual testers	If needed a lead person could be appointed to role out a questionnaire or the format that you wish to use and a methodology be put in place to gather the information.
	Data collection via Qualibat qualification (required)	Various articles have been published they are available on airbase (AIVC database): key authors are Mélois, Bailly, Guyot, Carrié, and Leprince.
		Irbest as largest tester company could provide some statistic data for last period

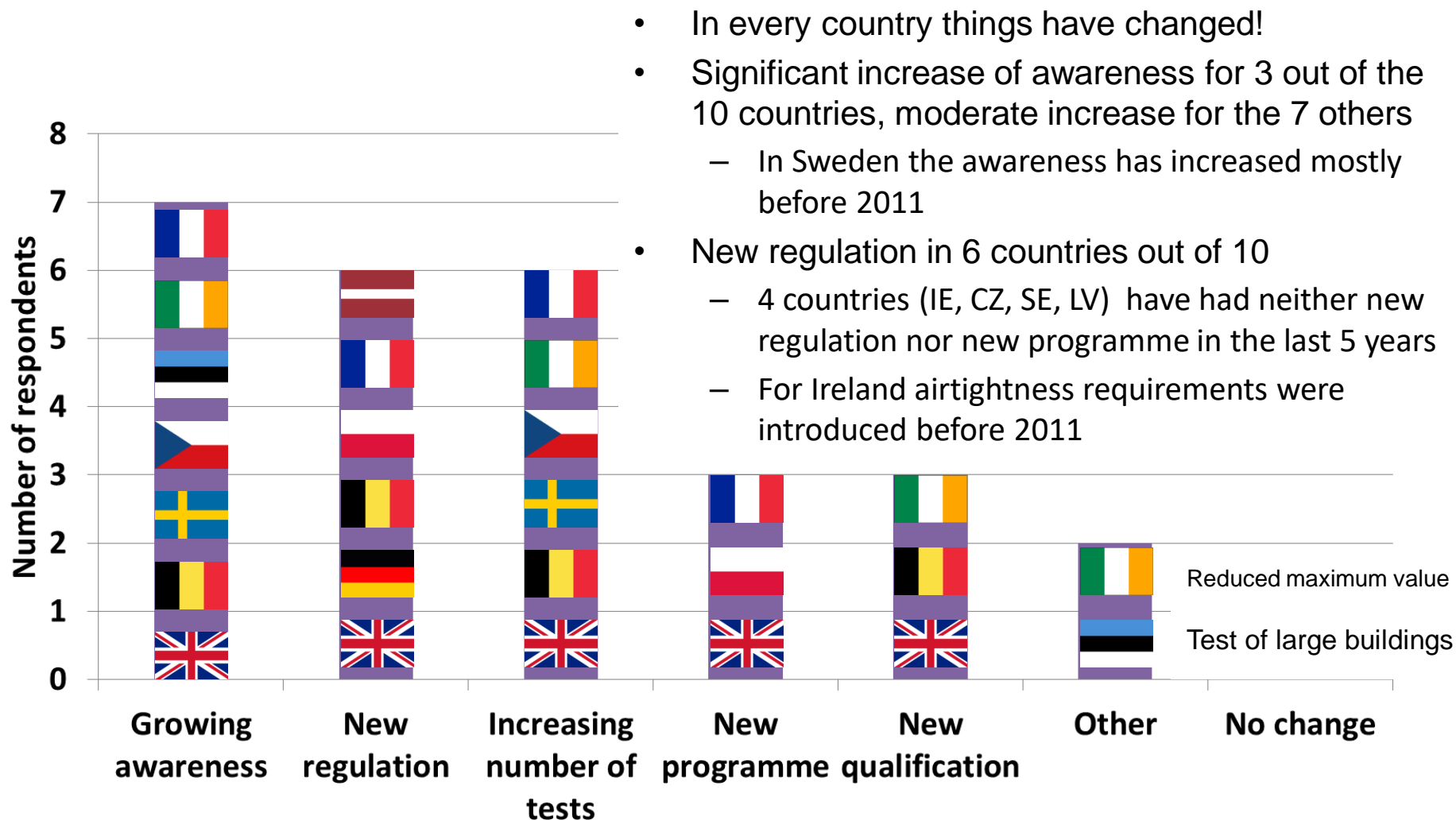


Awareness

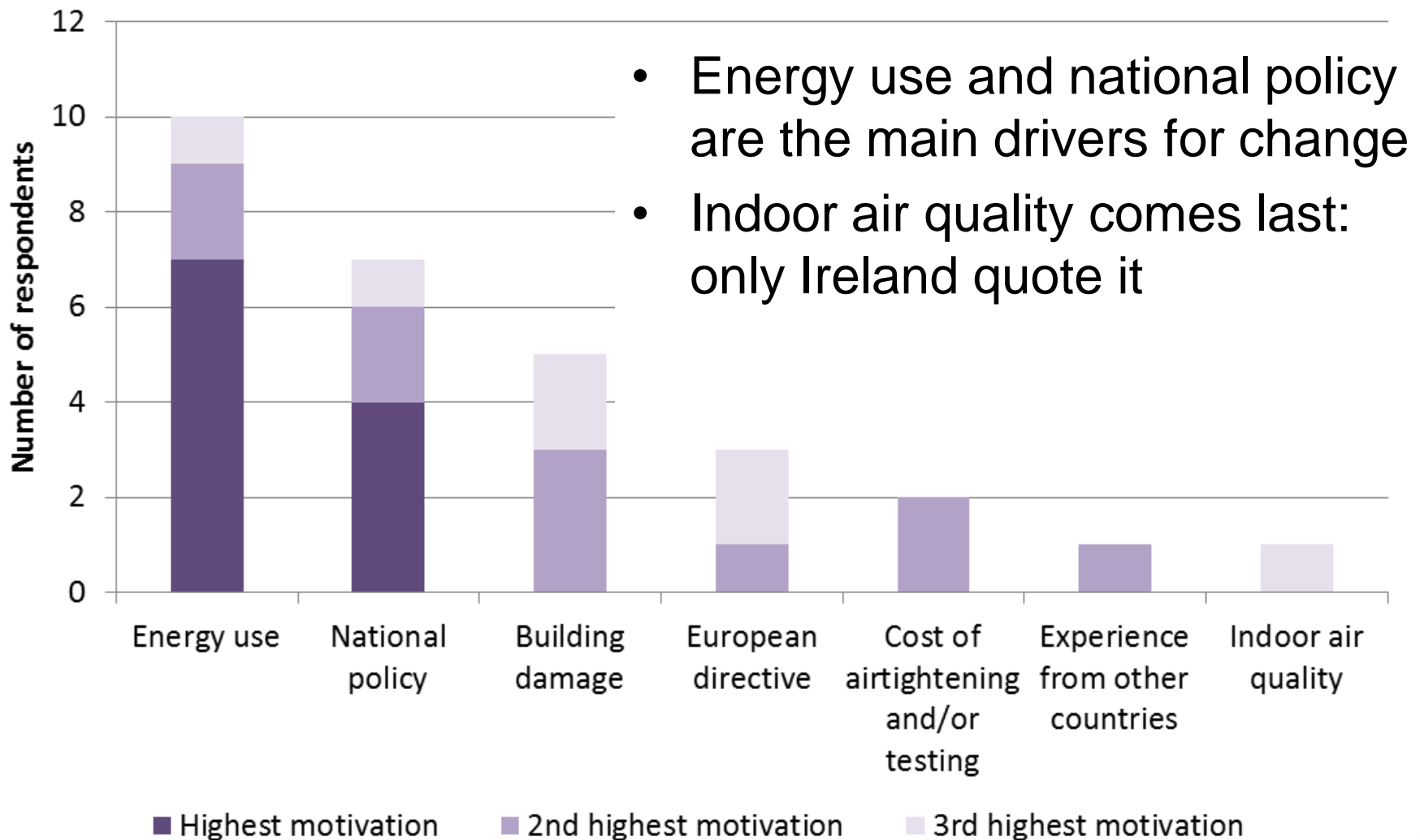
# BUILDING AIRTIGHTNESS



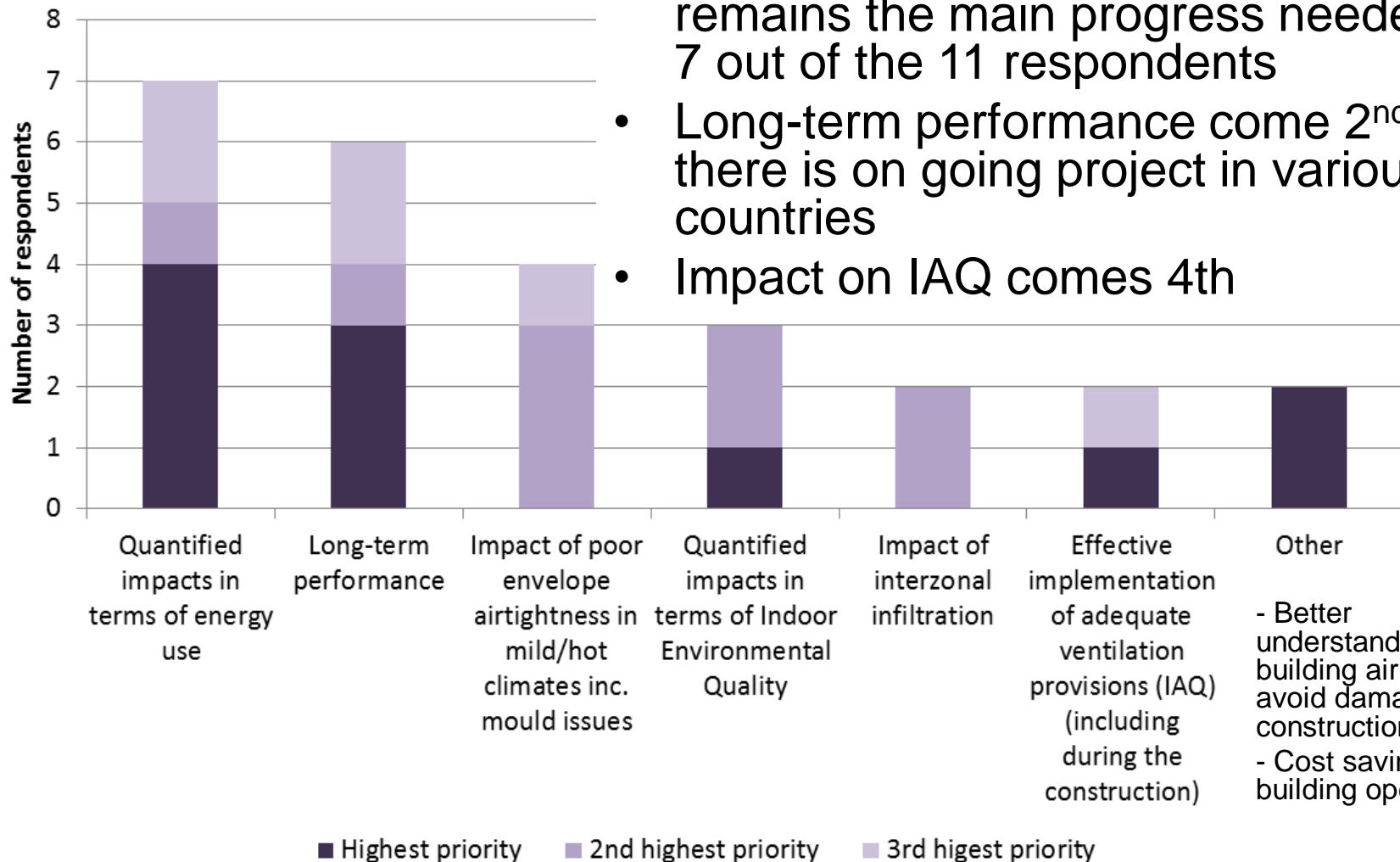
# What has changed regarding building airtightness in the last 5 years in your country?



# What were the motivations for change?

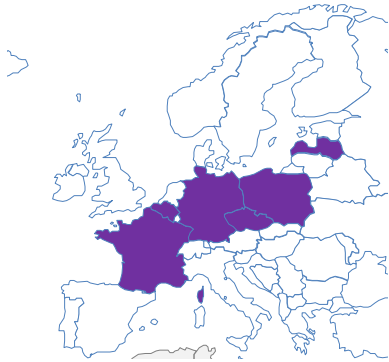


# What is in your view the progress needed to promote building airtightness in your country?



- Energy use is the main driver and remains the main progress needed for 7 out of the 11 respondents
- Long-term performance come 2<sup>nd</sup>, there is on going project in various countries
- Impact on IAQ comes 4th

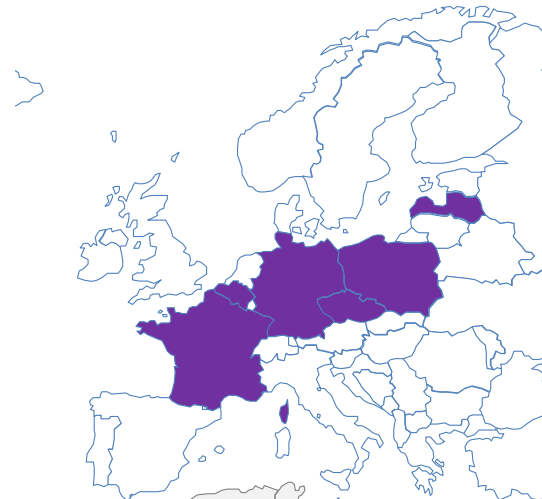
- Better understanding of building air tight to avoid damages in the construction  
- Cost savings during building operation



# DUCTWORK AIRTIGHTNESS

# Ductwork airtightness

- Only Belgium, France, Latvia and Germany have completed the questionnaire
- Czech republic and Poland have answered that ductwork airtightness was not really considered in their countries
- Answers from Sweden, UK, Ireland, Spain and Estonia are missing



# How ductwork airtightness is taken into account in regulations?

- Only France (RT2012) and Belgium (EPB) consider ductwork airtightness as an input in EP-regulation
  - But there is no minimum requirement
  - In France if a value better than default value is used then it has to be justified (testing or certified quality approach)
- In Belgium the leakage flow according EN 14134 is used
  - The ductwork area is not estimated
- In France the airtightness class is used according EN 12237
  - The ductwork area is estimated either with flat rate based on building floor area (residential buildings) or with flat rate based on flowrate (non-residential buildings)

# How ductwork airtightness is taken into account in EP-programmes?

- Only French programme Effinergie + and Effinergie BEPOS get requirement on ductwork airtightness with required justification
  - It applies to new buildings
  - Class A is required



# Qualification for ductwork testers

- Among respondent, only France has a qualification for ductwork testers (Qualibat 8721)
  - The qualification is required for testing in the context of regulation and programme.
  - 35 testers are qualified
- Specific guidelines exist: FD E 51-767, 2014
- No field data are available yet but their should be in 2017 in France

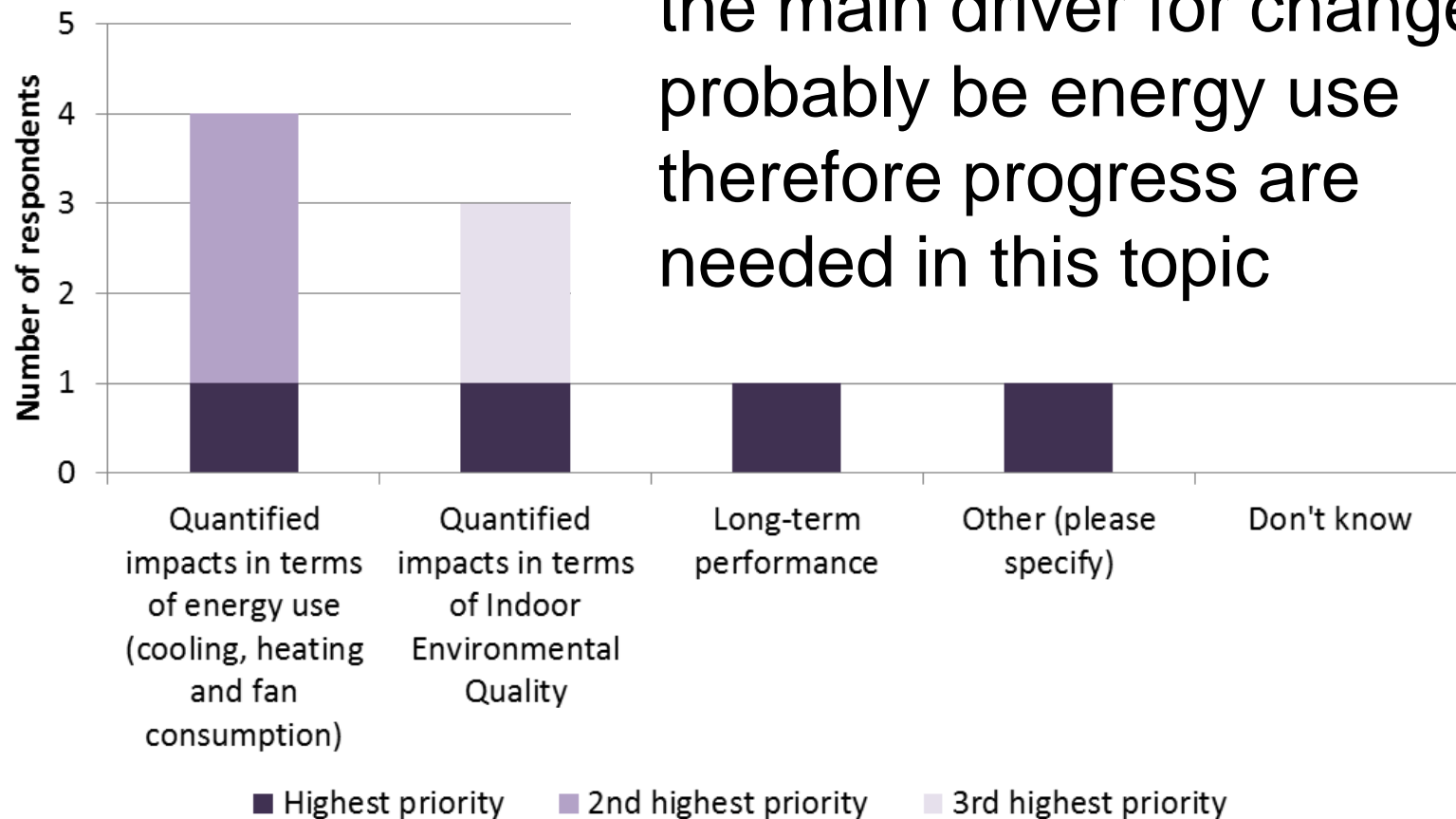


# Awareness for ductwork airtightness

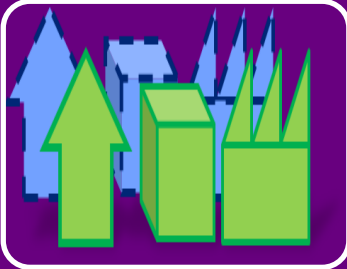
- Among respondent, only France has had change regarding ductwork airtightness in the last 5 years with a new regulation, a new programme, a new qualification an increasing number of test and an increasing of awareness.
- The awareness on ductwork airtightness has increased moderately in France, Belgium and Germany
  - In Belgium likely because of broader awareness of efficiency of ventilation system

# What is in your view the progress needed to promote ductwork airtightness in your country?

- As for building airtightness the main driver for change will probably be energy use therefore progress are needed in this topic



# Conclusion: Lots of change in 5 years regarding building airtightness



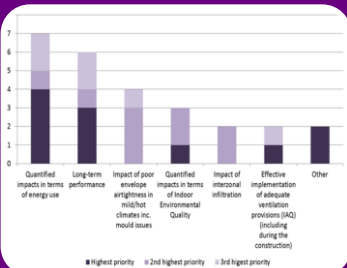
In most countries building airtightness is taken into account in EP-calculation

- Requirements with mandatory justification in 3 countries (many test s in 2 others)
- Lot of programmes
- Required values may be easy to achieve



Airtightness testers schemes

- 7 out of 10 countries have an airtightness testers schemes
- The number of testers in Europe has almost doubled in 4 years
- Database are set in 6 out o f 10 countries



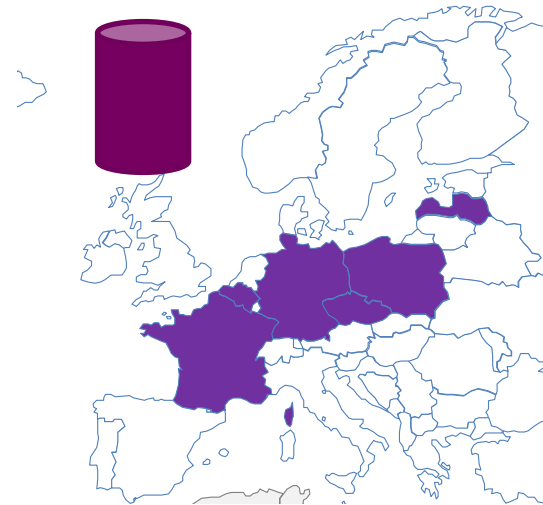
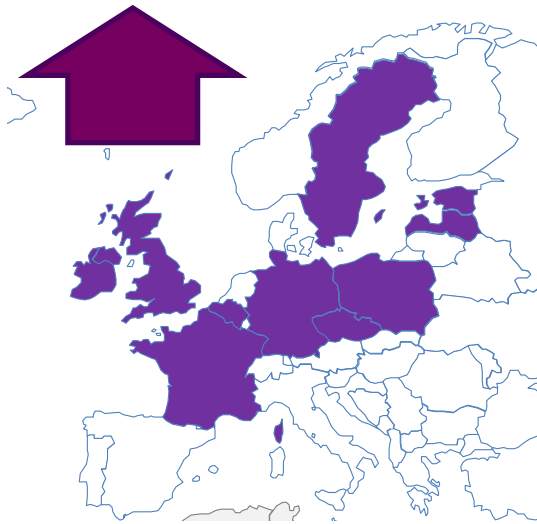
Every countries agree that things have changed in the last 5 years

- The main driver is energy : more work are needed on this topic
- The IAQ problem came farther but the problem of airtightness in not ventilated building (ex. refurbished) has been raised

# Conclusion: ductwork airtightness low awareness

- Only France and Belgium seem to take into account ductwork airtightness in their regulations
- Only France have a EP- programme with requirements on ductwork airtightness and a qualification for testers
- Progress are needed to better understand the impact of ductwork airtightness on energy use (fan, cooling and heating)

# THANK YOU FOR YOUR ATTENTION



Analysis of answers of airtightness associations representatives  
performed by:  
Valérie Leprince, Maria Kapsalaki, Rémi Carrié