



# Building and ductwork airtightness in Europe: Drivers and trends

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INIVE

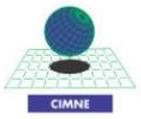
BUILD UP Webinar

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# INIVE

International Network for Information on Ventilation and Energy Performance





The IEA Information Centre on Energy Efficient Ventilation

2011: 12 member countries  
2012: 15 member countries  
2013: 17 member countries





## Right and Tight: What's New in Ductwork and Building Airtightness?



[www.buildup.eu](http://www.buildup.eu)  
04588

Legislative drivers and new research on the importance of building and ductwork airtightness are leading to increased activity in this aspect of building energy performance. Qualification schemes for competent testers, training and events and where to find the best information are summarised here.

Increasing pressure on building and ductwork airtightness with the EPBD recast

## Right and Tight: What's New in Ductwork and Building Airtightness?

### Examples of measures taken

The impact of envelope and, to a lesser extent, ductwork airtightness is accounted for in the energy performance regulations in many European countries ([ASIEPI project report](#)). The examples that follow include measures taken both for building and ductwork airtightness with respect to requirements and EP-calculation methods, as well as steps to encourage market transformation.

#### Airtightness requirements in European countries

An increasing number of countries (e.g. Czech Republic, Denmark, France, Germany, Ireland, Netherlands, Norway, Portugal, UK – for more, read this [article](#) published at 2009 AIVC conference) include in their regulations either required or recommended minimum airtightness levels with or without mandatory testing. The number of tests performed on a voluntary basis is rapidly increasing either because of the energy penalty for untested buildings in the calculation method or due to the specific requirements of a given program.

# Outline

- Increasing pressure on building and ductwork airtightness with the EPBD recast
- Requirements in EU countries
- Incentives through calculation procedures and/or subsidies
- Conclusions
- Perspectives

# Increasing pressure on building and ductwork airtightness with the EPBD recast

## Energy impact

- Several sources report an energy impact on the order of:
  - 10 kWh/m<sup>2</sup> of floor area per year for the heating needs in a moderately cold region (2 500 degree-days)
  - 0 to 5 kWh/m<sup>2</sup>/year for the ducts plus the additional fan energy use
- See [www.asiepi.eu](http://www.asiepi.eu)  
- Some more recent work...

# Increasing pressure on building and ductwork airtightness with the EPBD recast



- Looks at 2 similar dwellings in 2 phases
- Compares heat loss coefficients based on measurements
- Concludes that **15% energy savings** potential going:
  - From 11.5 m<sup>3</sup>/(m<sup>2</sup>.hr) @50 Pa (average current value)
  - Down to 5 m<sup>3</sup>/(m<sup>2</sup>.hr) @50 Pa (achievable)

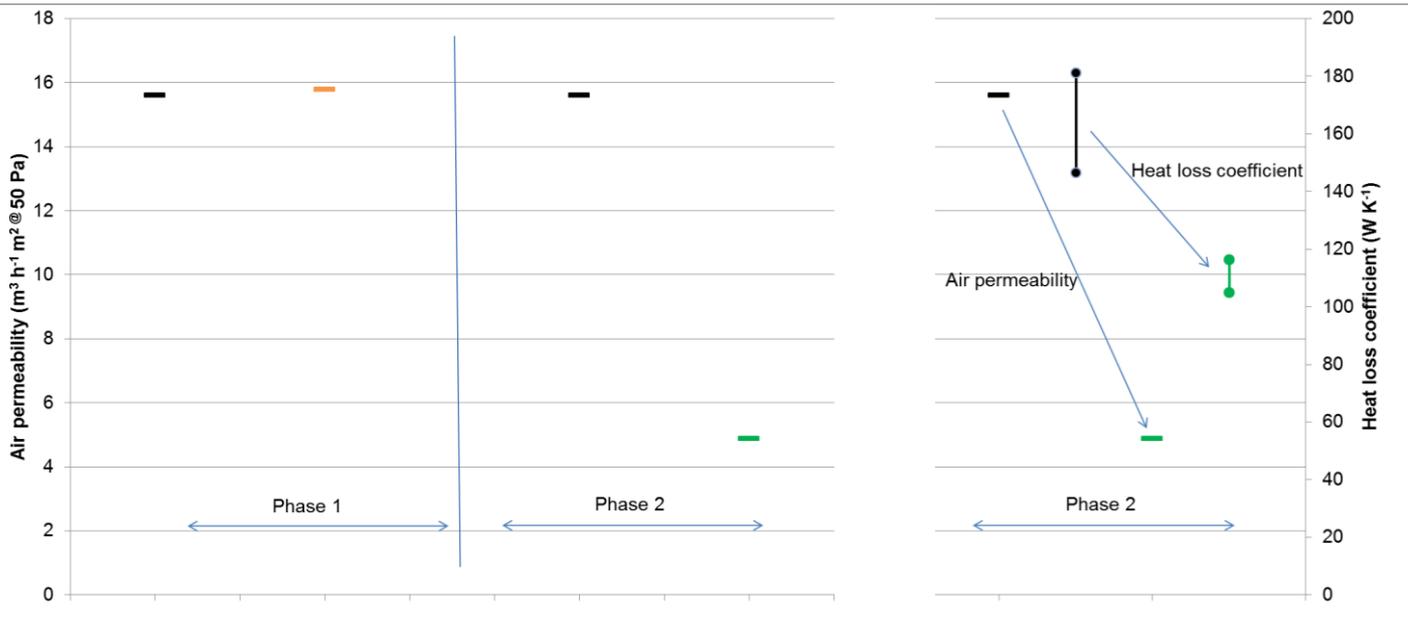
## Research into the effect of improving airtightness in a typical UK dwelling

The UK's Airtightness testing & Measurement Association (ATTMA) is a trade body that represents the UK's leading air-tightness testing and consultancy firms. Most of the work undertaken by these firms is for the builders of new housing and buildings, who are required to prove that they have achieved the required level of air-tightness in their buildings in order to satisfy Building Regulations.



### Experiment needed for reliable data

What is needed is more reliable evidence as to the positive impact that improved air-tightness can deliver in a typical UK building or dwelling, alongside an appropriately designed and controlled ventilation system. Aside



# Increasing pressure on building and ductwork airtightness with the EPBD recast

- There is a growing number of studies showing the significant impact of building and ductwork leakage in hot and mild climates as well (e.g., Spain, Portugal)



Evaluation of air leakage and its influence on thermal demands of office buildings in Madrid



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- Convergence between good IAQ and good airtightness, with an appropriate ventilation system



## QUAD-BBC, Indoor Air Quality and ventilation systems in low energy buildings

- Laure Mouradian, CETIAT and Xavier Boulanger, Association air.h

calculated in occupancy periods only. The possible interactions between pollutants or with the building are not taken into account.

### Evaluation of the impact of low energy buildings and ventilation systems on indoor air quality

Changes in building design and construction in the context of increasing building energy

The study also shows that the ventilation performance can be improved, especially in main rooms when improving building airtightness. While we could fear the contrary, improved airtightness appears to be beneficial to IAQ in our test cases.

For more information, the reader may download the synthesis report (in French) at

<http://www.airh.asso.fr/etudes.aspx>

# Increasing pressure on building and ductwork airtightness with the EPBD recast

→ The EPBD recast (2010/31/UE, 19/05/10)

Building and ductwork airtightness is a key issue

*Article 9*

**Nearly zero-energy buildings**

1. Member States shall ensure that:

- (a) by 31 December 2020, all new buildings are nearly zero-energy buildings; and
- (b) after 31 December 2018, new buildings owned by public authorities are nearly zero-energy buildings.

+ measures for existing stock

# Airtightness requirements in EU countries

- Requirements evolve
  - Although there is no explicit requirement for airtightness in the directive
  - Poor airtightness is often penalized in regulations in the member states  
see [www.asiepi.eu](http://www.asiepi.eu) ,  
  - In some countries, there are explicit minimum requirements
- On-going survey

# Airtightness requirements in EU countries

Country or Region	Programme, Standard or Regulation	Indicator	Minimum requirement in some cases	Maximum(s) value for the building leakage****
Belgium, Flanders (BE)*	Flemish EPB regulation	q50	No (default value)	--
Czech republic (CZ)***	CSN 73 0540-2 (2011) (Standard)	n50	Yes	Level I: from 0.6 h <sup>-1</sup> for passive houses to 4.5 h <sup>-1</sup> for naturally ventilated buildings Level II: from 0.4 h <sup>-1</sup> for passive houses to 3.0 h <sup>-1</sup> for naturally ventilated buildings
Czech republic (CZ)***	TNI 73 0329 (2010) (Preliminary Standard)	n50	Yes	0.6 h <sup>-1</sup> for a single-family passive house 1.5 h <sup>-1</sup> for a single-family low-energy house
Czech republic (CZ)***	TNI 73 0330 (2010) (Preliminary Standard)	n50	Yes	0.6 h <sup>-1</sup> for a multi-family passive residential building 1.5 h <sup>-1</sup> for a multi-family low-energy residential building
Denmark (DK)**	Danish building regulation (BR10)	w50	Yes	From 1 l/s/m <sup>2</sup> for low energy buildings to 1,5 l/s/m <sup>2</sup>
Finland (FL)**	Finnish building code, requirements and instructions 2012	q50	Yes	4 m <sup>3</sup> /h/m <sup>2</sup>
France (FR)***	Regulation RT2012, Effinergie label	Q4Pa_surf	Yes	0,6 m <sup>3</sup> /h/m <sup>2</sup> for new single family houses and 1 for other residential buildings
Germany (DE)**	En EV 2009 (Regulation), DIN 4108-2011, DIN V 18599 (Standards), Passivhaus (Program)	n50 and q50	Yes	From 0,6 h <sup>-1</sup> for Passivhaus to 3 h <sup>-1</sup> for houses without mechanical ventilation system
Greece (GR)*	--	--	No	--
Italy (IT)*	--	--	No	--
Netherlands (NL)**	Dutch building code, building act 2012	qv10	Yes	0,2 m <sup>3</sup> /s
Norway (No)*	Norwegian Technical Building Regulations	n50	Yes	3 h <sup>-1</sup>
Poland (PL)*	Technical Requirements as of 12 04 2002	--	No	--
Portugal (PT)*	--	--	No	--
Spain (ES)***	CTE-HE1/CTE-HE2 (Regulation)	--	Only for components	--
Switzerland	Minergie***	q50	Yes	n50st<0,6 (Passive houses) and n50st<1 low energy houses
Sweden	--	q50?	Yes	Maximum leakage for passiv houses of 0,3 l/m <sup>2</sup> s
United Kingdom (UK)**	UK building regulation, approved document part L	q50	Yes	Mostly 10 m <sup>3</sup> /h/m <sup>2</sup> (value from 3 to 5 m <sup>3</sup> /h.m <sup>2</sup> are foreseen for the next regulation)

# Airtightness requirements in EU countries

## Lessons learnt from the survey

- Most countries account for building airtightness in their EP regulations
- Several countries have minimum requirements either for specific programmes or regulations
- Mandatory testing applies in several countries
- The market share concerned varies a lot
- Several airtightness indicators are used
- Credit for better ductwork airtightness is included in Belgium and France

# Airtightness requirements in EU countries

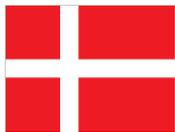
## Mandatory testing comes or has come gradually into force in several countries



Subjecting samples of newly built dwellings to a pressure test is compulsory



Tests must be carried out for new HVAC systems in buildings larger than 1,000 m<sup>2</sup>



Municipal council is required to demand airtightness measurements in no less than 5% of the construction projects



Tests must be carried out in dwellings, sampling rules apply.

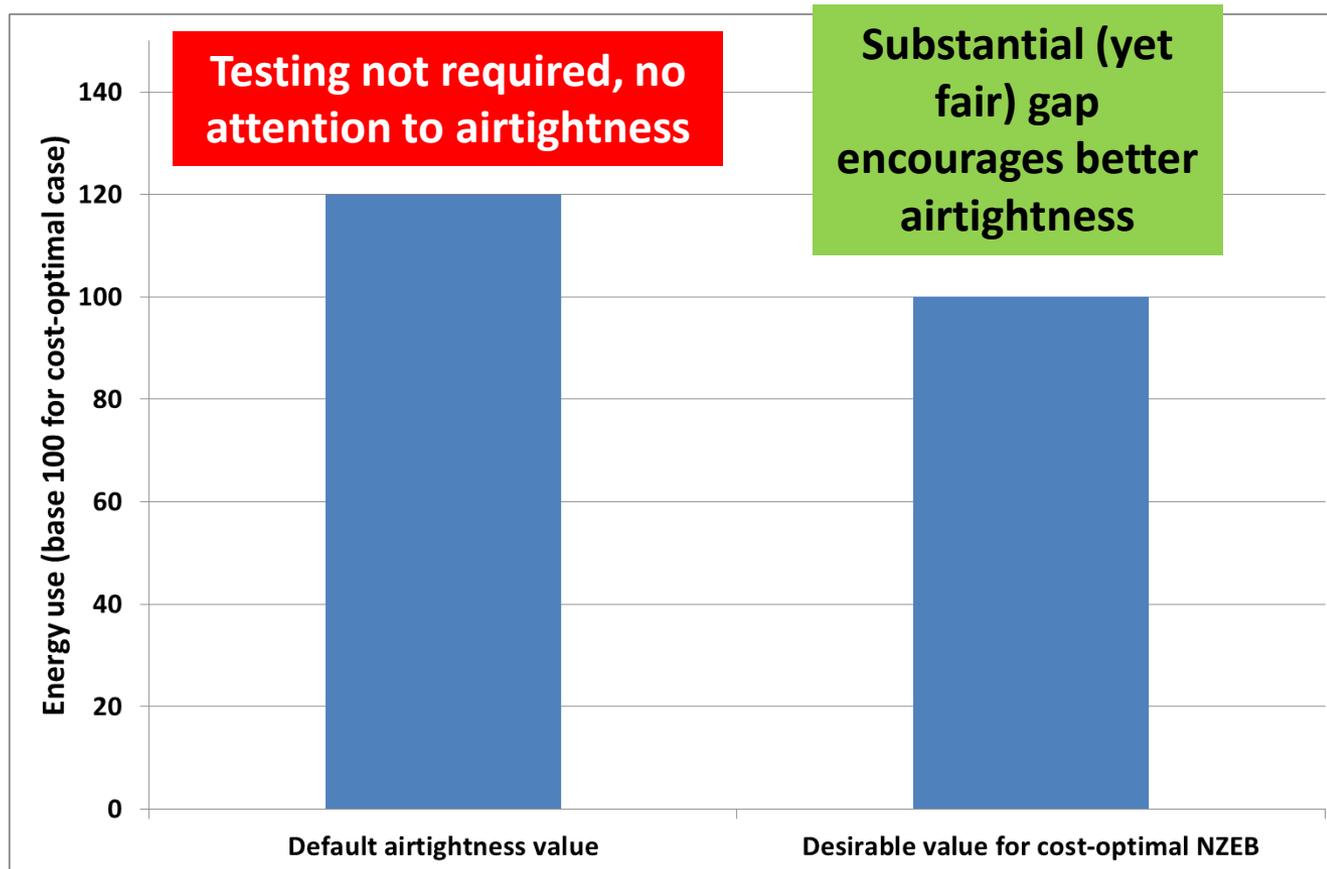


Airtightness of all new residential buildings must be justified either with a test or by an approved quality management approach (which involves testing on samples). Ductwork pressurization test is mandatory in Effinergie buildings.

Number of units	Number of tests
1 to 4	One test
Greater than 4, but equal to or less than 40	Two tests
Greater than 40, but equal to or less than 100	At least 5%
More than 100	
(a) where the first five tests achieve the design air permeability	At least 2% (for dwellings in excess of first 100 units)
(b) where one or more of first five tests do not achieve the design air permeability	At least 5% of units, until 5 successful consecutive tests are achieved, 2% thereafter

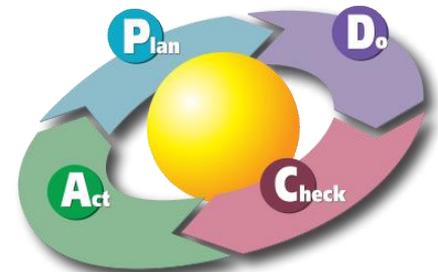
# Incentives through calculation procedures and/or subsidies

Most energy regulations in Europe include the impact of building airtightness on the overall energy performance calculation (ASIEPI project report)



# Incentives through calculation procedures and/or subsidies

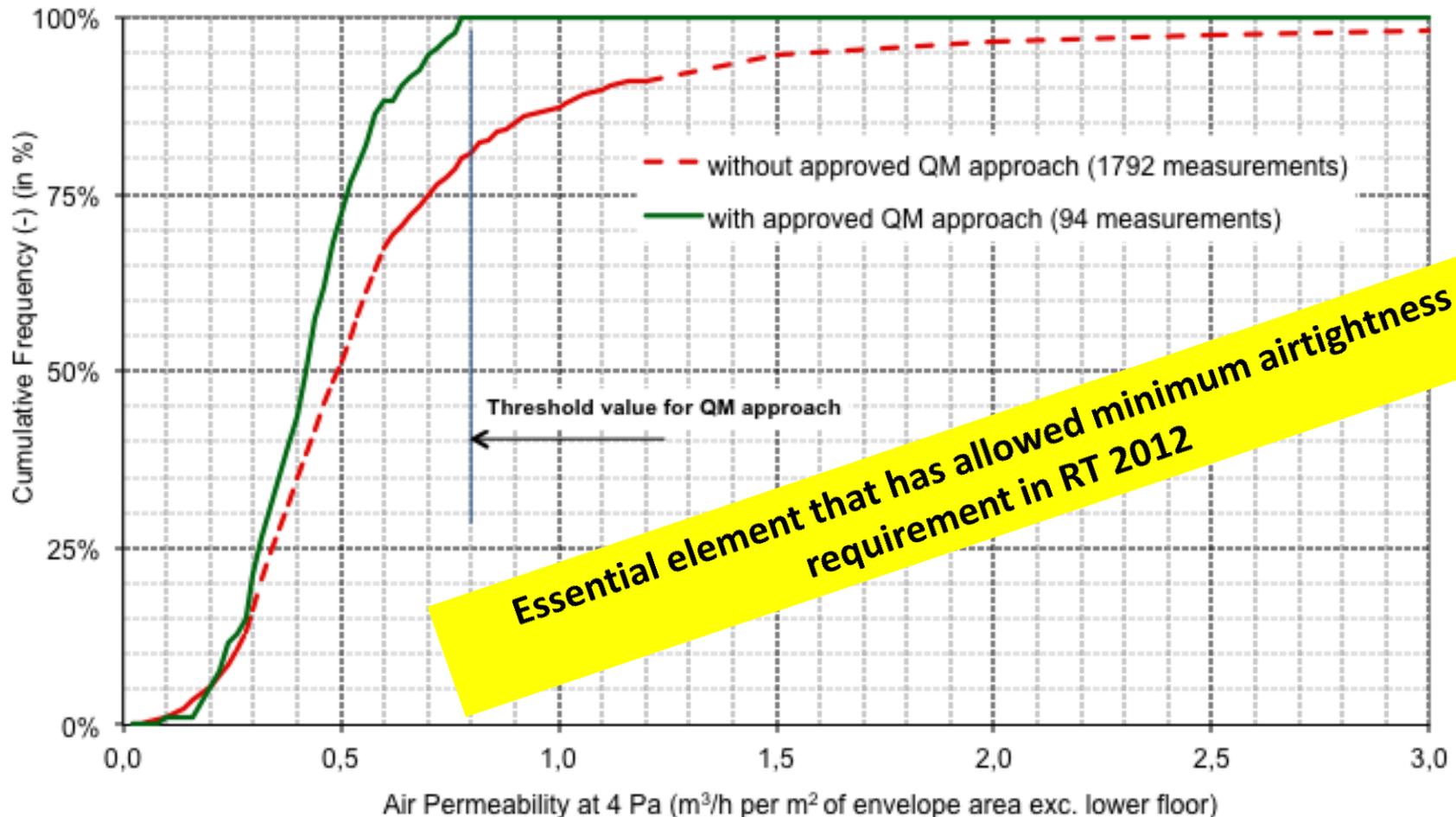
- Encouragement for Quality Management approaches in France
- Allows non-systematic testing
- Initially controversial approach but mandatory testing would probably not have been included in the new regulation (2012) without this possibility
  - Evaluation programmes with independent control are underway
  - Positive feedback so far although improvements are possible



PDCA cycle (source: Wikipedia)

# Incentives through calculation procedures and/or subsidies

Distribution of measured airtightness of houses with and without implementation of an approved quality management approach (France)



Essential element that has allowed minimum airtightness requirement in RT 2012

# Incentives through calculation procedures and/or subsidies

## Good airtightness as pre-condition for specific programmes

- Programmes based on PassivHaus or Minergie-P
- Mentioned in the ASIEPI project for:
  - **Norway:** governmental House Bank gives economic incentives
  - **France:** BBC-Effinergie label, since 2007, endorsed by French government to claim for subsidies
  - ...

# Questions raised

- Does the market react positively to these changes?
- Does it improve the quality of buildings in practice?
- How do we set up effective control frameworks to avoid wrong declarations (intentionally or not) in EP calculations?
- ...



# Summary

- Recent studies and developments confirm the relevance of improving building and ductwork airtightness in the EPBD recast context
- Airtightness requirements evolve significantly in the member states
- More and more countries require explicitly airtightness testing for specific programmes or for a wide range of buildings
- These changes raise a number of questions, including how to efficiently control the compliance with respect to airtightness

*Summary*



# Acknowledgements



<http://www.tightvent.eu>

The TightVent Europe “Building and Ductwork Airtightness Platform” was launched on January 1, 2011. It aims at facilitating exchanges and progress on building and ductwork airtightness issues.

Diamond partners



**BlowerDoor GmbH**  
MessSysteme für Luftdichtheit



Gold partners



Associate partners



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<http://www.aivc.org>

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