Airtightness of buildings in Poland

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Presentation plan

• Climate
• Typical buildings
• Ventilation systems
• Legal regulations & guidelines
• General situation
• Case studies
**Climate**

Poland
- middle Europe
- population: 38,500,000
- total area: 313,000 km² (120,000 sq mi)
- 5 winter & 2 summer design conditions regions
- low diversity
- winter design parameters: -24°C to -16°C (-11°F to -4°F)
- summer design parameters: 28°C to 30°C (82°F to 86°F)

**Typical buildings**

Single family houses (SFH)
- masonry brick walls
- wall thermal insulation outside
- walls plastered from inside
- double glazed casement windows
- pitched/flat roofs
- very few timber constructions

Large/complicated buildings
- reinforced concrete (masonry filling)
- casement windows or glass façades
Ventilation systems

Single family houses (SFH)
- existing: natural ventilation with stack effect domination
- new: natural / mechanical with heat recovery

Windows - fresh air supply for natural ventilation
- 1995-2010 most old leaky windows replaced with tight ones
- problems with natural ventilations but better tightness

Large/complicated buildings
- existing: natural / mechanical ventilation
- new: mechanical with heat recovery

Legal regulations until 2013

- till 2008 only windows & doors permeability requirements existed in Poland
- current requirements (Building Codes 2008):
  - $n_{50} < 1.5$ ACH for buildings with mechanical ventilation
  - $n_{50} < 3.0$ ACH for buildings with natural ventilation
  - measurement is only ADVISED
  - $n_{50}$ value is REQUIRED if measurement performed
  - no reference to measurement procedure standard in Building Codes
Legal regulations 2014

Building Codes 2014:
• the same $n_{50}$ values advised as now
• measurement is still only ADVISED
• but $n_{50}$ value is only ADVISED (no longer REQUIRED)
• measurement procedure standard reference in Building Codes:
  • the Polish/European norm PN-EN 13829

Other guidelines

Passive house standard:
• $n_{50}<0.6$ ACH is required
• few passive houses built in Poland with slowly growth observed due to lack of subsidies

National Fund for Environmental Protection and Water Management Programme:
• a step in a good direction
• Fund set up requirements for new low energy buildings
• obligatory testing of building airtightness
• fulfillment of all these demands in case of residential houses results in getting subsidy which is a good stimulus to care about the building quality
General situation

Commissioning companies
- the situation in the field of airtightness on the Polish construction market looks like at the very beginning of the whole long quality-improvement process
- at the moment no requirements imposed for commissioning companies: their competencies, experience, references, equipment and certification.
- this results in measurement failures leading to wrong n50 values
- about 15 commissioning companies in whole Poland
- most of them have nearly no experience in large buildings testing
- only several large buildings tested in Poland

Equipment
- most popular are Minneapolis Blower Door units (over a dozen units)
- no XXL trailer fans
- large building measured with multi Blower Door sets
- attempts to measure large building with AHUs (low test price)
- AHU producers cannot guarantee the accuracy of flow measurement - PN-EN 13829 fulfilment?
- hard to estimate how many test-devices necessary for test (poor n50 database)
**General situation**

Public/institutional investors
- subject to provisions of public procurement law (PPL)
- focused only on initial cost - the most popular tender criteria is the lowest investment price
- as a result poor quality of workmanship and technical solutions
- running cost and therefore n50 are neglected

Private investors
- more conscious in a field of energy efficiency (running cost)

General remark
- problems in investor’s and contractor’s budget planning, lack of awareness, knowledge and experience
- problems in offering (both sides investors and test companies)

**Measurements - case studies**

- building airtightness is a quite new subject in Poland
- 2008÷2013 period
- Blower Door unit
- for large building cooperation with other commissioning companies (up to 6 Blower Door units cascade)

Case studies
- single family houses
- large buildings
Single family houses

Old building recently retrofitted
- natural ventilation (sealed air outlets)
- masonry walls
- wooden structure pitched and flat roof
- small windows and walls leakages
- strong pitched roof influence

New buildings (less than 5 years old)
- left: timber wall construction
  open combustion chamber furnace DHW preparation
  piping shaft leakages connected to cold roof attic
- right: typical masonry brick walls construction
  low windows and walls leakages
Single family houses

Low energy buildings
- left: timber constructions, passive standard retrofitting
- right: masonry walls, low energy building
- roof-wall joint - most leaky area

\[ A_i = 73 \text{ m}^2, \quad n_{50} = 0.49 \text{ ACH} \]
\[ A_i = 108 \text{ m}^2, \quad n_{50} = 0.65 \text{ ACH} \]

Large buildings

- will be continued on our next presentation
Summary

• beginning of the airtightness subject in Poland
• low level of awareness, competencies, experience, knowledge among architects/designers, investors, contractors and commissioning companies
• airtight components: new windows, masonry walls and flat roofs
• leaky components: pitched roof, ventilation systems
• measurement and $n_{50}$ value is only ADVISED
• Building Codes: $n_{50} < 1.5 \div 3.0$ ACH
• $n_{50}$ varies $1.5\div 5.0$ ACH for typical SFH
• $n_{50}$ extremes $0.5 \div 8.4$ ACH