Airtightness of buildings in Poland

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Presentation plan

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

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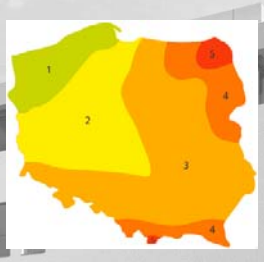
Climate



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÷-16°C -11÷3°F
- summer design parameters 28÷30°C 82÷86°F

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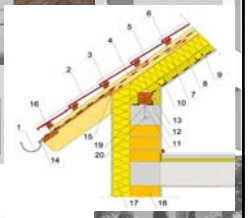
Typical buildings

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



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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

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Legal regulations until 2013

- till 2008 only windows & doors permeability requirements existed in Poland
- the European Union Energy Performance of Buildings Directive (EPBD) established in 2008 the first regulations in Polish law, regarding airtightness of whole buildings
- 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

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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

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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

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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 n_{50} 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

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General situation

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 fulfillment?
- hard to estimate how many test-devices necessary for test (poor n_{50} database)

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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 n_{50} 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)

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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

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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

A_f 102 m^2
n_{50} **1.8** ACH

A_f 72 m^2
n_{50} **8.4** ACH

A_f 115 m^2
n_{50} **7.0** ACH

A_f 385 m^2
n_{50} **5.9** ACH

A_f 134 m^2
n_{50} **2.2** ACH

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Single family houses

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

A_f 188 m^2
n_{50} **4.6** ACH

A_f 177 m^2
n_{50} **2.6** ACH

A_f 134 m^2
n_{50} **1.7** ACH

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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_f 73 m^2
n_{50} **0.49** ACH

A_f 108 m^2
n_{50} **0.65** ACH

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Large buildings

- will be continued on our next presentation

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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÷3.0 ACH
• n_{50} varies 1.5÷5.0 ACH for typical SFH
• n_{50} extremes 0.5÷8.4 ACH
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