Securing the quality of ventilation systems in residential buildings:
Status and perspectives in Poland

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The number of new apartments remains still insufficient in comparison with social expectations.

The size of apartments already in use is smaller than the average size in developed European countries.

Housing will continue to develop for at least the nearest ten or fifteen years.
Existing buildings – ventilation systems

- Mechanical ventilation
- Passive stack ventilation

Existing buildings – disfunctions of natural ventilation

- Variable, unpredictable air flow, depending on the external conditions
  
  **Seazon of the year**

- Winter
  - $T_{\text{external}} = +12°C$
  - $T_{\text{internal}} = +20°C$

- Summer
Existing buildings – disfunctions of natural ventilation

- Variable, unpredictable air flow, depending on the external conditions
  wind, shape of the building etc

- Excessive airtightness / insufficient supply of external air

- Humidity / mould and fungi / damage to the building structures
New buildings – ventilation systems 2009-2012

- Single family houses
  - Mechanical supply/exhaust ventilation with heat recovery
  - Passive stack ventilation
- Multi-family buildings
  - Mechanical exhaust ventilation
  - Passive stack ventilation

New buildings – ventilation systems

- natural exhaust ventilation
  - natural supply of fresh air through leaks or air inlets
  - natural exhaust of interior air through ducts
    - common or individual ducts (before 2000)
    - individual ducts (after 2000)
  - buildings of up to 9 stories
New buildings – ventilation systems

**mechanical exhaust ventilation**

- natural supply of fresh air through leaks or air inlets
- mechanical exhaust of air
  - common ducts for rooms serving the same purpose
  - central fan at the roof
  - individual fans in apartments

New buildings – ventilation systems

**mechanical supply/exhaust ventilation with heat recovery**

- mechanical supply of fresh air
- mechanical exhaust of internal air
- kitchen hood included in system or not
New buildings – ventilation systems

All buildings erected in Poland have to be designed and built in accordance with the detailed building code.

The code requires that continuously working ventilation be ensured in each building.

The regulations are a blend of goals to be reached on the one side and detailed technical guidelines on the other side.

The minimum volumetric flow rate of ventilation air for an apartment is determined as a sum of flow rates of air removed from the respective spaces.
New buildings – ventilation systems

Flow rate of exhaust air

<table>
<thead>
<tr>
<th>Type and intended use of space</th>
<th>[m³/h]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kitchen, fitted with a gas cooker</td>
<td>70</td>
</tr>
<tr>
<td>Kitchen, fitted with an electric cooker</td>
<td>50</td>
</tr>
<tr>
<td>Bathroom</td>
<td>50</td>
</tr>
<tr>
<td>Separate toilet</td>
<td>30</td>
</tr>
<tr>
<td>Auxiliary room without a window</td>
<td>15</td>
</tr>
</tbody>
</table>

Supply of fresh air

- Supply = exhaust
- Supply > 20m³/h/person
- Before 2009 - regulations not clear
- After 2009 - an obligation to install air inlets in windows or outer walls, both for natural and mechanical exhaust ventilation
### New buildings – ventilation systems

**Decision makers**

#### Single family houses

<table>
<thead>
<tr>
<th>&gt; 90% - architect</th>
<th>&lt; 10% - individual investor</th>
</tr>
</thead>
<tbody>
<tr>
<td>passive stack ventilation</td>
<td>mechanical ventilation with recovery &gt; 70%</td>
</tr>
</tbody>
</table>

**Main reasons**
- building tradition
- lack of knowledge
- designing cost reduction
- heating cost reduction

#### Multi-family buildings

<table>
<thead>
<tr>
<th>architect / investor</th>
<th>passive stack ventilation</th>
<th>mechanical ventilation</th>
</tr>
</thead>
</table>

**Main reasons**
- building tradition
- lack of knowledge
- designing cost reduction
- building costs reduction

**Main reason**
- bad experiences with natural ventilation
- costs analysis – saving the space in flats which can be sold
Designing a ventilation systems

- Architect – the main designer of the building
- Natural ventilation designed by architect
  - choosing appropriate locations of exhaust ducts
  - designing chimneys above the roof slope
  - ducts of 14x14cm cross section and height resulting from the building geometry
  - some ducts do not reach the capacity assumed as they are too short – 2 or 3 highest stories
  - the lower stories, having very high exhaust ducts, are often excessively ventilated

Designing a ventilation systems

- Mechanical ventilation is designed by specialized designers
- The designers should have special design licenses
- Designs of mechanical ventilation systems are in general correct
Installation of ventilation systems

- The contractors do their work using:
  - the technical knowledge and practical experience
  - diverse recommendations and guidelines given by various institutions, research institutes and ventilation technology suppliers
Installation of ventilation systems

Guidelines for ventilation systems with heat recovery (recuperation system) for single family houses

- worked out by the Polish Ventilation Association
- based on legal regulations and practical experience
- a greater comfort for the future occupants
- two groups of users: contractors and investors
<table>
<thead>
<tr>
<th>Type and intended use of space</th>
<th>Flow rate of supply air</th>
<th>Flow rate of exhaust air</th>
<th>Air change rate or air flow rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed kitchen, fitted with a gas cooker</td>
<td>70</td>
<td>70</td>
<td>2</td>
</tr>
<tr>
<td>Open kitchen, fitted with a gas cooker</td>
<td>-</td>
<td>70</td>
<td>2</td>
</tr>
<tr>
<td>Open kitchen, fitted with an electric cooker</td>
<td>-</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>Bathroom</td>
<td>-</td>
<td>50</td>
<td>2-3</td>
</tr>
<tr>
<td>Lavatory (without a bathtub or shower cabin)</td>
<td>-</td>
<td>30</td>
<td>2-3</td>
</tr>
<tr>
<td>Vestibule and auxiliary rooms, such as cloakroom, pantry</td>
<td>-</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Staircase / hall</td>
<td>-</td>
<td>-</td>
<td>50 m³/h minimum</td>
</tr>
<tr>
<td>Laundry / drying room / recreation rooms</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Living quarters: room, living room, bedroom, study</td>
<td>20 m³/h/person</td>
<td>20 m³/h/person</td>
<td>1</td>
</tr>
<tr>
<td>Attic (when its intended use is unspecified)</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Garage, boiler room, technical room, utility room</td>
<td>gravity ventilation or other type of ventilation in accordance with detailed regulations</td>
<td>-</td>
<td>1</td>
</tr>
</tbody>
</table>

Use the value from column A or B, whichever is higher.

Thank you