Criteria For Low Energy Buildings

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Market Transformation Toward Nearly Zero Energy Buildings Through Widespread Use of Integrated Energy Design

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Background

Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (EPBD recast)

New requirements for the energy performance of buildings :

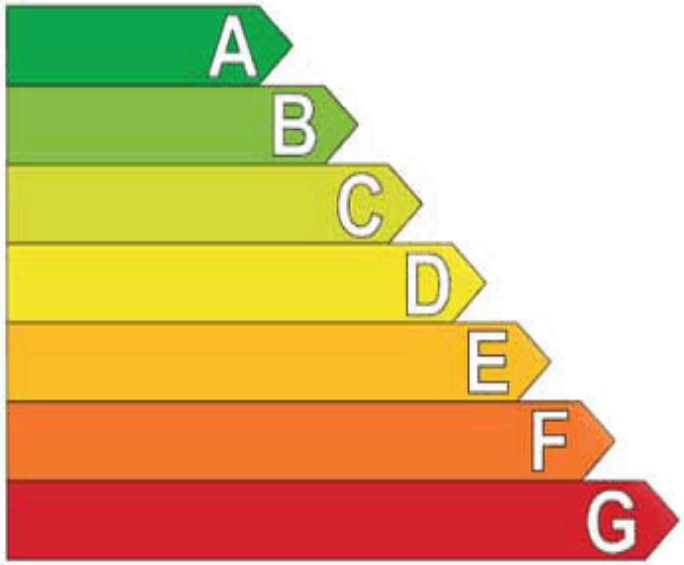
1. All new buildings after 31.12.2020 will be almost zero energy buildings
2. All new public buildings after 31.12.2018 will be nearly zero-energy buildings
3. Member states should create a plan to achieve almost zero energy buildings
4. Determination of primary energy consumption to almost zero energy building will take place at the national level

Building energy standard

The Directive defines a nearly zero-energy building as a high energy performance building and requires the determination of the ratio of primary energy.

Requirements describing low energy building:

1. Useful energy
2. Final energy
3. Primary energy
4. Other (construction, systems)



Low energy building standard - Poland

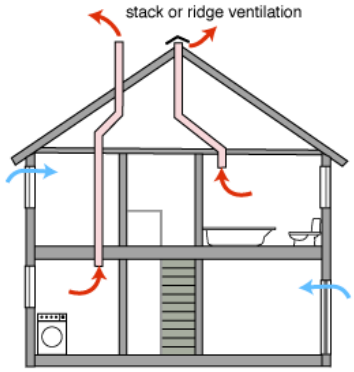
- National Found of Environmental Protection and Water Management support program
- Financing of low energy buildings
- Two standards: NF15 and NF40 (15 or 40 kWh/m^2 per year is useful energy for heating and ventilation, without elecrical energy of fans)
- Requirement of mechanical ventilation system with heat recovery

Calculation assumptions

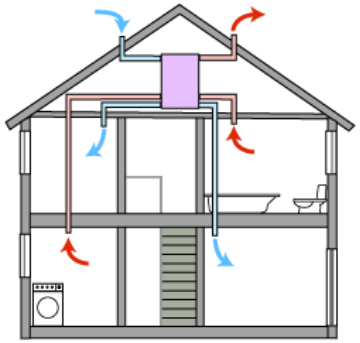
- Energy demand for ventilation in the single family house
- Heat loses through external envelopes are constant
- Only ventilation system was taken into account
- Hygienic air flow rates for single family house with two bathrooms and kitchen with gas cooker: 2x50+70=170 m^3/s
- Ventilated volume of the building is 300 m^3
- Warsaw climate data
- Monthly calculation method

Case study 1

NATURAL vs. MECHANICAL VENTILATION



VS.



- Mechanical ventilation works whole year
- Ventilation air flow without reduction
- Heat recovery of 85%
- Two fans of 80 W (typical single family house ventilation unit)

Case study 1 - results

Ventilation	Heat transfer coefficient [W/K]	Heat demand [kWh/a]
Natural	72.00	7031
Mechanical	18.96	1852

- Plus electrical energy of fans of 1387 kWh/a
- Primary energy factor of electricity equal to 3.0

Ventilation	Primary energy [kWh/a]
Natural	7031
Mechanical	6015

Case study 2

MECHANICAL VENTILATION

- Three steps of mechanical ventilation (in winter 12h on II step and 12h on I step, in summer 10h on III step and 14h on II step)
- Heat recovery of 85%
- Fans of 150 W
- Primary enery factor: gas – 1.1, electricity – 3.0
- Fuel cost: gas – 0.20 PLN/kWh, electricity – 0.54 PLN/kWh
- Calculated H_{ve} = 16.55 W/K

Case study 2

DEMAND CONTROL VENTILATION

- Buoyancy force supported by low speed exhaust fan
- Fans of 6-10 W (for single family house)
- Automatically regulated diffusers – reduction of ventialtion air flow by a factor of 0.7
- Primary enery factor: gas – 1.1, electricity – 3.0
- Fuel cost: gas – 0.20 PLN/kWh,
  electricity – 0.54 PLN/kWh
- Calculated H_{ve} = 50.20 W/K

Case study 2 - results

MECHANICAL VENTILATION

Parameter	Heat	Electricity	Total
Primary energy [kWh/a]	1.1*1616	3*1314	5720
Cost [PLN/a]	1616*0.20	1314*0.54	1032.76

DEMAND CONTROL VENTILATION

Parameter	Heat	Electricity	Total
Primary energy [kWh/a]	1.1*4902	3*88	5655
Cost [PLN/a]	4902*0.20	88*0.54	1027.92

Conclusion

- The choice of indicator for requirements should include not only the useful energy (heat), but also electricity (fans) and other non-energy operating costs (filters)
- The total primary energy demand can be higher for systems with lower energy demand for heating (DCV ventilation vs. mechanical ventilation with heat recovery)
- In some cases the additional energy demand for electricity for fan can provide higher primary energy demand for whole building
- Using only one indicator of energy requirement eg.: useful, final or primary energy may leads to excluding some systems that can be other than recommended

Thank You for your attention