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BIM qualification / Cross-craft (choose one) training module

THE INFLUENCE OF CRITICAL DETAILS OF INSULATION SYSTEM INTEGRATION ON APERTURE CONSTRUCTION ON ENERGY EFFICIENCY AND CONSTRUCTION PHYSICS

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Module outline

1. Introduction - Critical details
2. Preparation – Design
3. Execution - Construction

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1. Introduction - Critical details

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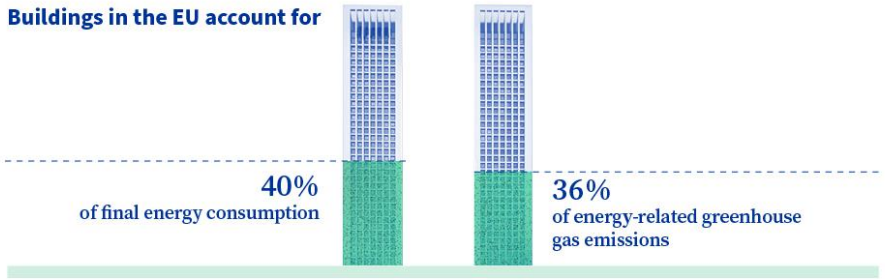
- **Fit for 55**

Energy performance of buildings directive explained

The revision of the directive sets up new, more ambitious energy efficiency standards for new and renovated buildings in the EU. The aim is to encourage property owners across the EU to renovate their buildings.

By 2050, all buildings in the EU should be zero-emission buildings.

How does it contribute to the goal of climate neutrality?



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What will change?

New constructions:

CO_2 New buildings that will have to be zero-emission:

2028 — new buildings owned by public bodies

2030 — all new buildings

A+ B C Energy performance certificates:

will be obligatory for all new buildings — as of 2030

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Greener energy for buildings

Solar energy installations must be installed on:

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- **Energy efficiency** is the amount of energy needed to meet all energy needs related to the normalized use of the building, especially the amount of energy needed for heating and hot water preparation, for cooling and ventilation, and for lighting.

- The energy efficiency of the building is determined by calculation or calculation using measured energy consumption and is expressed in numerical indicators of energy demand in the building and primary energy.

- Primary energy is energy from renewable and non-renewable sources that has not undergone a conversion or transformation process

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- Bill nr. 555/2005 Z. z. states that, since January 1st, 2021, buildings have to be designed with **net zero** need of energy.

- A building with almost zero need of energy is, from the energy efficiency point of view, filed under **A0** energy category for a global indicator, which is the primary energy.

- High-quality **thermal insulation**. Meeting standard requirements for thermal protection.

- **Architecture – design**. The building envelope also must create a design look taking sustainable architecture into account.

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- New buildings must fulfil normalized requirements on heating and technological features of constructions and buildings.

- Normalized requirements must be also fulfilled by the significantly renewed buildings. If it is functional, technically, and economically possible to make, all the building constructions where a significant renovation takes place must fulfil at least the minimum requirements of energy saving buildings.

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The factors having direct impact on the energy efficiency of the building itself:

- characteristics of the building construction,
- the position and orientation of the building,
- internal environment including the project demands on the internal environment,
- energy equipment,
- innate ventilation, especially the influence of heat losses on the internal environment

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- embedded lighting device,
- local environment,
- passive solar system,
- air conditioning system
- physical state of the building,
- compatibility of the proposed materials,
- other factors

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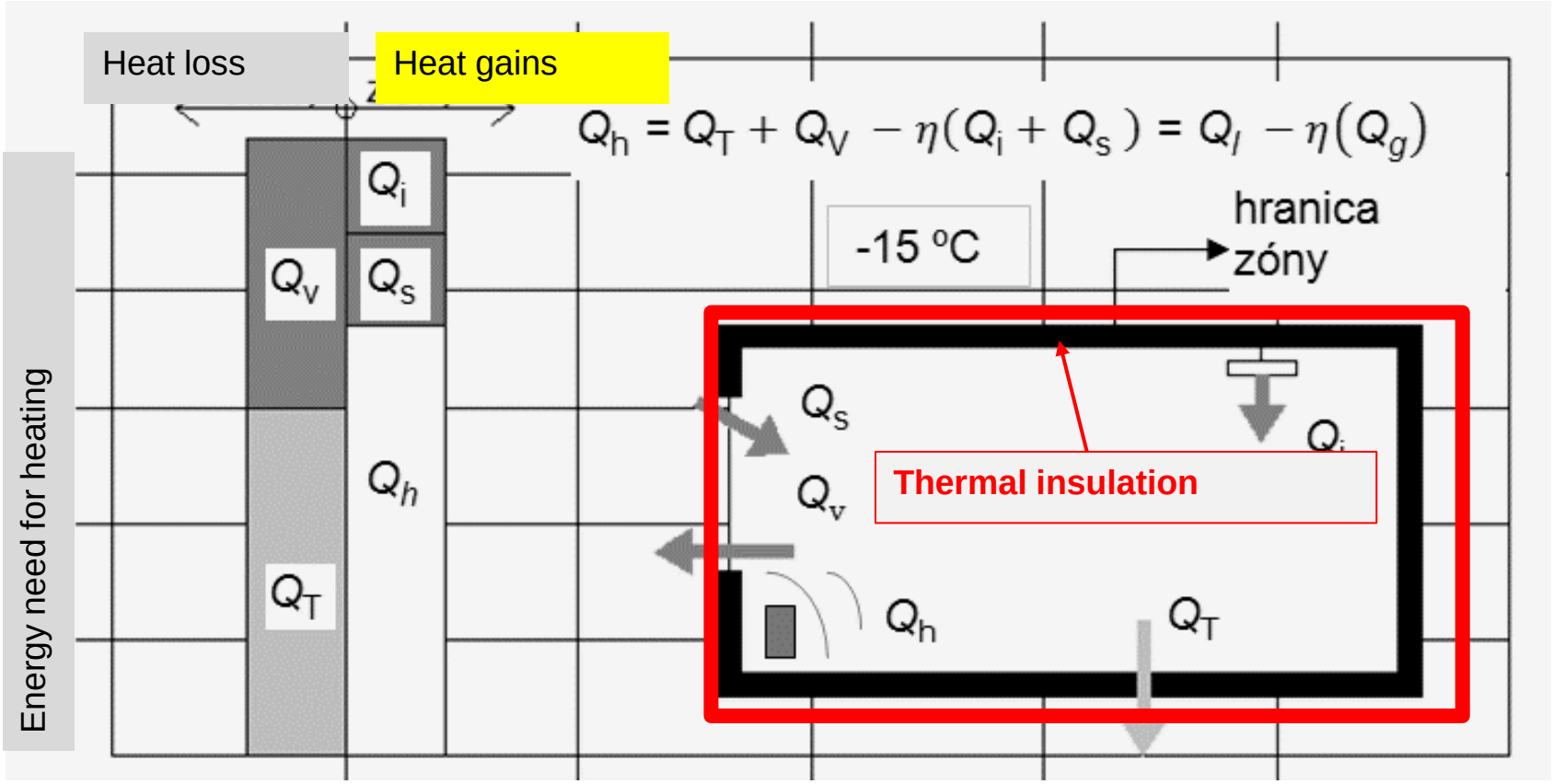
Energy balance



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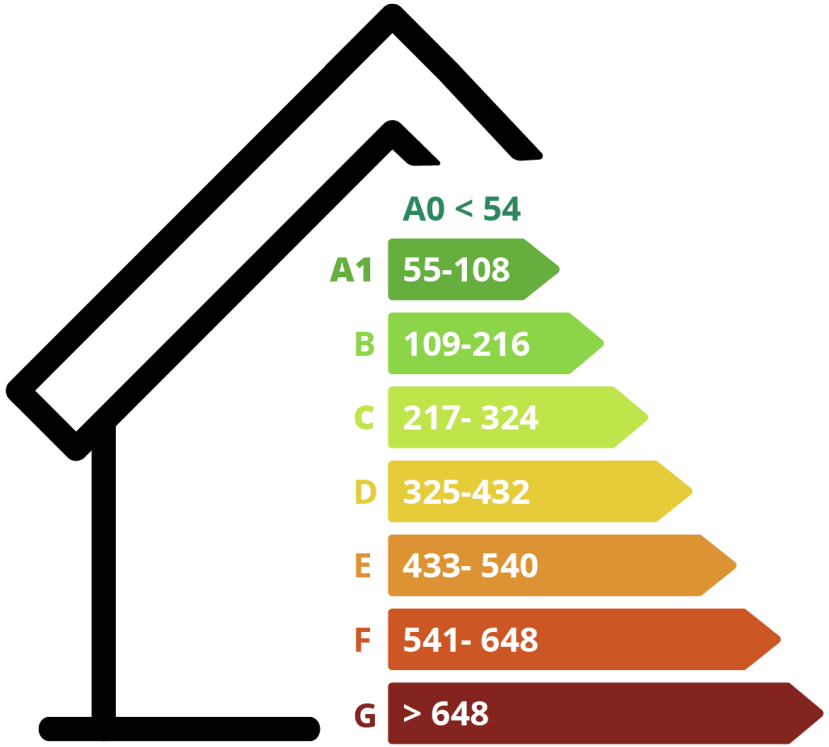
Energy classification of buildings:

- thermal protection of the building
- Lighting
- Heating
- hot water
- Ventilation
- Cooling



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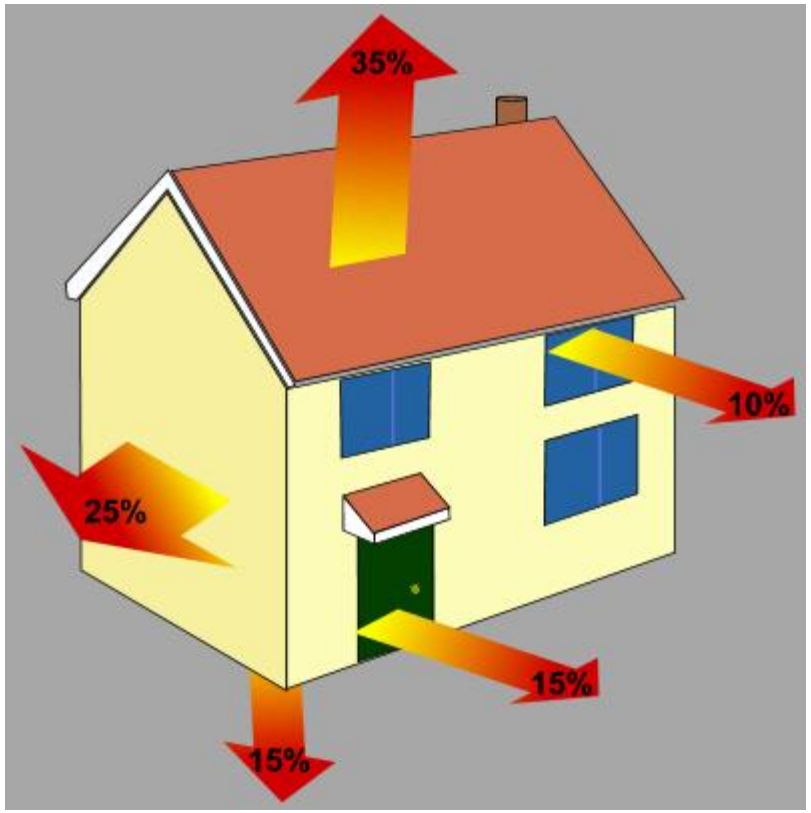
- One of the basic elements that has a direct impact on the energy efficiency is transparent construction.
- Transparent constructions - 10 – 25% thermal losess
- Roof – about 35 %
- Influence on the final cost of building operation.



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- Criterion of minimum thermal insulation properties of a building structure
- Hygienic criterion
- Air exchange criterion
- Energy criterion
- Criterion for the minimum energy performance requirement for buildings

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Type of building construction	Heat transfer coefficient U_N W/(m^2.K)			
		From 1.1.2013	From 1.1.2016 ultra-low energy buildings	From 1.1.2021 NZEB.
Wall	0,46	0,32	0,22	0,15
Roof	0,30	0,20	0,15	0,10
Ceiling over the outdoor environment	0,30	0,20	0,15	0,10

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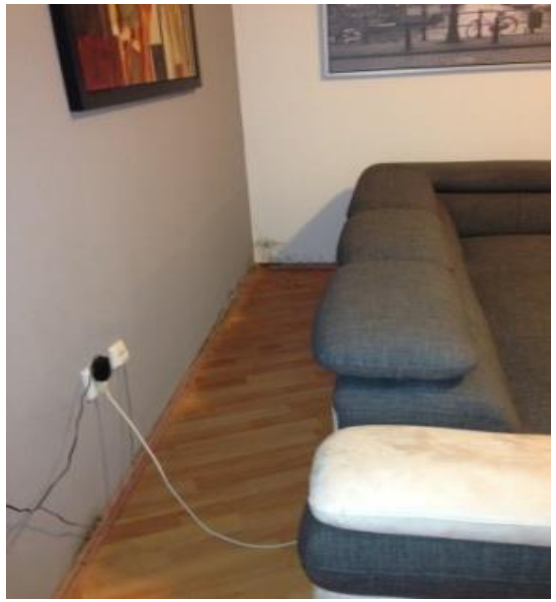
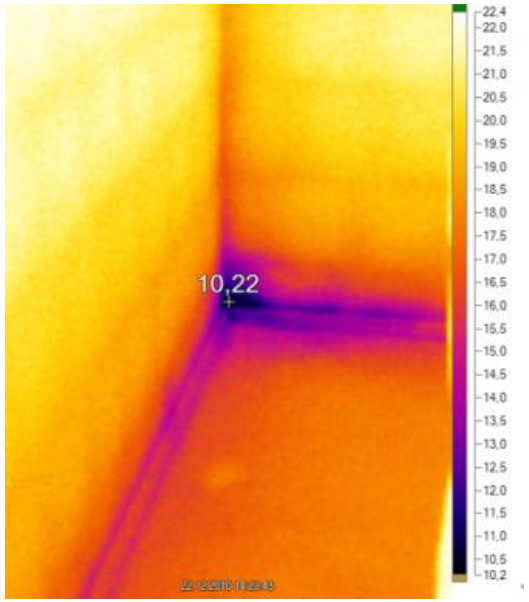
Hygienic criterion





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Thermal bridges

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Thermal bridges

Thermal bridges

a) connection of two walls - corner, b) connection of flat roof - attic, c) connection of flat roof - attic corner, d) lintels over the opening structure e) window sill of the opening structure, f) lining of the opening structure, g) detail at the plinth, h) detail when connecting a sloping roof

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We have 4 levels of energy classification of buildings:

- Energy saving building (minimum requirement),
- Low-energy building (required)
- Ultra-low-energy building (recommended requirement),
- Building with almost zero need of energy (target recommended requirement).

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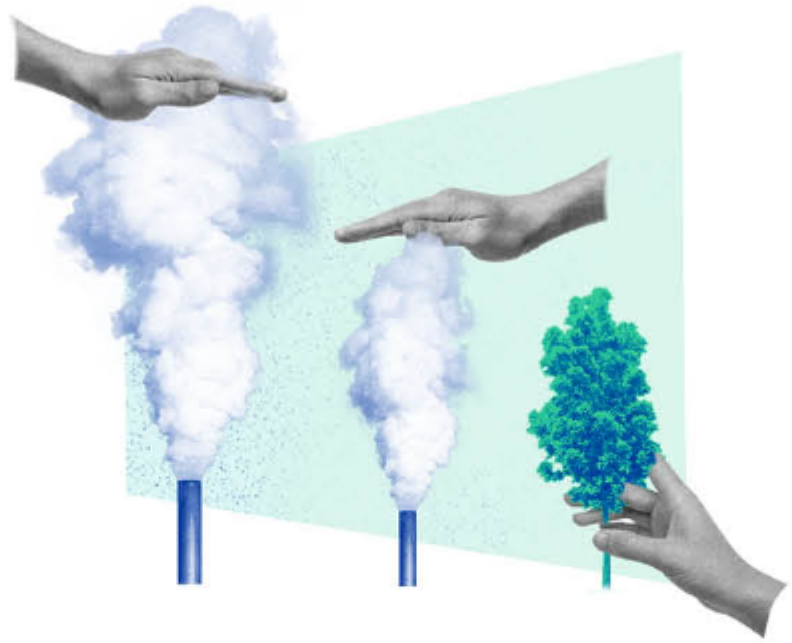
Regarding the tendencies of changes in climate conditions, it is ideal to start using ecological and accessible materials low carbon footprint in construction.

- Use of ecological materials
- One of these materials is also wood, which is used in CLT construction system.



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Thermal insulation	Thermal conductivity	Main advantages	Main disadvantages
Sheep wool	0,034 – 0,042 W/(m.K)	receives air humidity	lower fire resistance
Hemp seed	0,040 – 0,044 W/(m.K)	suitable for allergy sufferers	limited availability of raw material
Flax seed	0,040 – 0,043 W/(m.K)	resistant to mold	lower mechanical resistance
Straw	0,041 – 0,046 W/(m.K)	Low price	low resistance to mold
Cork	0,041 – 0,046 W/(m.K)	Long life	variable availability
Coconut	0,045 – 0,050 W/(m.K)	Long life	variable availabi
Cellulose	0,038 – 0,040 W/(m.K)	Favorable phase shift	professional installation
Fibreboard insulation	0,038 – 0,042 W/(m.K)	High strengh	high energy consumption in production
Textil insulation	0,035 – 0,041 W/(m.K)	low energy consumption in production,	

An example of various thermal insulation materials also used for sustainable architecture