



ROMANIAN ACADEMY
TIMISOARA BRANCH



POLITEHNICA" UNIVERSITY OF TIMIȘOARA
CIVIL ENGINEERING AND INSTALATION
DEPARTMENT

PASSIVE HOUSE – A FUTURE HOUSE IN ROMANIA?

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Passive house criteria for residential buildings

- heating energy demand ≤ 15 kWh/(m² a) or building heating load ≤ 10 W/m² ;
- useful cooling demand ≤ 15 kWh/(m² a);
- primary energy demand ≤ 120 kWh/(m² a);
- building airtightness $\leq 0,6$ /h;
- thermal bridge free;
- ventilation with 75% heat recover

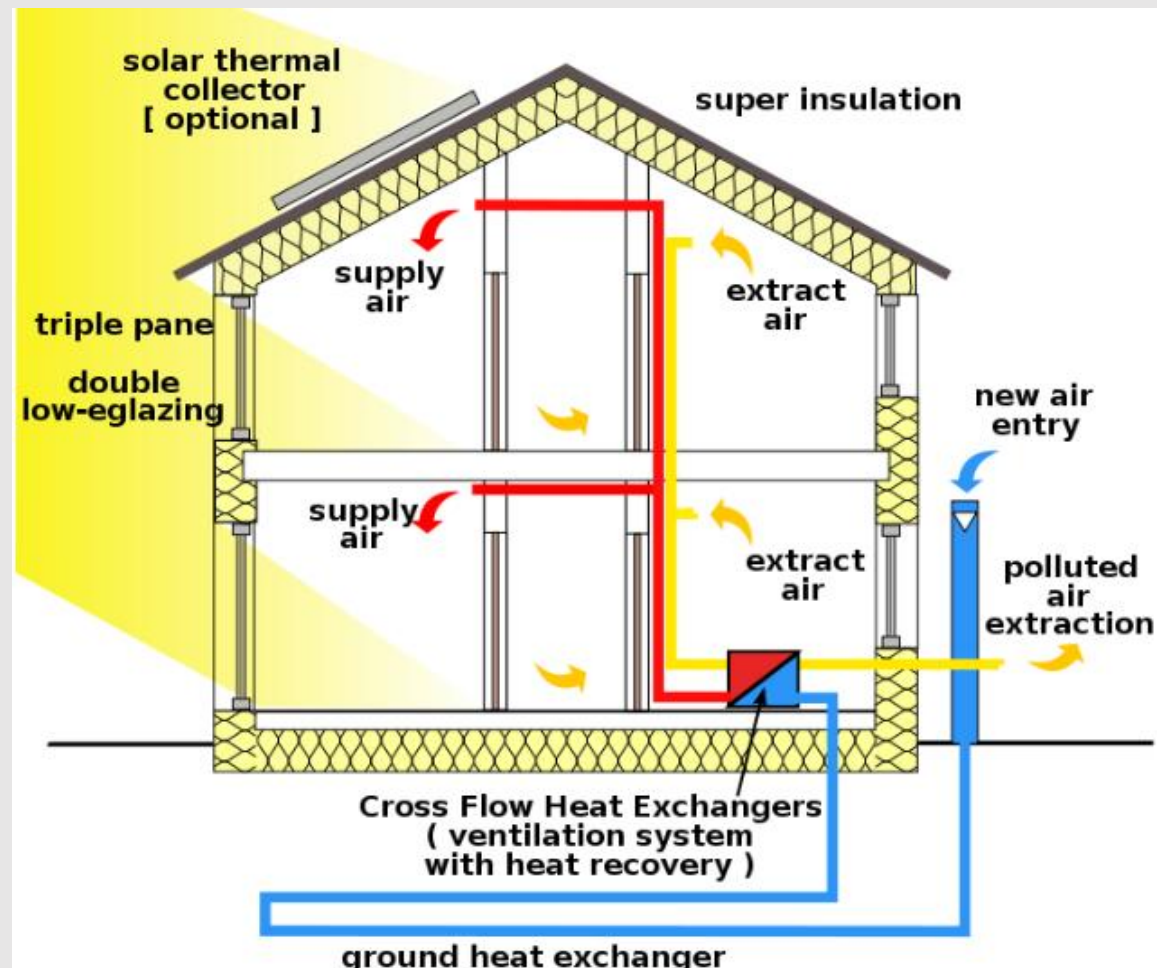
Heat protection:

wall ($U \leq 0,15$ W/(m² K);

roof ($U \leq 0,10$ W/(m² K);

ground floor ($U \leq 0,10$ W/(m² K)

window ($U \leq 0,8$ W/(m² K);



Studied house description

General information

- this passive house is a two story building and has a surface of 144 sq m living space, corresponding to the needs of space and comfort for an average family;
- the maximum dimensions are 14.15x13.65 m and 6.67m height;
- height of the ground floor is 2.95m and 2.90m of the 1st floor;
- the building orientation has a positive contribution (large windows to south);
- the exterior envelope of the passive house is composed of hollow ceramic block wall masonry of 25 cm thickness + thermal insulation (polystyrene) of 300 mm, and 400mm polystyrene for flat roof;

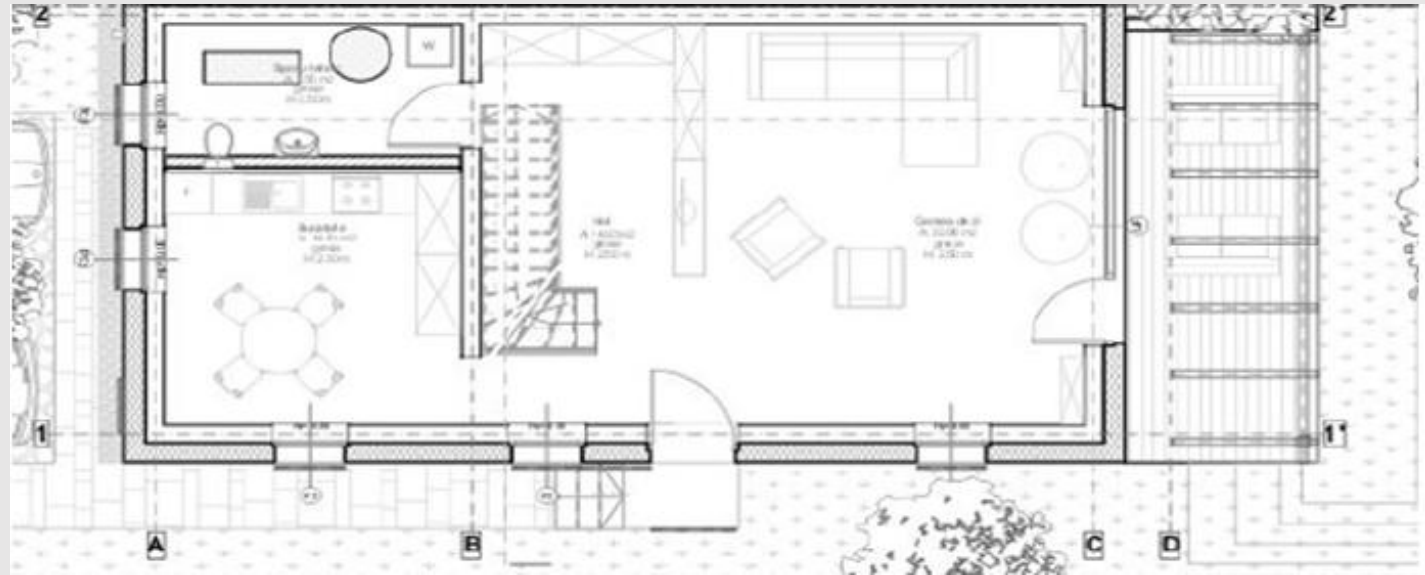
Studied house description

The
passive house
5 Quasar str.
Dumbravita
Timis county

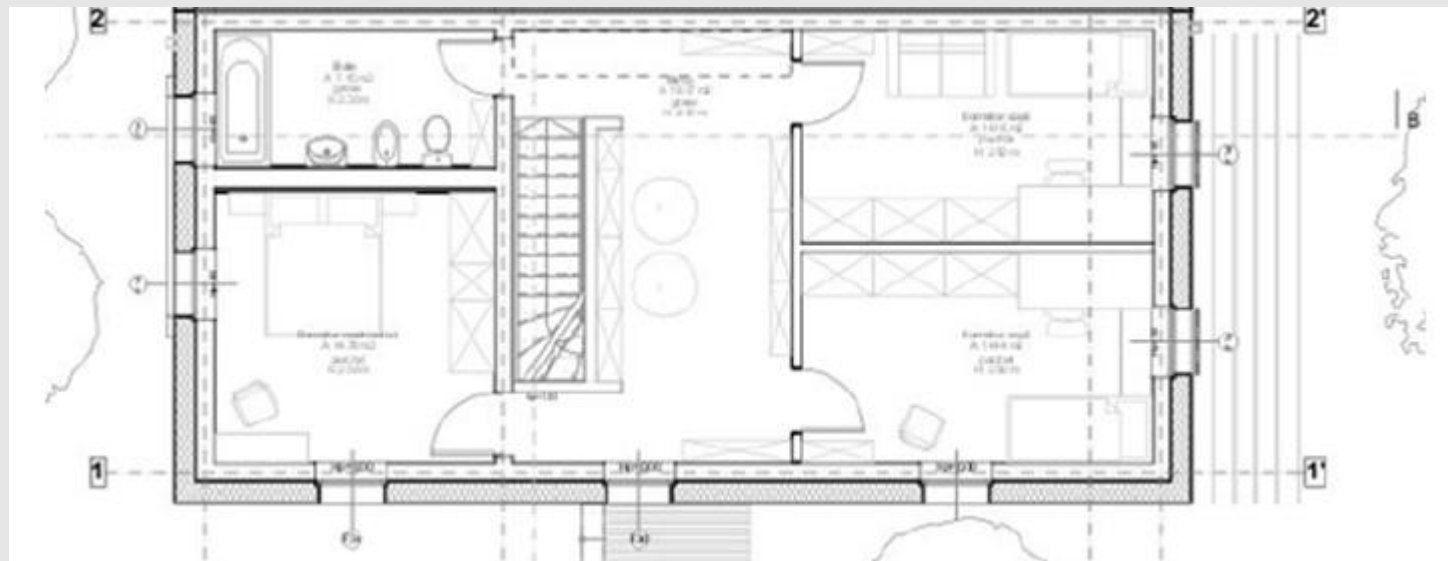


Studied house description

Ground floor plan

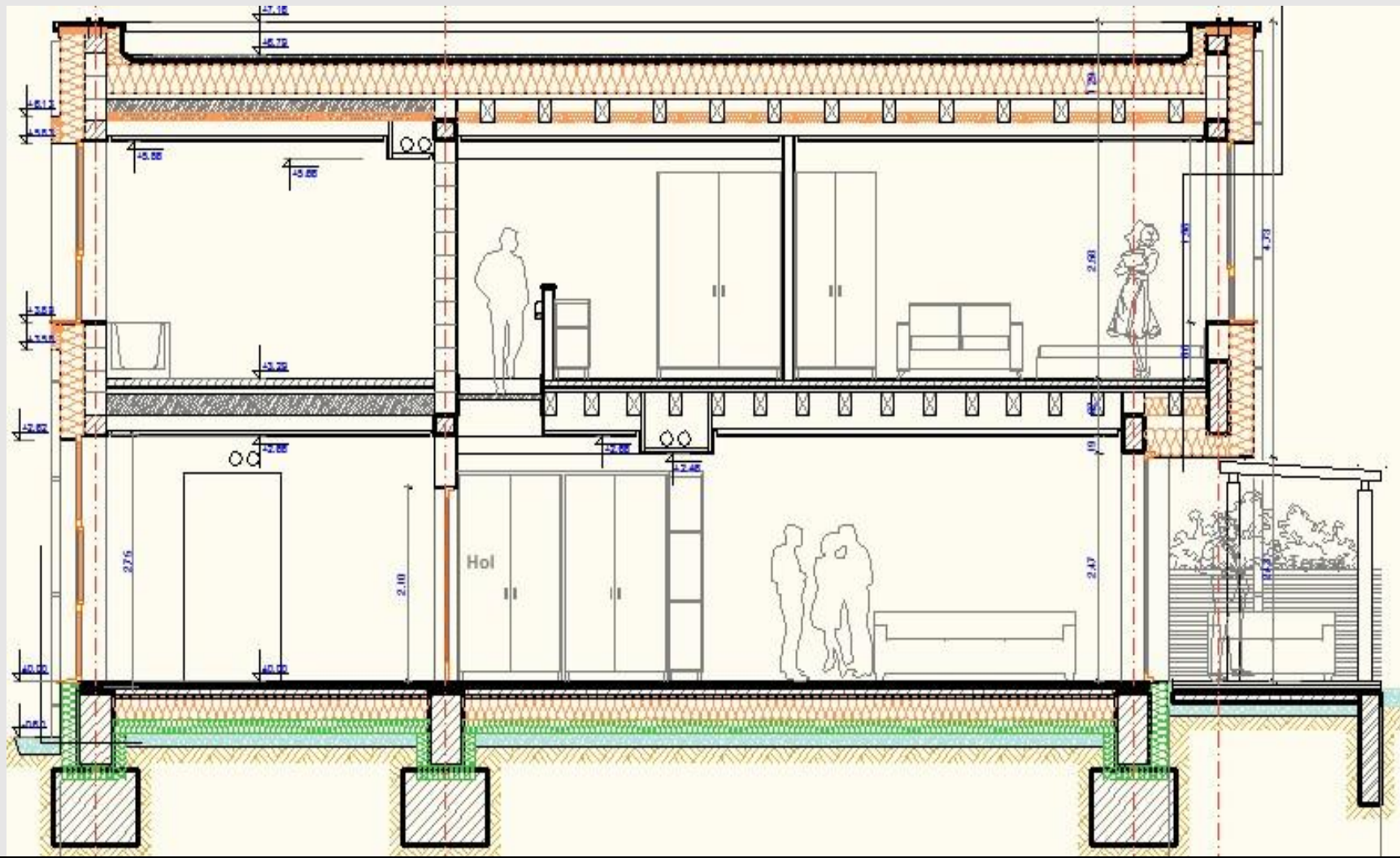


Floor plan



Studied house description

Cross section through the residential building



Studied house description

The building envelope description

Facade

- The house is built on masonry system of vertical hollow ceramic blocks of 25 cm thickness, confined by RC columns and belts
- The exterior envelope of the passive house has a thermal insulation of 300 mm thickness polystyrene expanded;
- windows used in the passive house have U-values for around $0.80 \text{ W/m}^2\text{K}$



Studied house description

The building envelope description

Ground floor

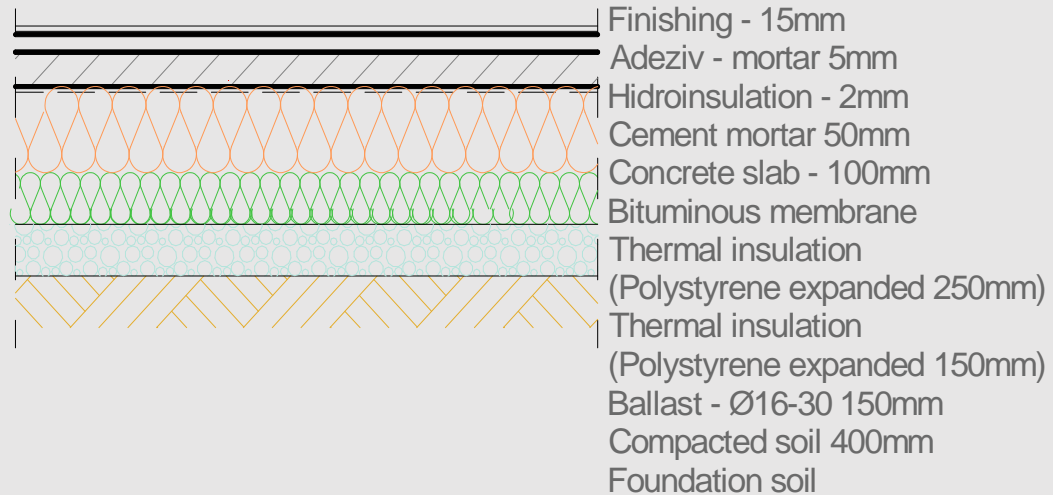
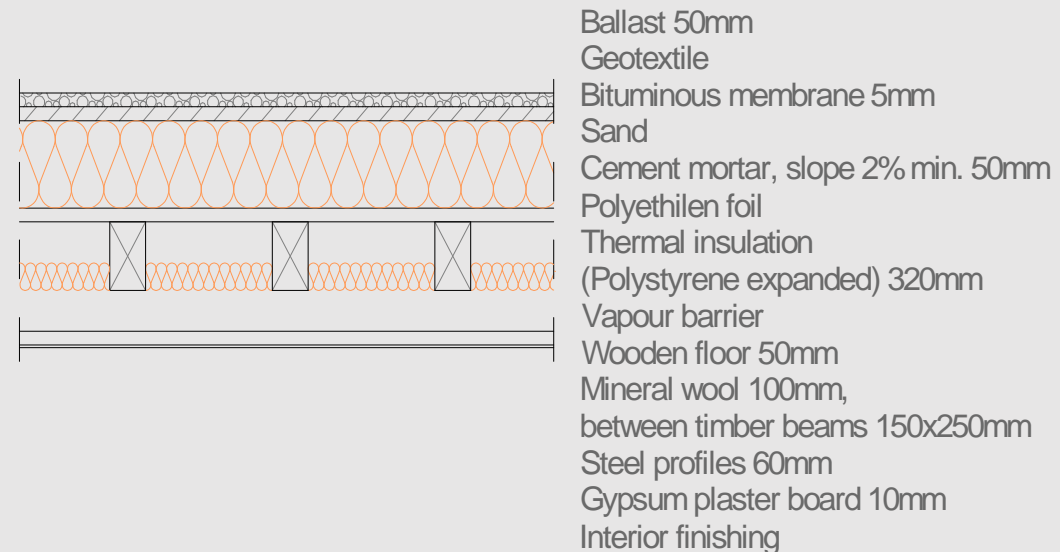


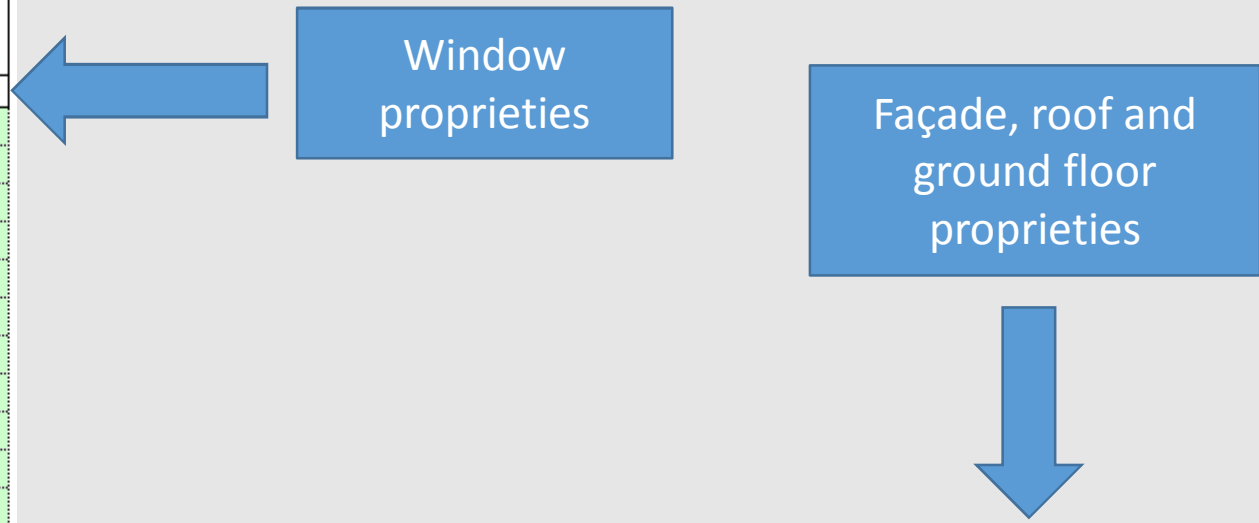
Plate roof



Studied house description

Thermal characteristics of the envelope according to the passive house criteria

Results			
Window Area	Glazing Area	U-Value Window	Glazed Fraction per Window
m ²	m ²	W/(m ² K)	%
2,8	1,96	0,80	0,71
2,8	1,96	0,80	0,71
2,1	1,44	0,81	0,69
2,1	1,44	0,81	0,69
2,8	1,96	0,83	0,71
2,8	1,96	0,83	0,71
2,8	1,96	0,83	0,71
2,8	1,96	0,83	0,71
2,8	1,96	0,83	0,71
2,8	1,96	0,83	0,71
6,0	4,88	0,76	0,82
4,2	2,88	0,84	0,69
2,5	1,78	0,81	0,70



	Total Thickness	U-Value
	m	W/(m ² K)
Exterior wall	0,588	0,10
Roof	0,924	0,08
Floor over ground	0,887	0,09
Floor over air	0,680	0,07

Estimated consumption

Energy balance for the passive house – design phase

In the design phase, the total in house necessary energy for:

Heating

Cooling

Domestic hot water

Electrical appliances

Equipments

has been evaluated using the following tools (energy balance):

-PHPP (Passive House Planning Package)- software .
the Passive House Institute calculation method;

-AX3000 . software - calculation methods using the Romanian code;

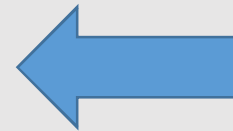
Estimated consumption

Energy balance for the passive house – design phase

The results using PHPP were:

The energy consumption for heating
13 KWh/m²/year.

The total energy consumption
74 KWh/m²/year and



**Estimated values
according to Passive
House Institute
method**

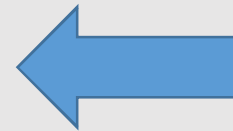
Estimated consumption

Energy balance for the passive house – design phase

The results using AX3000 were:

The energy consumption for heating
22 KWh/m²/year.

The total energy consumption
83 KWh/m²/year and



**Estimated values
according to the
Romanian code
method**

Monitoring results

The building's energy consumption, living comfort parameters and the surrounding environment was continuously monitored since October 2011.

The resulted data from monitoring activity has been uploaded to a web server, being available at any time, online.



www.sdac.ro

MONITORING PASSIVE HOUSE

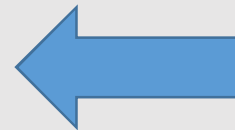
Monitoring results

Energy consumption evaluated through monitoring

The results were:

The energy consumption for heating
25.80 KWh/m²/year.

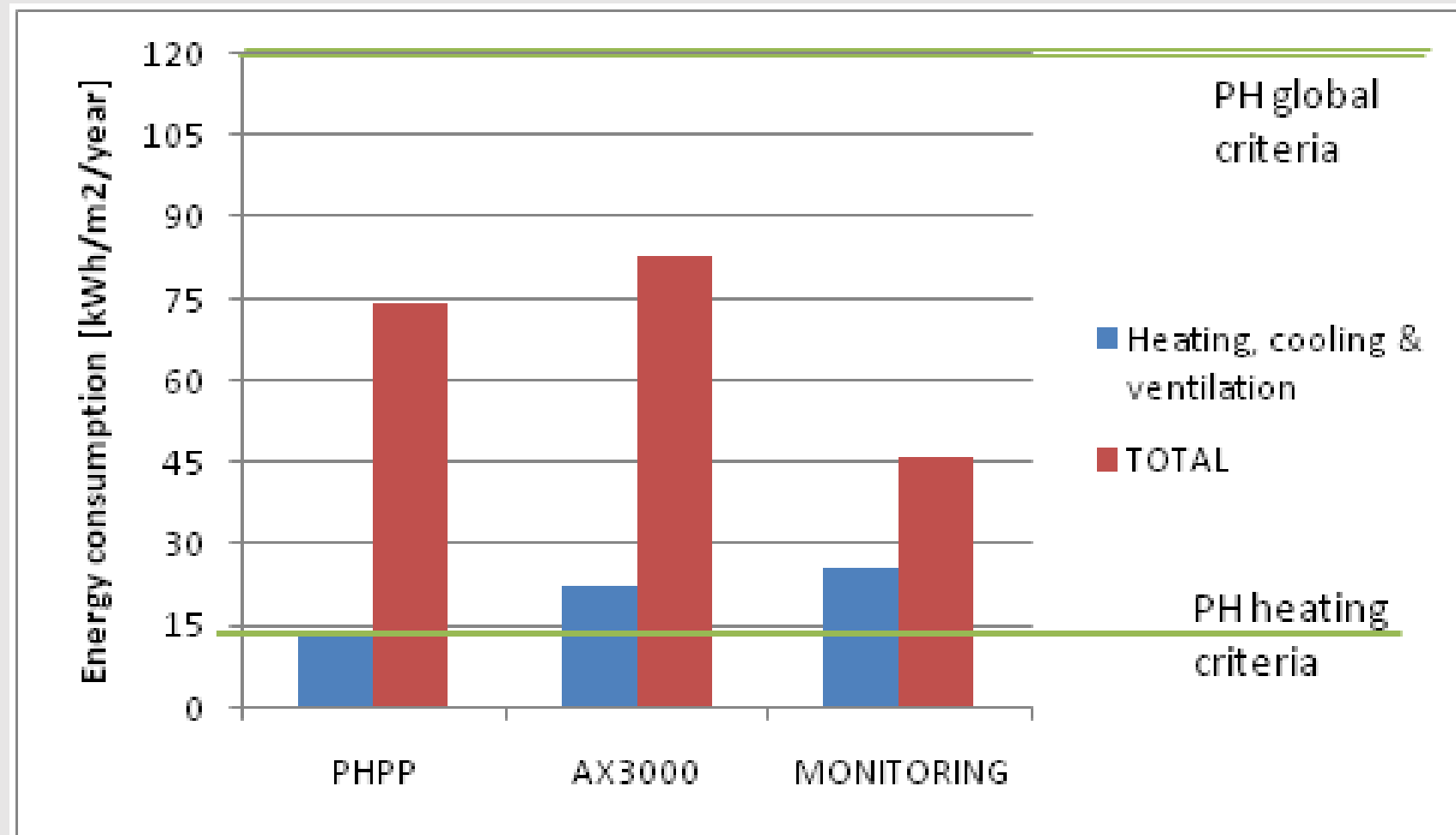
The total energy consumption
45,83 KWh/m²/year and



**Actual energy
consumption
registered by the
monitoring system**

Comparison between monitoring results and theoretical data

Energy consumption evaluated through monitoring



Comparison between monitoring results and theoretical data

Heating energy consumption is higher than estimated value using PHPP and AX3000:

- For the evaluation 20 °C were considered for the indoor temperature and the real temperature was 22 °C;
- The real climate data are not the same with theoretical data.

Total energy consumption is less than the estimated value using PHPP and AX3000:

- number of occupants i.e. 4 in the software/2 in reality;
- 50% of the total energy consumption is for DHW.

Estimated value is 510 euro/m² - 10 years for recover;

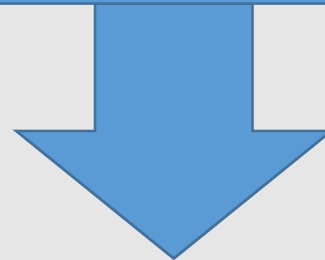
The real cost is 490 euro/m² - 5 years for recover.

Conclusion

The total energy consumption of the building is less than the estimated energy need according to PHPP and AX3000;

If the indoor temperature would be 20 °C , heating energy consumption will be lower than 15 kWh/m²/year which is the maximum allowed value for a passive house;

A passive house is more expensive than a traditional house with 20%, difference which can be recover after 5 years;



- The passive house represents the future house in Romania. Nevertheless appropriate climate data must be considered for accurate results.



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Thank you for your kind attention!