

ENERGY passport

Energy performance
certificate for a building

Category
A

Validity
2020

Petko Slaveykov
Secondary School

ENERGY PASSPORT

PETKO SLAVEYKOV SECONDARY SCHOOL

TRYAVNA, BULGARIA

INTERSTROYCONSULT Ltd. Certification of buildings for energy efficiency, Construction supervision

ENERGY PASSPORT DESCRIPTION

Energy performance certificate for a building

Category: A

Validity: until 2020

Petko Slaveykov Secondary School building,
19 Angel Kanchev str.
5350 Tryavna, Bugaria

Completion Criteria

The following energy characteristics for the building and the standards are set:

- $EP = 100.3 \text{ kWh/m}^2$
- $EP_{max,r} = 72.68 \text{ kWh/m}^2$
- $EP_{max,s} = 159.038 \text{ kWh/m}^2$
- $EP_{max,r} < EP < 0.5 (EP_{max,r} + EP_{max,s})$
- $72.68 < 100.3 < 0.5(72.68+159.03)$

EP: an energy characteristic

EP_{max,s}: a total specific energy consumption at the beginning

EP_{max,r}: a total specific energy consumption at the time of the assessment

The building meets the requirements for class C energy consumption and those for category A certification.

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MEASURES TAKEN TO REDUCE ENERGY COSTS

- Thermal insulation 1736.65 m² of Fibran –XPS, type BT and $\lambda_2=0.028$ W/mK is applied to external facades. This has resulted in a reduction in the heat transfer coefficient of the walls from $U=1.1$ W/m²K to $U=0.38$ W/m²K.
- Thermal insulation is applied to the roof, namely:
 - Thermal insulation on the ceiling slab 738 m²: Fibran XPS, type RT and $\lambda_2=0.028$ W/mK
 - Thermal insulation under the beamwork, over suspended ceiling, 602 m² - Fibran XPS, type RT, 8 cm thickness and $\lambda_2=0.028$ W/mK.

As a result of this energy saving measure, the roof heat transfer coefficient is reduced from $U=1.3$ W/m²K to $U=0.73$ W/m²K.

- Replacement of wooden joinery 35.5 m² - external doors with new PVC joinery with heat transfer coefficient $U=1.7$ W/m²K.

As a result of this energy saving measure, the summarized heat transfer coefficient is reduced from $U=2.38$ W/m²K to $U=2.19$ W/m²K.

As a result of the calibration, it was found that the building maintained an average 24-hour temperature 14.1°C, the same as in the original survey.

Under the new state of the building, the actual energy consumption (column state) is 232702 kWh, which is 39% lower than in 2009.

Building type

Custom

Climate zone 4 – Pleven, Veliko Tarnovo area

Reference values:

Parameter	Standard	State		Baseline	After	ESM	
	Kwh/m ²	Kwh/m ²	Kwh/a	Kwh/m ²		Kwh/a	Kwh/a
1.Heating	126.3	66.3	232702	72.9	255890	72.9	255890
2.Ventilation (heating)	0.0	0.0	0	0.0	0	0.0	0
3.DHW (domestic hot water)	0.0	0.0	0	0.0	0	0.0	0
4.Pumps (ventilation, heating)	0.9	0.9	3168	0.9	3168	0.9	3168
5.Lighting	5.4	5.4	19029	5.4	19029	5.4	19029
6. Various	0.4	0.4	1241	0.4	1241	0.4	1241
Total (heating)	133.0	73.0	256140	79.6	279329	79.6	279329
Total heated area 3510							

Figure 41. Reference values 1964

From the baseline, it can be seen that after the electricity saving measures (ESM), are made, the annual heating cost is 255890 kWh, and the same cost before the ESM is 416943kWh.

These costs are determined under the same climatic conditions, the climate zone, the normative temperature 18.5°C and the lowering temperature 13.5°C.

The annual saving achieved is 416943–255890=161053 kWh. The reduction of the annual energy consumption for heating is within 38.7%.

The reduction of the total annual energy consumption is within 36.6%.

For the walls: from 2247 W/K to 776 W/K;

For the roof: from 3037 W/K to 1705 W/K;

For the joinery: from 1821 W/K to 1675 W/K.

Figures 43 and 44 show the coefficients of losses through the enclosing members. The implemented measures have led to their significant reduction;

Heat loss from	State		After ESM	
	H W/K	H W/m ² K	H W/K	H W/m ² K
Outer walls	776	0.22	776	0.22
Doors and windows	1675	0.48	1675	0.48
Roof	1705	0.49	1705	0.49
Floor	724	0.21	724	0.21
Infiltration	1969	0.56	1969	0.56
Ventilation	622	0.18	622	0.18
Total	7472	2.13	7472	2.13

Figure 43. Heat loss after the implementation of ESM

Heat loss from	State		After ESM	
	H W/K	H W/m ² K	H W/K	H W/m ² K
Outer walls	2247	0.64	674	0.19
Doors and windows	1821	0.52	1691	0.48
Roof	3037	0.87	724	0.21
Floor	724	0.21	724	0.21
Infiltration	1969	0.56	1969	0.56
Ventilation	0	0.00	0	0.00
Total	9798	2.79	5782	1.65

Figure 44. Heat loss before the implementation of ESM

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TECHNICAL AND ECONOMIC EVALUATION OF THE MEASURES

The main parameters of the proposed measures are given in Table 16, and their graphical representation in figures 42 and 43.

Measure	Before ESM	After ESM	Economy			Investment BGN	Payback. period	Saved CO ₂
			kWh	BGN	%			
1. Wall insulation	416943	336608	80335	12050.25	19.3	40393.98	2.2	25.0
2. Roof insulation	416943	344198	72745	10911.75	17.4	24539.89	5.6	22.6
3. Joinery replacement	416943	408970	7973	1195.95	1.9	6670.08	3.0	2.5
Total	416943	255890	161053	24157.95	38.6	71603.06	3.4	50.1

ASSESSMENT OF THE ECOLOGICAL EFFECT OF THE IMPLEMENTED ENERGY SAVING MEASURES

The To produce heat is used diesel fuel. Saved CO₂ emissions due to the energy saving measures are:

$$\text{Saved CO}_2 \text{ emissions} = f * Q \text{ econ.}$$

Where $f=0.311 \text{ CO}_2 / \text{kWh}$ - the ecological equivalence ratio of energy sources and energy for diesel

$$Q \text{ econ.} = 324842 \text{ kWh} - \text{annual heat savings from energy-saving measures}$$

Then:

$$\text{Saved CO}_2 \text{ emissions} = 0.322 * 161053 = 50.1 \text{ t/year}$$

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CONCLUSION

The energy audit carried out shows that under the new state of the building, after the implementation of the ESM, the baseline annual energy consumption is significantly lower than the one before the implementation of the energy saving measures.

The energy performance summary of the building prior to the implementation of the energy saving measures is 125.5 kWh/m² and after the measures are implemented, it is 79.6 kWh/m².

The survey found a real reduction in the heating costs by 38.7% and in the total annual cost by 36.6%, which is equal to 161053 kWh/y and with an ecological effect of 50.1 tons of greenhouse gas emissions per year.

The implemented measures lead to a reduction in the annual fuel consumption of diesel oil with 13637 liters.

The total investments made for the implementation of the energy saving measures and repair activities amount to BGN 347690.96 including VAT and 14.4 years payback period.

Direct investments for the implementation of energy-saving measures amount to 71603.06 and have a payback period less than 3 year.

The implemented measures result in the energy consumption class C and the category A certificate.

Appendix

Energy performance certificate for a building /copy of the original/, Petko Slaveykov Secondary School


СЕРТИФИКАТ

за енергийните характеристики на сграда

Категория А

Номер 034МГП009 **Валиден до:** 2020г.

Сграда	СОУ „П Р Славейков“		
Адрес	гр. Трявна		
Въведена в експлоатация	1965 год.		
Разгъната застроена площ	5 202	m ²	
Отопляема площ	3 510	m ²	
Площ на охлаждания обем		m ²	



Скала на енергопотреблението по първична енергия	Актуално състояние	След ЕСМ	Актуални енергийни характеристики по потребна енергия
A			Разход на енергия за отопление, вентилация и БГВ: 72.9 kWh/m²
B			Разход на енергия за охлаждане: ... kWh/m²
C		C	Общ годишен разход на енергия: 279.3 MWh
D			Емисии CO ₂ : 50.1 t/год
E	E		
F			
G			

РАЗПРЕДЕЛЕНИЕ НА ГОДИШНИЯ РАЗХОД НА ПОТРЕБНА ЕНЕРГИЯ					ДЯЛ на ВЕИ
Отопление	Вентилация	Охлаждане	Гореца вода	Осветление	
91.6 %	... %	... %	... %	6.8 %	...%

Издаден на 22.04.2013г.

Срок на освобождаване от данък сгради

от: 2014 г. до: 2020 г

Издаден от

Интерстройконсулт
ООД

Рег. номер
00034

