REDUCTION OF CO_2 EMISSIONS WITH ENERGY EFFICIENCY MEASURES

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INTRODUCTION

- The largest energy-saving potential lies in the building sector since nearly 40% of the final energy consumption in Europe is in buildings

- The 2010 Energy Performance of Buildings Directive and the 2012 Energy Efficiency Directive are the EU's main legislation dedicated to reducing the energy consumption of buildings

- New regulations on energy efficiency and building certification in Serbia were adopted and have been in use since October 2012.

INTRODUCTION

- The average annual energy consumption in residential buildings in Serbia exceeds 150 kWh/m^2, while in developed European countries it is approximately 50 kWh/m^2
- Buildings retrofitting or refurbishment has been considered as one of the main approaches to achieve reduced building energy consumption and greenhouse gas emissions
- Given that heating and cooling account for over a third of global energy consumption in the buildings sector, optimizing building envelope design should be a key part of any long-term energy reduction strategy

ENERGY EFFICIENCY OF RESIDENTIAL BUILDING

- The analyzed family residential building with 4 separate flats is located in Novi Sad
- The building is built as a stand-alone facility consisted of basement, ground floor, first floor and loft
- The total area of the residential part of the building is 465.26 m^2
- Natural gas is used as the heating fuel

BUILDING THERMAL PERFORMANCES IMPROVEMENT

- Relevant values that indicate the energy consumption of current and improved state of the building

	Current	Improved
Lower heating value of natural gas	33.000 kJ/m^3	33.000 kJ/m^3
Coefficient of performance of boiler	0,85	0,85
Price of natural gas by 1m^3	43,4 din/m^3	43,4 din/m^3
Annual hours of space heating	2548 h	2548 h
Annual energy consumption of the building	193.052 kWh/a	82.695 kWh/a
Energy consumption of the building by 1m^2	415 kWh/m^2	178 kWh/m^2
Energy in kWh, from 1m^3 of natural gas	7,8 kWh/m^3	7,8 kWh/m^3
Annual consumption of natural gas	24.750 m^3/a	10.602 m^3/a
Annual consumption of natural gas in RSD	1.074.150 rsd/a	460.123 rsd/a
Annual CO_2 emissions	38.610 kg/a	16.539 kg/a

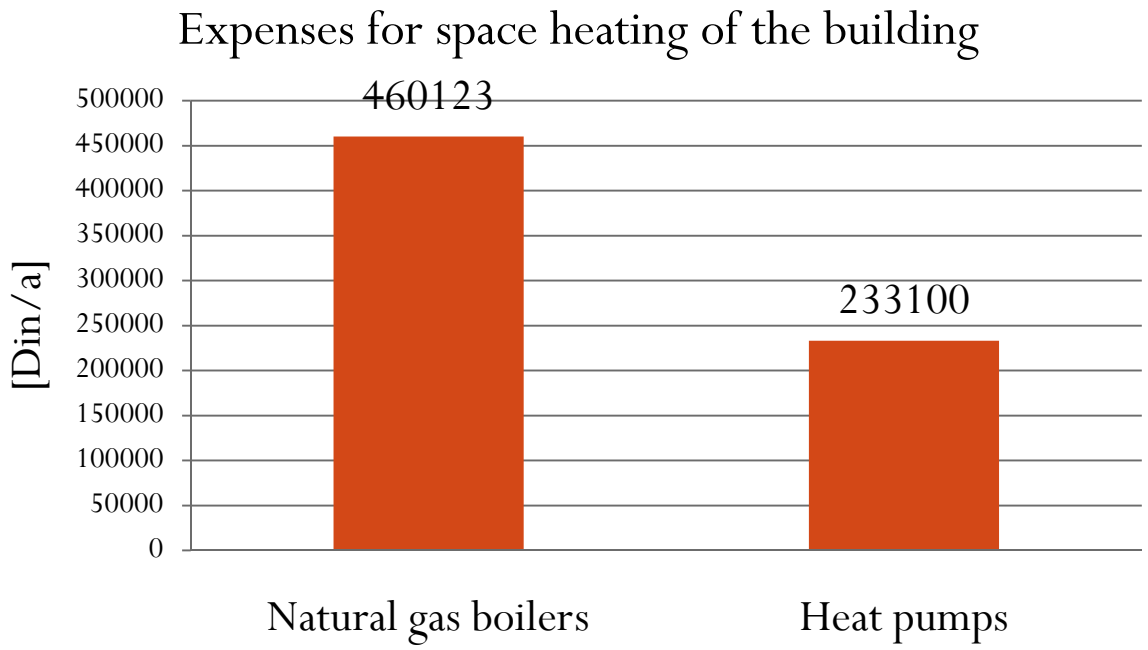
HEAT PUMP FOR SPACE HEATING OF THE BUILDING

- Relevant values that indicate the energy consumption for space heating after installation of heat pumps

Coefficient of performance of heat pump	4
Annual hours of space heating	2548 h
Annual energy needs of the building	82.695 kWh/a
Energy needs of the building by 1m²	178 kWh/m²
Annual consumption of electricity	20.674 kWh/a
Energy consumption of the building by 1m²	44 kWh/m²
Monthly consumption of electricity	3.446 kWh/m
Monthly consumption of electricity in RSD	38.850 rsd/m
Annual consumption of electricity in RSD	233.100 rsd/a
Annual CO_2 emissions	10.957 kg/a

HEAT PUMP FOR SPACE HEATING OF THE BUILDING

- CO_2 emissions were 16.539 kg/a before installation of heat pumps and 10.957 kg/a after installation of heat pumps
- Substitution of natural gas boilers with heat pumps resulted with reduction of expenses for space heating of the building



COMPARATIVE ANALYSIS OF PROPOSED ENERGY EFFICIENCY IMPROVEMENT MEASURES

Proposed measure	Thermal insulation	Heat pumps
Investment	1.273.435 rsd	848.700 rsd
Annual savings in energy consumption	110.357 kWh/a	62.021 kWh/a
Annual reduction of CO_2 emissions	22.071 kg/a	5.582 kg/a
Annual savings in monetary units	614.027 rsd/a	227.000 rsd/a
Payback period	2,1 year	3,7 year

CONCLUSION

- Unnecessary energy losses are causing large amount of expenses and environmental pollution
- There is a great potential for reduction of energy consumption in buildings by applying energy efficiency measures
- In order to achieve sustainable development it is very important to switch from fossil fuels to renewable energy
- Investments in energy efficiency measures bring multiple benefits to the society as a whole, in economic, energetic and environmental field of the development.