

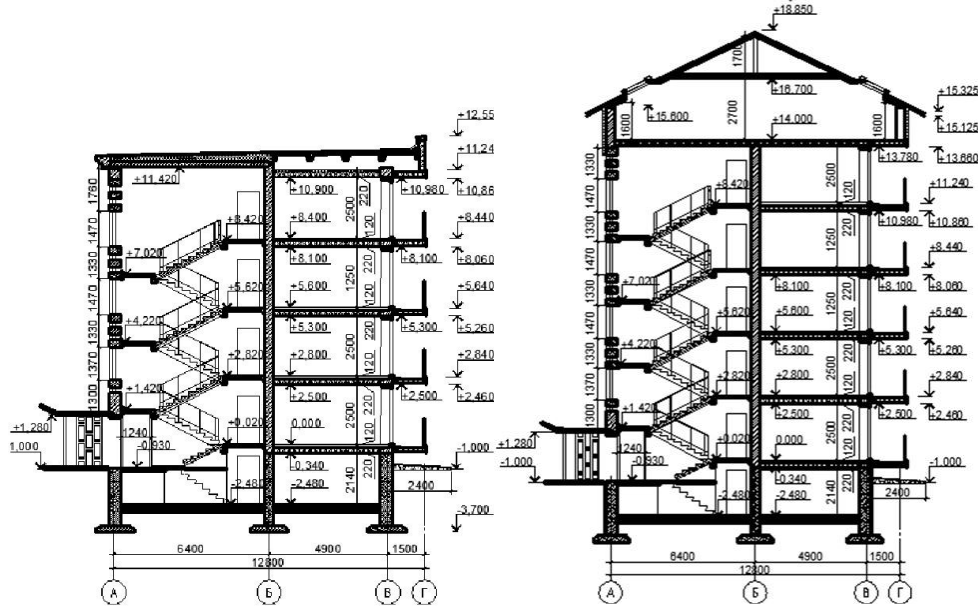
“Climate Policy, Sustainable Development and Green Finance”
Financial University under the Government of Russian Federation

THE PROBLEMS OF THE THERMAL RECONSTRUCTION OF MASS MULTIFAMILY DWELLINGS (CALLED “KHRUSCHEVSKI”)

1) Eutechna Energia (member of OICE), Italia / Maurizio Landolfi1) , Mech.Engineer

2) Kyiv National Kiev University of Construction and Architecture / Oleg Sergeychuk2) Dr.Sc., Professor
Mokhamad Dib2), Architect

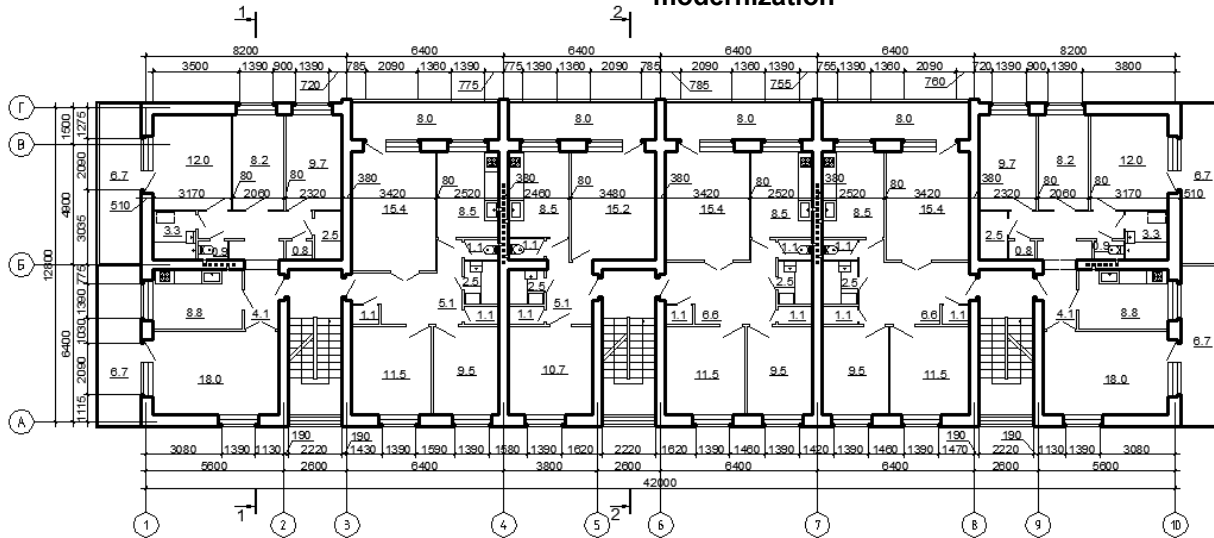
DESCRIPTION OF THE MODEL



Section of existing building envelop

Envelope section after thermal modernization

- Plan of series "Khrushchevki" 114-24-36 was built in 1972.
- Model is divided into 3 building sections.
- 5 typical storey's building with attic.
- Area of the floor is around 471 m² with floor attic 532.
- Each floor consists of 6 dwelling apartments.
- Area of 3 room apartment is about 36 m².
- Area of 4 room apartments is 48 m².
- Internal height of the floor is 2.8 m.
- Main façade is oriented to South.
- Energy efficiency class of the building (E).



Typical floor plan of the building

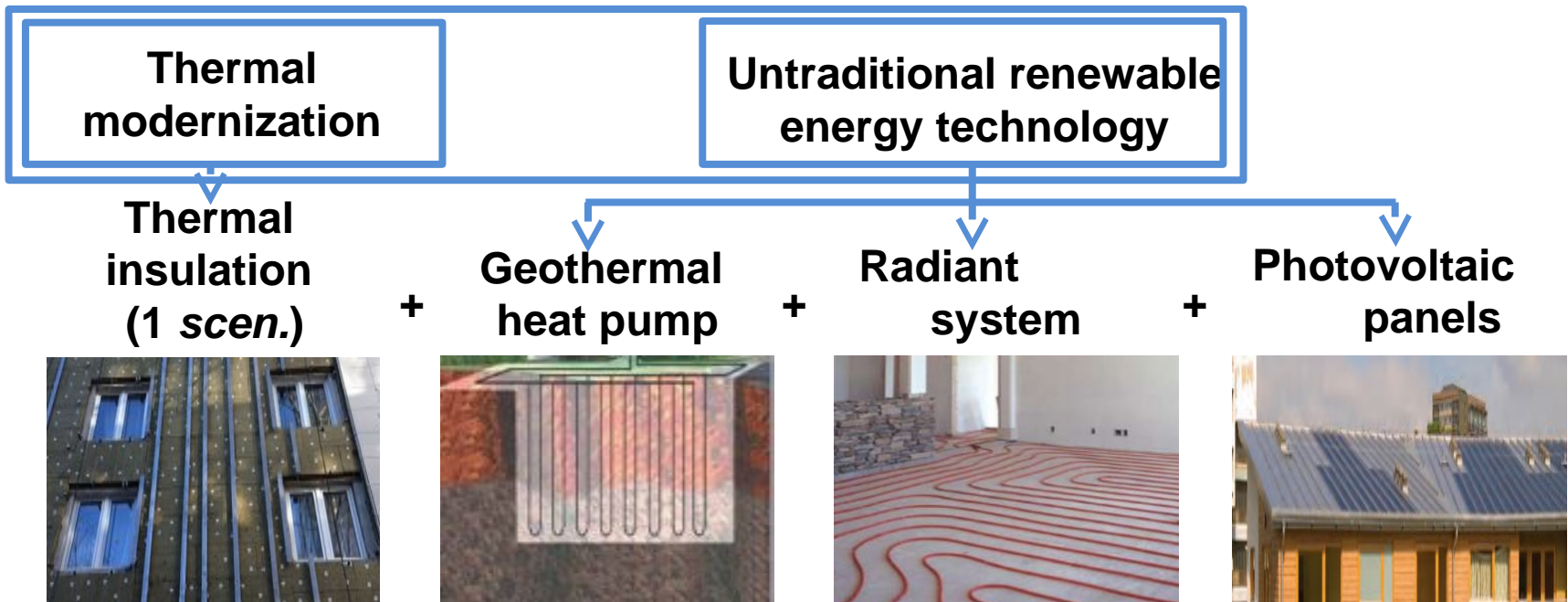
The thermal resistance (<i>R</i>), [m ² k/W]	
Wall	1,01
Window	0,3
Roof	1,21
Ground floor	0,5

Strategy of Survey

- * **First Scenario (1)** Thermal modernization of the building



- * **Second Scenario (2)** Combining thermal modernization with untraditional renewable energy sources instead of using gas



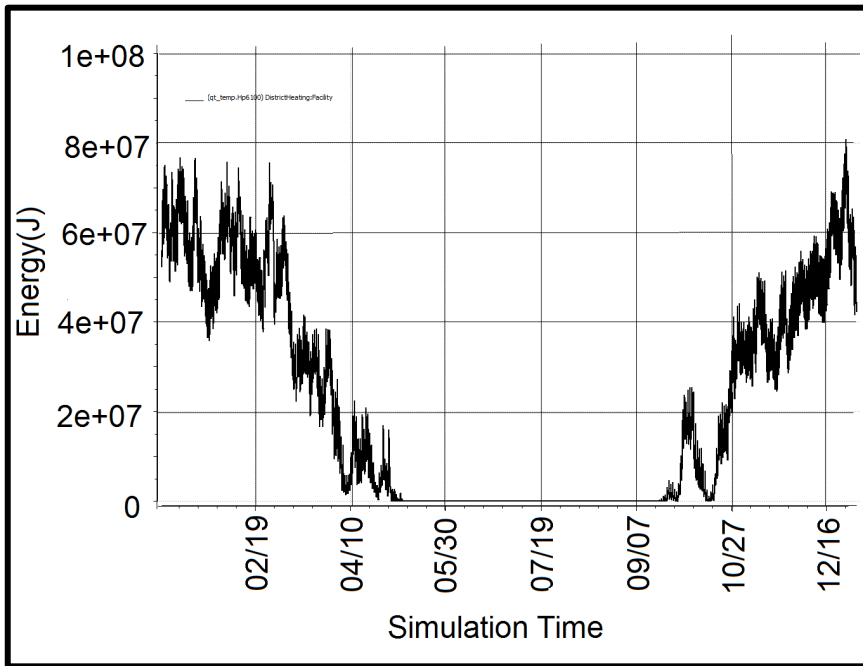
ENERGY CONSUMPTION CALCULATED BY "ENERGYPLUS" SIMULATION TOOL ,BASED ON CLIMATIC DATE

Program Version and Build	EnergyPlus-Windows-OMP-32 7.2.0.006, YMD=2013.04.14
Weather File	16:14 Kyiv –Ukr. IWECC Data WMO#=333450
Latitude [Deg.]	50,40
Longitude [Deg.]	30,45
Elevation [m]	168,00
Time Zone	2,00
Setpoint winter temp. [°C]	20

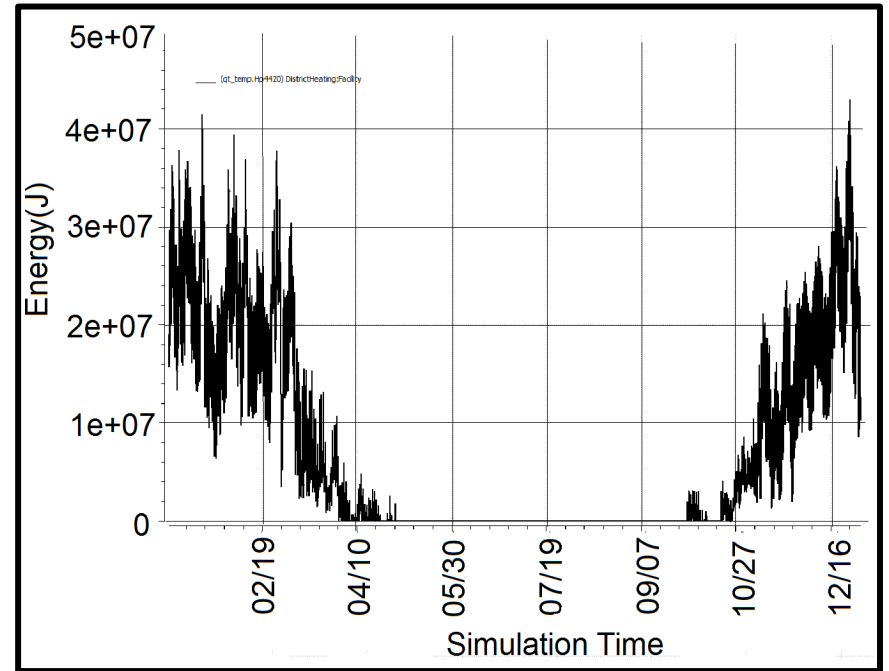
TRANSMITTANCE VALUE OF ENVELOPE OF EXISTING AND AFTER THERMAL MODERNIZATION AND COST OF NEW ENVELOPE

Area [m ²]	Total	Cost x 2 [€]	Total cost[€]	<i>Rexisti</i> <i>ng</i> [2k/]	<i>Rafter</i> [2k/]
Wall	1868,79	25,5	47,659	1,0	4,05
Window	351,48	96,85	34,042	0,3	0,8
Ground floor	537,6	25,5	13,709	0,5	4,3
Roof	582,8	26,3	15,328	1,21	4,5
Total cost[€]			110,738		

COMPARISON OF ENERGY CONSUMPTION BETWEEN EXISTING

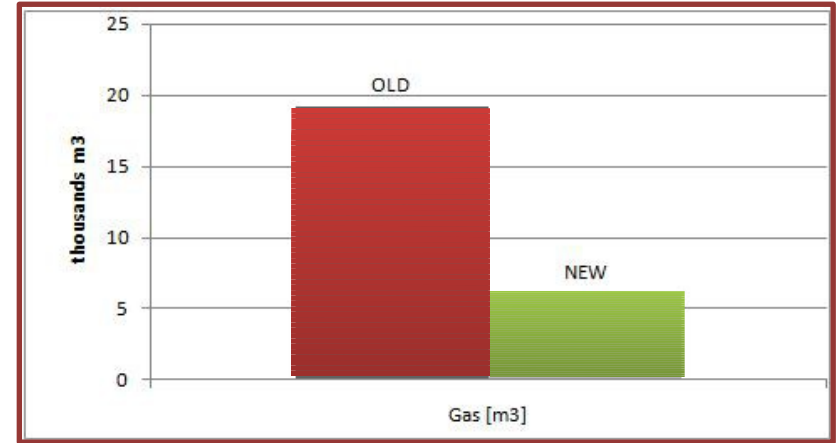
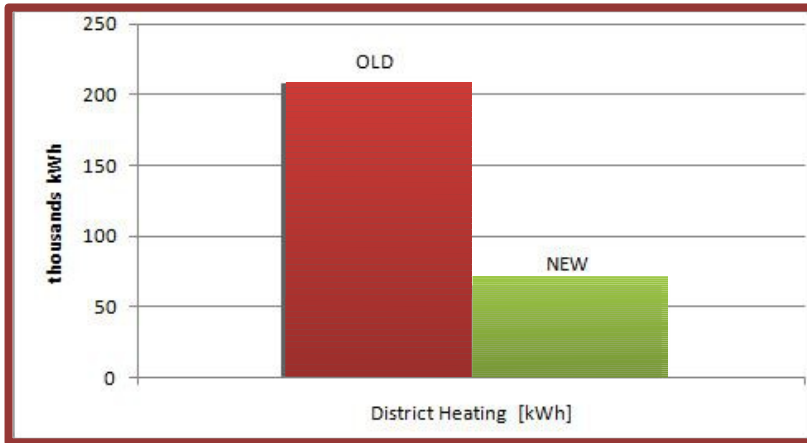


ENERGY CONSUMPTION IN EXISTING BUILDING




ENERGY CONSUMPTION AFTER THERMAL MODERNIZATION

COMPARISON GRAPHICS OF ENERGY CONSUMPTION



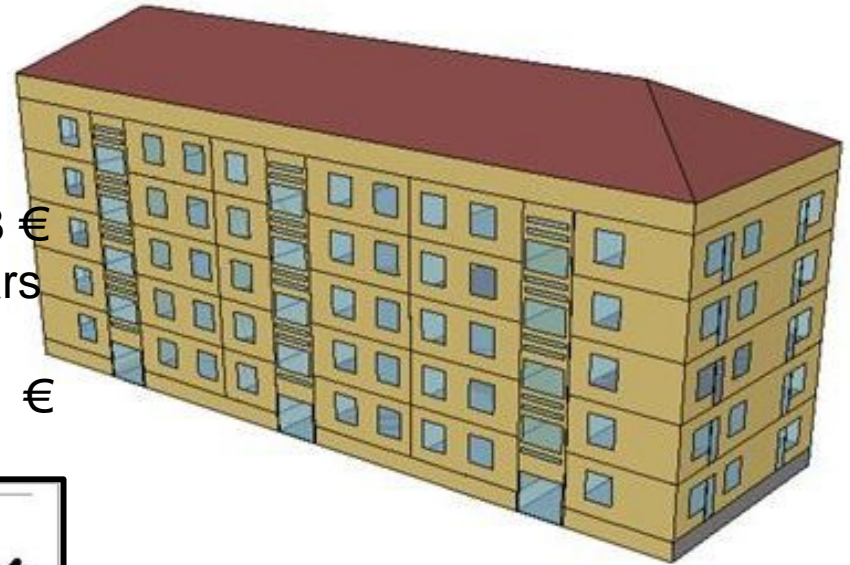
COMPARISON OF ENERGY CONSUMPTION BETWEEN EXISTING & AFTER THERMAL MODERNIZATION

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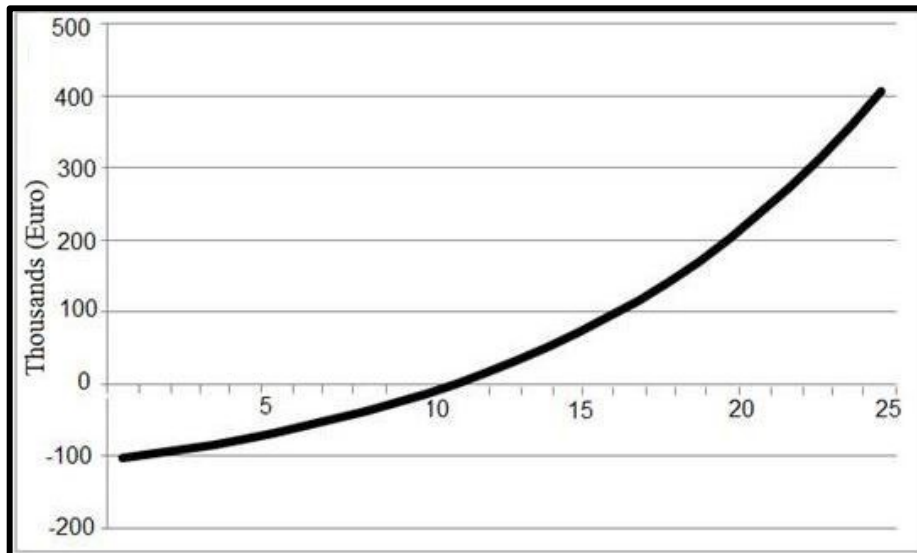
SIMULATION OF EXISTING ENVELOPE AND AFTER THERMAL MODERNIZATION			
Utility Use per year	Existing	After moder.	Difference
District Heating [kWh]	208,038,89	64,905,56	143,133,33
	19,209,50	5,993,13	13,216,37
	7,683,80	2,397,25	5,286,55
CO2 emission [TONN]	3,841,90	1,198,63	2,643,27

FINANCIAL ANALYSIS OF FIRST SCENARIO

- Cost of money 15%
- General inflation 7,4%
- Inflation of gas 17%
- Total investment cost 110,738 €
- Investment payback 10,7 years
- Investment will generate a positive value of 405981 €



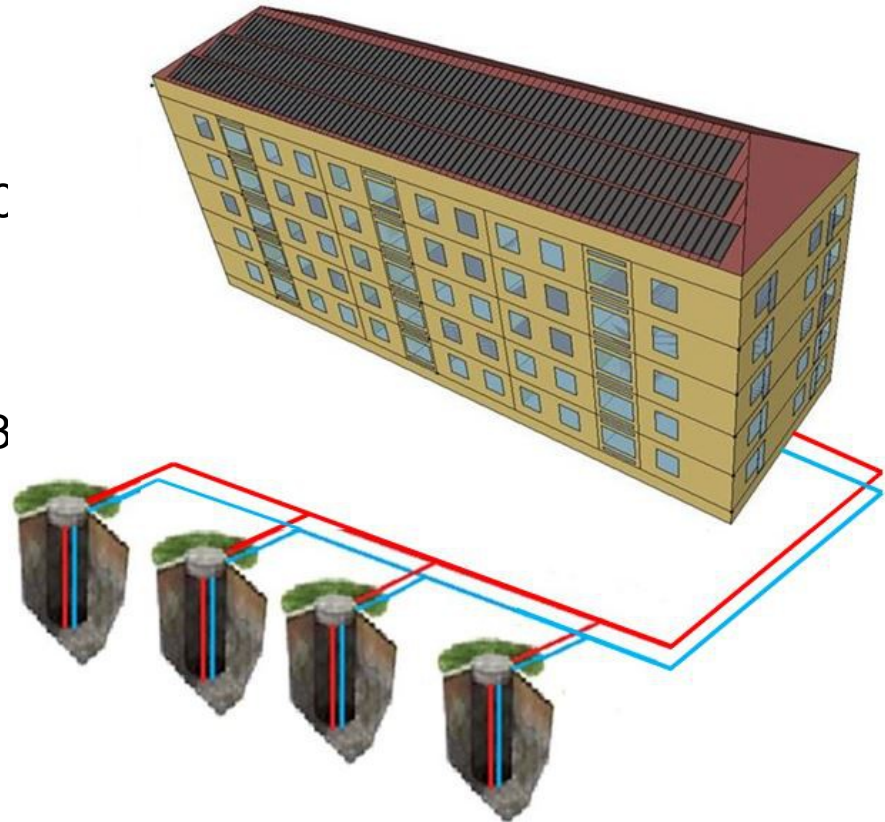
THERMAL MODERNIZATION MODEL



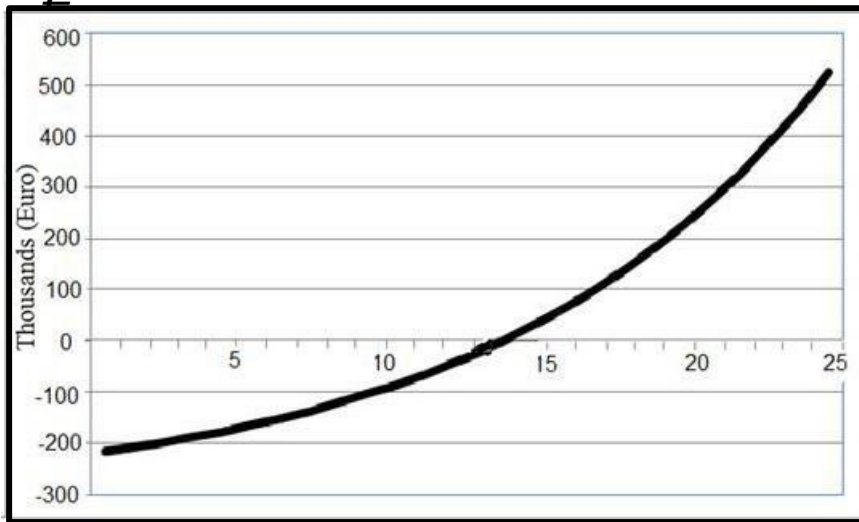
FINANCIAL ANALYSIS OF FIRST SCENARIO (1)

FINANCIAL ANALYSIS OF SECOND SCENARIO (no gas)

· Thermal insulation	110738
€	
· Geothermal pump + holing	18935
€	
· Radiant system	29220
€	
· Photovoltaic	45000
€	
Total investment cost	203893



MODEL WITH THERMAL MODERNIZATION, GEOTHERMAL, RADIANT SYSTEMS & PV PANELS.



FINANCIAL ANALYSIS OF FIRST SCENARIO (2)

CONCLUSIONS

Scenario shows

(1)

(2)

- * Returning capital of investment cost during 10,7 years.
- * If the life cycle of "Khruschevki" is considered 10 or 15 years, the first scenario is to be considered as profitable investments.

- * Returning capital of investment cost during 13,5 years.
- * Second one requires making heavy investments due to the cost of Geothermal, heat pump and radiant systems.
- * However, the second scenario is to be considered as profitable investments if the geothermal, heat pump and radiant system will consume the electricity produced by solar panels based on **"GREEN TARIFF"** scheme in

Taking into account not only cost efficiency but also environmental targets, reduced dependency of energy imports etc., these can be a meaningful option, which is realized already in some of the assessed countries.

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Many thanks for attention

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