Applied technologies and solutions of heritage preservation and energy efficiency in Belarus

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Estimates of recoverable world reserves of fossil fuels and solar energy

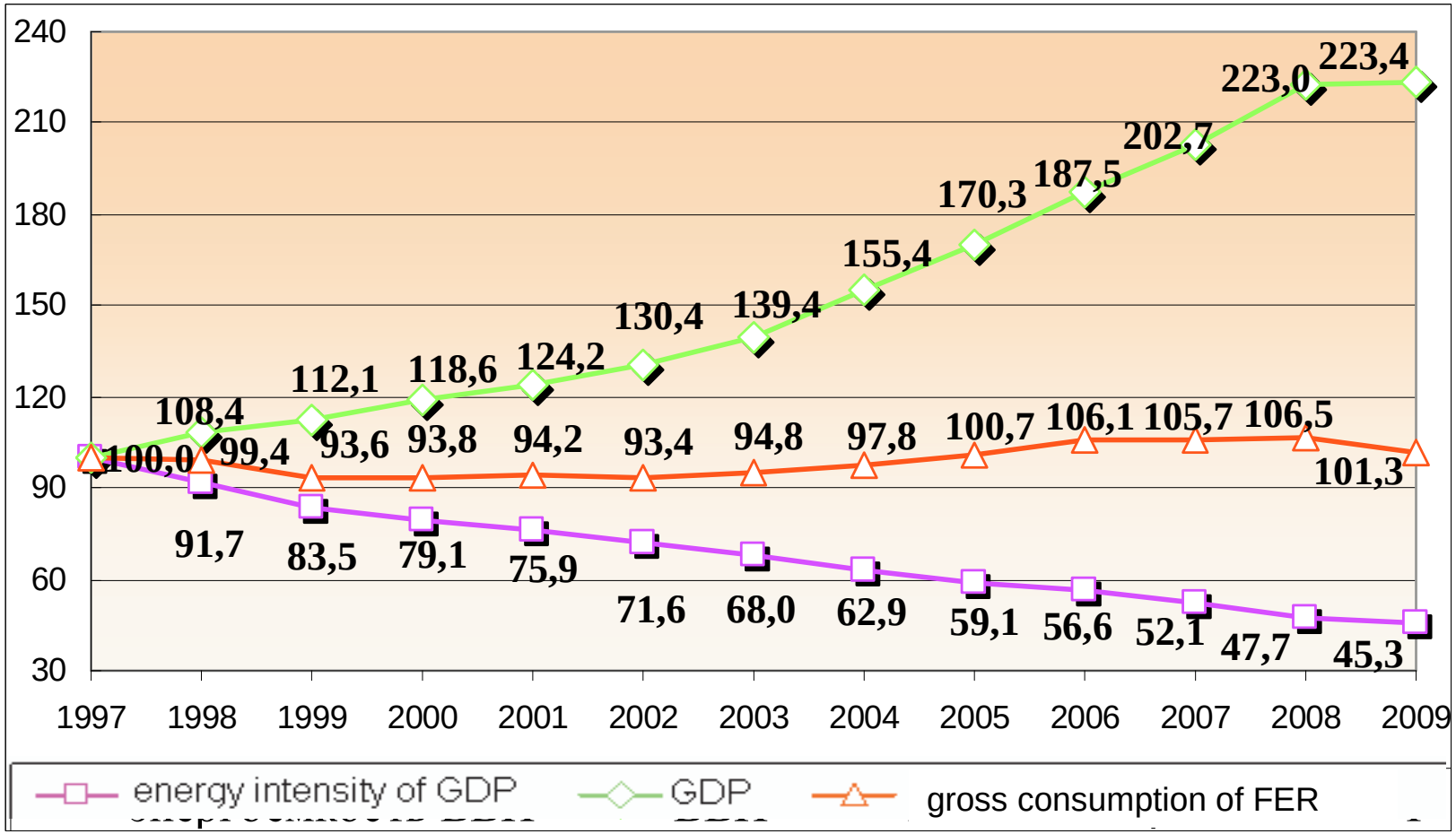
Fossil fuel energy:

5.1×10^{16} kW·h

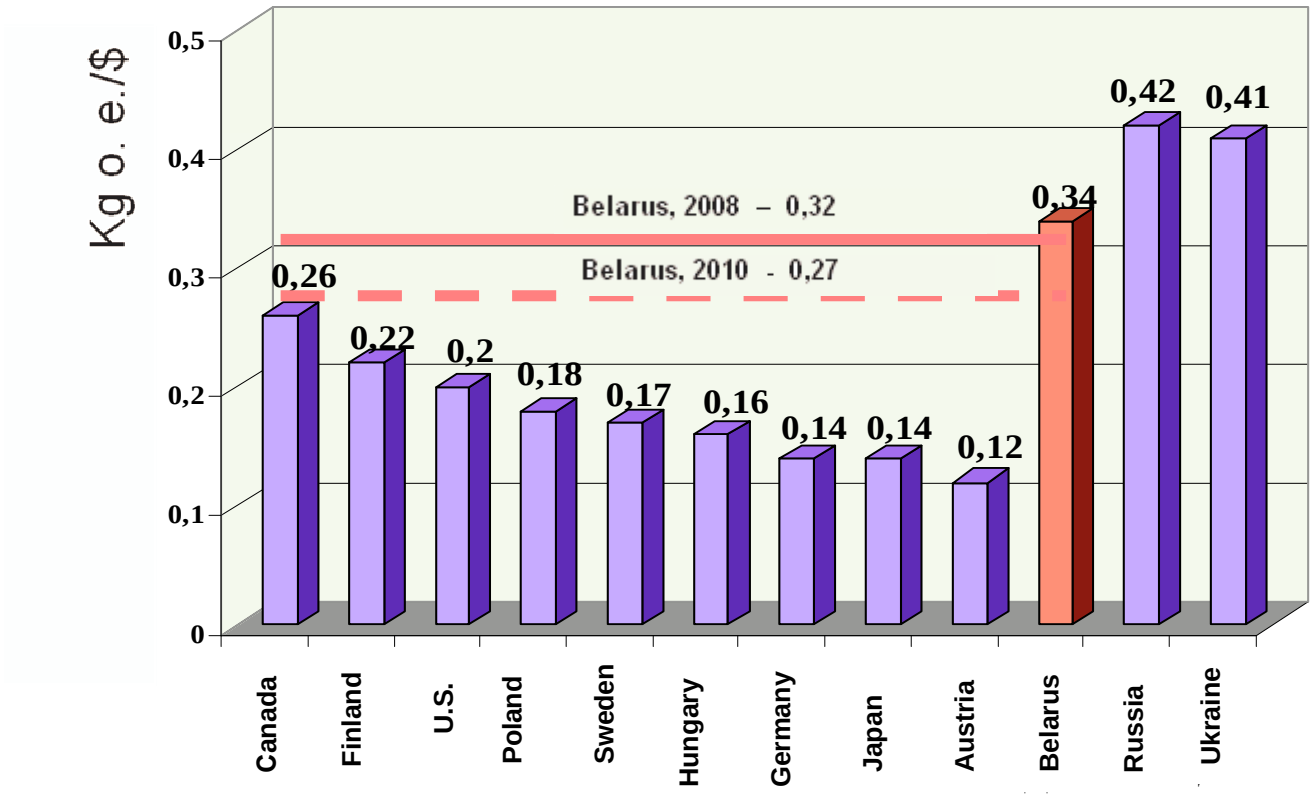
Solar energy:

1.35×10^{18} kW·h / year

Dynamics of GDP, gross consumption of energy resources and energy intensity of GDP in 1998-2009 years. (%)



. Energy intensity of GDP in 2007 (in 2000 prices in PPP terms)

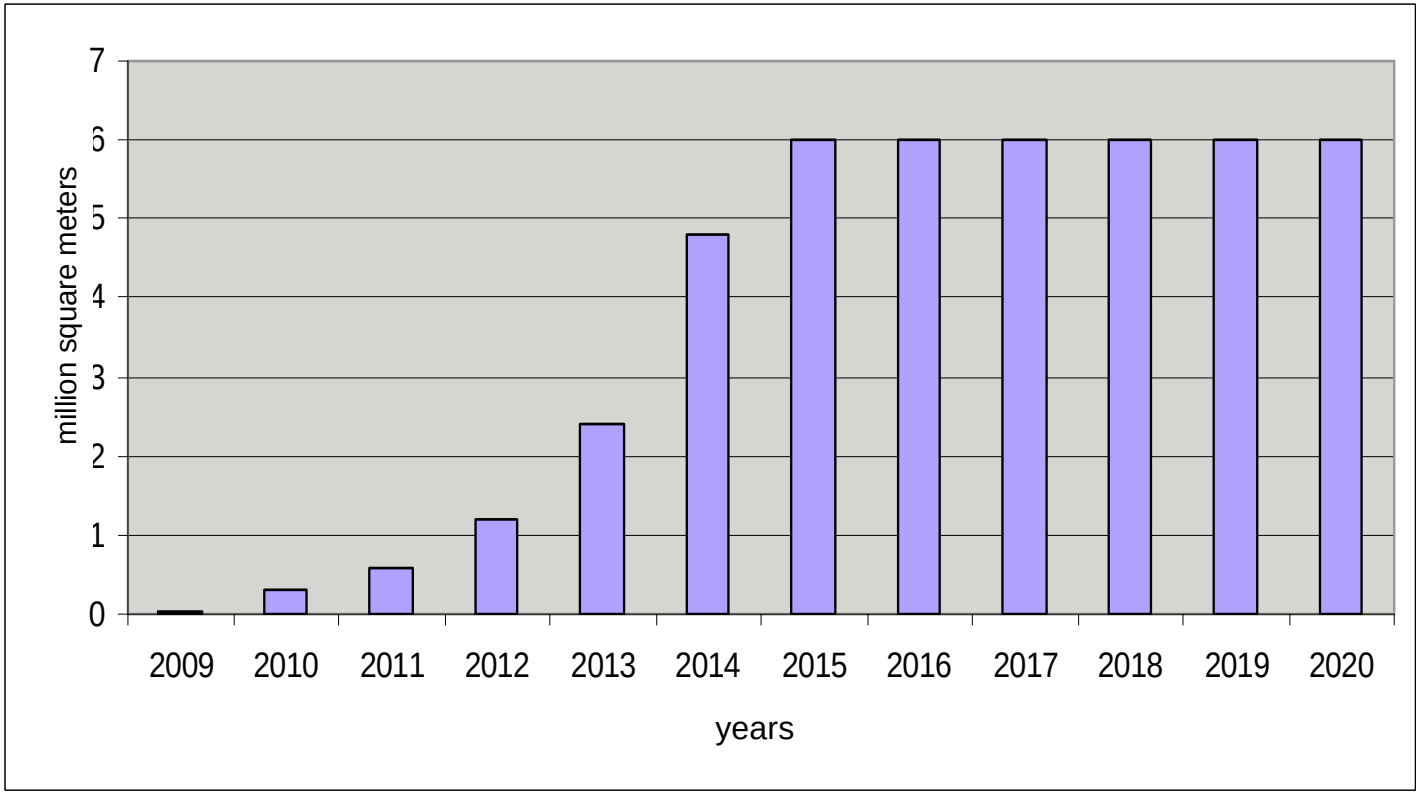


Source : International Energy Agency "Key world energy statistics from the IEA", 2009.

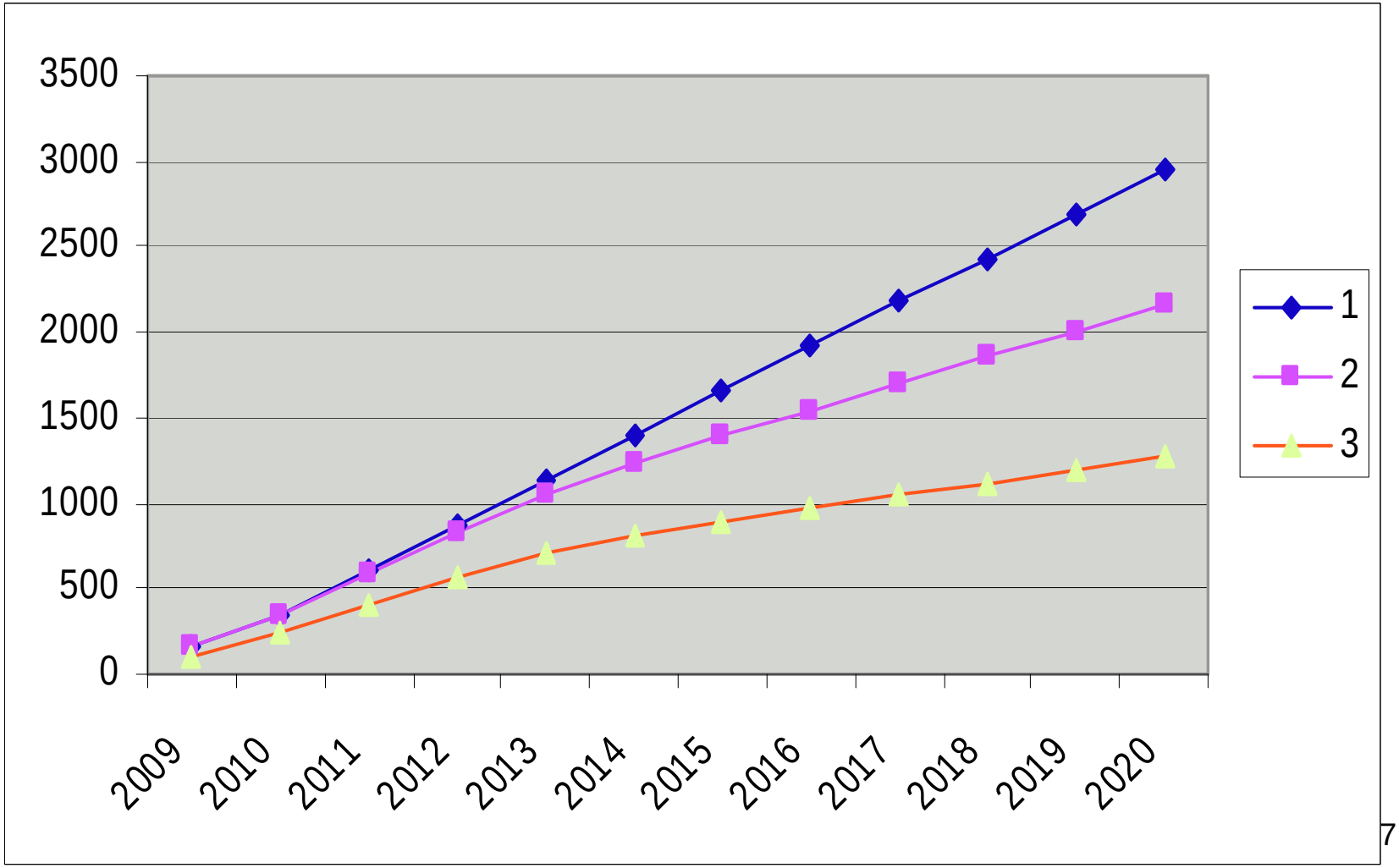
Determination of energy-efficient buildings

- **Energy efficient a building - a building, thermal resistance walling which meets the requirements building norms, and the specific consumption of thermal energy for heating and ventilation does not exceed 40 kW·h/m and middle-rise (4 floors or more) and 90 kW·h/m^2 per year for low-rise buildings.**

Program for the construction of energy efficient buildings in the 2009 - 2020 years.



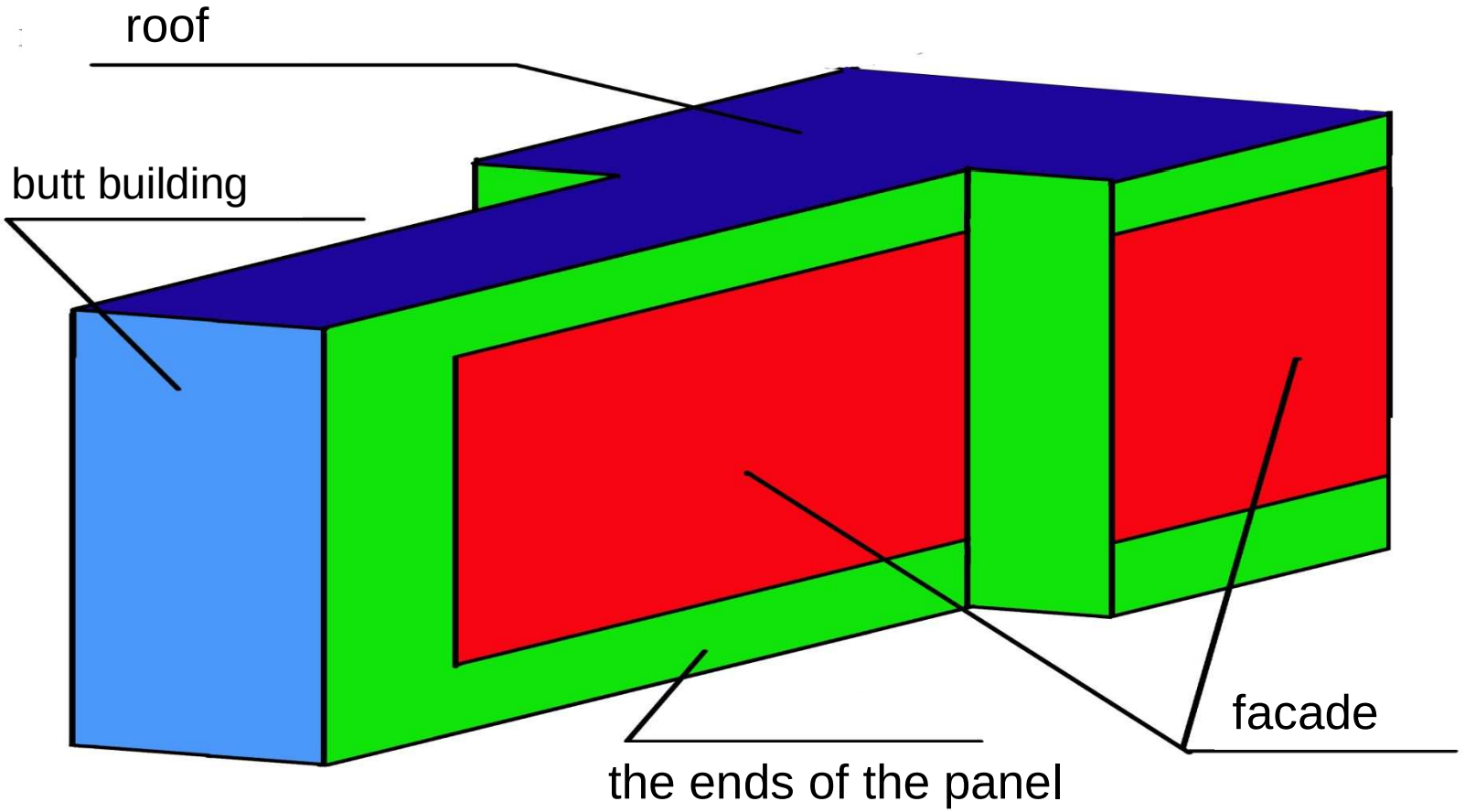
Fuel consumption in the ordinary construction (1), with the energy efficient construction (2), taking into account the energy-efficient construction and introduction of new normative requirements for the values of heat transfer resistance (3)



Features energy efficient buildings

Regional centers	Wall construction	Year of const-ruction	Num-ber of storeys	Number of flats	Total area	Specific energy consumption for heating kW·h/m^2 per year	
						standard	energy-efficient
Vitebsk	Small- pieces materials	2010	10	120	6726	94,81	32,36
		2009	10	40	2119		31,53
Gomel	Small- pieces materials	2009	10	36	2696	87,07	29,28
Grodno	Small- pieces materials	2009	9-11	68	4456	82,55	30,40
Minsk	Ferroconcret panels	2007	9	144	9491	85,91	31,70

Energy efficient building



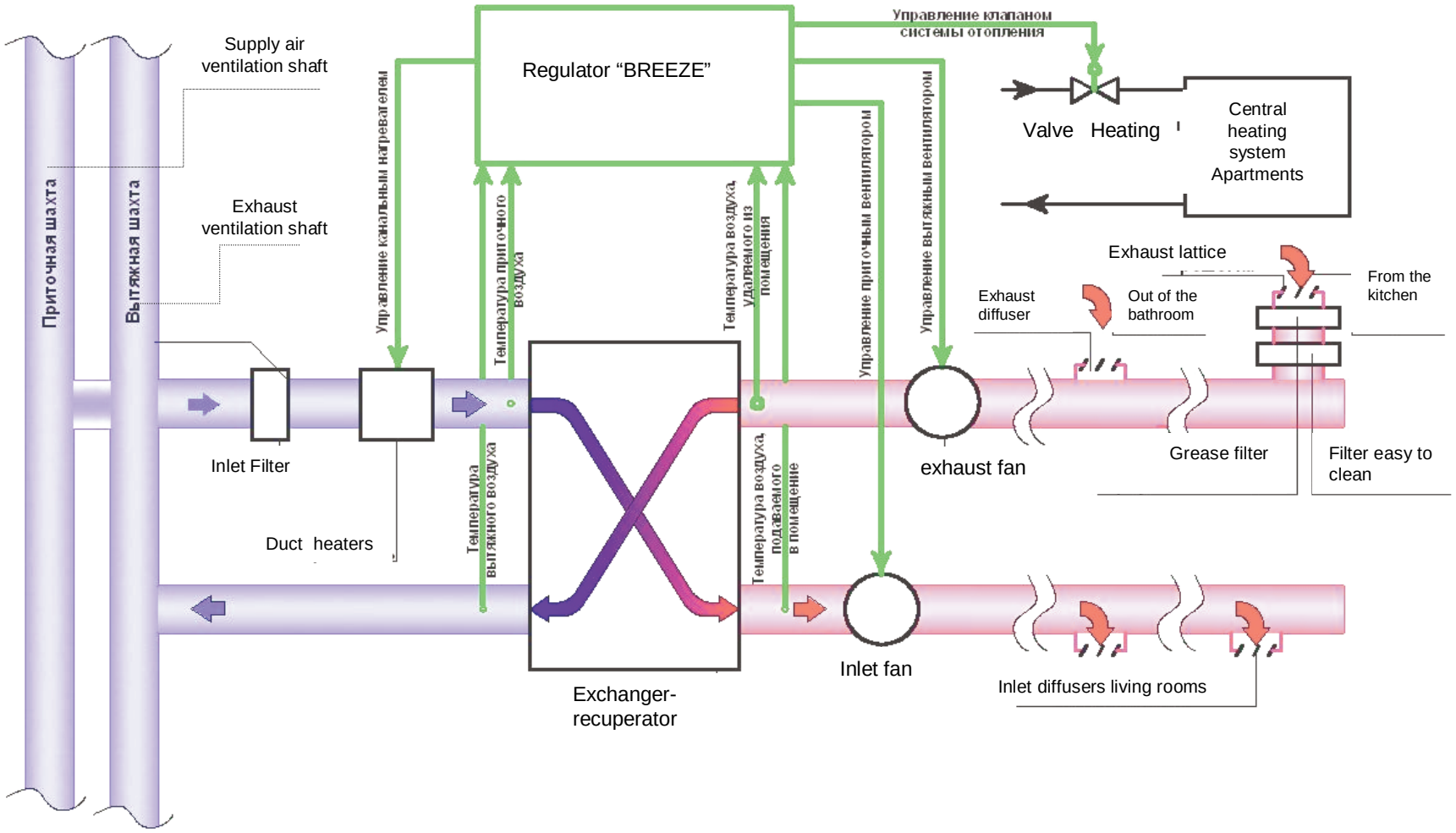
R = 6 $m^2 \cdot K/W$

R = 5,2 $m^2 \cdot K/W$

R = 4,2 $m^2 \cdot K/W$

R = 3,2 $m^2 \cdot K/W$

Functional diagram of the life support systems



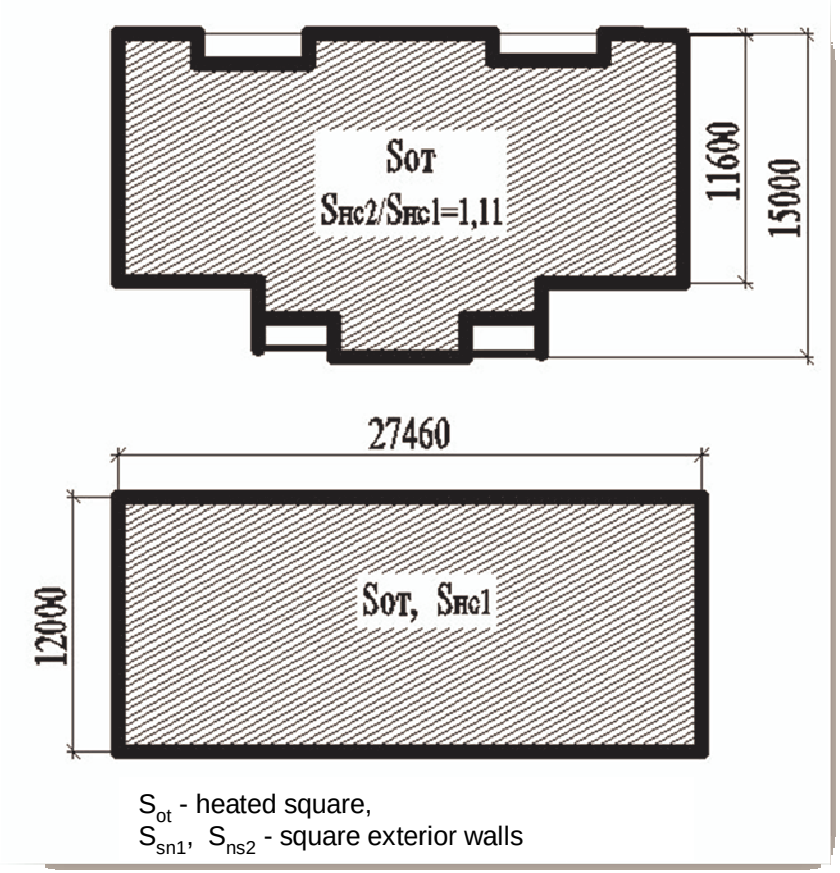
Energy-efficient buildings SERIES 111-90 MAPID

Energy-efficient buildings in Grodno.

Energy-efficient buildings in Vitebsk

Energy-efficient house in the city of Gomel.

Plans sections of the building



S_{ot} - heated square,
S_{sn1}, S_{ns2} - square exterior walls

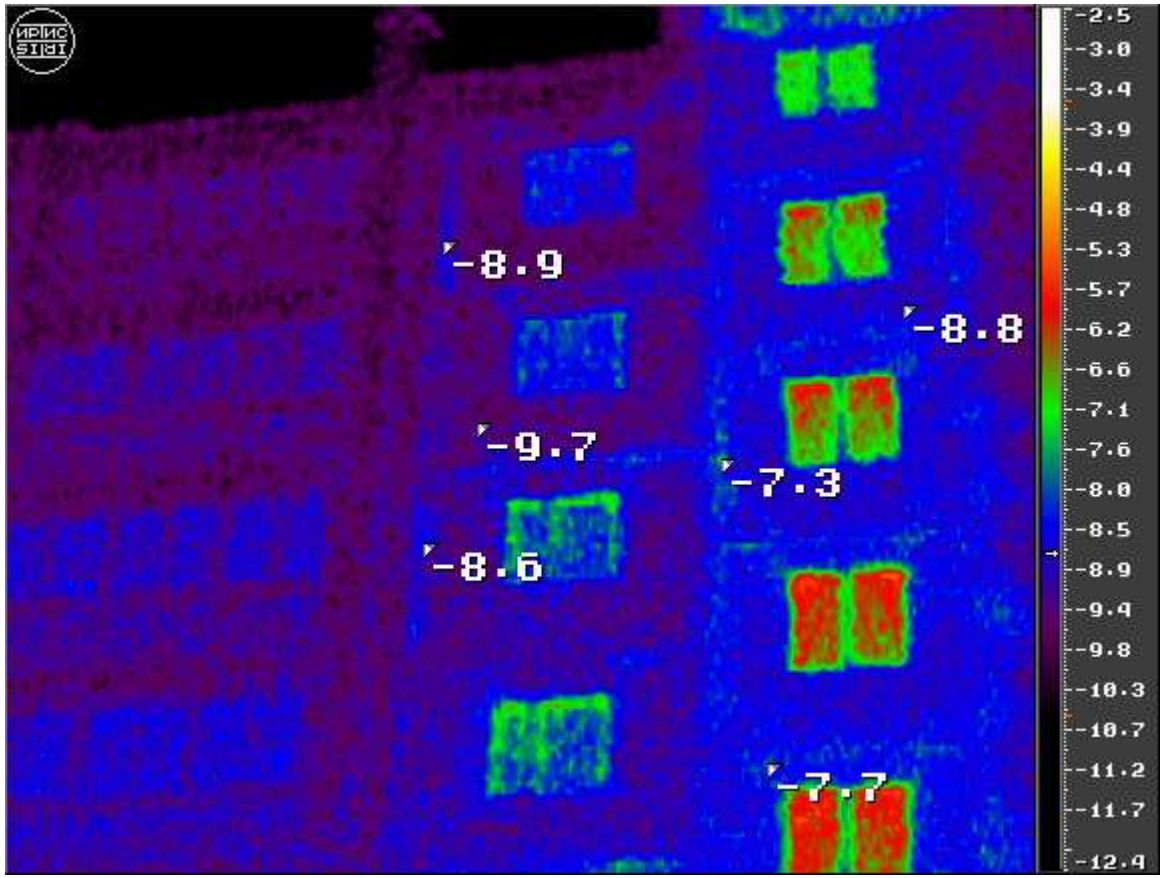
Facades and heat loss

Object name	Square exterior walls, m^2, Designed The calculated	Compact-ness index, k, m^{-1}, Designed The calculated	Heat loss through walls kWh/m^2 heated area for per year Designed The calculated	Specific consumption of heat energy for heating buildings kWh/m^2 per year Designed The calculated	Square saving wall % mln. BYR
4-sectional 142- apartment building series 111-90	6062 3673	0,38 0,29	37,6 30,5	31,6 24,7	65 95
Residential 10-storey 119-apartment house in Vitebsk	5073 2711	0,45 0,32	43,7 32,1	35,3 23,4	46,5 94,5

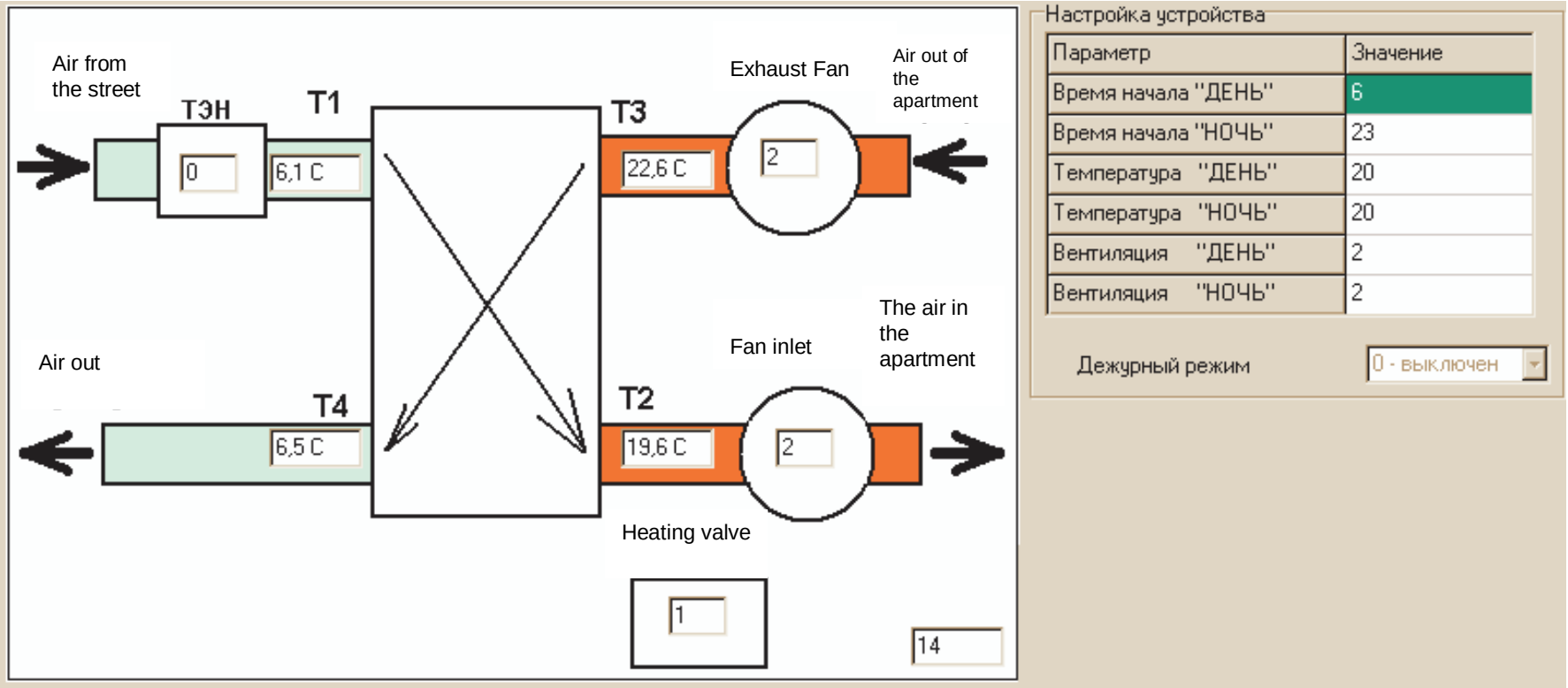
Block ventilation with recuperator

Ducts in the interior of the apartment.

Thermogram of the building



RESULTS OF MONITORING APARTMENTS



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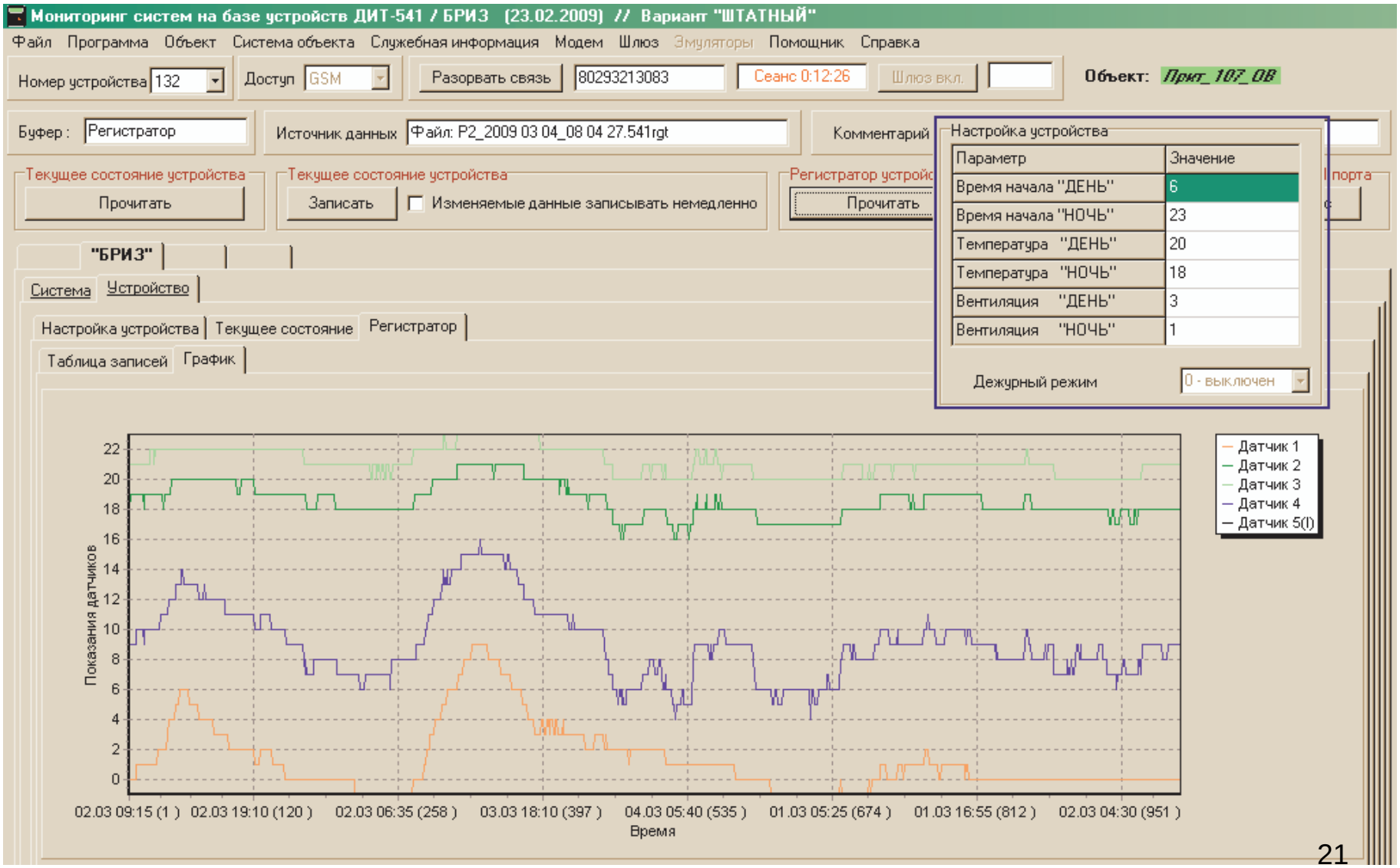
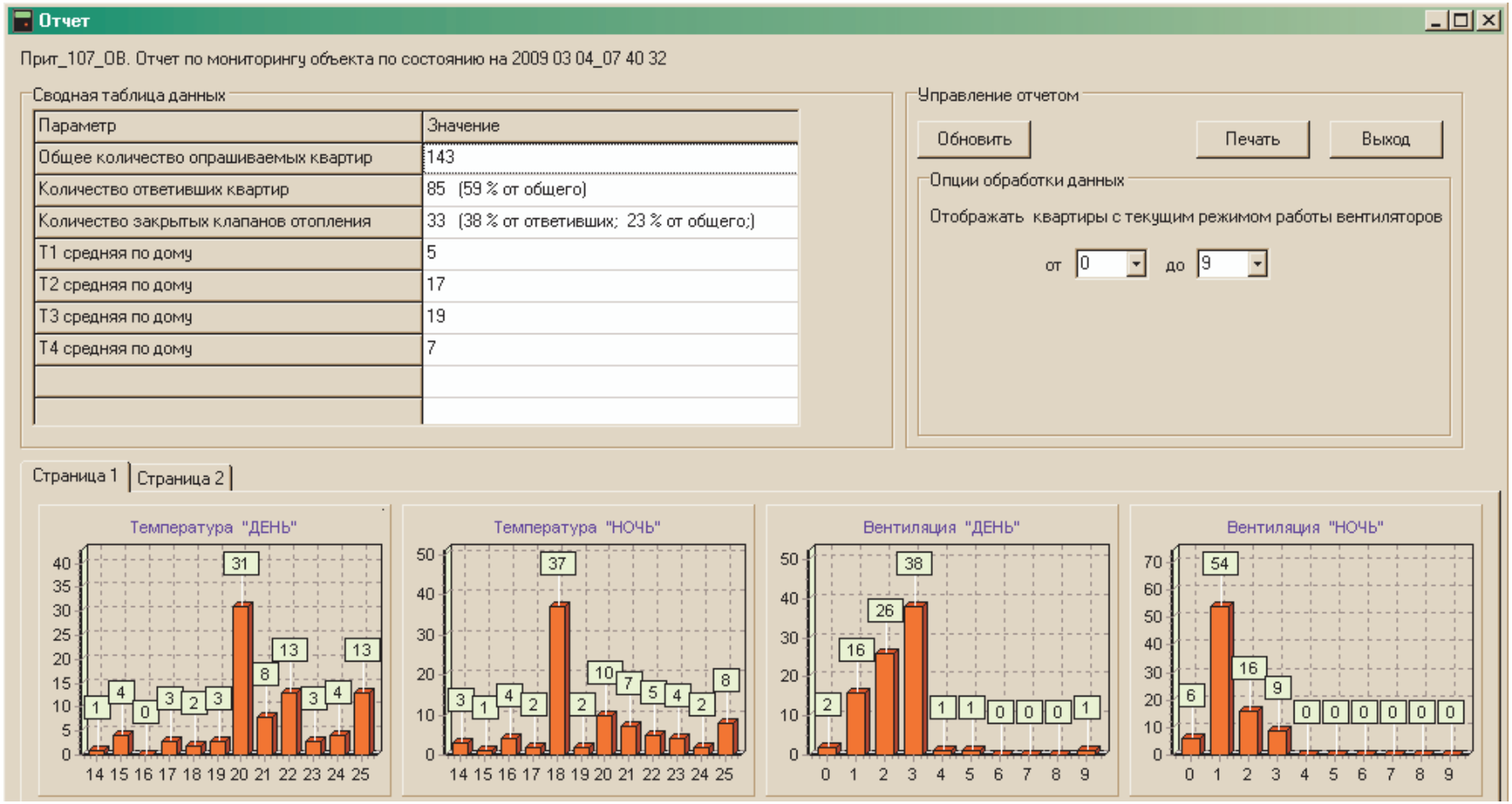
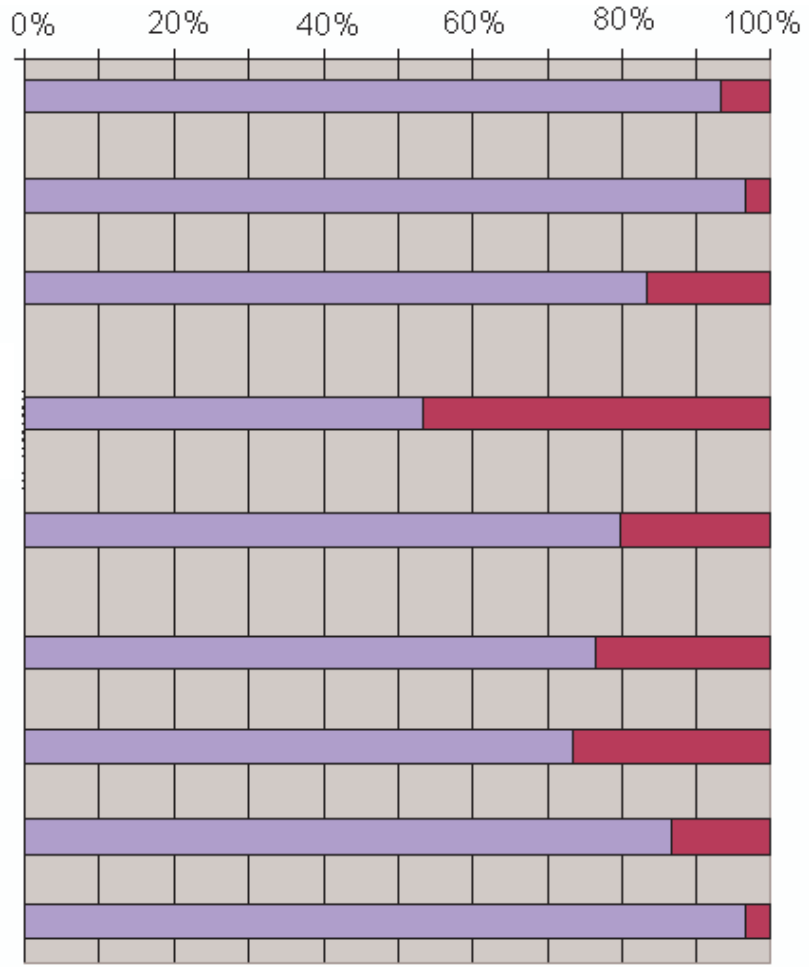


RESULTS OF MONITORING OF THE BUILDING



Results of questioning residents the house



Whether you have read the instruction manual of engineering equipment apartment?

Whether you have read a CD with a movie about your home?

Whether the information presented in the manual and on CD-ROM?

There is a need for further clarification you individually features of your home and rules of operation of engineering equipment apartment?

Convenient if you use the remote control air and heat?

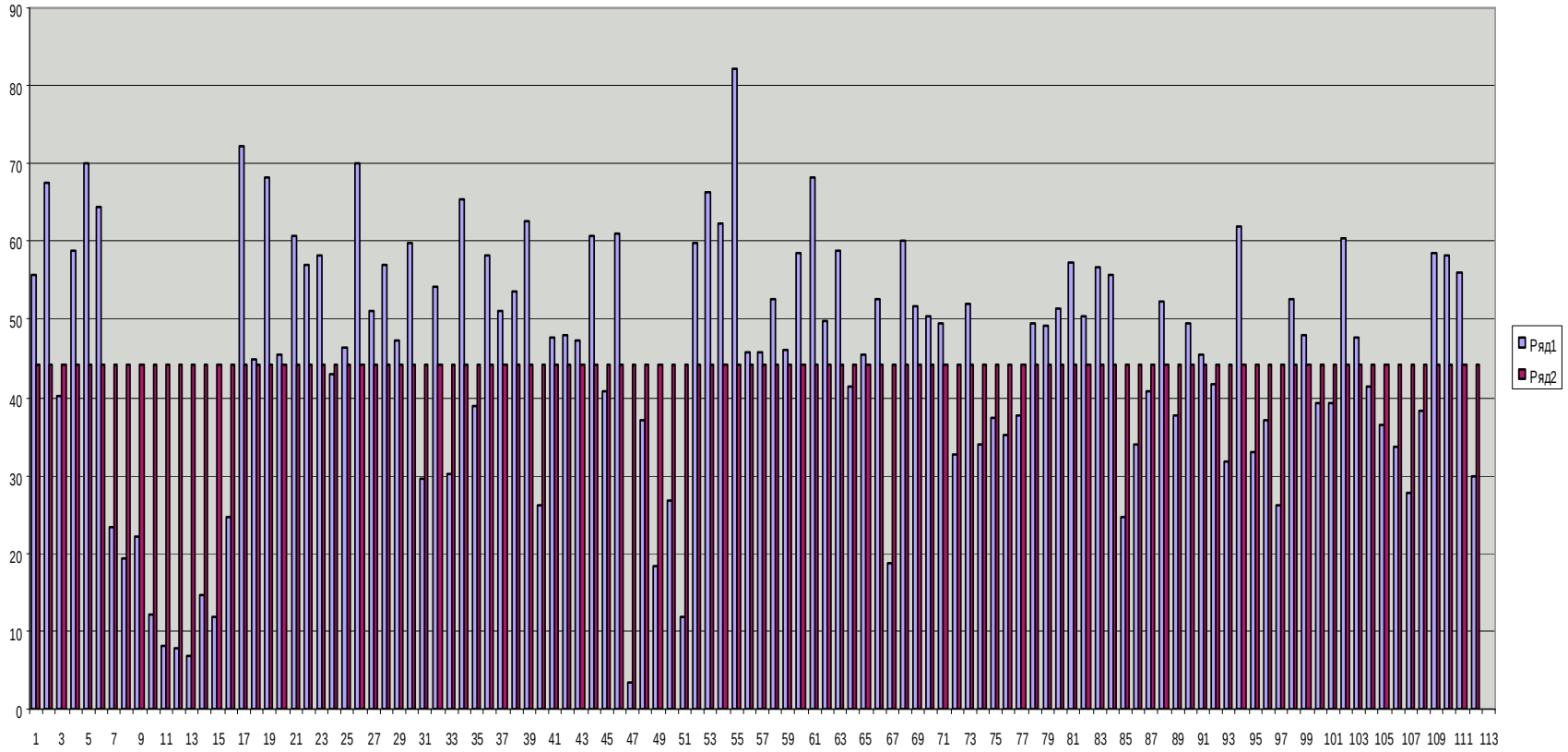
Are you satisfied with the quality of indoor air?

Do respond promptly to your requests and comments by representatives of services that serve your house?

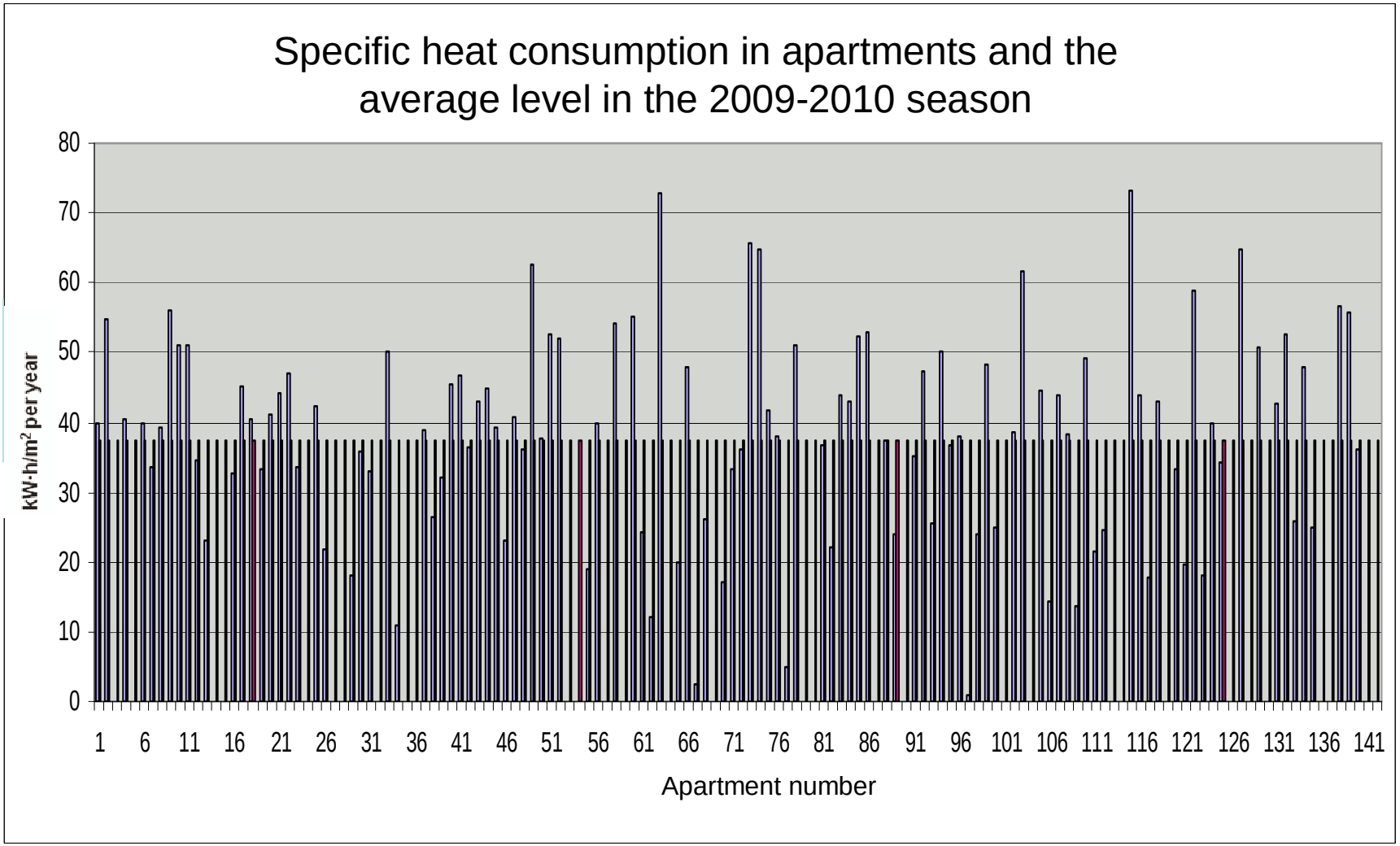
Comfortable if you live in your home?

Are you willing to pay for the consumed thermal energy to heat meter readings of the apartment (after the approval of the appropriate methods)?

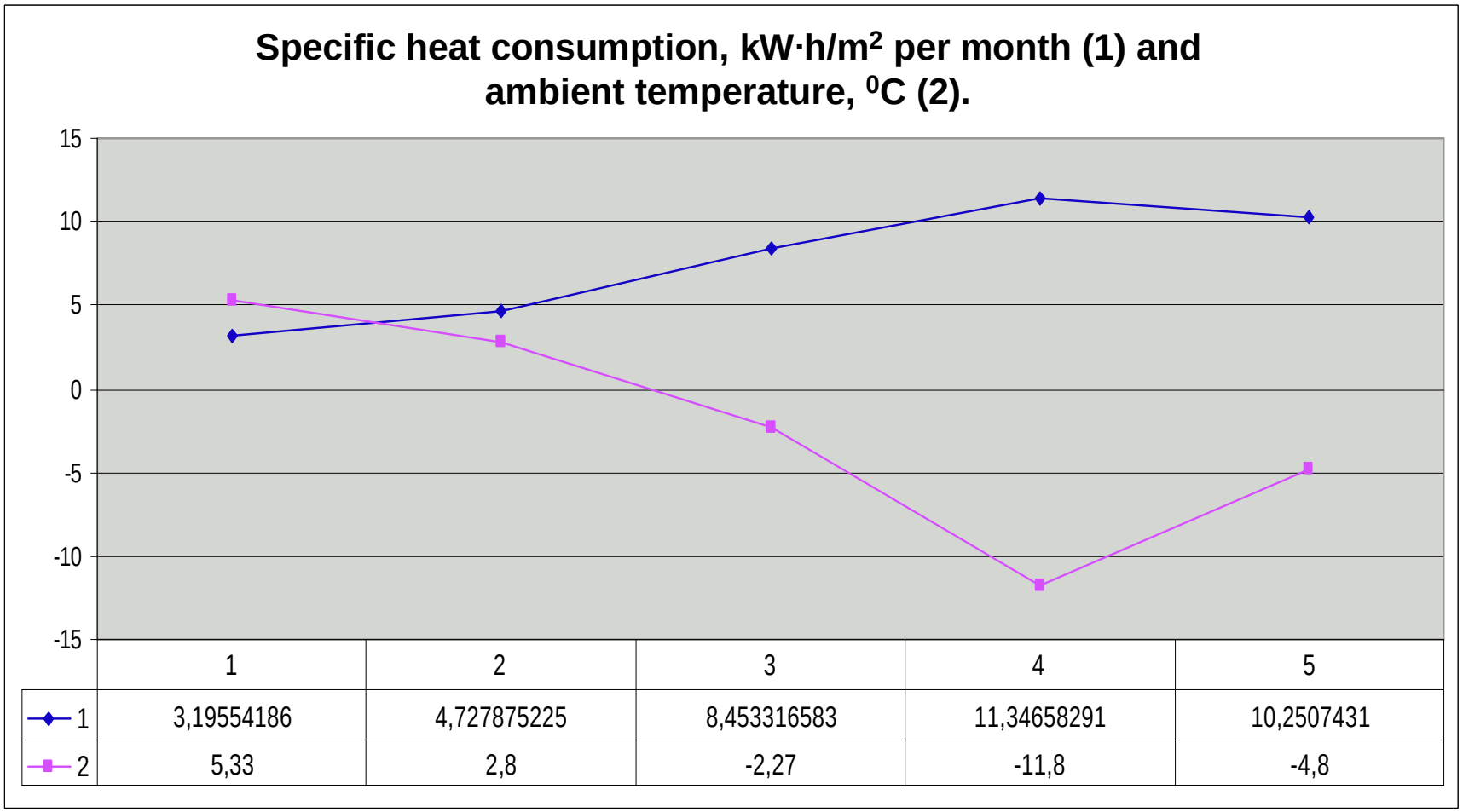
Specific heat consumption for heating apartments and an average value kW·h/m² per year heating season 2007 - 2008 and 2008 - 2009.



Specific heat consumption for heating apartments and an average value kW·h/m² per year heating season 2009-2010.



Specific heat consumption for heating apartments and an average value kWh/m^2 month heating season 2009 - 2010.



	1	2	3	4	5
1	3,19554186	4,727875225	8,453316583	11,34658291	10,2507431
2	5,33	2,8	-2,27	-11,8	-4,8

Vacuum powder insulation

- More problematic zone is the insulation of buildings, because the historic appearance of the building have to be preserved. Here it is expedient to use an innovative product - vacuum powder insulation in the form of vacuum insulated panels, production technology which was developed at the Institute NIPTIS of a name of Ataev S.S. Vacuum insulated panels have a low "effective" thermal conductivity $\lambda_{eff} \approx 0{,}004$ W /(m· K) that allows the insulation shell elements of buildings, both from outside and inside the vacuum insulation panels with a thickness of 8 mm and above without much noticeable change appearance of the historic appearance of buildings.

Vacuum insulated panels

- Thank you for your attention!
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