



Kalevala kindergarten investment project

Thermal imaging survey – before and after

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Project activities

The works has been made within Activity 13 «Selection of demonstration targets and implementation of development projects» under WP 3 and Activity 20 «Writing and distributing teaching materials » under WP 5.

Demonstration object

Demonstration object: kindergarten №2 «Ruchee» in Kalevala settlement

Reasons for the object selection:

- 1) Social importance of the object;
- 2) Excessive heating expenses showing;
- 3) Standard building construction typical for other Karelian municipalities.

Object description



- commissioned in 1992;
- two-store wooden building in the central part and one-store on the sides;
- area - 306 m²;
- heating system - by circulating hot water heated by the electric boiler ;
- personnel – 10 people;
- number of children (aged 3 to 7 years) – 50.

Problems and challenges

- Insufficient attention paid to heating insulation when constructing the building
- Cheap construction technologies used
- Outdated and inefficient heating insulation materials used
- Room temperature should be no less than +24°C
- Outside temperature in winter is up to -30°C and lower
- Heating season lasts up to 9 months a year

As a result: significant heat loss and high heating expenses

Goals and objectives

Goal: to decrease the heating costs while maintaining the required temperature indicators in the building.

Objectives:

- identify the most vulnerable and troubled spots in the structure of the building in terms of energy efficiency;
- eliminate these spots by using modern energy solutions;
- make comparative analysis before and after the investment;
- define economic efficiency of the investments.

Work stages

- First thermal imaging survey of the building,
- Analysis of the survey results,
- Working out of the energy efficiency recommendations for the building ,
- Practical implementation of energy saving activities ,
- Second thermal imaging survey,
- Comparative analysis of the survey results before and after energy saving activities,
- Efficiency estimation of the implemented activities.

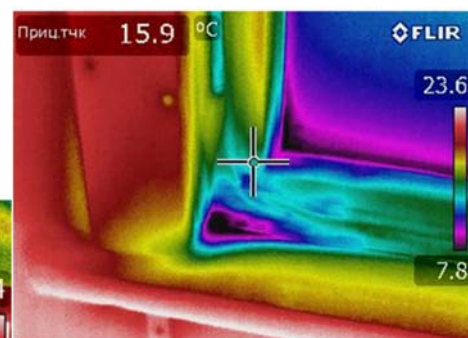
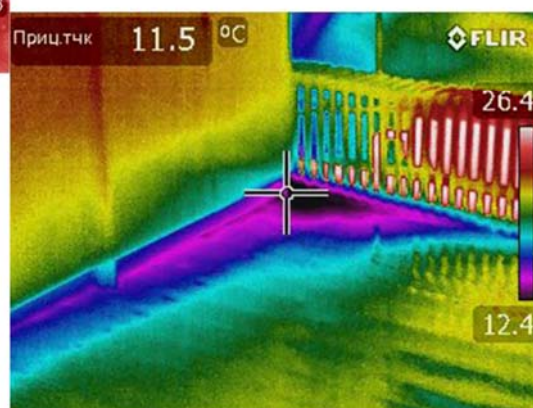
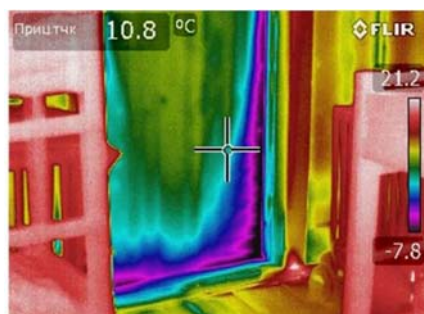
First thermal imaging survey

- Was made on April 5, 2013
- Included the survey of inside and outside surfaces of the walls
- Revealed latent defects in the constructions, heating insulation breaches spots, air infiltration, moisture standards violations
- Survey was made by means of FLIR T420bx imager.



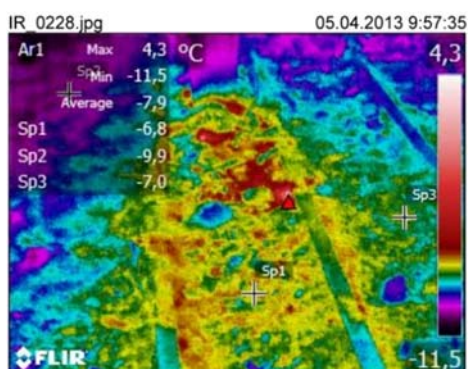
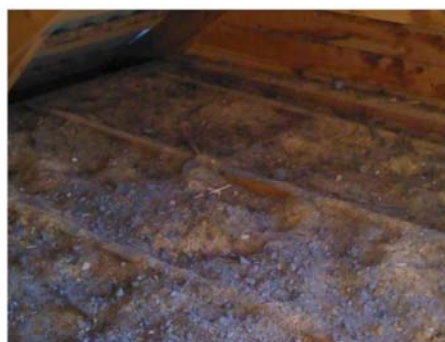
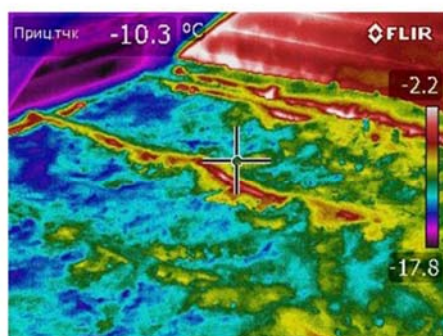
Analysis of the survey results

The heating loss spots were detected.



First survey results analysis

The most extensive areas of heat loss were detected in the attic floor areas.



Heat insulation material selection

- Originally wooden sawdust with the irregular layer thickness of 150-200 mm were used as the attic floor heat insulation material.
 - Chips density – $300\text{--}350\text{ kg/m}^3$
 - Heating conductivity - $0,095\text{ W/m}\times^{\circ}\text{C}$
- It was suggested to replace sawdust for basalt mineral wool with the layer of 200mm thickness (2 layers 100 mm each).
 - The wool consists of extremely thin (3-5 mm thick) interwoven fibers forming the cells that contain the air.
 - Wool density – 30 kg/m^3
 - Heating conductivity - $0,038\text{ to }0,042\text{ W/m}\times^{\circ}\text{C}$



Repair works

- Made during summer 2013,
- Completed in August 2013,
- Sawdust were removed from the attic floor ,
- Steam insulation material laid down and fixed,
- On top 2 layers of overlapping basalt mineral wool Paroc UNS 37 panels $600\times1200\times100\text{mm}$ were laid,
- The upper layer was protected by steam insulation material.



Second thermal imaging survey

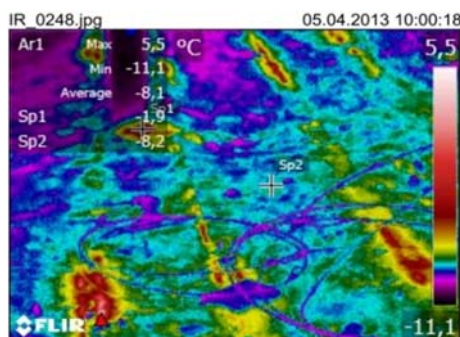
- Was made to compare the heat loss before and after the energy saving activities
- Was made on January 22, 2014
- The temperature rates during the first and the second surveys were matching:
 - room temperature was $+24^{\circ}\text{C}$
 - outdoor temperature was around -18°C



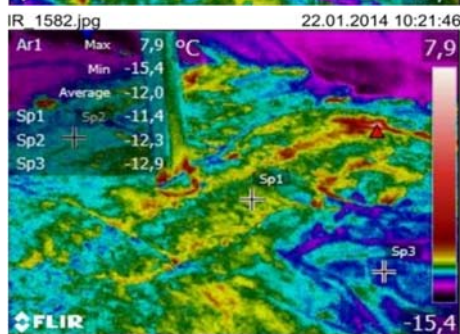
Efficiency estimation of the implemented activities

- insulation surface temperature in the attic floor decreased for $3\text{-}5^{\circ}\text{C}$

Before (Average temperature -8.1°C)

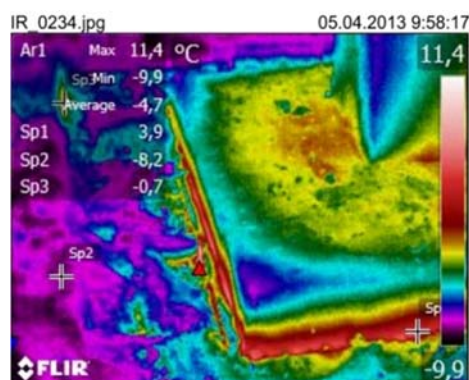


After (Average temperature -12°C)

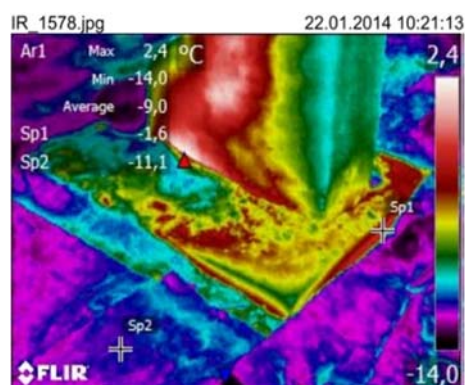


Efficiency estimation of the implemented activities

Before (Average temperature $-4,7^{\circ}\text{C}$)



After (Average temperature -9°C)



Efficiency estimation of the implemented activities

- Thermograms show the heat loss decreased.
- Rough calculation show the energy consumption should have decreased for 15-19%.



Efficiency estimation of the implemented activities

- To confirm the findings, heating energy consumption numbers were also compared
- Comparative periods: September - December 2012 and 2013
- Energy consumption for heating, kWh:

<i>Month</i>	<i>2012</i>	<i>2013</i>
September	-	3368
October	9922	7961
November	11396	8697
December	16640	12264
TOTAL:	37958	32290

Efficiency estimation of the implemented activities

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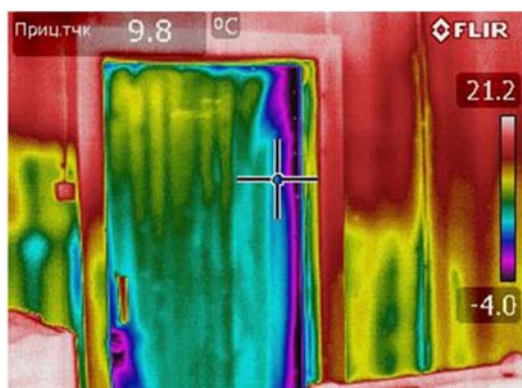
- Heating energy consumption in kWh decreased for 15%.
- Monthly average outdoor temperature should be amended
- In September 2013 monthly average temperature was lower than in September 2012
- In December 2013 the temperature was higher than in December 2012
- Optimal period for comparison analysis: October – November 2012 и 2013
- For the period October-November 2013 the energy consumption decreased for 22% in comparison to October – November 2012.

Key conclusions

- Various methods of analysis show reduction in actual heating energy consumption by an average of 19%.
- this will entail 15 200 kWh per year energy saving
- at the rate of 6 rubles 41 kopecks per 1 kWh (for December 2013), savings will make 97 400 rubles per year
- total costs for the reconstruction of heat insulation - 393 697 rubles.
- payback period of the project implemented - 4 years.

Further activities recommendations

- The following steps for further energy consumption reduction are recommended:
 - ✓ Replacement of the window frames for plastic ones with multiple glass units
 - ✓ Replacement or insulation of the emergency exit door in the bedrooms
 - ✓ Installation of the automatic heating boiler



Project outcomes

- The most vulnerable and troubled spots in the structure of the building in terms of energy efficiency were identified;
- Excessive heat loss through the attic floor was eliminated by using modern energy saving solutions;
- Implemented activity entailed considerable heat loss decrease and money saving;
- Expedience and advantage of using such solutions is established;
- The solution can be recommended for wide application .



Thank you for attention!

