The typical project of the kindergarten for 100 children

Energy-efficient measures for implementation

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Explanatory Card

100 energy efficiency measures to be implemented with a typical project of kindergarten for children

In 2018, the Ministry of Economy and Sustainable Development of Georgia developed a draft law on the requirements of the energy specifications of buildings. Three climatic zones were defined for the use of the energy specifications of buildings. This project discusses the energy efficiency measures that should be taken into the process of construction of kindergartens.

Under the regulatory requirement of minimum energy characteristics, the building must satisfy the requirements of the energy specifications for the climate zone. The following information is required to achieve:

• The location of the building;

• Days of cooling and heating;

• Solar radiation share for the location;

• Landscape (plants or buildings close to the building); etc.

The mentioned project is prepared for 3 climatic zones. Energy efficiency and properties of materials used in the building of a kindergarten "provides information about thermal insulation materials and double or triple glass aluminum frame-windows.

Selected thermal insulation material meets the requirements of the state regulation of "minimum energy characteristic requirements for buildings" in the construction sector.

In our particular case, with the demand for energy characteristics, wetlands of Western Georgia and regions of moderate climatic conditions lie in the second zone, and mountainous regions belong to the third zone.

Walls:

1Wetlands of Western Georgia for regions and moderate climatic conditions:

The project envisages δ=0,4 m thickness pumice walls, with thermal capacity coefficient λ=0,336 w/m K., internal plaster thickness δ=0,02m, thermal capacity coefficient λ=0,56 w/m K, external plastering cement-sand solution thickness δ=0,02m, thermal capacity coefficient λ=0,76 w/m K.

R^{req} =1/8.7 +0,02/0,76+0,4/0,336+0,02/0,56+1/23,3 = 1,407 w/m K

U_{value}=0,71 w/m^{2}K

For the second zone wall thermal capacity coefficient should be U_{value}=0,38 w/m^{2}K.

For thermal insulation of a kindergarten rock wool thermal insulation was chosen. It is made from basalt. The rock-wool is material which is resistant to fire, it belongs to A1 class of fire resistant material. It can be used as thermal insulation of a building carcass, protection from noise and acoustic comfort. This material can be used with different decorative materials. For thermal insulation of pumice block wall 5 cm thickness rock-wool insulation is needed. Its thermal capacity coefficient is λ=0,038 w/m K

R^{req} =1/8.7 +0,02/0,76+0,4/0,336+0,05/0,038+0,02/0,56+1/23,3 = 2,72 w/m K

U_{value}=0,36 w/m^{2}K

2. For high mountainous regions:

The project envisages δ=0,4 m thickness pumice block walls with thermal capacity coefficient λ=0,336 w/m K., internal plaster thickness δ=0,02m, thermal capacity coefficient λ=0,56 w/m K, external plastering cement-sand solution thickness δ=0,02m, thermal capacity coefficient λ=0,76 w/m K.

R^{req} =1/8.7 +0,02/0,76+0,4/0,336+0,02/0,56+1/23,3 = 1,407 w/m K

U_{value}=0,71 w/m^{2}K

For the third zone wall thermal capacity coefficient should be U_{value}=0,25 w/m^{2}K. For thermal insulation of a kindergarten rock wool thermal insulation was chosen. It is made from basalt. The rock-wool is material which is resistant to fire, it belongs to A1 class of fire resistant material. It can be used as thermal insulation of a building carcass, protection from noise and acoustic comfort. This material can be used with different decorative materials.

For thermal insulation of pumice block wall 10 cm thickness rock-wool insulation is needed. Its thermal capacity coefficient is λ=0,038 w/m K.

R^{req} =1/8.7 +0,02/0,76+0,4/0,336+0,1/0,038+0,02/0,56+1/23,3 = 4,037 w/m

U_{value}=0,24 w/m^{2}K

Installing

Before packing the outer wall of the building, wall surface should be checked. It shouldbe clean and dry, I the surface is not flat, it should be plastered. The insulation tiles are fixes on wall surface with cement solution so that there is no gap between the tiles. The solution for wall should be applied at the edges so that the connection areas won't reveal flow of the solution. The tiles will be placed in sequence on facade and corners of the building. When the solution dries (in about 24 hours) the tile attachment process might start on walls with special ankers. When insulation layer is added on the building with ankers, the tile surface shall be painted with cement solution (I layer of plastering) followed by glass-fiber grid which exceeds the tile edges with 10cm. Glass-fiber grid shall be plastered with cement solution (the second layer of plastering) and the working on armored layer should be finisged. When it will dry, the facade will be painted with required texture decorative paint without solution. The exterior plastering thickness depends of gypsum type. With different polishing methods, different surface might be formed.

Technical characteristics of material:

- thermal capacity coefficient 0,038 ≤ λ w/m K. (10°C)
- Resistant coefficient of water steam diffusion $\mu = 1$.

The product type can be used at different temperature -50 / + 650°C, melting temperature> 1000°C.

• Even when it is affected by heat and moisture, it keeps its form

• It is durable. Resistant against mold, pests and microorganisms.

• It is not hygroscopic and capillary.

• Non-facade rock-wool products are classified as fire resistant materials of the "A1" group according to TS EN 13501-1.

During installing of thermal insulation material, the following should be envisaged :

• The above mentioned installation works should not be carried out in rainy weather.

• Load and unloading should be done by min. 2 persons

• The material must be packed with waterproof cover, no matter the shipment distance

• The product should not be placed on the pallets

• The product should not be vertically placed

• External damage to material should be avoided, for example, walking on material

• The warehouse building must be protected from the causes of moisture. For example Rain, steam, etc. It will be better if a warehouse will be in a closed space.

• Fuels should be carefully positioned on the floor so as not to damage the edges of the material

<u>Note:</u>

If wall material- pumice block was changed with another material or block thickness (40cm) was changed, thermal capacity coefficient of the wall should be re-calculated. The following should be considered:

- Thermal bridge impact which permanently accompany the building elements such as wall joint areas or light block wall plastering. U value must be considered. U_{Σ} calculation should be done in accordance with EN ISO 6946, EN ISO 10077-1, EN ISO 14683 with formula:

$$U_{\Sigma} = 1/R_0$$

  where: R_0- is building outer component thermal resistance total value with thermal flow direction w/m^{2}K;
- Insulation material installing and thermal insulation should be done in accordance with manufacturer's instruction.

1. Doors and windows

The project indicates that double glass aluminum frame windows and doors shall be installed. The II zone envisaged that thermal coefficient for 3-camera aluminum framed windows and doors should be U=1,8 w/m2 K

The following is required:

• The thermal coefficient is U = 1,8 w / m2 degree for window/door frame

• The thermal coefficient is U = 1,5 w / m2 for glass-packet thermal coefficient

• Sizes to insert glass in frame 4X12X4 (mm)

In joint areas between window frame and wall and window frame and sill, the thermal insulation should be arranged with 3cm thickness rock-wool. Thermal insulation scheme is shown on the drawing.

Note:

Insulation layer between the outer window / door frame / threshold and gaps should be installed without any gaps. The coverage perimeter should be insulated.

Floor:

1Wetlands of the West Georgia and moderate climatic conditions:

The Ū value of floor should be determined by material of floor, including insulation layers, non-heated areas and soil Ū value which should comply with U value in accordance with climate zones of the floor. Thermal capacity coefficient for II zone building floor should be U_{value}=0,38 w/m²K

If the non-heated basement ceiling is insulated with 6 cm rock-wool, the thermal coefficient will be:

The floor on the top of non-heated basement will be arranged on δ=0,2m thickness concrete tile, thermal capacity coefficient λ=1,76 vt/m degree, the penoplastipol layer with thickness δ=0,02m will be arranged on concrete flattened surface, thermal capacity coefficient λ=0,04; it will be covered with laminated parquet - thickness δ=0,022m. Rock wool tile thermal capacity coefficient λ=0,031 w/m degree, thickness δ=0,6m.

R^{soil} =1/8.7 +0,2//1,76+0,02//0,04+0,022/0,29+0,6/0,031+1/18,2 = 2,679 m²K/W

U_{value}=0,37 W/m²K

2. For high mountainous regions:

The Ū value of floor should be determined by material of floor, including insulation layers, non-heated areas and soil Ū value which should comply with U value in accordance with climate zones of the floor. Thermal capacity coefficient U_{value}=0,25 w/m²K for III zone building flooring,

If the non-heated basement ceiling is insulated with 10 cm rock-wool, the thermal coefficient will be:

The floor on the top of non-heated basement will be arranged on δ=0,2m thickness concrete tile, thermal capacity coefficient λ=1,76 w/m degree, the penoplastipol layer with thickness δ=0,02m will be arranged on concrete flattened surface, thermal capacity coefficient λ=0,04; it will be covered with laminated parquet - thickness δ=0,022m, thermal capacity coefficient λ=0,29;

Glass wool tile thermal capacity coefficient λ=0,031 w/m ^{0} thickness δ=0,1∂.

R^{soil} =1/8.7 +0,2//1,76+0,02//0,04+0,022/0,29+0,1/0,031+1/18,2 = 3,97 m²K/W

U_{value}=0,25 W/m²K

Montage:

For the installation of glass-wool slabs, profiles should be attached to the ceiling. The glass wool tile is placed on the ceiling with ankers. Anchor cable will be placed at every 50 cm interval along the axis where profiles are used.

In the course of any material changes in the project it is necessary to calculate the thermal conductivity coefficients.

In the case of defining the specific location of the project as defined by the project, it is necessary to determine the minimum energy requirements for elements of the buildings and their technical systems to ensure energy efficiency and cost efficiency in the building to maintain internal climate and reduce the gas emissions, therefore the thickness of the thermal insulation material should be selected and the glass count (or two or three glazes) used in the door-windows.