Strengthening Civil Society Trough Community Development in Ribnita

GREEN COMMUNITY CENTER
Feasibility Study

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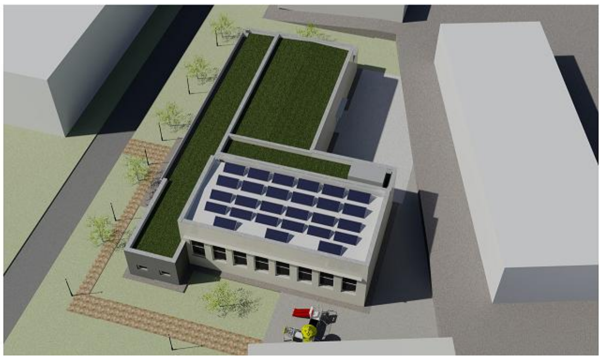

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II. Executive summary

1. Goals

The aim of the Green Community Centre project is to establish a place for environmentally sustainable community development initiatives in Rîbnița, Transnistria.

2. Background

The almost 400 year old town of Rîbnița is under the administration of the breakaway government of Transnistria and also seat of the Rîbnița sub-district. The district contains a total of 47 localities, including small villages/hamlets and is home to more than eight thousand people. The different communities share a common interest and identity with a potential for better collaboration between interest groups, government and citizens.

Development of a community is based on a recognition that some people are excluded from social, economic and political opportunities and its role is to work with such groups to achieve change.

Community development seeks to strengthen civil society by seeking the empowerment of local communities, taken to mean both geographical communities and communities of interest or identity. It will strengthen the capacity of people as active citizens through their community groups, organizations and networks; and the capacity of institutions and agencies (public, private and non-governmental) to work in dialogue with citizens to shape and determine change in their communities. It plays a crucial role in supporting active democratic life by promoting the autonomous voice of disadvantaged and vulnerable communities.

The philosophy of a community is the idea that individuals are collectively working to meet personal needs and the needs of others. This, in turn, leads to community developing as a whole. By creating a sustainable eco-friendly community centre, our project will not only meet the needs of the current generation, but do so in a way that protects the needs of future generations. This idea generates greater social awareness and allows members to participate and take pride in the current community as well as future community development.

3. Presentation of the study

In the introductory part of this study, we present the ICDT, the Pridnestrovian Territory (Transnistria) and Rîbnița, also including the fundamental targets of this project. Amongst the fundamental information intended to enable a deeper understanding of the study, we present the European Directives that played a part during the planning, while the renewable energy sources and the green investments are also explained. Between other generalities, we also include local weather data taken into account during the design phase. The enumeration of the methods used in the study is also done in this chapter.

After an on-site visit and survey of a currently operating youth centre, which is documented with photos in the study, the current state of this building was evaluated based on a 3D energetic simulation and its current utility bills paid. Development proposals were made based on the surveying, our goal being the environmentally friendly reconstruction and renovation of the building, increasing its comfort level and expanding its community functions.

In this study, we've compiled three different renovations proposals for the environmentally friendly and energy-conscious reconstruction of the exiting youth centre of Rîbnița. Concept plans for these three variant were also elaborated. The renovations' investment elements were created based on the concepts of the green architecture, and, taking into account the local possibilities, were summarized related to three main viewpoints (Eco tech & materials usage, Energy savings & efficiency, Comfort & usabililty increase) were rated one-on-one. The specific values and general description of each investment element were also provided. The variants are based on each-other regarding both price and technical contents, the elements of the investments are interchangeable if needed.

The buildings renovated according to the different variants were modelled and the expected energy consumptions and the decrease in energy demand of the buildings created using these renovation variants were calculated.

We've also made a proposal on increasing the workforce employed in the future community centre, in order to prevent the building's degradation and to be able to assure the hygienic conditions.

Duration estimation of the project was also elaborated, according to which the expected implementation time is 14-18 months, with actual construction activities taking up 7-9 months.

The costs of the three variants are summarized in the following table, where the quality of the respective variants' eco-friendliness is marked by the three-step scale using shades of green.

	A variation	B variaton	C variation
Building Construction	105 609 €	168 003 €	204 481 €
Interior Architecture	60 882 €	77 614 €	114 626 €
Building Services	44 934 €	68 958 €	125 664 €
Building Electricity	104 544 €	104 544 €	111 244 €
Environment Construction	10 592 €	10 592 €	€ 10 592
Equipments	29 500 €	29 500 €	€ 29 500
Ancilary Costs of Project Management, Experts, Construction & Design[1]	39 187 €	51 565 €	67 993 €
Salaries for one year	16 300[2] €	16 300[2] €	16 300[2] €
(Expected) Utility costs for one year	4 023 €	3 695 €	2 374 €
Maintenace costs for one year[3]	3 266 €	4 297 €	5 666 €
Sum	**418 837 €**	**535 068 €**	**697 751 €**

[1] Ancilary costs are depending on the variations and about 12% of the the construction costs of the building
[2] Five new jobs are included in the increased payments besides the existing youth centre's 17 workers
[3] Maintenance costs are estimated about 1% of the construction costs of the building

4. Benefits

Incorporating green building technologies, such as active and passive solar energy usage, thermal insulated building envelope, green roofs, natural lighting, water saving greywater and rainwater utilization and energy efficient appliances, green building materials, etc. the community centre can improve the economic, environmental, and social benefits to the community.

These technologies are nowadays not represented in the Transnistrian Region, but their constructions are realistic idea contemplating the current conditions and for example the local contractors whom will building the green community centre for the most part as possible by the guidance of expreienced professionals can improve their skills and study how to use the new and green construction technologies properly.

A low-energy building also providing lower operating costs and increased health benefits, it can be a catalyst for greater pride in the community and a beacon for hope in depressed areas.

III. Introduction

1. Introduction of the project owner

1.1. About the International Centre for Democratic Transitions

The ICDT is an international non-profit organization based in Budapest, Hungary which collects the experiences of recent democratic transitions and shares them with those who are determined to follow that same path. Within the general promotion of democracy, the ICDT has focused its efforts on creating concrete and pragmatic goals. Through collecting and analysing data, organizing and hosting conferences, drafting and presenting reports, and, perhaps most importantly, by running field-projects in many transition countries, the ICDT has been able to compile the collective and individual experiences of peoples from all around Europe. The ICDT believes that this research, coupled with the expertise of some of the world's greatest minds and the practical experience gained through our own transitions, facilitates the use of a toolbox that is instrumental to societies preparing to set off on the difficult path towards a well functioning democracy.

The ICDT was established as an organisational unit with independent legal entity status under the supervision of the Board of Trustees of the Centre for Democracy Public Foundation. It performs the necessary tasks to achieve the goals of the Centre for Democracy Public Foundation according to the Deed of Foundation of the Public Foundation corresponding to the paragraph 74/B. § (3) of the Hungarian Civil Code.

1.2. Mission

Because the International Centre for Democratic Transition was founded in Central Europe, we are acutely aware of the complexity of democratic transition as a process. We ourselves have recently undergone this process and know full well the fragility of new democracies. We firmly believe that a transition can only be judged to be successful when the benefits of democracy are shared by the whole of society. The ICDT's mission is to facilitate the smooth and peaceful process of democratic transition on the basis of participatory principles; the political, economic, legal, cultural, and civil societal aspects of transformation; and the socio-cultural context of regions and countries where the process takes place.

1.3. Vision

In a future filled with daunting challenges and serious obstacles that could impede the spread of democracy, the International Center for Democratic Transition will be a leading organization on the difficult issue of democratic transition. Combining hard-won exceptional practical knowledge with an unyielding commitment to the process of transition, the ICDT will stand at the side of those who seek to bring democracy's benefits to their own people and to provide the skills to do so effectively.

1.4. Operational Method

The ICDT:

- Facilitates the process of democratic transition by using the knowledge pool of transitional experiences and by sharing experiences and best practices;

- Convenes the most important indigenous stakeholders to play key roles in the transition process;

- Provides an adaptable toolbox and appropriate models for the creation and consolidation of democratic institutions;

- Mediates between cultures and regions by generating dialogue.

1.5. History of the ICDT

The idea to establish an institute to collect and share the experiences of past democratic transitions originated from former US Ambassador Mark Palmer, Vice President of the Council for a Community of Democracies (CCD). His proposal was followed by a meeting between the Hungarian Foreign Minister Laszló Kovács and the US Secretary of State in June 2004. At a conference in Budapest in March 2005 civil society and governmental leaders from Africa, Asia, Latin America, Europe, and the USA, as well as representatives of a number of international organizations approved the concept paper on the new Centre. Subsequently, the idea was presented by the Hungarian Foreign Minister at the Third Ministerial Conference of the Community of Democracies in Santiago de Chile.

Once again, the idea was well received and endorsed by the participating Foreign Ministers, representing more than 100 democratic governments of the world. Finally, in September 2005, the Hungarian president announced at the World Summit of the United Nations that "an International Centre for Democratic Transition (ICDT) has been set up in Budapest."

2. Presentation of the project environment

2.1. Transnistria

The Transdniestrian Territory (Pridnestrovie, or simply Transnistria, as this study will refer to this rogue state) is a thin line of land east of the Dniester river, gaining its only „de facto" independence from the Moldovan Republic, after the dissolution of the Soviet Union. Most of the region lies east of the river, only a minor portion is part of the western river bank. Transnistria is divided into five local municipalities, which are the following from north to south: Camenca, Ribnita, Dubasai, Grigoriopol, Slobozia. Although the region is de jure part of the Republic of Moldova, its sovereignty has not yet been recognized by any country in the world (except for Abkhazia and South Ossetia, two likewise unrecognized entities). The region is therefore a member of the „Internationally Not Recognized States" along with Nagorno-Karabakh and the previously mentioned Abkhazia, or South Ossetia.

The area is divided into two parts by the river Jagorlik, an affluent of the Dniester river. The composition of the area's landscape is mostly plains with minor hills and valleys, the soil is 80% chernozyom, famous for its fertility. The area north of it is the foothill of the Ukraininan Podolia-ridge, consisting a network of much deeper valleys and rivers. South of the Jagorlik is mostly steppe, which is common in the Black Sea shore area. Natural forests are considered rare here, existing forestation is man-made.

Mineral resources are scarce in the region of Transnistria, merely limestone, cheramic resources and quartz stone (ingredient of glass production) is available. The Transnistrian region is, however the most industrious area of Moldova.

Although the region has its own currency, called the Transnistrian Rubel, it does not have an official ISO 4217, local banks use the codes PRB and RUB TMR. Acquiring local currency is only possible within the country, but exchange places accept every major currencies (EUR, USD, RUB). The exchange rate in October 2013 was 14,5 PRB/EUR and 11 PRB/USD.

Approximately half million inhabitans live in the area of 4000 square kilometres. Its nationalities (based on the estimation of 2004) are: 31.9% Moldovan, 30.3% Russian, 28.8%

Ukraininan, 2% Bulgarian, 2% Gagauzian, and 2% other. Moldovan Romanian, Russian and Ukraininan are all official languages. The city with the largers population is Tiraspol, with an estimated population of 159.163 in 2005, followed by Bender (97.027) and Ribnita (56.988).

2.2. Rîbniț a

Rîbnița was founded in 1628 as a Ruthenian village Rybnytsia, its name meaning "fishery" and situated in the northern half of Transnistria, on the left bank of the Dniester, (Coordinates: 47°46′ N 29°0′ E) and separated from the river by a concrete dam. The city is the seat of the Rîbnița sub-district.

Central Rîbnița has tall buildings and an active city life. There is a popular park near the town reservoir, and many historical and architectural monuments in the town and its surrounding areas. The main street in the town is called Bulevardul Birulintei meaning "Victory Boulevard”.

1. figure: Ribnita seen from across the river

Rîbnița is home to Transnistria's largest company, a steel plant which traditionally has accounted for between 40% to 50% of Transnistria's GDP. Other industries are also present in Rîbnița, including the oldest sugar plant in Transnistria (founded in 1898), an alcohol distillery, and a cement factory. The city has a large railway station and a river port, as well as a supermarket, called "Sheriff".

Rîbnița has three places of worship located right next to each other: a Catholic church, an Orthodox church, and a synagogue.

3. The objectives of the project

The Green Community Centre project reflects and promotes a number of ideas. These include: full citizenship, community led collective action, participative democracy, empowerment, collaboration and preventative action in a “green way”. It seeks to establish a forum for people of all ages, economic status and cultures to gather in a non threatening environment, break down cultural barriers and come together as a community. Through openly hosting local, social and political activities, community members are given the opportunity to participate in the development of their own community. The community centre would be equipped with specific skills and knowledge to advocate for a set of social principles such as promoting human rights, social inclusion, equality and respect for diversity.

Incorporating green technologies, such as active and passive solar energy usage, green roofs, natural lighting, water saving and energy efficient appliances, green building materials, etc, the community centre can improve the economic, environmental, and social benefits to the community. For example the local contractors whom will building the green community centre for the most part as possible by the guidance of expreienced professionals can improve their skills and study how to use the new and green construction technologies properly. A low-energy building also providing lower operating costs and increased health benefits, it can be a catalyst for greater pride in the community and a beacon for hope in depressed areas.

Recently, Hungary has taken on innovative and successful sustainable living projects. In an area where the land is very important to people for both personal and economic reasons there is a common goal to successfully implement these eco-friendly strategies. This common goal is not only beneficial for the environment but it also unites the communities working towards sustainable living.

The project seeks to identify and define issues of public concern and influence public policy in relation to those. It also hopes to play a particular role in advocating for private troubles and making them a recognized public issue. In doing so, it reflects all the values discussed above, but seeks to reflect them in the way that public issues are identified, and in the way the formulation of policy is influenced.

During the project implementation, the International Centre for Democratic Transition (ICDT), in cooperation with all stakeholders, identifies and discusses core issues and challenges for community work and the marginalized communities and excluded groups, including women. Using best practices, the ICDT also shares information and experiences regarding community work, community development and the common principles in an environmentally sustainable way.

The Centre also explores and examines strategies appropriate for community development work for the next few years and considers ways to enhance mutual support and dialogue nationally and internationally.

The three main target groups of the project are women, teenagers and elderly people.

For young children with working parents the most crucial service a community centre offers is low cost, reliable and quality child care. For single and/or young mothers, this service allows women to be self-sufficient and earn their own income while their children are in a stable environment that nurtures intellectual growth. Young children who are consistently in such a stable environment, are equipped with better social skills as they grow and develop. Along with the child care support, it is important to offer parenting classes for young people expecting or with a child. These classes are necessary to equip these young parents with an understanding of the responsibilities of a child as well as the skills needed to be a good parent. The classes cover topics such as what to expect, how to budget for a child, providing children with a nurturing home environment, etc. It is also just as important that these young parents finish school and focus on their own future, as well. Programs and classes that assist young mothers and fathers in completing school will have an impact on their future success. The community centre also seeks to provide other services such as counseling (for young mothers, victims of abuse, depression, etc) affordable and safe temporary housing, employment resources, a health and wellness centre.

For young adults, the community centre seeks to play a critical role as they grow up. Different programs offer educational programs, sports programs and a variety of activities to keep young adults busy after school and on the weekends. It is at this age that some adolescents begin experimenting with drugs and getting involved in crime. If a community centre can offer interesting activities that keep young adults occupied and out of trouble, the risk of bad behavior significantly decreases. The community centre also seeks to offer training and dialogue with adolescents about issues like drugs, alcohol, sex and violence. Through these community programs, adolescents will develop social skills, leadership, goal setting, decision making, self-esteem and confidence. The community centre programs also allow adolescents to cultivate their understanding of bad influences and the importance of forming healthy relationships. Some programs link young adults with different service projects to help them learn as well as take an active role in their community. Other programs offer fun and exciting classes, activities, and events as well as input on teen issues in the community.

For the elderly population, community centres are important in preventing isolation and alienation. It is a reliable support system to keep busy and involved in different activities and events. Programs for both elderly helping youth and youth helping elderly establish a sense of empowerment for both groups as well as further develop the community bond. It is also important to offer the elderly population access to medical information and care facilities. The community centre gives an opportunity to provide this group with a comfortable supportive place to establish relationships and participate in the community.

4. Fundamentals related to the project

4.1. Guidelines

At the moment, Transnistria does not have an independent directive or strategy regarding energy efficiency. As such, the energy-efficient design and operation of the green community centre will be done according to the relevant directives of the European Union.

According to the Kyoto Protocol attached to the United Nations Framework Convention on Climate Change, the member states of the European Union have to respect their long-term commitments regarding the keeping of global temperature increase under 2 °C and the one expressing the desire to reduce the emission of greenhouse-effect gases under 20% (30% in the case of an international agreement) of the level measured in 1990. Reduction of energy consumption and increasing the use of renewable energy have paramount importance in this commitment.

The 2010/31/EU directive states that buildings have an effect on long-term energy consumption. Because of this, regarding the long renovation cycle of existing buildings, new buildings and the existing ones under significant modernization have to comply with minimum requirements for energy efficiency, adjusted to the local climate. Because the use of alternative energy supply systems is not fully revealed viewing its potential, the use of these systems must be considered – regardless of their size – with respect of the principle stating that energy required for heating and cooling must be reduced to a cost-optimized level.

More specific measures must be defined for reaching the vast potential inherent in the energy saving of buildings and the reduction of the significant differences in the results of member states in this domain.

Action is needed to increase the number of buildings which not only satisfy the current minimum requirements for energy efficiency, but are even more energy efficient and as such, they diminish both energy consumption and carbon-dioxide emissions. For this reason, member states must elaborate national plans intended to raise the number of near-zero energy-demand buildings and report to the Commission regularly on these plans. The design of near-zero energy-demand buildings (in which most of the near-zero or very low amount of energy used must come from renewable sources, including energy produced on site or in the nearby area) is possible only with the use of renewable energy sources.

Directive 2010/31/EU also states that energy efficiency of buildings must be calculated using a methodology that can be differentiated on national and regional level and other measures meant to improve energy efficiency must take into account the climatic and local conditions, including interior climatic conditions and cost-efficiency.

In this study, establishing investment elements was done respecting the requirements for the environmentally friendly design of energy related products and Directive 2009/125/EK of the European Parliament and Council, endeavouring to minimize the life-cycle pollution of each product.

Directive 2012/27/EU on the energy efficiency was also kept in mind during the establishing of energy-efficiency-improving investment elements for existing buildings.

4.2. Renewable energy sources

4.2.1. Solar energy

One possible source of renewable energy is the Sun. Measured by human standards solar radiation is inexhaustible as a source of energy, it provides energy for millions of years without need of any expenses. However, the amount of solar energy reaching the surface of the Earth varies in position and from day to day, even hour to hour.

Active solar energy utilization

During active solar energy utilization, we convert solar energy into final energy using active utilization devices. Two different means of active solar energy utilization are currently common. In the first case the radiation energy of the Sun is converted to thermal energy using a transfer medium in a device called the solar collector, after which we store and use this thermal energy by means of the building services. In this case we gain hot water from solar energy. Two types of solar panels are common: flat plate collectors that heat the water circulated in them directly, and evacuated tube solar collectors, where due to solar energy a liquid-gas state change happens and the water is heated by the generated gas using a heat exchanger.

In the second case the solar energy is directly converted to electric energy by the device – the solar cell – which can be stored or utilized by the means of electro-technical devices. In this case we gain electric energy from solar energy. There are three common types of photovoltaic cells: the most effective monocrystallyne, the policrystalline photocell and the thin-layer amorphous crystal solar cells.

Passive solar energy utilization

Solar radiation reduces somewhat the amount of energy needed for heating by thermal transfer or thermal radiation on the surfaces of the buildings' facades, roofs, windows and doors. During passive utilization we try to provide the larger amount of the energy needed for heating by solar energy using the specific tools of architecture. In this process the buildings orientation, the design and quality of transparent elements, the methods of shielding and screening and the utilized construction materials are decisive.

Passive solar energy utilization may be done using direct or indirect radiation-collecting elements. Direct radiation gains enter the heated area directly through transparent elements (such as windows) while in the case of indirect radiation some kind of intermediary storage and transfer element is also present in the process (like mass walls).

Solar energy utilization against climate change

Solar energy is an obvious solution for the stopping of the acceleration of climate change. If we only use the conventional gas-heating for our buildings then we damage our environment with greenhouse-effect gases. The average heating energy value of 1 m^3 natural gas equals 9.455 kWh, which generates 1.9 kg of CO_2 emission, so that the production of 1 kWh energy lets 0.2 kg CO_2-t into the air. In contrast, the utilization of solar energy does not pollute the environment, neither with materials (carbon-monoxide, sulphur dioxide, radioactive waste, etc.), nor with waste heat. This is also absolutely true for the means of energy utilization examined in the study and the direct solar gains of the building. The active utilization is not fully pollution-free, as the production and transport of solar panels and solar cells generates pollutants.

4.2.2. Geothermal energy

We call geothermal energy the thermal energy generated by the decay of long half-life radioactive isotopes present in the components of the earth, the radioactive decay of mineral contents of deep bedrock types present in the upper crust due to volcanic activity and the thermal energy stored in the pore water and rocks generated by the chemical metamorphosis processes of different rock types, that tend to flow towards the Earth's surface.

In a narrower definition, the geothermic energy is the energy stored in the sub-surface waters, as some of the literature states that ground heat can only be utilized by the means of thermal waters, which is made possible by the large thermal capacity of water. In a broader definition, geothermic energy is the non-solar-originated energy present in the crust due to the Earth's thermal energy flows.

The main characteristic of geothermic energy in contrast with other energy types is that it is always available regardless meteorological conditions and can easily be used for both base performance and peak performance needed at the time of maximum demand. Geothermic energy is available locally, and as such may be used in a decentralized manner, diminishing the dependence on imported energy.

Geothermic energy may be utilized using soil heat exchangers or soil probes and heat pumps, which can be operated all year, in the winter for heating and for cooling during the summer.

4.2.3. Wind energy

Wind is the movement of the air with respect to the Earth's surface occurring due to the differences in atmospheric pressure generated in the lower layers of the atmosphere by solar radiation. Kinetic energy of the wind can be converted to electricity using wind turbines. However, based data provided by literature, wind may be worth utilizing in areas where the annual mean wind speed exceeds 4 m/s.

4.2.3. Water energy

Although it cannot be used on the current project location, for the sake of comprehensiveness this must also be mentioned. Approximate calculations suggest that 23% of the solar energy reaching the Earth is used for the sustainment of the cycle of water. About 99 %of this energy is being used for the evaporation-condensation cycle, which is unusable for us. The remaining fraction is the kinetic energy of water moving on the Earth's surface. Stationary waters have only potential and pressure energy, but in case of running waters kinetic energy is also present. By water energy we understand the totality of these.

4.2.4. Biomass

When talking about biomass in relation to buildings, we usually speak about biomass types directly used for heating, a group which consists of low moisture-content, high caloric value flammable materials like firewood, wood chips, agricultural waste or pellets that are made by any of the biomass types mentioned before. Flammable biomasses may be gasified in special boilers made for this task, where we incinerate the solid fuel in an imperfect burning process first and then we burn the gas generated in the previous process in another chamber of the boiler where we can assure ideal burning conditions.

4.2.5. External air's energy content

We can generate heat from external, even cold air using heat pumps. Due to the Carnot cycle process, heat pumps are capable of extracting thermal energy from the external air using a medium circulating in the heat pump system and of transmitting this thermal energy into the heating system. However, the effectiveness of air heat pump systems drops in the case of very cold external air temperature, so their utilization may be economical only in transition periods or as supplementary heating.

4.3. Green investments

4.3.1. Environmentally advantageous location

From the point of view of the building's users, one of the most important factors is the building's location. Location defines how many people will be able to approach the building from the planned target audience. When choosing the location availability of public transport means nearby is important, which, due to environmental considerations, should be prioritized in front of individual transport. It is also important that, in the case of individual transport, approach possibilities by bicycle to be supported and aided by establishing bicycle paths and sheds and by providing possibility for changing clothes inside the building.

The building's close environment influences the image of the building and, as such, the surrounding environment should fit into the concept of green building.

4.3.2. Use of renewable energy sources

When using renewable energy we must always use the best alternative available locally. In the case of existing buildings this mostly means the placing of solar cells on the southern façade or the roof, which enable us to cover the building's electricity demand from a renewable source. The building's hot water needs can be partially satisfied using solar panels. Active solar energy-collecting devices need to be mounted on adjustable supports, so that the Sun's path can be followed in each season.

In order to cover the energy needed for heating we may implement heat-pump systems, which, with the partial use of electricity generated by the solar cells, provide precious thermal energy, reducing the use of fossil fuels.

4.3.3. Energy efficiency

After producing the needed energy the effectiveness of energy use must also be increased. The ability to measure the consumption is of basic importance, as with the help of this we may be able to implement an energy-efficient building use strategy in the future. In the case of lighting, for example, we may be able to reduce the amount of electricity needed by installing motion and light intensity sensors. By using low pressure system with heat recovery devices for ventilation we may also be able to save precious thermal energy.

Not only must the use of thermal energy and electricity be reduced, but running water consumption also. We can achieve this by the means of rainwater and grey water utilization and implementation water-economical faucets.

4.3.4. Building materials

We need to prefer local, environmentally friendly and recycled materials during the energy-optimization process of the building. The recycling of used materials has to be done in the highest possible amount on site. The disposal of pollutants should always be cared of.

Environmentally friendly construction materials have two different approaches. Construction materials which are made using recycled materials or materials that do not pollute the environment can be considered environmentally friendly. However, according to a more common point of view, the environmental effects of construction materials need to be studied for their whole life-cycle.

Following the latter principle, a polystyrene insulation may also be considered a green solution, if viewing its whole life-cycle it saves humanity from a greater amount of pollution than the amount generated during its production. Obviously, comparing polystyrene foam to a cellulose insulation, the latter will have a smaller amount of generated pollutants, its production being based on recycled paper, but its costs of utilization are higher and its availability is significantly restricted.

4.3.5. Construction technology and Quality

Even with the use of green building materials energy-wasting buildings can be made. The need for materials and the construction technology must always be precisely planned and executed exactly according to the regulations and prescriptions. An implementation technologist must always be present on site at least for performing control tasks in order to prevent construction errors.

The quality of the construction process influences the energy consumption of the building fundamentally. Buildings having satisfactory quality and thermo-technical properties, but executed inadequately have an effect not only on the building, but also on the surrounding environment and the people. A green energy-conscious building which is not working properly generates more trouble than gain.

In addition, the execution quality of the building also influences its level of comfort. For example, even in the case of buying very good thermal-insulating windows, if we do not act with proper caution during the montage process and leave gaps around the element, wind will blow in and heated warm air will escape.

4.3.6. Local contractors

In the case of building an environmentally friendly building involving local workforce into the building process is of fundamental importance. As such, local contractors may have the possibility to learn the correct implementation methods for green building technologies and may acquire experience in quality execution, which they perform under the supervision and guidance of an experienced building technologist. In this case sending only a building technologist to the construction site is sufficient. By training the local workforce the interests of local population may also be served, as they not only receive a building, but also they learn to build one in an environmentally-friendly manner.

4.3.7. Comfort requirements

Energy saving may not be implemented at the expense of basic comfort. The energy consumption of a well-functioning building can be kept low in a way so that the beneficiary will not experience any disadvantage.

4.4. Community functions

When expanding or modifying the community function of an existing building careful and forethoughtful planning and design is required. Decision on the expansion or specializing of the building's function has to be taken knowing the local users' habits. The building of an eco-friendly centre will be in vain if locals do not consider it theirs and do not exploit its and capabilities.

The fact that the building should be used at maximum and not periodically is of fundamental importance.

From amongst the three target groups presented in the study, focusing on the youth may provide the opportunity for designing the community halls in which day-care-like occupations may be provided for the youngest during the day, while also being appropriate of common parent-child occupations. During the afternoons the same spaces may provide study-room-like services or relaxation opportunities for the young ones coming from the school. Providing possibility for sports for the youth must be a priority not only in the case of physical occupations but also for intellectual sports (i.e. chess).

The comfort of the community areas may be increased using basic electronic equipment; installing computers may help not only with the progression of the younger but also with the closing up of the elderly. Using video projectors installed in the community areas they may be able to hold movie screenings as well as to increase the cohesion of the community.

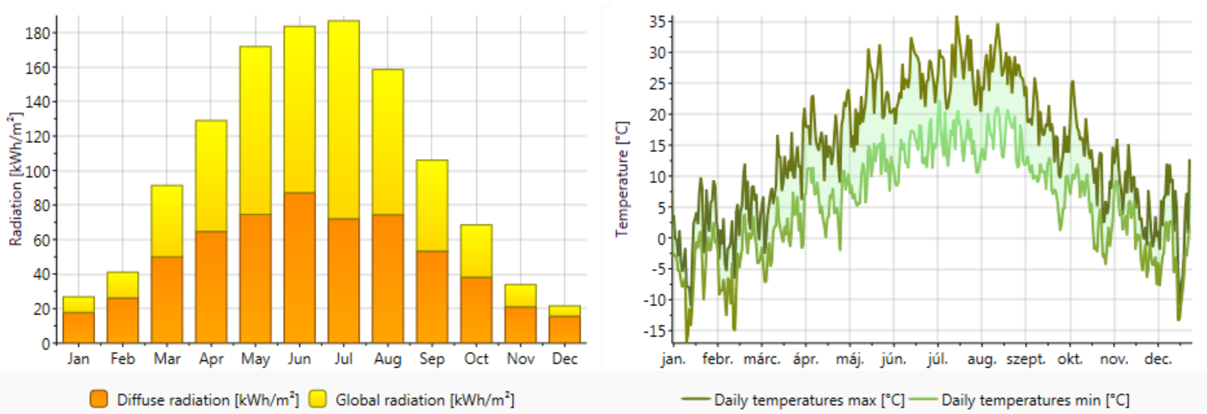
Installation of microwave ovens in the community areas is highly recommended, where local youngsters may be able to warm their food brought from home.

Taking local particularities into account, community sanitary facilities have to be constructed in order to be used by the youth performing sport activities and by their parents. We may also provide equipment such as a washing machine, as local circumstances make it impossible for many families to have such equipment at home. As the equipment is environmentally-friendly, it may contribute to the emergence an environmentally responsible way of thinking.

4.5. Climate in Ribnita

The climate in Ribnita is moderately continental. The summers are warm and long, with temperatures averaging in July about 22,4 °C, and the winters are relatively mild and dry, with January temperatures averaging −2,2 °C.

The dailiy sunshine duration is low in the heating (winter) season, a 3 hours average in October to March. There are three times more solar radiation in the cooling (summer) season, than in the cooling season. The global horizontal irradiation ranges from 22 kWh/m^2 in December to 187 kWh/m^2 in July. As shown in the second figure, the the proportion of diffuse radiation in the winter months are higher. Based on the interpolated data, the solar gains can be useful and usable for active or passive utilization in Ribnita.



2. figure: Left: Monthly distribution of radiation, Right: Daily temperature extremes in Ribnita

The wind speed the wind speed is average, during the winter months a little more significant than in summer. Based on the monthly data, the utilization of wind energy in Ribnita is considered a risky investment because of a year-round average wind speeds below 3 m/s.

Precipation in Ribnita which ranges from around 3 centimeters in April to 7,5 centimeters in July, can vary greatly. The heaviest rainfall occurs in the mid-summer. Heavy showers and thunderstorms are common in the region. Because of the irregular terrain, heavy summer rains often cause erosion and river silting. Sufficiently large catchment area can provide profitable rainwater utilization in Ribnita.

The temperature, humidity, wind speed and precipation data of Ribnita are interpolated using the surrounding meteorological stations data, such as Ljubasevka, Kisinev, Iasi, Razdelnaja, Uman. The datasets contains hourly data from 2000 till 2009. Other climate datas are interpolated from hourly model based satellite data, the period is from 1986 till 2005. The monthly data are summarized in the following table.

	Average Temperature	Average Humidity	Sunshine Duration	Global Horizontal Irradiation	Wind speed	Precipation
	°C	%	h	kWh/m^2	m/s	mm
January	-2,2	82,0	2,1	27	3,1	40
February	-1,1	78,0	2,3	41	3,2	34
March	3,9	71,0	4,0	91	3,4	40
April	10,5	63,0	6,0	129	3	28
May	16,5	60,0	8,0	172	2,7	42
June	19,7	63,0	9,0	184	2,5	56
July	22,4	62,0	9,1	187	2,4	75
August	21,8	60,0	9,0	159	2,3	48
September	15,9	66,0	7,3	106	2,5	56
October	10,3	73,0	5,2	68	2,6	37
November	4,7	81,0	2,3	34	3	45
December	-0,8	83,0	1,9	22	3,1	36
Heating s.	2,5	78,0	3,0	47,2	3,3	38,7
Cooling s.	17,8	62,3	8,1	156,2	2,6	50,8
Year	10,1	70,2	5,5	101,7	2,8	44,8

1. table: Interpolated monthly climate data of Ribnita

5. The methodology used in the study

5.1. Visual inspection

On the 24th of September we had a field trip to Rîbnița, where we had the opportunity to view the buildings considered for the Green Community Centre. During the day we've seen four constructions which were presented to us by local decision-makers.

After viewing all four alternatives we've chosen the one being closest to ideal for the project. Amongst others the main considered aspects were the building's location, current function, technical condition, the room arrangement, the size of the building and the preliminary cost estimate of the measures needed in order to increase its energy efficiency.

The building finally chosen is going to be discussed in detail in the next chapter.

5.2. Measurements on site

After selecting the building the local authorities made the floor plans of the building available for our use, after which we went on with verifying the main dimensions on site. The differences in execution were within the allowed tolerances, so because of this and the short available period of time we did not carry out the complete measuring of the building. During actual design and planning some of the proposed elements of the investment may require precise measurements which will have to be done on site.

Additionally, we've verified the building's overall condition using moisture-measuring device and an infrared thermometer. The damage to the building and the errors were recorded in a photographic documentation.

The local construction authority provided us with information on the construction materials used at the erection of the building, which was verified by us on site.

5.3. 3D BIM modelling

Based on the floor plans provided and on the measurements taken on site we've elaborated a 3D model of the existing building. After this we were able to take the measurements needed for the preliminary design on the Building Information Model. The tri-dimensional model contributes to the understanding of structure and the building's current state and permits us a more favourable design of the investment's elements.

5.4. Building analysis

The management of the building provided us the 2012 utility bill of the existing building, also including data on the consumption. Knowing the consumption characteristics and using the data on the local clime and the 3D model simultaneously with the modelling of the real thermo-technical parameters, the analysis of the existing building was done, defining the main renovation potentials. The simulated model is capable of bringing the users' habits and the amount of energy required by the building together providing information on the required and useful modifications needed to create a green building.

5.5. Assessment of the local potential

In the creation process of a truly environmentally friendly building the use of local resources is of maximum importance, while taking into account the local conditions is inevitable. As such, local authorities were consulted in each case on the locally available materials, the disposal of demolition by-products and regarding the locally available workforce.

During the design of the renovation elements regarding energy-efficiency or the building's utility we've employed a green investment comparison, during which the use of locally available construction materials, the amount of pollution calculated on the whole life-cycle, the amount of saved energy during the operation of the existing building, the amount of the available local workforce and the investment's elements visible for the users of the building (and, as such, encouraging to environmental awareness) and which increase their comfort were prioritized and implemented. However, we've kept costs in mind in each case.

During the cost estimation of the renovation elements prices of the local industry were used in the largest possible part. In the case this not being possible, the data of the Hungarian cost-estimation databases were transformed following the cost-estimation of the elements.

5.6. Determining the energy-efficiency-raising improvements

In the process of the elaboration of the investment steps, amongst the European Union's directives already mentioned in the study, we also took into account the energy-efficiency increasing proposals of the known green building rating systems, not forgetting about local particularities and possibilities.

In the buildings reconstruction process we emphasised the implementation of real green solutions, which may prove useful for the actual Transnistrean society and whose realization may spread the environmentally responsible way of thinking with respect to the local conditions.

After this, the investment elements were analysed by adding them to the existing building model. We have established three different scenarios in this study, while the components of the proposals were designed to be compatible with each other, so that the elements in the packets can be varied. As such, the total reconstruction can be divided into three units in each case: elements needed for operation (i.e. water insulation or the establishing of minimal hygienic conditions), steps for energy-saving and for the reduction of energy consumption (i.e. posterior thermal insulation of the building, changing of doors/windows) and the renovation of building services. During the elaboration of these, we've tried to cover the building's energy need in a more economical manner, while also trying to raise the current level of comfort.

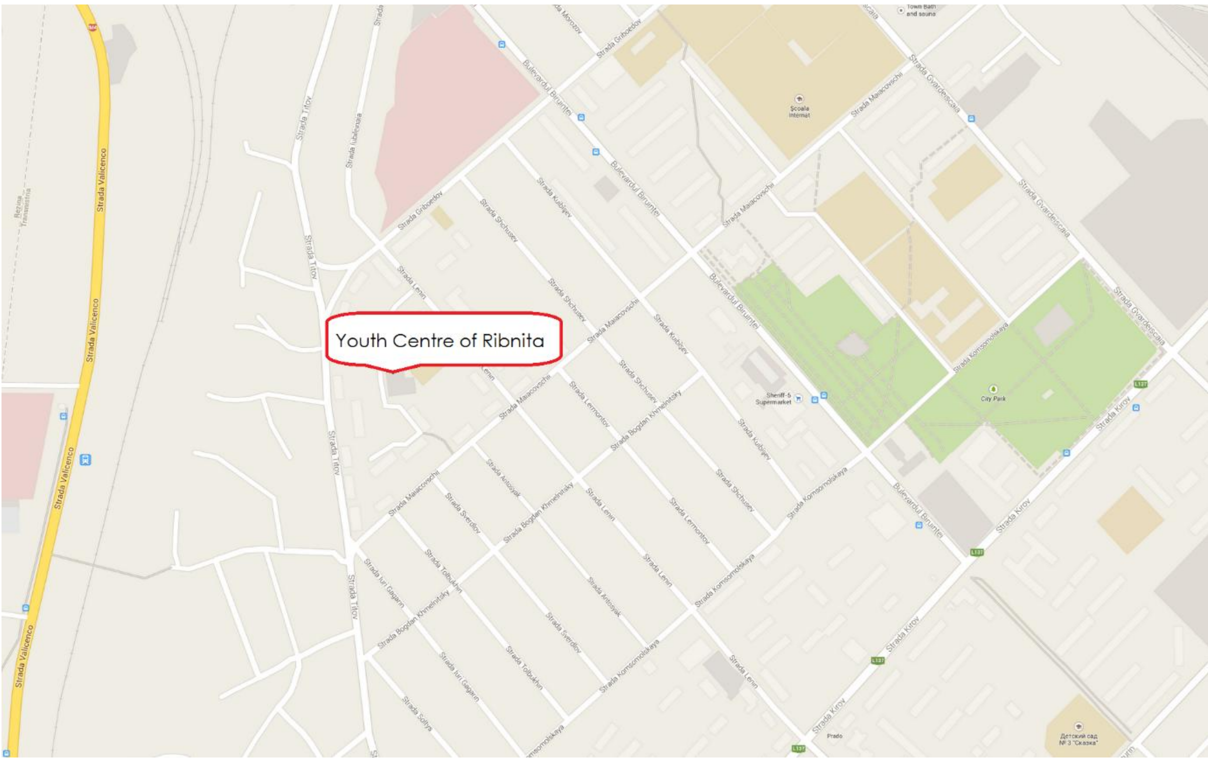
IV. Description of the current conditions

1. The existing youth centre

1.1. Location

From the point of view of the target audience, the location of the existing youth centre is favourable. The nursery school is located in the building's vicinity, while the local school, the train station and the town centre are in a proximity of maximum 1 km each.

One station of the local mass transit system is only 600 m away. The building may be reached by car also, but the number of parking lots in the vicinity of the building is very limited.

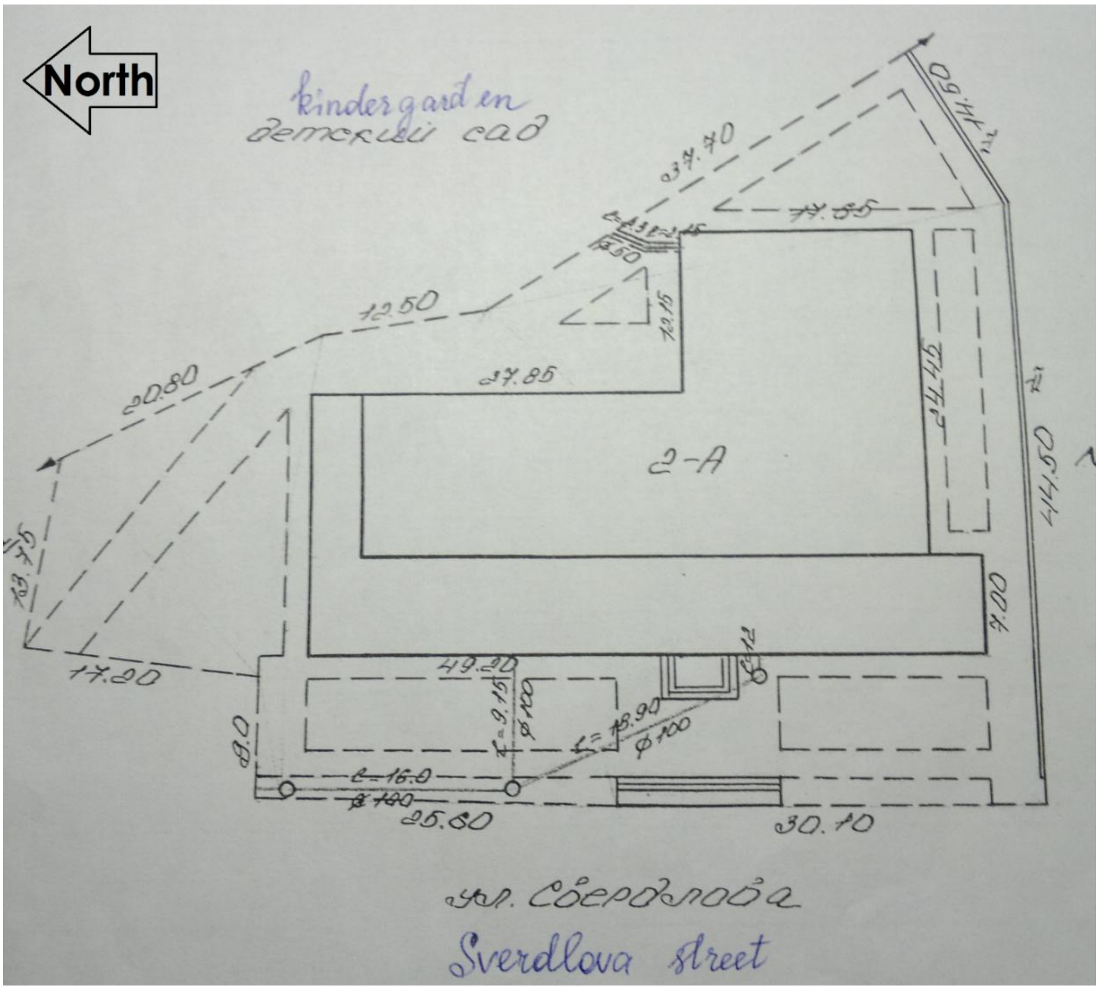


3. figure: Location of the existing Youth Centre

As shown on the image above, the building is at equal distance from the train station, the school and the main square of the town centre. The youngsters composing the target audience only have to take a 10 minute walk to reach the centrum. The proximity of the public transport system's station brings the Youth Centre into an acceptable distance for the ones living in the periphery of the town.

1.2. Site description

The youth centre is located mainly amongst residential buildings, the area being wooded. The fact that the heating pipes of the district heating and the electric cables are not placed underground, but mounted as overhead cables and ducts between the buildings. The thermal insulation of the district heating's piping is here-and-there damaged, so the system's distribution losses are presumably high. On the North side of the youth centre there is an electric transformer building, while being bordered by the local nursery school on the eastern-north-eastern side.



4. figure: Site plan of the building

The building has been constructed in a moderate cut which is bordered on the eastern and northern side by reinforced concrete buttresses having the height of 1,5 - 2 m. The building may be walked around completely.

The soil on site is clayey – loamy, which must undergo an examination in the case of works also needing structural interventions.

As it can be seen on the site plan, the building's orientation is favourable, as the main facades are positioned almost perfectly towards the four main geographical directions, while in the case of the building existing on the southern side large windows are present, helping to ensure the direct solar radiation gains and natural lighting in nearly the half of the building.

1.3. Current usage and functions

At the moment the building hosts Rîbnița's youth centre. This youth centre provides sporting, learning and entertainment possibilities for the youngsters of the town. One of the building's two largest premises functions as a theatre, being able to accommodate hundreds of people. This theatre not only provides entertainment possibilities for the youth, but also makes dance lessons able to be held on the large scene.

The other large room is used as a gym, currently hosting box trainings, a box ring being present in one half of the premise. In the smaller rooms of the building, located between the two large halls, on the first floor, function as study rooms, where study circles may be held.

5. figure: Box training in the gym hall

In the lobby one can find photos of the everyday activities of the local community and some of the festive events.

However, walking inside the building, we can find many idle spaces, where we may be able to arrange other functions. Anyway, the existing functions' circumstances also need to be corrected.

1.4. The operation of the building

Currently 17 people working in 12 different posts are responsible for the operation of the building, however this means that some of the post. The following table presents the situation of the employees currently working for the youth centre and their respective salaries:

No.	Post	Quantity of staff monthly	Salary RUB TMR	Salary Euro
1.	Director	1	1794,00	120
2.	Deputy director	1	1656,00	110
3.	Art director	1	1794,00	120
4.	Secretary	0,5	414,00	27
5.	Porter	1	690,00	46
6.	Cleaner	1	1000,00	67
7.	Guard	1	966,00	65
8.	Worker on electrical equipment	0,25	215,00	15
9.	Department supervisor	1	1578,00	105
10.	Chief specialist	1	1449,00	97
11.	Leading specialist	0,5	621,00	41
12.	Leader of club/study group	6 x 0,5	6 x 414,00	6 x 27

2. table: Salaries at the youth centre

According to Rîbnița's local administration, the cumulated salaries of the employees are equal to €975 per month ie a total of €11.700 per year. It can be deducted from the list that the maintenance of the electric equipment and the cleaning operations of the more than 1000 m^2 area building lack some of the required personnel. This is also reflected by the comfort and sanitary conditions presented later.

1.5. Unsanitary conditions

The present comfort and sanitary conditions are disappointing. The spaces of the building are not cleaned as it would be required and the needs of maintenance are also neglected. Some of the facilities, such as the showers located in the dressing rooms are disused by the youngsters due to their appalling condition and crowded layout. Many of the rooms, like the dressing and sanitary rooms where the youngsters can change clothes and prepare for trainings, completely lack radiators. The sole equipment to serve the users in the dressing rooms are some chairs.

The situation of the toilets is the most critical, as ceramic elements are dirty, while metallic parts are corroded. There are no flush toilets in the building, making it impossible to hold conferences or theatrical performances.

The building currently lacks the hygienic conditions required for everyday operation, a situation which must be improved in order to guarantee the health of the youngsters using the building even in the current appalling situation.

6. figure: Sanitary facilities in the building

In many places inside the building traces of water penetrating through the leaks of the water isolation of the roof can be seen. As a result of constant wetness, in most of these spots mouldiness can be seen.

2. The condition of the building structures

2.1. Layout and generalities

The existing building can be divided into 4 main structural units. On the northern side a 12 m x 24 m reinforced concrete frame hall structure can be found currently hosting the theatre room. On the southern side another hall structure is present, having the same interior dimensions but being positioned with a 90 degree rotation with respect to the other one, which is used as the gym. The internal height of the two halls is different. The northern and southern halls are linked by a two-level structural-wall-based building, having the first floor opened towards the southern hall, containing a corridor also serving as a stand and three additional rooms. This part of the building also contains sanitary rooms and the mechanical and electrical equipment's control rooms. The 4th distinct part is the mixed structural wall - reinforced concrete frame part on the southern side, having in composition the entrance-side façade, and also surrounding the neighbouring hall on the northern side. We can find here the lobby – from where the other rooms may be entered – the office, the dressing rooms belonging to the theatre and gym halls respectively and also the toilets.

2.2. Structural systems, solutions and implementations

The building was designed and erected using two different approaches and, consequently, it displays two different types of structural systems. The large halls and parts of the smaller reception building are based on industrial technology and have been built using prefabricated reinforced and pre-stressed concrete elements – reinforced and pre-stressed beams, reinforced concrete columns, isolated cup foundations and prefabricated roof panels – that can easily be detected by visual examination. This system was probably intended for the use with industrial halls and buildings and was easy to implement in the Soviet era because the industrial character of the town and the resulting availability of construction elements intended for the local heavy industry, which may have looked suitable also for these kinds of socio-cultural buildings. The other approach was used was the conventional structural masonry wall system, used for the smaller parts of the building which did not have large spans and heights. However, the co-working of the two different systems was not taken care of and the implementation of these two different systems resulted in some execution and, of course, consequent operation errors. Between others the building presents traces of floor and wall cracks due to missing dilatation gaps and poorly executed foundations, unaligned montage of prefabricated elements due to lack of precision and many improvised solutions that affect the usability of the building.

2.2.1. Foundation

It was impossible to verify the type of the foundations directly, however, the cracks inside the building suggest that the 4th part of the building, as mentioned above, the lobby section built near the theatre hall does not have adequate foundations. Because of the cracks inside the building the foundations of this structure need to be verified in order to prevent future damage. The building's north-western corner and the load-bearing wall of the northern façade show traces of possible sinking.

The reinforce concrete frame hall structures were probably built with isolated foundations (cup foundations) belonging to this type of prefabricated structural system, so in this case damage due to inadequate foundations was not visible.

2.2.2. Vertical structures

The hall structure is supported by reinforce concrete columns having a 45 cm x 90 cm cross section, between which 45 cm thick limestone-brick masonry infill walls were used. However, during the inspection of the building small-sized ceramic brick masonry was found and the thickness and homogeneity of the walls differs from the one figured on the plans in some cases.

We can find a structural wall-based supplementary construction on the north of the theatre hall, in which the “behind-the-scenes” dressing rooms of the theatre are found.

2.2.3. Horizontal structures

In the case of the frame structure, pre-stressed reinforced concrete beams with a span of 12m bear the weight of the prefabricated thin-panel roof structure. The roofing system of the lobby area is probably realised using monolithic reinforced concrete, which has to be verified during further intervention. The current static condition of the roofing system must be examined before any new element that generate additional loads (like the layer of soil needed for green roofs or new mechanically loaded gravelled roofing system), as the corrosion of the reinforced concrete elements may have been started due to the leaks of the inadequate roof water isolation and gutter system, and this may have resulted in the decreasing of the load-bearing capacity.

2.3. Building thermal envelope

2.3.1. Structures in contact with the soil

The floor of the lobby is made of gravel concrete with natural stone decorative insertions. The floor presents a serious horizontal dilatation crack, which may have been caused by the different thermal loading of the floor or even by the sinking of the building’s northern side.

The floor of this part of the building is located 10 cm-s below the level of the floor in the hall structures, accessibility being solved using ramps. At the edges of the building, near the reinforced concrete columns the joints of these columns with the flooring presented signs of wetting, which suggests inadequate waterproofing. Montage of waterproofing and thermal insulation on the existing flooring system is recommended, which may also help in the elimination of the level difference. Before any intervention we have to verify the current state of the floor structure with destructive methods, in order to find out more about the layers present there and to investigate the source of the longitudinal crack found on the floor.

7. figure: Floor of the entrance hall

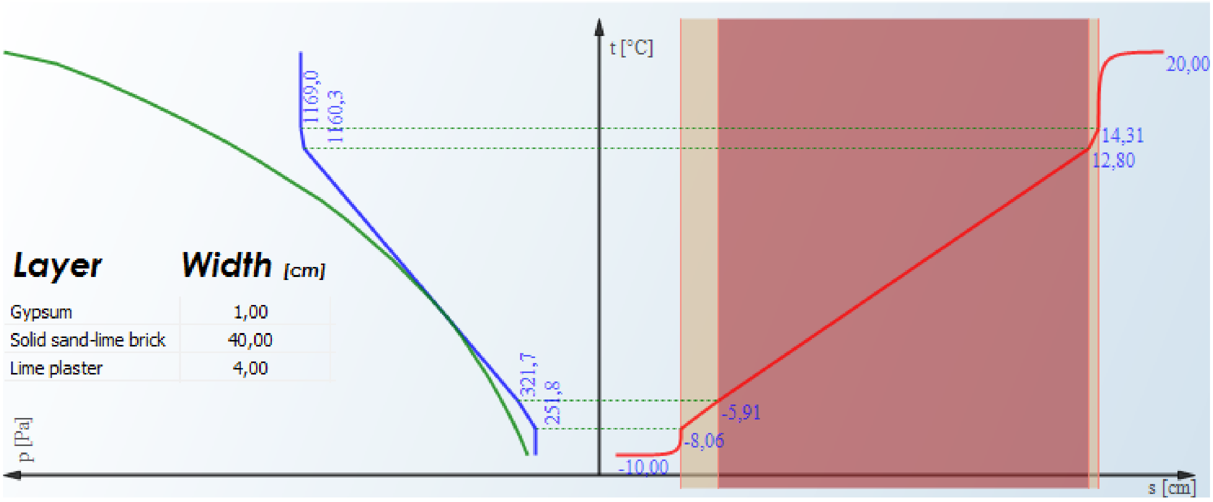
In the gym area of the building we can find a shabby plank flooring with planks being displaced with respect to each other, making the use of the hall potentially dangerous. At least renovation and repairing of the flooring is necessary to assure safe operation, but the complete change of this flooring is highly recommended.

The service areas have tiled floors, the glazed ceramic tiles are highly degraded, their surface and the fugues are dirty.

It can be said about all the flooring systems in contact with the soil that the issue of accessibility must be solved, the differences in level must be eliminated and the possible change of the coverings must be considered.

2.3.2. Boundary wall structures

In the case of the building, the external division walls have the role of simple infill, they do not have any structural role. Accordingly, the wall structures have been made in a diversified manner – which we verified on site – the material and structure of the walls can be seen at the various plastering defects. Most of the masonry was done using carved limestone or lime-sand bricks, while small-sized ceramic bricks also being present in the walls' composition. The existing walls are highly unfavourable from thermo-technical point of view, as in the heating season the walls' internal temperature is very low compared to the internal air temperature, which significantly reduces the comfort factor of the building. The mean thermal transfer coefficient of the external walls is 1.4 W/m^2K, which must be reduced in the case of renovation by applying thermal insulation on the outer side of these walls.



8. figure: Vapour and thermal simulation for existing walls

Most of the external surfaces is paved with yellow ceramic tiles, while in the areas with missing paving mortar filling was used. The walls of the two halls are finished with coloured rough stone powder lime plastering.

The surfaces on the interior are covered with gypsum sheets or finished using gypsum plastering or painted to colour. Surface cracks on the interior side are present at least on the northern part of the building, where also traces of roofing leakage can be found. Non-destructive wall humidity tests indicate that the wall structure did not dry out, so in the case of the renovation of this wall (the dressing rooms near the theatre hall) it must be dried out properly.

The plinth wall on the western façade is covered with granite tiles. These tiles and the fugue needs to be cleaned. In the case of applying thermal insulation on the building these granite sheets may be used in the interior after being polished.

2.3.3. Doors and windows

The entrance of the youth centre is a two-winged door with one glazed wing with a metallic frame and another similar metallic frame wing having a sheet of metal in the place of the glazing. The joints of the door are inexact, from thermo-technical point of view neither the material nor the execution quality are satisfactory.

The western façade incorporates a 92 m^2 – area glazed wall which has a determinative role in the collection of the solar gains. The framing used for this element is made of metal and is painted in black. The black paintwork amplifies the deformations of the already heat sensitive metallic frame, as the dark surface tends to heat up more due to sunshine. The glazing of these windows is one-layer only.

9. figure: Main entrance

Moreover, large windows can also be found on the southern side of the building, these windows having an important role in the natural lighting of the gym, while the direct radiation gains getting through the glass reduce the energy needed for heating in the transition period. Again, the problem consists in the technic and qualitative state of these windows. The paintwork of the wooden frame holding the one-layer glazing has peeled off, while the joints are also defective.

On the eastern side two metallic doors are present, belonging to the theatre hall. At the negative corner that is formed by the meeting point of the eastern and northern another external metallic door can be found. The other, smaller windows that can be found on the building also have wooden frames and monolayer glazing.

On the northern side of the building three window-openings can be found, but in the case of two of these the windows are covered with gypsum sheets on the exterior side. As such, natural diffuse light does not enter the dressing rooms that are provided with this solution. Another filled window opening can be found in one of the first floor rooms that is oriented to the east. In this case the opening was filled with small-sized solid bricks. The interior doors are also made of timber, the sills are quite high in all of the cases. Some of the rooms of the buildings have accessibility issues.

10. figure:Windows with steel or wood frames

All summed up, we can state that the current location of the windows satisfies the requirements of a green community centre, while the replacement of the existing components is essential not only for energy-efficiency reasons, but also to ensure fundamental operation conditions.

2.3.4. Flat roof

The building has a flat roof. The roof is covered with a bituminous waterproofing, which was applied in one layer with overlapping on the roof. There is no thermal or other type of insulation under the waterproofing layer, the bituminous sheets being applied directly onto the slab.

The bituminous sheets show signs of aging, the execution is of low quality, the joints are inaccurate. In many places the sheets have detached from the surface. The joints of the bituminous sheets at the attic is amateurishly executed, the metallic sheets were positioned over the bituminous sheets and the fastenings penetrate through both the metallic and the bituminous sheet. In some places the waterproofing sheets are fixed on the vertical walls only with bituminous glue, the execution of the corners is of sub-standard quality. The drainage system is inadequate, the slope of the roof being in many cases unsatisfactory. The waterproofing of the buildings parts having different height is not linked.

11. figure: Image compilation about the condition of the roof

The attic, and subsequently the drainage is missing in many places around the perimeter of the roof. The absence of the attic is inadequate for safety reasons also. The interior-side surface of the attics is in most of the cases plastered, the application of the waterproofing onto this surface has only been done on the lobby building section, but even here the waterproofing has only been fixed to the surface. Because of this the bituminous sheet has detached from the surface. The metallic sheet coating of the attics is deficient, even where this is present, the fastenings are inadequate, as penetrative fixing was used, which also induces leakage.

12. figure: Corroded drainage opening

The gutter system is also inadequate. Because of this the slabs are severely damaged in the areas neighbouring drainage elements. The areas of the slabs in the vicinity of these elements need to be repaired, as the reinforcements of the RC elements are severely corroded, while the concrete cover is missing.

Thermal insulation, the replacement of the waterproofing and the realization of proper roof slopes is of fundamental importance in case of the building.

2.4. Interior non-structural walls

The most of the non-structural interior walls are made of gypsum sheets mounted on wooden frames. However, we can also find small-brick masonry interior walls on the ground floor. In many places the interior separation walls are cracked, which can be the result of improper joining with the load-bearing elements.

In order to assure proper utilization conditions most of the interior walls must be replaced. During this process the layout of the rooms can also be changed. This is mainly required in the case of the sanitary areas, which are of improper arranging and of narrow design.

3. Building services

3.1. District heating and heat emitters

The heating of the building is provided by the town's district heating. Inside the town the heating pipes run between the buildings and have only minimal thermal insulation. The pipes, running above ground, are subjected to the effects of the weather and subsequently lack thermal insulation or it is in an awful state. These pipes form an interconnected network in the town. Hot water enters the building on the north-east. There are no heat exchangers on the pipes entering the building. At the entrance point measuring devices have been installed in order to be able to measure the consumptions.

Inside the building, the internal piping runs in the heated space. In fact, in many places the heating of the rooms is done not using radiators, but by the distribution pipes only. The piping runs freely even in the areas not meant to be heated, there is no thermal insulation the pipes in these spaces. Many of the pipes are corroded and in bad condition. In some of the places the pipes represent obstacles in the rooms and reduce the free cross-section of the corridors.

In the spaces intended to be heated cast iron radiators can be found. In the lobby area, the radiators are located near the parapet walls of the façade, in order to be able to dry the moisture that condensates on the large glazing surface. We have found no adjustment valves on the radiators.

13. figure: District heating pipes in the mechanical room

3.2. Ventillation

The ventilation of the theatre hall is assured by an open ventilation duct. This runs directly from the western to the eastern façade on the first floor and has internal openings at the theatre hall, where fresh air can enter the space. The ventilation system seemed neglected, the duct was dirty and showed signs of lacking maintenance. On the western façade the duct is separated from the outside environment by a metallic net, protection against rainfall or snow is not solved. On the eastern side a metal cover box was installed. The vents cannot be closed. In the case of the open ending on the western side, the watering of the neighbouring areas is probably caused by the vent's lack of covering.

If we decide to keep the original ventilation concept, the condition of these openings has to be improved, they have to be modified. The openings have to be provided with a fan and a closable latch, improving thus the efficiency and reducing the losses when there is no need for ventilation. Due to the current design the heat losses caused by the ventilation cannot be limited.

14. figure: Ventillation openings

3.3. Domestic water

The required hot water for use in the building is provided by the local district heating service. There are currently two sanitary areas in the youth centre. One of these is located in the vicinity of the dressing rooms near the gym, while the other one can be located in the building part linking the gym and theatre halls. The current condition of these sanitary areas does not comply to present basic hygienic requirements, a fact that is also true for the water distribution system. The reconstruction of the sanitary areas in the case of a renovation is inevitable.

3.4. Sewage

There is a public sewage system in the town and the building is connected to this system. The connection to the sewage network can be found on the western side of the building. At the moment all drains are connected to the sewage system, the utilization of grey water is not solved. The rainwater-collecting piping is not connected to the sewage system, as this issue was neglected.

3.5. Electrical system

The building is connected to the power grid via an air cable at its north-eastern corner and there is an electric transformer building immediately near the youth centre. The room containing the electric distribution system is located in the building section between the theatre hall and the gym, in the proximity of the sanitary area and the stairs. The electric switch cabinet is old and in very bad condition, the fuses and the state of the electric system is also inadequate. The electric plug sockets lack grounding, the electric wires in the building are old. The replacement of the electric network located in the building is requred.

15. figure: Electric equipments and fuse box

3.6. Lighting

In most of the places internal artificial lighting is realised using neon tubes, while conventional incandescent bulbs are also present. In the lobby area the lamps are built into the ceiling. Traditional light bulbs can be found in the dressing rooms and other smaller spaces. The lights can be operated using conventional wall switches. During the renovation of the building's electric network the replacement of some of the lamps may be required as the position of these is not optimal in many cases.

4. Other components of the building

4.1. Rainwater drainage

The draining of the rainwater accumulated on the roof is not solved at the moment. The collected rainwater may leave the roof at the absent attics and the corroded sinkers, as there is no gutter. Based on the leafs and other residues that can be found on the roof we can affirm that the rainwater cannot be evacuated correspondingly from some areas of the roof. The water flowing down from the roof wets the concrete sidewalk near the building. The sidewalk has no slope, the drainage of the water was not taken care of. Moss, peeling of the plastering and wetting present on the plinth are a sign of this. The draining of the rainwater must be solved, the sidewalk needs to be repaired.

4.2. Fire safety system

There is no fire safety system present in the building at the moment. No smoke detectors, no automated extinguishing system, and not even a manual dry powder fire extinguisher was seen in the building. Fire safety is one of the most important subjects in the safety of community centres, as the building may be used by many hundred people simultaneously, which induces that an automated fire extinguisher system must be installed in the case of a renovation. The fire detection system must be built together with the electric system, the fireproofing of the electrical wiring for the needed amount of time and the marking of the evacuation routes must be assured.

4.3. Lightning protection system

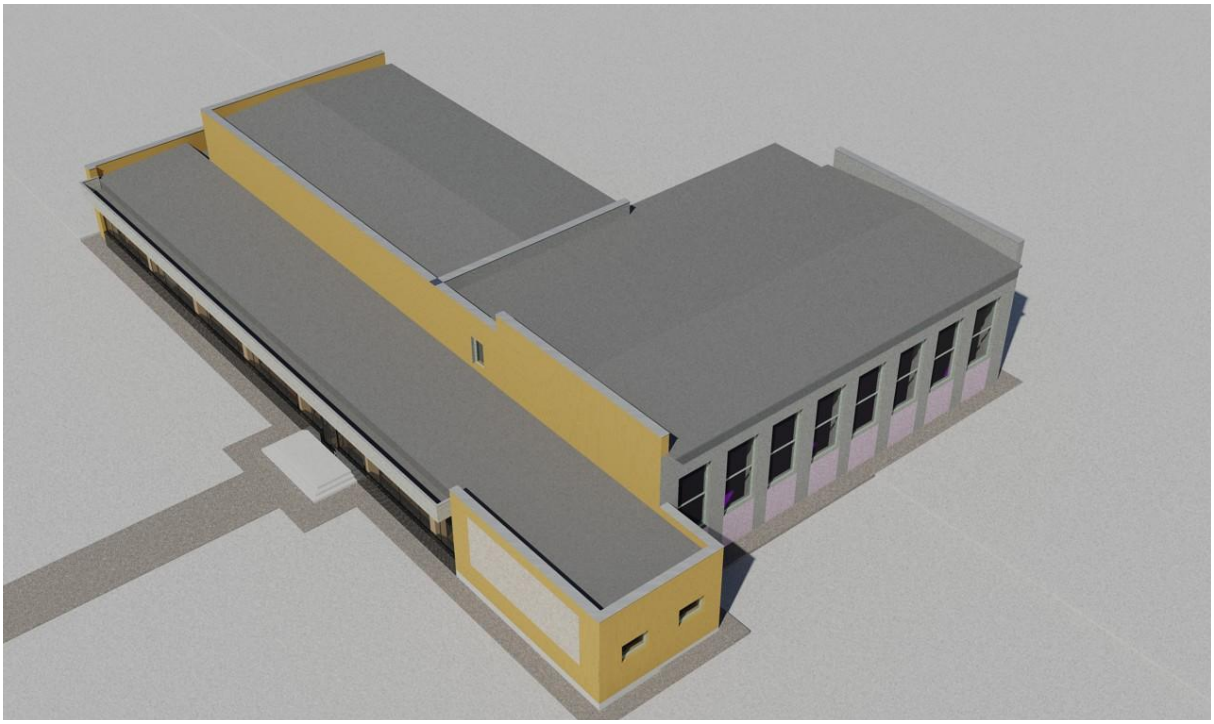
The building's protection against lightning is not assured. We have found traces of a lightning rod at the building's north-west corner but this was probably corroded and was subsequently dismounted. Replacement for this has not been provided.

4.4. Adjacent environment

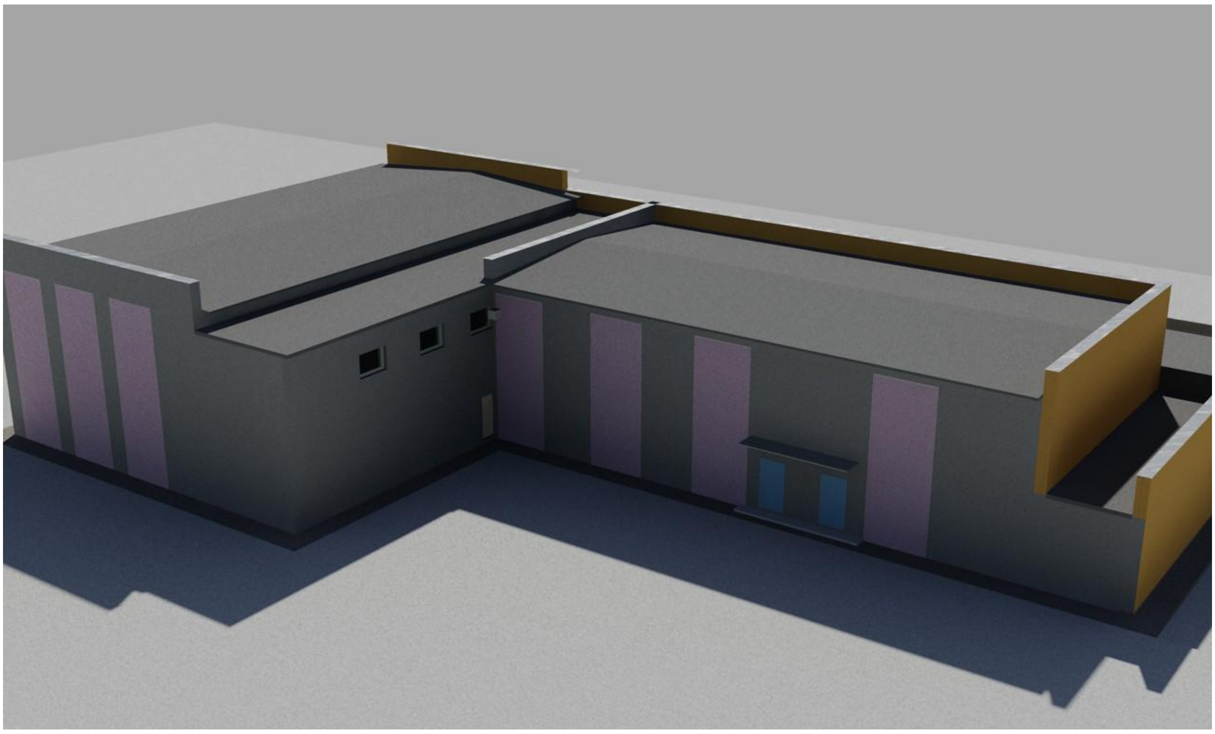
The environment of the building consists mainly of concrete-paved areas. A higgledy-piggledy garden area can be found near the main entrance. On the southeast corner of the site, at the part that borders the plot, the area required for the community centre was established using a reinforced concrete buttress, placing the building in a cut. Behind the building, at this corner, there is possibility for the arrangement of a small garden or a little playground, which would surely be used by the neighbouring nursing school and would enhance the concept of community centre. Landscaping around the building is necessary to assure a favourable image.

5. 3D model of the building

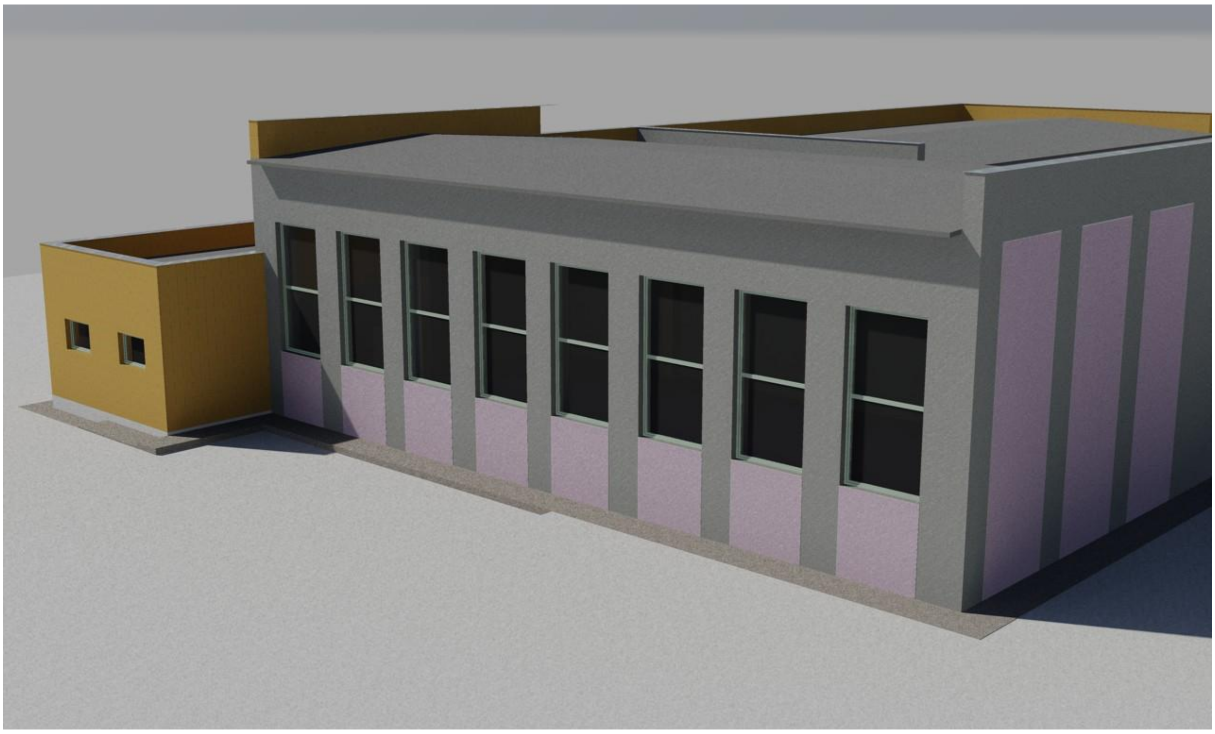
17. figure: 3D model of the existing youth centre, main entrance



16. figure: 3D model of the existing youth centre, flat roof



18. figure: 3D model of the existing youth centre from east



19. figure: 3D model of the existing youth centre from south

The building's interior was modeled only whit structural elements without any existing equipments, furniture or installed pipes. The following dynamic building energy simulations was made using these 3D models and added and simulated building services and electricity.

6. The building's energy consumption

6.1. Public service prices in Rîbnița

Local authorities provided us with the current utility prices in Rîbnița. The different types of utilities and their unit prices in local currency and converted to Euro are synthetized in the following table:

No.	Services	Unit	RUB TMR	Euro
1.	Thermal energy	10^6 Kcal	520,20	35,46
2.	Electricity	1 kWh	0,51	0,03
3.	Water consumption	1 m^3	3,70	0,25
4.	Sewage	1 m^3	3,48	0,24
5.	Gas	1 m^3	1,79	0,12
6.	Internet	monthly	168,00	11,45

3. table: Prices for public services from 2013

6.2. The existing building's energy consumption and costs in 2012

The overall electricity, thermal energy, sewage and water consumption of the existing building for the year 2012 are as follows:

No.	Services	Unit	Consump-tion	Price 2012 RUB TMR	Price 2013 RUB TMR	Unit changes %	Price 2013 Euro
1.	Thermal energy	10^6 Kcal	215,78	93153,00	112248,76	20,50	7651,59
2.	Electricity	1 kWh	5916	2840,00	3017,16	6,24	205,67
3.	Water consumption	1 m^3	120	300,00	444,00	48,00	30,27
4.	Sewage	1 m^3	120	445,00	417,60	-6,16	28,47

4. table: Consumption patterns in 2012

The quantities enumerated above were recalculated with the prices provided by the local authorities for 2013, in order to be able to estimate the actual situation more precisely. The difference for some of the services are quite remarkable, public running water price, for example, was raised by 48%. The total cost of maintaining the building in 2013 according to the mentioned salaries in the IV.1.4. is €19.616 per year.

However, it is important to analyse these consumptions and deduce the conclusions. The thermal energy consumption reported to the gross area (1092.2 m2) was 229.8097 kWh/m^2/year based on the bills paid in 2012. The largest part of the building's utility costs was the heating. We will detail the subject of required annual thermal energy at a later point.

The other annual utility costs are nearly negligible with respect to the cost of the heating. The annual electricity cost of €205.67 can be explained with the currently very low electricity prices.

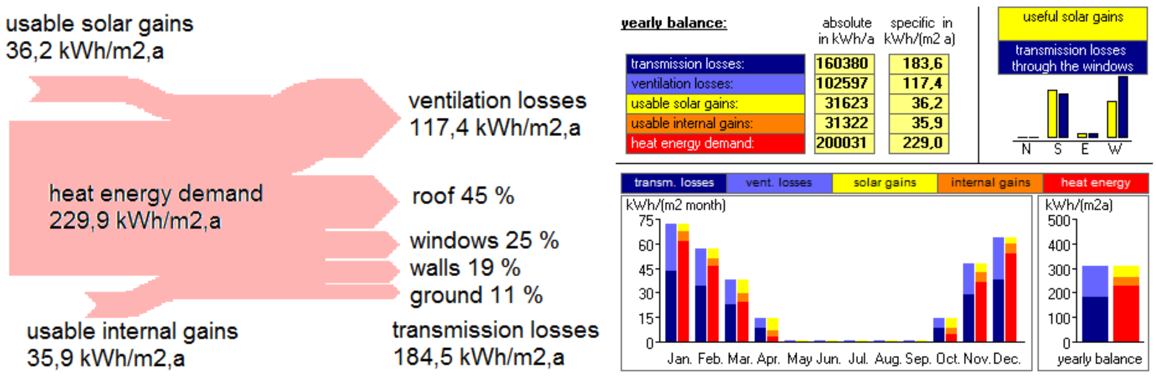
At the same time, the water and sewage costs are small due to the low level of consumption. Due to the hygienic condition of the building, even having two sanitary areas per dressing room and other two separate sanitary areas, these fall into disuse both by the visitors of the theatre hall and by the daily guests who come here for sporting activities.

During the renovation process the degree of comfort of the building needs to be raised, the basic hygienic conditions need to be created. Based on this, the growth of the water and electricity demand is expected.

6.3. Simulated energy consumption of the existing building

During the simulation, the thermal energy losses of the structural elements are given and, by knowing the building materials, the thermal transfer coefficients of the respective structural elements can easily be estimated. The value of the solar gains collected using the transparent structural components can also be approximated well. However we've based the approximation on the mean temperature and solar energy gains of the past 30 years and, as such, there can be differences in the annual values. The value of the internal thermal energy gains was taken into account with the value of 7 W/m^2 given in the Hungarian 7/2006. TNM Decree. The simulation process was done by iteration: based on the 2012 energy consumptions the building's other utilization parameters have been defined. Such parameters are the mean air exchange rate needed for the determination of the losses due to ventilation in the heating season or the value of the imposed internal temperature. The larger the value of the air exchange rate, the larger the losses due to ventilation are. A similar relation can be observed in the case of the imposed internal temperature: by raising the internal temperature with 1 degree Celsius we raise the costs of the building's heating by 13 %.

The results of the dynamic building simulation were summed up on the 16th figure. It can be seen that amongst the transmission heat losses the most significant heat quantity is the one escaping through the roof, so heat insulation of the roof is of high priority. However, the heat losses due to ventilation have nearly the same importance as the heat losses through transmission. Airtightness of the building must be increased. In addition, it can be seen that the building's solar gains through the southern windows exceed the thermal losses even with the current low thermo-technical quality windows. Although the solar gains will lightly decrease in the case of replacing the windows (the radiation transmittance of the multi-layer glazing windows is somewhat smallee), the significant reduction of transmission and ventilation heat losses is expected. An increase in the internal gains caused by the expanded functions and the increasing the internal comfort level is also expected.



20. figure: Simulated energy flow diagram for heating

Although not represented on the figure, it is important to mention that according to the simulations, in the case of the existing building, when setting the parameters required for operation corresponding to the European regulations, double of the amount of thermal energy needed for heating paid in the last year resulted as energy demand. However, the local facility management stated that in the case of cold winter days they are incapable of properly heating the building and they even shut down and close the youth centre in case of cold weather. The overall heating of the building is not constant, the heating in the unused areas is adjusted. The required interior temperature of 20 °C needed in the case of II. comfort level was, because of this, reduced to the 16 °C required for human presence. However, even in this case, the required amount of thermal energy was higher than the bills paid. We were only able to reproduce the desired 229.8 kWh/m^2 value for the annual thermal energy demand through dynamic simulation only if we used a 0.6 value for the ventilation air exchange rate, which is absolutely improbable in the case of this building.

However, in the case that we raise the mean air exchange ratio to the value of 1.5 1/h, which is induced by the building's present condition, the desired value of the thermal energy demand can be reached in case of 13.3 degrees Celsius internal temperature. This extremely small value indicates that the building is only tempered during the heating season, while heating in the unused areas is really shut down.

The eco-friendly raising of the level of comfort and environmentally aware and green expansion of the current function are top priorities in the case of a reconstruction.

7. Evaluation of the existing building; recommendations

As a summary of this chapter, it can be said that the building will be able to host the community centre function, which is our goal, in the case that it undergoes an intervention intended to raise the level of comfort and energy efficiency.

The reconstruction has to include the whole building, the thermal insulation of the external envelope (roofing system, walls) and the replacement of windows and doors being inevitable. Waterproofing of the roof and plinth wall is also required during the reconstruction.

The modification of the interior space may also be required, as the sanitary areas need to be modified due to the hygienic requirements, while the other existing areas due to the expanded functions. The renovation of the gym is required and desired, while achieving the complete accessibility of the lobby area and the corridors is also a basic need. The installing of a hydraulic lift may supply the method of reaching the 1^{st} floor for the disabled.

Replacement of the electric system is also required, this also being linked to the implementation of a fire detection system. Although the current electric energy consumption is not significant compared to the heat demand, the placement of solar cells on the southern roof of the building is recommended. Due to the quality of the local network, this should be done in an isolated system, as feeding back solar electrical energy to the town's public grid is currently impossible. The local authorities do not permit the disconnecting from the town's local district heating system, so the heating and the hot water will be provided by the central system, while replacement of the radiators and repairs of the piping is recommended. Another energy-efficiency-increasing measure may consist of the implementation of heat-recovery ventilation in some areas of the building, which further diminishes the heating demand. The revision of the presently active ventilation system is required, discontinuing the always-open ventilation and establishing of a controllable system is inevitable.

The building's current water consumption is very low, but, after the investment, due to the expected growth in the number of visitors and the increase in demand caused by the raising of the comfort level, the local utilization of grey water and the collection and utilization of the rainwater collected on the woof should be considered, as it would have a precedent-value.

Drainage of rainwater and in the building's vicinity and the issue regarding the lighting protection of the youth centre must be solved. After the reconstruction work, landscaping in the building's close environment is needed and establishing bike parking racks is recommended.

V. Presentation of the investments

1. Conception of the investment variations

The investment elements containing the repairs needed for the improvement of the building's condition presented in the previous chapter and as a consequence of the required increasing in the building's comfort factor and hygienic situation. The particular investment elements are presented in groups. We've created more options for specific works while providing the differences between them and their contents, including each one's basic components. Using the different options, we've created three different cost estimations. From among these three, in the first case (marked as option A) we've focused on the building's functioning and utility, and the reduction of its energy consumption while the comfort conditions are increasing. In the second option (marked B) utilization of environmentally friendly building materials was considered, including the elements for improving the comfort and functioning conditions and the increased reduction of energy consumption. The third cost estimation compilation (marked C) a modern, representative and premium quality, exceedingly energy-saving and environmentally friendly green building was considered.

We've evaluated each investment option composing the cost evaluations using our green investment comparison system. We've categorized the results using three main viewpoints, which were: 1. environmentally friendly (construction) technology and the use of green building materials, 2. The potential amount of energy-saving of the building in the case of the investment element and the energy efficiency of these, 3. The increase in the building's comfort factor and utilization from the potential users' point of view. The categorization was summarized in text and represented on a five-level scale. Classification levels in increasing order: no, slight, moderate, significant and high. The categorization follows the general description of each investment element.

The cost estimation of each article and their estimated unit price are both shown. In each case, the prices were defined taking local conditions, local building materials, workforce and technological development into account. The prices are valid for the works described on the respective articles. However, due to the absence of detailed surveying and planning, the prices are only estimates which may slightly vary in the detailed planning phase because of eventual unforeseen conditions, components requiring special design or local particularities.

2. Investment elements

2.1. Structure erection, demolition

Due to the low level of salaries, the cost of each building or demolition process will be included in the overall costs of the respective activities. The professional realization and the required operations (i.e. removal of existing, damaged plastering before complementary thermal insulation, cleaning of the acceptable-state plastering, etc.) in the case of each investment unit goes without saying. The eco-friendly disposal or on-site recycling of the demolition debris needs to be taken care of.

2.2. Building Construction

2.2.1. Flat roof insulation and waterproofing

a, White UV-resistant environmentally friendly soft-PVC roof waterproofing with 20 cm of EPS thermal insulation

Straight layers. Perforation of existing bituminous boards with the placement of 2x10 cm expanded polystyrene foam, with offsets and slope shaping, with geotextile separation layers. UV resistant, white coloured PVC waterproofing with at least 1.5 mm mesh-reinforced PVC sheet, with 10 kg/m^2 loading by pavement tiles in spots. Vertical waterproofing, closing and edge-shaping of the attics. Edging of the superstructures, placing drip profiles, sinkers, piping, roof drain pans, and gutter.

Eco tech & materials usage:	*moderate*	Estimated average cost per unit:
Energy savings & efficiency:	*high*	50 €/m^2
Comfort & usability increase:	*significant*	

b & c, White UV-resistant environmentally friendly soft-PVC roof waterproofing with 20 cm of mineral wool thermal insulation

Straight layers. Perforation of existing bituminous boards with the placement of 2x10 cm mineral wool, with offsets and slope shaping, with geotextile separation layers. UV resistant, white coloured PVC waterproofing with at least 1.5 mm mesh-reinforced PVC sheet, with 10 kg/m^2 loading by pavement tiles in spots. Vertical waterproofing, closing and edge-shaping of the attics. Edging of the superstructures, placing drip profiles, sinkers, piping, roof drain pans, and gutter.

Eco tech & materials usage:	*moderate*	Estimated average cost per unit:
Energy savings & efficiency:	*high*	70 €/m^2
Comfort & usability increase:	*significant*	

b & c, Extensive green roof, UV-resistant environmentally friendly soft-PVC roof waterproofing with 20 cm of mineral wool thermal insulation

Straight layers. Perforation of existing bituminous boards with the placement of 2x10 cm mineral wool, with offsets and slope shaping, with geotextile separation layers. UV resistant, white coloured PVC waterproofing with at least 1.5 mm mesh-reinforced PVC sheet, with 10 kg/m^2 loading by pavement tiles in spots. With filtration and draining layer, water retention layer, extensive green roof, 30-50 kg/m^2 fertile soil and gravelled bands near the attics. Vertical waterproofing, closing and edge-shaping of the attics. Edging of the superstructures, placing drip profiles, sinkers, piping, roof drain pans, and gutter.

Eco tech & materials usage:	*high*	Estimated average cost per unit:
Energy savings & efficiency:	*high*	100 €/m^2
Comfort & usability increase:	*high*	

2.2.2. Subsequent exterior wall insulation

a, 14 cm EPS thermal insulation with thin layer plastering

Subsequent thermal insulation in Dryvit system, with 14 cm EPS 80 façade thermal insulation, with glued fixing and mechanical fastenings and glass-fabric-reinforced thin-layer plastering.

Eco tech & materials usage:	*slight*	Estimated average cost per unit:
Energy savings & efficiency:	*significant*	28 €/m^2
Comfort & usability increase:	*significant*	

b & c, 20 cm mineral wool insulation with thin-layer plastering

Subsequent thermal insulation in Dryvit system, with 20 cm of plasterable mineral wool thermal insulation, with glued fixing and mechanical fastenings and glass-fabric-reinforced thin-layer plastering.

Eco tech & materials usage:	*significant*	Estimated average cost per unit:
Energy savings & efficiency:	*high*	47 €/m^2
Comfort & usability increase:	*high*	

c, 20 cm mineral wool insulation with prefabricated fiber cement façade cover

Montage of ventilated eco-friendly fiber cement façade cover system with aluminium supports, 20 cm of black fleece-laminated mineral wool thermal insulation having mechanical fastenings.

Eco tech & materials usage:	*high*	Estimated average cost per unit:
Energy savings & efficiency:	*high*	86 €/m^2
Comfort & usability increase:	*high*	

2.2.3. Footing insulation and drainage

a, 14 cm XPS thermal insulation with footing plastering

Thermal insulation and waterproofing of the footing, solving the rainwater drainage. 14 cm closed-cell XPS thermal insulation with adhesive mortar fixing, filter and drainage layers and special footing plastering. Footing design are half meters above and depth 1 meters bellow the surface.

Eco tech & materials usage:	*slightly*	Estimated average cost per unit:
Energy savings & efficiency:	*significant*	42 €/m
Comfort & usability increase:	*significant*	

b és c, 20 cm XPS thermal insulation with footing plastering

Thermal insulation and waterproofing of the footing, solving the rainwater drainage. 20 cm closed-cell XPS thermal insulation with adhesive mortar fixing, filter and drainage layers and special footing plastering. Footing design are half meters above and depth 1 meters bellow the surface.

Eco tech & materials usage:	*slightly*	Estimated average cost per unit:
Energy savings & efficiency:	*high*	54 €/m

Comfort & usability increase:	*significant*	

2.2.4. Windows

a, Double-layer thermal-insulating glazing, usual PVC frame

Window replacement, double-layer argon filled Low-e film thermally insulating glazing, openable windows with 3-chamber plastic frame, having a 75 % average glazing ratio (U_w=1,4 W/m^2K). Using airtight montage, with accessories, ledge connector, defective operation blocker and interior & exterior ledges.

Eco tech & materials usage:	*moderate*	Estimated average cost per unit:
Energy savings & efficiency:	*significant*	95 €/m^2
Comfort & usability increase:	*significant*	

b, Double-layer thermal-insulating glazing, high quality PVC frame

Window replacement, double-layer argon filled Low-e film thermally insulating glazing, openable windows with 5-chamber plastic frame, having a 75 % average glazing ratio (U_w=1,0 W/m^2K). Using airtight montage, with accessories, ledge connector, defective operation blocker and interior & exterior ledges.

Eco tech & materials usage:	*moderate*	Estimated average cost per unit:
Energy savings & efficiency:	*significant*	115 €/m^2
Comfort & usability increase:	*significant*	

c, Triple-layer thermal-insulating glazing, high quality timber + aluminium thermal-insulated frame

Window replacement, triple-layer argon filled Low-e film thermally insulating glazing, openable windows with timber/aluminium frame, having a 75 % average glazing ratio (U_w=0,7 W/m^2K). Using airtight montage, with accessories, ledge connector, defective operation blocker and interior & exterior ledges.

Eco tech & materials usage:	*significant*	Estimated average cost per unit:
Energy savings & efficiency:	*high*	160 €/m^2
Comfort & usability increase:	*high*	

2.2.5. Glazed facade

b, Glass wall with aluminium framing

Large-size argon-filled thermal-insulating glass panels with low-e film on the southern side, with thermal-insulated aluminium framing and bracing system, with aluminium profiles.

Eco tech & materials usage:	*moderate*	Estimated average cost per unit:
Energy savings & efficiency:	*high*	180 €/m^2
Comfort & usability increase:	*significant*	

c, Spider glass wall

Large-size argon-filled thermal-insulating glass panels with low-e film on the southern side, having aluminium point-fixing devices, being fixed to the existing columns, with aluminium profiles.

Eco tech & materials usage:	*significant*	Estimated average cost per unit:
Energy savings & efficiency:	*high*	270 €/m^2
Comfort & usability increase:	*high*	

2.2.6. Exterior doors

a, Thermal-insulated glazed entrance door, thermal-insulated back doors

Main entrance portal door having double-layer thermal-insulating glazing, with accessories, the backside doors being metallic doors with safety locks.

Eco tech & materials usage:	*slightly*	Estimated average cost:
Energy savings & efficiency:	*moderate*	1200 €
Comfort & usability increase:	*moderate*	

b, Entrance door with photocells, thermal-insulated back doors

Main entrance portal door with automatic photocell-controlled opening, with accessories, the backside doors being metallic doors with safety locks.

Eco tech & materials usage:	*moderate*	Estimated average cost:
Energy savings & efficiency:	*significant*	3500 €
Comfort & usability increase:	*moderate*	

c, Entrance door with photocells and air curtain, thermal-insulated back doors

Main entrance portal door with automatic photocell-controlled opening and an air curtain device, with accessories, the backside doors being metallic doors with safety locks.

Eco tech & materials usage:	*significant*	Estimated average cost:
Energy savings & efficiency:	*high*	6000 €
Comfort & usability increase:	*High*	

2.2.7. Additional structures

a, b & c, Passive shadowing system on the western side

Cantilever-based shadowing system with length designed according to the sun's path over the west-side windows for the prevention of summer-time insolation.

Eco tech & materials usage:	*high*	Estimated average cost:
Energy savings & efficiency:	*high*	2500 €
Comfort & usability increase:	*High*	

a, b & c, Entrance steps for use with ramp for the disabled

Reinforced concrete stairs mounted with adequate foundation and waterproofing, with an access ramp on one side, with exterior non-slip pavement and handrail.

Eco tech & materials usage:	*high*	Estimated average cost:
Energy savings & efficiency:	*no*	800 €
Comfort & usability increase:	*High*	

a & b, Green vegetation on the façade wall

Ivy grown on a metallic mesh mounted on the western wall. Aesthetical intervention, creation of a green area near the entrance.

Eco tech & materials usage:	*no*	Estimated average cost:
Energy savings & efficiency:	*no*	500 €
Comfort & usability increase:	*No*	

2.3. Interior architectural elements

2.3.1. Suspended ceilings

a & b, Ceiling grid with gypsum tiles

Load-bearing structure made of galvanized steel profiles with fastenings, with smooth-edged ceiling tiles, positioned in a grid, using locally available gypsum boards, in waterproof version in the case of sanitary areas, with assured side wall joints, with insertion points for built-in energy-saving lamps.

Eco tech & materials usage:	*moderate*	Estimated average cost per unit:
Energy savings & efficiency:	*slightly*	24 €/m²
Comfort & usability increase:	*Significant*	

c, Premium continuous-surface dropped ceiling

Load-bearing structure made of galvanized steel profiles with fastenings, with smooth-edged ceiling tiles having a smooth continuous surface, using locally available gypsum boards, in waterproof version in the case of sanitary areas, with assured side wall joints, with insertion points for built-in energy-saving lamps.

Eco tech & materials usage:	*moderate*	Estimated average cost per unit:
Energy savings & efficiency:	*slightly*	63 €/m²
Comfort & usability increase:	*Significant*	

2.3.2. Mounted division dry walls

Support frame with 62.5 cm profile axis distance, with anchored fastenings, 100 mm wall thickness, two-side two-layer 12.5 mm thick fireproof gypsum board coating (with waterproof boards in the case of sanitary areas), 12.5 mm thick gypsum boards, 5 cm thick mineral wool thermal insulation, grouting, wall joints, with temporary secondary structures, and building service components in case of sanitary areas.

Eco tech & materials usage:	*moderate*	Estimated average cost per unit:
Energy savings & efficiency:	*slightly*	29 €/m²
Comfort & usability increase:	*Significant*	

2.3.3. Cold floor coverings

a & b, Glossy gres tile flooring

Granite powdered glossy gres tiles in bedding mortar, with self-levelling equalizer layer, including adhesive and grouting. After polishing, the granite coating of the footing on the main façade to be used on the walls of the sanitary areas.

Eco tech & materials usage:	*significant*	Estimated average cost per unit:
Energy savings & efficiency:	*no*	32 €/m^2
Comfort & usability increase:	*significant*	

c, Polished gres tile flooring

Large-size polished granite powdered gres tile flooring in bedding mortar, with self-levelling equalizer layer, including adhesive and grouting. After polishing the granite coating of the footing on the main façade to be used on the walls of the sanitary areas

Eco tech & materials usage:	*significant*	Estimated average cost per unit:
Energy savings & efficiency:	*no*	56 €/m^2
Comfort & usability increase:	*high*	

2.3.4. Warm floor coverings

a, b & c, Natural floor carpets

Floor carpet made of natural material, with a supporting layer of felt, cut to size from rolls, fixed.

Eco tech & materials usage:	*high*	Estimated average cost per unit:
Energy savings & efficiency:	*slightly*	24 €/m^2
Comfort & usability increase:	*high*	

2.3.5. Sports flooring

a, Repairing the existing parquet

Reconstruction of the gym's existing parquet flooring. Polishing, repairs, lacquer painting, grouting, edges.

Eco tech & materials usage:	*significant*	Estimated average cost per unit:
Energy savings & efficiency:	*no*	12 €/m^2
Comfort & usability increase:	*moderate*	

b & c, Building a sporting floor

Triple-layer prefabricated parquet (5.1mm lumber + 9 layer extra wear-proof sport lacquer), with energy-absorbing substrate system (strand-board cushion, three-layer closed cell foam, for surface flexibility and prospective building), having vapour protection and oak surface, edging.

Eco tech & materials usage:	*moderate*	Estimated average cost per unit:
Energy savings & efficiency:	*slightly*	74 €/m^2
Comfort & usability increase:	*high*	

2.3.6. Lobby flooring

a, Glossy gres tile flooring

Granite powdered glossy gres tiles in bedding mortar, with self-levelling equalizer layer, including adhesive and grouting. Including separation layer, vapour barrier, using 5 cm EPS boards to overcome the floor's height difference.

Eco tech & materials usage:	*moderate*	Estimated average cost per unit:
Energy savings & efficiency:	*moderate*	36 €/m^2
Comfort & usability increase:	*significant*	

b & c, Stone flooring

Representative stone flooring in bedding mortar, with self-levelling equalizer layer, including adhesive and grouting. Including separation layer, vapour barrier, using 5 cm EPS boards to overcome the floor's height difference.

Eco tech & materials usage:	*significant*	Estimated average cost per unit:
Energy savings & efficiency:	*moderate*	84 €/m^2
Comfort & usability increase:	*high level*	

2.3.7. Complete reconstruction of the sanitary areas

Four sanitary areas are going to be developed in the building, the ones belonging to the dressing rooms getting showers also. Significant elements in the four areas are: 10 flush toilets, 6 sinks, 6 shower stalls, 2 urinals including fittings, montage of water consumption reducing aerators, water-saving flush system, energy-saving hand dryers, montage of piping, chutes. The extra costs of the eventual grey water and rainwater utilization systems can be found in a separate article.

Eco tech & materials usage:	*high*	Estimated average cost:
Energy savings & efficiency:	*high*	9000 €
Comfort & usability increase:	*high*	

2.3.8. Finishing using Bio paint

Surface smoothing using filler and grinding, painting in two layers using bio paint, in basic colours.

Eco tech & materials usage:	*high*	Estimated average cost per unit:
Energy savings & efficiency:	*no*	4 €/m^2
Comfort & usability increase:	*significant*	

2.3.9. Simple interior doors

Painted fibreboard-covered full door, with framing and fittings, average 80/210 or 90/210 size

Eco tech & materials usage:	*significant*	Estimated average cost per unit:
Energy savings & efficiency:	*no*	130 €
Comfort & usability increase:	*moderate*	

2.3.10. Special doors with soundproofing

Soundproof doors for the community areas including fittings and framing, average 80/210 or 90/210 size

Eco tech & materials usage:	*no*	Estimated average cost per unit:
Energy savings & efficiency:	*no*	200 €
Comfort & usability increase:	*high level*	

2.3.11. Special fireproof doors

Special, precise-sized fireproof safety doors with fittings and framing, for the theatre and gym halls, double swinging doors

Eco tech & materials usage:	*no*	Estimated average cost per unit:
Energy savings & efficiency:	*no*	600 €
Comfort & usability increase:	*significant*	

2.4. Building services

2.4.1. Heating system

a, Maintenance of the existing system, montage of adjustment valves

System maintenance, cleaning of the radiators and piping, even replacing where it is needed, protection against corrosion, montage of adjustment valves.

Eco tech & materials usage:	*slightly*	Estimated average cost per unit:
Energy savings & efficiency:	*slightly*	12 €/m^2
Comfort & usability increase:	*moderate*	

b, Replacement of the radiators, isolation and maintenance of the piping

Montage of new radiators, system maintenance, replacement and isolation of the piping, protection against corrosion, montage of adjustment valves.

Eco tech & materials usage:	*moderate*	Estimated average cost per unit:
Energy savings & efficiency:	*moderate*	34 €/m^2
Comfort & usability increase:	*significant*	

c, Modernisation of the whole system

Complete reconstruction of the building's heating, new radiators and piping, including heat exchanger, central and local adjustment devices, electrical optimising adjustment solutions.

Eco tech & materials usage:	*significant*	Estimated average cost per unit:
Energy savings & efficiency:	*significant*	60 €/m^2
Comfort & usability increase:	*high*	

2.4.2. Ventilation system

a & b, Maintenance of the current system

Establishing controllability of the existing system, maintenance, cleaning, montage of a fan.

Eco tech & materials usage:	*slightly*	Estimated average cost per unit:
Energy savings & efficiency:	*high*	5 €/m^2

Comfort & usability increase:	*moderate*	

c, Montage of a heat recovery-based system

Reconstruction of the theatre and community areas' ventilation system using heat-recovery and upper-middle category air blowing vents.

Eco tech & materials usage:	*high*	Estimated average cost per unit:
Energy savings & efficiency:	*high*	104 €/m^2
Comfort & usability increase:	*high*	

2.4.3. Grey water & rainwater utilization

With two 5 m^3 tanks, filter system, pump, control unit and required fittings, using the roof as a water collector, a resupply freshwater intake and an overflow. For toilet flushing and irrigation, with the montage of the required piping.

Eco tech & materials usage:	*high*	Estimated average cost:
Energy savings & efficiency:	*high*	7800 €
Comfort & usability increase:	*high*	

2.4.4. Lift

Installation of hydraulic elevators of 400 kg maximum loading, with 2 stops, mounted in a 1.40 m x 1.45 m sized reinforce concrete shaft with adequate foundation. With structural components, automatics, completely installed, in a stainless design.

Eco tech & materials usage:	*moderate*	Estimated average cost:
Energy savings & efficiency:	*moderate*	22600 €
Comfort & usability increase:	*high*	

2.5. Building Electricity

2.5.1. Electric network, lighting

With main and secondary distribution networks, installing Ev relays, double-isolated cabling in a protective tube, using high-quality fittings, with LED lamps installed in the lobby, lavatory and toilet areas, installation of internet (Wi-Fi), television and alarm system, installation of external lightning protection.

Eco tech & materials usage:	*high*	Estimated average cost per unit:
Energy savings & efficiency:	*high*	58 €/m^2
Comfort & usability increase:	*high*	

2.4.2. Solar cells

a & b, 4,32 kWp isolated system

Single-phase system, 30.24 m^2 of polycrystalline solar cell surface, southern orientation, with inverters, charge controllers, solar batteries, adjustable supports and wiring, built to satisfy current consumption needs.

Eco tech & materials usage:	*high*	Estimated average cost:
Energy savings & efficiency:	*high*	15000 €
Comfort & usability increase:	*high*	

c, 6,48 kWp isolated system

Single-phase system, 45.36 m^2 of polycrystalline solar cell surface, southern orientation, with inverters, charge controllers, solar batteries, adjustable supports and wiring, built to satisfy future consumption needs also.

Eco tech & materials usage:	*high*	Estimated average cost:
Energy savings & efficiency:	*high*	21700 €
Comfort & usability increase:	*high*	

2.5.3. Building management and fire safety

Implementation of the fire detection and alarm system, property protection system, system monitoring the building's energy consumption.

Eco tech & materials usage:	*significant*	Estimated average cost per unit:
Energy savings & efficiency:	*high level*	24 €/m^2
Comfort & usability increase:	*significant*	

2.6. Environmental Constructions

2.6.1. Pavements

Paving around the building, outdoor concrete tiles, designed drainage and slopes.

Eco tech & materials usage:	*moderate*	Estimated average cost per unit:
Energy savings & efficiency:	*no*	16 €/m
Comfort & usability increase:	*significant*	

2.6.2. Playground

Small playground behind the building, outdoor jungle gym, slides, swinsg, etc. with safe ground coverings.

Eco tech & materials usage:	*moderate*	Estimated average cost:
Energy savings & efficiency:	*no*	2000 €
Comfort & usability increase:	*high*	

2.6.3. Landscaping

Landscape design next to the property, tree and flowers planting, grassing, arrangement of lawns. Bicycle racks next to the entrance.

Eco tech & materials usage:	*high*	Estimated average cost per unit:
Energy savings & efficiency:	*no*	24 €/m^2
Comfort & usability increase:	*high*	

2.7. Equipments

2.7.1. Community and study rooms

Furnitures from local manufacturers: tables, chairs, lockers, chalk boards, wall paper, showcases, mirrors, eco wastebins. IT equipments: laptop computers, projectors, speakers. Tools: chess sets and other board games. Electrical equipment for community use: energy saving microwave & water heater.

Eco tech & materials usage:	*high*	Estimated average cost:
Energy savings & efficiency:	*high*	6000 €
Comfort & usability increase:	*high*	

2.7.2. Gym and associated rooms

Gym equipment: dividing curtain, gym tools: gymbench, strengthening devices (portable dumbbell, barbell, kettlebell, etc.), punching bags, ropes, step pads, other fitness equipments, mattresses, appliances. Equipments for locker room from local manufacturers: benches, lockers, mirrors, eco wastebins. Coaching room: desk, locker, chair, computer, energy saving microwave & water heater, eco wastebin, survival kits. Storage room equipments: lockers, energy efficient and water saving washing machine for washing jerseys and dresses.

Eco tech & materials usage:	*significant*	Estimated average cost:
Energy savings & efficiency:	*high*	12000 €
Comfort & usability increase:	*high*	

2.7.3. Theater and associated rooms

Dressing and storage room equipments from local manufactureres: tables, chairs, benches, lockers, mirrors, couch, eco wastebins. Theatrical equipments.

Eco tech & materials usage:	*significant*	Estimated average cost:
Energy savings & efficiency:	*high level*	3500 €
Comfort & usability increase:	*significant*	

2.7.4. Lobby hall

Showcases, tables, energy efficient displays, eco wastebins, potted green plants.

Eco tech & materials usage:	*significant*	Estimated average cost:
Energy savings & efficiency:	*high level*	3000 €
Comfort & usability increase:	*significant*	

2.7.5. Offices and maintenance rooms

Furnitures from local manufacturers: tables, chairs, lockers, eco wastebins. IT equipments: laptop computers, displays, speakers, Safety equipments: defibrillator, survival kits, dry powder fire extinguishers

Eco tech & materials usage:	*significant*	Estimated average cost:
Energy savings & efficiency:	*high level*	5000 €
Comfort & usability increase:	*significant*	

2.8. Ancilary costs of construction and design

2.8.1. Project management

Project management, technical supervision, professional fees, training costs, a surveying costs.

Estimated cumulative percentage of the total cost of construction:
4,6 %

2.8.2. Desing

Architectural design and planning of special branch (statics, mechanics, electricity, building, building physics, etc.), construction technology design

Estimated cumulative percentage of the total cost of construction:
6,0 %

2.8.3. Others

Licensing costs, attorneys' fees, preparation costs, insurance

Estimated cumulative percentage of the total cost of construction:
1,4 %

3. Preliminary cost estimation

The cost estimation is calculated based on the 3D building model using the above listed investment elements.

3.1. A variant – Usability improvement and energy efficient solutions

Item	Work amount	Unit price	Total cost

Building Construction

	Quantity	Unit	Cost	Unit	
Flat roof insulation and waterproofing					
White UV-resistant environmentally friendly soft-PVC roof waterproofing with 20 cm of EPS thermal insulation	1066	/m²	50 €	/m²	53 300 €
Subsequent exteriror wall insulation					
14 cm EPS thermal insulation with thin layer plastering	880	/m²	28 €	/m²	24 640 €
Footing insulation and drainage					
14 cm XPS thermal insulation with footing plastering	162	/m	42 €	/m	6 804 €
Windows and glazed façades					
Double-layer thermal-insulating glazing, usual PVC frame	167	/m²	95 €	/m²	15 865 €
Exterior doors					
Thermal-insulated glazed entrance door, thermal-insulated back doors					1 200 €
Additional structures					
Passive shadowing system on the western side					2 500 €
Entrance steps for use with ramp for the disabled					800 €
Green vegetation on the façade wall					500 €
				Σ	105 609 €

Interior Architectural Elements

	Quantity	Unit	Cost	Unit	
Suspended ceilings					
Ceiling grid with gypsum tiles	460	/m²	24 €	/m²	11 040 €
Mounted division dry walls					
100 mm wall thickness, two-side two-layer 12.5 mm thick fireproof gypsum board coating (with waterproof boards in the case of sanitary areas), 5 cm thick mineral wool insulation	280	/m²	29 €	/m²	8 120 €
Cold floor coverings					
Glossy gres tile flooring	237	/m²	32 €	/m²	7 584 €
Warm floor coverings					
Natural floor carpets	104	/m²	24 €	/m²	2 496 €
Sports flooring					
Repairing the existing parquet	286	/m²	12 €	/m²	3 432 €
Lobby hall's flooring					
Glossy gres tile flooring	172	/m²	12 €	/m²	2 064 €
Complete reconstruction of the sanitary areas					
Four sanitary areas completely assembled					9 000 €

Finishing					
Finishing using Bio paint	2524	/m2	4 €	/m2	10 096 €
Doors					
Simple interior doors	15	/pc	130 €	/pc	1 950 €
Special doors with soundproofing	6	/pc	250 €	/pc	1 500 €
Special fireproof doors	6	/pc	600 €	/pc	3 600 €
				Σ	60 882 €

Building Services

Heating system					
Maintenance of the existing system, montage of adjustment valves	1092	/m2	12 €	/m2	13 104 €
Ventilation system					
Maintenance of the current system	286	/m2	5 €	/m2	1 430 €
Grey water & rainwater utilization					
For toilet flushing and irrigation					7 800 €
Lift					
Installation of hydraulic elevators of 400 kg maximum loading					22 600 €
				Σ	44 934 €

Building Electricity

Electric network, lighting					
With main and secondary distribution networks, installing Ev relays, double-isolated cabling in a protective tube, using high-quality fittings, with LED lamps installed in the lobby, lavatory and toilet areas, installation of internet (Wi-Fi), television and alarm system, installation of external lightning protection.	1092	/m2	58 €	/m2	63 336 €
Solar cells					
4,32 kWp isolated system					15 000 €
Building management and fire safety					
Fire detection and alarm system, property protection system, system monitoring the building's energy consumption.	1092	/m2	24 €	/m2	26 208 €
				Σ	104 544 €

En.

Pavements					

Paving around the building, outdoor concrete tiles, designed drainage and slopes	162 /m	16 € /m	2 592 €
Playground			
Outdoor jungle gym, slides, swinsg, etc. with safe ground coverings			2 000 €
Landscaping			
Tree and flowers planting, grassing, arrangement of lawns	250 /m²	24 € /m²	6 000 €
		Σ	10 592 €

Construction cost of the building			**326 561 €**
Total cost of construction with ancilary costs			**365 748 €**
Specific construction cost of the building	1092 /m²	**335 €** /m²	

Equipments

Community rooms and study rooms	
Furnitures from local manufacturers, it equipments, tools, electrical equipments	6 000 €
Gym and associated rooms	
Gym equipments, tools, locker room furnitures, coaching & storage room furnitures & equipments	12 000 €
Theater and associated rooms	
Dressing and storage room equipments from local manufactureres, theatrical equipments	3 500 €
Lobby hall	
Showcases, tables, energy efficient displays, eco wastebins, potted green plants.	3 000 €
Offices and maintenance rooms	
Furnitures from local manufacturers, it equipments, fire and health safety equipments	5 000 €
Σ	29 500 €

Total cost of the building			**395 248 €**
Specific cost of the building	1092 /m²	**362 €** /m²	

3.2. B variant – Energy efficient green building

Item	Work amount	Unit price	Total cost

Building Construction

	Quantity	Unit	Cost	Unit	
Flat roof insulation and waterproofing					
White UV-resistant environmentally friendly soft-PVC roof waterproofing with 20 cm of mineral wool thermal insulation	704	/m^2	70 €	/m^2	49 280 €
Extensive green roof, UV-resistant environmentally friendly soft-PVC roof waterproofing with 20 cm of mineral wool thermal insulation	360	/m^2	100 €	/m^2	36 000 €
Subsequent exteriror wall insulation					
20 cm mineral wool insulation with thin-layer plastering	880	/m^2	47 €	/m^2	41 360 €
Footing insulation and drainage					
20 cm XPS thermal insulation with footing plastering	162	/m	54 €	/m	8 748 €
Windows and glazed façades					
Double-layer thermal-insulating glazing, high quality PVC frame	73	/m^2	115 €	/m^2	8 395 €
Glass wall with aluminium framing	94	/m^2	180 €	/m^2	16 920 €
Exterior doors					
Main entrance portal door with automatic photocell-controlled opening, with accessories, the backside doors being metallic doors with safety locks.					3 500 €
Additional structures					
Passive shadowing system on the western side					2 500 €
Entrance steps for use with the disabled					800 €
Green vegetation on the façade wall					500 €
				Σ	168 003 €

Interior Architectural

	Quantity	Unit	Cost	Unit	
Suspended ceilings					
Ceiling grid with gypsum tiles	460	/m^2	24 €	/m^2	11 040 €
Mounted division dry walls					
100 mm wall thickness, two-side two-layer 12.5 mm thick fireproof gypsum board coating (with waterproof boards in the case of sanitary areas), 5 cm thick mineral wool insulation	280	/m^2	29 €	/m^2	8 120 €
Cold floor coverings					
Glossy gres tile flooring	237	/m^2	32 €	/m^2	7 584 €
Warm floor coverings					
Natural floor carpets	104	/m^2	24 €	/m^2	2 496 €
Sports flooring					

Triple-layer prefabricated sportparquet	286	/m²	74 €	/m²	21 164 €
Lobby hall's flooring					
Glossy gres tile flooring	172	/m²	12 €	/m²	2 064 €
Complete reconstruction of the sanitary areas					
Four sanitary areas completely assembled					8 000 €
Finishing					
Finishing using Bio paint	2524	/m²	4 €	/m²	10 096 €
Doors					
Simple interior doors	15	/pc	130 €	/pc	1 950 €
Special doors with soundproofing	6	/pc	250 €	/pc	1 500 €
Special fireproof doors	6	/pc	600 €	/pc	3 600 €
				Σ	77 614 €

Building Services

Heating system					
Replacement of the radiators, isolation and maintenance of the piping	1092	/m²	34 €	/m²	37 128 €
Ventilation system					
Maintenance of the current system	286	/m²	5 €	/m²	1 430 €
Grey water & rainwater utilization					
For toilet flushing and irrigation					7 800 €
Lift					
Installation of hydraulic elevators of 400 kg maximum loading					22 600 €
				Σ	68 958 €

Building Electricity

Electric network, lighting					
With main and secondary distribution networks, installing Ev relays, double-isolated cabling in a protective tube, using high-quality fittings, with LED lamps installed in the lobby, lavatory and toilet areas, installation of internet (Wi-Fi), television and alarm system, installation of external lightning protection.	1092	/m²	58 €	/m²	63 336 €
Solar cells					
4,32 kWp isolated system					15 000 €
Building management and fire safety					
Fire detection and alarm system, property protection system, system monitoring the building's energy consumption.	1092	/m²	24 €	/m²	26 208 €
				Σ	104 544 €

Environment Constructions

Pavements					
Paving around the building, outdoor concrete tiles, designed drainage and slopes	162	/m	16 €	/m	2 592 €
Playground					
Outdoor jungle gym, slides, swinsg, etc. with safe ground coverings					2 000 €
Landscaping					
Tree and flowers planting, grassing, arrangement of lawns	250	/m²	24 €	/m²	6 000 €
				Σ	10 592 €

Construction cost of the building					**429 711 €**
Total cost of construction with ancilary costs					**481 276 €**
specific construction cost of the building	1092	/m²	**441 €**	/m²	

Equipments

Community rooms and study rooms	
Furnitures from local manufacturers, it equipments, tools, electrical equipments	6 000 €
Gym and associated rooms	
Gym equipments, tools, locker room furnitures, coaching & storage room furnitures & equipments	12 000 €
Theater and associated rooms	
Dressing and storage room equipments from local manufactureres, theatrical equipments	3 500 €
Lobby hall	
Showcases, tables, energy efficient displays, eco wastebins, potted green plants.	3 000 €
Offices and maintenance rooms	
Furnitures from local manufacturers, it equipments	5 000 €
Σ	29 500 €

Total cost of the building					**510 776 €**
Specific cost of the building	1092	/m²	**468 €**	/m²	

3.3. C variant – High comfort, energy efficient green building

Item	Work amount		Unit price		Total cost
	Quantity	Unit	Cost	Unit	

Building Construction

Flat roof insulation and waterproofing				
White UV-resistant environmentally friendly soft-PVC roof waterproofing with 20 cm of mineral wool thermal insulation	288	/m²	70 € /m²	20 160 €
Extensive green roof, UV-resistant environmentally friendly soft-PVC roof waterproofing with 20 cm of mineral wool thermal insulation	778	/m²	100 € /m²	77 800 €
Subsequent exteriror wall insulation				
20 cm mineral wool insulation with thin-layer plastering	538	/m²	47 € /m²	25 286 €
20 cm mineral wool insulation with prefabricated fiber cement façade cover	342	/m²	86 € /m²	29 412 €
Footing insulation and drainage				
20 cm XPS thermal insulation with footing plastering	162	/m	54 € /m	8 748 €
Windows and glazed façades				
Triple-layer thermal-insulating glazing, high quality timber + aluminium thermal-insulated frame	73	/m²	115 € /m²	8 395 €
Spider glass wall	94	/m²	270 € /m²	25 380 €
Exterior doors				
Main entrance portal door with automatic photocell-controlled opening and an air curtain device, with accessories, the backside doors being metallic doors with safety locks				6 000 €
Additional structures				
Passive shadowing system on the western side				2 500 €
Entrance steps for use with the disabled				800 €
				Σ 204 481 €

Interior Architectural

Suspended ceilings				
Premium continuous-surface dropped ceiling	460	/m²	63 € /m²	28 980 €
Mounted division dry walls				
100 mm wall thickness, two-side two-layer 12.5 mm thick fireproof gypsum board coating (with waterproof boards in the case of sanitary areas), 5 cm thick mineral wool insulation	280	/m²	29 € /m²	8 120 €
Cold floor coverings				
Polished gres tile flooring	237	/m²	56 € /m²	13 272 €
Warm floor coverings				

Natural floor carpets	104	/m²	24 €	/m²		2 496 €
Sports flooring						
Triple-layer prefabricated sportparquet	286	/m²	74 €	/m²		21 164 €
Lobby hall's flooring						
Stone flooring	172	/m²	84 €	/m²		14 448 €
Complete reconstruction of the sanitary areas						
Four sanitary areas completely assembled						9 000 €
Finishing						
Finishing using Bio paint	2524	/m²	4 €	/m²		10 096 €
Doors						
Simple interior doors	15	/pc	130 €	/pc		1 950 €
Special doors with soundproofing	6	/pc	250 €	/pc		1 500 €
Special fireproof doors	6	/pc	600 €	/pc		3 600 €
					Σ	114 626 €

Building Services

Heating system						
Modernisation of the whole system	1092	/m²	60 €	/m²		65 520 €
Ventilation system						
Montage of a heat recovery-based system	286	/m²	104 €	/m²		29 744 €
Grey water & rainwater utilization						
For toilet flushing and irrigation						7 800 €
Lift						
Installation of hydraulic elevators of 400 kg maximum loading						22 600 €
					Σ	125 664 €

Building Electricity

Electric network, lighting					
With main and secondary distribution networks, installing Ev relays, double-isolated cabling in a protective tube, using high-quality fittings, with LED lamps installed in the lobby, lavatory and toilet areas, installation of internet (Wi-Fi), television and alarm system, installation of external lightning protection.	1092	/m²	58 €	/m²	63 336 €
Solar cells					
6,48 kWp isolated system					21 700 €
Building management and fire safety					
Fire detection and alarm system, property protection system, system monitoring the building's energy consumption.	1092	/m²	24 €	/m²	26 208 €

		Σ	111 244 €

Environment Constructions

Pavements			
Paving around the building, outdoor concrete tiles, designed drainage and slopes	162 /m	16 € /m	2 592 €
Playground			
Outdoor jungle gym, slides, swinsg, etc. with safe ground coverings			2 000 €
Landscaping			
Tree and flowers planting, grassing, arrangement of lawns	250 /m²	24 € /m²	6 000 €
		Σ	10 592 €

Construction cost of the building			**566 607 €**
Total cost of construction with ancilary costs			**634 600 €**
specific construction cost of the building	1092 /m²	**581 €** /m²	

Equipments

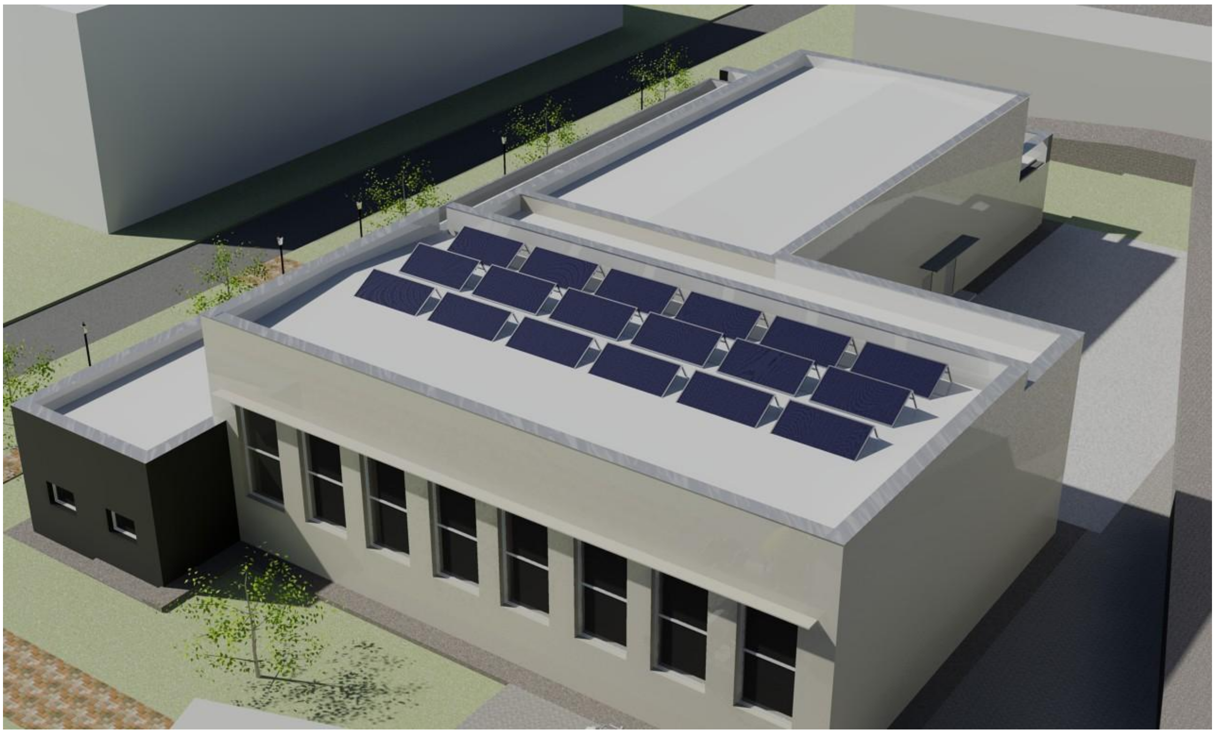
Community rooms and study rooms	
Furnitures from local manufacturers, it equipments, tools, electrical equipments	6 000 €
Gym and associated rooms	
Gym equipments, tools, locker room furnitures, coaching & storage room furnitures & equipments	12 000 €
Theater and associated rooms	
Dressing and storage room equipments from local manufactureres, theatrical equipments	3 500 €
Lobby hall	
Showcases, tables, energy efficient displays, eco wastebins, potted green plants.	3 000 €
Offices and maintenance rooms	
Furnitures from local manufacturers, it equipments	5 000 €
Σ	29 500 €

Total cost of the building			**664 100 €**
Specific cost of the building	1092 /m²	**608 €** /m²	

4. Rendered 3D concept views of the variants

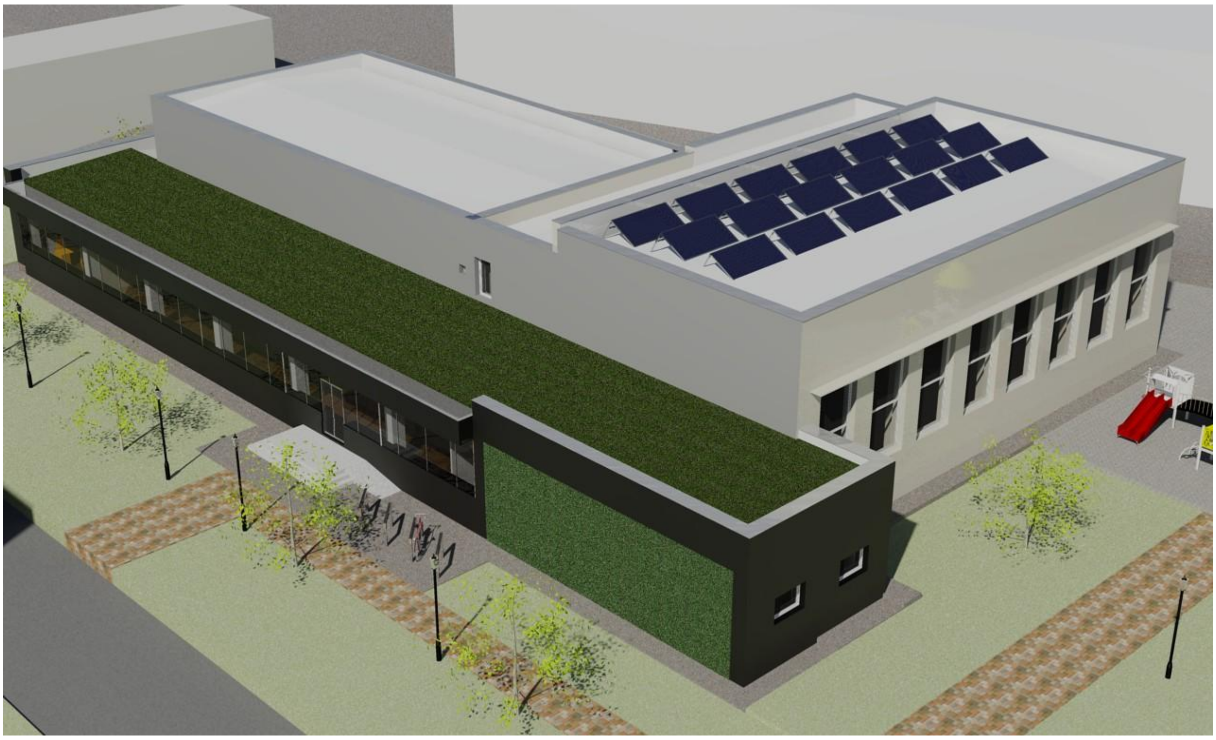
A variant

21. figure: South facace, A variant



22. figure: Rooftop view from South-East, A variant

B variant

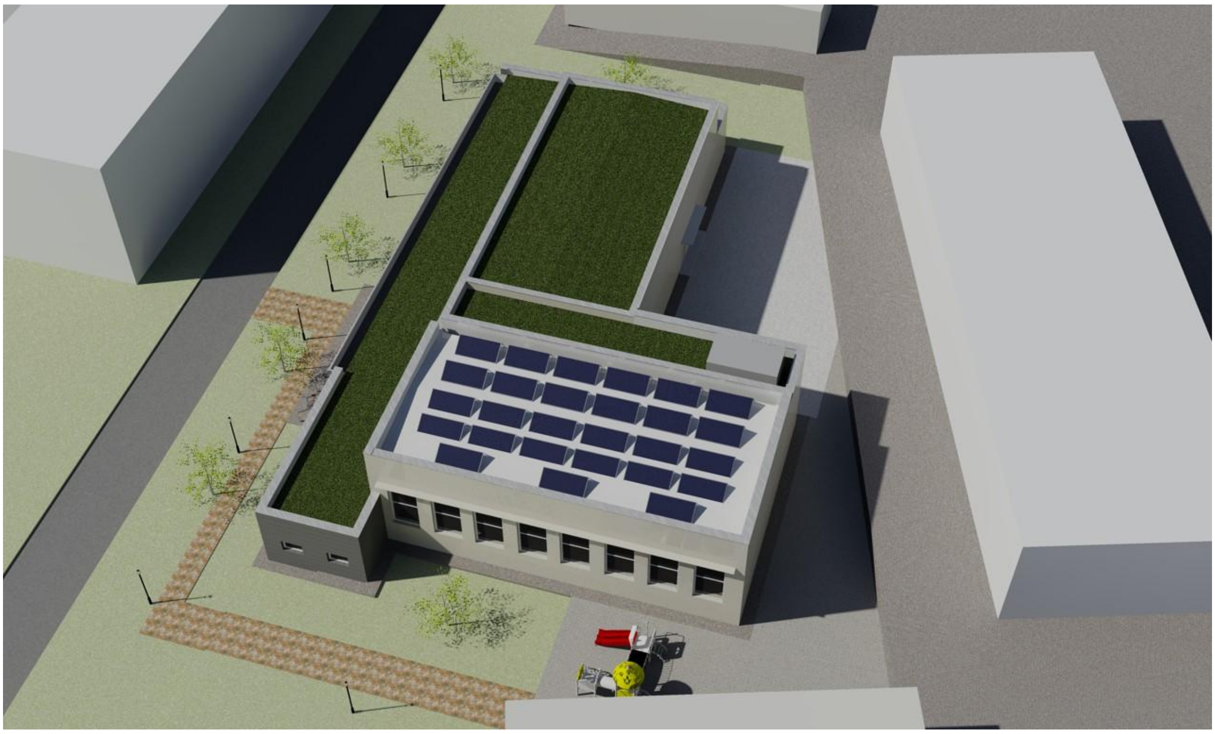


23. figure: Bird view from South-West, B variant

24. figure: Bike racks and south facade, B variant

C variant

25. figure: Bird view from West, playground, C variant



26. figure: Roof view, C variant

5. Estimated costs of operation

5.1. Personnel costs

We increase the number of personnel of the existing building presented at IV.1.4. Due to the expected growth in the number of served visitors, the increasing of the number service crew members is necessary. We double the number of secretaries, as they will have enough work regarding the activities to be held in the new community centre. Tripling the number of the currently employed cleaning staff goes without saying as because the current sanitary and hygienic conditions of the building proper conditions must be ensured, and such a facility needs at least three people taking care of the cleaning. As such, cleaning may be done by working in two shifts. The number of security guards is also increased, the new building is guarded 24/7. For the maintenance of the high number of electronic devices we employ two people in part-time positions. As a result, we are increasing the total number of employees from the current 17 to 22, creating 5 new jobs. Calculating with the present salaries, this means an expenditure €1360/month, or €16.300 per year. The overall maintenance costs of the old building were €19616, from which €11.700 were spent directly on salaries.

No.	Post	Monthly quantity of staff	Monthly Salary Euro	Monthly Raised Salary Euro
1.	Director	1	120	130
2.	Deputy director	1	110	120
3.	Art director	1	120	130
4.	Secretary	2 x 0,5	2 x 54	2 x 60
5.	Porter	1	46	55
6.	Cleaner	3	3 x 67	3 x 75
7.	Guard	2	2 x 65	2 x 75
8.	Worker on electrical equipment	2 x 0,5	2 x 60	2 x 60
9.	Department supervisor	1	105	120
10.	Chief specialist	1	97	110
11.	Leading specialist	0,5	41	49
12.	Leader of club/study group	6 x 0,5	6 x 27	6 x 32

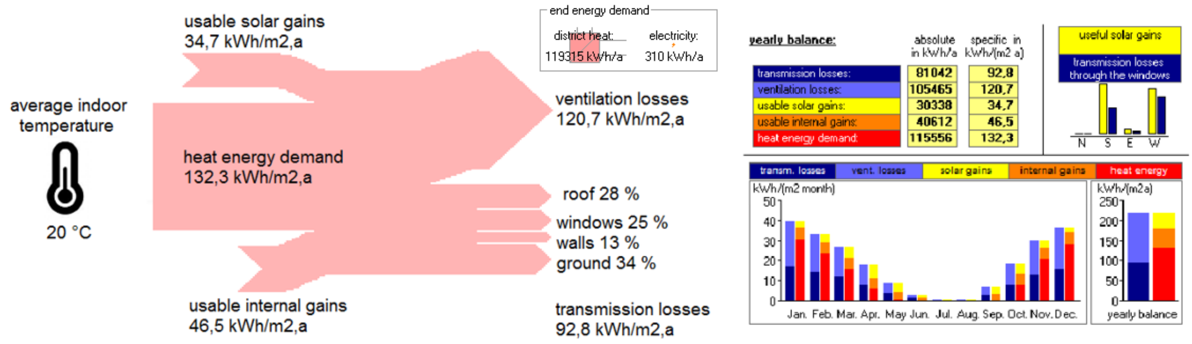
5. table: Salaries of the green community centre

Raising the salaries of the employees becomes sustainable due to the reduction of the building's operational expenditures and the increase in income attributed to the expansion of the functions of the building. Our proposal is to raise the salaries in the new institution by 10 – 20 %. We suggest a larger raise for the workers currently having lower salaries. Total expenditure on salaries is €1521/month, or €18.252/year.

5.2. Expected change in utility costs

5.2.1. Predicted utility costs of the A variant

The building's operator gains a significant saving already in the case of the A variant being implemented. In this case the building can be used in the whole heating season, while being able to keep an internal temperature of 20 degrees Celsius with only 50% of the thermal energy demand of the old building. This significant reduction can be achieved by reducing the transmission and ventilation heat losses, while the radiation solar gains being kept almost at the same level. The amount of internal gains will also increase due to building's increased utilization, however this increase was not taken into account during the calculations.



27. figure: Simulated energy flows of the A variant

Due to the montage of solar cells, the building's electric consumption is expected to be minimal, the system compiled in combination A is capable of providing the energy required for the whole original building. The utility of the building increases significantly due to the electric system being capable to function independent from the public electricity grid of the town. However, to be absolutely sure, we suppose a 1000 kWh/annum electricity consumption, which equals a two-month consumption in the case of the present building.

The water consumption is very low in the presently functioning youth centre. Reasons for this have already been explained in the study. Even if the building operates only at 50 % utilization, a drastic increase is expected. The 60 youngsters who are expected to use the gym daily generate a 2-3 cubic meter water consumption only by taking a shower, this means a 40-60 m^3 consumption per month. The consumption in the building attributed to hand washing can be considered minimal. The quantity of water needed for toilet-flushing and irrigation is assured by the grey water system, which can handle as much as 500 flushes a day. The system also helps to minimize sewage costs.

In the following table we can find the expected annual utility costs, the thermal energy demand's value of 119.315 kWh/a obtained using the modelling being converted to 102.661 $*10^6$ Kcal.

No.	Services	Unit	Estimted usage	Unit price RUB TMR	Total price RUB TMR	Total Price Euro
1.	Thermal energy	10^6 Kcal	102,661	520,20	53404,25	3640,37
2.	Electricity	1 kWh	1.000	0,51	510	34,76
3.	Water consumption	1 m^3	720	3,70	2664	181,60
4.	Sewage	1 m^3	120	3,48	417,6	28,47

5.	Gas	1 m^3	-	1,79	-	-
6.	Internet	monthly	12	168,00	2016	137,42

6. table: Estimated usage of services, A variant

The building's overall annual costs, expressed based on 2013 prices is €4022.62. The utility costs paid by the currently operating youth centre are €7.916. In this case, calculating with the current workforce costs and the expanded, 22 person-strong staff the building's sustainment costs are €706 larger than the ones in the current state. In order to maintain the current level of costs we need to give up on 1 security guard or 0.5 technical staff. We've achieved a very significant increase in the level of comfort and widened the palette of functions while keeping the costs on the same level – all this in an environmentally friendly manner.

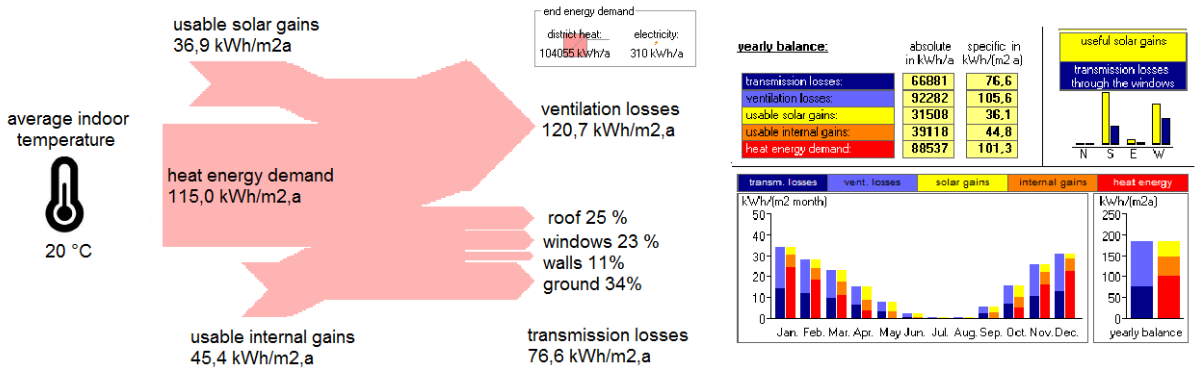
5.2.1. Predicted utility costs of the B variant

In variant B the use of environmentally friendly materials became dominant in the thermal insulation of the building. The eco-friendly design does not bring a significant reduction of energy consumption compared to the optimal thermal insulation in variant A. However, the safety of the building is increased by the non-flammable mineral wool thermal insulation and the new sports floor which increases the level of safety in the gym.

The buildings transmission losses decrease further compared to the previous variant, this being responsible for the decrease in thermal energy demand for heating. Due to the use of better-quality windows, solar gains are also increased.

The electricity and water demand for variant B can be estimated in the same manner as for variant A.

The thermal energy demand of this variant of the green community centre is only 41 % of that of the original building.



28. figure: Simulated energy flows of the B variant

In the following table, we can find the expected utility costs, supposing normal, intended utilization.

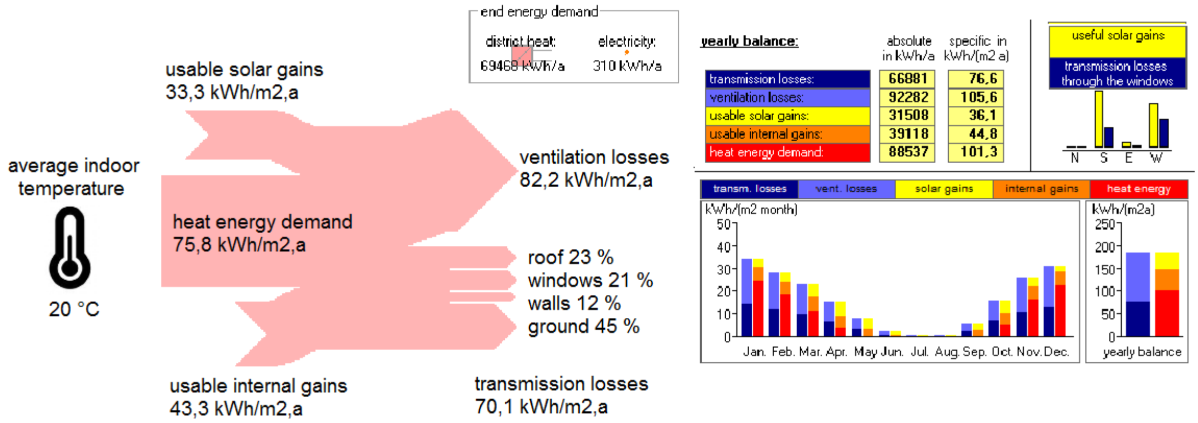
No.	Services	Unit	Estimated usage	Unit price RUB TMR	Total price RUB TMR	Total Price Euro
1.	Thermal energy	10^6 Kcal	89,531	520,20	46574,03	3174,78
2.	Electricity	1 kWh	1.000	0,51	510	34,74
3.	Water consumption	1 m^3	720	3,70	2664	181,60
4.	Sewage	1 m^3	120	3,48	417,6	28,47
5.	Gas	1 m^3	-	1,79	-	-
6.	Internet	monthly	12	168,00	2016	11,45

7. table: Estimated usage of services, B variant

The total annual utility costs sum up €3695.52.

5.2.3. Predicted utility costs of the C variant

In the case of variant C we've chosen the components having the smallest possible environmental effect and utilized many comfort-increasing and aesthetical interventions during the building's reconstruction. In order to reduce the utility cost even more, the complete replacement of the building services is done, while the ventilation of the community areas and the theatre hall is solved using a periodically operated heat recovery ventilation. Due to the artificial ventilation installed, the buildings heat losses through ventilation are diminished even with respect to the other two variants, while the transmission heat losses slightly decrease because of the extensive green roof and the triple-layer windows. The extra energy demand generated by the artificial ventilation system is compensated by the installation of greater capacity solar cell system on the roof.



29. figure: Simulated energy flows of th C variant

In the following table, we can find the expected utility costs, supposing normal, intended utilization an professional operation of the built-in services.

No.	Services	Unit	Estimated usage	Unit price RUB TMR	Total price RUB TMR	Total Price Euro
1.	Thermal energy	10^6 Kcal	59,731	520,20	31072,07	2118,07
2.	Electricity	1 kWh	1000	0,51	510	34,74
3.	Water consumption	1 m^3	720	3,70	2664	181,60
4.	Sewage	1 m^3	120	3,48	417,6	28,47
5.	Gas	1 m^3	-	1,79	-	-
6.	Internet	monthly	12	168,00	2016	11,45

8. table: Estimated usage of services, C variant

In the case of this variant, the utility bills for the whole year sum up €2.374, this being only 30% of the present energy costs, while significant increase in the level of comfort is also achieved.

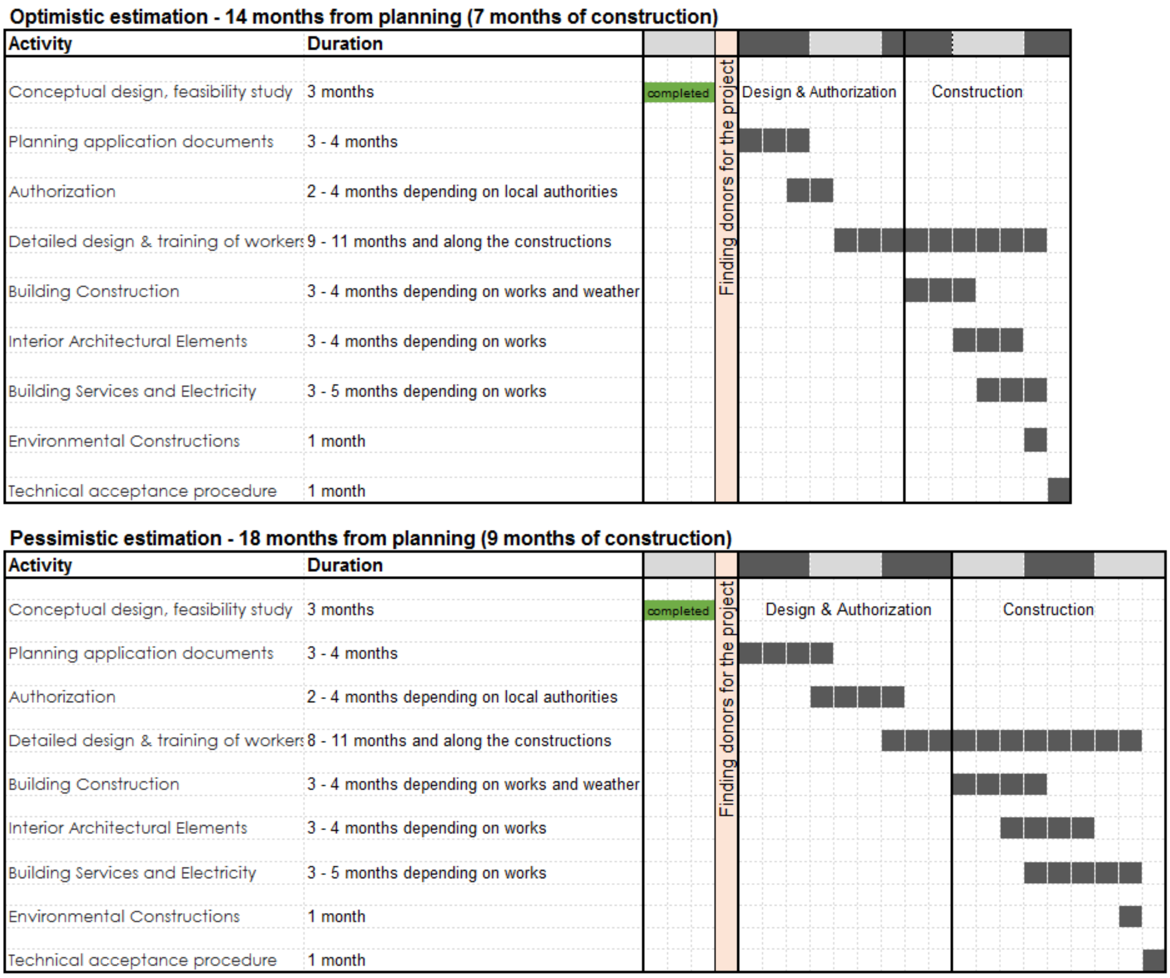
5.3. Costs of maintenance

In order to achieve optimal and energy-saving operation, the building has to be under continuous maintenance. The annual maintenance costs of the building are defined as 1% of the building's construction costs. Usually, after the beginning of utilization, maintenance costs do not exceed this value. The repairs of damage due to construction errors in the warranty period are done by the contractors. The building's continuous maintenance enables us to prevent damage and degradation and, as such, loss of functionality also.

6. Project and construction time estimates

The following Gantt chart contains the project's estimated durations. The project cannot be linked to a specific date, the current operation being the search for donors, whose duration is unknown. The estimation, as seen on the following chart, contains optimistic and pessimistic scenarios on a monthly division. In the case that no surprise events will occur, the actual duration of the project is expected to fall between the two margins.

According to the optimistic estimation, the planning, checking and construction operations will advance smoothly. The local authorities collaborate, the local workforce is easily trainable and their work has no quality issues. The work schedule is continuous, the parallel running of specific work phases is solved. The building material supply is continuous, does not face obstacle. According to the pessimistic estimation, the time needed for some of the activities is 33% longer than usual, authorities proving to be less collaborative.



30. figure: Project and construction time estimates

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