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Energy Efficiency Approach for Buildings in Georgia: Energy Passport Software Program and Certification of Buildings

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Energy efficiency requirements for buildings

- Over the past decade, a new generation of construction thermal engineering codes has been implemented in the EU and elsewhere, including CIS countries.

- The energy efficiency approach for building sector with regard to technology level considers 2 main aspects:

  - the thermal properties of the building envelope components that reflect its enhanced thermal performance level and is defined by high thermal resistance values -R [m^2 ^oC /W] ;
  - efficiency and management of the energy end use systems.

- Advanced codes mandate reduction of at least 40 percent of energy consumption for heating in winter through enhanced energy efficiency level of the building envelope.

- Consequently, a fundamental transformation has taken place toward the production, sale, and use of energy-efficient construction materials and products as well as changes in building design methods.

- In countries where energy advanced thermal engineering codes have been adopted the specific energy consumption became the main index for certification of buildings, since it defines the amount of energy consumed by building per square meter during heating season - $q= Q/F$ [W/m^2]

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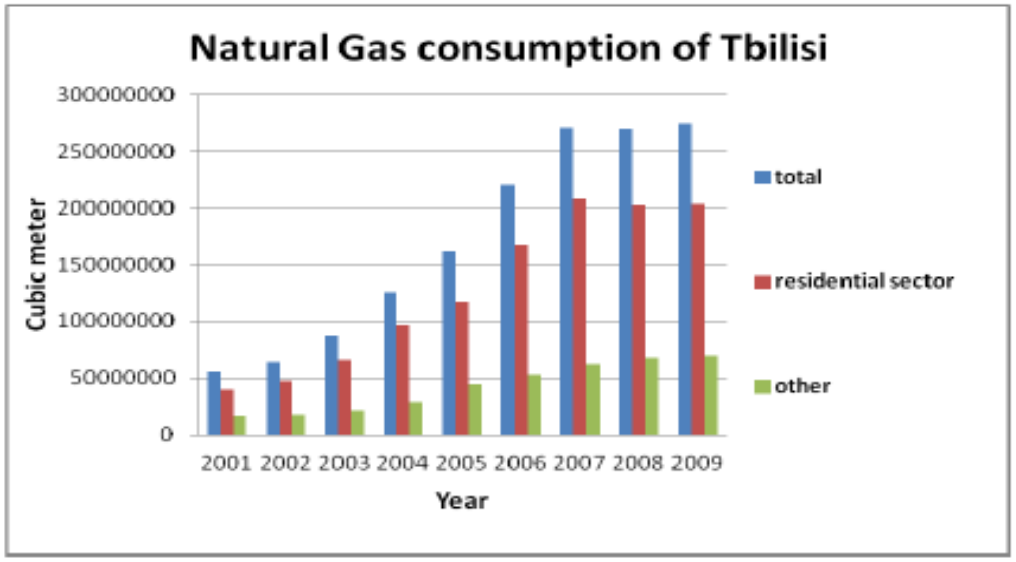
Overview of existing situation with the EE legislation in Georgia

- In Georgia the buildings sector accounts for over 40% of energy consumption in country's energy balance;
- Buildings, especially the residential ones, are the biggest energy (and money) wasters and largest sources of greenhouse gas emissions in the country.



- For the buildings sector new national construction standardization documents (codes) have not been developed and adopted yet;

- As a result of absence of such regulation the thermal properties of the most new buildings aren't reflecting energy efficiency and are characterized by the minimum or required R-value for building envelope components that at best stick to the former "Soviet" values.

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- The mandatory level **R**-value required by the old Soviet codes as an example for Tbilisi and Rustavi for walls constitutes:
  R=0.55 $m^2 \cdot {}^oC/W$, which is four times lower than the level with consideration of energy efficiency

- To improve energy efficiency in residential buildings development and construction companies are generally using only double glazed windows single-sash units in the new buildings

- Reduction of heat losses through the windows is an important but not sufficient measure since windows constitute on average 18% (ranking in some cases up to 25%) of total wall area in the whole building geometry

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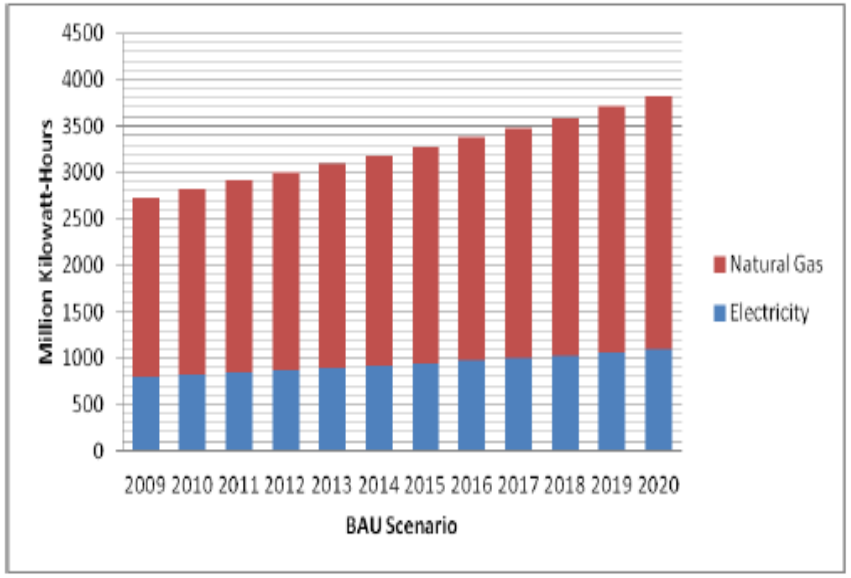
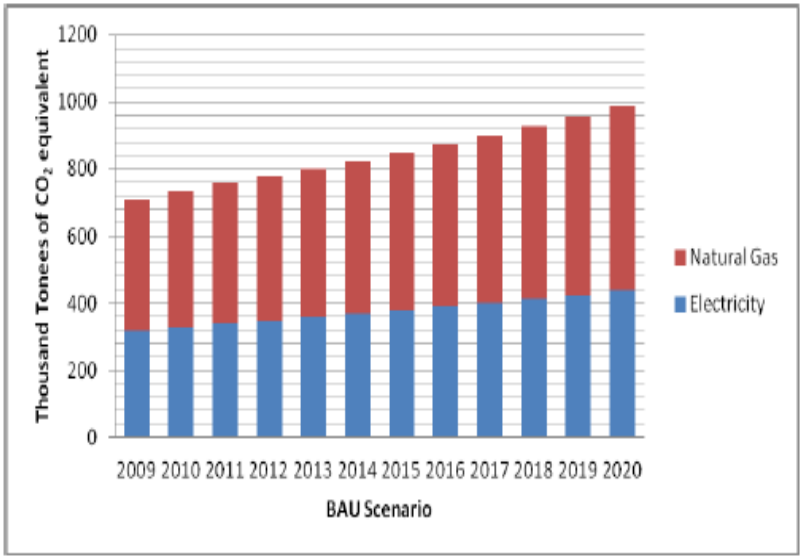
Energy consumption forecast and associated emissions for residential sector of Tbilisi city by BAU scenario

- Energy consumption trends for residential sector
- Emission trends from residential sector





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State of Energy Efficiency in Georgia's building sector

- Over the recent years some transformations have been initiated concerning implementation of energy efficiency in Georgia mainly through energy efficiency interventions in buildings sector performed by USAID /Winrock International Georgia:
  - Assessment of the current construction practices has been performed and recommendations have been developed regarding energy efficiency improvements for residential sector;
  - Sustainable Energy Action Plan for Tbilisi city has been developed (with its main indispensable part - the Buildings sector).
  - Energy audits have been carried out as a systemic tool for verification of energy efficiency in existing buildings;
  - Energy passports have been developed for new buildings regarding enhanced thermal performance of the building envelope.

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Results of assessment of the current construction practices

- It is recommended to apply the most cost effective practice for implementation of energy efficiency measures of the building envelope -use of light weight concrete blocks and modern efficient windows, considering Georgian climatic conditions

- Since the country is located in seismically active zone the static stability of buildings is ensured by the framed construction method required for construction in Georgia

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- Several energy efficient residential buildings have been built in the capital of Georgia on voluntary basis in recent years .

- It was revealed that Georgian advanced construction and development companies mostly understand necessity of energy efficiency but due to the absence of the legal framework as well as financial instruments to regulate their business aren’t ready to make the appropriate offers to customers.

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Energy efficiency strategies for existing and new buildings- the recent Georgian experience

- Energy efficient strategies differ with regard to the existing and new buildings and foresee:

  - conducting energy audits for identification of the energy saving potential in existing buildings;

  -designing enhanced thermal performance level of the building envelope/ developing Energy Passports.

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Energy Efficiency - Energy Audits/ Energy Passports–Overview of the Recent Georgian Experience

- The group of professionals have been certified by the ENSI International for conducting energy audits with the EA ENSI Software and Economic Profitability Programs.
- USAID NATELI project has been focused on energy efficiency Interventions resulting in:

  - 16 energy audits for hospital buildings, GTU buildings as well as residential buildings,
  - Energy Audit manual within framework of assistance to GTU in development of innovative curricula;
  - 9 Energy Passports for hospital buildings aiming at enhanced thermal performance design of the building envelope and labelling by specific consumption criteria.

- Syllabi for Energy Managers Certification Program;

- Trainings on buildings energy efficiency delivered to different target group representatives as: banking sector, municipalities, hospitals management staff, IDP-s etc. (USAID NATELI Project)

- “Energy Saving Initiative in the Building sector "in the Eastern European and Central Asian Countries (ESIB INOGATE) Project framework covered development of the “Catalogue of Technical Solutions “(for thermal insulation of the building envelope) and carrying out energy audits of kindergarten in Rustavi and the residential building in Tbilisi with the appropriate trainings on these issues.

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Results of energy audit of the residential building in Tbilisi carried out by the EA ENSI Software Program

EE Potential - Energy Audit						
Saburtalo 53 Residential Building			Heated Area:		5083 m²	
EE Measures		Investment [GEL]	Net Savings [kWh/yr]	Net Savings [GEL/yr]	Payback [year]	NPVQ *
1.	Insulation of walls	117299	150719	9193	12.8	0.11
2.	Insulation of ceiling	29464	38688	2360	12.5	0.14
3.	Replacement of the windows	79120	224114	13671	5.8	1.45
4.	Installation of a new lighting system	3000	11160	1786	1.7	0.67
5.	Installation of a new heating system	43000	219586	12800	3.4	3.42
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Total		271883	644267	39810	6.8	

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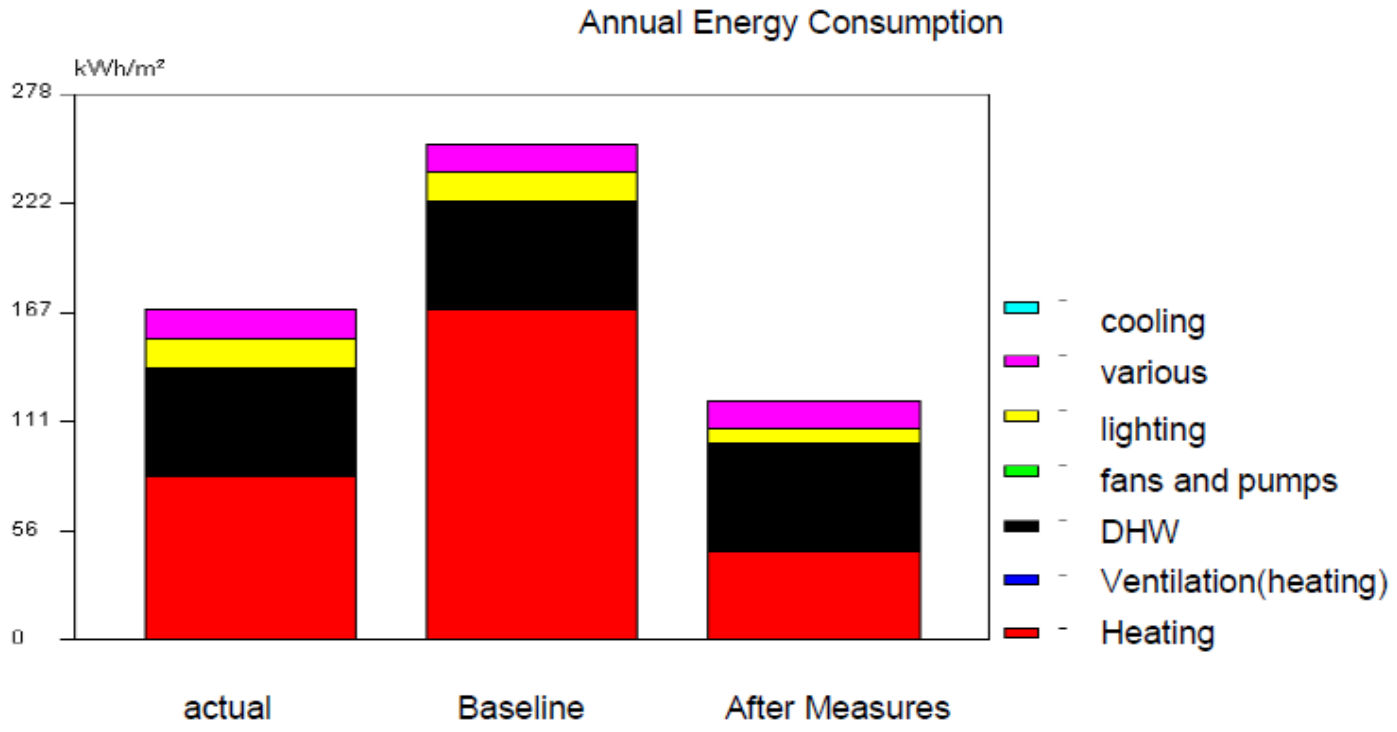
Annual energy consumption calculated by EA ENSI Software program



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Environmental Benefits

	Energy Carrier				
	Central Heating	Electricity	Gas	Oil	Other
Present Situation – Baseline (kWh/m²a)	-	14.6	168.3		
After EE and Renovation Measures (kWh/m²y)	-	7.3	48.9		
Savings (kWh/m²y)	-	7.3	119.4		
Savings (kWh/y)	-	37106	607161		
CO_2 Emission Coefficients (kg/kWh)	-	**0,3999**	**0.202**		
CO_2 Emission Reductions (kg/m²y)	-	2.91	24.1		
CO_2 Emission Reductions (t/year)	137.2				

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“Building Energy Passport” Software program

- One of the comprehensive and advanced way for designing building’s thermal performance level with the enhanced energy efficiency is the software tool, which enables assessment of energy consumption during the whole year.
- However software tools are often not used by designers and developers for the following reasons:
  - due to the problem of accessibility of the software tools,
  - due to a lack of information on building energy consumption during the design stage.

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- SDAP Center has developed a Building Energy Passport (BEP) Software program that aims at assessment of building energy consumption during the planning and design stages as well as achievement of the energy efficient thermal performance level and certification of building by specific energy consumption value.

- Such an approach helps to make a decision for project implementation together with a cost benefit analysis for verification of reasonable cost.

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Objectives of the “Building Energy Passport” (BEP)

- The main aim in the application of a Building Energy Passport software tool for energy efficient design purposes is an achievement of the optimal balance between all the factors that affect minimisation of energy consumption.

- The software is developed for all types of the buildings to calculate the thermal performance of the building envelope and labelling according to the requirements that are imposed by European Energy Performance of Buildings Directive.

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- Methodology reflects integrated approach in thermal performance design by setting up normative/ recommended specific energy consumption values according to the type of building and number of storeys.
- The overall demand in energy/heat consumption for the heating period foresees the calculation of thermal balance components and is calculated as a function of conductive heat losses, heat losses via air exchange, domestic and solar radiation intakes, coefficient of efficiency of automatic regulation of heat supply, as well as coefficient that considers additional heat consumption by the heating system.
- Normative / recommended specific energy consumption value indicates benchmark level during design process and is very informative for its comparison with the designed specific consumption value that results from the design process aiming at selecting design solutions and insulation materials for exterior components of the building.

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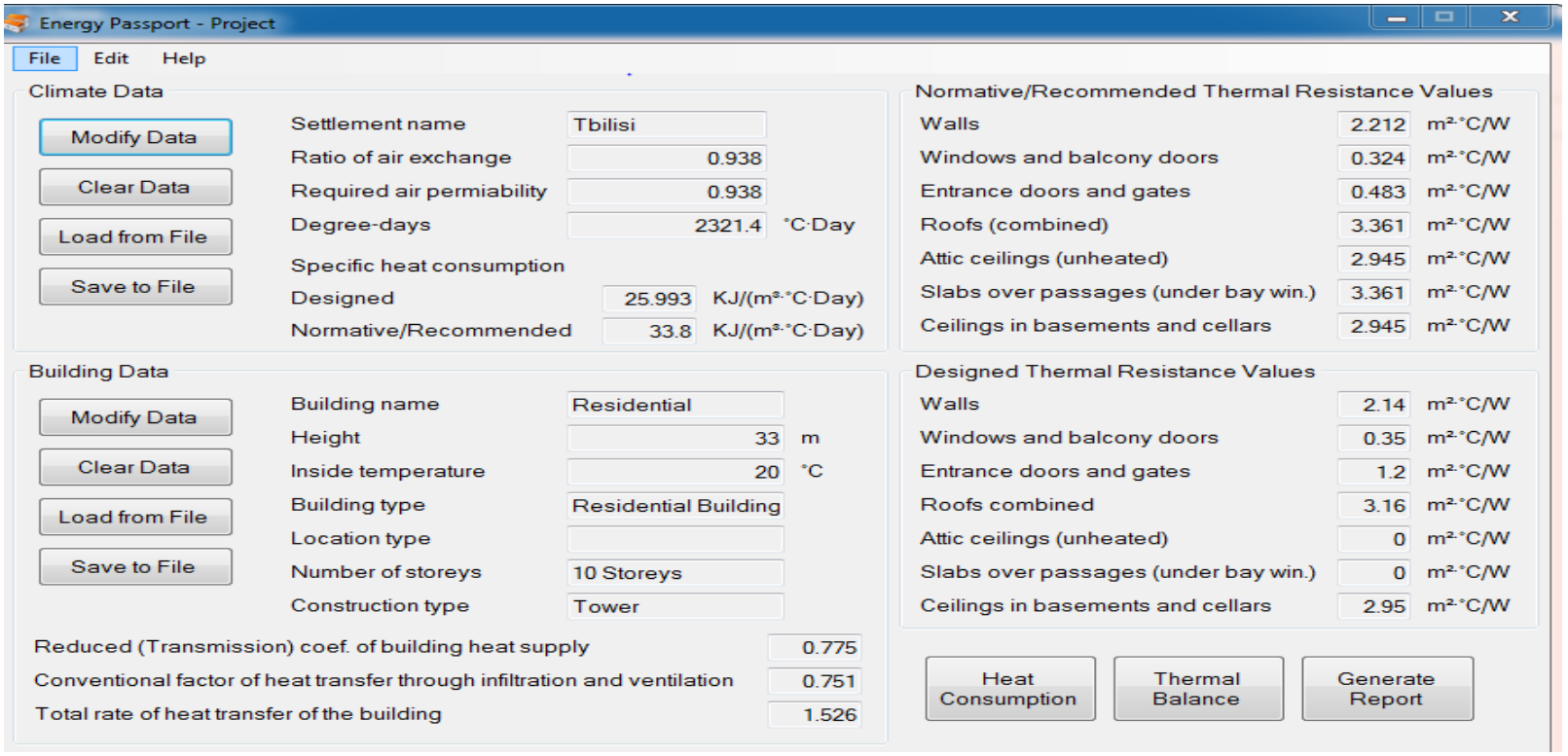
- The Energy Passport software is a standalone desktop application.
- All required entrance data is divided into two parts: Climate Data and Building Data.



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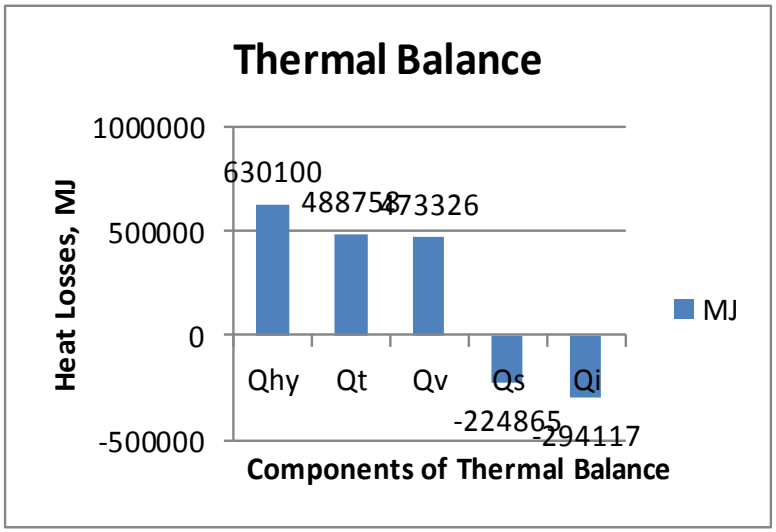
Thermal performance design and labeling with Building Energy Passport

- The thermal performance design of a new residential building designed by one of the Georgian development company ‘s was performed with the aid of the “Energy Passport” software tool. Results of calculations are shown on diagrams.



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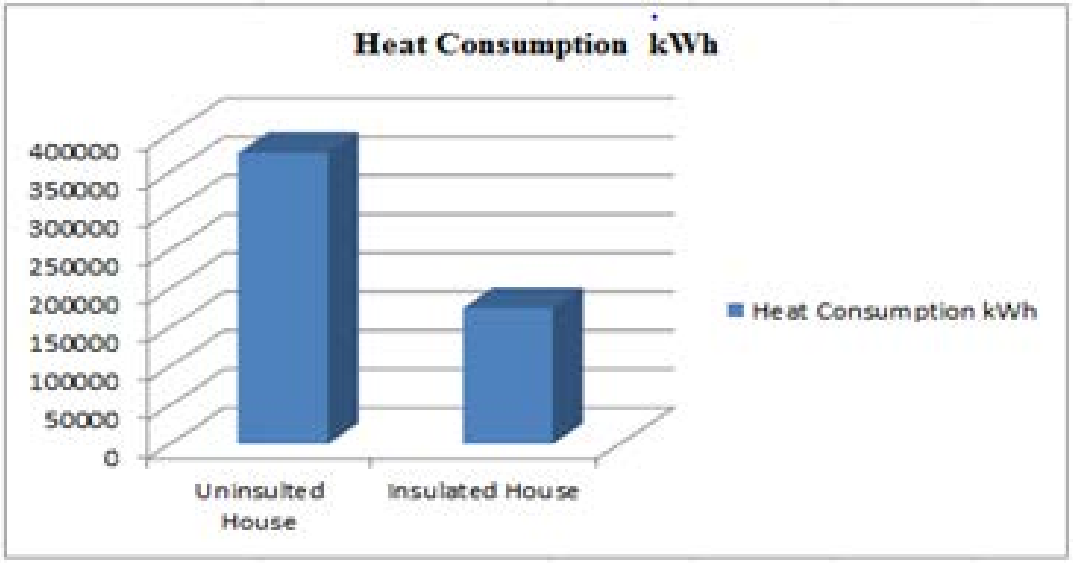
- Results of thermal performance design with the enhanced energy efficiency have been compared for the prototype building designed with the old Soviet approach – an un-insulated house version that represents the current construction practice in Georgia.



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Conclusions

- Calculations prove 53 % savings in heat consumption over the heating period, since R values of the un-insulated version are benchmarked by old Soviet codes and are rather low.

- The Energy Passport" software tool provides the opportunity for a quick assessment of a building design with the thermal protection level at the design stage and labeling with the wide possibility for evaluation of volumetric-planning indicators and thermal insulation solutions.

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Thank you