ECO-Life project results and challenges in Lithuania (Birštonas)

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DEPT. OF BUILDING ENERGETICS (BE)

DEPT. OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT (CTM)

Description of UNI-LT investigated objects (Birštonas)

Birštonas is a balneological resort and a spa town in Lithuania situated 30 km south of Kaunas on the right bank of the Nemunas River.

Birštonas received its city rights 1529.

The city is the administrative center of the Birštonas municipality.

Description of UNI-LT investigated objects (Birštonas)

The research objects in Birštonas are: (13) A, B, C, D and E type multi-apartment houses built in 1968-1979 Vilniaus str. 4, Vilniaus str. 6, Vilniaus str. 8, , Vilniaus str. 12

- B. Sruogos str. 8, B. Sruogos str. 12, B. Sruogos str. 14, Sruogos str. 10,
- Pušyno str. 5, Pušyno str. 9, Pušyno str.11, Pušyno str. 13, Pušyno str. 15,

and F, G and H type public buildings.

- School of arts (Basanavičiaus av. 6), Birštonas Clinic (Jaunimo str. 8) and Office building (Jaunimo str. 3).

Description of UNI-LT investigated objects (Birštonas)

A, B, C, D type multi-apartment buildings

Description of UNI-LT investigated objects (Birštonas)

E type multi-apartment buildings

Current regulations for energy audits in public sector

Supported programs for energy saving measures in commercial and public services sectors started from 2001.

To be eligible for state support public buildings had been forced to perform the energy audits.

The form, content and execution methodology of the energy audits in practice by the year 2008 were not formally regulated, and were developed in a practical way differently.

- Methodology of detailed energy, energy recourses and cold water use audit performance in public buildings. Validated by Minister of Economy of the Lithuanian Republic in 29 April, 2008. Order Nr. 4184. (*Išsamiojo energijos, energijos išteklių ir šalto vandens vartojimo audito atlikimo viešojo naudojimo paskirties pastatuose metodika Lietuvos Respublikos ūkio ministro 2008 m. balandžio 29 d. įsakymu Nr. 4 184 (Žin., 2008, Nr. 55-2097))*

  3 public buildings (School of arts, Birštonas Clinic and Office) in Birštonas are participating in ECO-life project; their energy audits where performed in accordance with the mentioned methodology.

Current regulations for energy audits in dwelling houses sector

Energy performance of building certification (before and after modernization). Investment project

Nr. KG-0038-0001

Unikalus pastato Nr.

Pastato adresas:	Sruogos 12, Birštonas, Birštono sav.
Pastato paskirtis:	Kiti gyvenamieji pastatai
Pastato naudingasis plotas:	1945,11 m²

Skaičiuojamosios suminės energijos sąnaudos vienam kvadratiniam metrui pastato naudingojo ploto:	400,55 kWh/(m²×metai)
Pagrindinis pastato šildymui naudojamas šilumos šaltinis:	Šilumos tinklai, rankinis reguliavimas
Sertifikato išdavimo data:	
Sertifikato galiojimo terminas:	

Sertifikatą išdavė
pastatų energinio naudingumo sertifikavimo ekspertas:
Jolanta Čiuprinskienė, atestato Nr.0038

VGTU, pastatų energetikos katedra

Skaičiavimai atlikti pagal STR 2.01.09:2005 reikalavimus. Sertifikatų registras skelbiamas www.spsc.lt

Priemonių pastato energiniam naudingumui gerinti įvertinimas

Priedas prie sertifikato Nr.KG-0038-0001

Eil. Nr.	Priemonės pavadinimas pastato energiniam naudingumui gerinti	Energijos kiekis, galimas sutaupyti kvadratiniame metre pastato naudingojo ploto per metus, įdiegus priemonę, kWh/(m²×metai)	Energijos dalis nuo dabartiniu metu pastato suvartojamo energijos kiekio, galima sutaupyti įdiegus priemonę
1	Pastato sienų apšiltinimas taip, kad visų sienų šilumos perdavimo koeficientas atitiktų normų reikalavimus	61,29	0,15
2	Pastato stogų apšiltinimas taip, kad visų stogų šilumos perdavimo koeficientas atitiktų normų reikalavimus	36,90	0,09
3	Pastato perdangų, kurios ribojasi su išore, apšiltinimas taip, kad visų perdangų, kurios ribojasi su išore, šilumos perdavimo koeficientas atitiktų normų reikalavimus	Pastate nėra	Pastate nėra
4	Pastato perdangų virš nešildomų rūsių ir pogrindžių apšiltinimas taip, kad visų perdangų virš nešildomų rūsių ir pogrindžių šilumos perdavimo koeficientas atitiktų normų reikalavimus	2,74	0,01
5	Pastato grindų ant grunto apšiltinimas taip, kad jų šilumos perdavimo koeficientas atitiktų normų reikalavimus	Pastate nėra	Pastate nėra
6	Horizontaliai pakraščiuose apšiltintų grindų ant grunto apšiltinimas taip, kad jų šilumos perdavimo koeficientas atitiktų normų reikalavimus	Pastate nėra	Pastate nėra
7	Vertikaliai pakraščiuose apšiltintų grindų ant grunto apšiltinimas taip, kad jų šilumos perdavimo koeficientas atitiktų normų reikalavimus	Pastate nėra	Pastate nėra
8	Vertikaliai ir horizontaliai pakraščiuose apšiltintų grindų ant grunto apšiltinimas taip, kad jų šilumos perdavimo koeficientas atitiktų normų reikalavimus	Pastate nėra	Pastate nėra
9	Šildomo rūsio atitvarų, kurios ribojasi su gruntu, apšiltinimas taip, kad jų šilumos perdavimo koeficientas atitiktų normų reikalavimus	Pastate nėra	Pastate nėra
10	Pastato langų keitimas langais, atitinkančiais normų reikalavimus	32,71	0,08
11	Pastato išorinių įėjimo durų keitimas durimis, atitinkančiomis normų reikalavimus	0,00	0,00
12	Pastato karšto vandens ruošimo sistemos rekonstravimas: karštas vanduo ruošiamas pastato šilumos punkte su automatiniu reguliavimu arba įrengiama kita tokio pat efektyvumo kaip šilumos punkto su automatiniu reguliavimu sistema	12,28	0,03
13	Viso pastato patalpų šildymo reguliavimą apimančių šildymo sistemos reguliavimo įtaisų įrengimas. Termostatinių šildymo prietaisų ventilių ir patalpų arba išorės termostato sumontavimas	35,33	0,09
14	Šilumos šaltinio keitimas: pastato šildymas pajungiamas prie šilumos tinklų su automatiniu šilumos šaltinio reguliavimu arba prie kito analogiško efektyvumo šilumos šaltinio	34,02	0,09
15	13 ir 14 eilutėje išvardytų priemonių įdiegimas	66,42	0,17

Pastatų energinio naudingumo sertifikavimo ekspertas:

Jolanta Čiuprinskienė, atestato Nr.0038

VGTU, pastatų energetikos katedra

Pastato energijos sąnaudų skaičiavimo rezultatai

Priedas prie sertifikato Nr.KG-0038-0001

Eil. Nr.	Energijos sąnaudų apibūdinimas	Skaičiuojamosios energijos sąnaudos kvadratiniame metre pastato naudingojo ploto per metus, kWh/(m²×metai)
1	Šilumos nuostoliai per pastato sienas	71,53
2	Šilumos nuostoliai per pastato stogą	43,14
3	Šilumos nuostoliai per pastato perdangas, kurios ribojasi su išore	0,00
4	Šilumos nuostoliai per pastato perdangas virš nešildomų rūsių ir pogrindžių	9,86
5	Šilumos nuostoliai per atitvaras, kurios ribojasi su gruntu:	0,00
5.1	- per grindis ant grunto	0,00
5.2	- per horizontaliai pakraščiuose apšiltintas grindis ant grunto	0,00
5.3	- per vertikaliai pakraščiuose apšiltintas grindis ant grunto	0,00
5.4	- per vertikaliai ir horizontaliai pakraščiuose apšiltintas grindis ant grunto	0,00
5.5	- per šildomo rūsio atitvaras, kurios ribojasi su gruntu	0,00
6	Šilumos nuostoliai per pastato langus	70,51
7	Šilumos nuostoliai per pastato išorines įėjimo duris, neįskaitant nuostolių dėl durų varstymo	0,62
8	Šilumos nuostoliai per pastato ilginius šiluminius tiltelius	65,79
9	Šilumos nuostoliai dėl išorinių įėjimo durų varstymo	0,82
10	Energijos sąnaudos pastato vėdinimui	24,04
11	Šilumos nuostoliai dėl viršnorminės išorės oro infiltracijos	32,73
12	Šilumos pritekėjimai į pastatą iš išorės	-35,33
13	Vidiniai šilumos išsiskyrimai pastate	-9,50
14	Elektros energijos suvartojimas pastate	21,00
15	Energijos sąnaudos karštam vandeniui ruošti	33,33
16	Pastato suminės energijos sąnaudos neįvertinus šildymo sistemos efektyvumo	328,54
17	Pastato suminės energijos sąnaudos įvertinus šildymo sistemos efektyvumą	400,55

Pastatų energinio naudingumo sertifikavimo ekspertas:

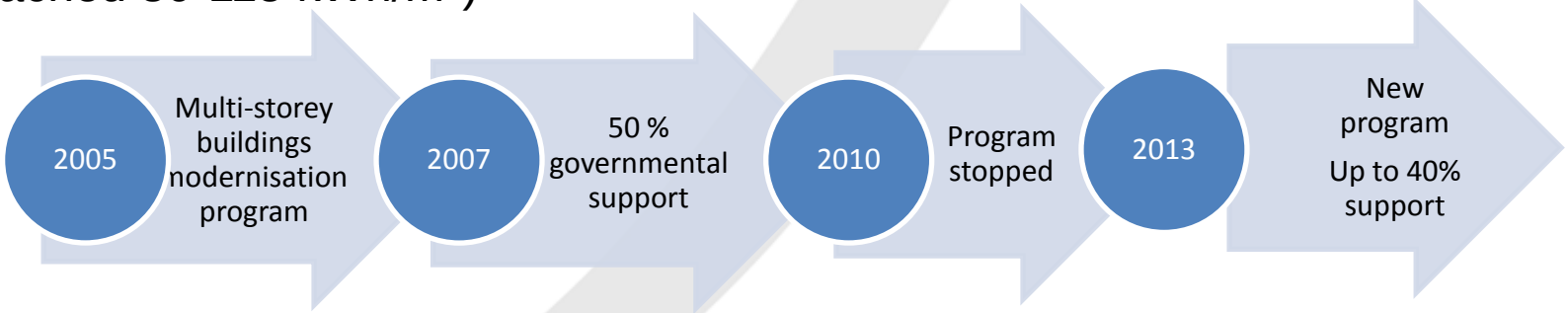
Jolanta Čiuprinskienė, atestato Nr.0038

VGTU, pastatų energetikos katedra

Current regulations for energy audits in dwelling houses sector

Under the new financial model (until 2015) the State support for the implementation of the multi-apartment buildings modernization projects will be provided in the following ways:

- Preferential credit with not higher than **3 percent** fixed annual interest;
- Support for low income families covering the costs of project preparation, credit insurance and preferential credit and interests;
- **100 percent** contribution to the preparation of project and construction supervision;
- **40 percent** support for the implementation of energy efficiency improvement measures (if there is at least C class of building energy performance would be reached 80-115 kWh/m^2)

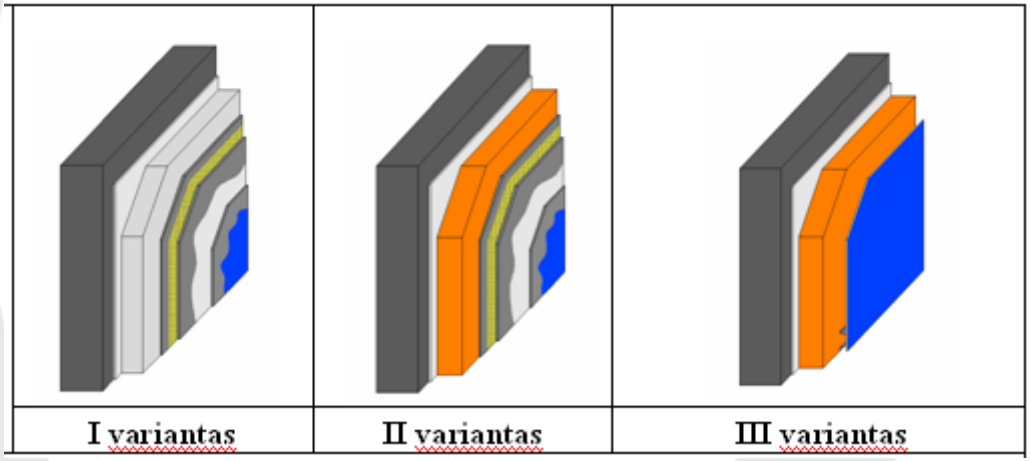


Feasibility study for building envelope modernization

The aim of study - to determine the **rational building envelope insulation systems**, which let reducing energy consumption in buildings and improving energy efficiency.

To reach the aim the following objectives are determined:

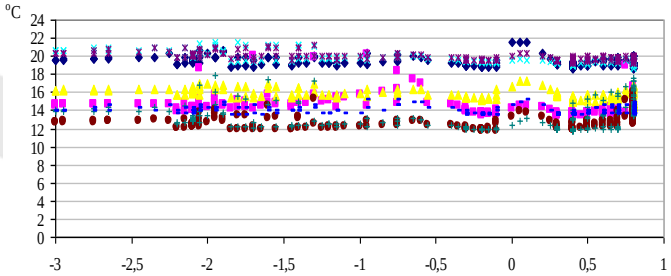
1. To determine the current state of the buildings:
   - to identify the technical characteristics of buildings' envelopes;
   - to identify the heat insulation parameters of buildings' envelopes;
   - to propose the findings of existing buildings condition assessment and
   - recommendations for improving the situation;
2. To perform the technical-economic assessment of modernization measures:



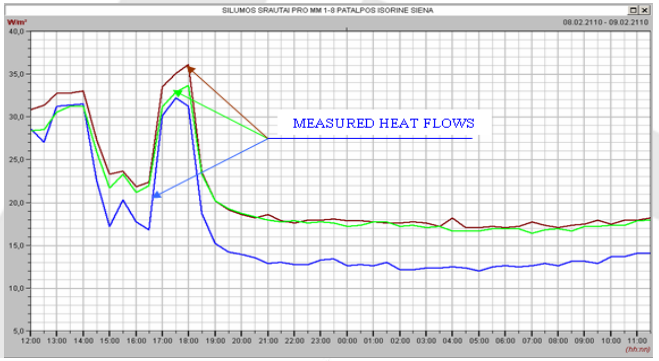
Actual physical and thermal envelope characteristics

During the analysis of building envelopes, engineering systems and indoor climatic conditions in the cold period the following measurements were carried out:

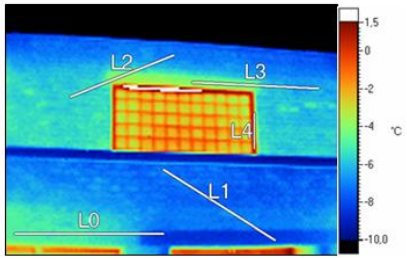
- Outdoor temperatures, room microclimate conditions (temperature, RH, CO2 emission) indoor



- Heat transfer coefficients of envelope constructions (exterior walls, the upper floor slab, first floor slab (basement ceiling)).



- For the evaluation of the state of building envelope structures the thermal analysis using infrared camera was performed.



Feasibility study for building envelope modernization

Study resulted by proposal of three variants for insulation of external walls:

- thin plaster system with grey polystyrene foam;
- tile facade with grey polystyrene foam;
- ventilated facade system wooden board covered and insulated with grey polystyrene foam.
- This proposal is based on the results of calculation applying the proposed methods, taking
- into account the technical characteristics of proposed insulation material (better insulation
- characteristics, safe, incombustible).

Table 1. The description of thin plaster system insulated with grey polystyrene foam

The code of system	Description of energy saving measure	U, W/m²K	The price of proposed measures, Lt (incl VAT), Lt/m²
1v-PL/N-A	Exterior walls are insulating with grey polystyrene foam board of 230 mm thickness and covering with thin plaster.	0,14	235,08
1v-PL/N-B	Exterior walls are insulating with grey polystyrene foam board of 160 mm thickness and covering with thin plaster.	0,19	215,93
1v-PL/N-C	Exterior walls are insulating with grey polystyrene foam board of 120 mm thickness and covering with thin plaster.	0,24	212,19

Feasibility study for buildings heating, ventilation and electricity systems optimization

The aim of this feasibility study is to offer the most suitable combinations of building service systems modernisation (heating, ventilation, domestic hot water, electricity).

Actual situation.

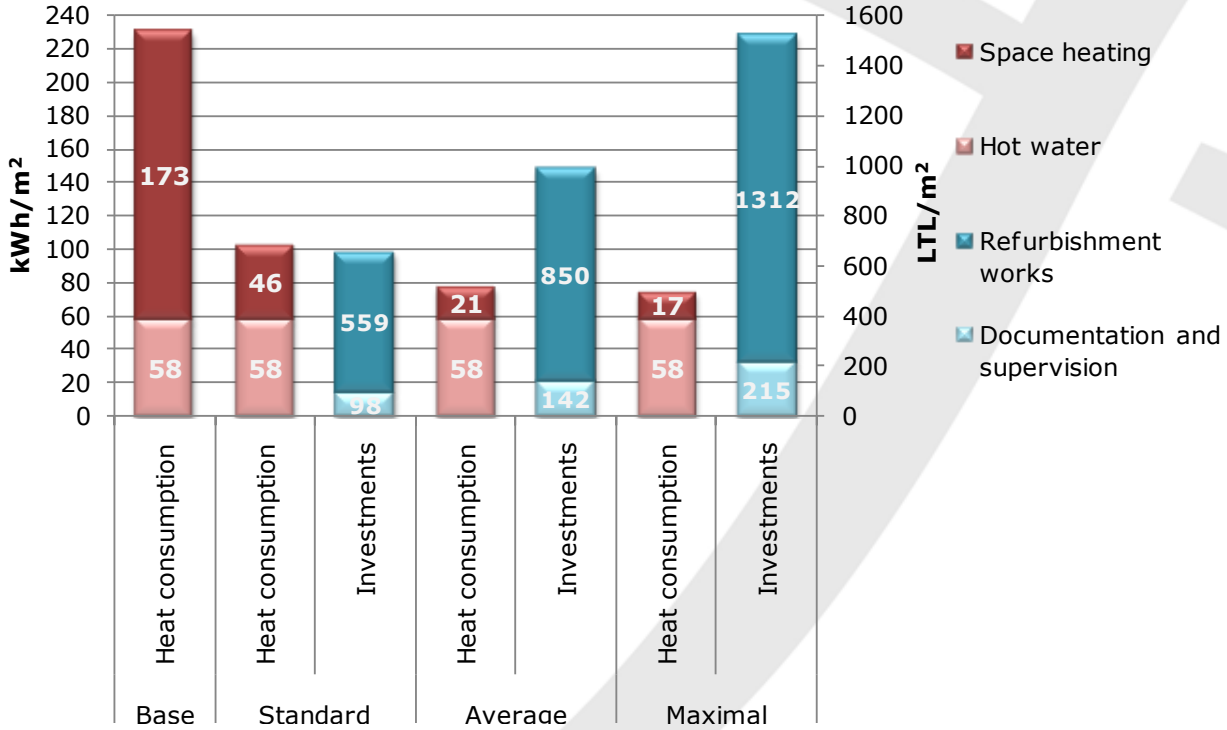
The buildings were constructed 20-40 years ago.

A detailed analysis of the buildings has shown that the state of buildings' passive and active elements is in bad shape. Major repairs in these buildings have not been carried out during the time of their use.

Only the new heating substations were installed more than 15 years ago. Some windows in multi-apartment residential buildings have been changed by users, some balconies have been glazed.

Feasibility study for buildings heating, ventilation and electricity systems optimization

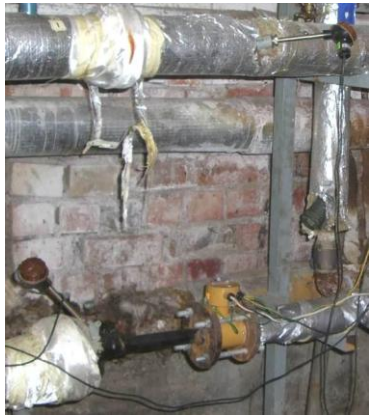
- The main result of this study is several alternatives of energy-saving measures combinations
- The economic analysis of active energy saving measures shows that all the three analyzed (Standard, Average and Maximum) packages have a relatively long payback period, especially maximum investment package.



Feasibility study for metering system installation

The aim of this feasibility study - to suggest for analyzed buildings suitable smart system for metering and recording data flows taking into account the energy and economic values.

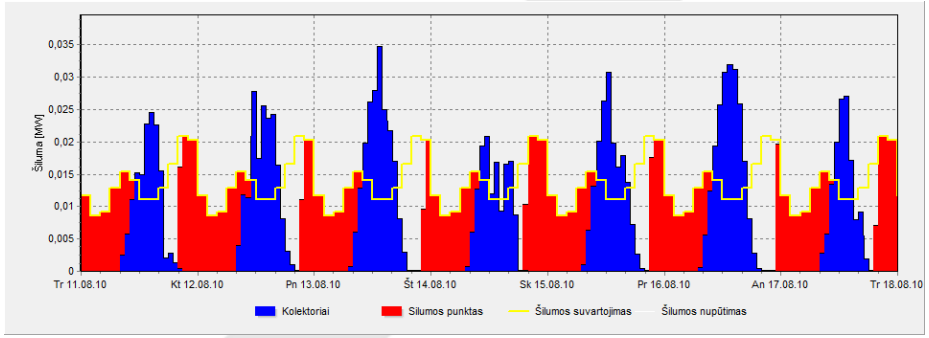
- Simple payback period analysis shows that in all cases of energy-saving measures and in case of received support and ensuring the relative savings in B and C smart metering installation variants (without electricity and gas metering), the results may be acceptable (within 20 years).
- In the case when the discount rate over the 20-year period increased from 5% to 10%, while the savings rate remains the same 5%, the NPV in case of implementation the smart metering alternatives and energy-saving measures will be negative.



Feasibility study for solar collectors, photo voltaic or wind turbine installations

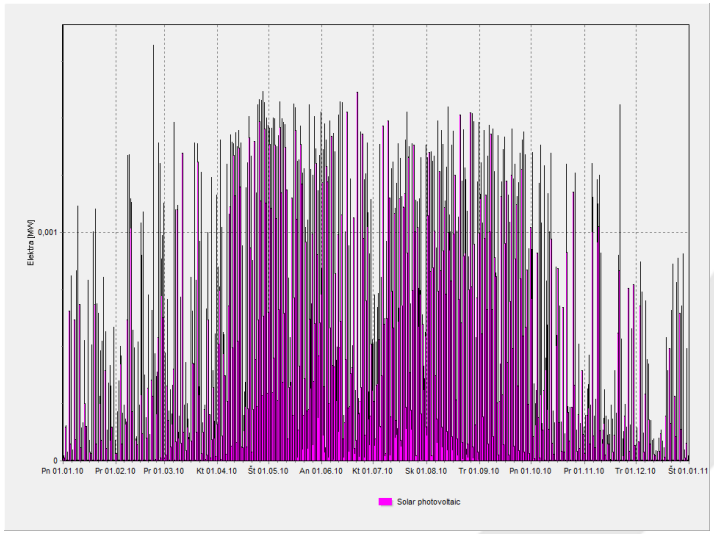
The aim of study – to determine the rational alternative, to cover the part of the annual heat demand in domestic hot water system, as well as evaluate the possibilities of PV panels or small/micro wind turbine installations for electricity generation.

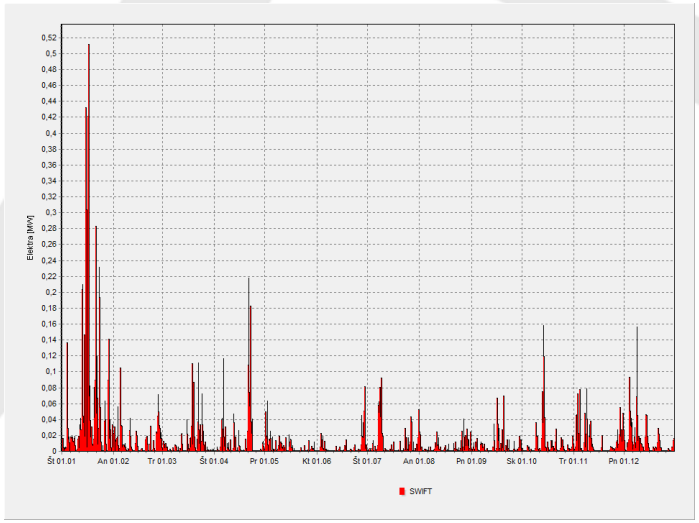
- Performed technical and economic sensitivity analysis of potential systems of solar collectors in multi-apartment buildings have shown that the results are strongly influenced by the change of the investment value, the interest rate, produced (or saved) quantity of heat, and additional operating costs.
- Almost all marginal variations in economic terms, within 20-year equipment life cycle, are acceptable. The best alternative in this building is 75 m^2 of solar collectors with 4 m^3 of accumulation. There is possibility to use smaller scale variations, because some of their economic results are very close.
- The results of simulation showed that vacuum solar collectors are more efficient and produce more heat than flat plate solar collectors. But they are more expensive and therefore very sensitive to the changes of economic and technical indicators. Therefore, it is recommended to install system of flat plate solar collectors with accumulator tank in the analyzed buildings.



Feasibility study for solar collectors, photo voltaic or wind turbine installations

- Performed investigation of solar photovoltaic modules indicates that installation of such system is economically feasible in case of the polycrystalline solar cell power plant and only if the sale of electricity to the national electricity network under the current subsidized rate (1,63 Lt/kWh) is guaranteed. The power of photovoltaic solar plants should be at least 2 kWp.
- The study of micro wind turbine installation on the roof (the system of 1,5 kW power was analyzed) showed that average annual amount of electricity produced by micro-wind turbines is almost **four times** less than produced by solar photovoltaic plant. Investments into micro wind turbine installation are almost **twice higher** than in the solar power plant. Electricity purchase prices to the national grid differ by more than **5 times**. Therefore, due to unfavorable wind velocity in Birštonas and economic indicators it is recommended not to install micro wind turbines.

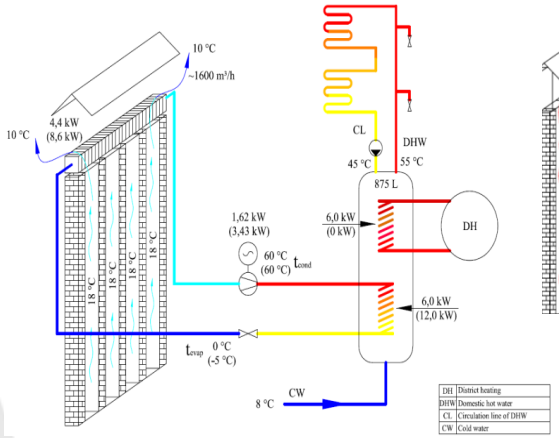


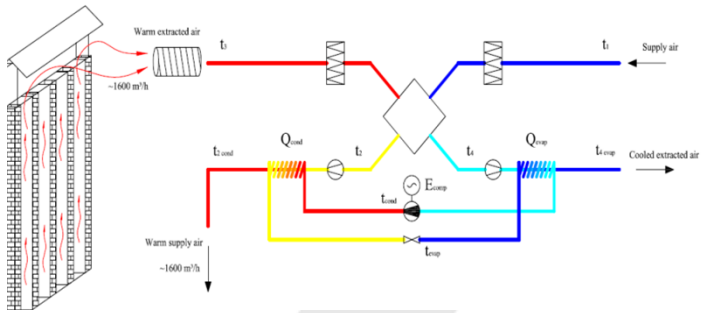


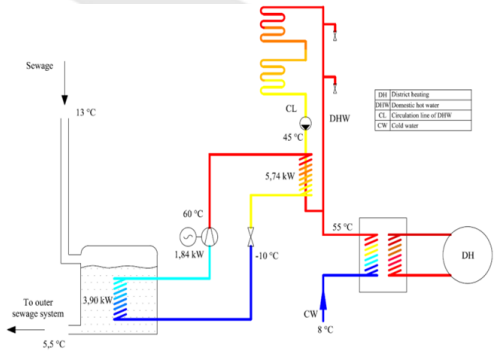
Feasibility study for geothermal heating installation

The aim of this feasibility study is to investigate the possibility of using heat pump for supplying the heat to the residential buildings in Birštonas.

- This feasibility study analyses primarily two different groups of heat pumps - soil/geothermal heat pumps (G) and heat pumps using waste heat (R).
- This feasibility study provides the environmental assessment of the alternatives. The assessment shows, that none of the analyzed heat pumps alternatives are environmentally better than the current district heating case, were biomass amounts app. 80% of the fuel balance.







Conclusions

- Feasibility studies evaluated existing situation, investments and RES integration possibilities and showed great potential to reach the high energy savings level.
- Change in supporting financing scheme and high investment demand for more efficient modernisation made CONCERTO support unavailable.
- Lack of governmental support and financial crisis led to modernisation rejection from people of investigated buildings.

VILNIUS GEDIMINAS TECHNICAL UNIVERSITY

Thank you for your attention

Questions?

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ECO-Life project

CONCERTO