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Market demand study for energy efficiency projects in the public sector in Lithuania

Final report

Client:

European Bank for Reconstruction and Development

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Glossary

Bn	Billion
CAPEX	Capital Expenditure, investments
CF	Cohesion Fund
Client, EBRD	European Bank for Reconstruction and Development
CO_2	Carbon dioxide
CPO	Central Purchasing Organisation
CSF	Common Strategic Framework
DH	District heating
DHW	Domestic hot water
EE	Energy efficiency
EED	Energy Efficiency Directive
EEF	Energy efficiency fund
EIB	European Investment Bank
ELENA	European Local Energy Assistance
EnPC	Energy performance contract
ERDF	European Regional Development Fund
ESCO	Energy service company
ESCO client	The party which pays ESCO for services
ETS	Emissions trading systems
EU	European Union
EUR	Euro
FF	Forfeiting facility
FI	Financial Instrument
GDP	Gross Domestic Product
JEREMIE	Joint European Resources for Micro to Medium Enterprises
JESSICA	Joint European Support for Sustainable Investment in City Areas
kWh	Kilowatt-hours
LBSA	Lithuanian business support agency
LDHA	The Lithuanian District Heating Association
LED	Light-emitting diode

LRA	Lithuanian Road Administration under the Ministry of Transport and Communications
LTL	Lithuanian currency – Litas
M	Million
Ministry of Energy	Ministry of Energy of the Republic of Lithuania
MWh	Megawatt-hours
M^2	Square metre
N/A	Not available
OPEX	Operational expenses
Police department	Police department under the Ministry of the Interior
PPO	Public Procurement Office
PPP	Public Private Partnership
PV	Present value
RC	Centre of Registers
ROE	Return on equity
SET	Saved energy tariff
Statistics Lithuania	Lithuanian statistics department
STR	Construction technical regulation
Street lights	Lights used to light streets
Study	Market demand study for energy efficiency projects in the public sector in Lithuania
ToR	Terms of reference for the Market Demand Study for ESCO Energy Efficiency Projects in the Public Sector
t oe	Tonne of oil equivalent
VIPA	Public investment development agency
W	Watt

Important notice

Our analysis and recommendations outlined in this report are based on the limited public and non-public data that was provided to us.

UAB 'KPMG Baltics', law firm 'Glimstedt', UAB 'Ekotermija' are not responsible for any misleading information that was presented to us. Our findings give only an indicative assessment on assumptions input and specific parameters input for a specific case at a specific time. Over time these parameters and assumptions may change.

Neither the European Bank for Reconstruction and Development nor any other parties should make any irreversible or costly decisions based solely on the information provided in this report.

This document represents a first draft and it is subject to further adjustments on content and language matters.

Executive summary

Introduction

European Bank for Reconstruction and Development (hereinafter – Client) has commissioned KPMG Baltics to conduct a Market demand study for energy efficiency projects in the public sector in Lithuania (hereinafter – Study).

In recent years, there has been an increasing interest in energy efficiency projects. Investments in energy efficiency bring a number of significant benefits, e.g. lower energy costs, reduction of a country's CO_2 emissions, improvement in a country's trade balance (through reduction of energy imports) etc. The European Union (hereinafter – EU) has stressed the importance of increasing energy efficiency by forming the 'Europe 2020' strategy for its member states. It targets to lower greenhouse gas emissions by 20% compared to 1990 levels; achieve 20% of energy from renewable resources and increase energy efficiency by 20%. In order to fulfil these goals, the EU has allocated structural funds for the 2014-2020 programming period with recommendations as to their use. One of the requirements is the adoption of the Energy Efficiency Directive (hereinafter – EED), which obliges member states to modernise 3% of buildings owned and occupied by central governments.

As public building modernisation requires a substantial amount of financing, energy service companies (hereinafter – ESCO) can play a significant role – they would allow leveraging public funds by employing commercial finance and thus, enable more modernisation projects to be implemented. Financial engineering could be used by blending grants with commercial finance, especially in cases where market failure prevails. For instance, deep retrofits with long payback periods. In such way the payback period could be reduced to a commercially viable term. Also, grants would diminish the investment barriers and transaction costs of ESCO projects. In addition, technical, economic and financial risks would be reduced for the public sector, since modernisation services are outsourced to the private sector.

In this study, we analyse the market for ESCO services in Lithuania by assessing the energy saving potential in the public building and street lighting segments and the capacity of the private sector to deliver ESCO services; we determine the main barriers to ESCO market development and identify and recommend possible solutions to overcome these barriers.

To conduct the study we used primary and secondary information sources: Ministry of Energy, Ministry of Finance, Central Purchasing Organisation, Public Procurement Office, Public investment Development Agency, Lithuanian Business Support Agency, Lithuanian District Heating Association, The Centre of Registers, Statistics Lithuania, 60 municipalities, banks and potential ESCOs were the main information sources for this study.

The report consists of 4 chapters. In the first chapter we assess the energy efficiency services market – we provide an overview of public building and street lighting stock, recent modernisation programmes, we analyse the potential modernisation scenarios, assess the willingness and capabilities of the private sector to undertake ESCO projects, and evaluate the potential financing mechanisms. In the second chapter we determine the major barriers which should be overcome in order to encourage ESCO market development in Lithuania. The third chapter is dedicated to our proposed solutions on how to overcome the aforementioned barriers. Finally, in the fourth chapter, we estimate how the development of the ESCO market would affect Lithuania's economy.

Key findings

Market assessment

The central government and the municipalities of Lithuania own 8,600 public buildings – approximately 45% of all buildings of administrative, cultural, educational, sports and medical categories. The total area owned by the central government adds up to 4.6 M m^2, while 8.4 M m^2 is owned by the municipalities. Although there is no centralised database on energy consumption, approximations done in the course of this study have shown that the average heating consumption in all classes of buildings ranages – 180-200 kWh per m^2 of heated area.

Approximations based on a review of 17 municipalities and JSC Lithuanian Railways, have shown that the length of the street (and railway) lighting network is more than 10,500 km (46% – cable lines and 54% – overhead lines). The total number of luminaires is more than 260,000 units, of which the majority (83%) consist of luminaires with sodium vapour lamp and luminaires with mercury vapour lamp (13%). The annual costs of running these networks are estimated to be more than LTL 47 M.

Since there is no centralised database on street lighting assets and on energy consumption of public buildings – additional difficulties for potential ESCOs arise. It is complicated to evaluate such projects due to lack of data about asset conditions and their savings potential.

During the period 2002-2012 several regional and national level energy efficiency programmes were implemented in Lithuania, and a total of approximately LTL 1.48 Bn was invested in public building modernisation. A sample of 177 projects has demonstrated that, on average, after the modernisation heating consumption decreased by 25%. The aforementioned programmes were financed through governmental and structured EU funds subsidies. Public buildings modernisation tenders were based on the lowest price criteria, rather than the goal to reduce energy consumption. Procurement of building modernisation focused only on pre-listed measures and no alternative energy efficiency measures were supported. Thus, no real mechanism to disseminate the best practice through standardisation of requirements or contracting oriented towards energy consumption was put in place.

Although the chosen strategy of addressing the least energy efficient buildings through subsidies could have been justified in the past, future programmes need to focus on contractual energy saving obligations, and should use more sophisticated financial instruments to address the financing gap.

To achieve the public building modernisation targets set by EED, at least 67,000 m^2 of centrally owned public buildings need to be modernised annually. Based on our calculations, the total investment (i.e. costs of project design and constructions) needed to reach the goal by 2020 is more than LTL 300 M. For the street lighting segment, we have calculated that total investment needed is more than LTL 210 M.

We addressed the issue of the willingness and capabilities of private companies to operate under the ESCO model while modernising public buildings by analysing more than 60 public procurement tenders related to the modernisation of public buildings; and by surveying 40 companies in Lithuania, which represent the architectural/engineering, construction, buildings maintenance, materials and equipment selling sectors. The results of the survey proved that the most likely companies to play ESCO roles would come from the building maintenance, construction or architectural/engineering sectors. These companies would expect an annual return on investment of between 10% and 20%. Representatives of these industries named the following barriers which need to be addressed: risks related to contract complexity, lack of on-hand experience and long term financing issues.

The analysis of public tenders demonstrated that in the majority of cases lowest price was the only criterion used in selecting the winner of the procurement. The economic utility formula was only used to select the winner in 5% of tenders. This formula uses a few other criteria besides the lowest price (e.g. offered guarantees, quality of materials, etc.). None of the past tenders that we reviewed were based on energy performance contracts.

To understand how the commercial banking system sees the risks associated with ESCO operation financing, we met with representatives of 4 commercial banks in Lithuania. The banks clearly indicated that they are ready to provide short-term financing, however, long-term financing was not something they would consider at present.

Commercial banks also indicated several risks: complexity of contracts, absence of track record, long-term use of the modernised buildings, ESCO client credit risks, political risk, credibility and in house capacity – were the biggest issues for banks. It is important to note that the ESCO concept is relatively new in Lithuania and therefore banks have no experience in assessing these risks.

Major barriers

After assessing the energy efficiency services market, analysing the relevant regulatory framework and reviewing the available financing mechanisms we have identified several barriers which may limit the development of the ESCO market in Lithuania. The identified barriers can be divided into four categories: regulatory limitations, technical and contractual barriers, capabilities of potential ESCOs and financing constraints.

First, under the regulatory limitations category we identified that: the current budget allocation and fund transfer procedures used by the State and municipalities do not encourage energy saving; the current regulatory framework limits the scope of ESCO services which could be provided by Lithuanian district heating (hereinafter – DH) companies, e.g. the provision of technical maintenance of the heating equipment and hot water system of a building is prohibited by the Law on Heating Sector; Lithuanian public procurement law is not well adapted for the conclusion of long-term service contracts; the right of procuring agencies to initiate multi-object procurements that would include both – works, services and products – is limited; there is no practice or formal guidance for the procurement of energy efficiency improvement measures; the existing EE programmes do not promote Energy Performance Contract (hereinafter – EnPC) and legislation does not sufficiently enable EnPC. Moreover, we identified several imperfections pertaining to the draft Law on EED implementation prepared by the Ministry of Energy.

Second, regarding the technical and contractual barriers, we identified several issues related to the infrastructure for ESCO market development, e.g. there is no unified database on public buildings and street lighting assets, most public buildings do not have a separate meter for hot water and there is no seperate meter for electricity or lighting, etc. However , largest barrier is related to the absence of a standart contract documentation and contracting procedure.

Third, when analysing the capabilities of potential ESCOs, we identified that most companies have little or no relevant ESCO knowledge and experience.

Lastly, we have identified several important financing constraints that may impede the development of the ESCO market in Lithuania, e.g. a lot of potential ESCOs do not have the necessary financial capabilities to undertake average or big ESCO projects; the commercial banks are not willing to issue long-term loans for ESCO project financing, and would consider short-term loans if ESCOs would ensure the possibility of refinancing the loans after modernisation. What is more, we have identified

that long payback periods for ESCO clients and high project ROE demanded by ESCOs may prove to be a significant stumbling block for the development of the ESCO market.

Proposed solutions

The underlying solutions to the aforementioned issues, which may impede the development of the ESCO market, are related to 4 areas: procurement, contracting, financing and increase of awareness.

First, under the procurement area, after meeting with the Public Procurement Office we have formed the opinion, that the existing regulations in essence allow the procurement of ESCO services. However, these ESCO projects should be included in the long-term energy efficiency in public buildings and public infrastructure (street lighting) programme, which should be approved by the government. Consequently it would be possible to sign longer than 3-year service contracts without additional formalities.

Second, we suggest, that selection of the supplier in public building modernisation tenders should be completed using the economic utility criterion which is based on planned annual payments and energy savings. We recommend that payment for the services provided should be calculated as an annuity of investment and running costs.

In the area of contracting, we have provided a scheme on how risks between the building owner and the ESCO may be allocated through a methodology of savings calculation. If competent authorities (e.g. Ministry of Energy) were to create a contract template, it would be beneficial for banks in assessing risks and governmental institutions while dealing with the uncertainty of a new concept. In order to lower the risks and to decrease the entry barriers for potential players, we recommend that during the first phase of operations under the ESCO model, the measurement of contractual energy saving obligations would be limited to 5 years only and to parallel the warranty requirement period under the Law on Construction.

In the area of financing we believe that without an adequate mix of public and private finance the development of an ESCO market is hardly feasible. Since the record of ESCO projects in Lithuania is almost non-existent and there are too many perceived risks in financing ESCO projects, the intervention of the government is needed to accelerate the process of ESCO market development. Given that the Ministry of Finance is planning to establish the Energy Efficiency Fund (hereinafter– EEF), we provide our suggestions for various financial instruments (subordinated loans, guarantees and grants) which could be issued through the use of this fund.

What is more, we believe that the role of grants will remain important for those ESCO projects which do not show strong financial viability (e.g. buildings of D and E energy efficiency classes) and in cases, when ESCO companies are not able to attract sufficient funds to implement large ESCO projects. The efficient use of grants is important to the government since available grants and budget are limited. The EU stresses the importance of using Financial Instruments in energy efficiency projects during the new programming period as well. Grants should be used to effectively leverage commercial finance and allow more projects to be implemented.

To address the barriers of long-term financing, we recommend establishing a forfeiting facility (hereinafter – FF), which would be engaged in investing in receivables of ESCOs in those projects, where major risks related to contractual obligations under EnPC risks are no longer present, i.e. when achieved energy savings have been approved by an independent party. Furthermore, we identified that commercial banks show high interest in financing ESCO projects through the FF. Thus, the FF could facilitate in achieving the adequate mix of private and public financing. The use of grants should

be leveraged with the assistance of commercial finance and as a result more projects could be implemented.

To achieve more efficient use of private finance, both funds (FF and EEF) should satisfy the following conditions. Institutions should be set up as commercial entities and managed commercially. The main objective should be to efficiently attract additional private sector finance. In the case of issuing grants, they could be provided directly as capital grants to public owners in order to reduce EnPC paybacks to reasonable levels. Apart from reducing payback periods, the effective use of grants would allow increasing the quantity of investments. With 50% grants for the cost of modernisation works ESCOs would be able to finance approximately 80% more modernisation projects. Thus, at the beginning of ESCO market development, we suggest a 50-60% of grant intensity, which would allow doubling the quantity of modernisation projects. After the track record of ESCO projects is established and risks are reduced – the grant intensity should be gradually lowered and more private financing attracted.

Finally, we believe that in order to increase the level of awareness and the knowledge of ESCO type transactions in contracting, financing and supervision there is a great need for training. We estimate that 150–200 representatives from the public sector, from potential ESCOs and from the banking sector should be provided with comprehensive training.

Economic impact analysis

The economic impact analysis of ESCO market development revealed that in the long term (over 20 years) the modernisation of the most inefficient public buildings is 'profitable' in economic terms – for each EUR 1 invested, up to EUR 1.8 of direct economic value is created (taking into account the effect of change in expenditure for heating energy, reduced CO_2 emissions, reduced imports of natural gas and change in tax revenues). Additionally, the development of an ESCO market creates new jobs and has an overall positive effect on the local economy. Finally, in order to properly evaluate the effects of ESCO market development, additional 'subjective' effects have be considered, e.g. increased comfort level for building users, increased representative characteristics of the buildings, more efficient use of energy resources, assured hygiene standards in the buildings, etc.

1 Energy efficiency services market assessment

In an attempt to estimate the market potential for energy efficiency services, we have analysed the demand and supply factors that may drive the market. To understand the demand side, the existing public buildings and street lighting stock, energy consumption and administrative arrangements were examined. We have also reviewed the recent programmes and activities to improve energy efficiency in public buildings.

Given the fact that the demand side is very much influenced by the rate of modernisation of the assets to achieve reduction in energy consumption, we have built different investment scenarios to get a better understanding of the potential. On the supply side, we have looked at the willingness and capabilities of the private sector to participate in providing energy efficiency services.

As the energy efficiency service provision requires significant capital investment in the early stages of the projects, we have examined the financial constraints (level of returns, risks, financing sources, etc.) that may significantly influence the supply side of the energy efficiency services market.

1.1 Public building stock analysis

Data on different public building categories, energy consumption and information on administrative arrangements is provided in this section.

1.1.1 Basic information about public buildings

Basic information about the public building sector in Lithuania (i.e. ownership of the buildings, year of construction, external building envelope design type) is based on the data from the Centre of Registers (hereinafter– RC).

Table 1 shows the breakdown of public buildings by ownership. Building owners are divided into three categories: the State, the municipality or other owner.

Based on data from the RC, at the beginning of 2013 the State owned almost 2,900 buildings (52% administrative type buildings, 35% cultural, educational and sports type buildings and just 13% medical type buildings).

The Republic of Lithuania has 60 municipalities. Together they own slightly more than 5,700 buildings (13% administrative type buildings, 75% cultural, educational and sports type buildings and 12% medical type buildings).

Table 1: Public buildings breakdown by ownership (as of 2013.01.01)

Building type	State ownership		Municipal ownership		Other ownership	
	Number of buildings	Total area, m^2	Number of buildings	Total area, m^2	Number of buildings	Total area, m^2
Administrative buildings	1,504	1,488,120	746	436,366	7,744	7,016,667
Cultural, educational and sports buildings	992	2,188,634	4,287	6,773,481	2,025	1,977,696
Medical buildings	387	966,090	676	1,169,805	777	719,506
Total	2,883	4,642,844	5,709	8,379,652	10,546	9,713,869

Source: Centre of Registers

Thus, 45% of administrative, cultural, educational, sports and medical buildings are owned by the State and municipalities.

62% of the public buildings were constructed during the period 1961-1990 (see Table 2). Only 10% of all administrative, cultural, educational, sports and medical public buildings were built in 1991 and later.

Table 2: Public buildings breakdown by year of construction (as of 2013.01.01)

Building type	until1940		1941-1960		1961-1990		1991 and later	
	Number of buildings	Total area, m^2	Number of buildings	Total area, m^2	Number of buildings	Total area, m^2	Number of buildings	Total area, m^2
Administrative buildings	1,588	1,198,781	848	519,470	6,147	5,520,694	1,411	1,702,211
Cultural, educational and sports buildings	1,547	1,416,630	655	600,356	4,665	7,782,037	437	1,140,781
Medical buildings	429	389,725	198	120,041	1,014	1,898,428	199	447,207
Total	3,564	3,005,136	1,701	1,239,867	11,826	15,201,159	2,047	3,290,199

Source: Centre of Registers

Buildings which were constructed before 1990 complied with the construction regulations available at that time. Today these regulations are 3–5 times stricter – for example, the heat transfer coefficient of external partitions of residential houses built during 1959 to 1990 was approx. 1.1-1.3W/(m2K). Today, this indicator is equal to 0.2W/(m2K), which is 5 times lower. Given the fact that most of the buildings were built during the period 1961-1990, it is clear that due to poorly-insulated partitions (roof, external walls, floor and windows) a significant percentage of buildings consumes a lot of heating energy to maintain a comfortable indoor temperature.

Data provided in Table 3 shows that 76% of public buildings in Lithuania were built from bricks and blocks.

Table 3: Public buildings breakdown by outdoor wall type (as of 2013.01.01)

Building type	Outdoor walls							
	Bricks and blocks		Concrete slabs		Monolithic concrete		Others	
	Number of buildings	Total area, m^2	Number of buildings	Total area, m^2	Number of buildings	Total area, m^2	Number of buildings	Total area, m^2
Administrative buildings	8,144	6,586,988	751	1,457,089	56	361,689	1,043	535,374
Cultural, educational and sports buildings	4,862	7,263,979	1,090	2,911,304	49	92,732	1,303	471,799
Medical buildings	1,464	2,350,790	87	386,927	6	36,601	283	81,082
Total	14,470	16,201,757	1,928	4,755,320	111	491,022	2,629	1,288,255

Source: Centre of Registers

Most administrative, cultural, educational, sports and medical buildings in Lithuania are low height buildings. 81.6% of public buildings have 1-2 floors and 18.2% – 3-5 floors (see Table 4). Essentially, the same building heights persist in the breakdown of public buildings by buildings types.

Table 4: Public buildings breakdown by number of floors (as of 2013.01.01)

Building type	1-2 floors		3-5 floors		6-9 floors		10 and more floors	
	Number of buildings	Total area, m^2	Number of buildings	Total area, m^2	Number of buildings	Total area, m^2	Number of buildings	Total area, m^2
Administrative buildings	7,900	3,745,933	1,946	4,038,890	114	659,788	34	496,536
Cultural, educational and sports buildings	6,150	5,954,330	1,133	4,791,424	19	181,135	2	12,922
Medical buildings	1,429	1,005,082	372	1,475,522	34	311,839	5	62,960
Total	15,479	10,705,345	3,451	10,305,836	167	1,152,762	41	572,418

Source: Centre of Registers

1.1.2 Heating consumption in public buildings

Lithuania does not have a centralised database containing information about public buildings (e.g. building area, heated area, building energy efficiency class, heating demand). Therefore, in order to assess the actual heating and electricity consumption in public buildings, we sent questionnaires to all 60 municipalities and the Police department. Responses were received from 16 municipalities. In addition, we used data collected by the Ministry of Energy, about 20 municipalities and the Police department.

While collecting the relevant data from municipalities we encountered several problems: pre-Christmas timing; little motivation and shortage of available resources in municipalities; and the absence of a uniform database on energy consumption resulted in a relatively low response rate.

Originally we planned to classify buildings by type and by year of construction, however, due to the fact that the questionnaires were completed by a relatively small number of the municipalities, we decided to analyse heating consumption in public buildings only by the types of public buildings (rejecting the year of construction criterion).

Information was collected on 287 buildings: 57 were administrative type buildings, 208 were cultural, educational and sports type buildings (150 schools and 58 preschools) and 22 were medical buildings (hospitals).

Table 5: Weighted average annual heating consumption in public buildings by categories, kWh/m^2 heated area

Building type	Heating consumption* , kWh/m^2	Weighted average annual heating consumption*, kWh/m^2
Administrative buildings	180	210
Cultural, educational and sports buildings, of which	215	
Schools	190	
Preschools	240	
Medical buildings	200	

Source: 287 buildings, 2012 data

The results presented in Table 5, show that in the majority of public buildings heating consumption is approximately 180-200 kWh/m2. However, heating consumption in preschools is higher (approximately 240 kWh/m^2) due to the fact that preschools are subject to a stricter Lithuanian Hygiene Standard. For example, (see Table 6) the temperature of playrooms in preschools must be maintained at about 20–23°C, while the temperature in school class rooms – 18–20°C, in offices of the administrative buildings – 20–22°C, and in hospital wards – 19–21°C.

Table 6: Indoor air temperature values in different types of buildings

Building type – Administrative buildings	Area name	Air temperature in °C
	Offices	20–22
	Corridors	19–21
Building type – Schools	Area name	Air temperature in °C
	The class room, hall	18–20
	Gym	15–17
	WC	18–19
	Corridor, staircase	16–18
Building type – Preschools	Area name	Air temperature in °C
	The playroom	20–23
	Physical Educational-Music Hall	18–20
	WC-washroom	19–23
	Corridors, stairwells	18–21
	Bedroom	18–22
Building type – Medical buildings	Area name	Air temperature in °C
	Patient ward	19–21
	Preoperative, operative, post-operative intensive care units	21–23
	Doctors' offices, staff rooms	19–21
	Reception and information area, dressing room, waiting	17–19

Source: HN 21:2011, HN 75:2010 and HN 42:2004.

Weighted average annual heating consumption in State and municipality owned public buildings is 210 kWh/m^2 per heated area.

It should be noted that in most buildings it is not possible to separate heating consumption for area heating because heating consumption for the preparation of hot water is calculated in the total demand of heating in the buildings.

1.1.3 Electricity consumption in public buildings

Electricity consumption in public buildings can be divided into two parts: electricity consumed for lighting and electricity consumed for other purposes (mechanical ventilation system, electric water heating, computers, and other electrical devices). It should be noted that electricity consumption could be reduced only in the electricity consumed for lighting segment.

Lithuania does not have a centralised database containing information on public buildings (building area, building energy efficiency class, electricity consumption, etc.). Therefore, in order to assess the actual electricity consumption in public buildings, questionnaires were sent to all 60 municipalities and the Police department. Responses were received from 16 municipalities. We also used data collected by the Ministry of Energy from 20 different municipalities and Police department.

Information about electricity consumption was collected on 287 buildings (57 administrative type buildings, 208 cultural, educational and sports type buildings (150 schools and 58 preschools) and 22 medical type buildings).

Analysis of the information gathered revealed the following:

- data on actual electricity consumption in public buildings is skewed and unreliable (ranging from 3 to 296 kWh/m$^{2)}$;

- data represents total building electricity consumption instead of electricity consumption for lighting due to the fact that buildings do not have a separate energy metering system.

We therefore decided to analyse the data provided by the Lithuanian Business Support Agency (hereinafter – LBSA) regarding electricity consumption before and after the modernisation. However, data submitted by the LBSA on the changes in electricity consumption after modernisation cannot be used in calculations either – in half of the buildings electricity consumption after modernisation was reduced, however, in the other half – electricity consumption increased. It was not possible to identify the reasons for this inconsistency in electricity consumption (whether the reason is the modernisation of the lighting system, change in the hot water preparation method or any other reason). Therefore, we decided not to carry out a detailed analysis on electricity consumption for lighting in public buildings.

Having decided to reject incorrect data, we prepared guidance on how electricity consumption for lighting in buildings without a separate electricity meter should be assessed. To distinguish electricity consumption for lighting from the total building electricity consumption the following steps should be taken:

- collection of detailed information on the building lighting system (number of lamps (units), lamp types and power (W));

- identification of lighting regimes, taking into account the daylight period duration and work schedule (i.e., from 7:30 a.m. to 5:00 p.m.; from 7:45 a.m. to 8:00 p.m.), if the building is multifunctional – identification of work schedule in separate rooms;

- collection of information about the habits of building users(e.g. in schools for one or a few months most people are on holidays).

Given the fact that in most of the buildings there is no separate electricity consumption metering for lighting, we used a theoretical method of electricity consumption assessment. This methodology is used by such companies as JSC Mano Būstas.

1.1.4 Administrative arrangements

State-owned buildings are often managed by other institutions, i.e. building users (i.e. the Police Department, schools, preschools, hospitals). The State provides allocations from its budget to compensate the electricity, heating, maintenance and other costs to those building users who are state institutions.

Buildings owned by municipalities are often managed by other institutions as well.

Buildings are used in one of the following ways:

- open-ended use contract. According to data from 20 municipalities, this type of contract is used in 75% of all municipality-owned buildings;
- fixed-term use contract. According to data from 20 municipalities, this type of contract is used in 24% of municipality-owned buildings;
- property Trustee rights. According to data from 20 municipalities, this type of contract is rare and is used in only 1% of municipality-owned buildings.

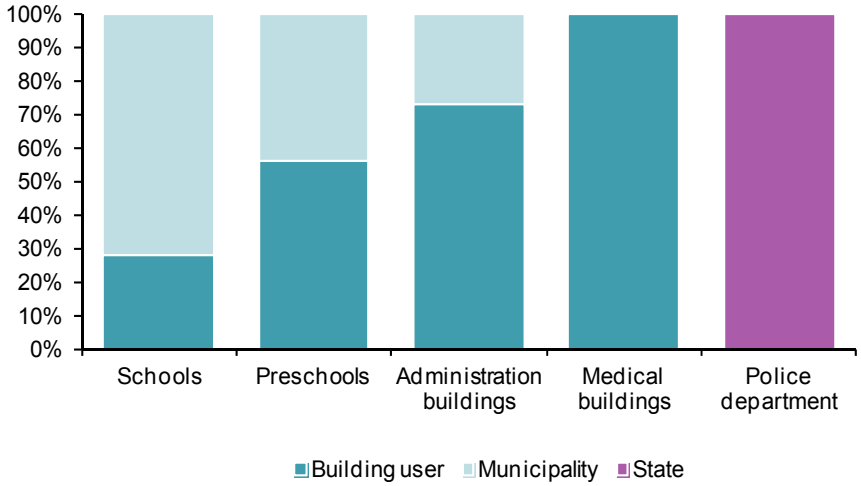
Bills for electricity, heating, water, maintenance and other utilities are paid in the following ways:

- a municipality draws up an annual budget, from which a certain amount is allocated to payment of electricity bills, heating and other utilities. In this case, it is the municipality that pays the bills directly to utility companies;
- a municipality sets annual allocations for building users to pay for electricity, heating, maintenance and other utilities. In this case, it is the building user that pays the bills directly to utility companies.

Figure 1 shows reimbursement arrangements in different types of buildings.

Data suggests that there is no dominant model for reimbursement arrangements in schools, preschools and administrative buildings — each municipality individually decides on what method to use to reimburse costs (i.e. whether it pays the bills directly or transfers allocations to the building user). Meanwhile, in buildings used by hospitals and by the Police Department the situation is different – expenses in all of these buildings are reimbursed either by the building user (in hospital) or by the state (in Police Department buildings).

Figure 1: Reimbursement arrangements in schools, preschools and administration buildings (2012)



Source: 150 schools, 58 preschools, 57 administration buildings, 22 medical buildings and Police department, 2012 data.

All bills are usually paid every month. However, there are instances when the municipality (building user or state institution) have debts for heating or electricity companies. Debts usually accumulate owing to the following reasons:

- municipality collects a lower than expected budget so the granted allocations (for heating, electricity costs) are decreased;

> Example: in 2013 a school's total heating expenses were LTL 30,000, but the municipality only granted LTL 25,000 for heating in 2014 due to the lower budget. In this case if the winter is as cold and as long as usual (heating bills will not be unusually low) it is most likely the school will be LTL 5,000 in debt to the heating company.

- municipality grants the planned allocations for building heating and electricity, but expenditure ends up higher than expected due to the increase in energy demand (for example an unusually long and cold winter).

1.1.5 Summary

The analysis of public building stock, energy consumption and administrative arrangements revealed the following results:

- data on physical parameters and ownership is managed by the Centre of Registers. However, data on energy consumption is fragmented – sometimes it is tracked by separate municipalities or building users. At present, Lithuanian authorities do not have a centralised database describing energy consumption in public buildings. A unified database would create more transparency and serve as an information source for potential ESCOs;

- central government and municipalities own 8,600 buildings, or 45% of all administrative, cultural, educational, sports and medical buildings in Lithuania;

- total area of public buildings owned by the central government is 4.6 M m^2, while the area owned by municipalities is 8.4 M m^2;

- 62% of these public buildings were built in the period 1961–1990. The percentage of all administrative, cultural, educational, sports and medical public buildings built in 1991 and later is 10%. The majority of public buildings were built from bricks and blocks and have 2-3 floors;

- buildings which were constructed before 1990 complied with the construction regulations available at that time. Today these regulations are 3-5 times stricter. For example, the heat transfer coefficient of external partitions of residential houses built during 1959 to 1990 was approx. 1.1-1.3W/(m^2K). Today, this indicator is equal to 0.2W/(m^2K), which is 5 times lower;

- the analysis of 300 buildings has shown that heating consumption in all public buildings is similar – 180-200 kWh/m^2 of heated area. Heating consumption in preschools is highest due to Lithuanian Hygiene Standards (about 240 kWh per m^2);

- with the available information it is hardly possible to separate the heating consumption for area heating from heating consumption for hot water preparation. In the majority of buildings heating consumption for hot water preparation is included in the total building heating consumption; moreover, in some buildings hot water is heated with electrical water boilers;

- data on actual electricity consumption in the sample of 300 buildings has proven to be unreliable – consumption ranges from 3 to 296 kWh/m^2. This can be explained by the fact, that buildings do not have separate electricity metering systems for lighting.

1.2 Street lighting assets analysis

In this section we analyse data pertaining to street lighting assets, energy consumption and administrative arrangements.

1.2.1 Basic information about street lighting assets

There is no centralised database on street lighting assets in Lithuania, therefore, in order to collect data, questionnaires were sent to 60 municipalities, the JSC Lithuanian Railways and the Lithuanian Road Administration under the Ministry of Transport and Communications (hereinafter – LRA). Replies were received from 17 municipalities and the JSC Lithuanian Railways. Detailed results are provided in Annex 1.

Based on the collected data, we approximated street lighting asset data for the entire country. Calculations were carried out according to the following methodology:

- calculate the annual electricity consumption in 17 municipalities and JSC Lithuanian Railways – 41.35 GWh;

- estimate the electricity consumption index (MWh/capita) in 17 municipalities and JSC Lithuanian Railways. Estimated average electricity consumption index – 0.026 MWh/capita;

- by using the estimated average electricity consumption index – 0.026 MWh/capita and Statistics Lithuania data (2013), calculate the annual electricity consumption in street lighting stock in Lithuania – 103.5 GWh;

- finally, calculate the market size index, which shows how many times the annual electricity consumption in all street lighting stock in Lithuania is higher than in 17 municipalities and JSC Lithuanian Railways (103.5/41.35) – 2.5 times.

Using the data provided by 17 municipalities and JSC Lithuanian Railways and the market size index, calculations on street lighting assets in Lithuania were carried out (see Table 7).

We estimate that the length of the street (and railway) lighting network in all street lighting assets in Lithuania adds up to more than 10,500 km (46% cable lines and 54% overhead lines). The total number of luminaires is more than 260,000 units (83% luminaires with sodium vapour lamp, 13% luminaires with mercury vapour lamp, 4% luminaires with metal halogen lamp).

Table 7: Basic information about all street lighting assets in Lithuania (2012)

The total network length, km	10,500
cable lines	4,900
overhead lines	5,600
The total number of luminaires, units	263,300
luminaires with sodium vapour lamp	219,500
luminaires with mercury vapour lamp	32,800
luminaires with metal halogen lamp	11,000
Cabinets, units	6,300
Power supply points, units	6,100
Lamps, units replaced during the year	39,200
The average lamp life cycle, years	3.6

Note: * - data is indicated for whole Lithuania by using aggregated indicators from data, given by 17 municipalities and JSC Lithuanian Railways.

Source: Ekotermija, UAB analysis

More than 39,000 lamps were replaced in 2012 – more than 8,200 units were replaced in Vilnius city municipality alone.

The average lamp life cycle is about 3.6 years, while in some municipalities lamp life cycle varies from 8 years to 1.3 years (see Figure 2). However, it should be noted that municipalities and JSC Lithuanian Railways did not provide data on the average life cycle of different types of lamp. Moreover, 5 municipalities did not provide any data.

In order to assess whether lamps are outdated, the calculated lamp lifetime indicated by the manufacturer was compared with different lamp usage periods (see Table 8). The lifetime of new sodium vapour lamps (83% of all street lighting lamps in Lithuania) indicated by the manufacturer is 3.3-6.6 years. Data shows that the average lamp usage period is 3.6 years. Therefore the majority of lamps in Lithuania are outdated and are approaching their expiry date.

Table 8: Street lights comparison[1]

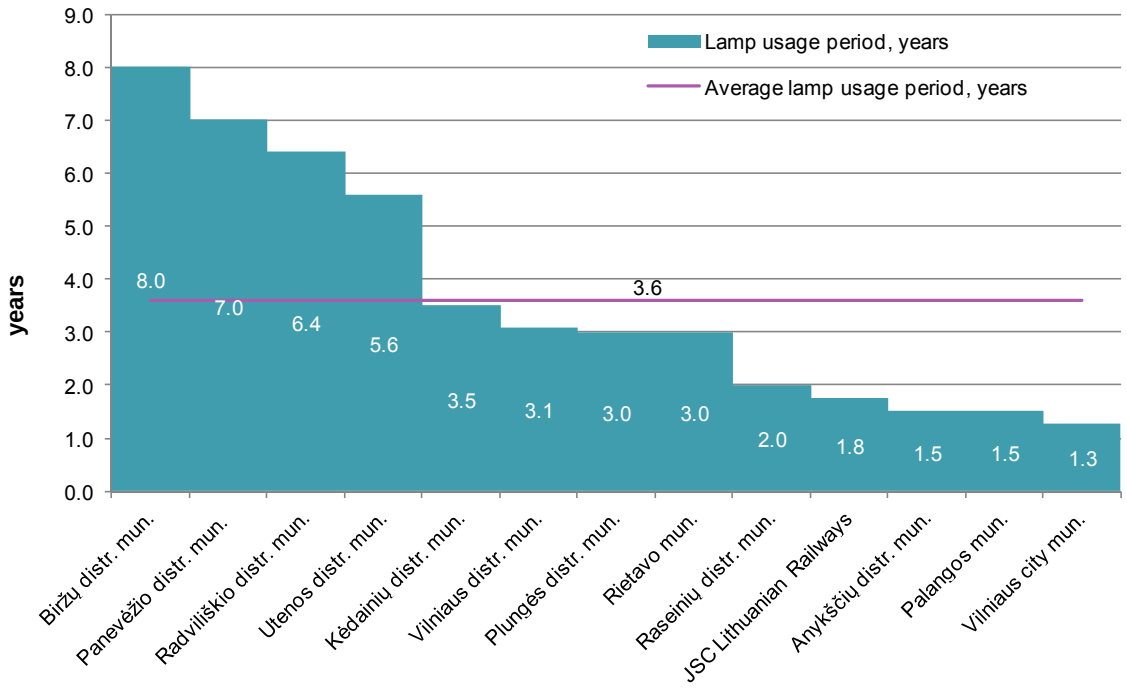
Light technology	life time (hrs)	life time (years)*	lumens per watt	ignition time
mercury vapour lamp	12,000 - 24,000	3.3 - 6.6	13 - 48	up to 15 min
metal halogen lamp	10,000 - 15,000	2.7 – 4.1	60 - 100	up to 15 min
sodium vapour lamp	12,000 - 24,000	3.3 – 6.6	45 - 130	up to 15 min
LED lamp	50,000 - 100,000	13.7 – 27.4	70 - 150	instant

Note: * - it is assumed that lamp operating time is 10 hours. a day, 365 days.

Source: Ekotermija, UAB analysis

[1] Source: http://www.grahlighting.eu/en/street-lighting-technology-comparison

Figure 2: The average lamp usage period by municipalities and JSC Lithuanian Railways, years (2012)



Source: Ekotermija, UAB analysis

In an attempt to assess the street lighting equipment renewal expenses for the entire stock, we approximated data collected from the replies to the questionnaires from municipalities and JSC Lithuanian Railways.

It was estimated that in 2012 the annual renewal costs of street lighting equipment in Lithuania was approximately LTL 6.4 M (see Table 9). As can seen from Figure 3, most of the expenses are due to purchasing luminaires (almost 26% of all expenses) and new poles (almost 32% of all expenses).

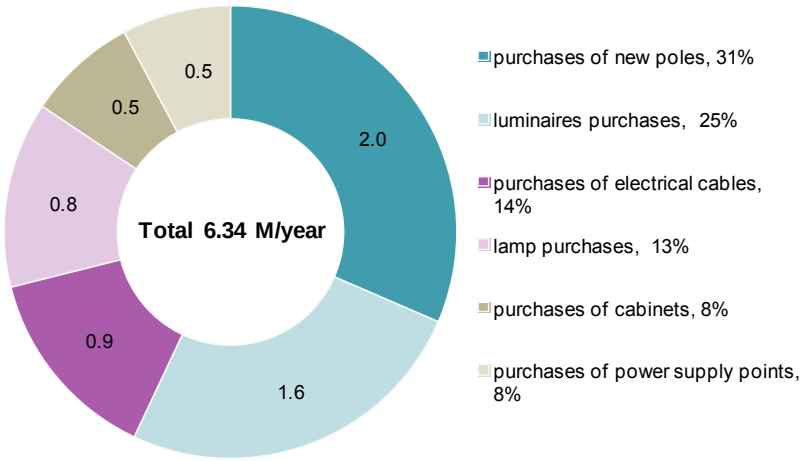
Table 9: Estimated lighting equipment renewal in 60 municipalities, JSC Lithuanian Railways and LRA*

Lighting equipment renewal	lamp purchases	luminaire purchases	purchases of new poles	purchases of cabinets	purchases of power supply points	purchases of electrical cables
Unit/m	30,400	5,400	1,600	250	500	221,300
Price per unit, LTL	30	300	1.200	2.000	1000	4.5
Expenses, LTL	843,500	1,617,100	1,997,000	497,600	492,700	894,000
Total expenses, LTL	6,341,900					

Note: * - data is indicated for the whole of Lithuania by using aggregated indicators from data, given by 17 municipalities and JSC Lithuanian Railways.

Source: Ekotermija, UAB analysis

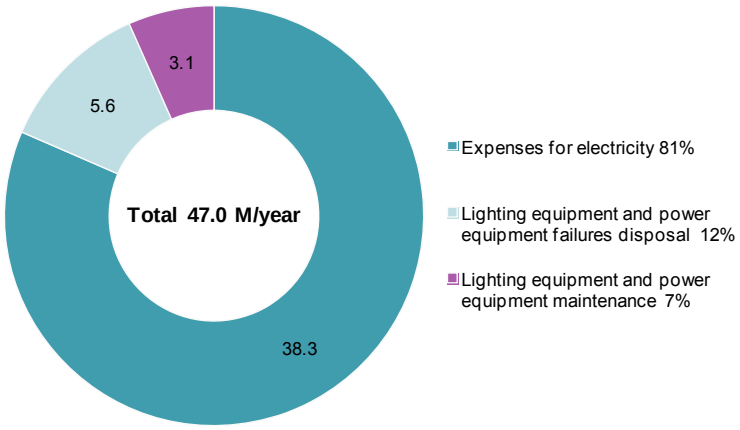
Figure 3: Estimated annual lighting equipment renewal costs in Lithuania



Source: Ekotermija, UAB analysis

It was estimated that in 2012 the street lighting electricity costs and maintenance costs in 60 municipalities, JSC Lithuanian Railways and LRA were up to LTL 47 M (see Figure 4). Most expenses came from electricity consumption. Data shows that the repair costs for lighting equipment and power equipment were almost double the maintenance costs for lighting equipment and power equipment. This is further proof that street lighting assets are outdated and require new investments.

Figure 4: Electricity costs and maintenance costs in street lighting assets in Lithuania*



Note: * - data is indicated for the whole of Lithuania by using aggregated indicators from data, given by 17 municipalities and JSC Lithuanian Railways.

Source: Ekotermija, UAB analysis

Data provided by municipalities indicates that it is not possible to automatically adjust the lighting levels and/or automatically detect the faults of lamps. All lighting intensity adjustments are carried out mechanically and all lamp faults are recorded by visual inspection.

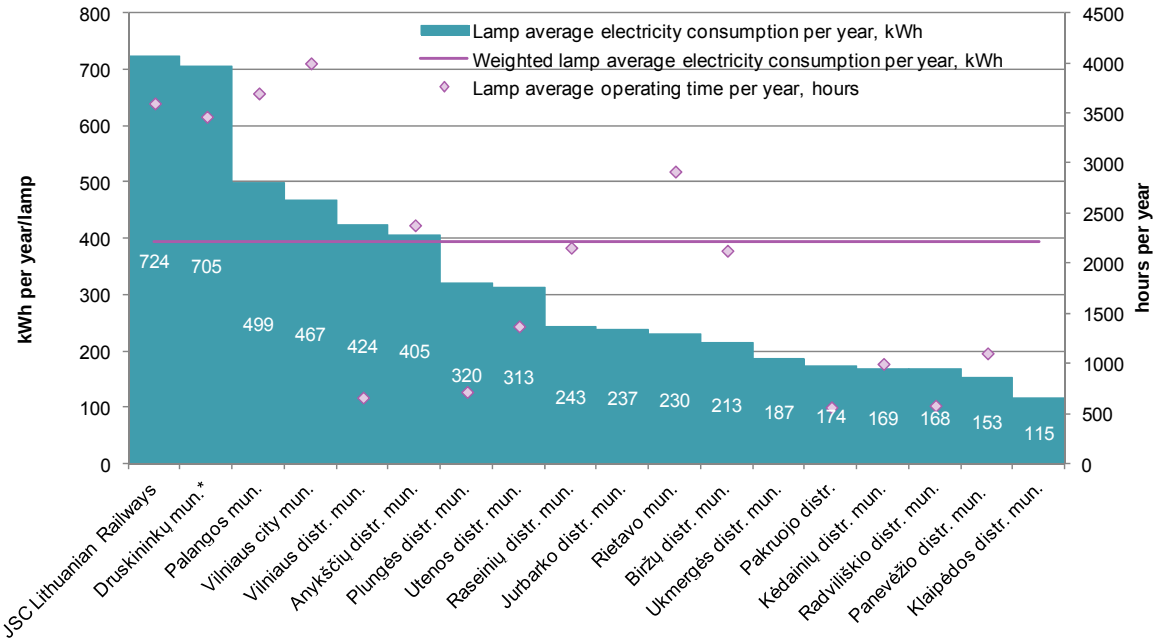
1.2.2 Energy consumption in street lighting segment

In order to determine the electricity consumption by all municipalities, JSC Lithuanian Railways and LRA the average electricity consumption per lamp (kWh per lamp per year) in 17 municipalities and JSC Lithuanian Railways was calculated. This index (kWh per lamp per year) was used for further calculations in order to establish indicative electricity consumption. Collected data shows that electricity consumption in 2012 for street lighting was about 41.35 GWh. Vilnius city municipality electricity consumption was 20.4 GWh which is almost half of all electricity consumed in 17 municipalities and JSC Lithuanian railways.

Figure 5 shows lamp average electricity consumption in 17 municipalities and JSC Lithuanian Railways as well as lamp weighted average electricity consumption. In 12 municipalities lamp average electricity consumption is lower than the weighted average electricity consumption – 390 kWh per year – and varies from 115 to 320 kWh per lamp per year. In the other 5 municipalities and in Lithuanian Railways lamp average electricity consumption varies from 405 to 724 kWh per lamp per year. It should be noted that Druskininkai municipality provided information on electricity consumption which includes not only electricity used for street lighting but also electricity used for city video cameras, fountains and various other uses.

Significant differences among the electricity consumption per lamp (kWh per lamp) could be a result of different street lighting modes applied in different municipalities. Due to the economic crises some municipalities implemented austerity measures in the street lighting sector. For example, some municipalities were illuminating only the most important streets, other municipalities were not switching on all lamps (every second or third lamp), in some municipalities the duration of illumination (hours per day) was shortened. Therefore, to be more precise, lamp average electricity consumption (kWh per year) was compared with lamp annual operating time (hours per year).

Figure 5: Lamp average electricity consumption and operating time by municipalities and JSC Lithuanian Railways (2012)



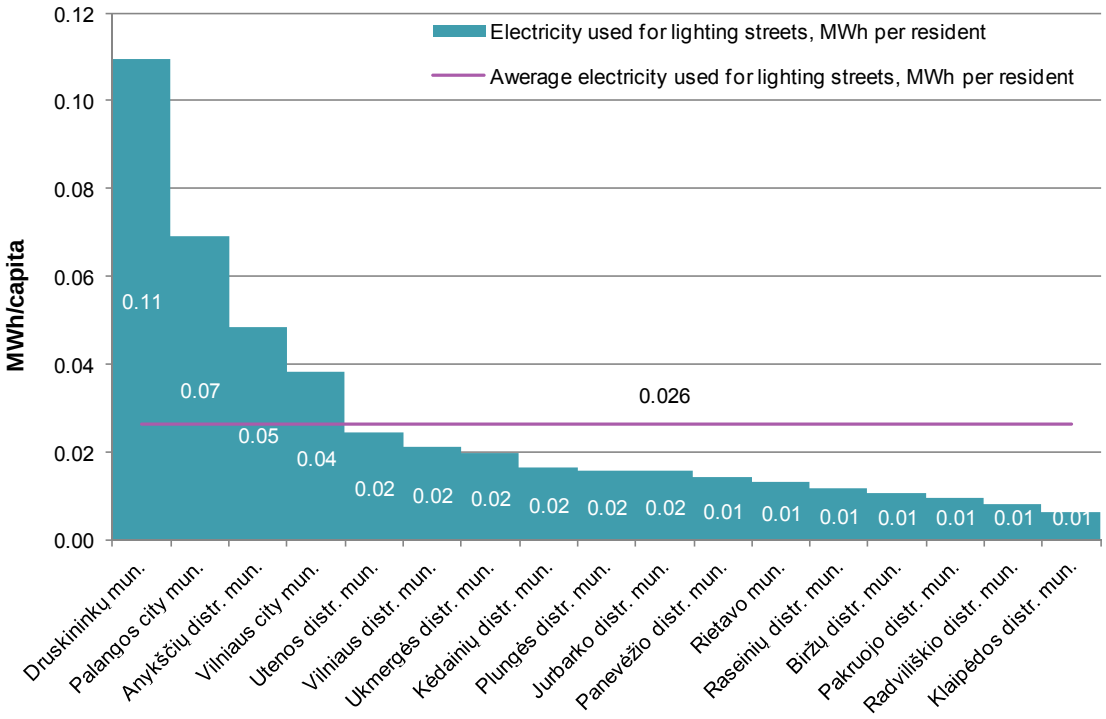
Note: * Druskininkai municipality provided information of electricity consumption which includes not only energy used for street lighting but also energy used for city's video cameras, fountains and other places.

Source: Ekotermija, UAB analysis

Figure 5 shows electricity consumption dependence on operating time. The highest electricity consumption per lamp is in municipalities where lamp annual operating time is lower than lamp average electricity consumption. This ratio is only high in a few municipalities. The street lighting system in these municipalities is not efficient — lamps use a lot of electricity while working for a short period of time. For example, in Vilnius district municipality the average electricity consumption per lamp is more than 420 kWh per year, while the average operating time is just 700 hours per year.

In order to evaluate the total electricity consumed by all street lighting stock in Lithuania, the electricity consumption index (MWh per capita) was estimated. This index shows how much electricity is consumed per resident. For calculations, the total number of residents was taken from Statistics Lithuania as for the beginning of 2013. In different municipalities the electricity consumption index varies from 0.11 MWh/capita to 0.01 MWh/capita (see Figure 6)

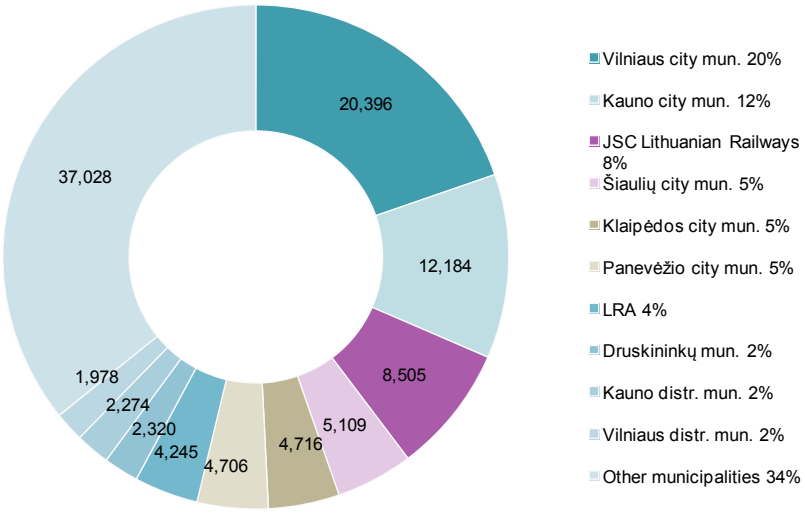
Figure 6: Electricity consumption index, MWh per capita



Source: Ekotermija, UAB analysis

The average electricity consumption index of 0.026 MWh/capita will be used for further calculations in order to establish indicative electricity energy consumption for all street lighting stock in the whole of Lithuania.

Figure 7: Annual electricity consumption for all street lighting stock in Lithuania, MWh per year



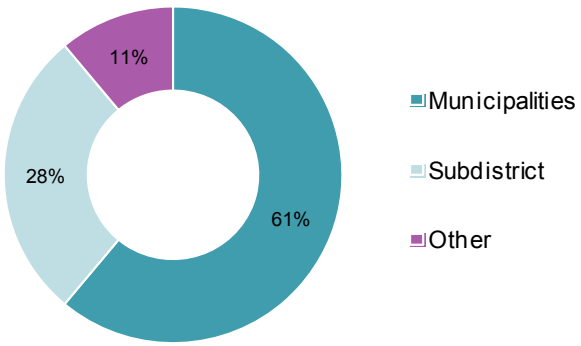
Source: Ekotermija, UAB analysis

Calculations revealed that the total electricity consumption is more than 103 GWh per year (see Figure 7). The biggest electricity consumption is in Vilnius city municipality – around 20 GWh (20%) and Kaunas city municipality – more than 12 GWh (12%). Less than 2% of electricity is consumed by each of 51 municipalities. These municipalities together consume 34% (or 37 GWh) of total electricity consumed in Lithuania.

1.2.3 Administrative arrangements

Figure 8 shows that in 11 municipalities, the electricity bills and bills for network maintenance are paid directly by municipalities, in 5 municipalities by subdistricts and in 2 cases – by other institutions. Other institutions refer to JSC Lithuanian Railways and one private company in one of the municipalities.

Figure 8: Reimbursement arrangements in 17 municipalities and JSC Lithuanian Railways (2012)



Source: 17 municipalities and JSC Lithuanian Railways, 2012 data

It should be noted that municipalities plan their expenses for street lighting by taking into account the approved lamp monthly operating time schedules.

1.2.4 Summary

The analysis of public street lighting stock, energy consumption and administrative arrangements revealed the following results:

- as there is no unified source of information on street lighting stock and electricity consumption, the analysis was based on a survey of 17 municipalities and JSC Lithuanian Railways. Data gathered from the replies was approximated for the entire country using kWh consumption per resident ratio;

- the length of the street (and railway) lighting network is more than 10,500 km (46% cable lines and 54% overhead lines);

- the total number of luminaires is more than 260,000 units. The majority of them are luminaires with sodium vapour lamp (83%) and luminaires with mercury vapour lamp (13%);

- the average lamp usage period is about 3.6 years. Thus the majority of lamps used by municipalities and JSC Lithuanian Railways are outdated, or approaching their expiry date. Average lamp operating time per year is 114,000 min;

- in 2012 street lighting equipment renewal expenses were almost LTL6.4 M, most of the expenses were for the purchases of luminaires (almost 26% of all expenses) and new poles (almost 32%);

- approximated total electricity consumption for street lighting was more than 103 GWh in 2012. The expenses for street lighting fall into 3 main categories: electricity bill payments (81%), repair expenses (12%) and maintenance costs (7%). Approximated total expenditure for street lighting in 2012 was LTL 47 M .

- the biggest electricity consumption was in Vilnius city municipality – around 20 GWh (20%) and Kaunas city municipality – more than 12 GWh (12%). Each of 51 municipalities used less than 2% of the total electricity consumed. These municipalities together consumed 34% (or 37,0 GWh) of the total electricity consumed in Lithuania;

- data provided by the municipalities indicates that it is not possible to automatically adjust the lighting levels and/or automatically detect the luminaires' faults. All lighting intensity adjustments are carried out mechanically and all lamp faults are recorded by visual inspection;

- the average electricity consumption per lamp varies from 115 kWh per year to 724 kWh per year, with an average electricity consumption of 390 kWh per year. The high variance may be explained by different lighting regimes used in municipalities;

- there is no dominant mode of reimbursement arrangements – in some cases the municipality pays for electricity bills and bills for network maintenance directly, while in other cases the bills are paid by subdistrict or other parties.

1.3 Review of recent energy efficiency programmes in public buildings modernisation

During the period 2002-2013 several regional and national level energy efficiency programmes were implemented in Lithuania. These programmes can be categorised into 3 groups:

- modernisation of public buildings at the national level;
- modernisation of public buildings at the regional level; and
- power supply stability, availability and higher energy efficiency assurance.

Detailed descriptions of these programmes are outlined in Annexes 6 and 7.

Although the programmes were focused towards an increase of energy efficiency in the public building segment, a few major drawbacks can be noticed.

First, the programmes focused on the modernisation of buildings rather than on reduction of energy consumption. For example, no energy consumption reduction obligation was set as a requirement in the procurement tender or contract. Typical construction contracting was used for procurement of works.

Second, procurement of buildings modernisation focused only on pre-listed measures (for example heating system, ventilation, hot water supply, repairs and/or reconstruction/construction of a building's external partitions, external walls). No alternative energy supply measures (such as air pumps, photovoltaic panels, etc.) were supported.

Third, there was no real mechanism to disseminate the best practice of energy consumption through the standardisation of requirements or contracting. The main emphasis was on compliance with the rules for subsidies allocation.

Strategies which were used in the past can be justified, as it was possible to achieve energy savings in the least energy efficient buildings just by modernising the building's appearance. Simple insulations provided immediate energy savings in buildings consuming the most heating energy. However, future programmes should focus on contractual energy savings obligations in order to achieve a higher reduction in energy consumption. Also, more sophisticated financial instruments should be employed in order to address the financing gap.

Table 10 contains information about the recent energy efficiency programmes implemented during the 2002-2013 period. Total funds allocated made up nearly LTL 1.48 Bn LTL and the biggest allocations were provided for Programme 4 – more than 62% of the total allocated fund (a detailed description of the programmes is provided in Annex 6). According to the Energy Agency data[2] average heating energy savings after modernisation ranges from 40 kWh/m^2 to 120 kWh/m^2 and the total number of modernised buildings is 1,060 units.

[2] Energy Agency provides data only on the total number of buildings modernised under the programmes 4 and 6 – 244.

Table 10: Recent energy efficiency programmes (2002-2013)

Programme No.	Allocated fund, LTL M	Modernised buildings, unit
Programme 1	130	52
Programme 2	44	78
Programme 3	36	67
Programme 4	918	244*
Programme 5	15	22
Programme 6	198	244*
Programme 7	66	576
Programme 8	81	18
Total	1,479	1,057

Source: Energy Agency, 2012 data

To analyse the actual impact of energy efficiency programmes on public buildings energy consumption, we relied on the data provided by LBSA. In this section we review the modernisation projects which were carried out through LBSA, the only institution monitoring the actual impact.

Summarised data is provided in Table 11. The intensity of support (%) goes up to 100% of eligible costs. The total number of modernised buildings for the period of 2002-2013 is almost 650 and the total amount of money spent – about LTL 1.11 Bn.

Table 11: Basic information about LBSA public building modernisation instruments

Key indicators	Public building modernisation instrument		
	Modernisation of public buildings at the national level	Modernisation of public buildings at regional level and	Power supply stability, availability and higher energy efficiency assurance
Intensity of support,%	Up to 100% of eligible costs	Up to 100% of eligible costs	Up to 100% of eligible costs
Funding, units of buildings	304	320	21
Funding, LTL M	726.0	341.6	42.9

Source: LBSA, 2013.12.31 data

Based on monitoring data provided by LBSA, achieved annual heating energy savings in 177 public buildings after modernisation were 71.6 GWh. Heating energy consumption was reduced by almost 25%. Before modernisation, these buildings consumed approximately 300 GWh of heating energy. Total investments reached LTL 250 M. The largest portion (76%) was allocated for the modernisation of buildings built in the 1961-1990 period (see Table 12).

Table 12: Statistics of public buildings modernisation projects (2012)

Total number of buildings modernised in 2010-2011	Total area, m^2	Total heated area, m^2	Total investment, M Lt	Total annual heating energy savings, MWh	Weighted average annual heating energy savings, kWh/m^2 heated area
177	739,348	698,505	250	71,604	103
Construction completion year before 1940					
19	99,067	78,009	32	8,638	110
Construction completion year 1941-1960					
11	55,827	49,946	25	6,131	123
Construction completion year 1961-1990					
145	570,784	560,364	190	56,098	100
Construction completion year 1991 and later					
2	13,670	10,186	3	737	73

Source: LBSA (2012.12.31 data)

Weighted average annual heating energy savings range from 73 to 110 kWh/m^2 heated area. The largest savings were achieved in buildings which were built during the 1941–1960 period.

1.3.1 Achieved heating energy savings in modernised buildings

One of the main indicators which help to assess project's feasibility is the saved energy tariff (hereinafter – SET). SET shows whether the optimal energy-saving measures were selected during the modernisation. It is calculated by applying the following formula:

$$SET = \frac{I + i + x}{Q_r \cdot t} < P_{H\,\min}$$

SET – saved energy tariff, LTL/kWh

I – total investments, LTL

i – total interest, LTL

x – other costs (e.g. wages), LTL

Q_r – annual heating savings, kWh per year

t - contract validity period, years

P_H – the average annual heat tariff, LTL/kWh

The project pays off if the saved energy tariff is smaller than the annual average heat tariff. If the SET is higher than the heat price (LTL/kWh) this means that optimum energy-saving measures have not been selected during the modernisation. In such case the project is unprofitable.

To measure SET index (LTL/kWh) for public buildings, we have gathered data of total investments and energy consumption after the modernisation of 177 public buildings during the period 2010-2011. All of these buildings were modernised with the help of LBSA fund.

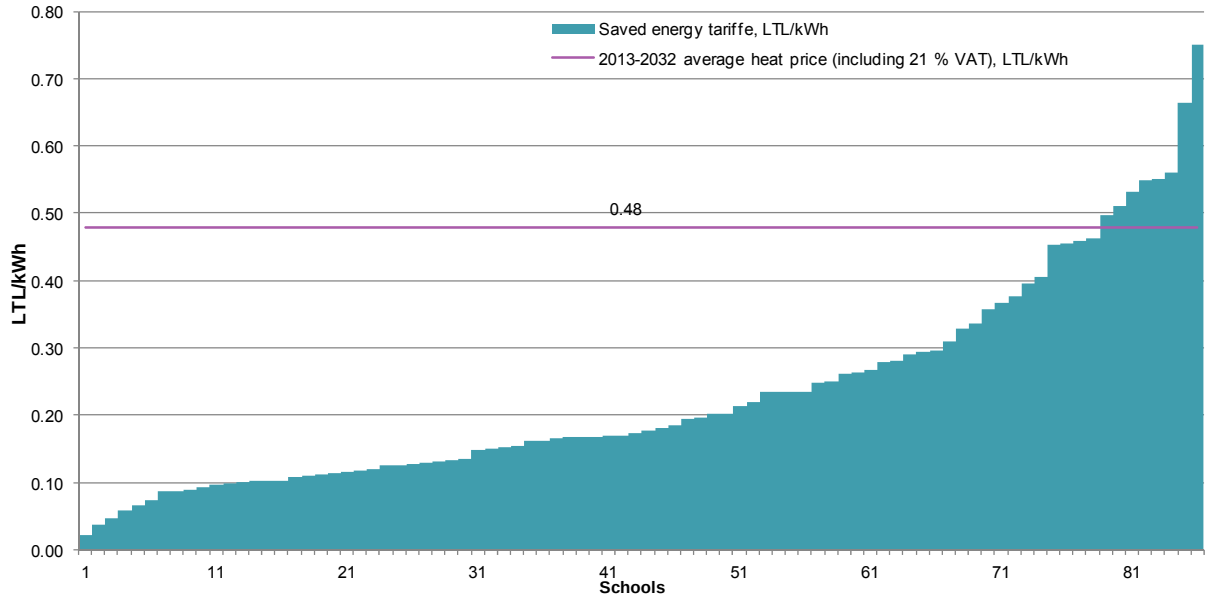
Notes and assumptions:

- the investment data provided by LBSA does not include interest and other costs (e.g. wages);
- 16 outlier buildings were excluded;
- annual heating energy savings (MWh) of buildings decrease every year by 1% after the modernisation;
- contract maturity – 20 years;
- average heat price during 2013 – 0.29 LTL/kWh, annual growth rates – 5%. Average heat price during 20-year period (2013–2032) – 0.48 LTL/kWh.

Results of energy tariff savings in 85 schools are presented in Figure 9. The results are compared with the average heat price during the 2013-2032 period.

It can be inferred from Figure 9 (and Annex 2) that in the majority of buildings SET is less than the heat price. This implies that energy-saving measures have been well chosen during the modernisation. Each public building type includes 10-15% of buildings where SET is significantly higher than the average heat price (0.48 LTL/kWh). Data shows that around 50% of modernised buildings (where SET is several times lower than the average heat price) were particularly inefficient before the modernisation. Investment in these buildings pays off quickly due to higher savings from increased heating energy savings.

Figure 9: Saved energy tariff in 85 schools

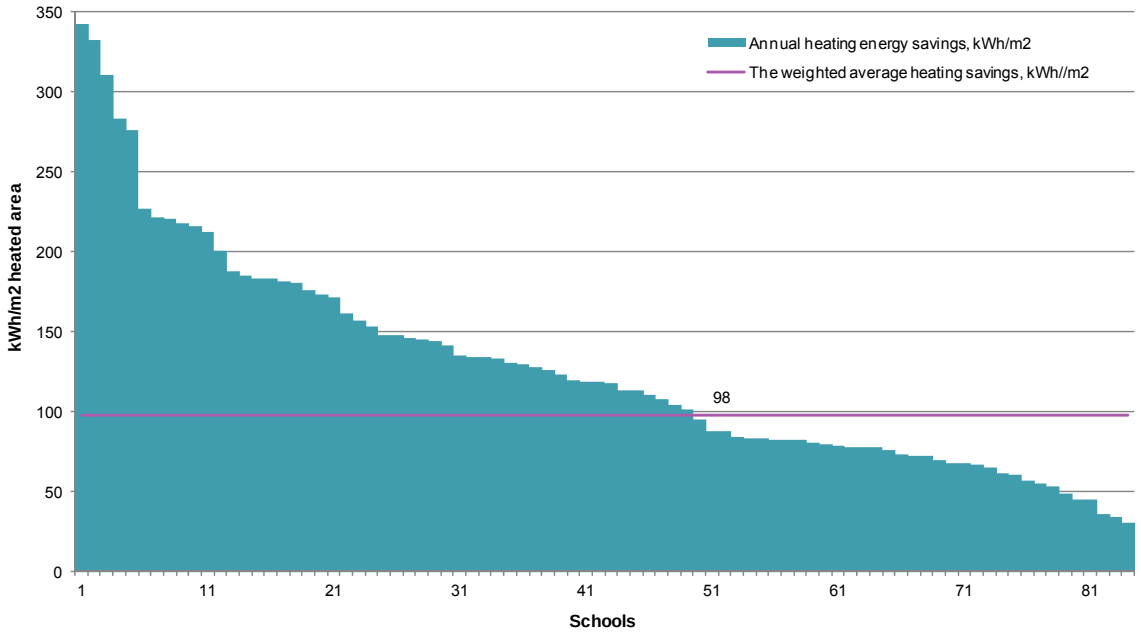


Source: Ekotermija, UAB analysis

In order to measure the possible reduction in heating consumption (kWh/m^2 of heated area) in public buildings, we have obtained data of energy consumption before and after the modernisation of 177 public buildings. All of these buildings were modernised during 2010-2011 with the help of LBSA fund.

The majority of these public buildings were educational-type buildings (93 schools and 35 preschools), 30 – hospitals and care homes and 19 – administration type buildings.

Figure 10: Annual heating energy savings in schools, kWh/m^2 heated area per year (2012)



Source: Ekotermija, UAB analysis

Analysis showed that annual savings from heating consumption in schools ranges from 343 kWh/m^2 to 35 kWh/m^2 for the heated area (see Figure 10). The average annual heating savings in schools are almost 98 kWh/m^2 for the heated area. In further calculations we have rounded up the potential of heated area savings to 100 kWh/m^2.

The annual savings from heating consumption in preschools varies from almost 260 kWh/m^2 to slightly more than 50 kWh/m^2 for the heated area (see Annex 3). The average annual heating savings in preschools reaches 130 kWh/m^2 for the heated area. This savings potential is used in further calculations.

The annual savings from heating consumption in hospitals and care homes ranges from 263 kWh/m^2 to 30 kWh/m^2 for the heated area (see Annex 3). The average savings from annual heating consumption in hospitals and care homes reaches 105 kWh/m^2 for the heated area. This saving potential is used in the further calculations.

The annual savings from heating consumption in administration type buildings ranges from 204 kWh/m^2 to 40 kWh/m^2 for the heated area (see Annex 3). The average annual heating savings in hospitals and care homes reaches 87 kWh/m^2 for the heated area. In further calculations we use 90 kWh/m^2.

1.3.2 Summary

The analysis of recent public buildings modernisation programmes produced the following results:

- over the period 2002-2012, total investment in public buildings was approx. LTL 1.48 Bn. These investments were carried out through several programmes. Estimated energy savings vary from 40 kWh/m^2 to 120 kWh/m^2 per heated area. Total number of buildings modernised is 1,060 units;

- heating energy consumption in 177 buildings was reduced by almost 25% (or 71.6 GWh);

- analysis of the implemented projects using SET methodology has proven that in general government programmes achieved fairly good results, as only 10%–15% of all projects implemented by LBSA were below the investment calculated rationale;

- the approach used in recent public building modernisation programmes had several drawbacks: the programmes focused on modernisation of buildings rather than on reducing energy consumption; procurement of buildings modernisation focused only on pre-listed measures, no alternative energy supply measures were supported; no real mechanism to disseminate the best practice through standardisation of requirements or contracting oriented towards energy consumption were put in place;

- future programmes should focus on contractual energy savings obligations in order to achieve higher reduction in energy consumption. Also, wider use of financial instruments should be employed in order to address the financing gap.

1.4 Modernisation scenarios for public buildings and street lighting segments

Given the energy efficiency targets set by the EED, in this section we analyse different modernisation scenarios to estimate the energy savings potential and the investment needed for modernisation in the public buildings and street lighting segments.

1.4.1 Scenarios of public building modernisation

In 2012, the Ministry of Environment established targets for stimulating the modernisation of buildings into nearly zero-energy buildings (according to the energy performance of buildings Directive 2010/31/EU) by requiring that refurbished buildings would not be lower than Class C.[3] Therefore, in the scenarios and calculations presented below we assume that public buildings are modernised to reach class 'C'.

Based on the requirements set by the EED and the ToR, we have built two scenarios of public building modernisation:

1. 'Directive' – based on the requirements of the EED, member states are required to modernise 3% of centrally owned and occupied building stock per annum over the period 2014-2020 (starting with buildings with a useful area of 500 m², extending it to 250 m² from July 2015).

2. 'Volumes' – based on the conditions set in the ToR, 4 different volumes of public building modernisation are evaluated in this scenario:

    - 'Volume 25' – 25,000 m^2 of total public building area is modernised each year;
    - 'Volume 50' – 50,000 m^2 of total public building area is modernised each year;

    - 'Volume 100' – 100,000 m^2 of total public building area is modernised each year;
    - 'Volume 200' – 200,000 m^2 of total public building area is modernised each year.

3 Source: Construction Technical Regulation STR 2.01.09:2012. Energy performance of buildings. Energy performance certification. (STATYBOS TECHNINIS REGLAMENTAS STR 2.01.09:2012. Pastatų energinis naudingumas. Energinio naudingumo sertifikavimas).

Scenario 'Directive'

A preliminary assessment has shown that approximately 470,000 m^2 of centrally owned building stock needs to be modernised during the period 2015-2020[4] (see Table 13). The absolute majority (86%) of buildings to be modernised falls under energy efficiency class 'E'.

Table 13: Extent of modernisation for the 'Directive' scenario 2014-2020

Indicator	Area, m^2
Gross building area	3,137,933
Gross building area F, E, D energy efficiency class	1,068,759
Gross area of buildings without energy efficiency classes	1,154,686
General modernised buildings in the area (FED class and without classes)	2,223,445
3% modernised area per year	66,703
3% modernised area in 2014-2020	466,921

Source: The Ministry of Energy

To estimate the total investment needed for modernisation (i.e. design and construction costs) we have used the investment needed per m^2 for each energy efficiency class. The level of investment needed per m^2 is calculated based on data, provided in the Smart Continent study[5] by Housing Energy Saving Agency (Busto Energijos taupymo agentura) and factual data provided by LBSA. The total investment needed for modernisation of public buildings is LTL 307 M (see Table 14).

Table 14: Investment needs for period 2014–2020

Indicator	Investment needs
F class, LTL/m^2	774
F class, LTL M	0.7
E class, LTL/m^2	660
E class, LTL M	263.6
D class, LTL/m^2	545
D class, LTL M	36.3
Total investments, LTL M	306.6

Source: Ekotermija, UAB analysis

In order to estimate potential savings for scenario 'Directive' we have used different heating savings potentials for different building classes (Table 15). Energy savings are based on the above-mentioned Smart Continent study.

[4] The Ministry of Energy estimates that in the period 2014-2020 a total of 470,000 m^2 of centrally owned public buildings should be modernised. Taking into account that public building modernisation projects have not yet been initiated, we decided to select 2015 as the start date for our calculations, at the same time maintaining the same total area to be modernised to fulfil the requirements set in the EED.

5 Smart Continent study 'Renovacijos srities visapusiškos analizės atlikimas ir nacionalinio pastatų fondo ilgalaikės renovacijos strategijos parengimas', 2013.

Table 15: Heating energy consumption before and after modernisation for different energy efficiency classes

Indicator	Value
F class heating consumption before modernisation, kWh/m^2	300
F class heating consumption after modernisation to C class, kWh/m^2	100
E class heating consumption before modernisation, kWh/m^2	200
E class heating consumption after modernisation to C class, kWh/m^2	100
D class heating consumption before modernisation, kWh/m^2	150
D class heating consumption after modernisation to C class, kWh/m^2	100

Source: Ekotermija, UAB analysis

Next, we have evaluated the influence of heat price on the payback period of modernisation projects. The payback period is calculated for two cases with different heat tariffs:

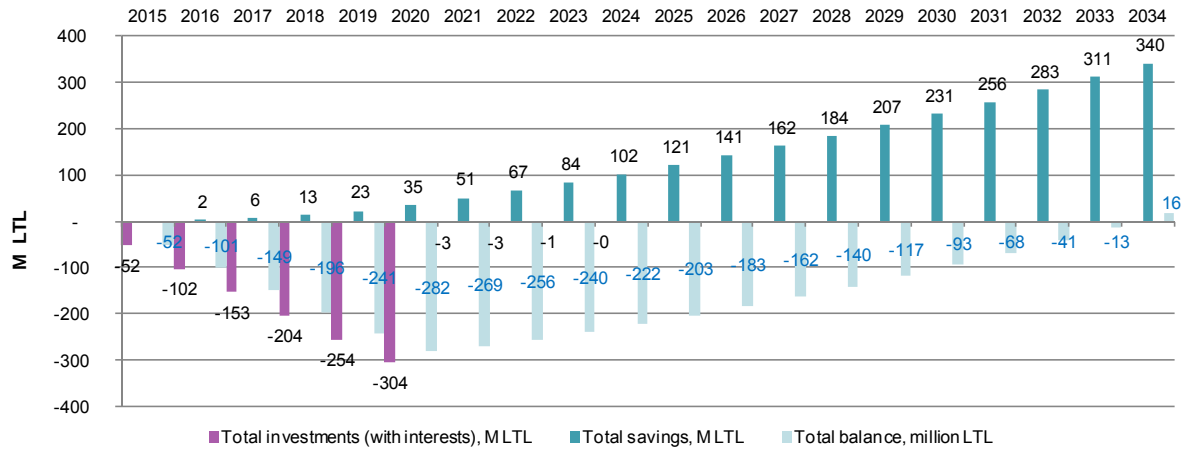
1. 'Base heat tariff' – heat price in 2015 – 0.30 LTL/kWh (based on the average heat tariff rate in Lithuanian district heating sector in 2013), the price increases by 5% each year (from 2015 to 2034));
2. 'High heat tariff' – heat price in 2015 – 0.35 LTL/kWh (based on the average heat tariff of 10 district heating companies that have the highest tariff), the price increases by 5% each year (from 2015 to 2034)).

The payback period for the 'Directive' scenario based on two cases with different heat tariffs is presented in Figure 11 and Figure 12.

The payback calculations assume that modernisation starts in 2015 (assuming that in year 2015 a total of 6% of centrally owned public buildings are modernised), 50% of investments are financed through bank loans (loan duration – 5 years, interest rate – 6%).

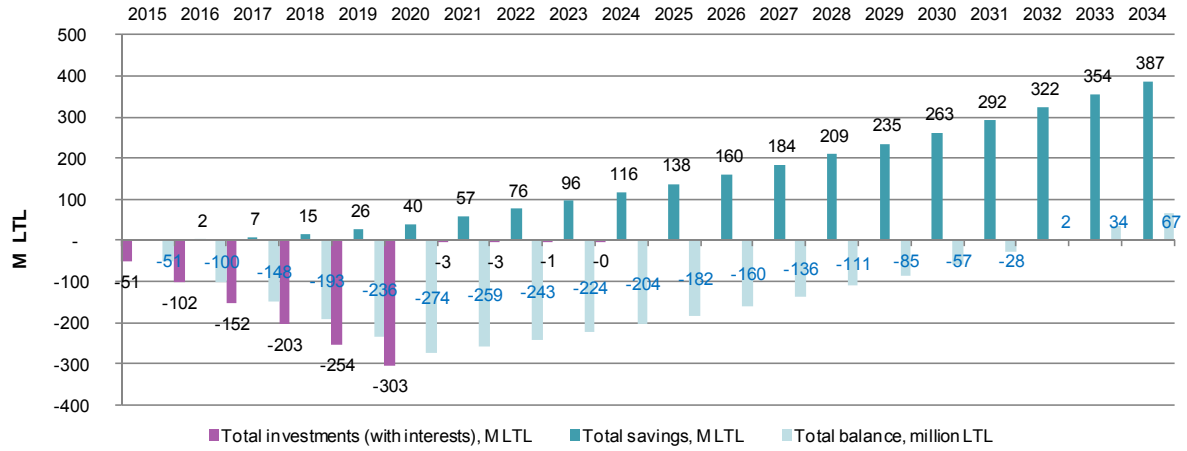
As can be seen from Figure 11, Figure 12 and Table 16, the total interest adds up to LTL 23.5 M or 6.5% of total investments. The payback period for modernisation of 470,000 m^2 of centrally owned buildings varies between 17 and 19 years, depending on the heat tariff.

Figure 11: 'Directive' scenario payback period with 'Base heat tariff'



Source: Ekotermija, UAB analysis

Figure 12: 'Directive' scenario payback period with 'High heat tariff'



Source: Ekotermija, UAB analysis

Table 16: 'Directive' scenario main indicators

Indicator	Heat tariff	
	Base heat tariff	High heat tariff
Total modernised area, m^2	466,921	466,921
Total expenses, LTL M , which consist of:	324	324
Total investments, LTL M	300.6	300.6
Total interests, LTL M	23.4	23.4
Total savings, LTL M	340.4	387.4
Payback time, years	19	18
Total balance in 2034, LTL M	16.4	63.3

Source: Ekotermija, UAB analysis

Scenario 'Volumes'

A preliminary assessment of public buildings shows that:

- in the 'Volume 25' scenario 150,000 m^2 of public buildings need to be modernised during the period 2015-2020. The absolute majority of the buildings to be modernised falls under energy efficiency class 'E'.

- in the 'Volume 50' scenario 300,000 m^2 of public buildings need to be modernised during the period 2015-2020. The absolute majority of the buildings to be modernised falls under energy efficiency class 'E'.

- in the 'Volume 100' scenario 600,000 m^2 of public buildings need to be modernised during the period 2015-2020. Half of the buildings to be modernised in this scenario falls under class 'E', the other half – class 'D'.

- in the 'Volume 200' scenario 1,200,000 m^2 of public buildings need to be modernised during the period 2015-2020. The majority of buildings to be modernised in this scenario falls under class 'D' (74%), while the minority – class 'E' (26%).

To estimate the total investment needed for modernisation (i.e. design and construction costs) we have estimated the investment needed per m^2 for each energy efficiency class. Level of investment per m^2 needed is calculated based on data given in scenario 'Directive'. Total investment needed ranges from LTL 100 M in the 'Volume 25' to LTL 700 M in 'Volume 200' (see Table 17).

Table 17: Investment needs in period 2015-2020

Indicator	Investment needs
'Volume 25'	
F class, LTL M	0.7
E class, LTL M	98.4
Total investments, LTL M	99.1
'Volume 50'	
F class, LTL M	0.7
E class, LTL M	197.4
Total investments, LTL M	198.1
'Volume 100'	
F class, LTL M	0.7
E class, LTL M	202.9
D class, LTL M	158.9
Total investments, LTL M	362.5
'Volume 200'	
F class, LTL M	0.7
E class, LTL M	202.9
D class, LTL M	485.9
Total investments, LTL M	689.5

Source: Ekotermija, UAB analysis

Similarly as in the scenario 'Directive', the payback period is evaluated by using two different heat price cases – 'Base heat tariff' and 'High heat tariff'. The financing assumptions are also the same as in scenario 'Directive': 50% of the investments are financed through bank loans (loan duration – 5 years, interest rate – 6%).

As can be seen from Table 18 and Annex 4, the payback period in scenarios 'Volume 25' and 'Volume 50' varies from 16 to 18 years depending on heat price, while in scenarios 'Volume 100' and 'Volume 200' the payback period is longer than 20 years due to the relatively small savings potential in class 'D' buildings.

Table 18: 'Volumes' scenarios main indicators

Indicator	Heat tariff	
	Base heat tariff	High heat tariff
'Volume 25'		
Total modernised area, m^2	150,000	150,000
Total expenses, LTL M, which consist of:	106.8	106.8
Total investments, LTL M	99.1	99.1
Total interests, LTL M	7.7	7.7
Total savings, LTL M	128.1	145.8
Payback time, years	18	16
Total balance in 2034, LTL M	21.3	38.9
'Volume 50'		
Total modernised area, m^2	300,000	300,000
Total expenses, LTL M, which consist of:	213.6	213.6
Total investments, LTL M	198.1	198.1
Total interests, LTL M	15.5	15.5
Total savings, LTL M	255.4	290.6
Payback time, years	18	16
Total balance in 2034, LTL M	41.8	77.0
'Volume 100'		
Total modernised area, m^2	600,000	600,000
Total expenses, LTL M, which consist of:	391.0	391.0
Total investments, LTL M	362.6	362.6
Total interests, LTL M	28.4	28.4
Total savings, LTL M	277.5	315.7
Payback time, years	-	-
Total balance in 2034, LTL M	-133.5	-75.2
'Volume 200'		
Total modernised area, m^2	1,200,000	1,200,000
Total expenses, LTL M, which consist of:	744.0	744.0
Total investments, LTL M	689.6	689.6
Total interests, LTL M	54.5	54.5
Total savings, LTL M	284.3	323.5
Payback time, years	-	-
Total balance in 2034, LTL M	-459.8	-420.6

Source: Ekotermija, UAB analysis

1.4.2 Street lighting modernisation scenarios

Street lighting modernisation scenarios were built in accordance with the EED requirements to set energy consumption reduction obligations for energy suppliers in order to achieve a reduction in energy consumption by the end users.

According to the draft Law on implementation of the EED the obligated parties must save 48 ktoe of energy during the period 2015–2020. The savings for the electricity supply sector are 15.6 ktoe, for

the heating sector – 13.9 ktoe, the natural gas sector – 18.5 ktoe. Total energy savings add up to 3.336 TWh (electricity – 1.084 TWh, heating – 0.964 TWh, natural gas – 1.288 TWh)[6]. Consequently, savings in the electricity sector in 2015–2020 must reach 181 GWh annually. To achieve this goal street lighting network modernisation must be considered as one of the primary tools for reducing energy consumption.

To estimate the savings potential and the need for investments in the street lighting sector, we have designed a scenario of street lighting modernisation:

- scenario 'Usage' – modernisation of street lighting of the 5 largest electricity consumers in the street lighting segment – Vilnius city, Kaunas city, SC Lithuanian Railways, Klaipeda city and Siauliai city.

Two cases of the electricity saving potential are assessed[7]:

1. 'Usage 40%' – electricity savings – 40%;
2. 'Usage 50%' – electricity savings – 50%.

Table 19 shows the investment needs for street lighting.

Table 19: Investments needs in 2015-2020 year period

Lighting equipment	Unit price, LTL	Investments, LTL M
FUTURLUX Head M2	1,208	58
FUTURLUX Head M3	1,343	10.1
FUTURLUX Head M4	1,488	47.4
FUTURLUX Head M5	1,633	32.6
FUTURLUX Driver	228	31.7
Cabinets	5,697	8.3
Power points	1,899	1.7
Fuse boxes	135	9.6
Central management system (C-server)	31,075	0.5
Regional Management system (C-BOX)	2,089	3.5
Costs of installation	112	11.4
Total, LTL M		214.8

Source: Investments – KPMG Baltics, units – indicators calculated based on data, provided by 17 municipalities and JSC Lithuanian Railways.

To evaluate the savings of maintenance costs, it was assumed that costs of repairing and maintaining street lighting for the 5 'users' described above represents 49% (see Figure 7) of total annual costs of repairing and maintaining the street lighting stock in Lithuania. It was estimated that repairing the street lighting equipment and power equipment failures would cost LTL 5.6 M, while the maintenance

[6] Source: COWI. Energijos vartojimo efektyvumo įpareigojimų sistemos, 2012/27/ES direktyvos kontekste, sudarymas. 2013

[77] Source – 'Modernisation of street lighting of city Kaunas, Lithuania. Sector - city street lighting'

of lighting equipment and power equipment – LTL 3.1 M for all of the street lighting stock in Lithuania (see Figure 4).

The annual maintenance costs for street lighting assets before and after modernisation are indicated in Table 20. The calculations were carried out assuming that after modernisation the costs of repairs would be reduced by 60%, and the costs of maintenance would be reduced by 30%. Total annual savings add up to LTL 1.9 M per year.

Table 20: Annual maintenance costs for street lighting assets, LTL M

Costs	Before modernisation	After modernisation
Repairs (failure disposal), LTL M	2.7	1.2
Maintenance, LTL M	1.5	1.1
Total, LTL M	4.2	2.3

Source: Ekotermija, UAB analysis

The results of street lighting modernisation for 4 cities and JSC Lithuanian Railways at different electricity savings rates are given in Table 21.

Table 21: Results of 'Usage' scenarios

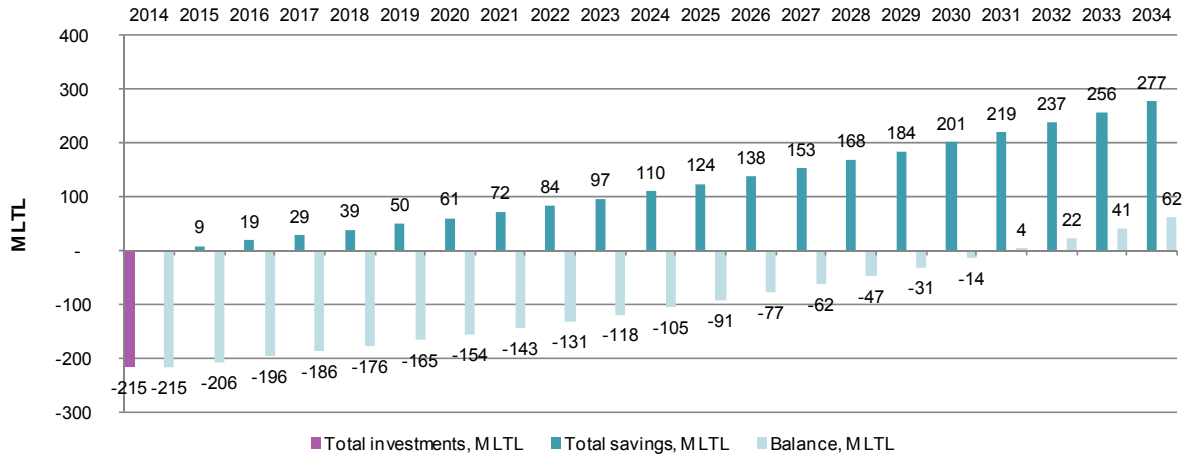
'Usage 40%'	**Value**
Electricity consumption for street lighting before modernisation, GWh per year	47.12
Electricity consumption for street lighting after modernisation, GWh per year	28.27
Electricity savings, GWh per year	18.85
The total number of lamps, units	101,452
Electricity price (2014), LTL/kWh	0.38
Electricity price growth rate, %	5
Electricity savings, LTL M (2015-2034)	236.8
Total investments, LTL M (2014)	215
Payback period, years	16
'Usage 50%'	**Value**
Electricity consumption for street lighting before modernisation, GWh per year	47.12
Electricity consumption for street lighting after modernisation, GWh per year	23.56
Electricity savings, GWh per year	23.56
The total number of lamps, units	101,452
Electricity price (2014), LTL/kWh	0.38
Electricity price growth rate, %	5
Electricity savings, LTL M (2015-2034)	296.0
Total investments, LTL M(2014)	215
Payback period, years	14

Source: Ekotermija, UAB analysis

Total investment needs in both scenarios are LTL 215 M. Total electricity savings in scenario 'Usage 40%' are LTL 237 M, in 'Usage 50%' – LTL 296 M (or 25% more than in 'Usage 40%').

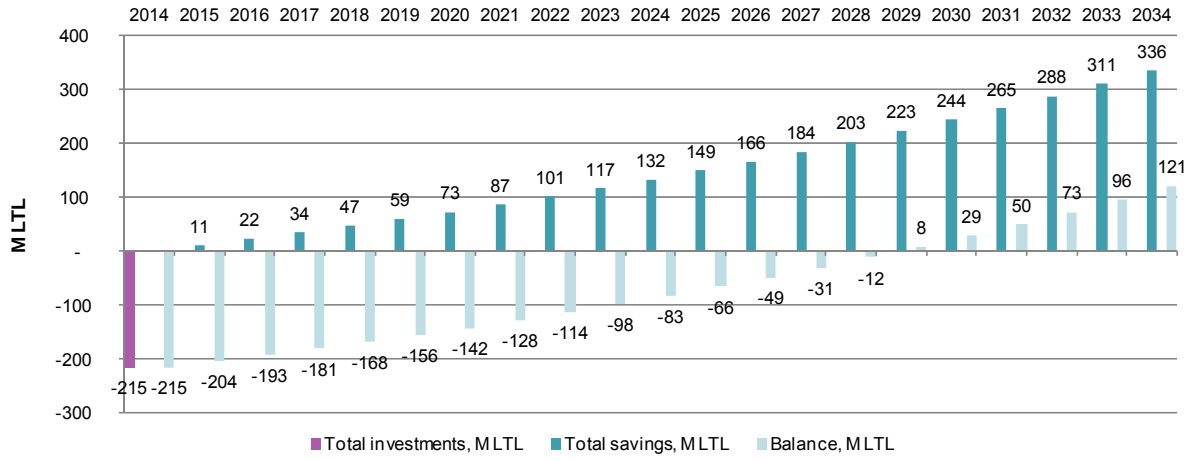
Figure 13 and Figure 14 show the payback period of street lighting stock modernisation. As can be seen from the figures, for scenario 'Usage 40%' the payback period is 16 years, while for scenario 'Usage 50%' – 14 years, due to the difference in achieved savings.

Figure 13: The payback period in scenario 'Usage 40%'



Source: Ekotermija, UAB analysis

Figure 14: The payback period in scenario 'Usage 50%'



Source: Ekotermija, UAB analysis

1.4.3 Summary

Analysis of the scenarios for public buildings and street lighting stock modernisation revealed that:

- to achieve the public building modernisation target set by EED, a total of 67,000 m^2 of centrally owned public buildings must be modernised annually. Total investment (i.e. project design and construction costs) needed to reach the goals by 2020 adds up to LTL 307 M (2014 prices);

- the average payback period for the investment (i.e. project design and construction costs) in public building modernisation in the scenario 'Directive' is 17–19 years;

- the average payback period for the investment (i.e. project design and construction costs) in public building modernisation in the scenario 'Volumes' are: 17–18 years for 'Volume 25' and 'Volume 50'; over 20 years for 'Volume 100' and 'Volume 200'. The total investment needed ranges from LTL 100 M ('Volume 25') to LTL 700 M ('Volume 200');

- to meet the goals set in the draft Law on implementation of the EED a total investment of LTL 215 M is needed for the modernisation of street lighting of the 5 largest consumers of electricity (Vilnius, Kaunas, JSC Lithuanian Railways, Klaipeda, Siauliai). The potential savings from modernisation range from LTL 237 M ('Usage 40%') to LTL 296 M ('Usage 50%') with 16 and 14 years for payback respectively.

1.4. Review of private sector willingness and capabilities to undertake ESCO projects

To assess the willingness and capabilities of the private sector to undertake ESCO projects, we have taken the following steps. First, to determine the main modernisation market players we have analysed procurement practice of Public Procurement Office (hereinafter –PPO) for the period 2011–2014. Second, to measure companies' willingness and capabilities to undertake ESCO projects we have pooled potential Lithuanian companies, which were selected based on our expertise and built value chain for ESCO operations. And last, using data from Statistics Lithuania, we have analysed sizes of economic sectors that represent potential companies for ESCO-type of operations.

1.5.1. Review of past public procurement practice

The response of the private and public sectors to public procurement was analysed for modernisation of buildings and street lighting separately.

There was no public procurement for the modernisation of public buildings and street lighting in Lithuania which would be based on energy performance contracting (An ongoing Vilnius street lighting network modernisation tender is described in Annex 8). Thus, only conventional (based on the price or economic utility) contracting of supply of goods, services and works procurement was overviewed.

A random selection of 65 tenders from the public procurement office information system was made. Additionally, based on data from the central purchasing organisation (hereinafter – CPO) one centralised tender for the modernisation of residential buildings was analysed. The list of companies which participated in these tenders is provided in Annex 9. Most of the participants were local firms. In general, the bigger and the more complex the project, the greater was the number of companies or groups of companies involved.

Based on the analysis of participants in sample tenders, we have clarified major economic sectors which are currently involved in the modernisation of public and residential buildings and which might be interested in undertaking ESCO projects. These sectors are construction, architectural/engineering and buildings maintenance.

Later, we examined the average number of participants in one tender, the average number of signed contracts in one tender and the criteria on which winners were selected.

The average number of tendering companies was determined in order to assess how active companies were in public procurement. On average 6 co-tenders participated in one tender with extremes of 1 and 18 participants. Tenders with values exceeding LTL 1 M usually attracted more participants compared to small tenders. No significant difference between the number of companies participating in the modernisation of public and residential buildings tenders was observed.

Comparison of the total number of participants and total number of signed contracts was made to measure the 'success rate'. On average 4 out of 6 companies were able to comply with the minimum technical and economic requirements and provide all the necessary documents. Thus, 67% of

companies were qualified enough to sign contracts and reach the second step in the tender. The main reasons why companies did not manage to succeed in the first step were inability to fulfil minimum economic and technical requirements (legal status of the company, financial capabilities, similar project experience, quality standards, etc.), missing documents or offered too high a price, which was not acceptable by the purchasing organisation. Requirements are set by the purchasing organisation and differ significantly depending on the tender.

From those companies which signed contracts, the winner was selected either based on the lowest price, economic utility or special criteria set by the purchasing organisation. Out of 65 sample tenders, 62 of those that proposed the lowest price were winners. A criterion of economic utility was applied in only 3 tenders (5% rate).

Street lighting modernisation and maintenance tenders were overviewed separately. Based on expert judgement we selected the 8 most relevant cases. A list of participants in these tenders is provided in Annex 10. Similarly as in tenders for the modernisation of buildings, the majority of participants are local and national companies. Only in the Vilnius city street lighting tender (described in Annex 8) were all of the participants international companies.

Based on the analysis of companies which participated in street lighting related tenders, economic sectors were clarified. These sectors were construction and maintenance of roads, materials and equipment selling, buildings maintenance.

On average five companies participated in one tender and three of them managed to sign contracts. Most winners were selected based on the lowest price rather than on the economic utility formula.

Analysis of past public procurement helped to identify companies which were involved in the modernisation of public and residential buildings and street lighting. These companies could potentially undertake ESCO projects assuming an appropriate environment is created. Construction, architectural/engineering, buildings maintenance, materials and equipment selling sectors are those economic sectors where identified companies operate in.

1.5.2. Assessment of possible private sector involvement

We decided to carry out a survey to assess which sectors and companies are the most willing and capable of undertaking ESCO projects.

Potential respondents were selected according to the ESCO value chain described in Annex 11. Then we built a questionnaire which consisted of 13 closed-end questions. The structure of the survey was the following:

1. General information about the company;
2. Public procurement experience;
3. Financial capabilities;
4. Technical and project management skills;
5. Willingness to undertake ESCO projects;
6. Functions which could be performed in the value chain of ESCO;
7. Expected returns on ESCO projects;
8. Importance of different measures for ESCO market development.

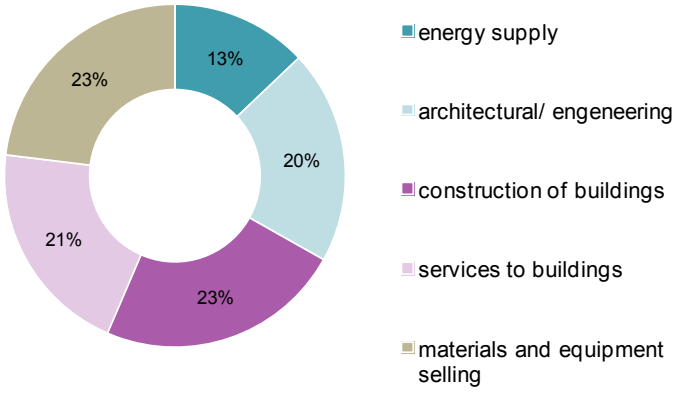
The questionnaire is provided in Annex 12.

Then 45 companies from the energy supply, construction, architectural/engineering, buildings maintenance and materials and equipment selling sectors were selected as a sample. Some of the sample companies were vertically integrated and operated in at least 2 economic sectors.

Questionnaires were distributed via email. Follow-up calls were made to all the companies 2-3 days after the distribution of the surveys. The survey was aimed at the top management positions of companies only (general managers, heads of departments). This was done with the purpose of pooling positions which make strategic and financial decisions. On average 3 calls were necessary in order to convince companies to fill in the questionnaires. The response rate was nearly 70%.

Figure 15 shows the distribution of sample companies between 5 economic sectors. Each sector is represented by a similar number of companies.

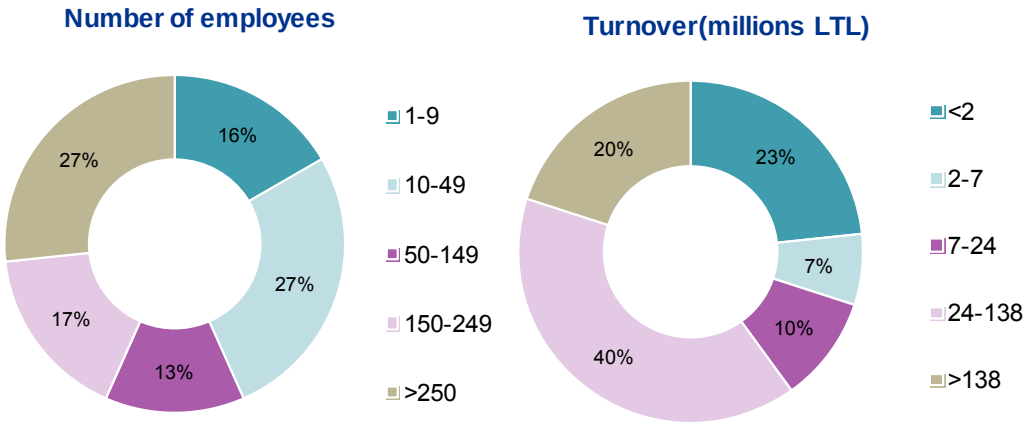
Figure 15: Sample companies' distribution between economic sectors



Source: KPMG Baltics, UAB analysis

Number of employees and turnover of the sample companies is indicated in Figure 16.

Figure 16: Sample companies' distribution between number of employees and turnover



Source: KPMG Baltics, UAB analysis

The selected sample represents the largest companies based on figures from Statistics Lithuania. In these 5 economic sectors the average number of employees is 17 and the average turnover

generated by a single enterprise is LTL 3.8 M.In order to assess which companies are the most likely to become ESCOs we have selected three criteria:

- experience in public procurement and project management skills;
- interest in providing ESCO services;
- financial capabilities.

Based on these criteria the answers of each company were evaluated and graded. Then grades of companies from the same economic sectors were generalised and assumptions about whole sectors were made.

Public procurement experience and project management skills

A total of 73.3% of respondents had participated in at least 1 public building modernisation tender during the last 12 months. The majority of companies which had not participated in any tender were energy suppliers. Only 37.5% of energy suppliers had participated in public procurement during the last 12 months, while the participation level of companies from other sectors was 86.4%.

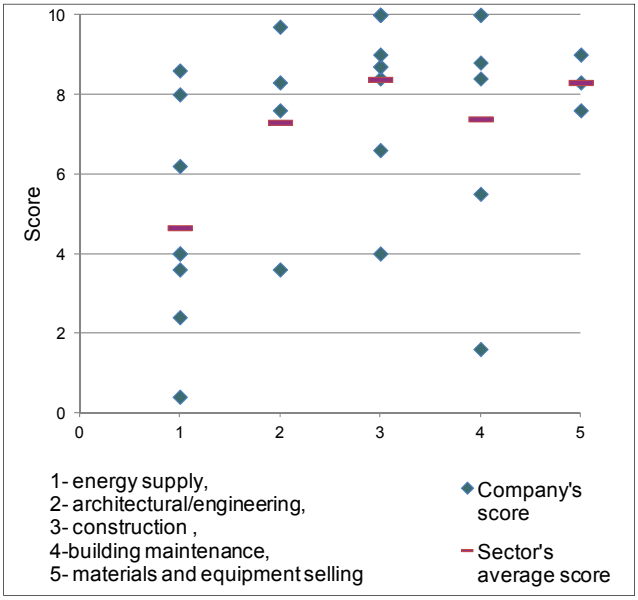
Those companies which participated in public tenders evaluated their capabilities to match the minimum technical requirements on average by 8.1 out of 10 points. Ability to match financial and economic requirements was evaluated by 8.1 as well. Therefore, the conclusion may be drawn that surveyed companies except for energy suppliers, have enough experience in public procurement in buildings modernisation.

Companies were asked to self-evaluate their project management skills. The average assessment was 8.2 out of 10. Because most of the sample companies were large by number of employees and turnover, and the majority of them had participated in public tenders, it is probable that in reality companies have good project management skills. However, it is hard to measure whether self-evaluation grades match the exact situation.

Companies' project management skills and public procurement experience was evaluated by assessing their project management skills (weight – 0.4), ability to match minimum financial and economic requirements (weight – 0.3) and ability to match minimum technical requirements (weight – 0.3).

Accumulated grades for companies and sectors are depicted in Figure17.

Figure 17: Companies' project management skills and public procurement experience



Source: KPMG Baltics, UAB analysis

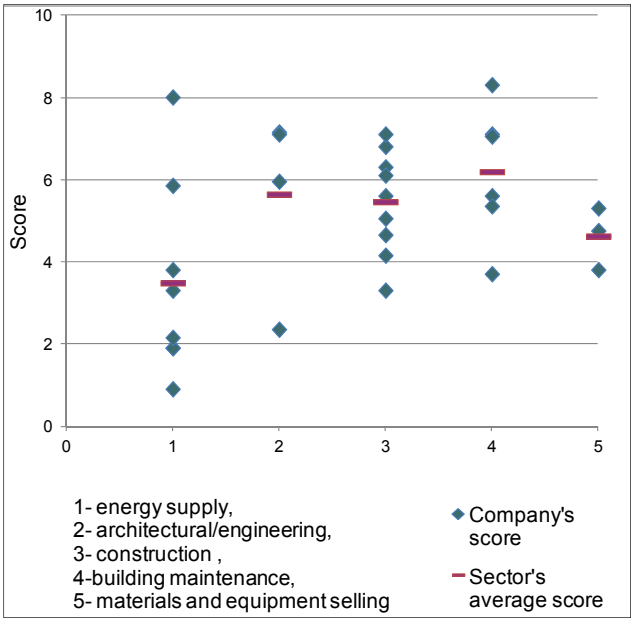
Companies from materials and equipment selling and construction sectors have the best project management skills and public procurement experience.

Interest in providing ESCO services

To measure interest in undertaking ESCO projects, we weighted three components: willingness to execute energy efficiency projects in public buildings (weight 0.6); expected annual rate of return (0.1); willingness to finance projects by companies' own capital (0.3).

Figure 18 shows how each company was graded and what the average grade for the sector was.

Figure 18: Companies' Interest in providing ESCO service



Source: KPMG Baltics, UAB analysis

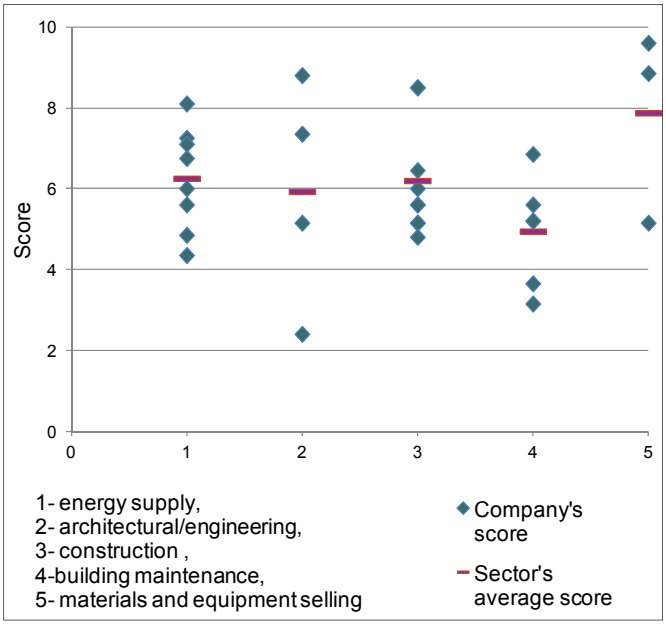
The highest willingness to become an ESCO was observed in companies from the buildings maintenance sector. Architectural/ engineering and construction companies also demonstrate a high level of interest in providing ESCO services.

Financial capabilities

Financial capabilities of the companies pooled were evaluated by assessing their profit margin (weight – 0.3), turnover (0.2), current ratio (0.5).

Figure 19 indicates accumulated grades of companies and average grades for sectors.

Figure 19: Companies' financial capabilities



Source: KPMG Baltics, UAB analysis

Based on the results from the sample companies, materials and equipment resellers, energy suppliers and construction companies have the best financial capabilities to finance ESCO projects from their own and/or borrowed capital. However, a large number of sample companies that expressed interest in implementing ESCO projects admitted that they are not strong financially and thus, would have difficulties in financing ESCO projects by equity or raising debt from commercial banks. Additional financial instruments, such as guarantees and grants, should be considered in these instances, in order to boost ESCO market growth, e.g. grants might be used to leverage commercial finance, as it would make more ESCO projects possible.

Identification of the most potential sectors

All 3 criteria – project management skills and public procurement experience, interest in providing ESCO services and financial capabilities – were taken into account while selecting the most potential economic sectors which could undertake ESCO projects.

Table 22 shows generalised sector scores for each criterion.

Table 22: Generalised scores for economic sectors

Sector	Project management skills and public procurement experience	Interest in providing ESCO services	Financial capabilities
1- Energy supply	4.7	3.5	6.3
2- Architectural and engineering	7.3	5.6	5.9
3- Construction	8.4	5.5	6.2
4- Buildings maintenance	7.4	6.2	4.9
5- Materials and equipment selling	8.3	4.6	7.9

Source: KPMG Baltics, UAB analysis

We assumed that 5 is the minimum grade that a sector has to achieve from every criterion in order to be qualified to perform ESCO functions. Construction and architectural/engineering sectors were the only two sectors which achieved the minimum grade from each criterion. As the buildings maintenance sector was graded the highest for its interest in providing ESCO services, it was also considered as a potential sector to perform ESCO functions.

Thus, results from the questionnaires helped to identify 3 economic sectors – architectural/engineering, construction and buildings maintenance, which are the most potential sectors to undertake ESCO projects.

1.5.3. Barriers and measures to improve economic environment from the viewpoint of the pooled companies

It was important to identify what barriers companies recognise as the major ones preventing ESCO market development in Lithuania. Based on the results from the questionnaire and meetings with companies organised by KPMG and the Ministry of Energy, 5 major obstacles were identified:

- regulatory environment especially regarding the description of ESCO in the legal framework and the regulation of public procurements;
- time and complexity needed to prepare ESCO contracts;
- high political risk as companies recognised that laws are changed after politicians change;
- where project payback is more than 15 years, administration of loans is too expensive;
- lack of knowledge of ESCO standards by procuring governmental institutions.

From the potential ESCOs point of view, regulatory limitation is the major barrier to undertaking ESCO projects.

Of the companies surveyed 30 evaluated the impact of different measures on their willingness and capability to execute ESCO projects. They evaluated each measure from 1 to 10 where 1 was not important and 10 was extremely important.

We compared the answers of the whole sample with the answers of 19 companies from the most potential economic sectors. The results are shown in Table 23.

Table 23: Importance of different measures to potential ESCOs

Measure	Mean (n=30)	Rank	Mean (n=19)	Rank
Governmental guarantees for loans from commercial banks	6.8	1	7.8	1
Additional financing (e.g. subsidies from government or municipalities)	6.7	2	7.5	2
Public procurement law changes – usage of economic utility formula	6.4	3	6.9	4
Public procurement law changes – prolongation of 3 years period	6.1	4	7.3	3
Better conditions for factoring service	5.7	5	6.3	6
Examples of successful ESCO projects	5.5	6	6.5	5
ESCO contract preparation training	5.3	7	5.8	7
ESCO project management training	5.0	8	5.6	8

Source: KPMG Baltics, UAB analysis

Companies from the most potential sectors are more positive about the impact of measures on their willingness to undertake ESCO projects.

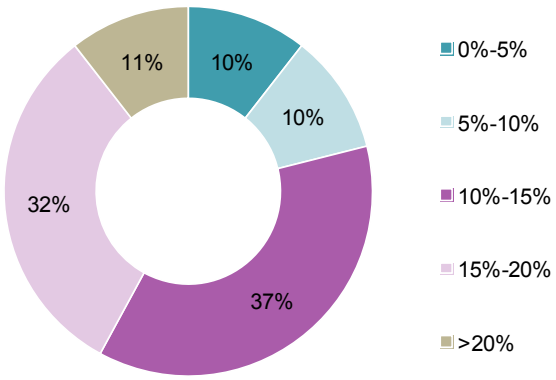
The most important measure which would encourage companies to become ESCOs is government guarantees for loans from commercial banks.

The following measures were suggested by the respondents and evaluated by a grade of 10 as extremely important:

- possibility to distinguish public building modernisation and installation of energy efficiency products (LED lights, heating boilers) in the public building in the public procurement;
- mitigation of political risk;
- financial control and responsibility for resources used;
- clear description of ESCO in the legislation;
- EED 2020 inclusion in the construction technical regulation.

Figure 20 indicates the average annual rate of return most potential companies expect from ESCO projects. Rate of return is estimated by dividing investment from future cash flows.

Figure 20: Average expected annual rate of return from ESCO projects from sample companies



Source: KPMG Baltics, UAB analysis

Most companies are expecting an average annual rate of return of 15%–20% and 10%–15% on their investments.

1.5.4. Analysis of economic sectors potential

In this section 3 potential economic sectors were analysed in order to determine their sizes. Sectors are named and classified in Statistics Lithuania in the following way:

- F41 Construction of buildings;
- M71 Architectural and engineering activities, technical testing and analysis;
- N81 Services to buildings and landscape activities.

Companies with the legal status of sole proprietorship were excluded from the analysis, as there were numerous individual enterprises but the revenue they generate was very small. Another reason for exclusion was that the majority of such enterprises were financially weak and would not be able to finance ESCO projects. Thus, in order not to distort data, analysis of selected economic sectors was conducted without taking into account companies with the legal status of sole proprietorship.

These 3 economic sectors represent 9% of the total number of enterprises and 3% of total operating income generated by companies in Lithuania.

Table 24: Statistics on economic sectors

	Construction of buildings	Architectural/ engineering	Services to buildings and landscape
Number of enterprises, units	2,845	1,513	424
Number of employees	40,971	14,048	16,835
Operating income (thousands LTL)	4,642,960	965,436	789,326
Net profit (thousands LTL)	-86,574	31,313	20,810
Profit margin (%)	-1,86	3,24	2,64
Average number of employees in one enterprise	14	9	40
Average operating income in one enterprise (thousands LTL)	1,632	638	1,862

Source: Statistics Lithuania, 2012.

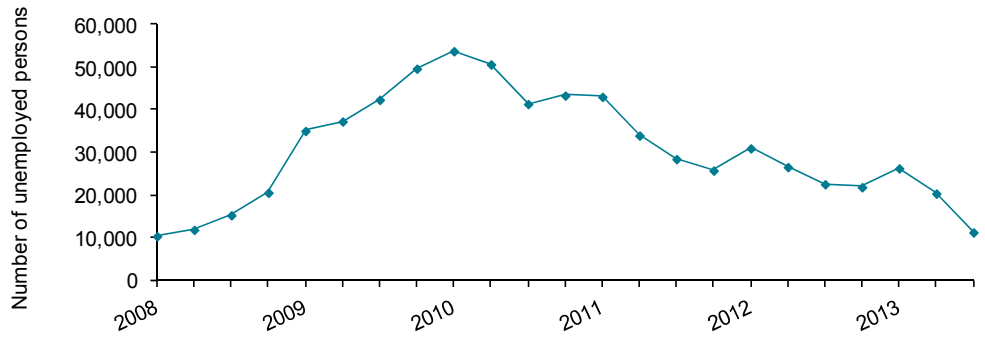
Out of the 3 analysed sectors, the construction of buildings sector was the biggest by the number of enterprises and operating income. However, the construction of buildings sector faced losses and had negative profitability in 2012 (see Table 24).

Companies from the architectural/engineering sector had the smallest number of employees and the least operating revenue in one enterprise. However, this sector was the most profitable with an average profit margin of 3.24%.

The services to buildings and landscape activities sector had the most employees in one enterprise. However, the total number of employees in this sector was the lowest in comparison with other analysed sectors.

Economic sector analysis helped to identify the following issue. Tendencies show that there might not be enough qualified workers in the construction sector. Figure 21 indicates that the number of unemployed persons in the construction sector has nearly reached its pre-economic crisis (2008-2009) level.

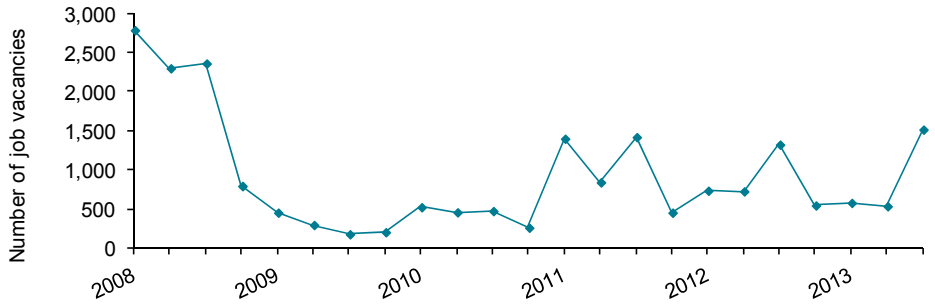
Figure 21: Unemployment in the construction sector in 2008-2013



Source: Statistics Lithuania, 2013.

Due to the accelerated residential buildings modernisation programme and the general recovery in the construction sector, the demand for workers is slowly growing. Figure 22 indicates job vacancies in the construction sector.

Figure 22: Job vacancies in the construction sector in 2008-2013



Source: Statistics Lithuania, 2013.

Due to the growing demand for workers in the construction sector and the significantly reduced number of unemployed construction workers, there might be a shortage of a qualified workforce in the near future.

1.5.5. Summary

Results from the analysis of past public procurement revealed that:

- architectural/engineering, construction, buildings maintenance, materials and equipment selling sectors were the most active in replying to building modernisation tenders;
- on average 6 companies participated in each tender and 67% of them were qualified enough to sign contracts and reach the second stage in the tender;
- in 95% of cases lowest price was the only criterion used to select the winner of a public procurement tender. In only 5% of tenders was the winner selected using the economic utility formula. None of the past tenders reviewed, were based on energy performance contracts.

Analysis of the results of the companies' survey has shown the following:

- based on the results from the sample companies, materials and equipment resellers, energy suppliers and construction companies have the best financial capabilities to finance ESCO projects from their own or borrowed capital;

- companies indicated that on average they would expect a 10%–20% annual rate of return from ESCO projects. By rating different factors (expressed interest in providing ESCO services, qualifications and financial capability) it was assessed that architectural/engineering, construction and buildings maintenance may be the most willing and capable sectors to undertake ESCO projects;

- the survey revealed that major obstacles which prevent ESCO market development in Lithuania are regulatory limitations, contract preparation difficulties, lack of knowledge of ESCO and project financing issues.

- the most important measures that would encourage undertaking ESCO projects are government guarantees for loans from commercial banks and subsidies.

1.6. Review of principal financing mechanisms

To map the potential financing constraints and the possibilities for ESCO operations in Lithuania, we analysed the barriers by the source of capital to be involved in financing ESCO projects. First, we reviewed the financing support schemes by the government under the new EU structural funds programming period 2014–2020, and how these could be applied to stimulate ESCO activity. Second, we assessed the possibility of financing projects through the commercial banking system, thus lowering equity contributions and providing additional capital to improve energy consumption. And last, we analysed the conditions at which private equity could be channelled into the sector, i.e. the rate of return which would not jeopardise the financial reasonability of ESCO contracts from the building owners (state) point of view.

1.6.1 Role of the financial instruments in the new EU support programming period for 2014–2020

The Position Paper of the Commission Services on the development of Partnership Agreement and programmes in Lithuania sets out the country-specific challenges and presents the Commission's preliminary view on Lithuania's funding priorities for the 2014–2020 programming period.[8] Four complementary and mutually interrelated funding priorities have been proposed: innovation-friendly business environment; modern infrastructure to enhance competitiveness and foster sustainable growth; maximising the use of labour force potential; sustainable and efficient use of natural resources. Several objectives were outlined under the 'Sustainable and efficient use of natural resources' funding priority. However, as our primary aim of the study is the energy efficiency of public buildings and street lighting, we will be focusing on the objective 'Supporting the shift towards a low carbon economy in all sectors'. For this objective, the funding priority translates into several specific objectives reflecting key challenges for Lithuania. For instance:

[8] Source: Position of the Commission Services on the development of Partnership Agreement and programmes in LITHUANIA for the period 2014-2020, http://ec.europa.eu/regional_policy/what/future/pdf/partnership/lt_position_paper.pdf

- to 'Promote energy efficiency and renewable energy use in residential buildings through a continuation of the activities currently funded through financial instruments and any future grant-based measures.'

The Common Strategic Framework[9] (hereinafter – CSF) funds have a key role to play in supporting financial instruments that can leverage private investment and thus multiply the effects of public finance. In addition, most of the contributions to energy efficiency investments will be through the European Regional Development Fund (hereinafter – ERDF) and the Cohesion Fund (hereinafter –CF). It is planned to allocate more than LTL ~19 Bn through these funds.[10] It is planned to assign approximately LTL 3.3 Bn for energy efficiency and renewable energy projects[11] and around 1.5 Bn LTL for public and residential buildings modernisation.[12] However, the investment demand for the 2014–2020 programming period is higher (see Table 25). According to the preliminary calculations, in order to meet EED requirements, more than LTL 300 M must be invested in public buildings modernisation. However, the total estimated investment demand according to the Ministry of Energy is about LTL 1,000–2,000 M. Other studies[13] indicate that a minimum of LTL 2,500 M is needed in order to reach the 20% mandatory energy saving target by 2020. Therefore, to finance these investments additional funding is needed from both the public and private sectors.

Table 25: Potential investment areas and demand for the 2014–2020 programming period by ministry

Ministry	Investment area	Investment demand, LTL M	Preliminary allocations of investment, LTL M
Ministry of Cultural	Reconstruction of public cultural heritage objects	N/A	N/A
	Reconstruction of private cultural heritage objects	N/A	N/A
	Construction of cultural infrastructure	N/A	N/A
	Modernisation of cultural infrastructure	N/A	N/A
Ministry of Educational and Science	Modernisation of dormitories	100	N/A
Ministry of Energy	Bio fuel boilers	1,200	240
	Bio-CHP plants	3,500	240
	Wind power plants	350 - 500	N/A
	District heating lines	900	160
	Electricity grids	1,000	200
	Gas distribution and transmission system	300	80
	Modernisation of public buildings	1,000 – 2,000	1,000
Ministry of Environment	Water treatment infrastructure	4,000	N/A
	Waste management infrastructure	300	N/A
Ministry of Interior	Urban development projects	1,000	N/A
Ministry of Transport	Airports infrastructure	492	128/149
	Railway infrastructure	8,159	2,417/2,494
	Seaport and water transport Infrastructure	5,744	516/380
	Public transport infrastructure	5,629	N/A

Source: 2014-2020 Jessica evaluation study for Lithuania. European Investment Bank (2013).

[9] The EU funds covered by the Common Strategic Framework (CSF), i.e. the European Regional Development Fund (ERDF), the European Social Fund (ESF), the Cohesion Fund (CF), the European Agricultural Fund for Rural Development (EAFRD) and the European Maritime and Fisheries Fund (EMFF).

[10] Source: EU structural assistance: *EU Structural Funds and investment partnership contract prepared for the European Commission,* http://www.esparama.lt/projektu-naujiena?id=175713

[11] Source: *http://www.esparama.lt/projektu-naujiena?id=185656*

[12] According to the preliminary data from the Ministry of Energy

[13] Source: European Investment Bank (2013): *2014-2020 Jessica evaluation study for Lithuania*.

Apart from CSF funds, there are several EU funding sources which also co-finance and contribute to the development of energy efficiency projects:

- the 2020 European Fund for Energy, Climate Change and Infrastructure (Marguerite Fund) is supported by six major European financial institutions to make capital-intensive infrastructure investments. It targets attractive long-term and stable risk-adjusted returns in the development of transportation, energy, and climate change[14].

- the European Local Energy Assistance (ELENA) fund provides financial and technical assistance to support the EU's climate and energy policy objectives by sustaining the implementation of energy efficiency or renewable energy projects.

- Joint European Resources for Micro to Medium Enterprises (hereinafter – JEREMIE) is a joint initiative developed by the European Commission in co-operation with several financial institutions, with a goal to making cohesion policy more efficient and sustainable. JEREMIE provides support to selected local financial intermediaries via national or regional governments by means of equity, loans or guarantees.

In order to increase the number of projects during the programming period and to develop a long-term strategy for efficient use of structural funds use, financial instruments (hereinafter – FIs) should be employed. With the support of the 2014–2020 CSF funds, member states are encouraged to use FIs more widely in sectors where they are particularly suitable. A broad range of financial instruments could be used, including loans, guarantees, equity, seed capital, microcredits, etc. They could be used for investments in projects which have a demonstrated capacity to pay back all or some of the resources invested, including the promotion of integrated urban development operations and the promotion of energy efficiency. A summary of regulation differences with regard to FIs are illustrated in Table 26.

Table 26: Differences between the 2007-2013 and 2014-2020 programmes regulations regarding financial instruments

Theme	2007-2013	2014-2020	Development
Supported activities	Restrictions on sectors, beneficiaries (funds for SME's, urban development and energy efficiency) and thereby types of projects and activities that are to be supported.	Member States and managing authorities may use financial instruments in relation to all thematic objectives and for all Funds, where it is efficient and effective to do so.	Flexibility to EU Member States and regions in terms of target sectors, beneficiaries, types of projects and activities.
Synergy between instruments	An expenditure co-financed by the Funds shall not receive assistance from another Community financial instrument.	Financial instruments may be combined with grants, interest rate subsidies and guarantee fee subsidies. In this case, separate records must be maintained for each form of financing.	Detect synergies between financial instruments and other forms of support, such as grants.
Implementation options	Financial engineering instruments, including holding funds, shall be set up as: a) independent legal entities governed by agreements between the co-financing partners or shareholders; or b) as a separate block of finance within a financial institution. Where the financial	Managing authorities may provide financial contributions to: a) financial instruments set up at Union level, managed directly or indirectly by the Commission. Contributions shall be placed in separate accounts and used, to support actions and final recipients consistent with the programme;	The Commission's proposal offers different implementation options from which Member States and managing authorities may choose the most suitable solution.

[14] Source: http://www.margueritefund.eu/about-us/background/

	engineering instrument is established within a financial institution, it shall be set up as a separate block of finance.	b) financial instruments set up at national, regional, transnational or cross border level, managed by or under the responsibility of the managing authority. These can be the already existing or newly created instrument or standardised instruments complying with the standard terms and conditions laid down by the Commission.	

Source: URBACT (European exchange and learning programme promoting sustainable urban development), compiled by KPMG Baltics, UAB

The use of financial instruments in economic development policy is not a new concept. Many countries within and outside the EU have operated such instruments for decades. In Europe there are few examples of programmes which have delivered the scale and public sector financial leverage of Germany's KfW, having stimulated a total investment flow of EUR 54 Bn from 2006–2009 from a core public subsidy of EUR 6 Bn. The UK's Green Deal also looks to stimulate broad scale energy efficiency refurbishment with target investment rates of 0.5-0.7% of UK GDP. Achieved wholesale leverage for direct public finance solutions appears to lie between 1:4 to 1:9.[15] Therefore, inputs from existing examples should be taken into account while creating a financial vehicle for the 2014-2020 programming period.

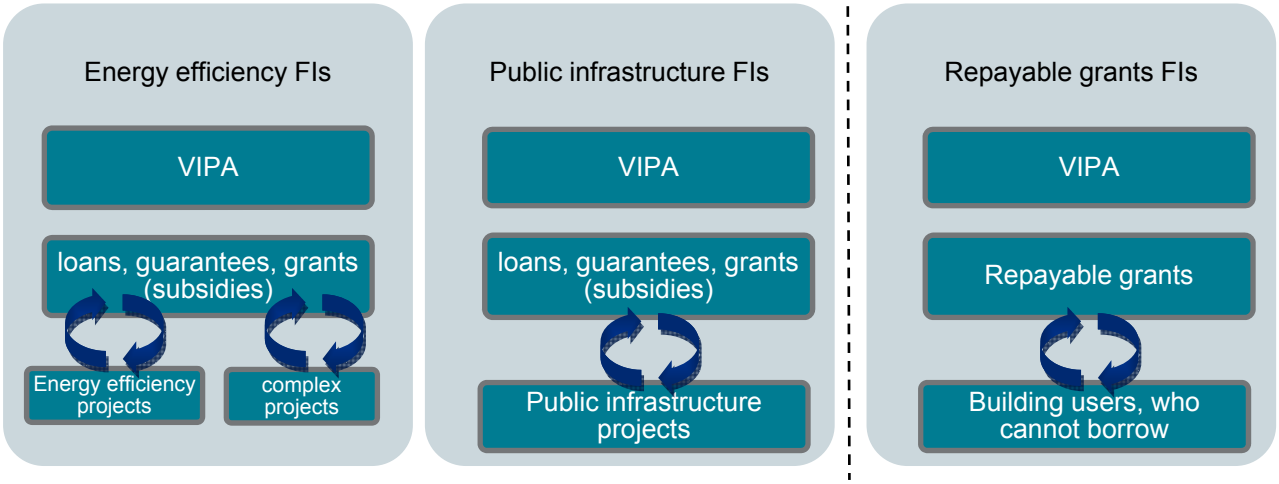
In the draft of Partnership Agreement, the government has integrated the development strategy with the objectives for achieving national goals. Also, the government suggests the use of the ESCO model for the modernisation of public buildings. However, to our knowledge, the document has not yet been approved. Currently, the government is in the process of constructing a financial vehicle, which would combine EU structural funds, national budget and financial instruments.

In order to close the gap in financing needs and to meet the EU recommendations on inclusion of FIs, the Ministry of Finance is planning to create an Energy Efficiency Fund. The fund will allow leveraging the EU structural funds by combining them with loans or equity from the private sector. It is planned that the fund will be managed by public investment development agency (hereinafter – VIPA), and will consist of EU structural funds assigned for energy efficiency and renewable energy projects. The EEF could issue concessional loans, guarantees and subsidies for three groups of projects:

- energy efficiency – buildings modernisation, district heating networks, street lighting and other.
- public infrastructure – all projects which have a capacity to pay back all or some of the resources invested.
- repayable grants – projects which cannot be financed by loans or cannot use FIs (budgetary institutions and institutions, whose debt obligations increase the budget deficit).

[15] Source: Climate & Strategy Partners, *Financing Mechanisms for Europe's Buildings Renovation*
http://icanz.org.au/wp-content/uploads/2013/04/InsulationFinancingEurope.pdf

Figure 23: Financial system proposed by the government



Source: VIPA (Engl. Public investment development agency), UAB, compiled by KPMG Baltics, UAB

It is planned to finance the energy efficiency and public infrastructure projects by similar FIs (see Figure 23). Through these FIs it is planned to finance buildings modernisation, district heating networks, city lighting and other projects. It is proposed to implement these projects using the ESCO model.

Some EEF investments might be assigned for repayable grant projects: modernisation of national theatres, sports complexes, public schools and other. These buildings will be modernised in order to improve building appearance, increase comfort and representative characteristics. Moreover, it could achieve energy savings as well, but this is not the main requirement for such type of projects. However, if the building generates a return from energy savings, then a decision would be made as to how much of the investment should be returned to the EEF.

In comparison to the previous programming period, during the 2014–2020 programming period, the Ministry of Finance is planning to use FIs for a wider range of projects (see Table 27).

Table 27: Potential investment areas for financial instruments use

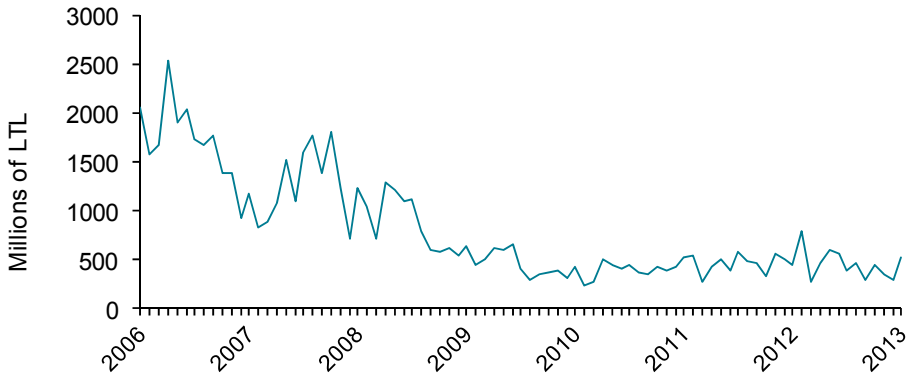
2007-2013	2014-2020
Dormitories modernisation	Buildings modernisation
Residential apartments modernisation	Water and waste management
	Renewable energy and heating supply and consumption
	Research and development
	Information technology
	Transport and railway infrastructure
	Educational infrastructure
	Social infrastructure
	Health infrastructure
	Cultural heritage
	Urban development, integrated territorial development and other

Source: VIPA (Engl. Public investment development agency), UAB

1.6.2. Attitude of commercial banks to financing ESCO projects

According to the statistics of the Central Bank of Lithuania, during the financial crisis there was a significant decrease in lending to non-financial corporations[16] (see Figure 24). For instance, during March 2007 loans in excess of LTL 2,500 M were issued, while during January 2011 this figure was only LTL 235 M. Despite the fact that the current position on lending to non-financial corporations has stabilised, the figures are far below the pre-crisis situation. This implies that commercial banks are risk adverse towards issuing new loans to non-financial corporations.

Figure 24: New loans issued to non-financial corporations during the 2006–2013 period



Source: Central Bank of Lithuania , 2013.

In order to identify the possibility of commercial banks' participation in financing ESCO projects, meetings with four commercial banks in Lithuania were organised: SEB, SWEDBANK, NORDEA and DNB. The following representatives of the banks were interviewed: head of public sector and institutions, head of business clients sector, head of small and medium business clients department and project manager from energy clients' sub-department. To avoid language differences and possible competition bias due to commercial secrets, meetings were organised with each bank separately. The main goals of the meetings were to identify the attitude of commercial banks towards ESCO projects in terms of financing risks and the willingness of the banks to participate in different stages of financing these projects.

During the meetings, the ESCO model was explained in depth to make sure that the concept was clear and to avoid misleading interpretations. After the model had been discussed, banks representatives provided their opinion about the main risks associated with financing ESCO projects. The main risks are presented in Table 28.

[16] Non-financial corporations include: private limited companies, public limited companies, state owned companies and public institutions which cover major part of expenses by the revenue from the sale of goods and services.

Table 28: Main risks identified by commercial banks' representatives

Risk	Description
Credit	Uncertainty which party takes the risk of loan repayment in case of ESCO client's inability to pay. Since the majority of public buildings' bills are paid by the municipalities, commercial banks' representatives see risk that there might not be enough money allocated in the municipalities' budgets for ESCO payments.
Long term use of the assets	The repayment for ESCO projects might take a long period of time. During this period there is a risk that the building will be closed or changed. Banks want to have a guarantee that buildings will be used for the whole period of the contract or that payments would be allocated from another building in case of closing the modernised building.
Political	The ESCO concept in Lithuania is new and there is a risk that a new government might change the relevant laws after a few years. Banks see a risk that the government by changing laws might stop financing ESCO projects.
Long term financing	Commercial banks' representatives believe that the nature of the ESCO projects is complicated. There are many risks involved in financing such type of projects for a long term. Therefore, co-financing or re-financing through funds would be a less risky option.
Credibility	Commercial banks see a risk that company's shareholders might not be reliable, especially due to the long term of the contract. Banks would need to perform vindication of potential ESCOs.
Contractual	Since the projects have accumulated a pool of many short-term and long-term obligations (assurance of energy savings, maintenance during the payback period etc.), banks recognise a high risk that the company will not be able to meet all contractual obligations.
Qualification	Limited knowledge of existing companies, since the record of ESCO projects in Lithuania is almost non-existent. Banks see the risk that companies will not have enough technical knowledge for ESCO type projects.

Source: KPMG Baltics, UAB analysis

After defining the main financing risks associated with ESCO projects, discussions regarding the possible involvement of commercial banks in financing took place. Commercial banks' representatives were asked to express their opinion on whether the bank would be interested in financing ESCO projects and/or become the Fund's manager. Different stages of financing were discussed:

- 1st stage – short-term financing to support the investment in the initial phase;
- 2nd stage – long term financing (15-20 years) to support the investment;
- 3rd stage – financing through the forfeiting facility;
- Managing Fund - fiduciary nature (administrating accounts, looking into applications, etc.).

Responses are identified in the following Table 29.

Table 29: Commercial banks' willingness to participate in different ESCOs financing stages

ESCOs financing stages	Commercial banks' willingness to participate in ESCOs financing			
	Bank 1	Bank 2	Bank 3	Bank 4
1st stage	Would consider, probably high margin	Would consider only in special cases with maturity up to 5 years	Would consider, probably high margin	Would consider for existing clients mainly
2nd stage	Would consider only with a state guarantee	Not interested	Not interested	Would consider only with a state guarantee
3rd stage	Would be interested	Would be interested	Would be interested	Would be interested
Managing Fund	Would consider	Not interested	Would consider	Would consider

Source: KPMG Baltics, UAB analysis

In the case of 1st stage financing, the opinions of the commercial bank representatives were different. Some banks would be willing to finance projects, however, with a high margin due to the many risks involved. Others would consider lending only in special cases or if a credible company with a strong balance sheet were implementing the project. None of the interviewed commercial banks were interested in financing 2nd stage investments without state guarantees. The main reasons were named as too high uncertainty and risks involved in such type of projects. On the other hand, the situation for 3rd stage financing is completely the opposite – all banks would be interested or at least would consider the opportunity of refinancing projects through the forfeiting facility due to reduced risks. In the case of forfeiting facility's management, there was only one bank which would not consider the possibility of managing the fund due to the bank's policies in Lithuania.

1.6.3. Balancing return on investment and payback

Recent studies[17] revealed that the participation of private capital should be increased in order to fulfil EU requirements for public buildings modernisation. The ESCO model is one of the ways to unlock new sources of investment capital and improve the flow of financing into energy efficient modernisation of public buildings. However, for an ESCO market to develop in Lithuania, ESCO projects must be attractive to both – potential ESCOs and ESCO clients.

Long payback period of modernisation for ESCO clients and high ROE demanded by potential ESCOs would reduce the attractiveness of ESCO projects for both parties and may be two significant constraints for the development of the ESCO market. In this section we analyse a hypothetical ESCO project in order to assess the relevance of these two factors.

The analysis is based on a hypothetical ESCO project, where an ESCO modernises a specific public building, provides maintenance for 10 years after the modernisation and allows the ESCO client to pay for this service through a yearly annuity payment. Analysis includes calculations based on four different categories of public buildings (described in the next subsection) and three types of annuities – 10-year, 15-year and 20-year - making a total of 12 different scenarios.

The financial calculations were made for four different categories (CAT) of public buildings with the assumptions displayed in Table 30.

[17] Studies: 'EIB and Energy: Delivering Growth, Security and Sustainability. *EIB's Screening and Assessment Criteria for Energy Projects';* 'Financing Mechanisms for Europe's Buildings Renovation. *Assessment and Structuring Recommendations for Funding European 2020 Retrofit Targets' and other.*

Table 30: Assumptions for ESCO project financial calculations: Buildings' characteristics

Categories (CAT)	CAT1	CAT2	CAT3	CAT4
Characteristics before modernisation				
- Energy efficiency class	C	D	E	F
- Average heating consumption, kWh/m^2 per year	100	150	200	300
Modernisation measures				
- Measures	Installation of individual heating metering devices, modernisation of ventilation systems.	Insulation of external building envelope (external walls, roof, cap), replacement of windows, reorganisation of heating and hot water systems (modernisation of heating substation), installation of individual heating metering devices.	Insulation of external building envelope (external walls, roof, cap, basement floor), replacement of windows, reorganisation of heating and hot water systems (modernisation of heating substation), installation of individual heating metering devices.	Insulation of external building envelope (external walls, roof, cap, basement floor), replacement of windows, reorganisation of heating and hot water systems (modernisation of heating substation), installation of individual heating metering devices.
- Cost of modernisation works,[18] LTL/m^2 incl. 21% VAT	54.45	484.00	592.90	701.80
Characteristics after modernisation				
- Energy efficiency class	B	C	C	C
- Average heating consumption (kWh/m^2 per year)	70	100	100	100

Source: Ekotermija, UAB analysis

In addition to the cost of modernisation works described above, financial calculations also include the following costs:

- wages of 1 worker performing maintenance on the modernised building for 10 years after modernisation – 1.4 LTL/m^2 per year in the first year, increased at the rate of inflation;
- wages of 1 worker performing modernisation supervision during the modernisation works – 14 LTL/m^2;
- certification costs, incurred in the second and fourth year of the modernisation – 1 LTL/m^2;
- maintenance costs – incurred for 10 years after the modernisation, 0.5% of the cost of modernisation (increased at the rate of inflation);
- annuity interest rate costs – interest on the annuity payment paid by the ESCO client, which covers the financing costs of the modernisation for the ESCO. The annuity interest rate is selected to allow the ESCO to achieve 15% return on equity (ROE), therefore it is different for each of the 12 scenarios (see Table 31).

[18] Design and construction costs, i.e. maintenance, certification and financial costs are not included.

Table 31: Assumptions for ESCO project financial calculations: Annuity interest rates

	CAT1	CAT2	CAT3	CAT4
Annuity interest rate				
- 10-year annuity	8.75%	10.10%	10.10%	10.15%
- 15-year annuity	9.10%	10.20%	10.20%	10.30%
- 20-year annuity	9.35%	10.30%	10.30%	10.50%

Source: KPMG Baltics, UAB analysis

Financial calculations assume that ESCO project financing is composed of:

- 50% debt financing with 6% interest rate; and
- 50% equity financing with a required ROE of 15%.

Additional assumptions included in the financial calculations are presented in Table 32.

Table 32: Assumptions for ESCO project financial calculations: Financial and energy price

Inflation, % per year	3%
Discount rate, %	6%
Heat price (at the year of modernisation), LTL/kWh incl. 21% VAT	0.30 LTL/kWh
Heat price growth rate, % per year	5%

Source: Ekotermija, UAB, KPMG Baltics, UAB analysis

1.6.3.1. Results

Results of the financial calculations are summarised in Table 33.

Table 33: Results of the financial calculations for a hypothetical ESCO project

Building category	CAT1			CAT2			CAT3			CAT4		
Type of annuity (number of years)	10	15	20	10	15	20	10	15	20	10	15	20
Cost of modernisation, maintenance and certification (LTL/m²)												
- Cost of *modernisation* (design, construction and supervision)		72.38			501.93			610.83			719.73	
- Cost of maintenance (wages + other costs)		16.99			40.62			46.61			52.60	
- Cost of certification		2.06			2.06			2.06			2.06	
Total:		91.44			544.61			659.50			774.39	
PV:		*85.91*			*533.41*			*646.86*			*760.31*	
Cost of annuity (LTL/m²)												
- Cost of annuity	46.48	75.38	107.02	338.42	537.77	745.43	410.40	652.15	903.98	485.05	766.54	1087.15
ESCO clients' annuity payments (LTL/m²)												
- Yearly annuity payment	13.24	10.75	9.65	87.18	71.41	63.94	105.73	86.60	77.54	124.54	101.79	92.37
Total:	132	161	193	872	1,071	1,279	1,057	1,299	1,551	1,245	1,527	1,847
Payback period for ESCO client (years) [19]												
- Payback period	10 years	5 years	1 year	27 years	29 years	>30 years	20 years	22 years	25 years	14 years	16 years	15 years
ROE for ESCO (%)												
- ROE	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%

Source: KPMG Baltics, UAB analysis

[19] The number of years needed for the cumulative amount spent after modernisation (i.e. sum of costs of heating and the annuity payment) to become less than the amount spent without modernisation (i.e. costs of heating).

As can be seen from Table 33:

- the payback period is shortest in CAT1 buildings, and for both – CAT1 and CAT4 buildings, i.e. for the building categories that are at the extreme ends of the heating energy efficiency spectrum, it is 16 years or less;
- CAT2 and CAT3 buildings have long payback periods (over 20 years);
- the shortest (10-year) annuity payments allowed to achieve the shortest payback period (with the exception of CAT1 buildings);
- the relatively large required ROE used in the calculations led to high annuity payments, and made the cost of annuity larger than the costs of modernisation works in scenarios with 15- and 20-year annuities.

1.6.3.2. Effect of the use of grants on ESCO projects

Results of the grants effect for ESCO projects on payback period are summarised in Table 34.

Table 34: Payback periods for ESCO projects at different grant intensity levels

Building category	CAT1			CAT2			CAT3			CAT4		
Type of annuity (number of years)	10	15	20	10	15	20	10	15	20	10	15	20
Payback period for ESCO client (years) [20]												
- Payback period without grants	10 years	5 years	1 year	27 years	29 years	>30 years	20 years	22 years	25 years	14 years	16 years	15 years
- Payback period with 10% grants for cost of modernisation works	10 years	2 years	<1 year	25 years	28 years	29 years	18 years	21 years	23 years	13 years	15 years	11 years
- Payback period with 25% grants for cost of modernisation works	6 years	<1 year	<1 year	23 years	25 years	28 years	16 years	19 years	21 years	11 years	8 years	4 years
- Payback period with 40% grants for cost of modernisation works	1 year	<1 year	<1 year	20 years	22 years	25 years	14 years	16 years	16 years	8 years	<1 year	<1 year
- Payback period with 50% grants for cost of modernisation works	<1 year	<1 year	<1 year	18 years	20 years	23 years	12 years	13 years	10 years	1 year	<1 year	<1 year

Source: KPMG Baltics, UAB analysis

As can be seen from Table 34:

- largest impact of grants is for CAT4 buildings since their modernisation costs are highest and biggest energy savings are achieved after the modernisation;
- in the shortest (10-year) annuity payments, 10% grants reduces the payback period up to 1-2 years for all categories of buildings;

[20] The number of years needed for the cumulative amount spent after modernisation (i.e. sum of costs of heating and the annuity payment) to become less than the amount spent without modernisation (i.e. costs of heating).

- in the longest (20-year) annuity payments, 50% grants reduces the payback period up to 14-15 years for CAT 3 and CAT 4 modernised buildings.

Apart from reducing the payback period for ESCO clients, the combination of grants and commercial finance enables more modernisation projects to be implemented:

- with 10% grants for the cost of modernisation works ESCOs would be able to finance approximately 10% more modernisation projects, i.e. the amount of equity needed to finance one modernisation project would be reduced by 10%;
- with 25% grants for the cost of modernisation works ESCOs would be able to finance approximately 30% more modernisation projects;
- with 40% grants for the cost of modernisation works ESCOs would be able to finance approximately 55% more modernisation projects;
- with 50% grants for the cost of modernisation works ESCOs would be able to finance approximately 80% more modernisation projects.

1.6.4. Summary

The government of Lithuania is facing mounting needs to finance energy efficiency measures in the area of modernisation of public buildings. This may become a serious barrier to achieving significant energy savings in public and residential segments. The analysis of capital sources to finance ESCO projects has shown the following:

- LTL 1.5 Bn allocations to energy efficiency measures in EU Structural Funds and the investment partnership contract prepared for the European Commission for the new programming period represent an opportunity to channel this money to finance ESCO projects, however, it may become an obstacle if a proper financial vehicle is not created. Current plans by the Ministry of Finance are to create an Energy Efficiency Fund managed by VIPA, to be used for bank guarantees, direct loans and subsidies;

- although the EU calls for a wider use of FIs to finance energy efficiency projects, the role of the commercial banking sector in providing financing recourses to ESCO projects is even more crucial. The performed analysis of attitude by the commercial banks towards ESCOs revealed that the banking sector is interested in short-term lending to ESCOs. However, currently the banks see several barriers to short-term lending: long-term use of modernised assets, credibility of ESCO, assurance of the proper balance of risk allocation by the EnPC contracts, ESCO client credit risks, absence of financing products to replace short-term financing with long term. It is to be noted that ESCO training to loan officers of commercial banks would be needed to reduce risk perception levels in the commercial banking system;

- absence of rationale to provide equity for ESCO operations may become one of the major financing barriers. However, a misbalance of ESCO clients' interest in an as short as possible payback period and the interest of ESCOs to maximise their ROE may prove to be a stumbling block in promoting modernisation of public buildings using the ESCO model. Financial modelling of hypothetical ESCO projects for different energy efficiency categories of public buildings has demonstrated that, while ensuring an attractive ROE for ESCOs' (15%), the payback period is shortest (16 years or less) for buildings that are at the opposite ends of the energy efficiency spectrum, i.e. highest and lowest energy consuming buildings. However, for the average buildings (in terms of energy efficiency) the payback period exceeds 20 years, which might not be attractive for ESCO clients. Therefore, additional

financing instruments (e.g. subordinated loans, guarantees and/or grants) should be considered for these 'unattractive' projects in order to reduce the equity required to invest by ESCOs, which would in turn reduce the costs of covering the demanded ROE for ESCO clients and therefore – shorten the payback period.

2 Determination of main barriers for ESCO market development

2.1 Regulatory limitations

1. Budget allocation and fund transfer procedures do not encourage energy saving

The Factual users (State or municipality budgetary institutions) of public buildings receive budget allocations annually. Allocations come from the State or municipality budgets and are transferred either directly, i.e. to pay salaries to institution officials, to the accounts used by State or municipality budgetary institutions, or indirectly to the suppliers (i.e. to pay for specific costs). State budget funds from the State treasury accounts are transferred when there is a need for specific costs within the limits of annual allocations or other implemented programmes (The State budget transfer rules, approved by the Directive No. 195 of the Minister of Finance, 21 July 2000, Article I (3)). State Treasury Department transfers allocated funds to the State budgetary institution directly to the suppliers to pay for goods, works and services supplied to the Factual users of the public buildings (The State budget transfer rules, approved by the Directive No. 195 of the Minister of Finance, 21 July 2000, Article II (6)). Municipality budget funds are transferred to the municipality budgetary institutions when there is a need for specific costs within the limits of annual allocations or other implemented programmes (The Description of Vilnius City municipal funding procedure, Article II (14)). In many cases the Factual users (State or municipality budgetary institutions) of the public buildings do not have rights to voluntarily use the annually allocated funds. They also cannot keep the unused allocations as a result of their savings. All unused allocations even though they are being directly used by State or municipality budgetary institutions have to be returned to the State or municipality budgets (The budget structure law of the Republic of Lithuania, Article 32 (1)). Consequently, the Factual users of the public buildings are not financially motivated to engage in EnPC procurement.

2. Possibilities of DH companies to provide ESCO services are limited

According to the value chain of ESCO services provided in Annex 11, ESCO services in buildings generally include the provision of technical maintenance of heating equipment and hot water systems of the building. The DH company or any other undertakings related to it are prohibited from providing technical maintenance of heating and electricity equipment of a building (The Law on Heating Sector, Article 20(2)). This regulation limits the scope of ESCO services which could be provided by DH companies.

3. Lithuanian public procurement law is not well adapted for the conclusion of long-term service contracts (EnPC inclusive)

It is a general rule that the term of a public procurement contract in Lithuania cannot exceed 3 years (Lithuanian Public Procurement Law, Article 18).

In accordance with the Resolution of the government of the Republic of Lithuania of May 5, 2006, No. 432, a procuring organisation can enter into a public contract for service for a term >3 years only if:

- such agreement is concluded within the frames of a State-financed or via a Public Private partnership (hereinafter – PPP) -implemented investment project or an approved long-term programme; or

- permission of the National Public Procurement agency is received.

It might be impractical and cumbersome for procuring agencies to initiate conclusion of EnPC contracts with a validity term longer than 3 years in cases when such agreements are not being made within the frames of State-financed or via PPP-implemented investment projects or approved long term programmes.

4. Right of procuring agencies to initiate multi-object procurements that would include both works, services and products is limited

There is a legal uncertainty with regard to the extent procuring agencies are allowed to engage in multi-object procurement when procuring ESCO services.

The combination of different works, services and/or products in a single procurement limits the number of potential participants compared to a situation where each type of works, services and/or products would be acquired under separate public procurement effort. As is evident from the Lithuanian case law, in order to engage in multi-object procurement, procuring agencies might be required to prove that:

i) initiation of a multi-object procurement was significant due to material reasons (e.g. economic or technical reasons);

ii) initiation of a multi-object procurement was inevitable in order to reach the goal of a procuring agency and it was impossible to reach this goal by dividing the multi-object procurement into individual procurements (The Supreme Court of Lithuania, May 4, 2010 civil case No. 3K-3-126/2010).

There is no universal or public procurement law specific definition of EnPC provided in the present legal regulation therefore it is (at least from a legal perspective) unclear what kind of works, services or products might be legitimately considered as an integral part of the ESCO model.

In addition, failure to recognise a particular multi-object procurement as a procurement of EnPC and vice-versa might discredit the ESCO model (The Supreme Court of Lithuania, Civil Division, August 1, 2013, civil case No. 3K-3-415/2013).

5. Existent energy efficiency programmes do not promote EnPC

In accordance with the existent energy efficiency programmes, all support has been given only to the modernisation measures prescribed in the energy efficiency programmes. Modernisation measures are aimed at construction works. Therefore, existent energy efficiency programmes do not promote EnPC.

6. There is no practice and formal guidance for the procurement of energy efficiency improvement measures

The Lithuanian public procurement office provides general guidance on the use of competitive dialogue and on the application of the most economically advantageous tender criterion. Notwithstanding, there is no specific guidance on how procuring organisations could apply the most economically advantageous tender criterion and/or competitive negotiations procedure to procure energy efficiency improvement measures.

7. Draft Law on EED implementation is not fully adjusted for ESCOs

In order to implement the EED, the Ministry of Energy has prepared a draft Law on EED implementation.

The following barriers implied in the norms have been identified:

- municipality-owned buildings are not included in the contemplated energy efficiency system, which can unduly limit the application of general ESCO-based measures in most public buildings, i.e. municipality-owned buildings;
- the government and/or its authorised institution is not obliged to prepare and approve specific ESCO programmes for general or public buildings, which is necessary for swift implementation of EnPC procurement
- obligated parties, i.e. energy distributors responsible for achievement of energy saving targets, are not provided with an option to fulfil their obligations by contributing annually to the Energy Efficiency National Fund an amount equal to the investments required to achieve those obligations. It means that potential tools of financing that could be employed are not utilised;
- obligated parties, i.e. energy distributors responsible for achievement of energy saving targets, are not encouraged to engage in EnPC, which means that traditional procurement of reconstruction works could prevail;
- there is unnecessary administrative burden foreseen in the suggested legislation to certify ESCOs.

2.2 Technical and contractual barriers

8. There is no unified database on public buildings (and on street lighting assets)

Lithuania does not have a unified database containing information about buildings, e.g. the area of a building, the heated area, building energy efficiency class, building heating demand for heating, building heating (electricity) demand for hot water preparation, building electricity demand, etc.

Lithuania does not have a unified database containing information on street lighting assets. The data on the street lighting network can be maintained by a number of companies.

This may result in lack of transparency and lower possibilities for ESCOs to use such database for decision making in early stages of the projects.

9. Most public buildings do not have a separate heating meter for hot water and electricity meter for lighting; there is no separate meter for street lighting

In order to correctly calculate the factual heating consumption for area heating it is necessary to determine what amount of heating is used for hot water preparation, however, most public buildings do not have a separate meter for hot water.

What is more, public buildings do not have a separate meter for electricity used for lighting; therefore, it is difficult to assess the effect of modernisation on electricity costs. For example, to evaluate accurate electricity consumption used for street lighting, it is necessary to know if electrical equipment of other legal entities can be connected to the operating networks (passenger waiting halls, billboards, city video cameras, outdoor lighting etc.).

This is creating complexity in measuring ESCOs performance under the EnPC and risks to reach contractual obligations.

10. Depreciation of quality of materials and works performed

The largest energy savings in the building are achieved within 1-2 years after modernisation (during the first 1-2 years heating energy is used to evaporate the moisture). However, the EnPC shall account for the impact of ageing on energy consumption.

Thus, additional risk to reach contractual obligations might be created.

11. The ESCO may decide to rely on 'quick and cheap' solutions, neglecting the actual modernisation needs of the building

Comprehensive modernisation of buildings not only achieves the greatest savings but also ensures comfort conditions in the building, improves the external condition of the building and increases the value of the building. Thus, if the ESCO chooses not to modernise a public building comprehensively and to rely on 'quick and cheap' solutions, the ESCO client may not get the potential benefits.

12. Certain voluntarism exists in setting the limits for the duration of the heating season

The start/end of the heating season is regulated by municipalities, which may also be influenced by political motivation. This may have an impact on actual energy savings by EnPC contracts.

13. The building owner may provide inaccurate information about the indoor temperature during the heating season

The information about the temperature maintained in the building provided to the ESCO must be as accurate as possible, since it is directly related to the energy savings achieved after modernisation. For example, if the actual average temperature in the building was 18ºC, and the building owner declared that the temperature was 20ºC, the ESCO (committed to maintaining a temperature of 20ºC) may not reach the contractual savings due to reduced saving potential.

It is calculated that a rise of indoor temperature by 1ºC (from 17 to 18ºC) will reduce the saving potential by 5.6%. If the building owner states that the indoor temperature was 20ºC, and actually it was 18ºC, the heating saving potential will decrease by 10.6%.

14. Essential modifications initiated by the building owner may decrease the savings potential

During the contracting period the ESCO client may initiate modifications (floor spacing, window, heating system, etc.) that may have impact on energy consumption. If not mentioned in the EnPC, it may become a serious obstacle for the ESCO to reach its contractual obligations.

15. Building owner's expectations for heating energy savings potential may be unjustified

If a building is of Category F, E or D, this does not necessarily mean that it's heating energy saving potential is high. When a building is provided with an energy efficiency class, it is not only heating, but also electricity consumption that is taken into account. For example, a hospital with a mechanical ventilation system, electrical boilers for hot water preparation may be of Class D or E even if its heat consumption for 1 m^2 is low. In this case, the heating savings potential would also be low.

16. Insufficient human resources in municipalities

Most municipalities do not have full-time employees or subdivisions that would be responsible for building modernisation and energy efficiency. This poses a constraint in the development and promotion of the ESCO market in individual municipalities. Annex 5 shows the number of employees in each municipality, and their education level and specifies whether there is a separate department for energy efficiency projects.

2.3 Capabilities of potential ESCOs

17. Lack of relevant ESCO knowledge and experience among potential ESCOs

There have been no public procurements based on energy performance contracts for modernisation of public buildings in Lithuania. Due to this, Lithuanian companies do not have relevant ESCO knowledge and experience.

As firms are unfamiliar with the ESCO business model, principles, risks and benefits, they might be either reluctant to undertake ESCO projects or face difficulties if projects are undertaken.

18. Labour supply shortages

Statistics show that the number of unemployed persons in the construction sector decreased significantly during the last 3 years – it is almost back to the pre-crisis level. This was mainly caused by emigration, requalification of workers and recovering construction companies.

Due to the accelerated modernisation of residential buildings and recovering construction sector, demand for workers is growing.

With additional demand for modernisation of public buildings, scarcity of construction workers might become an even bigger issue. This lack of a qualified workforce might cause a decrease in the quality of modernisation, inability to undertake projects or increased wages and total project costs.

2.4 Financing constraints

19. Insufficient financial capabilities of potential ESCOs

Based on the results from the questionnaire and the meetings with companies it is clear that there are a couple of companies which show a high level of interest in undertaking ESCO projects but they do not have sufficient financing capabilities. Thus, these companies would not be able to finance large ESCO projects. However, as these companies are highly motivated, they may be good examples for other Lithuanian companies of the ESCO model.

20. Uncertain possibility to refinance short term loans after implementation of modernisation projects

One of the main financing barriers distinguished by the commercial banks is the uncertainty as to whether borrowers will be able to refinance short-term loans after the implementation of the projects. Absence of such mechanism will create additional difficulties in obtaining short-term financing.

21. Credibility of the shareholders of ESCOs

Commercial banks see a risk that a company's shareholders might not be reliable, especially when the long term of the contract is taken into account. Banks would need to perform a thorough check on shareholders of the ESCOs.

22. It is unlikely that commercial banks would provide long-term financing for ESCO projects

Currently, commercial banks are not willing to issue long-term loans for ESCO projects due to the current regulatory environment, the structure of the contracts and uncertainties about the qualifications of potential ESCOs. However, commercial banks would be willing to re-finance ESCO projects through the alternative mechanisms when the risks are reduced.

23. ESCO client credit related risks

There is uncertainty as to which party takes the risk of loan repayment in the case of a default by an ESCO client. Since the majority of public buildings bills are paid by the municipalities, commercial bank representatives see the risk that there might be insufficient money allocated in the municipality budgets for ESCO payments.

24. Uncertainty over the use of assets

As ESCO projects might take more than 20 years, there is a risk that during this period the building will be closed or the purpose of use will be changed. Banks want to have a guarantee that buildings will be used for the whole period of the contract or that payments would be allocated from another building in case of the closing of the modernised building.

25. Lack of relevant ESCO knowledge and experience among the banking system representatives

During the meetings with the representatives of the commercial banks we were informed that it would be difficult to evaluate ESCOs financial risks before issuing new loans. This is because the ESCO concept is relatively new in Lithuania and the banks have not financed similar projects before. Current employees do not have experience of issuing loans for ESCO projects and, therefore, might not have enough knowledge to evaluate financial risks accurately. Thus, commercial banks would have to employ new experts in order to accurately evaluate lending risks.

26. Long payback periods for ESCO clients and high project ROE demanded by ESCO

Due to high risk and obligations assumed, private companies demand a high ROE on ESCO projects. The survey discussed in Chapter 1.5 suggests that the demanded ROE can reach 10-20%. The financial calculations analysed in the previous section shows that demanded ROE of 15% may lead to large annuity payments, and as a result – long payback periods, which may not be accepted by ESCO clients. On the other hand, in order to reduce the payback period, companies would have to reduce their demanded ROE, which may result in ESCO projects becoming unattractive for private companies. This balance between the ESCO clients' interest in an as short as possible payback

period and interest of ESCOs to maximise their ROE may prove a stumbling block in promoting modernisation of public buildings using the ESCO model.

3 Recommended solutions

3.1 Regulatory and contract related

1. Amendments in regulations of fund transfer procedures

The amendments in regulations of fund transfer procedures by giving direct funds for heating facilities and allowing the surplus of such funds to be kept would boost the motivation in energy saving of the factual users of the public buildings. It is recommended to amend Article 32 (1) of The Budget Structure Law of the Republic of Lithuania by adding an exception that allocated funds which are saved by the budgetary institutions due to implementation of energy saving measures do not have to be returned to the State or municipality treasure accounts. It is also advised to amend The State budget transfer rules, approved by the directive No. 195 of the Minister of Finance, 21 July 2000, by adding the exception that the allocated funds which will be used for energy saving measures in public buildings could be used by the factual users of the public buildings and the surplus of such funds could be kept at their disposal.

Related barriers: #1

2. Amendment of the Law on Heating Sector

We suggest amending Article 20(2) of the Law on Heating Sector by establishing an exemption that the restriction does not apply to DH companies providing technical maintenance of heating equipment and hot water systems of a building under EnPC.

Related barriers: #2

3. Adoption of 'Long-term energy efficiency in public buildings and public infrastructure (street lighting) programme'

According to Article 3.8 of the Resolution of the Government of the Republic of Lithuania of May 5, 2006, No. 432, the 3-year limitation period applicable to public contracts on the provision of services is not applicable, *inter alia,* when such public contracts are concluded in order to implement long-term (>3 years) programmes approved by the government. Accordingly, the government or its authorised institution could approve the 'Long-term energy efficiency in public buildings and public infrastructure (street lighting) programme', which should specifically indicate that energy savings should be achieved via long-term EnPC. The programme might be prepared by the Ministry of Energy in conjunction with the Ministry of Environment in accordance with the Draft law on EED implementation and current legal regulation (the Law on Environmental Protection, Article 6(5), the Law on Energy, Article 6). The programme should indicate:

1. the scope of the programme (municipality-used buildings, State-used buildings and street lighting);
2. energy efficiency targets;
3. the budget allocated for the implementation of the energy efficiency projects, based on EnPC;
4. institutions authorised to coordinate and implement the programme;
5. the support for the implementation of the EnPC procedure;
6. the list of energy efficiency improvement measures.

In accordance with the programme, the support should be given for the implementation of the EnPC and not related to the construction works. In addition, in order to further facilitate the use of EnPC as a mode of procurement of energy efficiency measures, the Ministry of Energy could consider suggesting to the government to amend Article 3 of the Resolution of the Government of the Republic of Lithuania of May 5, 2006, No. 432 by supplementing the list of exceptions when a public contract on services can be concluded for a term longer than three years with the following clause: 'when procuring energy efficiency services'.

Related barriers: #3, #5, #15, #23, #24

4. Right of procuring agencies to initiate multi-object procurements that would include both works, services and products

In accordance with Article 2 (27) of the EED, the Ministry of Energy should consider including the definition of energy performance contracting in the Draft law on EED implementation.

The Ministry of Energy should also consider drafting the 'Model list of energy efficiency improvement measures' which could be adopted as an annex to the 'Rules of implementation of energy efficiency improvement measures in public buildings and public infrastructure (street lighting)', adoption of which should be considered as per section 5 below.

Related barriers: #4

5. Amendment of draft Law on EED implementation

We suggest amending the draft Law on EED implementation by:

- including municipality-owned buildings in the contemplated energy efficiency system:

  1. to amend Article 2 by setting the definition of municipality-used buildings;
  2. to amend Article 5 by indicating that the draft Law on EED implementation is applicable for State-used and municipality-used buildings (Article 5((1)), to state that the targets of the draft Law on EED implementation are applicable for municipality-owned buildings (Article 5(1)), (Article 5 (2)), to include municipality-used buildings in the list of public buildings which should be modernised (Article 5 ((3), (4), (6));

- setting the government or its authorised institution competence and obligation to approve the 'Long-term energy efficiency in public buildings and public infrastructure (street lighting) programme' (Article 3((2), 13);

- setting the Ministry of Energy in conjunction with the Ministry of the Environment competence and obligation to prepare the 'Long-term energy efficiency in public buildings and public infrastructure (street lighting) programme' (Article 4, 13);

- providing the option for obligated parties, i.e. energy distributors responsible for achievement of energy saving targets, to fulfil their obligations by contributing annually to the Energy Efficiency National Fund an amount equal to the investments required to achieve those obligations or providing ESCO services;

- removing the requirements related to the certification of ESCOs (Article 9((1));

- specifically providing that a model agreement on provision of ESCO services in public buildings should be prepared and made public (Article 9(2-4)).

Related barriers: #3, #5, #6, #7, #16

6. Guidance for the procurement of energy efficiency services

The Ministry of Energy should consider adopting the 'Rules of implementation of energy efficiency improvement measures in public buildings and public infrastructure'. These rules could provide the procedure for the implementation of energy efficiency projects in line with the principles set in the 'Long-term energy efficiency in public buildings and public infrastructure (street lighting) programme'.

The Ministry of Energy, in cooperation with the National Public Procurement Office or alone should consider introducing guidance specifically addressing the use of a competitive dialogue procedure and application of the most economically advantageous tender criterion to procure energy efficiency improvement measures.

In addition, The Ministry of Energy, in cooperation with the National Public Procurement Office or alone should consider preparing standard documentation of procurement of energy efficiency improvement measures (model conditions, technical specification, agreement etc.). These standard documents could be adopted as annexes to the 'Rules of implementation of energy efficiency improvement measures in public buildings and public infrastructure'. ESCO public procurement, EnPC related recommendations are outlined below.

ESCO public procurement

Table 35 presents the essential principles of a contract: qualification requirements, requirements for the offer, economic efficiency criteria and the methodology for calculation of fines.

- *Qualification requirements*

Table 35: Qualification requirements

No.	Qualification requirements	Significance of qualification requirements	Documents evidencing qualification requirements
1.	The supplier has sufficient working capital to meet contractual obligations, i.e. LTL X.YXY.XYX (XY million litas)	If a Tender offer submitted by the supplier does not meet the requirement, the offer is rejected.	Documents (bank statement(s) proving (i) the amount of money available in the tenderer's account); or (ii) the tenderer's credit line/overdraft, indicating its amount, designation and balance; or (iii) statement proving that the bank will unconditionally provide the successful tenderer with a loan/credit line of appropriate amount) evidencing that the tenderer will have the working capital required for performance of this contract. Tenderer' free-form consent entitling the contracting authority to apply to the tenderer's bank or the bank that issued documents to obtain statements about the tenderer. The tenderer must submit scanned documents in electronic form.
2.	The supplier can perform maintenance works of the heating and hot water systems of the building in accordance with Order No 1-229 of 26 November 2009 of the Minister of Energy of the Republic of Lithuania.	If a Tender offer submitted by the supplier does not meet the requirement, the offer is rejected.	Documents evidencing that the supplier is an entity meeting the requirements of the Law on Heat Sector, is certified in accordance with the procedures established and is engaged in the system maintenance (operation) activities. The tenderer must submit scanned documents in electronic form.

Source: Ekotermija, UAB analysis

- *Requirements for the Offer submitted*

The supplier, together with the offer, submits building modernisation design proposals — a conceptual design drafted in accordance with the requirements for the composition of design projects provided by STR 1.05.06:2005 'Designing of Constructions'.

The supplier's offer has to comply with the minimal energy performance requirements for the modernised building provided by STR 2.01.09:2012 'Energy performance of buildings. Energy performance certification (if applicable)'.

- *Economic utility criteria*

Table 36: Economic utility criteria in supplier's selection

No	Evaluation criteria and their parameters	Criteria relative weighting, X,Y, Z and H	Evaluation method	Source of evaluation data
1.	Annual amount payable, having implemented the savings declared in the tender offer [LTL]	X = _	Comparative quantification	Supplier's offer
2.	Heating cost savings (compared with the standard year) [MWh]	Y = _	Comparative quantification	Supplier's offer
3.	Electricity cost savings due to reconstruction of the lighting system [MWh]	Z = _	Comparative quantification	Supplier's offer
4.	Effect of heat production in new heat production sources on costs if the price of heat is __ LTL/MWh [LTL]	H = _	Comparative quantification	Supplier's offer

Source: Ekotermija, UAB analysis

Economic utility (S) is calculated as the sum of the scores of the Supplier's price (C), heating cost savings (Q), electricity savings (E) and more cost-effective heat production (K):

$$S = C + Q + E + K\ .$$

The scores of the tender's price — annual fee for the services — are calculated by multiplying the ratio between the lowest price (C_{min}) and evaluated price (C_p) by the price's relative weighting:

$$C = \frac{C_{\min}}{C_p} \cdot X\ .$$

The scores of heating cost savings (Q) are calculated by multiplying the ratio between the highest tendered savings (Q_{max}) and evaluated Tender's savings (Q_p) by the savings' relative weighting:

$$Q = \frac{Q_p}{Q_{\max}} \cdot Y$$

The scores of electricity cost savings (E) are calculated by multiplying the ratio between the highest tendered savings (E_{max}) and evaluated Tender's savings (E_p) by the savings' relative weighting:

$$E = \frac{E_p}{E_{\max}} \cdot Z$$

The scores of the effect of heat production in new heat production sources on costs (K) are calculated by multiplying the ratio between the highest tendered savings (K_{max}) and evaluated Tender's savings (K_p) by the savings' relative weighting:

$$K = \frac{K_p}{K_{\max}} \cdot H$$

- *Methodology for the calculation of fines*

1. Energy savings are determined by measuring and/or calculating energy resources and/or energy consumption before and after the performance of the agreed building's modernisation designing and modernisation contract works and the implementation of other agreed energy saving measures, while at the same time ensuring the normalisation of external factors affecting energy consumption. Normalisation is carried out by converting the actually consumed energy resources and/or energy under standard conditions, i.e. the consumed energy resources and/or energy are/is calculated using the temperatures under the standard conditions instead of the actual outdoor air and indoor air temperatures. The standard conditions are the local outdoor air temperatures and indoor air temperatures corresponding to the requirements of hygiene standards provided for by normative documents.

2. The conversion of the actual heat consumption for space heating into the standard year has to be carried out in accordance with the RSN 156-94 'Construction climatology'. The following equation is used for the conversion of the actual heat consumptions for space heating into the standard year:

$$Q_N = \frac{Q_F \cdot DL_N}{DL_F};$$

Where,

Q_N – heat consumed for space heating in the standard year, KWh;

Q_F – actual heat consumption for space heating for the year of calculation, kWh;

DL_N – standard number of degree days;

DL_F – number of degree days in the factual year.

3. In the event that the actual period heating costs converted to the standard conditions exceed the average annual heating costs indicated in the tender (Q_p), a fine imposed on the service provider for the specified period is calculated as follows:

$$L = (Q_{FN} + Q_{HN} - Q_p) \cdot K$$

Where,

L – fine payable by the service provider, LTL;

Q_{FN} – actual heating consumption of the period specified in the contract converted into the standard year, MWh;

Q_{HN} – amount of heat evaluating the indoor temperature compliance with the standard conditions in accordance with HN 42:2009 'Indoor microclimate of residential and public buildings';

Q_P – building's annual heat consumption for the standard year indicated in the service provider's tender offer, MWh;

K – maximal building's heating price for the evaluated period (where a building is heated from the central heating supply network) or maximal average monthly heat production cost (where heat is prepared in private heat production sources), LTL/MWh.

4. In the event that the actual periodic heat costs converted into the standard conditions are lower than the average annual heating costs indicated in the tender offer (Q_p), additional heat savings are transferred to the next year of the period.

The above-mentioned methodology and criteria should be applied in order to improve public procurement for ESCO projects. However, the first potential buildings for ESCO public procurement should be selected carefully. These pilot projects could be identified using recommendations which are provided in Annex 15.

Related barriers: #6, #16, #20

7. Obligations regarding the calculation of actual heating and electricity consumption

One of the possible ways to assess energy consumption in public buildings is to install hot water meters. It may be covered by the scope of modernisation. Also, the costs for space heating and costs for hot water preparation should be separated.

An alternative for a separate metering for hot water preparation would be to use calculation method, which was set out by the Minister of Economy of the Republic of Lithuania 'Rules for the Installation of Hot Water Systems in Buildings approved by Order No 4-253 of 28 June 2005' If the building owner wishes to perform building lighting system modernisation works, the service provider must provide the building owner with a lighting system modernisation proposal based on engineering calculations and estimates. Mandatory provision — installation of separate electricity meter for the lighting system.

When the service provider has performed the building lighting system modernisation, the actual electricity savings cannot be determined by way of monitoring due to difficulties arising from the installation of the separate electricity meter as well as the unclear operating mode of the lighting system.

Therefore, energy consumption of the lighting system before (and after) the modernisation could be calculated according to the following methodology:

- collect detailed information about the building's lighting system (number of lamps (units), lamp types and power (W));
- identify building's used lighting regime by the daylight period duration and work schedule (i.e., from 7:30 a.m. to 5:00 p.m. from 7:45 a.m. to 8:00 p.m.), if the building is multifunctional – identify work schedule in separate rooms;
- collect information about the leave habits of users of the building (e.g. in schools one or more months when most people are on holidays).

In the street lighting sector electrical equipment of other legal entities can be connected to the operating networks (passenger waiting halls, billboards, city video cameras, outdoor lighting etc.). To evaluate electricity consumption used for street lighting accurately, information about the total capacity of other legal entities' equipment connected to the networks operating by the company (kW) as well as about operating modes (i.e. hours per day) must be obtained.

Related barriers: #9

8. Inclusion of the depreciation of quality of materials and works performed in the contract

We recommend allowing a decrease in energy savings by 1 percentage point per annum from the second year after the implementation of the project. This has to be reflected in the EnPC.

Related barriers: #10

9. Inclusion of the minimum and optimal required modernisation scope in the contract

The contract between the building owner (or other contracting authority) and the ESCO has to provide that the ESCO, when choosing optimal building modernisation measures, must coordinate all essential modernisation solutions with the building owner (or other contracting authority).

It is recommended that the contracting authority, together with the contract documents, provide the basic information about the modernised building, i.e. explanatory notes of the building partitions and engineering systems. It is also proposed to provide for open days, which would be specified in the contract documents and during which the ESCO could come to visit the object.

A ample document is provided in Annex 13.

Also, the building owner (or other contracting authority) must provide the minimum required modernisation scope in the contract documents (see Table 37), which is determined depending on the technical condition of the building. These minimal requirements will lower the risk of the ESCO client relating to the decision of ESCO to rely on 'quick and cheap' solutions.

Table 37: Example of minimal requirements for the modernisation of the building

No	Modernisation measures	Yes (+) No (-)
I.	The buildings energy efficiency improvement measures	
1.	Heating and domestic hot water systems rebuilding or replacement	
1.1.	heat energy source (e.g. the substation or local boiler) and domestic hot water heating equipment replacement or rearrangement	
1.2.	installation of balancing valve on the riser	
1.3.	piping thermal insulation improvement	
1.4.	replacement of heating device and pipe	
1.5.	installation of individual heat metering device or divider system and (or) thermostatic valves	
2.	Ventilation and heat recovery systems restructuring, replacement or installation	
3.	Roof insulation, as well as a new cover or new pitched roof installation	
4.	Facade walls (including socle) insulation, walls (socle) construction defect removal	
5.	Staircase entrance doors and vestibule doors replacement	
6.	Replacement of windows in the lower thermal conductivity windows	
7.	Basement ceiling insulation	
8.	Modernisation of lighting system	
9.	Lifts renewal	
II.	Others buildings modernisation measures	
10.	Sewage systems, electrical wiring, fire safety equipment, drinking water pipelines and equipment replacement and (or) re-engineering	

Source: Ekotermija, UAB analysis

Related barriers: #11

10.Conversion of the actual heating consumption into standard year

We recommend carrying out the conversion of the actual heating consumption/savings for space heating into the standard year in accordance with RSN 156-94 'Construction climatology' approved by Order No 76 of 18 March 1994 of the Ministry of Construction and Urban Development of the Republic of Lithuania. The conversion of the actual heat consumption for space heating must be carried out using the equation below.

$$Q_S = Q_F \cdot \frac{DL_S}{DL_F},$$

where:

Q_s – amount of heat consumed during the standard year, kWh;

Q_F – amount of heat consumed during the factual year, kWh;

DL_s – standard year degree-day number;

DL_F – factual year degree-day number.

Degree days are calculated: in accordance with the following formula:

$$DL = z \cdot (t_i - t_{out});$$

where:

z – duration of the heating season (number of days);

t_i - indoor temperature in°C;

t_{out} - the average outside air temperature (during the heating season) in°C.

We also recommend considering the possibility of obliging the Public Health Centre (whose direct function, having received requests or claims, is to monitor compliance with the hygiene standards in health, catering, educational, culture, nursing, public institutions and other premises), after receiving a request from the ESCO, to perform unplanned measurements of the indoor air temperature in the building.

Related barriers: #12, #13

11. Coordination of decisions between the building owner (or other contracting authority) and the ESCO

The contract between the building owner (or other contracting authority) and the ESCO must provide that the ESCO, when choosing the optimal building modernisation measures, must coordinate all essential modernisation solutions with the building owner (or other contracting authority).

We propose that the contract between the building owner (or other contracting authority) and the ESCO would provide that the building owner (or other contracting authority) during the contract period must coordinate with the ESCO all decisions directly or indirectly related to changes in heat consumption.

Also, the contract should provide that the ESCO can initiate a draft amendment to the contract (based on independent engineering calculations and estimates), provided that the building owner has made modifications that directly or indirectly caused changes in heat demand.

List of the building modifications that cause changes in heat demand:

- increase/decrease of the heated area;
- installation of additional energy saving measures;
- modernisation of the ventilation system;
- change of the intended purpose of the premises leading to a change in requirements of hygiene standards;
- retirement of a part of the premises or of the entire building;
- other.

Given the fact that adjustment and control of the substation have the greatest influence on the changes in heat demand, we recommend that the contract between the building owner (or other contracting authority) and the ESCO would include a provision that the service provider, i.e. ESCO, for the contract period takes over the operation and maintenance of the building heating (and hot water) system.

Related barriers: #13

12. Calculation of energy savings

Heating savings calculations submitted by the ESCO must be checked in accordance with the Technical Construction Regulation STR 2.09.04:2008 'Power of the building heating system. Heat demand for heating' approved by Order No D1-248 of 12 May 2008 of the Minister of Environment of the Republic of Lithuania. Calculations must be performed by an independent auditor, which is specified in the ESCO's contract or selected by means specified in the ESCO's contract.

Energy savings are determined by measuring and/or calculating the energy resources and/or energy consumption before and after the performance of the agreed building's modernisation designing and modernisation contract works and the implementation of other agreed energy saving measures, while at the same time ensuring the normalisation of external factors effecting energy consumption.

Normalisation is carried out by converting the actually consumed energy resources and/or energy under standard conditions, i.e. the consumed energy resources and/or energy are/is calculated using temperatures under standard conditions instead of the actual outdoor air and indoor air temperatures. The standard conditions are the local outdoor air temperatures and indoor air temperatures corresponding to the requirements of hygiene standards provided for by regulation documents. The conversion of the actual heat consumption for space heating into the standard year has to be carried out in accordance with RSN 156-94 'Construction climatology'. The following equation is used for the conversion of the actual heat consumptions for space heating into the standard year:

$$Q_S = \frac{Q_F \cdot DL_S}{DL_F};$$

Where,

Q_S – heating consumption for space heating in the standard year, KWh;

Q_F – factual heating consumption for space heating for the year of calculation, kWh;

DL_S – number of degree days in the standard year;

DL_F – number of degree days in the year of calculation.

5. In case when the actual period heating costs converted to the standard conditions exceed the average annual heating costs indicated in the tender (Q_p), a fine is to be imposed on the ESCO for the specified period. The fine should be calculated as follows:

$$L = (Q_{FN} + Q_{HN} - Q_p) \cdot K$$

Where,

L – fine payable by the ESCO, LTL;

QF_N – actual heating costs of the period specified in the contract converted into the standard year, MWh;

Q_{HN} – amount of heat needed for the indoor temperature to comply with the standard conditions in accordance with the HN 42:2009 'Indoor microclimate of residential and public buildings';

Q_P – building's annual heat costs for the standard year indicated in the ESCOs tender offer, MWh;

K – maximum building's heat price for the evaluated period (in case a building is heated from the central heating supply network) or maximum average monthly heat production cost (where heat is prepared by private heat production sources), LTL/MWh.

If the actual periodic heat costs converted into the standard conditions are lower than the average annual heating costs indicated in the tender offer (Q_p), additional heat savings are transferred to the next year of the period.

Related barriers: #13, #15

3.2 Financing related

13.The financing of ESCO projects

We believe that without an adequate mix of public and private finance the development of an ESCO market is hardly feasible. Since the record of ESCO projects in Lithuania is almost non-existent and there are too many risks involved in financing ESCO projects, the intervention of the government is needed to accelerate the process of ESCO market development. As mentioned in section 1.6., the Ministry of Finance is planning to establish an Energy Efficiency Fund. There are several ways how EEF could participate in supporting ESCO projects, e.g. by providing:

- subordinated loans;
- guarantees;
- subsidies.

The EEF could finance part of the investments by issuing subordinated loans. This would result in lower equity contributions being required from the ESCOs. The part, which would be financed by the EEF, would depend on project type. Also, the EEF would be able to issue guarantees for a major portion (up to 80%) of investments needed for the ESCO projects. Such guarantees would act as safeguards for commercial banks, thus the risk and the cost of financing would be reduced. Moreover, the EEF could participate by providing subsidies, especially when the business case does not show strong financial viability (e.g. when modernising buildings with D or E energy efficiency classes). The EEF could allocate a subsidy directly to the building owner when the modernisation is done in order to improve the building's appearance, comfort level or representative characteristics (e.g. the visual part, which does not generate savings).

Addressing the barrier of long-term financing, we recommend establishing the forfeiting facility (FF), which would operate under different principles than the EEF. The FF objective would be to attract additional private sector finance. It should be engaged in investing in receivables of ESCOs on those projects, where major risks related to contractual obligations under EnPC risks are no longer present – savings have been approved by an independent party.

It could buy future receivables from ESCOs through a forfeiting transaction. These forfeiting transactions could take place after the energy savings are measured and verified in order to protect the ESCO client. As a further safeguard, forfeiting transactions would relate only to a part of the efficiency investments (i.e. 70-80% of total EnPC contractual value), and not to operational project components. The ESCO would continue to operate the EnPC, including their contractual saving

obligations, in order to receive the remaining 20-30% which constitutes the service charge and profit[21].

To lower the risks and to lower the entry barriers for potential players we recommend that during the first phase of operations under the ESCO model the measurement under contractual energy saving obligations would be limited to 5 years only, to parallel the warranty requirement period under the Law on Construction.

Activity of the FF would allow unlocking the availability of equity capital invested in a specific project, which would allow refinancing a project at lower costs, providing liquidity in the market, and reduce risks of the short-term financing parties.

VIPA and several commercial banks had expressed interest in investing in such a fund. The EEF could participate in the forfeiting transactions as well. According to VIPA, the preliminary EEF would be willing to allocate funds to the FF.

In order to establish the FF its legal form must be determined and a partnership agreement created which would cover the terms and liabilities of the partners, and that would also incorporate re-financing opportunities, accountability for private profits and alternative investment structures.

We propose that both funds (FF and EEF) should satisfy the following conditions. First of all, both should be set up as commercial entities and managed commercially. Also, the main objective should be to efficiently attract additional private sector finance. In case of issuing grants, they could be provided directly as capital grants to public owners in order to reduce EnPC paybacks to reasonable levels.

Related barriers: #19, #20, #21, #22, #23, #25

3.3 Knowledge and experience related

14. Trainings to increase knowledge and awareness

One possible solution to gradually increase the knowledge of ESCOs, governmental institutions and banks is to start the modernisation with small projects. In this way, parties could gradually get to know the process and functions of ESCO. However, this method would postpone the modernisation of large objects and the whole process would become long and impractical.

To accelerate the modernisation process consultants could be procured in order to prepare ESCO tenders, supervise tendering and implementation and monitor performance. Also, it would be valuable to organise comprehensive seminars, trainings and discussions.

There is a great need for technical assistance (training) to be provided to potential ESCOs, the banking sector and public administration representatives.

Seminars could be arranged in the following forms: class-based, round table discussions and individual consultations. During these seminars the regulatory environment, contract peculiarities, risks and other important issues should be clarified. Foreign ESCOs could be invited to the discussions to share their practices. Banks and governmental institution representatives could also

[21] EBRD, *Outline of an ESCO Concept for the Baltics*

discuss with potential ESCOs. An intensive course of such seminars should take about 3 months and later - individual consultation should be provided.

We estimate that the total number of people to be trained is between 150 and 200 consisting of industry, government and bank representatives.

Related barriers: #16, #17, #24

15.Creation of a centralised database on public buildings and street lighting

We recommend that municipal/State authorities create a database on the main technical characteristics of public buildings and on their annual energy consumption. Also, we recommend that municipalities prepare and send questionnaires to companies operating the street lighting network annually. With such information databases, which would be beneficial for ESCOs and governmental institutions related to energy efficiency projects, could be created.

Related barriers: #8, #15

3. Economic impact of ESCO market

We analysed the economic impact of developing an ESCO market for public buildings in Lithuania in this section. The economic impact is analysed for two different scenarios:

- **Scenario I – 'Directive'**, public buildings are modernised according to the requirements set in the EED (3% of central government-owned buildings, which is approximately 67,000 m^2 each year).

- **Scenario II – 'Volume 25', 'Volume 50', 'Volume 100'** and **'Volume 200'**: 25.000 m^2; 50,000 m^2; 100,000 m^2 and 200,000 m^2 areas, respectively, of total public buildings are modernised annually.

Least efficient buildings are selected for modernisation first, and all buildings are modernised to reach energy efficiency class C.

Both scenarios are analysed in three different time periods: short term (3 years), medium term (10 years) and long term (20 years). To analyse the economic impact of ESCO market development five factors were selected:

- **Heating expenditure.** Modernisation will increase the energy efficiency of the building and as a result reduce the heating expenditures for ESCO clients.

- **Employment.** As a result of ESCO market development, new workplaces will be created. To perform modernisation services, the ESCOs will need to hire supervising employees, construction and maintenance workers.

- **CO_2 savings.** Modernisation will decrease the consumption of heating, which in turn will reduce the amount of CO_2 emission and as a result – the emission trading systems (hereafter – ETS) expenses.

- **Energy imports.** Due to increased energy efficiency, the demand for energy consumption will decrease thereby reducing the amount of imported energy required.

- **Tax revenues.** ESCO market development will have an effect on collected tax revenue, i.e. VAT, corporate income tax and personal income tax.

The analysis approach and the results of each factor are described in the following section.

4.1 Approach and results

To assess the monetary impact of each of the five factors described above, certain assumptions are applied. A detailed list of assumptions is provided in Annex 14. Additional assumptions for each factor are described below.

Important note: As defined in the Terms of Reference, calculations in this section use euro currency.

Heating expenditure

The present value (hereinafter – PV) of total savings of heating expenditures are shown in Table 38.

Table 38: Heating expenditure savings

PV of total savings on heating expenditure:	'Directive' (EUR)	'Volume 25 (EUR)'	'Volume 50' (EUR)	'Volume 100' (EUR)	'Volume 200' (EUR)
Short term	5,732,000	2,382,000	4,525,000	8,809,000	17,379,000
Medium term	43,966,000	19,567,000	38,361,000	75,948,000	151,122,000
Long term	101,538,000	68,893,000	136,308,000	271,139,000	483,917,000

Source: KPMG Baltics, UAB

As can be seen from Table 37 above, the highest heating expenditure savings are reached in the scenario 'Volume 200' since the largest area of public buildings is modernised, while in scenario 'Directive' savings are 4 times less.

Employment

Additional assumptions: Currently firms are operating at full capacity. Thus, to implement energy efficiency projects in public buildings new employees will have to be hired. Three types of work force will be hired: construction, construction supervision and maintenance. One construction supervisor can handle up to 3,000m^2 area per year and is supervising only for 1 year (during modernisation works). One maintenance worker is in charge of 30,000m^2 area per year and for a total of 10 years after modernisation works are completed. Construction workers account for 24% of modernisation costs.

The results of gross employment effects are presented in Table 39.

Table 39: New workplaces and wages

Total number of new employees[22]:	'Directive' (Units)	'Volume 25' (Units)	'Volume 50' (Units)	'Volume 100' (Units)	'Volume 200' (Units)
Short term	1,000	400	800	1,600	3,100
Medium term	2,400	1,300	2,600	5,300	10,600
Long term	2,500	2,700	5,400	10,700	20,000
PV of total wages in:	(EUR)	(EUR)	(EUR)	(EUR)	(EUR)
Short term	7,149,000	2,754,000	5,431,000	10,786,000	21,495,000
Medium term	16,423,000	8,455,000	16,833,000	33,590,000	67,103,000
Long term	16,930,000	15,367,000	30,656,000	61,236,000	114,726,000

Source: KPMG Baltics, UAB, Ekotermija, UAB analysis

As can be seen from Table 38 above, the largest effect of employment in the sector is the highest when scenario 'Volume 200' is carried out since the largest area of public buildings is modernised. The total number of employees is over 3,100 in the short term and almost 20,000 in the long term, while in the scenario 'Directive' this number is 8 times lower. The PV of total wages is distributed similarly – most wages are paid in the scenario 'Volume 200', and amount to over EUR 114 M in the long term.

CO_2 savings

Additional assumption: The modernised public buildings are connected to the district-heating network.

[22] Total number of employees needed for a single year during the specific period.

Results are presented in Table 40.

Table 40: CO2 savings

PV of total CO_2 savings in:	'Directive' (EUR)	'Volume 25' (EUR)	'Volume 50' (EUR)	'Volume 100' (EUR)	'Volume 200' (EUR)
Short term	49,000	20,000	38,000	75,000	147,000
Medium term	177,000	78,000	151,000	299,000	594,000
Long term	832,000	671,000	1,269,000	2,464,000	4,188,000
CO_2e/1000 EUR	8	17	16	16	13

Source: KPMG Baltics, UAB, Ekotermija, UAB analysis

As can be seen from Table 39 above, the present value of decreased ETS is lowest in scenario 'Volume 2' – over EUR 670,000 – since the smallest area is modernised in this scenario**.** The largest PV of CO_2 savings is in the scenario 'Volume 200' - more than 6 times as much. The highest CO_2 savings per EUR 1000 invested is in the scenario 'Volume 25' – EUR 17 per EUR 1000 invested. The lowest savings of CO_2 will be reached in the scenario 'Directive'.

Energy imports

Additional assumptions: Only natural gas imports are considered when calculating the ESCO market development effect on imported energy. The decreased demand of heating energy reduces the natural gas imports that are needed to produce heating energy. Calculations are based on the fuel balance in a central heating network.

The results are presented in Table 41.

Table 41: Reduction of energy imports

PV of total reduced imports of energy in:	'Directive' (EUR)	'Volume 25' (EUR)	'Volume 50' (EUR)	'Volume 100 (EUR)'	'Volume 200' (EUR)
Short term	1,159,000	485,000	918,000	1,784,000	3,516,000
Medium term	4,480,000	1,952,000	3,803,000	7,505,000	14,908,000
Long term	8,130,000	5,039,000	9,933,000	19,721,000	35,826,000

Source: KPMG Baltics, UAB, Ekotermija, UAB analysis

As can be seen from Table 40 above, the PV of total reduced imports of energy are highest in scenario 'Volume 200' for all three time periods because the largest area of public buildings is modernised in this scenario.

Tax revenue

The results of ESCO market development effect on tax revenue are presented in Table 42.

Table 42: Tax revenues

PV of total taxes paid in:	'Directive' (EUR)	'Volume 25' (EUR)	'Volume 50' (EUR)	'Volume 100' (EUR)	'Volume 200' (EUR)
Short term	7,045,000	2,698,000	5,337,000	10,615,000	21,170,000
Medium term	18,023,000	8,603,000	17,203,000	34,403,000	68,802,000
Long term	16,781,000	10,349,000	20,810,000	41,732,000	84,485,000

Source: KPMG Baltics, UAB, Ekotermija, UAB analysis

As can be inferred from Table 41 above, the biggest positive effect on tax revenue in scenario 'Directive' is in the medium term. This is because of the decrease in VAT collections caused by reduced heating expenditures. However, in 'Volume' scenarios the biggest positive effect on tax revenue is in the long term – unlike in the 'Directive' scenario, modernisation projects are continued

throughout the whole 20-year period, and the increase in taxes from modernisation projects outweigh the reduction in VAT collected from heating expenditures.

4.2 Cost–benefit analysis

The outcome of this analysis is the benefit/cost ratio, which shows the economic value generated for each EUR 1 invested, and is calculated by dividing the PV of economic benefits, by the PV of total annuity payments (i.e. the costs incurred to achieve these benefits). The total value of benefits is calculated by adding the monetary impacts of reduced heating expenditures, CO_2 savings, energy imports and tax revenues.

Important note: the costs related to the organisation of seminars and trainings for potential ESCOs, the banking sector and public administration representatives are not included in the calculation since their impact is minor. The effect of new job creation is not included in the analysis, as it is difficult to estimate the precise economic value of each workplace created.

Results of the cost-benefit analysis are presented in Table 43.

Table 43: Cost benefit analysis

	'Directive' (EUR)	'Volume 25' (EUR)	'Volume 50' (EUR)	'Volume 100' (EUR)	'Volume 200' (EUR)
PV of benefits:					
Short term	13,985,000	5,585,000	10,818,000	21,283,000	42,212,000
Medium term	66,646,000	30,200,000	59,518,000	118,155,000	235,426,000
Long term	127,281,000	84,952,000	168,320,000	335,056,000	608,416,000
PV of total annuity[23] payments + 21% VAT					
Short term	5,311,000	2,108,000	4,095,000	8,069,000	16,020,000
Medium term	64,165,000	24,682,000	48,919,000	97,393,000	194,342,000
Long term	126,213,000	48,383,000	96,131,000	191,628,000	382,620,000
Benefit/cost ratio:					
Short term	2.63	2.65	2.64	2.64	2.63
Medium term	1.04	1.22	1.22	1.21	1.21
Long term	1.01	1.76	1.75	1.75	1.59

Source: KPMG Baltics, UAB analysis

As can be inferred from Table 43 above:

- in the short term, all of the analysed scenarios have a benefit/cost ratio larger than 2.6. This implies that EUR 1 invested generates EUR 2.6 of economic value in the short term.

- in the medium term the benefit/cost ratio falls below 1.2. This is caused by decreased VAT collections for heating energy, as well as the fact that the bulk of annuity payments are collected during this period.

- in the long term, even with decreased VAT collections for heating payments, all of the scenarios have a benefit/cost ratio larger than 1, because annuity payments for most of the ESCO projects are paid off, while the benefits of reduced heating expenditures is accumulating.

[23] It is assumed that all annuity payments are paid over a 15-year period, therefore the PV of total annuity might not reflect the total costs associated with the ESCO projects.

- scenario 'Directive' has a relatively low (near 1.00) benefit/cost ratio in the long term, because: i) VAT collections from heating expenditures are lower (as explained above); and ii) this scenario includes a relatively small portion of 'worst' buildings (in terms of energy efficiency) for which modernisation would have the largest energy saving effect, and, therefore, 20 years are not enough for energy expenditure savings to outweigh the costs incurred.

4.3 Summary

The economic impact analysis of ESCO market development revealed that:

- in the long term (over 20 years) the modernisation of the most inefficient public buildings is positive in economic terms – for EUR 1 invested, up to EUR 1.8 of direct economic value is created[24];

- the development of an ESCO market creates new jobs and has an overall positive effect on the local economy;

- in order to properly evaluate the effects of ESCO market development, additional 'subjective' effects have to be considered, e.g. increased comfort level for the users of the building, increased representative characteristics of the buildings, more efficient use of energy resources, etc.

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[24] Taking into account the effect of change in expenditure for heating energy, reduced CO_2 emissions, reduced imports of natural gas and change in tax revenues, as described in section 4.1.

Annex 1: Street lighting data

Municipalities	Rietavas city		Panevėžys district		Radviliškis city		Pakruojis district		Anykščiai district		Druskininkai city	
Network investment												
Lighting equipment renewal	Unit	Unit price, LTL	Unit	Unit price, LTL	Unit	Unit price, LTL	Unit	Unit price, LTL	Unit	Unit price, LTL	Unit	Unit price, LTL
lamp purchases	40	26.74	244	20	60	18.15	178	23.2	320		100	60
luminaires purchases			24	260			136	181.0	2		100	350
purchases of new poles							5	1,590.4	2		100	1,000
Electricity supply equipment renewal	Unit	Unit price. LTL	Unit	Unit price. LTL	Unit	Unit price. LTL	Unit	Unit price, LTL	Unit	Unit price, LTL	Unit	Unit price, LTL
cabinets											5	4,000
power supply points											5	2,000
electrical cables, m											8,000	30
Expenses												
Electricity used for lighting streets, MWh	108.60		523.57		210		206.9		1326.88		2,320	
Network maintenance costs, Lt			200,000		171,700		708.85		24,960		368,000	
lighting equipment and power equipment maintenance costs	35,218.32		24,000		165,000		621.12		157,851			
lighting equipment and power equipment failures disposal costs	4,952.17		176,000		6,700		87.73		4,500			
Reimbursement arrangements												
What institution pays the electricity bill*	M		M		S		S		M		M	
How often electricity bill is paid	monthly		monthly		monthly		monthly		monthly		monthly	
What institution pays the cost of network support*	M		M		S		S		M		M	
How often network support bill is paid	monthly		monthly		monthly		monthly		monthly		monthly	
Troubleshooting and maintenance control												
Is it possible to automatically adjust lighting levels	No		No		No		No		No		No	

Is it possible to automatically detect lamps faults	No	No	No	No	No	No
Other information						
The total network length, km	20.7	401.7	65.0	101.5	188.0	135.3
cable lines	9.7	10.7	19.0	25.4	34.0	105.0
overhead line	11.0	391.0	46.0	76.1	154.0	30.3
The total number of luminaires, units	473	3,427	1,980	1,583	3,275	3,290
luminaries with sodium vapour lamp	462	2,360	1,957	460	2,601	2,880
luminaires with mercury vapour lamp	0	1,067	19	1,123	592	400
luminaires with metal halogen lamp	11	0	4	0	82	10
Cabinets, units	7	190	28	53	84	104
Power supply points, units	7	190	28	38	84	104
Lamps, units replaced during the year	34	220	120	79	280	200
Lamps average operating time per year, min.	175,200	66,360	120,000	33,987	143,040	208,020
Lamps weighted average electricity consumption per year, kWh	229.6	152.8	106.1	173.6	405.2	705.2
The average lamp life cycle, years	3.0	7.0	5.0	12.0	1.5	
Poles, units replaced during the year	-	-	6		2	
Poles, units repaired during the year	-	-				

Note: *M – Municipality, S – Subdistrict.

Municipalities	Radviliškis district		Utena district		Vilnius district		Raseiniai district		Jurbarkas district		Kėdainiai district	
Network investment												
Lighting equipment renewal	Unit	Unit price, LTL	Unit	Unit price, LTL	Unit	Unit price, LTL	Unit	Unit price, LTL	Unit	Unit price, LTL	Unit	Unit price, LTL
lamp purchases	136	30	163	27.5	878	35.35	350	21	800	12	1,002	
Luminaires purchases	9	208	15	300	111	350.58	77	192	68	160	472	
purchases of new poles	5	496	8	700	35	3,087.67	8	1,200			16	
Electricity supply equipment renewal	Unit	Unit price. LTL	Unit	Unit price. LTL	Unit	Unit price. LTL	Unit	Unit price. LTL	Unit	Unit price. LTL	Unit	Unit price, LTL

cabinets	4	898	2	600	4	942.55	7	350			1	
power supply points			2	400			7	580			25	
electrical cables, m	12,000	3	500	4	1,996	4.6	2.88	6.5	8,200	2.00	6.32	
Expenses												
Electricity used for lighting streets, MWh	311.667		1,000.64		1,978.20		411,089		450		844.18	
Network maintenance costs, Lt	232,976.71		26,131.03		449,571.04		443096		102,000		195,731	
lighting equipment and power equipment maintenance costs	213,698		8,519.28		215,874.04		194881		102,000		169,427	
lighting equipment and power equipment failures disposal costs	19,278.71		151,92.75		233,697		248215				26,304	
Reimbursement arrangements												
What institution pays the electricity bill*	M		S		S		UAB 'Raseinių kom. Paslaugos'		S		M	
How often electricity bill is paid	monthly		monthly		monthly		monthly		monthly		monthly	
What institution pays the cost of network support*	M		S		S		UAB 'Raseinių kom. Paslaugos'		S		M	
How often network support bill is paid	monthly		monthly		monthly		monthly		monthly		monthly	
Troubleshooting and maintenance control												
Is it possible to automatically adjust lighting levels	No		No		No		No		No		No	
Is it possible to automatically detect lamp faults	No		No		No		No		No		No	
Other information												
The total network length, km	225.0		83.2		333.3		184.8				276.6	
cable lines	38.6		25.0		117.7		61.6				54.7	
overhead line	186.4		50.8		215.6		123.2				221.9	
The total number of luminaires, units	4,327		3,201		4,783		1,691		1,900		5,002	
luminaires with sodium vapour lamp	3,552		2,791		2,993		1,157		1,400		4,214	
luminaires with mercury vapour lamp	763		365		1785		449		400		582	
luminaires with metal halogen lamp	12		45		5		85		100		206	
Cabinets, units	102		85		310		137		40		112	
Power supply points, units	138		77		296		137		102		265	

Lamps, units replaced during the year	221	189	850	321	780	744
Lamps average operating time per year, min.	35,024	82,488	39,851.62	129,600		60,000
Lamps weighted average electricity consumption per year, kWh	167.8	312.6	423.9	243.1	236.8	168.8
The average lamp life cycle, years	6.4	5.6	3.1	2.0		3.5
Poles, units replaced during the year	11	8	6	7		
Poles, units repaired during the year		10	15	5		

Note: *M – Municipality, S – Subdistrict.

Municipalities	Klaipėda district		Palanga city		Plungė district		Ukmergė district		Vilnius city		Biržai district	
Network investment												
Lighting equipment renewal	Unit	Unit price, LTL	Unit	Unit price, LTL	Unit	Unit price, LTL	Unit	Unit price, LTL	Unit	Unit price, LTL	Unit	Unit price, LTL
lamp purchases			450	23	193	30	180	23.44	8,218		42	50
luminaires purchases			27	275	49	200	54	218.71	137		42	350
purchases of new poles			25	220	47	1,000	0	0	56		42	1,457
Electricity supply equipment renewal	Unit	Unit price, LTL	Unit	Unit price. LTL	Unit	Unit price. LTL	Unit	Unit price, LTL	Unit	Unit price, LTL	Unit	Unit price, LTL
cabinets					1	2,450	2	2,200	1		1	4,520
power supply points							1					
electrical cables, m			550	8.75	4,796	8.5	1,180	10.72	4,134		1.7	3.11
Expenses												
Electricity used for lighting streets, MWh	305		1,059		574.4		746.98		20,396,000		281,304	
Network maintenance costs, Lt	370,000		483,449		223,860		238,823.60		5,486,800		56,690	
lighting equipment and power equipment maintenance costs	36,000		423,619		220,600		222,522.60				36,690	
lighting equipment and power equipment failures disposal costs	97,000		24,648		3,260		16,301				20,000	
Reimbursement arrangements												
What institution pays the electricity bill*	M		M		M		S		M		M	
How often electricity bill is paid	monthly		monthly		monthly		monthly		monthly		monthly	

What institution pays the cost of network support*	M	M	M	S	M	M
How often network support bill is paid	monthly	monthly	monthly	monthly	monthly	monthly
Troubleshooting and maintenance control						
Is it possible to automatically adjust lighting levels	No	No	No	No	No	No
Is it possible to automatically detect lamp faults	No	No	No	No	No	No
Other information						
The total network length, km			102.7	192.0	1547.0	63.9
cable lines			19.3	47.0	1194.0	15.0
overhead line			83.4	145.0	150.0	49.0
The total number of luminaires, units	2,649	2,120	1,795	3,999	82,815	1,319
luminaires with sodium vapour lamp	2,600	1,750	1,330	3,595	43,675	1,135
luminaires with mercury vapour lamp	0	370	440	391	38,899	131
luminaires with metal halogen lamp	49	0	25	13	241	53
Cabinets, units	155	38	44	130	318	30
Power supply points, units	155	38	44	125	239	12
Lamps, units replaced during the year	220	530	196	0	631	159
Lamps average operating time per year, min.		222,000	43,200	0	82,180	127,800
Lamps weighted average electricity consumption per year, kWh	115.1	499.4	320.0	186.8	246.3	213.3
The average lamp life cycle, years		1.5	3.0		1.3	8.0
Poles, units replaced during the year		5	45		4	4
Poles, units repaired during the year		2				12

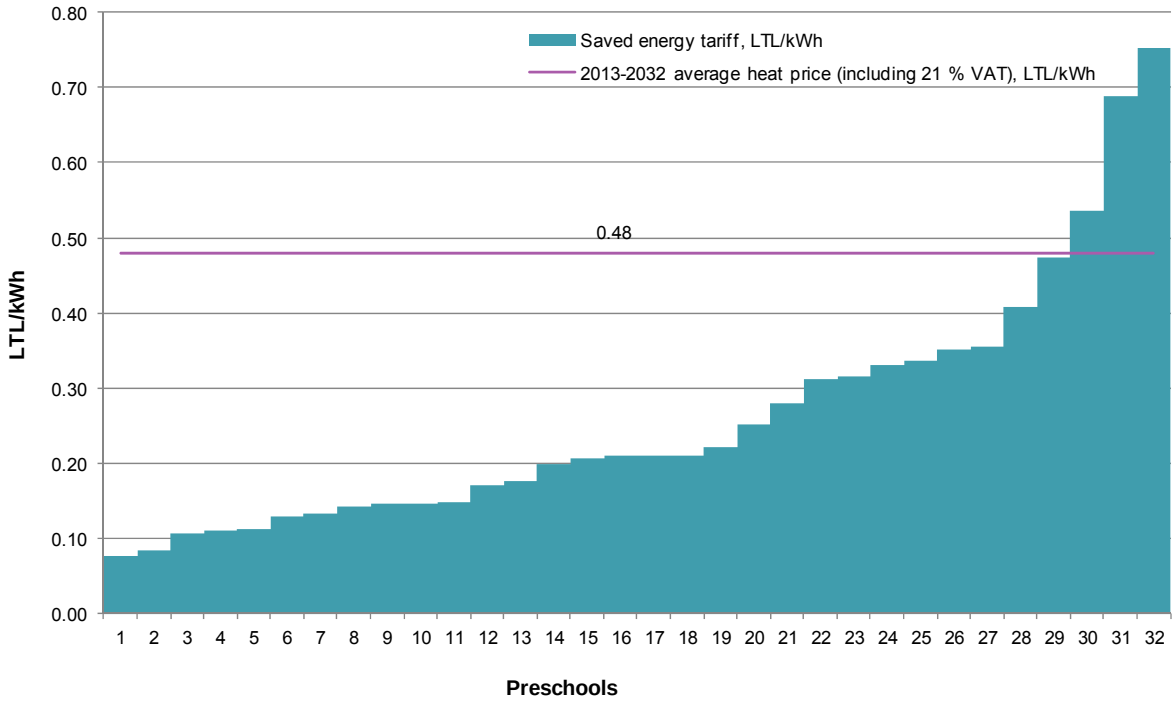
Note: *M – Municipality, S – Subdistrict.

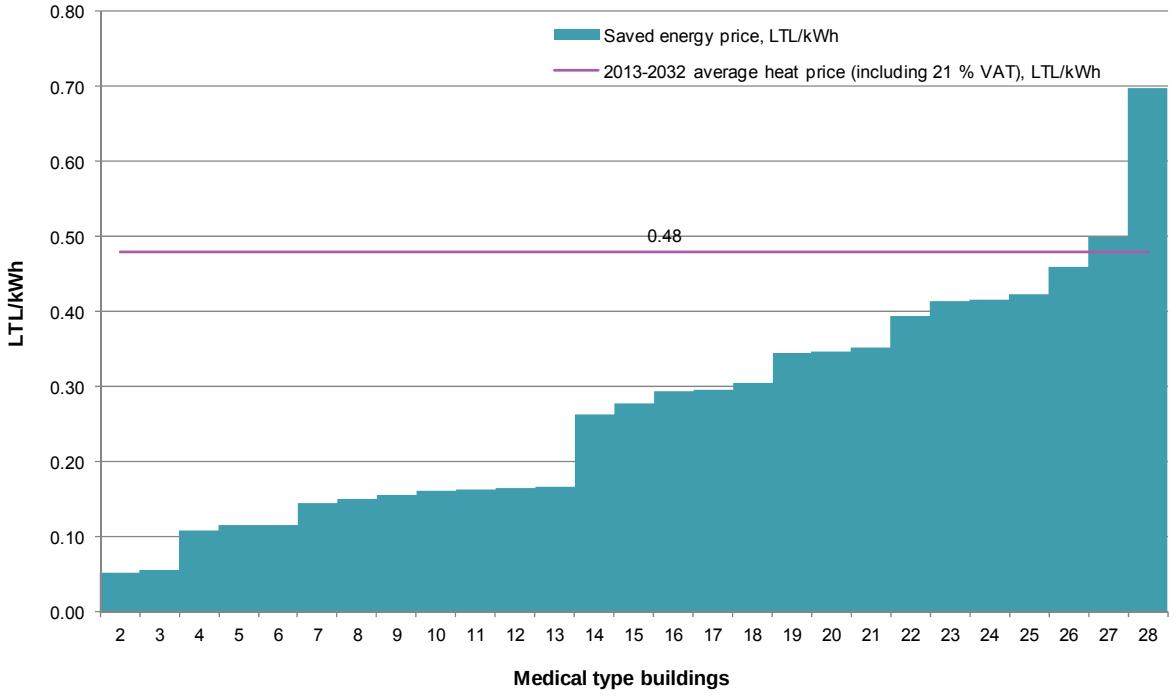
Municipalities	JSC Lithuanian Railways		**TOTAL**	
Network investment				
Lighting equipment renewal	Unit	Unit price, LTL	Unit	Unit price, LTL
lamp purchases	1,894	34	15,248	28.9
luminaires purchases	180	848	1,503	299.5
purchases of new poles	86	1,490	435	1,224.1
Electricity supply equipment renewal	Unit	Unit price, LTL	Unit	Unit price. LTL
cabinets	65	2,245	93	2,022.9
power supply points			40	993.3
electrical cables, m	14,071	12	46,688	8.4
Expenses				
Electricity used for lighting streets, MWh	8,505		41,559.1	
Network maintenance costs, Lt	121,583		9,196,080.2	
lighting equipment and power equipment maintenance costs	121,583		2,348,104.4	
lighting equipment and power equipment failures disposal costs			896,136.4	
Reimbursement arrangements				
What institution pays the electricity bill*	LG		M/S/LG/other	
How often electricity bill is paid	monthly		monthly	
What institution pays the cost of network support*	LG		M/S/LG/other	
How often network support bill is paid	monthly		monthly	
Troubleshooting and maintenance control				
Is it possible to automatically adjust lighting levels	No		No	
Is it possible to automatically detect lamp faults	No		No	
Other information				
The total network length, km	448.6		4,369.3	
cable lines	249.2		2,025.9	

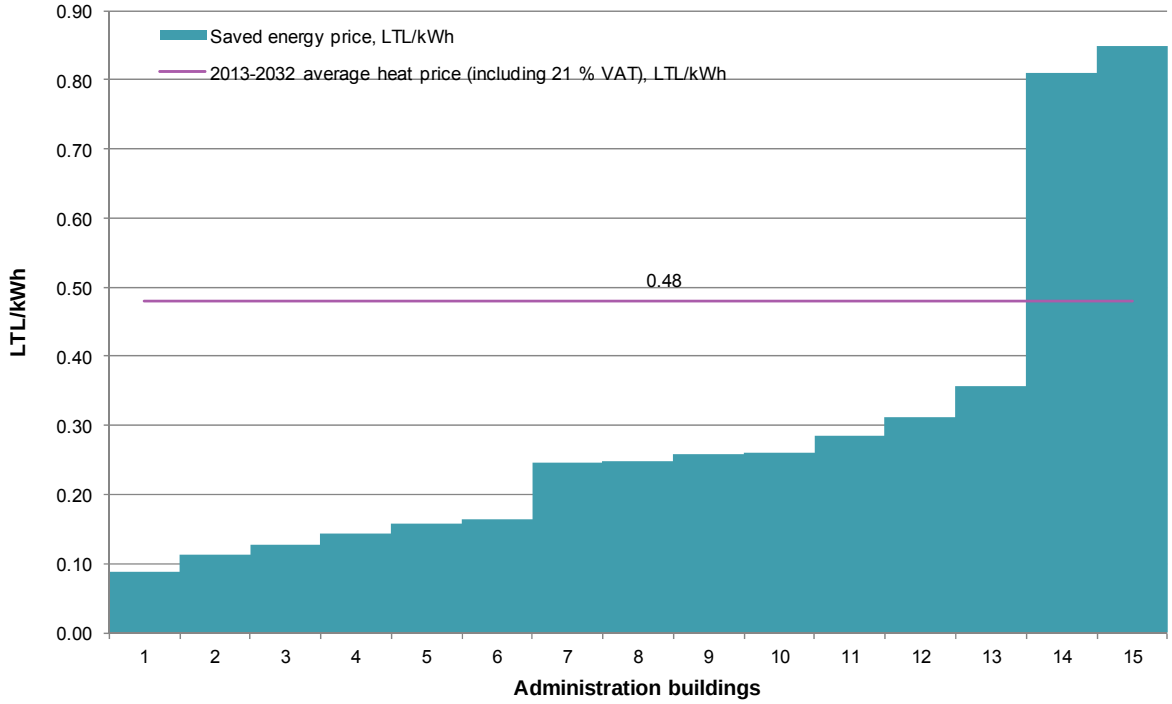
overhead line	199.4	2,133.0
The total number of luminaires, units	5,994	135,623
luminaires with sodium vapour lamp	1,090	82,002
luminaires with mercury vapour lamp	2,164	49,940
luminaires with metal halogen lamp	2,740	3,681
Cabinets, units	655	2,622
Power supply points, units		2,079
Lamps, units replaced during the year	2,432	8,206
Lamps average operating time per year, min.	216,000	111,547
Lamps weighted average electricity consumption per year, kWh	723.8	279.6
The average lamp life cycle, years	1.8	4.3
Poles, units replaced during the year	80	178
Poles, units repaired during the year		44

Note: M – Municipality, S – Subdistrict, LG - JSC Lithuanian Railways.

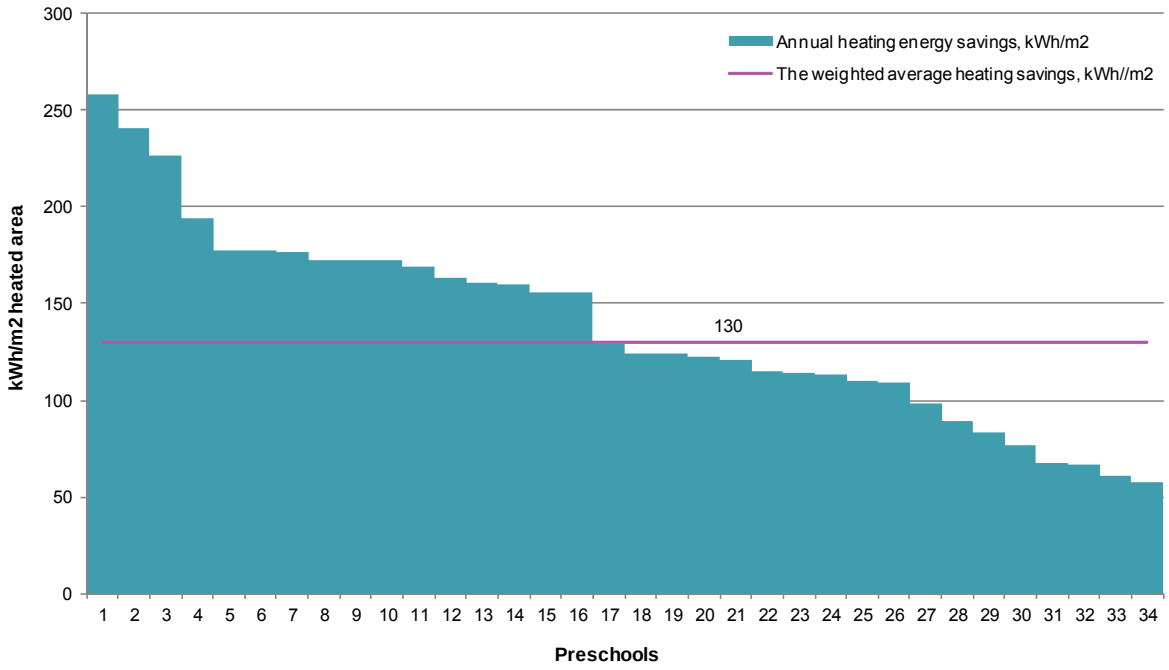
Annex 2: Public buildings SET

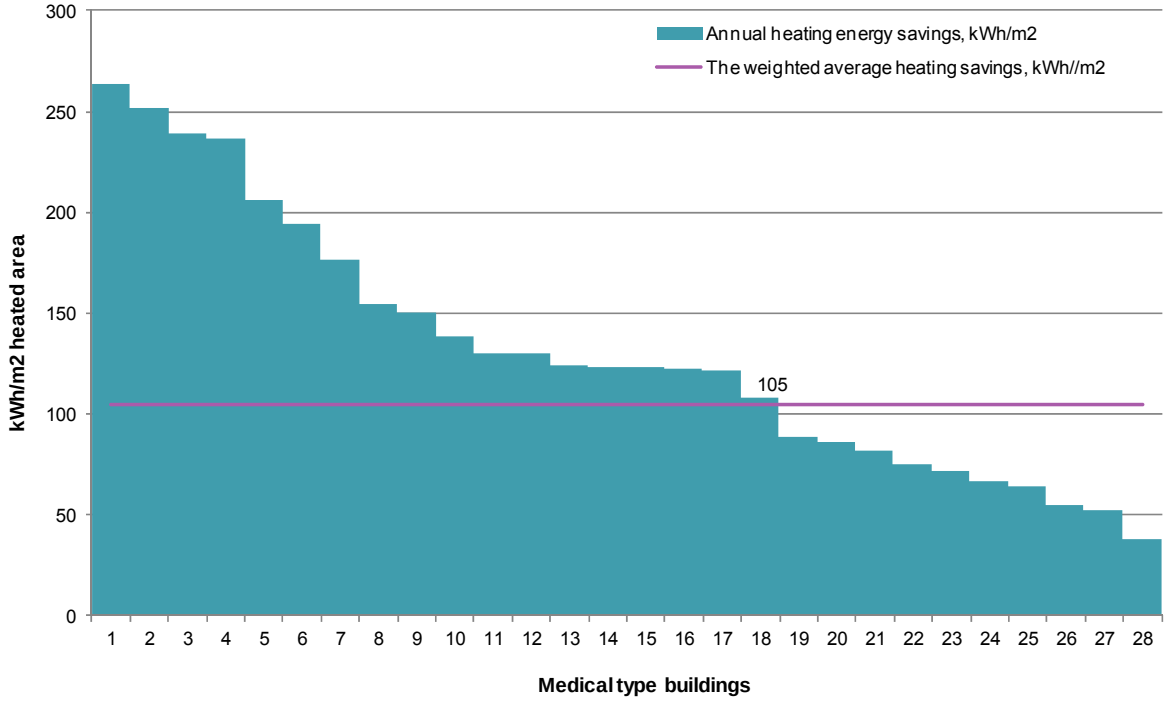


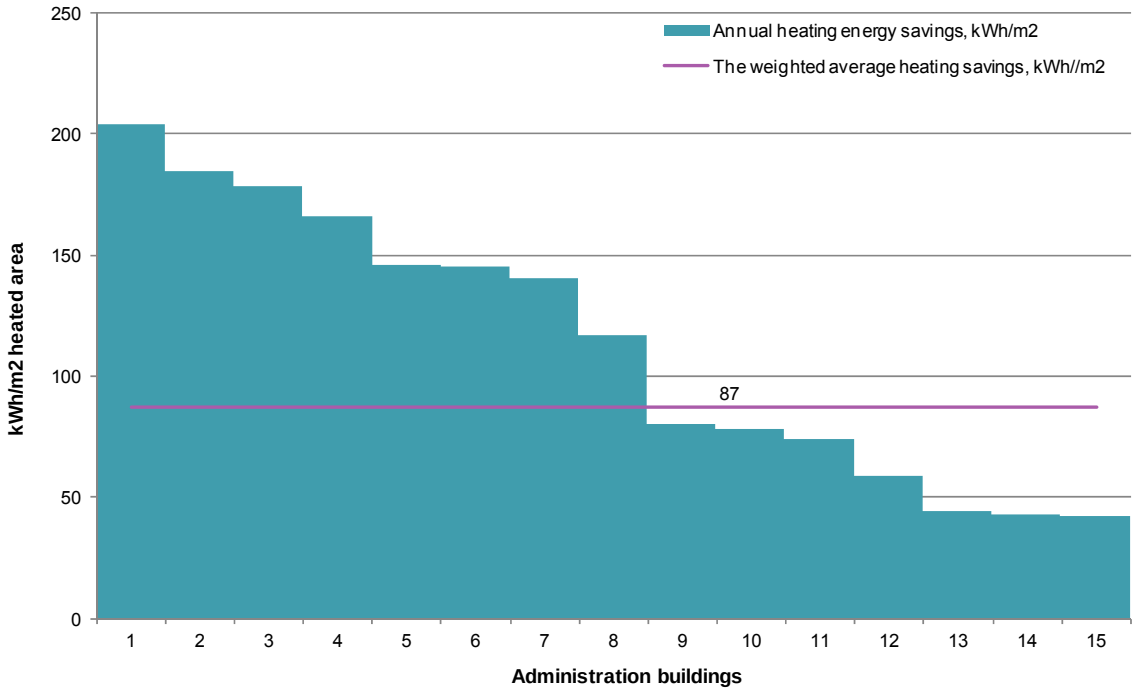



0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
LTL/kWh
Saved energy price, LTL/kWh
2013-2032 average heat price (including 21 % VAT), LTL/kWh
0.48
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Administration buildings

Annex 3: Public buildings data, annual savings

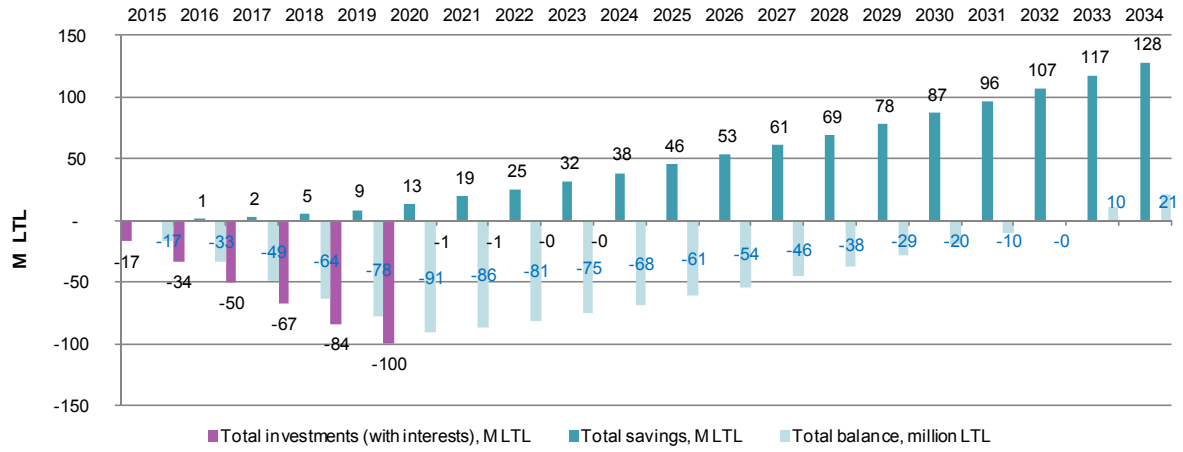



Annual heating energy savings, kWh/m2
The weighted average heating savings, kWh//m2
kWh/m2 heated area
105
Medical type buildings

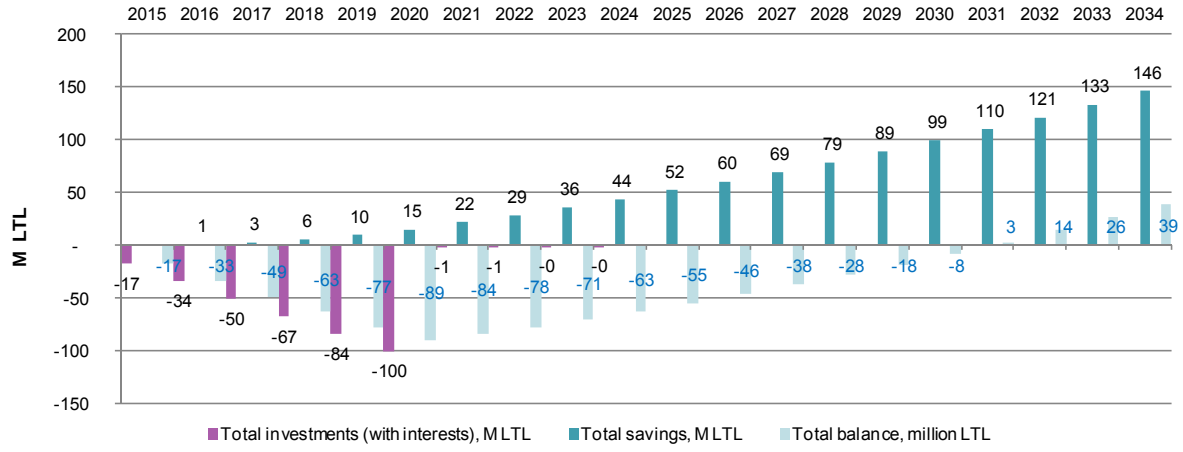

Annual heating energy savings, kWh/m2
The weighted average heating savings, kWh//m2
kWh/m2 heated area
87
Administration buildings

Annex 4: Scenario 'Volumes' graphs

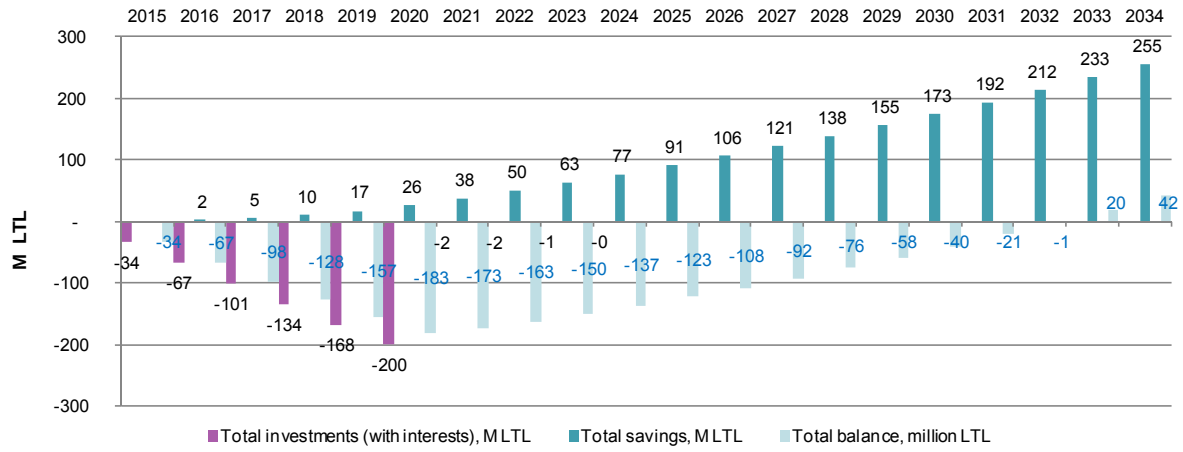
Scenario 'Volume 25' payback time at 'Base heat tariff'



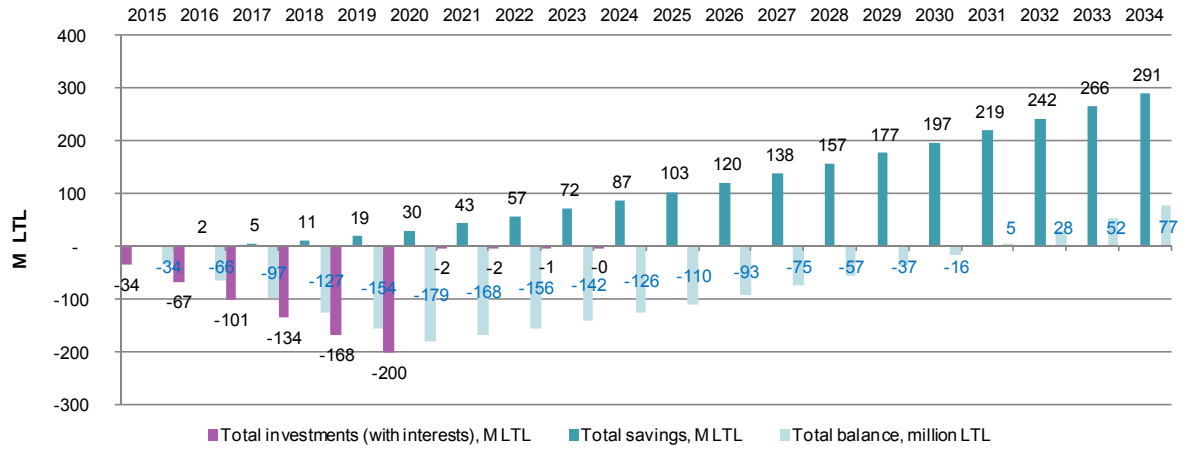
Scenario 'Volume 25' payback time at 'High heat tariff'



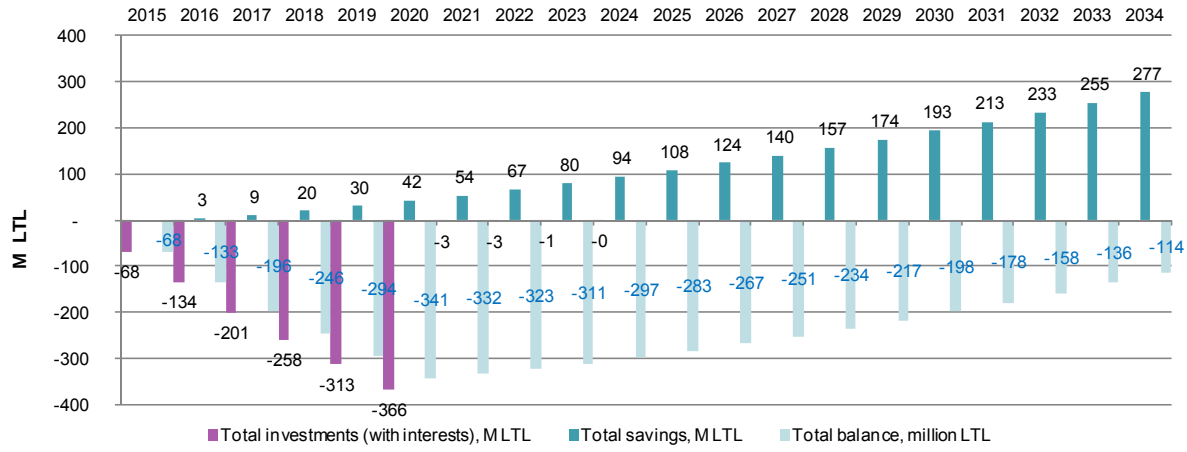
Scenario 'Volume 50' payback time at 'Base heat tariff'



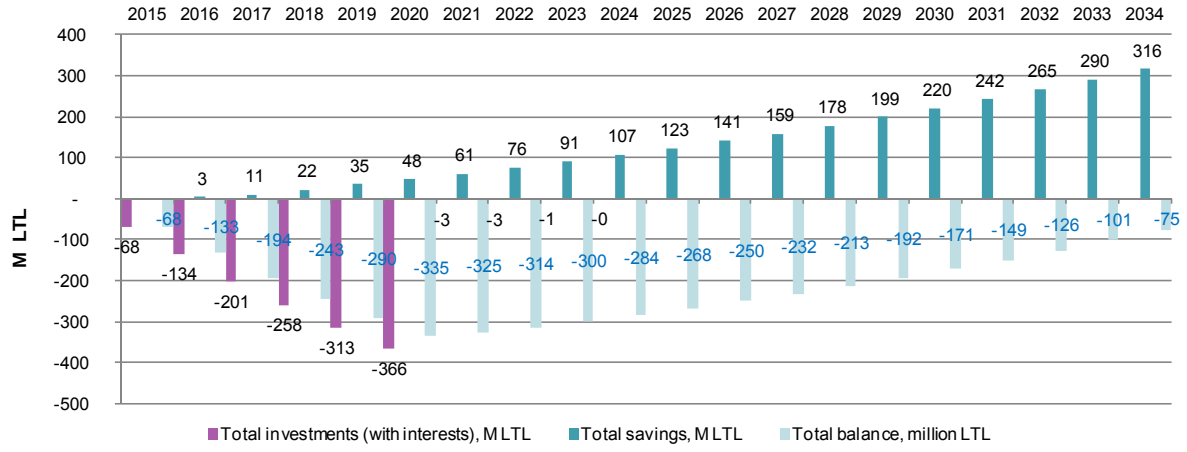
Scenario 'Volume 50' payback time at 'High heat tariff'



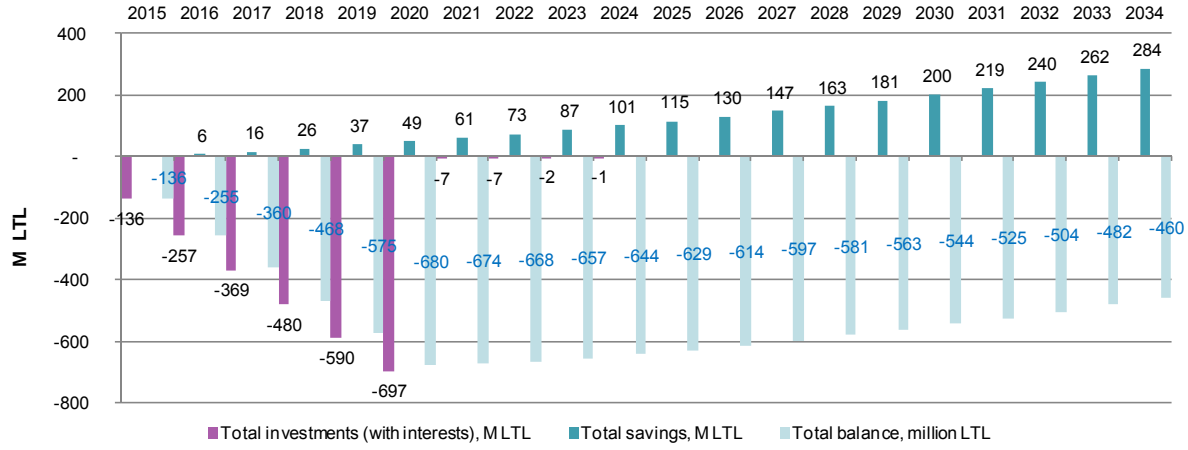
Scenario 'Volume 100' payback time at 'Base heat tariff'



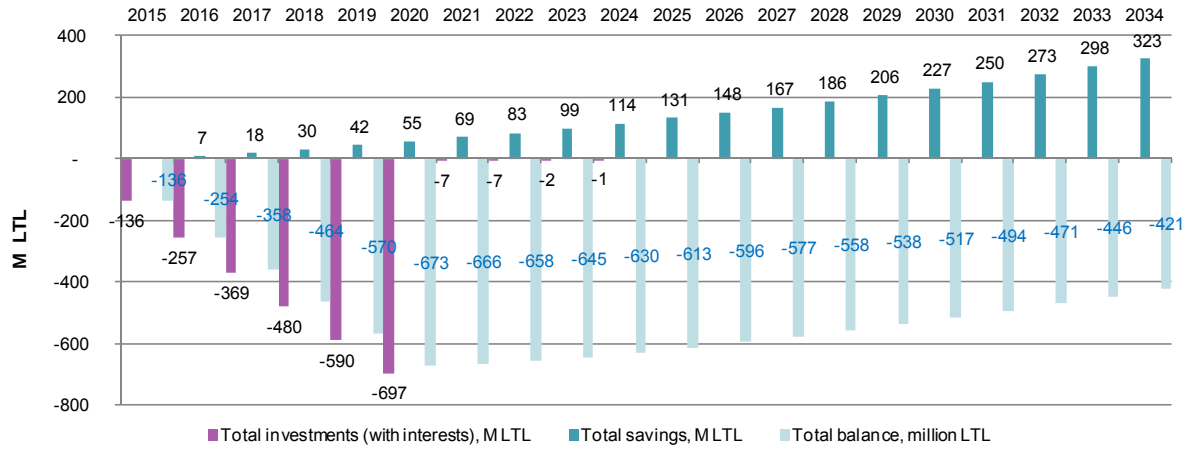
Scenario 'Volume 100' payback time at 'High heat tariff'



Scenario 'Volume 200' payback time at 'Base heat tariff'



Scenario 'Volume 200' payback time at 'High heat tariff'



Annex 5: Municipalities human resources

Municipality	Buildings owned by the State and municipalities, unit	Number of modernised public buildings, unit	1	1.2.	1.2.1.	1.2.2.	1.2.3.	1.2.4.	1.2.5.
			Department, responsible for energy efficiency and/or building modernisation projects	Number of department employees, broken down by educational direction	Humanitarian direction	Social direction	Physical sciences direction	Technology direction	Other
Akmenė district	82	3	There is no specific department. Some of the functions are carried out by the Local agricultural department, the Investment department and the Building Department.	2		1		1	
Alytus district	156	3	There is no specific department. Some of the functions are carried out by the Municipal economy department.	6	1			4	1
Druskininkai city	95	2	There is no specific department. Some of the functions are carried out by the Investment and asset management department, the Architecture and urbanization department and the Maintenance department.	24	1	5		18	
Jonava district	133	1	There is no specific department. Some of the functions are carried out by the Repair and construction department.	6	1		5		
Kaunas city	712	24	Yes, the Energy department.	2			2		
Kėdainiai district	134	1	There is no specific department. Some of the functions are carried out by the Construction department and the Municipal economy department.	4				4	
Klaipėda city	366	7	Yes, the Flats and energy subdivision.	13		12	1		
Lazdijai district	79	5	There is no specific department. Some of the functions are carried out by the Local agricultural department and the Economics department.	11				11	

Municipality	Buildings owned by the State and municipalities, unit	Number of modernised public buildings, unit	1	1.2.	1.2.1.	1.2.2.	1.2.3.	1.2.4.	1.2.5.
			Department, responsible for energy efficiency and/or building modernisation projects	Number of department employees, broken down by educational direction	Humanitarian direction	Social direction	Physical sciences direction	Technology direction	Other
Neringa city	34	1	There is no specific department. Some of the functions are carried out by the Urban management department and the Construction department.	4				4	
Pakruojis district	111		There is no specific department. Some of the functions are carried out by the Local agricultural department.	0					
Panevėžys district	128	4	There is no specific department. Some of the functions are carried out by the Local agricultural department.	7				7	
Radviliškis district	180	1	There is no specific department. Some of the functions are carried out by the Asset management department and the Local agricultural department.	6		5		1	
Raseiniai district	131	1	There is no specific department. Some of the functions are carried out by the Asset management department and the Local agricultural department.	1				1	
Rietavas city	25		There is no specific department. Some of the functions are carried out by the Asset management department and the Local agricultural department.	6				4	2
Skuodas district	69		There is no specific department. Some of the functions are carried out by the Local agricultural department.	0					
Šiauliai city	298	5	There is no specific department. Some of the functions are carried out by the Asset management department.	15	2			13	

Municipality	Buildings owned by the State and municipalities, unit	Number of modernised public buildings, unit	1	1.2.	1.2.1.	1.2.2.	1.2.3.	1.2.4.	1.2.5.
			Department, responsible for energy efficiency and/or building modernisation projects	Number of department employees, broken down by educational direction	Humanitarian direction	Social direction	Physical sciences direction	Technology direction	Other
Šilalė district	75	3	There is no specific department. Some of the functions are carried out by the Investment and construction department and the Local agricultural department.	8	1	2		5	
Trakai district	107		There is no specific department. Some of the functions are carried out by the Strategic planning and investment department and the Economic development department.	14		6		8	
Ukmergė district	151	5	There is no specific department. Some of the functions are carried out by the Strategic planning and investment department, the Territorial planning and construction department, the Agricultural and infrastructure department.	13		6		7	
Varėna district	128	2	There is no specific department. Some of the functions are carried out by the Strategic planning and investment department.	5		2	1	2	
Vilnius district	237	6	There is no specific department. Some of the functions are carried out by the Strategic planning and architecture department, the Investment department and the Maintenance department.	38	3	7	8	20	
Visaginas city	75	1	There is no specific department. Some of the functions are carried out by the Local agricultural department.	1				1	
Zarasai district	82		There is no specific department. Some of the functions are carried out by the Municipal economy department.	2		1		1	

Annex 6: Recent energy efficiency programmes

1. **Programme 2006–2008 for the reconstruction of general educational and vocational schools and for providing them with teaching aids (timeframe: 2006-2008, legal basis: resolution No 1230 of the government of 16 November 2005)**

Goals and outcomes

Goals:

To enhance the learning conditions for pupils by means of modernisation of school buildings and teaching aids and adaptation of the buildings for the introduction of informational and other technologies.

Target buildings: buildings of general educational and vocational schools.

Energy saving measures for programme implementation: replacement of windows and external doors, reconstruction of heating units (boiler-houses), heating, water, hot water and wastewater supply systems; thermal insulation of roofs and walls; modernisation and installation of electrical and ventilation systems.

Outcomes:

Prior to 2010 52 projects were implemented. The total area of reconstructed buildings is 286,696.19 m2.

Energy savings for 2010: 23 GWh

Financing structure

Programme funding sources:
a) Government budgetary fund;
b) Participating municipal budgetary funds.

In 2006–2007, funding for 52 schools was allocated from the funds of the State Budget and municipal budgets. In 2006–2007, each school received LTL 1,875,000 of State Budget funds and LTL 625,000 of municipal funds.

Model of implementation

1. Grant programme;
2. Participants (target buildings) selection was not related to actual final energy consumption.
3. Programme implementers – Ministry of Education and Science, administrations of municipalities and county
4. Governors;
5. Monitoring authority – Ministry of Education and Science.
6. Implementation procedure:

(i) Ministry of Education and Science, administrations of municipalities and county
Governors select programme participants (buildings of general educational and vocational schools);
(ii) Ministry of Education and Science approves the list of programme participants;
(iii) Beginning of the modernisation procedures (the programme does not indicate who is responsible for modernisation procedures: public procurements and etc.).

The programme does not indicate any targets which particular buildings should achieve in terms of energy savings.

2. **Programme for the modernisation of dormitories of schools of higher education (timeframe: 2006-2009, legal basis: resolution No 843 of the government of 1 September 2006)**

Goals and outcomes	*Financing structure*	*Model of implementation*
Goals: To modernise dormitory buildings, to ensure their compliance with the essential requirements for buildings, and to improve energy efficiency, student living conditions and the conditions of hygiene and use of premises. Target buildings: Residents of dormitories of schools of higher educational. Implementing measures: replacement of heating units; reconstruction of heating supply networks; roof repair and thermal insulation; window replacement; external door replacement; repair and thermal insulation of external walls; repair of existing heating systems, installation of new heating systems; repairs of hot, cold and circulation water systems and wastewater systems; repairs of electrical installation and light systems. *Outcomes:* In the course of programme implementation, reconstruction work was carried out at the dormitories of 78 Lithuanian schools of higher education. The total heated area of reconstructed buildings amounts to 286,568.86 m^2. Energy savings for 2010: 4 GWh.	Programme financial sources: a) State funds (LTL 40 M) b) Funds of schools of higher education (LTL 4 M). A total of LTL 44 M was allocated for Programme implementation.	1. Grant programme; 2. Programme implementers – schools of higher educational; 3. Programme administrator/coordinator – Ministry of Education and Science; 4. Implementation procedure: (i) Schools of higher education present the application with investment projects to the Ministry of Education and Science; (ii) Special committee (composed of representatives from the Ministry of Education and Science and higher educational schools) select projects which should be financed under the programme; (iii) Ministry of Education and Science signs financing agreements. Selection of participants (target buildings) is related to actual final energy consumption (energy savings is one of the selection criteria).

3. **Programme for the modernisation and reconstruction of scientific and educational institutions in 2007-2009 (timeframe: 2007-2009; legal**

basis: Order No ISAK-2456 of the Minister for Education and Science of 28 December 2006)

Goals and outcomes	*Financing structure*	*Model of implementation*
Goals: To modernise the buildings of science and higher educational institutions, to ensure their compliance with the essential requirements for buildings, to increase the energy efficiency of buildings, to enhance the quality of the process of science and higher education, and to improve the conditions of use and maintenance. The following measures are implemented to achieve the tasks set in the programme: replacement of windows; roof repair without thermal insulation; roof repair including thermal insulation; replacement of external walls and heating units; reconstruction of external heating supply networks; partial modernisation of heating systems; installation of new heating systems; repairs of hot, cold and circulation water supply systems and wastewater systems; installation of air supply and removal systems; replacement of external doors; repairs of electrical installation and light systems. Target buildings: buildings of science and higher educational institutions. *Outcomes:* The programme included 42 projects implemented before 2009. Reconstruction work was carried out on 67 buildings of scientific designation. The total heated area of the reconstructed buildings amounts to 334,762 m^2. Energy savings for 2010 – 1 GWh.	Programme financial sources: a) State funds (LTL 30 M) b) Funds of science and higher educational institutions. (LTL 6 M). The programme budget amounts to LTL 36 M,	1. Grant programme; 2. Programme implementers – science and higher educational Institutions; 3. Programme administrator/coordinator – Ministry of Education and Science; 4. The participants were selected following the list principle (approved by the Ministry of Education and Science). Selection criteria and financing proportions were not related to energy savings or actual final energy consumption.

4. **Programme for the upgrading of educational institutions (timeframe: 2009-2012, legal basis: Resolution No 1290 of the Government of 3 December 2008)**

Goals and outcomes	*Financing structure*	*Model of implementation*

Goals:

The programme's objective is to upgrade educational institutions in order to enable a reduction of energy consumption in buildings and to improve the teaching environment and educational quality. The programme's tasks are to modernise the buildings of educational institutions in order to reduce energy consumption; to ensure health and safety conditions for learning and education; to provide some of the general educational and vocational schools being upgraded with up-to-date teaching aids, to enable teachers to work with new teaching aids, and to prepare technical projects for building upgrading.

The following measures are implemented to achieve the tasks set in the programme: Replacement of windows and external doors, modernisation of heating units and boiler-houses, upgrading of heating and hot water supply systems, thermal insulation of building roofs and walls, installation of a ventilation system, modernisation of electrical fire prevention and security systems; development of technical projects for building upgrading.

Target buildings: buildings of educational institutions.

Outcomes:

Prior to the end of 2010 14 building upgrading projects were implemented and 148 buildings of educational institutions are undergoing modernisation.

The upgrading of buildings is expected to result in energy savings of 20%.

Programme implementing measures are funded from:
(i) The general appropriations for the Ministry of Education and Science in the State Budget;
(ii) the State Investment Programme;
(iii) European Union and co-financing resources;
(iv) Resources of the Privatisation Fund;
(v) Municipal budget funds.

Funds requirement for Programme implementation totals LTL 508.2 M, including LTL 490.7 M for building upgrades.

1. Grant programme;
2. Programme administrators/coordinators – Ministry of the Economy,
1. Ministry of Education and Science, municipality administrations, educational institutions.
2. Programme implementers – municipality administrations, educational institutions
3. The participants were selected following the list principle (approved by the Ministry of Education and Science). Selection criteria were related to energy savings or actual final energy consumption.
4. Implementation procedure:

(i) Municipality administrations propose the list of educational institutions which should be modernised under the programme;
(ii) Ministry of Education and Science evaluate the proposed educational institutions;
(iii) Ministry of Education and Science approves the list of programme participants;
(iv) Beginning of the modernisation procedures (responsible parties: educational institutions and municipality administrations).

Expected energy savings for 2016: 13 GWh.

5. **Special programme for the Implementation of energy saving projects (timeframe: 2004-2008, legal basis: Order No 4-143 of the Minister for Economy of 27 April 2006)**

Goals and outcomes

Goals:

To promote energy efficiency.

Target buildings: schools, preschools, nurseries and hospitals

Outcomes:

Overall, 22 projects were implemented. Schools, preschools, nurseries and hospitals were modernised. The total area of modernised premises amounts to 63,365.3 m^2.

Financing structure

Programme implementing measures are funded from:
(i) Special fund (AB Lietuvos Dujos).

LTL 15 M was allocated for programme implementation.

Model of implementation

1. Grant programme;
2. Programme administrator/coordinator – Ministry of Economy;
3. Programme implementers – companies which applied for the grant (following the procedure set by the Ministry of Economy).
4. Selection of participants was not related to actual final energy consumption;

Energy savings for 2010: 6 GWh

6. **Programme for library modernisation and upgrading in 2003-2013 (timeframe: 2003-2013, legal basis: Resolution No 1454 of the Government of 17 September 2002)**

Goals and outcomes

Goals:

One of the tasks is to improve library activities by modernising library buildings.

Energy saving measures for programme implementation: replacement of windows and external doors, modernisation of heating units and boiler-houses, upgrading of heating and hot water systems, thermal insulation of building roofs and walls, installation of ventilation systems, modernisation and installation of electricity, fire prevention and security systems.

Target buildings: library buildings.

Financing structure

Programme implementing measures are funded from:
(i) the State Budget;
(ii) Municipal budget funds;

LTL 188.7 M has been allocated for building reconstruction and repairs.

Model of implementation

1. Grant programme;
2. The participants were selected following the list principle. Selection of participants (target buildings) was not related to actual final energy consumption;
3. Programme implementer – Ministry of Culture;
4. Monitoring authority – Ministry of Culture.

Outcomes:

Overall, 28 library modernisation projects were implemented

7. **Programme for the construction, reconstruction and repair of municipal buildings of educational, cultural, health care, social and other designations and for the provision of material resources to such buildings for 2003–2008 (timeframe: 2003 – unspecified, legal basis: Resolution No 425 of the Government of 8 April 2003; Resolution No 449 of 19 April 2004; Resolution No 595 of 30 May 2005; Resolution No 481 of 29 May 2006; Resolution No 720 of 11 July 2007; Resolution No 694 of 9 July 2008)**

Goals and outcomes

Goals:

To promote energy efficiency by providing financial assistance (up to 100%) for the implementation of energy efficiency improvement projects.

Target: municipal buildings of educational, cultural, health care, social and administrative designations, street lighting networks, heating sector systems.

Programme funds were used for the repairs and reconstruction of preschools, nurseries, schools, health care institutions, institutions providing social services, cultural institutions and sports institutions, reconstruction and repairs of municipal and sub-district administrative buildings, reconstruction of street lighting networks, and maintenance of heating, gas supply and water management systems.

Outcomes:

Overall 105 projects were included in the programme for 2008; 94 projects included in the programme for 2007; 87 projects included in the programme for 2006; 82 projects included in the programme for 2005; 85 projects included in the

Financing structure

Programme implementing measures are funded from:
(i) Privatisation Fund (one of the State Budget funds);
(ii) Municipal budget funds.

LTL 66.5M L has been allocated from the privatisation fund.

Model of implementation

1. Grant programme;
2. The participants were selected following the list principle. Participants (target buildings) selection was not related to actual final energy consumption.
3. Participants were selected by the municipalities and approved by the government.
4. Programme implementers – municipalities;
5. Programme coordinator – Ministry of the Interior;
6. Programme does not indicate any targets which particular buildings should achieve in terms of energy savings.

programme for 2004; 82 projects included in the programme for 2003.

Planned energy savings for 2016: 5 GWh.

8. **Programme for the modernisation of prisons and humanisation of imprisonment conditions for 2004-2009 (timeframe: 2004-2009, legal basis: Resolution No 619 of the Government of 24 May 2004)**

Goals and outcomes	*Financing structure*	*Model of implementation*
Goals: To reconstruct prisons by 2010 in order to bring them into compliance with Lithuanian hygiene standards and the requirements laid down in the European Prison Rules, to improve the living environment and health care for prisoners, to move the prison hospital and to provide penal institutions with long-term assets. Target buildings: prison buildings. Programme funds are used for reconstruction of prison heating, water and wastewater removal systems in order to reduce their operating costs and enhance the living environment and health care for prisoners. 16 objects have been included in the list of reconstructed facilities. *Outcomes:*	Programme implementing measures are funded from: (i) the State Budget; (ii) Municipal budget funds. A total of LTL 81 M has been allocated for the implementation of this programme.	1. Grant programme; 2. The participants were selected following the list principle. Participants (target buildings) selection was not related to actual final energy consumption. 3. Programme implementers – prisons; 4. Programme coordinator – Prison Department under the Ministry of Justice of the Republic of Lithuania. 5. Programme does not indicate any targets which particular buildings should achieve in terms of energy savings.

Planned energy savings for 2016: 5 GWh.

9. **EU Structural Funds 2007–2013 (Programme for Cohesion Promotion) (timeframe: 2007-2015, legal basis: Order No 4-298 of the Minister of Economy of 14 July 2008 amending Order No 4-265 of the Minister of Economy on the approval of the forms for the special part (B) of project funding under the measures 'National-level modernisation of public buildings', 'Regional-level modernisation of public buildings' and 'Public building modernisation projects meeting the benefit and quality assessment criteria for measure 1.2 'Ensuring energy supply, stability and availability and higher energy efficiency' under the Lithuanian Single Programming Document 2004–2006)**

Goals and outcomes	*Financing structure*	*Model of implementation*
Goals: To reduce energy consumption in public buildings.	Programme implementing measures are funded from: (i) the State Budget (LTL 139.6 M);	1. Grant programme; *Measure 'Regional-level modernisation of public buildings':*

Target buildings: public buildings.

Programme funds are used for repair and/or modernisation of the external envelopes of public buildings, and upgrading and/or reconstruction of building energy systems by improving their technical characteristics.

Outcomes:

Energy savings for 2010: 16 GWh;
Planned energy savings for 2016: 100GWh

(ii) EU funds (LTL 930.9 M).

(i) Participants – municipalities and their established legal entities;
(ii) Programme coordinator/administrator - public body Lithuanian Business Support Agency;
(iii). Involved parties – regional development councils.
(iv) Project implementation procedures:
(a) Municipalities propose projects for regional development councils;
(b) Regional development councils approve the lists of projects which should be implemented in the county;
(c) Public body Lithuanian Business Support Agency sends an invitation to persons indicated in the lists approved by Regional development councils;
(d) Participants send applications to the Lithuanian Business Support Agency.
(e) Lithuanian Business Support Agency approves the project financing;
(f) Participants implement projects.

Measure 'National-level modernisation of public buildings'
(i). Participants – public buildings indicated in the list approved by the Ministry of Economy;
(ii) Programme coordinator/administrator - public body Lithuanian Business Support Agency;
(iii) Projects' implementation procedure:
(a) Ministry of Economy approves the lists of projects which may be implemented under the programme;
(b) Public body Lithuanian Business Support Agency sends an invitation to persons indicated in the lists approved by Regional development councils;
(c) Participants send applications to the Lithuanian Business Support Agency.
(d) Lithuanian Business Support Agency approves the project financing;
(e) Participants implement the projects.

Measure 'Public building modernisation projects meeting the benefit and quality assessment criteria for measure 1.2 'Ensuring energy supply, stability and availability and higher energy efficiency'

(i) Participants: legal entities established by the state or municipalities;
(ii) Programme coordinator/administrator - Lithuanian Business Support Agency;
(iii) Project implementation procedures:
(a) Ministry of Economy approves the lists of projects which may be implemented under the programme;
(b) Lithuanian Business Support Agency sends an invitation to persons indicated in the lists approved by Regional development councils;
(c) Participants send applications to the Lithuanian Business Support Agency.
(d) Lithuanian Business Support Agency approves the projects financing;
(e) Participants implement projects.

Annex 7: Existing energy efficiency programmes

1. **Energy efficiency improvement in the public buildings of the municipalities in the Ignalina Nuclear Power Plant region (timeframe: 2009-unspecified)**

Goals and outcomes	*Financing structure*	*Model of implementation*
Goals: To reduce energy consumption in public buildings. Target buildings: the buildings of schools, hospitals, support and art centres in Visaginas, Ignalina and Zarasai municipalities. Implementing measures: repair and/or reconstruction of the external partitions of public buildings, upgrading and/or of building energy systems and improvement of their energy characteristics. *Outcomes:* Energy savings for 2010: 3 GWh Expected energy savings for 2016: 19 GWh.	Programme financial sources: (i) Ignalina Nuclear Power Plant Decommissioning Fund (financed by EU); (ii) State budget; (iii) Visaginas, Ignalina, Zarasai municipalities' budgets. Financial assistance for the implementation of energy efficiency improvement projects may be up to 100%. Municipalities should cover projects' expenditures which are not related to energy efficiency measures. Municipalities may cover expenditures using commercial banks loans.	1. Grant programme; 2. Programme coordinator/administrator - Central Project Management Agency 3. Programme implementers - Visaginas, Ignalina and Zarasai municipalities. 4. Implementation procedure: (i) European Commission approves the list of projects which may be financed by INPP decommissioning fund (in accordance with Central Project Management Agency application based on information received from municipalities); (ii) Central Project Management Agency informs the Municipalities about the possibilities to apply for project financing; (iii) Municipalities confirm the lists of projects and apply for financing; (iv) Municipalities sign agreements with Central Project Management Agency regarding the financing of the implementation of the energy efficiency projects. (v) Municipalities implement the projects.

2. **Programme for the modernisation of dormitories of schools of higher educational and professional training institutions (timeframe: 2012-2015, legal basis: Order No V-2551/D1-1038 of the Minister for Education and Science and the Minister of Environment of 29 December 2011).**

Goals and outcomes	*Financing structure*	*Model of implementation*
Goals: To modernise dormitory buildings (constructed before 1993), to ensure their compliance with the essential requirements for buildings, and to improve energy efficiency, student living conditions.	Programme financial sources: (i) JESSICA fund; (ii) European investment bank (hereinafter – EIB) loan; (iii) State Budget (iv) Funds of the schools of higher	1. Loan/grant programme model 2. Programme implementers – schools of higher educational and professional training institutions; 3. Financing agencies – Central Project Management Agency and private company Public Investment Development Agency (JESSICA fund), Ministry of

Target buildings: Residents of dormitories of schools of higher educational and professional training institutions (33 residents of dormitories of schools of higher educational and 2 residences of professional training institutions).

Implementing measures: replacement of heating units; reconstruction of heating supply networks; roof repair and thermal insulation; window replacement; external door replacement; repair and thermal insulation of external walls; repair of existing heating systems, installation of new heating systems; repairs of hot, cold and circulation water systems and wastewater systems; repairs of electrical installation and light systems, other measures indicated in the programme.

Outcomes:

The programme is under implementation.

educational and professional training institutions.

Education and Science (the State Budget).

4. Implementation procedure:

(i) Schools of higher educational and professional training institutions present the applications for the loan to the Public Investment Development Agency;
(ii) Public Investment Development Agency evaluates projects and decides to provide funding (JESSICA loan). Terms and conditions of the loan: (a) Interest rate does not exceed 3%; (b) Loan terms – up to 20 years; (c) Loan may be provided for the implementation of the measures indicated in the programme list.
(iii) Schools of higher educational and professional training institutions implement the projects;
(iv) According to the achieved results (energy savings, project financing structure and etc.) after the implementation of the projects, projects implementers may apply for additional financing: (a) The grants from the Ministry of Education and Science (b) Additional subsidies.

3. **Programme for the upgrading of educational institutions (timeframe: 2013-2016, legal basis: Order No V-410 of the Minister for Educational and Science of 10 May 2013)**

Goals and outcomes

Goals:

To upgrade educational institutions in order to achieve a reduction in the energy consumption of buildings and to improve the teaching environment and educational quality.

Target buildings: buildings of educational institutions (at least 120 buildings, the projects implemented under the programme are expected to produce heating savings of 20%.

Outcomes:

Financing structure

Programme implementing measures are funded from:
(i) State Budget and State Investment Programme funds allocated to the Ministry of Education and Science;
(ii) Municipal budget funds;
(iii) EU funds;
(iv) Other funds.

Municipalities should cover at least 20% of project implementation expenditures. Municipalities may cover expenditures using

Model of implementation

1. Grant programme;
2. Programme administrators/coordinators - Ministry of Educational and Science, municipality administrations, educational institutions;
3. Programme implementers – municipality administrations, educational institutions;
4. Implementation procedure:

(i) Ministry of Education and Science informs Municipalities about the allocated State funds for the implementation of the programme and invites municipalities to present the list of projects to be part of the programme;
(ii) Municipalities prepare the lists of projects and present the applications to the Ministry of Education and

The programme is under implementation.	commercial banks loans.	Science; (iii) Ministry of Education and Science evaluates the projects and confirms the list of projects financed by the programme. (iv) According to the confirmed list of projects, Ministry of Education and Science signs a financing agreements with Municipalities; (v) Municipalities implement the projects.

4. **Museum upgrading programme 2007–2015 (timeframe: 2007-2015, legal basis: Resolution No 275 of the Government of 14 March 2007)**

Goals and outcomes	*Financing structure*	*Model of implementation*
Goals: To enable museums to collect, store, restore, exhibit and protect cultural heritage. Target buildings: museum buildings. Energy saving measures for programme implementation: replacement of windows and external doors, modernisation of heating units and boiler-houses, upgrading of heating and hot water systems, thermal insulation of building roofs and walls, installation of ventilation systems, modernisation and installation of electricity, fire prevention and security systems. *Outcomes:* Buildings with a total area of 3,500 m^2 should be reconstructed by 2016. Judging from the data on analogous reconstructed buildings, implementation of similar measures in buildings is expected to result in average heating savings of 50 kWh/m^2. Planned energy savings for 2016: 1 GWh.	Programme implementing measures are funded from: (i) State Budget; (ii) State investment programme; (iii) EU financial assistance; (iv) Municipal budget funds.	1. Grant programme; 2. The participants are selected following the list principle. 3. Programme implementer – Ministry of Cultural, Ministry of Environment, Ministry of National Defence, and Department of Cultural Heritage under the Ministry of Cultural, municipalities, the museums. 4. Programme does not indicate any targets which particular buildings should achieve in terms of energy savings.

5. **Programme for the upgrading of community centres 2007–2020 (timeframe: 2007-2020, legal basis: Resolution No 785 of the Government of 4 August 2006)**

Goals and outcomes	*Financing structure*	*Model of implementation*

Goals:

To create the necessary conditions for the cultural activities of municipal community centres; to improve the working conditions of the staff of municipal community centres; to reduce the operating costs of the buildings of municipal community centres.

Target buildings: buildings of municipal community centres.

Energy saving measures for programme implementation: reconstruction and major repairs of buildings by replacing windows and external doors, thermally insulating building partitions and modernising and modernising the engineering systems of buildings.

Outcomes:

Buildings with a total area of 14,161 were reconstructed prior to 2010. Reconstruction of buildings with a total area of 96,000 m^2 should be completed by 2016. Based on the presented data on reconstructed buildings, it was found that similar measures implemented in buildings save 59 kWh/m^2 of energy on average.

Energy savings for 2010: 1 GWh.
Planned energy savings for 2016: 6 GWh.

Programme implementing measures are funded from:
(i) State Budget;
(ii) EU financial assistance;
(iii) Municipal budget funds.

Priority is given to projects which are part-financed by the municipalities.

1. Grant programme;
2. The participants were selected following the list principle. Selection of participants (target buildings) was not related to actual final energy consumption;
3. Programme implementer – Ministry of Culture, municipalities.
4. Programme does not indicate any targets which particular buildings should achieve in terms of energy savings.

6. **Special programme for climate change (timeframe: 2010-unspecified, legal basis: Law on the Financial Instruments for Climate Change Management)**

Goals and outcomes	*Financing structure*	*Model of implementation*
Goals: Relevant activities supported under the measure: (i) modernisation/upgrading of public buildings by	Programme implementing measures are funded from: (i) State Budget (special financial programme);	1. Grant programme; 2. Programme administrator – Budgetary institution Lithuanian Environmental Investment Fund; 3. Programme coordinator – Ministry of the Environment

reducing energy consumption; (ii) modernisation/upgrading of public buildings to achieve a low or passive consumption of energy; (iii) the use of renewable energy sources (sun, wind, geothermal energy, bio-fuel etc.) in public buildings.

Target group: renewable energy; buildings.

The following energy efficiency improvement and modernisation /upgrading measures are financed under the programme: (i) major repair or reconstruction of heating and cold and hot water supply systems; (ii) replacement of windows and external doors; (iii) thermal insulation of roofs, including the construction of a new sloping roof (excluding the construction of attics); (iv) glassing of balconies under a single design; (v) thermal insulation of external walls; (vi) thermal insulation of cellar ceilings; (vii) thermal insulation of wall bases; (viii) installation of equipment for renewable energy sources (sun, wind etc.); (ix) major repair and replacement of elevators; (x) replacement or reorganisation of building services (wastewater, electrical installation, fire prevention, drinking water pipelines and installations); (xi) upgrading of public area lighting.

Outcomes:

Expected energy saving for 2016: 145 GWh.

(ii) Municipality Budgets;
(iii) Public buildings owners' resources.

Financial intensity: modernisation /upgrading of public buildings – up to 100% of the project value.

of the Republic of Lithuania
3. Programme implementers – owners of public buildings.
4. Implementation procedure:
(i) The Ministry of the Environment approves the estimate of the funds annually;
(ii) the Ministry of the Environment approves funding guidelines annually:
(ii) In accordance with funding guidelines, the Lithuanian Environmental Investment Fund publishes an invitation for applications for projects to be financed ;
(iii) Owners of public buildings submit an application to the Lithuanian Environmental Investment Fund for financing .
(iv) Lithuanian Environmental Investment Fund evaluates the projects and approves the list of approved projects;
(v) Lithuanian Environmental Investment Fund signs the financing agreements with project implementers;
(vi) Implementation of the projects.

Annex 8: Case study: Vilnius city street lighting modernisation

Vilnius city street lighting modernisation public procurement is an example of a private partnership project in Lithuania. This public procurement was announced in September 2012 both in Lithuania and internationally.

The project involves modernisation and maintenance of approximately 40,000 street lights with a depreciation level of 90%. The preliminary term of the contract is 19 years. During this period the public sector will be obligated to pay a specified sum of money, which covers all the costs and provides sufficient return on investment for the private sector. Amount to be paid should be indicated in the contract.

Minimum requirements for the private sector are split into 3 categories: general, financial and technical requirements.

General requirements state that a company must not be bankrupt, under liquidation, or have entered into a solvency agreement with creditors, have suspended or limited its activities.

There are four financial requirements stated in the terms and conditions. First, average annual turnover received from the street lighting services within the last 3 financial years shall be not less than LTL 10 M. Second, a candidate's net profit within the last 3 financial years shall be positive. Third, liquidity ratio within the last financial year shall be not less than 0,5 (if current liabilities were 0, then the third requirement is satisfied as well). Fourth, the applicant shall be financially capable of financing the project.

The third group of requirements is related to technical and professional capabilities. First, a candidate must have experience in implementing at least one maintenance project of at least 20,000 street lights for at least 5 years. Second, modernisation of at least 20,000 streets lights has to have been completed in a previous project. Third, the street lights offered for the project have to be certified by an independent laboratory and comply with IES LM-79 and IES LM-80 requirements. Fourth, the candidate has to be certified and have the right to create project design and provide electricity networks maintenance. Fifth, at least one manager must have not less than 3 years experience in managing a similar street lighting maintenance project. Sixth, the candidate must assure that qualified and experienced specialists (with at least 3-years experience in street lighting modernisation and maintenance) will implement the project. Seventh, the candidate must have an integrated quality management system (LST EN ISO 9001, LST EN ISO 9002, LST EN ISO 9003 or alternative). Last, the candidate must have sufficient technical capabilities and resources for implementation of the project.

Competitive dialogue was the method selected for the procurement. It was indicated that from three to five of the most qualified applicants would be invited to the competitive dialogue. Table 1 indicates candidates who were invited to the competitive dialogue.

Table 1: Candidates invited to the competitive dialogue

Name		Country
Eltodo EG, a.s		Czech Republic
Group of entities	Citelum S.A	France
	Citelum Iberica S.A	France
	Philips Lighting Poland S.A.	Poland
Group of entities	Strabag AG	Austria
	Strabag Anlagentechnik GmbH	Austria
Group of entities	Gemmo S.p.A	Italy
	VSLS OÜ	Italy
KH Energia-Konsult AS		Estonia

Source: CVP IS

No Lithuanian companies managed to reach the competitive dialogue stage.

Out of the 5 companies mentioned above, the winner will be selected by using the economic utility formula instead of the lowest price criteria. Components of the formula with indicated weights are outlined in Table 2 below.

Table 2: Vilnius street lighting modernisation economic utility formula

Criteria	Maximum grade	Weight in economic utility formula
Price (P)	P_{max} – 100	X=40
Energy savings (T)	T_{max} – 100	Y=40
Duration of guarantees (G)	G_{max} – 100	Z=20

Source: Vilnius municipality, 2012

Formula components are the following:

- Price (P) – fixed payment for the first year after the modernisation is completed (inflation in not considered).

- Energy savings (T) – difference between the average annual electricity consumption (19 M kWh) and the candidate's calculated electricity consumption in the first 12 months after the modernisation is completed. Energy savings must be based on technological and financial calculations.

- Duration of guarantees (G) – number of years the winner of a tender will guarantee the proper functioning of street lights.

Proposal's economic utility grade (S) is calculated by adding Price (P), Energy savings (T) and duration of guarantees (G):

$$S=P+T+G$$

a) Grade for price (P) is calculated by dividing lowest offered Price (P_{min}) from the candidate's Price (P_p) and multiplying by weight (X):

$$P = \frac{P_{\min}}{P_p} \cdot X$$

b) Grade for Energy savings (T) is calculated by dividing a candidate's offered Energy savings (T_t) from the largest offered energy savings(T_{max}) and multiplying by weight (Y):

$$T = \frac{T_t}{T_{\max}} \cdot Y$$

c) Grade for duration of guarantee (G) is calculated by dividing a candidate's offered Duration of guarantee (G_g) from the largest offered Duration of guarantee (G_{max}) and multiplying by weight (Z):

$$G = \frac{G_g}{G_{\max}} \cdot Z$$

The candidate who gets the highest economic utility grade (S) will become the winner of the tender.

Even though it is over one and a half years since the tender was announced, no winner of the project has yet been announced. This proves that for the time being the public private partnership process in Lithuania is long and complicated.

Annex 9: List of companies which participated in public and residential buildings modernisation

AB	Sidona	UAB	Prie lėvens	UAB	Žeista
UAB	Konsolė	UAB	Sweco Lietuva	UAB	Meleksas
UAB	Ekvada	UAB	Duventa	UAB	Evikonas
UAB	Virdaleka	UAB	Grontmij Lietuva	UAB	Ignalinos statyba
UAB	Statmax	UAB	SDG	UAB	Gensera
UAB	Darstamas	UAB	Statech	UAB	Adakris
UAB	Stafas	UAB	Optimum Projektai	UAB	Rotonda
UAB	Kaunesta	UAB	Altrys	UAB	Ekodora
UAB	Reforsas	UAB	Saugvila	UAB	Saverda
UAB	Inovus	MB	Forintas	UAB	Dalis erdvės
UAB	Vidista	UAB	Plungės lagūna	UAB	Bioprojektas
UAB	Altitudė	UAB	SMD	UAB	Dailista
UAB	Dauniškis ir KO	UAB	Mato ranga	UAB	EiTiNiT
UAB	Anrestas	UAB	Rekosta	UAB	Jaraks
UAB	Alža	UAB	Sauslaukio statyba	UAB	Dauda
UAB	Minduvos statyba	UAB	Gora	UAB	Ranga
UAB	Lakaja	UAB	Meliovesta	UAB	Izobara
UAB	Drūtnamis	UAB	Tomosta	UAB	Eiresta
UAB	Dangesta	UAB	CCM Baltic	UAB	Hidrostatyba
UAB	PA Group	UAB	Kriautė	UAB	Dzūkijos statyba
UAB	Vikjona	UAB	Struktūra	UAB	Projektų centras
UAB	KRK Baltic	UAB	Elti	UAB	Restructus
UAB	Sviremsta	UAB	Jumaida	UAB	Mažeikių Varduva
UAB	Vilungė	UAB	Varėnos statyba	UAB	Sanda
UAB	Vidara	UAB	NG projektai	UAB	Alfva
UAB	Raseinių statyba	UAB	DG ir Ko	UAB	Mobusta
UAB	Alvarsas	UAB	Social Solutions	UAB	Granitas
UAB	Didma	UAB	Statybų laikas	UAB	Žibai
UAB	Vilkasta	UAB	Baltic status	UAB	Merko statyba
UAB	Mačiūnai	UAB	Absta	UAB	Ukmergės statyba
UAB	Kegisa	UAB	Verslo bitė	UAB	Mūras

UAB	Daistatus	UAB	Atesta	UAB	Salvus Baltija
UAB	Avona	UAB	Rūdupis	UAB	Edmuna
UAB	Alvista	UAB	Džiugo statyba	UAB	TM Capital
UAB	Statybos ritmas	UAB	Eigesa	UAB	VT statyba
AB	Virgula	UAB	Irdaiva	UAB	Gersta
UAB	Skirnuva	UAB	Kaminta	UAB	Alkor
UAB	Ortitas	UAB	Vėsa ir partneriai	UAB	Agentus
UAB	Eikos statyba	UAB	Getstata	UAB	Kortas
UAB	Statva	UAB	Klaista	UAB	Konstra
UAB	Vėtrūna	UAB	Deglas	UAB	NORD Via
UAB	A.Žilinskio ir ko	UAB	Statybų vizija	UAB	Garantas
UAB	Promostas	UAB	Kuršasta	UAB	Stapora
UAB	Restauracija	UAB	Tilta	UAB	Magirnis
UAB	Henvida	UAB	Versina	UAB	Hausera
UAB	Docilis	UAB	Fima	UAB	Šilo statyba
UAB	Telšių statyba	UAB	Intega	UAB	Viremida
UAB	LitCon	UAB	KLP statyba	UAB	Algraižė
UAB	Ligaja	UAB	Šalčininkų statyba	UAB	Pamario statyba
UAB	Paulista	UAB	Molesta	UAB	Mitnija
AB	Pakruojo arka	UAB	Įrengimas	UAB	Tavastis
UAB	Santechniniai darbai	UAB	Eco inžinerija	UAB	Viksenis
AB	YIT Kausta	UAB	Jonavos ranga	UAB	Lyderio grupė
UAB	G & J GROUP	UAB	Santeka	UAB	Rainių statyba
UAB	Aukštaitijos ranga	UAB	Baltresta	UAB	SKF Arkada
UAB	Pietų Megrame	AB	VITI	UAB	Axis Industries
UAB	Monrema	UAB	Autairas	UAB	Orlista
UAB	Rusakalnis	UAB	Apastata	UAB	Medingė
UAB	Costum	UAB	Sumeda	UAB	Gedsta
UAB	Statybų skliautas	UAB	Kvėdarsta	UAB	Polistatyba
UAB	R2K grupė	UAB	Elsis TS	UAB	Lankstinys
UAB	Ogmios pulsas pro	UAB	Panevėžio miestprojektas	AB	Panevėžio statybos trestas
UAB	Visagino tiekimas ir statyba				

Annex 10: List of companies which participated in street lighting modernisation tenders

Eltodo EG, a.s	G. Zubricko firma
Citelum S.A	UAB Elbra
Citelum Iberica S.A	UAB Elpreka
Philips Lighting Poland S.A.	UAB Indastrus
Strabag AG	UAB Axis Power
Strabag Anlagentechnik GmbH	UAB Elektros tinklo paslaugos
Gemmo S.p.A	UAB Informatikos ir ryšių technologijų centras
VSLS OÜ	UAB Meleksas
KH Energia-Konsult AS	AB Panevėžio keliai
UAB Dažnis	UAB Etis
UAB Projektų rengimo biuras	UAB Atea
UAB G.Kleiza ir ko	UAB Transeco group
UAB Eltecha	UAB Elsis TS
UAB Fotonas	UAB Biržų komunalinis ūkis
UAB Projektija	UAB Automatikos sistemos
UAB Kelvista	UAB Kauno gatvių apšvietimas
UAB Sweco Hidroprojektas	UAB A. Žilinskio ir ko
UAB Kelprojektas	UAB Tauro ženklas
UAB Patvanka	Rolando Naciaus individuali įmonė
MB Kaida	

Annex 11: Value chain of ESCO services

Based on KPMG previously conducted studies (e.g. Feasibility study for energy efficiency projects in the modernisation of multi-flat apartments) and other publicly available studies (e.g. A snapshot of the European energy service market in 2010 and policy recommendations to foster a further market development[25]) a value chain of ESCO service was developed. This represents the main functions and responsibilities of ESCOs.

Value chain:

1. **Energy supply** – production and/or transportation of energy: heating, electricity, gas, water;

2. **Technical project design** – architectural and engineering activities for energy efficiency improvement in buildings and street lighting;

3. **Construction and/or modernisation** – construction and/or modernisation services which lead to energy efficiency improvements in buildings and street lighting;

4. **Maintenance** – maintenance of proper functioning of buildings and street lighting, technical services to heating and electricity equipment, assurance for implementation of energy saving plan;

5. **Administration and client service** – collection of payments and credit, contract management, information provision;

6. **Project financing** – financing capabilities with a firm's capital and/or ability to raise sufficient amount of capital by borrowing money;

7. **Energy efficiency audit** – audit of the energy efficiency in the building and street lighting; audit of the savings achieved due to energy efficiency, comparison of actual results with the rates and goals indicated in the contract;

8. **Supply of materials and equipment** – supply of construction materials and equipment which are necessary to improve energy efficiency; delivery of relevant services.

Based on our expert judgement, the principal economic sectors which could potentially perform ESCO functions are energy supply, architectural/engineering, construction, buildings maintenance and materials and equipment selling.

[25] A. Marino, P. Bertoldi, S. Rezessy, B. Boza-Kiss, 2011, Energy policy 39, A snapshot of the European energy service market in 2010 and policy recommendations to foster a further market development

Annex 12: Questionnaire for companies

1. Name of company:

2. Number of employees:

1-9	10-49	50-149	150-249	>250

3. Annual turnover (LTL M):

< 2	2- 7	7-24	24-138	>138

4. Average profit margin during the last 3 years:

<0	0-5%	5%-15%	>15%

5. Current ratio (current assets/current liabilities):

<1	1-1.5	1.5-2	>2

6. Have you participated in any public procurement during the last 12 months?

YES	NO

If you answered NO to question number 6, please move to question number 9.

7. Evaluate your company's capabilities to match the minimum technical requirements (experience, employees skills, applied quality standards) in public procurement (from 1 to 10, where 1 – very poor, 10 – excellent).

1	2	3	4	5	6	7	8	9	10

8. Evaluate your company's capabilities to match the minimum financial requirements in public procurement (from 1 to 10, where 1 – very poor, 10 – excellent).

1	2	3	4	5	6	7	8	9	10

9. Evaluate your company's project management skills (from 1 to 10, where 1 – very poor, 10 – excellent).

1	2	3	4	5	6	7	8	9	10

10. Assuming there is a public buildings (schools, preschools, hospitals, police departments, administrative buildings or others) modernisation public procurement based on the ESCO model, what is the probability of your company tendering in such a procurement?

1	2	3	4	5	6	7	8	9	10

11. In which parts of the value chain could your company participate in energy efficiency projects (from 1 to 10, where 1– definitely no, 10 – definitely yes)?

o Energy supply	1	2	3	4	5	6	7	8	9	10
o Technical project design	1	2	3	4	5	6	7	8	9	10
o Buildings construction/ modernisation	1	2	3	4	5	6	7	8	9	10
o Project financing	1	2	3	4	5	6	7	8	9	10
o Building maintenance	1	2	3	4	5	6	7	8	9	10
o Building administration and client service	1	2	3	4	5	6	7	8	9	10
o Energy efficiency audit	1	2	3	4	5	6	7	8	9	10
o Supply of materials, equipment for energy efficiency projects	1	2	3	4	5	6	7	8	9	10

12. Taking into account credit risk and payoff of approximately 15 years, what annual return would you expect?

0%-5%	5%-10%	10%-15%	15%-20%	>20%

13. What measures would encourage you to participate in an energy efficiency project? Evaluate the importance of each measure from 1 to 10, where 1 – not important, 10 – extremely important:

Additional financing (e.g. subsidies from government or municipalities)	1	2	3	4	5	6	7	8	9	10
governmental guarantees for loans from commercial banks	1	2	3	4	5	6	7	8	9	10
ESCO project management training	1	2	3	4	5	6	7	8	9	10
ESCO contracts preparation trainings	1	2	3	4	5	6	7	8	9	10
Examples of successful ESCO projects	1	2	3	4	5	6	7	8	9	10
Public procurement law changes – extension of 3-year period	1	2	3	4	5	6	7	8	9	10

Public procurement law changes- usage of economic utility formula	1	2	3	4	5	6	7	8	9	10
Better conditions for factoring service	1	2	3	4	5	6	7	8	9	10
Other (write down):										
	1	2	3	4	5	6	7	8	9	10

Thank you for your answers.

Annex 13: Basic information about the modernised building

Building's data

The purpose of the building	
Address	
Number of floors	
Building construction year	
Building unheated space (basement, shelter, garage, etc.).	
Building geometric dimensions (X length X width X height above the ground)	
The height of the building (from floor to ceiling)	

Building's floor area

Total area	
Total unheated area	

Building's elements and engineering systems upgrades

Insulated exterior walls (m^2 or %)	
Replaced windows, patio doors (m^2 or %)	
Insulated roof (m^2 or %)	
Modernised heating substation	
Modernised heating and hot water system	
Modernised ventilation system	

External envelope of the building

External walls (e.g., 30 cm concrete slab)	
Basement partitioning (e.g. 30 cm concrete slab, wood floor on joists, insulated with 5 cm of mineral wool)	
Roof (e.g. flat or pitched)	
Windows (for example: separate wooden frames with double glazing and vents, 50% of windows replaced to the plastic with 2 cameras)	

The building's ventilation system

Type (e.g. natural duct, mechanical, etc.):	
Describing the state of ventilation (e.g., does not pull, dew walls and glass surfaces, observed mould, etc.)	
The average working hours per day	

Domestic hot water (hereinafter – DHW) supply system

Description of DHW preparation type	
DHW pipeline insulation condition (pipelines trunk and stands are separated)	

The building's heating system

Heating energy source (e.g., the heating substation or local boiler)	
Thermal heat distribution type in risers (upper or lower)	
Trunk pipeline insulation (insulated piping or not, the percentage of pipes isolated)	
Heating system type of connection to substation (dependent/independent)	
Substation type (heat exchanger/other - specify which)	
The dominant heating devices (iron sectional/flat steel/...)	

Regulation of the heating system and thermal comfort in building

Heating systems adjustment (automatic or manual)	
Average heating season indoor temperature	
Building indoor air temperature description (whether there are areas which are much colder or warmer)	

Building's heat energy and domestic hot water accounting

Are there thermal energy devices, used for space heating metering?	
Are there domestic hot water meters?	
Are there thermal energy devices, used for DHW preparation metering?	

Building's electricity energy accounting

Electricity metering devices (units, types)	
Building's electrical supply category	

Building's energy consumption and expenses in 2013

2013						
Month	Electricity		Heat energy			
	KWh	Costs, LTL (including VAT)	Total, MWh	For domestic hot water, MWh	For space heating ,MWh	Costs, LTL (including VAT)
January						
February						
March						
April						
May						
June						
July						
August						
September						
October						
November						
December						
TOTAL						

Building's energy consumption and expenses in 2012

2012						
Month	Electricity		Heat energy			
	kWh	Costs, LTL (including VAT)	Total, MWh	For domestic hot water, MWh	For space heating ,MWh	Costs, LTL (including VAT)
January						
February						
March						
April						
May						
June						
July						
August						
September						
October						
November						
December						
TOTAL						

Building's energy consumption and expenses in 2011

2011						
Month	Electricity		Heat energy			
	kWh	Costs, LTL (including VAT)	Total, MWh	For domestic hot water, MWh	For space heating ,MWh	Costs, LTL (including VAT)
January						
February						
March						
April						
May						
June						
July						
August						
September						
October						
November						
December						
TOTAL						

Annex 14: Assumptions for financial and economic impact calculations

Modernised area	Units	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025-2033
Scenario 'Directive'													
Total modernised buildings	m^2	66,703	66,703	66,703	66,703	66,703	66,703	66,703	-	-	-	-	-
Category F	m^2	885	0	0	0	0	0	0	-	-	-	-	-
Category E	m^2	65,818	66,703	66,703	66,703	41,535	66,703	66,703	-	-	-	-	-
Category D	m^2	0	0	0	0	25,168	0	0	-	-	-	-	-
Scenario 'Volume 25'													
Total modernised buildings	m^2	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
Category F	m^2	13,022	0	0	0	0	0	0	0	0	0	0	0
Category E	m^2	11,978	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
Category D	m^2	0	0	0	0	0	0	0	0	0	0	0	0
Scenario 'Volume 50'													
Total modernised buildings	m^2	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Category F	m^2	13,022	0	0	0	0	0	0	0	0	0	0	0
Category E	m^2	36,978	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Category D	m^2	0	0	0	0	0	0	0	0	0	0	0	0
Scenario 'Volume 100'													
Total modernised buildings	m^2	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Category F	m^2	13,022	0	0	0	0	0	0	0	0	0	0	0
Category E	m^2	86,978	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Category D	m^2	0	0	0	0	0	0	0	0	0	0	0	0
Scenario 'Volume 200'													
Total modernised buildings	m^2	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000

Category F	m^2	13,022	0	0	0	0	0	0	0	0	0	0	0
Category E	m^2	186,978	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	31,895	0
Category D	m^2	0	0	0	0	0	0	0	0	0	0	168,105	200,000

	Units	2014	2015	2016	<...>	2031	2032	2033	Average
Assumption for heating price	LTL/kWh + VAT	0.303	0.318	0.334	<...>	0.693	0.728	0.764	**0.5**
Share of natural gas in central heating fuel balance	%	55.5	46.7	40.9	<...>	19.8	19.8	19.8	**25.07**
Imported natural gas price (without VAT and excise)	LTL/tne	1625	1549	1588	<...>	2300	2357	2416	**1936**
Natural gas needed to produce 1 MWh (for heating)	tne/1MWh	0.09	0.09	0.09	<...>	0.09	0.09	0.09	**0.09**
Average CO_2 emission in central heating sector	t CO_2e/MWh	0.11	0.10	0.08	<...>	0.04	0.04	0.04	**0.05**
Average ETS price	LTL/t CO_2	21	28	35	<...>	228	228	228	**97**

	Units	**Value**
Average heating consumption in the public building before modernisation, from which:	kWh/$1m^2$	210
Category F	kWh/$1m^2$	350
Category E	kWh/$1m^2$	275
Category D	kWh/$1m^2$	200
Average heating consumption in the public building after modernisation, from which:	kWh/$1m^2$	100
Category F	kWh/$1m^2$	100
Category E	kWh/$1m^2$	100
Category D	kWh/$1m^2$	100

Annex 15: Recommendations of building types for pilot projects

When selecting a pilot project it is recommended to use the following criteria:

1. Simple building, i.e. not recommended to choose complex buildings (hospital, theatre and sports hall) for the pilot project;
2. Electricity consumption (kWh) per 1 m^2 of the total area is maximum;
3. Heat consumption (kWh) per 1 m^2 of heated area is maximum;
4. Building area (m^2) is maximum;
5. The building is minimally modernised or has not been modernised.

According to the above criteria scores are awarded for each building. These scores will help sort the buildings into an order of priority. Recommended scores are shown below for each criterion:

Table 1: Criteria for selecting potential buildings for pilot projects

Seq. No.	Criteria	Scores (min-max)
1	**Electricity consumption, kWh/m^2**	**0-10***
2	**Heat energy consumption for heating, kWh/m^2 heated area**	**0-10***
3	**Area, m^2**	**0-5***
4	**Measures implemented**	**-12 to 12**
4.1	*Replaced windows*	*-2 to 2***
4.2	*Modernised lighting system*	*-1 to 1***
4.3	*Replaced heating devices*	*-1 to 1***
4.4	*Replaced heating pipelines*	*-2 to 2***
4.5	*Installed thermostats*	*-1 to 1***
4.6	*Insulated roofs*	*-2 to 2***
4.7	*Insulated external envelope*	*-3 to 3***
5	**The maximum amount of scores**	**37**

*- The maximum score is awarded to the building whose rate is highest. The scores of other buildings are determined by interpolation
** - If the measure is implemented – given a negative score (-), if the measure is not implemented – given the positive (+) score.

Source: Ekotermija, UAB analysis

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