ENERGY EFFICIENCY PROGRAM

MUNICIPALITY OF VALANDOVO

Period 2020-2022

Municipality of Valandovo

February 2019

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ABBREVIATIONS

CA	City Authorities
CFL	Compact fluorescent lamps
CP	Contracting Party
CPS	Central Primary School
DD	Degree Day
EC	European Community
EE	Energy Efficiency
EEP	Energy Efficiency Program
ESCO	Energy Service Company
EU	European Union
EVN	EVN Austria1 that purchased the Macedonian retail electricity distribution network in April 2006
GG	Greenhouse Gas
HPML	HPML
IPCC	Intergovernmental Panel on Climate Change
LSGU	Local Self-government Unit
M&E	Monitoring & Evaluation
MEPSO	Macedonian Electricity Transmission System Operator
MF	Ministry of Finance
MHL	Mercury Halide Lamps
MKD	Macedonian Denar
MSIP	Municipal Service Improvement Project
N/A	Not Applicable
NPEEPB	National Program for Energy Efficiency in Public Buildings
OT	Other (types) of lamps
PPP	Public Private Partnership
PUE	Public Utility Enterprise
RE	Renewable Energy
RES	Renewable Sources of Energy
RM	Republic of Macedonia
RPS	Regional primary school
SHP	Small Hydropower Plant
SWOT	Strengths, Weaknesses, Opportunities and Threats conclude
TRACE	Tool For Rapid Assessment of City Energy
USAID	United States Agency for International Development

[1] EVN is a retailer, ie, a supplier of tariff customers. EVN purchases transmission services from MEPSO and power from Power Plants of North Macedonia, (ESM). EVN concludes individual contracts with the end users and collects payments. EVN's website: https://www.evn.at/EVN-Group/Uberblick/Unternehmensprofil.aspx

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INTRODUCTION

The energy and the impacts of its use in the everyday life are a worldwide important area of study. Raising people's awareness is a significant factor in the environmental protection, climate change mitigation, promotion of efficient use of energy and improving living comfort.

Municipality of Valandovo, the Mayor and the municipal administration are aware of the necessity for long-term energy planning, as it represents a key element for the long-term economic development of the municipality, as well as a key factor for reducing the environmental impact and the energy dependency. This Energy Efficiency Program (EEP) will:

- Provide overview of the municipality's current energy consumption as well as overview of its obligations,
- Consider the opportunities for implementation of several proposals for improvement of the energy efficiency, distribution and energy use,
- Define activities designed to improve local energy supply and use.

We know that EEP is an obligation for the local government in accordance with the Law on Energy[2] and the Strategy for Energy Development in the Republic of Macedonia until 2030. The national Strategy for Promotion of Energy Efficiency by 2020 and the Third National Energy Efficiency Action Plan of the Republic of Macedonia by 2018 require specific actions and activities, most of which need to be managed at municipal level.

This EEP is prepared to be effective for the next three years and can be applied throughout the territory of the Municipality of Valandovo. The Program proposes three priority areas for development of the energy sector, in particular:

- Security in energy supply
- Sustainable energy development
- Development of competitive energy market aimed to facilitate environmental protection, climate change mitigation and improve the social life of the citizens.

[2]Law on Energy (Official Gazette No. 96 from 28.05.2018), in accordance with Article 242 matters related to energy efficiency are being appropriately applied in accordance with the previous Law on Energy (Official Gazette No.16 from 02.10.2011) pending the entry into force of the Law that will regulate the matters related to energy efficiency.

Program goals

Municipality of Valandovo aims to improve the living conditions of its population by using the advantages of the environment (surrounding) and the existing infrastructure. Energy Efficiency (EE) is an integral part of the process, enabling improvements in the environment and population's comfort. The municipality aims to accelerate the implementation of the energy efficiency by achieving several goals:

- Implementation of energy efficiency measures in public buildings that are under the authority of the Municipality of Valandovo;
- Creation of favorable conditions for involvement of the private sector in the process of implementation of the measures for energy efficiency in the public buildings, aimed at development of local entrepreneurship;
- Creation conditions for implementation of measures for energy efficiency in all priority sectors identified.

In order to achieve these goals, it is necessary to consider the current development priorities of the municipality, the capacities of the staff and the available financial resources. The following sections discuss in detail the goals of the Energy Efficiency Program, in order to assist the municipality to further develop its annual action plans and specific detailed activities. The EEP is a formal, legally binding agreement. The goals, activities and limitations defined in this document are in accordance with the Law on Energy.

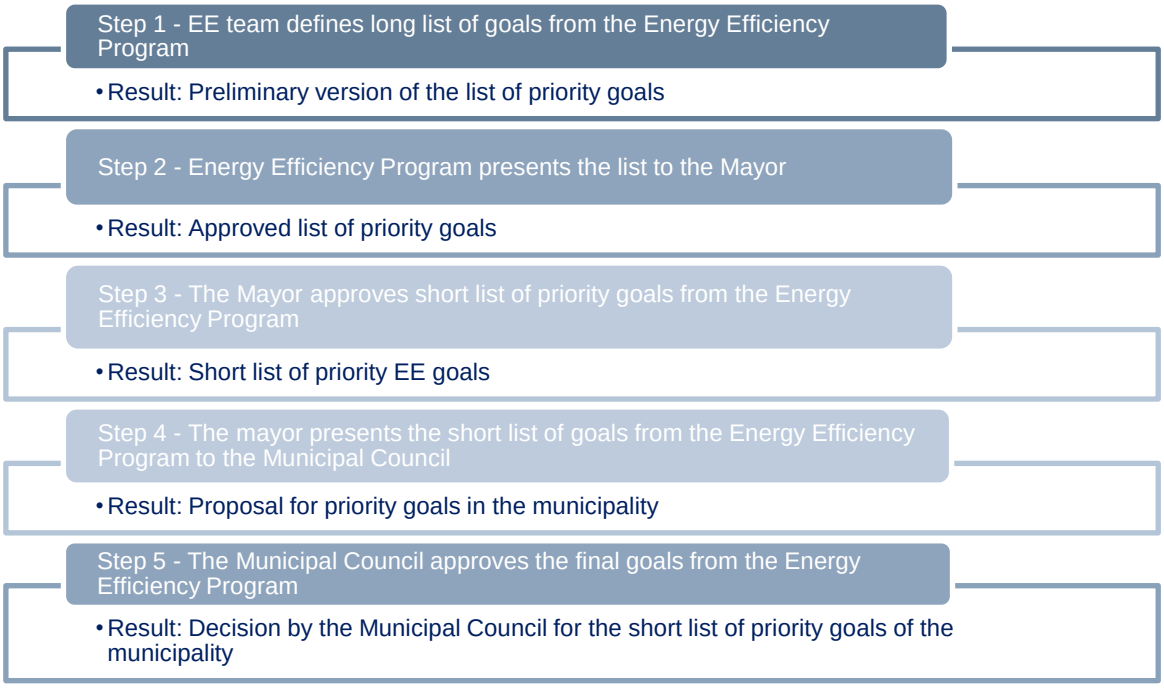


Figure 1: General Process for identification of the EEP goals

Energy policy and legislation

The development of the Energy Efficiency Program (EEP), considers the current and applicable energy policy and regulation as well as the other relevant strategic documents..

1.1.1 Local policies and energy regulations

The table below presents the strategic documents at local level that are of particular significance for the development of the EEP.

Table 1: Municipal planning documents

Title of the document	Status	Year	Description and significance for the EEP
Local Environmental Action Plan of the Municipality of Valandovo (2010 – 2014)	Adopted	2010	The Local Environmental Action Plan does not include the sector energy and energy efficiency. The water sector has been covered with the thematic area water and water resources which presents in detail the hydro potential of the municipality, supply with drinking water, communal wastewater and irrigation. From the energy point of view, this thematic area does not cover electricity consumption and potentials of hydro energy.
Strategy for Local Development of the Municipality of Valandovo (2014-2020)	In process of adoption	2014	In this strategic document, several projects have been selected with the specific aim to reduce the local dependence on fossil fuels through the use of renewable energy sources. Prioritization has been carried out and the following projects have been listed: › Construction of ecological (energy independent) house (E.D Kalinka Valandovo) › Replacement of street lights with installation of solar lighting › Feasibility study for measuring the potentials for utilization of the solar energy as a renewable energy source › Public campaign for utilization of the solar energy in the households › Feasibility study for measuring the wind potentials near the village of Udovo The municipality performs analyses in order to find ways of financing the above mentioned projects.

1.1.2 National energy policies and regulations[3]

Below is presented an overview of the current national legislation applicable for the local self-government units (LSGU).

› **Law on Energy (Official Gazette of the Republic of Macedonia No.96/18)**. The article 242 of this law reads: “The provisions of the Law on Energy (Official Gazette of the Republic of Macedonia” No. 16/11, 136/11, 79/13, 164/13, 41/14, 151/14, 33/15 (192/15, 215/15, 6/16, 53/16 and 189/16), which regulate the matters in the area of energy efficiency, apply accordingly until the entry into force of the Law which will regulate the maters in the area of energy efficiency”. Accordingly, in the area of energy efficiency and

[3] Since these legal documents are subject of change, they have to be continuously and carefully followed.

the development of Energy Efficiency Programs, the old Law on Energy (Official Gazette of the Republic of Macedonia No. 16/2011) remains into force, in accordance to which, each of the local self-government units must develop a three-year EEP and annual Action Plan. In addition, local self-government units are obliged to prepare annual energy consumption analyses and to monitor their energy consumption. With the newly adopted amendments to this Law, some of the obligations of the local self-government units will become enforceable on the day the Republic of Macedonia enters in the EU. For example, local self-government units should provide Certificates for energy performance of buildings or building units that are owned by public sector and built after the day this Law came into force - 5 March, 2015.

- **Draft version of the Law on Energy Efficiency**. The Article 7, paragraph (1) of this draft Law reads: “Upon request of the Mayor, in accordance with the Strategy for reconstruction of buildings and with previously obtained positive opinion from the Agency, the Council of the local self-government unit adopts Energy Efficiency Program for a period of three years, every three years.” The Law on Energy Efficiency is in process of adoption.
- **Strategy for Promotion of Energy Efficiency by 2020 (Official Gazette of the Republic of Macedonia No. 143/10)**. This Strategy aims to accelerate the adoption of practices for implementation of energy efficiency in the Republic of Macedonia, so that by 2018 energy consumption will be at least 9% lower than the average recorded for the period 2002-2006. By 2020, the total energy savings are expected to reach 14.5%, which is close to the EU's target of 20%. Most of these savings are expected to derive from cities, and shall be achieved through reduced use of electricity and heat for the buildings, more efficient public utility enterprises and more sustainable transport sector. The reform initiatives will focus on the following activities:

  (1) Legal and regulatory framework (such as update of the Law on Energy, introduction of clear energy performances of buildings, improvement of the legal framework that regulates the Energy Service Companies (ESCO) and their operation);

  (2) Building institutional capacities (such as specialized courses in the institutions for higher education, raising awareness and promotion of the principles for energy efficiency);

  (3) Social measures (such as energy efficiency in households that could represent smaller bills, block tariffs for electricity that will enable poor families to manage the planned increase of the tariffs);

  (4) Financial issues (such as financing the energy efficiency).
- **Third Energy Efficiency Action Plan of the Republic of Macedonia for the period 2016 – 2018 (adopted on 18.07.2017).** In accordance with the Directive 2006/32/EC on Energy Efficiency, this document has been developed with an assistance of USAID. This Action Plan provides an overview of the measures that will support Macedonia to reach energy savings of 9% until 2018, as specified with the Strategy for Energy Efficiency until 2020. It is estimated that about EUR 406 million are needed for the implementation of these energy efficiency measures that will assist in reaching about EUR 1,360 million in savings and expenses (at liberalized energy market prices). Most of the measures focus on the cities, and some of them are specifically customized for Skopje (for example, introduction of a tram in Skopje, or renovation of the district heating network).

- **Strategy for Energy Development in the Republic of Macedonia until 2030 (Official Gazette of the Republic of Macedonia No. 61/10).** This Strategy sets the instructions for more efficient utilization of the energy sources and increasing the utilization of renewable sources of energy. Many of the activities listed in the Strategy have direct impact on the organization and the management of the cities.
- **Strategy for Utilization of Renewable Energy Sources of the Republic of Macedonia by 2020 (Official Gazette of the Republic of Macedonia No. 125/10).** The Strategy for energy development of the Republic of Macedonia until 2030 is additionally supported by this Strategy.
- **Rulebook for Energy Performance of Buildings (Official gazette of the Republic of Macedonia No. 94/13).** This Rulebook defines the methodology for determination of energy performances of buildings and the min. requirements for energy efficiency of new buildings, as well as for buildings that are in process of significant reconstruction. This Rulebook ensures transposition of the Directive 2010/31/EU of the European Parliament and of the Council of Europe from 19.05.2010 (EUR-Lex - 32010L0031)
- **Rulebook for Energy Audit (Official gazette of the Republic of Macedonia No. 130/09).** Regarding the EEP, this Rulebook this Rulebook sets out the rules for energy audit, assessment of the energy consumption and the methodology for measurement and verification of the energy savings.
- **Law on Construction (Official Gazette of the Republic of Macedonia No. 130/09)**. This Law sets the criteria and standards for preparation and carrying out construction projects.
- **Law on Local Self-Government (Official Gazette of the Republic of Macedonia No. 05/02).** This Law represents the regulatory framework for the process of decentralization and achievement of independence of the local self-government units.
- **Law on Concessions and Public Private Partnership (Official Gazette of the Republic of Macedonia No. 06/12).** This Law regulates the procedures and rules for establishment of public-private partnership (PPP), as a funding source for the implementation of the EEP.
- **Law on the Financing of Local Self-Government Units** (Official Gazette of the Republic of Macedonia No. 61/04). This Law defines and describes the individual sources of funding of the municipalities such as the municipal revenues, as well as the revenues of the state budget and various possibilities for in debt financing. This Law represents legal basis for preparation of financial plan for implementation of the EEP.
- **Law on Environment (official gazette of the Republic of Macedonia No. 53/05).** This Law regulated the rights and obligations of Republic of Macedonia, the municipalities, City of Skopje and the municipalities in the City of Skopje, as well as the rights and the obligations of the legal entities and natural persons (citizens) in the provision of conditions for protection and the improvements in the environment aimed at protection and exercising the right to a healthy environment. This is also one of the goals set with the implementation of the energy efficiency measures in the EEP.
- **Instructions for implementation of energy efficiency and measures for energy saving,** determining the performances of goods and services for the public procurements and carrying out criteria related to energy efficiency and energy saving during the bidding procedure (collecting offers). The aim of these instructions is to assist the contracting

bodies to conduct the public procurement procedures, as well as to enable the representatives of the contracting parties to assess their understanding of energy efficiency during decision making related to procurement.

1.1.3 European Energy Policies and Regulations

Macedonia as a candidate country for membership in the European Union has an obligation to efficiently carry out the reforms in the social system. The development of the energy sector has a particular significance.

In September 1998, Republic of Macedonia ratified the Energy Charter Treaty, the Energy Community Treaty, the United Nations Framework Convention on Climate Change, and the Kyoto Protocol. In accordance with the Energy Community Treaty, the country is harmonizing its legislation with the existing legal framework of the European Union for energy, environment, competitiveness, renewable sources of energy, energy efficiency and oil reserves. In that context, there are several important directives in the energy sector which are listed below:

- **Directive 2012/27/EU** on energy efficiency, amending Directives 2009/125/EC and 2010/30EU and repealing Directives 2004/8/EC and 2006/32/EC
- **Directive 2010/31/EU** on the energy performance of buildings
- **Directive 2018/844** amending Directive 2010/31/EU on energy performance of buildings and Directive 2010/27/EU on energy efficiency
- **Regulation (EU) 2017/1369** on setting a framework for energy labeling and repealing Directive 2010/30/EU on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products

Methodology for preparation of EEP

This EEP has been prepared using the methodology developed and provided by the Energy Agency, in consultations with the World Bank. The methodology which is provided in separate document (held by the Energy Agency) describes in details the process for development of EEP, including the whole cycle of preparation and adoption. This EEP is entirely prepared and harmonized with the Methodology.

Templates for preparation of EEP are available at the official website of the Energy Agency on the following link:

http://www.ea.gov.mk/index.php?option=com_content&view=article&id=2881&Itemid=142&lang=mk

DATA FOR THE MUNICIPALITY

Valandovo is an urban municipality in the Republic of North Macedonia with a population of 11,980[4] inhabitants. The territory of the municipality includes 29 settlements: the town of Valandovo which is the seat of the municipality and has a population of 4,402 inhabitant, and 28 villages. The annual population growth rate is 10.4% and the population density is 35.88 inhabitants per km^2.

Geographical and climatic characteristics

Municipality of Valandovo is situated in the southeast part of the Republic of North Macedonia. It covers an area of 331 km^2 between northern latitude 41°14' and 41°28' and eastern longitude 22°23' and 22°45' with an average altitude of 226 meters. The municipality is completely located in the Valandovo Valley, which is situated between the mountains Belasica, Gradeshka Planina, Plavush, Pogana, Kozhuf and Marjanska Planina.

With the new territorial division from 2005, the Municipality of Valandovo borders Municipalities of Gevgelija, Bogdanci, Dojran, Strumica, Konce and Demir Kapija, while defining the state border of the country with the Republic of Greece with a small share of eight kilometers.

According to the geographical characteristics, there is a domination of flatland villages (12) in the Municipality of Valandovo and only 4 are hill villages (Bashibos, Kazandol, Kochuli and Prsten.

The roads leading to Strumica, Dojran, Bogdanci and Gevgelija pass through the Municipality of Valandovo. On the left side of the river Vardar passes the Corridor 10/E-75. All settlements are connected by asphalt roads which rank as IV, which connect the village with the city, with the regional road routes P-110 (village Udovo - village Rabrovo), P-604 (Orangeries - village Marvinci) as well as the local roads with which the Municipality connects with other settlements. Regional roads cover an area of 46.5 km, and local roads 74.3 km. The municipality is 26 km from the border crossing Dojran and 30 km from the border crossing Bogorodica, as well as 48 km from the border crossing Novo Selo.

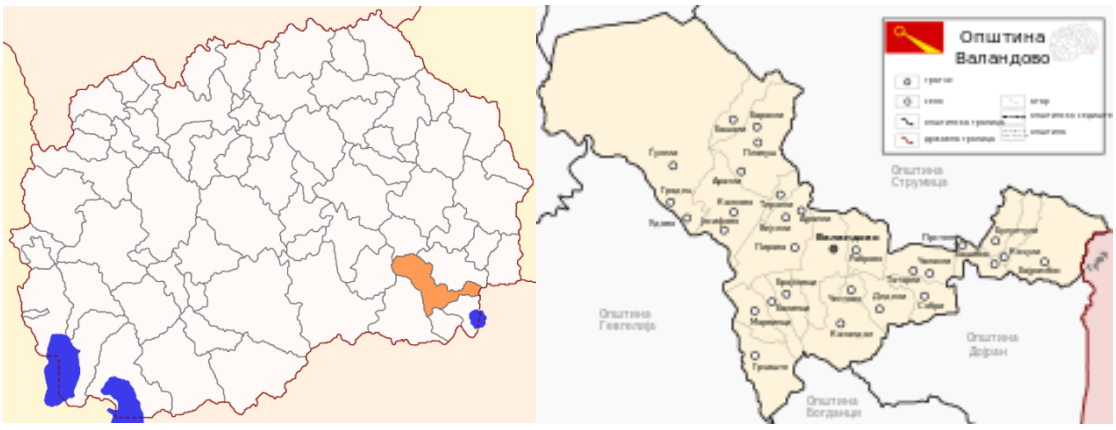


Figure 2: Location and map of the Municipality of Valandovo

[4] Statistics of the Census of Population, Households and Dwellings in the Republic of North Macedonia, 2002, Book XIII.

Significant part of Valandovo Basin falls under the thermal influence of the Aegean Sea (Mediterranean climate impact). The average annual temperature here is 14.5°C. The Mediterranean climate impacts are particularly evident in the cold season, which is also reflected in the relatively high temperature values in the winter months. The average temperature in January is 3.6°C. Due to the relatively good openness of the Valandovo Valley to north, quite low temperatures occur in the colder seasons, especially in the winter months, which disrupt the temperature stratification of the Aegean, sea climate influence. Temperatures below -8°C occur almost every year. The average freezing period lasts 118 days in the Valandovo Field.

The values higher than 40°C happen once at every 4 to 5 years, while values above 35°C every year. High values of the heat regime are also manifested through increased number of summer and tropical days, i.e. days in which the daily maximum air temperature is equal or higher than 25°C (summer) or 30°C (tropical days). In average there are 135 summer and 73 tropical days. The warmest month is July, with an average monthly temperature of 25.2°C. It can be said that the Valandovo Valley is most threatened by the spring frosts, especially those that appear during April. They have a particularly damaging effect on fruit plantations during their flowering period.

The precipitation regime in the Valandovo Valley is under Mediterranean climate influence. Summer months are low in rainfall, with the maximum fall in the late autumn months. The average annual amount of rainfall is 646 mm. The precipitation is highest in November with 85 mm, followed by December and October with 75 mm. The precipitation is lowest in July and August, with an average of about 30 mm. Autumn is a season with highest precipitation with an average of 203 mm and season with lowest precipitation is the summer with 108 mm. The precipitation is mostly of rain, and there are only 6 to 10 days of snow a year. Although the annual precipitation is quite high, dry periods occur with high frequency. Dry periods with duration of 10 to 15 days are very often. Hail appears almost every year, from April to October. The intensive hail often causes significant damages on farming.

Valandovo Valley is an area that has solar radiation which lasts the longest period in Macedonia, with over 2,600 hours, i.e. the cloud coverage has the lowest value (average 4.3 tenths). The most prominent are the winds along the River Vardar: “Vardarec” from the North and “Jugo” from the southeast (Lazarevski, 1993). The mentioned climatic features provide excellent opportunities for development of diverse agricultural production, and in particular cultivation of certain Mediterranean plants such as: pomegranate, olive, fig etc.

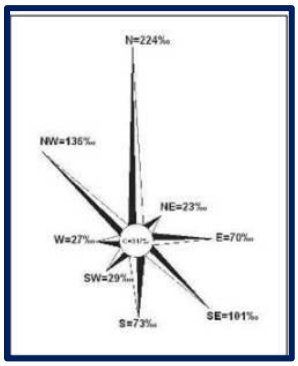


Figure 3: Rose of winds

Table 2 provides presentation of some additional information for the municipality.

Table 2: General data for the Municipality of Valandovo

Description	Information
Address	St. “Ivo Lola Ribar“ bb
Website	www.valandovo.gov.mk
E-mail	administracija@valandovo.gov.mk
Part of larger municipality	/
Region	Southeast Region
Postal number	2460
Phone prefix	+389 (0)34
Municipal characteristics	
Area [km^2]	
City of Valandovo	1.2
Municipality of Valandovo	331,4
Population	
City of Valandovo	4,402
Municipality of Valandovo	11,980
No. of households	
Municipality of Valandovo	3,545
Land	
Agricultural land [ha]	10,000
Forests [ha]	24,910
Geographic characteristics and climate data	
Altitude (m)	110-150
Geographic characteristics	
latitude (° , ”)	(41°91'36“)
longitude (° , ”)	(22°42’52“)
Climate zone	1
Climate data	Heating season
Temperature for design of heating installation (°C)[5]	-12
Average temperature during heating season (°C)	7.7
Length of heating season (days)	118
Degree Day (HDD)	2,080

Overview of sectors for EE

In preparation of this EEP, a long list of relevant sectors of the EE market was taken into account by the municipality, in line with the methodology for EEP. They are divided in two groups: basic

[5] Reference value for design of heating installations.

and additional sectors (Table 3). The analyses should indicate which sectors should be part of the EEP while taking into account the following criteria:

- Priority sectors for the municipality;
- Availability and reliability of the input data;
- Level of control by the municipality.

Table 3: Energy Efficiency Program (EEP for the market sectors

Market sectors	Level of control by the municipality [6]	Included in the EEP (YES/NO)	Comments
Basic sectors			
Water	BM*	YES	
Public lighting	BM*	YES	
Municipal buildings	BM*	YES	
Public transport	N/A	NO	Does not exist in the municipality
Additional sectors			
Waste	N/A	NO	There is organized waste collection by the Public Utility Enterprise which is considered incomplete and irregular without primary selection of the waste. Waste is being collected in inappropriate, non-standard and unprotected wastelands without any previous treatment. Since there are no official information or data regarding the quantity of the waste collected or data related to the percentage of solid waste collected, this sector will not be analyzed but will be considered as weak area in the municipal management.
Energy and heat	N/A	NO	Does not exist in the municipality
Residential buildings	LC** / LP***	NO	Although only general data have been provided, the sectors were not analyzed due to lack of sufficient and reliable data. The analysis of these sectors is suggested for the next EEP, after collection of relevant detailed data.
Private transport	LC** / LP***	NO	
Industry	LC** / LP***	NO	

**Municipal Budget Management (BM)*
*** Local Committee (LC)*
**** Local Participant (LP*

The municipality is not focusing on private buildings or the industrial sector at this time. Its future participation in development policies and energy consumption should play important role in the residential sector by making appropriate typology as well as for the industry and industrial capacities due to the participation of different types of fuels and their impact on the environment.

[6] For the sectors described, certain control is being performed in accordance with the levels of municipal control presented in Appendix II.

The approach for assessment of these sectors is described in the EEP methodology as well as in the general definition (template).

The table above presents the priority sectors selected by the municipality.

Potential for utilization of renewable energy

The municipality has significant potential for generation of renewable energy, as described in the table below:

Table 4: Potential for utilization of renewable energy in the Municipality of Valandovo

Renewable Energy Sources	Description
Hydro energy	The River Anska as well as the rivers Hamadashi, Demidare and Elazdere pass through the territory of the Municipality of Valandovo. In accordance with the Study[7] for utilization of the hydro potential in this region, in event of construction of all planned SHPPs, the total annual electricity production would be around 1.13 GWh. The following watercourses have potential for construction of SHPP: › *Barlenski d. (with an installed flow of 0.225 м^3/s, installed power of 150 kW and produced energy of 580 MWh)* › *Demidere (with an installed flow of 0.183 м^3/s, installed power of 74 kW and produced energy of 288 MWh)* › *Elajzder (installed flow of 0.126 м^3/c, installed power of 68 kW and produced energy of 264 MWh)*
Geothermal water	Based on the study "Geothermal potential in eastern and southeastern Macedonia – creation of preconditions for utilization of the geothermal resources in the region Bregalnica – Strumica", the future research work in eastern and southeastern Macedonia should focus on already registered areas where there are indications of increased earth thermal flow and recorded surface manifestations based on previous geothermal examination, such as the region of Delcevo, extension of the geothermal area Vinica and Kocani, the region of Probishtip, the region of Valandovo, the region of Dojran – Valandovo and Gevgelija, in the zone of Vardar and contact area with the Serbian-Macedonian massif in the region of Bregalnica - Strumica.
Solar energy	Estimation of the potential in the residential sector can be carried out if assumed that 25% of the households in the Municipality of Valandovo will install solar collectors for hot water, meaning: 3,545 households x 25% x 2.2 m^2 x 600 kW/m^2 = 1.17 GWh Currently, on the territory of the Municipality of Valandovo there are two legal entities registered with a status of preferential generator of electricity 49.98 KW (204 panels @ 245 W) and 962.36 KW (3,928 panels @ 245 W) with a total installed capacity of 1,012.34 kW.

[7] Study for possibility for mini and small hydro power plants in the SR Macednia, National Committee for Energy of SR Macednia 1982

Wind energy	In accordance with the existing data and the prepared preliminary Atlas of winds of Macedonia, there is no location with potential suitable for utilization of wind energy identified on the territory of the Municipality of Valandovo.
Biomass (forest, agricultural and farm waste)	**Waste from logging of woods:** Forests occupy about 21,000 ha, or 63% of the territory of the municipality. Most of these areas (over 99%) are state owned forests. Private wood loggings are very small and are used exclusively for private use (firewood). The possible annual felling, meaning the total possible annual wood logging is just over 14,000 m^3. The planned gross annual volume of the PSC Saladjak - Valandovo on the territory of the Municipality of Valandovo is around 11,070 m^3, with anticipated waste by the norm of 10.31% or about 1,140 m^3. Assuming that the volume mass of such waste is 650 kg / m^3, and the heat capacity is 14.5 MJ / kg, it represents an energy potential of: 1,140 x 650 x 14.5 = $7.53x10^6$ MJ/year, or 2,100 MWh/year or 187 toe (tons of oil equivalent) year. **Waste from agriculture:** The total available area of agricultural land in the municipality is 8,449 ha out of which about 3,424 ha are used agricultural land. With an annual production of 3 tons of vine rods per hectare obtained while pruning, about 2,343 tons of biomass waste is produced for the total area of 781 ha of vineyards. The practical availability of vine rods is estimated at around 879 tons per year. If assumed a thermal power of the rods of about 11.5 MJ / kg, the total energy potential contained in them is: 879,000 kg/year x 11.5 MJ/kg = $10.104x10^6$ MJ/year, or 2,807 MWh/year or 241 toe (tons of oil equivalent) year. For a production of at least 1 ton of waste per hectare, about 224 tons waste from biomass is obtained from the pruning of orchards. **Waste from livestock:** The livestock waste contained in the manure is used for energy purposes primarily through biogas obtained by anaerobic fermentation. Cattle, sheep, goats, pigs and poultry are being breaded on the territory of the Municipality. In accordance with the Study on the potential and utilization of renewable energy sources in the cross-border region[8], in the Municipality of Valandovo, the manure waste from livestock and poultry is estimated at around 10,000 tons per year. It can produce a total of about 258 m^3 of biogas per year with a total energy of about 1.72 GWh or about 150 toe (tons of oil equivalent) per year.

The assessment of biomass in the region of Valandovo is presented in the table below:

[8] Study on the potential and utilization of renewable energy sources in the cross-border region (Southeast region in the Republic of North Macedonia and southwest region in the Republic of Bulgaria)

Table 5: Gross wood mass produced in 2008[9]

No.	Subsidiary	Max. annual logging (m^3)	Planned annual logging (m^3)	% of utilization	Planned production of wood mass in 2008				
					Technical wood (m^3)	Firewood (m^3)	Total wood mass (m^3)	Waste wood (m^3)	% of waste wood (m^3)
	1	2	3=7+8	4=3:2*100	5	6	7=5+6	8	9=8:3*100
7	"Salandzak" - Valandovo	16,866	13,322	78.99	0	11,984	11,984	1,374	10.31

Budget of the municipality

The Law on Local Self-Government defines the legal framework on the process of decentralization. In addition, the Law on the Financing of Local Self-Government Units contributes to the process of decentralization. These laws ensure appropriate legal frameworks and conditions necessary for securing independence of the local self-government units. They define the sources of revenue (including local taxes and fees as well as contributions from the state budget, debts financing)

In accordance with the Law on the Financing of Local Self-Government Units, the sources of revenue in the municipalities must insure their functional and financial independence, including:

- Local taxes (property taxes, municipal taxes, administrative taxes and other local taxes determined by law)
- Local fees (construction land fee, municipal fees, spatial and urban planning fees and other local fees determined by law);
- Ownership income (rental income, income from interest and from sale of property that does not impede the performance of the public functions and responsibilities of the municipality);
- Income from personal income taxes levied on the residents (the municipality collects 100% of the tax on natural persons performing craft activities in the municipality in accordance with the Law on Craftsmanship and 3% of the personal income tax on individuals living in the municipality);
- Incomes and other profits;
- Incomes from fines, donations and other sources determined by Law.

Table 6 presents the total budget of the municipality for the last three years compared with the municipal expenses for electricity for the same period.

[9] Popovski, K., Armenski, S., Popovska, E., Vasilevska, S., Energy from biomass in the Republic of North Macedonia

Table 6: Municipal budget for the period 2016 – 2018[10]

Year	Total budget of the municipality (MKD)	Total expenses for energy[11] (MKD)	Expenses for energy as % of the municipal budget
	Basic budget		
2016	72,751,000	7,535,254	10.36%
2017	55,975,000	5,707,090	10.2%
2018	66,975,000	5,937,273	8.87%
2019	The budget foreseen for 2019 is: 72,575,000.		

As presented in Table 6, the budget of the municipality varies in accordance with the projects approved by the state authorities from the state budget. They are being identified as transfers in the basic budget of the municipality.

The municipal expenses for energy consumption are in line with the tendencies of the basic budget. The expenses for energy include all sources (electricity and fuels) that are being used by the municipality in a particular year. Due to irregular issue of invoices or purchasing of these fuels, the expenses can spill from one year to another.

The Table 7 and

Table 8 presented below, provide illustration of the main problems during investments in energy sector as well as in the environmental protection. The

Table 9 presents the priority investment projects in near future.

Table 7: Main problems for investment in energy sector

No.	Main energy problem	Investments foreseen for solving the problems (MKD)	Responsibility
1	Incomplete system for public lighting without automatic regulation that needs to undergo significant renovations to a highly energy efficient system. The street lighting of the square is in very poor condition. Solution: installation of new street lighting with LED technology.	MKD 45,510,000	Municipality of Valandovo

[10] Expenses for energy include all sources of energy for which invoices have been issued.
[11] The total expenses for energy in the municipality do not include the water sector since the expenses for operation of the pumps are being paid by the Public Enterprise “Communal Service”.

2	The heating systems in the public buildings are using mostly firewood and oil. Solution: change of the heating system with more efficient systems that use pellets.	MKD 12,300,000	Municipality of Valandovo
3	Lack of heating systems in part of the buildings that are under the authority of the municipality (House of Culture, Sports Hall, etc.) Solution: installation of new heating system with possibility to be used as central for several buildings.	MKD 18,450,000	Municipality of Valandovo
4	Existence of energy inefficient public municipal buildings. Solution: implementation of measure for energy efficiency in the buildings.	MKD 92,000,000	Municipality of Valandovo
5	Lack of electricity connections at the locations of the water supply tanks due to inaccessible terrain. The solution: setting up renewable energy sources.	MKD 8,000,000	Municipality of Valandovo

Table 8: Main ecological problems in the municipality

No.	Main ecological problems in the municipality	Necessary investments to solve the problems (MKD)	Responsibility of
1	Lack of treatment of the wastewater of the town of Valandovo that are directly drained into the River Anksa	MKD 30,000,000	Municipality of Valandovo
2	Regional waste landfills that are not regulated. The existing location is inappropriate for this type of waste and is not equipped for collection and management of waste materials.	MKD 61,000,000	State authorities
3	Wood is the most common source of energy for heating of the residential buildings.	MKD 2,000,000	Inhabitants of the municipality
4	Due to the frequent occurrence of fire, the territory of the Municipality of Valandovo is classified as category I in risk of fire.	MKD 20,000,000	Municipality of Valandovo

Table 9: Priority investment projects of the Municipality of Valandovo in near future

No.	Future priority investment projects for the municipality	Needed investments (MKD)
1	Replacement of the water supply system in the town of Valandovo	MKD 12,300,000
3	Construction of sewage system in the settlements of Rabrovo, Chalakli, Kalkovo, Grchishte, Sobri	MKD 10,000,000
4	Construction of water supply system for Udovo, Josifovo and Kalkovo	MKD 20,000,000
5	Construction of a canal and bridge on the ravine of River Kalkovska	MKD 10,000,000
6	Construction of a road and a canal for connecting the regional road P1105 with the settlement of Gorna Mala	MKD 20,000,000

OVERVIEW OF THE CURRENT ENERGY CONSUMPTION

The electricity consumption in Valandovo reflects the dynamics of development of the municipality as well as the financial limitations it faces. For the last few years, total energy consumption follows the conditions in the budget and represents 8% - 11% of the total municipal budget. It is expected that in 2019, the part of the budget for energy will be in accordance with the expected increase of the municipal budget as compared to the previous two years.

Supplier of electricity in the municipality is EVN. The network operates at medium and low voltage.

Water sector

3.0.1 Drinking water

The water supply system in the Municipality of Valandovo is organized through six independent systems: one water supply system of the city covering the settlements of Valandovo, Rabrovo, Dedeli and Chalakli and five separate systems for the rural parts of the municipality. All six systems are operated by the Valandovo-based Public Utility Enterprise “Communal Service”, established by the municipality. Four of the five rural systems listed in the public utility system are included in March 2018. In addition, there are several more rural systems still managed by the local communities and are planned to be incorporated into the existing communal management system in the future.

The construction of the water supply system started in 1958 and covers only one municipality with about 10.000 inhabitants. All end users of the system have installed water consumption meters (water meters), while there is a lack of a main water meter to measure the flow exiting from the tanks and record the total amount of water delivered to the system. An exception to this is the main pipeline for the city of Valandovo where a magnetic flow meter was installed in December 2018.

The water supply system of Valandovo is fed by three springs of water from three wells connected to a single reservoir of reinforced concrete with a total capacity of 1.300 m^3. The pipeline of this system has not been renovated since its installation in the 50s and is mainly consisted of asbestos pipes with a high loss rate of about 50-60%. Therefore this system is characterized as an energy inefficient system.

In the rural areas, each of the system consists of a power supply pump and a tank of reinforced concrete with a capacity of 100-120 m^3. Regarding the water quantity control, the absence of electricity connectors as precondition for placement of appropriate floaters for automatic supply of the reservoirs, represents the biggest challenge. In these rural areas, the pipelines have been installed more recently from PE/PVC pipes which results with minimal loses in the network.

Nine pumps are included in the system. Their characteristics have been summarized in Table 10. All pumps are without frequency control and they do not have automatic on/off switching as necessary measures for the energy efficiency of the system.

Table 10: Characteristics of water pump equipment

Type of equipment	Age of equipment (years)	Installed capacity of pump [kW]	Capacity [l/s]	Type
Pump No.1 Valandovo	1 year	75 kW	25 l/s	Submersible pump
Pump No.2 Valandovo	6 years	25 kW	18 l/s	Submersible pump
Pump No.3 Josifovo	15 years	5,5 kW	6 l/s	Submersible pump
Pump No.4 Josifovo	3 years	7,5 kW	10 l/s	Submersible pump
Pump No.5 reserve pump in separate well Josifovo		5,5 kW	6 l/s	Reserve pump
Pump No.6 Grchishte	5 years	3 kW	4 l/s	Water pump
Pump No.7 Brajkovci	6 years	5,5 kW	6 l/s	Submersible pump
Pump No.8 Balinci	8 years	5,5 kW	6 l/s	Submersible pump
Pump No.9 Marvinci	1 year	5,5 kW	6 l/s	Submersible pump

Figure 4 presents the data related to water production and electricity consumption for the last three years. The quantity of potable water produced in 2016 is twice as lower compared to the quantity in the next two years, 2017 and 2018. Taking into consideration the weather conditions in the spring and summer of 2016 when the overflows of the Kalkovska riverbed has been recorded, the correlation between the precipitation and the amount of water produced is obvious. This leads to the conclusion that the water from the water supply system, besides for the needs of the households is being used also for irrigation[12].

[12] With the start of the project for the South-Vardar valley, there will be investments in modern irrigation system for the agricultural land in an area of 2,000 ha Valandovo field in a total amount of EUR 24,3 million, financed by KfW.

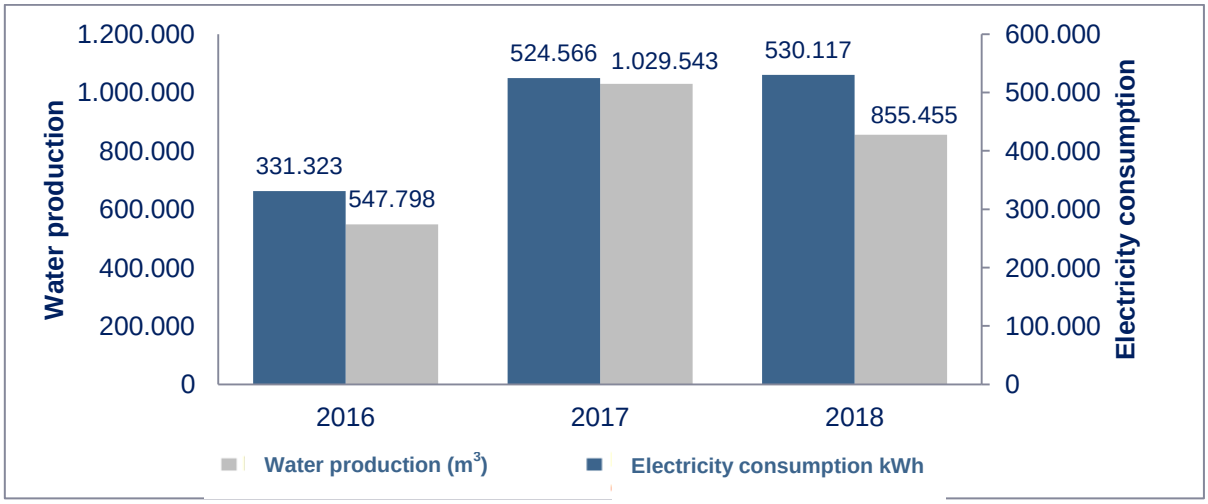


Figure 4: Water consumption and electricity consumption in the period 2016 - 2018[13]

The decrease in water produced on one side, and the increase of electricity consumption on the other for the period of 2017 and 2018 occurs due to the inclusion of four more rural settlements in the charging system in March 2018, which results with an increase in the total recorded electricity consumption.

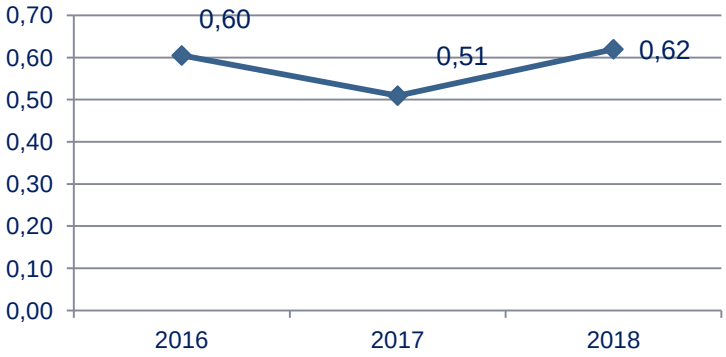


Figure 5: Specific water consumption in kWh/m^3, 2016 - 2018

Figure 5 presents the trends of specific consumption of drinking water. These trends occur due to the inclusion of four more rural settlements in the water supply system of the Municipality of Valandovo.

[13] During March 2018, four additional pump stations from the rural areas in the municipality have been included in the system.

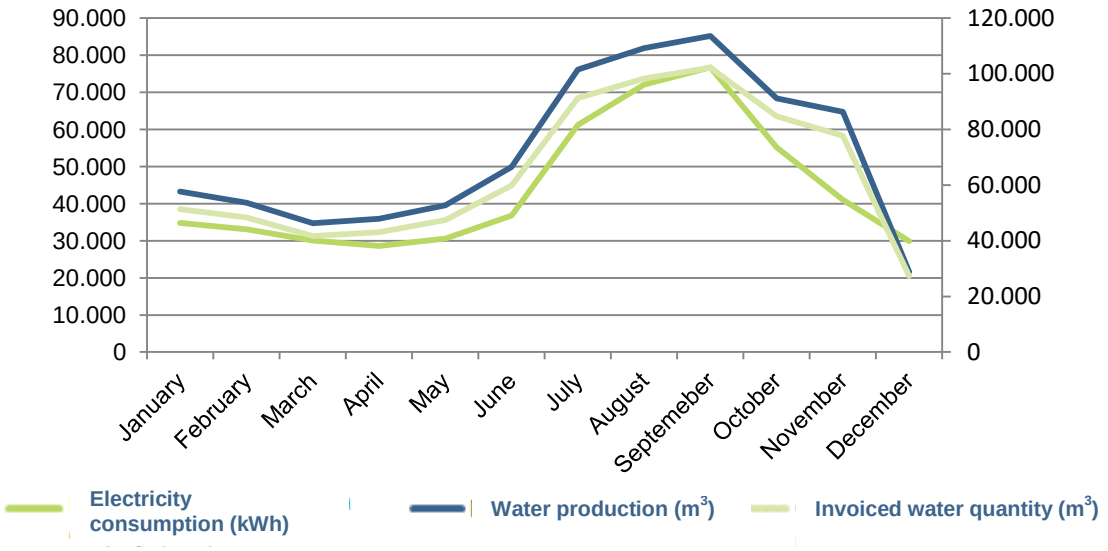


Figure 6: Consumption of electricity, production of water and quantity of water for which invoices have been issued, for the reference year 2018

As presented on Figure 6, the level of water consumption throughout the year is not constant. Fluctuation occurs due to the needs and the habits of the citizens as well as their awareness related to the utilization of the water. The summer is the period of the year with highest consumption of water, especially in July and August; therefore the production of water is highest during these two months. The reason is that the drinking water is heated in the pipes that lead from the water supply system to the households. While using the water for drinking, people tend to leave the water flow from the tap running until it becomes cooler. In addition, people living in houses tend to use tap water to cool their yards on the hottest days of summer.

The percentage of non-revenue water (that has not been charged) for the reference year is 10%, which includes system losses and unbilled water.

Table 11: Annual consumption of energy for the sector drinking water, reference year 2018

Water supply system	No. Of inhabitants	Annual production of water for 2018 (m^3)	Consumption of energy for production of water (kWh/a)	Specific consumption of drinking water [kWh/(m^3. a)]	Percentage of non-charged water (%)
Water supply system of the Municipality of Valndovo	8,508	855,455	530,117	1.15	10%

The main challenges related to drinking water are: (1) major loses in the water supply system related to the supply of the city of Valandovo, and (2) lack of automatic control. These two issues are result to several factors presented below:

- The water supply network of the Municipality of Valandovo has not been restored since the initial installation in the 50s. Due to degradation, the water supply system suffers large water losses estimated at over 50%;
- The water supply network is consisted of asbestos pipes that have negative impact on human health and require urgent replacement;
- Unsustainable plan for investment in the water supply network by the responsible institutions;
- Small or no investments in alternative sources of water for irrigation;
- Lack of involvement of the private sector in the construction of own wells for water supply;
- Lack of electrical installation near the tanks;
- Low level of awareness and irrational use of the drinking water that characterize the behavior of the local population;
- Low level of awareness and irrational use of the drinking water such as leaving the water flow from the taps running to cool during the summer, or to avoid freezing of the pipes in winter;
- Irrational use of the drinking water for irrigation of yards and agricultural land.

Some measures might solve the problems:

- Preparation of plan for investment in the water supply system of Municipality of Valandovo;
- Modernization of the water supply network and improvement of the dimensioning and standardization in accordance with the users' needs;
- Regular maintenance of the water supply network;
- Improvement of the system for regulation of the water consumption;
- Conducting appropriate electricity installation to the existing reservoirs;
- Keeping record, regulation of the existing wells and implementation of standards for further drilling of wells for water;
- Finding alternative sources for irrigation of yards such as accumulation of rainwater;
- Raising public awareness about the irrational utilization of the water.

3.0.2 Waste water

In the Municipality of Valandovo, the Utility Enterprise "Communal Service" is responsible for the communal activities. The sewage system covers the city of Valandovo and the villages of Josifovo, Udovo and Pirava with a total sewage network of 20 km. In addition, in the city of Valandovo there is a 1.5 km long storm water drainage network.

There are no pump stations or plants for treatment of the waste water in this system, meaning that the entire system for waste water works based on gravity and the water is being discharged in Anska Reka. For this reason, this section will not be considered in the further analyses.

Sector public lighting

Municipality of Valandovo has public lighting system that covers the city of Valandovo and additional 15 settlements. 90% of the total number of lighting poles is owned by EVN Macedonia while the remaining 10% are owned by the municipality. The payment for street lighting is based on the utility fee for public lighting presented in the electricity bills, while the monthly bills issued by EVN Macedonia are paid from the municipal budget.

The payment for the street lighting is based on a communal tax for public lighting included in the electricity bills of the households and EVN transfers the funds entirely to the municipality. Then EVN issues monthly invoices to the municipality for the consumed electricity for public lighting which is being paid from the municipal budget.

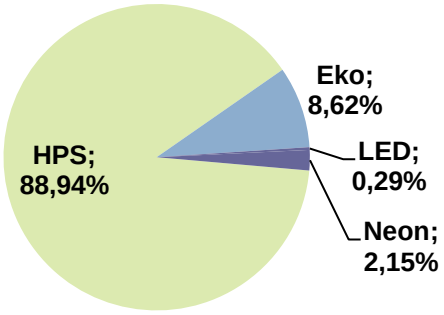
Major reconstruction of the public lighting has been carried out in 2014 which included also obligation for the contractor to maintain the system for the next three years, starting from the date of completion of the works. With this reconstruction, the quality of the lighting regarding area of coverage and intensity can be assessed as satisfactory in accordance with the existing standards for lighting of public spaces. Only the illumination of the promenade “Marshal Tito” was left substandard and its modernization is among the investment priorities of the municipality.

After the expiry of the 3-year warranty, the maintenance and replacement of lamps of the entire public lighting network is handed over to the municipality where a public, lighting monitoring unit operates. The person in charge of this unit has complete inventory of the public lighting and keeps detailed record of the current condition of the lamps per measuring pole, as presented below:

Table 12: Structure of the light sources of the public lighting system in the Municipality of Valandovo, reference year 2018

Type of lighting	Type of poles	Installed power (W)	No. of poles	Total No. of poles	Total installed power (kW)
(HPS) High-pressure sodium lamp	1 lamp/pole	70	1,424	1,424	113.9
	2 lamps/pole	70	48	96	
	1 lamp/pole	150	32	32	
	2 lamps/pole	150	9	18	
Eco lamps	1 lamp/pole	40	176	176	11.04
	2 lamps/pole	40	38	76	
	4 lamps/pole	40	6	24	
LED	1 lamp/pole	5	18	18	0.37
	2 lamps/pole	5	28	56	
HPS	2 lamps/pole	2x36	19	38	2.76
			TOTAL	**1,958**	**128.07**
			Total No. of poles		**1,798**
			No. of burnt lamps		**261**

The figures below present that the mercury halide lamps and the high-pressure mercury lamps represent about 95% of the total no. of lights compared to the installed capacity.



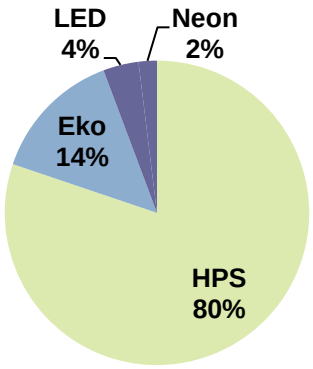


Figure 7: Types of lamps – capacity **Figure 8: Types of lamps – total No.**

The public lighting system does not have automatic control. There is a need for installation of timers as well as regulation of photometric parameters in groups, continuously, with electronic controllers.

Table 13: Overview of illuminated roads

Type of road	Total length of the road (km)	Total illuminated roads (km)	Percentage of illuminated roads (%)
Main streets	19.9	19	95.48
Secondary streets	38.9	38.5	98.97
Regional road	38	9.5	25

Table 14: Illuminated squares

Squares	No.	Area [m^2]	Total area [m^2]

The figure below presents the recorded consumption of electricity for 2016, 2017 and 2018, based on the data provided by EVN.

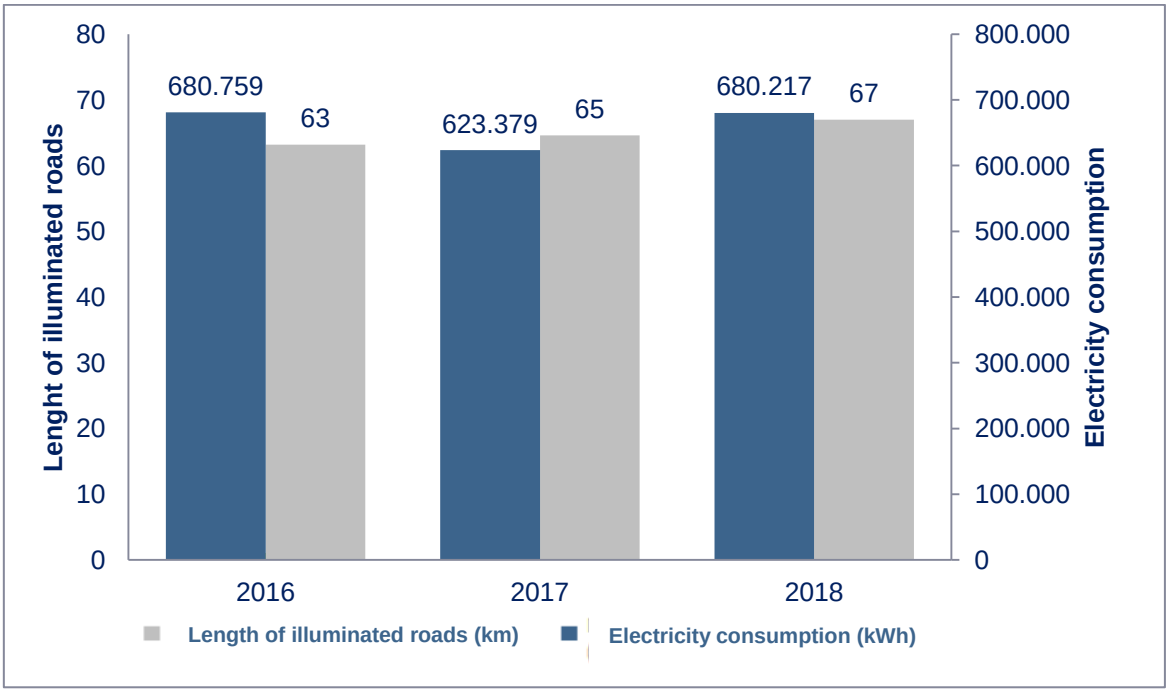


Figure 9: Electricity consumption for public lighting (kWh) and illuminated roads (km)

As presented on Figure 9, the electricity consumption does not show significant changes during the years. Available data show that the public lighting system hasn't been renovated for the past three years that are subject of the analysis; only replacement of burnt lamps has been performed. The length of illuminated roads is also remained unchanged for the past three years.

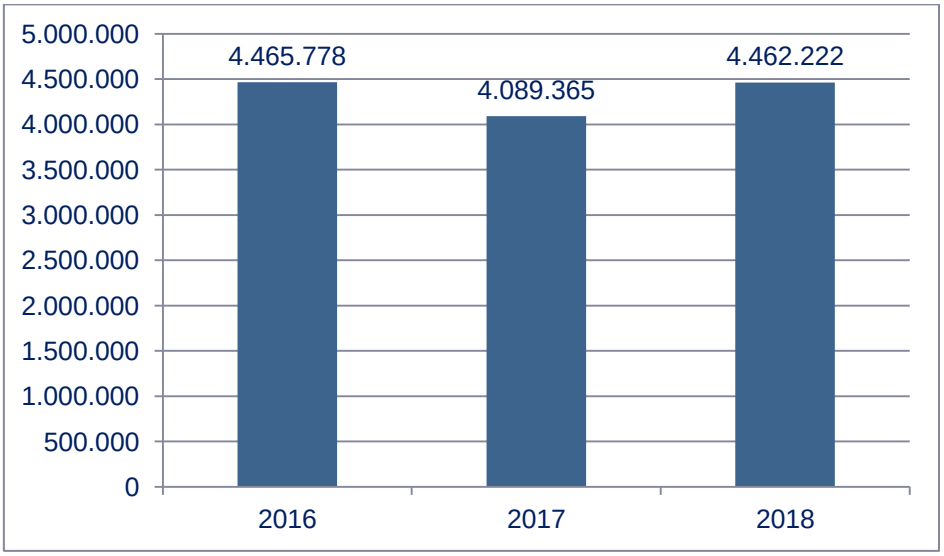


Figure 10: Annual expenses for public lighting **(MKD), 2016-2018**

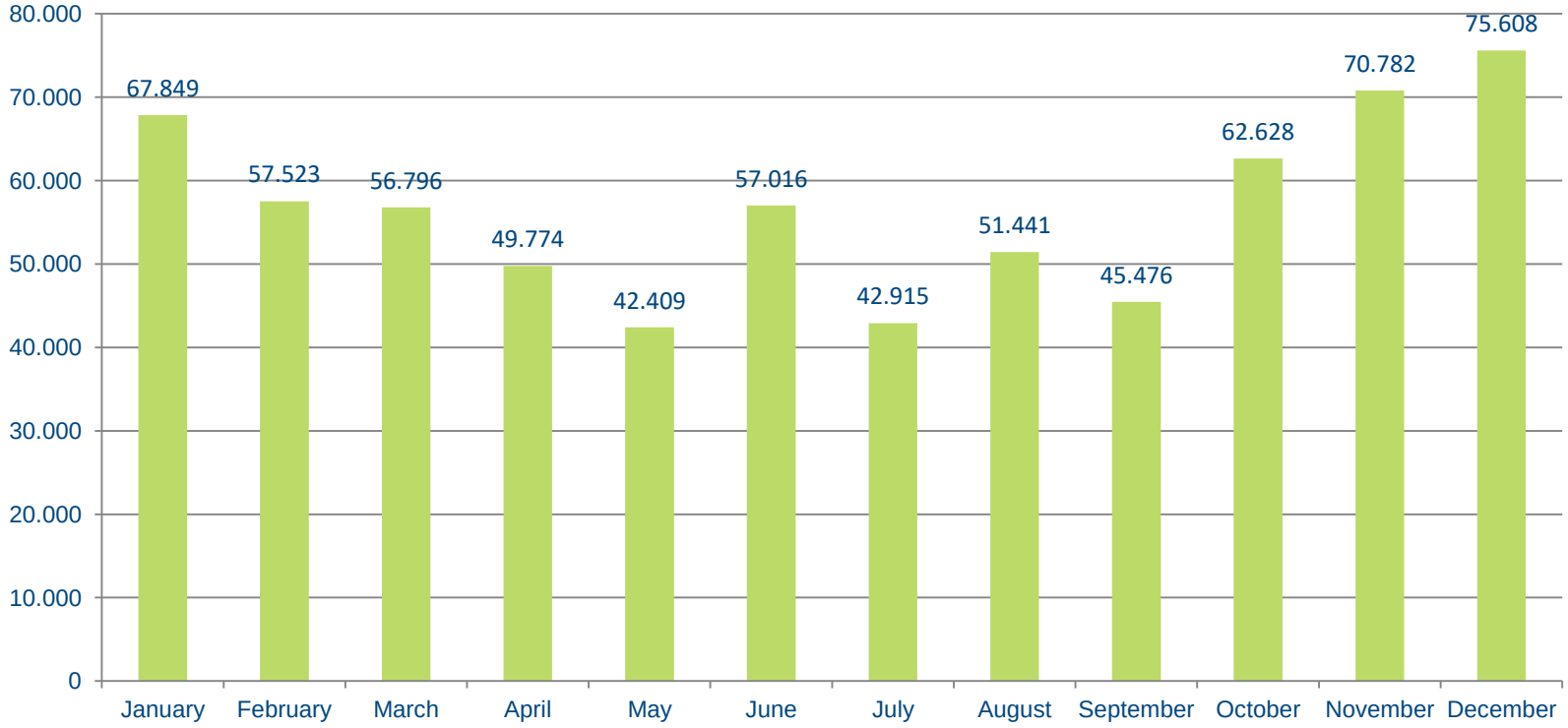


Figure 11: Electricity consumption (kWh) for the reference year 2018

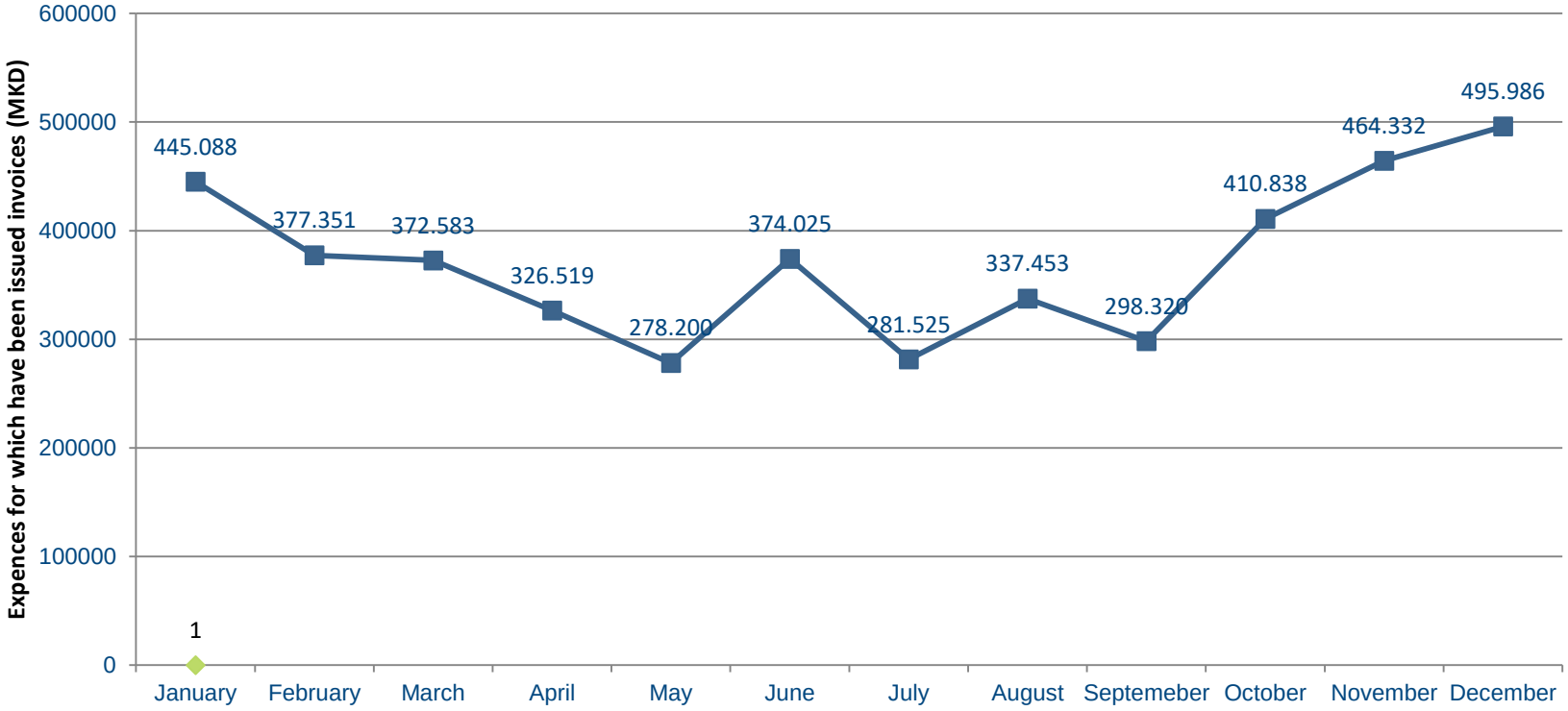


Figure 12: Expenses for electricity (MKD) for lighting for the reference year 2018

Table 15: Annual electricity consumption for public lighting, reference year 2018

System for public lighting	No. of poles for public lighting (pcs)		Total road length (km)		Total length of illumi-nated roads (km)	Electricity consump-tion in public lighting (kWh/a)	Electricity consumption per illuminated pole [kWh/(per pole.a)]	Consumed electricity per km of road [kWh/(km.a)]	% of illuminated city roads (%)
Public lighting in the Municipality of Valandovo	1 lamp/pole	1,650				680,217	378.3	10,152	69.3
	2 lamps/pole	142							
	4 lamps/pole	6							
Total	**1,798**		**96.8**		**67**				

Regardless of the previously conducted reconstruction, and due to the development of new technologies, the change of street lighting is however feasible for the municipality, and with the use of renewable energy sources (for example the square Marshal Tito), the investment costs can be reduced in the development and installation of new network.

Sector municipal buildings

There are two types of municipal buildings listed in the entire inventory:

- Educational facilities
- Administrative buildings

The representatives of the municipality did not provide data related to buildings for social protection, therefore this category has not been included in the analysis.

As part of the educational facilities, there are two central primary schools (CPS), in Valandovo and Josifovo; ten regional schools (RS/RPS) and one high school.

Municipal administrative facilities owned by the municipality include the municipal administrative building and regional center for certification.

Table 16: Overview of municipal buildings

Type of municipal building	Description	No. of users[14]	Total area (m^2)
Educational facilities	- PMS “Strasho Pindzur”“ Josifovo - RS “29 Noemvri“ Kalkovo - RS “Jane Sandanski“ Grchishte - RS „Mito Simeonov“ Marvinci - RPS “Strasho Pindzur“ Udovo	350 49 7 30 67	2,300 191 216 333 573
	SMS “Goce Delchev“ Valandovo	258	3,400
	PMS “Josip Broz Tito” Valandovo	470	7,535
	- RS “Goce Delchev” Pirava	136	1,095
	- RS “Dame Gruev“ Brajkovci	40	323
	- RPS “Ham’k Kemal“ Chalakli	73	494
	- RS “Jeni Gjun“ Bashibos	9	153
	- RS “Mosha Pijade“ Dedeli	21	311
	- RS „Cvetan Dimov“ Kazandol	19	124
Social protection facilities	/	/	/
Municipal administrative facilities	Municipal building	34	607
	Regional center for certification		230
	TOTAL	**1,563**	**17,885**

The table below presents the energy consumption and the energy expenses for energy for each building separately.

[14] No. of users represents the total number of users of the facility. For example, for school it represents the total number of students and personnel of the institution.

Table 17: Annual consumption of energy in the municipal buildings

End user	No. of users	Total area of the building m^2	Total heated area m^2	Consump-tion of electricity kWh/a	Consump-tion of energy for heating kWh/a	Total energy consump-tion kWh/a	Specific electricity consump-tion kWh/(m^2.a)	Specific consump-tion of energy for heating kWh/(m^2.a)	Specific energy consump-tion kWh/(m^2.a)	Expenses for energy MKD/a	Expenses for energy as % of the municipal budget[15] %
Educational facilities											
- PMS “Strasho Pindzur”“ Josifovo	350	2,300	2,300	31,372	125,023	156,395	14	54	68	571,559	
- RS “29 Noemvri“ Kalkovo	49	191	191	2,773	30,240	33,013	15	158	173	83,706	
- RS “Jane Sandanski“ Grchishte	7	216	191	627	26,880	27,507	3	141	144	58,532	
- RS „Mito Simeonov“ Marvinci	30	333	333	875	30,240	31,115	3	91	93	67,317	
- RPS “Strasho Pindzur“ Udovo	67	573	573	3,809	50,400	54,209	7	88	95	132,493	
SMS “Goce Delchev“ Valandovo	258	3,400	3,400	31,832	194,000	225,832	9	57	66	1,160,748	
PMS “Josip Broz Tito” Valandovo	470	7,535	7,535	38,146	225,041	263,187	5.1	29.9	34.9	1,035,688	
- RS “Goce Delchev” Pirava	136	1,095	1,095	8,214	75,014	83,228	8	69	76	310,932	
- RS “Dame Gruev“ Brajkovci	40	323	323	1,300	28,002	29,302	4	87	91	102,960	

[15] Calculated using relation between the total energy consumption in the municipality divided with the municipal budget for the current year.

End user	No. of users	Total area of the building m^2	Total heated area m^2	Consump-tion of electricity kWh/a	Consump-tion of energy for heating kWh/a	Total energy consump-tion kWh/a	Specific electricity consump-tion kWh/(m^2.a)	Specific consump-tion of energy for heating kWh/(m^2.a)	Specific energy consump-tion kWh/(m^2.a)	Expenses for energy MKD/a	Expenses for energy as % of the municipal budget[15] %
- RPS “Ham’k Kemal“ Chalakli	73	494	494	3,173	57,120	60,293	6	116	122	140,282	
- RS “Jeni Gjun“ Bashibos	9	153	153	391	10,080	10,471	3	66	68	23,291	
- RS “Mosha Pijade“ Dedeli	21	311	311	1,959	16,800	18,759	6	54	60	49,419	
- RS „Cvetan Dimov“ Kazandol	19	124	124	259	16,800	17,059	2	135	138	35,436	
Total educational facilities	**1,529**	**17,048**	**17,023**	**124,729**	**885,639**	**1,010,368**	**7.3**	**52**	**59.4**	**3,772,363**	**5.6**
Social protection facilities											
Municipal administrative facilities											
Municipal building	34	607	607	54,047		54,047	89		89	568,809	
Regional center for certification		230	230	2,566		2,566	11		11	27,010	
Total municipal facilities	**34**	**837**	**837**	**56,613**		**56,613**	**67.6**		**67.6**	**595,819**	**0.9**
TOTAL	**1,563**	**17,885**	**17,860**	**181,342**	**885,639**	**1,066,981**	**10.2**	**49.6**	**59.7**	**4,368,182**	**6.5**

Overview of the energy consumption

After a separate analysis of this sector was carried out, an overall overview of energy consumption and the related expenses has been provided in Table 18. This information leads to the conclusion that the sector municipal building is the largest energy consumer with total of 1,066,981 kWh/a. The water sector is second largest consumer of energy with 833,292 kWh/a. (for the reference year 2018) and the sector public lighting which has the lowest rate of energy consumption with 680,217 kWh/a. The sector water and public lighting consume only electricity and the sector municipal buildings, beside electricity consume also heating oil, firewood and pellets.

The analysis of the energy expenses shows that the sector public lighting participates with a largest share in the total expenses of the municipality for energy, with almost 39.5 %, and the sectors municipal buildings and water participate with about 38.6% and 21.9%, accordingly. The total energy consumption is about 8.9% of the municipal budget for 2018[16]. Currently, the city authorities do not have a detailed breakdown of their energy expenses.

When considering only the sector municipal buildings, the largest energy consumers are the educational facilities. Municipal administration buildings account for less than 5.6% of the total energy consumption of the educational buildings.

As part of the priority tasks of the Municipality is development of the gas network with emphasis on the preparation of a strategic study at the level of the Municipality due to the dependence of this fuel on its use. It is essential for the Municipality to cover the gas network of industrial sections, large consumers at the municipality level, as well as the residential sector. Due to the insufficient capacity of the Municipality to produce technical documentation for this type of projects, any assistance from the central government along with education is crucial.

[16] These costs include only the expenses for energy of the municipality. The overview of the total expenses presented in Table 18, includes also the expenses for the water sector covered by the PE “Communal Service”.

Table 18: Annual consumption of energy and expenses per sectors

Sector	Electricity consumption [kWh/a]	Consumption of energy for heating					Total energy consumption kWh/a	Expenses for electricity MKD/a	Expenses for other sources of energy MKD/a	Total expenses for energy[17] MKD/a
		Heavy oil [kWh/a]	Extra light oil kWh/a	Fire-wood kWh/a	Wood pellets kWh/a	Total for other sources of energy kWh/a				
Water sector										
Drinking water	530,117	/	/	/	/	/	530,117	2,919,120	/	2,919,120
Public lighting sector										
	680,217	/	/	/	/	/	680,217	4,462,222	/	4,462,222
Municipal buildings sector										
Educational facilities	124,729	/	619,077	238,560	28,002	885,639	1,010,368	1,037,963	2,734,400	3,772,363
Social care facilities										
Municipal administrative facilities	56,613	/	/	/	/	/	56,613	595,819	/	595,819
Total for the sector municipal building	**181,342**		**619,077**	**238,560**	**28,002**	**885,639**	**1,066,981**	**1,633,782**	**2,734,400**	**4,368,182**
TOTAL	**1,391,676**	**885,639**					**2,277,315**	**9,015,124**	**2,734,400**	**11,749,524**

[17] Including VAT of 18%

Table 19: **Expenses per source of energy in the sector municipal buildings**

Expenses for electricity	Expenses for heating					Total expenses for energy
	Heavy oil	Extra light oil	Firewood	Electricity	Total for all sources of energy except of electricity	
[MKD/a]	[MKD/a]	[MKD/a]	[MKD/a]	[MKD/a]	[MKD/a]	[MKD/a]
1,633,782	/	2,160,000	471,440	102,960	2,734,400	4,368,182
37.4%		49.5%	10.8%	2.3	62.6%	100.0%

4 ENVIRONMENTAL IMPACT – GREENHOUSE GAS EMMISSIONS

The impact on the environment is mainly specified by greenhouse gas emissions, such as CO_2. Table 20 shows that each sector is a high CO_2 emitter, especially the municipal buildings and street lighting sector. Investing in energy efficiency measures can significantly reduce CO_2 emissions and contribute to the environmental protection.

Table 20: Total annual energy consumption and CO_2 emissions per energy source and sector

Source of energy	Emission factors[18] kg CO_2/kWh$_{eq}$	Conversion factors	Water sector		Public lighting sector		Municipal buildings sector	
			Energy consumption kWh/a	CO_2 emissions kg CO_2/a	Energy consumption kWh/a	CO_2 emissions kg CO_2/a	Energy consumption kWh/a	CO_2 emissions kg CO_2/a
Electricity	0.915	2.5	530,117	1,212,643	680,217	1,555,996	181,342	414,820
Extra light oil	0.267	1.138					619,077	188,104
Firewood	0 (0.403)[19]	1					238,560	96,140
Pellets	0.0344	0.123					28,002	119
TOTAL			**833,292**	**1,212,643**	**680,217**	**1,555,996**	**1,066,981**	**699,183**

[18] Source: "Rulebook for energy audit", Official Gazette No. 94 from 04.07.2013. In force from 12.07.2013.

[19] 0 kg CO_2 / kWh is the value declared in the Rulebook for energy audit. Comparison to "Guidelines for IPCC, 2006, National inventory of greenhouse gas emissions, book 2: Energy" shows value of 0,403 kg CO_2 / kWh for wood / wood residues.

5 COMPARISON OF SECTOR INDICATORS WITH APPROVED REFERENCE VALUES

Comparison with a reference value (Benchmark) is a process that compares particular city with other cities at same or similar level throughout the world. In order to determine the energy efficiency, potential criteria have been set for each sector. During the determination of the relevant standards, several alternative criteria for provision of reference values have been reviewed:

- Cities that belong to the first quarter of the TRACE list are considered to have very high standards for the Republic of North Macedonia. It would impose too ambitious goals for energy efficiency for the Macedonian municipalities which due the lack of funds and lack of local service providers wouldn't be achievable.
- Cities with similar size as Municipality of Valandovo have several weaknesses. Demographic size of the smallest city in the TRACE database is of about 200.000 inhabitants, which is far above the population of Valandovo. The 10 smallest cities range from 198.000 to 523.000 inhabitants and are quite expanded geographically, so their indicators significantly vary. In addition, some of the cities haven't declared all indicators which reduce the size of the sample and makes the use of the average meaningless.
- Selection of cities only in the region represents an approach based on a sample of the following cities: Belgrade (Serbia); Prishtina (Kosovo); Sarajevo (Bosnia and Herzegovina); Skopje (Macedonia) and Gaziantap (Turkey). Although these municipalities are far larger then Valandovo, we believe that they represent more relevant reference values since they are reflecting goals that have been achieved in the region.

The selected approach includes finding of average of the selected indicators on the basis of existing values in the TRACE database. While using the reference values from TRACE, it is assumed that they haven't been normalized and that they do not consider the level of the service. The TRACE guidelines do not mention the issue related to the normalization of the reference values and the level of service provided. Furthermore, while inserting data in TRACE the municipalities do not make difference between normalized or non-normalized data and do not pay any attention at the level of service. For that reason the data we have used for the TRACE in order to conduct the comparison, have not been normalized.

Especially for the buildings, before entering the data in TRACE, normalization of the consumption has been performed.

For the municipal building we used the data for basic consumption of energy in NPEEPB[20] for Macedonia. The reference values for residential buildings from the "Rulebook for energy performances of building" were used for private buildings. For particular situations in the industry sector average values for consumption from the ODYSSEE-MURE project were used.[21]

Reference values are provided not only for the sectors analyzed in the current EEP, but also for the other sectors in case they are analyzed in the next version of the EEP.

[20] "National Program for Energy Efficiency in Public Buildings in the Republic of Macedonia, 2012-2018. Last Draft Program". Consortium led by ENSI consultant company for energy saving (Energy Saving International AS), January 2012, prepared for the Ministry of Economy, as part of the Project for Sustainable Energy GEF.

[21] http://www.odyssee-mure.eu/project.html

Table 21: Criteria (benchmarks) for various sectors

Sector	Unit	Benchmark criteria	Source	Valandovo data
Transport			TRACE	
Energy consumption in public sector[22]	MJ/passenger km	0.30		N/A
Water			TRACE	
Drinking water density[23]	kWh/m^3	0.777		0.62
Percentage of water that is not being charged [24]	%	53.8		10
Density of wastewater during purification treatment[25]	kWh/(m^3.a)	0.101		N/A
Public lighting			TRACE	
Electricity consumed per pole[26]	kWh/pole	838.5		378.32
Electricity consumed per km from city roads[27]	kWh/km	37,803.5		10,152.5
Percentage of illuminated city roads[28]	%	62.5		69.21
Municipal buildings			Basic energy consumption in NPEEPB for Macedonia	
Educational Specific heating energy consumption	kWhe/(m^2.a)	175		52.0
Educational Specific electricity consumption	kWh/(m^2.a)	27		7.3
Social care Specific heating energy consumption	kWhe/(m^2.a)	185		N/A
Social care Specific electricity consumption	kWh/(m^2.a)	44		N/A
Administration Specific heating energy consumption	kWhe/(m^2.a)	190		0
Administration Specific electricity consumption	kWh/(m^2.a)	51		67.6
Private buildings				
Minimum class for new residential buildings C	kWh/(m^2.a)	≤100	Rulebook for energy performance of buildings [29]	N/A

[22] The criterion is the average calculated from the values for Belgrade, Pristina, Sarajevo and Skopje.
[23] The criterion is the average calculated from the values for Belgrade, Prishtina and Sarajevo.
[24] The criterion is the average calculated from the values for Belgrade, Prishtina and Sarajevo.
[25] The criterion is the average calculated from the values for Belgrade, Banja Luka and Gaziantep.
[26] The criterion is the average calculated from the values for Belgrade, Prishtina and Skopje.
[27] The criterion is the average calculated from the values for Belgrade, Prishtina, Sarajevo and Skopje.
[28] The criterion is the average calculated from the values for Belgrade, Prishtina, Sarajevo and Skopje.
[29] "Rulebook for energy performance of buildings", Official Gazette No. 94 from 4 July, 2013

Sector	Unit	Benchmark criteria	Source	Valandovo data
Minimum class for reconstructed residential buildings D	kWh/(m2.a)	≤150	Rulebook for energy performance of buildings	N/A
Waste			TRACE	
Waste per inhabitant [30]	kg/inhabitant	360.6		N/A
Energy and heat			TRACE	
Percentage of heat losses from the network [31]	%	22.3		N/A
Industry			ODYSSEE-MURE project[32]	
Unit of raw steel consumption	toe/t	0.318		N/A
Unit of cement consumption	toe/t	0.078		N/A
Unit of paper consumption	toe/t	0.376		N/A

The data presented from Figure 13 to Figure 17 show a wider range of reference values for the sectors public lighting, water and buildings from series of cities that have been subject of TRACE analysis. These data shall complement the process of receiving reference values, as presented above, for provision of more indicative and more global overview of the results from the cities for various indicators. For each of the numbers, the entire name of the city used for the comparison, is given in the footnote.

[30] The criterion is the average calculated from the values for Belgrade, Ljubljana, Prishtina, Sofia and Skopje.
[31] The criterion is the average calculated from the values for Prishtina, Belgrade, Sarajevo, Ljubljana and Skopje.
[32] The indicated values for individual consumption refer to the average values of EY 2000-2012

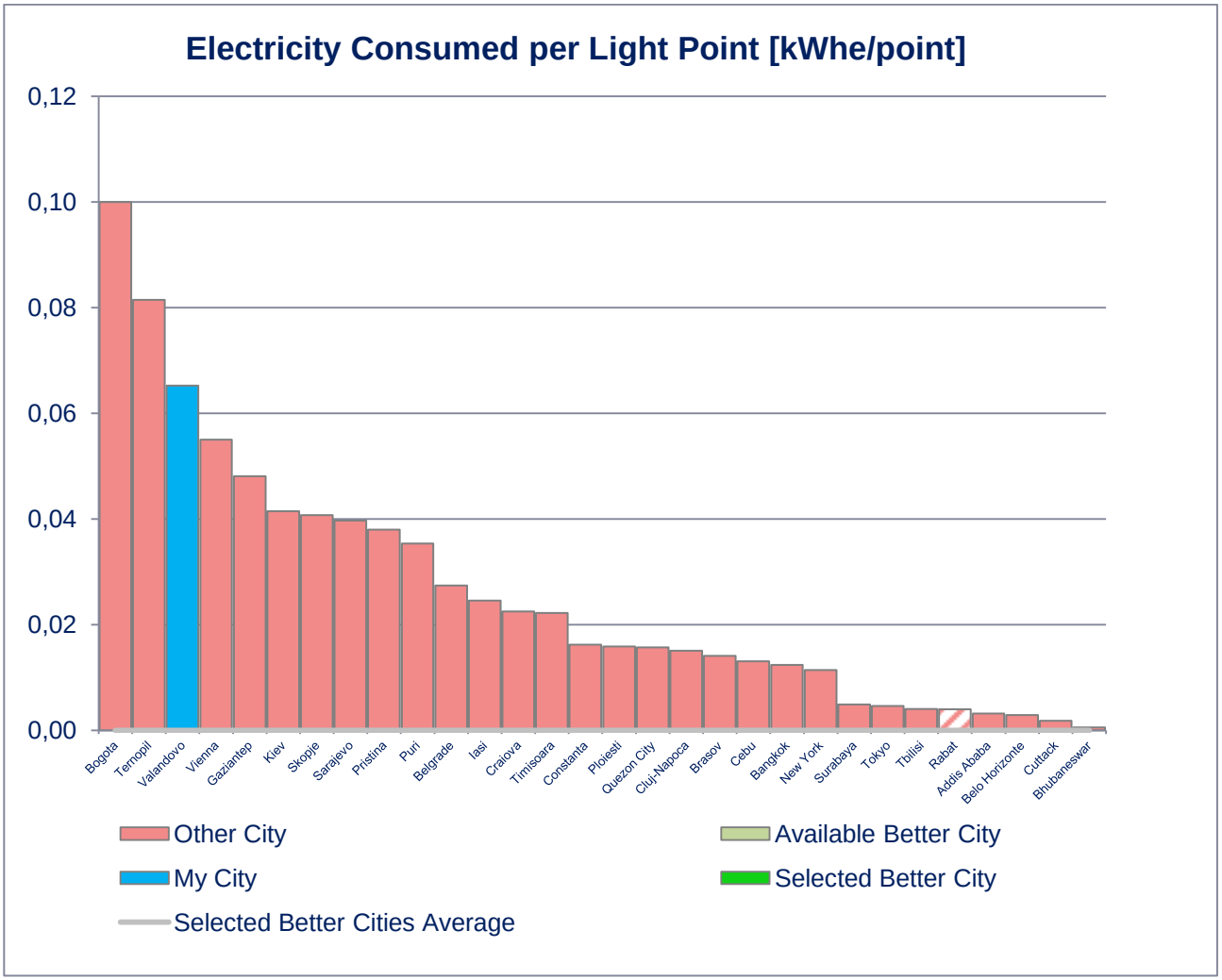


Figure 13: Electricity consumed per lighting pole, TRACE database

From a total of 96 cities (in the TRACE database presented on Figure 13), for the indicators “consumed electricity per lighting pole” form the sector public lighting, Valandovo with its 378.32 kWhe/pole is positioned at the lower half, between Tokyo and Karakas.

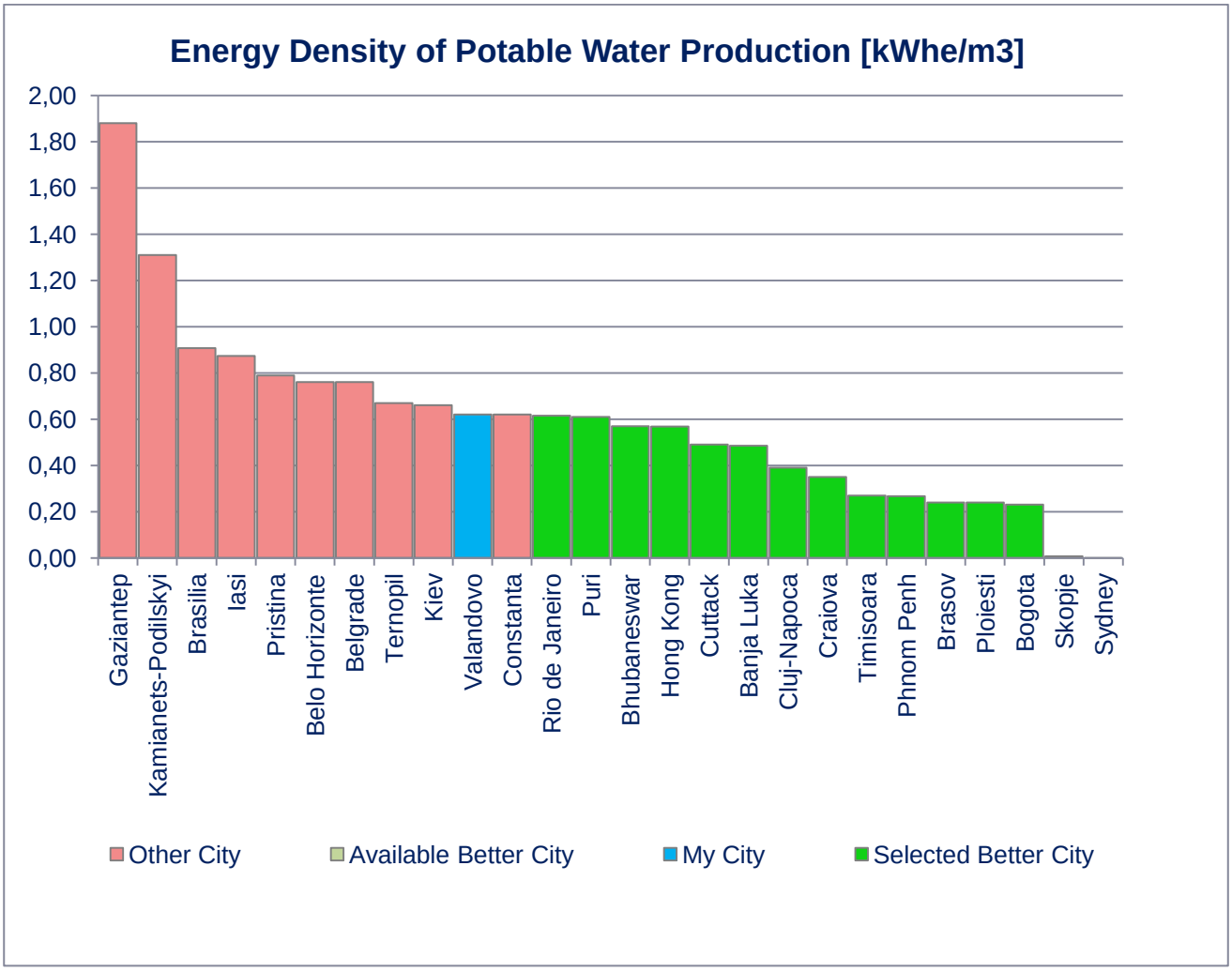


Figure 14: Specific energy consumption for drinking water, TRACE database

Regarding the "Specific energy consumption of drinking water" indicator from the water sector, according to the TRACE database Valandovo with 0,62 kWhe/m^3 is positioned in the middle third of the 26 cities, between Kiev and Constanta.

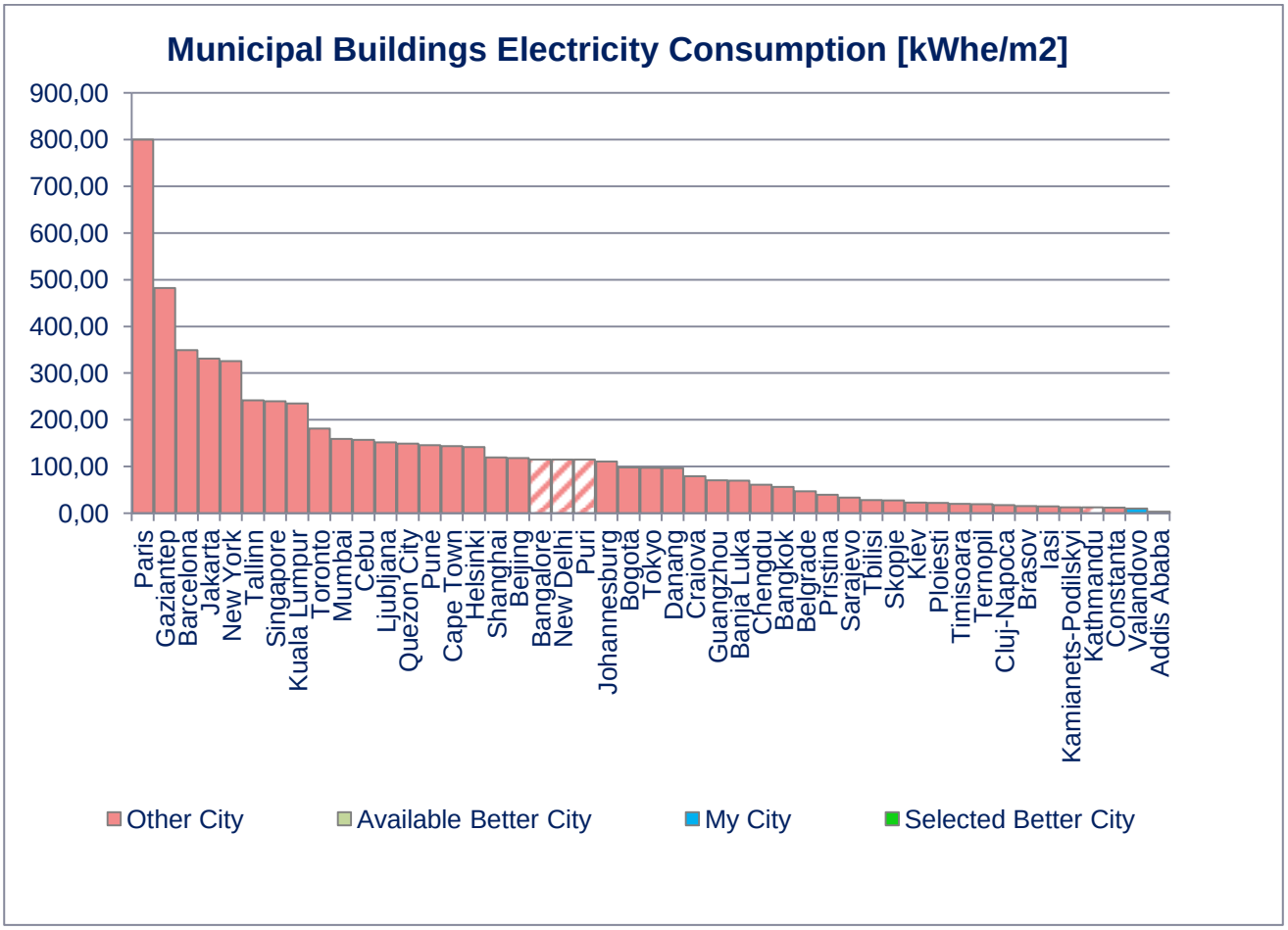


Figure 15: Electricity consumption in the sector municipal buildings, TRACE database

The electricity consumption indicator for municipal buildings sector in Valandovo (Figure 15) is 10.2 kWh/m^2.a which represents one of the best energy performance values compared to the benchmark data given in the database. The only city with better performances is the city of Addis Ababa.

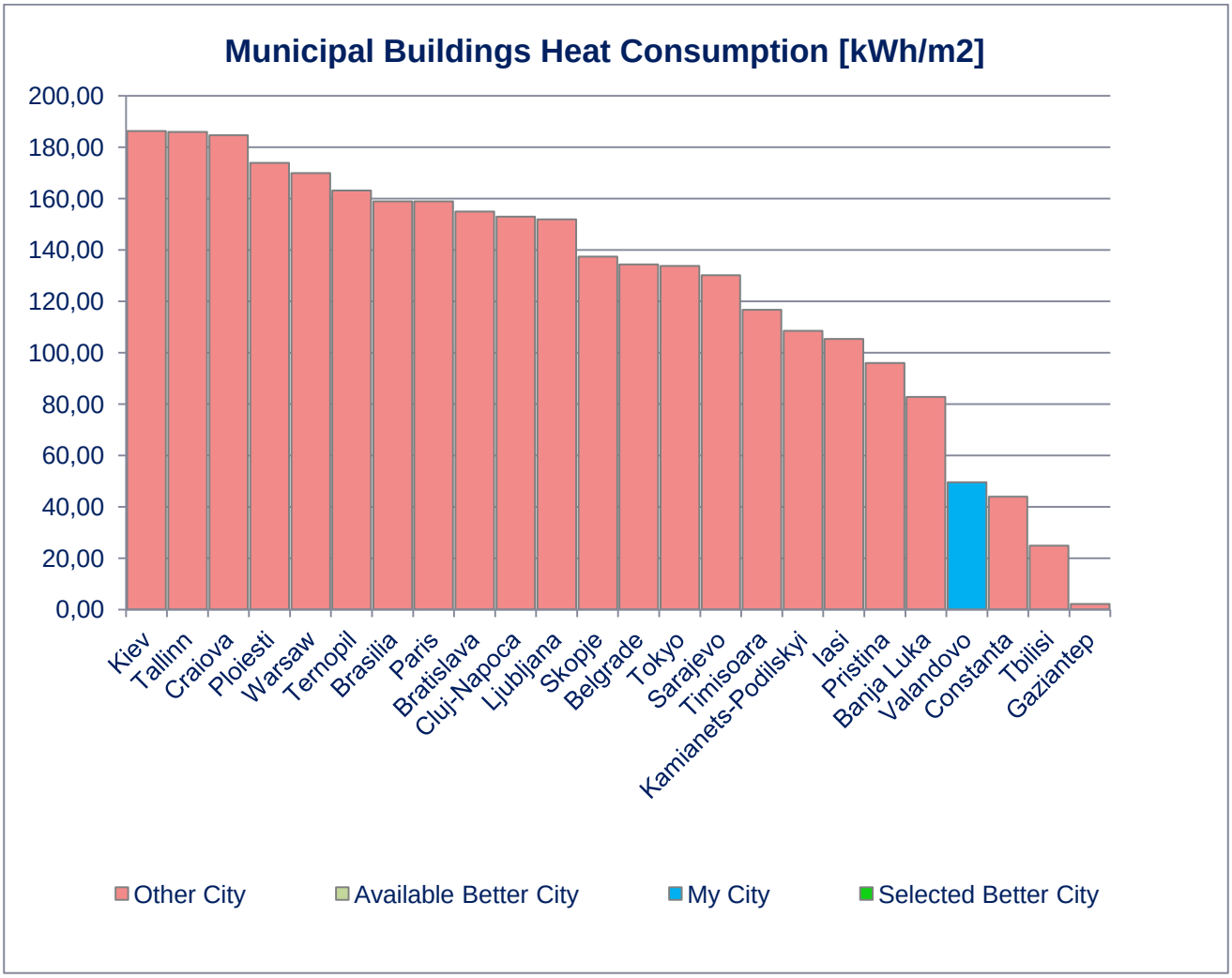


Figure 16: Heating energy consumption in the sector municipal buildings, TRACE database

Comparison of municipal buildings with indicator for heating energy consumption which for Valandovo is 49.6 kWh/m^2.a (Figure 16), results in the positioning of the Municipality of Valandovo in the group of cities with the best energy performance, right after Banja Luka and Constanta.

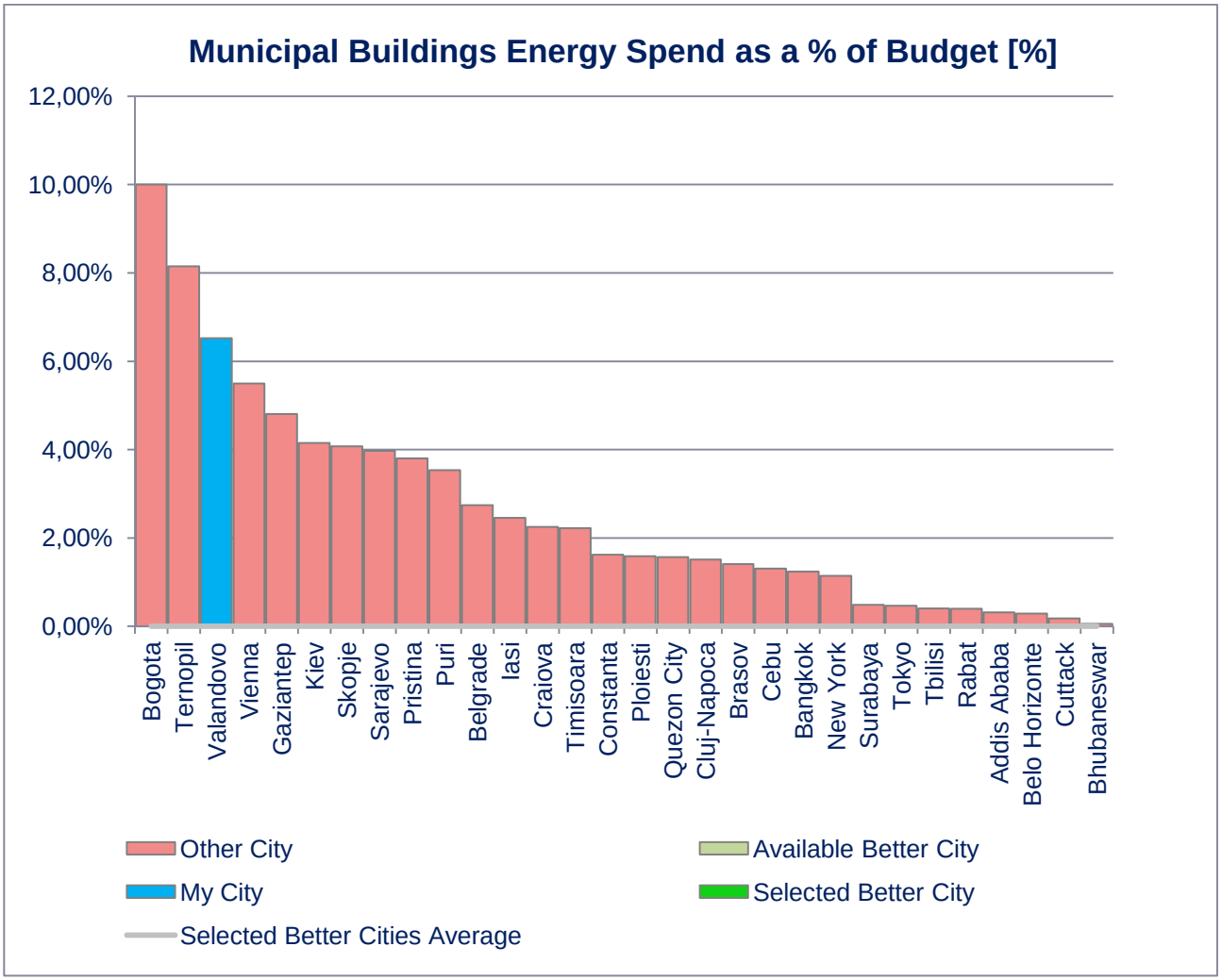


Figure 17: Energy expenses in the sector municipal buildings as **% of the municipal budget, TRACE database**

The comparison of the sector municipal buildings for the indicator “energy expenses as % of the municipal budget” is positioning Municipality of Valandovo among the 3 cities with highest reference values, right after Ternopil and Vienna with a value of 6.52 %.

ENERGY EFFICIENCY POLICIES AND PROJECTS

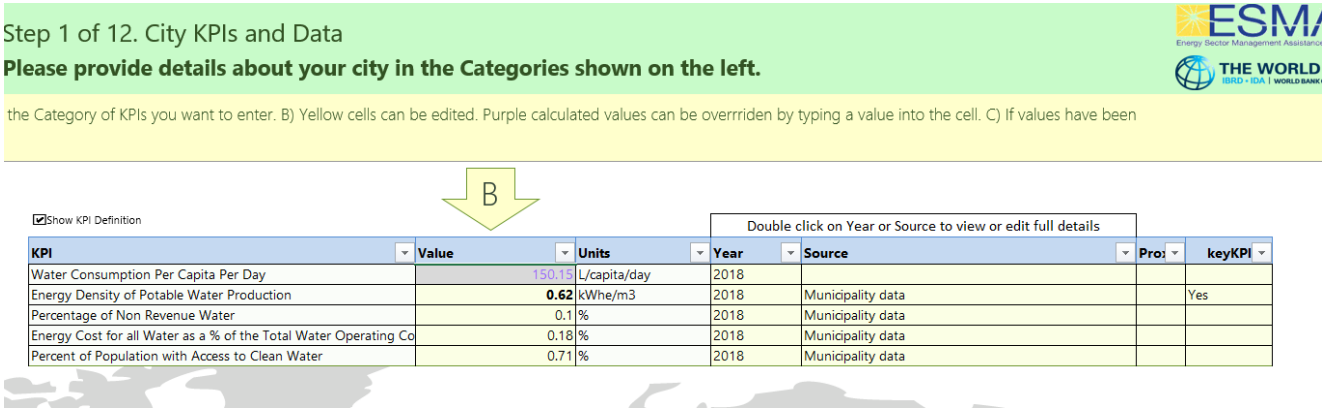
Relevant energy efficiency policies and projects for the Municipality of Valandovo are defined with the utilization of the TRACE tool, developed by ESMAP (World Bank). Prioritization of the analyzed sectors and defining of recommendations/projects for energy efficiency is being performed.

Sector prioritization

In the process of sector prioritization, while entering the data in the "TRACE" tool, for each sector that has already been identified in the part 2.2, the following three segments are analyzed:

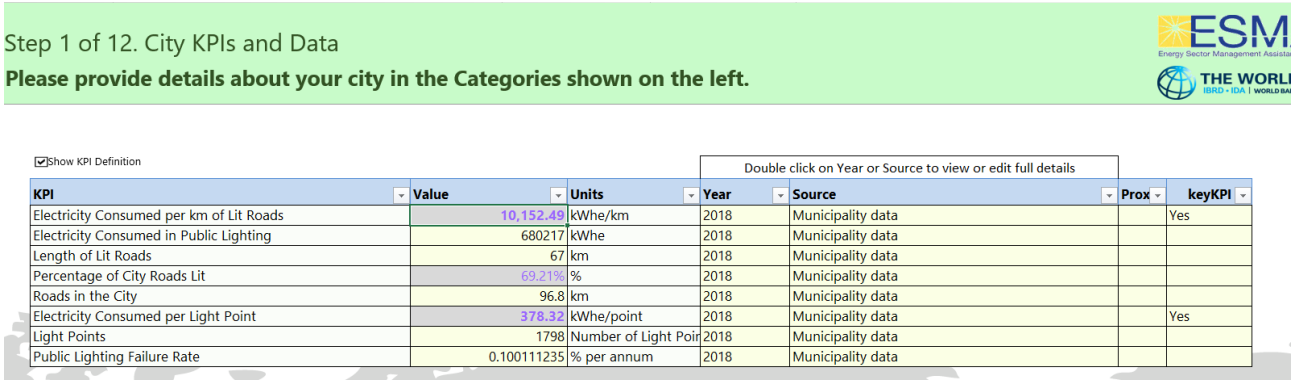
> Energy savings based on the comparison with selected and appropriate cities
> Energy consumption per sectors
> Municipal control

First, the data for the selected sectors from Table 18 are inserted into the Module for comparison (benchmarking) of the energy from the "TRACE" tool, as presented on the following three figures.



KPI	Value	Units	Year	Source	Pro:	keyKPI
Water Consumption Per Capita Per Day	150.15	L/capita/day	2018			
Energy Density of Potable Water Production	**0.62**	kWhe/m3	2018	Municipality data		Yes
Percentage of Non Revenue Water	0.1	%	2018	Municipality data		
Energy Cost for all Water as a % of the Total Water Operating Co	0.18	%	2018	Municipality data		
Percent of Population with Access to Clean Water	0.71	%	2018	Municipality data		

Figure 18: Data for water sector



KPI	Value	Units	Year	Source	Prox	keyKPI
Electricity Consumed per km of Lit Roads	10,152.49	kWhe/km	2018	Municipality data		Yes
Electricity Consumed in Public Lighting	680217	kWhe	2018	Municipality data		
Length of Lit Roads	67	km	2018	Municipality data		
Percentage of City Roads Lit	69.21%	%	2018	Municipality data		
Roads in the City	96.8	km	2018	Municipality data		
Electricity Consumed per Light Point	378.32	kWhe/point	2018	Municipality data		Yes
Light Points	1798	Number of Light Poir	2018	Municipality data		
Public Lighting Failure Rate	0.100111235	% per annum	2018	Municipality data		

Figure 19: Data for the sector public lighting

Step 1 of 12. City KPIs and Data

Please provide details about your city in the Categories shown on the left.

Show KPI Definition

Double click on Year or Source to view or edit full details

KPI	Value	Units	Year	Source	Pro:	keyKPI
Municipal Buildings Electricity Consumption	10.15	kWhe/m2	2018			Yes
Municipal Building Electricity Consumption	181342	kWhe	2018	Municipality data		
Municipal Buildings Area	17860	m2	2018	Municipality data		
Municipal Buildings Energy Spend as a % of Budget	6.52%	%	2018			
Energy Spend	79421.49091	$	2018	Municipality data		
Municipal Budget	1217727.273	$	2018	Municipality data		
Municipal Buildings Heat Consumption	49.59	kWh/m2	2018			
Municipal Building Heat Consumption	885639	kWhe	2018	Municipality data		

Figure 20: Data for the sector municipal buildings

After the insertion of these data in the module for comparison with reference values, the predefined potential for energy savings in the first phase of the sector prioritization can be determined in accordance with performed benchmarking with other cities. The city's energy savings value is being calculated with the TRACE tool as average of the values of all selected appropriate cities with better performances, as presented in the following figure.

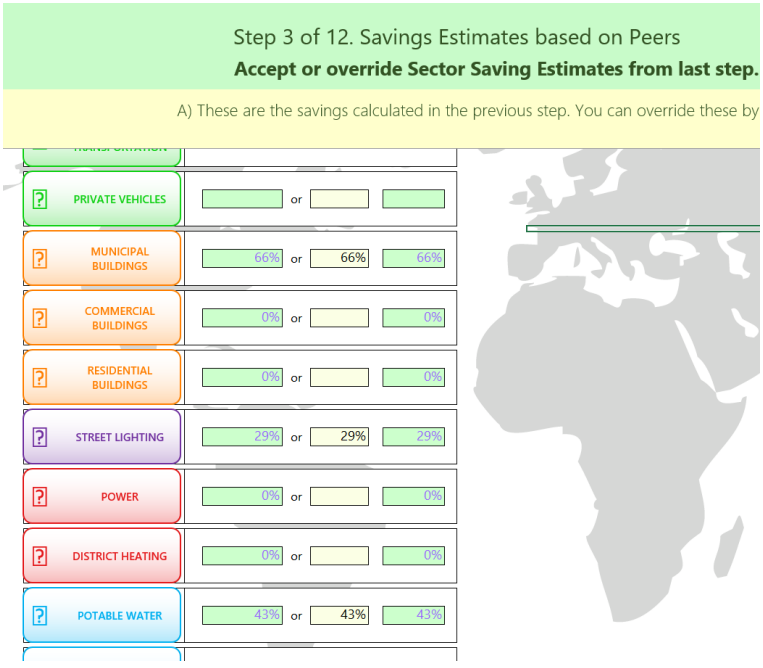


Figure 21: Output of energy savings based on comparison with selected appropriate cities

The second phase of prioritization of the sectors is presentation of the expenses for energy for each analyzed sector as shown on Figure 22.

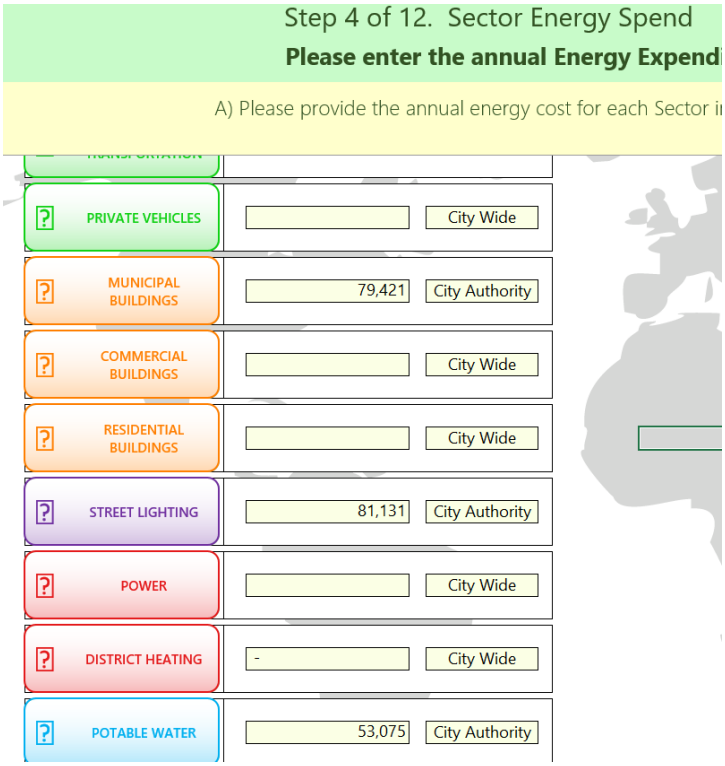


Figure 22: Input data on energy expenses per sectors in USD

Regarding municipal control, Municipality of Valandovo has the overall financial control over service provision, procurement of means and infrastructure development for all three selected sectors.

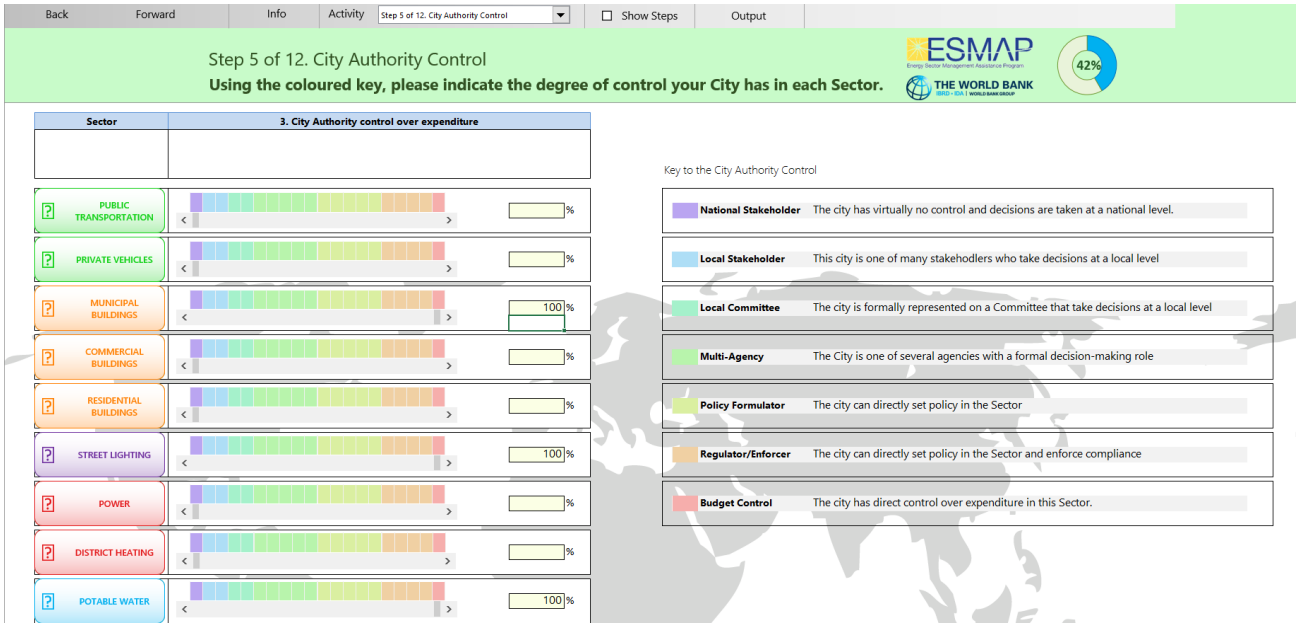


Figure 23: Input data regarding the level of municipal control per sectors

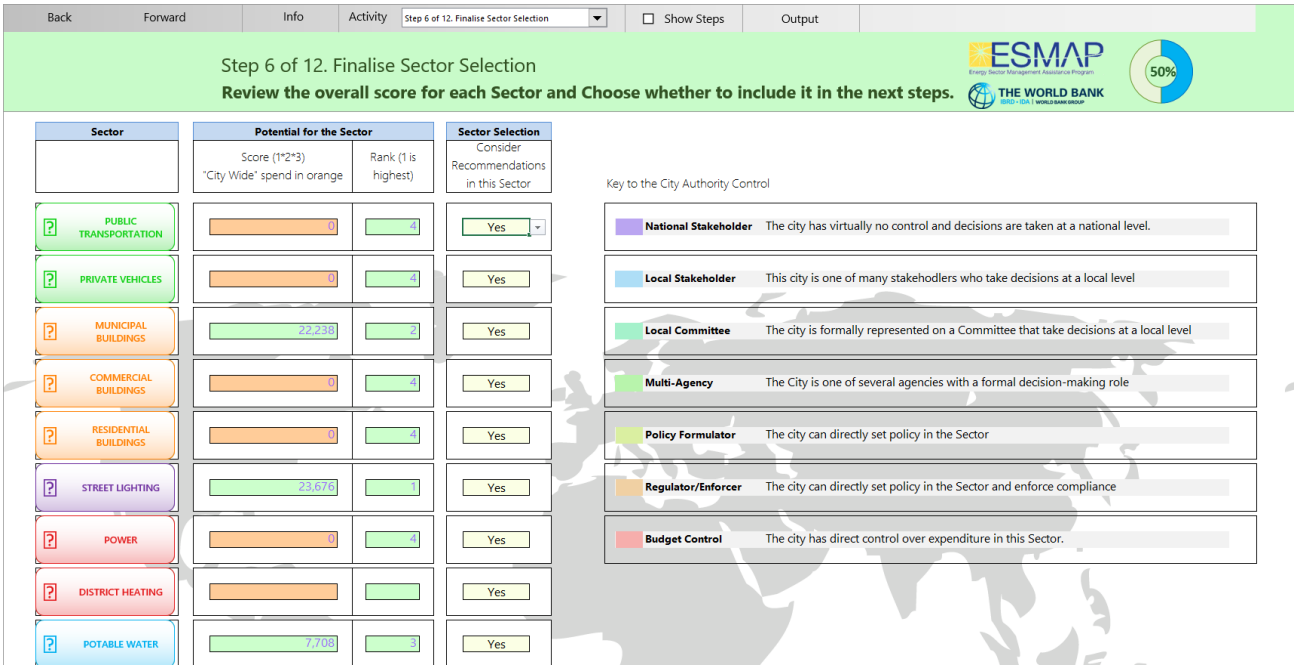


Figure 24: Sectors prioritization

Based on the input data, the sector public lighting is ranked as top priority sector by the TRACE tool. The sector municipal buildings is ranked as second in this prioritization, while the water sector i third.

Selection of projects/priorities

After the selection of the priority sector, the TRACE tool suggests set of recommendations for energy efficiency. Each recommendation is being revised in order to establish its applicability for the Municipality of Valandovo. This initial evaluation process is necessary to focus on the recommendations that are technically and financially sustainable.

6.1.1 Street lighting

Regarding the public lighting, initial assessment related to five separate segments has been carried out, where the level of competence/EE possibility is rated as Low (L), Medium (M) or High (H).

Table 22: Table of initial assessment

Segment	Level of competence/EE possibility	Description
Finances	MEDIUM	The city has experience with: public private partnership, other sources of funding such as grants, soft loans and commercial financing.
Human resources	MEDIUM	The city authority has access to highly trained/qualified individual to lead the initiative and / or available mid-size workforce. The staff can be trained/the workforce to be expanded as part of the city authority.

Data and information	MEDIUM	There are reliable and accurate record data. This may be developed as part of the recommendation.
Policies, regulation and support	LOW	The city authorities have limited capacity to regulate the public lighting at local level. No or limited standards for public lighting. The execution is weak.
Ownership and infrastructure	MEDIUM	The city authorities own/maintain part or entire infrastructure for public lighting. They have prepared feasibility studies for energy efficiency in the past. It is planned to renovate and expand the street lighting network.

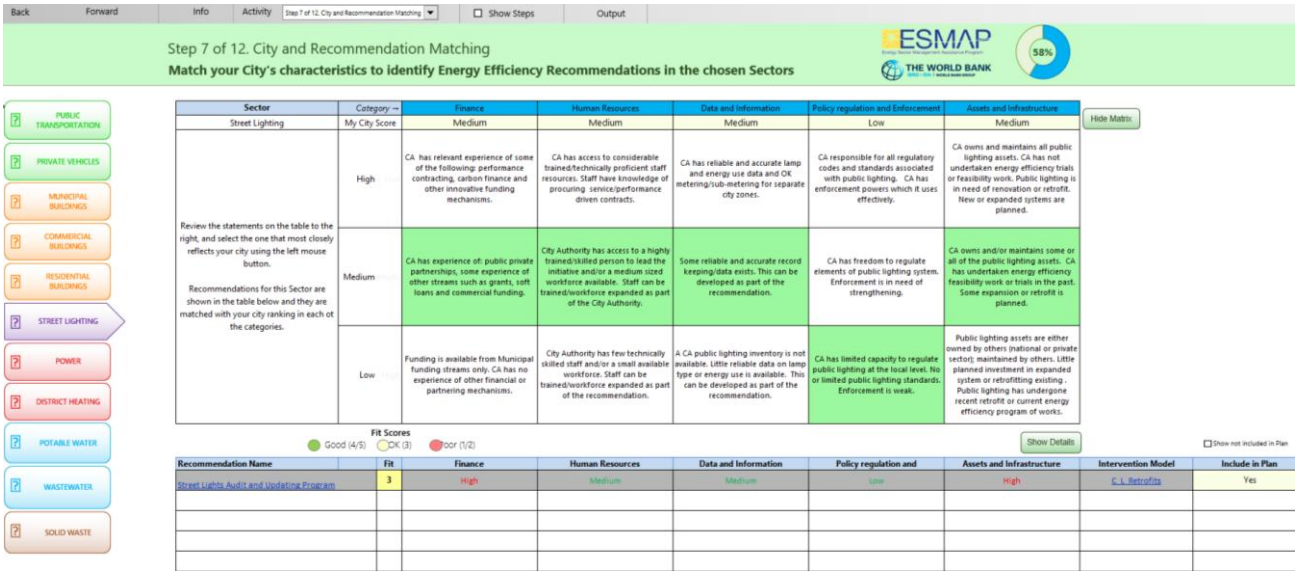


Figure 25: Initial assessment of recommendations

As most relevant recommendation for the public lighting sector regarding the improvement of the energy efficiency and according to the input data provided in the TRACE tool, is the following:

› **Complete street lighting restoration program**

The most dominant light source in the Municipality of Valandovo is high-pressure sodium (HPS) lamps. This technology together with the high-pressure mercury (HPM) lamps are considered outdated and in accordance with the Regulation 245/2009 should be discarded and should not be available in the future. New lighting technologies may considerably increase the efficiency of lighting and have longer lifetime. The aim of this recommendation is assessment of the current efficiency of lighting and implementation of upgrade where needed.

Modernization may deliver the same levels of illumination with lower energy consumption, thereby decreasing the greenhouse gas emissions and operation costs. The extended lifetime decreases the needs and the expenses for maintenance as well as the disruptions in operation, thus improving public health and safety.

This project would include three sub-projects:

- “Integrated program for assessment of the public lighting” to audit the existing inventory, as well as assessment of the operational activities and activities for maintenance which will assist in identifying appropriate measures for significant increase of the energy efficiency.
- “Guidelines for procurement of new street lamps” that can be used while replacement of broken lamps. It shall also include data on the minimum light-technical characteristics that must be met when purchasing new lamps.
- “Modernization of the street lighting” where physical replacement of the existing lamps with new EE lamps will be performed.

To estimate the potential savings related to the "Street Lighting Audit and Modernization Program", the next step is to calculate the expected energy savings in a separate TRACE Energy Saving Assessment table and their input data. Based on the current situation, several scenarios were considered, and the most appropriate solution was selected for implementation. Others were rejected as a result of the costs and the investment payback period. Given the current situation, replacement of the existing (high-pressure sodium) lamps with new LED lamps is a solution with significant savings as shown in the figure below:

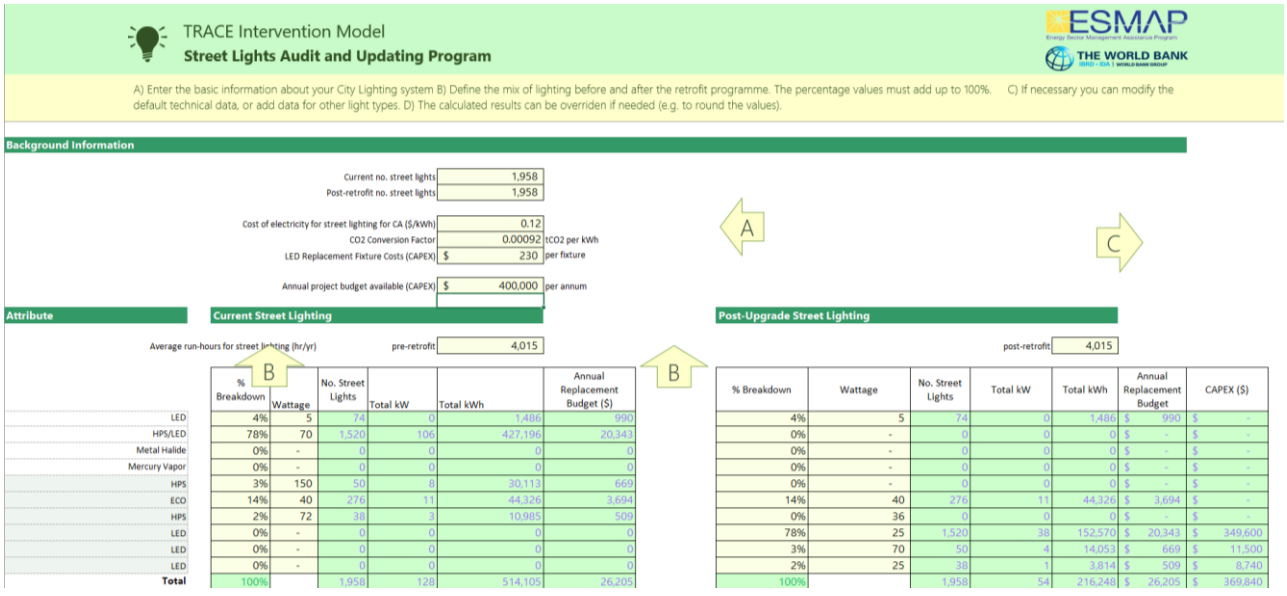


Figure 26: Upgrade of the system for public lighting

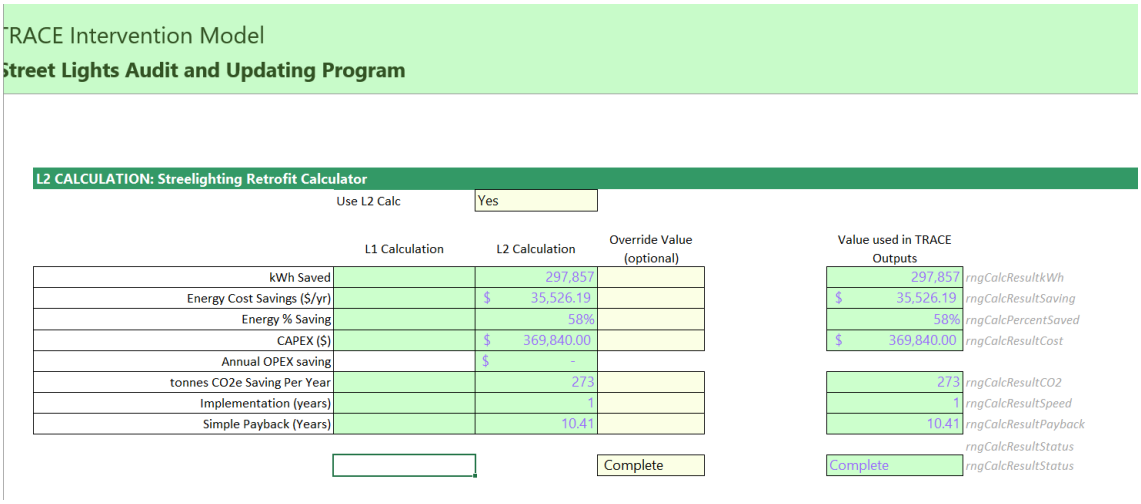
The selected scenario includes replacement of the following items:

› Existing 1,520 high-pressure sodium lamps (HPS), 70W each, with 1,520 new LED lamps, 25 W each

› Existing 50 high-pressure sodium (HPS) lamps, 150 W each, with 50 new LED lamps, 70 W each;

› Existing 275 ECO high-pressure lamps, 40W each – will not be changed;

› Existing 74 LED lamps, 5 W each – will not be changed.



TRACE Intervention Model

Street Lights Audit and Updating Program

L2 CALCULATION: Streelighting Retrofit Calculator

Use L2 Calc: Yes

	L1 Calculation	L2 Calculation	Override Value (optional)	Value used in TRACE Outputs	
kWh Saved		297,857		297,857	rngCalcResultkWh
Energy Cost Savings ($/yr)		$ 35,526.19		$ 35,526.19	rngCalcResultSaving
Energy % Saving		58%		58%	rngCalcPercentSaved
CAPEX ($)		$ 369,840.00		$ 369,840.00	rngCalcResultCost
Annual OPEX saving		$ -			
tonnes CO2e Saving Per Year		273		273	rngCalcResultCO2
Implementation (years)		1		1	rngCalcResultSpeed
Simple Payback (Years)		10.41		10.41	rngCalcResultPayback
					rngCalcResultStatus
			Complete	Complete	rngCalcResultStatus

Figure 27: Assessment of energy savings – street lighting

Energy efficiency indicators for the conducted calculation with the TRACE tool are summarized on Figure 27. By using this tool, and taking into consideration the information provided by an expert from the municipality related to the working hours (11 hours a day, 365 day of the year) and the submitted lamp inventory, the initially calculated current energy consumption is 514,105 kWh/a. It differs from the adopted reference consumption provided in the electricity bills, which for 2018 is equal to 680,217 kWh/a. The difference is due to the simplified calculation performed by TRACE which takes into account only the power of the lamps, without considering the lamp ballasts. The total saving is expressed in relation to the reference value as starting energy consumption and the energy consumption after the reconstruction which would be equal to 216,248 kW/a, or the saving will be 463,969 kWh/a.

Table 23: List of projects for EE selected for the Energy Efficiency Program

Sector	Energy efficiency project	Initial (preliminary) investment [MKD]	Energy savings potential (kWh/a)	Energy savings potential (МКД/a)	CO_2 emissions reduction (Tons of CO_2)	Payback period (years)	Implementation period (years)
Public lighting	Complete Program for revitalization of the street lighting [33] [34]	20.34 million	463,969	3.04 million	426.9	6.7	1

[33] These are strictly project-oriented assessments made by the municipal EE Team

[34] Includes components from all four TRACE recommendation – assessment, audit, renovation, duration and procurement

6.1.2 Municipal buildings

Although the municipal buildings sector is not considered a priority in accordance with the TRACE principles and methodology for prioritization, it will be subject to analysis due to the fact that it has significant share in the total energy costs.

There are two different types of municipal buildings in the Municipality of Valandovo: educational and municipal administrative buildings. Within this sector, further ranking of facilities was carried out, based on the specific energy consumption in kWh/m^2 for each building.

Table 24: Table of initial assessment – municipal buildings

Department	Level of competency / possibility for energy efficiency	Description
Finances	MEDIUM	City authority has experience with: public private partnership, experience with other funding such as grants, soft loans and commercial financing.
Human resources	LOW	City authority has limited technically qualified personnel and / or available workforce. The personnel may be trained/workforce may be expanded as part of the recommendation.
Data and information	MEDIUM	There are some relevant and accurate data about the communal service bills, but they are not being collected on regular basis or do not correspond clearly at all to the particular buildings.
Policies, regulation and implementation	MEDIUM	City authority has the freedom to regulate elements of construction activity. Implementation is in need of strengthening.
Available assets and infrastructure	MEDIUM	City authorities own or maintain some or all of the building assets. City authorities have undertaken the feasibility studies for energy efficiency in the past. Renovations and few new buildings are planned.

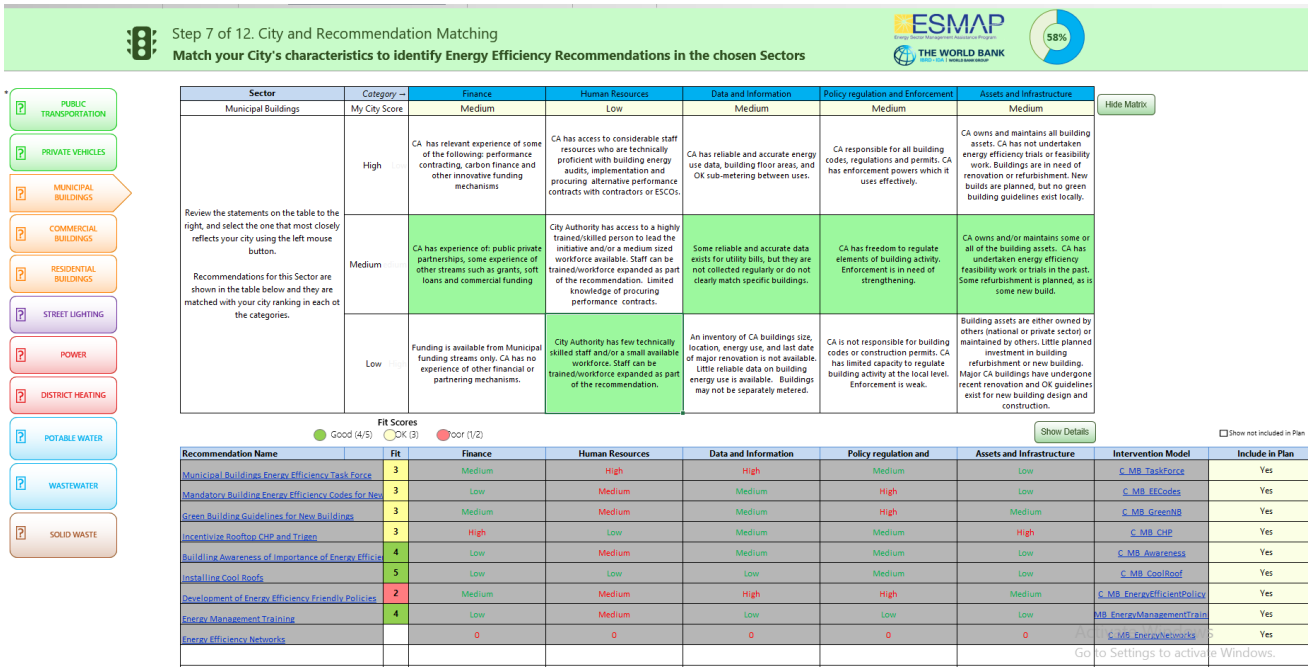


Figure 28: Initial assessment of recommendationsи

The following recommendations shall be considered by the city authorities as suggested:

- **Establishment of Energy Efficiency Team at municipal level.** Valandovo has 15 municipal buildings for which monitoring of the energy consumption and all actual energy efficiency programs is required, as well as provision of implementation of programs for reconstructions and upward extension.
- **Audits for the municipal administrative buildings and Program for reconstruction.** Development of the Program for reconstruction aimed at research and implementation of possibilities for modernization of the energy efficiency and upgrade. The benefits of this Program are the costs savings for the municipality and reduction of the carbon dioxide. The Program will identify possibilities for savings, as well as for fast payback of the investments that can be further used for other municipal services.
- **Program for reconstruction and audit of the municipal schools.** Development of Program for modernization and audit of all municipal schools in order to enable examination of the possibilities for additional modernization and upgrade. The benefits of this Program are decreased operational costs (lower bills for electricity and heating) and improved visual and thermal comfort that will improve the learning abilities of the students. After the execution of the benchmark Program, identification of the school program and setting the available budget are performed, a detail audit of the energy shall be conducted to identify the possibility for energy efficiency in the schools. By preparing these audits, total energy savings can be obtained for each proposed EE measure.
- **Program for solar hot water.** This Program refers to installation of solar systems for hot water on the roofs of residential or other municipal buildings aimed at decreasing the demand for electric water heaters and fossil fuel boilers. This project will be considered as part of other

EE projects, but only for municipal buildings. Residential buildings are not included in this EEP. Furthermore, the Rulebook on energy performance of buildings[35], article 26, paragraphs (1) and (2) obliges municipalities to install hot water solar collectors, whenever possible while constructing new or conducting significant reconstruction of existing public buildings.

- **Program for municipal buildings benchmarking.** Development of benchmarking (criteria based) Program for the municipal buildings that collects and generates reports on annual basis about the utilization of energy, electricity bills, utilization of water and related bills, floor areas and names of the managers of the buildings (if applicable). The aim of the Program is to identify the most energy intensive buildings in the portfolio of the city authorities, in order to enable focusing of the best energy efficiency opportunities.
- After the development of the benchmark Program, identification of the school program and setting out the available budget, a detailed feasibility study shall be carried out to identify the specific possibilities for energy efficiency in the municipal buildings. By preparing these studies, total energy savings can be obtained for each proposed EE measure.

Table 25: Prioritization of buildings in the sector municipal buildings

	Final user	No. of users	Total area of the building m^2	Total heated area kWh/a	Total energy consumption kWh/a	Specific energy consumption kWh/(m^2a)	Energy costs MKD/a
1	- RS "29 November Kalkovo	49	191	191	33,013	172.8	83,706
2	- RS "jane Sandanski" Grchishte	7	216	191	27,507	144.0	58,532
3	- RS "Cvetan Dimov" Kazandol	19	124	124	17,059	137.6	35,436
4	- RPS "Ham'k Kemal" Chalakli	73	494	494	60,293	122.1	140,282
5	- RPS "Strasho Pindzur" Udovo	67	573	573	54,209	94.6	132,493
6	- RS "Mito Simeonov" Marvinci	30	333	333	31,115	93.4	67,317
7	- RS "Dame Gruev" Brajkovci	40	323	323	29,302	90.7	102,960
8	Municipal building	34	607	607	54,047	89.0	568,809
9	- RS "Goce Delchev" Pirava	136	1,095	1,095	83,228	76.0	310,932

[35] Rulebook on energy performance of buildings (Official Gazette of the Republic of Macedonia, No. 94/13)

	Final user	No. of users	Total area of the building m^2	Total heated area kWh/a	Total energy consumption kWh/a	Specific energy consumption kWh/(m^2a)	Energy costs MKD/a
10	- RS “Jeni Gjun” Bashibos	9	153	153	10,471	68.4	23,291
11	- PMS “Strasho Pindzur” Josifovo	350	2,300	2,300	156,395	68.0	571,559
12	SMS “Goce Delchev” Valandovo	258	3,400	3,400	225,832	66.4	1,160,748
13	- RS “Mosha Pijade” Dedeli	21	311	311	18,759	60.3	49,419
14	PMS „Josip Broz Tito” Valandovo	470	7,535	7,535	263,187	34.9	1,035,688
15	Regional center for certification		230	230	2,566	11.2	27,010

The sector municipal buildings is being analyzed as sector of a secondary priority. The municipality shall be capable to implement the key priorities in its three-annual EEP (street lighting) in a shorter period of time. Table 25 above provides relevant data for the municipal buildings. These will be evaluated in more details as soon as the Project for rehabilitation of the street lighting is completed.

OBJECTIVES TO BE ACHIEVED WITH THE IMPLEMENTATION OF THE ENERGY EFFICIENCY MEASURES

In this chapter, the municipality shall indicate the percentages obtained by the various selected energy efficiency projects included in the total energy savings in the priority sector. The TRACE tool suggests utilization of the calculator for assessment of the energy savings, as part of the methodology for priority selection. By using this tool, calculations can be made to assess the energy savings.

Table 26: Annual energy savings

Project No.	Project for energy efficiency	Total energy consumption before the EE measures (kWh/a)	Total energy consumption after the EE measures (kWh/a)	Expected energy savings		Total energy savings (%)
				(kWh/a)	(ktoe*/a)	
Water sector						
	N/A					
Public lighting sector						
1	Complete program for revitalization of the street lighting	680,217[36]	216,248	463,969	0.04	68.2
Buildings sector - municipal buildings						
	N/A					

* 1 toe = 41.868 GJ = 11630 kWh

Following the introduction of energy savings at municipal level, these values shall be compared to the national energy efficiency targets provided in Appendix I. The savings achieved by the municipalities that have implemented energy efficiency projects of the Energy Efficiency Program will contribute to the reaching the country's obligations as set with the National Energy Efficiency Action Plans.

[36] This number of 680,217 kWh/a (reference consumption for 2018) differs from the value of the calculated consumption given on Figure 26 of 514,105 kWh/a, since it doesn't include the consumption related to the lamp ballasts.

FINANCIAL SOURCES FOR IMPLEMENTATION OF THE ENERGY EFFICIENCY PROGRAM

In this chapter, the municipality evaluates the available financial sources and the amount that can be obtained for financing the investments in energy efficiency for the next three years.

The municipality shall distinguish the following:

- Basic financing: capability of the municipality to finance projects for energy efficiency by using its own budget;
- Additional conditional capabilities for financing: its capability to use additional finds (loans) for financing projects for energy efficiency;
- Extended capabilities for financing: its capability to provide additional financing using innovative methods, such as public – private partnership, ESCo partnerships, concessions, taxations, green bonds, etc.

These sources of funding shall correspond to the priority sectors, projects and measures from the Energy Efficiency Program (EEP) in order to identify profitable priorities, unlike of those that are not, for the next three-annual period of the Energy Efficiency Program.

Municipality of Valandovo is able to obtain access to various sources of funding that although limited, have a potential to be used for the realization of the investments in energy efficiency. In principle, the municipality has access to the following sources of funding:

- Tax revenues - from state and local taxes;
- Non-tax revenues - from local taxes, fines and charges;
- Capital revenues - sale of municipal property (assets);
- Transfers and donations from the state budget and various donators;
- Borrowing - from international and local creditors;
- Teaming up with private partners.

Some of these revenues are aimed for various expenses, and some might be used for various purposes which are on the municipality to decide. Since this is first Energy Efficiency Program (EEP) of the Municipality of Valandovo, the municipality hasn't synchronized the plan for the current budget (for 2020) with the energy efficiency goals proposed with this Program. For that reason, audit of the budget for 2020 was executed in order to identify:

- Unallocated funding that can be used for priority energy efficiency investments;
- Allocated capital or other costs that may also be related to the energy efficiency measures and activities.

These are presented in the sub-sections below.

Basic capacity for funding

This refers to the ability of the municipality to allocate energy efficiency investment funds from its own budget.

8.0.1 Basic capacity for funding

A quick overview of the budget for 2020 provides information that some expenses might be safely reallocated for EE investments within the areas that are currently included in the budget

Several categories of expenses are marked and accordingly presented in the Table 27 below.

- **PROGRAM FOR PUBLIC LIGHTING – current operating costs.** Costs for public lighting **(MKD 7 million)** - This category includes several types of costs related to the operation and maintenance of the public lighting in the Municipality of Valandovo. There are 3 (three) expenditure sub-accounts as follows: (421) electricity charge, (423) procurement of public lighting network maintenance materials and (424) public lighting network maintenance.
- **ACCOUNT 421** – expenditures account for covering costs for electricity for public lighting **(MKD 5 million).** These funds are intended for payment of electricity bills for the street lighting system. These expenditures include the cost of New Year's decoration which in 2018 was 590,000 denars. Although these are currently operating costs and not investment costs, some assets may be reallocated to supplement investment funds. This will be possible since, once the energy efficiency project in street lighting is implemented - the savings will have a direct impact on energy costs. Therefore, the savings from the first year can be reallocated from the energy costs category to the investments category (dedicated to this project).
- **ACCOUNT 423** – material and accessories – expenditures account for procurement of material, replacement of burnt lamps and other equipment **(MKD 800.000).**
- **ACCOUNT 424** – Repairs and ongoing maintenance - expenditures account intended for maintenance of the street lighting network **(MKD 1,200,000).** Similar to 421, funds intended to replace burnt lamps can be used for purchasing more efficient lamps. In addition, some of the resources typically used to maintain and replace other equipment (such as relays, control panels, etc.) can be reallocated for energy efficiency measures in the system. The Action Plan for the first year of the Energy Efficiency Program should provide more details. It is reasonable to expect that up to 10% of these costs can be reallocated to EE investments **(700,000 denars)**.
- **ACCOUNT 733** – sale of municipal material and non-material assets **(MKD 8.106.000).** These are revenues from the sale of municipal land and buildings, as well as from the sale of various rights (such as services – right for utilization) to private investors. Usually these revenues are not intended for a particular sector. Most often, they are allocated to the **PROGRAM G1** - support for local economic development. Some of these funds can be reallocated to the priority sectors of the Energy Efficiency Program. It can be expected that the allocation of 5% **(MKD 405,300)** for EE should not have a major impact on the municipality's budget. However, for such cases, the Mayor needs to receive approval from the Municipal Council.

The analytical codes (JA, J3) and the appropriate sub-categories of expenses (421, 424, 482, etc.) refer to the same expenditure categories in the municipal budget.

The table below quantifies these categories of expenses.

Table 27: Basic capacity for financing by the municipality

Budget item	2015 TOTAL MKD million
Funds that can be used for investments in energy efficiency – from the source	
1. Code J3 - public lighting expenses	0.7
2. Code 733 - sale of municipal tangible and intangible assets	0.405
Gross basic capacity for financing (1+2):	**1.105**
Planned higher priorities for non-EE investments	
5. ex., disaster management	-
6. ex., infrastructure	-
7. ex., urgent repair	-
Total priority of investments (5+6+7):	**-**
Net basic capacity for financing of EE:	

Municipality has highlighted a number of high priority investments (see Table 6, Table 7 and Table 8). However, funding for most of them has already been allocated (not included in the core funding capacity). Therefore, we believe that the entire amount could be potentially used to implement measures for energy efficiency (subject of approval by the Municipal Council).

Additional (conditional) financial capacity

The additional financial capacity refers to the ability of the municipality to attract additional (external) funding in the form of grants and debts. It depends on certain number of factors, such as:

- Ability of the municipal administration to prepare projects that fulfill the conditions of the granting programs that are currently active in the Republic of North Macedonia, or to proactively reach donators and develop adjusted projects/programs for which a grant is approved.
- Ability of the municipality to conduct tenders for public procurement for selection of financing institutions that will secure the financing of the debt.
- Debt limitations of the municipality, as defined by Law (for example, annual loan repayments should be less than 25% of the municipality's budget)

8.1.1 Grant financing

Currently, the municipality does not have access to funding, nor has explored the possibilities to join various EE grant programs.

8.1.2 Debt financing

In accordance with the current legislation, the municipality can borrow up to 100% of the size of the previous year's municipal budget, while maintaining the annual repayments of credit below 15% of the previous year's municipal budget.

Currently, a financier with mostly attractive financing terms is the Municipal Improvement Project (MSIP), implemented by the Ministry of Finance (MoF). MSIP Component A provides low-interest investment loans for the eligible municipalities "... *Investments that will be funded under this component would be mainly for generating revenue for public services or other investment projects with a potential for costs savings and projects that are of high priority to municipalities …"* The program foresees loans of up to 13 years with a 5 year grace period, with a price of 6-month EURIBOR.

The eligibility criteria are as follows:

- Municipalities need approval by the Ministry of Finance for the second phase of decentralization;
- Municipalities must meet the legal requirements for borrowing in accordance with the national legislation;
- Additional criteria, promoting basic transparency and responsibility:
  - Municipalities must have IBNET data delivery
  - Municipalities must publish the annual budget and audit reports (their (i) annual planned and implemented budget, and (ii) the latest available internal results and / or external audit on their municipal websites;
- Municipalities have established a feedback mechanism (for ex. municipal website, public relations center and / or a feedback box.

Until now, the Municipality of Valandovo has not used loans and there is a possibility to use long-term borrowing as defined by the Law on the Financing of Local Self-Government Units, in the area of long-term borrowing. In accordance with this Law, Municipality of Valandovo has a possibility for a long-term loan of MKD 54.687.141 and the annual repayment annuity (the basic amount and the interest not to exceed 30% of the total revenues of the current operating budget for the previous fiscal year, which is USD 16,406,224).

Table 28: Capacity for debt financing of the municipality

Number of inhabitants in the Municipality of Valandovo		**11.890**
Tax revenues per capita (for the current year)	21.795.000	1.833,05
Non-tax revenues per capita (for the current year)	14.184.000	119,29
Capital revenues per capita (for the current year)	8.106.000	681,75
Revenues from transfers and donations revenues per capita (for the current year)	89.818.000	7.554,08

71	TAX REVENUES	19.922.866
72	NON-TAX REVENUES	7.843.188
731	SALES OF CAPITAL ASSESTS	6.937.524
731120	REVENUES FROM SALES OF CAPITAL ASSETS THAT ARE MUNICIPAL INCOME	0
733	SALES OF LAND AND NON-MATERIAL INVESTMENTS	6.937.542
741115	DOTATIONS OF THE MUNICIPALITY FROM REVENUES FROM VAT	19.983.818
CURRENT-OPERATIONAL REVENUE OF THE MUNICIPALITY IN THE PREVIOUS FISCAL YEAR (71+72 +731 – 731 120 + 733 + 741 115)		54.687.414
30% OF THE CURRENT-OPERATIONAL REVENUE OF THE MUNICIPALITY IN THE PREVIOUS FISCAL YEAR		54.687.414x30%=16.406. 224

Extended capacity for financing with public – private partnership (PPP)

The municipality has no intentions to implement any of the priority projects for energy efficiency using the PPP. Not because it has no interest to do that, but because the municipalities that have already implemented projects for energy efficiency through public-private partnership has shared their negative experience.

Three other municipalities have already implemented project for energy efficiency in the sector public lighting through the public-private partnership - Kavadarci, Chair and Struga and faced the following problems:

- The renowned private partners refrain from entering into PPP transactions. They believe that municipal projects are too risky (payment depends on political will due to a weak judicial system) and this is reflected in their prices, which makes the creation of projects impossible. As a result, smaller and inexperienced companies are competing for these projects.
- The municipality requires from the private partner to deal with future development and expansion of the street lighting system for the duration of the contract, and on the other hand the private partner is not supportive to it. This problem has not been properly addressed in the existing PPP contracts and is now a point of conflict.
- The Law on concessions and public private partnership (prepared by the Ministry of Finance) is not sufficiently defined and the municipalities do not have the capacity, or confidence (credibility) to define the details of the contract by themselves. The existing PPP contracts have either ambiguities or fail to define all aspects of the transaction.

The lack of detailed guidelines and forms for transactions in PPP that have been approved by the government and that deal with all possibilities (for ex. Warranties for the savings, change of the price of electricity, change of the exchange rate, vandalism, theft, etc.) is being considered as potential risk for the municipality.

Due to the stated above, the municipalities were offered new model of PPP – ESCO model of PPP for street lighting, small distribution systems for heating and for water supply. Hereby it is good to mention that the creation of the ESCO model was foreseen with the new Law on Energy Efficiency as successful model for financing in number of countries.

Connection with appropriate list of priority projects with the financing capabilities of the municipality

In this part, the municipality connects the list of priority projects with the appropriate available sources of funding.

The goal of the municipality is to specify the projects that they plan to finance and which source of funding will be used, so that later, in the Action Plan they are able to plan appropriate activities for achieving this goal.

Table 29: Sources of funding and budgets

List of priority projects			Sources of funding				Other possibilities for funding		
Project title	**Payback period**	**Amount of investment MKD million**	**Available basic funding MKD million**	**Grant programs MKD million**	**Loans MKD million**	**PPP/ESCO MKD million**	**Basic financing**	**Grant programs**	**Loans**
TOTAL FUNDS AVAILABLE				**-**	**16.4**	**-**	**-**	**-**	**-**
Complete program for revitalization of the public lighting	6.7	20.34		-	-	20.34	-	-	
Total investment for the project:		**20.34**							

Comments on the financial plan (if any)

The recommended priority project in the EEP cannot be financed with basic funds. Regardless of the fact that the municipality can use a long-term loan, currently are being analyzed new ways of financing of the selected project. Namely, the municipality has signed Letter of intent to take part in the EBRD project for technical support for the implementation of procedures for the award of Energy Service Contracts for public lighting reconstruction under the ESCO model. The phase of preparation of Feasibility study for rationalization for award of Contract for establishment of PPP is currently ongoing. In addition, a Decision that approves the execution of a procedure for concluding a contract for PPP using an ESCO model was adopted by the Municipal Council. By doing so, the Private Partner fully undertakes the overall project investment as well as the maintenance of the equipment. The Public Partner pays the investment exclusively through energy savings, while not burdening the underlying budget and causing no public debt.

TIMEFRAME FOR IMPLEMENTATION OF PROJECTS FOR ENERGY EFFICIENCY AND RESPONSIBLE PARTIES

Municipal Energy Efficiency Team is created and has a mandate of 3 years to develop, implement and monitor the Energy Efficiency Program. The EE Team in the Municipality of Valandovo is consisted of the EE Manager, Gligorije Dzilvidziev and Katerina Nikolov, Associate in the Department for Local Economic Development. The main responsibility of the EE Team is to monitor the implementation the Energy Efficiency Program and to report directly to the Mayor. The EE Team will perform the following tasks:

- Participation in data collection for the energy consumption in the municipality; works and manages with the database for energy consumption in the municipalities.
- Development and management of the Program for monitoring of energy in the municipality.
- Participation in the preparation in the municipal budget for energy.
- Identification of approaches towards securing funding sources.
- Preparation of tenders in cooperation with the employees responsible for tender procedures, negotiation and management with external associates engaged for conducting energy audits, development of business plans and management with projects.

To ensure effective monitoring of the planned activities of each project, a simple Excel-based Gantt chart can be used.

Table 30: Implementation of projects for energy efficiency included in the three-year EEP

No.	Energy Efficiency Projects	Description	Source of funding	Implementation period	Responsible person	Implementation approach (public procurement, deadlines, activities, cooperation etc.)
1	**Complete Program for revitalization of the street lighting**	› Integrated program for assessment of the public lighting	Municipal budget	2020	EE Manager	Municipal team
		› Guide for procurement of new street lamps	Municipal budget	2020	EE Manager	Municipal team
		› Modernization of the street lighting: Existing 1,520 high-pressure sodium (HPS) lamps, 70 W each, with 1,520 new LED lamps of 25 W each;	„ESCO“ model of PPP	2020	EE Manager	Public procurement
		› Modernization of the street lighting: Existing 50 high-pressure sodium (HPS) lamps, 150 W each, with 50 new LED lamps, 70 W each;	„ESCO“ model of PPP	2020	EE Manager	Public procurement

The partners that will be directly or indirectly involved in the implementation of the Energy Efficiency Program are:

> Financial institutions;

> International donors / programs;

> Consultants;

> Contractors;

> Suppliers;

> ESCO.

MONITORING OF IMPLEMENTATION OF THE ENERGY EFFICIENCY PROGRAM

Regular monitoring of the Energy Efficiency Program, work progress and impact assessment

Regular monitoring is a key element in the process of the Energy Efficiency Program. The monitoring and evaluation (M&E) might include different phases and aspects of the process of the Energy Efficiency Program. It usually starts at the very beginning and continues during the implementation of the Program. It is strongly recommended that the monitoring and evaluation (M&E) continues even after the completion of the planned framework of the Energy Efficiency Program towards creation of long-term impacts of the EEP on the local economy, energy sector, environment and the human behavior.

The implementation of the municipal EEP will be carefully monitored and evaluated on annual level by the municipal team for energy efficiency in Valandovo. Evaluation will be conducted in November and December and will cover the current year.

Monitoring and assessment will be performed based on the previously defined indicators approved by the municipal administration. As soon as the installation is completed, each project separately will be commissioned and the overall period of the realization of the Energy Efficiency Program will start to expire, therefore the changes can be quantified. The easiest way to do this is by comparison using the data for:

- Situation of sites / systems affected, as well as impacts on the municipality as a whole, before and after the program implementation.
- The total amount of energy savings achieved during the overall period of implementation of the Program and the energy savings foreseen for a particular period, by using the data from actual measurements and projections based on the real results from the implemented measures.

The following indicators of successfulness may be identified and used for proper assignment of responsibilities:

- Achieving the listed preliminary qualitative program goals.
- Achieving the listed preliminary quantitative program goals.
- Creating conditions for replication of successful practices in the same or other municipalities.
- Influence of the implementation of the program on the planning and the development of the municipality in other areas.
- Effectiveness of the program on the management.

Interim reports for the results to the political authorities

Reporting on the results may be performed towards internal or external authorities.

Internal reporting will be performed the way that the results from the monitoring of the Energy Efficiency Program will be summarized by the Energy Efficiency Team in written and will be reported to the Mayor and the Municipal Council of Valandovo. The reporting periods depend on the City Government's decision-making policy. Good example of inclusion of the Municipal Council and other stakeholders in the implementation of the Program, is scheduling regular meetings for

exchange of information in December. In addition to reporting, it will be extremely useful if the EE Team Leader publishes information on the achievements of the Energy Efficiency Program on the municipal website as well as in the local media and discusses this information at special EE events.

In accordance with Article 132, paragraph 5 of the Law on Energy (Official Gazette of the Republic of Macedonia No. 16/2011) which is still in force regarding the issues in the area of the energy efficiency until the entering into force of the law that will regulate the issues in the area of energy efficiency, the municipalities shall prepare external report on the implementation of the Energy Efficiency Program by providing information to the Energy Agency in relation to the implementation of the Energy Efficiency Program from the previous year about the evaluation, monitoring and verification. The information shall be delivered by the end of February each year.

Table 31: Information on the implementation of the Program

Project for EE	Detailed description of the project	Evaluation of the implemented project	Status of the Project within the Energy Efficiency Program
Public lighting	Integrated program for assessment of the public lighting	*<The project is being implemented in accordance with the EEP /* *The project is being implemented with a delay /* *The project is being implemented partially /* *The project is not being implemented.>*	*<Achieved/* *Implementation continues /* *Postponed>*
	Guidelines for procurement of new street lights	*<The project is being implemented in accordance with the EEP /* *The project is being implemented with a delay /* *The project is being implemented partially /* *The project is not being implemented.>*	*<Achieved/* *Implementation continues /* *Postponed>*
	Modernization of the street lighting	*<The project is being implemented in accordance with the EEP /* *The project is being implemented with a delay /* *The project is being implemented partially /* *The project is not being implemented.>*	*<Achieved/* *Implementation continues /* *Postponed>*

Interim upgrades of the EEP based on the received observations and results

As part of the process of continuous monitoring, the implemented projects may be evaluated through their influence on the energy consumption and reduction of the CO2 emissions. Based on the results and the monitored problems, if there are any, additional corrective and prevention measures can be undertaken.

The monitoring and evaluation (M&E) results may lead to change and update of the Energy Efficiency Program. The updated Energy Efficiency Program will serve as a base for the development of the Action Plan.

APPENDIX I
NATIONAL GOALS FOR ENERGY EFFICIENCY

As a Contracting Party (CP) to the Energy Community Treaty, as of 1 July 2006, Republic of North Macedonia has obligation to implement the applicable energy legislation. Along with the adoption of bylaws, implementation of the legislation entails different reporting obligations. Implementation of the legislation on renewable energy sources and energy efficiency is based on comprehensive, multi-annual action plans. As a first step, the parties prepare and adopt action plans outlining the steps to achieve the negotiation objectives. National Energy Efficiency Action Plans (NEEAPs) provide a framework for development of a national strategy on how to best increase the level of EE. These action plans, which shall be submitted to the Energy Community Secretariat every two years, also provide platform for parties to evaluate energy savings as result of the implementation of these strategies. While the first NEEAP covered the period 2010–2012, the second NEEAP set the target for action for 2013-2015 under the Energy Services Directive 2006/32/EC. Republic of North Macedonia was presented the third NEEAP in October 2016 covering the period 2016-2018.

The Energy Services Directive 2006/32/EC was repealed by the Energy Efficiency Directive 2012/27/EU. Incorporated into EU legislation in October 2015, the Energy Efficiency Directive requires that the Parties report and design a set of measures that contribute to the national final energy saving objective. Pursuant to this Directive, the EE target of 20% reduction in final and primary energy has been set at the Energy Community level. In order to achieve this goal, the CPs shall set their own indicative national EE targets and pave the way for their achievement through their EE action plans. This Directive has become binding for the Republic of North Macedonia since October 2017 and sets out the goals and obligations that should be fulfilled by the country.

In 2018, the Energy Community published a study with detailed 2030 EE targets for each CP in the Energy Community, in accordance with the PRIMES model which was developed for the EU Member States. In line with this model, each CP has an EE goal to reduce 30% of the energy consumption on national level compared to the reference value for 2009 (EU member states' reference year is 2005). The last study prepared by the Energy Community and published in June 2019, provides in tables the EE goals regarding the final energy for the Republic of North Macedonia which are presented on the figure below. The table shows total energy savings of 31.3% until 2030 or 927 ktoe.

Table 46: EE targets in terms of final energy for North Macedonia for different scenarios

EE targets for North Macedonia in terms of final energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	1,803	1,888	2,957	2,030	+12.6%	+7.5%	-31.3%
Base year 1	1,803	1,888	2,957	1,785	-1%	-5.4%	-39.6%
Base year 10	1,803	1,888	2,957	1,623	-10%	-14%	-45.1%
Base year 19	1,803	1,888	2,957	1,461	-19%	-22.6%	-50.6%
Baseline 26	1,803	1,888	2,957	2,188	+21.3%	+15.9%	-26%
Baseline 32.5	1,803	1,888	2,957	1,996	+10.7%	+5.7%	-32.5%
Baseline 39	1,803	1,888	2,957	1,804	+0%	-4.4%	-39%

Figure 29: EE goals in terms of final energy for the Republic of North Macedonia for various analyzed scenarios[37]

[37] Originally, the table is part of the "Study for the overal 2030 goals", published on 12 June 2019 for the Energy Community Secretariat

The Strategy of the Republic of North Macedonia for improvement of the energy efficiency until 2020 sets the goal for accelerated adoption of EE practices in the country. Until 2020, the total energy savings is expected to reach 14.5% which is close to the EU target of 20%. Most of these savings are expected to come from the cities, with decreased electricity and heating energy consumption in the buildings, more efficient public enterprises and more sustainable transport sector.

In carrying out the planning and development phase of the Energy Efficiency Program, the Municipality should be familiar with the national energy efficiency goals and shall pursue the objectives at local level.

APPENDIX II
LEVEL OF GOVERNMENTAL CONTROL

National participants

- City authority does not have control; all decisions are being made on national level.

Local participants

- City authority is one of the several participants in the decision making at local level.

Local Board

- City authority is formally represented by a Board that makes all decisions at local level.

Multiple agencies

- City authority is one of the multiple agencies that have formal role in the decision making processes.

Policy makers

- City authority directly set the policies in particular sector.

Regulator / Executor

- City authority directly sets policies in a particular sector and supports them.

Municipal budget management

- City authority has direct control over the budget spending in particular sector.