

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY EFFICIENT PUBLIC LIGHTING SYSTEM

CITY OF ŽIVINICE



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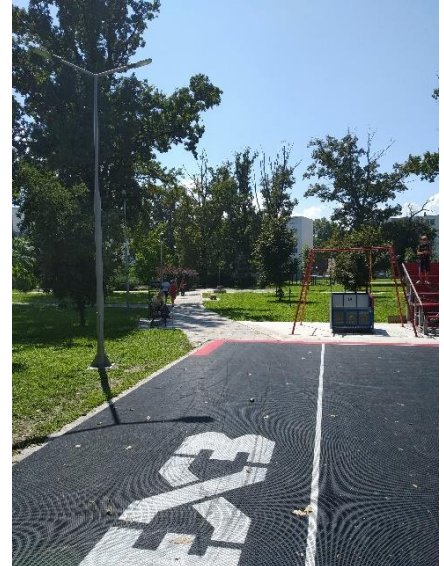
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**DEVELOPMENT OF NEW AND UPGRADE OF EXISTING
FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY
EFFICIENT PUBLIC LIGHTING SYSTEM**

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4 INTRODUCTION

The fact is that energy, i.e. the availability of energy at affordable prices, is a key prerequisite for achieving economic and social development of any society. However, it is also a fact that energy production and its use significantly affect the environment, causing pollution of local and regional character, but also problems such as global warming and climate change.

Therefore, it is clear that the energy sector in Bosnia and Herzegovina, the European Union, and around the world today is facing the challenge of sustainable development - development that enables secure energy supply, while reducing negative environmental impacts.

High energy consumption, but also great potential for savings, have made energy efficiency a priority, as well as an increasingly important place in the public sector in Bosnia and Herzegovina, which has significant potential for energy conservation in the region. Bosnia and Herzegovina can base its further medium-term economic development and job creation on energy efficiency improvement measures. There is also a high potential for energy conservation in the public lighting system.

Of particular importance to the application of the principle of energy efficiency is the fact that the public lighting in use today was mainly designed at a time when there was no highly effective lighting technique, and when electricity was significantly cheaper. Currently, public lighting systems are one of the main sources of electricity consumption, with 3.19% of global electricity production allocated to public lighting.

This amount is higher than the production of all hydro or nuclear plants and is equal to the production from natural gas. It is generally known that public lighting is a sector characterized by excessive and disproportionate energy consumption in relation to the quality and functionality of the service offered to citizens. Investing in optimal measures to improve the energy efficiency of public lighting systems has become strategic for the economic, technological and social development of cities.

Therefore, new public lighting needs to be designed and built in accordance with the principles of energy efficiency, and the existing ones, if at all possible, need to be adapted. Improving energy efficiency is one of the most important pillars of modern energy policy, and is the key and most economically effective mechanism for achieving the goals of sustainable development of the energy sector.

Improving energy efficiency reduces costs and contributes to the competitiveness of the national economy. Energy efficiency means consuming less energy for the same product or service. Energy efficiency offers many benefits, depending on the type of intervention. It can:

- reduce the burden of rising energy prices,
- increase energy security,
- increase the necessary energy supply investment ,
- reduce air pollution and slow down climate change,
- improve the employment of skilled and unskilled labor,
- reduce the burden on budgets,

increase economic competitiveness.

In order to assess the energy saving potential of public lighting, the existing situation must be defined. In other words, the following basic activities should be established:

preparation,
inspection / review,
description of the current situation and identified measures,
energy budget and,
economic budget.

It is important to point out that energy efficiency should by no means be seen as energy saving. Namely, saving always implies certain sacrifices, while efficiency means maintaining, in this case, the given level of lighting with the use of a smaller amount of electricity.

The costs of public lighting are becoming an increasing burden on the budgets of various levels of government from year to year. Newer technologies and more economical lighting fixtures provide the possibility of savings while maintaining the existing or even improving the quality of lighting. With newer technologies, and with acceptable investments, municipalities can reduce allocations for the operation of public lighting systems, which will create opportunities for redirecting such saved funds to further expansion of the system, development or some other priority purposes.

Therefore, there is a need to increase energy efficiency in the field of lighting. This has also been recognized by the international community, and through various analyses, general directives and guidelines have been created that are used to influence the increase of this efficiency.

These directives and guidelines are defined within the EU under the EU Directive 2002/91 / EC, and in Bosnia and Herzegovina they are translated and adopted under the title BAS EN 12464 1: 2012 for indoor lighting and BAS EN 1838 for panic lighting, while for outdoor lighting they were adopted under the names:

- **BAS CEN/TR 13201-1:2016** - Road lighting - Part 1: Selection of lighting classes,
- **BAS EN 13201-2:2017** - Road lighting - Part 2: Performance requirements,
- **BAS EN 13201-3:2017** - Road lighting - Part 3: Performance calculation,
- **BAS EN 13201-4:2017** - Road lighting - Part 4: Methods for measuring road lighting characteristics
- **BAS EN 13201-5:2017** - Road lighting - Part 5: Energy performance indicators.

As a technology to reduce emissions and costs, LED public lighting should be the first instance of every municipality's investment. The latest energy efficient LED lamps can achieve energy savings between 50-70%. LED public lighting offers instant savings in terms of energy, maintenance and running costs.

5 GENERAL PART

5.1 Geographical location

The town of Živinice is located in the northeastern part of Bosnia and Herzegovina (BiH) in Tuzla Canton (TC), which consists of the towns of Tuzla, Živinice, Srebrenik, Gradačac and Gračanica and eight other municipalities (Banovići, Čelić, Doboj Istok, Kalesija, Kladanj, Lukavac, Sapna and Teočak). The area of Tuzla Canton is 2,649 km², which is 10.15% of the area of the Federation of Bosnia and Herzegovina (FBiH), whose area is 26,110.5 km², or 5.17% of the territory of BiH (51,209.2 km²).

The town of Živinice consists of 26 local communities, namely: Bašigovci, Barice, Dubrave Gornje, Dubrave Donje, Donja Višća, Donja Lukavica, Đurđevik, Gornje Živinice, Gračanica, Gornja Višća, Gornja Lukavica, Kovači, Litve, Oskova, Priluk, Podgajevi, Rudar Živinice, Stari Đurđevik, Suha, Svojat, Šerići, Šišići, Šahići, Tupković, Zelenika, Živinice Centar, and covers an area of 298.06 km² which is 11.25% of the territory of Tuzla Canton, 1.14% of the territory of FBiH and 0.58% of the territory of BiH.

Significant road communications pass through the territory of the City of Živinice, such as the main road Sarajevo - Tuzla - Orašje, regional roads Banovići - Živinice - Zvornik and Lukavac - Živinice - Šekovići, and railways Brčko - Banovići and Tuzla - Zvornik. On the territory of the City of Živinice, there is PE Tuzla International Airport, which in the last three years experienced the development expansion of passenger and cargo traffic.¹

The average altitude of the area is from 200 to 1,156 m with a temperate continental climate. The average annual air temperature is 10 °C, with a medium summer air temperature of 19.6 °C.² The official language in majority use is Bosnian. Image 1 shows the position of the City of Živinice in Tuzla Canton, FBiH and BiH.

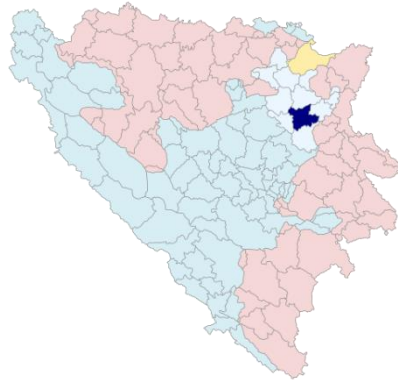


Image 1: Position of the city of Živinice in Tuzla Canton, FBiH and BiH 3

¹Strategija integrisanog razvoja Općine Živinice 2017. – 2026. (*Strategy of integrated development of the Municipality of Živinice*)

²Lokalni ekološki akcioni plan Općine Živinice (LEAP) 2016. – 2026. [*Local Environmental Action Plan of the Municipality of Živinice (LEAP) 2016 - 2026*]

³Socioekonomski pokazatelji po općinama u FBiH (2011-2019) (Socio-economic indicators by municipalities in FBiH (2011-2019))

5.2 Overview of the socio-economic situation

According to the 2013 census, the City of Živinice has 57,765 inhabitants, which is by 43.2% more than in 1971, and by 5.4% more than in 1991. The average population density of 193.8 inhabitants per km² is by 2.3 times higher than the average population density in FBiH (85.0 inhabitants / km²).

The estimate of the total population by age structure is 17% of young people under the age of 14, 74% of the population aged 15- 64 and 9% of population over 65. The reduced number of live births and the continuously increasing number of deaths led to the fact that the natural increase in 2015 was 76 people, while in 2011 it was 187 people, and the birth and death rate in 2010 were 12.87 and 6.91 respectively, while the natural increase rate for 2010 was 5.97.

The current percentage of the population living in urban areas is 16,157 or 28%, while according to the 1991 census this value was 11,947 or 21.8%, which shows that the population is moving from rural to urban areas. The migration balance in 2010 was -6, while the year before the value was positive and amounted to 6. The reason for the departure of the population (primarily to other countries) is most often the difficult economic situation. According to the 2013 census, the majority of the population is Bosniak, 91.9%, Croat 4.3%, Serb 0.4% and others 3.3%.⁴

According to the indicators of the Federal Bureau of Statistics in 2015 in the area of the City of Živinice there were 2,406 registered business entities, of which 791 legal entities, 528 legal entities parts and 1,087 trades. Comparative indicators of the number of business entities indicate a continuous increase over a period of ten years, so in 2015 the number of business entities was higher by 348 or 22.13% compared to 2008.

The number of active legal entities in 2015 was higher by 30 legal entities or 9.3% compared to 2014, while in 2015 there was an increase of 1,087 natural persons, which is an increase of 33 natural persons compared to 2014. year, i.e. an increase of 112 individuals compared to 2011. In 2015, natural persons or crafts employed 923 persons, 615 persons or 66% in permanent employment, and 308 persons or 34% occasionally during the year.⁵

Sectorly speaking, the area of the City of Živinice is numerically dominated by trade companies or 39.60%, then transport, storage and construction companies or 10.83% each, companies from professional, scientific and technical activities with 7.12%, and wood processing companies with 5.98%. The realized profit of all companies in 2015 amounted to 17,519,066 BAM, which is an increase of 71.40% compared to 2014 when the realized profit amounted to 10,220,596 BAM.

Gross domestic product (GDP) per capita for the City of Živinice in 2014 amounted to 3,971 BAM, which classifies it as a developed city in Tuzla Canton, while in 2010 it was 3,616 BAM, which is 8.94% less compared to 2014. GDP in the period from 2010 to 2014 grew continuously, and in 2014 it amounted to 223,077 BAM, which is 23,067 BAM or 11.5% more than in 2010.

During 2015, business entities from the area of the City of Živinice realized imports of 149,090,000 BAM, while in the same period exports amounted to 55,288,000 BAM, which created a trade deficit in the amount of 93,802,000 BAM. The coverage of imports by exports in 2015 for the City of Živinice was 37.08%, which is far less than the average of Tuzla Canton, which is 77.34%.

⁴ <http://www.statistika.ba/?show=1#link18>

⁵ Porezna ispostava Živinice, 2016. godine

The average net salary in the City of Živinice in 2018 amounted to 781 BAM, which is 88% of the average net salary in FBiH, while in 2019 it amounted to 777 BAM or 84% of the average net salary in FBiH, which is 0.5% less compared to the previous year.⁶

The number of employees in the area of the City of Živinice recorded a declining trend in the period 2011-2014, where in 2014 there were 864 or 9.68% fewer employees compared to 2011. During 2015, a slight increase in the number of employees was recorded, and 8,484 employees were registered, i.e. 429 persons more than in 2014.

Out of a total of 8,484 employed persons in the area of the City of Živinice, 4,838 or 57% are employed as legal entities. The structure of legal entities of the City of Živinice for 2015 shows that 7 activities employ approximately 85% of the population, i.e. that 25.16% or 1,217 persons are employed in the trade sector, 20.11% or 973 persons in the mining and quarrying sector, 9.92% or 480 of them in the metal industry sector and 9.67% or 468 of them in the construction sector, and 7.21% or 349 people in the health and social care sector.

Image 2 gives an overview of employees in the City of Živinice from 2005-2015.

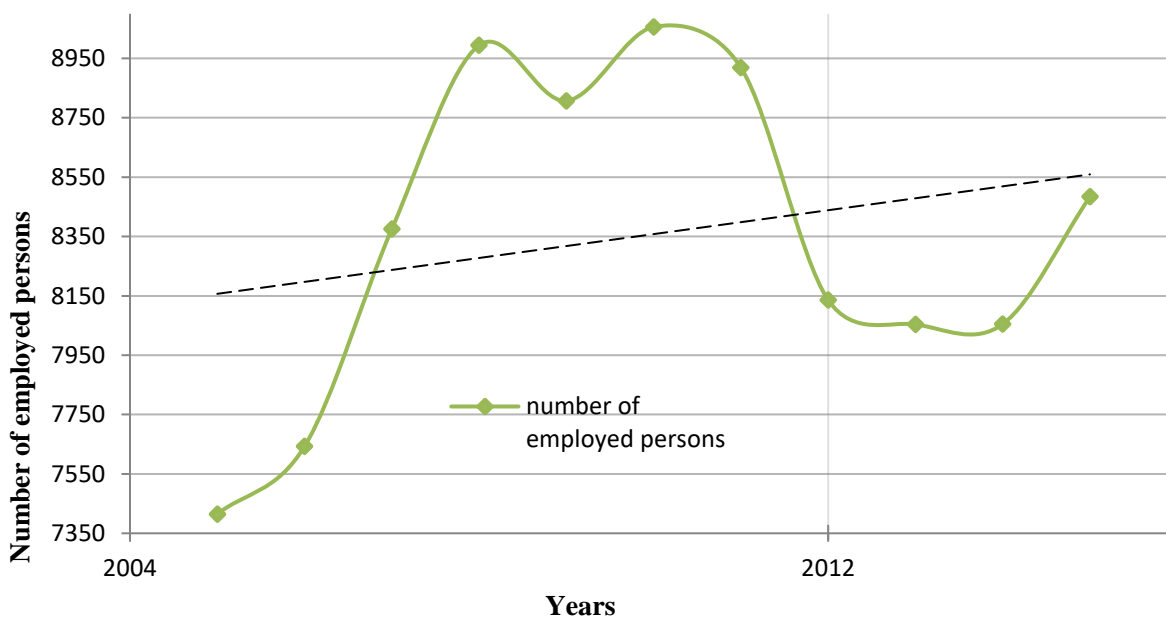


Image 2: Overview of employees in the City of Živinice

In 2015, 13,636 unemployed persons were registered in the area of the City of Živinice, which, by observing the total number of inhabitants, gives an unemployment rate of 24.5%. The unemployment rate of the working population, i.e. persons aged 15-65, in the area of the City of Živinice in 2015 was 61.65%, which shows that almost two thirds of the working population is unemployed.

The unemployment rate in the period from 2011 to 2015 ranged from 24.24% over 25.67% (during 2013) to 24.25% (2015). During 2015, the number of pensioners was 8,456, of which 3,200 were old-age pension

⁶ [Federal Institute for Development Programming, Socio-economic indicators by municipalities for 2018 and 2019]

beneficiaries, 2,048 were disability pension beneficiaries and 3,208 were family pension beneficiaries. The average amount of pension in the area of the City of Živinice for 2015 was 375.95 BAM and which is by 17.25 BAM lower than the average pension of FBiH.

The ratio of pensioners and the number of employees in 2015 is 1: 1,003, in favor of employees, which is extremely unfavorable from the aspect of providing financial sources from which pensions are paid (contribution to salaries).

5.3 State of the public infrastructural electricity network

Electricity supply in the area of the City of Živinice takes place through JP "Elektroprivreda Bosne i Hercegovine" d.d. Sarajevo, Branch Elektrodistribucija Tuzla, Business Unit Živinice. All local communities in the territory of the City of Živinice are covered by the electricity network system and all households have access to electricity.

The electricity distribution network of the City of Živinice has been developed at three voltage levels: 35 kV, 10 kV and 0.4 kV. Power supply of consumers is realized through four node transformer stations. Consumers are further supplied through LV lines with TS 10 / 0.4 kV which are located in settlements.

These four substations supply electricity to 23,356 consumers in the category "households" (21,336 households in the City of Živinice, the rest outside the city limits) and 1,833 consumers in the category "other" via 278 medium voltage substations 10 (20) / 0.4 kV and 26 output 10 kV consumption "(economic entities, public lighting, etc.). Out of the total installed capacity of TS 10 / 0.4 kV supplied from the four substations or 61 MVA, 57 MVA is used by the City of Živinice.⁷

The current average power per household of the City of Živinice, reduced to 10 kV outputs in the high voltage station, is approximately 1.0 kVA per connection. Of the total realized electricity consumption per (120 million kW), households consume 65%, and the economy 35%. Due to the large length of 10 kV lines and a large number of customers, voltage drops and losses are large.

The quality of electricity supply and security of supply of the existing 10 kV network is not satisfactory, because the network is mostly undercapacitated. Due to the pronounced problem of dislocation of consumers from the existing medium voltage network, voltage drops as well as losses are large.

The coverage of the population of the City of Živinice with public lighting in 2015 was 60%, which is an improvement compared to 2011 when the coverage was only 20%. At the annual level, the City of Živinice allocates approximately 1,000,000 BAM for public lighting, of which 35% is spent on maintaining the state of public lighting, and the remaining 65% on electricity consumption.

Given the dilapidation of public lighting and high consumption, in the coming period it is necessary to invest additional efforts in energy efficiency of public lighting in the direction of increasing the quality and intensity of lighting while minimizing its costs.

⁷ Strategija integrisanog razvoja Općine Živinice 2017. – 2026.(Integrated Development Strategy)

5.4 Analysis of socioeconomic population research

5.4.1 Introduction

As part of the Feasibility Study for the installation of new energy efficient public lighting systems for the City of Živinice, a survey of the population of Živinice was conducted to assess citizen satisfaction with the quality of key dimensions of public lighting performance.

A survey questionnaire was chosen as the method for collecting primary data. The survey was conducted in the period from July 14 to November 1, 2020. The survey questionnaire was distributed in electronic (web) form with the aim of increasing the response of citizens. The number of inhabitants of the town of Živinice is 61,201, while 109 respondents participated in the survey, where the level of reliability for the stated number of respondents is 95%, and the confidence interval is 9.4. The research was conducted anonymously, and the respondents were previously informed about the goal of the research.

5.4.2 General respondents' data

Out of the total number of respondents (109), 81.65% of the respondents were males, while in the percentage of 18.35% they were females (Image 3).

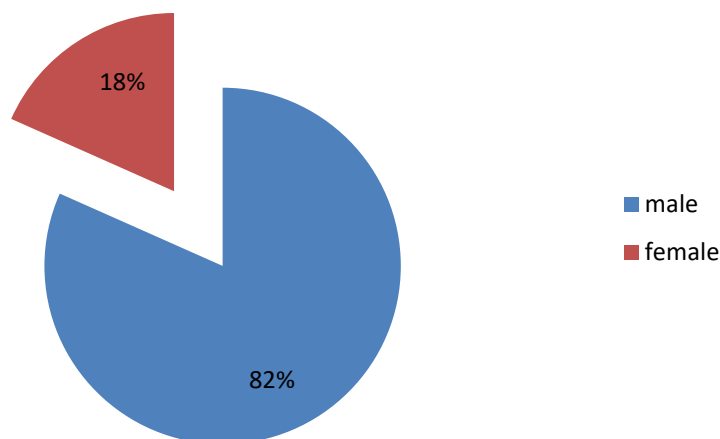


Image 3: Structure of respondents by gender

The age of respondents is categorized into four age groups: 18 - 29; 30 - 39; 40 - 49; 50 - 64; 65+. The most represented age group in the sample is the population aged 40-49 (35.78%), followed by respondents aged 30-39 (22.02%), as well as respondents aged 50-59 (22.02%). The least represented group of respondents is in the age group of 65+ years (0.92%), while the respondents in the age group of 18-29 years participated in the percentage of 19.27%.

The stated structure of respondents by age shows that approximately the same percentage of respondents belonging to the young and older population participated in the survey, which satisfied the equality in terms of age groups. The percentage of respondents who are employed is higher i.e. 81.65%, while the percentage of respondents who are unemployed is 18.35%.

In addition, out of the total number of respondents, the highest number had a university degree / baccalaureate level of education or 45.87%, while the percentage of respondents with completed high

school is 16.51%, and with student status is 8.26%. The percentage of respondents who have the status of higher education is 7.24%, and of those with a master's degree 21.11%.

Respondents who completed 6 years of study and have the title of MD did not participate in the survey, while there were 0.92% of respondents with the title of Doctor of Science. (Image 4).

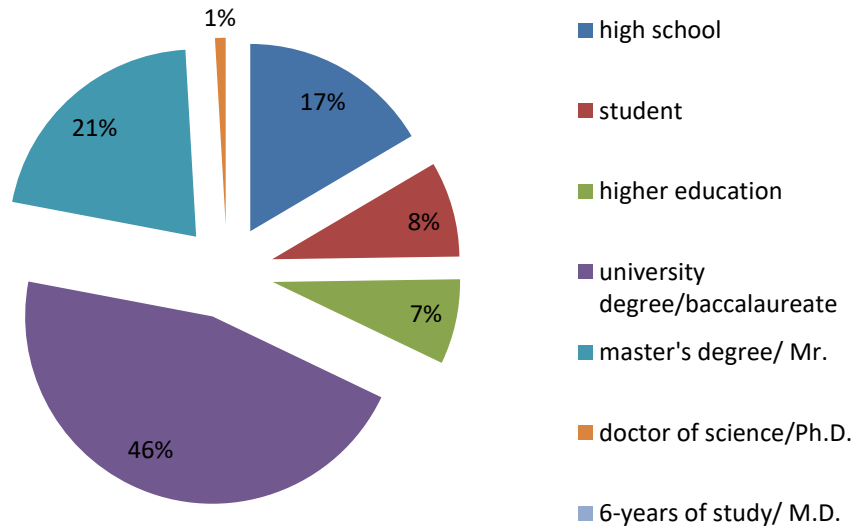


Image 4: Structure of respondents by level of education

5.4.3 Energy efficiency and population satisfaction with the quality of key dimensions of public lighting performance

Knowledge of energy efficiency is key to understanding the need to implement EE measures. Therefore, a set of 3 questions was formed, which were created with the aim of identifying the existing knowledge of the respondents about energy efficiency.

98.17% of respondents answered that they are familiar with what is meant by the term energy efficiency, while 1.83% of them answered that they are not familiar with it. 96.33% of respondents who participated in the survey, answered that energy efficiency is associated with environmental protection, while 3.67% of them said they were not familiar with it.

However, when it comes to knowledge about the cost of public lighting in the city of Živinice, most respondents or 68.81% are not aware of the cost of public lighting, while 31.19% of respondents are familiar with data on the cost of public lighting in the City of Živinice (Image 5).

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY EFFICIENT PUBLIC LIGHTING SYSTEM
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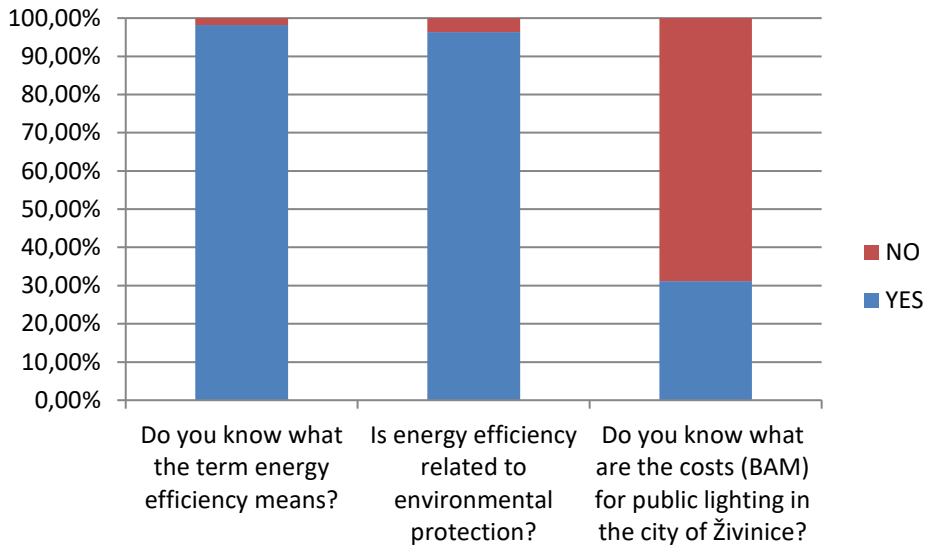


Image 5: Respondents' knowledge on energy efficiency

According to respondents' opinion on whether the city of Živinice is taking some of the energy efficiency measures, most respondents or 68.81% said that the measures are taken in the form of replacing existing lamps with LED lamps, while 18.35% of respondents said there were no action.

In addition, 8.26% of respondents cited the switching-off of lamps as a measure implemented by the city of Živinice, 1.83% of respondents stated that the city of Živinice applies dimming as a measure of energy efficiency, and 2.75% stated that applied measures include dimming of lamps and switching on and off the motion sensor lamps (Image 6).

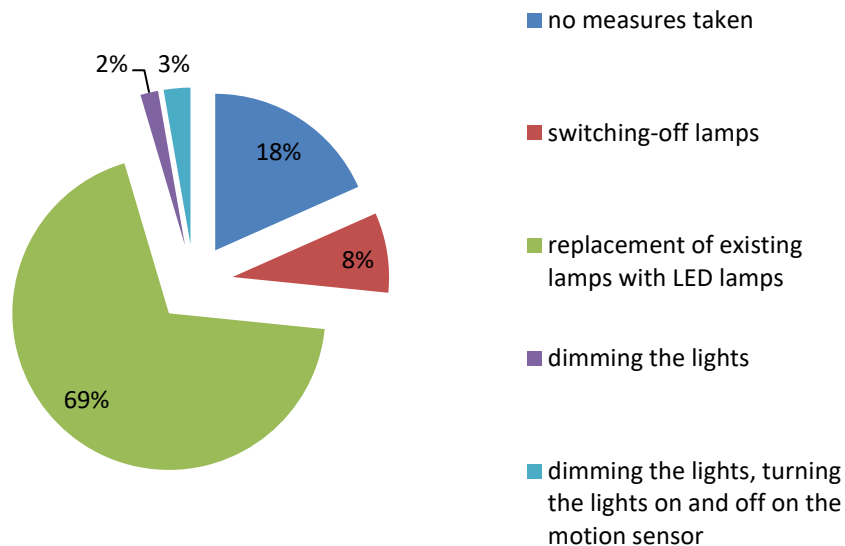


Image 6: Percentage share of respondents' answers to the question: In your opinion, does the city of Živinice take any of the energy efficiency measures?

Taking into account the instruction on Likert scale, where one = (minimum) to five = (maximum), the respondents expressed their satisfaction with the current public lighting. Out of the total number of respondents, 33.03% of respondents expressed their satisfaction with the current lighting with a score of

three, as well as a score of four 33.03%, while 12.84% of respondents gave the highest score of five to the current state of public lighting.

7.34% gave the lowest score to the state of public lighting in the town of Živinice (Image 7). According to the overall answers, the respondents are mostly satisfied.

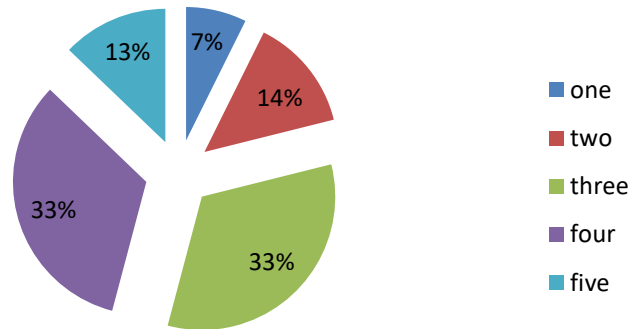


Image 7: Percentage of respondents' answers to the question: Your level of satisfaction with the current public lighting?

The majority of respondents, 26.61%, rated the maintenance of public lighting in the city of Živinice with a grade of three, while 23.85% rated it with five. According to the data shown in Image 8, over 70% of respondents gave a rating of three, four or five to the maintenance of public lighting, while 20.18% gave a grade of two, and 9.17% gave the lowest grade, one.

According to the results of the survey, it can be concluded that most of the surveyed residents of the city of Živinice are satisfied with the current way of maintaining public lighting.

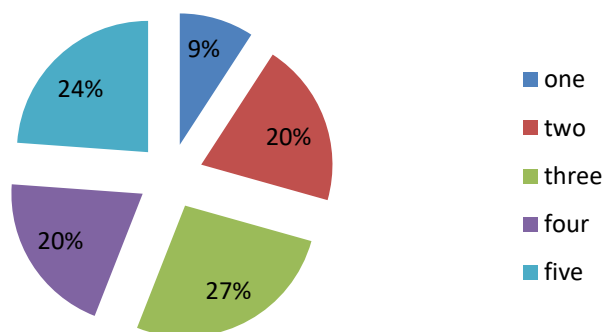


Image 8: Percentage of respondents' answers to the question: Does the city of Živinice regularly maintain public lighting?

According to 35.78% of the respondents, investing in innovative technologies in terms of public lighting in the city of Živinice, is at level three, while 22.94% of them said that it is at level one. The lowest number of respondents, 10.09%, stated that the level of investment in innovative technologies in terms of public lighting is at the highest level, five.

59.63% of respondents stated that in the town of Živinice there are lamps that are covered with trees, buildings, advertisements, while the rest of the respondents in the percentage of 40.37% stated that this is not the case (Image 9).

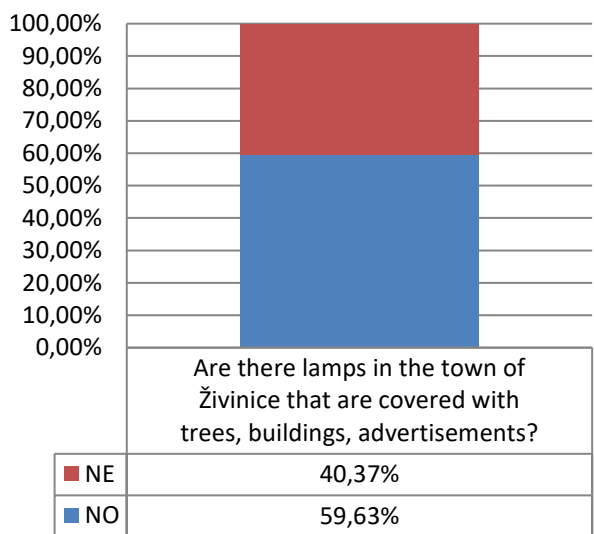


Image 9: Percentage of respondents' answers to the question: Does the City of Živinice invests sufficiently in innovative technologies (in this case, for example, in LED lighting or in automatic control of the public lighting system)?

Respondents were also asked about the characteristics of current lighting through a survey, answering questions related to light pollution and glare. The majority of respondents or 43.12% gave a grade of three in the case of the presence of lamps that cause light pollution, while 21.1% gave the lowest grade, one. When it comes to the existence of lamps that cause the effect of glare, 78.9% of respondents, which represents the majority, gave a grade of one, two or three, while 21.1% of them gave a grade of four or five (Image 10).

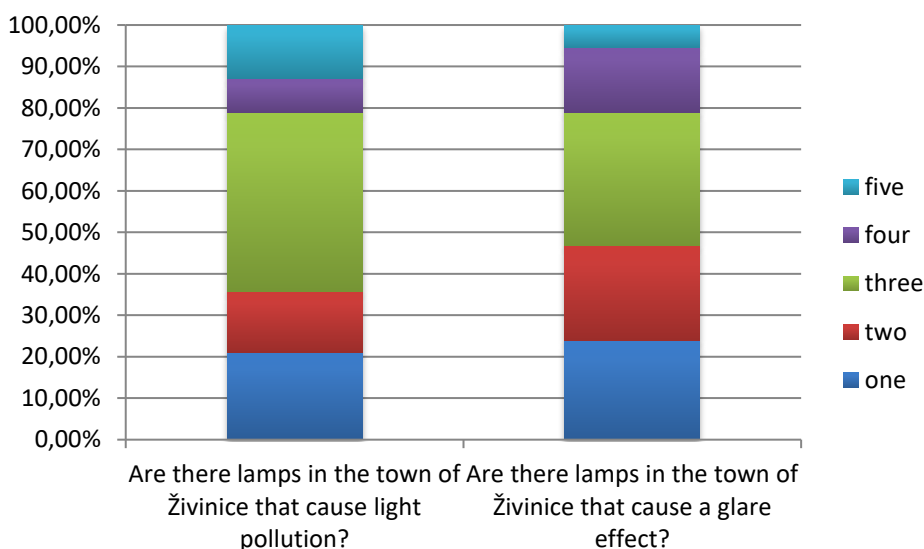


Image 10: Percentage of respondents' answers to questions about the characteristics of current public lighting in the city of Živinice

Through the conducted survey, the respondents had the opportunity to list the areas or facilities in the city of Živinice that they believe should be illuminated by dynamic lighting. According to the respondents, the highlighted areas / facilities that need to be illuminated by dynamic lighting are as follows: sports, cultural and religious facilities, areas around schools, peripheral roads, lighting in local communities, new bike path, the First Primary School, polygon in front of PI Mixed Secondary School of Živinice, city market, part of the Đurđevik-Križaljka road and summer stage.

5.5 Review of energy efficient public lighting trends

The trend of using public lighting starts from the discovery of fire, which man used as a source of heat and light. Lighting in public areas was primarily used for safety when the ancient Romans and Greeks illuminated their streets to prevent looting and maintain the safety of citizens. The era of electric lighting began only with the invention of the incandescent light bulb, Thomas Alva Edison's first commercial lamp in 1879. Until then, oil lamps, candles and torches were used to produce light from oil or gas.

The first electric lighting in Bosnia and Herzegovina began to be used in 1890 in Semizovac near Sarajevo. The first electric lighting in Sarajevo began to be used on May 1, 1895 (the first test ignition was performed on April 3, 1895). Thanks to technological advances, and the evolution of ideas, humanity has been able to create an artificial light source that is used daily in the lighting of public spaces. Electricity is generated to light in light sources, on the principle of luminescence or temperature radiation.

Over the years, the lamps have experienced rapid development. All today's light sources are divided into two basic groups: sources with bursts in precious gases or metal vapors and sources with incandescent filament. In the public lighting system, electric sources based on electroluminescence are mainly used, i.e. they convert energy directly into light, without gas discharge and these are:

- High pressure sodium lamp -NAV,
- High pressure mercury lamp - HQL,
- High pressure metal halide lamp – HQI,
- Low pressure sodium tube –SOX-E,
- Low pressure fluorescent tube –L.

Image 11 shows the trend of using individual lighting sources, and the following will describe the trends in the use of individual lamps and the use of additional technologies to increase the energy efficiency of public lighting.

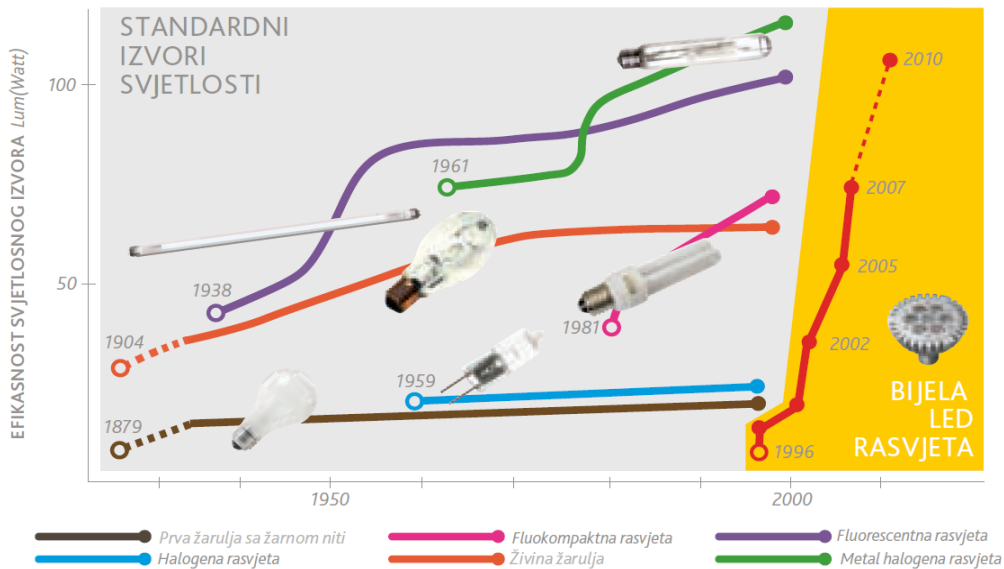


Image 11: Development trend of individual light sources⁸

High pressure sodium lamp (NAV)

High-pressure sodium lamps (NAV) are light sources that operate on the basis of high-pressure sodium vapor eruptions up to 10 millibars, emitting a yellow light color, with good color rendering, which allows their wide application, especially in public lighting systems.

Light efficiency is between 95 and 150 lm / W. The lamp can reach a lifespan of up to 24,000 hours, electricity 1,000 W, and a color temperature of up to about 2,000 K. The lamp consists of a glass balloon inside which is a ceramic weevil. The outer glass balloon is usually transparent, tubular or ellipsoidal in shape, having a thin white layer on the inside that lowers the luminance to only 4 to 30 cd / cm², which is advantageous for use in road lighting.

High-pressure sodium lamps are produced in a wide range of powers, different shapes and sizes. According to the EU Eco design Directive no. 2005/32 / EC, which requires the phasing out of inefficient forms of lighting, the year of cessation of use of the high-pressure sodium lamp is 2012.



Image 12: High-pressure sodium lamp

⁸ [www.osram.hr]

High pressure mercury lamp (HQL)

High-pressure mercury lamps (HQL) are one of the first light sources to be used in public lighting systems. They work on the basis of the eruption, through mercury vapors, of high pressure into the lamp coil, creating visible and invisible ultraviolet radiation, blue or green.

In its most common variant, this lamp gives a neutral white color of light and has a very weak color rendering index reaching from 23 to 50. Electrical power ranges from 50 W to 1,000 W. This type of lamp has good luminous efficiency (from 40 to 60 lm / W) and a lifespan of about 8,000 to 10,000 hours.

The color of mercury lamps is monochromatic and therefore their application is limited to places where color recognition is not required but it is important to achieve good illumination over a large area. They are produced in a large selection of strengths, different designs and dimensions. They are used to illuminate highways, squares, streets, parks, etc.

According to the EU Eco design Directive no. 2005/32 / EC, which requires the phasing out of inefficient forms of lighting, the year of cessation of use of high-pressure mercury lamps is 2015.



Image 13: High-pressure mercury lamp

High pressure metal halide lamp (HQI)

High-pressure metal halide lamps (HQI) are a special version of high-pressure mercury lamps. They were created to obtain a light source with an improved spectrum. As with high-pressure mercury lamps, mercury is added to the weevil, but also a number of other compounds such as iodine with sodium and indium with thallium. The high-pressure metal halide lamp is a modern light source with high light efficiency, good color rendering and high durability.

The HQI light color is warm white, neutral white, or daylight color. The life of the lamp is about 15,000 hours, the color temperature depends on the exact composition of the inert gas and can reach from about 3,000 K to 20,000 K, and the efficiency ranges from 67 to 95 lm / W. Because it has a wide power range, it is compact in shape and has a good color rendering index.

It is used in public lighting mainly in urban areas, where good color reproduction is required. According to the EU Eco design Directive no. 2005/32 / EC, which requires the phasing out of inefficient forms of lighting, the year of cessation of use of high-pressure metal halide lamps is 2015.



Image 14: High pressure metal halide lamp

Low Pressure Sodium Tubes (SOX)

Low pressure sodium tubes (SOX) produce light based on the eruption of low pressure sodium vapor. They are similar in mode of operation to mercury lamps, except that they contain sodium instead of mercury. This produces a monochromatic distinct yellow-orange color of light. The color rendering of the low-pressure sodium tube is extremely weak because the white color is reproduced as yellow and all the others as shades of black.

The wavelength of the maximum radiation of this light source is very close to the wavelength at which the human eye is most sensitive and thus makes them suitable for conditions and spaces where increased visual acuity is required, namely roads with frequent fog. They emit a yellow-orange color of light that numbs the ambience and puts people to sleep. The color temperature of the low-pressure sodium lamp is 1,750 K, the lifespan is about 16,000 hours, and the electricity takes values up to 180 W. The main advantage of low-pressure sodium lamps is their high light efficiency of up to about 180 lm / W. The dimensions of low-pressure sodium bulbs are relatively large, and this in combination with the low color rendering index is one of the reasons why they are almost never used. According to the EU Eco design Directive no. 2005/32 / EC, which requires the phasing out of inefficient forms of lighting, the year of cessation of use of the low-pressure sodium lamp is 2012.



Image 15: Low Pressure Sodium Tube

Fluorescent tube (CFL)

Fluorescent tubes (CFLs) are light sources based on the evaporation of low-pressure vapor through mercury, which produces ultraviolet radiation that is converted into visible light by a phosphor applied to the inside of the glass tube wall. Fluorescent tubes are filled with krypton and argon gases with little presence and mercury. They are energy efficient and have good color rendering, but poor optical monitoring capabilities.

Rare products do not drastically reduce the luminous flux by dropping the ambient temperature. A special group of fluorescent tubes with improved color rendering properties, better light efficiency and greater durability are fluorescent with the commercial name LUMILUX. Important light sources that are increasingly found in road lighting systems are DULUX compact fluorescent luminaires.

They are small in strength, small in size, but of great economy. DULUX is a small bent fluorescent tube with a special ballast integrated in the luminaire instead of a ballast and starter. Fluorescent tubes and fluorescent lamps are also produced in different designs, powers, light colors and dimensions.

They are connected directly to a voltage of 230 V. According to the EU Ecological Design Directive no. 2005/32 / EC, which requires the phasing out of inefficient forms of lighting, the year of cessation of use of a fluorescent lamp is 2012.



Image 16: CFL lamp

LED based lamp (*LED*)

LED (Light Emitting Diode) is a semiconductor element that in a conductive state, when connecting electrons and cavities, emits light of a certain wavelength. As with diodes, an LED consists of a chip made of a semiconductor material to create a PN junction. By the action of voltage, electrons pass from the N to the P side, merge with cavities, pass into lower energy levels, and by releasing energy create images.

There are two ways to produce white LED light. The first is that the LED itself emits white light, and the second way is to get white light by mixing the three primary colors. Another advantage of LED lighting is that it has an almost instantaneous response to voltage changes, and the flicker is almost imperceptible. When using an LED lighting system that uses a color temperature of up to 3500 K, very good contrast sensitivity, color recognition and minimal light pollution are achieved.

A color temperature that exceeds 4000 K and reaches 5000 K is extremely unfavorable because it contains a large proportion of blue light. The law stipulates that roads with motor traffic do not exceed the temperature of LED lights at 4000 K, because the share of blue light is much lower. The advantage of LED lighting is its high energy efficiency.

The lifespan of LEDs is more than 50,000 hours (lamps used in the study for 100,000 hours) and this largely depends on the cooling quality of the LEDs. Color rendering and light efficiency characteristics improve significantly from year to year. The current efficiencies of this type of diodes in use in public lighting range from 50 - 70 lm / W, while the color rendering index is 60 - 80.

Their use in public lighting has led to major changes in lamp design. The compact shape and relatively low intensity of the LEDs require the use of a larger number of diodes in the lamp and the direction of the light flux of each diode separately.



Image 17: LED lamp

Organic light emitting diode lamp (OLED)

The latest trends in electric lighting speak of OLED lighting, which is the next step in LED lighting, the letter "O" in the abbreviation OLED stands for "organic", but it is still LED lighting. The difference is that organic materials are used to make OLED lighting, which is claimed to be mechanically more flexible, which can lead to OLED lamps being made or printed using a 3D printer one day, while the principle of operation of the LED remains the same.

As light emitting diodes will reach the maximum possible theoretical efficiency, OLED technology, even if it replaces them, will not be due to efficiency but due to some other trends, i.e. if it manages to be cheaper than LED lighting. Also, if some new artificial light sources appear, it is questionable whether it will be profitable to develop them and replace LED lighting with them because they cannot be more efficient than LED technology, and LED technology will become very cheap and accessible to everyone.

Therefore, the only ways to increase the energy efficiency of public lighting today is to replace existing luminaires with LED technology and to manage public lighting and use additional technologies such as solar panels, rather than creating new light sources.

Trends in the use of additional technologies to increase the energy efficiency of public lighting

Currently, the world believes that LED lighting sources have reached the pinnacle of technology, and the possibility of increasing energy efficiency is reflected in technological additions to LED sources such as solar panels and lighting control.

The basic principle of solar lighting is that the Image-voltaic PV module located at the top of the pole converts solar radiation into electricity that accumulates in batteries. The accumulation itself is electronically monitored via a regulator that keeps the battery charging voltage within the allowable limits. Solar public lighting has proven to be a very cost-effective, economical and durable solution in many situations where bringing electricity networks is too expensive or the terrain is ungrateful for laying cables or electrification poles. The advantages of solar public lighting are:

- no digging, laying cables or mounting electrification transmission poles,
- simple project implementation requires minimal human resources,
- no need for transformer installation, calculation of KS currents and voltage drops,
- environmental friendliness,
- economic profitability - no electricity bills.



Image 18: Example of solar LED public lighting (island of Murter, Croatia)

The current trend of public lighting management has mostly relied on the following ways:

1. Manual control,
2. By means of a time relay
3. By means of a Imagecell,
4. A combination of different commands.

Previous systems have made it possible to manage public lighting in terms of turning on the lights at the end of the day and turning them off at the beginning of the day. The new systems enable the management of public lighting during the night as well. Technological advances have made it possible to replace the traditional public lighting management system with a more modern system that is energy efficient, simplifies maintenance and reduces their costs, is more environmentally friendly and improves pedestrian and road traffic.

Such system includes the use of equipment and services such as:

- on / off switch depending on the light intensity or depending on a fixed (desired) on / off schedule,
- fault signaling part,
- remote control of the on / off switch lighting (WSN wireless sensors) enabling remote communication and control)
- calculation of lighting costs from a remote central point (central technical monitoring of the system),
- dimming of lighting,
- turning on public lighting on a motion sensor, etc.

Nowadays, more and more cities are accepting the urban way of city development and acquiring the name "Smart City". The goal is to increase comfort and living standards through advanced information and communication technology solutions and Internet interfaces. Precisely these types of technology bring many advantages and improvements in the management and optimization of public services, and among them are transportation and parking, public lighting, surveillance and maintenance of public areas,

collection of waste, preservation of cultural heritage, etc. Data collected in this way can be used to increase transparency and promote local government action.

Furthermore, a very important component of a smart city concept is precisely the public lighting system. By using information and communication technologies and the Internet, smart cities strive to improve the quality of urban services and their energy efficiency. As the percentage of urbanization increases and the economy develops, the public lighting system becomes one of the key items of every modern city.

Thus, smart public lighting is used through advanced surveillance; it reduces electricity consumption, optimizes energy efficiency, increases safety and reduces maintenance costs. The latest public lighting systems consist of an LED lamp, a solar panel and a smart pole.

Such systems can be used for various purposes such as: wireless remote control system, electric advertisements, digitalized traffic signs, power station for electric vehicles (cars and bicycles), traffic monitoring sensors, traffic counter, speakers, air quality sensors, decorative lighting, water level display, Push-to-talk service, Wi-Fi and mobile network, cameras, etc. (Image 19).



Image 19: Example of smart solar lighting

One or more different control network protocols are used for continuous communication between individual components in the smart public lighting system as well as the public lighting system and the central computer system. Thus, such a network protocol is a set of rules and standards that allow the display and verification of collected data and the detection and verification of possible errors in the public lighting system. If the geographical area is wider, then there are several public lighting networks, and each has its own control network protocol. Most often, these control protocols are not connected and each network system requires a separate central control system. The most commonly used control network protocols in public lighting are: DALI (Digital Addressable Lighting Interface), TCP / IP (Transmission Control Protocol / Internet Protocol), 6LoWPAN (Low power Wireless Personal Area Networks), ZIGBEE, KNX (Konnex), 0 - 10V analog type control protocol and PLC (Power Line Communication).

6 PUBLIC LIGHTING ENERGY CHARACTERISTICS ANALYSIS AND ENERGY CONSUMPTION AND EXPENSES MANAGEMENT CHARACTERISTICS

6.1 General

According to development strategy of City of Živinice, internal powers analysis, electronetwork and lighting is well developed. Main streets are illuminated, as most rural streets. However, existing public lighting has low energy efficiency. Table 1 gives general data on public lighting system, and table 2 gives a list of overviewed streets.

Amenable administration	Grad Živinice	Street	Mehmed-paše Sokolovića	No.	bb
Contact person	Almir Halilović	Phone	035/743-372		
Cell phone	061/662-581	Mail:	almir@gradzivinice.ba		
Public lighting (type) goal	Street lighting, walking zone lighting, suburb residential zone lighting				
First year of building	Before 1965				
Lamp operating system	<input checked="" type="checkbox"/> Imagecell <input type="checkbox"/> Time relay <input checked="" type="checkbox"/> Timer switch				
Daily operating time (h)	Ljeto: 8:30 pm – 5 am Zima: 4:30 - 7:00 am Average: approx 12h				
Operating system	Not regulated				
Subject obligated/under contract for public lighting maintenance	Kopkomerc LLC Svojat bb, 75270 City of Živinice				
Contact person	Osman Nurkić, director				
Phone					
Electricity supplier	PC Elektroprivreda BiH				

Table 1: General informations on public lighting system

Ordinal No.	Street name
1	1. Mart
2	1. ulica
3	2. ulica
4	2. ulica (prostor oko zgrade)
5	25. Novembar
6	3. ulica
7	Adići
8	Alagići
9	Alije Izetbegovića
10	Atlić mahala
11	Bajrami
12	Bajrići

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13	Bare
14	Bašigovci
15	Begići
16	Bosanska
17	Ciljuge
18	Civilnih žrtava rata
19	Dedići
20	Delići
21	Djedovača
22	Donja Lukavica
23	Donja Višća
24	Dubrave Donje
25	Dubavska
26	Dubavska C
27	Dubavska(naselje uz r469)
28	Durići
29	Đulići
30	Đurđevik
31	Gložik
32	Golubinjak
33	Gornje Dubrave Husići
34	Gostelja
35	Grabik
36	Gračanica
37	Gračanica-Šljivići
38	Gračanica-Zelenika
39	Gradski park konjuh (25. Novembar)
40	Gradski park Živinice(Alije Izetbegovića)
41	Hadžići
42	Hornica
43	igralište Kadrići 800m ²
44	igralište Svojat 800m ²
45	igralište Tupkovići 800m ²
46	igralište Tupkovići-Trojan 800m ²
47	igralište Višća 800m ²
48	igralište(Omerkići)
49	igrališze (Barice)
50	Jablanica
51	Jezero
52	Kadirići
53	Kadrići
54	Klopići
55	Kopjevići
56	Košare
57	Kovači

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58	Krzevići
59	Kupjerusi
60	Kupjerusi-poligon
61	Kupjerusi-Taletovići
62	Livada
63	Lug
64	Lukavica Donja
65	Lukavica Gornja
66	Luke
67	magistralni put M18
68	magistralni put M18
69	Maline Spreča
70	Maline-M18
71	Maršala Tita
72	Modračka
73	Mujići
74	Musići
75	Mustafići
76	Nova cesta
77	Nukići
78	Omerkići
79	Omići
80	Omladinskih radnih brigada
81	Oslobođenja
82	Otawa
83	park(Ulica Oslobođenja)
84	parking općine/grada
85	parking površine cca 600m
86	parking supermarketa
87	parking(Bosanski kulturni centar)
88	parking(Meše Selimovića)
89	parking(Ulica Oslobođenja)
90	Partizanska
91	Pasci donji
92	Pašage Gocića
93	Patriotske lige
94	Petrovići
95	Podgaj
96	Podgajevi
97	Podoljani
98	Podoljani
99	Poljice
100	Prijeki put
101	Priluk
102	prostor oko Crkve sv. Ane

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103	prostor oko džamije Orašje
104	Prva ulica
105	Prvi maj
106	regionalni put R455a
107	regionalni put R469
108	Rudarska
109	Sadnice
110	Sjever
111	Smajići
112	stadion FK Metalac 5000m ²
113	Stara pruga
114	Strašanj
115	Strašanj igralište 800m ²
116	Strašanj-M18
117	Suha
118	Svojat
119	Šarenjak
120	Šehići
121	Šerići
122	Šetnica iza općine/grada
123	Šišići
124	Školska
125	Tadići
126	Toplička
127	Toplička 2
128	Tupkovići
129	Tupkovići Donji
130	Tupkovići Gornji
131	Tupkovići Gornji Čauševići
132	Tupkovići- Trojan
133	Tupkovići-Ćasuri
134	Tupkovići-Mučinovići
135	Tupkovići-Trojan
136	Turijanci
137	Alije Izetbegovića
138	Višća
139	Višća Donja
140	Vrnojevići donji
141	Vrtage
142	XVI. muslimanske brigade
143	Zelenika
144	Zelenika-Krivača
145	Zlatnih ljiljana
146	Željeznička
147	Živčići

148	Živinice Gornje
149	Živiničke ose
150	Živinički sokolovi
151	Živiničkih brigada
152	Rasadište
153	Košare Samardžije

Table 2: Streets listed for an overview⁹

6.2 Energy characteristics analysis

City of Živinice does construction, management and public lighting and device maintenance. Outside lighting in the City shares into: street, urban and spotlight lighting. Street lighting or traffic lighting provides:

- safe, quick and comfortable movement for motor vehicle drivers, bikers and cyclists,
- safe walking, in terms of providing possibilities to notice a threat, to orient themselves and recognize other walkers,
- repair a night look for traffic proximate surrounding.

Urban lighting meets a need for creating ambient atmosphere on public places, squares and streets. Spotlight lighting emphasizes architectural work and significant historic monuments. Image 20 shows public lighting system elements.

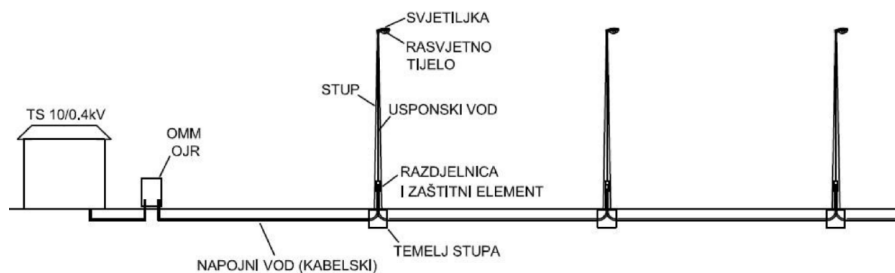


Image 20: Public lighting system elements

Energy characteristics analysis consists of light source optical and technical characteristics analysis, measuring points and substation, poles, conductors/lines and geolocation coordinates of poles and lighting bodies. Detailed information on all analysis and collected data are shown on the following pages.

6.2.1 Lighting source optical and technical characteristics

Subject part of public lighting Study in City of Cazin is installed mostly with sodium lamps in 77,67%, LED lamps in 17,59% and remaining 4,74% are mercury, metal halogen spotlights and fluorescent lamps. Lamp box is mostly built in a mechanical protection IP65 degree.

Table 3 shows a lighting source overview on subject streets, partaking lighting sources are shown in Image 21.

⁹ Podaci dobiveni od nadležne općinske Službe

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

Ordinal No.	Street name	Lighting source type	Rated power per source (W)	Lighting sources (pcs)
1	Tupkovići	LED	50	20
2	Tupkovići	LED	50	44
3	Tupkovići	LED	50	12
4	Tupkovići	LED	50	21
5	Tupkovići Gornji	LED	50	23
6	igralište Tupkovići 800m ²	Metal-halogen spotlight	250	6
7	Tupkovići Gornji	Sodium	150	23
8	Tupkovići Gornji	LED	50	1
9	Tupkovići Gornji	Sodium	150	21
10	Tupkovići Gornji Čauševići	Sodium	150	18
11	Košare	Sodium	150	34
12	Tupkovići-Mujčinovići	Sodium	150	9
13	Tupkovići-Mujčinovići	Sodium	150	16
14	Tupkovići Donji	Sodium	150	33
15	Tupkovići Donji	LED	50	6
16	Tupkovići-Časuri	Sodium	150	17
17	Tupkovići-Trojan	Sodium	150	33
18	Tupkovići-Trojan	Sodium	150	7
19	Tupkovići-Trojan	LED	50	2
20	igralište Tupkovići-Trojan 800m ²	Metal-halogen spotlight	250	6
21	Tupkovići- Trojan	Sodium	150	24
22	Gračanica	Sodium	150	21
23	Gračanica	Sodium	150	6
24	Gračanica	LED	50	12
25	Gračanica	Sodium	150	15
26	Gračanica	LED	100	1
27	Gračanica	LED	50	11
28	Gračanica	Sodium	150	2
29	Gračanica	Sodium	150	27
30	Gračanica	Sodium	150	21
31	Gračanica	Mercury	125	46
32	Gračanica	Mercury	125	11
33	Gračanica	LED	50	10
34	Gračanica	Sodium	150	29
35	Durići	Sodium	150	13
36	Durići	Sodium	150	28
37	Durići	LED	50	1
38	Vrtage	Sodium	150	6
39	Gračanica	Sodium	150	11
40	Gračanica	Sodium	150	20
41	Gračanica	Sodium	150	24

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

Ordinal No.	Street name	Lighting source type	Rated power per source (W)	Lighting sources (pcs)
42	Gračanica-Šljivići	Sodium	150	37
43	Gračanica-Šljivići	Sodium	150	10
44	Gračanica-Zelenika	Sodium	150	12
45	Gračanica-Zelenika	LED	50	26
46	Gračanica-Zelenika	Sodium	150	50
47	Omladinskih radnih brigada	LED	50	15
48	Omladinskih radnih brigada	Sodium	150	5
49	Omladinskih radnih brigada	Sodium	150	42
50	Omladinskih radnih brigada	LED	50	2
51	Omladinskih radnih brigada	Sodium	150	6
52	Hornica	Sodium	150	26
53	Omladinskih radnih brigada	Sodium	150	18
54	stadion FK Metalac 5000m ²	Sodium	150	8
55	Šarenjak	Sodium	70	46
56	Omladinskih radnih brigada	LED	50	2
57	Hornica	Sodium	150	15
58	Omladinskih radnih brigada	Sodium	70	25
59	Maline-M18	Sodium	150	5
60	Maline Spreča	Sodium	150	7
61	Strašanj-M18	Sodium	150	5
62	Strašanj-M18	LED	50	3
63	Strašanj	Sodium	70	31
64	Strašanj	Sodium	70	53
65	Strašanj	Fluorescent	35	23
66	Strašanj	Mercury	125	5
67	Strašanj igralište 800m ²	Metal-halogen spotlight	250	4
68	Strašanj	LED	50	3
69	Šehići	Fluorescent	35	7
70	Šehići	LED	50	1
71	Turijanci	LED	50	18
72	Turijanci	Sodium	150	3
73	Hadžići	Sodium	150	7
74	Nova cesta	Sodium	150	19
75	Nova cesta	LED	50	5
76	Luke	Sodium	150	31
77	Mustafići	Fluorescent	35	32
78	Hadžići	Sodium	150	20
79	Djedovača	Sodium	150	14
80	Djedovača	Mercury	125	17
81	Prijeki put	Sodium	70	11
82	Gložik	Sodium	150	19
83	Gložik	Sodium	150	11

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

Ordinal No.	Street name	Lighting source type	Rated power per source (W)	Lighting sources (pcs)
84	Hadžići	Sodium	150	25
85	Dubrave Donje	Sodium	150	11
86	Prijeki put	Sodium	150	13
87	Hadžići	Sodium	150	12
88	Dubrave Donje	Sodium	150	18
89	prostor oko Crkve sv. Ane	Sodium	70	6
90	Dubravska	Sodium	150	24
91	Dubravska	LED	50	4
92	Dubravska	Sodium	150	35
93	Višća	Sodium	150	10
94	Višća	Sodium	150	56
95	igralište Višća 800m ²	Metal-halogen spotlight	250	6
96	regionalni put R469	Sodium	150	6
97	regionalni put R469	LED	50	7
98	Višća Donja	Sodium	150	51
99	Višća Donja	Sodium	150	54
100	Višća Donja	Sodium	150	23
101	Kupjerusi	Sodium	150	28
102	Kupjerusi-poligon	Sodium	250	6
103	Smajići	Sodium	150	14
104	Smajići	LED	50	2
105	Bajrami	Sodium	150	16
106	Kupjerusi-Taletovići	Sodium	150	26
107	Dubravska	Sodium	250	16
108	Dubravska	Sodium	150	4
109	magistralni put M18	LED	50	31
110	Dubravska C	Sodium	150	12
111	Sjever	Sodium	70	37
112	Sjever	Fluorescent	35	36
113	Sjever	LED	50	5
114	Sjever	LED	50	26
115	Sjever	Sodium	150	15
116	Hadžići	Sodium	150	18
117	Hadžići	Sodium	150	29
118	Hadžići	Sodium	150	14
119	prostor oko džamije Orašje	LED	50	10
120	regionalni put R469	Sodium	150	19
121	Begići	Fluorescent	35	24
122	regionalni put R469	Sodium	150	13
123	Begići	Fluorescent	35	28
124	Begići	Sodium	70	2
125	Delići	Sodium	70	26

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY EFFICIENT PUBLIC LIGHTING SYSTEM
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Ordinal No.	Street name	Lighting source type	Rated power per source (W)	Lighting sources (pcs)
126	Dedići	Fluorescent	35	7
127	Dedići	LED	50	3
128	Begići	LED	50	5
129	Begići	Fluorescent	35	4
130	Gornje Dubrave Husići	Fluorescent	35	38
131	Gornje Dubrave Husići	LED	50	9
132	Kadrići	Sodium	70	32
133	Kadrići	Mercury	125	13
134	Kadrići	LED	50	3
135	igralište Kadrići 800m ²	Metal-halogen spotlight	250	16
136	Kadrići	Fluorescent	35	12
137	Kadrići	Sodium	70	24
138	Bajrići	Sodium	70	23
139	Bajrići	Sodium	70	33
140	Kadrići	Sodium	70	21
141	Krzevići	Sodium	70	24
142	Ciljuge	Sodium	150	8
143	Ciljuge	Sodium	150	45
144	Toplička 2	LED	50	26
145	Ciljuge	LED	50	7
146	Ciljuge	LED	50	16
147	Ciljuge	Sodium	150	4
148	Ciljuge	Sodium	150	12
149	Bašigovci	LED	50	46
150	Bašigovci	LED	50	21
151	Toplička	LED	50	5
152	Toplička	Sodium	70	10
153	Toplička	Sodium	150	5
154	Toplička	Fluorescent	35	2
155	Lukavica Donja	Sodium	150	25
156	Lukavica Donja	Sodium	150	26
157	Lukavica Donja	Sodium	150	35
158	Lukavica Donja	Sodium	150	18
159	Lukavica Donja	Sodium	150	21
160	Lukavica Donja	Sodium	150	36
161	Lukavica Gornja	Sodium	150	14
162	Lukavica Gornja	LED	50	13
163	Lukavica Gornja	Sodium	150	22
164	Lukavica Gornja	Sodium	150	19
165	Lukavica Gornja	Sodium	150	18
166	Lukavica Gornja	LED	50	12
167	Lukavica Gornja	Sodium	150	36

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

Ordinal No.	Street name	Lighting source type	Rated power per source (W)	Lighting sources (pcs)
168	Lukavica Gornja	Sodium	150	12
169	Lukavica Gornja	Sodium	150	12
170	Lukavica Gornja	Sodium	150	26
171	Lukavica Gornja	Sodium	150	21
172	Lukavica Gornja	Sodium	150	12
173	Lukavica Gornja	LED	50	25
174	Svojat	LED	50	11
175	Svojat	Sodium	150	22
176	Svojat	Sodium	150	30
177	Svojat	Sodium	150	27
178	Svojat	Sodium	150	18
179	Svojat	Sodium	150	23
180	Svojat	Sodium	150	36
181	igralište Svojat 800m ²	Sodium	150	4
182	Svojat	LED	50	6
183	Zelenika-Krivača	Sodium	150	22
184	Zelenika-Krivača	LED	50	3
185	Zelenika	Sodium	150	7
186	Zelenika	Sodium	150	20
187	Zelenika	Sodium	150	19
188	Livada	Sodium	150	21
189	Podoljani	Sodium	150	17
190	Donja Lukavica	Sodium	150	13
191	Donja Lukavica	Sodium	150	22
192	Donja Lukavica	Sodium	150	7
193	Donja Lukavica	LED	50	59
194	Bašigovci	Sodium	150	30
195	regionalni put R469	Sodium	150	59
196	regionalni put R469	LED	50	1
197	Pasci donji	Sodium	150	38
198	3. ulica	LED	50	5
199	3. ulica	LED	50	9
200	magistralni put M18	LED	50	10
201	magistralni put M18	LED	50	14
202	magistralni put M18	LED	50	57
203	2. ulica	LED	50	48
204	Alije Izetbegovića	LED	50	29
205	1. ulica	Sodium	150	12
206	1. ulica	Sodium	150	14
207	1. ulica	LED	50	53
208	Zlatnih ljiljana	LED	50	6
209	Zlatnih ljiljana	Sodium	150	31

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Ordinal No.	Street name	Lighting source type	Rated power per source (W)	Lighting sources (pcs)
210	parking(Bosanski kulturni centar)	LED	50	6
211	parking(Bosanski kulturni centar)	Sodium	150	11
212	25. Novembar	LED	50	19
213	25. Novembar	Sodium	150	9
214	25. Novembar	Mercury	125	14
215	parking supermarketa	LED	50	9
216	parking supermarketa	Mercury	125	4
217	parking površine cca 600m	Mercury	125	8
218	parking površine cca 600m	LED	50	13
219	Gradski park konjuh (25. Novembar)	LED	50	29
220	Gradski park konjuh (25. Novembar)	Sodium	150	7
221	Prvi maj	Sodium	150	13
222	Školska	LED	50	15
223	Školska	Sodium	150	1
224	Maršala Tita	LED	50	4
225	Maršala Tita	LED	50	5
226	Prva ulica	Sodium	150	4
227	2. ulica (prostor oko zgrade)	Sodium	150	8
228	Oslobođenja	LED	50	15
229	Oslobođenja	LED	50	15
230	Alije Izetbegovića	Sodium	150	5
231	parking(Meše Selimovića)	Metal-halogen spotlight	250	15
232	Oslobođenja	Sodium	150	11
233	park(Ulica Oslobođenja)	Sodium	150	11
234	parking(Ulica Oslobođenja)	Sodium	150	6
235	Gradski park Živinice(Alije Izetbegovića)	Sodium	150	14
236	ulica iza Općine/Grada (Alije Izetbegovića)	Sodium	150	4
237	ulica iza Općine/Grada (Alije Izetbegovića)	LED	50	4
238	parking Općine/Grada	Metal-halogen spotlight	250	1
239	parking Općine/Grada	LED	50	2
240	Šetnica iza Općine/Grada	Sodium	150	8
241	Pašage Gocića	LED	50	3
242	Pašage Gocića	Sodium	150	18
243	Patriotske lige	Sodium	150	8
244	Željeznička	LED	50	6
245	Željeznička	Sodium	150	1
246	XVI muslimanske brigade	Sodium	150	8
247	Rudarska	Sodium	150	11
248	Rudarska	Sodium	150	3
249	Rudarska	LED	50	7
250	Rudarska	Mercury	125	1

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY EFFICIENT PUBLIC LIGHTING SYSTEM
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Ordinal No.	Street name	Lighting source type	Rated power per source (W)	Lighting sources (pcs)
251	Živiničkih brigada	Sodium	150	7
252	Civilnih žrtava rata	Sodium	150	6
253	Dubavska(naselje uz r469)	Sodium	150	10
254	regionalni put R469	Sodium	150	11
255	regionalni put R469	LED	50	2
256	Bosanska	Sodium	150	197
257	Bosanska	LED	50	2
258	Jezero	Sodium	150	24
259	Jezero	LED	50	13
260	Jezero	Sodium	150	28
261	Jezero	Mercury	125	4
262	Jezero	Sodium	150	6
263	Jezero	Sodium	150	5
264	1. Mart	Sodium	150	32
265	1. Mart	LED	50	1
266	1. Mart	Sodium	150	5
267	1. Mart	LED	50	1
268	1. Mart	Sodium	150	3
269	Sadnice	Sodium	150	16
270	Toplička	Sodium	150	10
271	Toplička	LED	50	6
272	Toplička	Sodium	150	7
273	regionalni put R469	Sodium	150	12
274	regionalni put R469	LED	50	4
275	1. ulica	Sodium	150	8
276	regionalni put R455a	Sodium	100	22
277	Poljice	Sodium	100	14
278	Klopići	Sodium	100	9
279	Klopići	Sodium	100	4
280	Klopići	Sodium	100	12
281	regionalni put R455a	Sodium	100	2
282	Priluk	Sodium	100	75
283	regionalni put R455a	Sodium	100	23
284	Priluk	Sodium	100	17
285	Priluk	LED	50	29
286	Priluk	Sodium	100	32
287	regionalni put R455a	Sodium	100	7
288	Omići	LED	50	3
289	Omići	Sodium	100	16
290	regionalni put R455a	Sodium	100	7
291	Omerkići	Sodium	100	22
292	Omerkići	LED	50	5

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

Ordinal No.	Street name	Lighting source type	Rated power per source (W)	Lighting sources (pcs)
293	R455a	Sodium	100	16
294	Alagići	Sodium	100	11
295	Alagići	Sodium	100	26
296	Šehići	Sodium	100	42
297	Šehići	Sodium	100	44
298	Šehići	Sodium	100	16
299	Šerići	Sodium	100	22
300	Šerići	Sodium	100	40
301	regionalni put R455a	Sodium	100	8
302	Šerići	Sodium	100	10
303	regionalni put R455a	Sodium	100	18
304	Omerkići	Sodium	100	5
305	igralište(Omerkići)	Sodium	100	10
306	regionalni put R455a	Sodium	100	13
307	Šerići	Sodium	100	65
308	regionalni put R455a	Sodium	100	15
309	Šerići	Sodium	100	51
310	Šerići	LED	50	1
311	Šerići	Sodium	100	13
312	regionalni put R455a	Sodium	100	30
313	regionalni put R455a	Sodium	100	9
314	regionalni put R455a	LED	50	1
315	Suha	Sodium	100	63
316	Suha	Sodium	100	63
317	Suha	LED	50	42
318	regionalni put R455a	Sodium	100	8
319	Suha	Sodium	100	32
320	Suha	LED	50	9
321	Suha	Sodium	100	38
322	Suha	LED	50	9
323	Đulići	Sodium	100	26
324	Đulići	Sodium	100	6
325	Barice	Sodium	100	23
326	Atlić mahala	Sodium	100	46
327	Jablanica	Sodium	100	9
328	Jablanica	Sodium	100	24
329	Tadići	Sodium	100	10
330	Tadići	Sodium	100	25
331	Živinice Gornje	Sodium	100	18
332	Živinice Gornje	Sodium	100	8
333	Živinice Gornje	LED	50	3
334	Kopjevići	Sodium	100	14

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

Ordinal No.	Street name	Lighting source type	Rated power per source (W)	Lighting sources (pcs)
335	Kopjevići	Sodium	100	37
336	Grabik	Sodium	100	22
337	Petrovići	Sodium	100	19
338	Petrovići	Sodium	100	18
339	Šišići	Sodium	100	42
340	Šišići	LED	50	4
341	Šišići	LED	50	24
342	Šišići	Sodium	100	10
343	Adići	Sodium	100	22
344	Adići	Sodium	100	19
345	Adići	LED	50	5
346	Lug	Sodium	100	8
347	Lug	LED	50	8
348	Lug	Sodium	100	12
349	magistralni put M18	Sodium	100	10
350	Đurđevik	Sodium	100	21
351	Đurđevik	Sodium	100	55
352	Đurđevik	LED	50	3
353	Gostelja	Sodium	100	24
354	magistralni put M18	LED	50	10
355	Gostelja	Sodium	100	21
356	Musići	Sodium	100	49
357	Musići	LED	50	2
358	Musići	Sodium	100	30
359	Gostelja	LED	50	6
360	Gostelja	Sodium	100	18
361	Golubinjak	Sodium	100	54
362	Golubinjak	LED	50	7
363	Nukići	Sodium	100	66
364	Nukići	LED	50	2
365	regionalni put R469	Sodium	100	24
366	Živiničke ose	Sodium	100	47
367	Živiničke ose	LED	50	10
368	Živiničke ose	Sodium	70	76
369	Živiničke ose	LED	50	56
370	Živiničke ose	Sodium	70	24
371	Živiničke ose	Fluorescent	35	14
372	Gostelja	Sodium	100	28
373	Gostelja	LED	50	29
374	Golubinjak	Sodium	100	31
375	Golubinjak	LED	50	1
376	Golubinjak	Sodium	100	32

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Ordinal No.	Street name	Lighting source type	Rated power per source (W)	Lighting sources (pcs)
377	regionalni put R469	Sodium	100	38
378	Donja Višća	Sodium	100	21
379	Donja Višća	LED	50	1
380	Donja Višća	Sodium	100	15
381	regionalni put R469	Sodium	100	8
382	regionalni put R469	LED	50	4
383	Šišići	Sodium	100	71
384	Šišići	Sodium	100	32
385	Šišići	LED	50	3
386	Gostelja	Sodium	100	6
387	Gostelja	LED	50	11
388	magistralni put M18	Sodium	100	8
389	magistralni put M18	LED	50	5
390	Stara pruga	Sodium	100	75
391	Stara pruga	LED	50	3
392	Bare	Sodium	100	9
393	Bare	LED	50	5
394	Kovači	Sodium	100	31
395	Kovači	Sodium	100	10
396	Kovači	Sodium	100	38
397	Kovači	Sodium	100	34
398	Kovači	Sodium	100	17
399	Kovači	Sodium	100	13
400	Mujići	Sodium	100	16
401	Bašigovci	Sodium	100	27
402	Bašigovci	LED	50	4
403	Bašigovci	Sodium	100	8
404	Bašigovci	Sodium	100	27
405	Bašigovci	Sodium	100	21
406	Bašigovci	Sodium	100	14
407	Bašigivco	Sodium	100	24
408	Bašigivco	Sodium	100	14
409	Bašigivco	Sodium	100	9
410	Bašigivco	Sodium	100	13
411	Bašigivco	LED	50	1
412	Podoljani	LED	50	25
413	Podoljani	Sodium	100	3
414	Bašigovci	Sodium	100	13
415	Bašigovci	Sodium	100	8
416	Bašigovci	Sodium	100	5
417	Bašigovci	Sodium	100	15
418	Bašigovci	Sodium	100	3

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CITY OF ŽIVINICE

Ordinal No.	Street name	Lighting source type	Rated power per source (W)	Lighting sources (pcs)
419	Bašigovci	LED	50	3
420	Vrnojevići donji	Sodium	100	4
421	Vrnojevići donji	LED	50	14
422	regionalni put R455a	Sodium	150	40
423	Toplička	Sodium	150	15
424	Toplička	Sodium	150	17
425	Toplička	LED	50	4
426	Toplička	Sodium	150	6
427	3. ulica	Sodium	150	18
428	3. ulica	LED	50	3
429	3. ulica	Sodium	70	4
430	Stara pruga	Sodium	150	9
431	Stara pruga	LED	50	3
432	Stara pruga	Sodium	150	10
433	Stara pruga	LED	50	6
434	regionalni put R455a	Sodium	150	5
435	regionalni put R455a	Sodium	150	2
436	Živinički sokolovi	Sodium	150	5
437	Partizanske	Sodium	150	17
438	Živinički sokolovi	Sodium	150	7
439	Živinički sokolovi	LED	50	1
440	Partizanska	Sodium	150	18
441	Partizanska	Sodium	150	18
442	Partizanska	LED	50	1
443	Partizanska	Sodium	150	26
444	Partizanska	LED	50	1
445	Partizanska	Sodium	150	12
446	Partizanska	Sodium	150	18
447	Partizanska	LED	50	3
448	Živinički sokolovi	Sodium	100	13
449	Živinički sokolovi	Sodium	100	17
450	Živinički sokolovi	LED	50	2
451	regionalni put R455a	Sodium	150	50
452	Modračka	Sodium	150	18
453	regionalni put R455a	Sodium	150	24
454	regionalni put R455a	Sodium	150	18
455	Barice	Sodium	150	22
456	regionalni put R455a	Sodium	150	21
457	Barice	Sodium	150	9
458	Barice	Sodium	100	22
459	igrališze (Barice)	Sodium	100	4
460	Otawa	Sodium	100	28

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Ordinal No.	Street name	Lighting source type	Rated power per source (W)	Lighting sources (pcs)
461	Otawa	LED	50	12
462	Podgaj	Sodium	100	13
463	Podgaj	LED	50	6
464	Podgaj	Sodium	100	20
465	Podgaj	Sodium	100	14
466	Podgaj	Sodium	100	21
467	Podgaj	LED	50	3
468	Podgaj	Sodium	100	14
469	Kovači	Sodium	100	3
470	Kovači	LED	50	10
471	Podgajevi	Sodium	100	13
472	magistralni put M18	Sodium	100	25
473	Šahići	Sodium	100	27
474	Đurđevik	Sodium	100	51
475	Đurđevik	Sodium	100	20
476	Živčići	Sodium	100	8
477	Živčići	Sodium	100	18
478	Podgaj	Sodium	100	10
479	Podgajevi	LED	50	31
480	Košare Samardžije	Led p	50	25
481	Rasadište	Led p	50	35
TOTAL				8530

Table 3: Lighting types by subject streets

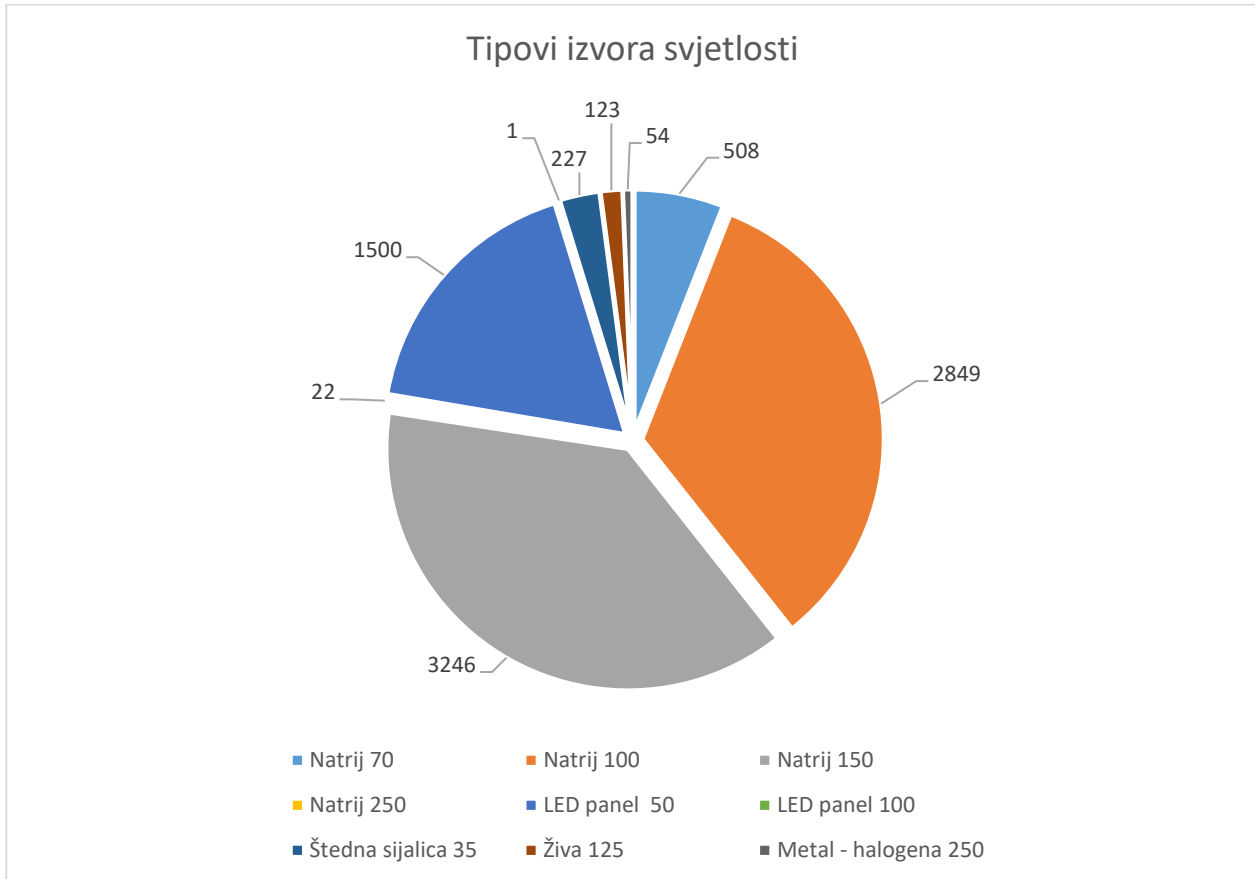


Image 21: Partaking lighting source types

Image 22 i image 23 show an existing public lighting lamps overview in City of Živinice. Due to lighting source obsolescence, lamps are filthy and that characteristic is a poor one for illumination. Lighting engagement regime especially has a seasonal character due to different day lengths in a year. Table 3 shows a conclusion on outdated inadequate lighting system which has a certain unwanted consequences, and they are:

- frequent malfunctions in public lighting system,
- extra damaging as a consequence due to poor gear quality,
- maintenance expenses,
- great electricity consumption,
- lamps without (quality) reflector lead to dispersing luminosity on unintended surfaces, flare and extra unnecessary energy loss,
- outdated lamp design,
- luminous environment pollution in terms of unintended sky illuminations and obstructing light.



Image 22: Sodium lamps



Image 23: LED panels

6.2.2 Geolocation coordinates of poles and lighting bodies

Public lighting mapping is done by using GARMIN GPS73 instrument and a mobile application SW Maps. Mapped lamps are lamps located on parts of traffic roads with different lamp order, done in a way of moving –from lamp to lamp and marking a lamp/pole and found on vertical axis of a lamp, picturing significant lamps. After done lamp mapping, data was delivered into computer program QGIS. In QGIS there was installed an addition for OpenStreetMap map and addition for import/export of Images. Processing data, we get a mapped lamp overview (Image 24).

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Image 24: Pole and lamp mapping example

Mapping comes to expression when it is necessary to write down several distribution cabinet, substations and extra lamp types, etc. Detailed report on geolocation coordinates is shown in annex. Besides mapping distances between poles are measured and tested, lamp console length, pole height, road to pole distance with an instrument – Leica DISTO D210 and in a QGIS program. Image 25 shows a measuring example. Data on all measurements is shown in the following chapters.



Image 25: Laser measuring parameter example

6.2.3 Measuring points and substations

Total number of measuring points (OMM) in the system referring to this study, there are 219 measuring points for measuring public lighting system energy consumption. 14 measuring points are located inside substation, remaining are located on the outside of substation. 217 Image cells are installed in central building for controlling power of installed lamps. It is a partial convenient management system, due to it is not necessary to set a new time interval in every central building for turning public lighting on/off. Besides Image cells, two central building installed time switches.

Circuits are protected with automatic fuses usually Hager on which there are no signs of damaging on fuses. Main switches are operable and new. Switchboards fulfill current demands of the right standard STN. While operating, there is no greater risk of electric shock. Leading cables for all public lighting distributors are mechanically protected. Control and safety parts are mostly protected with casings in case of possible electric shock and they are not life threatening while maintaining. Table 4 shows data on measuring points (OMM), and Image 26 shows OMM overview.

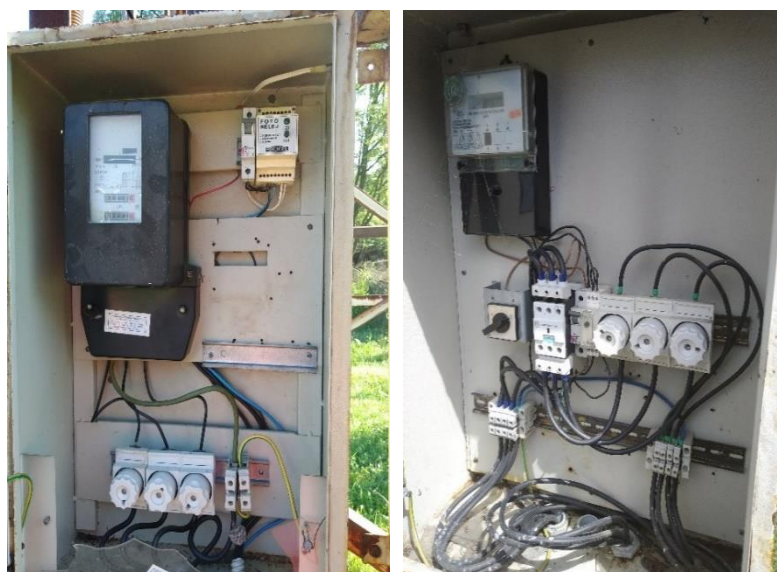


Image 26: OMM (left – Strašanaj, right – Šerići)

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Measuring point unique ID (based on electricity supplier numeration)	Label OMM (officially based on EE overview numeration)	Substation name/label	OMM is located inside substation (yes / no)	Average lighting daily working hours (h)	Management type	Switching device functional (yes / no)	Luminous flux regulation (yes / no)	Regulation type	Regulation device functional (yes / no)	Public lighting power lines in OMM	Labels for the right circuits	Power line type for PL (overground/underground / mix)
01/A	9802320	PL TUPKOVIĆI	No	12	Image cells	yes	no	no regulation	-	1	01/A/1	over ground
02/A	9802495	PL TUPKOVIĆI	No	12	Image cells	yes	no	no regulation	-	1	02/A/1	over ground
03/A	9789081	PL TUPKOVIĆI	No	12	Image cells	yes	no	no regulation	-	3	03/A/1-03/A/2-03/A/3	over ground
04/A	9868070	PL TUPKOVIĆI	no	12	Image cells	yes	no	no regulation	-	1	04/A/1	over ground
05/A	9532188	PL(G.TUPKOVIĆI)	no	12	Image cells	yes	no	no regulation	-	1	05/A/1	over ground
06/A	8945535	PL TUPKOVIĆI	no	12	Image cells	yes	no	no regulation	-	1	06/A/1 06/A/2	over ground
07/A	8666970	PL TUPKOVIĆI	no	12	Image cells	yes	no	no regulation	-	1	07/A/1	over ground
08/A	9358544	PL(TUPKOVIĆI DONJI)	no	12	Image cells	yes	no	no regulation	-	1	08/A/1	over ground

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09/A	9512659	PL(TUPKOVIĆI)	no	12	Image cells	yes	no	no regulation	-	1	09/A/1	over ground
10/A	8946175	PL TUPKOVIĆI	no	12	Image cells	yes	no	no regulation	-	2	10/A/1 10/A/2	over ground
11/A	8945470	PL TUPKOVIĆI	no	12	Image cells	yes	no	no regulation	-	1	11/A/1	over ground
12/A	68859043	PL G.TUPKOVIĆI	no	12	Image cells	yes	no	no regulation	-	1	12/A/1	over ground
13/A	9842284	PL TUPKOVIĆI	no	12	Image cells	yes	no	no regulation	-	1	13/A/1	over ground
14/A	9802479	PL TUPKOVIĆI	no	12	Image cells	yes	no	no regulation	-	1	14/A/1	over ground
15/A	8632804	PL S.GRAČANICA	no	12	Image cells	yes	no	no regulation	-	1	15/A/1	over ground
16/A	8632650	PL S.GRAČANICA	no	12	Image cells	yes	no	no regulation	-	1	16/A/1	over ground

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17/A	8298203	PL S.GRAČANICA	no	12	Image cells	yes	no	no regulation	-	1	17/A/1	over ground
18/A	9532404	PL(GRAČANICA)	no	12	Image cells	yes	no	no regulation	-	1	18/A/1	over ground
19/A	8762457	PL GRAČANICA	no	12	Image cells	yes	no	no regulation	-	1	19/A/1	over ground
20/A	9324070	PL GRAČANICA SELO	no	12	Image cells	yes	no	no regulation	-	1	20/A/1	over ground
21/A	9552995	PL(GRAČANICA)	no	12	Image cells	yes	no	no regulation	-	1	21/A/1	over ground
22/A	8762449	PL GRAČANICA	no	12	Image cells	yes	no	no regulation	-	1	22/A/1	over ground
23/A	8393850	PL S. GRAČANICA	no	12	Image cells	yes	no	no regulation	-	1	23/A/1	over ground
24/A	90862889	PL ZELENKA	no	12	Image cells	yes	no	no regulation	-	1	24/A/1	over ground

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25/A	8904529	PL ZELENICA	no	12	Image cells	yes	no	no regulation	-	1	25/A/1	over ground
26/A	8904367	PL ZELENICA	no	12	Image cells	yes	no	no regulation	-	1	26/A/1	over ground
27/A	8390142	PL ĐAKOVIĆI	no	12	Image cells	yes	no	no regulation	-	1	27/A/1	mix
28/A	8135460	PL HORNICA	no	12	Image cells	yes	no	no regulation	-	1	28/A/1	over ground
29/A	8958394	PL(HORNICA)	no	12	Image cells	yes	no	no regulation	-	3	29/A/1 29/A/2 29/A/3	over ground
30/A	8958378	PL(HORNICA)	no	12	Image cells	yes	no	no regulation	-	2	30/A/1 30/A/2	mix
31/A	9631356	PL MAG.PUT MALINE	no	12	Image cells	yes	no	no regulation	-	1	31/A/1	over ground
32/A	8621896	PL(STRAŠANJ)	no	12	Image cells	yes	no	no regulation	-	1	32/A/1	over ground

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33/A	8381461	PL STRAŠANJ	no	12	Image cells	yes	no	no regulation	-	3	33/A/1 33/A/2 33/A/3	over ground
34/A	8680264	PL MZ DUBRAVE-ŠEHIČI	no	12	Image cells	yes	no	no regulation	-	1	34/A/1	over ground
35/A	9747389	PL G.DUBRAVE	no	12	Image cells	yes	no	no regulation	-	1	35/A/1	over ground
36/A	8413576	PL D.DUBRAVE	no	12	Image cells	yes	no	no regulation	-	2	36/A/1 36/A/2	over ground
37/A	9747362	PL G.DUBRAVE	no	12	Image cells	yes	no	no regulation	-	1	37/A/1	over ground
38/A	8560056	PL D.DUBRAVE	no	12	Image cells	yes	no	no regulation	-	1	38/A/1	over ground
39/A	117534	PL D.DUBRAVE	no	12	Image cells	yes	no	no regulation	-	2	39/A/1 39/A/2	over ground
40/A	8753202	PL D.DUBRAVE	no	12	Image cells	yes	no	no regulation	-	2	40/A/1 40/A/2	over ground

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41/A	8388903	PL D. DUBRAVE	no	12	Image cells	yes	no	no regulation	-	3	41/A/1 41/A/2 41/A/3	over ground
42/A	8606854	PL D.DUBRAVE RASKRŠĆE	no	12	Image cells	yes	no	no regulation	-	3	42/A/1 42/A/2 42/A/3	over ground
43/A	8607524	PL D.DUBRAVE SPREČA	no	12	Image cells	yes	no	no regulation	-	1	43/A/1	over ground
44/A	8606870	PL D.DUBRAVE SPREČA	no	12	time switch	yes	no	no regulation	-	1	44/A/1	over ground
45/A	8446024	PL VIŠĆA	no	12	Image cells	yes	no	no regulation	-	2	45/A/1 45/A/2	over ground
46/A	8474443	PL VIŠĆA	no	12	Image cells	yes	no	no regulation	-	2	46/A/1 46/A/1	over ground
47/A	9323457	PL DONJA VIŠĆA	no	12	Image cells	yes	no	no regulation	-	1	47/A/1	over ground
48/A	8412278	PL VIŠĆA	no	12	Image cells	yes	no	no regulation	-	1	48/A/1	over ground

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49/A	8474451	PL KUPJERUSI	no	12	Image cells	yes	no	no regulation	-	2	49/A/1 49/A/2	over ground
50/A	8818975	PL VIŠČA KUPJERUSI	no	12	Image cells	yes	no	no regulation	-	2	50/A/1 50/A/2	over ground
51/A	8818983	PL VIŠČA KUPJERUSI	no	12	Image cells	yes	no	no regulation	-	1	51/A/1	over ground
52/A	8413592	PL Ž. SJEVER	no	12	Image cells	yes	no	no regulation	-	2	52/A/1 52/A/2	mix
53/A	8391793	PL Ž. SJEVER	no	12	Image cells	yes	no	no regulation	-	1	53/A/1	over ground
54/A	8126437	PL Ž. SJEVER	no	12	Image cells	yes	no	no regulation	-	2	54/A/1 54/A/2	mix
55/A	9513132	PL(SJEVER 2)	no	12	time switch	yes	no	no regulation	-	1	55/A/1	over ground
56/A	8634564	PL G.DUBRAVE DEDIĆI	no	12	Image cells	yes	no	no regulation	-	3	56/A/1 56/A/2 56/A/3	over ground

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57/A	8634653	PL G.DUBR.BEGIĆI	no	12	Image cells	yes	no	no regulation	-	2	57/A/1 57/A/2	over ground
58/A	8634645	PL G.DUBR. REDŽIĆI	no	12	Image cells	yes	no	no regulation	-	1	58/A/1	over ground
59/A	9755934	PL G.DUBRAVE	no	12	Image cells	yes	no	no regulation	-	2	59/A/1 59/A/2	over ground
60/A	9317872	PL G.DUBRAVE	no	12	Image cells	yes	no	no regulation	-	1	60/A/1	over ground
61/A	8913439	PL KADRIĆI	yes	12	Image cells	yes	no	no regulation	-	2	61/A/1 61/A/2	mix
62/A	8347727	PL G.DUBRAVE	no	12	Image cells	yes	no	no regulation	-	1	62/A/1	over ground
63/A	8391637	PL G. DUBRAVE	no	12	Image cells	yes	no	no regulation	-	1	63/A/1	over ground
64/A	9512012	PL(G.DUBRAVE ŽUNOVIĆI)	no	12	Image cells	yes	no	no regulation	-	1	64/A/1	over ground

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65/A	8635587	PL G.DUBR. KRŽEVIĆI	no	12	Image cells	yes	no	no regulation	-	2	65/A/1 65/A/2	over ground
66/A	8957126	PL CILJUGE 2 PRUGA	no	12	Image cells	yes	no	no regulation	-	1	66/A/1	over ground
67/A	71472603	PL KOVAČI	no	12	Image cells	yes	no	no regulation	-	1	67/A/1	over ground
68/A	8957975	PL(CILJUGE)	no	12	Image cells	yes	no	no regulation	-	1	68/A/1	over ground
69/A	714726608	PL BAŠIGOVCI	no	12	Image cells	yes	no	no regulation	-	1	69/A/1	over ground
70/A	73773027	PL BAŠIGOVCI	no	12	Image cells	yes	no	no regulation	-	1	70/A/1	over ground
71/A	9317600	PL TOPLIČKA	no	12	Image cells	yes	no	no regulation	-	1	71/A/1	over ground
72/A	9868291	PL D.LUKAVICA	no	12	Image cells	yes	no	no regulation	-	1	72/A/1	over ground

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73/A	8955131	PL D.LUKAVICA	no	12	Image cells	yes	no	no regulation	-	1	73/A/1	over ground
74/A	9597182	PL DONJA LUKAVICA	no	12	Image cells	yes	no	no regulation	-	1	74/A/1	over ground
75/A	9864350	PL DONJA LUKAVICA	no	12	Image cells	yes	no	no regulation	-	1	75/A/1	over ground
76/A	76415068	PL DONJA LUKAVICA	no	12	Image cells	yes	no	no regulation	-	1	76/A/1	over ground
77/A	67438056	PL G.LUKAVICA	no	12	Image cells	yes	no	no regulation	-	1	77/A/1	over ground
78/A	51125601	PL G.LUKAVICA SPOMEN OBILJEŽJE	no	12	Image cells	yes	no	no regulation	-	1	78/A/1	over ground
79/A	9546669	PL LUKAVICA GORNJA	no	12	Image cells	yes	no	no regulation	-	1	79/A/1	over ground
80/A	8955107	PL G.LUKAVICA	no	12	Image cells	yes	no	no regulation	-	1	80/A/1	over ground

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81/A	8560498	PL G.LUKAVICA	no	12	Image cells	yes	no	no regulation	-	1	81/A/1	over ground
82/A	8955085	PL G.LUKAVICA	no	12	Image cells	yes	no	no regulation	-	1	82/A/1	over ground
83/A	8956251	PL BIJELI PUT	no	12	Image cells	yes	no	no regulation	-	1	83/A/1	over ground
84/A	8400067	PL G.LUKAVICA	no	12	Image cells	yes	no	no regulation	-	1	84/A/1	over ground
85/A	8775478	PL SVOJAT	no	12	Image cells	yes	no	no regulation	-	1	85/A/1	over ground
86/A	8958610	PL SVOJAT B	no	12	Image cells	yes	no	no regulation	-	1	86/A/1	over ground
87/A	9597204	PL SVOJAT	no	12	Image cells	yes	no	no regulation	-	1	87/A/1	over ground
88/A	8775486	PL SVOJAT	no	12	Image cells	yes	no	no regulation	-	2	88/A/1 88/A/2	over ground

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Measuring point unique ID (based on electricity supplier numeration)	Label OMM (officially based on EE overview numeration)	Substation name/label	OMM is located inside substation (yes / no)	Average lighting daily working hours (h)	Management type	Switching device functional (yes / no)	Luminous flux regulation (yes / no)	Regulation type	Regulation device functional (yes / no)	Public lighting power lines in OMM	Labels for the right circuits	Power line type for PL (overground/underground / mix)
89/A	9596348	PL SVOJAT	no	12	Image cells	yes	no	no regulation	-	1	89/A/1	over ground
90/A	8904456	PL ZELENKA	no	12	Image cells	yes	no	no regulation	-	1	90/A/1	over ground
91/A	8904529	PL ZELENKA	no	12	Image cells	yes	no	no regulation	-	1	91/A/1	over ground
92/A	95122462	PL BAŠIGOVCI	no	12	Image cells	yes	no	no regulation	-	1	92/A/1	over ground
93/A	8957088	PL D.LUKAVICA	no	12	Image cells	yes	no	no regulation	-	2	93/A/1 93/A/2	over ground
94/A	9864490	PL D.LUKAVICA	no	12	Image cells	yes	no	no regulation	-	1	94/A/1	over ground
95/A	895296	PL BAŠIGOVCI	no	12	Image cells	yes	no	no regulation	-	1	95/A/1	over ground
96/A	8810028	PL KLAPIĆI	no	12	Image cells	yes	no	no regulation	-	1	96/A/1	over ground

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97/A	8957037	PL GOLUBINJAK	no	12	Image cells	yes	no	no regulation	-	2	97/A/1 97/A/2	over ground
98/A	8957266	PL GOLUBINJAK	no	12	Image cells	yes	no	no regulation	-	2	98/A/1 98/A/2	over ground
99/A	8388318	PL ĐURĐEVİK	no	12	Image cells	yes	no	no regulation	-	2	99/A/1 99/A/2	over ground
100/A	8404518	PL PRILUK	no	12	Image cells	yes	no	no regulation	-	2	100/A/1 100/A/2	over ground
101/A	8658439	PL MZ ĐURĐEVİK	no	12	Image cells	yes	no	no regulation	-	2	101/A/1 101/A/2	over ground
102/A	9357424	PL ĐURĐEVİK MAG. PUT	no	12	Image cells	yes	no	no regulation	-	1	102/A/1	over ground
103/A	8612056	PL LUČIĆI	no	12	Image cells	yes	no	no regulation	-	1	103/A/1	over ground
104/A	8728577	PL MZ G.ŽIVINICE	no	12	Image cells	yes	no	no regulation	-	1	104/A/1	over ground

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105/A	9338632	PL SPAHIĆI	no	12	Image cells	yes	no	no regulation	-	1	105/A/1	over ground
106/A	8632677	PL G. ŽIVINICE	no	12	Image cells	yes	no	no regulation	-	1	106/A/1	over ground
107/A	8767297	PL KARAUŁA	no	12	Image cells	yes	no	no regulation	-	1	107/A/1	over ground
108/A	8137102	PL LUG	no	12	Image cells	yes	no	no regulation	-	1	108/A/1	over ground
109/A	9107134	PL LUG	no	12	Image cells	yes	no	no regulation	-	1	109/A/1	over ground
110/A	8392072	PL LITVE	no	12	Image cells	yes	no	no regulation	-	1	110/A/1	over ground
111/A	8427933	PL STRAŠANJ	no	12	Image cells	yes	no	no regulation	-	1	111/A/1	over ground
112/A	9525068	PL MODRAČKA	no	12	Image cells	yes	no	no regulation	-	2	112/A/1 112/A/2	over ground

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113/A	9594582	PL BARICE	no	12	Image cells	yes	no	no regulation	-	2	113/A/1 113/A/2	over ground
114/A	9514058	PL BARICE	no	12	Image cells	yes	no	no regulation	-	1	114/A/1	over ground
115/A	9528164	PL BARIČKI GAJ	no	12	Image cells	yes	no	no regulation	-	3	115/A/1 115/A/2 115/A/3	over ground
116/A	8626774	PL MZ RUDAR	no	12	Image cells	yes	no	no regulation	-	2	116/A/1 116/A/2	over ground
117/A	8341621	PL VIŠČA	no	12	Image cells	yes	no	no regulation	-	1	117/A/1	over ground
118/A	9317236	PL SUHA BAPLIČI	no	12	Image cells	yes	no	no regulation	-	1	118/A/1	over ground
119/A	8863105	PL KOPJEVIČI	no	12	Image cells	yes	no	no regulation	-	1	119/A/1	over ground
120/A	8870977	PL GRABIK	no	12	Image cells	yes	no	no regulation	-	1	120/A/1	over ground

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121/A	9624961	PL BREZIK	no	12	Image cells	yes	no	no regulation	-	1	121/A/1	over ground
122/A	8863075	PL KOPJEVIĆI	no	12	Image cells	yes	no	no regulation	-	1	122/A/1	over ground
123/A	9127119	PL DONJA VIŠĆA	no	12	Image cells	yes	no	no regulation	-	1	123/A/1	over ground
124/A	9940855	PL LITVE	no	12	Image cells	yes	no	no regulation	-	2	124/A/1	over ground
125/A	8955611	PL MZ LITVE	no	12	Image cells	yes	no	no regulation	-	2	125/A/1	over ground
126/A	8621888	PL 16.MUSLIMANSKE BRIGADE	no	12	Image cells	yes	no	no regulation	-	2	126/A/1 126/A/2	over ground
127/A	9534939	PL LITVE	no	12	Image cells	yes	no	no regulation	-	2	127/A/1 127/A/2	over ground
128/A	9505172	PL GOLUBINJAK	no	12	Image cells	yes	no	no regulation	-	1	128/A/1	over ground

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129/A	8958505	PL LUČIĆI	no	12	Image cells	yes	no	no regulation	-	1	129/A/1	over ground
130/A	9338306	PL LUČIĆI	no	12	Image cells	yes	no	no regulation	-	1	130/A/1	over ground
131/A	8560056	PL D.DUBRAVE	no	12	Image cells	yes	no	no regulation	-	1	131/A/1	over ground
132/A	8427925	PL ĐURĐEVİK	no	12	Image cells	yes	no	no regulation	-	1	132/A/1	over ground
133/A	8768099	PL STARI ĐURĐEVİK	no	12	Image cells	yes	no	no regulation	-	2	133/A/1 133/A/2	over ground
134/A	8896151	PL PRILUK OMERKIĆI	no	12	Image cells	yes	no	no regulation	-	1	134/A/1	over ground
135/A	8612048	PL PRILUK OMERKIĆI	no	12	Image cells	yes	no	no regulation	-	2	135/A/1 135/A/2	over ground
136/A	9756701	PL PETROVIĆI	no	12	Image cells	yes	no	no regulation	-	1	136/A/1	over ground

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137/A	9513957	PL PRILUK POLJIĆI	no	12	Image cells	yes	no	no regulation	-	1	137/A/1	over ground
138/A	8632685	PL ŠERIĆI	no	12	Image cells	yes	no	no regulation	-	1	138/A/1	over ground
139/A	8807167	PL ŠERIĆI RIBAC	no	12	Image cells	yes	no	no regulation	-	1	139/A/1	over ground
140/A	8807175	PL ŠERIĆI RIBAC	no	12	Image cells	yes	no	no regulation	-	1	140/A/1	over ground
141/A	8392064	PL ŠERIĆI	no	12	Image cells	yes	no	no regulation	-	1	141/A/1	over ground
142/A	8946094	PL ŠERIĆI	no	12	Image cells	yes	no	no regulation	-	1	142/A/1	over ground
143/A	9871236	PL MZ ŠERIĆI	no	12	Image cells	yes	no	no regulation	-	2	143/A/1 143/A/2	over ground
144/A	93162213	PL ŠERIĆI RIBAC	no	12	Image cells	yes	no	no regulation	-	2	144/A/1 144/A/2	over ground

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145/A	9761985	PL ŠERIĆI	no	12	Image cells	yes	no	no regulation	-	1	145/A/1	over ground
146/A	8412286	PL ŠERIĆI	no	12	Image cells	yes	no	no regulation	-	2	146/A/1 146/A/2	over ground
147/A	8460914	PL ŠIŠIĆI	no	12	Image cells	yes	no	no regulation	-	1	147/A/1	over ground
148/A	9512527	PL SUHA ŠERIĆI	no	12	Image cells	yes	no	no regulation	-	1	148/A/1	over ground
149/A	9935681	PL SUHA JABLANICA	no	12	Image cells	yes	no	no regulation	-	1	149/A/1	over ground
150/A	8810001	PL TADIĆI	no	12	Image cells	yes	no	no regulation	-	1	150/A/1 150/A/2	over ground
151/A	8766150	PL ZENUNI	no	12	Image cells	yes	no	no regulation	-	1	151/A/1	over ground
152/A	8766169	PL ZENUNI	no	12	Image cells	yes	no	no regulation	-	1	152/A/1	over ground

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153/A	8617082	PL ŽIVČIĆI	no	12	Image cells	yes	no	no regulation	-	1	153/A/1	over ground
154/A	1815148	PL ĐURĐEVİK	no	12	Image cells	yes	no	no regulation	-	1	154/A/1	over ground
155/A	8347735	PL BAŠİGOVCI	no	12	Image cells	yes	no	no regulation	-	1	155/A/1	over ground
156/A	8952966	PL BAŠİGOVCI	no	12	Image cells	yes	no	no regulation	-	1	156/A/1	over ground
157/A	8379882	PL BAŠİGOVCI	no	12	Image cells	yes	no	no regulation	-	1	157/A/1	over ground
158/A	8388776	PL KOVAČI	no	12	Image cells	yes	no	no regulation	-	1	158/A/1	over ground
159/A	9507531	PL KOVAČI	no	12	Image cells	yes	no	no regulation	-	1	159/A/1	over ground
160/A	8616418	PL KOVAČI	no	12	Image cells	yes	no	no regulation	-	1	160/A/1	over ground

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161/A	8616426	PL KOVAČI	no	12	Image cells	yes	no	no regulation	-	1	161/A/1	over ground
162/A	8727279	PL BAŠIG.NOVO NASELJE	no	12	Image cells	yes	no	no regulation	-	3	162/A/1 162/A/2 162/A/3	over ground
163/A	8783411	PL BAŠIGOVCI POBRĐANI	no	12	Image cells	yes	no	no regulation	-	3	163/A/1 163/A/2 163/A/3	over ground
164/A	8791244	PL MZ ĐURĐEVIK	no	12	Image cells	yes	no	no regulation	-	1	164/A/1	over ground
165/A	8429723	PL CILJUGE	no	12	Image cells	yes	no	no regulation	-	1	165/A/1	over ground
166/A	8895147	PL BAŠIGOVCI KOP	no	12	Image cells	yes	no	no regulation	-	1	166/A/1	over ground
167/A	8951799	PL PRILUK	no	12	Image cells	yes	no	no regulation	-	1	167/A/1	over ground
168/A	8952841	PL ČOKIĆI	no	12	Image cells	yes	no	no regulation	-	1	168/A/1	over ground

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169/A	9181199	PL FEHRIČI MUJAGIČI	no	12	Image cells	yes	no	no regulation	-	1	169/A/1	over ground
170/A	9522964	PL PODGAJEVI	no	12	Image cells	yes	no	no regulation	-	1	170/A/1	over ground
171/A	9522948	PL PODGAJEVI	no	12	Image cells	yes	no	no regulation	-	2	171/A/1 171/A/2	over ground
172/A	9244050	PL BAŠIGOVCI ŠKOLA	no	12	Image cells	yes	no	no regulation	-	1	172/A/1	over ground
173/A	9858504	PL PODGAJEVI	no	12	Image cells	yes	no	no regulation	-	1	173/A/1	over ground
174/A	9358099	PL KOTORNICA	no	12	Image cells	yes	no	no regulation	-	1	174/A/1	over ground
175/A	9858512	PL PODGAJEVI	no	12	Image cells	yes	no	no regulation	-	1	175/A/1	over ground
176/A	9505733	PL ŠAHIČI	no	12	Image cells	yes	no	no regulation	-	1	176/A/1	over ground

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177/A	9523057	PL PODGAJEVI	no	12	Image cells	yes	no	no regulation	-	1	177/A/1	over ground
178/A	9755950	PL TOPLIČKA	no	12	Image cells	yes	no	no regulation	-	1	178/A/1	over ground
179/A	9505776	PL BERIČI	no	12	Image cells	yes	no	no regulation	-	1	179/A/1	over ground
180/A	9315535	PL ZUKIČI	no	12	Image cells	yes	no	no regulation	-	1	180/A/1	over ground
181/A	9875530	PL PODGAJEVI	no	12	Image cells	yes	no	no regulation	-	1	181/A/1	over ground
182/A	1787039	PL LITVE	no	12	Image cells	yes	no	no regulation	-	1	182/A/1	over ground
183/A	8126275	PL CILJUGE	no	12	Image cells	yes	no	no regulation	-	2	183/A/1 183/A/2	over ground
184/A	8126437	PL OSLOBOĐENJA	yes	12	Image cells	yes	no	no regulation	-	2	184/A/1 184/A/2	mix

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185/A	8129533	PL KARAUULA	yes	12	Image cells	yes	no	no regulation	-	2	185/A/1 185/A/2	mix
186/A	8130590	PL TUZLANSKOG ODREDA	yes	12	Image cells	yes	no	no regulation	-	2	186/A/1 186/A/2	mix
187/A	8135207	PL JEZERO	no	12	Image cells	yes	no	no regulation	-	2	187/A/1 187/A/2	mix
188/A	8135215	PL BTS 5	yes	12	Image cells	yes	no	no regulation	-	2	188/A/1 188/A/2	mix
189/A	8135282	PL 1.MAJ 13	yes	12	Image cells	yes	no	no regulation	-	2	189/A/1 189/A/2	mix
190/A	8135576	PL RUDARSKA	yes	12	Image cells	yes	no	no regulation	-	2	190/A/1 190/A/2	mix
191/A	8137412	PL TRGOZAD	yes	12	Image cells	yes	no	no regulation	-	2	191/A/1 191/A/2	mix
192/A	8137447	PL TRGOZAD	yes	12	Image cells	yes	no	no regulation	-	2	192/A/1 192/A/2	mix

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193/A	8137552	PL SARAJKA	yes	12	Image cells	yes	no	no regulation	-	2	193/A/1 193/A/2	mix
194/A	8137595	PL BTS 4	no	12	Image cells	yes	no	no regulation	-	1	194/A/1	mix
195/A	8137609	PL BTS 4	no	12	Image cells	yes	no	no regulation	-	1	195/A/1	mix
196/A	8137900	PL MAJEVIČKA	yes	12	Image cells	yes	no	no regulation	-	2	196/A/1 196/A/2	mix
197/A	8138095	PL BTS 1	no	12	Image cells	yes	no	no regulation	-	2	197/A/1 197/A/2	mix
198/A	8182051	PL BARIŠIĆI	yes	12	Image cells	yes	no	no regulation	-	3	198/A/1 198/A/2 198/A/3	mix
199/A	8256500	PL RUDARSKA	yes	12	Image cells	yes	no	no regulation	-	2	199/A/1 199/A/2	mix
200/A	8280118	PL BTS 4-2	no	12	Image cells	yes	no	no regulation	-	1	200/A/1	over ground

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201/A	8338388	PL ĐAKOVIĆI	no	12	Image cells	yes	no	no regulation	-	1	201/A/1	over ground
202/A	8350124	PL GRADSKA DVORANA	no	12	Image cells	yes	no	no regulation	-	2	202/A/1 202/A/2	over ground
203/A	8383626	PL MEŠTRIĆI	no	12	Image cells	yes	no	no regulation	-	1	203/A/1	over ground
204/A	8471061	PL ŠERIĆI	no	12	Image cells	yes	no	no regulation	-	2	204/A/1 204/A/2	over ground
205/A	8598827	PL ŠERIĆI	no	12	Image cells	yes	no	no regulation	-	1	205/A/1	over ground
206/A	8658617	PL MZ SUHA	no	12	Image cells	yes	no	no regulation	-	1	206/A/1	over ground
207/A	8754365	PL MZ SUHA	no	12	Image cells	yes	no	no regulation	-	1	207/A/1	over ground
208/A	8785066	PL MUSIĆI LIJEHA	no	12	Image cells	yes	no	no regulation	-	1	208/A/1	over ground

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Measuring point unique ID (based on electricity supplier numeration)	Label OMM (officially based on EE overview numeration)	Substation name/label	OMM is located inside substation (yes / no)	Average lighting daily working hours (h)	Management type	Switching device functional (yes / no)	Luminous flux regulation (yes / no)	Regulation type	Regulation device functional (yes / no)	Public lighting power lines in OMM	Labels for the right circuits	Power line type for PL (overground/underground / mix)
209/A	8785074	PL PODGAJEVI	no	12	Image cells	yes	no	no regulation	-	2	209/A/1 209/A/2	over ground
210/A	8787743	PL KRIŽALJKA	no	12	Image cells	yes	no	no regulation	-	1	210/A/1	over ground
211/A	8809992	PL SUHA ŠKOLA	no	12	Image cells	yes	no	no regulation	-	2	211/A/1 211/A/2	over ground
212/A	8946019	PL PRILUK	no	12	Image cells	yes	no	no regulation	-	1	212/A/1	over ground
213/A	9476903	PL CILJUGE	no	12	Image cells	yes	no	no regulation	-	1	213/A/1	over ground
214/A	9460861	PL REPUH	no	12	Image cells	yes	no	no regulation	-	1	214/A/1	over ground
215/A	9893342	PL ĐURĐEVİK	no	12	Image cells	yes	no	no regulation	-	2	215/A/1 215/A/2	over ground
216/A	9807705	PL DONJA VIŠĆA	no	12	Image cells	yes	no	no regulation	-	1	216/A/1	over ground

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Measuring point unique ID (based on electricity supplier numeration)	Label OMM (officially based on EE overview numeration)	Substation name/label	OMM is located inside substation (yes / no)	Average lighting daily working hours (h)	Management type	Switching device functional (yes / no)	Luminous flux regulation (yes / no)	Regulation type	Regulation device functional (yes / no)	Public lighting power lines in OMM	Labels for the right circuits	Power line type for PL (overground/underground / mix)
217/A	10083590	PL ŠIŠIĆI	no	12	Image cells	yes	no	no regulation	-	1	217/A/1	over ground
218/A	8958149	PL JELAH POTOK	no	12	Image cells	yes	no	no regulation	-	1	218/A/1	over ground
219/A	8842256	PL ALJIĆI PASIK	no	12	Image cells	yes	no	no regulation	-	1	219/A/1	over ground

Table 4: Data on measuring points (OMM)

6.2.4 Poles and support brackets

Lighting construction support is made out of lighting poles and support brackets (also called "Lire") mounted on poles. Lighting places in a circle of overviewed part of the network are made out of reinforced concrete poles and metal poles, there are no wooden poles.

Most poles are installed as one-sided. Existing steal poles are corroded on some places and it is necessary to protect adequately with protective coating and paint them. Supporting brackets on some places are smaller , which leads to uneven lighting.

Metal poles are made as an anchor, concrete poles are secured with concrete foundations. Depending on zone and part of network, poles are set on green surfaces, as on walking and traffic surfaces. Lamps are mounted under 5 degrees with a console set on poles. Console length is from 0,5 to 1 m. Pole height varies from 3 and 9 m. Table 5 shows data on pole construction.

Ordinal No.	City	Metal (pcs)	Reinforced concrete (AB) (pcs)	Wooden(pcs)	Total
1	Živinice	1197	7296	37	8530
		14,03%	85,53%	0,43%	100,00%

Table 5: Pole construction

Table 6, image 27 i image 28 show technical characteristics for pole geometry and consoles.



Image 27: Poles (Reinforced concrete - left, metal – centre, wooden - right)

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Image 28: Console overview

Street name	Average distance between poles (m)	Pole schedule (two-sided in a line, two-sided apart or one-sided)	Pole height (m)	Lamp mounted on console (yes/no)	Console length (m)	Console incline (%)	Po dis fro ro
Tupkovići	40	one-sided	8	yes	0.2	10	
Tupkovići	35	one-sided	8	yes	0.2	10	

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Street name	Average distance between poles (m)	Pole schedule (two-sided in a line, two-sided apart or one-sided)	Pole height (m)	Lamp mounted on console (yes/no)	Console length (m)	Console incline (%)	Pole distance from road
Tupkovići	35	one-sided	8	yes	0.2	10	
Tupkovići Gornji	35	one-sided	8	yes	0.2	10	1
Igralište Tupkovići 800m ²	10	two-sided	8	yes	0.2	45	
Tupkovići Gornji	35	one-sided	8	yes	0.2	10	1
Tupkovići Gornji Čauševići	35	one-sided	8	yes	0.2	10	
Košare	35	one-sided	8	yes	0.2	0	1
Tupkovići-Mujčinovići	30	one-sided	8	yes	0.2	0	1
Tupkovići-Mujčinovići	35	one-sided	8	yes	0.2	10	1
Tupkovići Donji	35	one-sided	8	yes	0.2	10	1
Tupkovići-Ćasuri	35	one-sided	8	yes	0.2	10	1
Tupkovići-Trojan	35	one-sided	8	yes	0.2	10	1
Igralište Tupkovići-Trojan 800m ²	10	two-sided	8	yes	0.2	45	
Tupkovići- Trojan	30	one-sided	8	yes	0.1	10	1
Gračanica	35	one-sided	8	yes	0.2	10	1
Gračanica	35	one-sided	8	yes	0.2	10	
Gračanica	35	one-sided	10	yes	1	0	
Gračanica	35	one-sided	8	yes	0.2	10	
Durići	30	one-sided	8	yes	0.2	10	1
Durići	35	one-sided	8	yes	0.2	10	
Vrtage	35	one-sided	8	yes	0.2	10	1
Gračanica	35	cik-cak	8	yes	0.2	10	
Gračanica	35	one-sided	8	yes	0.2	10	1
Gračanica-Šljivići	30	one-sided	8	yes	0.2	10	1

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Street name	Average distance between poles (m)	Pole schedule (two-sided in a line, two-sided apart or one-sided)	Pole height (m)	Lamp mounted on console (yes/no)	Console length (m)	Console incline (%)	Pole distance from road
Gračanica-Šljivići	35	one-sided	8	yes	0.2	10	
Gračanica-Zelenika	30	one-sided	8	yes	0.2	10	
Gračanica-Zelenika	35	one-sided	8	yes	0.2	10	
Omladinskih radnih brigada	35	one-sided	11	yes	0.5	0	
Omladinskih radnih brigada	35	one-sided	8	yes	0.2	10	
Omladinskih radnih brigada	30	one-sided	8	yes	0.2	10	
Hornica	35	one-sided	8	yes	0.2	10	
Omladinskih radnih brigada	35	one-sided	8	yes	0.2	10	
stadion FK Metalac 5000m ²	15	two-sided	8	yes	0.2	10	
Šarenjak	35	one-sided	8	yes	0.2	10	
Omladinskih radnih brigada	30	one-sided	8	yes	0.2	10	
Hornica	35	one-sided	8	yes	0.2	10	
Maline-M18	30	one-sided	8	yes	0.1	10	
Maline Spreča	30	one-sided	8	yes	0.2	10	
Strašanj-M18	30	one-sided	12	yes	0.5	0	
Strašanj	35	one-sided	8	yes	0.2	10	
Strašanj igralište 800m ²	20	two-sided	8	yes	0.2	45	
Strašanj	35	one-sided	8	yes	0.2	10	
Šehići	35	one-sided	8	yes	0.1	10	
Turijanci	35	one-sided	8	yes	0.2	10	
Hadžići	35	one-sided	8	yes	0.2	10	
Nova cesta	35	one-sided	8	yes	0.2	10	
Nova cesta	35	one-sided	8	yes	0.2	10	

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Street name	Average distance between poles (m)	Pole schedule (two-sided in a line, two-sided apart or one-sided)	Pole height (m)	Lamp mounted on console (yes/no)	Console length (m)	Console incline (%)	Pole distance from road
Luke	35	one-sided	8	yes	0.2	10	0
Mustafići	35	one-sided	8	yes	0.2	10	
Hadžići	35	one-sided	8	yes	0.2	10	
Djedovača	35	one-sided	8	yes	0.2	10	0
Prijeki put	35	one-sided	8	yes	0.2	10	0
Gložik	35	one-sided	8	yes	0.2	10	
Hadžići	35	one-sided	8	yes	0.2	10	
Dubrave Donje	35	one-sided	8	yes	0.2	10	1
Prijeki put	35	one-sided	8	yes	0.2	5	
Hadžići	35	one-sided	8	yes	0.2	10	1
Dubrave Donje	35	one-sided	8	yes	0.2	10	
prostor oko Crkve sv. Ane	10	two-sided	8	yes	0.1	10	
Dubravska	35	one-sided	8	yes	0.2	10	
Dubravska	30	one-sided	8	yes	0.2	10	
Dubravska	35	one-sided	8	yes	0.2	10	
Višća	35	one-sided	8	yes	0.2	10	1
Višća	35	one-sided	8	yes	0.2	10	
igralište Višća 800m ²	10	two-sided	8	yes	0.2	45	
regionalni put R469	30	one-sided	8	yes	0.3	5	
Višća Donja	30	one-sided	8	yes	0.2	10	1
Višća Donja	30	one-sided	8	yes	0.2	10	
Višća Donja	35	one-sided	8	yes	0.2	10	1
Kupjerusi	30	one-sided	8	yes	0.2	10	0

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Street name	Average distance between poles (m)	Pole schedule (two-sided in a line, two-sided apart or one-sided)	Pole height (m)	Lamp mounted on console (yes/no)	Console length (m)	Console incline (%)	Pole distance from road
Kupjerusi-poligon	20	two-sided	8	no	-	-	
Smajići	30	one-sided	8	yes	0.2	10	
Bajrami	30	one-sided	8	yes	0.2	10	
Kupjerusi-Taletovići	30	one-sided	8	yes	0.2	10	
Dubravska	35	one-sided	8	yes	0.2	10	
Dubravska	30	one-sided	8	yes	0.2	10	
magistralni put M18	30	one-sided	11	yes	0.5	5	
Dubravska C	30	one-sided	8	yes	0.2	10	
Sjever	30	one-sided	5	no	-	-	
Sjever	30	one-sided	8	yes	0.2	10	
Sjever	30	one-sided	8	yes	0.2	5	
Hadžići	35	one-sided	8	yes	0.2	10	
Hadžići	35	one-sided	8	yes	0.2	10	
Hadžići	35	one-sided	8	yes	0.2	10	
prostor oko džamije Orašje	20	two-sided	8	yes	0.2	5	
regionalni put R469	35	one-sided	8	yes	0.2	10	
Begići	35	one-sided	8	yes	0.2	10	
regionalni put R469	35	one-sided	8	yes	0.2	10	
Delići	35	one-sided	8	yes	0.2	10	
Dedići	35	one-sided	8	yes	0.2	10	
Gornje Dubrave Husići	35	one-sided	8	yes	0.2	10	
Gornje Dubrave Husići	35	one-sided	8	yes	0.2	10	
Kadrići	35	one-sided	7	yes	0.5	5	

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Street name	Average distance between poles (m)	Pole schedule (two-sided in a line, two-sided apart or one-sided)	Pole height (m)	Lamp mounted on console (yes/no)	Console length (m)	Console incline (%)	Pole distance from road
Igralište Kadrići 800m ²	20	two-sided	12	yes	0	45	
Kadrići	30	one-sided	7	yes	0.5	5	
Kadrići	35	one-sided	8	yes	0.2	10	
Bajrići	30	one-sided	8	yes	0.2	10	1
Bajrići	35	one-sided	8	yes	0.2	10	
Kadrići	35	one-sided	8	yes	0.2	10	1
Krzevići	35	one-sided	8	yes	0.2	10	1
Ciljuge	35	one-sided	8	yes	0.1	10	
Ciljuge	35	one-sided	8	yes	0.1	10	
Toplička 2	35	one-sided	8	yes	0.1	20	0
Ciljuge	35	one-sided	8	yes	0.1	20	
Ciljuge	35	one-sided	8	yes	0.1	20	
Bašigovci	35	one-sided	8	yes	0.1	20	
Bašigovci	35	one-sided	8	yes	0.2	10	1
Toplička	35	one-sided	8	yes	0.2	10	1
Lukavica Donja	35	one-sided	8	yes	0.2	10	1
Lukavica Donja	35	one-sided	8	yes	0.2	10	
Lukavica Donja	35	one-sided	8	yes	0.2	10	1
Lukavica Gornja	35	one-sided	8	yes	0.2	10	1
Lukavica Gornja	35	one-sided	8	yes	0.2	10	1
Lukavica Gornja	35	one-sided	8	yes	0.2	10	
Lukavica Gornja	40	one-sided	8	yes	0.2	15	1
Lukavica Gornja	30	one-sided	8	yes	0.2	15	1

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Street name	Average distance between poles (m)	Pole schedule (two-sided in a line, two-sided apart or one-sided)	Pole height (m)	Lamp mounted on console (yes/no)	Console length (m)	Console incline (%)	Pole distance from road
Svojat	35	one-sided	8	yes	0.2	10	
Svojat	35	one-sided	8	yes	0.2	10	
Svojat	35	one-sided	8	yes	0.2	10	
Svojat	30	one-sided	8	yes	0.2	10	
Svojat	40	one-sided	8	yes	0.2	10	
igralište Svojat 800m ²	20	one-sided	8	yes	0.2	10	
Zelenika-Krivača	35	one-sided	8	yes	0.2	10	
Zelenika	35	one-sided	8	yes	0.2	10	
Livada	30	one-sided	8	yes	0.2	10	
Podoljani	35	one-sided	8	yes	0.2	10	
Donja Lukavica	30	one-sided	8	yes	0.2	10	
Donja Lukavica	35	one-sided	8	yes	0.2	10	
Bašigovci	35	one-sided	8	yes	0.2	10	
regionalni put R469	35	one-sided	8	yes	0.2	5	
Pasci donji	40	one-sided	8	yes	0.2	10	
3. ulica	40	one-sided	9	yes	1.5	5	
3. ulica	40	one-sided	9	yes	1	0	
magistralni put M18	40	one-sided	9	yes	1.5	5	
magistralni put M18	40	one-sided	9	yes	1	0	
2. ulica	40	one-sided	9	yes	2	5	
Alije Izetbegovića	40	one-sided	9	yes	2	5	
1. ulica	40	one-sided	7	yes	0.1	45	
1. ulica	40	one-sided	9	yes	2	0	

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Street name	Average distance between poles (m)	Pole schedule (two-sided in a line, two-sided apart or one-sided)	Pole height (m)	Lamp mounted on console (yes/no)	Console length (m)	Console incline (%)	Pole distance from road
Zlatnih ljiljana	40	one-sided	5	no	-	-	0
Zlatnih ljiljana	40	one-sided	5	no	-	-	0
parking(Bosanski kulturni centar)	40	one-sided	9	yes	2	5	0
parking(Bosanski kulturni centar)	40	one-sided	4	no	-	-	0
25. Novembar	30	one-sided	5	no	-	-	1
25. Novembar	30	one-sided	4	yes	0.2	5	0
parking supermarketa	20	one-sided	6	yes	0.5	15	0
parking supermarketa	20	one-sided	4	no	-	-	0
parking površine cca 600m	25	one-sided	4	no	-	-	0
parking površine cca 600m	25	one-sided	4	yes	0.3	5	0
Gradski park konjuh (25. Novembar)	25	one-sided	5	yes	0.5	10	0
Gradski park konjuh (25. Novembar)	25	one-sided	5	yes	0.5	10	0
Prvi maj	40	one-sided	5	no	-	-	0
Školska	30	one-sided	5	no	-	-	0
Maršala Tita	40	one-sided	5	no	-	-	0
Prva ulica	30	one-sided	5	no	-	-	0
2. ulica (prostor oko zgrade)	25	one-sided	5	no	-	-	0
Oslobođenja	40	one-sided	9	yes	2	5	0
Alije Izetbegovića	40	one-sided	8	yes	0.2	20	0
parking(Meše Selimovića)	25	one-sided	12	no	-	-	0
Oslobođenja	40	one-sided	8	yes	0.2	10	0
park(Ulica Oslobođenja)	25	one-sided	4	no	-	-	0
parking(Ulica Oslobođenja)	25	one-sided	4	no	-	-	0

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Street name	Average distance between poles (m)	Pole schedule (two-sided in a line, two-sided apart or one-sided)	Pole height (m)	Lamp mounted on console (yes/no)	Console length (m)	Console incline (%)	Pole distance from road
Gradski park Živinice (Alije Izetbegovića)	25	one-sided	4	no	-	-	
ulica iza Općine/Grada (Alije Izetbegovića)	40	one-sided	9	yes	1	5	
ulica iza Općine/Grada (Alije Izetbegovića)	40	one-sided	9	yes	1	5	
parking Općine/Grada	25	one-sided	-	-	-	-	
parking Općine/Grada	25	one-sided	4	no	-	-	
Šetnica iza Općine/Grada	25	one-sided	4	no	-	-	
Pašage Gocića	40	one-sided	8	yes	0.2	10	
Pašage Gocića	40	one-sided	4	no	-	-	
Patriotske lige	40	one-sided	4	no	-	-	
Željeznička	35	one-sided					
XVI muslimanske brigade	40	one-sided	4	no	-	-	
Rudarska	40	one-sided	5	no	-	-	
Rudarska	40	one-sided	5	no	-	-	
Živiničkih brigada	40	one-sided	5	no	-	-	
Civilnih žrtava rata	40	one-sided	5	no	-	-	
Dubavska (naselje uz R469)	35	one-sided	8	yes	0.2	5	
regionalni put R469	35	one-sided	8	yes	0.2	5	
Bosanska	30	one-sided	4	no	-	-	
Jezero	40	one-sided	8	yes	0.2	5	
Jezero	40	one-sided	4	no	-	-	
Jezero	40	one-sided	8	yes	0.3	45	
1. Mart	40	one-sided	8	yes	0.2	10	
1. Mart	40	one-sided	8	yes	0.2	5	

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Street name	Average distance between poles (m)	Pole schedule (two-sided in a line, two-sided apart or one-sided)	Pole height (m)	Lamp mounted on console (yes/no)	Console length (m)	Console incline (%)	Pole distance from road
1. Mart	40	one-sided	8	yes	0.2	5	
Sadnice	40	one-sided	8	yes	0.3	10	
Toplička	40	one-sided	8	yes	0.2	10	
regionalni put R469	35	one-sided	8	yes	0.2	5	
1. ulica	40	one-sided	9	yes	2	0	
regionalni put R455a	40	one-sided	8	yes	0.2	20	
Poljice	40	one-sided	8	yes	0.2	20	
Klopići	40	one-sided	8	yes	0.2	20	
Klopići	40	one-sided	8	yes	0.2	20	
regionalni put R455a	40	one-sided	8	yes	0.2	20	
Priluk	40	one-sided	8	yes	0.2	20	
Priluk	40	one-sided	8	yes	0.2	20	0
regionalni put R455a	40	one-sided	8	yes	0.2	20	
Omići	40	one-sided	8	yes	0.3	20	
Omići	40	one-sided	8	yes	0.1	20	
Omerkići	40	one-sided	8	yes	0.2	20	
Omerkići	40	one-sided	8	yes	0.3	10	
R455a	40	one-sided	8	yes	0.2	10	
Alagići	40	one-sided	8	yes	0.2	20	
Alagići	40	one-sided	8	yes	0.2	20	
Šehići	40	one-sided	8	yes	0.2	10	1
Šehići	40	one-sided	8	yes	0.2	10	
Šehići	40	one-sided	8	yes	0.2	5	

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Street name	Average distance between poles (m)	Pole schedule (two-sided in a line, two-sided apart or one-sided)	Pole height (m)	Lamp mounted on console (yes/no)	Console length (m)	Console incline (%)	Pole distance from road
Šerići	40	one-sided	8	yes	0.2	10	
Šerići	40	one-sided	8	yes	0.2	10	
regionalni put R455a	40	one-sided	8	yes	0.2	5	
Šerići	40	one-sided	8	yes	0.2	5	
regionalni put R455a	40	one-sided	8	yes	0.2	10	
Omerkići	40	one-sided	8	yes	0.2	10	
igralište(Omerkići)	20	one-sided	8	yes	-	-	
regionalni put R455a	40	one-sided	8	yes	0.2	10	
Šerići	40	one-sided	8	yes	0.2	10	
regionalni put R455a	40	one-sided	8	yes	0.2	10	
Šerići	40	one-sided	8	yes	0.2	10	
regionalni put R455a	40	one-sided	8	yes	0.2	10	
Suha	40	one-sided	8	yes	0.2	0	
Suha	40	one-sided	8	yes	0.2	20	
regionalni put R455a	40	one-sided	8	yes	0.2	20	
Suha	40	one-sided	8	yes	0.3	10	
Suha	40	one-sided	8	yes	0.2	10	
Suha	40	one-sided	8	yes	0.2	10	
Đulići	40	one-sided	8	yes	0.2	10	
Đulići	40	one-sided	8	yes	0.2	10	
Barice	40	one-sided	8	yes	0.2	10	
Atlić mahala	40	one-sided	8	yes	0.2	10	
Jablanica	40	one-sided	8	yes	0.2	10	

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CITY OF ŽIVINICE

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Jablanica	40	one-sided	8	yes	0.2	10	
Tadići	40	one-sided	8	yes	0.2	10	1
Tadići	40	one-sided	8	yes	0.2	10	
Živinice Gornje	40	one-sided	8	yes	0.2	10	1
Kopjevići	40	one-sided	8	yes	0.2	10	
Kopjevići	40	one-sided	8	yes	0.2	10	1
Grabik	40	one-sided	8	yes	0.2	10	
Petrovići	40	one-sided	8	yes	0.2	10	
Petrovići	40	one-sided	8	yes	0.2	10	
Šišići	40	one-sided	8	yes	0.3	20	
Šišići	40	one-sided	8	yes	0.3	20	
Šišići	40	one-sided	8	yes	0.3	10	
Adići	40	one-sided	8	yes	0.2	10	
Lug	40	one-sided	8	yes	0.2	10	1
Lug	40	one-sided	8	yes	0.3	10	
Lug	40	one-sided	8	yes	0.2	10	
magistralni put M18	40	one-sided	8	yes	0.2	10	
Đurđevik	40	one-sided	8	yes	0.1	5	
Đurđevik	40	one-sided	8	yes	0.2	10	
Gostelja	40	one-sided	8	yes	0.1	5	
magistralni put M18	40	one-sided	8	yes	0.3	10	
Gostelja	40	one-sided	8	yes	0.2	10	
Musići	40	one-sided	8	yes	0.2	10	

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Musići	40	one-sided	8	yes	0.5	0	
Gostelja	40	one-sided	8	yes	0.3	20	
Gostelja	40	one-sided	8	no	-	-	
Golubinjak	40	one-sided	8	yes	0.2	10	
Golubinjak	40	one-sided	8	yes	0.3	20	
Nukići	40	one-sided	8	yes	0.5	5	
regionalni put R469	40	one-sided	8	yes	0.2	10	
Živiničke ose	40	one-sided	8	yes	0.3	10	
Živiničke ose	40	one-sided	5	no	-	-	
Gostelja	40	one-sided	8	yes	0.2	10	
Gostelja	40	one-sided	8	yes	0.3	10	
Golubinjak	40	one-sided	8	yes	0.2	10	
Golubinjak	40	one-sided	8	yes	0.2	10	
regionalni put R469	40	one-sided	8	yes	0.2	10	
Donja Višća	40	one-sided	8	yes	0.2	10	
regionalni put R469	40	one-sided	8	yes	0.2	10	
Šišići	40	one-sided	8	yes	0.2	10	
Gostelja	40	one-sided	8	yes	0.2	10	
Gostelja	40	one-sided	8	yes	0.2	10	
magistralni put M18	40	one-sided	8	yes	0.3	10	
magistralni put M18	40	one-sided	8	yes	0.2	10	
Stara pruga	40	one-sided	8	yes	0.2	10	
Stara pruga	40	one-sided	8	yes	0.5	0	

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Bare	40	one-sided	8	yes	0.3	20	
Bare	40	one-sided	8	yes	0.5	0	
Kovači	40	one-sided	8	yes	0.3	20	
Kovači	40	one-sided	8	yes	0.2	10	
Kovači	40	one-sided	8	yes	0.2	10	1
Mujići	40	one-sided	8	yes	0.2	10	
Bašigovci	40	one-sided	8	yes	0.2	10	
Bašigovci	40	one-sided	8	yes	0.3	10	
Bašigovci	40	one-sided	8	yes	0.3	15	1
Bašigovci	40	one-sided	8	yes	0.5	0	
Bašigivco	40	one-sided	8	yes	0.5	0	
Podoljani	40	one-sided	8	yes	0.2	10	
Bašigovci	40	one-sided	8	yes	0.2	20	
Bašigovci	40	one-sided	8	yes	0.2	10	
Bašigovci	40	one-sided	10	yes	0.2	10	
Bašigovci	40	one-sided	11	yes	0.1	20	
Bašigovci	40	one-sided	8	yes	0.2	10	
Bašigovci	40	one-sided	8	yes	0.2	20	
Vrnojevići donji	40	one-sided	8	yes	0.3	10	
Vrnojevići donji	40	one-sided	8	yes	0.3	0	
regionalni put R455a	40	one-sided	8	yes	0.2	20	
Toplička	40	one-sided	8	yes	0.2	5	
Toplička	40	one-sided	8	yes	0.3	5	

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3. ulica	40	one-sided	8	yes	-	-	
3. ulica	40	one-sided	8	yes	0.3	5	
3. ulica	40	one-sided	8	yes	0.3	5	
Stara pruga	30	one-sided	7	no	-	-	
Stara pruga	40	one-sided	8	yes	0.3	5	
regionalni put R455a	40	one-sided	8	yes	0.3	5	
regionalni put R455a	40	one-sided	8	yes	2	5	
Živinički sokolovi	40	one-sided	8	yes	0.2	5	
Partizanske	40	one-sided	8	yes	0.2	5	
Živinički sokolovi	40	one-sided	8	yes	0.2	5	
Živinički sokolovi	40	one-sided	8	yes	0.2	5	
Partizanska	40	one-sided	8	yes	0.2	5	
Partizanska	40	one-sided	8	yes	2	5	
Partizanska	40	one-sided	8	yes	0.3	10	
Partizanska	40	one-sided	8	yes	2	5	
Partizanska	40	one-sided	8	yes	0.2	5	
Živinički sokolovi	40	one-sided	8	yes	0.3	20	
Živinički sokolovi	40	one-sided	8	yes	0.2	5	
regionalni put R455a	40	one-sided	8	yes	0.2	5	
Modračka	40	one-sided	8	yes	0.2	5	
regionalni put R455a	40	one-sided	8	yes	0.2	5	
Barice	40	one-sided	8	yes	0.2	5	
Barice	40	one-sided	8	yes	0.2	5	

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Igralište (Barice)	40	one-sided	8	yes	0.2	5	
Otawa	40	one-sided	8	yes	0.2	5	
Podgaj	40	one-sided	8	yes	0.2	5	
Podgaj	40	one-sided	8	yes	0.2	20	
Kovači	40	one-sided	8	yes	0.2	20	
Kovači	40	one-sided	8	yes	0.2	10	
Podgajevi	40	one-sided	8	yes	0.2	10	
magistralni put M18	40	one-sided	8	yes	0.2	20	
Šahići	40	one-sided	8	yes	0.2	20	
Đurđevik	40	one-sided	8	yes	0.2	10	1
Đurđevik	40	one-sided	8	yes	0.5	0	
Živčići	40	one-sided	8	yes	0.5	0	
Živčići	40	one-sided	8	yes	0.2	20	
Podgaj	40	one-sided	8	yes	0.2	20	
Podgajevi	40	one-sided	8	yes	0.2	20	
Košare Samardžije	40	One-sided	8	yes	0,5	5	
Rasadište	40	One-sided	8	yes	0,5	5	

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1	Tupkovići	40	one-sided	8	yes	0.2	10	1
2	Tupkovići	35	one-sided	8	yes	0.2	10	1
3	Tupkovići	35	one-sided	8	yes	0.2	10	1
4	Tupkovići Gornji	35	one-sided	8	yes	0.2	10	1.5
5	igralište Tupkovići 800m ²	10	two-sided	8	yes	0.2	45	-
6	Tupkovići Gornji	35	one-sided	8	yes	0.2	10	1.5
7	Tupkovići Gornji Čauševići	35	one-sided	8	yes	0.2	10	1
8	Košare	35	one-sided	8	yes	0.2	0	1.5
9	Tupkovići-Mujčinovići	30	one-sided	8	yes	0.2	0	1.5
10	Tupkovići-Mujčinovići	35	one-sided	8	yes	0.2	10	1.5
11	Tupkovići Donji	35	one-sided	8	yes	0.2	10	1.5
12	Tupkovići-Ćasuri	35	one-sided	8	yes	0.2	10	1.5
13	Tupkovići-Trojan	35	one-sided	8	yes	0.2	10	1.5
14	igralište Tupkovići-Trojan 800m ²	10	two-sided	8	yes	0.2	45	-

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15	Tupkovići- Trojan	30	one-sided	8	yes	0.1	10	1.5
16	Gračanica	35	one-sided	8	yes	0.2	10	1.5
17	Gračanica	35	one-sided	8	yes	0.2	10	1
18	Gračanica	35	one-sided	10	yes	1	0	1
19	Gračanica	35	one-sided	8	yes	0.2	10	1
20	Durići	30	one-sided	8	yes	0.2	10	1.5
21	Durići	35	one-sided	8	yes	0.2	10	1
22	Vrtage	35	one-sided	8	yes	0.2	10	1.5
23	Gračanica	35	cik-cak	8	yes	0.2	10	1
24	Gračanica	35	one-sided	8	yes	0.2	10	1.5
25	Gračanica-Šljivići	30	one-sided	8	yes	0.2	10	1.5
26	Gračanica-Šljivići	35	one-sided	8	yes	0.2	10	1.5
27	Gračanica-Zelenika	30	one-sided	8	yes	0.2	10	1.5
28	Gračanica-Zelenika	35	one-sided	8	yes	0.2	10	1.5

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29	Omladinskih radnih brigada	35	one-sided	11	yes	0.5	0	2
30	Omladinskih radnih brigada	35	one-sided	8	yes	0.2	10	1
31	Omladinskih radnih brigada	30	one-sided	8	yes	0.2	10	1.5
32	Hornica	35	one-sided	8	yes	0.2	10	1.5
33	Omladinskih radnih brigada	35	one-sided	8	yes	0.2	10	1.5
34	stadion FK Metalac 5000m ²	15	two-sided	8	yes	0.2	10	-
35	Šarenjak	35	one-sided	8	yes	0.2	10	1
36	Omladinskih radnih brigada	30	one-sided	8	yes	0.2	10	1
37	Hornica	35	one-sided	8	yes	0.2	10	1.5
38	Maline-M18	30	one-sided	8	yes	0.1	10	0.5
39	Maline Spreča	30	one-sided	8	yes	0.2	10	0.5
40	Strašanj-M18	30	one-sided	12	yes	0.5	0	0.5
41	Strašanj	35	one-sided	8	yes	0.2	10	1
42	Strašanj igralište 800m ²	20	two-sided	8	yes	0.2	45	-

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43	Strašanj	35	one-sided	8	yes	0.2	10	1
44	Šehići	35	one-sided	8	yes	0.1	10	1
45	Turijanci	35	one-sided	8	yes	0.2	10	1.5
46	Hadžići	35	one-sided	8	yes	0.2	10	1.5
47	Nova cesta	35	one-sided	8	yes	0.2	10	2
48	Nova cesta	35	one-sided	8	yes	0.2	10	0.5
49	Luke	35	one-sided	8	yes	0.2	10	0.5
50	Mustafići	35	one-sided	8	yes	0.2	10	1
51	Hadžići	35	one-sided	8	yes	0.2	10	1
52	Djedovača	35	one-sided	8	yes	0.2	10	0.5
53	Prijeki put	35	one-sided	8	yes	0.2	10	0.5
54	Gložik	35	one-sided	8	yes	0.2	10	1
55	Hadžići	35	one-sided	8	yes	0.2	10	1
56	Dubrave Donje	35	one-sided	8	yes	0.2	10	1.5

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57	Prijeki put	35	one-sided	8	yes	0.2	5	1
58	Hadžići	35	one-sided	8	yes	0.2	10	1.5
59	Dubrave Donje	35	one-sided	8	yes	0.2	10	1
60	prostor oko Crkve sv. Ane	10	two-sided	8	yes	0.1	10	-
61	Dubravka	35	one-sided	8	yes	0.2	10	1
62	Dubravka	30	one-sided	8	yes	0.2	10	1
63	Dubravka	35	one-sided	8	yes	0.2	10	1
64	Višća	35	one-sided	8	yes	0.2	10	1.5
65	Višća	35	one-sided	8	yes	0.2	10	1
66	igralište Višća 800m ²	10	two-sided	8	yes	0.2	45	-
67	regionalni put R469	30	one-sided	8	yes	0.3	5	2
68	Višća Donja	30	one-sided	8	yes	0.2	10	1.5
69	Višća Donja	30	one-sided	8	yes	0.2	10	2
70	Višća Donja	35	one-sided	8	yes	0.2	10	1.5

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71	Kupjerusi	30	one-sided	8	yes	0.2	10	0.5
72	Kupjerusi-poligon	20	two-sided	8	no	-	-	-
73	Smajići	30	one-sided	8	yes	0.2	10	1
74	Bajrami	30	one-sided	8	yes	0.2	10	1
75	Kupjerusi-Taletovići	30	one-sided	8	yes	0.2	10	1
76	Dubravska	35	one-sided	8	yes	0.2	10	1
77	Dubravska	30	one-sided	8	yes	0.2	10	1
78	magistralni put M18	30	one-sided	11	yes	0.5	5	1.5
79	Dubravska C	30	one-sided	8	yes	0.2	10	0.5
80	Sjever	30	one-sided	5	no	-	-	0.5
81	Sjever	30	one-sided	8	yes	0.2	10	0.5
82	Sjever	30	one-sided	8	yes	0.2	5	1
83	Hadžići	35	one-sided	8	yes	0.2	10	1.5
84	Hadžići	35	one-sided	8	yes	0.2	10	1

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85	Hadžići	35	one-sided	8	yes	0.2	10	1.5
86	prostor oko džamije Orašje	20	two-sided	8	yes	0.2	5	-
87	regionalni put R469	35	one-sided	8	yes	0.2	10	1
88	Begići	35	one-sided	8	yes	0.2	10	1
89	regionalni put R469	35	one-sided	8	yes	0.2	10	1
90	Delići	35	one-sided	8	yes	0.2	10	1
91	Dedići	35	one-sided	8	yes	0.2	10	1
92	Gornje Dubrave Husići	35	one-sided	8	yes	0.2	10	0.5
93	Gornje Dubrave Husići	35	one-sided	8	yes	0.2	10	1
94	Kadrići	35	one-sided	7	yes	0.5	5	1
95	igralište Kadrići 800m ²	20	two-sided	12	yes	0	45	-
96	Kadrići	30	one-sided	7	yes	0.5	5	1
97	Kadrići	35	one-sided	8	yes	0.2	10	1
98	Bajrići	30	one-sided	8	yes	0.2	10	1.5

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99	Bajrići	35	one-sided	8	yes	0.2	10	1
100	Kadirići	35	one-sided	8	yes	0.2	10	1.5
101	Krzevići	35	one-sided	8	yes	0.2	10	1.5
102	Ciljuge	35	one-sided	8	yes	0.1	10	2
103	Ciljuge	35	one-sided	8	yes	0.1	10	1
104	Toplička 2	35	one-sided	8	yes	0.1	20	0.5
105	Ciljuge	35	one-sided	8	yes	0.1	20	1
106	Ciljuge	35	one-sided	8	yes	0.1	20	1
107	Bašigovci	35	one-sided	8	yes	0.1	20	2
108	Bašigovci	35	one-sided	8	yes	0.2	10	1.5
109	Toplička	35	one-sided	8	yes	0.2	10	1.5
110	Lukavica Donja	35	one-sided	8	yes	0.2	10	1.5
111	Lukavica Donja	35	one-sided	8	yes	0.2	10	1
112	Lukavica Donja	35	one-sided	8	yes	0.2	10	1.5

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113	Lukavica Gornja	35	one-sided	8	yes	0.2	10	1.5
114	Lukavica Gornja	35	one-sided	8	yes	0.2	10	1.5
115	Lukavica Gornja	35	one-sided	8	yes	0.2	10	1
116	Lukavica Gornja	40	one-sided	8	yes	0.2	15	1.5
117	Lukavica Gornja	30	one-sided	8	yes	0.2	15	1.5
118	Svojat	35	one-sided	8	yes	0.2	10	1
119	Svojat	35	one-sided	8	yes	0.2	10	1.5
120	Svojat	35	one-sided	8	yes	0.2	10	1
121	Svojat	30	one-sided	8	yes	0.2	10	1.5
122	Svojat	40	one-sided	8	yes	0.2	10	1.5
123	igralište Svojat 800m ²	20	one-sided	8	yes	0.2	10	-
124	Zelenika-Krivača	35	one-sided	8	yes	0.2	10	1.5
125	Zelenika	35	one-sided	8	yes	0.2	10	1.5
126	Livada	30	one-sided	8	yes	0.2	10	1

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CITY OF ŽIVINICE

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127	Podoljani	35	one-sided	8	yes	0.2	10	1.5
128	Donja Lukavica	30	one-sided	8	yes	0.2	10	1
129	Donja Lukavica	35	one-sided	8	yes	0.2	10	1
130	Bašigovci	35	one-sided	8	yes	0.2	10	1
131	regionalni put R469	35	one-sided	8	yes	0.2	5	1
132	Pasci donji	40	one-sided	8	yes	0.2	10	1
133	3. ulica	40	one-sided	9	yes	1.5	5	1.5
134	3. ulica	40	one-sided	9	yes	1	0	1.5
135	magistralni put M18	40	one-sided	9	yes	1.5	5	1
136	magistralni put M18	40	one-sided	9	yes	1	0	1.5
137	2. ulica	40	one-sided	9	yes	2	5	1.5
138	Alije Izetbegovića	40	one-sided	9	yes	2	5	2
139	1. ulica	40	one-sided	7	yes	0.1	45	0.5
140	1. ulica	40	one-sided	9	yes	2	0	2

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141	Zlatnih ljiljana	40	one-sided	5	no	-	-	0.5
142	Zlatnih ljiljana	40	one-sided	5	no	-	-	1
143	parking(Bosanski kulturni centar)	40	one-sided	9	yes	2	5	-
144	parking(Bosanski kulturni centar)	40	one-sided	4	no	-	-	-
145	25. Novembar	30	one-sided	5	no	-	-	1.5
146	25. Novembar	30	one-sided	4	yes	0.2	5	0.5
147	parking supermarketa	20	one-sided	6	yes	0.5	15	-
148	parking supermarketa	20	one-sided	4	no	-	-	-
149	parking površine cca 600m	25	one-sided	4	no	-	-	-
150	parking površine cca 600m	25	one-sided	4	yes	0.3	5	0.5
151	Gradski park konjuh (25. Novembar)	25	one-sided	5	yes	0.5	10	-
152	Gradski park konjuh (25. Novembar)	25	one-sided	5	yes	0.5	10	-
153	Prvi maj	40	one-sided	5	no	-	-	1
154	Školska	30	one-sided	5	no	-	-	0.5

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155	Maršala Tita	40	one-sided	5	no	-	-	0.5
156	Prva ulica	30	one-sided	5	no	-	-	0.5
157	2. ulica (prostor oko zgrade)	25	one-sided	5	no	-	-	-
158	Oslobođenja	40	one-sided	9	yes	2	5	3
159	Alije Izetbegovića	40	one-sided	8	yes	0.2	20	0.5
160	parking(Meše Selimovića)	25	one-sided	12	no	-	-	-
161	Oslobođenja	40	one-sided	8	yes	0.2	10	0.5
162	park(Ulica Oslobođenja)	25	one-sided	4	no	-	-	-
163	parking(Ulica Oslobođenja)	25	one-sided	4	no	-	-	-
164	Gradski park Živinice(Alije Izetbegovića)	25	one-sided	4	no	-	-	-
165	ulica iza Općine/Grada (Alije Izetbegovića)	40	one-sided	9	yes	1	5	0.5
166	ulica iza Općine/Grada (Alije Izetbegovića)	40	one-sided	9	yes	1	5	0.5
167	parking Općine/Grada	25	one-sided	-	-	-	-	-
168	parking Općine/Grada	25	one-sided	4	no	-	-	-

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169	Šetnica iza Općine/Grada	25	one-sided	4	no	-	-	-
170	Pašage Gocića	40	one-sided	8	yes	0.2	10	1
171	Pašage Gocića	40	one-sided	4	no	-	-	0.5
172	Patriotske lige	40	one-sided	4	no	-	-	1
173	Željeznička	35	one-sided					
174	XVI muslimanske brigade	40	one-sided	4	no	-	-	0.5
175	Rudarska	40	one-sided	5	no	-	-	1.5
176	Rudarska	40	one-sided	5	no	-	-	0.5
177	Živiničkih brigada	40	one-sided	5	no	-	-	0.5
178	Civilnih žrtava rata	40	one-sided	5	no	-	-	0.5
179	Dubavska(naselje uz r469)	35	one-sided	8	yes	0.2	5	1
180	regionalni put R469	35	one-sided	8	yes	0.2	5	1
181	Bosanska	30	one-sided	4	no	-	-	1
182	Jezero	40	one-sided	8	yes	0.2	5	0.5

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183	Jezero	40	one-sided	4	no	-	-	1
184	Jezero	40	one-sided	8	yes	0.3	45	1
185	1. Mart	40	one-sided	8	yes	0.2	10	1.5
186	1. Mart	40	one-sided	8	yes	0.2	5	1
187	1. Mart	40	one-sided	8	yes	0.2	5	2
188	Sadnice	40	one-sided	8	yes	0.3	10	2
189	Toplička	40	one-sided	8	yes	0.2	10	1
190	regionalni put R469	35	one-sided	8	yes	0.2	5	1
191	1. ulica	40	one-sided	9	yes	2	0	2
192	regionalni put R455a	40	one-sided	8	yes	0.2	20	1
193	Poljice	40	one-sided	8	yes	0.2	20	1
194	Klopići	40	one-sided	8	yes	0.2	20	2
195	Klopići	40	one-sided	8	yes	0.2	20	1
196	regionalni put R455a	40	one-sided	8	yes	0.2	20	1

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197	Priluk	40	one-sided	8	yes	0.2	20	1
198	Priluk	40	one-sided	8	yes	0.2	20	0.5
199	regionalni put R455a	40	one-sided	8	yes	0.2	20	2
200	Omići	40	one-sided	8	yes	0.3	20	1
201	Omići	40	one-sided	8	yes	0.1	20	2
202	Omerkići	40	one-sided	8	yes	0.2	20	1
203	Omerkići	40	one-sided	8	yes	0.3	10	1
204	R455a	40	one-sided	8	yes	0.2	10	1
205	Alagići	40	one-sided	8	yes	0.2	20	2
206	Alagići	40	one-sided	8	yes	0.2	20	1
207	Šehići	40	one-sided	8	yes	0.2	10	1.5
208	Šehići	40	one-sided	8	yes	0.2	10	2
209	Šehići	40	one-sided	8	yes	0.2	5	2
210	Šerići	40	one-sided	8	yes	0.2	10	2

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211	Šerići	40	one-sided	8	yes	0.2	10	1
212	regionalni put R455a	40	one-sided	8	yes	0.2	5	1
213	Šerići	40	one-sided	8	yes	0.2	5	1
214	regionalni put R455a	40	one-sided	8	yes	0.2	10	1
215	Omerkići	40	one-sided	8	yes	0.2	10	1
216	igralište(Omerkići)	20	one-sided	8	yes	-	-	-
217	regionalni put R455a	40	one-sided	8	yes	0.2	10	1
218	Šerići	40	one-sided	8	yes	0.2	10	2
219	regionalni put R455a	40	one-sided	8	yes	0.2	10	1
220	Šerići	40	one-sided	8	yes	0.2	10	2
221	regionalni put R455a	40	one-sided	8	yes	0.2	10	1
222	Suha	40	one-sided	8	yes	0.2	0	2
223	Suha	40	one-sided	8	yes	0.2	20	1.5
224	regionalni put R455a	40	one-sided	8	yes	0.2	20	2

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225	Suha	40	one-sided	8	yes	0.3	10	2
226	Suha	40	one-sided	8	yes	0.2	10	2
227	Suha	40	one-sided	8	yes	0.2	10	2
228	Đulići	40	one-sided	8	yes	0.2	10	2
229	Đulići	40	one-sided	8	yes	0.2	10	1
230	Barice	40	one-sided	8	yes	0.2	10	1.5
231	Atlić mahala	40	one-sided	8	yes	0.2	10	1.5
232	Jablanica	40	one-sided	8	yes	0.2	10	3
233	Jablanica	40	one-sided	8	yes	0.2	10	2
234	Tadići	40	one-sided	8	yes	0.2	10	1.5
235	Tadići	40	one-sided	8	yes	0.2	10	2
236	Živinice Gornje	40	one-sided	8	yes	0.2	10	1.5
237	Kopjevići	40	one-sided	8	yes	0.2	10	3
238	Kopjevići	40	one-sided	8	yes	0.2	10	1.5

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239	Grabik	40	one-sided	8	yes	0.2	10	2
240	Petrovići	40	one-sided	8	yes	0.2	10	2
241	Petrovići	40	one-sided	8	yes	0.2	10	1
242	Šišići	40	one-sided	8	yes	0.3	20	2
243	Šišići	40	one-sided	8	yes	0.3	20	1
244	Šišići	40	one-sided	8	yes	0.3	10	2
245	Adići	40	one-sided	8	yes	0.2	10	2
246	Lug	40	one-sided	8	yes	0.2	10	1.5
247	Lug	40	one-sided	8	yes	0.3	10	1
248	Lug	40	one-sided	8	yes	0.2	10	2
249	magistralni put M18	40	one-sided	8	yes	0.2	10	5
250	Đurđevik	40	one-sided	8	yes	0.1	5	2
251	Đurđevik	40	one-sided	8	yes	0.2	10	1
252	Gostelja	40	one-sided	8	yes	0.1	5	2

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253	magistralni put M18	40	one-sided	8	yes	0.3	10	3
254	Gostelja	40	one-sided	8	yes	0.2	10	1
255	Musići	40	one-sided	8	yes	0.2	10	2
256	Musići	40	one-sided	8	yes	0.5	0	1
257	Gostelja	40	one-sided	8	yes	0.3	20	1
258	Gostelja	40	one-sided	8	no	-	-	1
259	Golubinjak	40	one-sided	8	yes	0.2	10	1
260	Golubinjak	40	one-sided	8	yes	0.3	20	1
261	Nukići	40	one-sided	8	yes	0.5	5	1.5
262	regionalni put R469	40	one-sided	8	yes	0.2	10	2
263	Živiničke ose	40	one-sided	8	yes	0.3	10	1
264	Živiničke ose	40	one-sided	5	no	-	-	1
265	Gostelja	40	one-sided	8	yes	0.2	10	1.5
266	Gostelja	40	one-sided	8	yes	0.3	10	1.5

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267	Golubinjak	40	one-sided	8	yes	0.2	10	1.5
268	Golubinjak	40	one-sided	8	yes	0.2	10	1
269	regionalni put R469	40	one-sided	8	yes	0.2	10	3
270	Donja Višća	40	one-sided	8	yes	0.2	10	1
271	regionalni put R469	40	one-sided	8	yes	0.2	10	3
272	Šišići	40	one-sided	8	yes	0.2	10	1
273	Gostelja	40	one-sided	8	yes	0.2	10	1
274	Gostelja	40	one-sided	8	yes	0.2	10	2
275	magistralni put M18	40	one-sided	8	yes	0.3	10	2
276	magistralni put M18	40	one-sided	8	yes	0.2	10	2
277	Stara pruga	40	one-sided	8	yes	0.2	10	2
278	Stara pruga	40	one-sided	8	yes	0.5	0	1
279	Bare	40	one-sided	8	yes	0.3	20	1
280	Bare	40	one-sided	8	yes	0.5	0	1

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281	Kovači	40	one-sided	8	yes	0.3	20	1
282	Kovači	40	one-sided	8	yes	0.2	10	2
283	Kovači	40	one-sided	8	yes	0.2	10	1.5
284	Mujići	40	one-sided	8	yes	0.2	10	1
285	Bašigovci	40	one-sided	8	yes	0.2	10	2
286	Bašigovci	40	one-sided	8	yes	0.3	10	2
287	Bašigovci	40	one-sided	8	yes	0.3	15	1.5
288	Bašigovci	40	one-sided	8	yes	0.5	0	2
289	Bašigovci	40	one-sided	8	yes	0.5	0	1
290	Podoljani	40	one-sided	8	yes	0.2	10	2
291	Bašigovci	40	one-sided	8	yes	0.2	20	1
292	Bašigovci	40	one-sided	8	yes	0.2	10	2
293	Bašigovci	40	one-sided	10	yes	0.2	10	2
294	Bašigovci	40	one-sided	11	yes	0.1	20	2

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295	Bašigovci	40	one-sided	8	yes	0.2	10	2
296	Bašigovci	40	one-sided	8	yes	0.2	20	2
297	Vrnojevići donji	40	one-sided	8	yes	0.3	10	2
298	Vrnojevići donji	40	one-sided	8	yes	0.3	0	1
299	regionalni put R455a	40	one-sided	8	yes	0.2	20	1
300	Toplička	40	one-sided	8	yes	0.2	5	5
301	Toplička	40	one-sided	8	yes	0.3	5	1
302	3. ulica	40	one-sided	8	yes	-	-	-
303	3. ulica	40	one-sided	8	yes	0.3	5	1
304	3. ulica	40	one-sided	8	yes	0.3	5	1
305	Stara pruga	30	one-sided	7	no	-	-	0.5
306	Stara pruga	40	one-sided	8	yes	0.3	5	1
307	regionalni put R455a	40	one-sided	8	yes	0.3	5	1
308	regionalni put R455a	40	one-sided	8	yes	2	5	1

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309	Živinički sokolovi	40	one-sided	8	yes	0.2	5	1
310	Partizanske	40	one-sided	8	yes	0.2	5	1
311	Živinički sokolovi	40	one-sided	8	yes	0.2	5	1
312	Živinički sokolovi	40	one-sided	8	yes	0.2	5	1
313	Partizanska	40	one-sided	8	yes	0.2	5	1
314	Partizanska	40	one-sided	8	yes	2	5	1
315	Partizanska	40	one-sided	8	yes	0.3	10	1
316	Partizanska	40	one-sided	8	yes	2	5	1
317	Partizanska	40	one-sided	8	yes	0.2	5	1
318	Živinički sokolovi	40	one-sided	8	yes	0.3	20	1
319	Živinički sokolovi	40	one-sided	8	yes	0.2	5	2
320	regionalni put R455a	40	one-sided	8	yes	0.2	5	2
321	Modračka	40	one-sided	8	yes	0.2	5	2
322	regionalni put R455a	40	one-sided	8	yes	0.2	5	2

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323	Barice	40	one-sided	8	yes	0.2	5	2
324	Barice	40	one-sided	8	yes	0.2	5	2
325	igrališče (Barice)	40	one-sided	8	yes	0.2	5	1
326	Otawa	40	one-sided	8	yes	0.2	5	1
327	Podgaj	40	one-sided	8	yes	0.2	5	1
328	Podgaj	40	one-sided	8	yes	0.2	20	1
329	Kovači	40	one-sided	8	yes	0.2	20	1
330	Kovači	40	one-sided	8	yes	0.2	10	2
331	Podgajevi	40	one-sided	8	yes	0.2	10	2
332	magistralni put M18	40	one-sided	8	yes	0.2	20	1
333	Šahići	40	one-sided	8	yes	0.2	20	2
334	Đurđevik	40	one-sided	8	yes	0.2	10	1.5
335	Đurđevik	40	one-sided	8	yes	0.5	0	1
336	Živčići	40	one-sided	8	yes	0.5	0	1

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337	Živčići	40	one-sided	8	yes	0.2	20	1
338	Podgaj	40	one-sided	8	yes	0.2	20	1
339	Podgajevi	40	one-sided	8	yes	0.2	20	1
340	Košare Samardžije	40	One-sided	8	yes	0,5	5	1
341	Rasadište	40	One-sided	8	yes	0,5	5	1

Table 6: Technical characteristics of geometry poles and consoles

6.2.5 Lines/Cables

Public lighting powering is done accordant to instructions received from amenable power company, which is defined in previous electricity approval. Powering poles is done over ground (concrete poles) and under ground (metal poles). Over ground conductors are isolated.

All cables are dimensioned accordant to installed power in a circuit and power demands (accordant with subject standards), long approx from 50 to 1.200 meters. Underground power cables are connected onto a divider on metal poles, by upright cable connection is made and assures lamp powering, lighting body. Lamps powered by air cable are connected directly onto grid. Lighting circuits (power cables) have up to 100 lighting spots, poles. Image 29 shows cabling.



Image 29: Poles (unauthorized cabling - left, under ground cabling – centre, over ground cabling – right)

6.3 Measurements

6.3.1 Measuring electric parameters and electricity quality analysis

Analysis is done based on measuring electric values (voltage, electricity, $\cos\phi$, power). Measurements of electric parameters are published accordant to Law of electricity in Federation Bosnia and Herzegovina ("Official Gazzete FBiH", No. 66/13) and a Rulebook on determining fulfillment of terms for doing periodical examinations, measurings on electric energy facilities, electric devices, electric installations and issuing documentation (" Official Gazzete Federation of Bosnia and Herzegovina", No. 18/15).Measuring we have a referencial energy parameters of public lighting system. Manpower is set for every measuring point (OMM) based on implemented measures and based on completed budgets.

Measurements are taken using Metrel Mi 2892 and AC CLAMP METER MT 486 A devices, and budgets are calculated accordant to methodology and defined standard En 13 201. Metrel MI 2892 is a device with three phase energy control quality. It has a LCD screen that works in real time. Owns an option for simultaneous writing down parameters, tracking events providing users with a possibility for detailed energy quality analysis and correlation of occasional events. Data on types and powers of existing lighting sources is

collected on a field visit, while losses in dimmers, accordant with EN 13201-2 standard are taken as 15% of rated lighting source power on discharge. Table 7 shows measuring results, Image 30 shows an example of measuring electric parameters.



Image 30: Electric parameters measuring analyzer

Measurements are taken in three phase system and an instrument during measuring is connected as Image 31 shows. Electric coils are individually taken phases L₁, L₂, L₃ i N guide, while voltage clamps were attached on metal conductable parts of the phases L₁, L₂, L₃ under voltage and zero N guide which was on the ground potential. Before measuring, it was necessary to ground a device and check a connection if the same power and voltage connectors are connected on a same phase, because otherwise, measurements would not be correct.

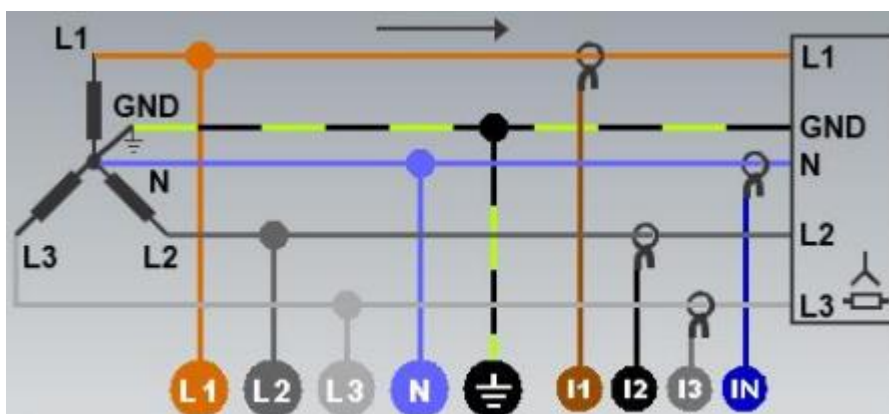


Image 31: Measuring instrument connection overview

Measuring voltage has generated sinus wave forms as Image 32 shows. It is visible on a Image that voltages inside phases are mutually moved closely to 120° per phase and their maximum and minimum values are around ±230 V.

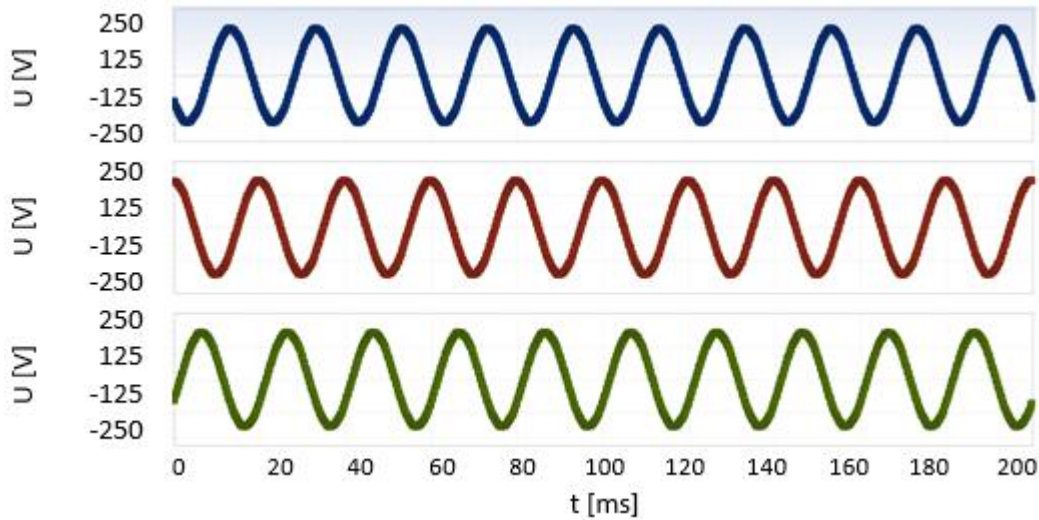


Image 32: Sinus wave form of measured voltage during 10 periods

Besides sinus wave form, a linear voltage overview is generated (Image 33). During turning public lighting on, voltage on effective value was the lowest, while reactive power component was vanishing, that is how voltage was growing inside overviewed time period of 20 minutes and in that moment it had a maximum effective value.

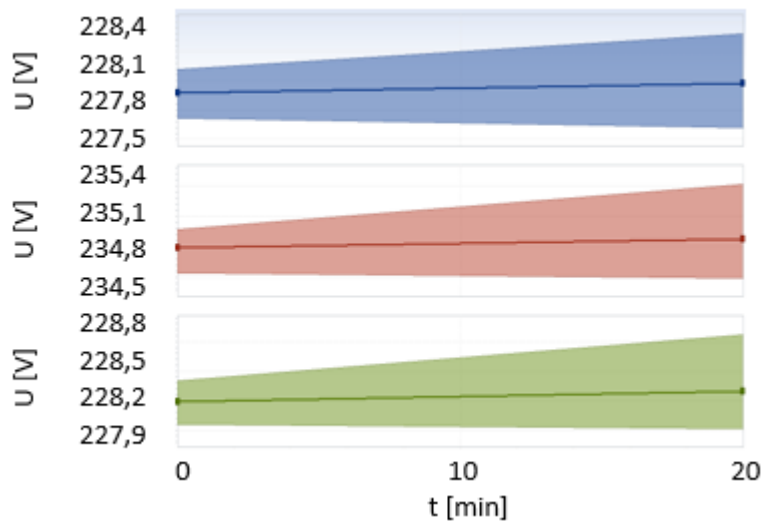


Image 33: Voltage effective values overview

Measuring power, similar review was given same as voltage. Image 34 shows a sinus wave power form which is deformed due to reactive power activity that is energy which is necessary for this lighting type. From sinus wave power form, it is closer to more pointed wave form due to which is necessary to enhance cross-sections surfaces for the purpose of stopping destruction of isolation during heating up guides.

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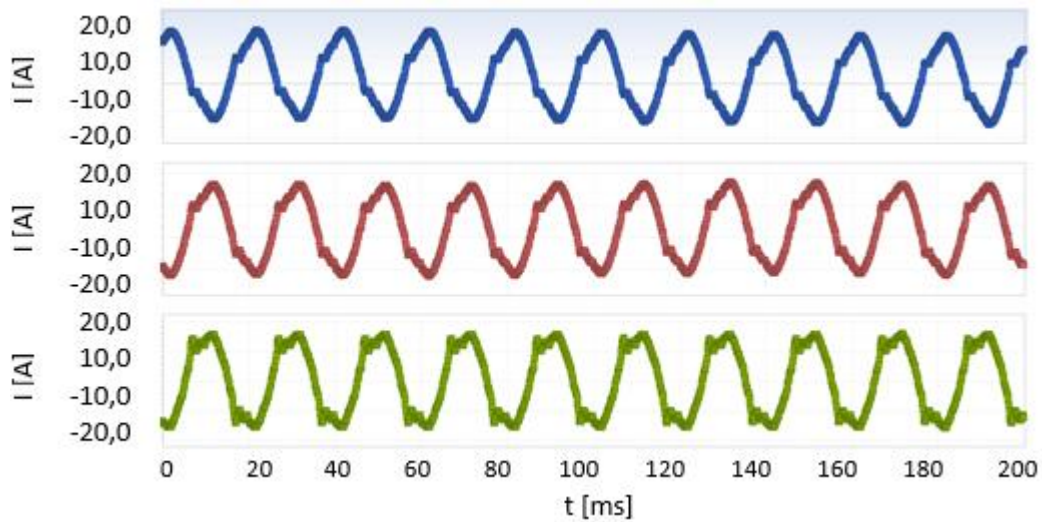


Image 34: Sinus wave form of measured voltage during 10 periods

Unlike voltage effective characteristics where there was a rise while need for reactive power was lowering, that is energy at power effective characteristics while there is no significant change in value (Image 35).

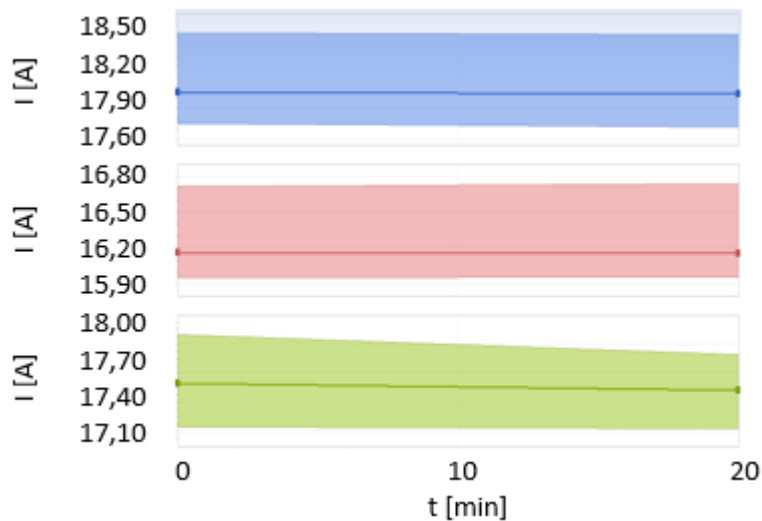


Image 35: Power effective value overview

During measuring voltage and power, effective display for active, reactive and apparent power triangle is generated. Great partaking in apparent power has a reactive power shown in Image 36 which needs to be compensated due to measured $\cos\phi$ is lower than 0,95.

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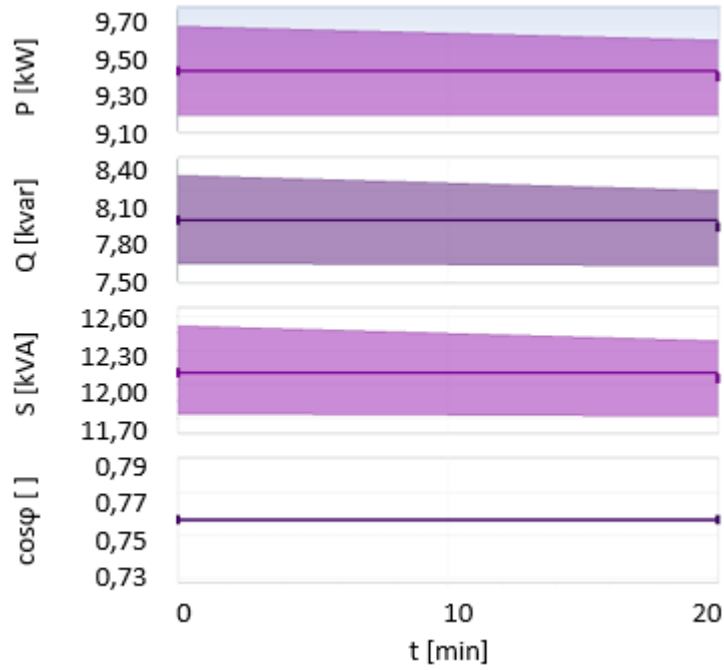


Image 36: Active, reactive, apparent powers and cosφ overview

Measured active and reactive energy follows power values in measuring period shown in Image 37.

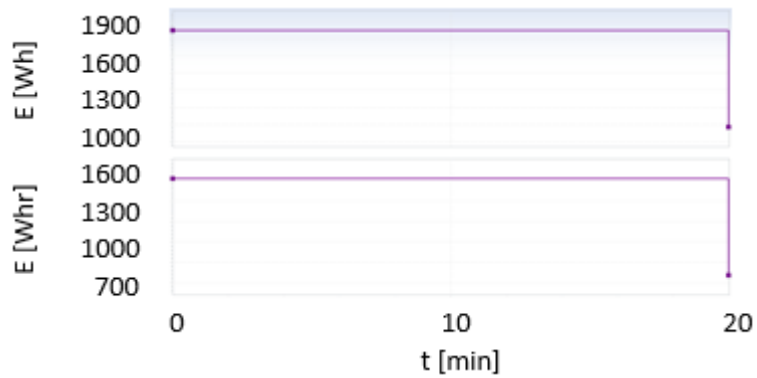


Image 37: Active and reactive energy

During measuring THD voltages are noted as general harmonics while from higher harmonics 5, 7 and 11 were noted and in total harmonic deformation approx 1% of total rated voltage value. Image 38 shows first 49 harmonics and total THD.



Image 38: Column overview THDU

Image 39 shows maximum (top line) and average (bottom line) values of THDU during overlooked period.

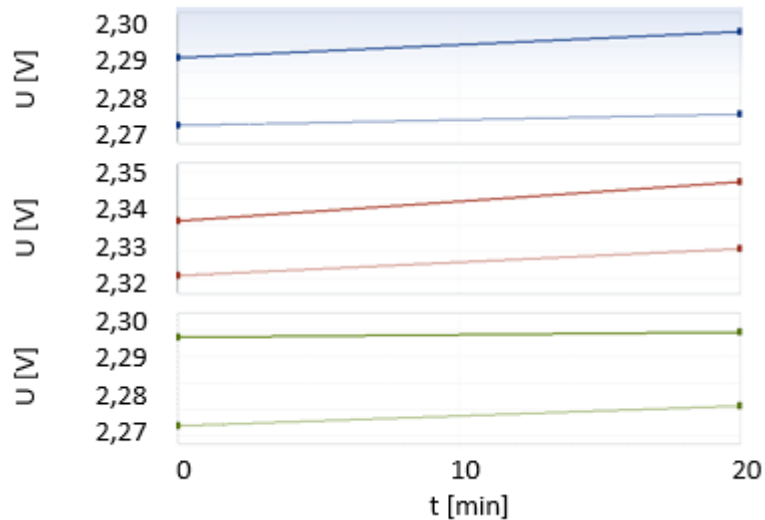


Image 39: Maximum and average value of THDU

Unlike voltages, power has greater harmonic deformation. Appearance of higher harmonics causes unlinearity consumption, that is pre-connected consumption device that makes them. During analysis of THDI, odd harmonics are noted up to 23rd. Total harmonic deformation of power is approx 17%. Image 40 shows an overview of higher power harmonics up to 49th harmonic.

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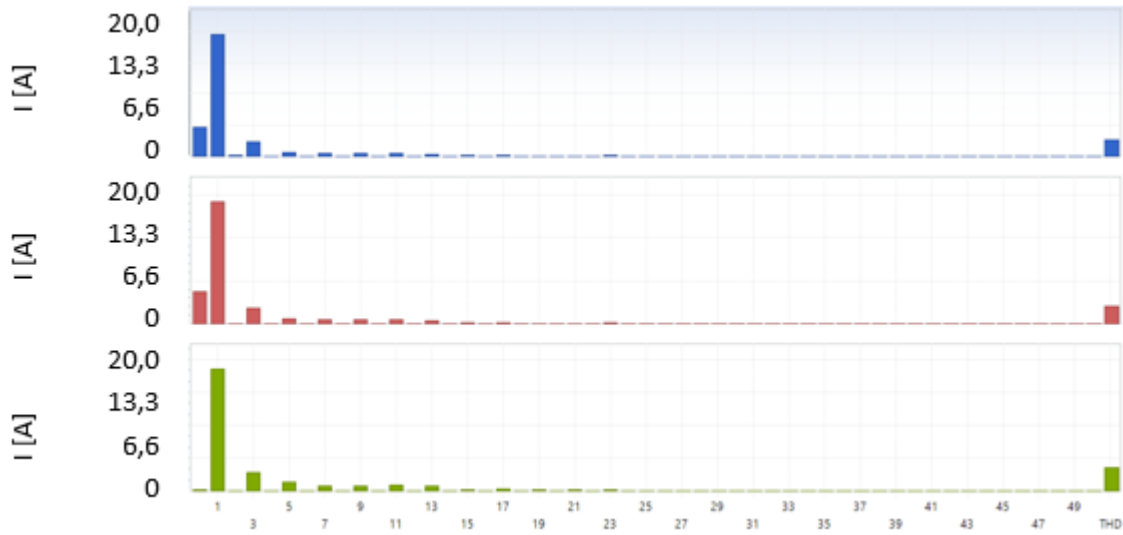


Image 40: Column overview THDi

Image 41 shows maximum (top line) and average (bottom line) values of THDi during overlooked period. Table 7 shows measuring results.

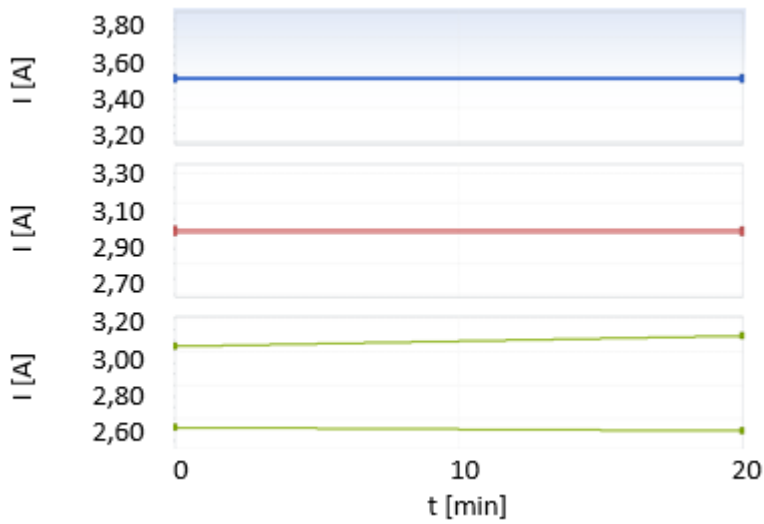


Image 41: maximum and average value of THD

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OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL LITVE	4X16mm2	233,9	230,3	227,9	13,33	13,30	14,88	2,525	2,450	2,646	0,81	0,80	0,78
PL ĐURĐEVIK	4X16mm2	229,1	233,9	233,9	11,58	12,19	11,91	2,097	2,109	2,034	0,79	0,74	0,73
PL CILJUGE	4X25mm2	233,9	227,3	228,2	34,80	34,64	34,88	6,757	6,221	6,527	0,83	0,79	0,82
PL Ž OSLOBOĐENJA	4X10mm2	228,2	233,9	233,9	4,90	5,20	4,86	0,883	0,888	0,852	0,79	0,73	0,75
PL Ž SJEVER	4X16mm2	230,3	233,9	229,1	17,61	17,76	19,02	3,204	3,323	3,224	0,79	0,80	0,74
R Ž KARLA	4X16mm2	233,9	227,3	233,9	23,43	24,77	22,37	4,110	4,110	4,238	0,75	0,73	0,81
PL TUZLANSKOG ODREDA	4X10mm2	230,3	232,1	232,7	1,57	1,68	1,75	0,300	0,324	0,326	0,83	0,83	0,80
PL Ž JEZERO	4X16mm2	229,4	233,9	233,9	14,19	14,01	14,89	2,637	2,687	2,786	0,81	0,82	0,80
PL Ž BTS 5	4X16mm2	227,9	226,7	233,6	21,34	23,07	21,71	3,939	4,185	4,209	0,81	0,80	0,83
PL Ž 1 MAJ 13	4X10mm2	227,6	233,0	229,7	1,54	1,72	1,69	0,281	0,304	0,299	0,80	0,76	0,77
PL HORNICA	4X16mm2	233,9	232,7	230,6	22,21	22,75	22,81	4,209	4,183	4,209	0,81	0,79	0,80
PL Ž RUDARSKA	4X10mm2	231,2	232,7	228,8	8,41	8,02	8,66	1,594	1,530	1,585	0,82	0,82	0,80
PL Ž LUG	4X10mm2	228,8	233,3	233,6	10,89	9,49	8,59	1,845	1,771	1,666	0,74	0,80	0,83

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CITY OF ŽIVINICE

OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL Ž TRGOZAD 8137412 2.ULICA 44	4X16mm2	233,6	233,9	229,4	16,89	15,61	17,33	2,958	2,993	2,941	0,75	0,82	0,74
PL Ž TRGOZAD 8137447 PAŠAGE GOGIĆA BB1	4X10mm2	233,0	233,9	233,9	5,79	5,46	5,80	1,052	0,996	1,071	0,78	0,78	0,79
PL Ž BTS SARAJKA	4X16mm2	233,9	233,9	227,6	20,96	21,24	21,49	3,922	3,876	4,060	0,80	0,78	0,83
PL Ž BTS 4 8137595	4X10mm2	230,0	233,9	233,9	1,41	1,38	1,48	0,265	0,255	0,253	0,82	0,79	0,73
PL Ž BTS- 4 8137609	4X10mm2	232,4	232,1	228,8	3,43	3,32	3,69	0,614	0,625	0,633	0,77	0,81	0,75
PL Ž MAJEVIČKA	4X10mm2	233,9	233,9	233,9	2,69	2,56	2,62	0,496	0,449	0,460	0,79	0,75	0,75
PL BTS 1	4X16mm2	232,7	233,9	230,9	18,63	16,32	18,42	3,209	3,093	3,189	0,74	0,81	0,75
PL BARIŠIĆ	4X16mm2	227,6	233,0	233,9	11,02	11,73	12,12	2,082	1,996	2,069	0,83	0,73	0,73
PL RUDARSKA	4X25mm2	226,4	233,9	231,2	30,67	30,93	33,78	5,485	6,004	5,935	0,79	0,83	0,76
PL D. DUBRAVE	4X16mm2	232,4	230,6	230,6	11,19	10,66	12,95	2,029	1,991	2,180	0,78	0,81	0,73
PL G.LUKAVICA SPOMEN OBILJEŽJE	4X16mm2	233,0	231,5	231,8	15,84	17,31	16,54	2,916	3,006	2,952	0,79	0,75	0,77
PL BTS IV-II	4X16mm2	233,9	231,8	233,9	17,36	17,87	18,84	3,045	3,273	3,349	0,75	0,79	0,76
PL S. GRAČANICA	4X10mm2	228,8	230,9	229,1	1,06	1,01	1,12	0,199	0,191	0,198	0,82	0,82	0,77

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CITY OF ŽIVINICE

OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL ĐAKOVIĆI	4X10mm2	231,8	228,8	233,9	2,19	2,13	1,93	0,391	0,375	0,362	0,77	0,77	0,80
PL VIŠĆA 8341621	4X16mm2	228,5	233,9	228,5	18,29	19,43	19,56	3,343	3,363	3,262	0,80	0,74	0,73
PL G.DUBRAVE	4X10mm2	227,6	233,9	232,7	10,32	10,50	10,12	1,738	1,792	1,836	0,74	0,73	0,78
PL BAŠIGOVCI	4X10mm2	226,7	233,9	226,7	10,35	10,15	10,41	1,783	1,733	1,794	0,76	0,73	0,76
PL GRADSKA DVORANA	4X10mm2	233,9	233,9	230,3	2,82	2,45	2,48	0,482	0,459	0,462	0,73	0,80	0,81
PL BAŠIGOVCI	4X25mm2	231,5	226,4	233,9	29,47	30,51	30,50	5,663	5,663	5,422	0,83	0,82	0,76
PL STRAŠANJ	4X25mm2	230,9	232,4	229,1	23,90	26,69	25,15	4,525	4,837	4,667	0,82	0,78	0,81
PL MEŠTRIĆ	4X10mm2	230,3	233,9	230,6	9,60	8,43	8,34	1,614	1,539	1,539	0,73	0,78	0,80
PL ĐURĐEVIK	4X10mm2	233,9	233,9	230,3	2,95	2,82	2,98	0,518	0,540	0,508	0,75	0,82	0,74
PL KOVAČI	4X10mm2	233,6	233,6	231,8	5,06	5,53	5,59	0,934	0,981	0,946	0,79	0,76	0,73
PL D.DUBRAVE 8388903	4X16mm2	233,9	233,6	233,9	17,91	17,66	19,29	3,142	3,260	3,338	0,75	0,79	0,74
PL ĐAKOVIĆI	4X16mm2	233,0	233,9	231,2	21,64	21,14	21,71	4,085	3,807	4,015	0,81	0,77	0,80
PL G.DUBRAVE 8391637	4X10mm2	233,9	233,9	233,9	6,32	6,10	6,32	1,152	1,099	1,139	0,78	0,77	0,77
PL Ž SJEVER 8391793	4X10mm2	231,8	233,9	228,2	1,54	1,55	1,67	0,293	0,300	0,281	0,82	0,83	0,74

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CITY OF ŽIVINICE

OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL ŠERIĆI 8392064	4X10mm2	232,1	229,4	233,9	5,35	4,93	4,66	0,919	0,860	0,850	0,74	0,76	0,78
PL LITVE 8392072	4X10mm2	233,9	229,4	230,0	2,17	2,58	2,32	0,416	0,432	0,406	0,82	0,73	0,76
PL S.GRAČANICA 8393850	4X10mm2	228,5	233,9	233,0	5,63	5,59	5,55	1,042	0,994	1,061	0,81	0,76	0,82
PL G.LUKAVICA 8400067	4X16mm2	231,8	229,7	229,1	21,79	21,86	22,27	3,990	3,966	3,826	0,79	0,79	0,75
PL PRILUK 8404518	4X16mm2	233,9	231,8	227,6	12,60	11,73	12,17	2,298	2,256	2,298	0,78	0,83	0,83
PL VIŠĆA 8412278	4X10mm2	233,6	226,7	233,0	6,54	6,30	6,22	1,116	1,142	1,116	0,73	0,80	0,77
PL ŠERIĆI 8412286	4X16mm2	233,9	233,9	232,4	18,30	17,81	18,06	3,253	3,332	3,273	0,76	0,80	0,78
PL D.DUBRAVE 8413576	4X10mm2	233,9	231,8	227,3	5,22	5,44	5,67	1,013	0,971	1,031	0,83	0,77	0,80
PL Ž SJEVER 8413592	4X10mm2	227,6	233,3	227,0	5,69	4,86	5,36	0,946	0,896	0,985	0,73	0,79	0,81
PL ĐURĐEVIK 8427925	4X10mm2	233,9	233,9	229,4	3,83	4,02	4,15	0,734	0,761	0,734	0,82	0,81	0,77
PL STRAŠANJ 8427933	4X25mm2	231,5	233,9	233,9	33,87	32,35	32,13	6,194	5,826	5,936	0,79	0,77	0,79
PL CILJUGE 8429723	4X10mm2	233,0	233,9	233,9	6,09	6,24	5,71	1,050	1,095	1,069	0,74	0,75	0,80
PL VIŠĆA 8446024	4X16mm2	233,9	232,4	232,4	22,54	21,59	23,63	4,218	4,114	4,504	0,80	0,82	0,82
PL ŠIŠIĆI 8460914	4X10mm2	233,9	227,6	227,3	8,61	8,28	8,91	1,611	1,527	1,621	0,80	0,81	0,80

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		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL ŠERIĆI 8471061	4X16mm2	233,9	227,6	233,9	20,11	21,56	20,36	3,763	3,974	3,810	0,80	0,81	0,80
PL VIŠĆA 8474443	4X16mm2	231,5	230,0	233,9	12,16	12,89	11,77	2,140	2,283	2,257	0,76	0,77	0,82
PL KUPJERUSI 8474451	4X10mm2	233,0	233,9	230,9	5,06	4,67	5,20	0,885	0,885	0,901	0,75	0,81	0,75
PL D.DUBRAVE 8560056	4X10mm2	227,9	230,9	228,2	9,58	9,66	10,13	1,813	1,761	1,803	0,83	0,79	0,78
PL G.LUKAVICA VERESIKE 8560498	4X10mm2	233,9	230,9	227,6	5,18	4,53	5,37	0,921	0,826	0,905	0,76	0,79	0,74
PL 8598827, ŠERIĆI ŠKOLA BB1, ŠERIĆI	4X10mm2	233,9	227,0	226,4	7,07	7,98	7,08	1,323	1,395	1,267	0,80	0,77	0,79
PL D.DUBRAVE RASKRŠĆE 8606854	4X10mm2	229,1	227,3	230,0	7,55	7,56	7,25	1,384	1,375	1,384	0,80	0,80	0,83
- PL D.DUBRAVE SPREČA 8606870	4X10mm2	233,9	229,1	232,1	6,50	7,30	6,24	1,246	1,254	1,202	0,82	0,75	0,83
- PL D.DUBRAVE SPREČA 8606870	4X10mm2	228,5	233,6	233,9	5,09	4,88	5,21	0,883	0,867	0,927	0,76	0,76	0,76
- PL PRILUK OMERKIĆI 8612048	4X10mm2	226,7	233,9	232,4	9,35	9,12	9,25	1,716	1,706	1,634	0,81	0,80	0,76
- PL LUČIĆI 8612056	4X10mm2	233,9	232,4	233,6	10,26	10,31	9,15	1,872	1,797	1,711	0,78	0,75	0,80
PL KOVAČI 8616418	4X10mm2	232,7	233,9	233,9	9,25	8,49	9,43	1,658	1,648	1,677	0,77	0,83	0,76
PL KOVAČI 8616426	4X10mm2	233,9	229,4	230,3	9,53	9,17	9,07	1,672	1,682	1,692	0,75	0,80	0,81

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CITY OF ŽIVINICE

OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL KOVAČI 8616426	4X10mm2	233,9	233,9	231,2	7,11	7,30	6,92	1,331	1,316	1,231	0,80	0,77	0,77
PL 8621888, 16.MUSLIMANSK E BRIGADE BB, ŽIVINICE	4X10mm2	230,9	232,7	233,9	11,00	10,59	9,71	1,879	1,824	1,726	0,74	0,74	0,76
PL 8621896, STRAŠANJ BB, ŽIVINICE	4X10mm2	231,8	230,6	233,3	1,81	1,82	1,96	0,336	0,348	0,352	0,80	0,83	0,77
PL MZ RUDAR 8626774	4X10mm2	229,7	227,9	233,9	2,43	2,64	2,37	0,408	0,439	0,421	0,73	0,73	0,76
PL S.GRAČANICA 8632650	4X10mm2	231,8	227,0	229,4	6,42	6,75	6,82	1,147	1,211	1,204	0,77	0,79	0,77
PL G.ŽIVINICE 8632677	4X10mm2	233,9	232,7	229,1	7,44	7,75	8,13	1,375	1,317	1,416	0,79	0,73	0,76
PL ŠERIČI 8632685	4X10mm2	228,5	233,9	233,9	4,57	3,95	4,48	0,794	0,739	0,808	0,76	0,80	0,77
PL GRAČANICA 8632804	4X10mm2	227,9	233,9	229,1	8,30	7,90	8,49	1,495	1,423	1,459	0,79	0,77	0,75
PL G.DUBRAVE DEDIČI 8634564	4X16mm2	227,6	231,5	233,9	16,45	15,27	13,84	2,770	2,721	2,591	0,74	0,77	0,80
PL G.DUBRAVE REDŽIČI 8634645	4X10mm2	233,9	233,9	233,0	3,09	3,17	2,99	0,557	0,578	0,564	0,77	0,78	0,81
PL G.DUBRAVE BEGIČI 8634653	4X16mm2	230,6	233,9	230,6	13,79	13,88	12,61	2,481	2,467	2,269	0,78	0,76	0,78
PL G.DUBRAVE KRIŽEVIČI 8635587	4X10mm2	233,9	229,4	230,0	11,47	11,54	12,34	2,173	2,038	2,100	0,81	0,77	0,74

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CITY OF ŽIVINICE

OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL MZ ĐURĐEVİK - MEDOVIĆI 8658439	4X16mm2	227,6	233,9	228,2	16,32	17,82	16,97	3,008	3,043	2,904	0,81	0,73	0,75
PL MZ SUHA 8658617	4X16mm2	233,3	233,9	233,9	16,26	14,55	16,65	2,808	2,825	2,843	0,74	0,83	0,73
PL TUPKOVIĆI 8666970	4X10mm2	233,9	227,0	230,9	6,89	6,81	6,49	1,209	1,159	1,244	0,75	0,75	0,83
PL MZ DUBRAVE -ŠEHIĆI 86680264	4X10mm2	226,7	233,9	231,8	0,69	0,71	0,71	0,129	0,130	0,133	0,83	0,78	0,81
PL ĐURĐEVİK 8718059	4X10mm2	227,6	233,3	233,9	13,66	13,56	13,62	2,548	2,563	2,548	0,82	0,81	0,80
PL BAŠIGOVCİ NOVO NASELJE 8727279	4X10mm2	233,6	229,4	233,9	3,23	3,18	3,15	0,589	0,555	0,575	0,78	0,76	0,78
PL MZ G.ŽIVINICE 8728577	4X10mm2	233,9	229,1	228,2	8,38	9,16	9,05	1,528	1,574	1,611	0,78	0,75	0,78
PL D.DUBRAVE 8753202	4X10mm2	229,1	228,5	232,4	5,55	5,48	5,78	0,966	1,015	1,021	0,76	0,81	0,76
PL MZ SUHA 875436	4X10mm2	233,9	231,5	227,6	15,29	12,87	14,75	2,611	2,472	2,719	0,73	0,83	0,81
PL GRAČANICA 8762449	4X16mm2	233,9	228,5	232,1	10,46	11,05	10,87	1,983	2,020	2,094	0,81	0,80	0,83
PL GRAČANICA 8762457	4X16mm2	232,4	229,4	227,9	11,76	11,47	13,03	2,023	2,185	2,197	0,74	0,83	0,74
PL ZENUNI 8766150	4X10mm2	231,8	233,9	232,4	4,74	5,14	4,71	0,868	0,889	0,832	0,79	0,74	0,76
PL ZENUNI 8766169	4X10mm2	230,6	227,9	233,0	6,98	7,30	6,64	1,208	1,215	1,222	0,75	0,73	0,79

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CITY OF ŽIVINICE

OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL KARAUULA 8767297	4X10mm2	232,1	231,2	232,1	2,54	2,58	2,69	0,471	0,471	0,499	0,80	0,79	0,80
PL STARI ĐURĐEVİK 8768099	4X10mm2	233,9	230,9	233,9	6,17	5,61	5,51	1,140	1,076	1,043	0,79	0,83	0,81
PL SVOJAT 8775478	4X16mm2	231,5	232,7	231,8	11,59	11,17	12,81	2,067	2,080	2,316	0,77	0,80	0,78
PL SVOJAT 8775486	4X16mm2	232,4	233,3	233,9	13,38	12,66	15,12	2,363	2,393	2,616	0,76	0,81	0,74
PL BAŠIGOVCI POBRĐANI 8783411	4X10mm2	229,4	233,9	230,0	9,49	9,34	9,31	1,741	1,639	1,649	0,80	0,75	0,77
PL MUSIĆI LIJEHA 8785066	4X16mm2	233,6	226,7	228,2	10,00	10,69	10,28	1,822	1,866	1,877	0,78	0,77	0,80
PL PODGAJEVI - M18 8785074	4X10mm2	226,4	227,0	233,9	1,60	1,39	1,41	0,264	0,261	0,261	0,73	0,83	0,79
PL KRIŽALJKA 8787743	4X10mm2	233,9	233,9	230,3	1,68	1,58	1,44	0,298	0,288	0,269	0,76	0,78	0,81
PL MZ ŠERIĆI 8791236	4X10mm2	233,3	228,8	233,9	2,49	2,82	2,48	0,482	0,485	0,482	0,83	0,75	0,83
PL MZ ĐURĐEVİK- ŽIVČIĆI 8791244	4X10mm2	233,9	233,9	233,9	4,02	3,41	3,80	0,706	0,637	0,649	0,75	0,80	0,73
PL ŠERIĆI 8807140	4X10mm2	228,2	231,8	231,2	7,60	6,72	7,14	1,370	1,277	1,354	0,79	0,82	0,82
PL ŠERIĆI RIBAC 8807167	4X10mm2	232,1	233,6	226,4	7,85	7,15	7,27	1,367	1,220	1,251	0,75	0,73	0,76
PL ŠERIĆI RIBAC 8807175	4X10mm2	233,9	230,6	233,9	11,06	10,29	11,39	2,043	1,969	2,104	0,79	0,83	0,79

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OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL SUHA ŠKOLA 8809992	4X10mm2	227,6	226,4	230,3	10,38	10,43	10,83	1,820	1,888	1,945	0,77	0,80	0,78
PL 8810001, TADIĆI BB1, ŽIVINICE	4X10mm2	233,9	233,9	228,2	6,76	7,18	7,82	1,280	1,310	1,303	0,81	0,78	0,73
PL KLAPIĆI 8810028	4X10mm2	233,9	233,9	227,6	6,59	6,25	6,58	1,155	1,169	1,109	0,75	0,80	0,74
PL VIŠĆA KUPJERUSI 8818975	4X10mm2	227,9	233,9	233,9	6,21	5,69	5,84	1,119	0,998	1,094	0,79	0,75	0,80
R VIŠĆA KUPJERUSI 8818983	4X10mm2	233,9	226,7	233,9	3,58	3,83	3,81	0,636	0,661	0,713	0,76	0,76	0,80
PL ALJIĆI PASIK 8842256	4X10mm2	233,9	233,6	227,9	4,01	4,02	4,31	0,759	0,695	0,716	0,81	0,74	0,73
PL KOPJEVIĆI 8863075	4X10mm2	232,7	226,7	233,9	10,55	10,21	9,68	1,817	1,806	1,720	0,74	0,78	0,76
PL KOPJEVIĆI 8863105	4X10mm2	226,7	233,9	232,1	4,63	4,40	4,74	0,808	0,844	0,814	0,77	0,82	0,74
PL GRABIK BB, 8870977	4X10mm2	233,9	229,1	227,9	5,30	5,51	5,58	1,016	0,922	0,992	0,82	0,73	0,78
PL BAŠIGOVCI KOP, 8895147	4X16mm2	230,9	226,7	232,7	15,36	14,17	14,51	2,801	2,634	2,734	0,79	0,82	0,81
PL 8896151, PRILUK OMERKIĆI BB1, ŠERIĆI	4X10mm2	233,9	229,4	231,2	4,14	4,22	3,35	0,708	0,716	0,643	0,73	0,74	0,83
PL ZELENKA 8904367	4X16mm2	229,7	230,0	233,3	16,13	14,69	15,66	2,889	2,737	2,923	0,78	0,81	0,80

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CITY OF ŽIVINICE

OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL ZELENKA, 8094456	4X16mm2	231,8	228,8	229,7	14,60	14,97	15,90	2,639	2,705	2,886	0,78	0,79	0,79
PL ZELENKA 8904529	4X10mm2	230,6	233,0	227,3	4,53	4,30	4,17	0,772	0,791	0,786	0,74	0,79	0,83
PL KADRIĆI 8913439	4X10mm2	226,4	233,9	230,0	7,13	6,34	6,22	1,211	1,143	1,088	0,75	0,77	0,76
PL TUPKOVIĆ 8945322, G. Tupkovići- Čauševići B2,	4X16mm2	233,9	233,9	231,8	11,39	12,17	12,45	2,078	2,078	2,193	0,78	0,73	0,76
PL TUPKOVIĆ 8945470, Trojan B2, GRAČANICA SELO	4X10mm2	230,0	231,8	233,9	5,35	4,80	4,52	0,910	0,856	0,867	0,74	0,77	0,82
PL TUPKOVIĆ 8945535, G. Tupkovići-Košare B1,	4X10mm2	233,9	226,7	232,7	7,86	8,79	7,90	1,471	1,554	1,508	0,80	0,78	0,82
PL PRILUK, 8946019	4X10mm2	227,3	233,9	233,9	7,66	6,43	7,21	1,271	1,248	1,332	0,73	0,83	0,79
PL ŠERIĆI 8946094	4X16mm2	233,6	233,9	231,8	11,54	11,31	13,40	2,210	2,143	2,330	0,82	0,81	0,75
PL TUPKOVIĆ, 8946175, TROJAN B2, GRAČANICA SELO	4X16mm2	233,9	229,4	229,4	10,16	12,22	10,81	1,972	2,131	2,009	0,83	0,76	0,81
PL PRILUK 8951799, PRILUK KLAPIĆI B, ŠERIĆI	4X10mm2	233,9	232,7	227,9	5,77	5,14	5,91	0,999	0,981	1,024	0,74	0,82	0,76
PL ČOKIĆI 8952841	4X10mm2	226,4	227,3	229,1	3,13	3,28	3,55	0,588	0,596	0,659	0,83	0,80	0,81

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OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL MZ ŠIŠIĆI 8952884	4X10mm2	233,9	228,8	233,9	8,80	9,15	9,07	1,503	1,550	1,634	0,73	0,74	0,77
PL BAŠIGOVC 8952965	4X10mm2	232,1	227,3	233,9	5,43	5,59	5,32	1,034	1,028	0,958	0,82	0,81	0,77
PL G.LUKAVICA 8955085	4X16mm2	229,4	233,9	230,3	10,66	10,03	10,28	1,809	1,854	1,776	0,74	0,79	0,75
PL 8955107, BRODIĆ BB2 ŽIVINICE	4X10mm2	227,0	228,2	233,9	9,61	8,12	7,87	1,592	1,482	1,454	0,73	0,80	0,79
PL D.LUKAVICA 8955131	4X10mm2	231,2	228,2	233,3	5,65	6,23	6,00	1,032	1,123	1,077	0,79	0,79	0,77
PL MZ LITVE 8955611	4X16mm2	233,9	231,2	227,6	11,94	11,98	11,53	2,151	2,077	2,126	0,77	0,75	0,81
PL (BIJELI PUT) 8956251	4X10mm2	230,9	228,8	233,3	4,56	5,06	4,75	0,873	0,868	0,920	0,83	0,75	0,83
PL 8957037, GOLUBINJAK BB, ŽIVINICE	4X10mm2	233,3	233,9	233,9	7,36	7,59	6,85	1,339	1,331	1,315	0,78	0,75	0,82
PL 8957088, DONJA LUKAVICA 2 BB, ŽIVINICE	4X10mm2	226,4	233,9	226,7	7,08	7,72	7,30	1,299	1,354	1,291	0,81	0,75	0,78
PL CILJUGE 2- PRUGA , 8957126	4X16mm2	233,9	228,5	227,3	12,01	13,78	12,74	2,163	2,394	2,258	0,77	0,76	0,78
PL 8957266, GOLUBINJAK BB, ŽIVINICE	4X10mm2	233,9	228,8	226,4	4,78	5,05	5,21	0,838	0,900	0,885	0,75	0,78	0,75
PL 8957975, CILJUGE BB, ŽIVINICE	4X10mm2	228,5	233,9	233,9	3,29	3,31	3,26	0,587	0,620	0,594	0,78	0,80	0,78

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OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL 8958149, JELAH POTOK B, ĐURĐEVİK	4X10mm2	230,3	233,9	228,2	2,33	2,36	2,61	0,430	0,459	0,464	0,80	0,83	0,78
PL 8958378, HORNICA O.R.B. BB2, ŽIVINICE	4X10mm2	233,9	233,6	233,9	2,53	2,68	2,75	0,486	0,489	0,489	0,82	0,78	0,76
PL 8958394, HORNICA O.R.B. BB2, ŽIVINICE	4X10mm2	227,0	232,7	233,9	3,27	2,76	2,97	0,550	0,527	0,570	0,74	0,82	0,82
PL 8958505, LUČIĆI BB1 ŽIVINICE	4X10mm2	226,7	227,6	233,9	1,68	1,50	1,45	0,282	0,264	0,282	0,74	0,77	0,83
PL 8958610, SVOJAT B, GRAČANICA SELO	4X10mm2	230,3	233,9	233,9	8,71	8,17	7,79	1,524	1,472	1,403	0,76	0,77	0,77
PL LUG, 9107134	4X10mm2	233,9	233,9	233,6	1,77	1,67	1,91	0,332	0,319	0,352	0,80	0,82	0,79
PL 9127119, DONJA VIŠČA BB4, ŽIVINICE	4X10mm2	227,0	233,9	227,9	3,83	3,86	3,51	0,643	0,658	0,624	0,74	0,73	0,78
PL FEHRIĆI MUJAGIĆI, 9181199	4X16mm2	233,9	228,5	233,9	9,06	10,64	9,11	1,673	1,800	1,747	0,79	0,74	0,82
- PL 9624961, BREZIK BB, ŽIVINICE	4X10mm2	233,9	233,9	227,9	5,22	4,94	5,83	0,964	0,947	1,022	0,79	0,82	0,77
PL 9597204, SVOJAT BB, GRAČANICA SELO	4X10mm2	233,9	226,4	227,6	3,13	3,14	3,22	0,586	0,576	0,572	0,80	0,81	0,78
PL 9596348, SVOJAT B, GRAČANICA SELO	4X10mm2	231,8	231,2	229,7	3,74	3,72	3,66	0,677	0,644	0,657	0,78	0,75	0,78

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OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL 9534938, LITVE BB, ŽIVINICE	4X10mm2	233,9	233,9	233,9	5,31	5,43	6,03	1,006	0,940	1,030	0,81	0,74	0,73
PL 9523057, PODGAJEVI BB, ĐURĐEVİK	4X10mm2	227,3	228,8	233,9	2,71	2,65	2,72	0,462	0,479	0,470	0,75	0,79	0,74
PL 9522964, PODGAJEVI BB, ĐURĐEVİK	4X10mm2	233,9	233,9	233,9	4,01	4,12	4,29	0,741	0,741	0,733	0,79	0,77	0,73
PL 9522948, PODGAJEVI BB, ĐURĐEVİK	4X10mm2	230,0	231,5	233,9	3,62	3,68	3,37	0,608	0,648	0,630	0,73	0,76	0,80
PL 9552995, GRAČANICA SELO BB, GRAČANICA SELO	4X10mm2	230,6	229,4	233,6	8,87	8,46	8,22	1,554	1,592	1,517	0,76	0,82	0,79
PL 9532404, GRAČANICA SELO BB, GRAČANICA SELO	4X10mm2	228,8	232,1	233,9	6,28	5,89	5,48	1,064	1,025	1,051	0,74	0,75	0,82
PL 9532188, G.TUPKOVIĆI-ČAUŠEVIĆI B2, GRAČANICA	4X10mm2	233,9	233,9	233,9	3,34	3,21	3,24	0,571	0,571	0,561	0,73	0,76	0,74
PL 952068, MODRAČKA BB, ŽIVINICE	4X10mm2	230,9	231,5	233,3	8,51	8,87	8,20	1,513	1,540	1,531	0,77	0,75	0,80
PL 9528164, BARIČKI GAJ BB, ŠERIĆI	4X10mm2	233,9	232,1	231,5	7,73	7,72	7,73	1,428	1,327	1,377	0,79	0,74	0,77
PL 9594582, BARICE BB, ŠERIĆI	4X10mm2	233,9	233,9	233,3	6,05	6,16	6,20	1,161	1,167	1,113	0,82	0,81	0,77
PL 9514058, BARICE BB ŠERIĆI	4X10mm2	231,2	228,8	233,3	8,73	9,94	9,82	1,655	1,728	1,833	0,82	0,76	0,80

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OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL 9513957 PRILUK POLJIĆI BB, ŠERIĆI	4X16mm2	228,8	233,9	227,6	16,91	15,65	17,52	3,018	2,966	3,070	0,78	0,81	0,77
PL 9513132 SJEVER 2 BB ŽIVINICE	4X10mm2	233,3	230,6	233,9	3,45	3,56	3,88	0,669	0,673	0,681	0,83	0,82	0,75
PL 9512527, SUHA B, ŠERIĆI	4X10mm2	227,9	227,3	227,9	6,99	7,32	6,67	1,275	1,230	1,171	0,80	0,74	0,77
PL 95122462 BAŠIGOVCI LIVADA BB, ŽIVINICE	4X10mm2	232,1	233,9	233,9	5,91	6,84	6,44	1,138	1,232	1,159	0,83	0,77	0,77
PL 9507531 KOVAČI BB, ŽIVINICE	4X10mm2	232,4	227,3	233,9	6,05	5,60	5,91	1,082	1,031	1,120	0,77	0,81	0,81
PL 9512012 G.DUBRAVE ŽUNOVIĆI BB, DUBRAVE	4X10mm2	228,2	230,9	231,5	6,08	6,48	6,77	1,097	1,138	1,144	0,79	0,76	0,73
PL 9512659, TUPKOVIĆI BB, GRAČANICA SELO	4X10mm2	233,9	233,6	233,9	4,81	5,28	5,04	0,878	0,900	0,943	0,78	0,73	0,80
PL 9505172 GOLUBINJAK BB 1 ŽIVINICE	4X10mm2	233,9	227,3	232,4	8,21	7,93	8,09	1,460	1,460	1,541	0,76	0,81	0,82
PL 9505776, BERIĆI BB, ĐURĐEVİK	4X10mm2	226,4	231,8	231,8	4,78	4,41	4,34	0,801	0,839	0,825	0,74	0,82	0,82
PL 9505733 ŠAHIĆI BB, ĐURĐEVİK	4X10mm2	233,9	229,1	233,9	7,40	6,66	6,22	1,281	1,237	1,178	0,74	0,81	0,81
PL 9476903, CILJUGE BB1 ŽIVINICE	4X10mm2	231,2	230,9	228,2	2,40	2,47	2,48	0,450	0,434	0,452	0,81	0,76	0,80

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL 9460861, REPUH BB, GRAČANICA SELO	2X10mm2	233,9	-	-	0,97	-	-	0,169	-	-	0,74	-	-
PL 317236 SUHA BAPLIČI BB, ŠERIČI	4X10mm2	229,4	231,5	233,9	4,78	4,64	5,16	0,834	0,881	0,881	0,76	0,82	0,73
PL 9358544 TUPKOVIČI DONJI BB, GRAČANICA SELO	4X10mm2	230,6	228,8	227,6	4,97	5,04	5,41	0,905	0,910	0,973	0,79	0,79	0,79
PL 9358099 KOTORNICA BB, ĐURĐEVİK	4X10mm2	233,9	233,9	230,0	4,21	3,67	3,60	0,729	0,687	0,687	0,74	0,80	0,83
PL 9357424 ĐURĐEVİK MAG.PUT BB, ĐURĐEVİK	4X10mm2	227,0	227,0	232,4	8,77	7,87	8,11	1,453	1,393	1,470	0,73	0,78	0,78
PL BAŠIGOVCI ŠKOLA, 9244050	4X10mm2	233,9	230,6	226,4	2,97	3,59	3,26	0,562	0,630	0,576	0,81	0,76	0,78
PL 9315535 ZUKIČI BB, ĐURĐEVİK	4X10mm2	233,9	233,9	231,2	0,93	1,09	0,96	0,181	0,189	0,180	0,83	0,74	0,81
PL 9317872 G.DUBRAVE HUSIČI BB, DUBRAVE	4X10mm2	226,4	227,0	229,7	7,79	7,59	7,05	1,376	1,344	1,264	0,78	0,78	0,78
PL 9317600 TOPLIČKA BB,, ŽIVINICE	4X10mm2	227,9	233,9	233,9	3,63	3,35	3,38	0,637	0,619	0,649	0,77	0,79	0,82
PL 93162213 ŠERIČI RIBAC BB1, ŠERIČI	4X10mm2	233,9	228,2	233,3	3,82	3,83	3,77	0,742	0,699	0,704	0,83	0,80	0,80
PL 9324070 GRAČANICA SELO	4X10mm2	233,9	226,4	227,0	7,50	7,48	6,93	1,404	1,355	1,274	0,80	0,80	0,81

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
BB, GRAČANICA SELO													
PL 9338632 SPAHIĆI BB1, ŽIVINICE	4X10mm2	233,9	230,0	233,9	5,88	5,49	4,93	1,004	0,922	0,946	0,73	0,73	0,82
- PL 9323457 DONJA VIŠĆA BB, ŽIVINICE	4X10mm2	233,9	232,7	232,1	7,74	8,36	7,71	1,448	1,517	1,396	0,80	0,78	0,78
PL 9338306 LUČIĆI BB1, ŽIVINICE	4X10mm2	230,3	233,9	232,7	2,28	2,21	2,27	0,410	0,393	0,418	0,78	0,76	0,79
PL 9338322 RASADINE BB1 ŽIVINICE	4X10mm2	233,9	231,2	233,9	6,51	6,64	6,32	1,203	1,167	1,138	0,79	0,76	0,77
PL 9842284 9755950 TOPLIČKA BB, ŽIVINICE	4X10mm2	233,9	227,6	233,9	4,34	4,87	4,57	0,823	0,809	0,781	0,81	0,73	0,73
PL 9842284 TUPKOVIĆI BB, GRAČANICA SELO	4X10mm2	233,9	231,5	233,9	3,11	3,47	3,00	0,583	0,586	0,568	0,80	0,73	0,81
PL 9935681 SUHA JABLANICA BB, ŠERIĆI	4X10mm2	228,5	233,9	233,9	4,15	4,34	4,11	0,759	0,741	0,759	0,80	0,73	0,79
PL 9940855 LITVE BB, ŽIVINICE	4X10mm2	226,7	226,7	230,9	1,67	1,62	1,68	0,287	0,305	0,284	0,76	0,83	0,73
PL 9935886 ĆENDA BB, ŽIVINICE	4X10mm2	233,9	228,2	233,9	2,95	3,16	2,88	0,553	0,569	0,526	0,80	0,79	0,78
PL 9864350 DONJA LUKAVICA BB, ŽIVINICE	4X10mm2	227,9	233,0	233,9	3,68	3,60	3,58	0,654	0,612	0,654	0,78	0,73	0,78

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL 9893342 ĐURĐEVİK ŽIVČIĆI BB, ĐURĐEVİK	4X10mm2	233,6	233,9	233,9	2,96	2,74	2,89	0,519	0,532	0,547	0,75	0,83	0,81
PL 9875786 DONJA VIŠĆA BB, ŽIVINICE	4X10mm2	229,7	231,8	230,3	1,11	1,01	0,99	0,186	0,179	0,175	0,73	0,77	0,77
PL 9868070 TUPKOVIĆI BB, GRAČANICA SELO	4X10mm2	233,6	227,9	232,1	5,26	5,27	5,18	1,020	0,997	0,938	0,83	0,83	0,78
PL 9875530 PODGAJEVI BB, ĐURĐEVİK	4X10mm2	229,1	233,9	233,9	4,04	4,26	4,40	0,722	0,768	0,781	0,78	0,77	0,76
PL 9864490 DONJA LUKAVICA BB, ŽIVINICE	4X10mm2	232,1	233,9	230,6	6,45	7,02	6,57	1,198	1,198	1,257	0,80	0,73	0,83
PL 9868291 DONJA LUKAVICA BB, ŽIVINICE	4X10mm2	233,3	227,9	232,4	3,91	3,93	3,72	0,692	0,680	0,692	0,76	0,76	0,80
PL 90862889 ZELENKA BB, GRAČANICA SELO	4X10mm2	232,1	230,0	229,4	2,04	2,07	2,13	0,393	0,391	0,405	0,83	0,82	0,83
PL 9853154 HORNICA O.R.B. BB1, ŽIVINICE	4X10mm2	233,9	229,7	229,4	4,80	4,61	4,89	0,831	0,816	0,908	0,74	0,77	0,81
PL 9858504 PODGAJEVI BB1, ĐURĐEVİK	4X10mm2	233,6	231,2	233,0	2,86	2,80	2,91	0,494	0,525	0,521	0,74	0,81	0,77
PL 9858512 PODGAJEVI BB1, ĐURĐEVİK	4X10mm2	233,6	231,8	233,9	2,21	2,22	2,36	0,424	0,401	0,431	0,82	0,78	0,78
PL 9807705 DONJA VIŠĆA BB, ŽIVINICE	4X10mm2	229,7	233,9	226,7	2,50	2,35	2,39	0,431	0,450	0,433	0,75	0,82	0,80

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CITY OF ŽIVINICE

OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL 9802479 TUPKOVIĆI BB, GRAČANICA SELO	4X10mm2	229,7	227,0	232,7	1,18	1,25	1,24	0,211	0,221	0,223	0,78	0,78	0,77
PL 9761985 ŠERIĆI BB, ŠERIĆI	4X10mm2	233,0	233,6	227,9	4,55	4,56	5,40	0,816	0,842	0,899	0,77	0,79	0,73
PL 9789081 TUPKOVIĆI BB, GRAČANICA SELO	4X10mm2	227,6	233,9	233,0	4,99	4,08	4,17	0,840	0,763	0,777	0,74	0,80	0,80
PL 9802320 TUPKOVIĆI BB, GRAČANICA SELO	4X10mm2	227,6	227,3	233,9	2,75	2,94	2,77	0,495	0,495	0,505	0,79	0,74	0,78
PL 9799079 GORNJA LUKAVICA BB, ŽIVINICE	4X10mm2	233,9	232,4	233,9	3,56	3,47	3,14	0,625	0,588	0,596	0,75	0,73	0,81
PL 9546669 GORNJA LUKAVICA BB, ŽIVINICE	4X10mm2	233,9	233,9	233,9	3,78	3,47	3,50	0,690	0,658	0,662	0,78	0,81	0,81
PL 9802495 TUPKOVIĆI BB, GRAČANICA SELO	4X10mm2	232,4	233,9	233,9	3,88	4,03	4,14	0,740	0,688	0,727	0,82	0,73	0,75
PL 9631356 MAGISTRALNI PUT MALINE BB, ŽIVINICE	4X10mm2	232,7	226,7	233,9	1,38	1,35	1,47	0,244	0,246	0,265	0,76	0,80	0,77
- PL 9747389 G.DUBRAVE BB, DUBRAVE GORNJE	4X10mm2	233,9	226,4	232,4	2,37	2,15	2,25	0,405	0,405	0,393	0,73	0,83	0,75
PL 9747362 G.DUBRAVE BB, DUBRAVE GORNJE	4X10mm2	233,9	232,1	231,5	2,31	2,40	2,53	0,443	0,440	0,468	0,82	0,79	0,80

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

OMM name	Cable	Voltage (V)			Electricity (A)			Power (kW)			Cosφ		
		L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
PL 9756701 PETROVIĆI BB, ŽIVINICE	4X10mm2	233,9	233,9	230,0	7,03	7,40	6,74	1,233	1,350	1,272	0,75	0,78	0,82
PL 9755934 G.DUBRAVE BB, DUBRAVE GORNJE	4X10mm2	233,9	233,9	228,8	6,81	5,99	6,24	1,163	1,163	1,114	0,73	0,83	0,78
PL 9597182 DONJA LUKAVICA 1 BB, ŽIVINICE	4X10mm2	233,9	229,7	226,7	4,80	4,88	4,80	0,831	0,841	0,893	0,74	0,75	0,82
PL 10083590 ŠIŠIĆI BB, ŽIVINICE	4X10mm2	227,0	226,7	226,7	4,19	3,91	4,51	0,704	0,691	0,756	0,74	0,78	0,74

Table 7: Electric parameters measuring results

6.3.2 Measuring luminosity intensity

Luminosity intensity analysis is done based on luminosity intensity measurements. For mentioned analysis the following standards are used:

- **BAS CEN/TR 13201-1:2016** – Traffic lighting - Part 1: Lighting class selection,
- **BAS EN 13201-2:2017** – Traffic lighting - Part 2: Performance requests,
- **BAS EN 13201-3:2017** – Traffic lighting - Part 3: Performance budget,
- **BAS EN 13201-4:2017** – Traffic lighting - Part 4: Traffic lighting characteristics of measuring methods,
- **BAS EN 13201-5:2017** – Traffic lighting - Part 5: Energy working characteristics indicators.

Bosnia and Herzegovina does not have accepted luminous pollution protection Law. For measuring luminosity intensity, we used measuring instrument LUX meter UNI-T UT383 and METREL. Image 42 shows luminosity intensity measuring example.



Image 42: Horizontal luminosity intensity measurement (left) and vertical luminosity intensity measurement (right)

Measuring is done in artificial lighting conditions. According to measured values, mostly it satisfies required values defined by standard. However, in parts where horticultural design where luminosity intensity unsatisfies required values defined by standard due to tree positioning which block a lamp (Image 43).



Image 43: Lamp covered by trees example

By removing branches or other solutions it can be concluded that current lighting as its intensity satisfies issued values defined by standard.

6.4 Energy characteristics analysis in electricity consumption system

6.4.1 Public lighting electricity consumption budget

Standardized annual electricity consumption calculates in a way:

$$E_{\text{ref}} = (P_{\text{is}} + P_{\text{gub}}) * T_{\text{ref}} \quad (1.)$$

$$E_{\text{ref}} = P_{\text{ref}} * T_{\text{ref}} \quad (2.)$$

where the following is:

E_{ref} – standardized annual electricity consumption (kWh/annually);

P_{is} – lamp source power;

P_{gub} – ballast losses;

P_{ref} – total reference power - $P_{\text{is}} + P_{\text{gub}}$;

T_{ref} – reference value of working hours for public lighting system (4.100 hours) – accordant to BAS EN 15900:2011 standard.

Lamp source installed power overview, working periods are taken from BAS EN 15900:2011 standard and total standardized annual consumption is shown in table 7.

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CITY OF ŽIVINICE

R.br	Street name	Lamp source type	(Pis) - Lamp source power	Quantity	(Tref) - Working period	(Eref) - Total standardized annual consumption
			(W)	(pcs)	(h/annually)	(kWh/annually)
1	Tupkovići	LED	50	20	4100	4715,00
2	Tupkovići	LED	50	44	4100	10373,00
3	Tupkovići	LED	50	12	4100	2829,00
4	Tupkovići	LED	50	21	4100	4950,75
5	Tupkovići Gornji	LED	50	23	4100	5422,25
6	igralište Tupkovići 800m ²	Metal halogen spotlight	250	6	4100	7072,50
7	Tupkovići Gornji	Sodium	150	23	4100	16266,75
8	Tupkovići Gornji	LED	50	1	4100	235,75
9	Tupkovići Gornji	Sodium	150	21	4100	14852,25
10	Tupkovići Gornji Čauševići	Sodium	150	18	4100	12730,50
11	Košare	Sodium	150	34	4100	24046,50
12	Tupkovići-Mujčinovići	Sodium	150	9	4100	6365,25
13	Tupkovići-Mujčinovići	Sodium	150	16	4100	11316,00
14	Tupkovići Donji	Sodium	150	33	4100	23339,25
15	Tupkovići Donji	LED	50	6	4100	1414,50
16	Tupkovići-Ćasuri	Sodium	150	17	4100	12023,25
17	Tupkovići-Trojan	Sodium	150	33	4100	23339,25
18	Tupkovići-Trojan	Sodium	150	7	4100	4950,75
19	Tupkovići-Trojan	LED	50	2	4100	471,50
20	igralište Tupkovići-Trojan 800m ²	Metal halogen spotlight	250	6	4100	7072,50
21	Tupkovići- Trojan	Sodium	150	24	4100	16974,00
22	Gračanica	Sodium	150	21	4100	14852,25
23	Gračanica	Sodium	150	6	4100	4243,50
24	Gračanica	LED	50	12	4100	2829,00
25	Gračanica	Sodium	150	15	4100	10608,75
26	Gračanica	LED	100	1	4100	471,50
27	Gračanica	LED	50	11	4100	2593,25
28	Gračanica	Sodium	150	2	4100	1414,50
29	Gračanica	Sodium	150	27	4100	19095,75
30	Gračanica	Sodium	150	21	4100	14852,25
31	Gračanica	Mercury	125	46	4100	27111,25

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CITY OF ŽIVINICE

R.br	Street name	Lamp source type	(Pis) - Lamp source power	Quantity	(Tref) - Working period	(Eref) - Total standardized annual consumption
			(W)	(pcs)	(h/annually)	(kWh/annually)
32	Gračanica	Mercury	125	11	4100	6483,13
33	Gračanica	LED	50	10	4100	2357,50
34	Gračanica	Sodium	150	29	4100	20510,25
35	Durići	Sodium	150	13	4100	9194,25
36	Durići	Sodium	150	28	4100	19803,00
37	Durići	LED	50	1	4100	235,75
38	Vrtage	Sodium	150	6	4100	4243,50
39	Gračanica	Sodium	150	11	4100	7779,75
40	Gračanica	Sodium	150	20	4100	14145,00
41	Gračanica	Sodium	150	24	4100	16974,00
42	Gračanica-Šljivići	Sodium	150	37	4100	26168,25
43	Gračanica-Šljivići	Sodium	150	10	4100	7072,50
44	Gračanica-Zelenika	Sodium	150	12	4100	8487,00
45	Gračanica-Zelenika	LED	50	26	4100	6129,50
46	Gračanica-Zelenika	Sodium	150	50	4100	35362,50
47	Omladinskih radnih brigada	LED	50	15	4100	3536,25
48	Omladinskih radnih brigada	Sodium	150	5	4100	3536,25
49	Omladinskih radnih brigada	Sodium	150	42	4100	29704,50
50	Omladinskih radnih brigada	LED	50	2	4100	471,50
51	Omladinskih radnih brigada	Sodium	150	6	4100	4243,50
52	Hornica	Sodium	150	26	4100	18388,50
53	Omladinskih radnih brigada	Sodium	150	18	4100	12730,50
54	stadion FK Metalac 5000m ²	Sodium	150	8	4100	5658,00
55	Šarenjak	Sodium	70	46	4100	15182,30
56	Omladinskih radnih brigada	LED	50	2	4100	471,50
57	Hornica	Sodium	150	15	4100	10608,75
58	Omladinskih radnih brigada	Sodium	70	25	4100	8251,25
59	Maline-M18	Sodium	150	5	4100	3536,25
60	Maline Spreča	Sodium	150	7	4100	4950,75
61	Strašanj-M18	Sodium	150	5	4100	3536,25
62	Strašanj-M18	LED	50	3	4100	707,25
63	Strašanj	Sodium	70	31	4100	10231,55
64	Strašanj	Sodium	70	53	4100	17492,65

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R.br	Street name	Lamp source type	(Pis) - Lamp source power	Quantity	(Tref) - Working period	(Eref) - Total standardized annual consumption
			(W)	(pcs)	(h/annually)	(kWh/annually)
65	Strašanj	Fluorescent	35	23	4100	3795,58
66	Strašanj	Mercury	125	5	4100	2946,88
67	Strašanj igralište 800m ²	Metal halogen spotlight	250	4	4100	4715,00
68	Strašanj	LED	50	3	4100	707,25
69	Šehići	Fluorescent	35	7	4100	1155,18
70	Šehići	LED	50	1	4100	235,75
71	Turijanci	LED	50	18	4100	4243,50
72	Turijanci	Sodium	150	3	4100	2121,75
73	Hadžići	Sodium	150	7	4100	4950,75
74	Nova cesta	Sodium	150	19	4100	13437,75
75	Nova cesta	LED	50	5	4100	1178,75
76	Luke	Sodium	150	31	4100	21924,75
77	Mustafići	Fluorescent	35	32	4100	5280,80
78	Hadžići	Sodium	150	20	4100	14145,00
79	Djedovača	Sodium	150	14	4100	9901,50
80	Djedovača	Mercury	125	17	4100	10019,38
81	Prijeki put	Sodium	70	11	4100	3630,55
82	Gložik	Sodium	150	19	4100	13437,75
83	Gložik	Sodium	150	11	4100	7779,75
84	Hadžići	Sodium	150	25	4100	17681,25
85	Dubrave Donje	Sodium	150	11	4100	7779,75
86	Prijeki put	Sodium	150	13	4100	9194,25
87	Hadžići	Sodium	150	12	4100	8487,00
88	Dubrave Donje	Sodium	150	18	4100	12730,50
89	prostor oko Crkve sv. Ane	Sodium	70	6	4100	1980,30
90	Dubavska	Sodium	150	24	4100	16974,00
91	Dubavska	LED	50	4	4100	943,00
92	Dubavska	Sodium	150	35	4100	24753,75
93	Višća	Sodium	150	10	4100	7072,50
94	Višća	Sodium	150	56	4100	39606,00
95	igralište Višća 800m ²	Metal halogen spotlight	250	6	4100	7072,50
96	regionalni put R469	Sodium	150	6	4100	4243,50

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R.br	Street name	Lamp source type	(Pis) - Lamp source power	Quantity	(Tref) - Working period	(Eref) - Total standardized annual consumption
			(W)	(pcs)	(h/annually)	(kWh/annually)
97	regionalni put R469	LED	50	7	4100	1650,25
98	Višća Donja	Sodium	150	51	4100	36069,75
99	Višća Donja	Sodium	150	54	4100	38191,50
100	Višća Donja	Sodium	150	23	4100	16266,75
101	Kupjerusi	Sodium	150	28	4100	19803,00
102	Kupjerusi-poligon	Sodium	250	6	4100	7072,50
103	Smajići	Sodium	150	14	4100	9901,50
104	Smajići	LED	50	2	4100	471,50
105	Bajrami	Sodium	150	16	4100	11316,00
106	Kupjerusi-Taletovići	Sodium	150	26	4100	18388,50
107	Dubravaska	Sodium	250	16	4100	18860,00
108	Dubravaska	Sodium	150	4	4100	2829,00
109	magistralni put M18	LED	50	31	4100	7308,25
110	Dubravaska C	Sodium	150	12	4100	8487,00
111	Sjever	Sodium	70	37	4100	12211,85
112	Sjever	Fluorescent	35	36	4100	5940,90
113	Sjever	LED	50	5	4100	1178,75
114	Sjever	LED	50	26	4100	6129,50
115	Sjever	Sodium	150	15	4100	10608,75
116	Hadžići	Sodium	150	18	4100	12730,50
117	Hadžići	Sodium	150	29	4100	20510,25
118	Hadžići	Sodium	150	14	4100	9901,50
119	prostor oko džamije Orašje	LED	50	10	4100	2357,50
120	regionalni put R469	Sodium	150	19	4100	13437,75
121	Begići	Fluorescent	35	24	4100	3960,60
122	regionalni put R469	Sodium	150	13	4100	9194,25
123	Begići	Fluorescent	35	28	4100	4620,70
124	Begići	Sodium	70	2	4100	660,10
125	Delići	Sodium	70	26	4100	8581,30
126	Dedići	Fluorescent	35	7	4100	1155,18
127	Dedići	LED	50	3	4100	707,25
128	Begići	LED	50	5	4100	1178,75
129	Begići	Fluorescent	35	4	4100	660,10

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY
EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

R.br	Street name	Lamp source type	(Pis) - Lamp source power	Quantity	(Tref) - Working period	(Eref) - Total standardized annual consumption
			(W)	(pcs)	(h/annually)	(kWh/annually)
130	Gornje Dubrave Husići	Fluorescent	35	38	4100	6270,95
131	Gornje Dubrave Husići	LED	50	9	4100	2121,75
132	Kadrići	Sodium	70	32	4100	10561,60
133	Kadrići	Mercury	125	13	4100	7661,88
134	Kadrići	LED	50	3	4100	707,25
135	igralište Kadrići 800m ²	Metal halogen spotlight	250	16	4100	18860,00
136	Kadrići	Fluorescent	35	12	4100	1980,30
137	Kadrići	Sodium	70	24	4100	7921,20
138	Bajrići	Sodium	70	23	4100	7591,15
139	Bajrići	Sodium	70	33	4100	10891,65
140	Kadirići	Sodium	70	21	4100	6931,05
141	Krzevići	Sodium	70	24	4100	7921,20
142	Ciljuge	Sodium	150	8	4100	5658,00
143	Ciljuge	Sodium	150	45	4100	31826,25
144	Toplička 2	LED	50	26	4100	6129,50
145	Ciljuge	LED	50	7	4100	1650,25
146	Ciljuge	LED	50	16	4100	3772,00
147	Ciljuge	Sodium	150	4	4100	2829,00
148	Ciljuge	Sodium	150	12	4100	8487,00
149	Bašigovci	LED	50	46	4100	10844,50
150	Bašigovci	LED	50	21	4100	4950,75
151	Toplička	LED	50	5	4100	1178,75
152	Toplička	Sodium	70	10	4100	3300,50
153	Toplička	Sodium	150	5	4100	3536,25
154	Toplička	Fluorescent	35	2	4100	330,05
155	Lukavica Donja	Sodium	150	25	4100	17681,25
156	Lukavica Donja	Sodium	150	26	4100	18388,50
157	Lukavica Donja	Sodium	150	35	4100	24753,75
158	Lukavica Donja	Sodium	150	18	4100	12730,50
159	Lukavica Donja	Sodium	150	21	4100	14852,25
160	Lukavica Donja	Sodium	150	36	4100	25461,00
161	Lukavica Gornja	Sodium	150	14	4100	9901,50

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY
EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

R.br	Street name	Lamp source type	(Pis) - Lamp source power	Quantity	(Tref) - Working period	(Eref) - Total standardized annual consumption
			(W)	(pcs)	(h/annually)	(kWh/annually)
162	Lukavica Gornja	LED	50	13	4100	3064,75
163	Lukavica Gornja	Sodium	150	22	4100	15559,50
164	Lukavica Gornja	Sodium	150	19	4100	13437,75
165	Lukavica Gornja	Sodium	150	18	4100	12730,50
166	Lukavica Gornja	LED	50	12	4100	2829,00
167	Lukavica Gornja	Sodium	150	36	4100	25461,00
168	Lukavica Gornja	Sodium	150	12	4100	8487,00
169	Lukavica Gornja	Sodium	150	12	4100	8487,00
170	Lukavica Gornja	Sodium	150	26	4100	18388,50
171	Lukavica Gornja	Sodium	150	21	4100	14852,25
172	Lukavica Gornja	Sodium	150	12	4100	8487,00
173	Lukavica Gornja	LED	50	25	4100	5893,75
174	Svojat	LED	50	11	4100	2593,25
175	Svojat	Sodium	150	22	4100	15559,50
176	Svojat	Sodium	150	30	4100	21217,50
177	Svojat	Sodium	150	27	4100	19095,75
178	Svojat	Sodium	150	18	4100	12730,50
179	Svojat	Sodium	150	23	4100	16266,75
180	Svojat	Sodium	150	36	4100	25461,00
181	igralište Svojat 800m ²	Sodium	150	4	4100	2829,00
182	Svojat	LED	50	6	4100	1414,50
183	Zelenika-Krivača	Sodium	150	22	4100	15559,50
184	Zelenika-Krivača	LED	50	3	4100	707,25
185	Zelenika	Sodium	150	7	4100	4950,75
186	Zelenika	Sodium	150	20	4100	14145,00
187	Zelenika	Sodium	150	19	4100	13437,75
188	Livada	Sodium	150	21	4100	14852,25
189	Podoljani	Sodium	150	17	4100	12023,25
190	Donja Lukavica	Sodium	150	13	4100	9194,25
191	Donja Lukavica	Sodium	150	22	4100	15559,50
192	Donja Lukavica	Sodium	150	7	4100	4950,75
193	Donja Lukavica	LED	50	59	4100	13909,25
194	Bašigovci	Sodium	150	30	4100	21217,50

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY
EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

R.br	Street name	Lamp source type	(Pis) - Lamp source power	Quantity	(Tref) - Working period	(Eref) - Total standardized annual consumption
			(W)	(pcs)	(h/annually)	(kWh/annually)
195	regionalni put R469	Sodium	150	59	4100	41727,75
196	regionalni put R469	LED	50	1	4100	235,75
197	Pasci donji	Sodium	150	38	4100	26875,50
198	3. ulica	LED	50	5	4100	1178,75
199	3. ulica	LED	50	9	4100	2121,75
200	magistralni put M18	LED	50	10	4100	2357,50
201	magistralni put M18	LED	50	14	4100	3300,50
202	magistralni put M18	LED	50	57	4100	13437,75
203	2. ulica	LED	50	48	4100	11316,00
204	Alije Izetbegovića	LED	50	29	4100	6836,75
205	1. ulica	Sodium	150	12	4100	8487,00
206	1. ulica	Sodium	150	14	4100	9901,50
207	1. ulica	LED	50	53	4100	12494,75
208	Zlatnih ljiljana	LED	50	6	4100	1414,50
209	Zlatnih ljiljana	Sodium	150	31	4100	21924,75
210	parking(Bosanski kulturni centar)	LED	50	6	4100	1414,50
211	parking(Bosanski kulturni centar)	Sodium	150	11	4100	7779,75
212	25. Novembar	LED	50	19	4100	4479,25
213	25. Novembar	Sodium	150	9	4100	6365,25
214	25. Novembar	Mercury	125	14	4100	8251,25
215	parking supermarketa	LED	50	9	4100	2121,75
216	parking supermarketa	Mercury	125	4	4100	2357,50
217	parking površine cca 600m	Mercury	125	8	4100	4715,00
218	parking površine cca 600m	LED	50	13	4100	3064,75
219	Gradski park konjuh (25. Novembar)	LED	50	29	4100	6836,75
220	Gradski park konjuh (25. Novembar)	Sodium	150	7	4100	4950,75
221	Prvi maj	Sodium	150	13	4100	9194,25
222	Školska	LED	50	15	4100	3536,25
223	Školska	Sodium	150	1	4100	707,25
224	Maršala Tita	LED	50	4	4100	943,00
225	Maršala Tita	LED	50	5	4100	1178,75
226	Prva ulica	Sodium	150	4	4100	2829,00
227	2. ulica (prostor oko zgrade)	Sodium	150	8	4100	5658,00

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY
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CITY OF ŽIVINICE

R.br	Street name	Lamp source type	(Pis) - Lamp source power	Quantity	(Tref) - Working period	(Eref) - Total standardized annual consumption
			(W)	(pcs)	(h/annually)	(kWh/annually)
228	Oslobođenja	LED	50	15	4100	3536,25
229	Oslobođenja	LED	50	15	4100	3536,25
230	Alije Izetbegovića	Sodium	150	5	4100	3536,25
231	parking(Meše Selimovića)	Metal halogen spotlight	250	15	4100	17681,25
232	Oslobođenja	Sodium	150	11	4100	7779,75
233	park(Ulica Oslobođenja)	Sodium	150	11	4100	7779,75
234	parking(Ulica Oslobođenja)	Sodium	150	6	4100	4243,50
235	Gradski park Živinice(Alije Izetbegovića)	Sodium	150	14	4100	9901,50
236	ulica iza Općine/Grada (Alije Izetbegovića)	Sodium	150	4	4100	2829,00
237	ulica iza Općine/Grada (Alije Izetbegovića)	LED	50	4	4100	943,00
238	parking Općine/Grada	Metal halogen spotlight	250	1	4100	1178,75
239	parking Općine/Grada	LED	50	2	4100	471,50
240	Šetnica iza Općine/Grada	Sodium	150	8	4100	5658,00
241	Pašage Gocića	LED	50	3	4100	707,25
242	Pašage Gocića	Sodium	150	18	4100	12730,50
243	Patriotske lige	Sodium	150	8	4100	5658,00
244	Željeznička	LED	50	6	4100	1414,50
245	Željeznička	Sodium	150	1	4100	707,25
246	XVI muslimanske brigade	Sodium	150	8	4100	5658,00
247	Rudarska	Sodium	150	11	4100	7779,75
248	Rudarska	Sodium	150	3	4100	2121,75
249	Rudarska	LED	50	7	4100	1650,25
250	Rudarska	Mercury	125	1	4100	589,38
251	Živiničkih brigada	Sodium	150	7	4100	4950,75
252	Civilnih žrtava rata	Sodium	150	6	4100	4243,50
253	Dubavska(naselje uz r469)	Sodium	150	10	4100	7072,50
254	regionalni put R469	Sodium	150	11	4100	7779,75
255	regionalni put R469	LED	50	2	4100	471,50
256	Bosanska	Sodium	150	197	4100	139328,25
257	Bosanska	LED	50	2	4100	471,50
258	Jezero	Sodium	150	24	4100	16974,00

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY
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CITY OF ŽIVINICE

R.br	Street name	Lamp source type	(Pis) - Lamp source power	Quantity	(Tref) - Working period	(Eref) - Total standardized annual consumption
			(W)	(pcs)	(h/annually)	(kWh/annually)
259	Jezero	LED	50	13	4100	3064,75
260	Jezero	Sodium	150	28	4100	19803,00
261	Jezero	Mercury	125	4	4100	2357,50
262	Jezero	Sodium	150	6	4100	4243,50
263	Jezero	Sodium	150	5	4100	3536,25
264	1. Mart	Sodium	150	32	4100	22632,00
265	1. Mart	LED	50	1	4100	235,75
266	1. Mart	Sodium	150	5	4100	3536,25
267	1. Mart	LED	50	1	4100	235,75
268	1. Mart	Sodium	150	3	4100	2121,75
269	Sadnice	Sodium	150	16	4100	11316,00
270	Toplička	Sodium	150	10	4100	7072,50
271	Toplička	LED	50	6	4100	1414,50
272	Toplička	Sodium	150	7	4100	4950,75
273	regionalni put R469	Sodium	150	12	4100	8487,00
274	regionalni put R469	LED	50	4	4100	943,00
275	1. ulica	Sodium	150	8	4100	5658,00
276	regionalni put R455a	Sodium	100	22	4100	10373,00
277	Poljice	Sodium	100	14	4100	6601,00
278	Klopići	Sodium	100	9	4100	4243,50
279	Klopići	Sodium	100	4	4100	1886,00
280	Klopići	Sodium	100	12	4100	5658,00
281	regionalni put R455a	Sodium	100	2	4100	943,00
282	Priluk	Sodium	100	75	4100	35362,50
283	regionalni put R455a	Sodium	100	23	4100	10844,50
284	Priluk	Sodium	100	17	4100	8015,50
285	Priluk	LED	50	29	4100	6836,75
286	Priluk	Sodium	100	32	4100	15088,00
287	regionalni put R455a	Sodium	100	7	4100	3300,50
288	Omići	LED	50	3	4100	707,25
289	Omići	Sodium	100	16	4100	7544,00
290	regionalni put R455a	Sodium	100	7	4100	3300,50
291	Omerkići	Sodium	100	22	4100	10373,00

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY
EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

R.br	Street name	Lamp source type	(Pis) - Lamp source power	Quantity	(Tref) - Working period	(Eref) - Total standardized annual consumption
			(W)	(pcs)	(h/annually)	(kWh/annually)
292	Omerkići	LED	50	5	4100	1178,75
293	R455a	Sodium	100	16	4100	7544,00
294	Alagići	Sodium	100	11	4100	5186,50
295	Alagići	Sodium	100	26	4100	12259,00
296	Šehići	Sodium	100	42	4100	19803,00
297	Šehići	Sodium	100	44	4100	20746,00
298	Šehići	Sodium	100	16	4100	7544,00
299	Šerići	Sodium	100	22	4100	10373,00
300	Šerići	Sodium	100	40	4100	18860,00
301	regionalni put R455a	Sodium	100	8	4100	3772,00
302	Šerići	Sodium	100	10	4100	4715,00
303	regionalni put R455a	Sodium	100	18	4100	8487,00
304	Omerkići	Sodium	100	5	4100	2357,50
305	igralište(Omerkići)	Sodium	100	10	4100	4715,00
306	regionalni put R455a	Sodium	100	13	4100	6129,50
307	Šerići	Sodium	100	65	4100	30647,50
308	regionalni put R455a	Sodium	100	15	4100	7072,50
309	Šerići	Sodium	100	51	4100	24046,50
310	Šerići	LED	50	1	4100	235,75
311	Šerići	Sodium	100	13	4100	6129,50
312	regionalni put R455a	Sodium	100	30	4100	14145,00
313	regionalni put R455a	Sodium	100	9	4100	4243,50
314	regionalni put R455a	LED	50	1	4100	235,75
315	Suha	Sodium	100	63	4100	29704,50
316	Suha	Sodium	100	63	4100	29704,50
317	Suha	LED	50	42	4100	9901,50
318	regionalni put R455a	Sodium	100	8	4100	3772,00
319	Suha	Sodium	100	32	4100	15088,00
320	Suha	LED	50	9	4100	2121,75
321	Suha	Sodium	100	38	4100	17917,00
322	Suha	LED	50	9	4100	2121,75
323	Đulići	Sodium	100	26	4100	12259,00
324	Đulići	Sodium	100	6	4100	2829,00

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY
EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

R.br	Street name	Lamp source type	(Pis) - Lamp source power	Quantity	(Tref) - Working period	(Eref) - Total standardized annual consumption
			(W)	(pcs)	(h/annually)	(kWh/annually)
325	Barice	Sodium	100	23	4100	10844,50
326	Atlič mahala	Sodium	100	46	4100	21689,00
327	Jablanica	Sodium	100	9	4100	4243,50
328	Jablanica	Sodium	100	24	4100	11316,00
329	Tadići	Sodium	100	10	4100	4715,00
330	Tadići	Sodium	100	25	4100	11787,50
331	Živinice Gornje	Sodium	100	18	4100	8487,00
332	Živinice Gornje	Sodium	100	8	4100	3772,00
333	Živinice Gornje	LED	50	3	4100	707,25
334	Kopjevići	Sodium	100	14	4100	6601,00
335	Kopjevići	Sodium	100	37	4100	17445,50
336	Grabik	Sodium	100	22	4100	10373,00
337	Petrovići	Sodium	100	19	4100	8958,50
338	Petrovići	Sodium	100	18	4100	8487,00
339	Šišići	Sodium	100	42	4100	19803,00
340	Šišići	LED	50	4	4100	943,00
341	Šišići	LED	50	24	4100	5658,00
342	Šišići	Sodium	100	10	4100	4715,00
343	Adići	Sodium	100	22	4100	10373,00
344	Adići	Sodium	100	19	4100	8958,50
345	Adići	LED	50	5	4100	1178,75
346	Lug	Sodium	100	8	4100	3772,00
347	Lug	LED	50	8	4100	1886,00
348	Lug	Sodium	100	12	4100	5658,00
349	magistralni put M18	Sodium	100	10	4100	4715,00
350	Đurđevik	Sodium	100	21	4100	9901,50
351	Đurđevik	Sodium	100	55	4100	25932,50
352	Đurđevik	LED	50	3	4100	707,25
353	Gostelja	Sodium	100	24	4100	11316,00
354	magistralni put M18	LED	50	10	4100	2357,50
355	Gostelja	Sodium	100	21	4100	9901,50
356	Musići	Sodium	100	49	4100	23103,50
357	Musići	LED	50	2	4100	471,50

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY
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CITY OF ŽIVINICE

R.br	Street name	Lamp source type	(Pis) - Lamp source power	Quantity	(Tref) - Working period	(Eref) - Total standardized annual consumption
			(W)	(pcs)	(h/annually)	(kWh/annually)
358	Musići	Sodium	100	30	4100	14145,00
359	Gostelja	LED	50	6	4100	1414,50
360	Gostelja	Sodium	100	18	4100	8487,00
361	Golubinjak	Sodium	100	54	4100	25461,00
362	Golubinjak	LED	50	7	4100	1650,25
363	Nukići	Sodium	100	66	4100	31119,00
364	Nukići	LED	50	2	4100	471,50
365	regionalni put R469	Sodium	100	24	4100	11316,00
366	Živiničke ose	Sodium	100	47	4100	22160,50
367	Živiničke ose	LED	50	10	4100	2357,50
368	Živiničke ose	Sodium	70	76	4100	25083,80
369	Živiničke ose	LED	50	56	4100	13202,00
370	Živiničke ose	Sodium	70	24	4100	7921,20
371	Živiničke ose	Fluorescent	35	14	4100	2310,35
372	Gostelja	Sodium	100	28	4100	13202,00
373	Gostelja	LED	50	29	4100	6836,75
374	Golubinjak	Sodium	100	31	4100	14616,50
375	Golubinjak	LED	50	1	4100	235,75
376	Golubinjak	Sodium	100	32	4100	15088,00
377	regionalni put R469	Sodium	100	38	4100	17917,00
378	Donja Višća	Sodium	100	21	4100	9901,50
379	Donja Višća	LED	50	1	4100	235,75
380	Donja Višća	Sodium	100	15	4100	7072,50
381	regionalni put R469	Sodium	100	8	4100	3772,00
382	regionalni put R469	LED	50	4	4100	943,00
383	Šišići	Sodium	100	71	4100	33476,50
384	Šišići	Sodium	100	32	4100	15088,00
385	Šišići	LED	50	3	4100	707,25
386	Gostelja	Sodium	100	6	4100	2829,00
387	Gostelja	LED	50	11	4100	2593,25
388	magistralni put M18	Sodium	100	8	4100	3772,00
389	magistralni put M18	LED	50	5	4100	1178,75
390	Stara pruga	Sodium	100	75	4100	35362,50

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY
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CITY OF ŽIVINICE

R.br	Street name	Lamp source type	(Pis) - Lamp source power	Quantity	(Tref) - Working period	(Eref) - Total standardized annual consumption
			(W)	(pcs)	(h/annually)	(kWh/annually)
391	Stara pruga	LED	50	3	4100	707,25
392	Bare	Sodium	100	9	4100	4243,50
393	Bare	LED	50	5	4100	1178,75
394	Kovači	Sodium	100	31	4100	14616,50
395	Kovači	Sodium	100	10	4100	4715,00
396	Kovači	Sodium	100	38	4100	17917,00
397	Kovači	Sodium	100	34	4100	16031,00
398	Kovači	Sodium	100	17	4100	8015,50
399	Kovači	Sodium	100	13	4100	6129,50
400	Mujići	Sodium	100	16	4100	7544,00
401	Bašigovci	Sodium	100	27	4100	12730,50
402	Bašigovci	LED	50	4	4100	943,00
403	Bašigovci	Sodium	100	8	4100	3772,00
404	Bašigovci	Sodium	100	27	4100	12730,50
405	Bašigovci	Sodium	100	21	4100	9901,50
406	Bašigovci	Sodium	100	14	4100	6601,00
407	Bašigovco	Sodium	100	24	4100	11316,00
408	Bašigovco	Sodium	100	14	4100	6601,00
409	Bašigovco	Sodium	100	9	4100	4243,50
410	Bašigovco	Sodium	100	13	4100	6129,50
411	Bašigovco	LED	50	1	4100	235,75
412	Podoljani	LED	50	25	4100	5893,75
413	Podoljani	Sodium	100	3	4100	1414,50
414	Bašigovci	Sodium	100	13	4100	6129,50
415	Bašigovci	Sodium	100	8	4100	3772,00
416	Bašigovci	Sodium	100	5	4100	2357,50
417	Bašigovci	Sodium	100	15	4100	7072,50
418	Bašigovci	Sodium	100	3	4100	1414,50
419	Bašigovci	LED	50	3	4100	707,25
420	Vrnojevići donji	Sodium	100	4	4100	1886,00
421	Vrnojevići donji	LED	50	14	4100	3300,50
422	regionalni put R455a	Sodium	150	40	4100	28290,00
423	Toplička	Sodium	150	15	4100	10608,75

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R.br	Street name	Lamp source type	(Pis) - Lamp source power	Quantity	(Tref) - Working period	(Eref) - Total standardized annual consumption
			(W)	(pcs)	(h/annually)	(kWh/annually)
424	Toplička	Sodium	150	17	4100	12023,25
425	Toplička	LED	50	4	4100	943,00
426	Toplička	Sodium	150	6	4100	4243,50
427	3. ulica	Sodium	150	18	4100	12730,50
428	3. ulica	LED	50	3	4100	707,25
429	3. ulica	Sodium	70	4	4100	1320,20
430	Stara pruga	Sodium	150	9	4100	6365,25
431	Stara pruga	LED	50	3	4100	707,25
432	Stara pruga	Sodium	150	10	4100	7072,50
433	Stara pruga	LED	50	6	4100	1414,50
434	regionalni put R455a	Sodium	150	5	4100	3536,25
435	regionalni put R455a	Sodium	150	2	4100	1414,50
436	Živinički sokolovi	Sodium	150	5	4100	3536,25
437	Partizanske	Sodium	150	17	4100	12023,25
438	Živinički sokolovi	Sodium	150	7	4100	4950,75
439	Živinički sokolovi	LED	50	1	4100	235,75
440	Partizanska	Sodium	150	18	4100	12730,50
441	Partizanska	Sodium	150	18	4100	12730,50
442	Partizanska	LED	50	1	4100	235,75
443	Partizanska	Sodium	150	26	4100	18388,50
444	Partizanska	LED	50	1	4100	235,75
445	Partizanska	Sodium	150	12	4100	8487,00
446	Partizanska	Sodium	150	18	4100	12730,50
447	Partizanska	LED	50	3	4100	707,25
448	Živinički sokolovi	Sodium	100	13	4100	6129,50
449	Živinički sokolovi	Sodium	100	17	4100	8015,50
450	Živinički sokolovi	LED	50	2	4100	471,50
451	regionalni put R455a	Sodium	150	50	4100	35362,50
452	Modračka	Sodium	150	18	4100	12730,50
453	regionalni put R455a	Sodium	150	24	4100	16974,00
454	regionalni put R455a	Sodium	150	18	4100	12730,50
455	Barice	Sodium	150	22	4100	15559,50
456	regionalni put R455a	Sodium	150	21	4100	14852,25

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R.br	Street name	Lamp source type	(Pis) - Lamp source power	Quantity	(Tref) - Working period	(Eref) - Total standardized annual consumption
			(W)	(pcs)	(h/annually)	(kWh/annually)
457	Barice	Sodium	150	9	4100	6365,25
458	Barice	Sodium	100	22	4100	10373,00
459	igrališče (Barice)	Sodium	100	4	4100	1886,00
460	Otawa	Sodium	100	28	4100	13202,00
461	Otawa	LED	50	12	4100	2829,00
462	Podgaj	Sodium	100	13	4100	6129,50
463	Podgaj	LED	50	6	4100	1414,50
464	Podgaj	Sodium	100	20	4100	9430,00
465	Podgaj	Sodium	100	14	4100	6601,00
466	Podgaj	Sodium	100	21	4100	9901,50
467	Podgaj	LED	50	3	4100	707,25
468	Podgaj	Sodium	100	14	4100	6601,00
469	Kovači	Sodium	100	3	4100	1414,50
470	Kovači	LED	50	10	4100	2357,50
471	Podgajevi	Sodium	100	13	4100	6129,50
472	magistralni put M18	Sodium	100	25	4100	11787,50
473	Šahići	Sodium	100	27	4100	12730,50
474	Đurđevik	Sodium	100	51	4100	24046,50
475	Đurđevik	Sodium	100	20	4100	9430,00
476	Živčići	Sodium	100	8	4100	3772,00
477	Živčići	Sodium	100	18	4100	8487,00
478	Podgaj	Sodium	100	10	4100	4715,00
479	Podgajevi	LED	50	31	4100	7308,25
480	Košare Samardžije	Led p	50	25	4100	5893,75
481	Rasadište	Led p	50	35	4100	8251,51
Total (kWh/annually)						4.360.337,70
Lamp sources (pcs)						8530
Specific annual consumption (kWh/per lamp source annually)						511,18

Table 8: Calculated public lighting electricity consumption overview

From table 8 we can notice that there are LED lamps which are energy efficient, therefore it is necessary to make a calculation and overlook electricity consumption of existing system that is not energy efficient, that is lamps that are not LED. Standardized annual electricity consumption of unefficient public lighting is calculated in the following:

$$E_m = E_{ref} - E_{LED} \quad (3.)$$

where the following is:

E_m – standardized annual electricity consumption that is unefficient public lighting (kWh/annually);

E_{ref} – standardized annual electricity consumption (kWh/annually);

E_{LED} – standardized annual consumption of LED lamps (kWh/annually).

Total standardized annual electricity consumption overview of unefficient public lighting by lamp types is shown in table 8, while Image 47 shows percentaged partaking of total standardized consumption E_m) by unefficient public lighting types. Ballast losses are 15%.

(E_m) – Total standardized annual electricity consumption of unefficient public lighting (kWh/annually)	3.968.780,53
Lamp sources (pcs)	6802
Specific annual consumption (kWh/per lighting source annually)	583,47

Table 9: Calculated consumption and unefficient public lighting electricity expenses overview

6.5 System regulation and management analysis

In City of Živinice, there is no installed gear per OMM for central surveillance and management over public lighting systems.

6.6 Public lighting maintenance analysis

User self-initiatively and accordant to possibilities replaces lighting source. However, accordant to informations confirmed from City of Živinice, City has no correct maintenance dana, the same ones are not delivered to the consultant.

7 ANALYSIS OF ENERGY EXPENSES AND FORECASTING FUTURE CONSUMPTION

The analysis of electricity consumption was done on the basis of data from the bills received from the customers (UNDP) and City of Živinice for 2017, 2018 i 2019. Based on the bills received from the City of Živinice, the control of bills received from the Expensesomers was performed. The tables and graphs in the following chapters show the electricity consumption for public lighting. Electricity is supplied from the public electricity distribution network, PC "Elektroprivreda BiH".

The expenses balance presents the total expenses for electrical energy, whereby the energy and expenses balances were prepared on the basis of the received bills on consumed electricity for 2017, 2018, and 2019. Total annual electricity consumption is shown in the energy balance. The energy balance is shown in the chapter above.

Electricity measuring point measures energy consumption, and it is measure consumption of active power. Total expenses for electricity are presented in the expenses balance, which is divided into two types (electricity and network charges) and tariff elements. The following tables provide an overview of electricity consumption and expenses by electricity measuring points.

The average price of electricity for the analyzed period is **0,2077 KM/kWh ili 0,106195 EUR/kWh**.

Month	2017		2018		2019	
	kWh	KM	kWh	KM	kWh	KM
January	384,279.00	68,478.73	449,411.99	90,913.18	457,325.97	96,036.39
February	337,397.00	60,432.76	352,307.59	70,422.52	381,418.90	79,817.70
March	316,559.00	56,487.23	345,248.98	69,945.92	358,923.82	75,679.87
April	293,252.00	53,139.37	313,809.35	62,975.05	332,538.00	70,659.87
May	261,555.00	47,514.05	277,948.62	55,779.81	307,453.21	65,182.45
June	231,494.00	42,165.23	256,462.79	51,972.62	222,334.76	47,399.27
July	231,000.67	42,116.53	245,602.78	49,817.76	273,712.61	58,238.79
August	267,548.27	48,579.62	272,376.43	54,735.38	286,087.50	60,518.95
November	291,199.12	52,201.33	318,199.08	64,539.99	326,362.55	75,909.57
October	380,651.14	68,696.12	371,902.06	75,451.75	402,688.18	85,432.21
November	392,739.22	70,840.25	418,650.75	84,443.19	401,853.26	85,278.37
December	397,310.00	71,657.17	446,458.72	90,448.27	464,306.73	98,554.26
Total	3,784,984.42	682,308.39	4,068,379.15	821,445.44	4,215,005.50	898,707.70

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Month	2017		2018		2019	
	kWh	EUR	kWh	EUR	kWh	EUR
January	384,279.00	35012.62	449,411.99	46483.17	457,325.97	49102.63
February	337,397.00	30898.78	352,307.59	36006.46	381,418.90	40810.14
March	316,559.00	28881.46	345,248.98	35762.78	358,923.82	38694.5
April	293,252.00	27169.73	313,809.35	32198.63	332,538.00	36127.82
May	261,555.00	24293.55	277,948.62	28519.76	307,453.21	33327.26
June	231,494.00	21558.74	256,462.79	26573.18	222,334.76	24234.86
July	231,000.67	21533.84	245,602.78	25471.42	273,712.61	29777.02
August	267,548.27	24838.37	272,376.43	27985.76	286,087.50	30942.85
November	291,199.12	26690.12	318,199.08	32998.77	326,362.55	38811.95
October	380,651.14	35123.77	371,902.06	38577.87	402,688.18	43680.8
November	392,739.22	36220.04	418,650.75	43175.12	401,853.26	43602.14
December	397,310.00	36637.73	446,458.72	46245.47	464,306.73	50389.99
Total	3,784,984.42	348858.7	4,068,379.15	419998.4	4,215,005.50	459502

Table 10: Electricity consumption and expenses for the analyzed period from 2017 to 2019

A more detailed analysis of electricity consumption by months and years, shown in the following Images and pages, can be very useful for proposing energy efficiency measures. This is especially evident when the nature of public lighting is taken into account, which directly affects the way electricity is consumed. After a more detailed analysis of consumption and Expenses, measures can be suggested to reduce or increase energy efficiency.

Image 44 shows a diagram of electricity consumption and its Expenses by months in 2017. It can be concluded that monthly consumption varies significantly throughout the year. Variations are noticeable by months within the season (winter or summer), and trend lines (added to the diagram) show a marked decline in consumption during the summer. The reason for the drop in consumption is the reduced use of artificial light. Consumption in June is the lowest due to the shortest nights of the year.

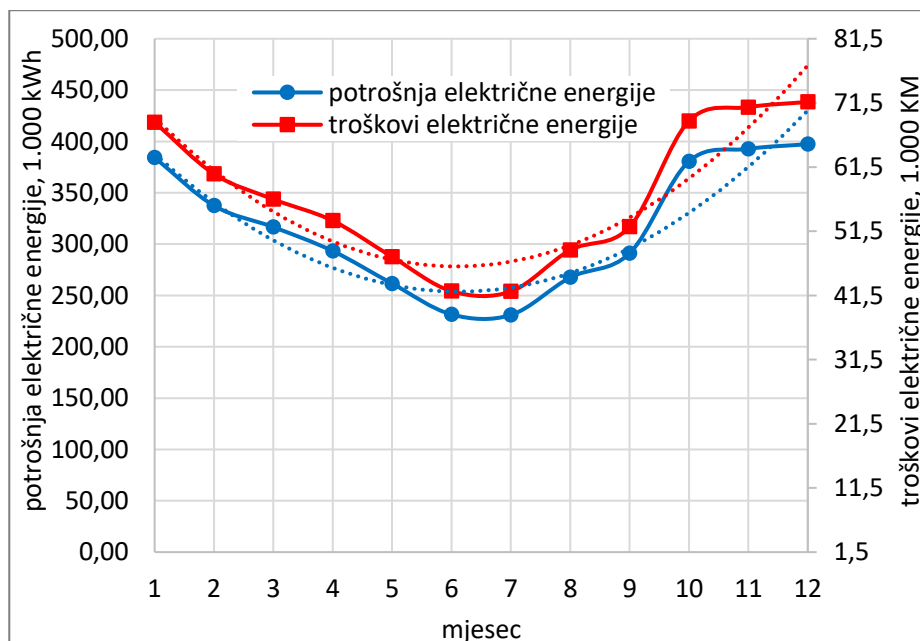


Image 44: Overview of total electricity consumption and Expenses during 2017

Image 45 shows diagrams describing electricity consumption and its Expenses by months in 2018.

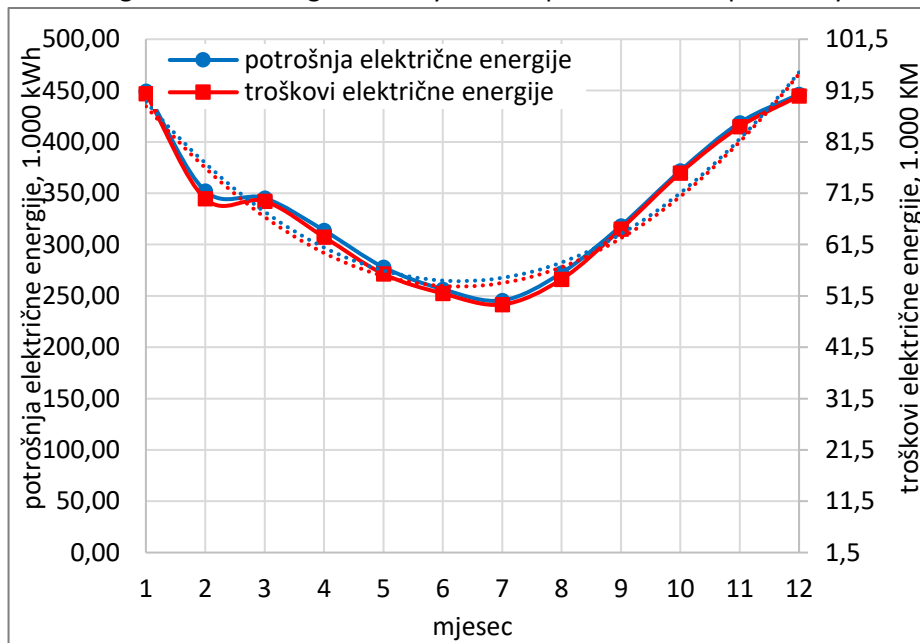


Image 45: Overview of total electricity consumption and Expenses during 2018.

It can be concluded that the consumption and Expenses have similar trends compared to those of the previous year (as shown by the trend line). In some months, consumption is slightly increased or decreased, which is the difference caused by the dynamics of use, or weather conditions. Electricity consumption has been reduced, but expenses of electricity have increased due to changes in the electricity tariff. The electricity transmission tariff has not changed.

Image 46 shows electricity consumption and its Expenses by months in 2019. It can be concluded that consumption and Expenses are similar trends compared to those of the previous two years, generally similar (as shown by trend lines). Electricity consumption increased compared to 2018, and is lower compared to 2017. Expenses electricity also increased due to the change in the electricity tariff compared to the previous two years. The electricity transmission tariff has not changed.

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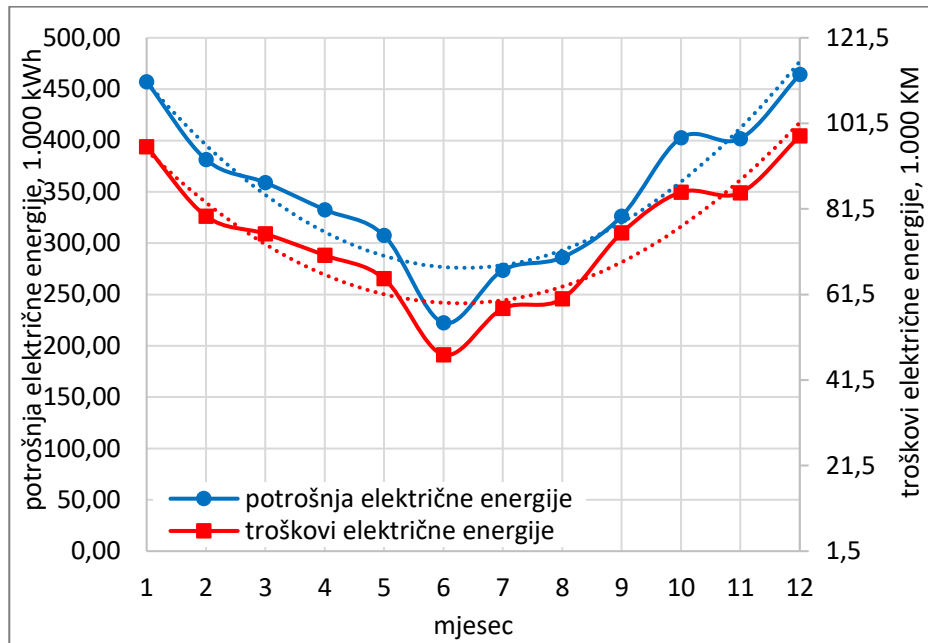


Image46: Overview of total electricity consumption and Expenses during 2019.

Consumption data are available for all three years, and it is noticeable that the consumption profile is relatively similar. Occasionally there are deviations that can be explained by changes in weather conditions. As can be seen, consumption is almost constant. Image 47 shows a diagram of total convertible marks (KM) and specific (Kf / kWh) electricity expenses in the period from 2018 to 2019. As can be seen, the lowest price was 2018, due to the lower electricity pricing. The electricity transmission tariff has remained constant in all three years.



Image 47: Total and specific Expenses of electricity in the period from 2017 to 2019

If some energy efficiency measures are implemented, both consumption and expenses could fall.

8 IMAGEMETRIC ANALYSIS

Imagemetric analysis was performed according to the defined requirements for the design of outdoor lighting, apropos the following norms: BAS CEN/TR 13201-1:2016 - Roadway lighting - Part 1: Selection of lighting classes, BAS EN 13201-2:2017 - Roadway lighting - Part 2: Performance requirements, BAS EN 13201-3:2017 - Roadway lighting - Part 3: Performance calculation, BAS EN 13201-4:2017 - Roadway lighting - Part 4: Methods of measuring roadway lighting characteristics, BAS EN 13201-5:2017 - Roadway lighting - Part 5: Indicators of energy performance in outdoor areas.

With medium brightness E_m , determined in lux (lx), it is necessary to calculate the uniform illuminance U_0 , which is determined by the ratio of the minimum and average value of illuminance (E_{min}/E_m) and must be greater than or equal, specified in the norm. The budget also needs to determine glare control. The calculation of the level of illumination in a mathematical way is obtained by the lighting calculation. The designer is obliged to determine by calculation how many lamps are needed for a certain purpose and with which light sources to determine the level of illumination. The maintenance factor has a major role in the design of lighting, and the designer when calculating must take into account the reduction of the luminous flux of the lamp through the time calculated according to this relation:

$$MF = LLMF \times LSF \times LMF (\times SMF) \text{ (outdoor areas),} \quad (4.)$$

MF	maintenance factor, indicates how quickly the light intensity in a system decreases
LLMF	lamp lumen maintenance factor, indicates the minimum luminous flux the luminaire has at the end of its useful life
LSF	Lamp survival factor, indicates how the total failure of individual bulbs should be assessed
LMF	Luminaire maintenance factor, indicates how the luminous flux of the luminaire decreases due to contamination
RMF	room maintenance factor, indicates how the luminous flux decreases due to contamination of the room
SMF	surface maintenance factor, takes into account the reduced reflection due to impurities on the illuminated surface (outdoor lighting)

During the creation a proposal and the optimal lighting solution, it is necessary to take into account the following basic principles:

- that the solution relies on the existing electrical installation,
- to propose a rational solution that satisfies the necessary lighting standards relating to a given category of roadway, to satisfy the required levels of brightness with a minimum number of quality lamps,
- to reduce the maintenance of the lighting installation to a minimum by choosing the appropriate types of lamps, without the need to clean the lamps and replace the protectors, and
- to significantly reduce electricity consumption and CO₂ emissions.

8.1 Light – based technology requirements and street classification

Light – based technology requirements and calculation must be corresponded with the required conditions of the roadway lighting class in accordance with the Standards BAS CEN/TR 13201-1:2016 - Roadway lighting - Part 1: Selection of lighting classes, BAS EN 13201-2:2017 - Roadway lighting - Part 2: Performance requirements, BAS EN 13201-3:2017 - Roadway lighting - Part 3: Performance calculation, , BAS EN 13201-4:2017 - Roadway lighting - Part 4: Methods of measuring roadway lighting characteristics, BAS EN 13201-5:2017 - Roadway lighting - Part 5: Energy performance indicators. The suggested lighting solution must satisfy all parameters prescribed by the competent legislation as well as the relevant standards, in accordance with the rules of public lighting design. The requirements for the calculation of lighting as well as the geometry of the road they cover and the method of calculation must be identical to those applied in the calculation of the reference condition. During selection of lamps and light sources to optimize public lighting should only be used existing lighting poles and connection points, and the newly constructed condition must be based on the existing infrastructure (installation) so that the minimum power of the lamps satisfies the required levels of illumination. The lighting must be such as to significantly reduce the consumption of electricity and maintenance, which should be in accordance with the laws, guidelines and recommendations of BiH (Smjernice za projektovanje, građenje, održavanje i nadzor na putevima / FBiH i RS), and in accordance with the recommendations of International Commission on Illumination CIE1 - No. 88/90, No. 115/95, No.15/2-10, European Standard EN 13201-2 do 4 / EN 12464, and Summaries of EU Legislation CEN/TC 169/WC 6/9. The suggested light – based technology solution should be suitable and appropriate quality and performed in such a way that during operation it satisfies the projected lighting technical and electrical parameters (according to the attached Imagemetric calculation and technical specification).

In order to perform a Imagemetric calculation, it is primarily necessary to classify the roadway according to Table 1-Table 3 of the above standards. To determine the class of the street and for the Imagemetric calculation, input data are required on: vehicle speed, number of street lines, average distance between light poles, light pole height, the ratio of the lamp mounted on the console, the inclination... The input data was collected by the consultant ZGI d.o.o. Mostar. The Imagemetric calculation and determination of the street class is defined by the appropriate equations from the established norms. Nowadays, computer softwares are used for Imagemetric calculation and determination of street class. Imagemetric analysis and Imagemetric calculation for the subject study was done in Dialux software, and "Road Wizard" software was used to determine the street class. Ecological characteristics must also be taken into account during calculating and selecting lamps. It is important to mention that mercury gas discharge lamps (VTF) as well as sodium lamps (NaVT) need to be dispatched and properly disposed of as well as existing lamps. Newly installed

lamps must satisfy all environmental requirements and standards. According to the BiH adjustment program to EU standards, and according to the EU directive on ecological design no. 2005/32 / ECU which require decommissioning inefficient forms of lighting, lighting that is not coordinate with the requirements of sustainable development and environmental protection, stop using certain types of light sources in 2012. for: fluorescent lamps 38 mm / 26mm, high-pressure lamps, low-pressure lamps, high-pressure lamps and metal-halide lamps. As a large number of such light sources are present within the existing public lighting system, this is another of the additional motives to approach the optimization of the public lighting system, replacement of existing light sources with LED sources.

In the course of proposing and analyzing measures for the reconstruction of the public lighting system, it is necessary to respect the following minimum parameters and project guidelines for the public lighting system:

- light efficiency of the light source: minimal 100 lm/W;
- correlated temperature of the shade of white light - maximum 4000 K;
- shade design - full cut off (straight) ili semi cut off (slightly rounded shading);
- bulb protection
- light sources lifetime - minimum 50.000 h;
- lamp ingress protection code IP66;
- impact protection - minimum IK08;
- input voltage 220-240V
- frequency of current 50 Hz;
- uninterrupted operation of the lamp in the temperature range of -20°C to +35°C;
- surge protection

Maximum permissible ULOR factor in accordance with the light pollution protection zone:

- E0, Areas of natural light, Nearby observatories, Dark sky parks, $ULOR \leq 0$
- E1, Areas of dark landscape, Mostly unlit long-distance local roads, $ULOR \leq 0$
- E2, Areas of low ambient light, habitat zones, $ULOR \leq 2,5$
- E3, Areas of medium ambient light, Communication, industrial and trade zones, $ULOR \leq 5$
- E4, Areas of high ambient light, Urban areas of commercial character with a high degree of night activity, $ULOR \leq 15$

The process simulation is performed for characteristic sections of the public lighting system. The characteristic section is defined by the following parameters:

- classification of the illuminated surface in accordance with the norm BAS EN 13201;
- illumination zone (E0-E4);
- road width and number of lanes (W);
- width of the sidewalk (on the side of light pole, on the opposite side of light pole);
- lightpole height – lamp height (H);
- average distance between light poles (S);
- console tine length (K)
- tine console inclination (N)
- light pole position (one-sided, two-sided, opposite);
- estimate the distance of the optical axis from the road edge (lamp suspension height) (O);
- road surface classification (R1, R2, R3 i R4).

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- the type and power of the lamp illuminating the section

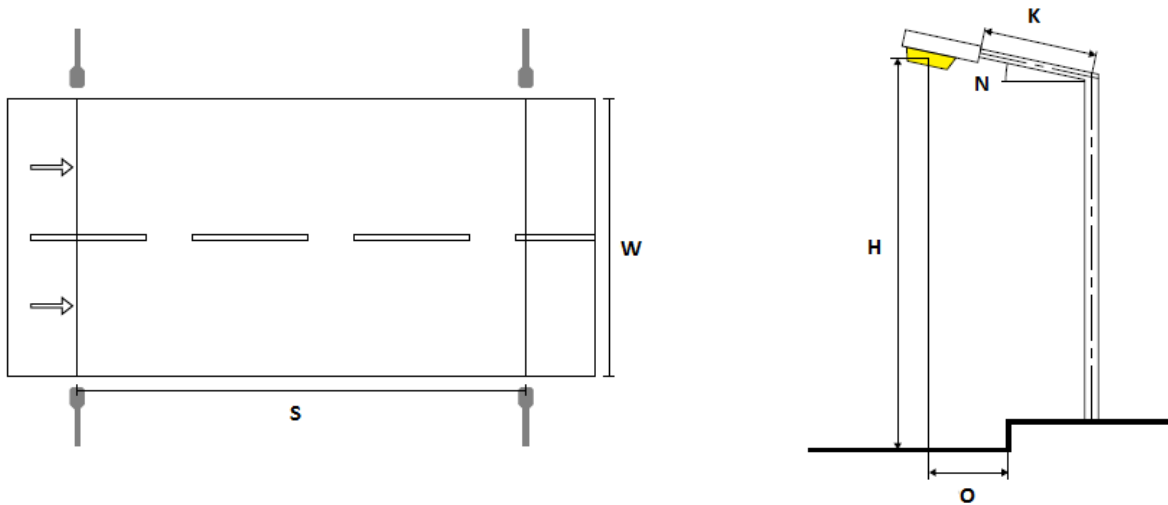


Image 48: Geometric display of characteristics parameters

Image 49 gives an example of Imagemetric calculation and determination of street class in software.

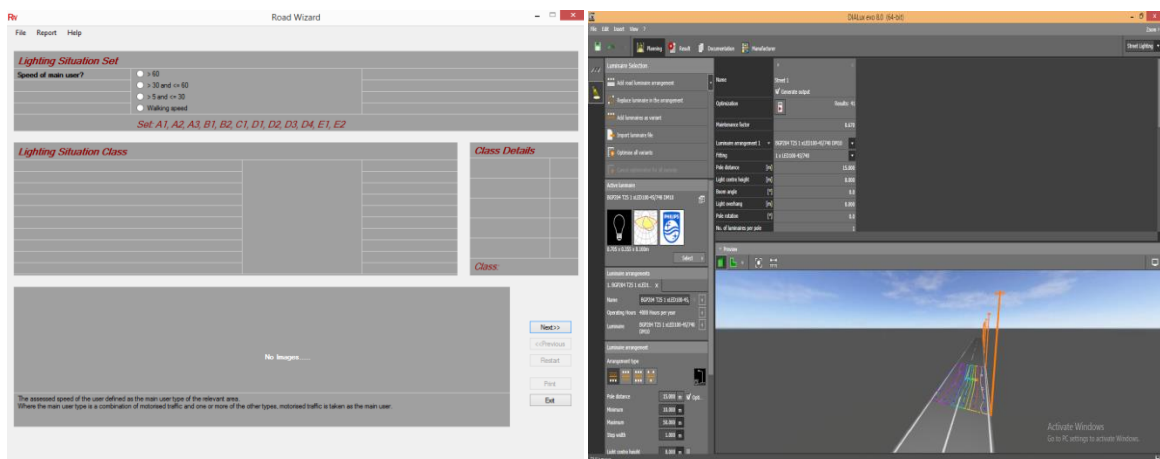


Image 49: Left – choosing street classification example in software package „Road Wizard“, right -primjer određivanja klase ulice u programskom paketu "Road Wizard", right – imagemetric road calculations in „Dialux“ software

For the purposes of the study, a calculation of completely new lighting was made on all the above streets from the previous chapter, and it is attached: "Imagemetric calculation".

It was determined that the replacement of existing lamps will achieve significant savings, all in accordance with the required values of the norms. Therefore, it can be concluded that this way of lighting will be satisfied by the law and the standard of the prescribed value. Table 11 gives certain classes of streets with all the input data necessary for Imagemetric calculations. Image 50, image 51, image 52 i image 53 show new luminosity solution examples.

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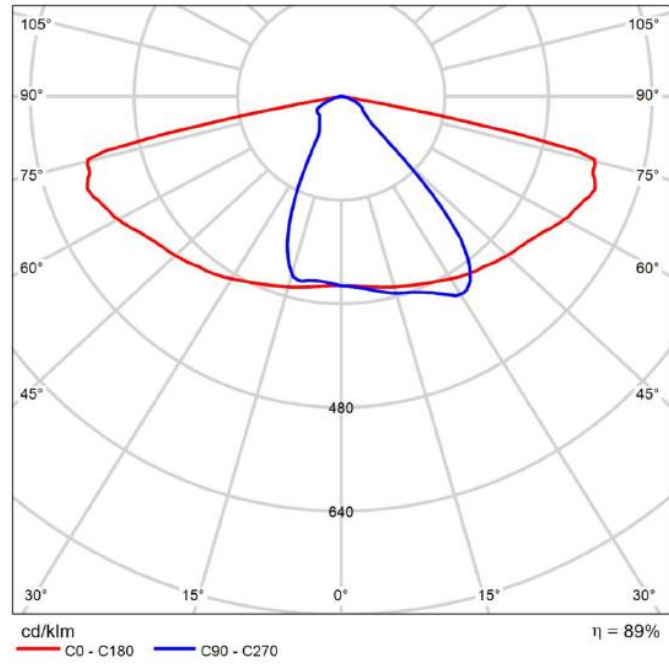


Image 50: Example of light emission calculation

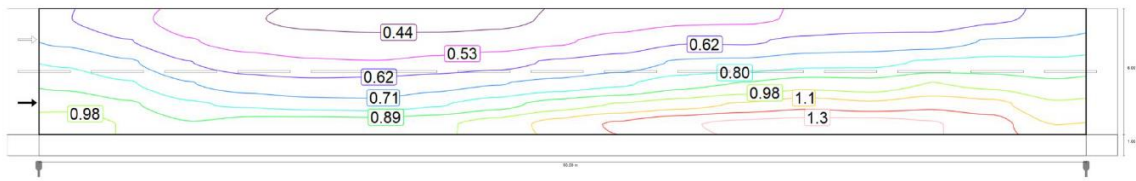


Image 51: Example of light intensity calculation and analysis results

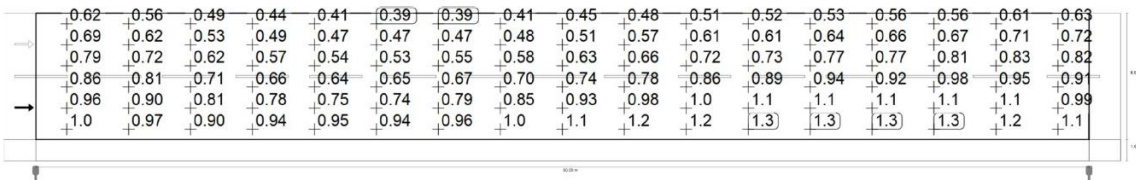


Image 52: Example of horizontal brightness calculation and analysis results

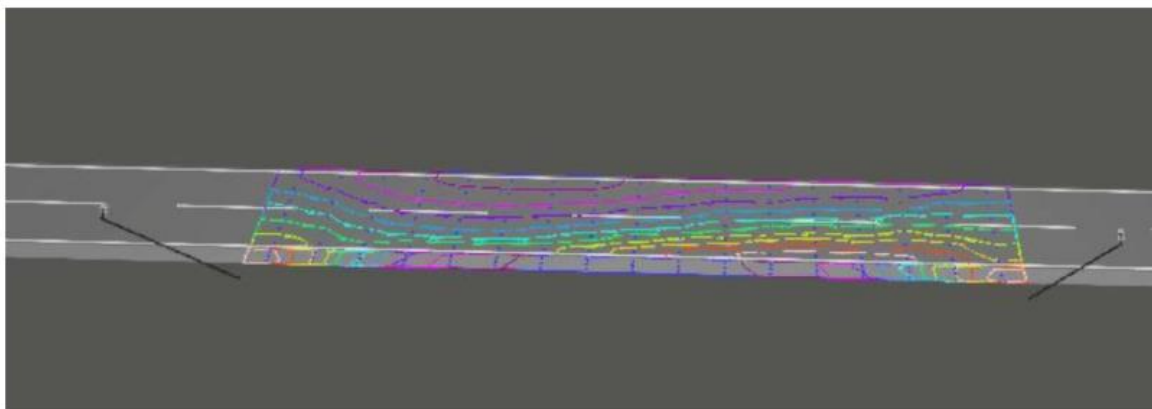


Image 53: Replacing existing lighting with LED lighting overview

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Ordinal No.	Street name	Movement speed (km/h)	Number of lanes	Total road width (m)	Sidewalk width 1 and 2 (m)	Average distance between light poles (m)	Arrangement of light poles	Light pole height (m)	Lamp mounted on tino / console (yes/no)	Tine / console length (m)	Inclination of the tine / console (%)	The distance of the light pole from the road (m)	Type of traffic participants	Road class
1	igrališče Tupkovići 800m ²	-	-	-	-	10	two-sided	8	yes	0.2	45	-	walkers	P
2	Tupkovići Gornji	40	1	5	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
3	Tupkovići Gornji	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
4	Tupkovići Gornji Čauševići	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
5	Košare	40	1	4	0/0	35	one-sided	8	yes	0.2	0	1.5	mix	M6
6	Tupkovići-Mujčinovići	40	1	3	0/0	30	one-sided	8	yes	0.2	0	1.5	mix	M6
7	Tupkovići-Mujčinovići	40	1	5	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
8	Tupkovići Donji	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
9	Tupkovići-Ćasuri	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
10	Tupkovići-Trojan	40	1	5	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6

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11	Tupkovići-Trojan	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
12	igralište Tupkovići-Trojan 800m ²	-	-	-	-	10	two-sided	8	yes	0.2	45	-	walkers	P
13	Tupkovići-Trojan	40	1	4	0/0	30	one-sided	8	yes	0.1	10	1.5	mix	M6
14	Gračanica	40	2	6	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M5
15	Gračanica	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
16	Gračanica	40	1	4	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
17	Gračanica	40	1	4	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
18	Gračanica	40	1	5	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
19	Gračanica	40	1	5	0/0	30	one-sided	8	yes	0.2	10	1.5	mix	M6
20	Gračanica	40	2	6	1/1	35	one-sided	10	yes	1	0	1	mix	M5/P3
21	Gračanica	40	1	4	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
22	Gračanica	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
23	Durići	40	1	4	0/0	30	one-sided	8	yes	0.2	10	1.5	mix	M6
24	Durići	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
25	Vrtage	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6

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26	Gračanica	40	2	6	0/0	35	cik-cak	8	yes	0.2	10	1	mix	M5
27	Gračanica	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
28	Gračanica	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
29	Gračanica-Šljivići	40	1	4	0/0	30	one-sided	8	yes	0.2	10	1.5	mix	M6
30	Gračanica-Šljivići	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
31	Gračanica-Zelenika	40	1	5	0/0	30	one-sided	8	yes	0.2	10	1.5	mix	M6
32	Gračanica-Zelenika	40	2	6	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M5
33	Omladinskih radnih brigada	40	2	6	1/0	35	one-sided	8	yes	0.2	10	1	mix	M5/P3
34	Omladinskih radnih brigada	40	1	3	0/0	30	one-sided	8	yes	0.2	10	1.5	mix	M6
35	Omladinskih radnih brigada	40	2	6	0/0	30	one-sided	8	yes	0.2	10	1.5	mix	M5
36	Hornica	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6

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37	Omladinskih radnih brigada	40	2	6	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M5
38	stadion FK Metalac 5000m ²	-	-	-	-	15	two-sided	8	yes	0.2	10	-	walkers	Klasa III
39	Šarenjak	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
40	Hornica	40	2	6	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M5
41	Omladinskih radnih brigada	40	1	4	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
42	Maline-M18	70	1	5	0/0	30	one-sided	8	yes	0.1	10	0.5	mix	M6
43	Maline Spreča	40	1	3	0/0	30	one-sided	8	yes	0.2	10	0.5	mix	M6
44	Strašanj-M18	70	2	6	0/0	30	one-sided	12	yes	0.5	0	0.5	mix	M5
45	Strašanj	40	1	5	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
46	Strašanj	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
47	Strašanj	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
48	Strašanj	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6

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49	Strašanj igralište 800m ²	-	-	-	-	20	two-sided	8	yes	0.2	45	-	walkers	P
50	Šehići	40	1	3	0/0	35	one-sided	8	yes	0.1	10	1	mix	M6
51	Turijanci	40	2	6	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M5
52	Hadžići	40	2	6	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M5
53	Nova cesta	40	2	6	0/0	35	one-sided	8	yes	0.2	10	2	mix	M5
54	Luke	40	1	3	0/0	35	one-sided	8	yes	0.2	10	0.5	mix	M6
55	Mustafići	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
56	Hadžići	40	3	9	1/1	35	one-sided	8	yes	0.2	10	1	mix	M5/P3/P4
57	Djedovača	40	1	3	0/0	35	one-sided	8	yes	0.2	10	0.5	mix	M6
58	Djedovača	40	1	3	0/0	35	one-sided	8	yes	0.2	10	0.5	mix	M6
59	Prijeki put	40	1	3	0/0	35	one-sided	8	yes	0.2	10	0.5	mix	M6
60	Gložik	40	1	5	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
61	Gložik	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
62	Hadžići	40	3	9	1/1	35	one-sided	8	yes	0.2	10	1	mix	M5/P3/P4
63	Dubrave Donje	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6

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64	Prijeki put	40	1	3	0/0	35	one-sided	8	yes	0.2	5	1	mix	M6
65	Hadžići	40	2	6	1/0	35	one-sided	8	yes	0.2	10	1.5	mix	M5/P3
66	Dubrave Donje	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
67	prostor oko Crkve sv. Ane	-	-	-	-	10	two-sided	8	yes	0.1	10	-	walkers	M6
68	Dubravka	40	2	6	1/0	35	one-sided	8	yes	0.2	10	1	mix	M5/P3
69	Dubravka	40	2	6	1/0	35	one-sided	8	yes	0.2	10	1	mix	M5/P3
70	Višća	40	2	6	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M5/P3
71	Višća	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
72	igralište Višća 800m ²	-	-	-	-	10	two-sided	8	yes	0.2	45	-	walkers	P
73	regionalni put R469	50	2	6	0/0	30	one-sided	8	yes	0.3	5	2	mix	M5
74	Višća Donja	40	1	5	0/0	30	one-sided	8	yes	0.2	10	1.5	mix	M6
75	Višća Donja	40	1	4	0/0	30	one-sided	8	yes	0.2	10	2	mix	M6
76	Višća Donja	40	1	5	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
77	Kupjerusi	40	1	3	0/0	30	one-sided	8	yes	0.2	10	0.5	mix	M6
78	Kupjerusi-poligon	-	-	-	-	20	two-sided	8	no	-	-	-	mix	P

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79	Smajići	40	1	3	0/0	30	one-sided	8	yes	0.2	10	1	mix	M6
80	Bajrami	40	1	3	0/0	30	one-sided	8	yes	0.2	10	1	mix	M6
81	Kupjerusi-Taletovići	40	1	3	0/0	30	one-sided	8	yes	0.2	10	1	mix	M6
82	Dubravska	40	2	6	1/0	35	one-sided	8	yes	0.2	10	1	mix	M5/P3
83	Dubravska	40	1	3	0/0	30	one-sided	8	yes	0.2	10	1	mix	M6
84	Dubravska C	40	1	4	0/0	30	one-sided	8	yes	0.2	10	0.5	mix	M6
85	Sjever	40	1	4	0/0	30	one-sided	5	no	-	-	0.5	mix	P
86	Sjever	40	1	4	0/0	30	one-sided	5	no	-	-	0.5	mix	P
87	Sjever	40	1	3	0/0	30	one-sided	8	yes	0.2	5	1	mix	M6
88	Hadžići	40	3	9	1/1	35	one-sided	8	yes	0.2	10	1.5	mix	M5/P3/P4
89	Hadžići	40	2	6	1/0	35	one-sided	8	yes	0.2	10	1	mix	M5/P3
90	Hadžići	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
91	regionalni put R469	40	2	6	0/0	35	one-sided	8	yes	0.2	10	1	mix	M5
92	Begići	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
93	regionalni put R469	40	2	6	1/0	35	one-sided	8	yes	0.2	10	1	mix	M5/P3
94	Begići	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6

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95	Begići	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
96	Delići	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
97	Dedići	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
98	Begići	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
99	Gornje Dubrave Husići	40	1	3	0/0	35	one-sided	8	yes	0.2	10	0.5	mix	M6
100	Kadrići	40	1	3	0/0	35	one-sided	7	yes	0.5	5	1	mix	M6
101	Kadrići	40	1	3	0/0	35	one-sided	7	yes	0.5	5	1	mix	M6
102	igralište Kadrići 800m ²	40	-	-	-	20	two-sided	12	yes	0	45	-	walkers	P
103	Kadrići	40	1	3	0/0	30	one-sided	7	yes	0.5	5	1	mix	M6
104	Kadrići	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
105	Bajrići	40	1	4	0/0	30	one-sided	8	yes	0.2	10	1.5	mix	M6
106	Bajrići	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
107	Kadrići	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
108	Krzevići	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
109	Ciljuge	40	1	5	0/0	35	one-sided	8	yes	0.1	10	2	mix	M6
110	Ciljuge	40	1	3	0/0	35	one-sided	8	yes	0.1	10	1	mix	M6
111	Ciljuge	40	1	5	0/0	35	one-sided	8	yes	0.1	20	1	mix	M6

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112	Ciljuge	40	1	3	0/0	35	one-sided	8	yes	0.1	20	1	mix	M6
113	Toplička	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
114	Toplička	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
115	Toplička	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
116	Lukavica Donja	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
117	Lukavica Donja	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
118	Lukavica Donja	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
119	Lukavica Donja	40	2	6	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M5
120	Lukavica Donja	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
121	Lukavica Donja	40	2	6	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M5
122	Lukavica Gornja	40	1	4	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
123	Lukavica Gornja	40	2	6	0/0	35	one-sided	8	yes	0.2	10	1	mix	M5

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124	Lukavica Gornja	40	1	4	0/0	30	one-sided	8	yes	0.2	10	1	mix	M6
125	Lukavica Gornja	40	1	4	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
126	Lukavica Gornja	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
127	Lukavica Gornja	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
128	Lukavica Gornja	40	2	5	0/0	40	one-sided	8	yes	0.2	15	1.5	mix	M5
129	Lukavica Gornja	40	1	3	0/0	30	one-sided	8	yes	0.2	15	1.5	mix	M6
130	Lukavica Gornja	40	1	4	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
131	Lukavica Gornja	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
132	Svojat	40	2	5	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M5
133	Svojat	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
134	Svojat	40	1	3	0/0	30	one-sided	8	yes	0.2	10	1.5	mix	M6
135	Svojat	40	1	3	0/0	30	one-sided	8	yes	0.2	10	1.5	mix	M6
136	Svojat	40	2	6	0/0	40	one-sided	8	yes	0.2	10	1.5	mix	M5

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137	Svojat	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1.5	mix	M6
138	igralište Svojat 800m ²	40	-	-	-	20	one-sided	8	yes	0.2	10	-	walkers	P
139	Zelenika-Krivača	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
140	Zelenika	40	2	6	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M5
141	Zelenika	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
142	Zelenika	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M6
143	Livada	40	1	3	0/0	30	one-sided	8	yes	0.2	10	1	mix	M6
144	Podoljani	40	2	6	0/0	35	one-sided	8	yes	0.2	10	1.5	mix	M5
145	Donja Lukavica	40	1	3	0/0	30	one-sided	8	yes	0.2	10	1	mix	M6
146	Donja Lukavica	40	2	6	0/0	35	one-sided	8	yes	0.2	10	1	mix	M5
147	Donja Lukavica	40	1	3	0/0	30	one-sided	8	yes	0.2	10	1	mix	M6
148	Bašigovci	40	1	3	0/0	35	one-sided	8	yes	0.2	10	1	mix	M6
149	R469	40	2	6	1/0	35	one-sided	8	yes	0.2	5	1	mix	M3/P1
150	Pasci donji	40	1	4	0/0	40	one-sided	8	yes	0.2	10	1	mix	M6
151	1. ulica	40	2	6	1/1	40	one-sided	7	yes	0.1	45	0.5	mix	M3/P1/P3

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Ordinal No.	Street name	Movement speed (km/h)	Number of lanes	Total road width (m)	Sidewalk width 1 and 2 (m)	Average distance between light poles (m)	Arrangement of light poles	Light pole height (m)	Lamp mounted on tino / console (yes/no)	Tine / console length (m)	Inclination of the tine / console (%)	The distance of the light pole from the road (m)	Type of traffic participants	Road class
152	1. ulica	40	2	6	1/1	40	one-sided	9	yes	2	0	2	mix	M3/P1/P3
153	Zlatnih ljiljana	40	1	5	0/0	40	one-sided	5	no	-	-	1	mix	M5
154	parking(Bosanski kulturni centar)	40	-	-	-	40	-	4	no	-	-	-	mix	P
155	25. Novembar	40	1	4	2/1	30	one-sided	5	no	-	-	1.5	mix	M3/P3/P4
156	25. Novembar	40	2	6	0/1	30	one-sided	4	yes	0.2	5	0.5	mix	M3/P3
157	parking supermarketa	40	-	-	-	-	-	4	no	-	-	-	mix	P
158	parking površine cca 600m	40	-	-	-	-	-	4	no	-	-	-	mix	P
159	Gradski park konjuh (25. Novembar)	40	-	-	-	25	-	5	yes	0.5	10	-	walkers	P
160	Prvi maj	40	1	3	0/0	40	one-sided	5	no	-	-	1	mix	P
161	Školska	40	1	4	1/1	30	one-sided	5	no	-	-	0.5	mix	M4/P3/P3

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162	Prva ulica	40	1	4	1/1	30	one-sided	5	no	-	-	0.5	mix	M4
163	2. ulica (prostor oko zgrade)	40	-	-	-	25	-	5	no	-	-	-	mix	P
164	Alije Izetbegovića	40	2	6	0,5/1	40	one-sided	8	yes	0.2	20	0.5	mix	M3/P2/P2
165	parking(Meše Selimovića)	40	-	-	-	25	-	12	no	-	-	-	mix	P
166	Oslobođenja	40	1	3	0/0	40	one-sided	8	yes	0.2	10	0.5	mix	M5
167	park(Ulica Oslobođenja)	40	-	-	-	25	-	4	no	-	-	-	walkers	P
168	parking(Ulica Oslobođenja)	40	-	-	-	25	-	4	no	-	-	-	mix	p
169	Gradski park Živinice(Alije Izetbegovića)	40	-	-	-	25	-	4	no	-	-	-	walkers	P
170	ulica iza općine(Alije Izetbegovića)	40	1	3	0/0	40	one-sided	9	yes	1	5	0.5	mix	M5
171	parking općine	40	-	-	-	25	one-sided	-	-	-	-	-	mix	P

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172	Šetnica iza općine	40	-	-	-	25	one-sided	4	no	-	-	-	mix	P
173	Pašage Gocića	40	2	3	0/0	40	one-sided	4	no	-	-	0.5	mix	M5
174	Patriotske lige	40	1	5	0,5/0,5	40	one-sided	4	no	-	-	1	mix	M3/P3/P3
175	XVI muslimanske brigade	40	1	4	0/0	40	one-sided	4	no	-	-	0.5	mix	M5
176	Rudarska	40	2	6	1/1	40	one-sided	5	no	-	-	1.5	mix	M3/P2/P3
177	Rudarska	40	1	3	0/0	40	one-sided	5	no	-	-	0.5	mix	M5
178	Rudarska	40	1	3	0/0	40	one-sided	5	no	-	-	0.5	mix	M5
179	Živiničkih brigada	40	2	6	1/1	40	one-sided	5	no	-	-	0.5	mix	M3/P2/P3
180	Civilnih žrtava rata	40	1	4	0/0	40	one-sided	5	no	-	-	0.5	mix	M5
181	Dubravka(naselje uz r469)	40	1	4	0/0	35	one-sided	8	yes	0.2	5	1	mix	M5
182	R469	40	2	6	1/0	35	one-sided	8	yes	0.2	5	1	mix	M3/P2

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183	Bosanska	40	2	6	1/1	30	one-sided	4	no	-	-	1	mix	M3/P3/P3
184	Jezero	40	1	4	0/0	40	one-sided	8	yes	0.2	5	0.5	mix	M5
185	Jezero	40	1	3	0/0	40	one-sided	8	yes	0.2	5	0.5	mix	M5
186	Jezero	40	1	3	0/0	40	one-sided	8	yes	0.2	5	0.5	mix	M5
187	Jezero	40	1	3	0/0	40	one-sided	4	no	-	-	1	mix	M5
188	Jezero	40	1	3	0/0	40	one-sided	8	yes	0.3	45	1	mix	M5
189	1. Mart	40	1	5	0/0	40	one-sided	8	yes	0.2	10	1.5	mix	M5
190	1. Mart	40	1	4	0/0	40	one-sided	8	yes	0.2	5	1	mix	M5
191	1. Mart	40	1	3	0/0	40	one-sided	8	yes	0.2	5	2	mix	M5
192	Sadnice	40	1	4	0/0	40	one-sided	8	yes	0.3	10	2	mix	M5
193	Toplička	40	2	6	1/1	40	one-sided	8	yes	0.2	5	2	mix	M3/P1/P2
194	Toplička	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1	mix	M5
195	R469	40	2	6	1/0	35	one-sided	8	yes	0.2	5	1	mix	M3/P2
196	1. ulica	40	2	6	1/1	40	one-sided	9	yes	2	0	2	mix	M3/P1/P2
197	Poljice	40	1	3	0/0	40	one-sided	8	yes	0.2	20	1	mix	M6
198	Klopići	40	1	4	0/0	40	one-sided	8	yes	0.2	20	2	mix	M6
199	Klopići	40	1	3	0/0	40	one-sided	8	yes	0.2	20	1	mix	M6

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200	Klopići	40	1	3	0/0	40	one-sided	8	yes	0.2	20	2	mix	M6
201	R455a	40	2	6	0/0	40	one-sided	8	yes	0.2	20	1	mix	M4
202	Priluk	40	1	3	0/0	40	one-sided	8	yes	0.2	20	1	mix	M6
203	R455a	40	2	6	0/0	40	one-sided	8	yes	0.2	20	1	mix	M4
204	Priluk	40	1	3	0/0	40	one-sided	8	yes	0.2	20	0.5	mix	M6
205	Priluk	40	1	3	0/0	40	one-sided	8	yes	0.2	20	1	mix	M6
206	R455a	40	2	6	0/0	40	one-sided	8	yes	0.2	20	2	mix	M4
207	Omići	40	1	3	0/0	40	one-sided	8	yes	0.1	20	2	mix	M6
208	R455a	40	2	6	1/0	40	one-sided	8	yes	0.2	10	1	mix	M3/P2
209	Omerkići	40	1	3	0/0	40	one-sided	8	yes	0.2	20	1	mix	M5
210	R455a	40	2	6	1/0	40	one-sided	8	yes	0.2	10	1	mix	M3/P2
211	Alagići	40	1	3	0/0	40	one-sided	8	yes	0.2	20	2	mix	M5
212	Alagići	40	1	3	0/0	40	one-sided	8	yes	0.2	20	1	mix	M6
213	Šehići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1.5	mix	M6
214	Šehići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
215	Šehići	40	1	3	0/0	40	one-sided	8	yes	0.2	5	2	mix	M6
216	Šerići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
217	Šerići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1	mix	M6
218	R455a	40	2	6	1/0	40	one-sided	8	yes	0.2	5	1	mix	M3/P2

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219	Šerići	40	1	9	0/0	40	one-sided	8	yes	0.2	5	1	mix	M6
220	R455a	40	2	6	1/0	40	one-sided	8	yes	0.2	10	1	mix	M3/P2
221	Omerkići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1	mix	M6
222	R455a	40	2	6	1/0	40	one-sided	8	yes	0.2	10	1	mix	M3/P2
223	Šerići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
224	R455a	40	2	6	0/1	40	one-sided	8	yes	0.2	10	1	mix	M3/P2
225	Šerići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
226	Šerići	40	1	4	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
227	R455a	40	2	6	0/0	40	one-sided	8	yes	0.2	10	1	mix	M4
228	R455a	40	2	6	0/0	40	one-sided	8	yes	0.2	10	1	mix	M4
229	Suha	40	1	4	0/0	40	one-sided	8	yes	0.2	0	2	mix	M6
230	Suha	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
231	R455a	40	2	6	0/0	40	one-sided	8	yes	0.2	20	2	mix	M4
232	Suha	40	1	4	0/0	40	one-sided	8	yes	0.3	10	2	mix	M6
233	Suha	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
234	Đulići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
235	Đulići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1	mix	M6
236	Barice	40	1	4	0/0	40	one-sided	8	yes	0.2	10	1.5	mix	M6
237	Atlić mahala	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1.5	mix	M6

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238	Jablanica	40	1	3	0/0	40	one-sided	8	yes	0.2	10	3	mix	M6
239	Jablanica	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
240	Tadići	40	1	4	0/0	40	one-sided	8	yes	0.2	10	1.5	mix	M6
241	Tadići	40	1	4	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
242	Živinice Gornje	40	1	4	0/0	40	one-sided	8	yes	0.2	10	1.5	mix	M6
243	Živinice Gornje	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1	mix	M6
244	Kopjevići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	3	mix	M6
245	Kopjevići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1.5	mix	M6
246	Grabik	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
247	Petrovići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
248	Petrovići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1	mix	M6
249	Šišići	40	1	4	0/0	40	one-sided	8	yes	0.3	20	2	mix	M6
250	Šišići	40	1	3	0/0	40	one-sided	8	yes	0.3	10	2	mix	M6
251	Adići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
252	Adići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1	mix	M6
253	Lug	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1.5	mix	M6
254	Lug	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
255	M18	40	2	6	0/0	40	one-sided	8	yes	0.2	10	5	mix	M4

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256	Đurđevik	40	1	5	0/1	40	one-sided	8	yes	0.1	5	2	mix	M4
257	Đurđevik	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1	mix	M5
258	Gostelja	40	1	5	0/1	40	one-sided	8	yes	0.1	5	2	mix	M5/P4
259	Gostelja	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1	mix	M6
260	Musići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
261	Musići	40	1	3	0/0	40	one-sided	8	yes	0.5	0	1	mix	M6
262	Gostelja	40	1	4	0/0	40	one-sided	8	no	-	-	1	mix	M6
263	Golubinjak	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1	mix	M5
264	Nukići	40	1	3	0/0	40	one-sided	8	yes	0.5	5	1.5	mix	M6
265	R469	40	2	6	0/0	40	one-sided	8	yes	0.2	10	2	mix	M4
266	Živinичke ose	40	1	4	0/0	40	one-sided	8	yes	0.3	10	1	mix	M5
267	Živinичke ose	40	2	6	0/0	40	one-sided	5	no	-	-	1	mix	M4
268	Živinичke ose	40	1	4	0/0	40	one-sided	5	no	-	-	1	mix	M5
269	Živinичke ose	40	1	4	0/0	40	one-sided	5	no	-	-	1	mix	M5
270	Gostelja	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1.5	mix	M6
271	Gostelja	40	1	4	0/0	40	one-sided	8	yes	0.2	10	1.5	mix	M6
272	Gostelja	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1	mix	M6
273	R469	40	2	6	0/0	40	one-sided	8	yes	0.2	10	3	mix	M4
274	Donja Višća	40	1	4	0/0	40	one-sided	8	yes	0.2	10	1	mix	M6

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275	Donja Višća	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1	mix	M6
276	R469	40	2	6	0/0	40	one-sided	8	yes	0.2	10	3	mix	M4
277	Šišići	40	1	4	0/0	40	one-sided	8	yes	0.2	10	1	mix	M6
278	Šišići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1	mix	M6
279	Gostelja	40	1	4	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
280	M18	40	2	6	0/0	40	one-sided	8	yes	0.2	10	2	mix	M4
281	Stara pruga	40	1	4	0/0	40	one-sided	8	yes	0.5	0	1	mix	M5
282	Bare	40	1	4	0/0	40	one-sided	8	yes	0.5	0	1	mix	M5
283	Kovači	40	1	5	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
284	Kovači	40	1	4	0/0	40	one-sided	8	yes	0.2	10	1	mix	M6
285	Kovači	40	1	4	0/0	40	one-sided	8	yes	0.2	10	1	mix	M6
286	Kovači	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
287	Kovači	40	1	4	0/0	40	one-sided	8	yes	0.2	10	1.5	mix	M6
288	Kovači	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1	mix	M6
289	Mujići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M5
290	Bašigovci	40	1	4	0/0	40	one-sided	8	yes	0.3	10	2	mix	M6
291	Bašigovci	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
292	Bašigovci	40	1	5	0/0	40	one-sided	8	yes	0.3	15	1.5	mix	M6
293	Bašigovci	40	1	4	0/0	40	one-sided	8	yes	0.5	0	2	mix	M6

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294	Bašigovci	40	1	3	0/0	40	one-sided	8	yes	0.5	0	1	mix	M6
295	Bašigivci	40	2	6	0/0	40	one-sided	8	yes	0.5	5	2	mix	M5
296	Bašigivci	40	1	4	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
297	Bašigivci	40	1	4	0/0	40	one-sided	8	yes	0.5	5	2	mix	M6
298	Bašigivci	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
299	Podoljani	40	1	3	0/0	40	one-sided	8	yes	0.2	20	1	mix	M6
300	Bašigovci	40	2	6	0/0	40	one-sided	8	yes	0.2	10	2	mix	M5
301	Bašigovci	40	1	3	0/0	40	one-sided	10	yes	0.2	10	2	mix	M6
302	Bašigovci	40	1	3	0/0	40	one-sided	11	yes	0.1	20	2	mix	M5
303	Bašigovci	40	2	6	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
304	Bašigovci	40	1	5	0/0	40	one-sided	8	yes	0.2	20	2	mix	M6
305	Vrnojevići donji	40	1	3	0/0	40	one-sided	8	yes	0.3	0	1	mix	M6
306	R455a	40	2	6	0/0	40	one-sided	8	yes	0.2	5	5	mix	M4
307	Toplička	40	2	6	0/0	40	one-sided	8	yes	0.2	5	5	mix	M4
308	Toplička	40	1	3	0/0	40	one-sided	8	yes	0.3	5	1	mix	M5
309	Toplička	40	-	-	-	20	one-sided	8	yes	-	-	-	mix	M5
310	3. ulica	40	1	3	0/0	40	one-sided	8	yes	0.3	5	1	mix	M5
311	3. ulica	40	1	4	0/0	30	one-sided	7	no	-	-	0.5	mix	M5

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Ordinal No.	Street name	Movement speed (km/h)	Number of lanes	Total road width (m)	Sidewalk width 1 and 2 (m)	Average distance between light poles (m)	Arrangement of light poles	Light pole height (m)	Lamp mounted on tino / console (yes/no)	Tine / console length (m)	Inclination of the tine / console (%)	The distance of the light pole from the road (m)	Type of traffic participants	Road class
312	Stara pruga	40	1	4	0/0	40	one-sided	8	yes	0.3	5	1	mix	M5
313	Stara pruga	40	1	3	0/0	40	one-sided	8	yes	0.3	5	1	mix	M5
314	Sadnice	40	1	4	0/0	40	one-sided	8	yes	0.3	5	1	mix	M6
315	R455a	40	2	6	1/0	40	one-sided	8	yes	2	5	1	mix	M3/P2
316	R455a	40	2	6	1/0	40	one-sided	8	yes	0.2	5	1	mix	M3/P1
317	Živinički sokolovi	40	2	6	0/0	40	one-sided	8	yes	0.2	5	1	mix	M4
318	Partizanske	40	2	6	0/0	40	one-sided	8	yes	0.2	5	1	mix	M4
319	Živinički sokolovi	40	1	3	0/0	40	one-sided	8	yes	0.2	5	1	mix	M5
320	Partizanska	40	1	3	0/0	40	one-sided	8	yes	2	5	1	mix	M5
321	Partizanska	40	1	3	0/0	40	one-sided	8	yes	0.2	5	1	mix	M5
322	Partizanska	40	2	6	1/0	40	one-sided	8	yes	2	5	2	mix	M3/P1
323	Partizanska	40	1	3	0/0	40	one-sided	8	yes	2	5	1	mix	M5
324	Partizanska	40	1	3	0/0	40	one-sided	8	yes	0.2	5	1	mix	M5
325	Živinički sokolovi	40	1	3	0/0	40	one-sided	8	yes	0.2	5	2	mix	M6
326	Živinički sokolovi	40	1	3	0/0	40	one-sided	8	yes	0.2	5	2	mix	M6
327	R455a	40	2	6	0/0	40	one-sided	8	yes	0.2	5	2	mix	M4

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Ordinal No.	Street name	Movement speed (km/h)	Number of lanes	Total road width (m)	Sidewalk width 1 and 2 (m)	Average distance between light poles (m)	Arrangement of light poles	Light pole height (m)	Lamp mounted on tino / console (yes/no)	Tine / console length (m)	Inclination of the tine / console (%)	The distance of the light pole from the road (m)	Type of traffic participants	Road class
328	Modračka	40	1	3	0/0	40	one-sided	8	yes	0.2	5	2	mix	M6
329	R455a	40	2	6	0/0	40	one-sided	8	yes	0.2	5	2	mix	M4
330	R455a	40	2	6	0/0	40	one-sided	8	yes	0.2	5	2	mix	M4
331	Barice	40	1	4	0/0	40	one-sided	8	yes	0.2	5	2	mix	M6
332	R455a	40	2	6	0/0	40	one-sided	8	yes	0.2	5	2	mix	M4
333	Barice	40	1	3	0/0	40	one-sided	8	yes	0.2	5	2	mix	M6
334	Barice	40	1	3	0/0	40	one-sided	8	yes	0.2	5	1	mix	M6
335	igrališče (Barice) 800m2	40	-	-	-	20	two-sided	8	yes	0.2	5	1	walkers	P
336	Otawa	40	1	5	0/0	40	one-sided	8	yes	0.2	5	1	mix	M6
337	Podgaj	40	1	3	0/0	40	one-sided	8	yes	0.2	20	1	mix	M6
338	Podgaj	40	1	3	0/0	40	one-sided	8	yes	0.2	20	1	mix	M6
339	Podgaj	40	1	3	0/0	40	one-sided	8	yes	0.2	20	1	mix	M6
340	Podgaj	40	1	3	0/0	40	one-sided	8	yes	0.2	20	1	mix	M6
341	Podgaj	40	1	3	0/0	40	one-sided	8	yes	0.2	20	1	mix	M6
342	Kovači	40	1	3	0/0	40	one-sided	8	yes	0.2	10	2	mix	M6
343	Podgajevi	40	1	3	0/0	40	one-sided	8	yes	0.2	20	1	mix	M6
344	M18	40	2	6	0,5/0	40	one-sided	8	yes	0.2	20	2	mix	M3/P2

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Ordinal No.	Street name	Move ment speed (km/h)	Number of lanes	Total road width (m)	Sidewalk width 1 and 2 (m)	Average distance between light poles (m)	Arrangement of light poles	Light pole height (m)	Lamp mounted on tino / console (yes/no)	Tine / console length (m)	Inclination of the tine / console (%)	The distance of the light pole from the road (m)	Type of traffic participants	Road class
345	Šahići	40	1	3	0/0	40	one-sided	8	yes	0.2	10	1.5	mix	M6
346	Đurđevik	40	1	4	0/0	40	one-sided	8	yes	0.5	0	1	mix	M6
347	Đurđevik	40	1	3	0/0	40	one-sided	8	yes	0.5	0	1	mix	M6
348	Živčići	40	1	4	0/0	40	one-sided	8	yes	0.2	20	1	mix	M6
349	Živčići	40	1	3	0/0	40	one-sided	8	yes	0.2	20	1	mix	M6
350	Podgaj	40	1	3	0/0	40	one-sided	8	yes	0.2	20	1	mix	M6
351	Košare Samardžije	40	1	4	0/0	40	one-sided	8	yes	0,5	5	1	mix	M6
352	Rasadište	40	1	4	0/0	40	one-sided	8	yes	0,5	5	1	mix	M6

Table 11: An overview of specific classes

9 ANALYSIS AND SUGGESTION ON POSSIBLE MEASURES FOR ENHANCEMENT OF PUBLIC LIGHTING

Replacement of existing lamps with LED lamps is considered based on existing condition and Imagemetry budget. Lighting measures are meant for lowering consumption of lighting electricity while leaving quality of lighting intact. Besides direct profits (energy consumption savings, or electricity expenses), implementation of this measure, like better lighting conditions, after implementation of previously mentioned measure, lowering negative effects on environment could be expected.

In the following, possible measures of improving energy efficiency of the facility are described and analyzed in detail. The following scenarios are analyzed:

1. Replacement of existing lighting with LED technology,
2. Lighting management analysis.

9.1 Replacement of existing lighting with LED technology

Replacement of existing lighting with LED technology is considered by 1 on 1 principle using existing electrical installations and existing lamp posts for installing LED lamps. Replacement of existing system refers only to energy, not efficient public lighting, therefore existing LED lamps are not a subject of replacement and budget, because it refers to already energy efficient public lighting.

Based on Imagemetry budget, replacement of existing energy, not efficient lamps with LED lamps is suggested. Lighting bodies overview is found in table 12.

Ordinal number	Street name	Lighting source type	Type
1	igralište Tupkovići 800m ²	Type as BVP125 LED80-4S/740 OFA52	T8
2	Tupkovići Gornji	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
3	Tupkovići Gornji	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
4	Tupkovići Gornji Čauševići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
5	Košare	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
6	Tupkovići-Mujčinovići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
7	Tupkovići-Mujčinovići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
8	Tupkovići Donji	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2

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9	Tupkovići-Ćasuri	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
10	Tupkovići-Trojan	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
11	Tupkovići-Trojan	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
12	igralište Tupkovići-Trojan 800m ²	Type as BVP125 LED80-4S/740 OFA52	T8
13	Tupkovići- Trojan	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
14	Gračanica	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T4
15	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
16	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
17	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
18	Gračanica	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
19	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
20	Gračanica	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
21	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
22	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
23	Durići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
24	Durići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
25	Vrtage	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
26	Gračanica	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
27	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
28	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
29	Gračanica-Šljivići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
30	Gračanica-Šljivići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
31	Gračanica-Zelenika	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
32	Gračanica-Zelenika	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
33	Omladinskih radnih brigada	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
34	Omladinskih radnih brigada	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
35	Omladinskih radnih brigada	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
36	Hornica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
37	Omladinskih radnih brigada	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
38	stadion FK Metalac 5000m ²	Type as BVP130 LED260-4S/740 OFA52	T11
39	Šarenjak	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
40	Hornica	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
41	Omladinskih radnih brigada	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
42	Maline-M18	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
43	Maline Spreča	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	T3
44	Strašanj-M18	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
45	Strašanj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
46	Strašanj	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2

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47	Strašanj	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
48	Strašanj igralište 800m ²	Type as BVP125 LED80-4S/740 OFA52	T8
49	Turijanci	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
50	Hadžići	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
51	Nova cesta	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
52	Luke	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
53	Hadžići	Type as BGP307 LED84-4S/730 II DM11 D9 48/60S	T7
54	Djedovača	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
55	Djedovača	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
56	Prijeki put	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
57	Gložik	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
58	Gložik	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
59	Hadžići	Type as BGP307 LED84-4S/730 II DM11 D9 48/60S	T7
60	Dubrave Donje	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
61	Prijeki put	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
62	Hadžići	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
63	Dubrave Donje	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
64	prostor oko Crkve sv. Ane	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
65	Dubavska	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
66	Dubavska	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
67	Višća	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
68	Višća	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
69	igralište Višća 800m ²	Type as BVP125 LED80-4S/740 OFA52	T8
70	regionalni put R469	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
71	Višća Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
72	Višća Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
73	Višća Donja	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
74	Kupjerusi	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	T3
75	Kupjerusi-poligon	Type as BDP102 LED60-4S/830 II DM D9 PCC GR 60P	T9
76	Smajići	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	T3
77	Bajrami	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	T3
78	Kupjerusi-Taletovići	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	T3
79	Dubavska	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
80	Dubavska	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	T3
81	Dubavska C	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
82	Sjever	Type as BDP102 LED30-4S/830 II DN D9 PCC GR 60P	T10
83	Sjever	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	T3
84	Hadžići	Type as BGP307 LED84-4S/730 II DM11 D9 48/60S	T7
85	Hadžići	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
86	Hadžići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
87	regionalni put R469	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
88	regionalni put R469	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4

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89	Begići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
90	Delići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
91	Kadrići	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	T3
92	Kadrići	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	T3
93	igralište Kadrići 800m ²	Type as BVP125 LED80-4S/740 OFA52	T8
94	Kadrići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
95	Bajrići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
96	Bajrići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
97	Kadirići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
98	Krzevići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
99	Ciljuge	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
100	Ciljuge	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
101	Ciljuge	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
102	Ciljuge	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
103	Toplička	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
104	Toplička	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
105	Lukavica Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
106	Lukavica Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
107	Lukavica Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
108	Lukavica Donja	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
109	Lukavica Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
110	Lukavica Donja	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
111	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
112	Lukavica Gornja	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
113	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
114	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
115	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
116	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
117	Lukavica Gornja	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
118	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
119	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
120	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
121	Svojat	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
122	Svojat	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
123	Svojat	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
124	Svojat	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
125	Svojat	Type as BGP307 LED69-4S/730 II DN10 D9 48/60S	T5
126	Svojat	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
127	igralište Svojat 800m ²	Type as BVP125 LED80-4S/740 OFA52	T8
128	Zelenika-Krivača	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
129	Zelenika	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
130	Zelenika	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
131	Zelenika	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
132	Livada	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	T3

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133	Podoljani	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
134	Donja Lukavica	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	T3
135	Donja Lukavica	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
136	Donja Lukavica	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	T3
137	Bašigovci	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	T2
138	regionalni put R469	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	T15
139	Pasci donji	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
140	1. ulica	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	T15
141	1. ulica	Type as BGP283 LED130-4S/730 II DN10 D9 48/60S	T18
142	Zlatnih ljiljana	Type as BGP307 LED35-4S/730 II DN10 D9 48/60S	T20
143	parking(Bosanski kulturni centar)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	T21
144	25. Novembar	Type as BGP282 LED80-4S/730 II DN10 D9 48/60S	T22
145	25. Novembar	Type as BGP282 LED80-4S/730 II DN10 D9 48/60S	T22
146	parking supermarketa	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	T21
147	parking površine cca 600m	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	T21
148	Gradski park konjuh (25. Novembar)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	T21
149	Prvi maj	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	T21
150	Školska	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	T12
151	Prva ulica	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	T12
152	2. ulica (prostor oko zgrade)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	T21
153	Alije Izetbegovića	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	T19
154	parking(Meše Selimovića)	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	T15
155	Oslobođenja	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
156	park(Ulica Oslobođenja)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	T21
157	parking(Ulica Oslobođenja)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	T21
158	Gradski park Živinice(Alije Izetbegovića)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	T21
159	ulica iza Općine/Grada (Alije Izetbegovića)	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
160	parking Općine/Grada	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	T21
161	Šetnica iza Općine/Grada	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	T21
162	Pašage Gocića	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	T12
163	Patriotske lige	Type as BGP282 LED80-4S/730 II DN10 D9 48/60S	T22
164	Željeznička	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	T12
165	XVI muslimanske brigade	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	T19
166	Rudarska	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	T12

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167	Rudarska	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	T12
168	Rudarska	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	T19
169	Živiničkih brigada	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	T12
170	Civilnih žrtava rata	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
171	Dubravska(naselje uz r469)	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	T15
172	regionalni put R469	Type as BGP282 LED80-4S/730 II DN10 D9 48/60S	T22
173	Bosanska	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
174	Jezero	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
175	Jezero	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
176	Jezero	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	T12
177	Jezero	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
178	Jezero	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
179	1. Mart	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
180	1. Mart	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
181	1. Mart	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
182	Sadnice	Type as BGP283 LED130-4S/730 II DN10 D9 48/60S	T18
183	Toplička	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
184	Toplička	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	T15
185	regionalni put R469	Type as BGP283 LED130-4S/730 II DN10 D9 48/60S	T18
186	1. ulica	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	T14
187	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
188	Poljice	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
189	Klopići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
190	Klopići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
191	Klopići	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	T14
192	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
193	Priluk	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	T14
194	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
195	Priluk	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
196	Priluk	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	T15
197	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
198	Omići	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	T15
199	regionalni put R455a	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
200	Omerkići	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	T19
201	R455a	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
202	Alagići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
203	Alagići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
204	Šehići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
205	Šehići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
206	Šehići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
207	Šerići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
208	Šerići	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	T19
209	regionalni put R455a	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	T12

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210	Šerići	Type as P283 LED120-4S/730 II DN10 D9 48/60S	T19
211	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
212	Omerkići	Type as BVP125 LED80-4S/740 OFA52	T8
213	igralište(Omerkići)	Type as P283 LED120-4S/730 II DN10 D9 48/60S	T19
214	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
215	Šerići	Type as P283 LED120-4S/730 II DN10 D9 48/60S	T19
216	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
217	Šerići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
218	Šerići	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	T14
219	regionalni put R455a	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	T14
220	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
221	Suha	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
222	Suha	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	T15
223	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
224	Suha	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
225	Suha	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
226	Đulići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
227	Đulići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
228	Barice	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
229	Atlić mahala	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	T12
230	Jablanica	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
231	Jablanica	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
232	Tadići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
233	Tadići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
234	Živinice Gornje	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
235	Živinice Gornje	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	T12
236	Kopjevići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
237	Kopjevići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
238	Grabik	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
239	Petrovići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
240	Petrovići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
241	Šišići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
242	Šišići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
243	Adići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
244	Adići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
245	Lug	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
246	Lug	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	T16
247	magistralni put M18	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	T14
248	Đurđevik	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
249	Đurđevik	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	T4
250	Gostelja	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
251	Gostelja	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
252	Musići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
253	Musići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1

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254	Gostelja	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
255	Golubinjak	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
256	Nukići	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	T15
257	regionalni put R469	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
258	Živiničke ose	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	T14
259	Živiničke ose	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	T12
260	Živiničke ose	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	T1
261	Gostelja	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
262	Golubinjak	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
263	Golubinjak	Type as BGP283 LED149-4S/730 II DM10 D9 48/60S	T17
264	regionalni put R469	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
265	Donja Višća	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
266	Donja Višća	Type as BGP283 LED149-4S/730 II DM10 D9 48/60S	T17
267	regionalni put R469	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
268	Šišići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
269	Šišići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
270	Gostelja	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	T15
271	magistralni put M18	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
272	Stara pruga	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
273	Bare	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
274	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
275	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
276	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
277	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
278	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
279	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
280	Mujići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
281	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
282	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
283	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
284	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
285	Bašigovci	Type as BGP307 LED84-4S/730 II DM11 D9 48/60S	T7
286	Bašigovco	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
287	Bašigovco	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
288	Bašigovco	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
289	Bašigovco	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
290	Podoljani	Type as BGP307 LED84-4S/730 II DM11 D9 48/60S	T7
291	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
292	Bašigovci	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	T13
293	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
294	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
295	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
296	Vrnojevići donji	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	T16
297	regionalni put R455a	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	T16

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298	Toplička	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	T13
299	Toplička	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	T13
300	Toplička	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	T13
301	3. ulica	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
302	3. ulica	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	T13
303	Stara pruga	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	T13
304	Stara pruga	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
305	regionalni put R455a	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	T14
306	regionalni put R455a	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	T19
307	Živinički sokolovi	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	T14
308	Partizanske	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	T14
309	Živinički sokolovi	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	T13
310	Partizanska	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	T13
311	Partizanska	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	T13
312	Partizanska	Type as BGP283 LE130-4S/730 II DN10 D9 48/60S	T18
313	Partizanska	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	T13
314	Partizanska	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	T6
315	Živinički sokolovi	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
316	Živinički sokolovi	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
317	regionalni put R455a	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	T16
318	Modračka	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
319	regionalni put R455a	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	T16
320	regionalni put R455a	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	T16
321	Barice	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
322	regionalni put R455a	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	T16
323	Barice	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
324	Barice	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
325	igrališze (Barice)	Type as BVP125 LED80-4S/740 OFA52	T8
326	Otawa	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
327	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
328	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
329	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
330	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
331	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
332	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
333	Podgajevi	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
334	magistralni put M18	Type as BGP283 LE130-4S/730 II DN10 D9 48/60S	T18
335	Šahići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
336	Đurđevik	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
337	Đurđevik	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
338	Živčići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
339	Živčići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1
340	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	T1

Table 12: Lighting bodies overview for which energy efficiency measures are suggested

Installed power overview (W) and total annual consumption (kWh) per particular lighting body types for which enhancement of lighting energy efficiency as suggested measure is given in the following chapters by streets.

9.1.1 Electricity consumption budget by applying replacement measures of existing lighting with LED technology

Electricity consumption budget by applying replacement measures of existing lighting with LED technology was made by equation:

$$E_{m1} = (P_{isLED} + P_{gubLED}) * T_{ref} \quad (5.)$$

$$E_{m1} = P_{refLED} * T_{ref} \quad (6.)$$

where the following is:

E_{m1} – standardized annual electricity consumption for considered measures 1 – M1 (kWh/annually);

P_{isLED} – LED lamp source power;

P_{gub} – ballast losses;

P_{refLED} – total reference power – $P_{is} + P_{gub}$;

T_{ref} – reference value number of public lighting system working hours (4.100 hours) – according to BAS EN 15900:2011 standard.

Ballast losses of LED lighting is calculated into total lamp power and standardized annual budget for account consumption as $E_{m1} = P_{refLED} * T_{ref}$, where into P_{refLED} , a lamp manufacturer included losses and lamp power sources shows as total power with ballast losses.

Installed power overview (W) and total annual consumption (kWh) by particular lighting bodies types for which is suggested energy efficiency enhancement measure found in table 13.

Ordinal No.	Street name	Lighting source type	PrefLED – Total reference power	Quantity	(Tref) - Working period	(Em1) - Total standardized annual consumption
			(W)			
1	igralište Tupkovići 800m ²	Type as BVP125 LED80-4S/740 OFA52	66	6	4100	1623,60
2	Tupkovići Gornji	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	23	4100	2074,60
3	Tupkovići Gornji	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	21	4100	1532,58
4	Tupkovići Gornji Čauševići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	18	4100	1313,64

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5	Košare	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	34	4100	2481,32
6	Tupkovići- Mujčinovići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	9	4100	656,82
7	Tupkovići- Mujčinovići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	16	4100	1443,20
8	Tupkovići Donji	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	33	4100	2408,34
9	Tupkovići- Časuri	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	17	4100	1240,66
10	Tupkovići- Trojan	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	33	4100	2976,60
11	Tupkovići- Trojan	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	7	4100	510,86
12	igralište Tupkovići- Trojan 800m ²	Type as BVP125 LED80-4S/740 OFA52	66	6	4100	1623,60
13	Tupkovići- Trojan	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	24	4100	1751,52
14	Gračanica	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	37	21	4100	3185,70
15	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	6	4100	437,88
16	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	15	4100	1094,70
17	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	2	4100	145,96
18	Gračanica	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	27	4100	2435,40
19	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	21	4100	1532,58
20	Gračanica	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	46	4100	6978,20
21	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	11	4100	802,78
22	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	29	4100	2116,42
23	Durići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	13	4100	948,74
24	Durići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	28	4100	2043,44
25	Vrtage	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	6	4100	437,88
26	Gračanica	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	11	4100	1375,55
27	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	20	4100	1459,60
28	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	24	4100	1751,52

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29	Gračanica-Šljivići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	37	4100	2700,26
30	Gračanica-Šljivići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	10	4100	729,80
31	Gračanica-Zelenika	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	12	4100	875,76
32	Gračanica-Zelenika	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	50	4100	7585,00
33	Omladinskih radnih brigada	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	5	4100	758,50
34	Omladinskih radnih brigada	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	42	4100	3065,16
35	Omladinskih radnih brigada	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	6	4100	750,30
36	Hornica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	26	4100	1897,48
37	Omladinskih radnih brigada	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	18	4100	2730,60
38	stadion FK Metalac 5000m ²	Type as BVP130 LED260-4S/740 OFA52	220	8	4100	7216,00
39	Šarenjak	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	46	4100	3357,08
40	Hornica	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	15	4100	2275,50
41	Omladinskih radnih brigada	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	25	4100	1824,50
42	Maline-M18	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	5	4100	364,90
43	Maline Spreča	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	12,8	7	4100	367,36
44	Strašanj-M18	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	5	4100	625,25
45	Strašanj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	31	4100	2796,20
46	Strašanj	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	53	4100	3867,94
47	Strašanj	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	5	4100	364,90
48	Strašanj igralište 800m ²	Type as BVP125 LED80-4S/740 OFA52	66	4	4100	1082,40
49	Turijanci	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	3	4100	455,10

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50	Hadžići	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	7	4100	1061,90
51	Nova cesta	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	19	4100	2882,30
52	Luke	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	31	4100	2262,38
53	Hadžići	Type as BGP307 LED84-4S/730 II DM11 D9 48/60S	54	20	4100	4428,00
54	Djedovača	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	14	4100	1021,72
55	Djedovača	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	17	4100	1240,66
56	Prijeki put	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	11	4100	802,78
57	Gložik	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	19	4100	1713,80
58	Gložik	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	11	4100	802,78
59	Hadžići	Type as BGP307 LED84-4S/730 II DM11 D9 48/60S	54	25	4100	5535,00
60	Dubrave Donje	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	11	4100	802,78
61	Prijeki put	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	13	4100	948,74
62	Hadžići	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	12	4100	1820,40
63	Dubrave Donje	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	18	4100	1313,64
64	prostor oko Crkve sv. Ane	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	6	4100	437,88
65	Dubravaska	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	24	4100	3640,80
66	Dubravaska	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	35	4100	5309,50
67	Višća	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	10	4100	1517,00
68	Višća	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	56	4100	4086,88
69	igralište Višća 800m ²	Type as BVP125 LED80-4S/740 OFA52	66	6	4100	1623,60
70	regionalni put R469	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	7	4100	875,35
71	Višća Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	51	4100	3721,98
72	Višća Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	54	4100	3940,92
73	Višća Donja	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	23	4100	2074,60

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74	Kupjerusi	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	12,8	28	4100	1469,44
75	Kupjerusi- poligon	Type as BDP102 LED60-4S/830 II DM D9 PCC GR 60P	47	6	4100	1156,20
76	Smajići	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	12,8	14	4100	734,72
77	Bajrami	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	12,8	16	4100	839,68
78	Kupjerusi- Taletovići	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	12,8	26	4100	1364,48
79	Dubravska	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	16	4100	2427,20
80	Dubravska	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	12,8	4	4100	209,92
81	Dubravska C	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	12	4100	875,76
82	Sjever	Type as BDP102 LED30-4S/830 II DN D9 PCC GR 60P	24	37	4100	3640,80
83	Sjever	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	12,8	15	4100	787,20
84	Hadžići	Type as BGP307 LED84-4S/730 II DM11 D9 48/60S	54	18	4100	3985,20
85	Hadžići	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	29	4100	4399,30
86	Hadžići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	14	4100	1021,72
87	regionalni put R469	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	19	4100	2882,30
88	regionalni put R469	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	13	4100	1972,10
89	Begići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	2	4100	145,96
90	Delići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	26	4100	1897,48
91	Kadrići	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	12,8	32	4100	1679,36
92	Kadrići	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	12,8	13	4100	682,24
93	igralište Kadrići 800m ²	Type as BVP125 LED80-4S/740 OFA52	66	16	4100	4329,60
94	Kadrići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	24	4100	1751,52
95	Bajrići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	23	4100	1678,54
96	Bajrići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	33	4100	2408,34
97	Kadrići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	21	4100	1532,58

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98	Krzevići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	24	4100	1751,52
99	Ciljuge	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	8	4100	721,60
100	Ciljuge	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	45	4100	3284,10
101	Ciljuge	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	4	4100	360,80
102	Ciljuge	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	12	4100	1082,40
103	Toplička	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	10	4100	729,80
104	Toplička	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	5	4100	364,90
105	Lukavica Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	25	4100	1824,50
106	Lukavica Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	26	4100	1897,48
107	Lukavica Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	35	4100	2554,30
108	Lukavica Donja	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	18	4100	2730,60
109	Lukavica Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	21	4100	1532,58
110	Lukavica Donja	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	36	4100	5461,20
111	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	14	4100	1021,72
112	Lukavica Gornja	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	22	4100	3337,40
113	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	19	4100	1386,62
114	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	18	4100	1313,64
115	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	36	4100	2627,28
116	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	12	4100	875,76
117	Lukavica Gornja	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	12	4100	1820,40
118	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	26	4100	1897,48
119	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	21	4100	1532,58
120	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	12	4100	875,76
121	Svojat	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	22	4100	3337,40
122	Svojat	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	30	4100	2189,40

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123	Svojat	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	27	4100	1970,46
124	Svojat	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	18	4100	1313,64
125	Svojat	Type as BGP307 LED69-4S/730 II DN10 D9 48/60S	43,5	23	4100	4102,05
126	Svojat	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	36	4100	3247,20
127	igrališče Svojat 800m ²	Type as BVP125 LED80-4S/740 OFA52	66	4	4100	1082,40
128	Zelenika- Krivača	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	22	4100	1605,56
129	Zelenika	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	7	4100	1061,90
130	Zelenika	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	20	4100	1459,60
131	Zelenika	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	19	4100	1386,62
132	Livada	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	12,8	21	4100	1102,08
133	Podoljani	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	17	4100	2578,90
134	Donja Lukavica	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	12,8	13	4100	682,24
135	Donja Lukavica	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	22	4100	3337,40
136	Donja Lukavica	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	12,8	7	4100	367,36
137	Bašigovci	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	17,8	30	4100	2189,40
138	regionalni put R469	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	65	59	4100	15723,50
139	Pasci donji	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	38	4100	3427,60
140	1. ulica	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	65	12	4100	3198,00
141	1. ulica	Type as BGP283 LED130-4S/730 II DN10 D9 48/60S	83	14	4100	4764,20
142	Zlatnih ljljana	Type as BGP307 LED35-4S/730 II DN10 D9 48/60S	23,5	31	4100	2986,85
143	parking(Bos anski kulturni centar)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	47	11	4100	2119,70
144	25. Novembar	Type as BGP282 LED80-4S/730 II DN10 D9 48/60S	54	9	4100	1992,60
145	25. Novembar	Type as BGP282 LED80-4S/730 II DN10 D9 48/60S	54	14	4100	3099,60

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146	parking supermarke ta	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	47	4	4100	770,80
147	parking površine cca 600m	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	47	8	4100	1541,60
148	Gradski park konjuh (25. Novembar)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	47	7	4100	1348,90
149	Prvi maj	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	47	13	4100	2505,10
150	Školska	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	37	1	4100	151,70
151	Prva ulica	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	37	4	4100	606,80
152	2. ulica (prostor oko zgrade)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	47	8	4100	1541,60
153	Alije Izetbegovića	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	76	5	4100	1558,00
154	parking(Meš e Selimovića)	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	65	15	4100	3997,50
155	Oslobođenj a	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	11	4100	1375,55
156	park(Ulica Oslobođenj a)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	47	11	4100	2119,70
157	parking(Ulic a Oslobođenj a)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	47	6	4100	1156,20
158	Gradski park Živinice(Alije Izetbegovića)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	47	14	4100	2697,80
159	ulica iza općine(Alije Izetbegovića)	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	4	4100	500,20
160	parking općine	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	47	1	4100	192,70
161	Šetnica iza općine	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	47	8	4100	1541,60
162	Pašage Gocića	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	37	18	4100	2730,60
163	Patriotske lige	Type as BGP282 LED80-4S/730 II DN10 D9 48/60S	54	8	4100	1771,20
164	Željeznička	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	37	1	4100	151,70

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165	XVI muslimanske brigade	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	76	8	4100	2492,80
166	Rudarska	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	37	11	4100	1668,70
167	Rudarska	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	37	3	4100	455,10
168	Rudarska	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	76	1	4100	311,60
169	Živiničkih brigada	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	37	7	4100	1061,90
170	Civilnih žrtava rata	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	6	4100	750,30
171	Dubravskanaselje uz r469)	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	65	10	4100	2665,00
172	regionalni put R469	Type as BGP282 LED80-4S/730 II DN10 D9 48/60S	54	11	4100	2435,40
173	Bosanska	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	197	4100	24634,85
174	Jezero	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	24	4100	3001,20
175	Jezero	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	28	4100	3501,40
176	Jezero	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	37	4	4100	606,80
177	Jezero	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	6	4100	910,20
178	Jezero	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	5	4100	758,50
179	1. Mart	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	32	4100	4001,60
180	1. Mart	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	5	4100	625,25
181	1. Mart	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	3	4100	455,10
182	Sadnice	Type as BGP283 LED130-4S/730 II DN10 D9 48/60S	83	16	4100	5444,80
183	Toplička	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	10	4100	1250,50
184	Toplička	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	65	7	4100	1865,50
185	regionalni put R469	Type as BGP283 LED130-4S/730 II DN10 D9 48/60S	83	12	4100	4083,60
186	1. ulica	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	62	8	4100	2033,60
187	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	22	4100	1984,40
188	Poljice	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	14	4100	1262,80

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189	Klopići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	9	4100	811,80
190	Klopići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	4	4100	360,80
191	Klopići	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	62	12	4100	3050,40
192	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	2	4100	180,40
193	Priluk	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	62	75	4100	19065,00
194	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	23	4100	2074,60
195	Priluk	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	17	4100	1533,40
196	Priluk	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	65	32	4100	8528,00
197	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	7	4100	631,40
198	Omići	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	65	16	4100	4264,00
199	regionalni put R455a	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	7	4100	1061,90
200	Omerkići	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	76	22	4100	6855,20
201	R455a	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	16	4100	2427,20
202	Alagići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	11	4100	992,20
203	Alagići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	26	4100	2345,20
204	Šehići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	42	4100	3788,40
205	Šehići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	44	4100	3968,80
206	Šehići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	16	4100	1443,20
207	Šerići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	22	4100	1984,40
208	Šerići	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	76	40	4100	12464,00
209	regionalni put R455a	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	37	8	4100	1213,60
210	Šerići	Type as P283 LED120-4S/730 II DN10 D9 48/60S	76	10	4100	3116,00
211	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	18	4100	1623,60
212	Omerkići	Type as BVP125 LED80-4S/740 OFA52	66	5	4100	1353,00
213	igralište(Om erkići)	Type as P283 LED120-4S/730 II DN10 D9 48/60S	76	10	4100	3116,00

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214	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	13	4100	1172,60
215	Šerići	Type as P283 LED120-4S/730 II DN10 D9 48/60S	76	65	4100	20254,00
216	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	15	4100	1353,00
217	Šerići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	51	4100	4600,20
218	Šerići	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	62	13	4100	3304,60
219	regionalni put R455a	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	62	30	4100	7626,00
220	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	9	4100	811,80
221	Suha	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	63	4100	5682,60
222	Suha	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	65	63	4100	16789,50
223	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	8	4100	721,60
224	Suha	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	32	4100	2886,40
225	Suha	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	38	4100	3427,60
226	Đulići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	25	4100	2255,00
227	Đulići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	6	4100	541,20
228	Barice	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	23	4100	2074,60
229	Atlić mahala	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	37	46	4100	6978,20
230	Jablanica	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	9	4100	811,80
231	Jablanica	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	24	4100	2164,80
232	Tadići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	10	4100	902,00
233	Tadići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	25	4100	2255,00
234	Živinice Gornje	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	18	4100	1623,60
235	Živinice Gornje	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	37	8	4100	1213,60
236	Kopjevići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	14	4100	1262,80
237	Kopjevići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	37	4100	3337,40
238	Grabik	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	22	4100	1984,40

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239	Petrovići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	19	4100	1713,80
240	Petrovići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	18	4100	1623,60
241	Šišići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	42	4100	3788,40
242	Šišići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	10	4100	902,00
243	Adići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	22	4100	1984,40
244	Adići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	19	4100	1713,80
245	Lug	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	8	4100	721,60
246	Lug	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	83	12	4100	4083,60
247	magistralni put M18	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	62	10	4100	2542,00
248	Đurđevik	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	21	4100	2626,05
249	Đurđevik	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	37	55	4100	8343,50
250	Gostelja	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	24	4100	2164,80
251	Gostelja	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	21	4100	1894,20
252	Musići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	49	4100	4419,80
253	Musići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	30	4100	2706,00
254	Gostelja	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	18	4100	2250,90
255	Golubinjak	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	54	4100	4870,80
256	Nukići	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	65	66	4100	17589,00
257	regionalni put R469	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	24	4100	3001,20
258	Živiničke ose	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	62	47	4100	11947,40
259	Živiničke ose	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	37	76	4100	11529,20
260	Živiničke ose	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	22	24	4100	2164,80
261	Gostelja	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	28	4100	2525,60
262	Golubinjak	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	31	4100	2796,20
263	Golubinjak	Type as BGP283 LED149-4S/730 II DM10 D9 48/60S	97	32	4100	12726,40

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264	regionalni put R469	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	38	4100	3427,60
265	Donja Višća	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	21	4100	1894,20
266	Donja Višća	Type as BGP283 LED149-4S/730 II DM10 D9 48/60S	97	15	4100	5965,50
267	regionalni put R469	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	8	4100	721,60
268	Šišići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	71	4100	6404,20
269	Šišići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	32	4100	2886,40
270	Gostelja	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	65	6	4100	1599,00
271	magistralni put M18	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	8	4100	1000,40
272	Stara pruga	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	75	4100	9378,75
273	Bare	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	9	4100	811,80
274	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	31	4100	2796,20
275	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	10	4100	902,00
276	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	38	4100	3427,60
277	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	34	4100	3066,80
278	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	17	4100	1533,40
279	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	13	4100	1172,60
280	Mujići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	16	4100	1443,20
281	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	27	4100	2435,40
282	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	8	4100	721,60
283	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	27	4100	2435,40
284	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	21	4100	1894,20
285	Bašigovci	Type as BGP307 LED84-4S/730 II DM11 D9 48/60S	54	14	4100	3099,60
286	Bašigivco	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	24	4100	2164,80
287	Bašigivco	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	14	4100	1262,80
288	Bašigivco	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	9	4100	811,80

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289	Bašigivco	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	13	4100	1172,60
290	Podoljani	Type as BGP307 LED84-4S/730 II DM11 D9 48/60S	54	3	4100	664,20
291	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	13	4100	1172,60
292	Bašigovci	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	27	8	4100	885,60
293	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	5	4100	451,00
294	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	15	4100	1353,00
295	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	3	4100	270,60
296	Vrnojevići donji	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	83	4	4100	1361,20
297	regionalni put R455a	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	83	40	4100	13612,00
298	Toplička	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	27	15	4100	1660,50
299	Toplička	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	27	17	4100	1881,90
300	Toplička	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	27	6	4100	664,20
301	3. ulica	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	18	4100	1623,60
302	3. ulica	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	27	4	4100	442,80
303	Stara pruga	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	27	9	4100	996,30
304	Stara pruga	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	10	4100	902,00
305	regionalni put R455a	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	62	5	4100	1271,00
306	regionalni put R455a	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	76	2	4100	623,20
307	Živinički sokolovi	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	62	5	4100	1271,00
308	Partizanske	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	62	17	4100	4321,40
309	Živinički sokolovi	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	27	7	4100	774,90
310	Partizanska	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	27	18	4100	1992,60
311	Partizanska	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	27	18	4100	1992,60
312	Partizanska	Type as BGP283 LE130-4S/730 II DN10 D9 48/60S	83	26	4100	8847,80
313	Partizanska	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	27	12	4100	1328,40

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314	Partizanska	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	30,5	18	4100	2250,90
315	Živinički sokolovi	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	13	4100	1172,60
316	Živinički sokolovi	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	17	4100	1533,40
317	regionalni put R455a	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	83	50	4100	17015,00
318	Modračka	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	18	4100	1623,60
319	regionalni put R455a	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	83	24	4100	8167,20
320	regionalni put R455a	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	83	18	4100	6125,40
321	Barice	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	22	4100	1984,40
322	regionalni put R455a	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	83	21	4100	7146,30
323	Barice	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	9	4100	811,80
324	Barice	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	22	4100	1984,40
325	igrališče (Barice)	Type as BVP125 LED80-4S/740 OFA52	66	4	4100	1082,40
326	Otawa	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	28	4100	2525,60
327	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	13	4100	1172,60
328	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	20	4100	1804,00
329	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	14	4100	1262,80
330	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	21	4100	1894,20
331	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	14	4100	1262,80
332	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	3	4100	270,60
333	Podgajevi	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	13	4100	1172,60
334	magistralni put M18	Type as BGP283 LE130-4S/730 II DN10 D9 48/60S	83	25	4100	8507,50
335	Šahići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	27	4100	2435,40
336	Đurđevik	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	51	4100	4600,20
337	Đurđevik	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	20	4100	1804,00
338	Živčići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	8	4100	721,60

339	Živčiči	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	18	4100	1623,60
340	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	22	10	4100	902,00
Total (kWh/annually)						894207,54
Lighting sources (pcs)						6802
Specific annual consumption (kWh/per lighting source annually)						131,46

Table 13: Total electricity consumption for public lighting after implementing measures

Imagemetry analysis confirmed that replacing existing lamps will achieve significant savings, but also that brightness will demand values accordant to BAS CEN/TR 13201-1:2016 standard – Traffic roads lighting – Part 1: Lighting class selection. Therefore, it can be concluded that with this way of lighting, as it's intensity, it will fulfill issued values as issued values by standards for degree of mechanical protection accordant to BAS EN 60598 – 1:2016 standard (or BAS EN 60529:2007) and for degree of impact resistance of the safeguard accordant to BAS EN 62262:2010 standard.

9.2 Public lighting management analysis

Lighting management plays an important role in electric lighting system providing turning lights on and off function with switches and/or setting light intensity with light intensity regulator. Managing lighting system can be managed manually or automatically. Manual management cannot complete all requested lighting system functions. Considering a decision on turning on/off lights depends on a man, from a perspective of energyefficiency, this way of managing is especially inconvenient.

In the last decades these functions are automatized and integrated into greater, more flexible systems. Accomplished results significantly expand possibilities of energy savings, flexibility, reliability, interoperability among devices of different manufacturers. In the Study there will be presented a possibility of electricitysavings through lighting system automatization. In the following, measures of automatic lighting management will be analyzed and in two ways:

- Replacement of existing lamps with LED lamps with a possibility of dimming – where dimming is possible and will not have any effect on functionality and safety.
- Replacement of existing lamps with LED lamps with a possibility of dimming – where dimming is possible and will not have any effect on functionality and safety with built in central technical surveillance.

9.2.1 Replacement of existing lamps with LED lamps with a possibility of dimming – where dimming is possible and will not have any effect on functionality and safety

Replacement of existing lamps with LED lamps with a possibility of dimming – where dimming is possible and will not have any effect on functionality and safety is considered with built in autonomous dimmer (Dynadimmer). Dynadimmer (image 54) is a managing device which provides dimming luminous flux to 5 levels, in intervals set by an investor. It is designed for internal and external use. Optimized for built in box for public lighting which provides great energy savings with

minor installation efforts. It can be mounted in any position if the box has IP43 protection or higher. Wiring has to be accordant to BAS EN 60598 – 1:2016 standard.



Image 54: Autonomous dimmer overview (Dynadimmer)

Main advantages of using Dynadimmer are:

- Energy savings by dimming,
- Lighting lowered interferences,
- Very small sizes,
- Fits almost into any lamp,
- Software provides energy savings prognosis,
- Software easy to use,
- Possession of programmed regimes.

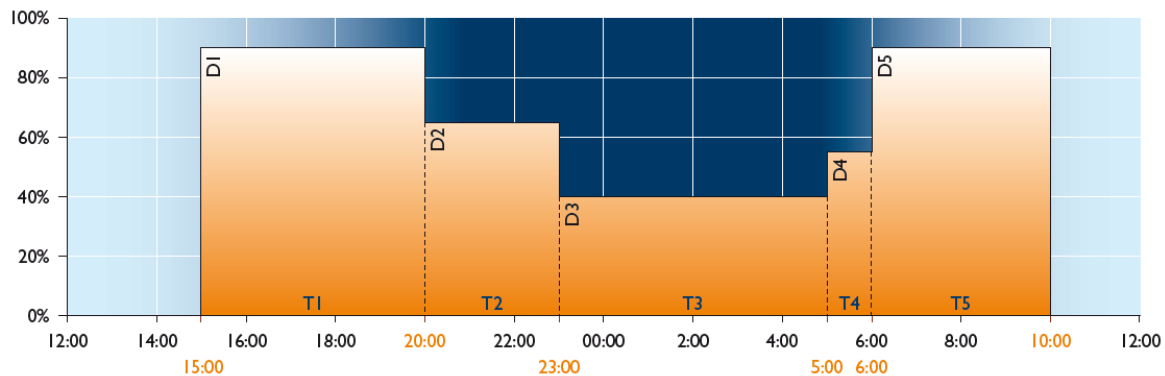


Image 55: Example of dimming luminous flux into 5 levels

For electricity consumption budget by applying replacement measures of existing lamps with LED lamps with a possibility of dimming – where dimming is possible and will not have any effect on functionality and safety, practice during winter and summer period system is implemented. Standardized annual electricity consumption was done by equation:

$$E_{m2} = E_{m1} * k_{m2} \quad (7.)$$

Where the following is:

E_{m2} – standardized annual electricity consumption for considered M2 – measure 2 (kWh/annually);

E_{m1} – standardized annual electricity consumption from M1 – measure 1 (kWh/annually);

k_{m2} – coefficient applied from practice during winter and summer period – 0,223929

Used model can be ordered programmed and built in a lamp. Due to low price, architects usually order lamp with dynadimmer. These systems are most commonly used in an outside part of the city due to possibility of bad influence on functionality and safety. However, if taken into

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consideration if dimming luminous flux is always possible to reprogramme, these systems are also used in urban parts of the city.

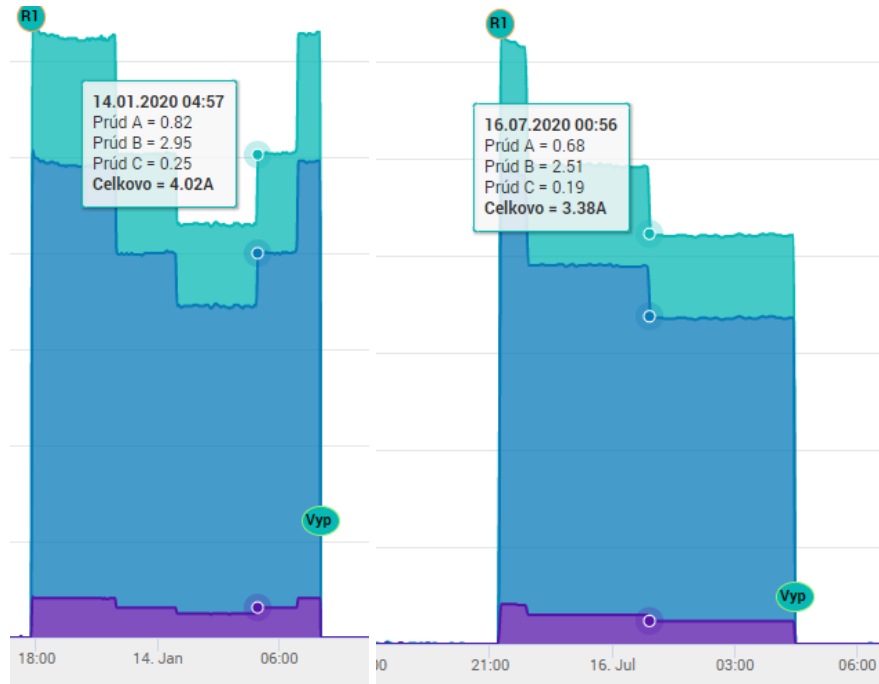


Image 56: Used model for dimming luminous flux for considered measure (left – diagram example for winter period, right – diagram example for summer period)

Table 14 shows a total electricity consumption applying measures based on a considered model.

Ordinal No.	Street name	Lighting source type with built in dimming device	(Em2) - Total standardized annual consumption
			(kWh/annually)
1	igrališče Tupkovići 800m ²	Type as BVP125 LED80-4S/740 OFA52	1260,03
2	Tupkovići Gornji	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1610,04
3	Tupkovići Gornji	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1189,39
4	Tupkovići Gornji Čauševići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1019,48
5	Košare	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1925,68
6	Tupkovići-Mujčinovići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	509,74
7	Tupkovići-Mujčinovići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1120,03
8	Tupkovići Donji	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1869,04

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Ordinal No.	Street name	Lighting source type with built in dimming device	(Em2) - Total standardized annual consumption
			(kWh/annually)
9	Tupkovići-Ćasuri	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	962,84
10	Tupkovići-Trojan	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	2310,05
11	Tupkovići-Trojan	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	396,46
12	igralište Tupkovići-Trojan 800m ²	Type as BVP125 LED80-4S/740 OFA52	1260,03
13	Tupkovići- Trojan	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1359,30
14	Gračanica	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	2472,33
15	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	339,83
16	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	849,56
17	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	113,28
18	Gračanica	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1890,04
19	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1189,39
20	Gračanica	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	5415,58
21	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	623,01
22	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1642,49
23	Durići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	736,29
24	Durići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1585,85
25	Vrtage	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	339,83
26	Gračanica	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	1067,52
27	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1132,75
28	Gračanica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1359,30
29	Gračanica-Šljivići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	2095,59
30	Gračanica-Šljivići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	566,38

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Ordinal No.	Street name	Lighting source type with built in dimming device	(Em2) - Total standardized annual consumption
			(kWh/annually)
31	Gračanica-Zelenika	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	679,65
32	Gračanica-Zelenika	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	5886,50
33	Omladinskih radnih brigada	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	588,65
34	Omladinskih radnih brigada	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	2378,78
35	Omladinskih radnih brigada	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	582,29
36	Hornica	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1472,58
37	Omladinskih radnih brigada	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	2119,14
38	stadion FK Metalac 5000m ²	Type as BVP130 LED260-4S/740 OFA52	5600,13
39	Šarenjak	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	2605,33
40	Hornica	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	1765,95
41	Omladinskih radnih brigada	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1415,94
42	Maline-M18	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	283,19
43	Maline Spreča	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	285,10
44	Strašanj-M18	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	485,24
45	Strašanj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	2170,05
46	Strašanj	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	3001,80
47	Strašanj	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	283,19
48	Strašanj igralište 800m ²	Type as BVP125 LED80-4S/740 OFA52	840,02
49	Turijanci	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	353,19
50	Hadžići	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	824,11
51	Nova cesta	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	2236,87
52	Luke	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1755,77

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Ordinal No.	Street name	Lighting source type with built in dimming device	(Em2) - Total standardized annual consumption
			(kWh/annually)
53	Hadžići	Type as BGP307 LED84-4S/730 II DM11 D9 48/60S	3436,44
54	Djedovača	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	792,93
55	Djedovača	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	962,84
56	Prijeki put	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	623,01
57	Gložik	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1330,03
58	Gložik	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	623,01
59	Hadžići	Type as BGP307 LED84-4S/730 II DM11 D9 48/60S	4295,55
60	Dubrave Donje	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	623,01
61	Prijeki put	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	736,29
62	Hadžići	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	1412,76
63	Dubrave Donje	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1019,48
64	prostor oko Crkve sv. Ane	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	339,83
65	Dubravska	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	2825,52
66	Dubravska	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	4120,55
67	Višća	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	1177,30
68	Višća	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	3171,71
69	igralište Višća 800m ²	Type as BVP125 LED80-4S/740 OFA52	1260,03
70	regionalni put R469	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	679,33
71	Višća Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	2888,52
72	Višća Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	3058,43
73	Višća Donja	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1610,04
74	Kupjerusi	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	1140,39

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Ordinal No.	Street name	Lighting source type with built in dimming device	(Em2) - Total standardized annual consumption
			(kWh/annually)
75	Kupjerusi-poligon	Type as BDP102 LED60-4S/830 II DM D9 PCC GR 60P	897,29
76	Smajići	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	570,19
77	Bajrami	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	651,65
78	Kupjerusi-Taletovići	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	1058,93
79	Dubravska	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	1883,68
80	Dubravska	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	162,91
81	Dubravska C	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	679,65
82	Sjever	Type as BDP102 LED30-4S/830 II DN D9 PCC GR 60P	2825,52
83	Sjever	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	610,92
84	Hadžići	Type as BGP307 LED84-4S/730 II DM11 D9 48/60S	3092,80
85	Hadžići	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	3414,17
86	Hadžići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	792,93
87	regionalni put R469	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	2236,87
88	regionalni put R469	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	1530,49
89	Begići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	113,28
90	Delići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1472,58
91	Kadrići	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	1303,30
92	Kadrići	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	529,47
93	igralište Kadrići 800m ²	Type as BVP125 LED80-4S/740 OFA52	3360,08
94	Kadrići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1359,30
95	Bajrići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1302,67
96	Bajrići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1869,04

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Ordinal No.	Street name	Lighting source type with built in dimming device	(Em2) - Total standardized annual consumption
			(kWh/annually)
97	Kadirići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1189,39
98	Krzevići	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1359,30
99	Ciljuge	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	560,01
100	Ciljuge	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	2548,69
101	Ciljuge	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	280,01
102	Ciljuge	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	840,02
103	Toplička	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	566,38
104	Toplička	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	283,19
105	Lukavica Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1415,94
106	Lukavica Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1472,58
107	Lukavica Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1982,32
108	Lukavica Donja	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	2119,14
109	Lukavica Donja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1189,39
110	Lukavica Donja	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	4238,28
111	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	792,93
112	Lukavica Gornja	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	2590,06
113	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1076,12
114	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1019,48
115	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	2038,96
116	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	679,65
117	Lukavica Gornja	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	1412,76
118	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1472,58

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Ordinal No.	Street name	Lighting source type with built in dimming device	(Em2) - Total standardized annual consumption
			(kWh/annually)
119	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1189,39
120	Lukavica Gornja	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	679,65
121	Svojat	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	2590,06
122	Svojat	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1699,13
123	Svojat	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1529,22
124	Svojat	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1019,48
125	Svojat	Type as BGP307 LED69-4S/730 II DN10 D9 48/60S	3183,48
126	Svojat	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	2520,06
127	igrališče Svojat 800m ²	Type as BVP125 LED80-4S/740 OFA52	840,02
128	Zelenika-Krivača	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1246,03
129	Zelenika	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	824,11
130	Zelenika	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1132,75
131	Zelenika	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1076,12
132	Livada	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	855,29
133	Podoljani	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	2001,41
134	Donja Lukavica	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	529,47
135	Donja Lukavica	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	2590,06
136	Donja Lukavica	Type as BGP307 LED18-4S/730 II DN10 D9 48/60S	285,10
137	Bašigovci	Type as BGP307 LED25-4S/730 II DN10 D9 48/60S	1699,13
138	regionalni put R469	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	12202,55
139	Pasci donji	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	2660,06
140	1. ulica	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	2481,88

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Ordinal No.	Street name	Lighting source type with built in dimming device	(Em2) - Total standardized annual consumption
			(kWh/annually)
141	1. ulica	Type as BGP283 LED130-4S/730 II DN10 D9 48/60S	3697,36
142	Zlatnih ljiljana	Type as BGP307 LED35-4S/730 II DN10 D9 48/60S	2318,01
143	parking(Bosanski kulturni centar)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	1645,04
144	25. Novembar	Type as BGP282 LED80-4S/730 II DN10 D9 48/60S	1546,40
145	25. Novembar	Type as BGP282 LED80-4S/730 II DN10 D9 48/60S	2405,51
146	parking supermarketa	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	598,20
147	parking površine cca 600m	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	1196,39
148	Gradski park konjuh (25. Novembar)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	1046,84
149	Prvi maj	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	1944,14
150	Školska	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	117,73
151	Prva ulica	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	470,92
152	2. ulica (prostor oko zgrade)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	1196,39
153	Alije Izetbegovića	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	1209,12
154	parking(Meše Selimovića)	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	3102,34
155	Oslobođenja	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	1067,52
156	park(Ulica Oslobođenja)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	1645,04
157	parking(Ulica Oslobođenja)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	897,29
158	Gradski park Živinice(Alije Izetbegovića)	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	2093,68
159	ulica iza općine(Alije Izetbegovića)	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	388,19
160	parking općine	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	149,55
161	Šetnica iza općine	Type as BDP102 LED60-4S/830 II DRW D9 PCC GR 60P	1196,39
162	Pašage Gocića	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	2119,14

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			(kWh/annually)
163	Patriotske lige	Type as BGP282 LED80-4S/730 II DN10 D9 48/60S	1374,58
164	Željeznička	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	117,73
165	XVI muslimanske brigade	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	1934,59
166	Rudarska	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	1295,03
167	Rudarska	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	353,19
168	Rudarska	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	241,82
169	Živiničkih brigada	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	824,11
170	Civilnih žrtava rata	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	582,29
171	Dubravka(naselje uz r469)	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	2068,23
172	regionalni put R469	Type as BGP282 LED80-4S/730 II DN10 D9 48/60S	1890,04
173	Bosanska	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	19118,39
174	Jezero	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	2329,14
175	Jezero	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	2717,33
176	Jezero	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	470,92
177	Jezero	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	706,38
178	Jezero	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	588,65
179	1. Mart	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	3105,53
180	1. Mart	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	485,24
181	1. Mart	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	353,19
182	Sadnice	Type as BGP283 LED130-4S/730 II DN10 D9 48/60S	4225,55
183	Toplička	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	970,48
184	Toplička	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	1447,76

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Ordinal No.	Street name	Lighting source type with built in dimming device	(Em2) - Total standardized annual consumption
			(kWh/annually)
185	regionalni put R469	Type as BGP283 LED130-4S/730 II DN10 D9 48/60S	3169,16
186	1. ulica	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	1578,22
187	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1540,04
188	Poljice	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	980,02
189	Klopići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	630,01
190	Klopići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	280,01
191	Klopići	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	2367,33
192	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	140,00
193	Priluk	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	14795,79
194	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1610,04
195	Priluk	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1190,03
196	Priluk	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	6618,33
197	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	490,01
198	Omići	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	3309,17
199	regionalni put R455a	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	824,11
200	Omerkići	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	5320,12
201	R455a	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	1883,68
202	Alagići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	770,02
203	Alagići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1820,04
204	Šehići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	2940,07
205	Šehići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	3080,07
206	Šehići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1120,03

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Ordinal No.	Street name	Lighting source type with built in dimming device	(Em2) - Total standardized annual consumption
			(kWh/annually)
207	Šerići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1540,04
208	Šerići	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	9672,95
209	regionalni put R455a	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	941,84
210	Šerići	Type as P283 LED120-4S/730 II DN10 D9 48/60S	2418,24
211	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1260,03
212	Omerkići	Type as BVP125 LED80-4S/740 OFA52	1050,02
213	igralište(Omerkići)	Type as P283 LED120-4S/730 II DN10 D9 48/60S	2418,24
214	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	910,02
215	Šerići	Type as P283 LED120-4S/730 II DN10 D9 48/60S	15718,54
216	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1050,02
217	Šerići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	3570,08
218	Šerići	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	2564,60
219	regionalni put R455a	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	5918,32
220	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	630,01
221	Suha	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	4410,10
222	Suha	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	13029,84
223	regionalni put R455a	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	560,01
224	Suha	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	2240,05
225	Suha	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	2660,06
226	Đulići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1750,04
227	Đulići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	420,01
228	Barice	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1610,04

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			(kWh/annually)
229	Atlič mahala	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	5415,58
230	Jablanica	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	630,01
231	Jablanica	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1680,04
232	Tadići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	700,02
233	Tadići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1750,04
234	Živinice Gornje	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1260,03
235	Živinice Gornje	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	941,84
236	Kopjevići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	980,02
237	Kopjevići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	2590,06
238	Grabik	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1540,04
239	Petrovići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1330,03
240	Petrovići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1260,03
241	Šišići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	2940,07
242	Šišići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	700,02
243	Adići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1540,04
244	Adići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1330,03
245	Lug	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	560,01
246	Lug	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	3169,16
247	magistralni put M18	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	1972,77
248	Đurđevik	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	2038,00
249	Đurđevik	Type as BGP307 LED54-4S/730 II DN10 D9 48/60S	6475,15
250	Gostelja	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1680,04

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Ordinal No.	Street name	Lighting source type with built in dimming device	(Em2) - Total standardized annual consumption
			(kWh/annually)
251	Gostelja	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1470,03
252	Musići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	3430,08
253	Musići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	2100,05
254	Gostelja	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	1746,86
255	Golubinjak	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	3780,09
256	Nukići	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	13650,31
257	regionalni put R469	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	2329,14
258	Živiničke ose	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	9272,03
259	Živiničke ose	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	8947,48
260	Živiničke ose	Type as BGP307 LED54-4S/730 II DM11 D9 48/60S	1680,04
261	Gostelja	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1960,04
262	Golubinjak	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	2170,05
263	Golubinjak	Type as BGP283 LED149-4S/730 II DM10 D9 48/60S	9876,59
264	regionalni put R469	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	2660,06
265	Donja Višća	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1470,03
266	Donja Višća	Type as BGP283 LED149-4S/730 II DM10 D9 48/60S	4629,65
267	regionalni put R469	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	560,01
268	Šišići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	4970,11
269	Šišići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	2240,05
270	Gostelja	Type as BGP282 LED99-4S/730 II DN10 D9 48/60S	1240,94
271	magistralni put M18	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	776,38
272	Stara pruga	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	7278,58

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Ordinal No.	Street name	Lighting source type with built in dimming device	(Em2) - Total standardized annual consumption
			(kWh/annually)
273	Bare	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	630,01
274	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	2170,05
275	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	700,02
276	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	2660,06
277	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	2380,05
278	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1190,03
279	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	910,02
280	Mujići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1120,03
281	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1890,04
282	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	560,01
283	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1890,04
284	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1470,03
285	Bašigovci	Type as BGP307 LED84-4S/730 II DM11 D9 48/60S	2405,51
286	Bašigivco	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1680,04
287	Bašigivco	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	980,02
288	Bašigivco	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	630,01
289	Bašigivco	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	910,02
290	Podoljani	Type as BGP307 LED84-4S/730 II DM11 D9 48/60S	515,47
291	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	910,02
292	Bašigovci	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	687,29
293	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	350,01
294	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1050,02

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Ordinal No.	Street name	Lighting source type with built in dimming device	(Em2) - Total standardized annual consumption
			(kWh/annually)
295	Bašigovci	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	210,00
296	Vrnojevići donji	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	1056,39
297	regionalni put R455a	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	10563,88
298	Toplička	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	1288,67
299	Toplička	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	1460,49
300	Toplička	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	515,47
301	3. ulica	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1260,03
302	3. ulica	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	343,64
303	Stara pruga	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	773,20
304	Stara pruga	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	700,02
305	regionalni put R455a	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	986,39
306	regionalni put R455a	Type as BGP283 LED120-4S/730 II DN10 D9 48/60S	483,65
307	Živinički sokolovi	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	986,39
308	Partizanske	Type as BGP282 LED90-4S/730 II DN10 D9 48/60S	3353,71
309	Živinički sokolovi	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	601,38
310	Partizanska	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	1546,40
311	Partizanska	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	1546,40
312	Partizanska	Type as BGP283 LE130-4S/730 II DN10 D9 48/60S	6866,52
313	Partizanska	Type as BGP307 LED40-4S/730 II DN10 D9 48/60S	1030,93
314	Partizanska	Type as BGP307 LED45-4S/730 II DN10 D9 48/60S	1746,86
315	Živinički sokolovi	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	910,02
316	Živinički sokolovi	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1190,03

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Ordinal No.	Street name	Lighting source type with built in dimming device	(Em2) - Total standardized annual consumption
			(kWh/annually)
317	regionalni put R455a	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	13204,85
318	Modračka	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1260,03
319	regionalni put R455a	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	6338,33
320	regionalni put R455a	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	4753,75
321	Barice	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1540,04
322	regionalni put R455a	Type as BGP283 LE130-4S/730 II DM10 D9 48/60S	5546,04
323	Barice	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	630,01
324	Barice	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1540,04
325	igrališče (Barice)	Type as BVP125 LED80-4S/740 OFA52	840,02
326	Otawa	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1960,04
327	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	910,02
328	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1400,03
329	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	980,02
330	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1470,03
331	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	980,02
332	Kovači	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	210,00
333	Podgajevi	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	910,02
334	magistralni put M18	Type as BGP283 LE130-4S/730 II DN10 D9 48/60S	6602,42
335	Šahići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1890,04
336	Đurđevik	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	3570,08
337	Đurđevik	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1400,03
338	Živčići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	560,01

Ordinal No.	Street name	Lighting source type with built in dimming device	(Em2) - Total standardized annual consumption
			(kWh/annually)
339	Živčići	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	1260,03
340	Podgaj	Type as BGP307 LED30-4S/730 II DN10 D9 48/60S	700,02
Total (kWh/annually)			693968,54
Lighting sources (pcs)			6802
Specific annual consumption (kWh/per lighting source annually)			102,02

Table 14: Total electricity consumption for public lighting after applying measures with LED lighting and autonomous dimmer

9.2.2 Replacement of existing lamps with LED lamps with a possibility of dimming – where dimming is possible and will not have any effect on functionality and safety with built in central technical surveillance

Building technical surveillance known as "telemangement" is an automatized digital management system consisting of few subsystems. Telemangement is a system which provides remote diagnostics, collecting and processing data for each lamp or a full circle of lamps (exp. to 200 lamps), as use of the same ones with purpose of further regulation (turning lamps on/off, dimming and other). Telemangement provides malfunction detection on a lamp, powering problems and etc., two-way communication between a lamp and management module where exists a feedback on a particular lamp status. A system consists of 3 main elements:

- gateway,
- controller,
- management software, recently "Cloud".

Remote management and control system of public lighting (telemangement) is conceived as a network system with a few command levels. User interface is accessible using mobile phone with GPRS connection and correct IP address, also using Internet accessing on a correct Web address and registration (WAN or LAN address). Server has an applying software in charge of whole management system, collecting, analyzing and processing data. From this management centre is possible to simultaneously manage more public lighting systems using segment controllers which is most commonly found on poles. Communication is two-way operative and it is done through TCP/IP protocol (GPS, GPRS, Edge, 3G, DSČ, ADSL, technologies, as existing LAN). This system presents general system "Smart city" in which is possible not to only control every lamp and consumption but to also collect remaining informations as number of traffic participants based on regulating traffic lights and other traffic electronic signs and other. Image 60, Image 61, Image 54 and Image 62 show an interface overview, using software with possibilities and settings.

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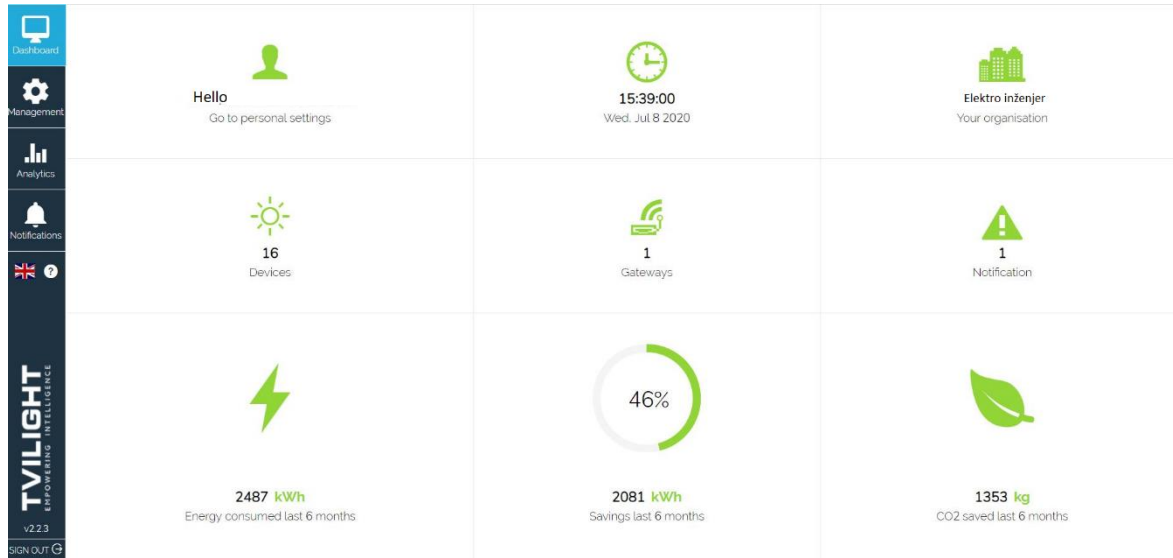


Image 57: Software interface overview



Image 58: Conducting analysis for electricity consumption example

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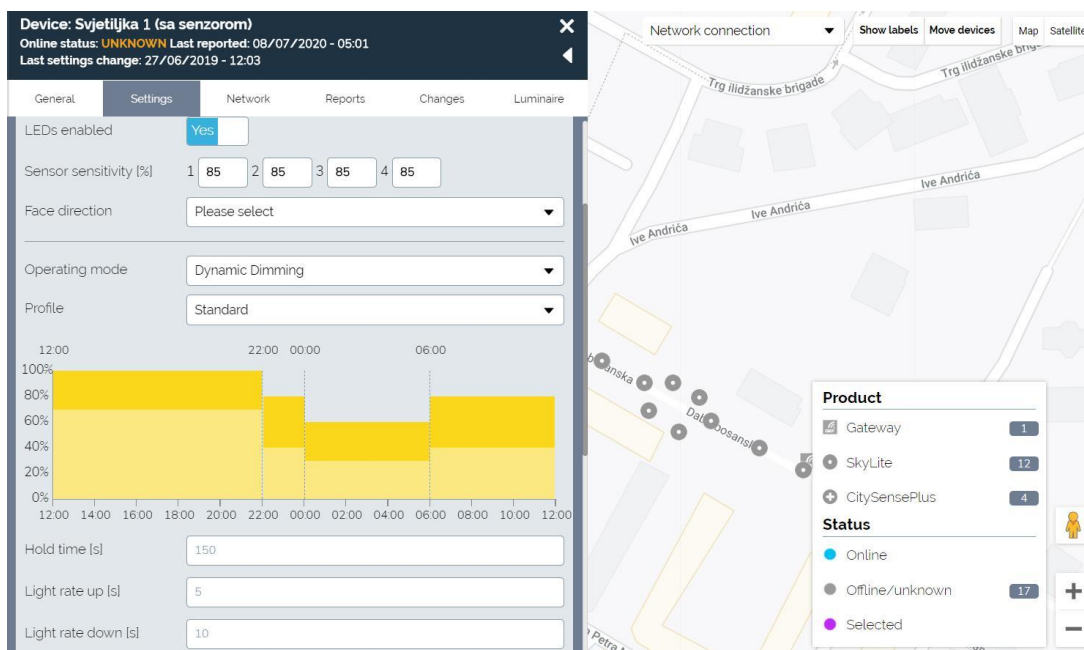


Image 59: Software settings example

For electricity consumption budget by applying replacement measures of existing lamps with LED lamps with a possibility of dimming – where dimming is possible and will not have any effect on functionality and safety with built in technical surveillance is an applied practice system. Standardized annual electricity consumption was made by:

$$E_{m3} = E_{m1} * k_{m3} \quad (8.)$$

where the following is:

E_{m3} – standardized annual electricity consumption for considered M2 – measure 2 (kWh/annually);

E_{m1} – standardized annual electricity consumption from M1 – measure 1 (kWh/annually);

k_{m3} – coefficient applied from winter and summer period practice – 0,374

Table 15 gives a description of a decision with automatized lighting way of work. Electricitiesavings move up to 40% - achieved by combination of 3 mentioned principles:

1. maintaining constant luminous flux installation level – savings up to 10%,
2. lighting power source regulation – savings up to 25%,
3. regulation depends on traffic density – savings up to 40%.

Measure name	Quantity	Wireless	Control room operable	(Em3) - Total standardized annual consumption
Telemangement system installation	set	YES	YES - Cloud	559773,92
Total (kWh/annually)				559773,92
Lighting sources (pcs)				6802
Specific annual consumption (kWh/per lighting source annually)				82,30

Table 15: Total electricity consumption for public lighting after implementing measures with technical surveillance

10 ANALYSIS OF ENERGY AND ECONOMIC EFFECTS OF THE SUGGESTED MEASURES

10.1 Quantitative analysis of energy and economizing

In this chapter, an analysis of the economic savings of the measures suggested in the previous chapter is performed.

10.1.1 Energy savings analysis

10.1.1.1 Analysis of energy savings by replacing existing lighting with LED

The calculation of electricity that would be needed after the implementation of this measure was performed, and the results are found in table 16 for each individual roadway. The annual number of working hours is 4100 according to the standard BAS CEN / TR 13201-1: 2016.

Ordinal No.	Street Name	(Em) - Total standardized annual consumption	(Em1) - Total standardized annual consumption	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
1	igralište Tupkovići 800m ²	7072,50	1623,60	5448,90	6	908,15
2	Tupkovići Gornji	16266,75	2074,60	14192,15	23	617,05
3	Tupkovići Gornji	14852,25	1532,58	13319,67	21	634,27
4	Tupkovići Gornji Čauševići	12730,50	1313,64	11416,86	18	634,27
5	Košare	24046,50	2481,32	21565,18	34	634,27
6	Tupkovići-Mujčinovići	6365,25	656,82	5708,43	9	634,27
7	Tupkovići-Mujčinovići	11316,00	1443,20	9872,80	16	617,05
8	Tupkovići Donji	23339,25	2408,34	20930,91	33	634,27
9	Tupkovići-Ćasuri	12023,25	1240,66	10782,59	17	634,27
10	Tupkovići-Trojan	23339,25	2976,60	20362,65	33	617,05
11	Tupkovići-Trojan	4950,75	510,86	4439,89	7	634,27
12	igralište Tupkovići-Trojan 800m ²	7072,50	1623,60	5448,90	6	908,15
13	Tupkovići- Trojan	16974,00	1751,52	15222,48	24	634,27
14	Gračanica	14852,25	3185,70	11666,55	21	555,55
15	Gračanica	4243,50	437,88	3805,62	6	634,27
16	Gračanica	10608,75	1094,70	9514,05	15	634,27
17	Gračanica	1414,50	145,96	1268,54	2	634,27

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Ordinal No.	Street Name	(Em) - Total standardized annual consumption	(Em1) - Total standardized annual consumption	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
18	Gračanica	19095,75	2435,40	16660,35	27	617,05
19	Gračanica	14852,25	1532,58	13319,67	21	634,27
20	Gračanica	27111,25	6978,20	20133,05	46	437,68
21	Gračanica	6483,13	802,78	5680,35	11	516,40
22	Gračanica	20510,25	2116,42	18393,83	29	634,27
23	Durići	9194,25	948,74	8245,51	13	634,27
24	Durići	19803,00	2043,44	17759,56	28	634,27
25	Vrtage	4243,50	437,88	3805,62	6	634,27
26	Gračanica	7779,75	1375,55	6404,20	11	582,20
27	Gračanica	14145,00	1459,60	12685,40	20	634,27
28	Gračanica	16974,00	1751,52	15222,48	24	634,27
29	Gračanica-Šljivići	26168,25	2700,26	23467,99	37	634,27
30	Gračanica-Šljivići	7072,50	729,80	6342,70	10	634,27
31	Gračanica-Zelenika	8487,00	875,76	7611,24	12	634,27
32	Gračanica-Zelenika	35362,50	7585,00	27777,50	50	555,55
33	Omladinskih radnih brigada	3536,25	758,50	2777,75	5	555,55
34	Omladinskih radnih brigada	29704,50	3065,16	26639,34	42	634,27
35	Omladinskih radnih brigada	4243,50	750,30	3493,20	6	582,20
36	Hornica	18388,50	1897,48	16491,02	26	634,27
37	Omladinskih radnih brigada	12730,50	2730,60	9999,90	18	555,55
38	stadion FK Metalac 5000m ²	5658,00	7216,00	-1558,00	8	-194,75
39	Šarenjak	15182,30	3357,08	11825,22	46	257,07
40	Hornica	10608,75	2275,50	8333,25	15	555,55
41	Omladinskih radnih brigada	8251,25	1824,50	6426,75	25	257,07
42	Maline-M18	3536,25	364,90	3171,35	5	634,27
43	Maline Spreča	4950,75	367,36	4583,39	7	654,77
44	Strašanj-M18	3536,25	625,25	2911,00	5	582,20
45	Strašanj	10231,55	2796,20	7435,35	31	239,85
46	Strašanj	17492,65	3867,94	13624,71	53	257,07
47	Strašanj	2946,88	364,90	2581,98	5	516,40
48	Strašanj igralište 800m ²	4715,00	1082,40	3632,60	4	908,15
49	Turijanci	2121,75	455,10	1666,65	3	555,55

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY
EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

Ordinal No.	Street Name	(Em) - Total standardized annual consumption	(Em1) - Total standardized annual consumption	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
50	Hadžići	4950,75	1061,90	3888,85	7	555,55
51	Nova cesta	13437,75	2882,30	10555,45	19	555,55
52	Luke	21924,75	2262,38	19662,37	31	634,27
53	Hadžići	14145,00	4428,00	9717,00	20	485,85
54	Djedovača	9901,50	1021,72	8879,78	14	634,27
55	Djedovača	10019,38	1240,66	8778,72	17	516,40
56	Prijeki put	3630,55	802,78	2827,77	11	257,07
57	Gložik	13437,75	1713,80	11723,95	19	617,05
58	Gložik	7779,75	802,78	6976,97	11	634,27
59	Hadžići	17681,25	5535,00	12146,25	25	485,85
60	Dubrave Donje	7779,75	802,78	6976,97	11	634,27
61	Prijeki put	9194,25	948,74	8245,51	13	634,27
62	Hadžići	8487,00	1820,40	6666,60	12	555,55
63	Dubrave Donje	12730,50	1313,64	11416,86	18	634,27
64	prostor oko Crkve sv. Ane	1980,30	437,88	1542,42	6	257,07
65	Dubravaska	16974,00	3640,80	13333,20	24	555,55
66	Dubravaska	24753,75	5309,50	19444,25	35	555,55
67	Višća	7072,50	1517,00	5555,50	10	555,55
68	Višća	39606,00	4086,88	35519,12	56	634,27
69	igralište Višća 800m ²	7072,50	1623,60	5448,90	6	908,15
70	regionalni put R469	4243,50	875,35	3368,15	7	481,16
71	Višća Donja	36069,75	3721,98	32347,77	51	634,27
72	Višća Donja	38191,50	3940,92	34250,58	54	634,27
73	Višća Donja	16266,75	2074,60	14192,15	23	617,05
74	Kupjerusi	19803,00	1469,44	18333,56	28	654,77
75	Kupjerusi-poligon	7072,50	1156,20	5916,30	6	986,05
76	Smajići	9901,50	734,72	9166,78	14	654,77
77	Bajrami	11316,00	839,68	10476,32	16	654,77
78	Kupjerusi-Taletovići	18388,50	1364,48	17024,02	26	654,77
79	Dubravaska	18860,00	2427,20	16432,80	16	1027,05
80	Dubravaska	2829,00	209,92	2619,08	4	654,77
81	Dubravaska C	8487,00	875,76	7611,24	12	634,27
82	Sjever	12211,85	3640,80	8571,05	37	231,65
83	Sjever	10608,75	787,20	9821,55	15	654,77
84	Hadžići	12730,50	3985,20	8745,30	18	485,85

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY
EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

Ordinal No.	Street Name	(Em) - Total standardized annual consumption	(Em1) - Total standardized annual consumption	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
85	Hadžići	20510,25	4399,30	16110,95	29	555,55
86	Hadžići	9901,50	1021,72	8879,78	14	634,27
87	regionalni put R469	13437,75	2882,30	10555,45	19	555,55
88	regionalni put R469	9194,25	1972,10	7222,15	13	555,55
89	Begići	660,10	145,96	514,14	2	257,07
90	Delići	8581,30	1897,48	6683,82	26	257,07
91	Kadrići	10561,60	1679,36	8882,24	32	277,57
92	Kadrići	7661,88	682,24	6979,64	13	536,90
93	igralište Kadrići 800m ²	18860,00	4329,60	14530,40	16	908,15
94	Kadrići	7921,20	1751,52	6169,68	24	257,07
95	Bajrići	7591,15	1678,54	5912,61	23	257,07
96	Bajrići	10891,65	2408,34	8483,31	33	257,07
97	Kadirići	6931,05	1532,58	5398,47	21	257,07
98	Krzevići	7921,20	1751,52	6169,68	24	257,07
99	Ciljuge	5658,00	721,60	4936,40	8	617,05
100	Ciljuge	31826,25	3284,10	28542,15	45	634,27
101	Ciljuge	2829,00	360,80	2468,20	4	617,05
102	Ciljuge	8487,00	1082,40	7404,60	12	617,05
103	Toplička	3300,50	729,80	2570,70	10	257,07
104	Toplička	3536,25	364,90	3171,35	5	634,27
105	Lukavica Donja	17681,25	1824,50	15856,75	25	634,27
106	Lukavica Donja	18388,50	1897,48	16491,02	26	634,27
107	Lukavica Donja	24753,75	2554,30	22199,45	35	634,27
108	Lukavica Donja	12730,50	2730,60	9999,90	18	555,55
109	Lukavica Donja	14852,25	1532,58	13319,67	21	634,27
110	Lukavica Donja	25461,00	5461,20	19999,80	36	555,55
111	Lukavica Gornja	9901,50	1021,72	8879,78	14	634,27
112	Lukavica Gornja	15559,50	3337,40	12222,10	22	555,55
113	Lukavica Gornja	13437,75	1386,62	12051,13	19	634,27
114	Lukavica Gornja	12730,50	1313,64	11416,86	18	634,27
115	Lukavica Gornja	25461,00	2627,28	22833,72	36	634,27
116	Lukavica Gornja	8487,00	875,76	7611,24	12	634,27
117	Lukavica Gornja	8487,00	1820,40	6666,60	12	555,55
118	Lukavica Gornja	18388,50	1897,48	16491,02	26	634,27
119	Lukavica Gornja	14852,25	1532,58	13319,67	21	634,27
120	Lukavica Gornja	8487,00	875,76	7611,24	12	634,27

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY
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CITY OF ŽIVINICE

Ordinal No.	Street Name	(Em) - Total standardized annual consumption	(Em1) - Total standardized annual consumption	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
121	Svojat	15559,50	3337,40	12222,10	22	555,55
122	Svojat	21217,50	2189,40	19028,10	30	634,27
123	Svojat	19095,75	1970,46	17125,29	27	634,27
124	Svojat	12730,50	1313,64	11416,86	18	634,27
125	Svojat	16266,75	4102,05	12164,70	23	528,90
126	Svojat	25461,00	3247,20	22213,80	36	617,05
127	igralište Svojat 800m ²	2829,00	1082,40	1746,60	4	436,65
128	Zelenika-Krivača	15559,50	1605,56	13953,94	22	634,27
129	Zelenika	4950,75	1061,90	3888,85	7	555,55
130	Zelenika	14145,00	1459,60	12685,40	20	634,27
131	Zelenika	13437,75	1386,62	12051,13	19	634,27
132	Livada	14852,25	1102,08	13750,17	21	654,77
133	Podoljani	12023,25	2578,90	9444,35	17	555,55
134	Donja Lukavica	9194,25	682,24	8512,01	13	654,77
135	Donja Lukavica	15559,50	3337,40	12222,10	22	555,55
136	Donja Lukavica	4950,75	367,36	4583,39	7	654,77
137	Bašigovci	21217,50	2189,40	19028,10	30	634,27
138	regionalni put R469	41727,75	15723,50	26004,25	59	440,75
139	Pasci donji	26875,50	3427,60	23447,90	38	617,05
140	1. ulica	8487,00	3198,00	5289,00	12	440,75
141	1. ulica	9901,50	4764,20	5137,30	14	366,95
142	Zlatnih ljiljana	21924,75	2986,85	18937,90	31	610,90
143	parking(Bosanski kulturni centar)	7779,75	2119,70	5660,05	11	514,55
144	25. Novembar	6365,25	1992,60	4372,65	9	485,85
145	25. Novembar	8251,25	3099,60	5151,65	14	367,98
146	parking supermarketa	2357,50	770,80	1586,70	4	396,68
147	parking površine cca 600m	4715,00	1541,60	3173,40	8	396,68
148	Gradski park konjuh (25. Novembar)	4950,75	1348,90	3601,85	7	514,55
149	Prvi maj	9194,25	2505,10	6689,15	13	514,55
150	Školska	707,25	151,70	555,55	1	555,55
151	Prva ulica	2829,00	606,80	2222,20	4	555,55
152	2. ulica (prostor oko zgrade)	5658,00	1541,60	4116,40	8	514,55
153	Alije Izetbegovića	3536,25	1558,00	1978,25	5	395,65

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY
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CITY OF ŽIVINICE

Ordinal No.	Street Name	(Em) - Total standardized annual consumption	(Em1) - Total standardized annual consumption	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
154	parking(Meše Selimovića)	17681,25	3997,50	13683,75	15	912,25
155	Oslobođenja	7779,75	1375,55	6404,20	11	582,20
156	park(Ulica Oslobođenja)	7779,75	2119,70	5660,05	11	514,55
157	parking(Ulica Oslobođenja)	4243,50	1156,20	3087,30	6	514,55
158	Gradski park Živinice(Alije Izetbegovića)	9901,50	2697,80	7203,70	14	514,55
159	ulica iza općine(Alije Izetbegovića)	2829,00	500,20	2328,80	4	582,20
160	parking općine	1178,75	192,70	986,05	1	986,05
161	Šetnica iza općine	5658,00	1541,60	4116,40	8	514,55
162	Pašage Gocića	12730,50	2730,60	9999,90	18	555,55
163	Patriotske lige	5658,00	1771,20	3886,80	8	485,85
164	Željeznička	707,25	151,70	555,55	1	555,55
165	XVI muslimanske brigade	5658,00	2492,80	3165,20	8	395,65
166	Rudarska	7779,75	1668,70	6111,05	11	555,55
167	Rudarska	2121,75	455,10	1666,65	3	555,55
168	Rudarska	589,38	311,60	277,78	1	277,78
169	Živiničkih brigada	4950,75	1061,90	3888,85	7	555,55
170	Civilnih žrtava rata	4243,50	750,30	3493,20	6	582,20
171	Dubravaska(naselje uz r469)	7072,50	2665,00	4407,50	10	440,75
172	regionalni put R469	7779,75	2435,40	5344,35	11	485,85
173	Bosanska	139328,25	24634,85	114693,40	197	582,20
174	Jezero	16974,00	3001,20	13972,80	24	582,20
175	Jezero	19803,00	3501,40	16301,60	28	582,20
176	Jezero	2357,50	606,80	1750,70	4	437,68
177	Jezero	4243,50	910,20	3333,30	6	555,55
178	Jezero	3536,25	758,50	2777,75	5	555,55
179	1. Mart	22632,00	4001,60	18630,40	32	582,20
180	1. Mart	3536,25	625,25	2911,00	5	582,20
181	1. Mart	2121,75	455,10	1666,65	3	555,55
182	Sadnice	11316,00	5444,80	5871,20	16	366,95
183	Toplička	7072,50	1250,50	5822,00	10	582,20
184	Toplička	4950,75	1865,50	3085,25	7	440,75

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CITY OF ŽIVINICE

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		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
185	regionalni put R469	8487,00	4083,60	4403,40	12	366,95
186	1. ulica	5658,00	2033,60	3624,40	8	453,05
187	regionalni put R455a	10373,00	1984,40	8388,60	22	381,30
188	Poljice	6601,00	1262,80	5338,20	14	381,30
189	Klopići	4243,50	811,80	3431,70	9	381,30
190	Klopići	1886,00	360,80	1525,20	4	381,30
191	Klopići	5658,00	3050,40	2607,60	12	217,30
192	regionalni put R455a	943,00	180,40	762,60	2	381,30
193	Priluk	35362,50	19065,00	16297,50	75	217,30
194	regionalni put R455a	10844,50	2074,60	8769,90	23	381,30
195	Priluk	8015,50	1533,40	6482,10	17	381,30
196	Priluk	15088,00	8528,00	6560,00	32	205,00
197	regionalni put R455a	3300,50	631,40	2669,10	7	381,30
198	Omići	7544,00	4264,00	3280,00	16	205,00
199	regionalni put R455a	3300,50	1061,90	2238,60	7	319,80
200	Omerkići	10373,00	6855,20	3517,80	22	159,90
201	R455a	7544,00	2427,20	5116,80	16	319,80
202	Alagići	5186,50	992,20	4194,30	11	381,30
203	Alagići	12259,00	2345,20	9913,80	26	381,30
204	Šehići	19803,00	3788,40	16014,60	42	381,30
205	Šehići	20746,00	3968,80	16777,20	44	381,30
206	Šehići	7544,00	1443,20	6100,80	16	381,30
207	Šerići	10373,00	1984,40	8388,60	22	381,30
208	Šerići	18860,00	12464,00	6396,00	40	159,90
209	regionalni put R455a	3772,00	1213,60	2558,40	8	319,80
210	Šerići	4715,00	3116,00	1599,00	10	159,90
211	regionalni put R455a	8487,00	1623,60	6863,40	18	381,30
212	Omerkići	2357,50	1353,00	1004,50	5	200,90
213	igralište(Omerkići)	4715,00	3116,00	1599,00	10	159,90
214	regionalni put R455a	6129,50	1172,60	4956,90	13	381,30
215	Šerići	30647,50	20254,00	10393,50	65	159,90
216	regionalni put R455a	7072,50	1353,00	5719,50	15	381,30

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY
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CITY OF ŽIVINICE

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		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
217	Šerići	24046,50	4600,20	19446,30	51	381,30
218	Šerići	6129,50	3304,60	2824,90	13	217,30
219	regionalni put R455a	14145,00	7626,00	6519,00	30	217,30
220	regionalni put R455a	4243,50	811,80	3431,70	9	381,30
221	Suha	29704,50	5682,60	24021,90	63	381,30
222	Suha	29704,50	16789,50	12915,00	63	205,00
223	regionalni put R455a	3772,00	721,60	3050,40	8	381,30
224	Suha	15088,00	2886,40	12201,60	32	381,30
225	Suha	17917,00	3427,60	14489,40	38	381,30
226	Đulići	12259,00	2255,00	10004,00	25	400,16
227	Đulići	2829,00	541,20	2287,80	6	381,30
228	Barice	10844,50	2074,60	8769,90	23	381,30
229	Atlić mahala	21689,00	6978,20	14710,80	46	319,80
230	Jablanica	4243,50	811,80	3431,70	9	381,30
231	Jablanica	11316,00	2164,80	9151,20	24	381,30
232	Tadići	4715,00	902,00	3813,00	10	381,30
233	Tadići	11787,50	2255,00	9532,50	25	381,30
234	Živinice Gornje	8487,00	1623,60	6863,40	18	381,30
235	Živinice Gornje	3772,00	1213,60	2558,40	8	319,80
236	Kopjevići	6601,00	1262,80	5338,20	14	381,30
237	Kopjevići	17445,50	3337,40	14108,10	37	381,30
238	Grabik	10373,00	1984,40	8388,60	22	381,30
239	Petrovići	8958,50	1713,80	7244,70	19	381,30
240	Petrovići	8487,00	1623,60	6863,40	18	381,30
241	Šišići	19803,00	3788,40	16014,60	42	381,30
242	Šišići	4715,00	902,00	3813,00	10	381,30
243	Adići	10373,00	1984,40	8388,60	22	381,30
244	Adići	8958,50	1713,80	7244,70	19	381,30
245	Lug	3772,00	721,60	3050,40	8	381,30
246	Lug	5658,00	4083,60	1574,40	12	131,20
247	magistralni put M18	4715,00	2542,00	2173,00	10	217,30
248	Đurđevik	9901,50	2626,05	7275,45	21	346,45
249	Đurđevik	25932,50	8343,50	17589,00	55	319,80
250	Gostelja	11316,00	2164,80	9151,20	24	381,30
251	Gostelja	9901,50	1894,20	8007,30	21	381,30

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CITY OF ŽIVINICE

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		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
252	Musići	23103,50	4419,80	18683,70	49	381,30
253	Musići	14145,00	2706,00	11439,00	30	381,30
254	Gostelja	8487,00	2250,90	6236,10	18	346,45
255	Golubinjak	25461,00	4870,80	20590,20	54	381,30
256	Nukići	31119,00	17589,00	13530,00	66	205,00
257	regionalni put R469	11316,00	3001,20	8314,80	24	346,45
258	Živiničke ose	22160,50	11947,40	10213,10	47	217,30
259	Živiničke ose	25083,80	11529,20	13554,60	76	178,35
260	Živiničke ose	7921,20	2164,80	5756,40	24	239,85
261	Gostelja	13202,00	2525,60	10676,40	28	381,30
262	Golubinjak	14616,50	2796,20	11820,30	31	381,30
263	Golubinjak	15088,00	12726,40	2361,60	32	73,80
264	regionalni put R469	17917,00	3427,60	14489,40	38	381,30
265	Donja Višća	9901,50	1894,20	8007,30	21	381,30
266	Donja Višća	7072,50	5965,50	1107,00	15	73,80
267	regionalni put R469	3772,00	721,60	3050,40	8	381,30
268	Šišići	33476,50	6404,20	27072,30	71	381,30
269	Šišići	15088,00	2886,40	12201,60	32	381,30
270	Gostelja	2829,00	1599,00	1230,00	6	205,00
271	magistralni put M18	3772,00	1000,40	2771,60	8	346,45
272	Stara pruga	35362,50	9378,75	25983,75	75	346,45
273	Bare	4243,50	811,80	3431,70	9	381,30
274	Kovači	14616,50	2796,20	11820,30	31	381,30
275	Kovači	4715,00	902,00	3813,00	10	381,30
276	Kovači	17917,00	3427,60	14489,40	38	381,30
277	Kovači	16031,00	3066,80	12964,20	34	381,30
278	Kovači	8015,50	1533,40	6482,10	17	381,30
279	Kovači	6129,50	1172,60	4956,90	13	381,30
280	Mujići	7544,00	1443,20	6100,80	16	381,30
281	Bašigovci	12730,50	2435,40	10295,10	27	381,30
282	Bašigovci	3772,00	721,60	3050,40	8	381,30
283	Bašigovci	12730,50	2435,40	10295,10	27	381,30
284	Bašigovci	9901,50	1894,20	8007,30	21	381,30
285	Bašigovci	6601,00	3099,60	3501,40	14	250,10
286	Bašigivco	11316,00	2164,80	9151,20	24	381,30

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Ordinal No.	Street Name	(Em) - Total standardized annual consumption	(Em1) - Total standardized annual consumption	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
287	Bašigivco	6601,00	1262,80	5338,20	14	381,30
288	Bašigivco	4243,50	811,80	3431,70	9	381,30
289	Bašigivco	6129,50	1172,60	4956,90	13	381,30
290	Podoljani	1414,50	664,20	750,30	3	250,10
291	Bašigovci	6129,50	1172,60	4956,90	13	381,30
292	Bašigovci	3772,00	885,60	2886,40	8	360,80
293	Bašigovci	2357,50	451,00	1906,50	5	381,30
294	Bašigovci	7072,50	1353,00	5719,50	15	381,30
295	Bašigovci	1414,50	270,60	1143,90	3	381,30
296	Vrnojevići donji	1886,00	1361,20	524,80	4	131,20
297	regionalni put R455a	28290,00	13612,00	14678,00	40	366,95
298	Toplička	10608,75	1660,50	8948,25	15	596,55
299	Toplička	12023,25	1881,90	10141,35	17	596,55
300	Toplička	4243,50	664,20	3579,30	6	596,55
301	3. ulica	12730,50	1623,60	11106,90	18	617,05
302	3. ulica	1320,20	442,80	877,40	4	219,35
303	Stara pruga	6365,25	996,30	5368,95	9	596,55
304	Stara pruga	7072,50	902,00	6170,50	10	617,05
305	regionalni put R455a	3536,25	1271,00	2265,25	5	453,05
306	regionalni put R455a	1414,50	623,20	791,30	2	395,65
307	Živinički sokolovi	3536,25	1271,00	2265,25	5	453,05
308	Partizanske	12023,25	4321,40	7701,85	17	453,05
309	Živinički sokolovi	4950,75	774,90	4175,85	7	596,55
310	Partizanska	12730,50	1992,60	10737,90	18	596,55
311	Partizanska	12730,50	1992,60	10737,90	18	596,55
312	Partizanska	18388,50	8847,80	9540,70	26	366,95
313	Partizanska	8487,00	1328,40	7158,60	12	596,55
314	Partizanska	12730,50	2250,90	10479,60	18	582,20
315	Živinički sokolovi	6129,50	1172,60	4956,90	13	381,30
316	Živinički sokolovi	8015,50	1533,40	6482,10	17	381,30
317	regionalni put R455a	35362,50	17015,00	18347,50	50	366,95
318	Modračka	12730,50	1623,60	11106,90	18	617,05
319	regionalni put R455a	16974,00	8167,20	8806,80	24	366,95
320	regionalni put R455a	12730,50	6125,40	6605,10	18	366,95

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Ordinal No.	Street Name	(Em) - Total standardized annual consumption	(Em1) - Total standardized annual consumption	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)			
321	Barice	15559,50	1984,40	13575,10	22	617,05
322	regionalni put R455a	14852,25	7146,30	7705,95	21	366,95
323	Barice	6365,25	811,80	5553,45	9	617,05
324	Barice	10373,00	1984,40	8388,60	22	381,30
325	igrališze (Barice)	1886,00	1082,40	803,60	4	200,90
326	Otawa	13202,00	2525,60	10676,40	28	381,30
327	Podgaj	6129,50	1172,60	4956,90	13	381,30
328	Podgaj	9430,00	1804,00	7626,00	20	381,30
329	Podgaj	6601,00	1262,80	5338,20	14	381,30
330	Podgaj	9901,50	1894,20	8007,30	21	381,30
331	Podgaj	6601,00	1262,80	5338,20	14	381,30
332	Kovači	1414,50	270,60	1143,90	3	381,30
333	Podgajevi	6129,50	1172,60	4956,90	13	381,30
334	magistralni put M18	11787,50	8507,50	3280,00	25	131,20
335	Šahići	12730,50	2435,40	10295,10	27	381,30
336	Đurđevik	24046,50	4600,20	19446,30	51	381,30
337	Đurđevik	9430,00	1804,00	7626,00	20	381,30
338	Živčići	3772,00	721,60	3050,40	8	381,30
339	Živčići	8487,00	1623,60	6863,40	18	381,30
340	Podgaj	4715,00	902,00	3813,00	10	381,30
TOTAL		3968780,53	894207,54	3074572,99	6802,00	452,01

Table 16: Energy savings for lighting after replacing existing lighting with LED

10.1.1.2 Energy savings analysis by replacing existing lamps with dimmable LED lamps - where dimming is possible and will not affect functionality and safety

The calculation of electricity that would be needed after the implementation of this measure was performed, and the results are found in table 17.

Ordinal No.	Street name	(Em1) - Total standardized annual consumption	(Em2) - Total standardized annual consumption	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)			
1	igralište Tupkovići 800m ²	1623,60	1260,03	363,57	6	60,60
2	Tupkovići Gornji	2074,60	1610,04	464,56	23	20,20
3	Tupkovići Gornji	1532,58	1189,39	343,19	21	16,34

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Ordinal No.	Street name	(Em1) - Total standardized annual consumption	(Em2) - Total standardized annual consumption	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
4	Tupkovići Gornji Čauševići	1313,64	1019,48	294,16	18	16,34
5	Košare	2481,32	1925,68	555,64	34	16,34
6	Tupkovići-Mujčinovići	656,82	509,74	147,08	9	16,34
7	Tupkovići-Mujčinovići	1443,20	1120,03	323,17	16	20,20
8	Tupkovići Donji	2408,34	1869,04	539,30	33	16,34
9	Tupkovići-Časuri	1240,66	962,84	277,82	17	16,34
10	Tupkovići-Trojan	2976,60	2310,05	666,55	33	20,20
11	Tupkovići-Trojan	510,86	396,46	114,40	7	16,34
12	igralište Tupkovići-Trojan 800m ²	1623,60	1260,03	363,57	6	60,60
13	Tupkovići- Trojan	1751,52	1359,30	392,22	24	16,34
14	Gračanica	3185,70	2472,33	713,37	21	33,97
15	Gračanica	437,88	339,83	98,05	6	16,34
16	Gračanica	1094,70	849,56	245,14	15	16,34
17	Gračanica	145,96	113,28	32,68	2	16,34
18	Gračanica	2435,40	1890,04	545,36	27	20,20
19	Gračanica	1532,58	1189,39	343,19	21	16,34
20	Gračanica	6978,20	5415,58	1562,62	46	33,97
21	Gračanica	802,78	623,01	179,77	11	16,34
22	Gračanica	2116,42	1642,49	473,93	29	16,34
23	Durići	948,74	736,29	212,45	13	16,34
24	Durići	2043,44	1585,85	457,59	28	16,34
25	Vrtage	437,88	339,83	98,05	6	16,34
26	Gračanica	1375,55	1067,52	308,03	11	28,00
27	Gračanica	1459,60	1132,75	326,85	20	16,34
28	Gračanica	1751,52	1359,30	392,22	24	16,34
29	Gračanica-Šljivići	2700,26	2095,59	604,67	37	16,34
30	Gračanica-Šljivići	729,80	566,38	163,42	10	16,34
31	Gračanica-Zelenika	875,76	679,65	196,11	12	16,34
32	Gračanica-Zelenika	7585,00	5886,50	1698,50	50	33,97
33	Omladinskih radnih brigada	758,50	588,65	169,85	5	33,97
34	Omladinskih radnih brigada	3065,16	2378,78	686,38	42	16,34
35	Omladinskih radnih brigada	750,30	582,29	168,01	6	28,00
36	Hornica	1897,48	1472,58	424,90	26	16,34

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Ordinal No.	Street name	(Em1) - Total standardized annual consumption	(Em2) - Total standardized annual consumption	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
37	Omladinskih radnih brigada	2730,60	2119,14	611,46	18	33,97
38	stadion FK Metalac 5000m ²	7216,00	5600,13	1615,87	8	201,98
39	Šarenjak	3357,08	2605,33	751,75	46	16,34
40	Hornica	2275,50	1765,95	509,55	15	33,97
41	Omladinskih radnih brigada	1824,50	1415,94	408,56	25	16,34
42	Maline-M18	364,90	283,19	81,71	5	16,34
43	Maline Spreča	367,36	285,10	82,26	7	11,75
44	Strašanj-M18	625,25	485,24	140,01	5	28,00
45	Strašanj	2796,20	2170,05	626,15	31	20,20
46	Strašanj	3867,94	3001,80	866,14	53	16,34
47	Strašanj	364,90	283,19	81,71	5	16,34
48	Strašanj igralište 800m ²	1082,40	840,02	242,38	4	60,60
49	Turijanci	455,10	353,19	101,91	3	33,97
50	Hadžići	1061,90	824,11	237,79	7	33,97
51	Nova cesta	2882,30	2236,87	645,43	19	33,97
52	Luke	2262,38	1755,77	506,61	31	16,34
53	Hadžići	4428,00	3436,44	991,56	20	49,58
54	Djedovača	1021,72	792,93	228,79	14	16,34
55	Djedovača	1240,66	962,84	277,82	17	16,34
56	Prijeki put	802,78	623,01	179,77	11	16,34
57	Gložik	1713,80	1330,03	383,77	19	20,20
58	Gložik	802,78	623,01	179,77	11	16,34
59	Hadžići	5535,00	4295,55	1239,45	25	49,58
60	Dubrave Donje	802,78	623,01	179,77	11	16,34
61	Prijeki put	948,74	736,29	212,45	13	16,34
62	Hadžići	1820,40	1412,76	407,64	12	33,97
63	Dubrave Donje	1313,64	1019,48	294,16	18	16,34
64	prostor oko Crkve sv. Ane	437,88	339,83	98,05	6	16,34
65	Dubavska	3640,80	2825,52	815,28	24	33,97
66	Dubavska	5309,50	4120,55	1188,95	35	33,97
67	Višća	1517,00	1177,30	339,70	10	33,97
68	Višća	4086,88	3171,71	915,17	56	16,34
69	igralište Višća 800m ²	1623,60	1260,03	363,57	6	60,60
70	regionalni put R469	875,35	679,33	196,02	7	28,00
71	Višća Donja	3721,98	2888,52	833,46	51	16,34

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Ordinal No.	Street name	(Em1) - Total standardized annual consumption	(Em2) - Total standardized annual consumption	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
72	Višća Donja	3940,92	3058,43	882,49	54	16,34
73	Višća Donja	2074,60	1610,04	464,56	23	20,20
74	Kupjerusi	1469,44	1140,39	329,05	28	11,75
75	Kupjerusi-poligon	1156,20	897,29	258,91	6	43,15
76	Smajići	734,72	570,19	164,53	14	11,75
77	Bajrami	839,68	651,65	188,03	16	11,75
78	Kupjerusi-Taletovići	1364,48	1058,93	305,55	26	11,75
79	Dubravaska	2427,20	1883,68	543,52	16	33,97
80	Dubravaska	209,92	162,91	47,01	4	11,75
81	Dubravaska C	875,76	679,65	196,11	12	16,34
82	Sjever	3640,80	2825,52	815,28	37	22,03
83	Sjever	787,20	610,92	176,28	15	11,75
84	Hadžići	3985,20	3092,80	892,40	18	49,58
85	Hadžići	4399,30	3414,17	985,13	29	33,97
86	Hadžići	1021,72	792,93	228,79	14	16,34
87	regionalni put R469	2882,30	2236,87	645,43	19	33,97
88	regionalni put R469	1972,10	1530,49	441,61	13	33,97
89	Begići	145,96	113,28	32,68	2	16,34
90	Delići	1897,48	1472,58	424,90	26	16,34
91	Kadrići	1679,36	1303,30	376,06	32	11,75
92	Kadrići	682,24	529,47	152,77	13	11,75
93	igralište Kadrići 800m ²	4329,60	3360,08	969,52	16	60,60
94	Kadrići	1751,52	1359,30	392,22	24	16,34
95	Bajrići	1678,54	1302,67	375,87	23	16,34
96	Bajrići	2408,34	1869,04	539,30	33	16,34
97	Kadirići	1532,58	1189,39	343,19	21	16,34
98	Krzevići	1751,52	1359,30	392,22	24	16,34
99	Ciljuge	721,60	560,01	161,59	8	20,20
100	Ciljuge	3284,10	2548,69	735,41	45	16,34
101	Ciljuge	360,80	280,01	80,79	4	20,20
102	Ciljuge	1082,40	840,02	242,38	12	20,20
103	Toplička	729,80	566,38	163,42	10	16,34
104	Toplička	364,90	283,19	81,71	5	16,34
105	Lukavica Donja	1824,50	1415,94	408,56	25	16,34
106	Lukavica Donja	1897,48	1472,58	424,90	26	16,34
107	Lukavica Donja	2554,30	1982,32	571,98	35	16,34

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		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
108	Lukavica Donja	2730,60	2119,14	611,46	18	33,97
109	Lukavica Donja	1532,58	1189,39	343,19	21	16,34
110	Lukavica Donja	5461,20	4238,28	1222,92	36	33,97
111	Lukavica Gornja	1021,72	792,93	228,79	14	16,34
112	Lukavica Gornja	3337,40	2590,06	747,34	22	33,97
113	Lukavica Gornja	1386,62	1076,12	310,50	19	16,34
114	Lukavica Gornja	1313,64	1019,48	294,16	18	16,34
115	Lukavica Gornja	2627,28	2038,96	588,32	36	16,34
116	Lukavica Gornja	875,76	679,65	196,11	12	16,34
117	Lukavica Gornja	1820,40	1412,76	407,64	12	33,97
118	Lukavica Gornja	1897,48	1472,58	424,90	26	16,34
119	Lukavica Gornja	1532,58	1189,39	343,19	21	16,34
120	Lukavica Gornja	875,76	679,65	196,11	12	16,34
121	Svojat	3337,40	2590,06	747,34	22	33,97
122	Svojat	2189,40	1699,13	490,27	30	16,34
123	Svojat	1970,46	1529,22	441,24	27	16,34
124	Svojat	1313,64	1019,48	294,16	18	16,34
125	Svojat	4102,05	3183,48	918,57	23	39,94
126	Svojat	3247,20	2520,06	727,14	36	20,20
127	igralište Svojat 800m ²	1082,40	840,02	242,38	4	60,60
128	Zelenika-Krivača	1605,56	1246,03	359,53	22	16,34
129	Zelenika	1061,90	824,11	237,79	7	33,97
130	Zelenika	1459,60	1132,75	326,85	20	16,34
131	Zelenika	1386,62	1076,12	310,50	19	16,34
132	Livada	1102,08	855,29	246,79	21	11,75
133	Podoljani	2578,90	2001,41	577,49	17	33,97
134	Donja Lukavica	682,24	529,47	152,77	13	11,75
135	Donja Lukavica	3337,40	2590,06	747,34	22	33,97
136	Donja Lukavica	367,36	285,10	82,26	7	11,75
137	Bašigovci	2189,40	1699,13	490,27	30	16,34
138	regionalni put R469	15723,50	12202,55	3520,95	59	59,68
139	Pasci donji	3427,60	2660,06	767,54	38	20,20
140	1. ulica	3198,00	2481,88	716,12	12	59,68
141	1. ulica	4764,20	3697,36	1066,84	14	76,20
142	Zlatnih ljljana	2986,85	2318,01	668,84	31	21,58
143	parking(Bosanski kulturni centar)	2119,70	1645,04	474,66	11	43,15
144	25. Novembar	1992,60	1546,40	446,20	9	49,58

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		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
145	25. Novembar	3099,60	2405,51	694,09	14	49,58
146	parking supermarketa	770,80	598,20	172,60	4	43,15
147	parking površine cca 600m	1541,60	1196,39	345,21	8	43,15
148	Gradski park konjuh (25. Novembar)	1348,90	1046,84	302,06	7	43,15
149	Prvi maj	2505,10	1944,14	560,96	13	43,15
150	Školska	151,70	117,73	33,97	1	33,97
151	Prva ulica	606,80	470,92	135,88	4	33,97
152	2. ulica (prostor oko zgrade)	1541,60	1196,39	345,21	8	43,15
153	Alije Izetbegovića	1558,00	1209,12	348,88	5	69,78
154	parking(Meše Selimovića)	3997,50	3102,34	895,16	15	59,68
155	Oslobođenja	1375,55	1067,52	308,03	11	28,00
156	park(Ulica Oslobođenja)	2119,70	1645,04	474,66	11	43,15
157	parking(Ulica Oslobođenja)	1156,20	897,29	258,91	6	43,15
158	Gradski park Živinice(Alije Izetbegovića)	2697,80	2093,68	604,12	14	43,15
159	ulica iza općine(Alije Izetbegovića)	500,20	388,19	112,01	4	28,00
160	parking općine	192,70	149,55	43,15	1	43,15
161	Šetnica iza općine	1541,60	1196,39	345,21	8	43,15
162	Pašage Gocića	2730,60	2119,14	611,46	18	33,97
163	Patriotske lige	1771,20	1374,58	396,62	8	49,58
164	Željeznička	151,70	117,73	33,97	1	33,97
165	XVI muslimanske brigade	2492,80	1934,59	558,21	8	69,78
166	Rudarska	1668,70	1295,03	373,67	11	33,97
167	Rudarska	455,10	353,19	101,91	3	33,97
168	Rudarska	311,60	241,82	69,78	1	69,78
169	Živiničkih brigada	1061,90	824,11	237,79	7	33,97
170	Civilnih žrtava rata	750,30	582,29	168,01	6	28,00
171	Dubravska(naselje uz r469)	2665,00	2068,23	596,77	10	59,68
172	regionalni put R469	2435,40	1890,04	545,36	11	49,58
173	Bosanska	24634,85	19118,39	5516,46	197	28,00

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Ordinal No.	Street name	(Em1) - Total standardized annual consumption	(Em2) - Total standardized annual consumption	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
174	Jezero	3001,20	2329,14	672,06	24	28,00
175	Jezero	3501,40	2717,33	784,07	28	28,00
176	Jezero	606,80	470,92	135,88	4	33,97
177	Jezero	910,20	706,38	203,82	6	33,97
178	Jezero	758,50	588,65	169,85	5	33,97
179	1. Mart	4001,60	3105,53	896,07	32	28,00
180	1. Mart	625,25	485,24	140,01	5	28,00
181	1. Mart	455,10	353,19	101,91	3	33,97
182	Sadnice	5444,80	4225,55	1219,25	16	76,20
183	Toplička	1250,50	970,48	280,02	10	28,00
184	Toplička	1865,50	1447,76	417,74	7	59,68
185	regionalni put R469	4083,60	3169,16	914,44	12	76,20
186	1. ulica	2033,60	1578,22	455,38	8	56,92
187	regionalni put R455a	1984,40	1540,04	444,36	22	20,20
188	Poljice	1262,80	980,02	282,78	14	20,20
189	Klopići	811,80	630,01	181,79	9	20,20
190	Klopići	360,80	280,01	80,79	4	20,20
191	Klopići	3050,40	2367,33	683,07	12	56,92
192	regionalni put R455a	180,40	140,00	40,40	2	20,20
193	Priluk	19065,00	14795,79	4269,21	75	56,92
194	regionalni put R455a	2074,60	1610,04	464,56	23	20,20
195	Priluk	1533,40	1190,03	343,37	17	20,20
196	Priluk	8528,00	6618,33	1909,67	32	59,68
197	regionalni put R455a	631,40	490,01	141,39	7	20,20
198	Omići	4264,00	3309,17	954,83	16	59,68
199	regionalni put R455a	1061,90	824,11	237,79	7	33,97
200	Omerkići	6855,20	5320,12	1535,08	22	69,78
201	R455a	2427,20	1883,68	543,52	16	33,97
202	Alagići	992,20	770,02	222,18	11	20,20
203	Alagići	2345,20	1820,04	525,16	26	20,20
204	Šehići	3788,40	2940,07	848,33	42	20,20
205	Šehići	3968,80	3080,07	888,73	44	20,20
206	Šehići	1443,20	1120,03	323,17	16	20,20
207	Šerići	1984,40	1540,04	444,36	22	20,20
208	Šerići	12464,00	9672,95	2791,05	40	69,78

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Ordinal No.	Street name	(Em1) - Total standardized annual consumption	(Em2) - Total standardized annual consumption	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
209	regionalni put R455a	1213,60	941,84	271,76	8	33,97
210	Šerići	3116,00	2418,24	697,76	10	69,78
211	regionalni put R455a	1623,60	1260,03	363,57	18	20,20
212	Omerkići	1353,00	1050,02	302,98	5	60,60
213	igralište(Omerkići)	3116,00	2418,24	697,76	10	69,78
214	regionalni put R455a	1172,60	910,02	262,58	13	20,20
215	Šerići	20254,00	15718,54	4535,46	65	69,78
216	regionalni put R455a	1353,00	1050,02	302,98	15	20,20
217	Šerići	4600,20	3570,08	1030,12	51	20,20
218	Šerići	3304,60	2564,60	740,00	13	56,92
219	regionalni put R455a	7626,00	5918,32	1707,68	30	56,92
220	regionalni put R455a	811,80	630,01	181,79	9	20,20
221	Suha	5682,60	4410,10	1272,50	63	20,20
222	Suha	16789,50	13029,84	3759,66	63	59,68
223	regionalni put R455a	721,60	560,01	161,59	8	20,20
224	Suha	2886,40	2240,05	646,35	32	20,20
225	Suha	3427,60	2660,06	767,54	38	20,20
226	Đulići	2255,00	1750,04	504,96	25	20,20
227	Đulići	541,20	420,01	121,19	6	20,20
228	Barice	2074,60	1610,04	464,56	23	20,20
229	Atlić mahala	6978,20	5415,58	1562,62	46	33,97
230	Jablanica	811,80	630,01	181,79	9	20,20
231	Jablanica	2164,80	1680,04	484,76	24	20,20
232	Tadići	902,00	700,02	201,98	10	20,20
233	Tadići	2255,00	1750,04	504,96	25	20,20
234	Živinice Gornje	1623,60	1260,03	363,57	18	20,20
235	Živinice Gornje	1213,60	941,84	271,76	8	33,97
236	Kopjevići	1262,80	980,02	282,78	14	20,20
237	Kopjevići	3337,40	2590,06	747,34	37	20,20
238	Grabik	1984,40	1540,04	444,36	22	20,20
239	Petrovići	1713,80	1330,03	383,77	19	20,20
240	Petrovići	1623,60	1260,03	363,57	18	20,20
241	Šišići	3788,40	2940,07	848,33	42	20,20
242	Šišići	902,00	700,02	201,98	10	20,20
243	Adići	1984,40	1540,04	444,36	22	20,20

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Ordinal No.	Street name	(Em1) -	(Em2) -	Annual savings	Quantity	Annual savings per lamp
		Total standardized annual consumption (kWh/annually)	Total standardized annual consumption (kWh/annually)			
244	Adići	1713,80	1330,03	383,77	19	20,20
245	Lug	721,60	560,01	161,59	8	20,20
246	Lug	4083,60	3169,16	914,44	12	76,20
247	magistralni put M18	2542,00	1972,77	569,23	10	56,92
248	Đurđevik	2626,05	2038,00	588,05	21	28,00
249	Đurđevik	8343,50	6475,15	1868,35	55	33,97
250	Gostelja	2164,80	1680,04	484,76	24	20,20
251	Gostelja	1894,20	1470,03	424,17	21	20,20
252	Musići	4419,80	3430,08	989,72	49	20,20
253	Musići	2706,00	2100,05	605,95	30	20,20
254	Gostelja	2250,90	1746,86	504,04	18	28,00
255	Golubinjak	4870,80	3780,09	1090,71	54	20,20
256	Nukići	17589,00	13650,31	3938,69	66	59,68
257	regionalni put R469	3001,20	2329,14	672,06	24	28,00
258	Živiničke ose	11947,40	9272,03	2675,37	47	56,92
259	Živiničke ose	11529,20	8947,48	2581,72	76	33,97
260	Živiničke ose	2164,80	1680,04	484,76	24	20,20
261	Gostelja	2525,60	1960,04	565,56	28	20,20
262	Golubinjak	2796,20	2170,05	626,15	31	20,20
263	Golubinjak	12726,40	9876,59	2849,81	32	89,06
264	regionalni put R469	3427,60	2660,06	767,54	38	20,20
265	Donja Višća	1894,20	1470,03	424,17	21	20,20
266	Donja Višća	5965,50	4629,65	1335,85	15	89,06
267	regionalni put R469	721,60	560,01	161,59	8	20,20
268	Šišići	6404,20	4970,11	1434,09	71	20,20
269	Šišići	2886,40	2240,05	646,35	32	20,20
270	Gostelja	1599,00	1240,94	358,06	6	59,68
271	magistralni put M18	1000,40	776,38	224,02	8	28,00
272	Stara pruga	9378,75	7278,58	2100,17	75	28,00
273	Bare	811,80	630,01	181,79	9	20,20
274	Kovači	2796,20	2170,05	626,15	31	20,20
275	Kovači	902,00	700,02	201,98	10	20,20
276	Kovači	3427,60	2660,06	767,54	38	20,20
277	Kovači	3066,80	2380,05	686,75	34	20,20
278	Kovači	1533,40	1190,03	343,37	17	20,20
279	Kovači	1172,60	910,02	262,58	13	20,20

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Ordinal No.	Street name	(Em1) -	(Em2) -	Annual savings	Quantity	Annual savings per lamp
		Total standardized annual consumption	Total standardized annual consumption			
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
280	Mujići	1443,20	1120,03	323,17	16	20,20
281	Bašigovci	2435,40	1890,04	545,36	27	20,20
282	Bašigovci	721,60	560,01	161,59	8	20,20
283	Bašigovci	2435,40	1890,04	545,36	27	20,20
284	Bašigovci	1894,20	1470,03	424,17	21	20,20
285	Bašigovci	3099,60	2405,51	694,09	14	49,58
286	Bašigovco	2164,80	1680,04	484,76	24	20,20
287	Bašigovco	1262,80	980,02	282,78	14	20,20
288	Bašigovco	811,80	630,01	181,79	9	20,20
289	Bašigovco	1172,60	910,02	262,58	13	20,20
290	Podoljani	664,20	515,47	148,73	3	49,58
291	Bašigovci	1172,60	910,02	262,58	13	20,20
292	Bašigovci	885,60	687,29	198,31	8	24,79
293	Bašigovci	451,00	350,01	100,99	5	20,20
294	Bašigovci	1353,00	1050,02	302,98	15	20,20
295	Bašigovci	270,60	210,00	60,60	3	20,20
296	Vrnojevići donji	1361,20	1056,39	304,81	4	76,20
297	regionalni put R455a	13612,00	10563,88	3048,12	40	76,20
298	Toplička	1660,50	1288,67	371,83	15	24,79
299	Toplička	1881,90	1460,49	421,41	17	24,79
300	Toplička	664,20	515,47	148,73	6	24,79
301	3. ulica	1623,60	1260,03	363,57	18	20,20
302	3. ulica	442,80	343,64	99,16	4	24,79
303	Stara pruga	996,30	773,20	223,10	9	24,79
304	Stara pruga	902,00	700,02	201,98	10	20,20
305	regionalni put R455a	1271,00	986,39	284,61	5	56,92
306	regionalni put R455a	623,20	483,65	139,55	2	69,78
307	Živinički sokolovi	1271,00	986,39	284,61	5	56,92
308	Partizanske	4321,40	3353,71	967,69	17	56,92
309	Živinički sokolovi	774,90	601,38	173,52	7	24,79
310	Partizanska	1992,60	1546,40	446,20	18	24,79
311	Partizanska	1992,60	1546,40	446,20	18	24,79
312	Partizanska	8847,80	6866,52	1981,28	26	76,20
313	Partizanska	1328,40	1030,93	297,47	12	24,79
314	Partizanska	2250,90	1746,86	504,04	18	28,00
315	Živinički sokolovi	1172,60	910,02	262,58	13	20,20
316	Živinički sokolovi	1533,40	1190,03	343,37	17	20,20

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Ordinal No.	Street name	(Em1) - Total standardized annual consumption	(Em2) - Total standardized annual consumption	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
317	regionalni put R455a	17015,00	13204,85	3810,15	50	76,20
318	Modračka	1623,60	1260,03	363,57	18	20,20
319	regionalni put R455a	8167,20	6338,33	1828,87	24	76,20
320	regionalni put R455a	6125,40	4753,75	1371,65	18	76,20
321	Barice	1984,40	1540,04	444,36	22	20,20
322	regionalni put R455a	7146,30	5546,04	1600,26	21	76,20
323	Barice	811,80	630,01	181,79	9	20,20
324	Barice	1984,40	1540,04	444,36	22	20,20
325	igrališče (Barice)	1082,40	840,02	242,38	4	60,60
326	Otawa	2525,60	1960,04	565,56	28	20,20
327	Podgaj	1172,60	910,02	262,58	13	20,20
328	Podgaj	1804,00	1400,03	403,97	20	20,20
329	Podgaj	1262,80	980,02	282,78	14	20,20
330	Podgaj	1894,20	1470,03	424,17	21	20,20
331	Podgaj	1262,80	980,02	282,78	14	20,20
332	Kovači	270,60	210,00	60,60	3	20,20
333	Podgajevi	1172,60	910,02	262,58	13	20,20
334	magistralni put M18	8507,50	6602,42	1905,08	25	76,20
335	Šahići	2435,40	1890,04	545,36	27	20,20
336	Đurđevik	4600,20	3570,08	1030,12	51	20,20
337	Đurđevik	1804,00	1400,03	403,97	20	20,20
338	Živčići	721,60	560,01	161,59	8	20,20
339	Živčići	1623,60	1260,03	363,57	18	20,20
340	Podgaj	902,00	700,02	201,98	10	20,20
TOTAL		894207,54	693968,54	200239,00	6802	29,44

Table 17: Energy savings for lighting after replacing existing LED lighting with Dynadimmer

10.1.1.3 Analysis of energy savings by replacing existing lamps with dimmable LED lamps - where dimming is possible and will not affect functionality and safety with the installation of central technical supervision

Table 18 shows the total realized electricity savings by installing a telemanagement systems

Measure name	(Em1) - Total standardized annual consumption	(Em3) - Total standardized annual consumption	Annual savings	Quantity	Annual savings per lamp
	(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
Installation of telemanagement system	3968780,53	559773,92	3409006,60	6802	501,18

Table 18: Calculation of potential electricity savings by installing a telemanagement system

10.1.2 Economic analysis

10.1.2.1 Analysis of economic savings of replacing existing lighting with LED

The calculation of electricity Expenses that would be after the implementation of this measure has been performed, and the results are found in table 19.

Ordinal No.	Street name	Expenses according to energy consumption Em	Expenses according to energy consumption Em1	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
1	igralište Tupkovići 800m ²	1468,96	337,22	1131,74	6	188,62
2	Tupkovići Gornji	3378,60	430,89	2947,71	23	128,16
3	Tupkovići Gornji	3084,81	318,32	2766,50	21	131,74
4	Tupkovići Gornji Čauševići	2644,12	272,84	2371,28	18	131,74
5	Košare	4994,46	515,37	4479,09	34	131,74
6	Tupkovići-Mujčinovići	1322,06	136,42	1185,64	9	131,74
7	Tupkovići-Mujčinovići	2350,33	299,75	2050,58	16	128,16
8	Tupkovići Donji	4847,56	500,21	4347,35	33	131,74
9	Tupkovići-Ćasuri	2497,23	257,69	2239,54	17	131,74
10	Tupkovići-Trojan	4847,56	618,24	4229,32	33	128,16
11	Tupkovići-Trojan	1028,27	106,11	922,17	7	131,74
12	igralište Tupkovići-Trojan 800m ²	1468,96	337,22	1131,74	6	188,62
13	Tupkovići- Trojan	3525,50	363,79	3161,71	24	131,74

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Ordinal No.	Street name	Expenses according to energy consumption Em	Expenses according to energy consumption Em1	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
14	Gračanica	3084,81	661,67	2423,14	21	115,39
15	Gračanica	881,37	90,95	790,43	6	131,74
16	Gračanica	2203,44	227,37	1976,07	15	131,74
17	Gračanica	293,79	30,32	263,48	2	131,74
18	Gračanica	3966,19	505,83	3460,35	27	128,16
19	Gračanica	3084,81	318,32	2766,50	21	131,74
20	Gračanica	5631,01	1449,37	4181,63	46	90,91
21	Gračanica	1346,55	166,74	1179,81	11	107,26
22	Gračanica	4259,98	439,58	3820,40	29	131,74
23	Durići	1909,65	197,05	1712,59	13	131,74
24	Durići	4113,08	424,42	3688,66	28	131,74
25	Vrtage	881,37	90,95	790,43	6	131,74
26	Gračanica	1615,85	285,70	1330,15	11	120,92
27	Gračanica	2937,92	303,16	2634,76	20	131,74
28	Gračanica	3525,50	363,79	3161,71	24	131,74
29	Gračanica-Šljivici	5435,15	560,84	4874,30	37	131,74
30	Gračanica-Šljivici	1468,96	151,58	1317,38	10	131,74
31	Gračanica-Zelenika	1762,75	181,90	1580,85	12	131,74
32	Gračanica-Zelenika	7344,79	1575,40	5769,39	50	115,39
33	Omladinskih radnih brigada	734,48	157,54	576,94	5	115,39
34	Omladinskih radnih brigada	6169,62	636,63	5532,99	42	131,74
35	Omladinskih radnih brigada	881,37	155,84	725,54	6	120,92
36	Hornica	3819,29	394,11	3425,18	26	131,74
37	Omladinskih radnih brigada	2644,12	567,15	2076,98	18	115,39
38	stadion FK Metalac 5000m ²	1175,17	1498,76	-323,60	8	-40,45
39	Šarenjak	3153,36	697,27	2456,10	46	53,39
40	Hornica	2203,44	472,62	1730,82	15	115,39
41	Omladinskih radnih brigada	1713,78	378,95	1334,84	25	53,39
42	Maline-M18	734,48	75,79	658,69	5	131,74
43	Maline Spreča	1028,27	76,30	951,97	7	136,00
44	Strašanj-M18	734,48	129,86	604,61	5	120,92
45	Strašanj	2125,09	580,77	1544,32	31	49,82
46	Strašanj	3633,22	803,37	2829,85	53	53,39
47	Strašanj	612,07	75,79	536,28	5	107,26

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Ordinal No.	Street name	Expenses according to energy consumption Em	Expenses according to energy consumption Em1	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
48	Strašanji igralište 800m ²	979,31	224,81	754,49	4	188,62
49	Turijanci	440,69	94,52	346,16	3	115,39
50	Hadžići	1028,27	220,56	807,71	7	115,39
51	Nova cesta	2791,02	598,65	2192,37	19	115,39
52	Luke	4553,77	469,90	4083,87	31	131,74
53	Hadžići	2937,92	919,70	2018,22	20	100,91
54	Djedovača	2056,54	212,21	1844,33	14	131,74
55	Djedovača	2081,02	257,69	1823,34	17	107,26
56	Prijeki put	754,07	166,74	587,33	11	53,39
57	Gložik	2791,02	355,96	2435,06	19	128,16
58	Gložik	1615,85	166,74	1449,12	11	131,74
59	Hadžići	3672,40	1149,62	2522,78	25	100,91
60	Dubrave Donje	1615,85	166,74	1449,12	11	131,74
61	Prijeki put	1909,65	197,05	1712,59	13	131,74
62	Hadžići	1762,75	378,10	1384,65	12	115,39
63	Dubrave Donje	2644,12	272,84	2371,28	18	131,74
64	prostor oko Crkve sv. Ane	411,31	90,95	320,36	6	53,39
65	Dubravaska	3525,50	756,19	2769,31	24	115,39
66	Dubravaska	5141,35	1102,78	4038,57	35	115,39
67	Višća	1468,96	315,08	1153,88	10	115,39
68	Višća	8226,17	848,84	7377,32	56	131,74
69	igralište Višća 800m ²	1468,96	337,22	1131,74	6	188,62
70	regionalni put R469	881,37	181,81	699,56	7	99,94
71	Višća Donja	7491,69	773,06	6718,63	51	131,74
72	Višća Donja	7932,37	818,53	7113,85	54	131,74
73	Višća Donja	3378,60	430,89	2947,71	23	128,16
74	Kupjerski	4113,08	305,20	3807,88	28	136,00
75	Kupjerski-poligon	1468,96	240,14	1228,82	6	204,80
76	Smajići	2056,54	152,60	1903,94	14	136,00
77	Bajrami	2350,33	174,40	2175,93	16	136,00
78	Kupjerski-Taletovići	3819,29	283,40	3535,89	26	136,00
79	Dubravaska	3917,22	504,13	3413,09	16	213,32
80	Dubravaska	587,58	43,60	543,98	4	136,00
81	Dubravaska C	1762,75	181,90	1580,85	12	131,74
82	Sjever	2536,40	756,19	1780,21	37	48,11
83	Sjever	2203,44	163,50	2039,94	15	136,00

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Ordinal No.	Street name	Expenses according to energy consumption Em	Expenses according to energy consumption Em1	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
84	Hadžići	2644,12	827,73	1816,40	18	100,91
85	Hadžići	4259,98	913,73	3346,24	29	115,39
86	Hadžići	2056,54	212,21	1844,33	14	131,74
87	regionalni put R469	2791,02	598,65	2192,37	19	115,39
88	regionalni put R469	1909,65	409,61	1500,04	13	115,39
89	Begići	137,10	30,32	106,79	2	53,39
90	Delići	1782,34	394,11	1388,23	26	53,39
91	Kadrići	2193,64	348,80	1844,84	32	57,65
92	Kadrići	1591,37	141,70	1449,67	13	111,51
93	igralište Kadrići 800m ²	3917,22	899,26	3017,96	16	188,62
94	Kadrići	1645,23	363,79	1281,44	24	53,39
95	Bajrići	1576,68	348,63	1228,05	23	53,39
96	Bajrići	2262,20	500,21	1761,98	33	53,39
97	Kadirići	1439,58	318,32	1121,26	21	53,39
98	Krzevići	1645,23	363,79	1281,44	24	53,39
99	Ciljuge	1175,17	149,88	1025,29	8	128,16
100	Ciljuge	6610,31	682,11	5928,20	45	131,74
101	Ciljuge	587,58	74,94	512,65	4	128,16
102	Ciljuge	1762,75	224,81	1537,94	12	128,16
103	Toplička	685,51	151,58	533,93	10	53,39
104	Toplička	734,48	75,79	658,69	5	131,74
105	Lukavica Donja	3672,40	378,95	3293,45	25	131,74
106	Lukavica Donja	3819,29	394,11	3425,18	26	131,74
107	Lukavica Donja	5141,35	530,53	4610,83	35	131,74
108	Lukavica Donja	2644,12	567,15	2076,98	18	115,39
109	Lukavica Donja	3084,81	318,32	2766,50	21	131,74
110	Lukavica Donja	5288,25	1134,29	4153,96	36	115,39
111	Lukavica Gornja	2056,54	212,21	1844,33	14	131,74
112	Lukavica Gornja	3231,71	693,18	2538,53	22	115,39
113	Lukavica Gornja	2791,02	288,00	2503,02	19	131,74
114	Lukavica Gornja	2644,12	272,84	2371,28	18	131,74
115	Lukavica Gornja	5288,25	545,69	4742,56	36	131,74
116	Lukavica Gornja	1762,75	181,90	1580,85	12	131,74
117	Lukavica Gornja	1762,75	378,10	1384,65	12	115,39
118	Lukavica Gornja	3819,29	394,11	3425,18	26	131,74
119	Lukavica Gornja	3084,81	318,32	2766,50	21	131,74
120	Lukavica Gornja	1762,75	181,90	1580,85	12	131,74

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Ordinal No.	Street name	Expenses according to energy consumption Em	Expenses according to energy consumption Em1	Annual savings	Quantity	Annual savings per lamp
		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
121	Svojat	3231,71	693,18	2538,53	22	115,39
122	Svojat	4406,87	454,74	3952,14	30	131,74
123	Svojat	3966,19	409,26	3556,92	27	131,74
124	Svojat	2644,12	272,84	2371,28	18	131,74
125	Svojat	3378,60	852,00	2526,61	23	109,85
126	Svojat	5288,25	674,44	4613,81	36	128,16
127	igralište Svojat 800m ²	587,58	224,81	362,77	4	90,69
128	Zelenika-Krivača	3231,71	333,47	2898,23	22	131,74
129	Zelenika	1028,27	220,56	807,71	7	115,39
130	Zelenika	2937,92	303,16	2634,76	20	131,74
131	Zelenika	2791,02	288,00	2503,02	19	131,74
132	Livada	3084,81	228,90	2855,91	21	136,00
133	Podoljani	2497,23	535,64	1961,59	17	115,39
134	Donja Lukavica	1909,65	141,70	1767,94	13	136,00
135	Donja Lukavica	3231,71	693,18	2538,53	22	115,39
136	Donja Lukavica	1028,27	76,30	951,97	7	136,00
137	Bašigovci	4406,87	454,74	3952,14	30	131,74
138	regionalni put R469	8666,85	3265,77	5401,08	59	91,54
139	Pasci donji	5582,04	711,91	4870,13	38	128,16
140	1. ulica	1762,75	664,22	1098,53	12	91,54
141	1. ulica	2056,54	989,52	1067,02	14	76,22
142	Zlatnih ljiljana	4553,77	620,37	3933,40	31	126,88
143	parking(Bosanski kulturni centar)	1615,85	440,26	1175,59	11	106,87
144	25. Novembar	1322,06	413,86	908,20	9	100,91
145	25. Novembar	1713,78	643,79	1070,00	14	76,43
146	parking supermarketa	489,65	160,10	329,56	4	82,39
147	parking površine cca 600m	979,31	320,19	659,12	8	82,39
148	Gradski park konjuh (25. Novembar)	1028,27	280,17	748,10	7	106,87
149	Prvi maj	1909,65	520,31	1389,34	13	106,87
150	Školska	146,90	31,51	115,39	1	115,39
151	Prva ulica	587,58	126,03	461,55	4	115,39
152	2. ulica (prostor oko zgrade)	1175,17	320,19	854,98	8	106,87
153	Alije Zetbegovića	734,48	323,60	410,88	5	82,18

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		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
154	parking(Meše Selimovića)	3672,40	830,28	2842,11	15	189,47
155	Oslobođenja	1615,85	285,70	1330,15	11	120,92
156	park(Ulica Oslobođenja)	1615,85	440,26	1175,59	11	106,87
157	parking(Ulica Oslobođenja)	881,37	240,14	641,23	6	106,87
158	Gradski park Živinice(Alije Izetbegovića)	2056,54	560,33	1496,21	14	106,87
159	ulica iza općine(Alije Izetbegovića)	587,58	103,89	483,69	4	120,92
160	parking općine	244,83	40,02	204,80	1	204,80
161	Šetnica iza općine	1175,17	320,19	854,98	8	106,87
162	Pašage Gocića	2644,12	567,15	2076,98	18	115,39
163	Patriotske lige	1175,17	367,88	807,29	8	100,91
164	Željeznička	146,90	31,51	115,39	1	115,39
165	XVI muslimanske brigade	1175,17	517,75	657,41	8	82,18
166	Rudarska	1615,85	346,59	1269,27	11	115,39
167	Rudarska	440,69	94,52	346,16	3	115,39
168	Rudarska	122,41	64,72	57,69	1	57,69
169	Živiničkih brigada	1028,27	220,56	807,71	7	115,39
170	Civilnih žrtava rata	881,37	155,84	725,54	6	120,92
171	Dubravska(naselje uz R469)	1468,96	553,52	915,44	10	91,54
172	regionalni put R469	1615,85	505,83	1110,02	11	100,91
173	Bosanska	28938,48	5116,66	23821,82	197	120,92
174	Jezero	3525,50	623,35	2902,15	24	120,92
175	Jezero	4113,08	727,24	3385,84	28	120,92
176	Jezero	489,65	126,03	363,62	4	90,91
177	Jezero	881,37	189,05	692,33	6	115,39
178	Jezero	734,48	157,54	576,94	5	115,39
179	1. Mart	4700,67	831,13	3869,53	32	120,92
180	1. Mart	734,48	129,86	604,61	5	120,92
181	1. Mart	440,69	94,52	346,16	3	115,39
182	Sadnice	2350,33	1130,88	1219,45	16	76,22
183	Toplička	1468,96	259,73	1209,23	10	120,92
184	Toplička	1028,27	387,46	640,81	7	91,54

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		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
185	regionalni put R469	1762,75	848,16	914,59	12	76,22
186	1. ulica	1175,17	422,38	752,79	8	94,10
187	regionalni put R455a	2154,47	412,16	1742,31	22	79,20
188	Poljice	1371,03	262,28	1108,74	14	79,20
189	Klopići	881,37	168,61	712,76	9	79,20
190	Klopići	391,72	74,94	316,78	4	79,20
191	Klopići	1175,17	633,57	541,60	12	45,13
192	regionalni put R455a	195,86	37,47	158,39	2	79,20
193	Priluk	7344,79	3959,80	3384,99	75	45,13
194	regionalni put R455a	2252,40	430,89	1821,51	23	79,20
195	Priluk	1664,82	318,49	1346,33	17	79,20
196	Priluk	3133,78	1771,27	1362,51	32	42,58
197	regionalni put R455a	685,51	131,14	554,37	7	79,20
198	Omići	1566,89	885,63	681,26	16	42,58
199	regionalni put R455a	685,51	220,56	464,96	7	66,42
200	Omerkići	2154,47	1423,83	730,65	22	33,21
201	R455a	1566,89	504,13	1062,76	16	66,42
202	Alagići	1077,24	206,08	871,16	11	79,20
203	Alagići	2546,19	487,10	2059,10	26	79,20
204	Šehići	4113,08	786,85	3326,23	42	79,20
205	Šehići	4308,94	824,32	3484,62	44	79,20
206	Šehići	1566,89	299,75	1267,14	16	79,20
207	Šerići	2154,47	412,16	1742,31	22	79,20
208	Šerići	3917,22	2588,77	1328,45	40	33,21
209	regionalni put R455a	783,44	252,06	531,38	8	66,42
210	Šerići	979,31	647,19	332,11	10	33,21
211	regionalni put R455a	1762,75	337,22	1425,53	18	79,20
212	Omerkići	489,65	281,02	208,63	5	41,73
213	igralište(Omerkići)	979,31	647,19	332,11	10	33,21
214	regionalni put R455a	1273,10	243,55	1029,55	13	79,20
215	Šerići	6365,49	4206,76	2158,73	65	33,21
216	regionalni put R455a	1468,96	281,02	1187,94	15	79,20
217	Šerići	4994,46	955,46	4039,00	51	79,20

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		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
218	Šerići	1273,10	686,37	586,73	13	45,13
219	regionalni put R455a	2937,92	1583,92	1354,00	30	45,13
220	regionalni put R455a	881,37	168,61	712,76	9	79,20
221	Suha	6169,62	1180,28	4989,35	63	79,20
222	Suha	6169,62	3487,18	2682,45	63	42,58
223	regionalni put R455a	783,44	149,88	633,57	8	79,20
224	Suha	3133,78	599,51	2534,27	32	79,20
225	Suha	3721,36	711,91	3009,45	38	79,20
226	Đulići	2546,19	468,36	2077,83	25	83,11
227	Đulići	587,58	112,41	475,18	6	79,20
228	Barice	2252,40	430,89	1821,51	23	79,20
229	Atlić mahala	4504,81	1449,37	3055,43	46	66,42
230	Jablanica	881,37	168,61	712,76	9	79,20
231	Jablanica	2350,33	449,63	1900,70	24	79,20
232	Tadići	979,31	187,35	791,96	10	79,20
233	Tadići	2448,26	468,36	1979,90	25	79,20
234	Živinice Gornje	1762,75	337,22	1425,53	18	79,20
235	Živinice Gornje	783,44	252,06	531,38	8	66,42
236	Kopjevići	1371,03	262,28	1108,74	14	79,20
237	Kopjevići	3623,43	693,18	2930,25	37	79,20
238	Grabik	2154,47	412,16	1742,31	22	79,20
239	Petrovići	1860,68	355,96	1504,72	19	79,20
240	Petrovići	1762,75	337,22	1425,53	18	79,20
241	Šišići	4113,08	786,85	3326,23	42	79,20
242	Šišići	979,31	187,35	791,96	10	79,20
243	Adići	2154,47	412,16	1742,31	22	79,20
244	Adići	1860,68	355,96	1504,72	19	79,20
245	Lug	783,44	149,88	633,57	8	79,20
246	Lug	1175,17	848,16	327,00	12	27,25
247	magistralni put M18	979,31	527,97	451,33	10	45,13
248	Đurđevik	2056,54	545,43	1511,11	21	71,96
249	Đurđevik	5386,18	1732,94	3653,24	55	66,42
250	Gostelja	2350,33	449,63	1900,70	24	79,20
251	Gostelja	2056,54	393,43	1663,12	21	79,20
252	Musići	4798,60	917,99	3880,60	49	79,20
253	Musići	2937,92	562,04	2375,88	30	79,20

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		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
254	Gostelja	1762,75	467,51	1295,24	18	71,96
255	Golubinjak	5288,25	1011,67	4276,58	54	79,20
256	Nukići	6463,42	3653,24	2810,18	66	42,58
257	regionalni put R469	2350,33	623,35	1726,98	24	71,96
258	Živiničke ose	4602,74	2481,47	2121,26	47	45,13
259	Živiničke ose	5209,91	2394,61	2815,29	76	37,04
260	Živiničke ose	1645,23	449,63	1195,60	24	49,82
261	Gostelja	2742,06	524,57	2217,49	28	79,20
262	Golubinjak	3035,85	580,77	2455,08	31	79,20
263	Golubinjak	3133,78	2643,27	490,50	32	15,33
264	regionalni put R469	3721,36	711,91	3009,45	38	79,20
265	Donja Višća	2056,54	393,43	1663,12	21	79,20
266	Donja Višća	1468,96	1239,03	229,92	15	15,33
267	regionalni put R469	783,44	149,88	633,57	8	79,20
268	Šišići	6953,07	1330,15	5622,92	71	79,20
269	Šišići	3133,78	599,51	2534,27	32	79,20
270	Gostelja	587,58	332,11	255,47	6	42,58
271	magistralni put M18	783,44	207,78	575,66	8	71,96
272	Stara pruga	7344,79	1947,97	5396,82	75	71,96
273	Bare	881,37	168,61	712,76	9	79,20
274	Kovači	3035,85	580,77	2455,08	31	79,20
275	Kovači	979,31	187,35	791,96	10	79,20
276	Kovači	3721,36	711,91	3009,45	38	79,20
277	Kovači	3329,64	636,97	2692,66	34	79,20
278	Kovači	1664,82	318,49	1346,33	17	79,20
279	Kovači	1273,10	243,55	1029,55	13	79,20
280	Mujići	1566,89	299,75	1267,14	16	79,20
281	Bašigovci	2644,12	505,83	2138,29	27	79,20
282	Bašigovci	783,44	149,88	633,57	8	79,20
283	Bašigovci	2644,12	505,83	2138,29	27	79,20
284	Bašigovci	2056,54	393,43	1663,12	21	79,20
285	Bašigovci	1371,03	643,79	727,24	14	51,95
286	Bašigivco	2350,33	449,63	1900,70	24	79,20
287	Bašigivco	1371,03	262,28	1108,74	14	79,20
288	Bašigivco	881,37	168,61	712,76	9	79,20
289	Bašigivco	1273,10	243,55	1029,55	13	79,20

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		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
290	Podoljani	293,79	137,95	155,84	3	51,95
291	Bašigovci	1273,10	243,55	1029,55	13	79,20
292	Bašigovci	783,44	183,94	599,51	8	74,94
293	Bašigovci	489,65	93,67	395,98	5	79,20
294	Bašigovci	1468,96	281,02	1187,94	15	79,20
295	Bašigovci	293,79	56,20	237,59	3	79,20
296	Vrnojevići donji	391,72	282,72	109,00	4	27,25
297	regionalni put R455a	5875,83	2827,21	3048,62	40	76,22
298	Toplička	2203,44	344,89	1858,55	15	123,90
299	Toplička	2497,23	390,87	2106,36	17	123,90
300	Toplička	881,37	137,95	743,42	6	123,90
301	3. ulica	2644,12	337,22	2306,90	18	128,16
302	3. ulica	274,21	91,97	182,24	4	45,56
303	Stara pruga	1322,06	206,93	1115,13	9	123,90
304	Stara pruga	1468,96	187,35	1281,61	10	128,16
305	regionalni put R455a	734,48	263,99	470,49	5	94,10
306	regionalni put R455a	293,79	129,44	164,35	2	82,18
307	Živinički sokolovi	734,48	263,99	470,49	5	94,10
308	Partizanske	2497,23	897,55	1599,67	17	94,10
309	Živinički sokolovi	1028,27	160,95	867,32	7	123,90
310	Partizanska	2644,12	413,86	2230,26	18	123,90
311	Partizanska	2644,12	413,86	2230,26	18	123,90
312	Partizanska	3819,29	1837,69	1981,60	26	76,22
313	Partizanska	1762,75	275,91	1486,84	12	123,90
314	Partizanska	2644,12	467,51	2176,61	18	120,92
315	Živinički sokolovi	1273,10	243,55	1029,55	13	79,20
316	Živinički sokolovi	1664,82	318,49	1346,33	17	79,20
317	regionalni put R455a	7344,79	3534,02	3810,78	50	76,22
318	Modračka	2644,12	337,22	2306,90	18	128,16
319	regionalni put R455a	3525,50	1696,33	1829,17	24	76,22
320	regionalni put R455a	2644,12	1272,25	1371,88	18	76,22
321	Barice	3231,71	412,16	2819,55	22	128,16
322	regionalni put R455a	3084,81	1484,29	1600,53	21	76,22
323	Barice	1322,06	168,61	1153,45	9	128,16

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		(kWh/annually)	(kWh/annually)	(kWh/annually)	(pcs)	(KM/annually)
324	Barice	2154,47	412,16	1742,31	22	79,20
325	igrališče (Barice)	391,72	224,81	166,91	4	41,73
326	Otawa	2742,06	524,57	2217,49	28	79,20
327	Podgaj	1273,10	243,55	1029,55	13	79,20
328	Podgaj	1958,61	374,69	1583,92	20	79,20
329	Podgaj	1371,03	262,28	1108,74	14	79,20
330	Podgaj	2056,54	393,43	1663,12	21	79,20
331	Podgaj	1371,03	262,28	1108,74	14	79,20
332	Kovači	293,79	56,20	237,59	3	79,20
333	Podgajevi	1273,10	243,55	1029,55	13	79,20
334	magistralni put M18	2448,26	1767,01	681,26	25	27,25
335	Šahići	2644,12	505,83	2138,29	27	79,20
336	Đurđevik	4994,46	955,46	4039,00	51	79,20
337	Đurđevik	1958,61	374,69	1583,92	20	79,20
338	Živčiči	783,44	149,88	633,57	8	79,20
339	Živčiči	1762,75	337,22	1425,53	18	79,20
340	Podgaj	979,31	187,35	791,96	10	79,20
TOTAL		824315,72	185726,91	638588,81	6802	93,88
TOTAL (€/annually)		421465,94	94960,66	326505,27		48,00

Table 19: Expenses calculation after replacing existing lighting with LED

10.1.2.2 Analysis of economic savings by replacing existing lamps with dimmable LED lamps - where dimming is possible and will not affect functionality and safety

The calculation of electricity Expenses that would be after the implementation of this measure has been performed, and the results are found in table 20.

Ordinal No.	Street name	Expenses according to energy consumption Em1	Expenses according to energy consumption Em2	Annual savings	Quantity	Annual savings per lamp
		(KM/annually)	(KM/annually)	(KM/annually)	(pcs)	(KM/annually)
1	igralište Tupkovići 800m ²	337,22	261,71	75,51	6	12,59
2	Tupkovići Gornji	430,89	334,40	96,49	23	4,20
3	Tupkovići Gornji	318,32	247,04	71,28	21	3,39
4	Tupkovići Gornji Čauševići	272,84	211,75	61,10	18	3,39
5	Košare	515,37	399,96	115,41	34	3,39
6	Tupkovići-Mujčinovići	136,42	105,87	30,55	9	3,39

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Ordinal No.	Street name	Expenses according to energy consumption Em1	Expenses according to energy consumption Em2	Annual savings	Quantity	Annual savings per lamp
		(KM/annually)	(KM/annually)	(KM/annually)	(pcs)	(KM/annually)
7	Tupkovići-Mujčinovići	299,75	232,63	67,12	16	4,20
8	Tupkovići Donji	500,21	388,20	112,01	33	3,39
9	Tupkovići-Ćasuri	257,69	199,98	57,70	17	3,39
10	Tupkovići-Trojan	618,24	479,80	138,44	33	4,20
11	Tupkovići-Trojan	106,11	82,35	23,76	7	3,39
12	igralište Tupkovići-Trojan 800m ²	337,22	261,71	75,51	6	12,59
13	Tupkovići- Trojan	363,79	282,33	81,46	24	3,39
14	Gračanica	661,67	513,50	148,17	21	7,06
15	Gračanica	90,95	70,58	20,37	6	3,39
16	Gračanica	227,37	176,45	50,91	15	3,39
17	Gračanica	30,32	23,53	6,79	2	3,39
18	Gračanica	505,83	392,56	113,27	27	4,20
19	Gračanica	318,32	247,04	71,28	21	3,39
20	Gračanica	1449,37	1124,82	324,56	46	7,06
21	Gračanica	166,74	129,40	37,34	11	3,39
22	Gračanica	439,58	341,15	98,43	29	3,39
23	Durići	197,05	152,93	44,13	13	3,39
24	Durići	424,42	329,38	95,04	28	3,39
25	Vrtage	90,95	70,58	20,37	6	3,39
26	Gračanica	285,70	221,72	63,98	11	5,82
27	Gračanica	303,16	235,27	67,89	20	3,39
28	Gračanica	363,79	282,33	81,46	24	3,39
29	Gračanica-Šljivici	560,84	435,25	125,59	37	3,39
30	Gračanica-Šljivici	151,58	117,64	33,94	10	3,39
31	Gračanica- Zelenika	181,90	141,16	40,73	12	3,39
32	Gračanica- Zelenika	1575,40	1222,63	352,78	50	7,06
33	Omladinskih radnih brigada	157,54	122,26	35,28	5	7,06
34	Omladinskih radnih brigada	636,63	494,07	142,56	42	3,39
35	Omladinskih radnih brigada	155,84	120,94	34,90	6	5,82
36	Hornica	394,11	305,85	88,25	26	3,39
37	Omladinskih radnih brigada	567,15	440,15	127,00	18	7,06
38	stadion FK Metalac 5000m ²	1498,76	1163,15	335,62	8	41,95

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		(KM/annually)	(KM/annually)	(KM/annually)	(pcs)	(KM/annually)
39	Šarenjak	697,27	541,13	156,14	46	3,39
40	Hornica	472,62	366,79	105,83	15	7,06
41	Omladinskih radnih brigada	378,95	294,09	84,86	25	3,39
42	Maline-M18	75,79	58,82	16,97	5	3,39
43	Maline Spreča	76,30	59,21	17,09	7	2,44
44	Strašanj-M18	129,86	100,78	29,08	5	5,82
45	Strašanj	580,77	450,72	130,05	31	4,20
46	Strašanj	803,37	623,47	179,90	53	3,39
47	Strašanj	75,79	58,82	16,97	5	3,39
48	Strašanj igralište 800m ²	224,81	174,47	50,34	4	12,59
49	Turijanci	94,52	73,36	21,17	3	7,06
50	Hadžići	220,56	171,17	49,39	7	7,06
51	Nova cesta	598,65	464,60	134,06	19	7,06
52	Luke	469,90	364,67	105,22	31	3,39
53	Hadžići	919,70	713,75	205,95	20	10,30
54	Djedovača	212,21	164,69	47,52	14	3,39
55	Djedovača	257,69	199,98	57,70	17	3,39
56	Prijeki put	166,74	129,40	37,34	11	3,39
57	Gložik	355,96	276,25	79,71	19	4,20
58	Gložik	166,74	129,40	37,34	11	3,39
59	Hadžići	1149,62	892,19	257,43	25	10,30
60	Dubrave Donje	166,74	129,40	37,34	11	3,39
61	Prijeki put	197,05	152,93	44,13	13	3,39
62	Hadžići	378,10	293,43	84,67	12	7,06
63	Dubrave Donje	272,84	211,75	61,10	18	3,39
64	prostor oko Crkve sv. Ane	90,95	70,58	20,37	6	3,39
65	Dubravaska	756,19	586,86	169,33	24	7,06
66	Dubravaska	1102,78	855,84	246,95	35	7,06
67	Višća	315,08	244,53	70,56	10	7,06
68	Višća	848,84	658,76	190,08	56	3,39
69	igralište Višća 800m ²	337,22	261,71	75,51	6	12,59
70	regionalni put R469	181,81	141,10	40,71	7	5,82
71	Višća Donja	773,06	599,95	173,11	51	3,39
72	Višća Donja	818,53	635,24	183,29	54	3,39
73	Višća Donja	430,89	334,40	96,49	23	4,20
74	Kupjerusi	305,20	236,86	68,34	28	2,44

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		(KM/annually)	(KM/annually)	(KM/annually)	(pcs)	(KM/annually)
75	Kupjerusi-poligon	240,14	186,37	53,77	6	8,96
76	Smajići	152,60	118,43	34,17	14	2,44
77	Bajrami	174,40	135,35	39,05	16	2,44
78	Kupjerusi-Taletovići	283,40	219,94	63,46	26	2,44
79	Dubavska	504,13	391,24	112,89	16	7,06
80	Dubavska	43,60	33,84	9,76	4	2,44
81	Dubavska C	181,90	141,16	40,73	12	3,39
82	Sjever	756,19	586,86	169,33	37	4,58
83	Sjever	163,50	126,89	36,61	15	2,44
84	Hadžići	827,73	642,37	185,35	18	10,30
85	Hadžići	913,73	709,12	204,61	29	7,06
86	Hadžići	212,21	164,69	47,52	14	3,39
87	regionalni put R469	598,65	464,60	134,06	19	7,06
88	regionalni put R469	409,61	317,88	91,72	13	7,06
89	Begići	30,32	23,53	6,79	2	3,39
90	Delići	394,11	305,85	88,25	26	3,39
91	Kadrići	348,80	270,70	78,11	32	2,44
92	Kadrići	141,70	109,97	31,73	13	2,44
93	igralište Kadrići 800m ²	899,26	697,89	201,37	16	12,59
94	Kadrići	363,79	282,33	81,46	24	3,39
95	Bajrići	348,63	270,56	78,07	23	3,39
96	Bajrići	500,21	388,20	112,01	33	3,39
97	Kadirići	318,32	247,04	71,28	21	3,39
98	Krzevići	363,79	282,33	81,46	24	3,39
99	Ciljuge	149,88	116,31	33,56	8	4,20
100	Ciljuge	682,11	529,36	152,74	45	3,39
101	Ciljuge	74,94	58,16	16,78	4	4,20
102	Ciljuge	224,81	174,47	50,34	12	4,20
103	Toplička	151,58	117,64	33,94	10	3,39
104	Toplička	75,79	58,82	16,97	5	3,39
105	Lukavica Donja	378,95	294,09	84,86	25	3,39
106	Lukavica Donja	394,11	305,85	88,25	26	3,39
107	Lukavica Donja	530,53	411,73	118,80	35	3,39
108	Lukavica Donja	567,15	440,15	127,00	18	7,06
109	Lukavica Donja	318,32	247,04	71,28	21	3,39
110	Lukavica Donja	1134,29	880,29	254,00	36	7,06

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		(KM/annually)	(KM/annually)	(KM/annually)	(pcs)	(KM/annually)
111	Lukavica Gornja	212,21	164,69	47,52	14	3,39
112	Lukavica Gornja	693,18	537,96	155,22	22	7,06
113	Lukavica Gornja	288,00	223,51	64,49	19	3,39
114	Lukavica Gornja	272,84	211,75	61,10	18	3,39
115	Lukavica Gornja	545,69	423,49	122,19	36	3,39
116	Lukavica Gornja	181,90	141,16	40,73	12	3,39
117	Lukavica Gornja	378,10	293,43	84,67	12	7,06
118	Lukavica Gornja	394,11	305,85	88,25	26	3,39
119	Lukavica Gornja	318,32	247,04	71,28	21	3,39
120	Lukavica Gornja	181,90	141,16	40,73	12	3,39
121	Svojat	693,18	537,96	155,22	22	7,06
122	Svojat	454,74	352,91	101,83	30	3,39
123	Svojat	409,26	317,62	91,65	27	3,39
124	Svojat	272,84	211,75	61,10	18	3,39
125	Svojat	852,00	661,21	190,79	23	8,30
126	Svojat	674,44	523,42	151,03	36	4,20
127	igralište Svojat 800m ²	224,81	174,47	50,34	4	12,59
128	Zelenika-Krivača	333,47	258,80	74,67	22	3,39
129	Zelenika	220,56	171,17	49,39	7	7,06
130	Zelenika	303,16	235,27	67,89	20	3,39
131	Zelenika	288,00	223,51	64,49	19	3,39
132	Livada	228,90	177,64	51,26	21	2,44
133	Podoljani	535,64	415,69	119,94	17	7,06
134	Donja Lukavica	141,70	109,97	31,73	13	2,44
135	Donja Lukavica	693,18	537,96	155,22	22	7,06
136	Donja Lukavica	76,30	59,21	17,09	7	2,44
137	Bašigovci	454,74	352,91	101,83	30	3,39
138	regionalni put R469	3265,77	2534,47	731,30	59	12,39
139	Pasci donji	711,91	552,49	159,42	38	4,20
140	1. ulica	664,22	515,49	148,74	12	12,39
141	1. ulica	989,52	767,94	221,58	14	15,83
142	Zlatnih ljljana	620,37	481,45	138,92	31	4,48
143	parking(Bosanski kulturni centar)	440,26	341,67	98,59	11	8,96
144	25. Novembar	413,86	321,19	92,68	9	10,30
145	25. Novembar	643,79	499,62	144,16	14	10,30
146	parking supermarketa	160,10	124,25	35,85	4	8,96

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		(KM/annually)	(KM/annually)	(KM/annually)	(pcs)	(KM/annually)
147	parking površine cca 600m	320,19	248,49	71,70	8	8,96
148	Gradski park konjuh (25. Novembar)	280,17	217,43	62,74	7	8,96
149	Prvi maj	520,31	403,80	116,51	13	8,96
150	Školska	31,51	24,45	7,06	1	7,06
151	Prva ulica	126,03	97,81	28,22	4	7,06
152	2. ulica (prostor oko zgrade)	320,19	248,49	71,70	8	8,96
153	Alije Izetbegovića	323,60	251,13	72,46	5	14,49
154	parking(Meše Selimovića)	830,28	644,36	185,92	15	12,39
155	Oslobođenja	285,70	221,72	63,98	11	5,82
156	park(Ulica Oslobođenja)	440,26	341,67	98,59	11	8,96
157	parking(Ulica Oslobođenja)	240,14	186,37	53,77	6	8,96
158	Gradski park Živinice(Alije Izetbegovića)	560,33	434,86	125,47	14	8,96
159	ulica iza općine(Alije Izetbegovića)	103,89	80,63	23,26	4	5,82
160	parking općine	40,02	31,06	8,96	1	8,96
161	Šetnica iza općine	320,19	248,49	71,70	8	8,96
162	Pašage Gocića	567,15	440,15	127,00	18	7,06
163	Patriotske lige	367,88	285,50	82,38	8	10,30
164	Željeznička	31,51	24,45	7,06	1	7,06
165	XVI muslimanske brigade	517,75	401,81	115,94	8	14,49
166	Rudarska	346,59	268,98	77,61	11	7,06
167	Rudarska	94,52	73,36	21,17	3	7,06
168	Rudarska	64,72	50,23	14,49	1	14,49
169	Živiničkih brigada	220,56	171,17	49,39	7	7,06
170	Civilnih žrtava rata	155,84	120,94	34,90	6	5,82
171	Dubravska(naselje uz r469)	553,52	429,57	123,95	10	12,39
172	regionalni put R469	505,83	392,56	113,27	11	10,30
173	Bosanska	5116,66	3970,89	1145,77	197	5,82
174	Jezero	623,35	483,76	139,59	24	5,82
175	Jezero	727,24	564,39	162,85	28	5,82

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		(KM/annually)	(KM/annually)	(KM/annually)	(pcs)	(KM/annually)
176	Jezero	126,03	97,81	28,22	4	7,06
177	Jezero	189,05	146,72	42,33	6	7,06
178	Jezero	157,54	122,26	35,28	5	7,06
179	1. Mart	831,13	645,02	186,11	32	5,82
180	1. Mart	129,86	100,78	29,08	5	5,82
181	1. Mart	94,52	73,36	21,17	3	7,06
182	Sadnice	1130,88	877,65	253,24	16	15,83
183	Toplička	259,73	201,57	58,16	10	5,82
184	Toplička	387,46	300,70	86,76	7	12,39
185	regionalni put R469	848,16	658,24	189,93	12	15,83
186	1. ulica	422,38	327,80	94,58	8	11,82
187	regionalni put R455a	412,16	319,87	92,29	22	4,20
188	Poljice	262,28	203,55	58,73	14	4,20
189	Klopići	168,61	130,85	37,76	9	4,20
190	Klopići	74,94	58,16	16,78	4	4,20
191	Klopići	633,57	491,69	141,87	12	11,82
192	regionalni put R455a	37,47	29,08	8,39	2	4,20
193	Priluk	3959,80	3073,09	886,71	75	11,82
194	regionalni put R455a	430,89	334,40	96,49	23	4,20
195	Priluk	318,49	247,17	71,32	17	4,20
196	Priluk	1771,27	1374,63	396,64	32	12,39
197	regionalni put R455a	131,14	101,78	29,37	7	4,20
198	Omići	885,63	687,31	198,32	16	12,39
199	regionalni put R455a	220,56	171,17	49,39	7	7,06
200	Omerkići	1423,83	1104,99	318,84	22	14,49
201	R455a	504,13	391,24	112,89	16	7,06
202	Alagići	206,08	159,93	46,15	11	4,20
203	Alagići	487,10	378,02	109,08	26	4,20
204	Šehići	786,85	610,65	176,20	42	4,20
205	Šehići	824,32	639,73	184,59	44	4,20
206	Šehići	299,75	232,63	67,12	16	4,20
207	Šerići	412,16	319,87	92,29	22	4,20
208	Šerići	2588,77	2009,07	579,70	40	14,49
209	regionalni put R455a	252,06	195,62	56,44	8	7,06

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Ordinal No.	Street name	Expenses according to energy consumption Em1	Expenses according to energy consumption Em2	Annual savings	Quantity	Annual savings per lamp
		(KM/annually)	(KM/annually)	(KM/annually)	(pcs)	(KM/annually)
210	Šerići	647,19	502,27	144,93	10	14,49
211	regionalni put R455a	337,22	261,71	75,51	18	4,20
212	Omerkići	281,02	218,09	62,93	5	12,59
213	igralište(Omerkići)	647,19	502,27	144,93	10	14,49
214	regionalni put R455a	243,55	189,01	54,54	13	4,20
215	Šerići	4206,76	3264,74	942,01	65	14,49
216	regionalni put R455a	281,02	218,09	62,93	15	4,20
217	Šerići	955,46	741,51	213,96	51	4,20
218	Šerići	686,37	532,67	153,70	13	11,82
219	regionalni put R455a	1583,92	1229,23	354,69	30	11,82
220	regionalni put R455a	168,61	130,85	37,76	9	4,20
221	Suha	1180,28	915,98	264,30	63	4,20
222	Suha	3487,18	2706,30	780,88	63	12,39
223	regionalni put R455a	149,88	116,31	33,56	8	4,20
224	Suha	599,51	465,26	134,25	32	4,20
225	Suha	711,91	552,49	159,42	38	4,20
226	Đulići	468,36	363,48	104,88	25	4,20
227	Đulići	112,41	87,24	25,17	6	4,20
228	Barice	430,89	334,40	96,49	23	4,20
229	Atlić mahala	1449,37	1124,82	324,56	46	7,06
230	Jablanica	168,61	130,85	37,76	9	4,20
231	Jablanica	449,63	348,94	100,68	24	4,20
232	Tadići	187,35	145,39	41,95	10	4,20
233	Tadići	468,36	363,48	104,88	25	4,20
234	Živinice Gornje	337,22	261,71	75,51	18	4,20
235	Živinice Gornje	252,06	195,62	56,44	8	7,06
236	Kopjevići	262,28	203,55	58,73	14	4,20
237	Kopjevići	693,18	537,96	155,22	37	4,20
238	Grabik	412,16	319,87	92,29	22	4,20
239	Petrovići	355,96	276,25	79,71	19	4,20
240	Petrovići	337,22	261,71	75,51	18	4,20
241	Šišići	786,85	610,65	176,20	42	4,20
242	Šišići	187,35	145,39	41,95	10	4,20
243	Adići	412,16	319,87	92,29	22	4,20
244	Adići	355,96	276,25	79,71	19	4,20

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Ordinal No.	Street name	Expenses according to energy consumption Em1	Expenses according to energy consumption Em2	Annual savings	Quantity	Annual savings per lamp
		(KM/annually)	(KM/annually)	(KM/annually)	(pcs)	(KM/annually)
245	Lug	149,88	116,31	33,56	8	4,20
246	Lug	848,16	658,24	189,93	12	15,83
247	magistralni put M18	527,97	409,74	118,23	10	11,82
248	Đurđevik	545,43	423,29	122,14	21	5,82
249	Đurđevik	1732,94	1344,89	388,06	55	7,06
250	Gostelja	449,63	348,94	100,68	24	4,20
251	Gostelja	393,43	305,33	88,10	21	4,20
252	Musići	917,99	712,43	205,57	49	4,20
253	Musići	562,04	436,18	125,86	30	4,20
254	Gostelja	467,51	362,82	104,69	18	5,82
255	Golubinjak	1011,67	785,12	226,54	54	4,20
256	Nukići	3653,24	2835,17	818,07	66	12,39
257	regionalni put R469	623,35	483,76	139,59	24	5,82
258	Živiničke ose	2481,47	1925,80	555,67	47	11,82
259	Živiničke ose	2394,61	1858,39	536,22	76	7,06
260	Živiničke ose	449,63	348,94	100,68	24	4,20
261	Gostelja	524,57	407,10	117,47	28	4,20
262	Golubinjak	580,77	450,72	130,05	31	4,20
263	Golubinjak	2643,27	2051,37	591,91	32	18,50
264	regionalni put R469	711,91	552,49	159,42	38	4,20
265	Donja Višća	393,43	305,33	88,10	21	4,20
266	Donja Višća	1239,03	961,58	277,46	15	18,50
267	regionalni put R469	149,88	116,31	33,56	8	4,20
268	Šišići	1330,15	1032,29	297,86	71	4,20
269	Šišići	599,51	465,26	134,25	32	4,20
270	Gostelja	332,11	257,74	74,37	6	12,39
271	magistralni put M18	207,78	161,25	46,53	8	5,82
272	Stara pruga	1947,97	1511,76	436,21	75	5,82
273	Bare	168,61	130,85	37,76	9	4,20
274	Kovači	580,77	450,72	130,05	31	4,20
275	Kovači	187,35	145,39	41,95	10	4,20
276	Kovači	711,91	552,49	159,42	38	4,20
277	Kovači	636,97	494,34	142,64	34	4,20
278	Kovači	318,49	247,17	71,32	17	4,20
279	Kovači	243,55	189,01	54,54	13	4,20
280	Mujići	299,75	232,63	67,12	16	4,20

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Ordinal No.	Street name	Expenses according to energy consumption Em1	Expenses according to energy consumption Em2	Annual savings	Quantity	Annual savings per lamp
		(KM/annually)	(KM/annually)	(KM/annually)	(pcs)	(KM/annually)
281	Bašigovci	505,83	392,56	113,27	27	4,20
282	Bašigovci	149,88	116,31	33,56	8	4,20
283	Bašigovci	505,83	392,56	113,27	27	4,20
284	Bašigovci	393,43	305,33	88,10	21	4,20
285	Bašigovci	643,79	499,62	144,16	14	10,30
286	Bašigovco	449,63	348,94	100,68	24	4,20
287	Bašigovco	262,28	203,55	58,73	14	4,20
288	Bašigovco	168,61	130,85	37,76	9	4,20
289	Bašigovco	243,55	189,01	54,54	13	4,20
290	Podoljani	137,95	107,06	30,89	3	10,30
291	Bašigovci	243,55	189,01	54,54	13	4,20
292	Bašigovci	183,94	142,75	41,19	8	5,15
293	Bašigovci	93,67	72,70	20,98	5	4,20
294	Bašigovci	281,02	218,09	62,93	15	4,20
295	Bašigovci	56,20	43,62	12,59	3	4,20
296	Vrnojevići donji	282,72	219,41	63,31	4	15,83
297	regionalni put R455a	2827,21	2194,12	633,09	40	15,83
298	Toplička	344,89	267,66	77,23	15	5,15
299	Toplička	390,87	303,34	87,53	17	5,15
300	Toplička	137,95	107,06	30,89	6	5,15
301	3. ulica	337,22	261,71	75,51	18	4,20
302	3. ulica	91,97	71,37	20,59	4	5,15
303	Stara pruga	206,93	160,59	46,34	9	5,15
304	Stara pruga	187,35	145,39	41,95	10	4,20
305	regionalni put R455a	263,99	204,87	59,11	5	11,82
306	regionalni put R455a	129,44	100,45	28,99	2	14,49
307	Živinički sokolovi	263,99	204,87	59,11	5	11,82
308	Partizanske	897,55	696,57	200,99	17	11,82
309	Živinički sokolovi	160,95	124,91	36,04	7	5,15
310	Partizanska	413,86	321,19	92,68	18	5,15
311	Partizanska	413,86	321,19	92,68	18	5,15
312	Partizanska	1837,69	1426,18	411,51	26	15,83
313	Partizanska	275,91	214,12	61,78	12	5,15
314	Partizanska	467,51	362,82	104,69	18	5,82
315	Živinički sokolovi	243,55	189,01	54,54	13	4,20
316	Živinički sokolovi	318,49	247,17	71,32	17	4,20

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Ordinal No.	Street name	Expenses according to energy consumption Em1	Expenses according to energy consumption Em2	Annual savings	Quantity	Annual savings per lamp
		(KM/annually)	(KM/annually)	(KM/annually)	(pcs)	(KM/annually)
317	regionalni put R455a	3534,02	2742,65	791,37	50	15,83
318	Modračka	337,22	261,71	75,51	18	4,20
319	regionalni put R455a	1696,33	1316,47	379,86	24	15,83
320	regionalni put R455a	1272,25	987,35	284,89	18	15,83
321	Barice	412,16	319,87	92,29	22	4,20
322	regionalni put R455a	1484,29	1151,91	332,37	21	15,83
323	Barice	168,61	130,85	37,76	9	4,20
324	Barice	412,16	319,87	92,29	22	4,20
325	igrališče (Barice)	224,81	174,47	50,34	4	12,59
326	Otawa	524,57	407,10	117,47	28	4,20
327	Podgaj	243,55	189,01	54,54	13	4,20
328	Podgaj	374,69	290,79	83,90	20	4,20
329	Podgaj	262,28	203,55	58,73	14	4,20
330	Podgaj	393,43	305,33	88,10	21	4,20
331	Podgaj	262,28	203,55	58,73	14	4,20
332	Kovači	56,20	43,62	12,59	3	4,20
333	Podgajevi	243,55	189,01	54,54	13	4,20
334	magistralni put M18	1767,01	1371,32	395,68	25	15,83
335	Šahići	505,83	392,56	113,27	27	4,20
336	Đurđevik	955,46	741,51	213,96	51	4,20
337	Đurđevik	374,69	290,79	83,90	20	4,20
338	Živčiči	149,88	116,31	33,56	8	4,20
339	Živčiči	337,22	261,71	75,51	18	4,20
340	Podgaj	187,35	145,39	41,95	10	4,20
TOTAL		185726,91	144137,27	41589,64	6802	6,11
TOTAL (€/annually)		94960,66	73696,22	21264,45		3,12

Table 20: Expenses calculation after installing the Dynadimmer system

10.1.2.3 Analysis of economic savings by replacing existing lamps with dimmable LED lamps - where dimming is possible and will not affect functionality and safety with the installation of central technical supervision

The calculation of electricity Expenses that would be after the implementation of this measure was performed, and the results are found in table 21.

Measure name	Expenses according to energy consumption Em1	Expenses according to energy consumption Em3	Annual savings	Quantity	Annual savings per lamp
	(KM/annually)	(KM/annually)	(KM/annually)	(pcs)	(KM/annually)
Installation of telemanagement system	824315,72	116265,04	708050,67	6802	104,09
	(EUR/god)	(EUR/god)	(EUR/god)	(kom)	(EUR/god)
	421465,94	59445,37	362020,56	6802	53,22

Table 21: Calculation of Expenses after installing a telemanagement system

11 FINANCIAL ANALYSIS

In general, the implementation of EE measures on public lighting systems leads to the realization of various positive effects. In technical terms, there is an optimization of lighting capacities, a reduction in electricity consumption, the release of capacity for further expansion of public lighting systems, and a number of other positive effects.

These technical improvements, consequently, lead to improvements of the financial situation in the companies that manage public lighting systems as well as on the side of their users. Within the technical analysis, which was done with the aim of finding the optimal way to improve the public lighting system in the Municipality of Laktaši, the implementation of 4 EE measures was considered:

- Measure 0 - Preparatory works / dismantling of existing lighting fixtures
- Measure 1 Procurement and installation of new LED lamps;
- Measure 2 Procurement and installation of a ballast for autonomous wireless attenuation of light flux;
- Measure 3 Procurement and installation of telemanagement.

The financial effects of the implementation differ both for each of the above measures individually and for a combination of 2 or more measures. In order to select a measure or combination of measures that will lead to the greatest financial effects, 3 EE scenarios have been defined, as follows:

- Scenario 1 - includes procurement and installation of new LED lamps;
- Scenario 2 includes the procurement and installation of new LED lamps and the procurement and installation of a ballast for autonomous wireless attenuation of light flux;
- Scenario 3 includes the procurement and installation of new LED lamps and the procurement and installation of telemanagement.

The analysis of the financial justification of the above scenarios was done on the basis of cash flow projections for each scenario for a period of 15 years (2020 -2035), which served as a basis for calculating financial indicators: (i) internal rate of return (internal rate of return(IRR)), (ii) Net Present Value (NPV), (iii) Simple Payback Period, and (iv) Discounted Payback Period.

It is important to note that the amounts of investment costs for the proposed measures, as well as the amounts of operating costs and revenues are shown without value added tax (VAT). Taking into account their amounts, it is expected that the implementer of measures, regardless of whether it is a local self-government unit or a third legal entity, will be a registered VAT payer and thus have the right to deduct VAT.

Cash savings that will be realized as a result of the implementation of a certain scenario are considered as cash inflows, while investment costs and maintenance costs for a given scenario are considered as cash outflows. Also, within the financial analysis of the considered scenarios, a discount rate of 5% was used.

11.1 Investment costs (CAPEX)

Table 22 provides an overview of investment costs for the considered scenarios.

ITEM	AMOUNT	
	BAM	EUR
Measures		
M0 Preparatory works / dismantling of existing lighting fixtures	136.040	69.556
M1 Procurement and installation of new LED lamps	2.857.320	1.460.925
M2 Procurement and installation of a ballast for autonomous wireless dimming of light flow	183.654	93.901
M3 Procurement and installation of telemanagement	3.241.927	1.657.571
Scenarios		
Scenario 1 (M0+M1)	2.993.360	1.530.481
Scenario 2 (M0+M1+M2)	3.177.014	1.624.381
Scenario 3 (M0+M1+M3)	6.235.287	3.188.052

Table 22: Investment costs by scenarios

The assumption is that the investments in the considered scenarios will be realized during 2020, and that the city of Živinice will start realizing the financial effects from the implementation of the investment in 2021.

11.2 Financial savings

The financial savings that will appear as a result of the implementation of the considered scenarios are calculated on the basis of the existing electricity consumption for public lighting in the city of Živinice and the electricity consumption after the implementation of the considered scenarios. The price of electricity from the chapter Analysis of energy costs and forecast of future consumption of 0.2077 KM / kWh or 0.1062 EUR / kWh was used in the analysis. Table 23 gives an overview of financial savings according to the considered scenarios.

ITEM	UNIT	AMOUNT
Existing considered electricity consumption	kWh/year	3.968.781
Electricity consumption by scenarios		
Scenario 1	kWh/year	894.208
Scenario 2	kWh/year	693.969
Scenario 3	kWh/year	559.774

Electricity savings		
Scenario 1	kWh/year	3.074.573
Scenario 2	kWh/year	3.274.812
Scenario 3	kWh/year	3.409.007
Electricity price	BAM/kWh	0,2077
	EUR/kWh	0,1062
Financial savings		
Scenario 1	BAM/year	638.588,81
	EUR/year	326.505,27
Scenario 2	BAM/year	680.178,45
	EUR/year	347.769,72
Scenario 3	BAM/year	708.050,67
	BAM/year	362.020,56

Table 23: Financial savings

11.3 Operating costs (OPEX)

11.3.1 Maintenance costs

The equipment that will be installed within the considered scenarios will have a warranty for a period of 5 years, which implies that there will be no maintenance costs in the period of 2020-2025. After the 2025., it is assumed that the annual maintenance costs will be 0.3% of the investment costs for the given scenario, which in addition to the regular maintenance costs also include the costs for the necessary licenses. Table 24 gives an overview of maintenance by scenarios.

Scenario	UNIT	
	BAM	EUR
Scenario 1	4.591,44	2347,57
Scenario 2	4.873,14	2491,60
Scenario 3	9.564,16	4890,07

Table 24: Maintenance costs

11.4 Cash flow projection

Based on the aforementioned investment costs and maintenance costs and expected financial savings, a cash flow projection was made for each scenario for the period 2020- 2035. Table 25, table 26 and table 27 provide an overview of cash flow for each scenario considered and the values of IRR, NPV, payback period and discounted payback period (DPP).

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STAVKA	JEDINICA	IZNOS	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
NOVČANI PRILIVI																		
Finansijske uštede	KM		638.588,81	638.588,81	638.588,81	638.588,81	638.588,81	638.588,81	638.588,81	638.588,81	638.588,81	638.588,81	638.588,81	638.588,81	638.588,81	638.588,81	638.588,81	638.588,81
NOVČANI ODLIVI																		
Troškovi održavanja	KM		0	0	0	0	0	0	4.591	4.591	4.591	4.591	4.591	4.591	4.591	4.591	4.591	4.591
Investicioni troškovi	KM		1.530.481	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NETO NOVČANI TOK	KM		-1.530.481	638.589	638.589	638.589	638.589	638.589	633.997	633.997	633.997	633.997	633.997	633.997	633.997	633.997	633.997	633.997
KUMULATIVNI NOVČANI TOK	KM		-1.530.481	-891.892	-253.303	385.286	1.023.875	1.662.463	2.296.461	2.930.458	3.564.455	4.198.453	4.832.450	5.466.448	6.100.445	6.734.442	7.368.440	8.002.437
IRR	%		41%															
NPV	KM		5.070.073,74															
Diskontirani period povrata	god.		3															
Period povrata	god.		3															

STAVKA	JEDINICA	IZNOS	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
NOVČANI PRILIVI																		
Finansijske uštede	EUR		0	326505,27	326505,27	326505,27	326505,27	326505,27	326505,27	326505,27	326505,27	326505,27	326505,27	326505,27	326505,27	326505,27	326505,27	326505,27
NOVČANI ODLIVI																		
Troškovi održavanja	EUR		0	0	0	0	0	0	2.348	2.348	2.348	2.348	2.348	2.348	2.348	2.348	2.348	2.348
Investicioni troškovi	EUR		782.522	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NETO NOVČANI TOK	EUR		-782.522	326.505	326.505	326.505	326.505	326.505	324.158	324.158	324.158	324.158	324.158	324.158	324.158	324.158	324.158	324.158
KUMULATIVNI NOVČANI TOK	EUR		-782.522	-456.017	-129.512	196.993	523.499	850.004	1.174.162	1.498.319	1.822.477	2.146.635	2.470.793	2.794.950	3.119.108	3.443.266	3.767.423	4.091.581
IRR	%		41%															
NPV	EUR		2.592.287,54															
Diskontirani period povrata	god.		3															
Period povrata	god.		3															

Table 25: Cash flow Scenario 1

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STAVKA	JEDINICA	IZNOS	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
NOVČANI PRILIVI																		
Finansijske uštede	KM		680.178,45	680.178,45	680.178,45	680.178,45	680.178,45	680.178,45	680.178,45	680.178,45	680.178,45	680.178,45	680.178,45	680.178,45	680.178,45	680.178,45	680.178,45	680.178,45
NOVČANI ODLIVI																		
Troškovi održavanja	KM		0	0	0	0	0	0	4.873	4.873	4.873	4.873	4.873	4.873	4.873	4.873	4.873	4.873
Investicioni troškovi	KM		1.624.381	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NETO NOVČANI TOK	KM		-1.624.381	680.178	680.178	680.178	680.178	680.178	675.305	675.305	675.305	675.305	675.305	675.305	675.305	675.305	675.305	675.305
KUMULATIVNI NOVČANI TOK	KM		-1.624.381	-944.203	-264.025	416.154	1.096.332	1.776.511	2.451.816	3.127.121	3.802.427	4.477.732	5.153.037	5.828.343	6.503.648	7.178.953	7.854.259	8.529.564
IRR	%		42%															
NPV	KM		5.406.154,84															
Diskontirani period povrata	god.		3															
Period povrata	god.		3															

STAVKA	JEDINICA	IZNOS	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
NOVČANI PRILIVI																		
Finansijske uštede	EUR		0	347769,72	347769,72	347769,72	347769,72	347769,72	347769,72	347769,72	347769,72	347769,72	347769,72	347769,72	347769,72	347769,72	347769,72	347769,72
NOVČANI ODLIVI																		
Troškovi održavanja	EUR		0	0	0	0	0	0	2.492	2.492	2.492	2.492	2.492	2.492	2.492	2.492	2.492	2.492
Investicioni troškovi	EUR		830.533	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NETO NOVČANI TOK	EUR		-830.533	347.770	347.770	347.770	347.770	347.770	345.278	345.278	345.278	345.278	345.278	345.278	345.278	345.278	345.278	345.278
KUMULATIVNI NOVČANI TOK	EUR		-830.533	-482.763	-134.994	212.776	560.546	908.316	1.253.594	1.598.872	1.944.150	2.289.428	2.634.706	2.979.984	3.325.262	3.670.540	4.015.819	4.361.097
IRR	%		42%															
NPV	EUR		2.764.123,08															
Diskontirani period povrata	god.		3															
Period povrata	god.		3															

Table 26: Cash flow Scenario 2

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STAVKA	JEDINICA	IZNOS	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
NOVČANI PRILIVI																		
Finansijske uštede	KM			708.050,67	708.050,67	708.050,67	708.050,67	708.050,67	708.050,67	708.050,67	708.050,67	708.050,67	708.050,67	708.050,67	708.050,67	708.050,67	708.050,67	708.050,67
NOVČANI ODLIVI																		
Troškovi održavanja	KM		0	0	0	0	0	0	9.564	9.564	9.564	9.564	9.564	9.564	9.564	9.564	9.564	9.564
Investicioni troškovi	KM		3.188.052	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NETO NOVČANI TOK	KM		-3.188.052	708.051	708.051	708.051	708.051	708.051	698.487	698.487	698.487	698.487	698.487	698.487	698.487	698.487	698.487	698.487
KUMULATIVNI NOVČANI TOK	KM		-3.188.052	-2.480.001	-1.771.950	-1.063.900	-355.849	352.202	1.050.688	1.749.175	2.447.661	3.146.148	3.844.634	4.543.121	5.241.607	5.940.094	6.638.580	7.337.067
IRR	%	21%																
NPV	KM	4.103.407,25																
Diskontirani period povrata	god.	5																
Period povrata	god.	5																

DEVELOPMENT OF NEW AND UPGRADE OF EXISTING FEASIBILITY STUDIES FOR INSTALLMENT OF NEW ENERGY EFFICIENT PUBLIC LIGHTING SYSTEM
CITY OF ŽIVINICE

STAVKA	JEDINICA	IZNOS	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
NOVČANI PRILIVI																		
Finansijske uštede	EUR		0	362020,56	362020,56	362020,56	362020,56	362020,56	362020,56	362020,56	362020,56	362020,56	362020,56	362020,56	362020,56	362020,56	362020,56	362020,56
NOVČANI ODLIVI																		
Troškovi održavanja	EUR		0	0	0	0	0	0	4.890	4.890	4.890	4.890	4.890	4.890	4.890	4.890	4.890	4.890
Investicioni troškovi	EUR		1.630.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NETO NOVČANI TOK	EUR		-1.630.025	362.021	362.021	362.021	362.021	362.021	357.130	357.130	357.130	357.130	357.130	357.130	357.130	357.130	357.130	357.130
KUMULATIVNI NOVČANI TOK	EUR		-1.630.025	-1.268.004	-905.984	-543.963	-181.943	180.078	537.208	894.339	1.251.469	1.608.600	1.965.730	2.322.861	2.679.991	3.037.122	3.394.252	3.751.383
IRR	%		21%															
NPV	EUR		2.098.038,81															
Diskontirani period povrata	god.		5															
Period povrata	god.		5															

Table 27: Cash flow Scenario 3

All considered scenarios have acceptable financial indicators. The IRR value for Scenario 1 is 41% and for Scenario 2 is 42%. The payback period for Scenario 1 and Scenario 2 is the same of 3 years, as is the discounted payback period of 3 years. The NPV in Scenario 1 is 5 million BAM or 2.59 million EUR, and in Scenario 2 it is 5.4 million BAM or 2.76 million EUR. In Scenario 3, the IRR is 21% and the payback period is 5 years and the discounted payback period is 5 years. The NPV in Scenario 3 is 4.1 million BAM or 2.09 million EUR.

Taking into account the above, it is recommended that the city of Živinice implements the EE measures proposed under Scenario 2, given that they lead to the realization of the greatest financial effects in relation to the financial resources invested in their implementation. Given that Scenario 3 has a payback period of 5 years, which is a favorable financial indicator for measures of this type, it is recommended that this scenario be proposed and nominated through other funds and organizations and implemented as a pilot project.

11.5 Analysis of funding sources

The city of Živinice has several different models and sources of funding available for the implementation of the proposed measures in the public lighting system.

First of all, it is necessary to consider the City of Živinice's own financial capacity to implement these measures. According to the data on the budget for 2018 and 2019, the city of Živinice allocated an average of 41% for capital projects. The investment in the proposed EE measures is approximately 14.5% of the amount of money allocated for capital projects from the budget of the city of Živinice in the mentioned period. Therefore, it can be concluded that there is a financial capacity of the city of Živinice to implement the proposed EE measures from its own resources.

An additional possibility of financing the implementation of the proposed EE measures is through loans. The city of Živinice can provide credit funds with domestic commercial banks or international financial institutions (EBRD, WB, etc.).

The third possibility for financing EE measures is through public-private partnership (PPP), which is becoming an increasingly common practice in the realization of many public investments. The PPP model can be attractive to both the public and private sectors. Private financing can support increased investment in projects of social interest without additional public sector borrowing. At the same time, better private sector management systems, and their capacities leading to innovation, can lead to increased efficiency in the implementation and management of various projects of social interest.

On the other hand, the interest of the private sector exists primarily for financially viable projects that have the possibility of commercialization. Also, the involvement of the private sector through the PPP model can lead to additional benefits for the public sector, such as:

- Faster project implementation;
- Reduction of implementation and project management costs;
- Creation of added value and additional income.

In accordance with the Law on Public-Private Partnership, the city of Živinice is able to involve the private sector in improving the public lighting system through two PPP models:

-Contractual form - according to which the partnership between public and private partner is based exclusively on contractual relations;

-Institutional form - according to which the partnership of the public and private sector includes the cooperation of the economic entity formed for that purpose.

In order to consider the possible costs and benefits of implementing EE measures through PPP, and to select the most acceptable PPP model, it is necessary to perform a detailed analysis of possible models of PPP implementation, taking into account the interests of the city of Živinice and potential private partners.

11.6 Least Cost analysis of public lighting systems

Least cost analysis of the public lighting system implies a comparison of possible public lighting systems from the financial aspect in relation to the proposed public lighting system. All public lighting systems use electricity to produce artificial light. So there are no alternatives between public lighting systems when it comes to the energy they use.

Therefore, the only segment in which it is possible to compare different public lighting systems is by the technology and equipment they use. Taking into account the above, in the city of Živinice, it is possible to identify and compare 2 public lighting systems:

- Existing system - which uses fluorescent and sodium lamps to produce artificial light;
- Proposed system - which uses LED lamps with the possibility of dimming the light.

In order to compare the mentioned systems from the financial aspect, the calculation of unit costs per lamp for both systems was performed. Table 28 provides an overview of these costs.

ITEM	UNIT	Existing system	Proposed system
Number of lamps	piece	6.802	6.802
Electricity costs	BAM/year	824.316	144.137
	EUR/year	421.466	73.696
Maintenance costs	BAM/year	0	4.873
	EUR/year	0	2.492
Investment costs	BAM	0	1.624.381
	EUR	0	830.533
Electricity costs per unit	(KM/lamp)	121	21
	(EUR/lamp)	62	11
Unit maintenance costs	(KM/lamp)	0	1
	(EUR/lamp)	0	1

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Unit investment costs	(KM/lamp)	0	21
	(EUR/lamp)	0	11
TOTAL UNIT COST	BAM	121	43
	EUR	62	22

Table 28: Unit costs of public lighting systems

Based on the previous table, it can be concluded that the proposed public lighting system is significantly more cost-effective for the city of Živinice, by 78 BAM or 39.88 EUR per lamp per year.

11.6.1 Sensitivity analysis

Sensitivity analysis includes an analysis of the impact of variables, which can lead to a change in either project costs or revenue, on the final result of the project. In this case, the variables that may affect the ultimate cost-effectiveness of implementing the selected scenario are investment costs (CAPEX) and operating costs (OPEX). For the purpose of making the sensitivity analysis, the changes of CAPEX and OPEX by / 5% were assumed and their impact on IRR, NPV, payback period and discounted payback period was analyzed. Table 29 shows the results of the sensitivity analysis.

Variable	Change	Result			
		IRR	NPV (EUR)	Payback period (yr.)	Discounted payback period (yr.)
CAPEX	-5%	44%	2.795.600	3	3
	0%	42%	2.754.073	3	3
	5%	40%	2.712.547	3	3
OPEX	-5%	42%	2.755.330	3	3
	0%	42%	2.754.073	3	3
	5%	42%	2.752.817	3	3

Table 29: Sensitivity analysis

Based on the results of the sensitivity analysis, it can be concluded that:

- Reduction of CAPEX by 5% leads to:
 - IRR increase by 2%;
 - NPV increase by 41 thousand EUR;
- Increasing CAPEX by 5% leads to:
 - IRR reduction by 2%;
 - NPV reduction 41 thousand EUR;

Reduction or increase of OPEX by 5% has no significant impact on the final profitability of the project.

12 ENVIRONMENTAL AND SOCIAL ASSESSMENTS

12.1 CO₂ reduction analysis

Earth is a large greenhouse in space where instead of glass, heat is maintained by some of the gases in the atmosphere. They let in the heat of the Sun that reaches the ground, and then retain it and maintain the temperature on a planet suitable for life. On the other hand, when coal burns, carbon combines with oxygen from the air and thus forms carbon dioxide - CO₂. Carbon dioxide is a colorless and odorless gas, and in the atmosphere it is one of the greenhouse gases. Increasing its concentration causes a decrease in heat loss by radiation from the Earth's surface into space and therefore increases the temperature on Earth.

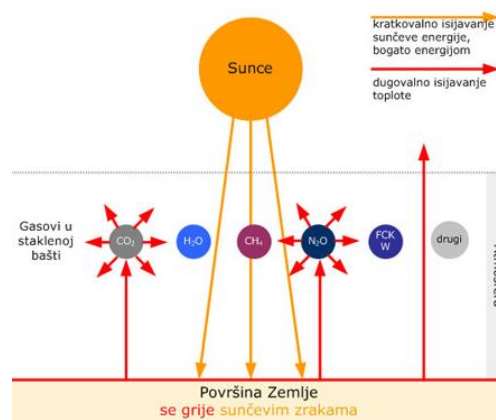


Image 60: Greenhouse effect

As CO₂ concentrations have increased over the last century the greenhouse effect is becoming more pronounced. The consequence is a global increase in average temperature which causes:

- melting of polar caps and glaciers,
- raising sea levels,
- climatic extremes,
- impact on agriculture.

According to the analysis of the current situation, at the locations in the city of Živinice that are the subject of this study, mostly sodium light sources are used, which are low-efficient in terms of electricity consumption, i.e. large consumers of electricity, which directly affects CO₂ greenhouse gas emissions.

CO₂ emissions from public lighting are indirect emissions from electricity consumption (emissions do not occur at the location of direct energy consumption), and data on annual electricity consumption and CO₂ emission factor for electricity will be used as input data for the calculation.

Emission factor for electricity according to the Ordinance on the methodology for calculating the energy performance of buildings (Official Gazette of FBiH 81/19), which is obtained from the ratio

of electricity produced from hydropower and thermal power plants depending on the structure of fossil fuels used (and other renewable sources) amounts to **0.7446 tCO₂ / MWh**.

According to the analyses of energy consumption and measures recommended in Chapter 7, the results of the calculation of CO₂ emissions for the current situation, scenario 1, scenario 2 and scenario 3, reductions in electricity consumption and indirect CO₂ emissions resulting from the implementation of each of these measures presented below.

Parameter	Current situation	Scenario 1	Scenario 2	Scenario 3
Electricity consumption (kWh / year)	3.968.781	894.208	693.969	559.774
CO ₂ emissions (t/year)	2955,15	665,83	516,73	416,81
Savings (kWh)	-	3.074.573	3.274.812	3.409.007
CO ₂ savings (t /year)	-	2289,33	2438,43	2538,35
CO ₂ emission reduction (%)	-	77,47%	82,51%	85,90%

Table 30: Electricity consumption for public lighting on the analyzed coverage and associated CO₂ emissions

Based on the results of the calculation, the annual indirect CO₂ emissions of public lighting in the city of Živinice for the current situation amount to 2955.15 tCO₂/year, with an annual electricity consumption in the amount of 3.968.781 kWh/year. By implementing the measures proposed by the project, it is possible to achieve an overall reduction in emissions of 77,47% by applying scenario 1, 82.51% by scenario 2 and 85.90% by scenario 3. By applying scenario 3, the largest reduction in electricity consumption is achieved, and thus indirect CO₂ emissions compared to the current situation.

The reduction of harmful components into the atmosphere is in line with the tasks that BiH needs to fulfill in terms of implementing international obligations. As a signatory to a number of international agreements and conventions related to environmental protection and renewable sources (Southeast European Energy Community Treaty, Framework Convention on Climate Change, Kyoto Protocol, Espoo Convention, etc.) and the Stabilization and Association Agreement itself, Bosnia and Herzegovina is committed to respect the same.

The members of the Energy Community have committed themselves to the implementation of a number of EU directives, including Directives 2001/77 / EC, 2003/30 / EC and 2009/28 / EC. The mentioned directives refer to the obligations of the EU member states, that is, the signatories, that they will work on the development and wider application of various renewable energy sources in the energy sector and transport.

In particular, Directive 2009/28 / EC provides a framework for the harmonization of activities and legislation related to the application of green technologies.¹⁰ Adherence to the provisions of the 2009 Directive would mean for BiH that the share of renewable sources will increase by 2% in the next two years, or by more than 6.5% in 2020 (to 33%) .

By signing the Agreement on the Common Energy Market of Southeast Europe, BiH, like other members, has committed itself to transposing the *acquis communautaire* in the field of energy and environmental protection.

The aim of establishing the Community, in addition to creating a single energy market, was to increase energy efficiency and the use of renewable energy sources.

BiH ratified the UN Framework Convention on Climate Change (UNFCCC) on December 6, 2000. As we are not a developed country (we do not belong to Annex I), we do not have a strict obligation to reduce greenhouse gases, but we have general obligations related to calculating annual greenhouse gas emissions, implementing measures to regulate anthropogenic emissions and measures to adapt to climate change, adoption and development of technologies that limit and reduce greenhouse gases.

12.2 Waste disposal

During the implementation of the project, the Investor is obliged, in accordance with the provisions of Article 19 of the Law on Environmental Protection and the provisions of Article 19 of the Law on Waste Management, to take adequate waste management measures and provide basic measures to prevent waste generation, recycling and waste treatment. reuse, extraction of raw materials and possible energy and safe disposal. Considering that the project includes the dismantling of existing lamps which according to the Rulebook on waste categories with lists ("Official Gazette of FBiH", No. 09/05) are classified as hazardous waste, and which includes any waste that has one or more characteristics that cause danger for human health and the environment by their origin, composition or concentration, as well as those wastes that are listed in the waste list as hazardous and regulated by an implementing regulation.

Therefore, the current legislation defines the manner of disposal of this type of waste, i.e. the operator / owner of waste is obliged to enter into a contract with an authorized company that deals with the collection and final disposal of this type of waste and with the prescribed documentation to hand it over. Also, the authorized company is obliged to give feedback to the owner of hazardous waste that the waste has been disposed of in the prescribed manner.

In order to minimize waste generation, during the implementation of project activities to replace existing lamps, it is necessary to take measures to prevent waste generation. One of the goals of waste management is controlled waste disposal, prevention of irresponsible waste management, controlled procurement of funds and education on waste management and safe disposal of waste while taking all necessary measures to protect human health and the environment.

¹⁰ Energy Community, Study of the Implementation of the New EU Renewables Directive in the Energy Community, juni 2010., p. 6., www.energy-community.org

Table 31 shows the waste flow of the Investor with a description of waste management practices, which the Investor is obliged to implement and the regulations according to which each measure is implemented.

No.	Emission	Description of the waste stream management procedure	Final disposal	Relevant regulations in FBiH that prescribe it
1.	Electronic waste from the removal of existing lamps	<p>Proper temporary storage in a specially designated place and special containers</p> <p>-Removal by special vehicles by an authorized company</p> <p>-Handing it over to an authorized company for further management</p>	Authorized company for this type of waste with which the Investor will enter into a contract	<p>-In accordance with the Law on Waste Management ("Official Gazette of FBiH", No. 33/03, 72/09, 92/17)</p> <p>-In accordance with the Regulation on Selective Collection and Labeling of Waste ("Official Gazette of FBiH", No. 38 / 06),</p> <p>- In accordance with the Rulebook on the conditions for the transfer of waste management obligations from producers and sellers to the Investor of the waste collection system ("Official Gazette of FBiH", No. 9/05)</p>

Table 31: Waste management procedures in accordance with regulations in FBiH and EU legislation

12.3 Light pollution

Light pollution includes any unnecessary emission of artificial light in a space outside the zone that needs to be illuminated. The main causes of this type of pollution include mainly improper installation and design of lighting fixtures and therefore when installing new lighting fixtures or designing a new public lighting network, it is important to adjust the design that will have the least negative impact.

In addition, light pollution can be avoided by using environmentally friendly lighting fixtures that do not scatter light outside the space that needs to be illuminated. According to the data of the First World Atlas of Light Pollution from 2001, 82% of the population in Bosnia and Herzegovina is exposed to clear skies whose light is greater than the natural light of the night sky: threshold bp which determines that the night sky is polluted [i.e. when the light of the artificial sky is greater than 10% of the natural light of the night sky above 45 ° altitude (Smith 1979)¹¹

¹¹ The first World Atlas of the artificial night sky brightness, P. Cinzano, F. Falchi, C.D. Elvidge, December 2001, Monthly Notices of the Royal Astronomical Society, Volume 328, Issue 3, December 2001, Pages 689–707



Image 61: Satellite image of Europe at night¹²

If we take into account that light pollution cannot be completely avoided, it is necessary to minimize negative impacts by applying simple principles and measures. Also, unlike other types of pollution, the results of the application of measures to reduce light pollution are visible immediately, at least at the local level. Effective reduction measures are based on the following principles:

- Artificial light should be directed where it is needed and emissions outside the coverage area should be minimized
- Depending on the purpose, it is necessary to ensure that the illumination does not exceed the required minimum
- Whenever possible, it is necessary to use light of warm tones and continuous spectrum, and avoid sources that emit a lot of light energy in the blue, purple and near UV range of the spectrum.

If we compare the current lighting fixtures and the project proposed lamps, the current lighting fixtures in the city of Živinice are designed to emit light in almost all directions, and the efficiency of emitted light to illuminate the desired area is only 10- 30%.

This type includes all those lighting fixtures in which the glass ball or hemisphere is "thrown" out of the luminaire housing. The use of these lighting fixtures is usually extremely energy inefficient, i.e. 30- 40% of electricity is wasted unnecessarily, which is also shown in the earlier chapters in which the comparison of electricity consumption was made.

Unlike existing lighting fixtures, the project envisaged alternative environmentally friendly lighting fixtures that are fully shaded and have the ability to control light emission and not allow light to be scattered into the environment.

Such luminaries have flat glass on the underside, and the cheaper versions are without glass and illuminate only the target area, without unnecessarily emitting light to the side and towards the sky. The implementation of measures to replace inefficient lighting fixtures in the city of Živinice achieves a significant reduction in light pollution and reduces the risks that this type of pollution has on the health and safety of residents.

¹² <http://www.savethenight.eu/Lights%20in%20Europe.html>

13 COMPARATIVE ANALYSIS OF PUBLIC LIGHTING ENERGY CONSUMPTION INDICATORS

When analyzing electricity consumption, it is necessary to provide consumption indicators in order to identify and analyze energy consumption in the system, compare consumption before and after the implementation of energy efficiency measures, and ultimately make comparisons on an annual level or with similar systems of other Cities / Municipalities. Energy consumption indicators are values derived from parameters that describe or provide information on the state of energy consumption of the system.

They appear as indices (a set of aggregated parameters or parameters with weight fractions), or as parameters (value measured or evaluated). Without energy consumption indicators in the field of energy, energy management is inconceivable, precisely because they provide a link between human activities, energy changes, but also the effects of measures.

Indicators allow individual systems to be compared with other or to be monitored over a longer period of time. Therefore, the indicators will be used to analyze the energy consumption of the system.

Energy consumption indicators can be expressed as ratios of produced / consumed energy per lamp unit or some similar criterion.

Therefore, the indicator of annual energy consumption can be presented through the ratio of total annual energy consumption (P , kWh) of the system and e.g. by the number of light sources (B_r , number), for which the following equation is used:

$$E = \frac{P}{B_r} \quad (9.)$$

Apart from the number of light bulbs, energy consumption can be expressed by the total area of the Municipality / City or the considered part of the public lighting system or by other specifics that have an impact on energy consumption, and this energy consumption indicator can be presented by the ratio of total annual electricity consumption. (City, Municipality, Street, etc.) and considered areas (City, Municipality, Street, etc.):

$$E = \frac{P}{A} \quad (10.)$$

In addition to these, there are other ways of expressing electricity consumption indicators, so in the case of this system, the indicators of actual electricity consumption are provided in earlier chapters.

13.1 Indicators of electricity consumption for the current situation

In order to compare and analyze the consumption of electricity for public lighting, it is necessary to provide indicators of energy consumption in the public lighting system. Electricity consumption indicators can depend on many factors such as geographical location, degree of utility of the system and the like.

For the purpose of analysis of electricity consumption for public lighting, the most important indicators are given below, which will be analyzed even after the possible implementation of the proposed energy efficiency measures, i.e. the realization of the optimal scenario. By having indicators for the current state of energy consumption, and indicators of energy consumption after the proposed energy efficiency measures, a comparative analysis of these indicators is possible.

Thus, the following energy consumption indicators will be considered:

- Number of light sources (pcs),
- Required electricity for public lighting (kWh / year),
- Specific annual consumption (kWh / light source /yr).

The most relevant and most frequently analyzed indicator is the consumption of electricity for public lighting by light source (kWh / pc per year).

The specific consumption of electricity, i.e. the need for electricity for public lighting, depends on the size of the system, i.e. the number of light sources. The listed indicators of electricity consumption for public lighting for the current situation are given in Table 32.

Indicator	Value
Number of light sources (pcs)	6802
Required electricity for public lighting (kWh / year)	3.968.780,53
Specific annual consumption (kWh / light source year)	583,47

Table 32: Overview of electricity consumption indicators for public lighting for the current condition of the building

It can be seen that required public lighting electricity for the current state is 3,968,780.53 kWh / year. If this value is divided by the considered number of light sources, it is obtained that the specific annual consumption is 583.47 kWh / light source per year.

13.2 Comparative analysis of electricity consumption indicators and electricity needs for the current situation and after the implementation of measures

Following the implementation of the proposed measures to increase energy efficiency, electricity consumption for public lighting would be reduced. This reduction in electricity consumption is represented by the energy indicators provided in Table 33, according to the optimal scenario described earlier in the document.

Indicator	Value
Number of light sources (pc)	6.802
Electricity required for public lighting (kWh /year)	693968,54
Specific annual consumption (kWh / light source/ yr)	102,02

Table 33: Overview of electricity consumption indicators for public lighting after the implementation of the proposed measures

It can be seen from the table that the electricity needs would be 693.968,54 kWh / year, and thus the specific electricity consumption per light source on an annual basis would be reduced to 102,02 kWh/ light source per year.

13.3 Comparative analysis of electricity consumption indicators and electricity needs for the current situation and after the implementation of measures

The comparative analysis established the state of electricity needs for public lighting before and after the implementation of energy efficiency measures. As expected, the electricity needs after the implementation of energy efficiency measures would be reduced. An overview of indicators before and after the implementation of energy efficiency measures is given in Table 34.

Indicator	Current situation	After the measures Implementation
Required electricity for public lighting (kWh / year)	3968780,53	693968,54
Specific annual electricity consumption (kWh/light)	583,47	102,02

Table 34: Overview of indicators before and after the implementation of the proposed measures to increase energy efficiency

Comparing the relevant indicators before and after the implementation of energy efficiency measures (according to the optimal scenario), it is obvious that the electricity needs are reduced by 82,51%, and thus the specific annual consumption from 583,47 kWh / light source to 102,02 kWh / light source/ yr.

14 CONCLUSION

Through the preparation of the Study for the replacement of existing lighting fixtures with LED lighting, the key aspects that are important in the implementation of such a project were considered and analyzed. The identification of the initial state of the lighting system was done, which determined the basis for further conceptual design of the system. It was determined that such solutions make sense and that the effects after the implementation of the project are positive both financially and environmentally.

The first part of the study focused on the analysis of the current state of light sources, electrical characteristics and electricity consumption. A field visit revealed that the lamps are of very low energy efficiency.

The second part of the study included an analysis of the electricity consumption of the public lighting system. It has been established that the costs for electricity in the last three years amount to 0,2077 BAM/ / kWh.

The third part of the study is the one in which the proposed measures are as follows:

- Replacement of existing lighting fixtures with LED lighting
- Replacement of existing lamps with LED lamps with dimming ability - where dimming is possible and will not affect functionality and safety
- Replacement of existing lamps with LED lamps with possibility of dimming - where dimming is possible and will not affect the functionality and safety with the installation of central technical supervision,

The fourth part of the study is the one in which the cost-effectiveness analysis of all proposed measures was performed. All measures are cost-effective within acceptable deadlines. Combinations of measures (scenarios) have been proposed and it has been shown that the optimal scenario is scenario 2. In addition, the reduction of CO₂ emissions has been calculated if any of the scenarios is realized.

If the measures are carried out according to the optimal scenario, it is possible to achieve energy savings of 82,51%. The investment would pay off in 3 years according to current electricity prices.

15 APENDICES

- Geolocation coordinates of poles and lighting fixtures
- Imagemetric calculations of new lighting with LED technology on the streets
- Specification of public lighting works

15.1 Geolocation coordinates of poles, light fixtures and BMP

15.2 Imagemetric estimates of new lighting with LED technology per streets

15.3 Specification of equipment and overview of public lighting works