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MODERNIZATION OF THE EXISTING PUBLIC LIGHTING FOR THE CITY OF IG

Project partner:

Občina Ig, Govekarjeva cesta 6, 1292 Ig



Author of the study:

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Velenje, September 2025

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PROJECT INFORMATION

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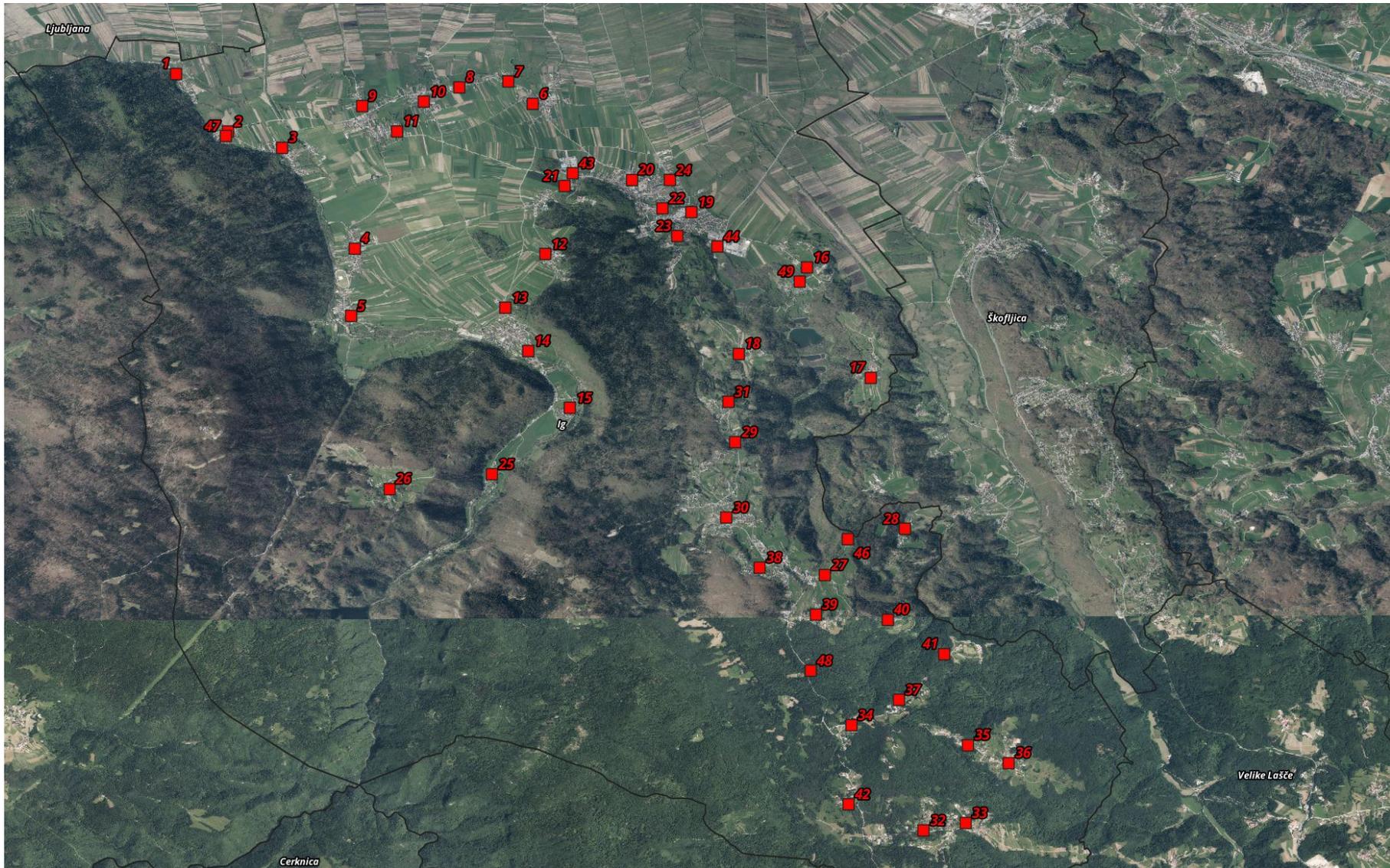
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0 INTRODUCTION

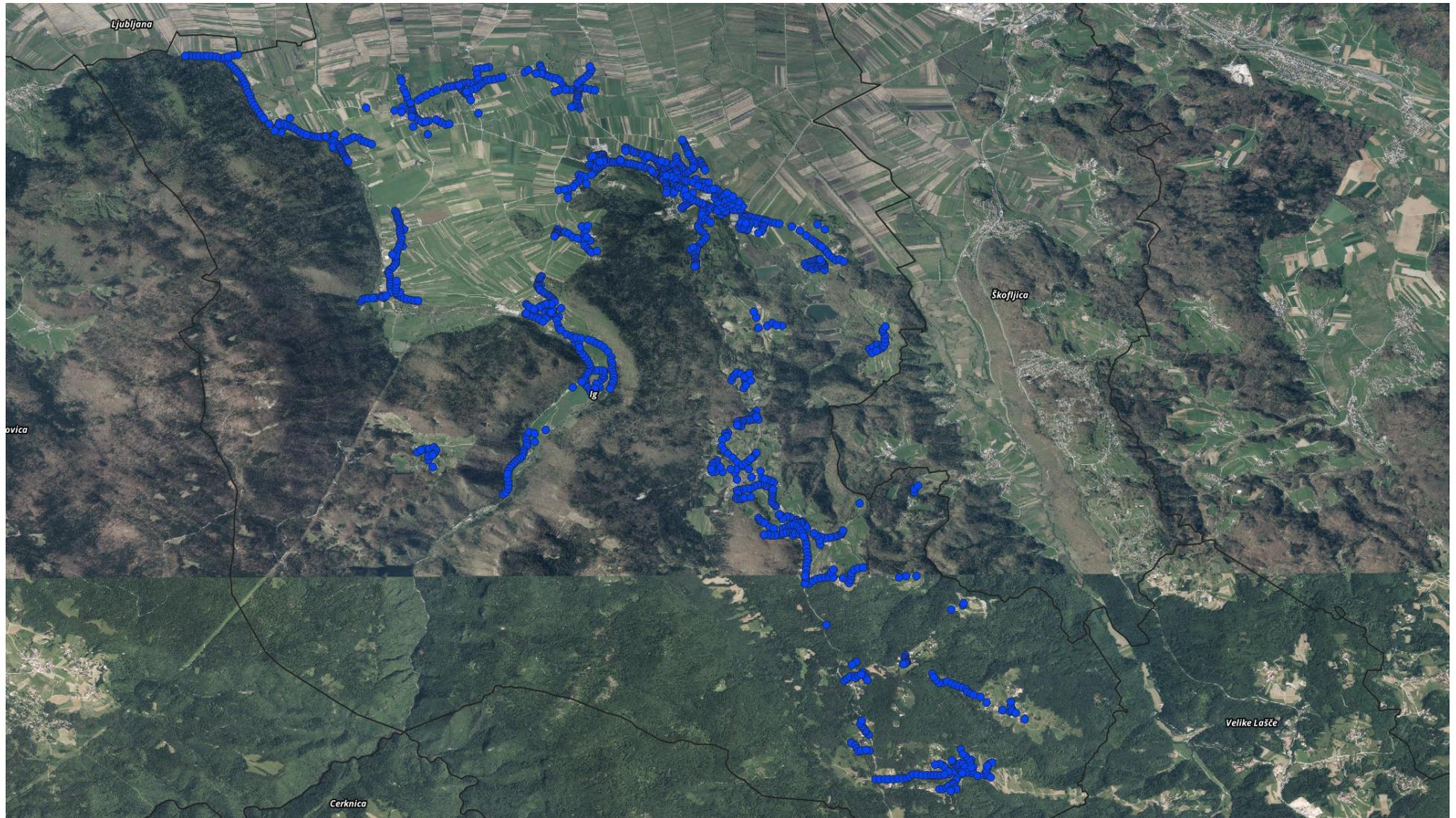
The purpose of the study is to identify the needs and priorities for the implementation of a gradual technological renovation/modernization of the existing public lighting system in the municipality of Ig. The goal of the renovation of the public lighting system is a technologically modern, energy-saving, user-friendly and environmentally friendly public urban lighting system.

The optimization of the existing public lighting system includes measures to modernize and adapt the existing PLI to new lighting requirements of various situations on traffic and other surfaces illuminated by the PLI. At the same time, the study also deals with the installation of additional PLI lamps in conflict areas (narrowed roads, dangerous junctions, bus stops, etc.), pedestrian crossings, on school routes, etc., which will ensure higher safety for users of public areas in the municipality.

The renovation of the public lighting infrastructure is planned for lamps, partially for poles and existing consoles. Ignition points are not part of the renovation.



Picture 1: Overview of the locations of existing electrical cabinets for the operation of public lighting



Picture 2: An overview of the locations of existing public lighting lamps

1 OVERVIEW OF THE EXISTING PUBLIC LIGHTING INFRASTRUCTURE

The public lighting infrastructure extends from the city entrance, main roads to compact settlements throughout the entire municipality. The PLI¹ also extends to smaller settlements on the outskirts of the city of Ig. Sections of regional roads, sections of main roads, local roads and parts of settlements are illuminated. In some parts of settlements where there is no significant population, there is no public lighting. Public lighting is concentrated around the central parts of the municipality.

Table 1: Basic data on public lighting infrastructure in the municipality of Ig

LAMPS²	Number (piece)
Lamps comply with the regulation ³	903
Lamps inconsistent with the regulation ²	345
Total number of lamps	1.248
LOKACIJE/DROGOVI	Number (piece)
Metal pole - painted	50
Metal pole - galvanized	1.058
Wooden pole	74
Concrete pole	20
Pole construction - composite mass	16
Facade/wall/tree/roof/column/floor	21
Total number of locations	1.239
Electrical connections to the LV network/electrical cabinets for the operation of public lighting	Number (piece)
A free-standing cabinet	45
In or on the facility	2
Total number of electrical cabinets	47

¹ PLI – Public lighting infrastructure.

² Lamps that are owned by the municipality of Slovenska Bistrica and are slated for replacement.

³ Regulation on limit values of light pollution of the environment (Official Gazette of the RS, no. 81/07, 109/07, 62/10, 46/13 and 44/22 – ZVO-2).

2 MEASURES TO UPDATE THE INFRASTRUCTURE OF PUBLIC LIGHTING

The renovation of public lighting includes the replacement of energy-inefficient lamps and lamps that do not comply with the Regulation. The following lamps are used in the calculations for individual sections:

1. **Road sections of higher lighting technical classes:** high-efficiency lamps using LED technology. Lamp optics adapted to the situation.
2. **Road sections of lower lighting technical classes:** high-efficiency lamps using LED technology. Lamp optics adapted to the situation.
3. **Pedestrian paths:** lamps with high-efficiency lamps using LED technology. Lamp optics adapted to the situation - symmetrical.
4. **Pedestrian crossings:** high-efficiency lamps using LED technology. Lamp optics adapted to the situation - asymmetrical.
5. **Conflict areas:** lamps with high-efficiency lamps using LED technology: Lamp optics adapted to the situation. Conflict areas include areas of roundabouts, intersections, dangerous junctions, bus stops, etc.

The scope of the renovation also includes the necessary consoles, extensions, junction boxes, cables and other necessary equipment, without which it is not possible or reasonable to carry out the energy renovation. For new locations, all associated construction work and the costs of installing new lamps are also taken into account.

2.1 Technical starting points for renovation and equipment

2.1.1 Basic documents and guidelines

The following basic and technical aspects, as well as legal requirements and recommendations, are considered during the renovation of the public lighting infrastructure:

Lamps:

- Lamps are replaced in accordance with the requirements of the Regulation on light pollution limit values.
- Slovenian standard for road lighting:
 - SIST-EN 13201-1
- EU criteria for green public procurement for road lighting and traffic signals, December 2018.
- Guideline for road lighting in the area of pedestrian and/or cyclist crossings, March 2019.
- Partially complied with - Road lighting - SDR recommendations.

Electrical cabinets for connection to LV grid and attached electrical cabinets for lighting control:

- No renovation planned

Locations / Poles:

- Restoration of poles (damages, corrosion, pole extensions etc.).

The following documents were taken into account during the preparation of the technical report:

- Cadastre of the infrastructure of public lighting:
 - Cadastre of the lighting - Ig (September 2025).

2.1.2 Technologies used for PLI equipment

The following technologies are used to ensure lighting technical parameters and the expected minimum savings:

- Luminaires – LED technology.
- PLI regulation and operation optimization technologies.

Table 2: Technical characteristics of the selected LED lights

Designation of the type of luminaire to be replaced	Lamp/lighting module type	Maximum total lamp power [W]	Lamp luminous efficiency [%]	Actual luminous flux of the lamp/lighting module [lm]	Lamp description	Number of luminaires in the proposal for complete replacement	Number of luminaires in the proposal for partial replacement	Number of luminaires in the proposal for new construction
S1	LED	16,0	98%	2.235	Luminaire with basic features - min. protection class (RZ): I., min. mechanical strength of the housing (IP): IP66, housing material: aluminum alloy, housing treatment: powder coated, housing color (RAL): customer's choice from the manufacturer's color palette, glass: Tempered glass, installation: pole mount Ø 60/76 mm, console with adjustment ±15° in 5° steps - equivalent or as. e.g. - LC Light Compact, GEOLUX	87	58	0
S2	LED	16,0	98%	2.235	Luminaire with basic features - min. protection class (RZ): I., min. mechanical strength of the housing (IP): IP66, housing material: aluminum alloy, housing treatment: powder coated, housing color (RAL): customer's choice from the manufacturer's color palette, glass: Tempered glass, installation: pole mount Ø 60/76 mm, console with adjustment ±15° in 5° steps - equivalent or as. e.g. - LC Light Compact, GEOLUX	21	21	0
S3	LED	25,0	98%	3.079	Luminaire with basic features - min. protection class (RZ): I., min. mechanical strength of the housing (IP): IP66, housing material: aluminum alloy, housing treatment: powder coated, housing color (RAL): customer's choice from the manufacturer's color palette, glass: Tempered glass, installation: pole mount Ø 60/76 mm, console with adjustment ±15° in 5° steps - equivalent or as. e.g. - LC Light Compact, GEOLUX	108	42	20
S4	LED	25,0	98%	3.079	Luminaire with basic features - min. protection class (RZ): I., min. mechanical strength of the housing (IP): IP66, housing material: aluminum alloy, housing treatment: powder coated, housing color (RAL): customer's choice from the manufacturer's color palette, glass: Tempered glass, installation: pole mount Ø 60/76 mm, console with adjustment ±15° in 5° steps - equivalent or as. e.g. - LC Light Compact, GEOLUX	76	53	0
S5	LED	32,0	98%	4.471	Luminaire with basic features - min. protection class (RZ): I., min. mechanical strength of the housing (IP): IP66, housing material: aluminum alloy, housing treatment: powder coated, housing color (RAL): customer's choice from the manufacturer's color palette, glass: Tempered glass, installation: pole mount Ø 60/76 mm, console with adjustment ±15° in 5° steps - equivalent or as. e.g. - LC Light Compact, GEOLUX	8	7	82
S6	LED	32,0	98%	4.471	Luminaire with basic features - min. protection class (RZ): I., min. mechanical strength of the housing (IP): IP66, housing material: aluminum alloy, housing treatment: powder coated, housing color (RAL): customer's choice from the manufacturer's color palette, glass: Tempered glass, installation: pole mount Ø 60/76 mm, console with adjustment ±15° in 5° steps - equivalent or as. e.g. - LC Light Compact, GEOLUX	19	11	78

Designation of the type of luminaire to be replaced	Lamp/lighting module type	Maximum total lamp power [W]	Lamp luminous efficiency [%]	Actual luminous flux of the lamp/lighting module [lm]	Lamp description	Number of luminaires in the proposal for complete replacement	Number of luminaires in the proposal for partial replacement	Number of luminaires in the proposal for new construction
S7	LED	50,0	98%	6.158	Luminaire with basic features - min. protection class (RZ): I., min. mechanical strength of the housing (IP): IP66, housing material: aluminum alloy, housing treatment: powder coated, housing color (RAL): customer's choice from the manufacturer's color palette, glass: Tempered glass, installation: pole mount Ø 60/76 mm, console with adjustment ±15° in 5° steps - equivalent or as. e.g. - LC Light Compact, GEOLUX	114	56	0
S8	LED	50,0	98%	6.158	Luminaire with basic features - min. protection class (RZ): I., min. mechanical strength of the housing (IP): IP66, housing material: aluminum alloy, housing treatment: powder coated, housing color (RAL): customer's choice from the manufacturer's color palette, glass: Tempered glass, installation: pole mount Ø 60/76 mm, console with adjustment ±15° in 5° steps - equivalent or as. e.g. - LC Light Compact, GEOLUX	128	62	16
S9	LED	80,0	98%	11.917	Luminaire with basic features - min. protection class (RZ): I., min. mechanical strength of the housing (IP): IP66, housing material: aluminum alloy, housing treatment: powder coated, housing color (RAL): customer's choice from the manufacturer's color palette, glass: Tempered glass, installation: pole mount Ø 60/76 mm, console with adjustment ±15° in 5° steps - equivalent or as. e.g. - LC Light Compact, GEOLUX	49	19	1
S10	LED	54,0	100%	6.200	Luminaire with basic features - min. protection class (RZ): I., min. mechanical strength of the housing (IP): IP66, housing material: aluminum alloy, housing treatment: powder coated, housing color (RAL): customer's choice from the manufacturer's color palette, glass: Tempered glass, installation: pole mount Ø 60/76 mm, console with adjustment ±15° in 5° steps - equivalent or as. e.g. - LIGHTSTREAM mini, RZB	3	3	0
S11	LED	34,0	100%	5.300	Luminaire with basic features - min. protection class (RZ): I., min. mechanical strength of the housing (IP): IP66, housing material: aluminum alloy, housing finish: powder coated, housing color (RAL): customer's choice from the manufacturer's color palette, glass: Tempered glass, installation: pole mount Ø 60/76 mm, console with adjustment ±15° in 5° steps - equivalent or as e.g. - LIGHTSTREAM mini, RZB	1	1	0
S12	LED	35,0	99%	4.752	Lamp with basic features - min. protection class (RZ): I., min. mechanical strength of the housing (IP): IP66, housing material: aluminum alloy, housing treatment: powder coated, housing color (RAL): customer's choice from the manufacturer's color palette, glass: Tempered glass, installation: pole mount Ø 60/76 mm, console with adjustment ±15° in 5° steps - equivalent or as. e.g. - PLAIN II RETRO, GEOLUX	2	2	0

Designation of the type of luminaire to be replaced	Lamp/lighting module type	Maximum total lamp power [W]	Lamp luminous efficiency [%]	Actual luminous flux of the lamp/lighting module [lm]	Lamp description	Number of luminaires in the proposal for complete replacement	Number of luminaires in the proposal for partial replacement	Number of luminaires in the proposal for new construction
S13	LED	35,0	99%	4.752	Lamp with basic features - min. protection class (RZ): I., min. mechanical strength of the housing (IP): IP66, housing material: aluminum alloy, housing treatment: powder coated, housing color (RAL): customer's choice from the manufacturer's color palette, glass: Tempered glass, installation: pole mount Ø 60/76 mm, console with adjustment ±15° in 5° steps - equivalent or as. e.g. – PLAIN II RETRO, GEOLUX	2	2	0
S14	LED	50,0	98%	6.158	Lamp with basic features - min. protection class (RZ): I., min. mechanical strength of the housing (IP): IP66, housing material: aluminum alloy, housing finish: powder coated, housing color (RAL): customer's choice from the manufacturer's color palette, glass: Tempered glass, installation: snap on pole Ø 60/76 mm, console with adjustment ±15° in 5° steps - equivalent or as. e.g. - LC Light Compact PEDESTRIAN, GEOLUX	0	0	2
TOTAL						618	337	199

The optical units taken from the previous table are presented below. For each individual location, the corresponding luminaire with the corresponding built-in optics is listed. The table in the appendix shows detailed information for each location.

Table 3: Lamp optics

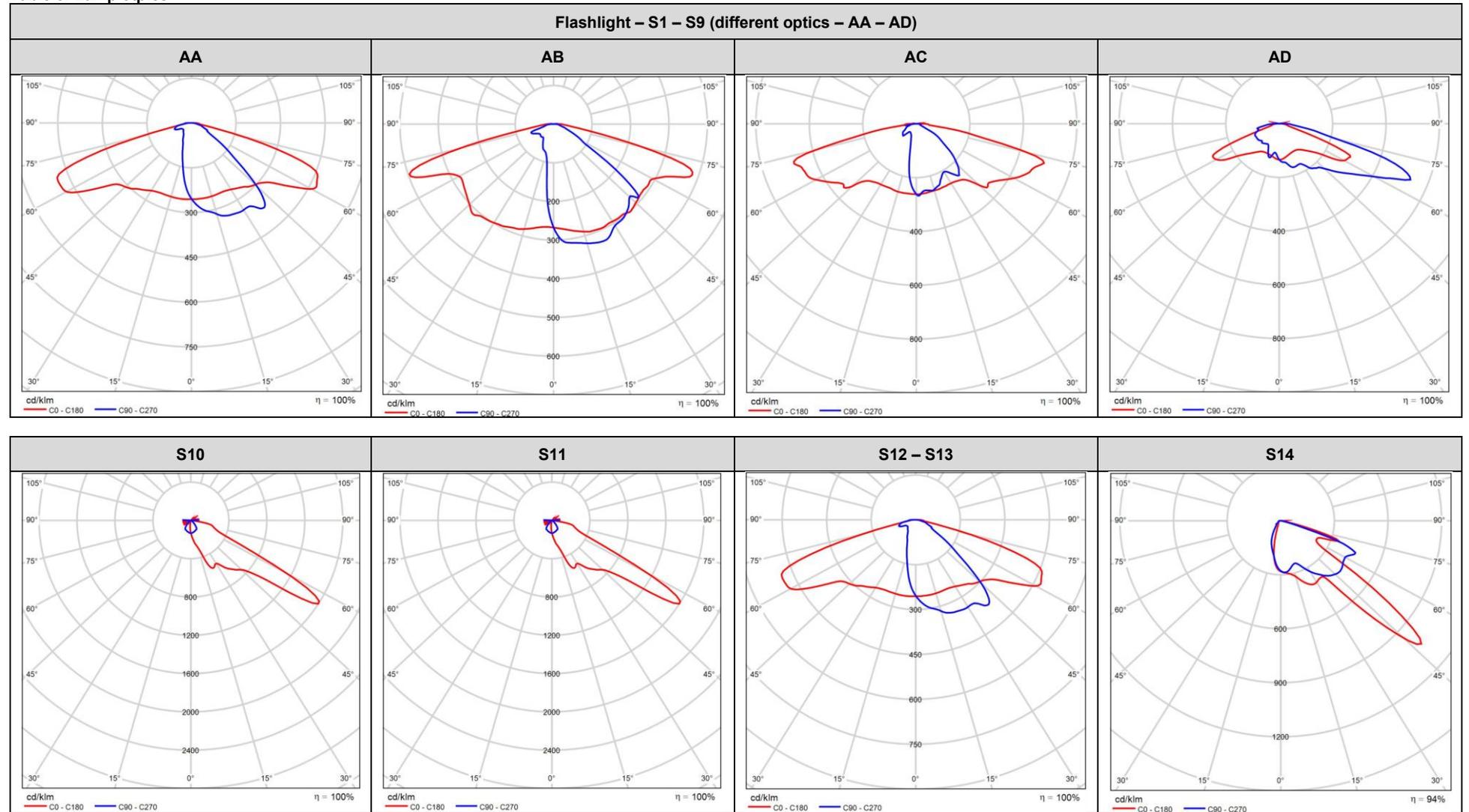


Table 4: Minimum technical requirements for LED module

Replacement lamp type designation	Light module type	Maximum light module power [W]	Minimum light module luminous flux [lm]	Color temperature [K]	Re - color rendering index	Service life of the light module [h]
S1	LED	16,0	2.281	3.000	80	100.000
S2	LED	16,0	2.281	4.000	80	100.000
S3	LED	25,0	3.142	3.000	80	100.000
S4	LED	25,0	3.142	4.000	80	100.000
S5	LED	32,0	4.562	3.000	80	100.000
S6	LED	32,0	4.562	4.000	80	100.000
S7	LED	50,0	6.284	3.000	80	100.000
S8	LED	50,0	6.284	4.000	80	100.000
S9	LED	80,0	12.160	4.000	80	100.000
S10	LED	54,0	6.200	4.000	80	50.000
S11	LED	34,0	5.300	2.700	80	100.000
S12	LED	35,0	4.865	3.000	80	100.000
S13	LED	35,0	4.865	4.000	80	100.000
S14	LED	50,0	6.284	3.000	80	100.000

2.1.3 Regulation, control, and supervision

Most of the existing public lighting infrastructure is based on simple control systems that enable the switching of luminaires on and off based on time schedules or the use of photocells. Such a method of regulation is technically simple and relies mainly on static parameters such as the time of day and the level of natural ambient light. Although the system is suitable for basic provision of public lighting functionality, it does not allow for adaptability to dynamic changes in real time, such as traffic loads, weather conditions or special local events.

Maintaining the existing approach to regulating, controlling and monitoring public lighting ensures stable and reliable system operation, but at the same time limits the possibilities for optimization in areas such as energy efficiency, cost-effectiveness and adaptability to the needs of users and the environment.

The transition to more modern, intelligent public lighting management systems would enable more advanced control, greater adaptability and a reduction in operation and maintenance costs in the long term, while contributing to sustainable energy management and improving the quality of lighting in urban and rural areas.

2.1.4 Renovation of electrical cabinets for connection to LV grid and attached electrical cabinets for lighting control⁴

The public lighting switchgears in the municipality are not located within the electricity distributor's infrastructure, i.e. in or at transformer stations, nor are they located in inaccessible areas. Due to their adequate accessibility and functionality, the renovation of the switchgears is not planned, as replacement or modernization would not bring significant improvements in the operation of the system at this time.

Such a decision allows for the rational use of financial resources and focusing on measures that bring the greatest benefits both in terms of energy efficiency and safety and quality of lighting of public areas.

Currently, the billing power of electricity is charged based on the actual consumption of an individual consumption point. In the event of a change in the billing methodology, it would be reasonable to conduct a detailed analysis of the possible reduction or increase in the consumption power by individual consumption points.

Based on operation measurements and calculated maximum load values, it is possible to prepare a plan for optimizing billing fuses. Such a plan allows for the appropriate

⁴ Separation and transfer of public lighting equipment from energy infrastructure facilities/equipment is required by Regulation on energy infrastructure (Official Gazette of the Republic of Slovenia, no. 22/16 and 173/21).

adjustment of the connection powers according to actual needs, which can prevent excessive system sizing and the associated unnecessary costs.

By properly optimizing the computing power, additional financial savings can be achieved, while at the same time ensuring more efficient use of electricity and greater operational efficiency of the entire system.

2.1.5 Calculations of new traffic surface sections

The given solutions cover the entire public lighting infrastructure owned by the Municipality of Ig, except for floor lamps and light traffic signals, which are not being processed. The proposal covers 2789 lamps (of which 818 lamps are planned on new locations) to be replaced by lamps with LED technology. Due to the specific characteristics of each road section and the associated public lighting infrastructure, it is impossible to treat all public lighting infrastructure sections with the same lighting technical standards or lamps. As a result of the above, control calculations for all different road sections have been made. If the two sections are comparable (same road width, speed of movement, users, situation, surrounding buildings etc.), the same parameters are used for the renovation (lights, heights etc.). For general road sections in the municipality of Ig, we divided them into groups of light technical situations according to the speed of traffic and the types of traffic participants: M - motor traffic, K - cyclists, P - pedestrians, T - slow traffic (tractors, horse-drawn vehicles, etc.). The light technical class for the following calculations was determined using characteristic data for roads - control calculations are given in the e-appendix of the document.

The instructions of the SIST EN 13201 standard are considered for the classification of individual lighting situations:

- Parameters of the road section:
 - the main participants in traffic,
 - the rest of the participants,
 - the typical speed of the main group of participants,
 - separation of lanes for opposite directions of travel,
 - the type of crosses or of connections,
 - the frequency of intersections or of connections,
 - frequency of level crossings,
 - conflict area,
 - physical barriers to slow down traffic,
 - the density of vehicles,
 - the frequency of riders,
 - the frequency of pedestrians,
 - difficulty of the visual task (orientation),
 - stationary traffic (parked vehicles),
 - the need for facial recognition,

- crime risk,
- the complexity of the visual field and
- the brightness of the surroundings.
- Lighting Parameters
 - road width,
 - column height and
 - distances between columns.

2.1.6 Renewal of public lighting poles

As part of the investment in the renovation of public lighting infrastructure, it is also reasonable to carry out the renovation of metal poles that show damage due to atmospheric influences (corrosion) and abrasions - renovation by cleaning and painting.

Cleaning the foundations of poles includes:

- checking the condition of the concrete cap that holds the pole in the pipe; or the condition of the anchor plate and screws,
- if necessary, the concrete cap is removed and a new one is made; or the old anchor for the pole is removed and replaced with a new one,

Cleaning the poles includes:

- inspection of corroded parts, damaged screws and parts of the pole,
- removal of old paint and rust.

Protective coating of poles includes:

- Coating of poles with a base paint that protects metal parts and levels the surface for applying a final coat of paint - two coats if necessary.

Final coating of poles includes:

- Coating the pole with a protective layer that is resistant to condensed water, petroleum, oil, fuels, oils and atmospheric influences - two coats if necessary. The color of the coating must be coordinated with the owner and operator of the IJR in the municipality of Ig before the start of the implementation

NOTE: The protective or base coat and the finishing coat can also be replaced with the Korocink coating, which is a single-component anti-corrosion zinc coating resistant to water and mechanical stress - the coating is applied in two to three layers.

Table 5: Economic analysis of the reconstruction of the existing public lighting infrastructure

Description	Complete Renovation [EUR excluding VAT]	Partial Renovation [EUR excluding VAT]
Cleaning and painting poles, height 3-4m	1.456,00	1.456,00
Cleaning and painting poles, height 5-6m	1.449,00	1.449,00
Cleaning and painting poles, height 7-8m	133,00	133,00
Total pole restoration	3.038,00	3.038,00
Console type, length 200 mm, for mounting the lamp on wooden and concrete poles.	4.141,20	3.069,36
Console type – double console, length 1500mm, for metal poles.	366,60	0,00
Console type, length 1500 mm, for mounting the lamp on wooden and concrete poles.	218,40	0,00
Total new consoles	4.726,20	3.069,36
Setting up or changing the pole 6m above the ground	504,85	504,85
Setting up or changing a pole 7m above the ground	0,00	0,00
Setting up or changing a pole 8m above the ground	0,00	0,00
Setting up or changing the pole 9m above the ground	0,00	0,00
Totally new pole	504,85	504,85
Pole extension, hot dip galvanized, with screw fastening, length 0.5 m	487,50	487,50
Pole extension, hot dip galvanized, with screw fastening, length 1.0m	1.319,50	659,75
Total extensions	1.807,00	1.147,25
Replacing the existing connector with MVL435/2.	8.564,40	4.397,49
Replacement of the existing socket with MVL435/2 and a surface-mounted socket.	4.185,56	3.128,15
Total number of new connectors	12.749,96	7.525,64
Cable (from the plug to the lamp)	5.199,60	2.839,20
Removal of waste equipment (dismantling and removal of existing lamps)	6.241,80	3.393,60
Removal of waste equipment (dismantling and removal of existing poles)	450,00	450,00
Total removal of waste equipment	6.691,80	3.843,60
The cost of using the truck lift	17.077,50	9.322,50
Lamp installation cost	12.978,00	7.119,00
Project documentation	9.000,00	9.000,00

Table 6: Economic analysis of the new building

Description	New construction [EUR excluding VAT]
Installation of a pole 7m above the ground	88.320,00
Installation of a pole 8m above the ground	24.777,90
Installation of a pole 9m above the ground	719,90
Total new pole	113.817,80
Delivery and installation of the connector with MVL435/2.	3.278,00
Total number of new connectors	2.069,60
Cable (from the plug to the lamp)	6.467,50
The cost of using the truck lift	5.174,00
Project documentation	9.000,00

2.2 Energy analysis of the implementation of the measures and assessment of the investment

The following shows the energy balance of the measures with an estimate of savings, the calculation of new operating and maintenance costs and the investment estimate with an economic analysis.

The financial calculations do not include costs such as:

- road closures (the number of closures depends on the dynamics of implementation),
- additional construction work at individual consumption points
- lighting measurements (carried out after implementation, during major interventions and changes, and periodically after implementation),
- electrical protection measurements (carried out in accordance with applicable regulations - after implementation, after maintenance work, and periodically after implementation),
- current load measurements (carried out after implementation and after major interventions, when the load symmetry along an individual phase conductor changes).

2.2.1 Energy balance of the renovation of PLI

Description	Complete renovation	Partial renovation	New construction
Condition before restoration [kWh]	384.808	384.808	/
Condition after restoration [kWh]	190.788	281.156	26.400
Estimated electricity savings [kWh]	194.020	103.652	-26.400
Installed power of lamps BEFORE RENOVATION [kW]	96,67	96,67	/
Installed power of lamps AFTER RENOVATION [kW]	48,17	70,76	6,60
Estimated power reduction [kW]	48,51	25,91	-6,60
Electricity cost - (excl. VAT) [€/kWh]	0,12852	0,12852	0,12852
Annual cost BEFORE RENEWAL (excl. VAT) [€]	49.456	49.456	/
Annual cost AFTER RENEWAL (excl. VAT) [€]	24.520	36.134	3.393
Estimated cost savings (excl. VAT) [€]	24.935	13.321	-3.393
Estimated cost savings (inc. VAT) [€]	30.421	16.252	-4.139
Payback period excluding financing	8,4	9,1	/

2.2.2 Calculation of maintenance costs

Opis	Complete renovation	Partial renovation	New construction
Estimated annual maintenance cost of luminaires (excl. VAT)	8.312 €	8.312 €	/
Estimated annual maintenance cost of luminaires AFTER RENOVATION (excl. VAT)	6.189 €	7.098 €	512 €
Savings (excl. VAT)	2.123 €	1.213 €	-512 €
Savings (inc. VAT)	2.590 €	1.480 €	-625 €

2.2.3 Assessment of the investment

The table below provides an estimate of the value of energy renovation of public lighting according to variant proposals.

Table 7: Total assessment of the value of energy renovation

Item	Complete renovation	Partial renovation	New construction
Lamp cost (excl. VAT) [€]	135.698	73.338	45.762
Conductor cost (excl. VAT) [€]	5.200	2.839	2.070
PVE cost (excl. VAT) [€]	12.750	7.526	3.278
Pole extension cost (excl. VAT) [€]	1.807	1.147	0
Pole replacement cost (excl. VAT) [€]	505	505	113.818
Pole bracket cost (excl. VAT) [€]	4.726	3.069	0
Pole painting cost (excl. VAT) [€]	3.038	3.038	0
Pole installation cost (excl. VAT) [€]	12.978	7.119	5.174
Cost of crane (excl. VAT) [€]	17.078	9.323	6.468
Cost of waste equipment removal (dismantling and removal of lamps) (excl. VAT) [€]	6.241	3.394	/
Cost of waste equipment removal (dismantling and removal of poles) (excl. VAT) [€]	450	450	/
Cost of waste equipment removal (dismantling and removal of poles) (excl. VAT) [€]	/	/	49.750
Cost of waste equipment removal (dismantling and removal of poles) (excl. VAT) [€]	9.000	9.000	9.000
TOTAL (excl. VAT)	209.471 €	120.748 €	235.320 €
22% VAT	46.084 €	26.565 €	51.770 €
TOTAL (including VAT)	255.555 €	147.313 €	287.090 €