

Energy Advanced

PROJECT OF ENERGY RETROFIT
OF BUILDINGS IN LJUBLJANA
2023



City of
Ljubljana



EUROPEAN UNION
COHESION FUND
INVESTING IN YOUR FUTURE



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Address by Mayor Zoran Janković

photo: Uroš Hočevar

The Greenest Energy is the Energy We Save.

The project of energy retrofit of buildings, which we have been implementing within the framework of a public-private partnership in Ljubljana since 2017, is one of the significant responses to climate change and other environmental challenges we face at a global level.

So far, together with private partners Petrol and Resalta, we have already renovated **87 public facilities**, among them are many kindergartens and schools, as well as sports, health and cultural facilities, with which we ensured a higher quality of living and work in these facilities and exceptional savings in energy consumption. In total, over the duration of the projects, we will save as much as **400,000 MWh of energy**. That is the equivalent of what approximately **3.2 million** average-sized **trees would absorb** or about 8,000 hectares of forest.

I am proud that this year our project was also recognised internationally, as we won second place for it at the prestigious United Nations global forum in Athens (UNECE International Public-Private Partnerships Forum). In the strong competition of 82 public-private partnership projects from around the world, the expert committee shortlisted it among the top five finalists. After presenting at the forum, the participants awarded us second place, and we missed the victory by only a few votes. In the award justification, they emphasised that the energy renovation project significantly contributes to all pillars of sustainable development (economic, social,

and environmental), thereby meeting the United Nations' sustainable development goals.

I sincerely congratulate the entire project team, led by Petra Šeme, the Energy Manager of the City of Ljubljana, for their work so far! At the City of Ljubljana, we understand that this award confirms our efforts, and at the same time commits us to continue with the energy retrofits of public buildings and other projects that will ensure a quality life for all generations of residents in a time that presents numerous environmental challenges, with measures against climate change and the path to the city's carbon neutrality being at the forefront. Here too, Ljubljana is among the leading cities in the world, as we were selected among the hundred most ambitious European cities that the European Commission will monitor and support in their transformation to achieve climate neutrality by 2030.

Good luck, dear Ljubljana!

Zoran Janković
Mayor of the City of Ljubljana

We are all working together for the same goal



A Conversation with Energy Manager Petra Šeme



What benefits do the residents of the city and on the other hand, the users of the facilities get from the Energy Retrofit of Ljubljana project?

Users are often also residents. Within the Energy Retrofit of Ljubljana project, we renovate facilities of various purposes, but the majority are kindergartens and schools. The primary users of kindergartens and schools are our youngest residents. With the energy retrofit of the buildings, we improve the standard of comfort while reducing energy costs. Part of the savings that belong to the City Municipality of Ljubljana is used for the educational purposes of our youngest. More broadly, with the Energy Retrofit of Ljubljana project, we reduce carbon dioxide emissions and thus improve air quality. The project is a good example and encouragement for others to embark on energy retrofits.

Most buildings undergoing comprehensive energy renovations are also entirely refurbished in other ways, which means that users gain not only an energy-efficient building but also one that's seismically reinforced, fire-safe, and equipped with new furnishings.

How many colleagues or partners are involved in the project? What does this mean for coordinating the entire team?

In the preparatory phase, the Expert Committee, consisting of representatives from the City of Ljubljana and external experts, is crucial. Together, we cover technical, economic, legal, and public procurement areas. This allows us competent participation in a competitive dialogue to even get to the next two phases.

During the energy renovation phase, the team is more operational, consisting of representatives from the City of Ljubljana, facility users, a private partner, supervision, super-supervision, and contractors at the construction site.

In the management phase, the most critical collaboration is between the energy managers of the private partner and the City of Ljubljana and the users. That's the essence of the entire project since we all work towards the same goal.

What was the biggest challenge for you in this project?

Balancing the economics of the project while maintaining the quality and standards of the implemented measures.

Which renovation project are you most proud of? Why?

The Savsko naselje primary school, due to the complexity of the project, because of its scope and division into new construction and renovation, time constraints, and the fact that we succeeded despite everything.

What are the plans for the Energy Retrofit of Ljubljana project for the future, somewhat more medium-term?

To continue to carry out comprehensive retrofits in accordance with energy standards, and above all to achieve the planned savings, which are an indicator that we are implementing projects successfully.



Major Recognition for Ljubljana

3

At the prestigious United Nations Global Forum in Athens, we were awarded the second prize for the best public-private partnership project.

At the 7th UNECE International Public-Private Partnership Forum in Athens, May 2023, our project "Energy Retrofit of Public Buildings in the City of Ljubljana (EOL 1-4)" clinched an impressive second place out of 82 global submissions.

An expert panel on public-private partnerships shortlisted the City of Ljubljana's project among the top five, with each finalist presenting at the forum. Based on these presentations, attendees voted for the top three PPP projects of 2023.

The top spot went to Turkey's construction of the world's largest suspension bridge over the Dardanelles Strait, valued at roughly EUR 2.3 billion. Our Ljubljana energy retrofit project has seen an investment of about EUR 60 million, primarily from our private partner, with partial EU cohesion funds and a minimal contribution from the City of Ljubljana.

Our Energy Retrofit of Ljubljana project aligns with Ljubljana's commitment to reduce energy consumption

and enhance renewable energy use. We have targeted public facilities including kindergartens, schools, sports venues, city administration buildings, cultural sites, and two parking garages.

Through the Energy Retrofit of Ljubljana 1 – 4 phases, we have refurbished a total of 87 facilities – 50 thoroughly and 37 partially – saving over 400,000 MWh of energy, equivalent to offsetting 80,000 tons of carbon dioxide. This is tantamount to the purification capacity of roughly 3.2 million average-sized trees or approximately 8,000 hectares of forest.

The majority of these savings go to our private partner as a return on investment. Yet, throughout the partnership, the City of Ljubljana also benefits from energy consumption savings.

The project pervades a circular approach by reducing the amount of energy used for the operation of public buildings,



while at the same time raising the standard of quality through rehabilitation. Thanks to the project, buildings that once lacked earthquake, fire, and energy safety, and were inefficient, have now been transformed into secure and energy-efficient structures.

Our financial model is anchored on the Energy Performance Contracting (EPC) principle. It involves a form of creative financing designed to enhance capital, allowing the funding of energy upgrades through cost savings. The EPC agreement includes an external entity, namely an Energy Services Company (ESCO), which undertakes energy efficiency or renewable energy projects. This ESCO uses the income stream from cost savings or produced renewable energy to repay the project expenses, including investment costs. Essentially, the ESCO gets paid only if the project achieves the anticipated energy savings.

The Energy Retrofit of Ljubljana 1-4 project of the City of Ljubljana received a second prize, on the grounds that it significantly contributes to all pillars of sustainable development – economic, social, and environmental. Hence, it meets the sustainable development goals as

defined by the United Nations.

This award is a testament to Ljubljana's holistic, innovative, and strategic approach to energy retrofitting of public buildings, adhering to the principle that the greenest energy is the energy we save.

"I'm proud that the Energy Retrofit of Ljubljana project is internationally recognised as successful, effective, and sustainable. It's a rewarding acknowledgment of our efforts put into the project and serves as great motivation for the future," said Petra Šeme, the manager of the Energy Retrofit of Ljubljana project.

We asked the team



At RESALTA, we are immensely proud to co-create a better living environment and contribute to the city's green transformation alongside the City of Ljubljana and our partner PETROL through the Energy Retrofit of Ljubljana projects.

Matic Baškovič

RESALTA d. o. o.

From 2017 to the present, we have completed comprehensive energy renovations of numerous public buildings in our four joint projects, significantly reducing their carbon footprint.

Recognising the importance of social responsibility and the values of sustainable development, we aspire to continue

our focus on energy retrofitting in the future. Alongside this, through our successful projects, we remain committed to maintaining and fostering genuine partnership relationships, which are key to achieving our shared successes.

Ljubljana, let's keep moving forward!

Tilen Smolnikar

Petrol d. d.

Ljubljana's energy retrofitting has become a benchmark for best practices and a catalyst for similar projects in Slovenia, Europe, and beyond.

Through expertise, dedication, and hard work, we've achieved results that will inspire other cities and organisations. For Petrol, it's a privilege to be part of a project boasting exceptional environmental and energy outcomes. It's worth noting that this is among the pioneering projects in Slovenia based on the energy performance contracting model, incorporating cohesion

funds. Furthermore, with the completion of its fourth phase, this has become one of the most substantial projects in the region, demonstrating the successful collaboration between public and private partners. We're grateful for this collaborative opportunity and hope our efforts continue contributing to positive changes and the sustainable development of our city and region.



Marko Umberger

UM Svetovanje d. o. o.

In Slovenia, buildings account for over a third of total energy consumption. We have 85 million square meters of built-up area, with 70% constructed before 1980, indicating significant potential for energy renovation.

Our experience with the Energy Retrofit of Ljubljana projects has shown that, besides a well-designed project and quality construction, achieving savings also hinges on the proper behaviour of building occupants. It's crucial to measure the actual energy consumption and calculate savings annually for all renovated structures.

As energy prices rise, the relevance of the energy performance contracting model becomes even more pronounced. Slovenia lacks a sufficient number of companies offering energy services (ESCO). It would be beneficial to expand this model to multi-residential, commercial, and other types of buildings.

Boštjan Ferk

Institute for Public Private Partnership

At the Institute for Public-Private Partnership, we began collaborating with the City of Ljubljana on energy performance contracting projects in 2014, when this concept was still emerging.

By 2023, we're already involved in the fourth public tender for selecting public buildings to undergo energy retrofits based on this principle. Together with the City of Ljubljana, we showcased our projects at the 7th UNECE International Public-Private Partnerships Forum, which took place from 3rd to 5th May 2023 in Athens. Out of



82 public-private partnership projects submitted from around the world, our project "Energy Retrofit of Public Buildings in the City of Ljubljana (EOL 1-4)" secured an impressive second place. The central theme of our presentation was that the cheapest and greenest energy is the one we successfully save.



We pay special attention to the youngest

In 2023, we concluded the first phase of the fourth set of energy retrofits for five properties owned by the City of Ljubljana. Once again, we devoted special attention to our youngest citizens, comprehensively renovating one school building and two kindergartens. We also partially renovated one parking garage and a sports facility.

The total investment for these energy renovations exceeds three million euros. The private partnership, comprising of PETROL d.d. and RESALTA d.o.o., is financing 51% of the total value, with 1.4 million euros sourced from the Cohesion Fund.

All energy retrofits were executed to the desired quality standard using top-tier materials. The energy performance contracting approach ensures servicing, maintenance, and a 15-year warranty for the installed materials and equipment. In addition to the energy-saving measures implemented, each facility now includes a central monitoring system. This system facilitates remote energy system management and monitors the building's energy consumption, pinpointing any anomalies, which serves as a foundation for calculating and verifying savings.

Due to the energy-saving measures adopted, we anticipate annual savings of over 500 MWh, equating to roughly 200,000 euros per year. Given the current societal and economic conditions, where energy prices are rising and every saved kWh is of great significance, the importance of the Energy Retrofit of Ljubljana project, under which we have so far renovated a total of 87 buildings, continues to grow.

The core concept of the project is that the greenest and most sustainable energy is the energy we don't use. This initiative stands as one of the most significant green and circular projects in Ljubljana.



5

energy retrofitted facilities

We included 5 public buildings in the energy retrofit project. We performed a comprehensive energy retrofit at 3 facilities and obtained the Cohesion Fund grants for them. On the remaining 2 facilities, we carried out a partial energy retrofit.



510 MWh
Guaranteed annual savings
(electric energy and heat)



EUR 200,000



CO₂
(eq)

200 tonnes
less emissions

This is the amount absorbed per year by 9,500 average-sized trees.



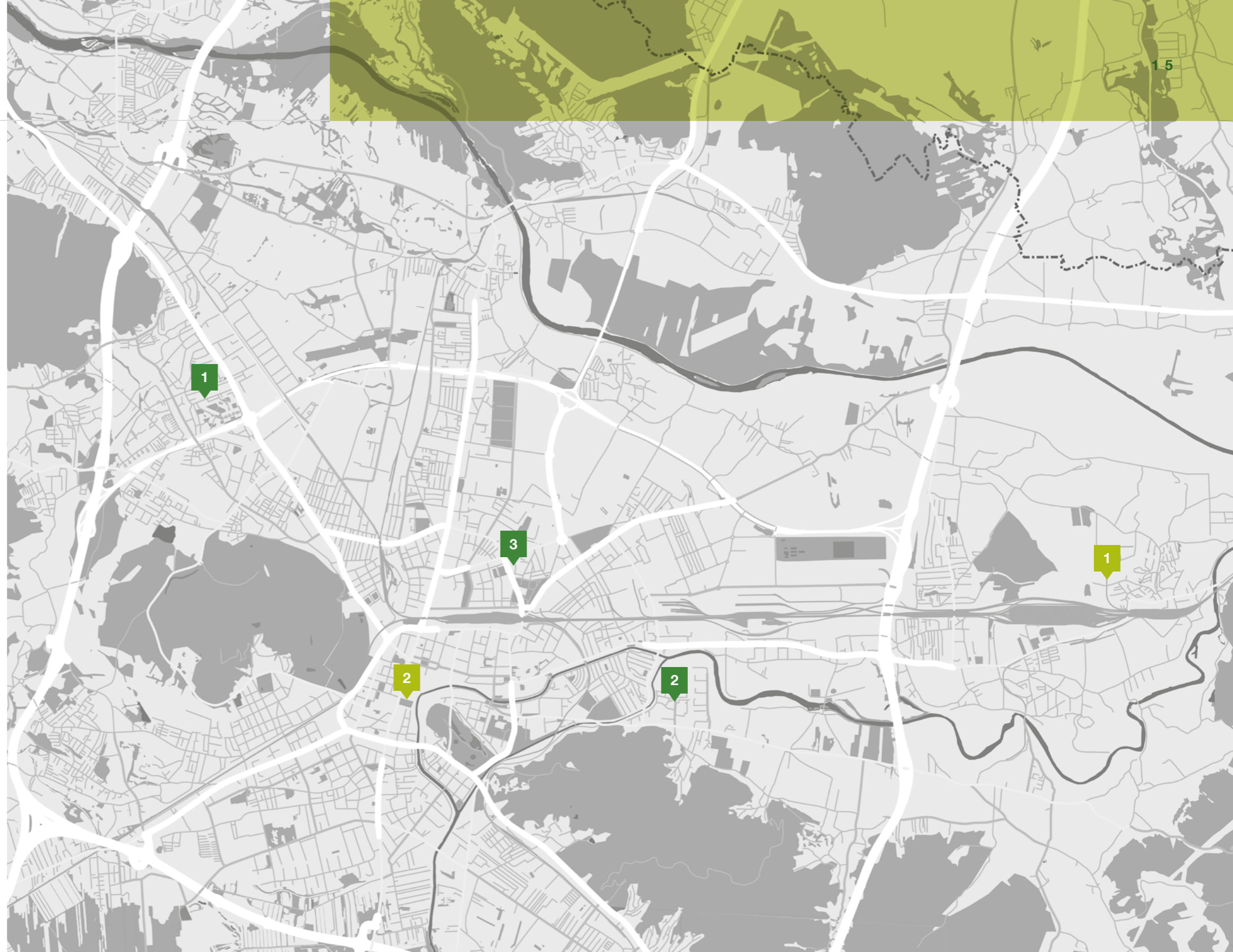
Public-private partnership based on the principle of energy contracting – PPP EP EOL 4

Comprehensive energy retrofits of buildings

- 1** Mojca Kindergarten – Kekec branch
- 2** Oton Župančič Kindergarten – Čurimuri branch
- 3** Savsko naselje Primary School

Partial energy retrofits of buildings

- 1** Zalog Ice Hall
- 2** Kongresni trg parking garage





4,136 m²
of building envelope


1,421 m²
of windows and doors


2,952 m²
of roofs and attic insulation


2
thermal stations


1,556
replaced lights


193
installed thermostatic valves



Comprehensive energy retrofits of buildings



6

This time, in the City of Ljubljana, as part of a public-private partnership based on the energy contracting model, three properties were comprehensively retrofitted.

All buildings were retrofitted in accordance with the Rules on the Efficient Use of Energy in Buildings (PURES), which set requirements for efficient use of energy and an increase in the share of renewable energy sources. We also installed a central control system at all facilities. These are the facilities for which we obtained Cohesion Fund grants. We retrofitted two kindergartens and one primary school. By reducing energy consumption and increasing the share of renewable energy sources, we will help reduce carbon dioxide emissions.



3

buildings
comprehensively retrofitted



2,900,000
EUR
investment value



8,000
m²
total renovated area



CO₂
(eq) **145** tonnes
less emissions



6,900
average-sized trees

Kindergarten Mojca, Kekec branch



📄	Name	Kindergarten Mojca, Kekec branch
✉️	Address	Klopčičeva ulica 5, 1000 Ljubljana
📅	Year of construction	1980

As part of the Energy Retrofit of Ljubljana project, we comprehensively retrofitted the building.

Baseline

The external walls were insufficiently insulated, and joinery from different periods was installed. Radiator heating allowed for local regulation, but without thermostatic valves and was hydraulically unbalanced. Lighting was primarily implemented using fluorescent technology with classic ballasts.

The building was in a poor state of energy efficiency.



- » **Start of works:** October 2022
- **Completion of works:** January 2023
- **Investment value:** € 530,590.00



Implemented measures of comprehensive energy retrofit

Thermal insulation: The external walls were thermally insulated.

Insulation of the facade below the ground: We replaced the flooring, installed waterproofing, and added XPS.

Builders' joinery: We replaced the old, energy-inefficient builders' joinery with new ones, including interior and exterior sills, and added external shading.

Installation of thermostatic valves and hydraulic balancing: We installed adjustable thermostatic valves and hydraulically balanced the heating system.

Lighting renovation: We have replaced all older, energy-wasting lighting with new lighting in LED technology. We replaced 270 lamps, upgraded 50 sensors for switching the lights, and upgraded the DALI system for smart lighting control in 30% of the facility.

Energy management: We introduced energy monitoring at the facility, through which we monitor the energy consumption in the facility and thus the achievement of the set goals (savings).



Contractually guaranteed results

Energy consumption* before the renovation:
98.44 kWh/m²a

Energy consumption* after the renovation:
71.67 kWh/m²a

* Energy use refers to the consumption of supplied energy for heating and domestic hot water.

We are happy and grateful that we were the recipients of a comprehensive retrofit of the Kekec branch this school year. With the renovation, we got modern interior spaces and a playground. The retrofitted unit now allows us to continue to pursue and realise our mission and vision. Thank you to everyone who made such a large and important project possible.

Management and colleagues of the Kekec branch

Oton Župančič Kindergarten Čurimuri branch



before

📄	Name	Oton Župančič Kindergarten Čurimuri branch
✉️	Address	Novosadska ulica 1, 1000 Ljubljana
📅	Year of construction	1965

As part of the Energy Retrofit of Ljubljana project, we comprehensively retrofitted the building.

Baseline

The building envelope of the property, the ceiling above the attic and the pitched roofs were insufficiently insulated according to the currently valid guidelines. The heating station needed renovation, the radiator heating did allow for local regulation, but it was hydraulically unbalanced. Lighting was primarily implemented using fluorescent technology with classic ballasts.

The building was in a poor state of energy efficiency.



- » **Start of works:** October 2022
- **Completion of works:** January 2023
- **Investment value:** € 678,366.61



today

Implemented measures of comprehensive energy retrofit

Building envelope: The entire facade was thermally insulated in thickness to meet PURES requirements. We additionally insulated the pitched roof with mineral wool and vapor-permeable foil and replaced the worn-out roof covering.

Insulation of the facade below the ground: We removed the flooring, installed waterproofing and XPS, and re-laid the cleaned exterior flooring.

External shades: We replaced the old external shades.

Heating system: We renovated the thermal station for heating, we also renovated the secondary system, installed new valves, sensors and gauges. New thermostatic valves and heads were installed on the radiator heating and the heating system was hydraulically balanced.

Lightning renovation: We have replaced all older, energy-wasting lighting with new lighting in LED technology. We replaced 367 lamps, upgraded 50 sensors for switching the lights, and upgraded the DALI system for smart lighting control in 40% of the facility.

Energy management: We introduced energy monitoring at the facility, through which we monitor the energy consumption in the facility and thus the achievement of the set goals (savings).



“

During the renovation, 12 groups were relocated to 7 locations. In February 2023, we were happy to return to the renovated building. Both parents and children expressed their enthusiasm for the new premises and playground, and the employees gained better working conditions. The spaces are bright and airy, and the rows are interconnected for the greater safety of the children.

Children's statements:

"I like that we have big windows and can watch the birds."

"I like everything!"

"Wooooow, what a playground!"

"I like that now we have a real garden and we will be able to plant flowers."

"I like the climbing wall in the gym and on the playground."

Statement from a mum who drove her children to two different locations: "Well, for this it was worth to be patient and wait a little longer".

Andreja Mekinc,
Assistant principal

”

Contractually guaranteed results

Energy consumption* before the renovation:
185.10 kWh/m²a

Energy consumption* after the renovation:
137.96 kWh/m²a

* Energy use refers to the consumption of supplied energy for heating and domestic hot water.

Savsko naselje Primary School



before

📄	Name	Savsko naselje Primary School
✉️	Address	Matjaževa ulica 4, 1000 Ljubljana
📅	Year of construction	1982

As part of the Energy Retrofit of Ljubljana project, we comprehensively retrofitted the building.

Baseline

The building envelope of the property, the ceiling above the attic, flat and pitched roofs were insufficiently insulated according to the currently valid guidelines, and old ALU and PVC joinery was installed. The heating station needed renovation, the radiator heating did allow for local regulation, but it was hydraulically unbalanced. The gyms were not sufficiently ventilated and lit. Lighting was primarily implemented using fluorescent technology with classic ballasts.

The building was in a poor state of energy efficiency.



- » **Start of works:** February 2023
- **Completion of works:** September 2023
- **Investment value:** € 1,645,037.84



today

Implemented measures of comprehensive energy retrofit

Building envelope: The entire facade was thermally insulated in thickness to meet PURES requirements. Additionally, we insulated the ceiling towards the attic of the building with mineral wool and vapor-permeable foil, and insulated the pitched and flat roofs.

Insulation of the facade below the ground: We removed the flooring, installed waterproofing and XPS, and finished with decorative smooth plaster.

Builders' joinery: We replaced the old energy-wasting joinery with new ones, including internal and external sills, and added external blinds.

Heating system: We renovated the heating station and also the secondary system, installed new valves, sensors and gauges. New thermostatic valves and heads were installed on the radiator heating and the heating system was hydraulically balanced.

Renovation of ventilation: We removed the old energy-inefficient ventilation system of the small and large gym and replaced it with a new energy-efficient system.

Lighting renovation: We have replaced all older, energy-wasting lighting with new lighting in LED technology. We replaced 150 lamps, upgraded the sensors for switching on the lamps and the DALI system for smart lighting control in 40% of the building.

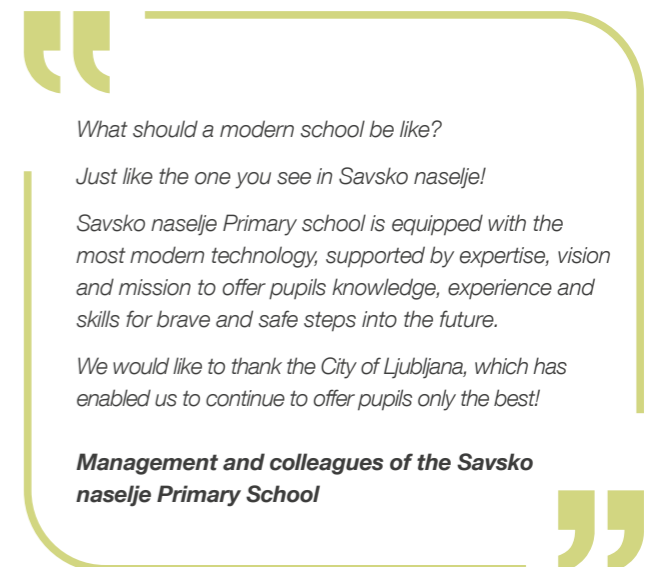
Energy management: We introduced energy monitoring at the facility, through which we monitor the energy consumption in the facility and thus the achievement of the set goals (savings).

Contractually guaranteed results

Energy consumption* before the renovation:
153.47 kWh/m²a

Energy consumption* after the renovation:
112.50 kWh/m²a

* Energy use refers to the consumption of supplied energy for heating and domestic hot water.



What should a modern school be like?

Just like the one you see in Savsko naselje!

Savsko naselje Primary school is equipped with the most modern technology, supported by expertise, vision and mission to offer pupils knowledge, experience and skills for brave and safe steps into the future.

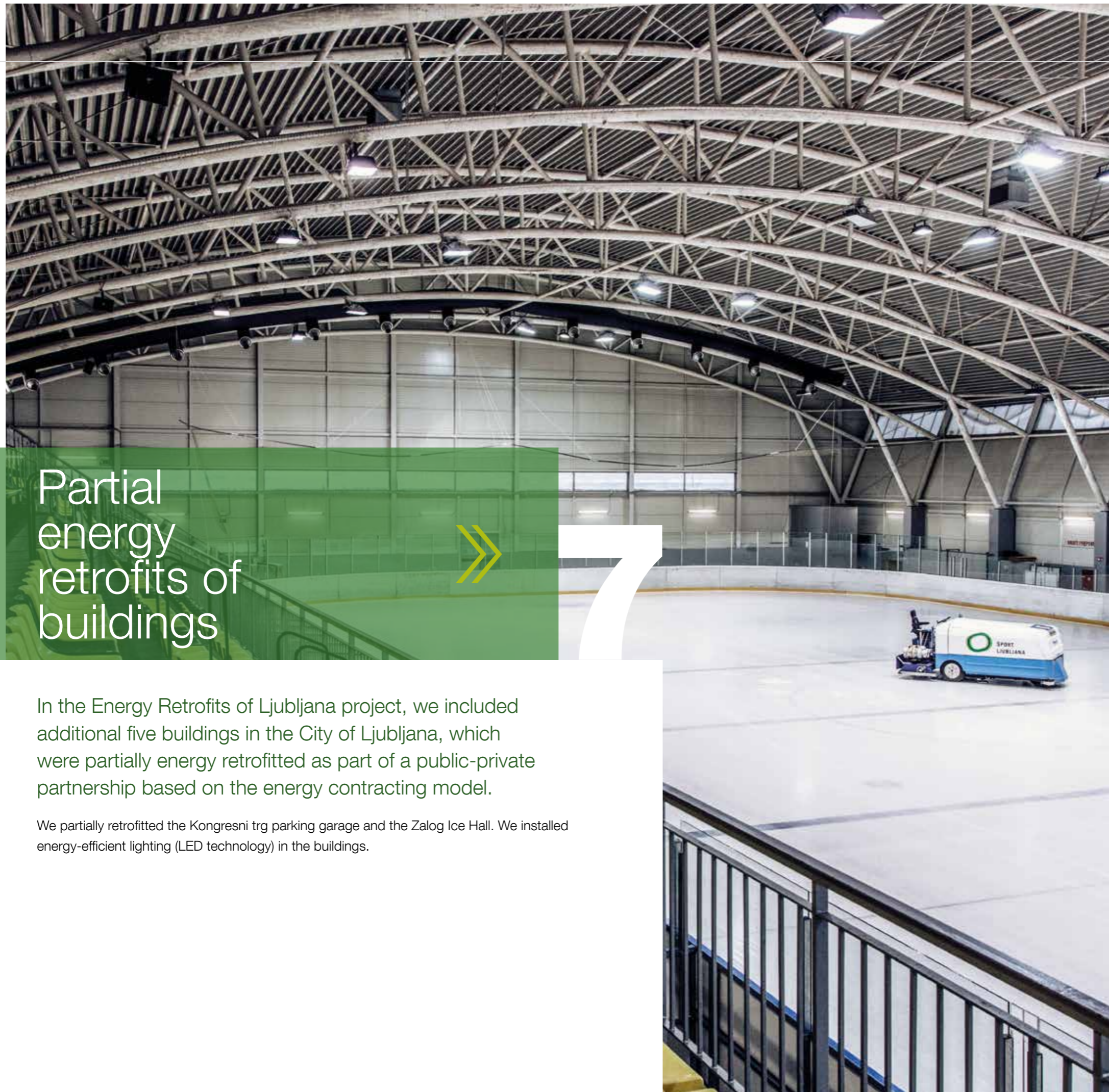
We would like to thank the City of Ljubljana, which has enabled us to continue to offer pupils only the best!

Management and colleagues of the Savsko naselje Primary School

Comprehensive energy retrofits of buildings

Facility	Address	Investment amount	Energy consumption before the retrofit (kWh/m ² a)	Energy consumption after the retrofit (kWh/m ² a)
Mojca Kindergarten – Kekec branch	Klopčičeva ulica 5, 1,000 Ljubljana	€ 530,590.00	98.44	71.67
Oton Župančič Kindergarten – Čurimuri branch	Novosadska ulica 1, 1,000 Ljubljana	€ 678,366.61	185.10	137.96
Savsko naselje Primary School	Matjaževa ulica 4, 1,000 Ljubljana	€ 1,645,037.84	153.47	112.50





Partial energy retrofits of buildings



In the Energy Retrofits of Ljubljana project, we included additional five buildings in the City of Ljubljana, which were partially energy retrofitted as part of a public-private partnership based on the energy contracting model.

We partially retrofitted the Kongresni trg parking garage and the Zalog Ice Hall. We installed energy-efficient lighting (LED technology) in the buildings.



2
facilities
partially energy retrofitted



210,000
EUR
investment value



23,000
m²
total renovated area



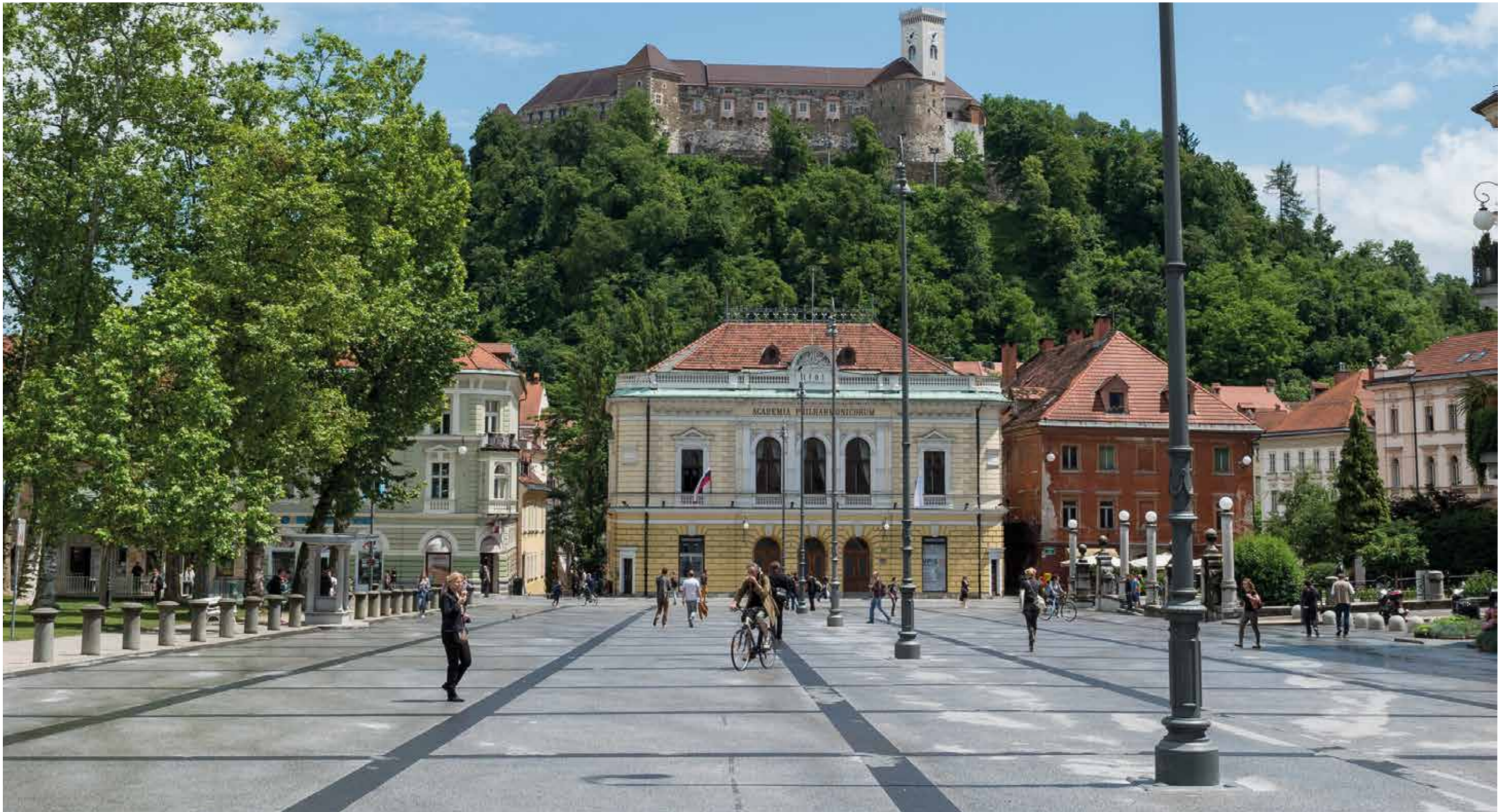
55 tonnes
less emissions

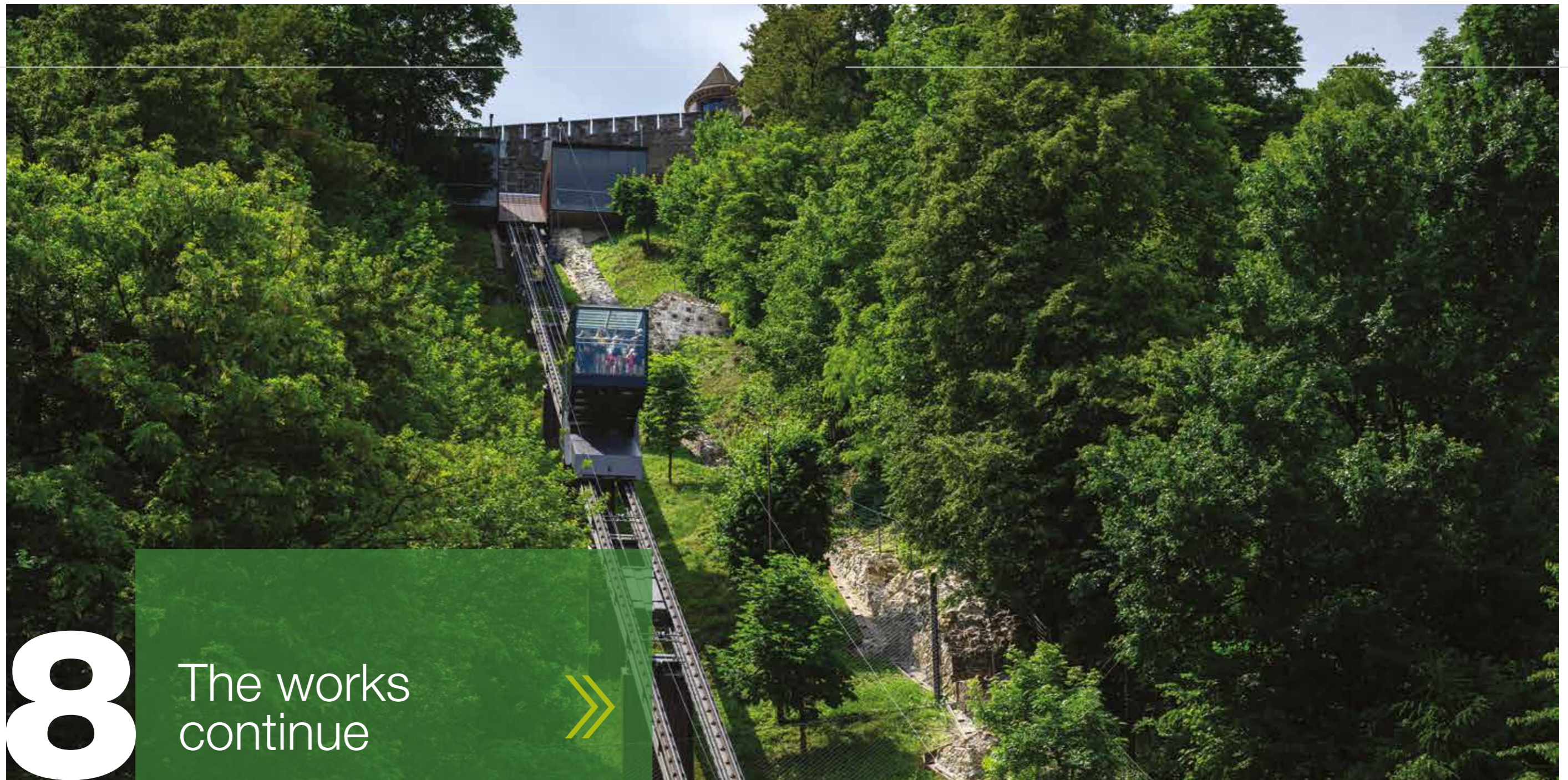


2,600
average-sized trees

Partial energy retrofits of buildings

Facility	Address	Investment amount	Energy consumption before the retrofit (kWh/m ² a)	Energy consumption after the retrofit (kWh/m ² a)
Zalog Ice Hall	Hladilniška pot 36 1,000 Ljubljana	€ 153,034.52	385,700	218,121
Kongresni trg parking garage	Kongresni trg 1, 1,000 Ljubljana	€ 58,594.12	349,292	119,342





8

The works
continue



In 2023, we will continue with the public-private partnership based on the energy contracting principle, as part of which we will renovate 5 buildings. We will complete the project in 2024.

As part of the second phase of the fourth public-private partnership, we will comprehensively retrofit two kindergartens. In addition, we will partially retrofit three buildings, where we will replace the existing inefficient lighting with modern LED technology, and we will also renovate the heating system in one of the libraries.

Comprehensive energy retrofits:

Jarše Kindergarten, Rožle branch
Mladi rod Kindergarten, Kostanjčkov vrtec branch

Partial energy retrofits:

Prežihov Voranc Library
Rudnik Library (Ljubljana Shooting Range)
Kozolec parking garage



Energy
Advanced