Energy Efficiency First

City of Ljubljana – Large scale renovation

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City of Ljubljana

City of Ljubljana

- **City Vision**: In the future Ljubljana will preserve the character of an agreeable green city, its dimension and convenient living standards will make it a nice place to live in.

- Ljubljana is the **political and cultural heart** of the Slovenian nation.
  Total population: **292,988**
  Surface area: **274.99 km²**

- In the past 10 years Ljubljana **implemented over 1,800 projects** to further increase the quality of life. Ljubljana is **signatory to the Covenant of Mayors** since 2009.

- The city owes its present appearance partly to Italian baroque and partly to Art Nouveau, which is the style of the numerous buildings erected immediately after **the earthquake of 1895**. In the first half of the 20th century, modern Ljubljana was shaped by the strong personal style of Jože Plečnik, a great European architect and a local of Ljubljana.

- Ljubljana has the **highest percentage of green space per inhabitant in Europe**, has been ranked #1 European Best Green Capital.

Large scale renovation project EOL (I)

- Ljubljana is implementing public buildings renovation projects since 2000. Initially, the renovations were financed solely through **public financing**, but with **limited scope**.

- 2008 data: 326 public buildings (537,316 m^2), final energy consumption for heating 84,085 MWh/year (158 kWh/m^2a), electricity consumption 22,340 MWh/year (51 kWh/m^2 a), energy cost EUR 7,5 mio/year.

- **2013 - 2016: ELENA Energetska obnova Ljubljane - EOL project (EIB technical assistance for energy efficiency and renewable energy investments)** - preparation of public buildings renovation projects pipe-line.

- **2016**: Announced the public tender for **renovation of 106 public buildings**.

- **2017 - 2018: EOL (I) implementation** via **Public-Private Partnership (PPP)** and **Energy Performance Contracting (EnPC)**

- **2018 – 2025**: Renovation of 100+ public buildings

EnPC is a contractual arrangement between the client (City of Ljubljana) and the provider(s) (two ESCOs) of the energy performance improvement project (EOL), the results of which are verified and monitored. Service providers are paid for in relation to a contractually agreed and guaranteed level of energy performance improvement or other related criteria, such as financial savings.

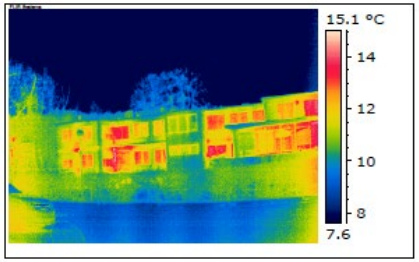
Renovation project EOL (I) background

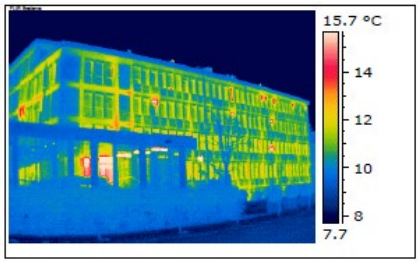
(A)

	Naziv javne ustanove	Lokacija / Naslov	Energent	Letna poraba energije - ref. leto 2008 (MWh/leto)								pov. raba elektrike	pov. raba en. za ogr.	Moč kotla	Leto izdelave	Objekt 1			Hlajenje		Priprava STV
			enota	DO	ZP	ELKO	EL (ogr.)	UNP	N.P.	ELEK.	skupno	kWh/m2	kWh/m2	kW		izgradnja/ obnova	ogrevano m2	delež %	št. naprav	skupna moč (kW)	naprava
39	ZD Ljubljana - Šiška	Derčeva ulica 5	DO	858,00						348,02	1.206,02	62	152	TP1: 368 kW; TP2: 284 kW		1979/2009	5.654	100			iz kotlovnice celo leto

- Data (A)
- Analysis (B)
- Measures (C)
- **Local Energy Concept (priorities, financing, …)**
- **Technical support (ELENA)**
- **Implementation (public financing, PPP - EPC)**

ZD ŠIŠKA





(B)

OŠ Polje – Zadobrovška cesta

(182 kWh/m^2)

1. **Toplotna izolacija podstrešja.**
2. **Zamenjava oken.**
3. **Izolacija ovoja in ureditev fasade.**
4. **Nizkotemperaturni kotel.**
5. Vgradnja termostatskih ventilov.
6. Varčna svetila.
7. Vgradnja senzorjev za vklop in izklop luči v sanitarijah.
8. Vgradnja varčnih kotličkov.
9. Vgradnja varčnih pip.

(C)

Lokalni energetski koncept Mestne občine Ljubljana

ELENA renovation project EOL (I)

European Investment Bank The EU bank

ELENA Completed Project Factsheet

Energetska obnova Ljubljane (EOL)

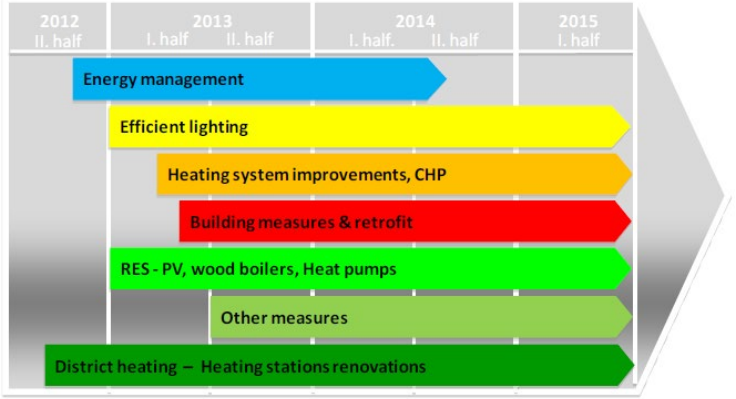
Location	Ljubljana, Slovenia
Beneficiary	City of Liubliana
CoM signatory	Yes
Sector	Energy efficiency
Total PDS costs	EUR 1 098 011
Elena contribution	EUR 975 034

Investment in implementation phase	EUR 49m
Results expected to be achieved	• Energy savings: 114 GWh/y • RE heat and electricity generation: 0.25 GWh/y • CO_2 reduction: 8,864 t/y
Leverage factor achieved	50
Lessons learnt	The project encountered many difficulties in its implementation, mainly due to the lack of legal basis and no practice in public-private partnership (PPP) and energy performance contracting (EPC) as well as underdeveloped ESCO market in Slovenia. Despite the complexity of the project, the EOL project played a significant role in the process of adopting the legal basis in Slovenia, including the publication of PPP EPC Guidelines in 2014 and adoption of other legal acts by the Slovenian Government that made PPP EPC approach feasible.
Further information sources	https://www.ljubljana.si/en/
Contact person at Beneficiary	Alenka Loose, Energy Manager, City of Ljubljana

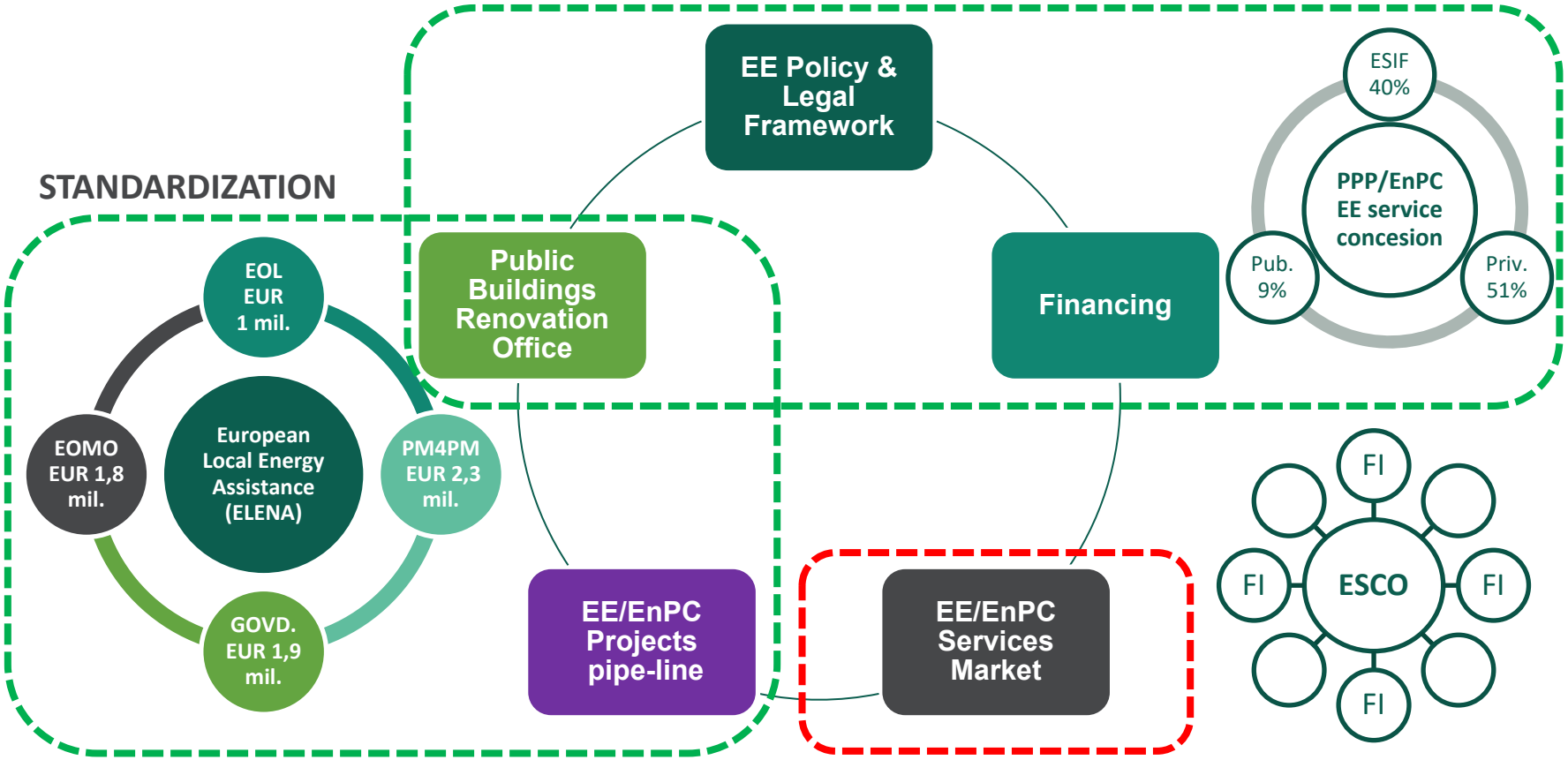
Project Implementation Unit

- ❑ Legal support
- ❑ Technical support.
- ❑ Economic and financial support

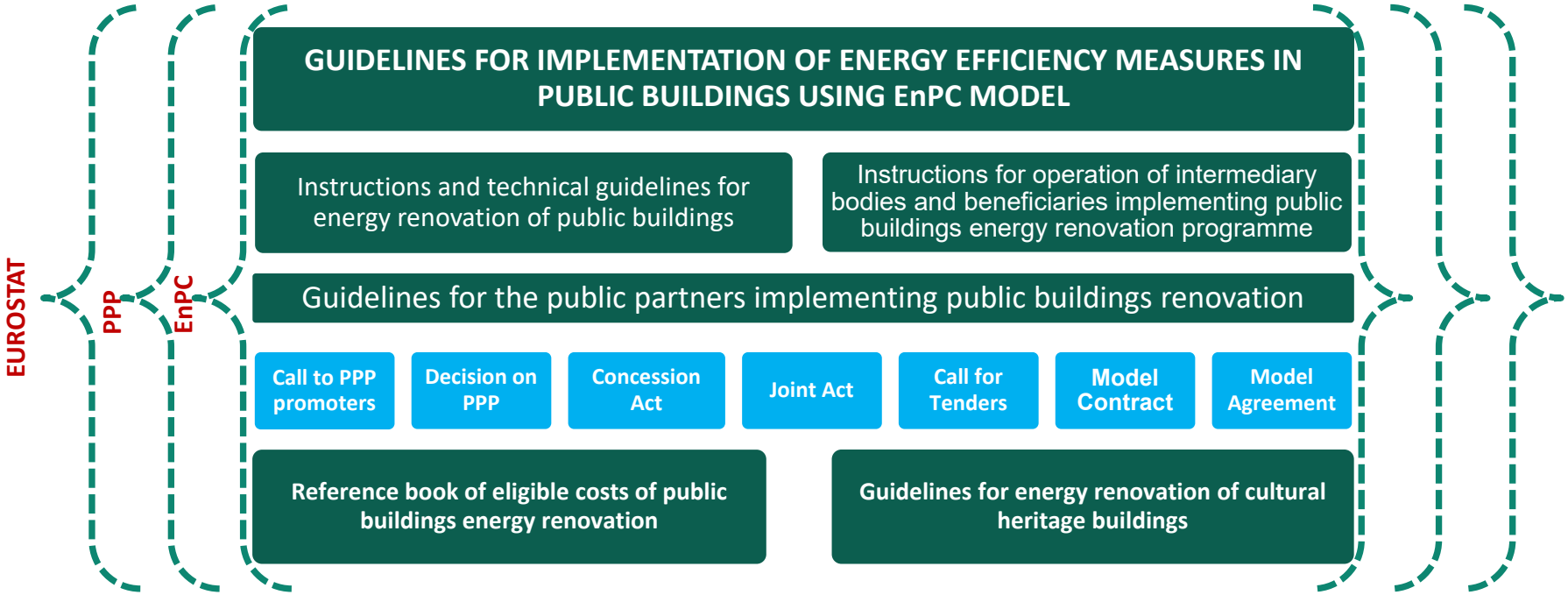
Timeframe: January 2013 – December 2016



EnPC.si: Critical success factors



EnPC.si: Standardization

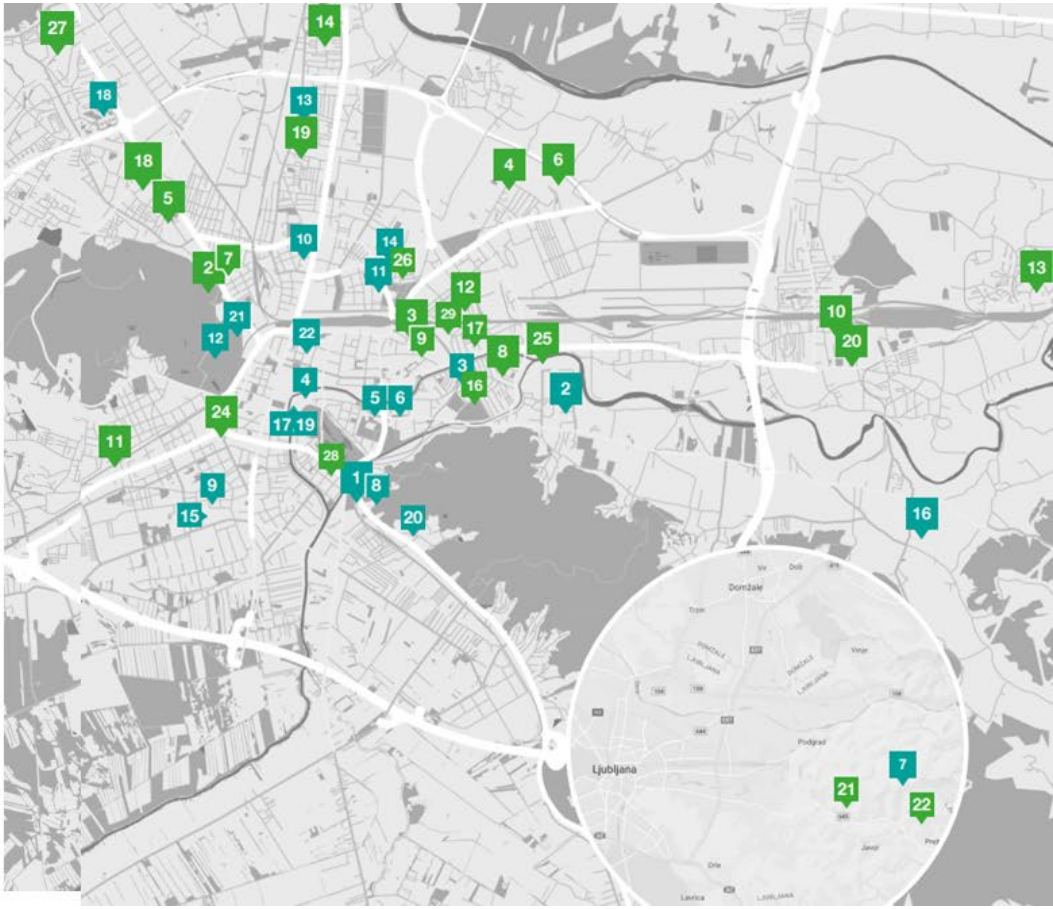


http://www.energetika-portal.si/podrocja/energetika/energetska-prenova-javnih-stavb/projektna-pisarna/ (in Slovene)

Large scale EOL (I) EnPC renovations

1. National Hero Maks Pečar Primary School, Črnuška 9
2. Tivoli Swimming Pool Complex
3. Vodmat Kindergarten, Unit Bolgarska
4. Jože Moškrič Primary School
5. Community Health Centre Ljubljana – Šiška
6. Nove Jarše Primary School
7. Najdihojca Kindergarten, Unit Čenča
8. Oton Župančič Kindergarten, Unit Ringaraja
9. Vodmat Kindergarten, Unit Klinični Center
10. Community Health Centre Ljubljana Moste Polje, Unit Polje
11. Vič Primary School, Tržaška 74
12. Zelena jama Kindergarten, Unit Zelena jama
13. Pedenjped Kindergarten, Unit Zalog
14. Danila Kumar International School
15. National Hero Maks Pečar Primary School, Dunajska 390
16. Kodeljevo Sports Facility – Hall
17. MOL City Administration, Proletarska cesta 1
18. H.C. Andersen Kindergarten, Unit Lastovica
19. Jelka Kindergarten, Unit Jelka
20. Polje Primary School
21. Sostro Primary School, Subsidiary Besnica
22. Sostro Primary School, Subsidiary Prežganje
23. Šmartno pod Šmarno goro Primary School
24. MOL City Administration, Trg MDB 7
25. Oton Župančič Kindergarten, Unit Mehurčki
26. Mladi rod Kindergarten, Unit Čira čara
27. Mojca Kindergarten, Unit Tinkara
28. Pod gradom Kindergarten, Unit Prule
29. Vodmat Kindergarten, Unit Vodmat Korytkova 24
30. Vodmat Kindergarten, Unit Vodmat Korytkova 26

1. Oskar Kovačič Primary School, Dolenjska 20
2. Božidar Jakac Primary School
3. Kette and Murn Primary School
4. MOL City Administration – Adamič-Lundrovo nabrežje 2
5. MOL City Administration, Poljanska 28
6. Community Health Centre Ljubljana – Moste Polje
7. Sostro Primary School, Subsidiary Janče with kindergarten
8. Rudnik Sports Facility – Strelišče
9. Kolezija Kindergarten, Unit Kolezija
10. Ljubljana City Library/Bežigrad Library
11. Bežigrad Primary School
12. International Centre of Graphic Arts
13. France Bevk Primary School
14. Savsko naselje Primary School
15. Kolezija Primary School
16. Sostro Primary School
17. City Art Gallery of Ljubljana
18. Dravlje Primary School
19. MOL City Administration, Mestni trg 1
20. Community Health Centre Ljubljana – Vič, Unit Rudnik
21. Tivoli Hall
22. Community Health Centre Ljubljana – Center
23. Community Health Centre Ljubljana – Šentvid



Renovation project EOL (I)

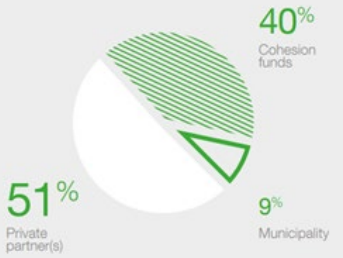
- Comprehensive and partial energy renovations of **48 city-owned public buildings** including **elementary schools, kindergartens, libraries, healthcare centres, sports facilities, administration buildings**.
- The total investment of **EUR 14.9 mil.** for the energy renovation.
- Energy cost savings more than EUR 1 mio.
- The **largest public-private partnership in Slovenia** in the area of energy performance contracting.

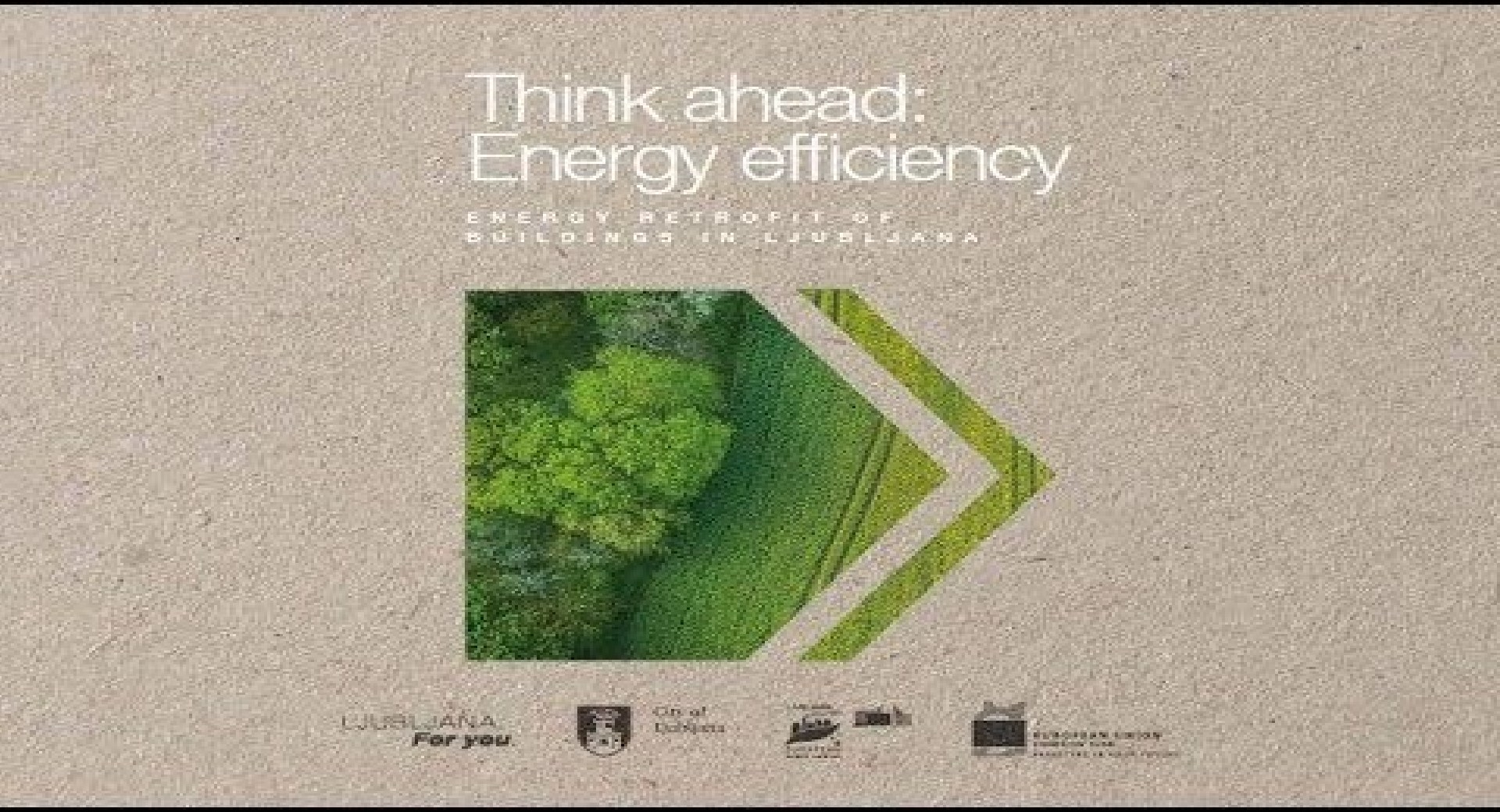
48

buildings renovated

We have comprehensively renovated 25 buildings and obtained a grant for this purpose from the Cohesion Fund. The remaining 23 buildings received a partial energy retrofit.

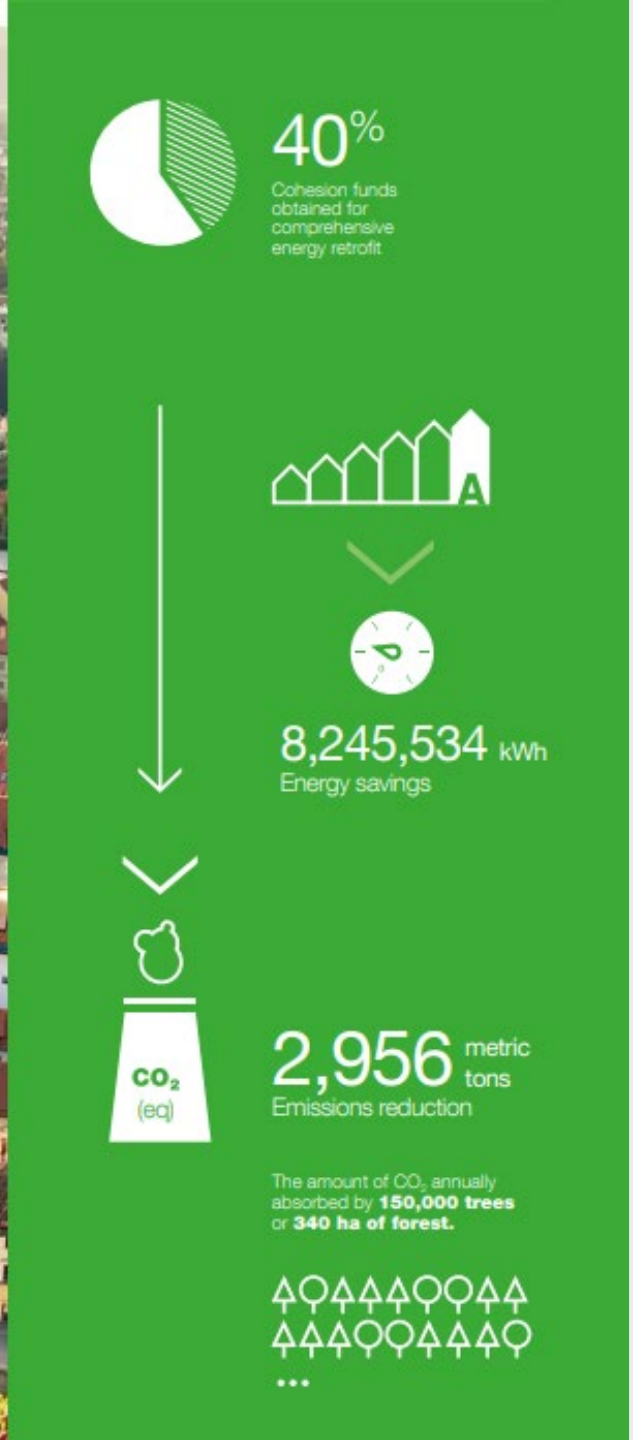
Division of comprehensive energy retrofit in a public-private partnership





RENOVATE EUROPE

PPP Renovation Financing Programme Ljubljana



- The total **guaranteed annual energy savings** for space heating and electricity amount to **8,245,534 kWh** or more than a million EUR per year. The annual greenhouse gas emissions have been reduced by **2,956 tons**.
- To achieve the set energy saving objectives, the buildings needed proper insulation and 25% of energy had to be provided from renewable energy sources.
- Over **30 'competitive dialogues'** performed to reach the final agreement between consortium of two ESCOs and City of Ljubljana.
- One ESCO acquired over 500 offers, signed over 53 contracts.
- Implementation period: **1.9.2017 - 31.8.2018.**
- <u>Project done on time and within budget!</u>

Jože Moškrič Primary School

Name	Jože Moškrič Primary School
Address	Jarška cesta 34, 1000 Ljubljana
Year of Construction	1964 (The building falls under the Cultural Heritage Protection Act.)
Architect	Emil Navinšek

The building has undergone a comprehensive retrofit under the Ljubljana Energy retrofit programme. A structural retrofit of the building has been performed under a separate project.

Baseline situation

The building was insufficiently insulated; only the gym was insulated (with 12 cm of insulation materials). Doors and windows were partially renovated. The retrofitted PVC doors and windows with double glazing had the thermal transmittance value of 1.1–1.3 W/m²K. The boiler room featured an independent heating station, connected to the district heating network, and lacking temperature and clock control.

- **Start date:** 1 March 2018
- **End date:** 30 August 2018
- **Value of the investment:** EUR 546,009

Comprehensive energy retrofit measures implemented

Building envelope: Insulation of exterior walls has been implemented according to PURES standards. Due to the protected status of the building, the natural stone façade (tufa) had to be preserved. The stone was removed, cleaned, and reinstalled to the façade.
Doors and windows: The existing doors and windows have been renovated. Windows have been fitted with external shades.
Roof insulation: The flat roof has been additionally insulated with 25 cm of insulation materials. Hydro insulation has been installed to prevent moisture and water penetration.
Heating system: Boiler room has been equipped with a new thermal station. A comprehensive retrofit of the SHW system and an air/water heat pump have been implemented, thus increasing the RES share in accordance with the Local Energy Concept of the City of Ljubljana (LEK MOL).
Heat recovery system: New climate control with heat recovery to ventilate the gym has been installed.
Thermostatic valves: Thermostatic valves have been installed.
Lighting retrofit: Lighting with wasteful energy consumption has been replaced by energy-saving LED lights.
Energy management: Central Energy Management System (EMS) has been installed to monitor consumption and achieve the set targets (energy savings).

Guaranteed energy savings

E › C

Pre-retrofit performance: 107.85 kWh/m²a, i.e., energy efficiency class **E**.
Post-retrofit performance: The energy consumption has been reduced to 43.33 kWh/m²a, and the building promoted to energy efficiency class **C**.

Kodeljevo Sports Facility – Hall

Name	Kodeljevo Sports Facility – Hall
Address	Gortanova ulica 21, 1000 Ljubljana
Year of Construction	1972

The building has undergone a comprehensive retrofit under the Ljubljana Energy retrofit programme.

Baseline situation

The building was insufficiently insulated. Copelite glass covered a large part of building envelope. Aluminium doors and windows had not been renovated and had the thermal transmittance of 1.6 W/m²K. The roof was not insulated. The building was connected to natural gas supply system. Heating was regulated according the outdoor temperature. The entire building was equipped with fluorescent lighting.

Start date: 1 March 2018
End date: 31 August 2018
Value of the investment: EUR 839,432

Comprehensive energy retrofit measures implemented

Building envelope: Insulation has been implemented according to PURES standards. Copelite glass and masonry walls have been rearranged.
Doors and windows: Copelite glass and windows have been replaced by glass (following PURES standards). Glass and masonry wall surfaces have been partly rearranged.
Roof insulation: The roof has been insulated and hydro-insulated in accordance with PURES.
Ventilation system: Degraded climate controls have been replaced by two new units featuring a run-around coil.
Thermal station: The existing energy product has been eliminated by connecting the building to the district heating system. A new thermal station has been installed.
Lighting retrofit: Lighting with wasteful energy consumption has been replaced by energy-saving LED lights (DALI).
Energy management: Central Energy Management System (EMS) has been installed to monitor consumption and achieve the set targets (energy savings).

Guaranteed energy savings

F › C

Pre-retrofit performance: 173.14 kWh/m²a, i.e., energy efficiency class **F**.
Post-retrofit performance: The energy consumption has been reduced to 46.41 kWh/m²a, and the building promoted to energy efficiency class **C**.

Community Health Centre Ljubljana – Šiška

Name	Community Health Centre Ljubljana – Šiška
Address	Derčeva ulica 5, 1000 Ljubljana
Year of Construction	1962 (the old wing) 1977 (the recent wing)

The building has undergone a comprehensive retrofit under the Ljubljana Energy retrofit programme.

Baseline situation

The building was insufficiently insulated. Doors and windows, covering larger areas, were deteriorated and only partially renovated in the old part of the building. The flat part of the roof had been renovated. The building was connected to the district heating network. The entire building had fluorescent lighting with specular louvre.

- **Start date:** 18 August 2017
- **End date:** 12 March 2018
- **Value of the investment:** EUR 973.579

Comprehensive energy retrofit measures implemented

Building envelope: Insulation has been implemented according to PURES standards.
Doors and windows: New doors and windows have been installed according to PURES standards.
Attic insulation: A new insulation has been installed (25 cm).
Roof insulation: The flat roof has been additionally insulated with 25 cm of insulation materials. Hydro insulation has been implemented as well.

Heating system: A comprehensive retrofit of thermal station for space heating and heating of sanitary water has been performed.
Thermostatic valves: All radiators have been equipped with thermostatic valves.
Lighting retrofit: Lighting with wasteful energy consumption has been replaced by energy-saving LED lights.
Energy management: Central Energy Management System (EMS) has been installed to monitor consumption and achieve the set targets (energy savings).

E › B

Guaranteed energy savings

Pre-retrofit performance: 131.02 kWh/m²a, i.e., energy efficiency class **E**.
Post-retrofit performance: The energy consumption has been reduced to 28.62 kWh/m²a, and the building promoted to energy efficiency class **B**.

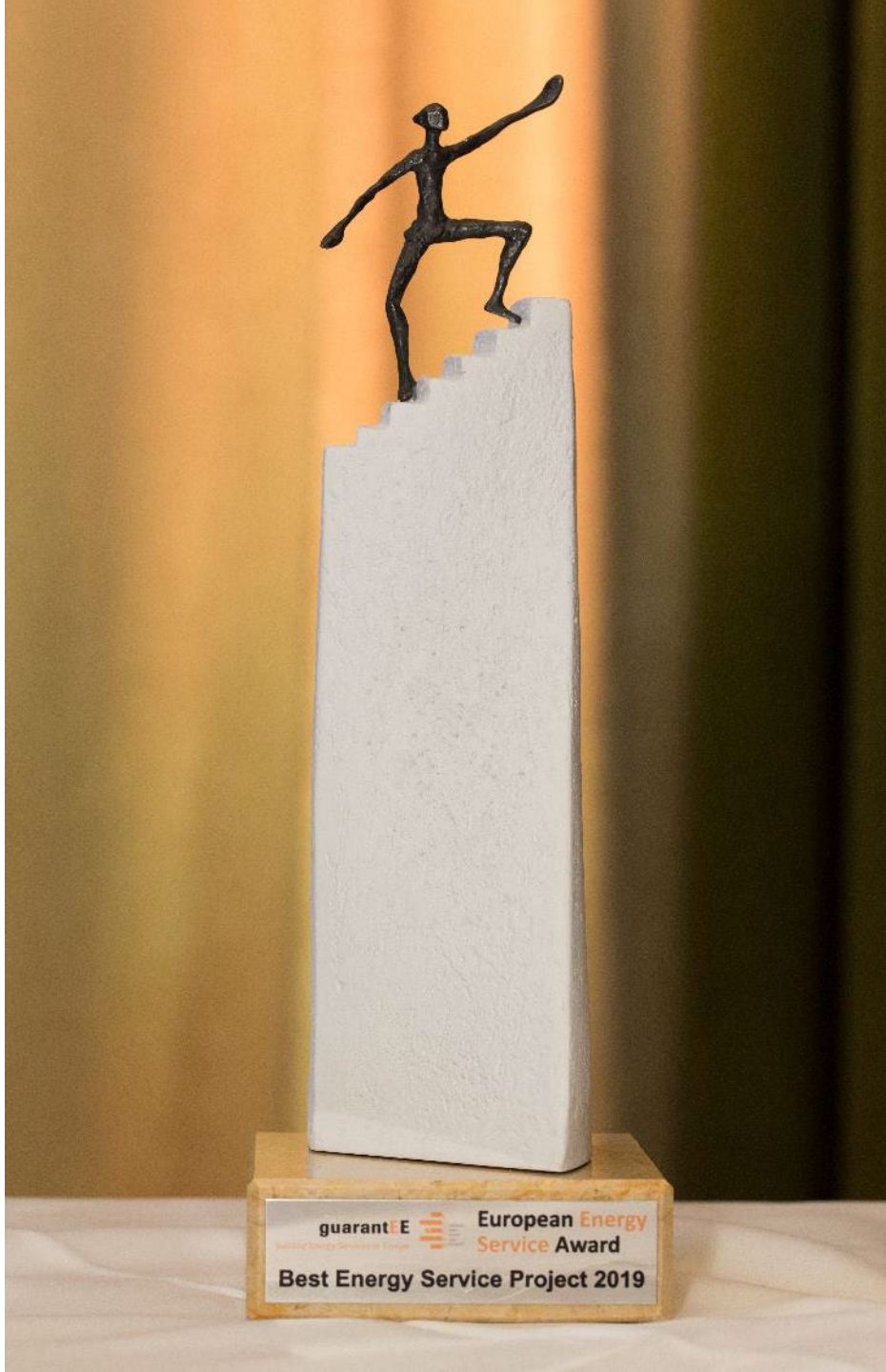
EOL (I) key challenges

- Buildings under cultural heritage or architectural protection, seismic-safety renovations needed
- Time squeeze - kindergartens and schools closed only during the summer period
- No implementation and financing framework for the PPP EnPC at the very beginning of projects
- Local and state public administrations‘ lack of experience with the EnPC - a year and a half of negotiations to work out the final agreement
- Scepticism of the local stakeholders preferring the public procurement renovations
- Establishment of large number of base lines to guarantee energy savings
- Securing ESCOs initial funding (debt/equity) of the whole investment (EUR 14.9 mil.)
- Coordination of energy renovations with general renovations

European Energy Service Award

The City of Ljubljana energy renovation project EOL - Best Energy Service Project in 2019

The prestigious award is given by the European Commission at the annual Covenant of Mayors Forum, to honour projects that contribute to the growth of energy efficiency and sustainability in Europe.



EOL II & III implemented
EOL IV + Solar PPA projects underway

- City of Ljubljana has continued with building renovation projects (EOL II, III. and IV.) with a total of more than **100+ buildings to be renovated**.
- In 2022 the City of Ljubljana started to install rooftop solar **PV systems** on public buildings, introducing the **PPA model**.
- **Satisfied users**, who yield the benefits of the improved comfort standards, reduced use of energy and increased use of RES, represent greatest achievement!

EUR 17 mil.

EOL 1 (2018)
48 buildings

EUR 4,5 mil.

EOL 2 (2020)
11 buildings

EUR 16,1 mil.

EOL 3 (2021)
27 buildings

EUR 3,0 + ? mil.

EOL IV ongoing
4 buildings (2022)
15 buildings (-> 2025)

EnPC.si: developments & new financial instruments

- NECP – **public procurement EnPC** (legal framework study), **revolving fund** (planned measure)

- **Pilot comprehensive energy renovations of multi-apartment buildings (funds blending)**:
  - ⇨ FI 1 - combination of Eco Fund soft loans, grants and own funds (buildings renovation funds)
  - ⇨ FI 2 - combination of co-financing by ESCOs (on-bill financing - OBF), grants and own funds (buildings renovation funds)

- **Guarantee fund and forfaiting** – gap analysis and implementation framework (basic design)

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Thank you for your attention.

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