

An aerial photograph of Zagreb, Croatia, showing a dense urban area with red-tiled roofs, green spaces, and a large cathedral in the center. The city is surrounded by rolling hills and mountains in the background.

**ZAGREB ENERGY EFFICIENT CITY**

Refurbishment of public buildings and modernization of public lighting

**Bratislava– 10 November 2015**





## City of Zagreb Administration

- City Assembly  
(as representative body)
- Mayor  
(as executive body)
- 21 City administrative bodies
- 328 City institutions
- 17 Council districts
- 218 local committees



## Energy consumption, water supply, sewage (2012)

Electricity consumption (thousands MWh)	2,913
Gas consumption (thousands m3)	410,455
Water consumption (thousands m3)	61,883
Water supply pipeline length (km)	2,341
Number of water supply system services	79,601
Sewage network length (km)	1,648
Disposed waste (tons)	367,660
Number of registered motor vehicles	414,353

## City- owned companies

The basic purpose of City-owned companies is to permanently provide quality vital public services of interest to natural and legal persons.



# ENERGY POLICY CITY OF ZAGREB



- Statement on the policy of energy efficiency and environmental protection, March 28th, 2008;
- **Covenant of Mayors, October 30th, 2008;**
- Member of ICLEI, April 19, 2000;
- Member of Eurocities and Metropolis, 2002;
- Member of the Association Energie-Cites, November 25th, 2008;
- Supporting Structure Covenant of Mayors, April 27th, 2009;
- **Sustainable Energy Action Plan, April 20th, 2010;** SEAP review Dec 2012
- Energy efficiency program in the immediate consumption 2010-2012;
- Protection and improvement of air quality program in the City of Zagreb 2009-2012;
- Green Digital Charter - Eurocities, October 24th, 2010;
- Plan for energy efficiency in the immediate consumption of the 2011, 2012; 2013, 2014
- Sustainable City International – Energy Lab 2013
- Climate Change Adoption Plan ,.....





## Main goals of energy policy

- Reduction of CO<sub>2</sub> emission in all sectors by implementing measures of energy efficiency, usage of renewable energy and environmentally friendly fuels, rational management of demand, continuing education and other measures;
- As much as possible to contribute to security and diversification of energy supply;
- Reduce energy consumption in buildings, transport, industry and public lighting;
- Enable the conversion of urban districts in environmentally sustainable areas.

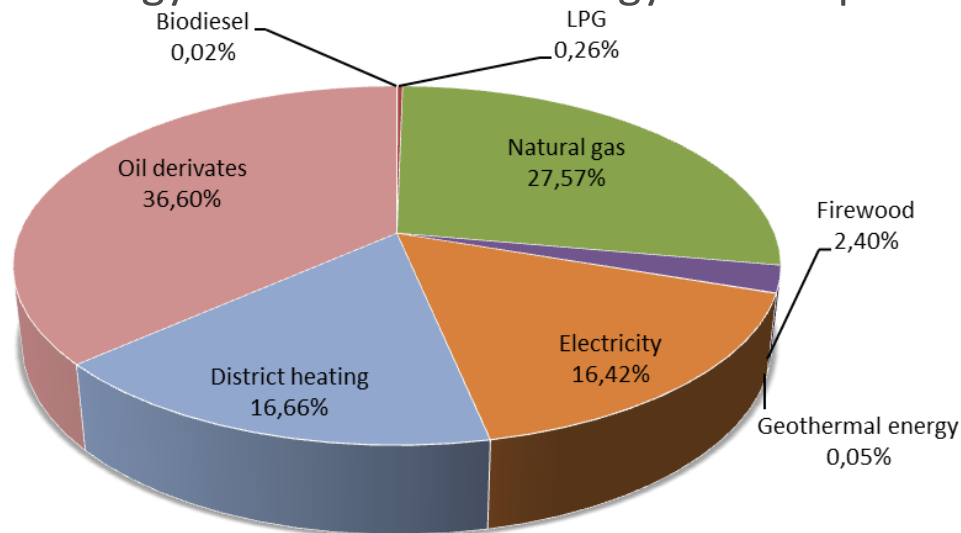




# ENERGY CONSUMPTION IN CITY OF ZAGREB

- Total annual energy consumption:
  - Buildings 8.310 GWh
  - Transport 3.532 GWh
  - Industry 2.506 GWh
  - Public lighting 90 GWh

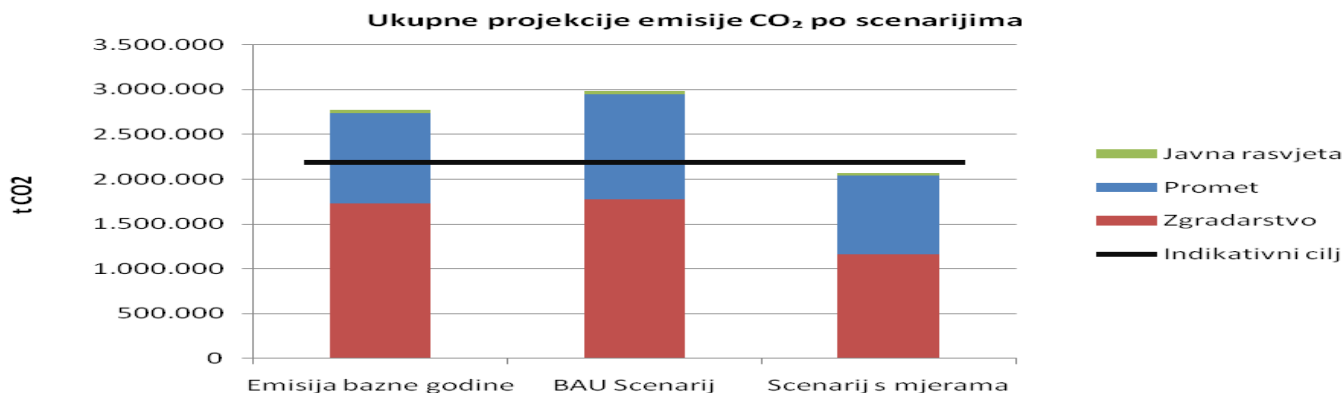
- The share of individual energy sources in total energy consumption





- **Total CO2 emissions for the City of Zagreb:** **3.177 kt CO2**
  - Buildings 1.760 kt CO2
  - Traffic 1.005 kt CO2
  - Industry 383 kt CO2
  - Public lighting 29 kt CO2
  
- Total emission tCO2/per capita in City of Zagreb is 4,03

**Priority measures –expected results**





## Building sector in the City of Zagreb:

- Buildings of the City Administration and Local Self-Government 236 objects
- School and preschool buildings 387 objects
- The health service facilities 123 objects
- Homes for retired and elder people 12 objects
- Buildings for cultural activities 84 objects
- Offices and apartments ( dilation + 51% ) 792 objects
  
- Zagreb holding (17 branches, 4 trade associations and 1 institution)
  
- Sector for commercial and service activities 19.893 objects





## Transport sector:

• Fleet of the City of Zagreb	1.109 vehicles
• Tram	297
• Bus	388
• Passenger cars and commercial vehicles	414.353

## Public lighting sector:

• electric lighting	(lighting)	105.000
	(light sources)	132.290
• gas lighting	(lighting)	214
	(light sources)	290





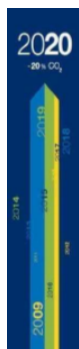
# WHY ZagEE ?



The building sector has the largest input of approximately 58% total consumption of the City of Zagreb. It has been estimated that the greatest potential for saving lies in exactly this sector.



The proactive energy policy of the City of Zagreb has set high targets in order to meet the obligations set out in the Covenant of Mayors and the Sustainable energy action plan of the City of Zagreb to reduce CO2 emissions min. by 21% through the application of energy efficiency measures and the use renewable energy sources by the year 2020.



Directive 2012/27/EU on energy efficiency obliges the public sector to acquire energy efficient buildings, products and services. The public sector is also obliged to reduce energy consumption in buildings it uses and owns by annually refurbishing 3% of total useful surface of heated or cooled parts of buildings belonging to the public sector in the aim of saving energy, starting with January 1, 2014.





## WHY ZagEE ?

In order to encourage the application of energy efficiency measures and the use of renewable energy sources, the City of Zagreb shall provide an example of the usefulness of such measures for individuals and the society.

The project ZagEE – Zagreb Energy Efficient City supports the realization of energy savings through the implementation of economically justified, energy efficient technologies and measures on objects owned by the City of Zagreb.





## APPLICATION PREPARATION

### GENERAL CONDITIONS

- SEAP of the City (planned EE measure)
- Data of energy consumption
- Energy audits (current state of buildings)
- Technical and human resources
- Good cooperation with stakeholders

### TIME FOR PREPARATION

- Approx. two months – activities on analyses data, project drafting, researches of costs for project documentation preparation and for works

### PARTNERS CONTRIBUTED

- The City Office for Energy, Environment and Sustainable development (coordinator)
- City offices who are competent for objects (buildings and public lighting)
- REGEA (project partner)





The project is implemented as part of the IEE program for technical assistance 2012. – MLEI Mobilization of local energy investments (call 2012) and includes financing of technical assistance as well as the production of the documentation necessary for energy refurbishment of objects, through the allocation of grants.

- the ZagEE project amounts **EUR 1.813.438**,
- total proposed energy investment cost (works for which the technical documentation will be produced amounts **EUR 29.379.114**
- Leverage factor is **16,2**
- Duration is **36 month** (1 April 2013 – 31 March 2016)
- The works must be finished in three years after the end of the project



## OBJECTIVES

### Primary objectives

- Renovation of 87 public buildings – deep retrofitting measures
- Modernization of park lighting (3000 lamps)
- Reduced Energy consumption by 33.526 MWh , CO2 emission by 8.390 t/year and 290 MWh green energy,
- More new jobs



### Project background

- Largest retrofitting project in Croatia in recent years
- 90% of buildings below F energy class
- Ambitious energy saving targets (49-72%)
- Short time for implementation (decisive project management needed – clear division of responsibilities and strict deadlines)



## OBJECTIVES

### Secondary objectives

- Capacity building (technical, financial, managerial) of city office employees and building managers
- Awareness raising among citizens and other stakeholders
- Find and use financing models for energy efficiency applicable to the city administration;
- Acquire knowledge and experience necessary for all participants of the energy refurbishment process through examples of energy efficiency implementation on a large number of objects of various purposes;
- To influence positive changes in the economy;
- to share the acquired skills and experiences and influence energy efficient development in other cities of the region and beyond;





#	Type of investment	Energy investment costs (€)	Avoided GHG emissions (tCO <sub>2</sub> e/year)	Primary energy savings (MWh/year)	Renewable energy produced (MWh/year)
1	Refurbishment of public buildings	26.579.114	8.043	32.056	290
2	Public lighting	2.800.000	347	1.470	-
<b>Total</b>		<b>29.379.114</b>	<b>8.390</b>	<b>33.526</b>	<b>290</b>





## Objects owned by the City of Zagreb

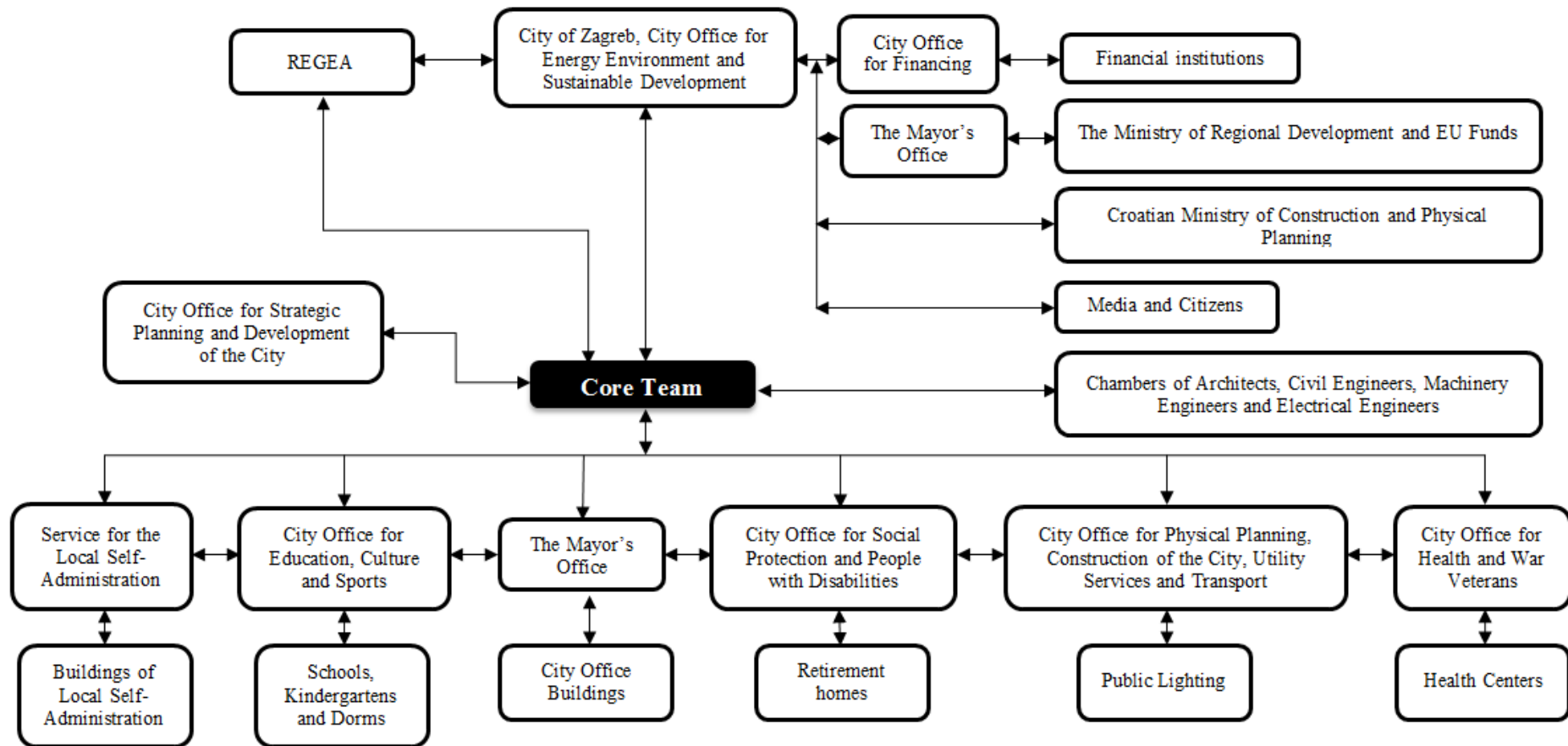
- 3 city administration buildings;
  - 15 elementary schools;
  - 7 secondary schools;
  - 36 kindergartens;
  - 6 retirement homes;
  - 3 health centers;
  - 17 buildings of local self-government
- TOTAL 87 buildings, gross surface 226.654 m2**
- modernization of 3000 outdated luminaries in the public lighting system by LED luminaries with time based lighting control system.





# MAIN STEPS

- Establish Project Core team named by the Mayor: experts from different city offices responsible for implementation of action;



## MAIN STEPS



- Core team manager – Head of City Office for Energy, Environment and Sustainable Development which acts as an overall coordinator;
- Buildings register and database (validated and updated data from all energy audits, selection of buildings, the list of RUE and RES measures);
- Production of the City of Zagreb Lighting Masterplan;
- Production of quality technical documentation for the energy refurbishment of objects with a feasibility study;
- Find various financing sources, i.e. the city budget, EU and national funds, favorable bank loans and other sources acceptable for the city administration;
- Performing public tenders for works on the energy refurbishments of objects;
- Procedure of public procurement for documentation, works and supervisory activities .



## CHALLENGESS

- Define financial sources and set up in the city budget according the regulations
- Public procurement (long and complicated process)
- Preparations a lot of tender documentation and procedure of public procurement in a short time
- Catch the summer holidays for refurbishment of buildings (in kindergartens and schools) in 2015, 2016 and 2017
- Estimated costs for works (there is no experience)

Project ZagEE has political and public acceptance

- Project Core team cooperate efficiently
- Politicians, experts, financial institutions and media support Project ZagEE

Program ZagEE 2013 – 2017 (in detail investment plan) is essential for estimate investment in the city budget and it is the base document for application on founs, banks, etc.

(Program ZagEE 2013 – 2017 has been approved by the City Assembly )

## Current situation

### Technical documentation for buildings

- 82 buildings (completed )
- 7 buildings ( in final stage)

### Technical documentation for public lighting

- I Part (completed )
- II Part ( in final stage)

### Refurbishment of buildings (37)

- 2 buildings (finished)
- 18 buildings (work is going on)
- 2 buildings ( in the process of contracting)
- 7 buildings ( in the process of public procurement)
- 8 buildings ( preparation phase for public procurement)

### Refurbishment of public lighting

- 167 led lamps (work is going on)
- 986 led lamps (in the process of public procurement)



## Current situation

### Measures in buildings

- Thermal insulation of envelopes (walls and roof) with rock wool
- Replacement of old joinery with energy efficient joinery
- Replacement of inefficient fuel oil boilers with gas boilers
- Balancing the heating system and the installation of thermostatic valves
- Replacement of inefficient indoor light bulbs
- Installation of solar panels and solar collectors
- Smart metering





## Kindergarten *Pčelica*

Surface: 2.700 m<sup>2</sup>

Year of built: 1972

### Before refurbishment

- Energy consumption (2013): 638,83 MWh/year
- Energy class: E

### After refurbishment

- Energy class: B
- Energy savings: 356 MWh/year
- CO<sub>2</sub> reduction: 85 t/year
- Investment: 362.000 EUR
- Financial savings: approx. 29.000 EUR per year

### The refurbishment involves

- the reparation of the building' s external envelope - thermal insulation: rock wool - 16cm walls, 20 cm roof
- replacement of existing windows with more energy efficient -
- replacement of inefficient indoor light bulbs
- balancing the heating system and the installation of thermostatic valves
- smart metering



# How it looks

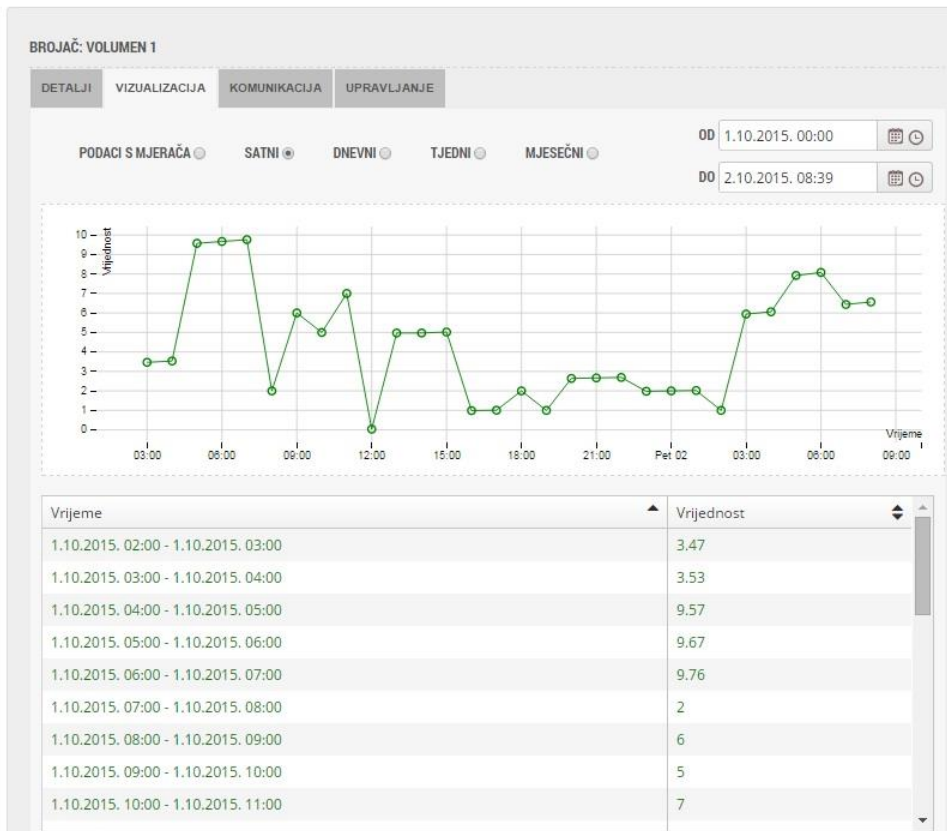
## KINDERGARTEN PČELICA



# Smart metering

## Mjerna oprema

- RVT
- JNTPO
- JVTPO
- JNTPR
- JVTPR
- GZ Rudes (Jablanska 51) -  
Kotlovnica - grijanje
  - Toplina
  - Volumen
- GZ Rudes (Jablanska 51) -  
Potrosnja vode
  - Volumen 1
  - Volumen 2
- Djecji vrtic Pcelica
  - GZ Djecji vrtic Pcelica - Brojilo 1 -  
el. energija
    - JNTPO
    - JNTPR
    - JVTPO
    - JVTPR
    - RNT
    - RVT
  - GZ Djecji vrtic Pcelica - Brojilo 2 -  
el. energija
    - JNTPO
    - JNTPR
    - JVTPO
    - JVTPR
    - RNT
    - RVT
  - GZ Djecji vrtic Pcelica - Plin
    - Volumen 1**
    - Volumen 2
  - GZ Djecji vrtic Pcelica - Potrosnja  
vode
    - Volumen 1
    - Volumen 2



# Smart metering

## Mjerna oprema

- RVT
- JNTPO
- JVTPO
- JNTPR
- JVTPR
- GZ Rudes (Jablanska 51) -  
Kotlovnica - grijanje
  - Toplina
  - Volumen
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    - JVTPR
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    - RVT
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    - JNTPR
    - JVTPO
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    - RVT
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    - Volumen 1**
    - Volumen 2
  - GZ Djecji vrtic Pcelica - Potrosnja  
vode
    - Volumen 1
    - Volumen 2


**BROJAČ: VOLUMEN 1**

DETALJI VIZUALIZACIJA KOMUNIKACIJA UPRAVLJANJE

OD 12.10.2015. 00:00

DO 25.10.2015. 08:39

PODACI S MJERAČA SATNI DNEVNI TJEDNI MJESEČNI



Vrijeme	Vrijednost
12.10.2015. 00:00 - 13.10.2015. 00:00	177.72
13.10.2015. 00:00 - 14.10.2015. 00:00	153
14.10.2015. 00:00 - 15.10.2015. 00:00	143.29
15.10.2015. 00:00 - 16.10.2015. 00:00	119.28
16.10.2015. 00:00 - 17.10.2015. 00:00	93.44
17.10.2015. 00:00 - 18.10.2015. 00:00	82
18.10.2015. 00:00 - 19.10.2015. 00:00	145
19.10.2015. 00:00 - 20.10.2015. 00:00	147
20.10.2015. 00:00 - 21.10.2015. 00:00	144



## Zagreb Lighting Masterplan

- **208 locations**
  - all of the visited locations photographed, intervention zones determined and graphically portrayed
  - an approximate number of lamps and light controls per location determined
  - locations sorted per city districts ( 15 city districts included)
  - project assignment made
  - the light parameters of the reconstructed public lighting system have been set
  - minimal technical characteristics of lamps, LED modules (lighting sources), regulations and managing the reconstructed public lighting system



MODERNIZATION OF PUBLIC LIGHTING



77-165W ( and over)



20-46W



# How it looks





## ESTIMATED IN PROJECT

Type of investment	Size of the investment (€)	Sources and share of funding		
		Own budget	Loans	EU funding
Refurbishment of buildings	26.579.114	30%	35%	35%
Public lighting	2.800.000	30%	35%	35%





## AVAILABLE FUNDING SOURCES

- Environmental Protection and Energy Efficiency Fund (EPEEF)  
**grants of 40% of total investment for works**
- Croatian Bank for Reconstruction and Development (HBOR)  
**loans 2.400.000 EUR**
- Calls for proposals of Ministry of Construction and Physical Planning  
Pilot programme *Energy renovation of public schools and other educational buildings*  
**grants 70% (3 kindergartens and 2 primary schools)**
- ESCo model - Agency for Transactions and Mediation in Immovable Properties is in charge of coordinating the programme on national level  
**1 building, payback time 14 years**



## IS IT WORTH IT TO APPLY FOR HORIZON 2020?



This allows the beneficiaries to produce project documentation and feasibility studies and obtain the necessary documentation needed for financing the energy refurbishment of objects from sources other than the city budget, such as banks and EU funds.

With more effort, capacities of city administrations are directed to implementation of works (refurbishments of buildings and modernization of public lighting) due to certain deadlines for works.

### Benefits of such investment have

- City administration (reduced bills, satisfied citizens, meeting performance target by SEAP, experience in implementation of such projects, economic growth)
- Manager of buildings (easier maintenance)
- Users of the buildings (quality)

**As renovation of buildings and public lighting will be done in any case, IEE - MLEI funding allows this to be done in energy efficient way**





WHAT IS NEXT ? ZagEE 2, ZagEE 3, ZagEE 4,.....

Yes !





# Thank you for your attention

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