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Consumption of Electrical Energy for Public Lighting in Slovenia

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Decree adopted in 2007

In 2007 Slovenia adopted Decree about limiting values of light pollution of environment:

"Uredba o mejnih vrednostih svetlobnega onesnaževanja okolja", Slovenian official gazette No. 81/2007, 07.09.2007

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Purpose of Decree

… to protect the living premises from the light trespassing, to reduce the energy used for outdoor lighting and also to limit the influence of the outdoor lighting installations on environment, protecting so the nocturnal animals and dark sky …

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Limitations in Decree

- Allowed are only the luminaires with ULOR=0.
- Energy consumption per capita or per area is limited.
- Time of illumination of some objects is limited.
- Luminance of the façades is limited.
- Monitoring is obligatory.

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Limitations in Decree

For public street lighting, following limitations apply:

- allowed yearly consumption per capita is 44,5 kWh for lighting managed by municipalities or community;
- additional 5,5 kWh per capita can be used for lighting of major roads managed by state.

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Transient period

- Until 31.12.2008 all proper luminaires (flat glass) need to be mounted so that ULOR=0.
- Until 31.12.2016 all street lighting installations need to be in accordance with the Decree.
- Minimum of 25% of luminaires need to be in accordance with the Decree until 31.12.2011 and minimum of 50 % until 31.12.2012.
- Accordance with the Decree should be stated in the monitoring report which each owner need to deliver to the Ministry of Environment and Spatial Planning.

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Performed study

To estimate the needed measures the study was made. In scope of it we try to find out:

- total electrical power consumption for street lighting in Slovenia,
- state of the lighting installations and
- possible energy savings.

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EE consumption estimation- municipalities

Source: municipalities (59 out of 210)

- Number of inhabitants included:
  961.578 (total 1.964.036)
- Electrical energy consumption for street lighting:
  73.427.557 kWh/year
- Yearly consumption per capita:
  76,4 kWh.
- Without the lighting on state roads.

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EE consumption estimation- electrical distribution companies

Source: Electrical distribution companies

- Number of inhabitants included:
  1.964.036
- Electrical energy consumption for street lighting:
  151.663.843 kWh/year
- Yearly consumption per capita:
  77,2 kWh
- Without the lighting on state roads.

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EE consumption estimation- state roads

Energy consumption for road lighting on state roads (DARS, DDC)

Source: Electrical distribution companies

- Number of inhabitants included:
  1.964.036
- Electrical energy consumption:
  DARS: **11.314.800 kWh**
  DDC: **2.193.947 kWh**
- Yearly consumption per capita:
  5,76 + 1,12 = 6,88 kWh

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Total EE consumption for street lighting in Slovenia

Results of the study concerning the electrical energy consumption for street lighting:

- Number of inhabitants in Slovenia in 2007: **1.964.036**
- Total electrical energy consumption for street lighting in 2007: **165.200.000 kWh (165,2 GWh)**
- Consumption per capita (should be 50 kWh): **84,11 kWh**.
- The road lighting on state roads included.
- Total electrical energy consumption in Slovenia in 2007: **13.700 GWh** ; street lighting: 1,2 %

Comparison with EU

Statistics:

State	Inhabitants (mio)	Area km²	EE consumption for street lighting GWh	Density of inhabit. cap./km²	Consum-ption kWh/c.	Consum-ption kWh/km²
Slovenia	2,0	20.273,00	165,2	98,7	84,1	8.138,9
Germany	82,3	357.021,00	3.456,6	230,5	42,0	9.681,8
The Netherlands	16,4	41.526,00	754,4	394,9	46,0	18.166,9
EU 25	465,8	3.975.481,00	23.802,4	117,2	51,1	5.987,3

Source: Dark Sky Association of Slovenia

State of the lighting installations

State of the lighting installation – reason for high energy consumption:

- old installations with HP Mercury Vapour lamps,
- bad maintenance of the lamps,
- bad planning of new installations – much higher luminance on roads as needed.

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Some examples

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Possible EE savings

Municipality of Celje

- inhabitants: 48.081 (third largest city),
- gross domestic product per capita: 89% NGDP,
- number of street luminaires: 4080,
- total electrical power: 862 kW,
- total electrical energy consumption: 3.706.660 kWh,
- total consumption per capita: 77 kWh.

Possible EE savings

Municipality of Celje

Light sources in use before renovation:

Light Source	El. Power [W]	number
HP Na or HP Hg	400	850
HP Na or HP Hg	250	620
HP Hg	125	2610
Total		**4080**

Possible EE savings

Municipality of Celje

Luminaires and light sources in use after renovation:

Luminaire	Light Source	El. Power [W]	Number
Lunoide	HP Na	250	850
Lunoide	HP Na	150	620
Axial	CFL	36	1840
Globe	HP MH	32	770
	Total		**4080**

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Possible EE savings

Municipality of Celje

Statistics after renovation of street lighting:

- number of street luminaires: 4080,
- total electrical power: 419 kW,
- total electrical energy consumption: 1.801.700 kWh ,
- total consumption per capita: 37 kWh.
- **savings: 51 %**

Unfortunately none of the new luminaires comply with the Decree, after replacement savings will probably be lower.

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Possible EE savings

Based on this and other examples, the total savings of the electrical energy could be:

Group of Municipalities	Total consumption of group [kWh]	Portion in total consumption [%]	Possible savings [%]	Possible savings [kWh]
with consumption larger than average	38.194.748	52,0	50,0	19.097.374
with consumption smaller than average	29.391.687	40,0	30,0	8.817.506
with consumption less than 50 kWh/c.	5.841.122	8,0	0,0	0
Total [kWh]	**73.427.557**			**27.914.880**
Possible savings [%]				**38,0**

Calculation based on data from municipalities.

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Possible EE savings

In accordance with the results of study we estimate that the total savings of electrivcal energy for public street lighting in Slovenia could be:

- 38 % of the present consumption at municipalities and DDC, which is
- 58,6 GWh or
- 35,4 % of present consumptions.

The yearly consumption of electrical energy could so be:

- 106,8 GWh or
- 54,4 kWh/capita.

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