GPP 2020 – Green Public Procurement for low carbon economy

Requirements for Green Lighting at night

Andrej Mohar

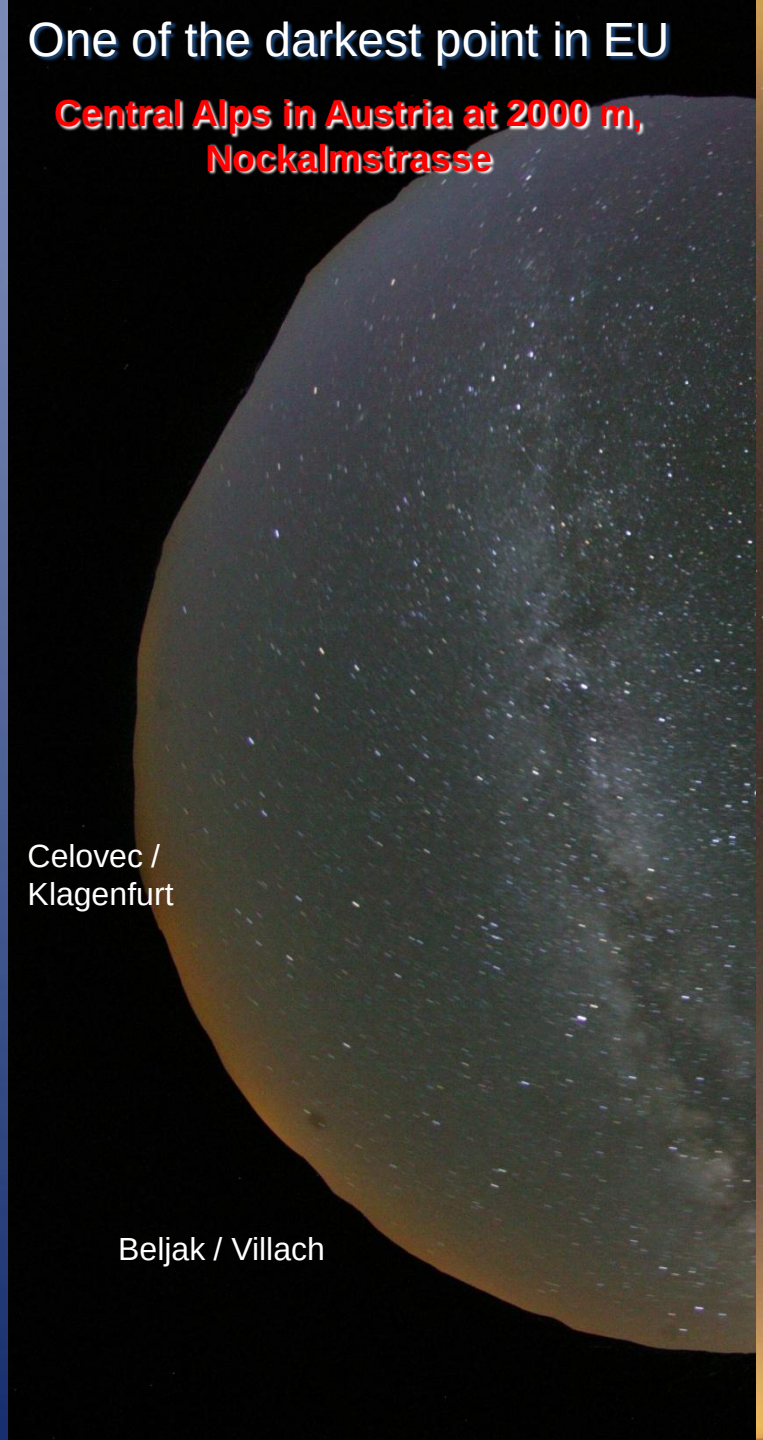
Dark-Sky Slovenia

Webinar, 23.2.2016

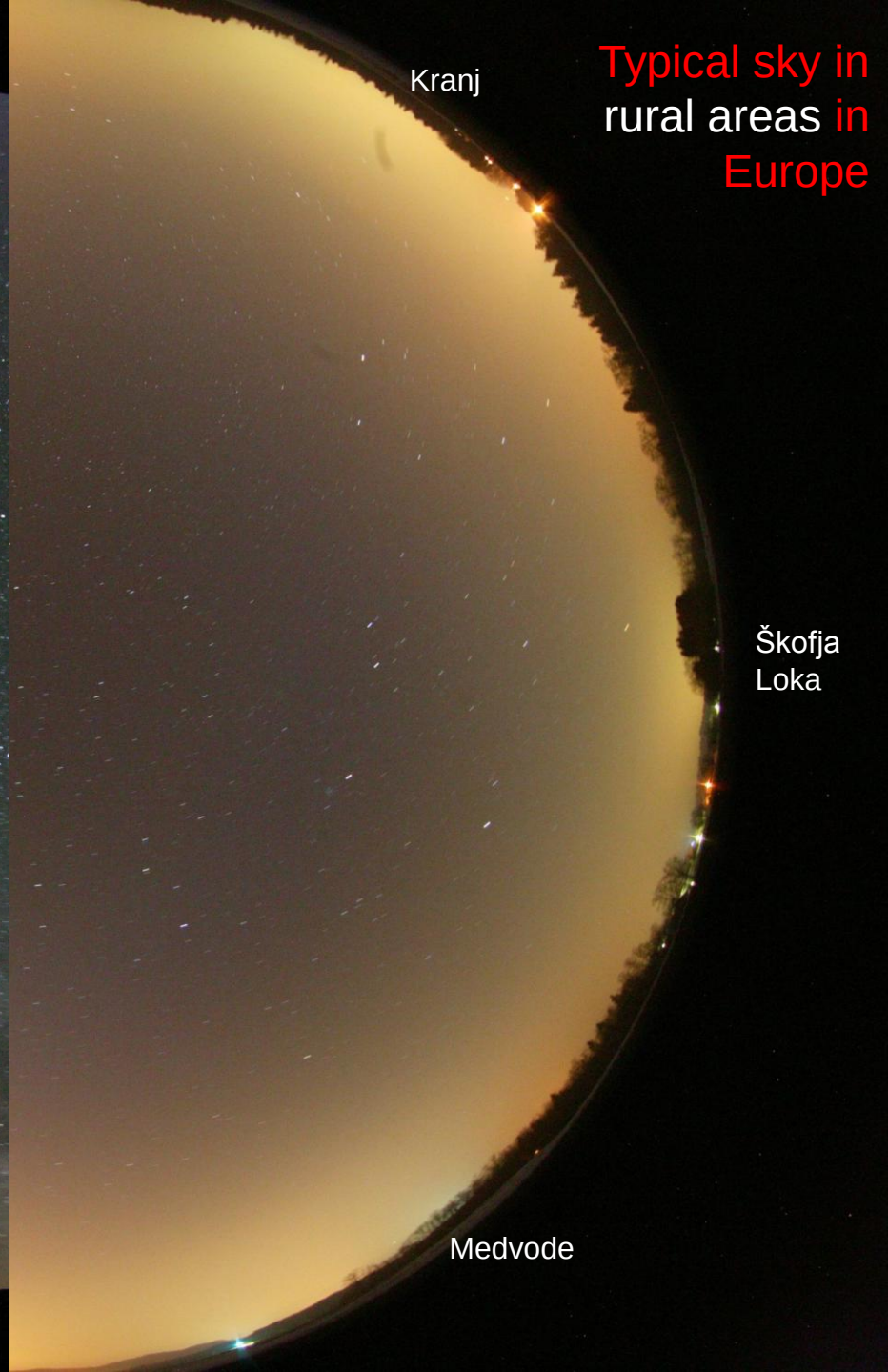
No single point with natural sky in EU !

One of the darkest point in EU

Central Alps in Austria at 2000 m, Nockalmstrasse



Typical sky in rural areas in Europe



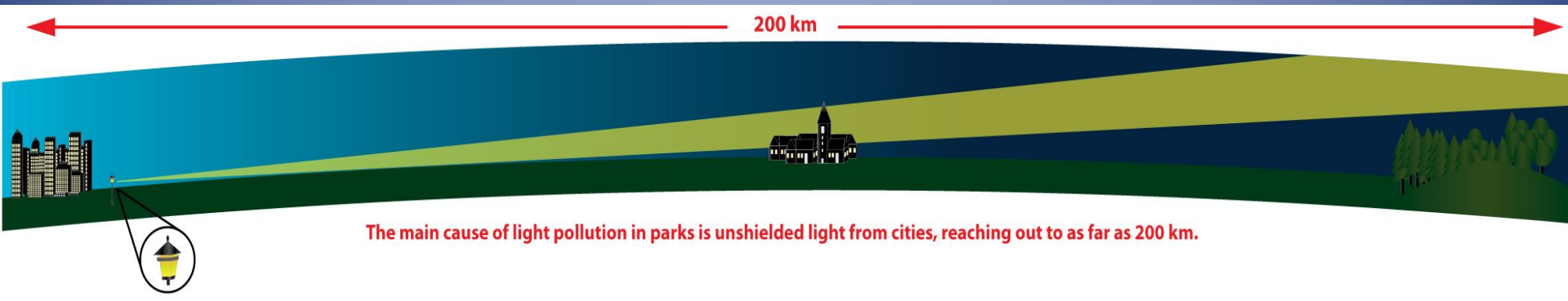
Light pollution at largest continental astronomical observatory in EU

(Calar Alto, Andalusia, Spain)


Trnovo
rural area in Slovenia
Lastovo
almost natural sky
photos were taken in the same week with the same camera
Credit: Primož Kuk
Problem 1
Natural heritage is already lost!
Nikon D5000
Sigma 18mm f.2,8
ISO 800, 45s

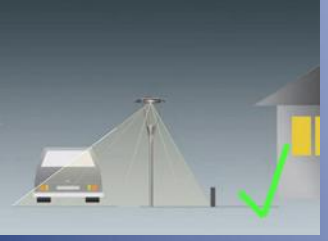
Cities and towns

are main sources of light pollution

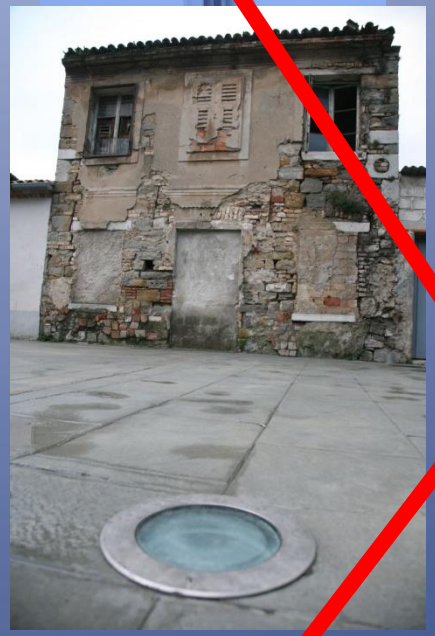


- This is why Slovene light pollution legislation requests 0% ULOR for all luminaires no matter of zones.

- Because light and light pollution can easily reach more than 200 km from light source we cannot protect park without implementation of strong measures in towns and cities.



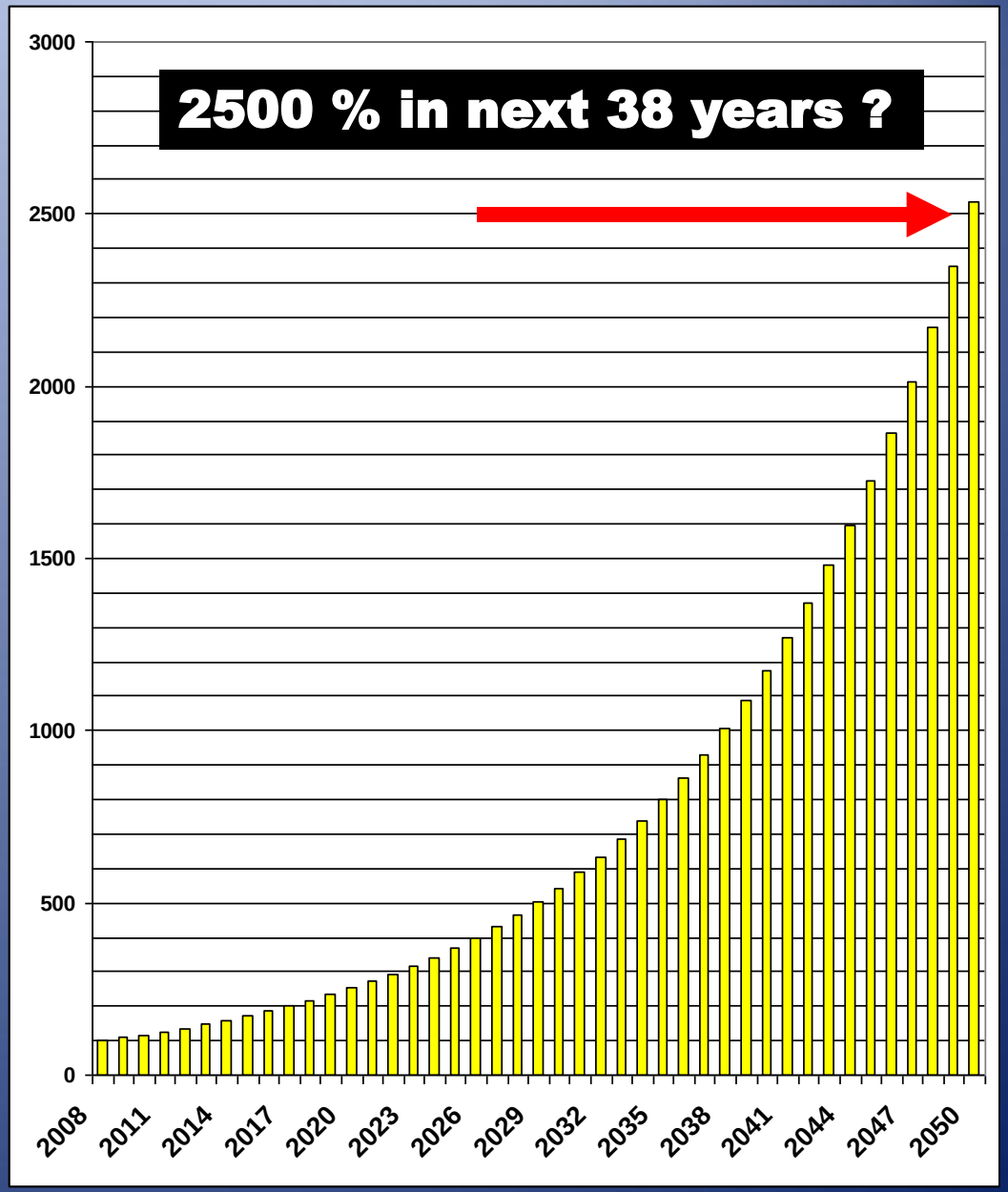
Slovenia has adopted in August 2007 perhaps the most advanced light pollution legislation on our planet (similar to Lombardy / Italian type of law)



Problem 2

Expected light pollution increase in EU with 8 % annual growth

8 % annual increase was measured at Črni Vrh Observatory, Slovenia during last 15 years. In some EU states this increase can vary between 3 % and 10 %



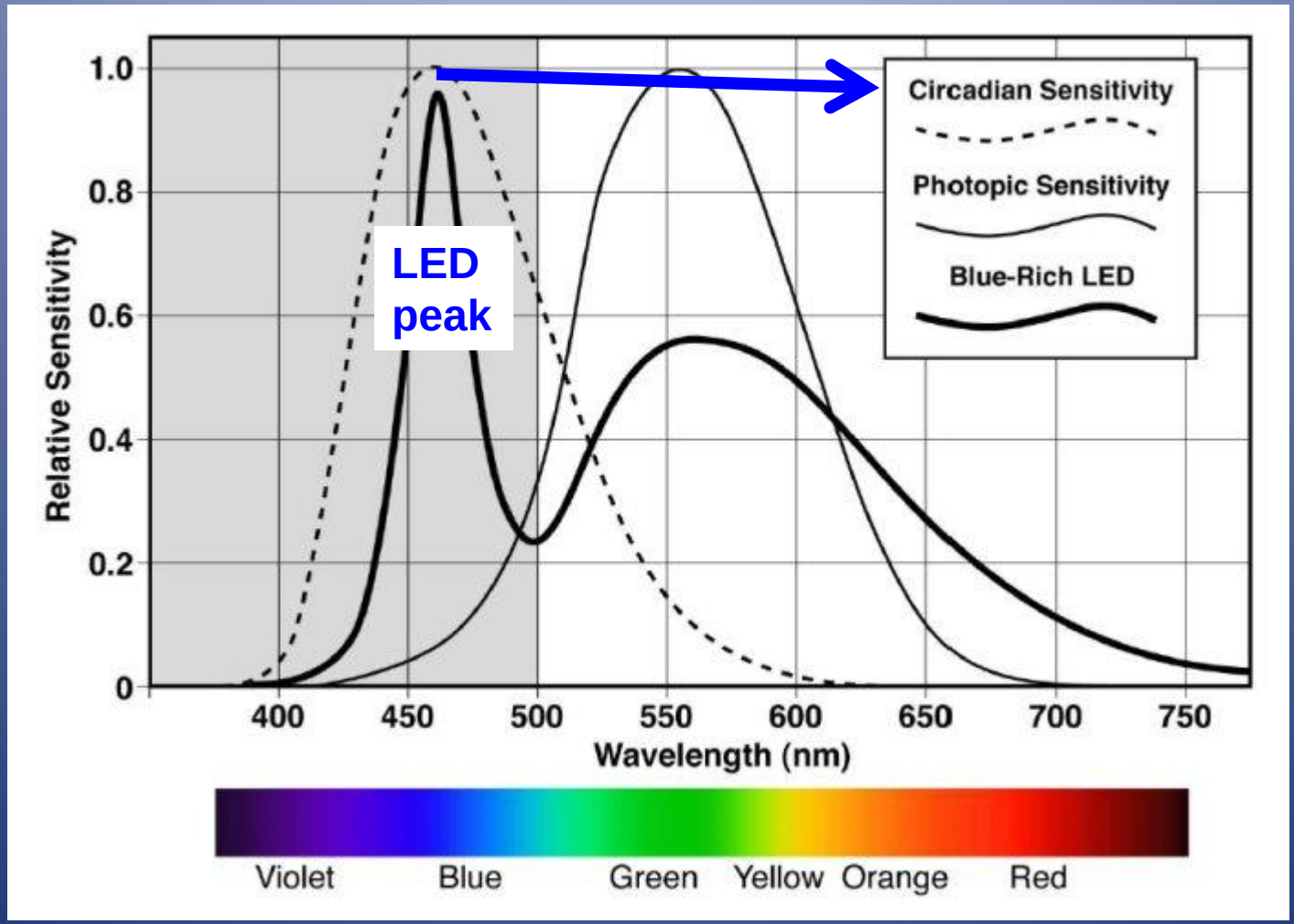
Problem 3

Health problems. It is necessary to sleep in total darkness.

New hotel Aurora, Mali Lošinj, Croatia

Problem 3

New LED i metalhalogene lamps may increase cancer incidence (breast, prostate, colon), obesity, diabetes, cardiovascular disseases.



We have to ban lamps which emit wavelenghts below 500 nm (just for night time use)

Biodiversity problem

Problem 4

1. Night butterflies (moths) are in big decline. Reports says that biomass decreased from significant to 1:10 or 1:100 in rural area. Many species disseapered.
2. Birds disturbed during migration.
3. Bats.
4. Sea turtles.
5. Prey-predator relationship. Darkness could help them to survive…
6. Most light pollution effects on biodiversity are still unknown especially prey-predator relationships.

WHITE LAMPS (LED, metalhalogene)

with color temperature above 2400K are a big threat for environment and human health.

Problem 5

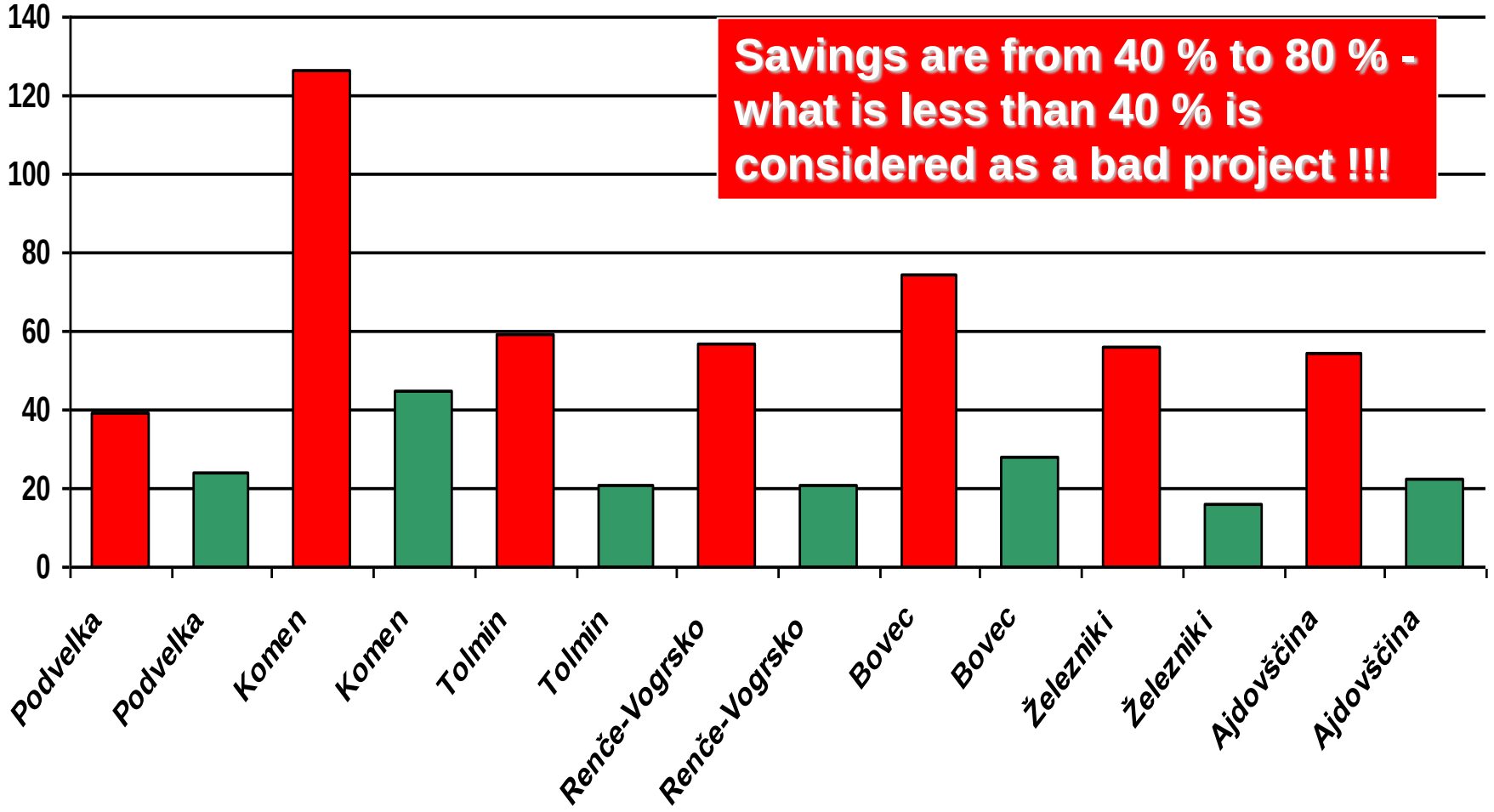
1. **White color MH attracts 3 time more insects vs. HPS (High pressure Sodium).**
2. **White color supress melatonine about 3 times faster than HPS.**
3. **White color increase light pollution about 3 times more than HPS.**
4. **White color makes more glare.**

Energy savings in a few communities in Slovenia

(in kWh/person/year)

red - before reconstruction,

green - after reconstruction according to Slovene LP Law



Light Pollution Law and its consequences in Ljubljana

250 W → **150 W (FCO)**

- 40 % reduction of CO2 emissions

+20 %

higher level of road illumination !!!

From 1970 to 2007

2008

Outdoor lighting is today LESS green than 10 years ago!

In year 2000:
50 % of manufacturers were able to suppy green lighting
(were able to provide warm high pressure sodium bulbs light with
0 % emission over horizon.

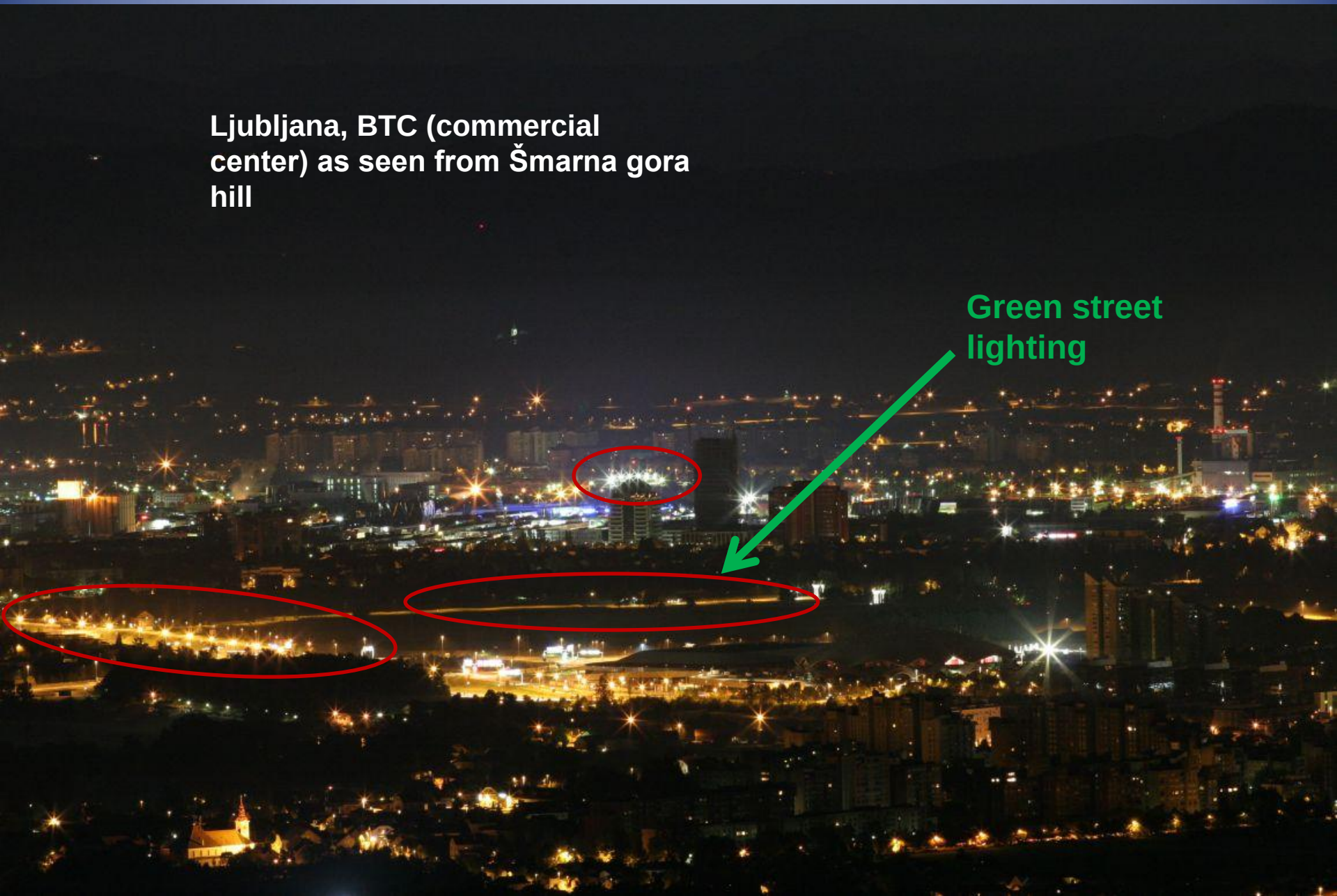
In 2016

Less than 1 % of LED lamps on market are green !!!!

99 % of lamps on today‘s market are cancerogeus
99 % of lamps on today‘s market are bad for biodiversity
99 % of lamps on today‘s market makes more light pollution than old technology
99 % of lamps on today‘s market are more glary (bad for safety)

The only good fact is that today‘s new LEDs lamps are up to 200 % more effcient (150 lm/W vs. 70 – 100 lm/W). But because light is cheaper it is used in higher quantities than in the past, which means more reflection from ground and more light pollution.

How green lighting should look from a birdview?



Requirements for green outdoor lighting

Energy consumption for public lighting must be:

Less than 25 kWh / inhabitant / year

(*) Light pollution law in Slovenia from 2007 requests less than 50 kWh / inhabitants / year (but now lumiaires are almost double (100 %) more effcient than technology from 2007.

(*) Many countries in EU have energy consumption more than 100 kWh / inhabitant / year (Spain, Italy, Croatia, etc.)

Requirements for green outdoor lighting

1. Color temperature must be less than 2700 K (use amber LED or warm LED).
2. Zero (0.0%) light emissions above horizon is obligatory.
3. Illumination lever must be much lower (minimum 50 % sometimes could be 80 % less) than it is defined in standard EN 13021. Several big cities (Vienna, Berlin) does not follow EN 13201 standard because it is too high. My measurements show that 99 % of public ighting in EU does not comply to high requirements (illumination level and uniformity) requested by EN 13201 standard.
4. In residental areas (streets with almost no traffice) we need just 5 W lamps which can provide 1 lx illumination – such low wattage is not available by manufactureres, because more power means higher price.
5. Curfew (reduction in evening and night time) must be at least 50 % but could be even 80 % or 90 % - at night most people sleep.
6. Public lighting must be designed in such way that illumination on windows is less than 0,01 lx (10 times illumination of Milky Way) for vast majority of inhabitants.
7. No illumination on highways and on junctions outside settlements.
8. Lifetime of lamps must be longer than 20 years.

Project Futurelights

Reconstruction of public lighting in municipalities Šempeter-Vrtojba, Tolmin, Portomaggiore and Gorizia

Andrej Mohar

Dark-Sky Slovenia

Webinar, 23.2.2016

2007-2013
cooperazione territoriale europea
programma per la cooperazione transfrontaliera
Italia-Slovenia
evropsko teritorialno sodelovanje
program čezmejnega sodelovanja
Slovenija-Italija

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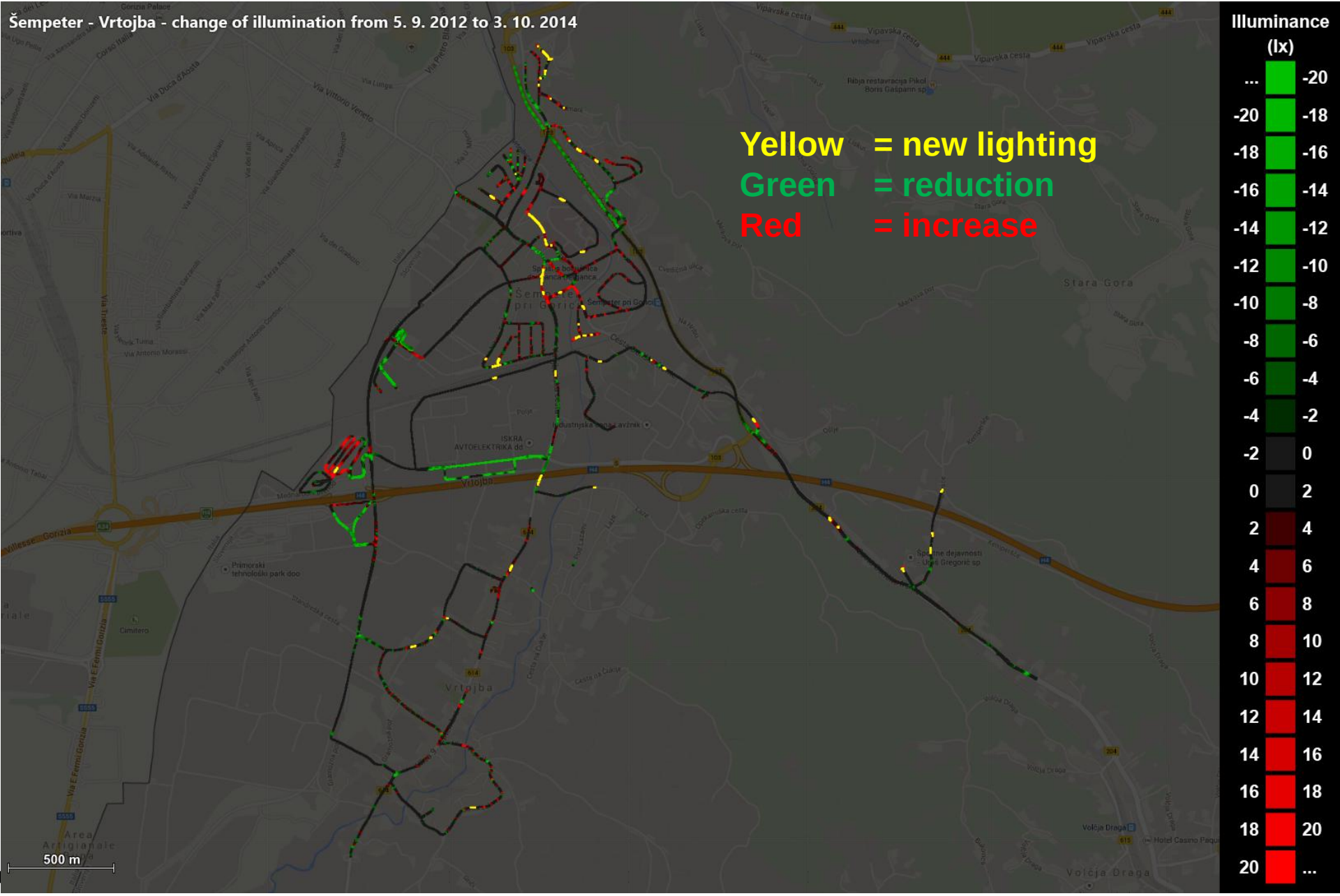
Projekt sofinancira Evropski sklad za regionalni razvoj

Občina Šempeter-Vrtojba

FUTURELIGHTS

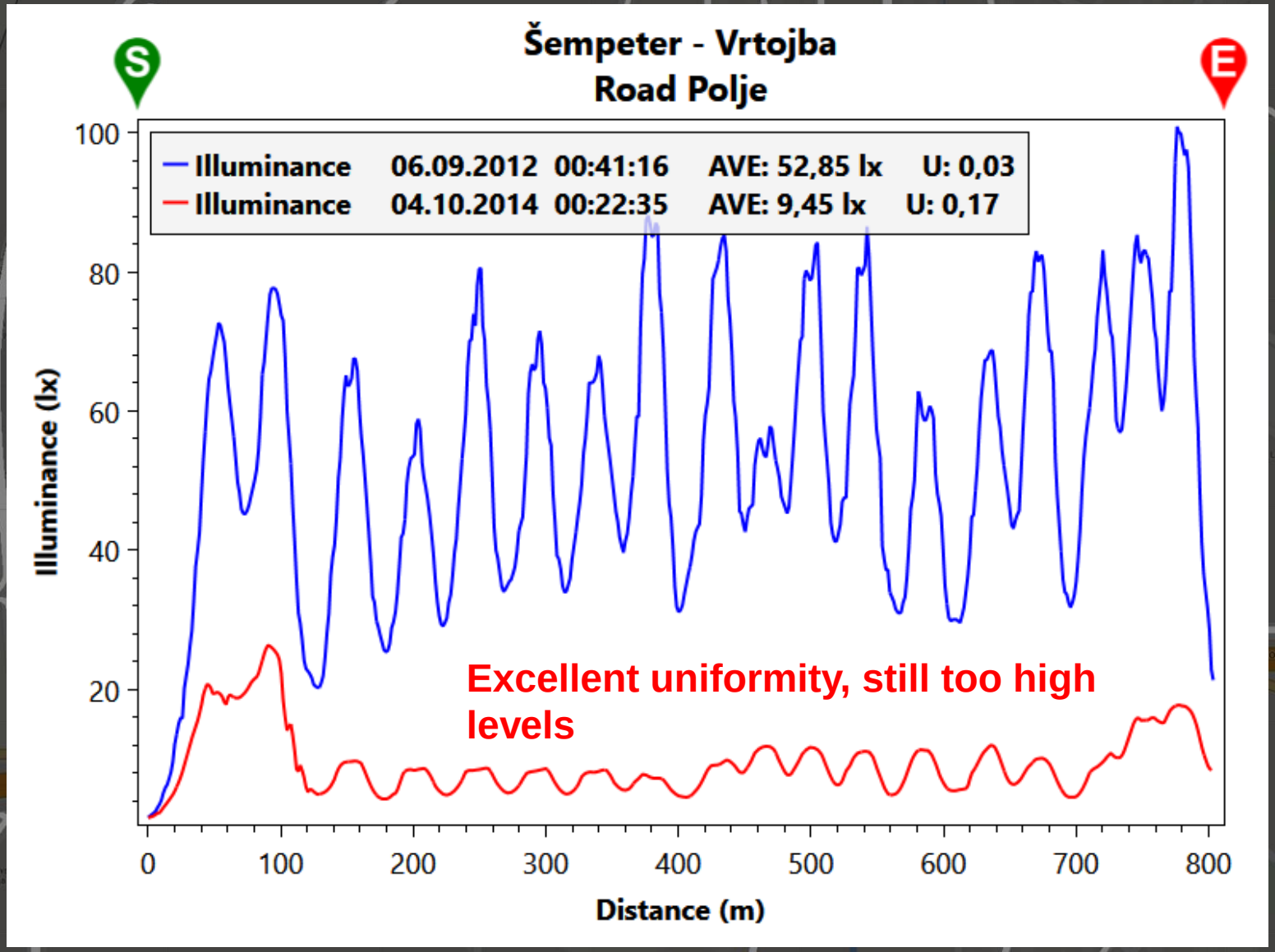

Šempeter - Vrtojba - change of illumination from 5. 9. 2012 to 3. 10. 2014
Yellow = new lighting
Green = reduction
Red = increase
Illuminance (lx)
... -20
-20 -18
-18 -16
-16 -14
-14 -12
-12 -10
-10 -8
-8 -6
-6 -4
-4 -2
-2 0
0 2
2 4
4 6
6 8
8 10
10 12
12 14
14 16
16 18
18 20
20 ...
500 m

Šempeter Vrtojba is the OLNY one municipality (out of 212 municipalities in Slovenia) which uses the best possible compromise in public lighting:

3000 K warm LED lamps

with 50 % curfew

All other municipalities in Slovenia installed blue rich 4000K – 4200K LED lamps which have several negative environmental effects and cannot are NOT green lighting at all !!!



Illuminance (lx)

...	1
1	2
2	3
3	4
4	5
5	6
6	7
7	8
8	9
9	10
10	11
11	12
12	13
13	14
14	15
15	16
16	17
17	18
18	19
19	20
20	21
21	22
22	23
23	24
24	25
25	26
26	27
27	28
28	29
29	30
30	...

100 m

Municipality Šempeter – Vrtojba

Positive facts:

1. Replacement of 350 luminaires (22W – 80 W)
2. Energy consumption before replacement: 361.44 kWh
3. Energy consumption after reconstruction: 127,26 kWh
4. Energy savings: 64,8 %
5. All new luminaires have light sensor and curfew (50 % reduction).
6. Municipality agreed to install lower CCT in order to reduce environmental impact. Less direct light into buildings, less nuisance.
7. 3000K LED is more pleasant for inhabitants than 4000K.

Negative facts:

1. Installed illumination levels are higher than before reconstruction in evening time, estimate is about +15% (not measured in evening time).
2. Light pollution was not reduced (problem of white light, high illumination levels).
3. Many newly illuminated small streets are still too bright – because it is impossible to get on market low wattage LED lamps.
4. 3000K LEDs makes about double light pollution are old HPS 2100K lamps.