FinEst Centre
for Smart Cities

SMART CITY CHALLENGE 2024

City Challenge

Max 3 pages

send to smartcity@taltech.ee by May 15, 2024

Challenge Title – Urban lighting innovation

City/county and country Tallinn, Estonia

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1. What is the future urban challenge that would need a solution to?

Modern urban lighting must balance the various needs of people, providing security, considering aesthetics, comfort, well-being, and be economical.

Street mobility systems like electric cars or traffic management systems require additional energy sources. Building of new grids enhances the total CO_2 footprint. Cities need new smart grid solutions that do not improve the negative environmental footprint.

Integrating LED streetlights with smart city infrastructure and provision of new services and opportunities is a key urban challenge. LED technology offers new opportunities for urban lighting, but excessive or poorly directed artificial light can cause light pollution, impacting energy use, ecosystems, wildlife, and human health.

- **Please describe the challenge of your city / county neighboring a city?**

Renewal of the entire amortized street lighting network usually occurs during a complete street renovation. Since Tallinn has no lamp-based control system, so the city lighting network allows limited use in the dark, and only 4-10% of its electrical connection amperage potential is utilized.

In 2023 50% of old streetlights are replaced with modern LEDs. Ledification should be completed within 4 years and City hopes to reach to 90% of LED-s within next 4 years. But other installation components (cables, poles, etc.) must also meet requirements and integrate with other Smart City solutions. We still have few experiences with luminaire-based management system. Smart Lighting is not a new idea anymore, but as it offers too many different solutions, the selection of the right solutions and data analysis is a new challenge for Tallinn, which needs to be clarified before the solutions are implemented in the whole city.

Before the devices are widely used, it is necessary to carry out a pilot project in order to select the most efficient, safe, reasonable solutions.

The urban lighting installation challenges and problems that need to be solved are:

1. Improve comfort and safety for pedestrians, vehicles, and plants and animal species
   1.1 LED lighting impact on biodiversity: The ecological impact of LED lighting is a concern for cities globally, as artificial light at night can disrupt ecosystems and affect wildlife behavior and habitats.
   1.2 LED lighting impact on human circadian rhythms: The influence of artificial lighting on human circadian rhythms is a concern shared by cities everywhere, as it can affect the health and well-being of residents.
   1.3 Possible positive RGB lighting impact on biodiversity: similarly to white light, the potential effects of RGB lighting on biodiversity have not been researched enough. Scientists around the world are looking into the benefits of the use of RGB lighting in street lighting at night.
2. Increase utilization of urban lighting installation through the integration of renewables and electric vehicle charging as a service
3. Testing new technologies to achieve continuous energy savings and renovation cost reduction.
4. Investing in smart lighting equipment requires preliminary analysis, user research and cost analysis. Data analysis and analysis of residents' behavior and preferences is also an under-researched area. what are the highest energy saving scenes, the lowest but still safe brightness levels.
5. Decarbonization of urban infrastructure by connecting energy sources, storages, and loads and providing efficient and flexible interaction between them.
6. Validation of other possible services, like energy trading, grid support, and possibilities for business opportunities from public EV charging and other potential services.
7. Lighting grid as IoT infrastructure access point: Utilizing the lighting grid for IoT infrastructure is a challenge and opportunity faced by many cities seeking to develop smart city initiatives and improve connectivity.
8. Lighting grid as data collector: Leveraging the lighting grid for data collection purposes is a strategy that cities around the world are exploring to gather information on various urban systems and improve efficiency.

If the test results are positive, we will develop new policies for more informed electrification programs. It will foster electric transport and other emerging technology uptake, making the urban environment healthier and more sustainable.

- **Why is it important for your city to solve it? How big priority it is for you and why?**

We need to provide higher living quality for people and city wildlife. Despite the advent of more efficient streetlights, lighting still consumes too much electricity. On2023, the total energy consumption for street lighting was 25,5 GWh, which may experience a significant reduction. We need to sustainably provide citizens with more Smart City services, utilizing the existing energy grid opportunities and maximizing utility functions that include health, security, sustainability, and comfort. We must think at least one step further and validate which opportunities for emerging technologies may be obtained.

- **Is this a unique challenge/problem of your city, why or is this by your knowledge a challenge/problem that many cities have – which kind of other cities**

The challenges outlined are not unique to Tallinn or its neighboring capitals; rather, they are common challenges many cities face globally.

2. Innovation.

- **How have you solved that issue so far? Why aren't the present solutions good enough? Are there legal obstacles, which ones?**

The urban lighting installation challenges and problems that need to be solved are:

1. City has ordered a survey from University of Technology "Analysis of Tallinn's lighting environment (brightness and light pollution)." Followed by an online light pollution survey for citizens.
2. City has ordered lighting thematic planning for parks around the Old Town which covered also lighting scenes for supporting biodiversity.
3. Tallinn has used focused direct lighting with good optics to help fight light pollution.
4. We have installed special pedestrian crossing lighting with almost 1800 crossings lit up.
5. Charging stations for EVs have been installed in various locations, but the time and financial investments necessary are quite high. Due to that we are looking into possible solutions, one of them being combining charging ports with existing lighting infrastructure.

We have not addressed other challenges because we don't have test site in city space.

Legal obstacles:

- No legal obstacles

3. Expected impact of your pilot solution.

- **What is the expected impact to your city environment you expect to see if the challenge gets solved?**

1. Improved environment for plants and animal species
2. Greener city space due to urban lighting installation through the integration of renewables and electric vehicle charging as a service
3. Sustainable and futureproof lighting infrastructure
4. Knowledge of best suiting lighting and automation equipment.
5. Validation of local alternative energy production possibilities.
6. Possibility to test Iot products and emerging consumer services in public space before launching them.
7. Knowledge of what is usable in the pool of collectable data and how it can be tied to citizen satisfaction.
8. decreased energy consumption

What is the expected impact to your citizens you expect to see if the challenge gets solved?

- Less harm from street light pollution
- Improved happiness, comfort and safety for citizens
- new additional options for charging electric cars in public urban spaces
- enhanced safety and security on streets.

- **What is the expected impact to your city governance you expect to see if the challenge gets solved?**

- The EV charger installation process is cut 10 times within the new lighting grids compared with existing solutions.
- integration of EV Charging System and Public Street Lighting
- renting public urban space for the construction of charging infrastructures

4. Piloting

- **Why would you be interested to become a piloting partner of a proposed solution to the challenge you are describing here? Describe shortly your capability to participate.**

1. Tallinn is interested in implementing new solutions to make the city more energy sustainable and healthier for its citizens.
2. We want to test complete solutions for innovative street lighting, electrical current conversion, and energy storage in the urban space to see if they have a more significant implementation capacity and thus be pioneers in implementing creative solutions on a city scale.