



**Audit of efficiency of electricity used in lightening of public spaces
in Połczyn-Zdrój with an indication of possible changes
in the city lighting system in terms of energy efficiency
and the exposition of spatial development elements
- summary**

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1. BACKGROUND AND JUSTIFICATION OF THE PROJECT

Paying attention of representatives of local governments and citizens on issues related to sustainable Energy in public spaces was one of main aspects of this BEA-APP pilot project. Implementation of RES require identifying initial steps, including understanding problems related with implementing RES and building/creating solutions, as well as energy efficiency and good lighting solutions. Moreover the implementation of the results of the lighting audit can be important input for spatial planning process (for example in context of reducing the effect of light pollution).

The subject of the “The Audit of the efficiency of electricity consumption in public space lighting in the Połczyn-Zdrój Municipality” (Audit) is the analysis of state of the public space lighting system in the Połczyn-Zdrój Municipality in terms of improving energy efficiency, reducing low emission and ensuring compliance with the national and the European standards. There were also prepared analysis of the modernization of the road lighting system, compares the variants of activities (including luminaires, owned by the Połczyn-Zdrój Municipality).

Steps of preparing the audit included:

- Analysis of Legal regulations specific to road lighting
- Review of standards for road lighting
- Assumptions of lighting modernization variants - in terms of improving their energy efficiency, reducing low emissions and ensuring compliance with the Polish Standard
- Analysis of the quality of lighting of roads and public areas as well as indication of directions of action to comply with the applicable standards
- Inventory - Organization of the Lighting System Data Base
- The condition of the road lighting system on the day the audit was started
- Compliance with Standards
- Selection of lighting classes
- A set of lighting recommendations
- Applications from lighting measurements
- General rules for lighting pedestrian choice
- Technical and technological analysis in terms of reduction of electricity consumption along with an indication of the costs of possible modernization of lighting
- Suggestions for lighting objects with interesting architecture to increase the attractiveness of the towns.
- Financial analysis of concluded contracts in context of reducing of the costs of electricity supply, indication of the possibility of changes in contracts aiming reduction of public lighting costs with the calculation of estimated savings
- Estimated valuation of investment outlays
- Institutional analysis
- Analysis of environmental impact

An energy audit point out weak points in the lightning of the streets and public spaces, and suggest optimal solutions for using RES to fix the existing problems. **This action was supposed to broaden the catalogue of solutions in using RES mix and to raise the awareness of RES regarding lightning in public spaces.** Moreover, undertaken action is directed mainly towards decision makers, but in long

term perspective it should also be directed towards citizens, in order to change their understanding and acceptance of RES in public places.

2. DIAGNOSED PROBLEMS

During conducted analysis in the pilot project the light pollution phenomenon in project area of Połczyn-Zdrój was observed. It was caused by street lamps and other light sources and is dependent on the construction of the light fixtures, and more precisely in the way, the light stream is directed by them. The best fixtures are ones that do not direct the light in unnecessary directions, particularly upwards, however each artificial light source placed outside of the building increases the light pollution. With the current lifestyle of modern societies it is impossible to eliminate night lightning completely, but a rational use of this lightning can reduce light pollution, and also provide safe energy. Existing fixtures currently used for sodium-vapor lamps can be replaced with LED light sources to help to direct the light in the appropriate direction without the use of reflectors.

Moreover, the following problems have been identified in the area and solutions regarding the lightning of public spaces have been suggested:

- energy efficiency – there are technologies on the market, which can successfully replace existing light sources; as an effect of these changes in accordance with the modernization of lightning, the electric energy use and the power of lightning points can be lowered by a level of 64%;
- economic efficiency: - Using new technologies will enable the financial returns within 12 years and further use of lightning infrastructure with lower maintenance costs.; changing tariff group doesn't require any expenditures, and it would bring 10% savings a year in energy distribution costs;
- ecological efficiency – choosing LED technology with a programmable power control of light source, to permit lower lightning conditions during so called „late night”. This will cause a reduction of gas and dust emissions by about 64 %. By introducing the investments related to signalling and information based on RES, despite a necessary increase in energy demand, will not cause increased air pollution in the city.
- lightning control – the implementation of new settings using digital astronomical programs will provide an option to schedule on and off times for the lightning; These times will be directly correlated with sunrises and sunsets and the so called sense of “darkness”;
- safety in public space – LED technologies enable a colour rendering index of 80 and higher, which means that space and colour perception is similar to daylight; it also improves the picture from CCTV. From a tourist's point of view, the attractiveness of such spaces are much better;

Examples of Types of diagnosed problems:

1. Light pollution in Połczyn-Zdrój. (photo by Dr Eng. Tomasz Walski)



2. Driver's uncertainty regarding the interpretation of the traffic situation



3. Example of inadequate light distribution



3. THE MAIN RESULTS FROM THE AUDIT

The method of energy cost management indicated in the study presents a way to reduce costs and increase the efficiency of public financial resources issued.

During the analysis of the modernization of the road lighting system, 5 variants of activities (including the current state) were compared, differing in type and number of exchanged luminaires. The recommended solution for the modernization of road lighting in the indicated area of the city of Połczyn-Zdrój should be made according to proposed Variant (A.1.2.2.2).

Modernization of public space lighting in this variant includes:

- replacement of 134 sodium light sources in existing fittings for controllable LED sources
- usage of 2 lighting columns on Grunwaldzka street to hang LED floodlights directed to the Adam Mickiewicz monument, primary school and 120-year-old oak and post office building
- remove of 3 lighting columns on at Parkowa Street and development of a power grid for lighting points illuminating the park.
- usage of the power of the lighting point on the lawn at Parkowa Street for illumination of the architecture of the neighbouring object
- installation of active road markers with solar energy buffer
- installation of polycarbonate LED illuminated information boards powered from the power grid.

Estimated value of modernization of public space lighting for the purposes of public procurement is the gross investment amount over PLN 275 000.00. In addition, the designation of light paths is recommended. It should be extended to park alleys and the designation of sanatoriums and objects characteristic of the Połczyn-Zdrój, which are not owned only by municipality. One of Suggested solutions contained installation of light strips located in the pavement - yellow for shopping path, red for history rout. Both of them can be powered from the local power grid. Moreover modernization of public space lighting includes also installation of markers delineating paths, in colours matching the type of rout (yellow - shopping, red – history), powered from a solar energy buffer.

Next proposal contains installation of benches equipped with PV panels with a capacity of approx. 500 W, located near the local school and church. Proposed installation of a battery system could allow access to the Internet via a Wi-Fi router - hotspot, USB charging of smartphones, tablets, and mp3 players. Power supply 12 V, through the cigarette lighter socket enable charging of the tourist refrigerators, compressors, mattress pumps. The battery can be charged also in electric vehicles. For detailed technical installation, contact with Alex Electro (start-up company) for a free installation of a bench to check the interest of residents and patients was suggested. Conducted analysis highlighted need of remaining, the character of the place during choosing of detailed solution. For the attractiveness of the city, it is worth considering a photovoltaic installation with a diameter of 10 m made of photovoltaic glass, where the central part is a fountain, which should be powered from the inside. It is suggested that the investment of modernization of lighting described in the audit should be carried out without the participation of own funds (contract with ESCO) or with a minimum share of own funds (grant programs).

Selected objects and locations indicated for lighting

4. *Local bank – Grunwaldzka street in Połczyn-Zdrój*



5. *Post Office– Grunwaldzka street in Połczyn-Zdrój*



6. *Old square in city center*



7. *Parkowa Street in Połczyn-Zdrój*



4. SUMMARY AND LESSONS LEARNED:

The view and landscape of the public space will change for better, which will lead to better identification with the place, not only in case of the inhabitants, but in case of visitors as well. This approach requires positive strategies and methods of communication between the local administration and citizens and it serves, as well as tourists and other users of space in the context of lighting solution using RES. Main reflexion from audit:

- 1) Cost of lighting is an important position in Municipality's budget.
- 2) Quality of lighting is an important item of public space.
- 3) Integrating RES with lighting system gives strong promotion for RES especially when complex change is made.
- 4) During an audit a wide range of stakeholders examined current state of the city lighting and defined problems to solve.
- 5) With specialists it has been prepared proposals for complex public lighting changes (light effectiveness, energy efficiency, cost savings) enabling implementation of RES.
- 6) Complex thinking resulted in adding extra value for lighting system increasing attractiveness of public space and RES due to:
 - installing polycarbonate LED illuminated information boards,
 - installing light strips located in the pavement – (for example in Połczyn-Zdrój: yellow for shopping path, red for history rout),
 - installing markers delineating paths, in colours matching the type of rout.
- 7) Municipality should be the leader in promotion of energy efficiency also on the field lighting - Promotion complex thinking about lighting systems integrated with RES.
- 8) Preparing model of investment in complex modernization of lighting system with minimum share of own funds (grant programs) or without the participation of own funds (contract with ESCO).

Regarding the improvement of lighting in public space it is recommended:

- conducting regular analysis of the quality of street and public space lightning and indicating the directions of actions in order to re-adapt to the new norms;
- developing a complete, consistent and unitary concept of lightning of all streets and other public areas based on lightning requirements. Function analysis in the spaces of the city, including specification of the main transit and local routes;
- minimizing the light pollution of the space with artificial light from dusk till dawn. This is an important step during the realization of illumination of buildings and local areas;
- replacement of lighting sources using solutions which reduce the scattering of light onto the facades of houses;
- using energy saving technologies which also reduce the CO2 emission, and are based on RES;
- using modern light steering systems;
- implementing an urban information system which operates with the use of RES.