

1.1.11 Street lighting in 4 districts - Miercurea Ciuc (RO)

Miercurea Ciuc is situated in the eastern part of Transylvania, in Harghita County. It joined the CoM on February 22, 2013 and its SEAP is under development. The objective of the sustainable energy action "Street lighting in Miercurea Ciuc" is to reduce the energy consumption and light-pollution of the city's public lightning system, without decreasing the security level of the streets. The above objective is easily achieved, nevertheless the bankability should be carefully analyzed since the payback period which is 19,6 years is long compared to the system's durability which is 25 years.

Technical aspects

Within the municipality, the maintenance of street lighting, pedestrian lighting, architectural lighting, ornamental lighting and ornamental - festive lighting is carried out by SC Electric-Inst SRL; at the level of the municipality, the department responsible for public lighting ensures the supervision of the design and works.

Currently, in Miercurea-Ciuc, there are 3.136 pieces of mounted lighting fixtures, with an installed capacity $P_i = 260$ kWh and a consumed power $P_c = 297$ kWh, taking into account losses occurring at equipment level. In 2013, the total energy consumption generated by the public lighting system was of 1.188.000 kWh. Unfortunately the consumption measuring system was lately implemented; consumption data before 2013 is unavailable.

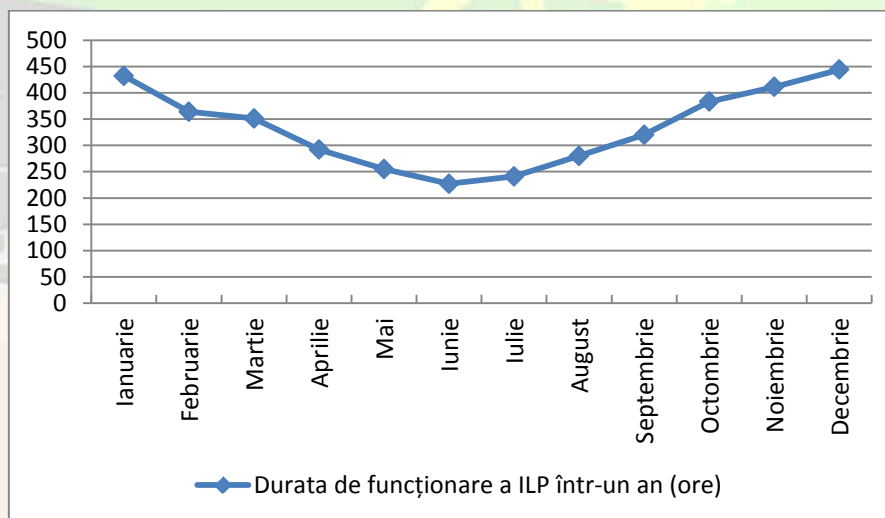


Figure 12 Number of operation hours of the public lighting system of the municipality on a yearly basis

The sustainable energy action in question will be implemented in the entire municipality (total length of street lighting is 60 km and regards two alternatives :

1. **Integral replacement of the old lighting fixtures with LED source fixtures** aiming at reducing electricity costs and maintenance and preservation costs. The associated reduction of the electricity consumption amounts to 217.964 kWh/year, instead of

296.108 kWh/year. The management and supervision of the consumption parameters will be made through a telemetry system. The estimated energy savings reduction is 26%.

2. **Preservation of existing lighting fixtures, installation of LED lighting fixtures (where applicable) and installation of a telemetry system**, allowing the performance of a total or partial interruption in the supply whenever the latter is not necessary. The associated reduction of electricity consumption is estimated at 223.860 kWh, compared to the baseline scenario which is 296.108 kWh. The estimated energy savings reduction is 24%.

Financial aspects

The sustainable energy action will be completed within 10 years and will be financed by the local budget. The total investment costs amount to **387.857€** and the annual revenues (electricity costs and maintenance costs savings due to the renovated system) amount to **19.732€**. Taking into account that the discount rate is **3,5%**, **the NPV is - 103.785€ and the IRR is 0.2%**.

Socio-economic aspects

The main socio - economic benefit of the investment is the electricity costs savings, which can be used on financing other investments such as repaired roads and upgraded industrial sites to attract the attention of the investors. The annual electricity savings are approximately 0,05% of the annual municipal budget and thus are assumed to be the socio-economic revenues. **The socio-economic NPV is 167.171€, while the IRR is 8%**.

Organisational aspects

The working team is composed of the Mayor and Vice-Mayor, and three municipal bureaus, i.e. the *public procurement*, the *investments* and *city management*. Hiring of experts was also required.

The project can be implemented in a **6-months period**. The schedule is flexible and is adapted to the financing means (own resources of the municipality).

The municipality plans to publish press releases in local newspapers, detailing the progress of the project implementation. The articles will highlight the importance of the investment, the benefits for the locals and the technical - financial details.

The investment will exceed the 100,000€ limit, so the public procurement process will be an open bidding. Romania has a very good, and transparent electronic system (e-licitatie.ro), where the procurement processes can be easily organized.

Miercurea Ciuc has concluded a twinning agreement with La Zubia municipality, that has several successful stories, like the public lightning powered by PV panels, electric cars charged by solar power, swimming pools heated by solar power, a cogeneration plant near

the city's wastewater treatment plant, using the biogas produced at the fermentation process. In the future Miercurea Ciuc is also planning to build a cogeneration plant near its wastewater treatment plant, where currently the sludge is not properly treated and the energy potential is not exploited at all. The twinning activities consist of collecting existing models, case studies and best practices, and sharing them with each other.

Results and recommendations

The long payback period estimated in the sustainable energy action assessment study (19,6 years of payback period) indicate a necessity for the identification of those sectors of the existing public lighting system where the investment would be more profitable.

The current state of the public lighting infrastructure within the area of interest of this study does not allow the improvement and reduction of the electricity consumption. In order to make the infrastructure more efficient, following measures should be taken:

- The resizing of the lighting systems in line with the European standards, if necessary;
- The establishment of differentiated timetable for turning the public lighting on, function of the road and pedestrian traffic conditions in the municipal areas; The implementation of the telemetry system in relation to all luminous spots, aiming at:
 - achieving the system for the automatic control and monitoring of the public lighting network working order;
 - implementing the computerised control system in order to reduce the supply voltage along each distribution direction, allowing the performance of a total or partial interruption in the supply (e.g. turning the architectural lighting off during certain time intervals in the night time etc.), whenever such supply is not necessary.

The following were taken into account for reducing the electricity consumption associated with public lighting:

- Street classification in line with the international normatives and establishment of the lumino-technical parameters in accordance with such classification;
- Reduction of the illumination level during low traffic hours by about 28% in one year and corresponding adjustment of the electricity invoice for lighting;
- Measures for the reduction of the unit price for electricity return (lei/kWh) in relation to public lighting, especially through the negotiation of a lower rate, given the consumption in the night time (gap in the total energy line of the electricity supplier);
- Use of high performance lamps as part of the rehabilitation process with regard to the public lighting systems, as well as the use of high performance lighting fixtures;

- According to the legislation regarding the establishment and operation of public lighting services, the public lighting services will comply and follow, at local community level, in its entirety, the performance indicators approved based on local council decisions;

The establishment, development and modernisation of the public lighting systems will be achieved based on certain feasibility studies prepared at the initiative of the public local administration authorities, which will analyse the necessity and appropriateness of the establishment/ development thereof, will assess the technical-economic indicators, will identify the financing sources for investments and will indicate the optimum solution from a technical-economic point of view.

The technical-economic scenario for the achievement of the objective is the following:

- Replacement of the lighting fixtures with LED source ones endowed with the following facilities:
 - lower consumption as opposed to the lighting fixtures with metal halogen lamps and luminous flux maintenance;
 - much increased service life: 100,000 hours;
 - no consumables needed;
 - drivers with dimming possibility (luminous flux reduction);
 - no time necessary for building-up or reignition;
- Implementation of the telemetry system for luminous flux reduction and for illumination state and energy consumption monitoring.
- remote adjustment of the luminous flux at luminous spot level;
- supervision of the equipment state;
- supervision of the energy consumption per luminous spot;
- reliable communication through standard wireless system.

The rehabilitation of public street lighting represents a combination and balancing of theoretical, practical and economic solutions (low energy consumption, minimum maintenance and installation costs, totality of costs incurred by the lighting system administrator). It is foreseen that the achievement of a comfortable iluminous climate, with minimum energy consumption, with an intense use of high performance and reliable lighting sources and fixtures and with a minimum investment, constitutes the criterion for assessment of a modern and efficient lighting system.

By analyzing the current situation and the findings of the auditing of the public lighting system in Miercurea Ciuc, we ascertained the fact that, further to the investments made within the aforementioned municipality during the period between 2006 and present time, 2,700 lighting

fixtures, out of a total of 3,136 lighting fixtures, have been replaced. The street modernisation during the previous years was carried out based on the lumino-technical calculations corresponding to each individual street. For category M4 and M5 streets, which have already undergone modernisation, the luminous flux cannot be diminished without an adverse influence on the safety of road and pedestrian traffic.

Upon the completion of the auditing of the public lighting system in Miercurea-Ciuc municipality and further to the discussions with the beneficiary's representatives, the following configuration of the public lighting system was proposed, with regard to the improvement of the electricity consumption efficiency:

- For the achievement of public lighting on the Frăției Blvd., Kossuth Lajos, Szek, Câmpul Mare, Harghitei, Brașovului, Pictor Nagy Istvan, Revoluției din Decembrie, Octavian Goga, Inimii, Stadion, Zold Peter, Timișoarei, Peșii, Iancu de Hunedoara, Toplița, Marton Aron, Leliceni, Harghita (Passage) Streets, alternative 1 will be chosen, meaning the use of LED lighting fixtures along with the mounting of a telemetry system, in order to reduce the supply voltage along each distribution direction, allowing the total or partial interruption of supply whenever this is not necessary.
- Along all the designed arteries, the lumino-technical parameters corresponding to the imposed lighting classes with LED source lamps were obtained. The parameters remain the same, however they are superior to the currently existing ones.
- In order for the investment to be minimum, its completion was scheduled based on the existing situation - laying the new fixtures on the same poles and ensuring the supply thereof from the same electrical systems. Thus, any additional costs with new electrical systems and poles were eliminated. This was possible through the use of high performance lighting fixtures which allow the achievement of the lumino-technical parameters using low installed capacities and preserving the location conditions.

Table 11 below summarises the results of the technical, financial, socio-economic and organisational analysis of the action entitled "Street lighting in 4 districts in Miercurea Ciuc".

Table 10 Summary of the findings of the assessment study of the action "Street lighting in 4 districts in Miercurea Ciuc"

Technical/ Environmental Assessment	Title	Street lighting in 4 districts in Miercurea Ciuc
	Baseline scenario data (kWh, tCO₂, €)	296,108 kWh
	Technology employed	LED lamps, Metal halide lamps, remote control systems
	Technology providers	various
	Technical specifications	Alternative 1: <ul style="list-style-type: none"> • Number of lighting fixtures: 570 pieces

		<ul style="list-style-type: none"> • Estimated installed capacity: 54.5 kWh • Durability: 25 years
	Energy savings	78,12 MWh/year
	CO ₂ savings	42,6 t/year
Financial assessment	Financing scheme	own funds
	Project cost	387.856,64 €
	Annual maintenance costs	0€
	Annual project revenues	19.732 €
	Discount rate	3,5 %
	IRR (%)	0,17 %
	NPV (€)	- 103.785 €
	Payback period (years)	19,6 years
Socio-economic assessment	Annual socio-economic costs	0 €
	Annual socio-economic benefits	19.732 €
	IRR	8 %
	NPV	1067.171 €
Organisational assessment	Time-schedule	within the next 10 years based on the availability of the municipal budget (the investment implementation duration will be 6 months)