

Upgrading streetlights using an Energy Service Company (ESCO) model

Municipality of Gabrovo (Bulgaria)

Background

Gabrovo is located in central Bulgaria, with a population of just under 60,000 people.

In 2020, the [Municipality of Gabrovo](#) decided to upgrade its entire street lighting network from sodium-vapour street lamps to Light Emitting Diode (LED) lamps, in order to reduce energy use and save money, while continuing to ensure that streets are well lit.



Image: Municipality of Gabrovo

Gabrovo street lighting before the new investments began

As a result of its commitment to energy efficiency and clean technology implementation over the past decade, Gabrovo was awarded the 2021 [European Green Leaf Award](#), alongside Lappeenranta (Finland).

Procurement objectives

Due to the size of investment required to modernise the entire street lighting network, Gabrovo decided to use an Energy Service Company (ESCO) model. In this type of contract, the contractor becomes responsible for the whole street lighting system as part of a longer-term contract (around 10 years). During this time, the supplier (i.e. the ESCO company) is responsible for achieving set goals defined in the contract. To achieve these goals, the ESCO company must invest in new, more efficient street lighting infrastructure. The idea is that payments made by the contractor to the ESCO company over the course of the long-term contract is enough to repay the company's initial investment. The contracting authority should also benefit from the investments, as they will lead to a reduction in electricity bills.

Gabrovo began this procedure in June 2020 by commissioning an [energy audit](#) of the city's street lighting, in order to create an inventory of the current infrastructure, and identify possible energy saving measures. The energy audit found the following:

- Gabrovo has 6834 luminaires, with a total installed power of 539.64 kilowatts (kW).
- The majority of existing lighting fixtures in the city are around 20 years old, and are coming to the end of their technical lifetime. This leads to deformations in light distribution, and deteriorated efficiency.
- The average life of existing luminaires is up to 16,000 hours, meaning replacement every four years is necessary.
- Around 15% of the luminaires in use are LED. However, some of these are low-quality, and have a short service life (2 years).
- There has been a tendency when installing new luminaires, or replacing old ones, that lamps are chosen which are significantly higher power than that required by law.
- The current lighting system is well maintained, and over 98% of the lighting works.
- The current total costs for the maintenance and operation of the street lighting system is 94,872 BGN per year (approximately €48,500).

The energy audit identified two main energy saving measures. First, all high pressure sodium lamps should be replaced with LED luminaires which meet the regulatory requirements for the corresponding class of street (for

example, higher powers in main arteries, and lower powers in side streets). Existing LEDs should also be gradually replaced with new, high-quality, appropriately powerful luminaires over several years. It is also recommended that all new LED luminaires with power over 40 W are dimmed to 50% of their luminous flux between the hours of 23.00 and 05.00. The second recommendation was that a new intelligent management system should be installed, in order to allow remote, centralised control of lighting. With such a system, a potential 150 annual lighting hours can be saved (against the current average lighting time of 4250 hours).

Gabrovo used an 'open' tender procedure.

Criteria used

Subject matter of the contract:

Implementation of energy-saving measures, modernisation and repair of Gabrovo's street lighting through a contract with guaranteed results.

Selection criteria:

Bidders must have an environmental management system according to BDS EN ISO 14001: 2015 or equivalent, issued by an independent, accredited certification body with a scope of activities related to the implementation of design, production or installation and dismantling of road lighting equipment.

Bidders must have completed at least one activity identical or similar to the subject of the contract within the last five years.

The contractor should have a project manager with a higher education qualification and at least two years of experience in the energy management field.

Technical specifications:

Gabrovo used functional specifications, providing bidders the flexibility to propose solutions which best meet the City's needs. For example, it is not necessary for bidders to maintain the current number of lamps, so long as the resulting illumination is achieved and the set energy savings are realised.

Street lighting should meet the following standards:

- Lighting of the streets according to the BDS EN 12 201-3: 2005 or equivalent;
- Minimum lifespan of installed luminaires of 80,000 hours;
- Warranty period of luminaires of no less than 60 months;
- Colour temperature between 4000 Kelvin (K) and 5500 K (except in areas with specific architectural and cultural features);
- Minimum light output of between 130 lumens/watt (lm/W) for street luminaires and 105 lm/W for park luminaires;
- Minimum amount of energy savings compared to the normalized consumption set in the Energy Efficiency Audit Report of 1,558,229 kilowatt hours (kWh)/year;
- Term for payment of the investment of no longer than 10 years;
- The design, construction and commissioning to be completed within 12 months from the date of signing the contract;
- Maintenance of the street lighting over the term of the contract.

Bidders should propose a new intelligent system for control, monitoring and management of street and park lighting, including some of the following functions as a minimum:

"The annual guaranteed savings offered by the winning consortium is 1,705,670 kWh per year, which represents a financial saving of around 70%."

- Ability to remotely switch street lighting on and off;
- Real-time information about consumed energy and voltage;
- Emergency information about unauthorised connections to street lighting;
- Information on broken street lights, indicating at least which branch these are on, and if possible, their exact location.

Award criteria:

The contract will be awarded on the basis of the most economically advantageous tender (MEAT), calculated according to the following price-quality ratio:

$$\text{MEAT} = (P \times 0.35) + (V \times 0.15) + (\text{ER} \times 0.4) + (\text{NPV} \times 0.1)$$

P = price for the design and implementation of the energy saving measures, modernisation and repair of the lighting system. 100 points are available (with a relative weight of 35). It is calculated by:

- lowest price for the execution of the contract / the price offered in the offer being evaluated x 100

V = value of additional improvements to the network, not related to energy saving (i.e. improvements to cable infrastructure and quality of existing LED lighting). 100 points are available (with a relative weight of 15). It is calculated by:

- lowest value for sample award activities as an option / values of sample activities proposed in the assessed offer x 100

ER = Guaranteed amount of CO₂ emissions reduction. 100 points are available (with a relative weight of 40). It is calculated by:

- guaranteed amount of reduced CO₂ emissions in the evaluated offer / the largest guaranteed amount of CO₂ emissions x 100
- CO₂ emissions should be calculated according to the offered amount of energy saved in the respective offer (in MWh), multiplied by 0.891 tonnes of CO₂

NPV= Evaluation of the effectiveness of the project is carried out on the indicator "Net present value" (NPV) – which is the measure of the profitability of the investment made by the ESCO company. The NPV is based on the value of the ESCO's proposed investment, the energy savings that would result, plus the discount rate (which depends on confidential information such as a company's credit rating, and is therefore defined by the bidder). 100 points are available (with a relative weight of 10). It is calculated by:

- NPV proposed in the evaluated offer / highest proposed NPV x 100

Contract performance clauses:

In order to achieve electricity savings, the contracting authority assigns the following responsibilities to the contractor:

- Design of energy saving measures, modernisation and repair of the lighting system in Gabrovo, and supervision of the implementation of these measures;
- The operation and maintenance of the lighting system which results from the above investment;
- The energy management of the lighting system, including provision of the necessary energy management software and human resources for the operation of the system.

"The new intelligent control system provides information on the exact location of each street light, and the technical situation before the contract. This saves resources, as it shows in real time where the contractors are working, and what kinds of lamps they are installing."

In implementing the above activities, the contractor guarantees annual energy savings for the entire street lighting system. Guaranteed Annual Savings of Energy (GASE) are calculated by taking the difference between Normalised Annual Energy Consumption (NAEC) (as provided within the Energy Audit) and Guaranteed Annual Energy Consumption (GAEC) (the annual energy consumption guaranteed by the Contractor for the lighting system after the implementation of energy saving measures).

The Contractor shall fully assume the financial, commercial and technical risk of achieving the GASE, and each year, within 10 days of the end of each contract year, must report the Achieved Annual Savings of Energy (AASE) using the following equation:

$$\text{Efficiency Ratio} = \text{AASE (kWh)} / \text{GASE (kWh)}$$

If the value of the Efficiency Ratio is greater than one, the Contractor is entitled to an additional payment of 40% of the additional energy savings achieved. If the Efficiency Ratio is less than one, meaning that the guaranteed savings are not achieved, the Contractor will be subject to a penalty, which will be calculated according to the difference between the Guaranteed Annual Savings of Energy and the Achieved Annual Energy Savings.

The contractor must also monitor the annual CO₂ savings achieved by the energy saving measures, as well as report any deviations from the amount of guaranteed CO₂ emissions guaranteed in the contract.

Results

The call for tenders was published on 7 July 2020, and the deadline for bids was the 25 August 2020. The contract was awarded in January 2021, and the implementation of the contract began in April 2021. The total value of the procurement (excluding VAT) is 3,993,300 BGN (€2,041,323). This does not include the value of the consumed energy, which shall be paid by the contracting authority to the respective energy company. The total value is around €40,000 less than the initial estimate of the value of the contract.

Two offers were received from consortiums consisting of Small- or Medium-Sized Enterprises (SMEs).

The contract will run for 118 months. Energy savings measures must be invested in and implemented by the ESCO company within the first 12 months. At this point, the ESCO company can invoice the contracting authority, and payments will begin (provided the GASE – described above under Contract Performance Clauses - are achieved).

Environmental impacts

The annual guaranteed savings offered by the winning consortium is 1,705,670 kWh per year, which represents a financial saving of around 70%. The associated carbon emission reductions will be calculated as part of the annual monitoring of the contract, which is done each calendar year.

The new intelligent control system provides information on the exact location of each street light, and the technical situation before the contract. This saves resources, as it shows in real time where the contractors are working, and what kinds of lamps they are installing. There is also a special [webpage](#) where citizens can see the progress of the project.

Lessons learned

Gabrovo initially opted for a competitive dialogue procedure. Competitive dialogue allows bidders to propose a range of solutions, provided they meet the contracting authority's need. This can result in innovative ideas to increase the efficiency and effectiveness of a solution. The negotiation stage also ensures that the needs of the municipality are fully understood. For example, in this case, Gabrovo wanted to make sure that the contractor understood the current condition of the cable network, and find a solution to ensure its maintenance and proper operation.

Gabrovo started with a competitive dialogue because they wanted to make sure the requirements gave enough freedom to bidders to offer their own solution, and be attractive enough to take on the risk of reaching the required savings. However, during this dialogue, it became clear that some problems in the network, including upgrades to the cable infrastructure and replacement of existing LEDs would not result in energy (and therefore financial savings), and that the competitive dialogue was not going to yield the best results. By using an open procedure, Gabrovo was able to address these issues, while also encouraging greater competition, and ensuring greater transparency in the selection of a contractor. The open procedure resulted in two offers. The dialogue done with the market, however, was still an important part of the process.

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Related information:

For related information, please see European GPP criteria for [Road lighting and traffic signals](#) and the [Technical Background Report](#).

The original tender documents can be viewed online [here](#).