

STREET LIGHTING PROBLEMS AND SOLUTIONS

By Andrei Panchuk

One of the first projects for street lighting, if we can apply these words to the Xth century, was implemented in Cordoba, Spain, about one thousand years ago. At that time street lamps were gas fired and each evening special functionaries were going round the town and lighting these lamps.

SINCE then a lot of things have changed. Gas-fired lamps were replaced by durable and energy conserving electrical lamps, and the process of turning on and off the lights has become automated. Without any doubts, street lighting is a benefit for all of us today - it offers safety and comfort during the dark hours. However the lighting networks put some serious problems in front of its owners, but also in front of the society in whole. In this article, we'll try to analyse these problems and suggest a solution for them.

Although different municipalities use different street lighting systems and have a different approach to their management, there is a range of problems that is common for all of them.

The first, without any doubt, is the high consumption. Each year, in the world, several trillion kWh are expended on street lighting. A high consumption means a high amount of generated energy, which in turn translates into a high level of noxious emissions.

Secondly, there are difficulties related to the maintenance of the system. How does the lighting network operator find out that a certain lamp or a component of a street-light came out of action and needs to be repaired or replaced?

Third, but no less important, is the problem related to the billing of the street lighting energy consumption. Another name for street lighting is "unmetered load" - the bills the municipalities have to pay are imprecise and are based on calculations (parameterized consumption vs working hours).

Of course, there are solutions for almost all these issues. For example, new, LED-based lamps consume has as much energy and last twice as long as the ordinary HPS or HID lamps and this really solves the high consumption problem. The photoelectric sensors will make the lamps light only during the night time. However, now and then, these photo-sensors go out of order or get dusty and then the lamp either won't turn on, or will work throughout the day.

As to the maintenance problem, people are reporting idle lights. Almost every municipality or street lighting network owner has a web page, which assists people to communicate about broken lamps, using a special form or through the telephone. However, it is unlikely the information will reach the dispatcher immediately after the lamp goes out of order and the delay between the time the lamp is broken and it is repaired can be quite long.

In addition all these solutions also have a significant disadvantage - they are isolated and fragmented, and treat each problem separately and not the system as a whole.

ADDAX Light is ADD GRUP's solution for the centralised management of a street lighting network. It offers the necessary tools for precise metering and for the monitoring of energy quality together with the condition of the equipment utilised in the lighting system. All the components of ADDAX Light are interconnected using appropriate media, thus enabling fast and reliable data exchange. The software suit, which is part of ADDAX Light, offers user friendly tools for the control, configuration and reporting on the operation of the lighting network.

The ADDAX Light solution can be built in three different variants, and the chosen structure influences the cost of the system and its functionality.

1. The solution based on Supply Station controller (SSC) allows the management of a group of street lamps on each separate feeder. In addition, it provides the monitoring of energy quality and observes the work condition of the supply station (Figure 1)
2. The solution based on Light control Unit (LCU) enables individual metering and management of each street lamp (Figure 2).
3. The combined solution, which allows a higher degree of flexibility, more advanced functionality and more powerful control over the system (Figure 3).

SUPPLY STATION CONTROLLER

The SSC is installed inside the supply station and controls group of lamps per feeder. In addition to this, the SSC is equipped with a sensor, which generates alarms in the case of the station's door being opened, thus ensuring the security and integrity of the supply station.

The SSC has an on-board LV PLC modem for communication with subordinate devices (LCU) and a GSM/GPRS modem for

ADDAX IMS

ADD GRUP's primary product – ADDAX IMS – is a suite of hardware and software tools designed for the building of advanced metering solutions. ADDAX IMS includes high accuracy metering equipment, a reliable communication network based on open standards and a set of software solutions, offering full control over the system. ADD GRUP's solution allows the integration of meters from third suppliers, thus performing the metering of several kinds of resources simultaneously.

ADDAX IMS development started back in 1998. The first version of the system was oriented towards remote data collection from electromechanical meters using add-ons – readers of pulse and digital outputs. The idea behind this basic AMR solution was a low cost integration of the existing meters into a one-way communication network.

After the first implementation, the system demonstrated robustness and stability, but it lacked functionality and flexibility. It was clear – one cannot build a future proof solution on an old foundation: induction meters and one-way communications. The utility needs were going beyond the collection of raw data, which was not giving any information on the time of consumption or load peaks. Besides, the system was not offering any means of control over the consumption. The old inductive meters were not allowing the implementation of saving incentive tools, such as time-of-use metering or demand side management, which would motivate consumers to decrease the level of consumption.

In 1999, ADD GRUP started the development of digital meters. The meters were equipped with built-in PLC modems and breaker relays. The internal clock tied the amount of consumed energy to the time when it was consumed.

upstream data exchange with the management and control centre (MCC). The SSC allows turning on and off the lamps in automatic mode - either according to a schedule or with the use of an astronomical clock - or in manual mode by remote access from the MCC.

The SSC performs the monitoring of voltage and power quality, and if required disconnects the lamps, thus ensuring their protection and prolonging their period of operation. It also generates alarms on events in the network, e.g. on energy quality, unsanctioned access, faulty equipment, etc.

LIGHT CONTROL UNIT

The LCU is designed for individual management of street lamps and includes meter, controller and LV PLC modem. The LCU has two independent channels, enabling it to control one or two lamps simultaneously and it also performs stepless dimming, which prolongs the lifespan of the lamp.

The measurement circuits enable precise metering of each lamp's consumption, thus avoiding inaccurate billing based on estimations. Besides, a meter installed in the supply station permits performing balance metering and helps to detect leakages or fraud attempts.

In the case when a certain lamp goes out of order, the LCU generates an alarm and sends it to the MCC. This feature enables faster location of the faulty lamp and the timely dispatch of a service team to repair the malfunction.

In whole, ADDAX Light offers the following advantages:

- Precise metering, and avoiding of estimated bills
- Powerful tools for remote or scheduled operation (connection/disconnection) and configuration

After demonstrating good performance in the first projects, PLC remained the primary communication media used in the ADDAX network. The structure of the system comprised three levels: metering equipment, communication equipment (routers) and the data management software. The GSM channel was used only for data exchange between the routers and the data management centre.

Integrated metering was introduced in 2003: the meter interface units designed by ADD GRUP enabled the integration of other resources into the metering system, such as water, gas and heat. It was followed by the launch of ADDAX Light – the solution for street lighting management.

The development continued and in 2004 ADD GRUP launched the MV PLC modems, which allowed to exclude the use of expensive GSM/GPRS communications. The new media was very well received by customers, as it allowed a significant decrease in operational costs. Since then, every new implementation has employed MV PLC as the basic media for communication between routers and the data management centre.

The first European mass rollouts have revealed that the most advantageous and efficient approach to automated metering is the one based on multi-vendor platforms. In 2008 ADD GRUP started the development of a more advanced communication solution, based on open protocols. The new development involves the use of new techniques, such as S-FSK and OFDM modulation, which increase the carrying capacity of the communication network and enable the integration of new tools and features.

- Information and statistics on street lamps operation
- User-friendly software in the MCC
- Decrease of consumption and increase of lamp's lifetime due to smart dimming
- Maintenance costs reduction
- Faster reaction to events in the network (fraud attempts, failures, etc.)
- Detection of technical losses and tampering.

However, the principal advantage is the consolidated approach to the organisation and the management of the street lighting network from a single MCC. ADDAX Light allows a full automation of the processes, cuts costs associated to maintenance and operation of the network and decreases the repair delays.

IMPLEMENTATIONS

ADDAX Light is being operated since 2005 in several networks in Uzbekistan, Bulgaria and Ukraine. The configuration of the system is different from project to project, and the average ROI of the implementation is up to two years. The main driver of such a short payback period is the decrease of operational costs, which comprises both energy savings and economy due to precise bills. MI

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ABOUT THE COMPANY:

ADD GRUP designs and provides smart metering solutions for the utility sector. ADDAX IMS, company's main product is successfully operating in more than 100 projects all over the world and has an implementation base of around 1.3 million smart meters installed.

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