

First Lighting ESCO in Latvia
Effective lighting in cities – Tukums

Ekodoma Ltd, Latvia

Summary

The project has been implemented in Latvia, in Tukums municipality. The project was started in December 2001 and will last to 2012. The project concerns the renovation of streetlighting system using efficient lighting technology. The main aspect is the use, for the first time in Latvia, of ESCO – Energy Service Company. The project has achieved energy savings for 630 000 kWh/year and CO₂ emission reduction of 365 t/year. Important result has been as well as the change in behaviour of Latvian municipalities towards energy efficiency projects and the increase of awareness for third party financing projects. The main sources of funding have been NIB – the Nordic Investment Fund - and LEIF – Latvian Environmental Investment Fund.

End-user area	Target Audience	Technical
<input type="checkbox"/> New buildings	<input type="checkbox"/> Citizens	<input type="checkbox"/> Energy efficiency
<input type="checkbox"/> Refurbishment of buildings	<input type="checkbox"/> Households	<input type="checkbox"/> Heating
<input type="checkbox"/> Transport and mobility	<input type="checkbox"/> Property owners	<input type="checkbox"/> Cooling
<input type="checkbox"/> Financial instruments	<input type="checkbox"/> Schools and universities	<input type="checkbox"/> Appliances
<input type="checkbox"/> Industry	<input type="checkbox"/> Decision makers	<input checked="" type="checkbox"/> Lighting
<input type="checkbox"/> Legal initiatives (municipal regulations, directives, etc)	<input checked="" type="checkbox"/> Local and regional authorities	<input type="checkbox"/> CHP
<input type="checkbox"/> Planning issues	<input type="checkbox"/> Transport companies	<input type="checkbox"/> District Heating
<input type="checkbox"/> Sustainable communities	<input type="checkbox"/> Utilities	<input type="checkbox"/> Solar energy
<input type="checkbox"/> User behaviour	<input checked="" type="checkbox"/> ESCOs	<input type="checkbox"/> Biomass
<input type="checkbox"/> Education	<input type="checkbox"/> Architects and engineers	<input type="checkbox"/> Wind
<input type="checkbox"/> Other	<input type="checkbox"/> Financial institutions	<input type="checkbox"/> Geothermal
	<input type="checkbox"/> Other	<input type="checkbox"/> Hydro power
		<input type="checkbox"/> Other

Context

The project has been carried out in Tukums municipality. Tukums is a city in Kurzeme region approximately 65 km from Riga, in Latvia. First time Tukums have been mentioned in year 1253 but the rights of the city Tukums attained in 1795. Today there are approximately 19 000 inhabitants living there. Latvia is characterized by cold, long and dark winters so that a good and warm streetlighting is more than a need.

The street lighting project of Tukums municipality has been elaborated within the framework of the ELI programme as one of the activities related to efficient lighting. Tukums streetlight system was between 25 and 40 years old and generally the quality of the street lighting was not good and inefficient with a great waste of energy. The main reasons of these were:

- Several light points were switched off, so that the lighting level was very poor
- The tilt of the luminaries was not well designed; therefore lot of light was wasted for lighting street ditches, house façades, gardens and open fields.
- Sometimes the luminaries were fixed too high from the road surface.
- 85% of bulbs had a power consumption of 250W; the rest were between 125W and 150W.
- The ballast had very high-energy consumption, from 150W to 250W.
- About 10% of bulbs were incandescent, with very short lifetime (even less than 1000 hours)
- Several luminaries had not protection and resistance to penetration of dust and water, into the space of the light chamber. The oldest luminaries were a merely casing made with a shaped steel sheet with the light chamber painted in white colour.

The lighting system in Tukums had approximately 1000 light points illuminating main streets, inner streets and squares for a total length of around 90km.

The old luminaries of the streetlighting system had not protection and resistance to penetration of water and dust into the space of the light chamber. The oldest luminaries were a simple casing made with a shaped steel sheet with the light chamber painted in white colour.

The most common bulbs used were DRL 250W and in some case DRL 125W or 150W incandescent bulbs. In few specific cases were used 250W Sodium bulbs.

Finally, in Tukums municipality the total electric power consumption due to streetlighting was around 896 000 kWh/year representing costs of 53 200 Euro/year. The full capacity of the lighting system was 320kW.

Objectives

The objectives of this project can be gathered in the following classes:

1. Energy efficiency in municipalities through efficient lighting – resulting in emission reduction
2. Initiate use of ESCO in Latvia
3. Improve aesthetic and social life of Latvian municipalities



Figure 1: Concrete pole in Raudas street - Tukums

Process

The project has started in December 2001, when Ekodoma engineering consulting company has started energy audit for the streetlighting system in Tukums municipality. The first milestone has been achieved in April 2002, when a detailed business plan has been prepared for Tukums Council. Following, in June 2002 a tender, addressed to ESCOs, has been announced for implementing an efficient streetlighting system in Tukums. At the end of September the selected ESCO and Tukums Council have signed a conception agreement for the duration of 10 years. During this period ESCO will implement the project and then O&M.

The final project has been the pick of a big iceberg. Indeed, the hardest part has been implemented before, concerning the creation of an ESCO system in Latvia and the promotion of energy efficiency measures between the Latvian Municipalities.

Ekodoma has carried out marketing investigation and a series of training courses for potential energy service companies and for Latvian Municipalities. All this work has required big effort and it has been implemented in the framework of the Efficient Lighting Initiative – ELI.

The main measures undertaken by the ESCO in order to achieve and guarantee the savings have been:

- Change of luminaries in 21 km of main streets
- Change of luminaries in all inner and small streets
- New street lighting system in 2,7km of main streets.
- Change of distribution panels

Accordingly 845 light points have been replaced by new for a total length of 77,3 km of streets and construction of new street lighting system for a total length of 2,7 km.

The existing street lighting system had 37 distribution panes of which 34 are very old and in bad conditions. In this variant all the 34 distribution panels will be substituted.

The use of lighting units with higher optical efficiency and luminous light sources with high specific output has achieved electricity consumption savings.

In particular have been used luminaries with the following requirements:

- Lighting engineering
 - *Asymmetry and mounting on a post top or short post arm*, lighting systems with single-sided luminaries required an asymmetric lighting distribution so that most of the light illuminates the road and only a minimum illuminates the surroundings, even when the luminaries are mounted off the road on a post top or on a post with a short arm.
 - *Low mounting height*, the light distribution of some luminaries has been adjusted to a low mounting height, meaning that the lighting system has not been higher than the surroundings (houses, trees, etc.). In this case the lighting system only influence its immediate surroundings. Quite often the luminous efficacy is higher since less light is wasted on the surroundings.
 - *Adjustable optics and no tilt*, optics or light sources need to be adjustable ensuring that the asymmetry of the light distribution can be adjusted to the precise layout, i.e. the width of the road, mounting height and mounting position without having to tilt the luminary.
 - *Plane shield or clear and suspended*, luminaries with plane or almost plane shields are recommended in order to reduce glare and action at a distance. Action at a distance is the effect that the luminaries are felt to be highly luminous seen from a place far away from

the road. Clear, suspended shields results in less action of distance than shields with a pattern (prismatic).

- *Inconvenience to neighbours*, When using a low mounting height, not tilting the luminaries and plane shields it is possible to avoid or restrict irritating glare through the windows of the people living along the road.
- *Capacity*, high-pressure sodium bulb from 70W to 100W, electronic ballast from 10W to 14W.
- **Luminary casing**
 - Long lifetime, in particular the selected luminaries had resistance to mechanical influences (wind and vibrations), resistance to corrosion, resistance to UV radiation and resistance to dust and moisture (minimum of class IP54)
 - Easy to service
- **Components**
 - *Electronic ballasts* comply with the applicable European Norms for EMC (limitation of harmonic distortion and 3rd harmonic currents in the neutral conductor in three-phase systems).

Requirements on luminaries were made for the following reasons:

1. For functional reasons in order to achieve the quality of lighting that is required for the type of road which needs to be illuminated.
2. For aesthetic/architectonic reasons so that the lighting system matches its surroundings both during day and night
3. For financial reasons in order to ensure low costs through a long lifetime, energy effectiveness and low maintenance costs.

Naturally, general electrical and safety requirements complied with. The luminaries were CE marked which is the manufacturer's guaranty that the luminaries comply with all European standards, including EN 60598-1 and EN 60598-2-3. Class II luminaries have been used since they need not be earthed.

Financial resources and partners

Total project cost for efficient lighting in municipalities - Tukums: 395 kEuro. Contribution from Tukums Council: 127 kEuro – loan from NIB – the Nordic Investment Bank, contribution from ESCO: 268 kEuro, of which 136 kEuro loan from LEIF – Latvian Environmental Investment fund and 132kEuro loan from Latvian Hipotek Bank.

(Note: 1 Euro = 0,59 LVL)

The partners were Ekodoma, Riga, Latvia – ELI Latvia programme leaders; Danish Power Consultant, Copenhagen, Denmark – ELI Europe programme manager; Hansen&Henneberg, Copenhagen, Denmark and client: Tukums Council, Tukums, Latvia

Results

The first objective has been achieved improving the streetlighting system in Tukums municipality. The project has reduced energy consumption and physical degradation of the streetlighting system, particularly changing old luminaries and bulbs with efficient lighting technology and correct lighting design. The bulbs now have energy consumption between 70-100W and the lighting level has improved due to the better optic of the new luminaries.

The second objective has been achieved; Energy Service Company has implemented the project providing third party financing.

Finally, the third objective has been achieved, indeed the project has brought:

- Safety and health of inhabitants by efficient and well-designed streetlighting system.
- Reduction of night crimes and transgression.
- Increasing night activities in Tukums municipality.

The estimated saving of the project are 630 000kWh/year as shown in table 1 below.

Table 1: after and before project implementation – energy savings

	Before	After
Operating time	2800 h/year	2800 h/year
Capacity of streetlighting	320 kW	95 kW
Energy consumption	896 000kWh	266 000kWh
Energy savings	630 000kWh	

The great savings achieved have made the project interesting for to be implemented by an ESCO, with estimated savings of 37 000 Euro/year. Important savings are as well as possible on the maintenance of the system. The calculated emission reduction of CO₂ are shown in table 2:

Table 2. Reductions in CO2 emissions

	Energy consumption, kWh	Tons of CO2
Emissions before project– per year	896 000	520
Emissions after project– per year	266 000	155
Total reduction in emissions – per year		365
Total reduction in emissions – 20 year		7300

[Erupt baseline methodology (CO₂ emission factor for Latvia 582 grCO₂/kWh)]

Another important result of the project is the possible change in behavior for two important actors involved in streetlighting projects:

- Municipalities
- ESCOs

In fact Latvian municipalities are now more conscious of hidden saving behind energy efficiency projects, while potential Latvian ESCO are more aware about third party financing projects.

Lessons learned and repeatability

This project has been implemented thanks to the very good cooperation established between partners, Tukums council, involved experts and financial institutions.

The project has been possible because it was included in a wider sphere of activities. The most important have been dissemination of information about energy efficiency projects, through seminars and training courses for municipalities. Then crucial has been the training of companies about third party financing and following the creation of an ESCO system in Latvia.

Another central aspect is allocated to available fund in Latvia with very good conditions for the borrowers. In particular for this project NIB – Nordic Investment Bank – and LEIF – Latvian Environmental Investment Fund.

Finally a very important aspect to be taken into account is strictly connected to human behaviour. In fact in this project Tukums Council has been very active and determined to carry out the project using third party financing.

The first problem encountered regards the selection of the right alternative during the feasibility study. The selection has been a trade off between the technical requirement of the project and the financial possibilities of the municipality. To overcome this problem has been necessary to undertake energy auditing of the existing street lighting system in order to estimate possible energy savings.

The second problem has occurred with financial institution. In particular it is has been very important to show them the environmental benefits of the project in order to comply with their requirements.

Finally a problem has been the lack experience and legislation for third party financing. The compilation of the concession agreement between Tukums Council and ESCO has required lot of investigation.

The project has very high repeatability in all small and middle size municipalities of Latvia and other Baltic states and other post socialism countries.

In Latvian there are over 500 municipalities where the project implemented in Tukums could be successfully repeated.

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Printed reports or other literature available:
Title: Business Plan - Effective lighting in cities – Tukums