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Intelligent Road and Street Lighting in Europe (E–Street)

Grant Agreement: EIE/05/157/SI2.419662

WP 3: Market penetration and procurement activities

D 3.4: Procurement evaluation report

WP Leader: BSREC

On behalf of the E-Street project (www.e-streetlight.com)

And supported by:

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Summary

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The WP 3 *Market penetration and procurement activities* of the project *Intelligent Road and Street Lighting in Europe* with leader **BSREC – Black sea regional energy centre – Bulgaria** should accomplish the following activities:

- To **harmonize the tender documentations** for the refurbishment of street lighting in the countries – partners and to elaborate **new tender documents** for the modernization of the street lighting installations with the account of the new possibilities, given by the new technology for intelligent control of street lighting.

- To establish a **street lighting Forum** where the owners of street lighting installations would be enabled to get actual and reliable information for the new technology, its advantages, practice examples from the producers and suppliers of the components for adaptive street lighting installations.

- To collect, analyze and assess reliable information for the **small scale test projects** taking place in several countries – partners as well get information from other countries

- To **evaluate the process and the outcome** on the base of the pilot project analysis and the meetings at the established E-street forum.

On the pages below are presented the results of the WP 3 activity.

D 3.1 Technical specifications and harmonized tender documents

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Tender documentation
For Adaptive Street Lighting

GENERAL

It would be hardly possible to elaborate a universal form for the tender documentation, considering the specific conditions, the existing practices and possibilities in each country.

The elaborated tender document describes the technical requirements of an Adaptive Street Lighting System with the following components:

- Lighting equipment (roadside equipment);
- Power supply system;
- Dynamic Adaptive remote control:
  - Central supervisory control system;
  - Local control system;
  - Sensors.
- Communication system/network.

The legal and financial questions are not object of this tender documentation.

Introduction

The traditional implementation and organization of street lighting have no possibilities for improving and development any more.

The dynamic changes in economy, energy supplies and ecology on a national, European and world like scale require an adequate modernization of street lighting. However, this would be possible only with a quite new functional conception which in fact means adaptability of street lighting. Simultaneous ensuring of the conditions of safe traffic and decreasing the energy consumption and operational costs could be realized in conformity with the constantly changing parameters of the environment. In conformity with the 24 hours change of daylight, the highly changeable traffic, the variable meteorological conditions and some extreme situations on the roads, the intensity of street lighting should change in a dynamic manner. New technical devices and methods that are offered by technical progress will be necessary obviously for the realization of adaptive lighting.

The tender documentation states the goals of the E-street Project and the ways of their implementation. It describes the system structure and the technical

requirements towards its subsystems: roadside equipment, power system, local control system, central supervisory system and communication network.

The content and project requirements for the implementation of Adaptive street lighting - project management, quality assurance and installation requirements - are given.

Overall architecture

Fig.1 presents the architecture of an "Adaptive Street Lighting System". Five subsystems are defined depending on the functions to be performed:

- Roadside equipment
- Power system
- Local control system
- Central supervisory control system
- Communication system/network

The Roadside equipment includes lamps, luminaires, gears, light pools.

The Power system consists of transformer stations, power cabinets and power lines.

The Local control system can be considered in terms of function as composed of two levels:

- **Level One** includes:
  - Luminaires with dimmable electronic ballast (DB) with power line modem;
  - Controlling high pressure sodium or metal-halide lamps;
  - Power line controller (PLC) with power line modem;
  - Controlling magnetic ballast and any sensor, such as camera or weather monitor connected to the power grid.

- **Level two** includes:
  - Substation (Sub Central) with **l**ocal **s**egment (network) **c**ontroller **LSC**;
  - Local **p**ower **l**ine **c**ontroller **PLC** (with power line carrier)

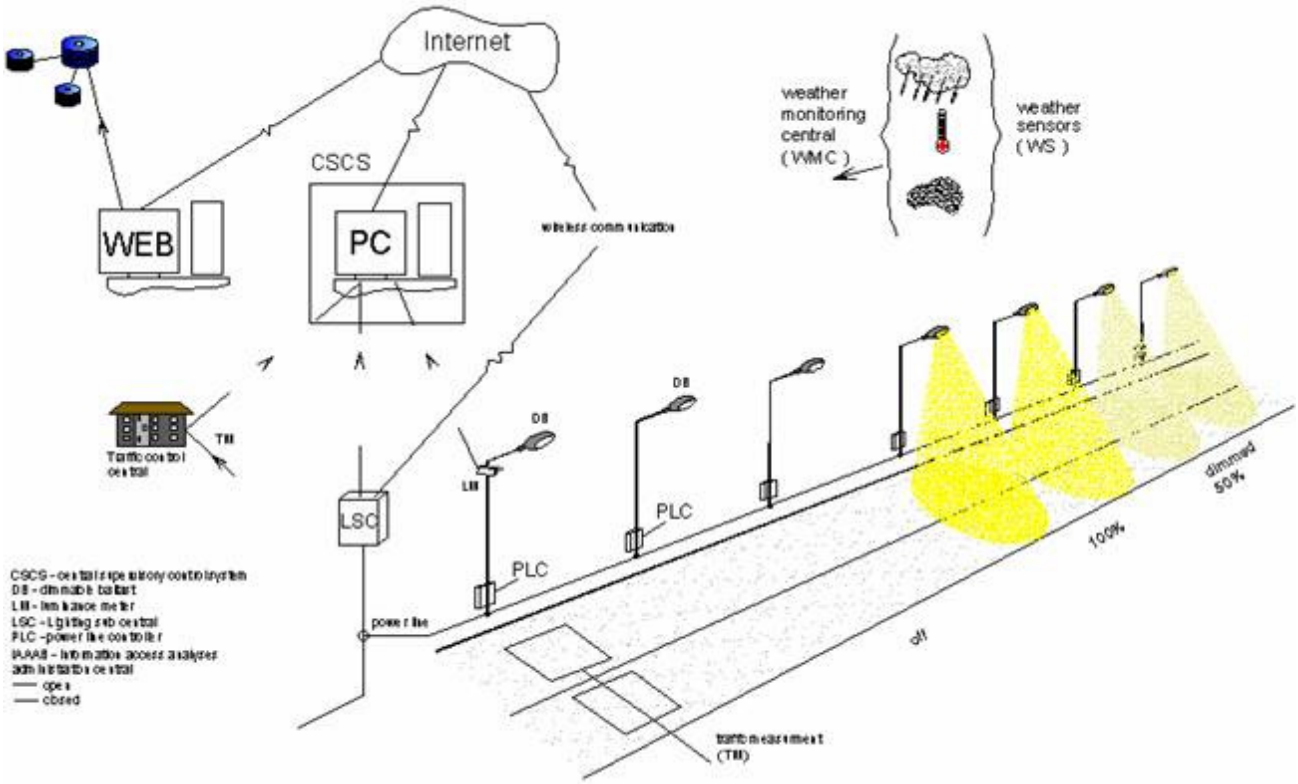
The **Central supervisory control system (CSCS)** system is web–based. The complete monitoring, programming and control are achieved by web–site programs. All the information is collected in a host server. The system and the visible sites or installations are protected by log-in usernames and passwords as well as password level limited actions.

Communication system/network performs information exchange between the different subsystems of E-Street and data collection in the Central Supervisory Control System and in the Lighting Sub Central.

The **organization of weather condition station** depends on the local possibilities, practice and conditions.

The **street lighting control centre** receives information about traffic volume from the traffic centre – TM.

The sensor system provides information about precipitation, slipperiness, snow, fog.



Overall architecture of the Monitoring System for Adaptive Street Lighting

Future expansion / integration

The system shall be adjusted for expansion and development over time. The supplier shall suggest a plan how this can be executed. For example it could be with more luminaires, more functionalities or connections to new/other external systems. The built Adaptive lighting system should not be a "closed system".

Data exchange with an external system

The Adaptive street lighting is a “living system”. It has permanent contact with other systems like: Traffic Management, Weather Sensor system, Central Lighting Application, etc. The efficient operation of E-street system is impossible without reliable contact to other systems.

DESIGN PROCEDURE

The project procedures shall guarantee quality and reliability of the all system and its elements...

Project Management Requirements

The Contractor has the following very important obligations as:

- To monitor and control the project regarding performance of obligations defined in the timetable and all deliverables included in the Contract

- Responsibility for the administration of all aspects of the project including any subcontractor's duties and tasks.

Project procedure

Each project includes different phases, which are described in the tender documentation: contract review, time table, preliminary design, technical (performance) phase, final project phase.

Quality Assurance and Control Requirements

Factory Acceptance Test (FAT)

The adaptive system can be installed in the production environment after an approved FAT (Factory Acceptance Test).

The FAT of the installation shall be conducted in a laboratory environment before delivery to the purchaser.

The FAT shall be performed according to a FAT protocol.

This test protocol is a part of the contract and shall be delivered to the purchaser for review well before the actual FAT is planned to take place.

All documentation shall be a subject to the Project Manager approval.

Stability test (OAT)

The behaviour and stability of the system shall be monitored during a certain period and during selected parts of the year (summer, winter, good weather conditions and poor weather conditions). The monitoring starts when all the installations in the system are connected and operational. This is done to ensure that no long-term errors arise. Suggestions on appropriate test periods and conditions shall be provided by the contractor in cooperation with the purchaser.

TECHNICAL DOCUMENTATION

It is essential that technical documentation is of a high standard and that text is presented in a clear and correct language.

Provision of documentation

Define all documentation items which shall be included in the delivery as for example:

- System documentation (overall architecture, technical requirements, functional requirements, performance requirements);
- Hardware documentation (technical requirements and functional requirements);
- Subsystem documentation (technical requirements, functional requirements and performance requirements);
- Software documentation;
- Maintenance, installation and equipment manuals.

All documentation shall be a subject to the Project Manager approval.

MAINTENANCE REQUIREMENTS

The traditional maintenance system has a high consumption of person hours: inspecting the lamps, urgency, different faults to be determined, etc.

The “Adaptive street lighting” will decrease running and maintenance cost, contributing to better and faster service and reducing the person hours and maintenance expenses.

The vendor has to provide at least 2-years warranty and at least 10 years post-warranty service with additional contract.

SPARES AND TEST EQUIPMENT

The supplier must guarantee that the requested equipment/ backup equipment/ replacement fixtures can be delivered for at least 15 years post delivery. The time of delivery should be not longer than 30 days.

TRAINING DESIGN AND IMPLEMENTATION

One of the main obligations of the contractor will be to train the staff of the purchaser's organization to operate the system using the delivered documentation.

General

The training should be organized according to the following stages scenario:

- At the end of the training programme all trainees will go through a written test in order to prove that the skills and knowledge taught are well mastered.
- Certificates will be issued to the participants who have successfully passed the training programme.
- Trainers. Trainers should be well qualified, understanding perfectly

8. REFERENCES

Directives 2002/96 EC and 2002/95 EC - Harmful substances.
EN 13201 – Road lighting
EN 60598-1 and EN 60598-2 – Luminaires General Requirements
EN 60188 – High pressure mercury lamps
EN 61167 – Metal-halide lamps
EN 62035 – Discharge lamps – Safety requirements
EN 61347-2-9 – Lamp control gear for discharge lamps
CIE 154:2003 The maintenance of outdoor lighting systems
ANSI/EIA 709.1 protocol
IEEE 802.11 Standards
IEEE 802.16 Standard
TCP/IP, OSI models
EN 60529

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D 3.2 – Small scale test projects

A contemporary and technologically new lighting system as **Adaptive street lighting system** usually are tested first like *small scale or pilot projects!* Such projects begin to be realized in the years 2001-2003 in different places – Europe, USA, Canada and al. One of their main purposes is to assess **the potential of energy savings in street lighting** using the new managing system. Here, in this report is summarized the experience gathered in the counties, participants in this project, as well the approachable results from other countries.

A high variety of projects are realized in connection scope, used elements, products and systems, duration of the project and the working time of the new street lighting system. As well the situation and the status of the street lighting installations are rather different from country to country and from city to city. Some of the counties start with full renovation of the systems changing High pressure Mercury lamps with Sodium lamps and introduction of the intelligent control system. As result the energy savings reach 60-70%. Other countries introduce only the new management system and the energy savings are about 20-25%.One of the main conclusions is that it **is too early for definite results and conclusions**.

We have received information for pilot projects from the following partners:

- Norway, Sweden, Finland, Czech Republic, Slovenia, Poland, the Netherlands, Germany, Portugal and Ireland.
- At present in Bulgaria there are only projects of adaptive street lighting systems for Sofia, Smolyan, Vratza, Varna and Sliven.

  Additional information is found for such projects in:
- USA, UK, Belgium, Italy, Austria, Japan, China, Thailand, United Arab Emirates.

The main actors in these projects are:

- Firms as: Powel, Hafslund, Echelon, Luminext, Selc, Capelon AB, Apeinlumtec, Datmolux, Mpes, Edelcom, Philips, Eltodo, Umpi, Siteco, Schreder, Raci d.o.o., Kongsberg Analogic, Osram, Thorn, Telensa, Urbis, Havard etc.
- the Municipalities,
- the Public road and traffic administrations,
- Universities,
- Energy agencies.

On the next pages in concise form and with ciphers is presented the experience in some of the countries listed above.

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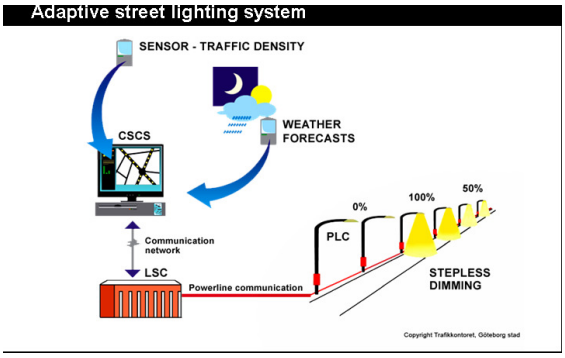
SWEDEN

Göteborgs Stad
Trafikkontoret

Adaptive street lighting, road sections Högsboleden and Tuveleden in Goteborg



Adaptive lighting	
Name:	Supervisory Control and Monitoring System – ÖSÖ and local intelligent street lighting system - Local Controller – MP-01 (developed by Capelon AB and Infracontrol AB in Gothenburg)
Number of luminaries before adaptive lighting	366
Number of luminaries after adaptive lighting	283
Kind of lamps	high pressure sodium lamps
Energy savings	~ 37% in summer and ~ 40-45% in winter

SLOVENIA - Pilot projects from Ljubljana:

PROJECT A): Highway junction:

Adaptive lighting	
Name:	Javna razsvetljava centralized power control system
Number of luminaries	~105
Kind of lamps	high pressure sodium lamps
Wattage of lamps [W]	100 W /150 W/ 250W
Installed power of the adaptive lighting [kW]	96 kW
Energy savings (predicted)	20-25%

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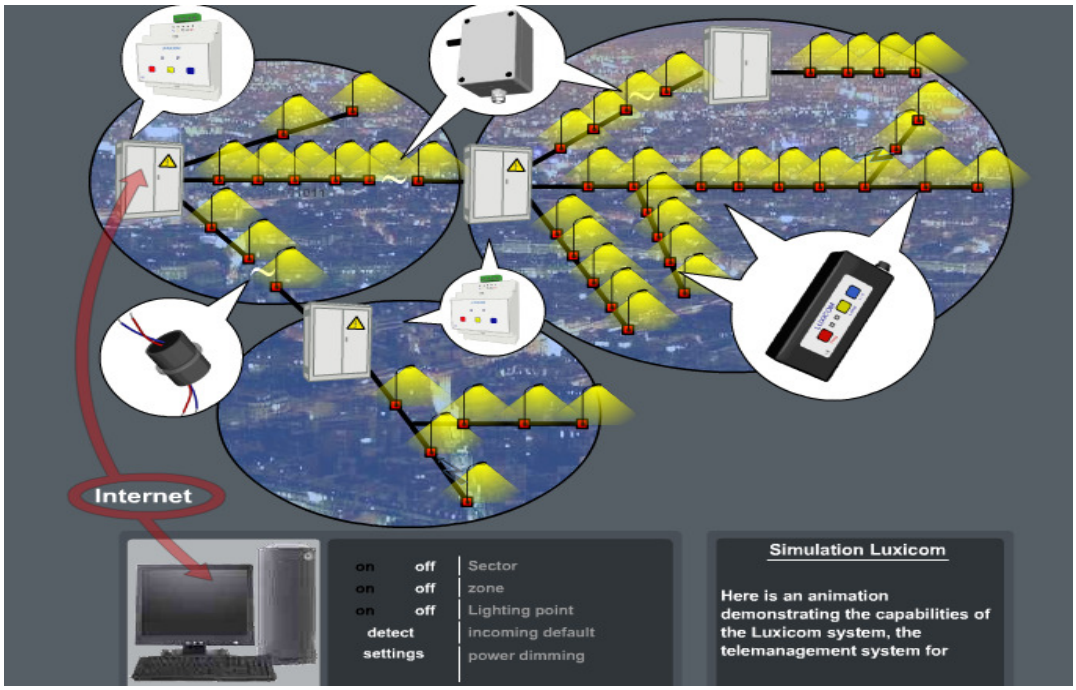
PROJECT B): Road and street lighting in Ljubljana

Adaptive lighting	
Name:	Javna razsvetljava centralized power control system
Number of luminaries	498
Kind of lamps	high pressure sodium lamps
Wattage of lamps [W]	100 W /150 W.
Installed power of the adaptive lighting [kW]	84,6 kW
Energy savings (predicted)	20-25%

CZECH REPUBLIC

Example No. 1 - Luxicom telemanagement system (Prague, Novodvorská):

- control unit in luminaire
- PLC communication
- remote management at "switchboard level"



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Adaptive lighting	
Name:	Luxicom telemanagement system
Number of luminaries	60
Kind of lamps	high pressure sodium lamps
Type of lamp	SON -T PIA Plus
Wattage of lamps [W]	100 W
Energy consumption before adaptive lighting [kWh/a]	5 080
Energy consumption after lighting [kWh/a]	3 911
Energy savings	23%

Example No. 2 – Revereri power control system (Prague, Jižní spojka):

- power control unit in the cabinet
- remote management at "switchboard level"

Adaptive lighting	
Name:	Revereri telemanagement system
Number of luminaries	600
Kind of lamps	high pressure sodium lamps
Type of lamp	SON -T PIA Plus
Wattage of lamps [W]	70,100,150, 250 W
Energy consumption before adaptive lighting [kWh/a]	748 000
Energy consumption after lighting [kWh/a]	575 000
Energy savings	23%

UNITED KINGDOM

Milton Keynes

Adaptive lighting	
Name:	Echelon remote control system
Number of luminaries	400
Kind of lamps	high pressure sodium lamps
Kind of ballasts	SELC electronic ballasts
Wattage of lamps [W]	70,100,150 W
Energy savings (predicted)	~40%

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ITALIA

(Lighting control in street lighting – An overview of the state of the art in technology and application – **Authors**: Dr.Nguyen van Tien –Institute of Materials Science, VAST Hanoi, Vietnam

Location: city of Costello, Italia

The overall installed power	650KW
Type of controller: power reducer by chopping wave shape with built in time switch SEC St /QIR	
Manufacture	Merloni-Progetti, Italia
Quantity of used controllers:	71 pieces
Annual working hours:	4200 h
Reduced rated working hours:	2270 h
Investment cost:	202,349.32 Euro
Annual energy saving %:	34, 9
Annual electricity cost saving:	74363.37 Euro
Pay back time:	2.7 years

After an analysis of the collected information from different pilot projects the following **conclusions** could be done:

- About 80000 luminaires controlled with the new intelligent technology are mounted in different countries, listed in the table beneath;
- Almost in all cases are used High pressure Sodium lamps and partially Compact Fluorescent Lamps;
- The used technologies listed by degree of implementation are: PLC (power line controller), RF (radio frequency), optical link, Internet, SMS, GSM;
- In most of the cases the regulation is done in step less dimmable way and less with reduced level at night.
- The assessed **energy savings** vary in large limits: **from 20% to 50%** depending on many factors. In some countries after retrofitting of very old street lighting installations the savings achieve 60% - 70%;
- The **energy savings due to the intelligent management** of the lighting installation are about 10% - 20%;
- The **market** of the new products and technologies in lighting is **very dynamic and still new** as nomenclature and prices. We have seen that large contracts and increased demand in the market has contributed to a decrease in p.u. cost. This development has increased the cost profit (lowered the payback time), and made it easier to recommend new installations. This is a development we believe will continue downwards as new providers appear and competition increases. The tendencies are:
  - Reduction of the prices of new products and technologies as result of developments and appearance of a greater number of producers all over the world;
  - Increasing of the energy prices with the running low of the energy resources;

- Increasing of the installation maintenance cost as salaries share and
- Reduction of maintenance cost as result of the new intelligent system management.

As result in few pilot cases the pay back period is shown. For the more simple technical solutions the PBP is about 2-3, 5 years.

- The **good maintenance** of the lighting systems all ways was of high importance for street lighting, but the adaptive lighting in view of its complexity increases these demands.
- A substantial factor for the successful implementation of this innovation and later it's maintenance is **the knowing of the technology** by the potential end-users – in most of the counties these are the municipalities (owners of the street infrastructures), as well the road and traffic administrations. This knowledge should cover all aspects – technical, technological, organisational, financial and administrative. **Pilot projects and education** are also important when it comes to the installers of streetlights. Challenges have been experienced in the way that "intelligent equipment" has to be treated in a different way than standard lighting fixtures. Examples: Use of insulation testing with high voltage spikes are normal as a quality check of a new electrical installation, this might cause failure in intelligent equipment. Polarity dependency in two wire communication causes failure, when this is in the luminaire it self, this causes both time and implementing problems. Registering of communication addresses, and use of more advanced control/implementing gear is a challenge that aren't normal for these kinds of installers. **Education and dissemination of knowledge are key factors.**
- The **clear and detailed standard regulations** in all aspects, but first technical/technological, will enable better coordination of the efforts for

the implementation of the new technology in all countries – members of EU. A key factor for the acceleration of the adaptive lighting standardization is the activity of **TC 4-44 of CIE**. The updated CIE publications will push the process of updating the relevant EN and as result all national regulations. [New international standards first have to be included in our national recommendations for street lighting. This is a process that might be difficult because of the mentality of what we have "works well" and what's new has to be well proven before taken into the recommendations. This is a general challenge when it comes to new technology. The solution to this is good working pilot projects that are used for informing and educating both the consultants and owners of these kinds of installations.]

- Keeping a life (as web based and real meetings) the **E-street Forum** as place for discussions and exchange of information, experience and results from the existing projects, as well announcing the future possibilities for building of news systems will help the future development and introduction of adaptive lighting systems.
- All countries are following the **directive of EU commission about public tenders**, opened to everyone to attend tenders, organized in anyone of the countries – member of EU. Difficulty could be the luck of sufficient practice and participation in such tenders. The economical needs, the technological development and the proven energy savings could accelerate the realization of more international tenders.
- For the implementation success of the new technology could have decisive influence the **way of contracting and procurements depending on the local/national practice, traditions and possibilities**:
  - Conventional method: separate design, construction and maintenance;

- Total contract including design;
- LCC method witch includes financing, design, construction and maintenance.

- A new kind of provider is increasingly involved in street lighting; **IT companies**. As control of streetlights is becoming a computer aided profession, new parts of the "owners work organization" gets involved in street lighting. But still it is important to remember the electrical challenges and not leave it all to the computer.
- Still it is seen the importance of being clear **on the demand for open protocols for communication.** This will continue to keep the competition in the market and for the future possibilities of competition in expanding/maintenance in the installations. This should also be of concern if there are areas that can't be fully adapted or renovated at one time, but has to take it in steps. **By use of open interchangeable standards you will not be locked to one supplier for a future continuation of a project.**

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Intelligent street lighting project in Europe

Name Location Country	Number of luminaires	Installed wattages/type of lamp (i.e. 70/100W HPSL)	Technology: Power line (PLC) Radio (RF) Other (specify)	Regulation: Step less dimmable (SD) Reduced level at night (RLN)
Poznan, **POLAND**	1540	70/150/250 HPS	PLC RF	SD
Kalisz town, **POLAND**	78	150/250 HPS	PLC RF	SD
Motorways, **POLAND**	1000	70/150/250/400 HPS	PLC RF	SD
CZECH REPUBLIC	10 000			
Belfast, **NORTHERN IRELAND**	600			
Dublin, **IRELAND**	5000			
Brown, the **NETHERLANDS**	7000			
A2, the **NETHERLANDS**	1523			
Hammerfest, **NORWAY**	3000			
∅vre Eiker, **NORWAY**	300			
Tingvold, **NORWAY**	3000			
Bærum, **NORWAY**	21			SD
Bærum, Skitrack **NORWAY**	100		RF	
Fornebu, **NORWAY**	350		PLC	SD
Drammen, **NORWAY**	71		RF	SD
Oslo, **NORWAY**	7500	70/100/150 HPSL	PLC	SD
Gothenburg, **SWEDEN**	1125	70/100/150 NaH	PLC	SD
Road 276 to Akersberga north to Stockholm, **SWEDEN**	85			
Staketleden north of Stockholm, **SWEDEN**	270			

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Name Location Country	**Number of luminaires**	**Installed wattages/type of lamp (i.e. 70/100W HPSL)**	**Technology: Power line (PLC) Radio (RF) Other (specify)**	**Regulation: Step less dimmable (SD) Reduced level at night (RLN)**
Allerpark Wolfsburg, **GERMANY**			GSM	SD
Werk Biberach, **GERMANY**	350		Internet, SMS	SD
Highway, Ljubljana, 2007 **SLOVENIA**,	368	100/150/250 HST	PLC Optical link	SD
Bundeswehr Schillkaserne Wesel, **GERMANY**	140		PLC	
Stadt Böblingen, **GERMANY**	22	70W HSE	Fiber optic cable	SD
Milton Keynes, 2007 **UK**	400		PLC	RLN
Dong, **DENMARK**	30 000	CFL: PL-T 42W		
HELSINKI RING III, Vantaa and Helsinki, **FINLAND**	500	ST 150-600 W	PLC	SD
MOTORWAY HELSINKI-TURKU Section Kolmperä-Lohjanharju Espoo, Kirkkonummi and Vihti, **FINLAND**	760	ST 150-600 W	RF	SD
Section Muurla-Lohja Muurla, Pertteli, Kiikala, Suomusjärvi, Sammatti, Nummi-Pusula and Lohja, **FINLAND**	1100	ST 150-600 W	PLC	SD
MOTORWAY HELSINKI – PORVOO Section Västersundom-PorvooVantaa, Sipoo and Porvoo, **FINLAND**	1240	ST 150-600 W	PLC	SD
MAIN HIGHWAY No 2 Section Palojärvi-Nummela Vihti, **FINLAND**	200	ST 150-600 W	PLC	SD
VUOSAARI HARBOUR ROAD Helsinki and Vantaa, **FINLAND**	300	ST 150-600 W	PLC	SD
Elvas, **PORTUGAL**	22	250W & 400W	PLC	Telemonitoring (100%, 75% and 50%)
Getafe **SPAIN**	1000	150W	PLC	SD
TOTAL	**78965**			

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D 3.3 Street light forum

The **Street Light Forum** was **founded in Prague** (Czech Republic), on the 9th June 2006. There it was decided that the Forum should be attended by owners of street lighting installations and street lighting experts, and that representatives of the big European countries that are not partners in the E-Street Project should also be invited. It was agreed that the partners in the E-Street Project **BSREC** (Sofia, Bulgaria – www.bsrec.bg), **SITO** (Espoo, Finland – www.sito.fi) and **Javna Razsvetljava** (Lubljana, Slovenia) should draw up a form for registration of the participants in the Street Lighting Forum.

The **Second Street Light Forum** was organized and held in **Berlin** (Germany) on 26.11.2006. The coordinator of the E-Street Project **Eirik Bjelland** (Hafslund ASA, Norway – www.hafslund.no) opened the Forum and pointed out its main objectives: information exchange, direct meetings among manufacturers, merchants and financial institution. The Forum was open to outside participants. It was attended by 22 representatives of manufacturers and experts working in the area of street lighting. **Siteco** (Germany), **Powel** (Trondheim, Norway – www.powel.com) and **LCI** (Germany) presented their companies before the other participants and shared their experience in street lighting. The partners in the E-Street Project offered assistance for development of the contacts among suppliers, merchants, owners, managers, banks and state institutions for the purpose of dissemination of knowledge, information and exchange of experience in energy efficient modernization of street lighting in Europe. It was decided to invite representatives of municipalities to take part in the next Street Light Forum.

The **Third Street Light Forum** took place in **Sandvika, Oslo (Norway)** on 9. 5. 2007. At it, the technology aspects of adaptive street lighting and its intelligent control

system were presented. **Trond Schjerven** (Hafslund Nett, Norway – www.hafslund.no) briefly presented the E-Street Project to the delegates of the Forum. **Tor Mjos** (Norconsult, Norway – www.norconsult.no) told about the European Union's initiatives in support of energy efficiency in street lighting. **Per Ole Vanwik** (Norwegian Public Roads Administration, Norway – www.DATEK.no) presented their experience accumulated with the pilot adaptive street lighting project in Drammen (Norway). **Axel Stockmar** (Light Consult International - LCI, Germany) introduced the attendants to his publication CIE 115:2007 on street lighting and offered to consider the changes in the regulation system concerning the adaptive street lighting. **Henk Walraven** (Luminext, The Nederlands – www.luminext.eu) made a technology overview of their adaptive street lighting system based in Lon Works of Echelon. **Philip Carrier** (Innovative Wireless Technology, USA – www.iwtwireless.com) described the potential of the wireless street lighting control technology and presented and summarized the experience from its previous applications. **Leonardo Botti** (Power One, www.power-one.com) presented the technological features of PLM (Power Line Modem) for remote observation and monitoring the street lighting system and the potential for electricity saving. **Luca Cecchini** and **Alberto Grossi** (UMPI Elettronica, Italy – www.umpi.it) told about the possibilities of the MINOS system developed by them 20 ago and its numerous applications in intelligent street lighting control worldwide.

The **Fourth Street Light Forum** took place in **Sofia (Bulgaria)** on 26. 11. 2007. The interest in the Forum in Bulgaria was quite high. It was attended by 54 representatives of various organizations concerned with street lighting – municipality councillors, firms for maintenance and servicing of street lighting installations, technological firms, commercial representatives, designers, lighting equipment manufacturers, lecturers at the Technical University, students, representatives of the Bulgarian Energy Efficiency Agency. Professor Sermin Onaygil from the Technical University in Istanbul (Turkey),

Mrs. Arlette Blochoose, Head of Lighting Engineering Laboratory of Schreder (Belgium) was present at it.

The Street Light Forum in Sofia was opened by **Mr. Ljulin Radulov** (Black See Regional Energy Centre, Bulgaria – www.bsrec.bg). Prof. **Nikolay Vassilev** (Lighting Laboratory, TU-Sofia, Bulgaria – www.tu-sofia.bg) introduced the attendants to the basic concepts of adaptive street lighting. **Ingemar Johansson** (Traffic & Public Transport Authority, City of Goteborg, Sweden – www.trafikkontoret.goteborg.se) offered to the attention of the audience the experience of Goetheborg municipality in the implementation of pilot sectors with adaptive street lighting along the boulevards of the town. **Bjorn Sandtveit** (Hafslund Nett, Norway – www.hafslund.no) told about the experience and problems faced by their company in the technical maintenance of street lighting in Oslo, Asker and Bærum in Norway. **Ludek Hladky** (ELTODO, Czech Republic – www.eltodo.cz) shared their experience in street lighting maintenance in Prague, the methods of billing the electricity consumption and the efficiency of pilot sectors with adaptive street lighting in Prague. **Tor Mjos** (Norconsult, Norway – www.norconsult.no) offered a presentation with guidance and recommendations for owners of street lighting installations who would like to perform reorganization towards adaptive street lighting, providing data on pilot projects in Oslo and the benefits offered by them. **Wilfried Gabler** (Investitionsbank SH, Germany – www.ib-sh.de) told about the methods of financing energy–efficient street lighting redesigns and their bank's experience in that business. **Pentti Hautala** (SITO, Finland – www.sito.fi) described the adaptive street lighting systems in Helsinki and the obtained results of their work.

The partners' presentations were welcome and have rise to many questions from the attendants. A discussion was held. The purpose of the Street Light Forum was achieved. The Bulgarian engineering community, the representatives of Bulgarian municipalities and foreign lighting experts were informed about the technological potential of adaptive street lighting. Contacts were established among potential

participants in future energy-efficient redesign of street lighting installations in Bulgaria.

The latest **Fifth Street Light Forum** within the period of E-Street Project took place in **Lisbon (Portugal)** on 15.05. 2008 г. It was attended by 30 participants invited by the partner and organizer Ageneal (Local Energy Management Agency of Almada, Portugal). The Director of Ageneal **Carlos Sousa** opened the Forum. After that the floor was given to the Mayor of Almada. Executive Member of the Board of AGENEAL **Catarina Freitas** delivered a speech of welcome to everybody, expressed her satisfaction with the participation of their municipal energy efficiency agency Ageneal in the E-Street Project and thanked the partners attending the forum for their readiness to make their Portuguese colleagues familiar with the new adaptive street lighting technology. Presentations related to adaptive street lighting were delivered by **Tor Mjos** (Norconsult, Norway – www.norconsult.no), **Bjorn Sandtveit** (Hafslund Nett, Norway – www.hafslund.no), **Ludek Hladky** (ELTODO, Czech Republic – www.eltodo.cz), **Ingemar Johansson** (Traffic & Public Transport Authority, City of Goteborg, Sweden – www.trafikkontoret.goteborg.se), **Wilfried Gabler** (Investitionsbank SH, Germany – www.ib-sh.de), **Tom Kristoffersen** (City of Oslo, Agency for Road and Transport, Contract Department, Head of Section Operation and Maintenance – postmotak@sam.oslo.kommune.no tom.kristoffersen@sam.oslo.kommune.no) and **Axel Stockmar** (Light Consult International - LCI, Germany). The attendants from Portugal heard the information prepared by the partners in the E-Street project. The Director of Ageneal asked a few questions. **Elisa Ruggeri** (UMPI, Italy – www.umpi.it) briefly introduced their firm and offered brochures of the MINOS system to everybody interested.

Discussion and conclusions

One of the main purposes of this project is to enable **the market enlargement** of the adaptive street lighting. The large scale effect of the new technology is of great importance for the right and reliable definition of the investment budgets and later the real assessment of the running costs of realized systems of adaptive street lighting. At present in most of the countries, where such systems are realized, these systems are newly installed and the real effect is not possible to be assessed as a whole by the end of this project. Assessing the collected by the moment information for **the small scale pilot projects**, the first results show about **80 000 luminaires** working in intelligent street lighting systems. The realized or assessed energy savings are between **20% and 50%** depending of scope of the system renovation, country place of the new installations and other specific factors. The payback period varies from **3 to 5 years** by the moment. The products from more than **22 firms** are put into the realized projects. About **40 municipality and/or road administrations of 14 countries** are involved in the implementation process of the new technology (see the table with procurements above). . For the moment it is too early for the development of unique assets for each country. Since each country (and in each country each municipality is independent) act independently in the field of Pilot projects the Forum could only assist with affording opportunity for reliable information.

The established **E-street Forum** (of street lighting owners) must be of real importance for the catalysis of the technology implementation process. It was the place where was exchanged experience between the partners of the project as well from the newly involved members of the forum. The E-street Forum was

and should continue to be a place for exchange of knowledge and experience, for education of good practice examples. In the frame of the project were organized **5 forums with 200 participants**.

The most important for the successful future procurement activity was the elaboration of a **Tender documentation for Adaptive street lighting**. It was collected a reliable data information for the practice in the field of low procedures, directives and general and technical standards from the countries – members of this project. On the base of it was elaborated tender document, where are described the technical requirements of an Adaptive Street Lighting System. The legal and financial questions are not object of this tender documentation. As all countries –members of the projects are following the **directive of EU commission about public tenders** this document should be of real public benefit for each country – member of EU. As well it was exchanged information about local tenders among the partner network. At present it is difficult to coordinate or arrange joint and/ or parallel tenders based on local and/ or international vendors.