



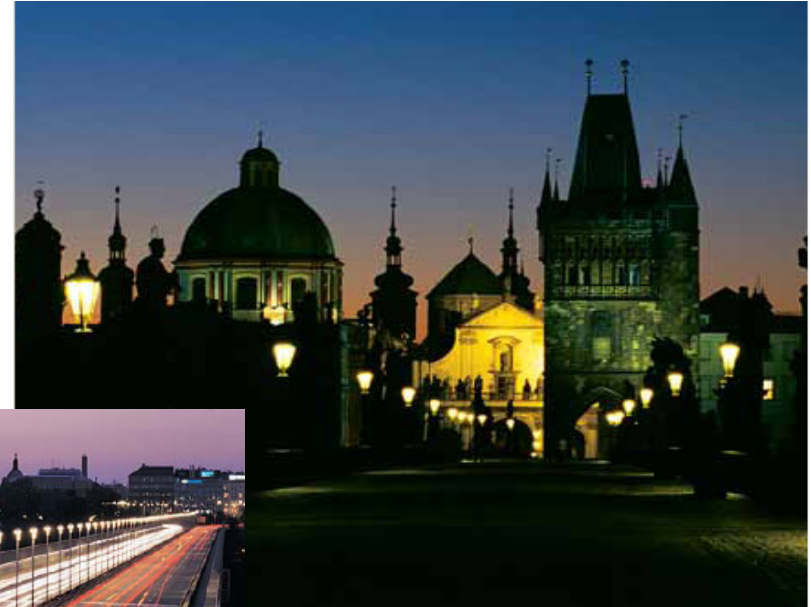
Metering and billing of road lighting



**E-Street
Almada, Portugal
May 2008**

ELTODO EG

- Electrical Installations
- Developer projects
- Transport
- Public lighting
- Airport and heliporters
- Manufacturing
- Other activities



Public lighting in the Czech republic

- Public lighting in the Czech republic counts approximately 1,2 million installed luminaires and the consumption of electrical energy reaches about 600 GWh per year, that represents up to 2 % of total consumption of electrical energy in the Czech republic.
- Total average year consumption of electrical energy, used for lighting in outdoor and indoor application, reaches about 12 % .
- ELTODO has been already occupying an exclusive position in the area of outdoor lighting in the Czech Republic of road lighting, festive and historical lighting on the platform of public private partnership (PPP).

PPP (public private partnership)

- PPP is a long – term contracting relation between qualified partner (administrator) and municipality (submitter).
- Qualified partner provides administration, maintenance, operation and also arranges financial means for innovation and development of public lighting for the municipality.
- Financial means are repaid via regular flat monthly instalment by municipality to the qualified partner.
- Components and devices of public lighting network remain in property of municipality providing also control activity on entrusted property.
- Main aim of a municipality is the improvement of technical condition of public lighting, achieving maximum level of luminosity and renovation of old - fashioned parts without increasing of original operation cost.
- Qualified partner operates according to standards of management quality EN ISO 9001.

Operation costs and benefits for the customer

- Operating costs of lighting systems increases during their ageing.
- Qualified partner usually starts to fulfill the PPP by retrofitting the old parts of the lighting systems to be able to increase the efficiency.
- Afterwards the operation costs of the customer (municipality) consists of reduced operating costs and the instalments for loans.
- Notwithstanding the total operation costs of the customer are lower than original operation costs before fulfilling of the contract.
- At the end of the contract, qualified partner hands over the whole system of public lighting in much better technical condition with lower operation costs.

Potential energy savings

- Installation of sealed luminaires with high IP (ingress protection of light active part of luminaire 65 and higher),
- using electronic ballasts with lower inner consumption,
- replacement inefficient insulated distribution cables and lines,
- correct design and operation of lighting systems according to the standards,
- using discharge lamps with higher luminous efficacy,
- uniform power loading of phases of power distribution,
- elimination of unauthorized power take – offs,
- installation of the **energy savings devices** for reduction of luminous flux in night time with reduced traffic flow such as specially equipt ballasts or lighting power control units located in power supply.

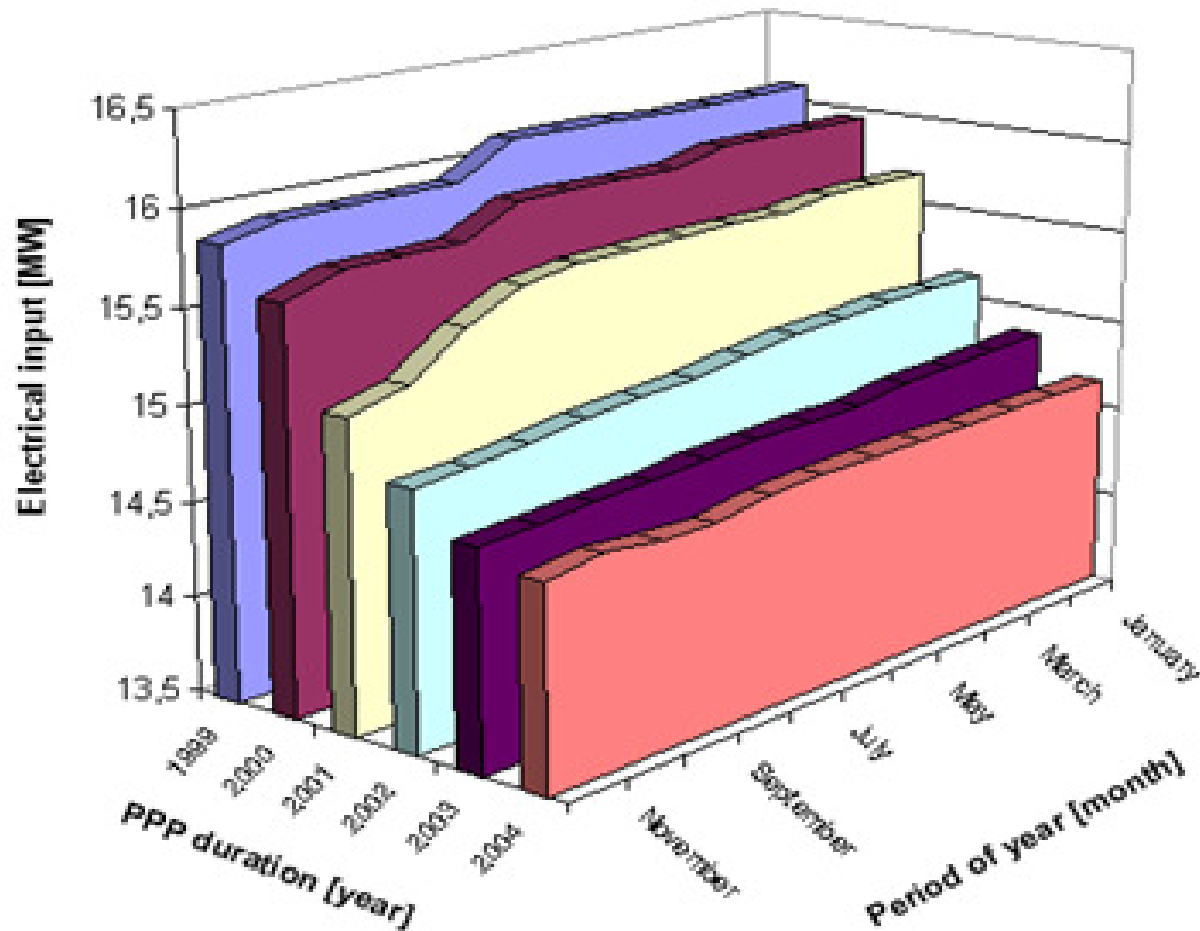
Documentation of energy savings in Prague

- Total electrical input of public lighting network was reduced from 16 MW before 1999 to 14,5 MW at the end of 2004,
- functionality of lighting systems is in any case keeping higher than 99,2 %,
- Public lighting network consists of lighting systems and devices connected to public lighting network, such as lighting traffic signs, traffic lights, bus stations, informative and advertising facilities and etc.

Performance of the conception for the years 1999 - 2013						
Device	Total number [unit, m]	Planned replacement		Total real replacement (31.12.2005)		Performance of conception [%]
		Replacement [unit,m]	Replacement [%]	Replacement [unit,m]	Replacement [%]	
Luminaires	136 690	109 352	80	124 966	91	114
Armature	123 881	37 164	30	47 677	38	128
Poles	110 765	20 824	19	23 762	21	114
Pole case	110 765	20 824	19	23 762	21	114
Painting of the poles	110 765	56 771	51	66 800	60	118
Discharge lamps	136 690	136 690	100	283 250	207	207
Cable	6 168 900	302 276	5	758 317	12	251
Switch boards	1 376	160	12	264	19	165

Documentation of energy savings in Prague

Evolution of total power requirement of public lighting network in Prague (MW)



Measuring of electricity

- Electronic or conventional electrometer located in the cabinet,
- Electronic electrometer has own microprocessor measuring current, voltage signals and providing calculation, communicates via optical-interface, storing chosen signals into the memory,
- equipt also with pulsed output with signal frequency corresponding to consumed energy,
- communication via RS 232, RS 485 with PC or GPRS modul with remote billing server.

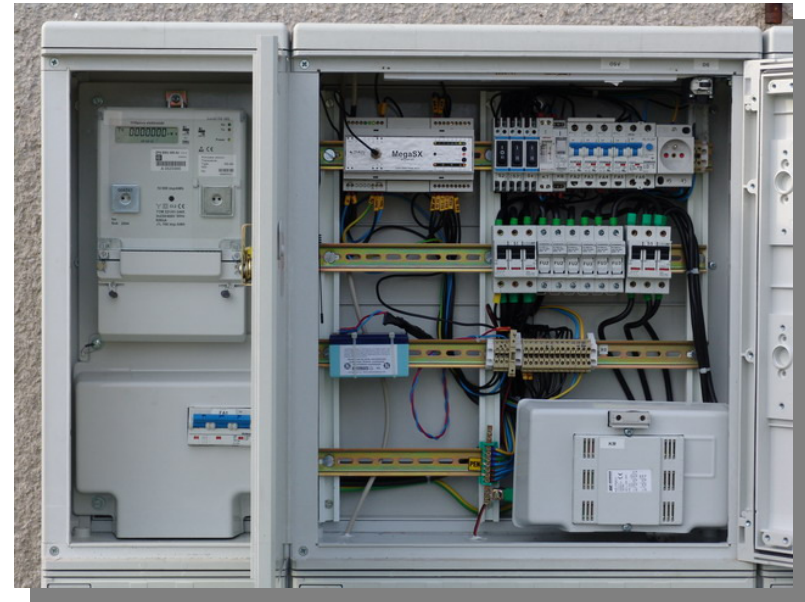
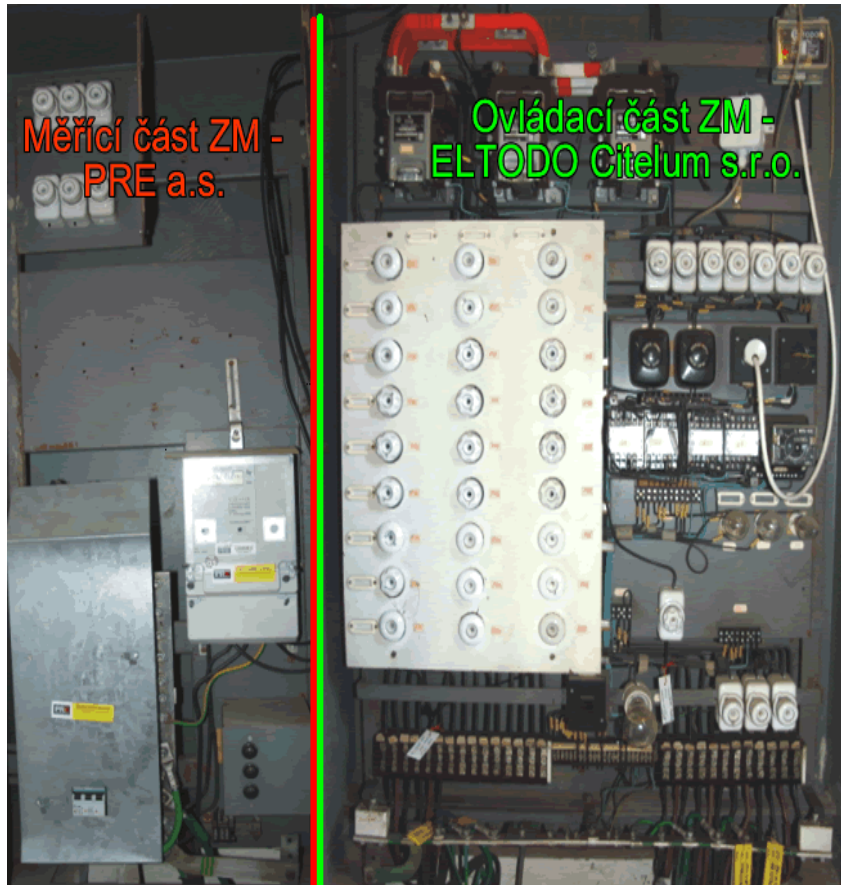
Electronic electrometer



F(x)
 0.0(xxxx)
 0.4.1(xx)(xx.xxx*kW)
 0.4.2(xx)(xx.xxx*kW)
 0.4.t(xx.xxx*kW)
 0.4.L1(xx.xxx*kW)
 0.4.L2(xx.xxx*kW)
 0.4.L3(xx.xxx*kW)
 0.6.1(x.xxx*kW)
 0.6.2(x.xxx*kW)
 0.8.1(xxxxxx.xxx*kWh)
 0.8.2(xxxxxx.xxx*kWh)
 2.4.t(xx.xxx*kvar)
 2.4.L1(xx.xxx*kvar)
 2.4.L2(xx.xxx*kvar)
 2.4.L3(xx.xxx*kvar)
 2.8.1(xxxxxx.xxx*kvarh)
 2.8.2(xxxxxx.xxx*kvarh)
 3.4.t(xx.xxx*kVA)
 3.4.L1(xx.xxx*kVA)
 3.4.L2(xx.xxx*kVA)
 3.4.L3(xx.xxx*kVA)
 3.8.1(xxxxxx.xxx*kVAh)
 3.8.2(xxxxxx.xxx*kVAh)
 5.0.L1(xxx*V)
 5.0.L2(xxx*V)
 5.0.L3(xxx*V)
 5.1.t(xx.xxx*A)
 5.1.L1(xx.xxx*A)
 5.1.L2(xx.xxx*A)
 5.1.L3(xx.xxx*A)
 5.2.L1(x.xx*cos)
 5.2.L2(x.xx*cos)
 5.2.L3(x.xx*cos)
 5.3(xx.x*Hz)
 5.4.1(xx*min)
 5.4.2(xx*min)
 5.5.1/xxx.xxx*p_kWh)
 5.5.2/xxx.xxx*p_kWh)
 5.6.1/xxxxxx.xxx*p_tot)
 5.6.2/xxxxxx.xxx*p_tot)

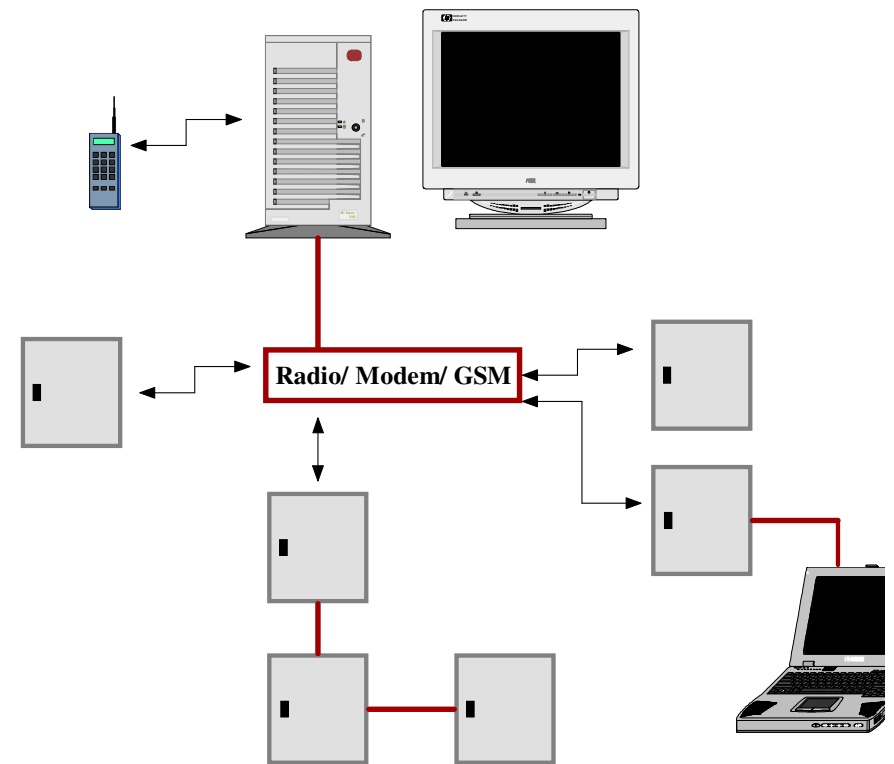
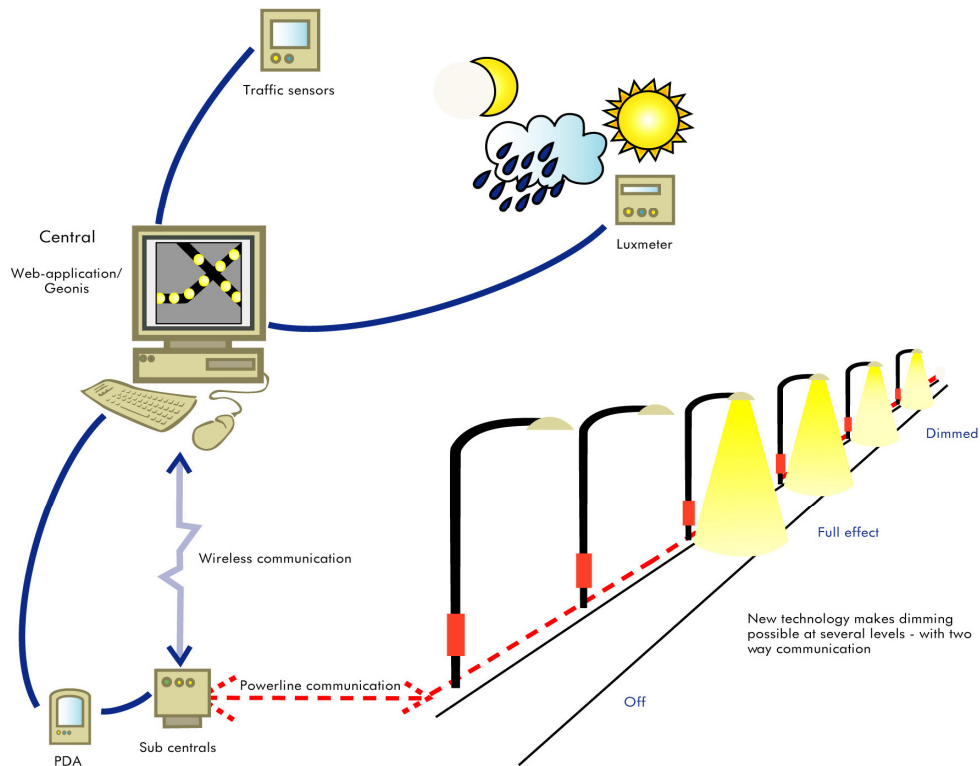
chybové hlášení
 číslo přístroje
 průběžný čas měření - tarif 1 (min)
 průběžný činný výkon - tarif 1 (kW)
 průběžný čas měření - tarif 2 (min)
 průběžný činný výkon - tarif 2 (kW)
 momentální celkový činný výkon (kW)
 momentální činný výkon L1 (kW)
 momentální činný výkon L2 (kW)
 momentální činný výkon L3 (kW)
 maximum činného výkonu - tarif 1 (kW)
 maximum činného výkonu - tarif 2 (kW)
 registr činné energie - tarif 1 (kWh)
 registr činné energie - tarif 2 (kWh)
 momentální jalový výkon celkový (kvar)
 momentální jalový výkon L1 (kvar)
 momentální jalový výkon L2 (kvar)
 momentální jalový výkon L3 (kvar)
 registr jalové energie - tarif 1 (kvarh)
 registr jalové energie - tarif 2 (kvarh)
 momentální zdánlivý výkon celkový (kVA)
 momentální zdánlivý výkon L1 (kVA)
 momentální zdánlivý výkon L2 (kVA)
 momentální zdánlivý výkon L3 (kVA)
 registr zdánlivé energie - tarif 1 (kVA)
 registr zdánlivé energie - tarif 2 (kVA)
 momentální síťové napětí L1(V)
 momentální síťové napětí L2(V)
 momentální síťové napětí L3 (V)
 momentální odběr proudu celkový (A)
 momentální odběr proudu L1 (A)
 momentální odběr proudu L2 (A)
 momentální odběr proudu L3 (A)
 momentální fázový posuv L1
 momentální fázový posuv L2
 momentální fázový posuv L3
 momentální síťový kmitočet (Hz)
 měřicí perioda pro maximum výkonu - tarif 1
 měřicí perioda pro maximum výkonu - tarif 2
 cena za kWh - tarif 1
 cena za kWh - tarif 2
 celková cena - tarif 1
 celková cena - tarif 2

Typical cabinet



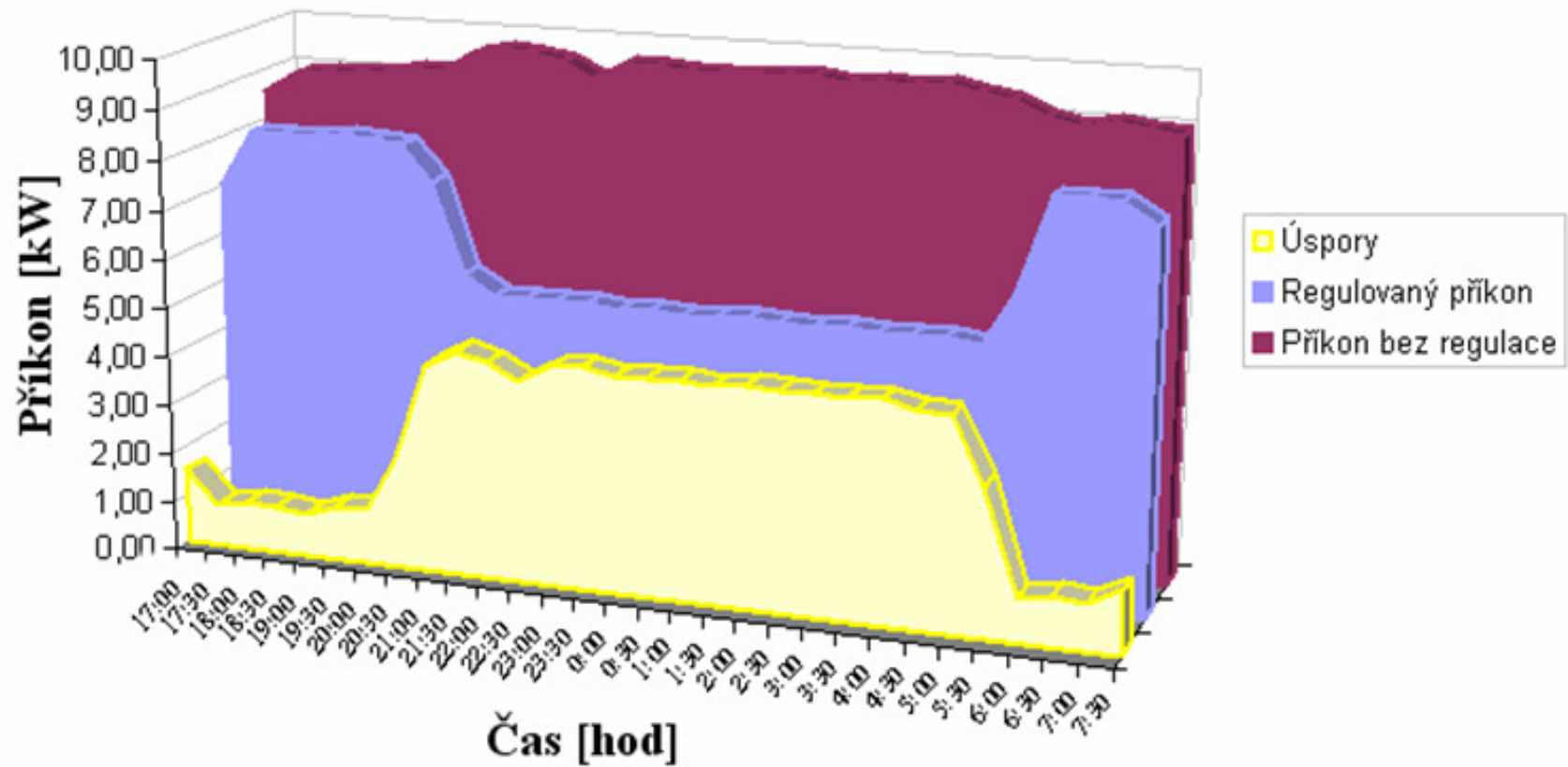
Telemangement systems

Example of intelligent road light control

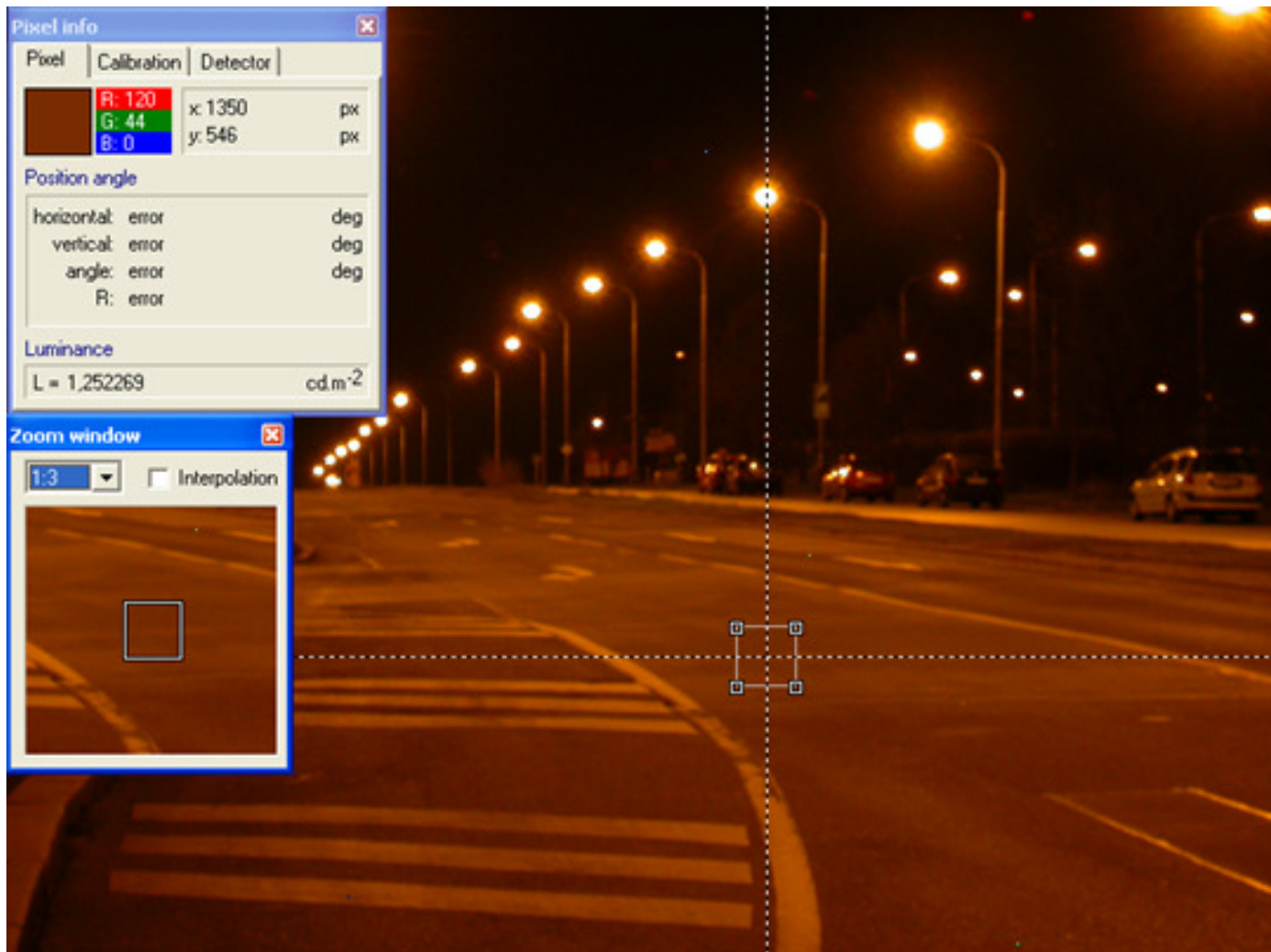


Real operational diagram

Provozní diagram osvětlovací soustavy Březiněves - Ďáblická -ZM 1307



Evaluation of luminance



How to calculate the price for electricity in public lighting

- Total price of electrical energy of public lighting in the Czech republic includes the price of **power electricity, distributional electricity and other services,**
- Calculation procedure of the price for electricity in public lighting is generally valid formula. The special rate is called C 62d – Special rate for lighting of public areas,
- In the case shown herein are specified particular prices of the greatest supplier of electricity in the Czech republic (ČEZ). The price of electrical energy for public lighting is quoted without tax (19%).
- Fixed prices of distributed electrical energy to final customers from the low - voltage network is established by the price resolution No. 15/2005. The price for related services is established by the price resolution No. 14/2005.

Participants on electricity market in the Czech republic

- producers of electrical energy (e.g. ČEZ a.s.)
- transmissional system operator (ČEPS. a.s.)
- distributional system operators (e.g. ČEZ Distribuce, a.s.; E.ON Distribuce, a.s.; PRE Distribuce, a.s.)
- Operator on electricity market - OTE (Operátor trhu s elektřinou, a.s.)
- trading companies (e.g. ČEZ Prodej, s.r.o; E.ON Energie, a.s)
- final customers (e.g. ELTODO - Citelum, s.r.o. – administrator of public lighting in Prague)

Key players on the electricity market in the Czech republic

ERÚ – Energetický regulační úřad (Energetic regulation office) was founded as a special authority to perform the control and regulation of energetics and its main tasks are:

- Protection of the customer rights against the force of energetic companies leading to price rising,
 - emphasize on quality and supplies of energy to the customers,
 - support the competition on the market with electricity and gas,
 - contribute to the effective activities of energetics companies,
 - stability of the price level.

OTE – Operátor trhu s elektřinou, a.s. (Operator on the electricity market) is responsible:

- for evaluating, billing and financial settlements of divergencies between real and negotiated supply of electricity,
- for the financial statements of electricity activated in providing promotive services
- for organization short – term market with electricity including financial

Main suppliers on the Czech electricity market - ČEZ group , E.ON, PRE

Power electricity

- Price for **power electricity** is defined by the trading companies and it is not controlled by any public authorities,
- includes fixed monthly fee for the point of supply and payment for consumed electricity for chosen rate:

Power electricity	Kč (Czech crown)	€
fixed price per the point of supply per month	30	1,05
price for 1MWh (High rate)	844	29,61
price for 1 MWh (Low rate)	-	-

Distributional electricity

- controlled by Energetic regulation office (ERÚ - Energetický regulační úřad)
- includes fixed monthly fee for electrical input according to the nominal current value of the main circuit breaker in front of the electrometer and payment for distributed amount of electricity:

Monthly fee for the electrical input according to the nominal current value of the main circuit breaker		
Nominal current value of the main circuit breaker [Ampere]	Kč	€
to 3x10 A and to 1x25 A incl.	77	2,70
over 3x10 A to 3x 16 A incl.	123	4,32
over 3x16 A to 3x20 A incl.	154	5,40
over 3x20 A to 3x25 A incl.	192	6,74
over 3x25 A to 3x32 A incl.	246	8,63
over 3x32 A to 3x40 A incl.	307	10,77
over 3x40 A to 3x50 A incl.	384	13,47
over 3x50 A to 3x63 A incl.	484	16,98
over 3x63 A to 3x80 A incl.	614	21,54
over 3x80 A to 3x100 A incl.	768	26,95

Other services

- controlled by Energetic regulation office (ERÚ - Energetický regulační úřad)

Other services	Kč / MWh	€/ MWh	More information
price for the system services	156,28	5,48	Fixed prices for system services provided by the transmission operator to all participants on the electricity market, whose device is connected to electricity supply system.
price for the support of electricity buyout	28,26	0,99	Price for covering the support of electricity from the renewable resources, combined generation of electricity and heat and secondary sources.
price for billing activity OTE	4,63	0,16	Fixed price for the billing activity of the OTE for real supply to the final customers.

Total payment for electricity in public lighting in the region Prague capital

Payment for electricity in the region Prague capital according to rate C 62 d (without VAT – 19%)				
Year	Payment entirely for consumed electricity		Total payment for consumed electricity and fixed fees	
	(Kč/kWh)	(€ /kWh)	(Kč/kWh)	(€ /kWh)
2005	1,279	0,045	1,377	0,048
2006	1,298	0,046	1,403	0,049

Thank your for your attention

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