EIE-05-157 E-Street project
Financial Instruments - Work Package 6

Comprehensive Report

Investitionsbank Schleswig-Holstein
Energieagentur
Fleethörn 29 - 31
24103 Kiel
www.ib-sh.de

Dipl.-Ing. Wilfried Gabler
Tel. (04 31) 99 05 - 36 62
Fax (04 31) 99 05 - 6 36 62
Email: wilfried.gabler@ib-sh.de

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Index of contents

A. Introduction

Numerous street lightings of the communes have been getting on a bit which means that renovation has also become increasingly necessary. Due to this the sum of the yearly electricity expenses for street lighting of a commune can be equal to the yearly costs for the electricity for the commune's real estates.
According to actual investigations an average savings potential of up to 40% is possible. Optimised operation of street lighting can be a factor in consolidating the budget of a commune.

The first step in sustainable optimising street lighting is to provide transparency of purposes and to compile a street lighting register which contains the present operational condition of the street lighting.
The number of different types of lamps, illumination lanterns and masts should be held as low as is possible. It is therefore very important to introduce standards. This regulation must also apply to the illumination requirements and to the text of the public tenders.

Economical aspects and the possibilities of financing are important for the energy and cost conscious operation of the street lighting:

- **Economical planning** e.g. by implementation of economical and long-life illuminating means.
- **Economical operating methods** e.g. by optimising lamp exchange and by use of up-to-date techniques and
- Reduction of **electricity expenses** e.g. by technical measures (lamp exchange, optimised regulation, etc.)
- Implementation of **financial aids** e.g. by energy conservation contracting.

The previous report is mainly concerned with contents of the last paragraph and addresses financial instruments in detail which are helpful in the area of optimised operation of street lighting.

The specific target of the partial project is dealt with in the following chapter.

B. Intention of the project, especially for the work package 6 (WP 6)

Increasing energy costs have caused the expenses of communal street lighting to become a serious cost factor for the commune: With modern illumination techniques and intelligent regulation a high savings effect can be realised, so that the expense of modernising the street lighting can be quickly recovered.

Street lighting is long ago a European wide global theme. Bundling the know-how of the individual EU-Countries provides the opportunity of generating an optimised solution in this sector.

The project, "Intelligent Road and Street Lighting in Europe“, was started in January 2006 under the participation of 12 European countries. The project, initiated by the companies Norconsult and Hafslund (Norway), has a duration of 2 1/2 years. The project partners come from the areas of consulting and supply organisations, energy agencies, lamp manufacturers, banks and communes. This constellation of major business partners participating on the project ensures that an intelligent street lighting will be realised.

Apart from the following themes and important work priorities in the project, such as;

- Estimation and evaluation of the energy saving on the market,
- Market penetration and efficiency of procurement (material and energy),
- Accomplishing larger renovation projects,
- Optimising tender contents and other documents,
- Acceleration of development regarding laws, standards and regulations,
- Customer requirements regarding administrative instruments and issuing of information,
- Practical tests of the project results in the communes and
- Propagation and duplication of the results.

Also finance technical instruments should be compiled in the project. The work package 6 deals with this theme.

When planning renovation measures for street lighting the savings realised by the reduction in electricity requirements and the savings arising from the reduction in maintenance and repair are included in the project economics. For this it is necessary that simple understandable EDV instruments be made available with which one can carry out the

corresponding economical calculations. It is further helpful to illustrate different financing possibilities of renovation projects in a calculation tool.

One possibility of financing saving measures in street lighting is the implementation of energy conservation contracting. This variant can be more cost-effective for the commune than by the implementation of communal own saving performances.

The energy agency of the Investitionsbank Schleswig-Holstein has compiled, within the framework of leading and processing the partial project "financial instruments“ together with a calculation tool for economical and financial calculation (calculation model) also a directive for carrying out an energy conservation contract with a model agreement (Saving Guarantee Contract for the lighting of streets, roads and places).
Furthermore, the calculation tool and the model agreement were matched to one another with regards to their data structure.

The project participants of the present project have agreed that telemanagement as an utilisation technique for intelligent street lighting should be concentrated upon.
Different examples of street lighting and different approaches of different European countries were examined in a short study within the partial project WP6 Contracting.
The energy agency has also illustrated a renovation case in conservation contracting in the area of telemanagement in the “calculation model”.

C. Work steps and Overview of the deliveries

Adapted standard EPC/ TPC contracts guidelines/ examples adapted to street-lighting (6.1)

- 6 calendar week (CW): contract between IB and Berlin Energy Agency (BE), including advices from the pre-preparation-meeting to WP6 and the kick-off meeting,
- 9. CW: Eltodo sent he main parts of the EPC of Prague,
- Query to the project-partners to send experiences and information's (example contracts, etc.), input from WP 2
- 10. CW: The IB discussed to cover the possibilities of Third Part Financing (TPF) in a Energy Performance Contract (EPC) with the Berlin Energy Agency.
- draft of street-lighting EPC in German Language,
- In cooperation with the Investitionsbank the "street-lighting EPC" was revised by consideration the requirements for EU and other important aspects from project-partners,
- The Berlin Energy Agency sent the English version "street-lighting EPC" (two versions with annex) (June 06) to put it on the E-Street- Website.
- Final information exchange
- Completion of WP 6.1 by issuing an invoice from Berlin Energy Agency to Investitionsbank
- Project meeting in Berlin, November 2006: presentation and final discussion
- Finish of subproject 6.1

Survey of deliveries

- **Guideline for saving contracting in street-lighting** (long version)
- Guideline for saving contracting in street-lighting (short version)
- **Saving Guarantee Contract for the lighting of streets, roads and places** (With metering energy consumption)
- Saving Guarantee Contract for the lighting of streets, roads and places (Without metering energy consumption)
- Saving Guarantee Contract - Annexes
- Project meetings: different presentations

Calculation model, database/ Excel worksheet for evaluation of economic efficiency (6.2)

- 7. CW: Inquest of existing calculation models or parts of calculation models and description and definition of main terms
- Allocation of the basics for calculation model: Input, Algorithm, Output (also results from 6.1!)
- query to the project-partners to send experiences and information's
- decision database/ Excel worksheet
- discuss financial indicators, running costs, different electricity costs in each country
- development of the calculation model as a worksheet and preparing a manual until 06 / 2006
- feedback from project partners 07-08 / 2006
- Final discussion, i.e. There is no possibility (and no aim) to put in traffic- safety- data, cause the calculation model uses only "hard"- calculated costs.
- Final revision of calculation model and manual in 08 / 2006, 12/2006, 07/2007: The manual is created as a small user guide. Other information's are directly in comments in the calculation model.
- The calculation model is created also for non technical persons, to use it in an easy, practical and practice-orientated way.
- Project meeting in Oslo, May 2007: presentation and final discussion
- Finish of subproject 6.2

Deliveries

- 1. Calculation model (worksheet) and 2. Manual / User guide:
  Street-lighting software development:
  Calculation model for evaluation of economic efficiency
- Project meetings: different presentations

Pilot cases Financial instruments (6.3)

- Presentation of E-street- projects in 1 conference and 2 workshops in Germany.
- Test of the calculation model (excel-sheet of 6.2) in projects by the project partners.
- Positive feedback from project partners, that the calculation model is a very helpful instrument.
- Completion of WP 6.3 (part “Status quo on Street Lighting Contracting in Europe”) by issuing an invoice from Berlin Energy Agency to Investitionsbank
- Feedback from project partners
- German pilot cases (in the calculation model)
- Project meeting in Oslo, May 2007: presentation and final discussion
- Finish of subproject 6.3

Deliveries

- short study about pilot cases of financial instruments:
  Status quo on Street Lighting Contracting in Europe
- Report: Pilot Cases financial instruments (Feb 07)
- Project meetings: different presentations

D. Guideline for saving contracting in street lighting (6.1) (short version)

Berliner Energieagentur GmbH

August 2006

(on behalf of the Investitionsbank Schleswig-Holstein)

August, 2006

Guideline for Saving Contracting in Street Lighting

Short version

Index of contents

D.1 Overview of Procedure

Saving Contracting projects usually are complex projects requiring thorough preparation and appropriate know-how. Therefore, anyone not yet familiar with the subject should seek support from energy representatives, energy agencies, consulting firms or responsible persons of current projects. Furthermore, a functioning energy consumption and cost registration is one of the most important prerequisites for successful project preparation and development. The time needed until project implementation is approx. 6 – 12 months from project development to contract conclusion.

After the decision of the owner of the street light to implement such a project the lighting system needs to be evaluated in the course of project development and the **operating (energy and maintenance) costs baseline** needs to be determined to serve as the reference value for the operating costs in the contractual period of the *Saving Guarantee Contract*. Furthermore, the **system requirements** should be defined already at this stage. This requires clarification of the interfaces with regard to maintenance and above all definition of the minimum savings to be expected and the client's share in it.

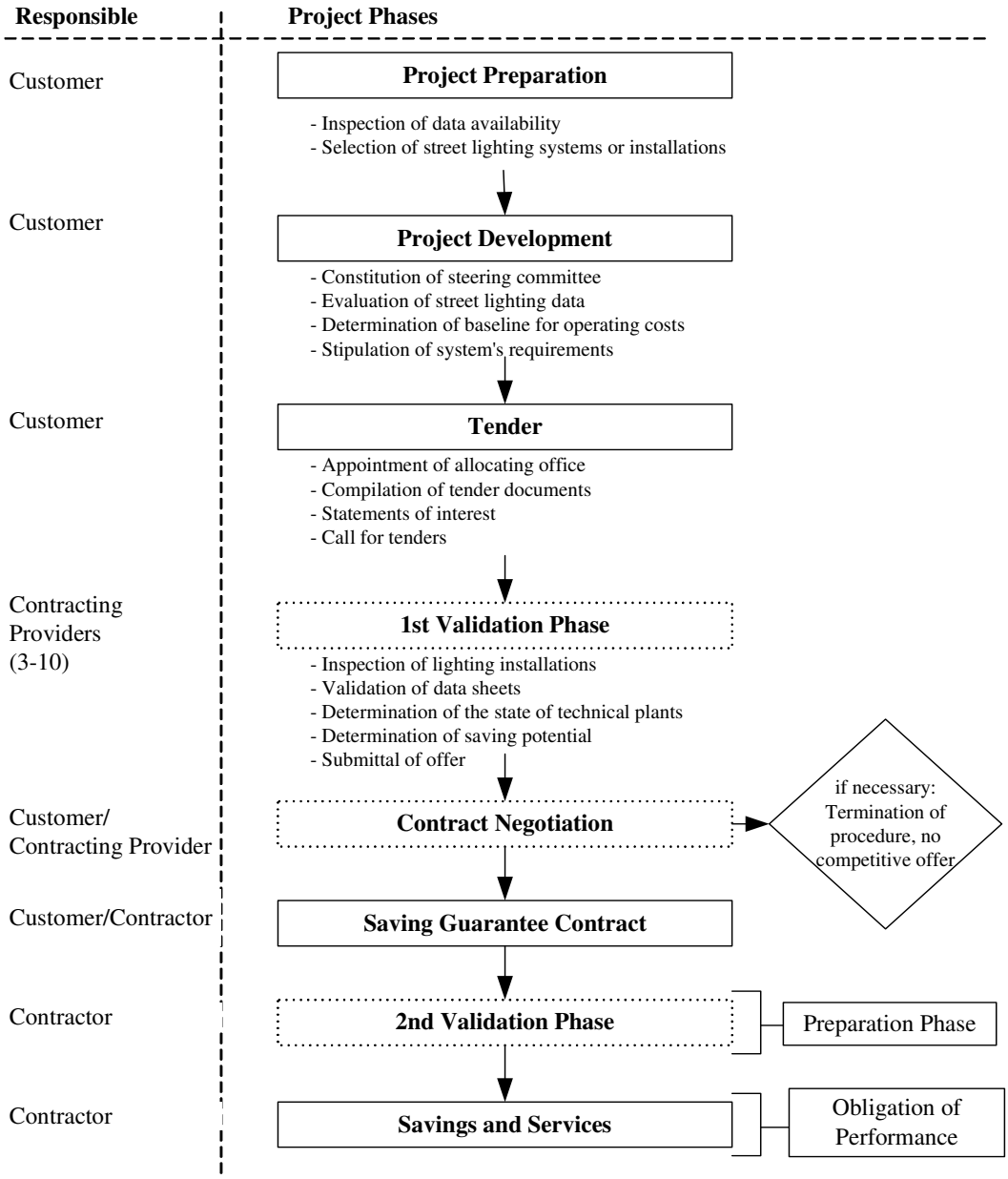
The client compiles the tender documents with the *Saving Guarantee Contract* as a main component. The next step is publication in the official gazette, other official publications for public contracts and above all in special databases. Prospective bidders may then express their interest and those apparently best suited are invited to tender in a **functional invitation to tender**.

The bidders are given the opportunity to inspect all installations and devices and validate the technical data. The most important characteristics of the tenders to be submitted are the guaranteed cost cuttings, data on investment volume and structure and on the required extent of maintenance. The best offers should be substantiated as the **negotiation process** progresses; only after this step the best bidder is finally selected.

Following the conclusion of the contract, the Energy Service Company (ESCO) implements the saving measures in street lighting system during the **preparatory phase**. Only on completion of the preparatory phase the **period of main obligation to perform** will commence in which the savings achieved are determined and the ESCO will have to answer for his saving guarantee.

The following figure shows the steps and responsibilities for the project preparation, development and the implementation of the Saving Guarantee Contract:

Implementation of Saving Guarantee Contract



Regarding the implementation and realisation of contracting projects there are some general issues to consider. Contracting is a win-win model for both partners, but it needs good preparation and partnership collaboration on the basis of adequate and proven contract models like the Hesse Energy Saving Guarantee model contract for Saving contracting projects in the building sector. The Federal Environmental Agency of Germany (UBA) states that the ecological and economical benefit of Saving Contracting depends significantly on the quality of the tender and the evaluation of offers.

D.2 Project identification and preparation

First step is the inspection of data availability and a selection of appropriate parts of the street lighting system for the Saving Contracting project. A fundamental element of the project identification process is the **energy audit** (expert examination). The results of the audit indicate the technical scope of the necessary refurbishment measures, the prospective volume of investment, and a cost-benefit ratio, which is a starting point for the definition of the financial needs.

A street light analysis including costs for energy and maintenance tells the extent of the economic saving potential. In the course of a street light analysis, the possibilities of technical improvement are identified and economically assessed. Measures are considered efficient if the cost savings are sufficient to cover investment costs over a certain period of time.

Principally, if **there is no street light analysis available** the following approaches are possible:

- You commission a street light analysis,
- You contact an ESCO directly, or
- You assess the energy and maintenance savings potential according to street light-specific indicators. For the assessment the calculation tool developed in the E-Street project can be used.

If the public authority commissions a **street light analysis**, you will get a detailed picture of the savings potential of the street light installations in question. There is, however, the disadvantage that such an analysis requires a lot of time and money. It may be necessary for the street light owner to employ an external partner.

You can also directly commission a neutral **Energy Agency** to examine the suitability for a Saving Contract project. An experienced company will, without too much effort, be able to tell you whether or not a Saving Contracting project is worthwhile for the object in question.

The third alternative is to assess the lighting according to selected **street light-specific indicators**. Based on these indicators (in particular: lamp-related energy consumption and maintenance costs per year) one can assess, in a relatively simple (and therefore both time- and cost-saving) way, whether a street lighting system offers favourable conditions for a Saving Contracting project. The indicators of the street lights in question must be compared to the respective desired value. The desired energy values for the use of energy of old and new street lights can be found in the National Standard.

Table 1: Specific Indicators of Street lighting

Indicator	*Bad values*	Actual average values	*Desired values after renovation*
Luminous efficacy [lm/W]	*< 60*	50 – 80	*90 – 120*
Nominal lifetime [h]	*8000*	15000	*18000*
Failure rate after 16,000 h [%]	*30*	15	*5 – 10*

If you wish to carry out energy-oriented improvements in street lighting, you should aim to reach the indicators given in table 1. If the **actual values** of the respective installations are significantly different than the **desired values**, one can assume that the street lighting system in question shows an economically viable potential for the reduction of operating costs.

Which requirements have to be fulfilled for an economical Saving Contracting?

- above-average energy consumption, energy and maintenance costs
- a long term usage concept
- guaranteed contractual relationships and ownership

D.3 Project Development

The next step is the constitution of a steering committee that works out targets and a time schedule. On the basis of energy and maintenance costs the reference value for the contractual period - the so-called **operating costs baseline** for the expected savings - is calculated. This can be done for energy costs on the basis of existing utility bills or calculative regarding number of lighting points, energy consumption, yearly operating hours and the definition of reference prices, while the costs for maintenance depend on material costs, wages, cleaning and disposal costs for a single change of lamp. Detailed calculation models can be found in the *Calculation Instructions (Annex 8).* The operating costs baseline is the sum of all operating costs for the last annual period before the beginning of the planned Saving Contracting.

The steering committee now has to stipulate the **system requirements** for the bidding documents with the **minimum level of operating cost savings** (e.g. 15% compared to the operating costs baseline) and other general conditions. From the targets defined for your Saving Contracting project, criteria can be deduced for the assessment of incoming offers. In addition, it has to be decided whether to give the Energy Service Companies a certain predefined general framework for preparing their offers. Set standards make it easier to

compare incoming offers. A general framework should be established for the following general aspects:

D.3.1 Duration of Contract

The longer the period available for the amortisation of investment expenses, the easier it is to also include less efficient energy-saving and/or more expensive investments in the project. It is easier to compare different offers if the ESCOs are given a definite contractual term on which to base their offers.

D.3.2 Quality criteria

To avoid inconveniences between the contract partners the client should predefine minimum desired quality criteria for all parts of the system and compile these. This should include aspects like minimum lifetime expectations, protection rates, design, luminous efficacy or possibilities to dim the lamp. All equipment provided and installed by the ESCO will have to meet at minimum these criteria.

D.3.3 Standards

In Germany there is no duty to retrofit old installations after the coming into force of DIN EN 13201. There is, however, the duty to follow these norms for any new installations and refurbishments. The contactor has to follow these regulations for any refurbishment and it also might have to be considered for the preparation of the operating costs baseline. If refurbishment measures are applied for older parts of the street lighting system, the baseline may have to be calculated for the theoretical energy consumption if the old installation would fulfil the DIN EN 13201. This is due to the fact that energy saving measures might not show their full saving potential because the DIN has to be followed and e.g. additional lighting posts are necessary.

D.3.4 Investment Costs Grants

If a measure is to be implemented by means of Saving Contracting, sufficient economic efficiency is a precondition. On principle, less profitable energy efficiency measures can be cross-subsidised within a whole package of measures. As an alternative, such measures can also be included in a project if the client offers to contribute to the investment costs. Such financing is called “additional contribution model” and may also enable the realisation of compulsory measures and/or a reduction of the contract duration. Subsidies make sense if the client can obtain more favourable terms of financing or if the attainable savings do not completely cover the ESCO’s expenses within the desired contract period. You should inform the ESCO on a willingness to grant a contribution towards investment costs at the beginning

of the tendering procedure to make it possible for the ESCO to consider this factor in their project calculation.

D.3.5 Financing

The following refinancing variants and contract constructions are possible, subject always to the precondition that funds are available (each separately or in combination):

- The client takes over all costs (full subsidy)
- The client takes over a reasonable portion of the costs (part subsidy)
- The client waives his share in the cost savings
- Longer contract duration
- Combination of Saving Contracting and energy supply contracting

D.4 Tendering procedure

The search for the best Saving Contracting provider begins. The project is advertised for bids. The offers received are compared and individually negotiated. Based on the suitability criteria stated, bidders are selected which will receive the tender documents and are invited to submit tenders.

The bidders are now given the opportunity to inspect the lighting system, validate the technical data, and perform a **draft analysis** with regard to energy on which they will base their tender. Through a call for tender the **most appropriate provider** will be found and charged with the financing, planning, implementation and maintenance of saving measures for these street lights.

Even if a public call for tender is not necessary for you, as a client you will, as a rule, profit from awarding a contract on competitive conditions.

D.4.1 Invitation to Submit Tenders / Call for tenders

The amount of time and money to be spent on the second stage of the awarding procedure depends on the estimated project scope. As a general rule, one can say, the larger your project, the more time should be invested in the preparation of the tender documents. If the project is small, it will be enough to lay down a number of essential framework conditions. As for larger projects, in order to reach your targets, it is important to use the basic principles described in the following section as a means of orientation.

D.4.2 Contents of the Tender Documents

It is helpful and/or necessary to address various aspects in the tender documents of a Saving Contracting project:

- subject matter and targets of the project
- tips for preparation of documents
- determination of remuneration
- general framework
- a draft of the Saving Guarantee Contract
- time planning
- assessment criteria
- street light installation-specific data

D.5 Validation phase

It is assumed that all costs covered by ESCO in connection with operating efficiency investment shall be repaid from the operating cost savings achieved. Thus, the savings achieved during the effective period of the contract have to be large enough to cover the bank interest and the very costs of the investment as well as the costs incurred by ESCO in connection with the provision of operation services.
In order to assess whether the savings achieved will cover all the costs incurred by the ESCO, a detailed analysis has to be carried out by the ESCO. The focus of this analysis is:

- precise assessment of the technical condition of the applied street lights,
- identification of all potential savings that could be achieved,
- planning of improvement measures and the scope of the modernisation,
- precise determination of shares in the investment and in the operation costs.

The specification of the street light's technical parameters before and after the modernisation makes it possible to determine the level of energy savings. Then, those savings have to be presented in the financial dimension.
The identified technical parameters and financial possibilities create a basis for the planning of the optimum modernisation measures, the guaranteed savings and the calculation of own costs and risks by the ESCO. This basis is used for the offer of the ESCO.

D.5.1 Identification of the best offer

The best offer will be determined from the incoming offers with the help of a defined procedure. The bidders have to be aware of the procedure and the criteria for identifying the best offer. The criteria are based on the predefined priorities and also the weights assigned to individual criteria may differ.

During the evaluation of the offers, both financial and non-financial effects of the selection of a particular offer should be considered. In order to be able to assess an offer comprehensively, the assessment of these two parts must be combined.

Monetary Assessment / Evaluation

A Saving Contracting contract leads first of all to a reduction of energy costs. However, during the contractual period other costs (e.g. maintenance costs) may be reduced too.

To compare the offers **all cost categories** under which changes will take place as a result of the ESCO's work (e.g. yearly share in the savings, operational costs etc) have to be considered.

A method to compare the different guaranteed yearly energy cost reduction is the **"net present value method":**

$$K = \sum_{t=1}^{t_v} E_t \cdot (1 + i)^{-t}$$

- K net present value of savings over the entire operating life with the interest rate i, at time t=1
- E_t saving in the year t
- i interest rate (e.g. 0,06 for 6 %)
- t_v contract duration

As savings achieved may be different in different years, it is most profitable to take into consideration the effects to be achieved over the whole period of operation of the installed equipment and elements, and to measure the project's economic effects by means of its net present value (NPV).

Non-Monetary Evaluation

The following non-financial qualitative evaluation criteria can be applied:

- reduction in the emission of pollutants,
- quality of the products,
- energy management measures,
- guarantees for maintenance and service,
- the ESCO's references and experience in implementing similar projects.

In this context it is necessary for you to formulate the criteria for the assessment of the qualitative effects of these measures on the basis of your project targets and to weight them according to their respective importance.
Using the **point system** or a **"cost-benefit analysis"** adopted for the project, it is possible to identify the offer which as a whole meets the non-financial requirements best. However, it should be remembered that the evaluation of non-financial effects is usually non-objective and as such should be carried out independently by several persons.
The following table includes a model form to be used for the cost-benefit analysis for the evaluation of the best offer **(the weighting may be adapted):**

Table 2: Cost-benefit Analysis for Saving Contracting

			assessment													
	criteria		0	1	2	3	4	5	6	7	8	9	10		Weigh-ting	points
1a	Net present value of the budgetary relief within the contract period (guaranteed savings less basis remuneration)	Low	(Rating is calculated)											High	35	
1b	Net present value of the budgetary relief after the end of contract	Low	(Rating is calculated)											High	8	
2	Investment in hardware	Low	(Rating is calculated)											High	35	
3	Reduction of CO_2-emissions	Low												High	3	
4	Compatibility of energy concept with existing structures	Low												High	3	
5	Compliance of energy management (measuring and metering concept) with the characteristics of performance features	Low												High	3	
6	Services offered maintenance/ troubleshooting	Low												High	10	
7	Quality, useful life and future availability of replacement parts	Low												High	3	
	Sum														100	

We would like to point out once more that tender assessment is a sensitive area. Quantification often gives the impression of a high degree of objectivity, but it is merely an expression of subjective will and individual objective. However, the cost-benefit method used and explained here will meet with the best acceptance among bidders, as the underlying economic principles to a great extent correspond to the calculation principles of the enterprises.

As a rule, hard criteria should always add up to more than 75% of the weighting. Too detailed scaling for soft assessment such as from 1 to 10 is not very plausible in practice. Scaling will be easier to justify if it is coarser, as in the example below:

10 points Very good, ideal
8 points Good, fully realisable
5 points Good, but with minor flaws
3 points Satisfactory, with major flaws
0 points Not realisable, not existing

D.5.2 Optimisation of offers / Conclusion of the contract

The bidders explain their offers, and the most appropriate Saving Contracting provider with the best offer is found. Based on the offers submitted by the ESCOs, it is possible to negotiate with the bidders any changes required in the offer. The Saving Guarantee Contract, finally signed from client and ESCO, is the result of these negotiations.

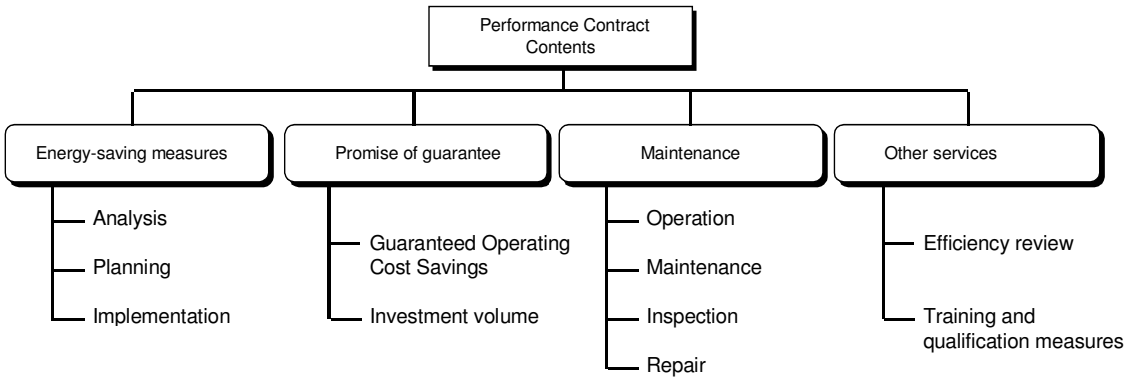
D.5.3 Final result

If one and the same offer turns out to be the best according to both financial and non-financial evaluation criteria, it should be selected as the winning one. If the two evaluation procedures give different results, all subjective criteria should be considered in detail.

D.6 Saving Guarantee Contract

This contract serves as a contractual framework for the implementation of Saving Contracting models. Since Saving Contracting is a comprehensive concept ranging from the planning of measures via their implementation to guaranteeing the cost-saving results, the contract regulates a whole series of services.

The analysis, planning and implementation of saving measures, including a permanent guarantee of the saving effect, are the central services contained in the Saving Guarantee Contract like the following figure:



In general, it is recommended that the contract that is to be used as the basis for the Saving Contracting project is always drafted by the client himself, and that tenderers are then invited to submit their offers on the basis of this contract. In the course of the final negotiations, individual items of the contract can then be adapted or specified.

Even though each Saving Contracting project must be adapted to the relevant project environment as well as to the client's specific interests and situation, a model contract can serve as a valuable standard tool and can provide the client with useful information and assistance.

E. Manual for “Street-Lighting”- software development: Calculation model for evaluation of economic efficiency (6.2)

Investitionsbank Schleswig-Holstein

EIE-05-157 E-Street project
Financial Instruments - Work Package 6

Manual for “Street-Lighting”- software development:
Calculation model for evaluation of economic efficiency

Investitionsbank Schleswig-Holstein
Energieagentur
Fleethörn 29 - 31
24103 Kiel
www.ib-sh.de

Dipl.-Ing. Wilfried Gabler
Mark Michling
Tel. 0431 / 9905 – 3662
wilfried.gabler@ib-sh.de

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Index of contents

Manual for "Street-Lighting"- software development:
Calculation model for evaluation of economic efficiency

E.1 Basis

The financial situation of the street-lighting can be positively influenced by using the replacement or relamping situation or the normal replacement of equipment in combination with the implementation of Telemanagement. The calculation method of the present software will show technical measures and the direct effect to the payback- period of the investment; in other words: Is the project profitable or not?!

The software programmed in MS Excel 2002. To reach the aim, it was better to choose calculation software, than database software.

This report is written as a guideline or reference book, most there are used listings. A main aspect is, to find the information in an easy way.

Most of illustrations are described as a comment in the work-sheet!

The basis parameters are recorded in chapter 3.
The Enlight- report describes further information's in detail:

- main terms lighting engineering:
  www.energiekonsens.de/Downloads/Projekte/Enlight-Zwischenbericht.pdf

The software development conforms to requirements of deliverable D6.2. The Investitionsbank Schleswig-Holstein is not liable for defects of the software and for their consequences and also not liable for damages.

E.2 Work steps

In the majority of cases the software products are strictly subdivided into

- data input
- calculations and
- data output.

In our case it is important, to lead the user through the worksheet. So it makes a difference to classic software-models. In this “street-lighting”- work-sheet the user can see directly the results and the effects after the data input.
There will be very different kinds of the potential software- users with different know-how, like planning offices, ESCO´ s and municipalities, who are the decision makers for reconstruction of street-lighting.

E.2.1 Technical planning software for street-lighting-reconstruction

The results from planning software are the input data for the work-sheet:

- Technical parameters from lamps, ballast, luminaries, control equipment, etc. for the reconstruction of street-lighting and
- Basic economic data like investment costs of the measure.

E.2.2 Static calculation for first results about economic efficiency

After the technical planning of the street-lighting the work-sheet can be used:

Input parameters

- From 2.1
- Data from the electricity bill
  - Three different possibilities for basic input: costs for
    - electric work,
    - luminaire wattage
    - and taxes
- Data about operation mode of street-lighting

Output parameters

- Savings by (technical) measures
  - Electric power consumption and costs
  - Power
  - Maintenance costs
- Efficiency (static calculation)
  - Investment costs
  - Payback period
  - Average useful life of reconstruction

E.2.3 Financing of reconstruction by annuity-credit

An annuity credit / annuity loan is a loan, which is paid back in constant rates. Usually an annuity credit is used for real-estate credits. The rate which can be paid is called annuity and is the sum of interest payment and amortization payment. Since by the repayment the credit sum decreases, also the interest which has to be paid becomes lower, thereby the repayment part (amortization payment) in annuity rises.

Input parameters

- From 2.2: investment costs
- Credit
- Rate of interest
- Repayment rate
- Date of out- payment

Output parameters

- rest-capital
- Interests
- Paying back
- annuity
- Payment (End-user)

E.2.4 Financing of reconstruction by contracting

It is possible to simulate a contracting:

Investment for new installation = credit (from sight of ESCO)

- Investment costs for refurbishment
- Running costs for processing contracting, risk sharing, etc.

The annuity = contracting rate of End-user

E.3 Work-sheets and usage

Please prepare the worksheets from left to right.

Green fields = input

Grey fields = output, results

E.3.1 Basics (red sheet)

The main theme is the electricity bill, the main output the averaged electricity tariff, which is also used for the calculation after reconstruction.

Input parameters

- parameters of the project (project, acronym of project, agreement N°, municipality and the object)
- currency
- data from the last electricity bill
- VAT

Output parameters

- total electric work = energy consumption
- total costs for electric power (excl. and incl. VAT)
- averaged electricity tariff (excl. and incl. VAT)

E.3.2 Actual (yellow sheets)

Consumption

The luminaire wattage of the system depends on the lamp wattage and the kind of ballast. It helps, to use the work-sheet “data lamps”

Input parameters

- lamp information (description, type, number, luminaire wattage)
- operation method of the existing installation (operation hours, reduced power)
- cable loss
  (If using a segment controller, choose a higher percentage. There are 3 Watt loss, 24 h a day)

Output parameters

- total electric work (calculated value):
  Compare with the total electric work from the electricity bill!

Maintenance costs

Input parameters

- price per lamp (material) and labour costs for an exchange (incl. costs for manpower, cleaning and waste management)

Output parameters

- total exchange costs for the installation

Electric power and total costs

Output parameters

- electric power costs (calculated value)
  Compare with the electric power costs from the electricity bill (incl. VAT)!
- sum cost (maintenance and el. power)

E.3.3 New (green sheets)

The work-sheets “New consumption”, New maintenance costs” and “New el. power & Total costs” are used like the “Actual…” work-sheets, with the exception of:

Consumption

With the input “reduced power” different new situations (reconstruction) can be simulated, for example

- lowered light-time lighting,
- Telemanagement,
- etc.

For Telemanagement can be used following values for the “reduced power”:

- original installation 80 % (= 20 % savings)
- improved installation 60 % (= 40 % savings)

Maintenance costs

Input parameters

If the reconstruction is combined with a lowered light-time lighting or telemanagement, the additional maintenance costs must be added to the labour costs for an exchange:

- manpower,
- cleaning,
- waste management and
- lowered light-time lighting, telemanagement etc.

E.3.4 Savings (summary) (blue sheet)

Input parameters

The investment costs include the costs for the complete reconstruction (lamp exchange, luminaire exchange, etc.), also costs for lowered light-time lighting or telemanagement. For the efficiency- calculation the investment costs are costs for saving measures.
In the work-sheet there is the possibility to put in one summarized value.

Output parameters

- Saving of electric work and power
- Cost-saving by maintenance
- Cost- saving by electric work and power reduction

- Total cost savings
- Efficiency (static calculation)

3.4 Financing of reconstruction (purple sheet)

- Annuity- credit
- Simulation of Contracting

E.3.5 Diverse diagrams (orange sheets)

E.3.6 Data lamps, currency, percentage (grey sheet)

F. Pilot Cases financial instruments (6.3)

Investitionsbank Schleswig-Holstein

EIE-05-157 E-Street project
Financial Instruments - Work Package 6

6.3 Pilot Cases financial instruments

Investitionsbank Schleswig-Holstein
Energieagentur
Fleethörn 29 - 31
24103 Kiel
www.ib-sh.de

Dipl.-Ing. Wilfried Gabler
Tel. (+49 4 31) 99 05 - 36 62
wilfried.gabler@ib-sh.de

Kiel, 28.02.2007

Short study about pilot cases of financial instruments

Intelligent Road and Street lighting in Europe (E-Street)

EIE/05/157/SI2.419662

Status quo on Street Lighting Contracting in Europe

short study

Berliner Energieagentur GmbH

July 2006

(on behalf of the Investitionsbank Schleswig-Holstein)

Index of contents

F.1.1 Summary

Investments to improve the uptake of energy efficient lighting are among the most cost effective and practical energy efficiency measures and offer the EU one of the most immediate and effective opportunities to increase the security and reliability of energy supply. The new **Directive on energy end-use efficiency and energy services in EU** (Energy Service Directive ESD) aims to stimulate the final energy efficiency, the programmes and measures of energy efficiency. The ESD will stimulate and facilitate cost-effective investment in energy efficiency of different sectors like buildings and lighting.

The public owners of street lighting systems have the duty to keep the systems in order to ensure road safety and to fulfil the other functions of public lighting. The lack of public budget has led to a stagnation of investment in energy efficiency of the public street lighting, now there is a critical situation with regard to high operating costs and large refurbishment necessities without public funding possibilities. There is a “drive” towards cost reductions and outsourcing of these services, and such Public-Private-Partnership (PPP) models like Contracting and especially Performance Contracting can be successful tools to save energy costs and guarantee quality standards and maintenance of the street light systems. The study gives an overview on the two basic forms of Contracting with the focus on Performance Contracting (EPC). It includes short descriptions of examples projects with different Contracting models of street lighting in the study. Such examples can support municipal decision makers to start with such projects and will help to develop the ESCO market in Europe.

In the total lighting sector there is a large energy saving potential, the EU could save 4.3 billion euro in running costs through energy efficient lighting each year. In Germany 9.125 Mio. lighting points illuminate the public streets of the 14,000 municipalities. The study summarizes the results of market analysis for some example countries.
Besides the existing saving potential the development of the ESCO market including the clearance of obstacles of frame conditions and the providing of standards and model contracts are crucial for the implementation of Contracting solutions for street lighting in the European countries. The study describes the key issues, barriers and obstacles in general for the main Contracting models, the frame conditions in countries with developed Contracting markets and for most of the other European countries.

Finally the needs to develop new standards with the implementation of new technical specifications and norms, of more efforts regarding the convincing of the public owners of street lighting, transfer of know-how and dissemination of information and experiences are

summarized. For countries with a low level of ESCO market development and experiences in this field it is suggested to start with capacity building measures and first easy pilot projects for street lighting Contracting.

F.1.2 Introduction

The new **Directive on energy end-use efficiency and energy services in EU** (Energy Service Directive) aims to stimulate the final energy efficiency, the programmes and measures of energy efficiency. The objective is that of increasing the efficiency in the final uses of energy by means of operational measures. One of them is the development of the energy service market for energy efficiency to be integrated in the national energy market. The Directive achieves its aims by providing a series of regulations for the promotion of the *energy service market* and the *market of measures for energy efficiency* in those sectors of final uses of energy. The Directive sets an energy saving target that member states will have to fulfil as requirement in order to measure the progress obtained in energy efficiency and to create an adequate level of energy services demand. It provides also an energy saving target for the public sector, together with the obligation for member states to ensure to the customers the offer of energy services by companies for energy supply and/or retail. The Directive will stimulate and facilitate cost-effective investment in energy efficiency and will foster the development of ESCOs by requiring member states to remove barriers to ESCOs and Third Party Financing (TPF).

The new Directive will support the development of existing large energy efficiency potential in such important sectors like buildings and lighting, to reach such goals like greenhouse gas emission reduction and saving of energy resources. Besides other sectors there is a large need in investment in energy efficiency of the public street lighting, and TPF is a powerful tool to get such investment without additional public investment. In this connection some existing and widely-used standard models from the building sector can be used or must be adapted for street lighting environment.

Street lighting systems are normally owned and operated by public bodies like street authorities, municipalities and special public owners of sites. There is a “drive” towards cost reductions and outsourcing of these services and such Public-Private-Partnership (PPP) models like Contracting and especially Performance Contracting can be successful tools to save energy costs and guarantee quality standards and maintenance of the street light systems.

Street lighting Contracting generally means **operating and financing procedures for the provision of specific energy services** for owners of the street lighting systems. It may also contain the cost effective delivery of electricity (and in some cases also gas) for the owner of

the system. There are also models with combination of using Renewable Energy Sources (RES) and/or integration of replacement measures of existing components/systems, energy metering and billing, Life Cycle Cost Assessment (LCCA) as well as interfaces with other customer services.
These procedures aim at cost effective energy supply and/or saving of energy and cutting costs by modernising and optimising necessary functions of system automation installations. Thus, Contracting is not just a financing instrument, but also includes essential elements of operation optimisation and management up to user motivation.

Differentiation of Public Private Partnership models
Third Party Financing (TPF) as a kind of Public Private Partnership is a well introduced tool to finance energy efficiency measures in buildings and other facilities. Especially Performance Contracting has become an instrument to realise relevant CO_2 emission reductions. Considering the specific limits, the different Third Party Financing concepts from Operation Contracting and Performance Contracting offer relevant advantages for an efficient management and refurbishment of public street lighting systems as well as the possibility to reduce operation costs.
From the customer's perspective, a Contracting project can be financed in one of three fundamental ways (1) through self-financing, (2) debt financing, or (3) third party financing. Also the ESCO has again these three fundamental ways to finance a project in which it engages. The may also use its own funds to finance the investment, which should ultimately be self-financing (in some cases with a subsidy for expensive investment measures by the building/street lighting owner), or use debt or third party financing.

The main distinguishing feature of Contracting is, that the service company obliged under the contract bears the risk (or major parts of the risk) of the street lighting and installation management with regard to energy and thus, of course, at the same time is given the chance to gain its own appropriate profit if the intended improvement in efficiency is actually achieved. The task undertaken is characterised by a more or less high degree of multidisciplinarity.

Basic models

Although in recent years the most varied models have emerged, a basic structure can still be determined which has led to the following widely recognised classification. Depending on the system approach or aim of Contracting, the following two basic forms can be distinguished:

- **Energy Supply Contracting** (also called Facility Contracting or Energy Delivery Contracting/delivery of useful energy) - EDC
- **Energy Performance Contracting** (also called Energy Saving Contracting) – EPC.

Both of these basic models and especially the EDC are widely-used in several building sectors, but also in several combinations and variants e.g. for the lighting sectors. The services in the field of energy services in the lighting environment offered by different companies range from project development, over operation, "light supply", servicing and maintenance, up to complete reconstruction and financing.

Thereby, it can be differentiated between pure service models, in which the lighting **remains in the ownership of the municipality**, **a complete transfer of the system to the private company** or rather a **combination of both models**.

In the lighting sector basically **three different models** of Contracting can be differentiated:

- Lighting Contracting (operation or facility Contracting)
- Light supply Contracting (supply Contracting)
- Performance Contracting

	Lighting Contracting	**Light Contracting (Light supply Contracting)**	**Performance Contracting (Energy saving Contracting)**
Applica-tion	Refurbishment of the lighting devices	Renewal, replacement and /or supplementing investments of the lighting system and additionally the operation of the lighting	Energy saving measures
Services	Financing (optional), Planning of the refurbishment, Installation and	Financing (optional), Planning of the refurbishment, Installation and maintenance, Additionally: Whole operation	Financing, Planning, Installation, maintenance and support of specific energy saving measures

	maintenance	of the lighting points including purchasing of the energy	
Financing	Contracting rate as remuneration for the services	All costs for the supplied light (Contracting rate with basis and working price)	Contracting rate as remuneration for the energy and operating cost savings achieved
remarks	For single refurbishment measures including maintenance	For total refurbishment/complex solutions including operation, can be combined with leasing/buying model	For more complex solutions with high saving potential; not so widely used (often combined model with subsidies of the lighting owner for refurbishment measures)
Type of Contracting	Facility Contracting	Supply Contracting	Performance Contracting

F.1.3 Examples

F.3.1.1 Street lighting Contracting projects

Example: Free Hanseatic City of Bremen (Light Supply Contracting, combined with a sale model)

A complete sale of the public lighting system to a private service company with an acquisition of maintenance, refurbishment and electricity supply for 20 years was resolved recently by the Free Hanseatic City of Bremen. The public lighting of the Free Hanseatic City of Bremen covers about 59.000 lamps. The Free Hanseatic City of Bremen decided in June 2004 to improve energy efficiency and traffic security by additional passages within the new contract for light supply Contracting. With the year 2005 the new contractor started to operate the lighting points of Bremen. The contract runs 20 years to 2024 and commits the contractor:

- To reduce the power density from today's 3.52 kWh/km to 3.31 kWh/km which results in a connected power reduction from 5,300 kW to 5,000 kW
- To substitute 10 % of the total luminaries by new efficient and insect protecting lamps until 2010, which will mostly be based on the technology of energy saving lamps, this will result in 2,500 new lamps

- To invest at least 1 Million €/year into the system
- To optimise energy saving switching mechanism by half night switches and voltage lowering

The contractor planned to refurbish the remaining 8.000 lamps during the contract period until 2024. It is also planned to replace all mercury vapour lamps (about 10.500) to more efficient lamps with luminescent material.

Example: City of Prague (Light Supply Contracting)

The City of Prague was in trouble with efficiency of administration and maintenance of public lighting as well as with investment. For this reasons Prague decided to pass on the responsibility for the public lighting via PPP methodology to the private company ELTODO - CITELUM on the basis of public tender for the years 1999 - 2013.
Total savings in public lighting in Prague was achieved via miscellaneous technical and organizational measures:

- Installation of sealed luminaires with high IP (ingress protection of light active part of luminaire 65 and higher)
- 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 devices for reduction of luminous flux in night time with reduced traffic flow such as lighting power control units located in power supply or specially equipped ballasts
- Optimization of maintenance
- Consistent register of the acquisitions via information systems

The PPP model is a Light Supply Contracting combined with a leasing model with following essentials:

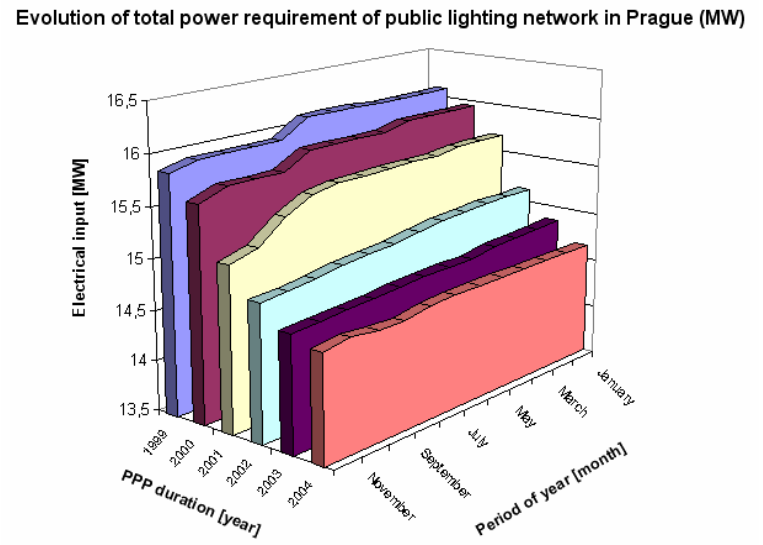
- Long-term Contracting relation between the ESCO (ELTODO - CITELUM) and city of Prague (15 years, 1999-2013).

- ESCO provides administration, maintenance, operation of public lighting (and town clocks) and purchasing of electrical energy.
- ESCO makes investments in renovation of devices of public lighting network (renewing of at least 30% of the devices during first 5 years of contract).
- Periodical exchange of light sources by the ESCO.
- Remuneration of the ESCO services via a Contracting rate (sum of negotiated working price for operating, managing, maintenance services including energy consumption costs and basic price per lighting point for whole activities) by municipal authority.
- Devices of public lighting network remain in property of municipal authority, but are leased to the ESCO for a yearly leasing rate.
- Municipal authority provides controlling activity.

According to the basic document for maintaining of public lighting in Prague "Conception of the renewal of the public lighting 1999 – 2013" is running replacement of the luminaires and more than 90 % of the luminaires were replaced during the first seven years of the contract. Planned replacements in the number of the units or in the length of the cables as well as real replacements are shown in the table below. Total number of the luminaires in the Prague is 136 690 on the date 31.12.2005. Total electrical input of public lighting network was reduced from 16 MW before 1999 to 14,5 MW at the end of 2004. The real 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.

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

The year - long consumption of electrical energy in public lighting network has been declining about 7 GWh during the first six years of PPP. Replacement of the luminaires have played key role for reduction of electrical energy consumption in the process of public lighting reconstruction. Monitoring of electrical input for single months of PPP duration is shown on the figure below.



Evolution of total power requirement of public lighting network in Prague (MW) 1999 – 2004

Example: management of the public street lighting of Berlin (Lighting Contracting/management)

The company AT.LUX got 2000 a contract for the maintenance of the 185.000 lamps of the public street lighting system from the city of Berlin, the service fee was about 10 Mio. €/year. There were a extension of the contract, and since end of 2003 the new Stadtlicht GmbH (subsidiary of Dutch company Nuon and German utility Stadtwerke Leipzig) is responsible for the maintenance of all 185.000 electric and additional the 44.000 gas operated lamps. Although there were additional quality standards agreed, the contract model is not sufficient to fulfil all requirements of the city with regard to increasing refurbishment necessities in the street lighting system, especially under the public budget shortages. Therefore the city is searching for a new PPP-model, the tender for the consulting services was in 2005. After the final decision for a model the city will award a new contract.

Example: management of the traffic lights in Berlin (Lighting Contracting)

The company Nuon Stadtlicht GmbH got a contract for the modernisation and maintenances of all 2.000 traffic lights in Berlin. The contractor is responsible for the comprehensive refurbishment and the operation of the system, first measure is the changing of 618 oldest traffic lights to modern LED lights. The contract duration is 10 years, the city will pay the total amount of 126 Mio. € for the services to the contractor. Before this contract the city had to pay yearly at least 10 Mio. € for maintenance and 2,6 Mio. € for new traffic lights, now the saving of operation costs (and the public budget) are 10,5 Mio. € for the whole contract duration.

Example: municipality of Gunskirchen, Austria (Performance Contracting)[1]

Gunskirchen started in the year 2003 an EPC project, with the aim to renovate the street lighting installations in the whole community area and to save costs and energy with this action. The EPC contract between client and the ESCO EWWAG was signed in august 2003 for a duration of 10 years.
With the exchange and renovation of pillars, the implementation of new lighting control devices and the enlargement of the street lighting energy savings of 24.615 kWh per year and a reduction of the energy costs of 3.200 Euros per year are guaranteed. Also a reduction of 7,4 tons per year carbon dioxide is guaranteed. The total investment amounts 138.930,58 Euros. A financial support of 3.603,70 Euros from the regional government was given to the municipality with the condition to use this money for refunding.

The municipality wanted to reduce failures in the street lighting and in combination with that to reduce the grievances of the citizens. This should also be reached with the implementation of the best available technology. In the contract was also fixed that the maintenance of the street lighting has to be done by the ESCO which causes less work in administration, maintenance and operation for the municipality.
As results of the project, the municipality of Gunskirchen mentions that all the guarantees of the contract were fulfilled: all the pillars were exchanged or renovated and the new lighting control devices were implemented. An effect of the third party financing project is that the lighting will be reduced during night time by reducing the lighting power by special lighting monitoring devices. This reduces costs and saves energy.

[1] Summary from “Catalogue of best practices of energy efficiency services in 8 European countries”, September 2005, IEE project PU-Benefs

The functionality of the street lighting was generally improved with this project and failures are now very seldom.

Example: municipality Gerasdorf, Austria (Performance Contracting)

The company Ökoplan GmbH performed comprehensive measurements and audit measures and developed the following measurement catalogue:

- renewing of lamps
- increasing of the intervals between the pylons
- re-fitting of meters
- adjustment control of voltage

The saving prognosis was 22.238 €/year for electricity costs and 9.084 €/year for maintenance cost. The contractor Ökoplan got the order for the Performance Contracting and is getting the remuneration for the services from the real savings over the contract duration of 9,2 years.

Example: municipality Schärding, Austria (Lighting Contracting)

The public street lighting was refurbished in 2002 and financed via a Contracting model. The total investment was 223.500 €. The following savings are guaranteed by the contractor: a saving of 30 % of the electricity costs per year and the reduction of the electricity consumption from 228.278 kWh to 140.728 kWh per year.

Example: municipality of Tukums, Latvia (Lighting Contracting)

In June 2002 a tender, addressed to ESCOs, has been announced for implementing an efficient street lighting system in Tukums. At the end of September 2002 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 operation and management. The main measures undertaken by the ESCO in order to achieve and guarantee the savings were

- 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.
Total project costs for efficient lighting project in Tukums amount 395.000 € (Financing model: subsidy from Tukums Council: 127.000 € as bank loan, contribution from ESCO: 268.000 €, of which 136.000 € loan from LEIF - Latvian Environmental Investment fund, and 132.000 € private bank loan).
The estimated savings are 630.000 kWh/a (about 37.000 € in 2002) and 365 t CO2 reduction/a.

F.3.1.2 Contracting projects with measures on building lighting

Example: Penitentiary Tegel/Berlin (Performance Contracting for a building complex, additional refurbishment of tracing illumination)

The contract for the Energy Saving Partnership between penitentiary Tegel and MVV Siemens Building Technologies GmbH & Co. OHG was signed on April 28, 2004. The project has been developed and managed by the Berlin Energy Agency. On basis of an energy cost baseline of 1.8 million Euro the contractor guarantee:

- to save 33 % energy costs over a contract period of 12 years which correspond to 162,000 Euro per year
- to reduce the CO2 emissions about 4,700 tons per year
- the refurbishment measures and the modernisation of the energy systems runs from the heating system to tracing illumination/outside lighting system

Example: municipality of Neunkirchen-Seelscheid, Germany (Performance Contracting of lighting systems in public buildings)
In cooperation with the energy agency NRW the municipality Neunkirchen-Seelscheid managed to realise the urgently necessary refurbishment of the lighting via Contracting first for a small gymnasium of the secondary school and then for further real estates as coliseum, primary schools, the secondary school, the aquarena indoor swimming pool and a kindergarten. Since the conclusion of the contracts spanning ten years with the company Eurolux AG the old lighting has been removed by the contractor and was replaced by luminaires which conform to the best available technology. This improvement could be approached without any financial costs for the municipal budget.
New in this project is the integral claim of the “saving” by the municipality Neunkirchen-Seelscheid. Thus, not only pure monetary aspects are in the focus, but also environmental aspects and business management reasons. So the costs referring to the total economic life-time of the goods are considered and evaluated.

The lighting concept focus has been laid on the installation of modern best available technology. For example the connection power in the secondary school Neunkirchen could be reduced about more than the triple from 61.5 Kilowatt to 18.13 Kilowatt. The energy costs such as for the lighting in the multipurpose gymnasium Neunkirchen could be reduced about 10,000 Euro per year.
The lighting refurbishment has achieved an yearly reduction of 590,000 kWh. With this effort the CO_2 equivalent emission could be reduced about nearly 400 tons per year. Neunkirchen-Seelscheid is GreenLight partner since 2003

F.1.4 Market analysis

F.4.1.1 Introduction

For lamps, the potential savings are striking; the EU could save **4.3 billion euro in running costs through energy efficient lighting each year**, this equates to the output of **12 medium sized power plants or 28 megatons of CO_2** or more than **50 million barrels of oil** annually!
Investments to improve the uptake of energy efficient lighting are among the most cost effective and practical energy efficiency measures and offer the EU one of the most immediate and effective opportunities to increase the security and reliability of energy supply. New energy efficient lamps can **reduce energy consumption by as much as 80%** and can **last between 5 and 30 times longer** than conventional equivalents.
Moreover, energy-efficient alternatives are available for all main lighting application areas, with close to 70-80% of the market devoted to 'professional' applications (e.g. street lighting, offices industry and restaurants and shops) and **20-30 % to domestic applications**.[2]

Besides the existing saving potential the development of the ESCO market is crucial for the implementation of Contracting solutions in the European countries. The draft of a report reviews and analyses the development and the current status of ESCO industries in the EU and the New Accession Countries (NACs)[3]. The report illustrates, that there can be a classification of the countries with regard to the intensity of ESCO activities and development of ESCO market into 3 leagues: the premium league (Germany, Austria, for some issues also United Kingdom, France, Hungary), the second league (Spain, Sweden, Czech republic, Italy) and the third league (all other European countries).

[2] "Doing more with less by getting Europe's lighting right", The ELC Response to the Commission's Green Paper on Energy Efficiency, December 2005

[3] ESCO-report, draft document of the EC Joint Research Centre, 2005

Other investigations of public bodies knowledge and usage of different types of Energy Service contracts in eight EU member states had the following results as summary:[4]

- Germany, Austria, United Kingdom: good or relatively good usage and knowledge (in some cases local/regionalised)
- Finland, Italy, Sweden: some usage, relatively good or some knowledge
- France, Spain: non or very limited usage, some or very limited knowledge

EPC is commonly used in Germany, Austria, Finland, Sweden, United Kingdom and less commonly used in Italy.

These more general investigations regarding intensity of ESCO market, usage and knowledge of different types of Energy Service contracts show some different results. After evaluation of the country reports from other EU-projects (see chapter 5.6) it can be summarized: Germany and Austria are in the “premium league” for EPC. On a lower level are at first Finland, United Kingdom, Sweden, Italy and the Czech Republic (in France there are legal requirements with four kinds of contract models which can’t be compared with the EPC model, there shall be a new EPC model developed in the frame of the project EUROCONTRACT).
It can be assumed, that some of these countries (especially Austria, Germany) are also in the “premium league” for Energy Services in the street lighting environment. They have large market potential (especially the larger countries with high population and number of municipalities) and experiences in Energy Services. But the list is incomplete because such European countries with most experiences in the field of Energy Services for street lighting are missing like the Netherlands and Norway.

The following sub-chapters give short information regarding the market potential and development for some example countries.

F.4.1.2 Germany

[4] Summary from “Country specific legal framework for public bodies concerning Energy efficiency Services”, September 2005, IEE project PU-Benefs

Market potential

In Germany in total 9.125 Mio. lighting points illuminate the public streets of the 14.000 municipalities. These are on average 111 lighting points per 1,000 citizens. In Germany more than 4,000 Mio. kWh are used for street illumination every year, which is about 7 % of the municipal electricity consumption. This consumption alone costs the municipalities about 500 Mio. € in total and 4 € per capita and year. These electricity costs are caused by out-dated technology and are accompanied by a high amount of maintenance and fault clearance. Including this effort the operating costs raise to yearly 720 Mio. €, which results in operating costs about 6 € per year and capita. Whereas the operating costs without personal costs range between 6.90 € for smaller municipalities (< 5,000 inhabitants) and 9.90 € for cities with more than 500,000 inhabitants, the operating costs including staff costs achieve the range of 7.10€ and 12.10 € per capita and year or rather the range of 57 € and 97 € per lighting point and year. The cost structure of the public street lighting in Germany is the following:

- 54 % energy costs
- 34 % maintenance costs
- 12 % staff costs

Success story Contracting

In the beginning and middle of the 90s, only very few Energy Performance Contracting (EPC) projects were initiated by a few selected ESCOs, mostly through **"informal" EPC**. There were no standard contracts, there was no public procurement and no transparency regarding the detailed contract agreements in the building sector and also in the sector of public lighting. Hence, there was no real publicity about the projects, although there were some technically properly designed concepts and energy saving investments programmes.

There was a young and growing market of **Energy Supply Contracting,** meaning a simpler case of energy services, focussing on heat supply (combined with electricity supply in case of micro CHP) for buildings and electricity/other media for some other cases. Potential clients as owners of the facilities and buildings were hesitating to approach the EPC offers made by the few existing contractors for EPC in the market. They did not know whether offers were **trustworthy**, whether submitted contracts were **legally reliable**, they were not sure what the real **value of the contract** was. Transparency, procedural and contractual security and the economic evaluation of EPC offers were (and still are) the main barriers for the EPC market.

At the beginning of 1995, the EPC model **Energy Saving Partnership (ESP)** was developed and implemented in public buildings of Berlin with the aim of reaching ambitious objectives for climate protection and reducing energy costs in the face of a tight budgetary position. Now the market for Energy Services in Germany is a standard market with standard procedures and tools for several building sectors, but it is also still in development for the lighting sector. With TPF-solutions in the building sector (90 % of that Delivery Contracting and Operation Management Contracting, remaining shares mainly Energy Performance Contracting) a lot of projects are realized. It can be assumed, that these percentage figures are similar for the street lighting environment.

The market is characterised by more than 80,000 concluded Contracting contracts, but most of these are for the building sector. Under the 500 existing vendors for Energy Contracting services there are about two thirds Energy Service Companies (ESCO's) and utilities. It can be assumed, that only max. 1 - 2 % of the contracts are for street lighting Contracting projects and between 2 – 3 % are for the more popular building lighting Contracting projects. General the Energy Services for street lighting is offered in different contract models by the utilities and specialized ESCOs. The market will be further developed in the near future, more and new ESCOs will be active on the German street lighting market, also from other countries.

F.4.1.3 Austria

Stage of the market

Since 1997 Energy Performance Contracting (EPC) became an often used tool to optimise and modernise federal and municipal buildings in Austria. Since then, more than 1.000 buildings have been energy-optimised with this tool. Most of these contracts are still active and successful. Besides the building sector there are also more and more Contracting projects for street lighting systems of Austrian municipalities.
The quality of projects, which were developed together with independent Energy agencies and consultants and under ideas and price competition is high, there exist several securing tools (standardised contracts, a standardised project development, quality labels for ESCOs (Thermoprofit) and ESCO services (eco-label) for the building sector and proved Contracting model examples for the street lighting sector (mostly from the ESCO side).

Market actors present

The Austrian ESCO market includes 30 to 50 ESCOs offering EPC services. However, just about 5 ESCOs cover about 70 to 80 % of all EPC-contracts in the building sector. Branches and outsourced parts of utilities are mostly the bidders for street lighting Contracting projects. Since the EPC market is still only in the developmental stage, these companies are still building up their capacity.

F.4.1.4 Czech market potential

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. The electrical energy consumption costs the municipalities about 30 Mio € per year. The calculation procedure of the price for electrical energy in public lighting is based on the special rate called C 62d – Special rate for lighting of public areas.
Majority of lighting systems were built before the year 1990. The system of public lighting was energetic over-designed at this time. Cost-savings measures have been provided since 1994 nevertheless the number of lighting points has been increasing since that time. The aim is to implement of such types of lighting technology, which can carry out the norms and reduce average consumption of a lighting point. That is provided by operating public lighting via PPP methodology by ESCOs. Main ESCO player on the market operates in 200 towns and municipalities at the moment. Total number of lighting points amounts more than 190,000 in such PPP projects.

F.1.5 Frame conditions

F.5.1.1 Introduction

In most of the EU member countries there exist legal obligations to improve the energy efficiency of the public sector. In some countries and regions like Upper Austria there is a legal obligation for energy accounting for municipalities, and programmes support the implementation of Contracting in the municipalities. In Germany there exist a national sustainability strategy since 2002, one important issue is the dissemination of Contracting and especially EPC in Federal owned buildings/sites. Such programmes and strategies contain also measures for the public lighting or street lighting sector – or can extended to the lighting sector.

Besides such basic legal duties like the duty of the owner of the streets to ensure road safety (in Germany based on section 823 of the Civil Code) there are a lot of **technical norms and standards** to consider. The outdoor lighting is processed in national/international technical standards (concerning both lighting and electrical requirements) and in national laws (concerning properties).

Despite the fact that new energy efficiency standards are being implemented in all EU member and EU associated countries, there are still different standards in force by EU countries (e.g. for Germany the new DIN EN 13201 and parts of DIN 5044 (Road Traffic), DIN 67523 (Pedestrian Crossing), DIN 67524 (Tunnels), DIN 67528 (Parking areas). European standards and norms will be developed as common basis, the CIE is elaborating the new TC 4-44 “management and maintenance of road lighting”, a draft is under discussion. The final publishing shall be in summer 2007.

Regarding the implementation and realisation of Contracting projects there are some general issues to consider. Contracting is a win-win model for both partners, but it needs a good preparation and partnership collaboration on the basis of adequate and proven contract models like the Hesse model contract for EPC projects in the building sector. There are some of the following general barriers for using of Contracting models especially in the municipal sector, which are also universalised for the street lighting sector:

- New, largely unknown instrument
- Lack of confidence in the model
- Lack of motivation
- Administrative hurdles

- Lack of necessary know-how (mostly on the side of building owners)
- Increased organizational efforts (e.g. for data collection, baseline calculation)
- Lack of optimized offers (high efforts/transaction costs for the bidder)
- Legal and regulatory uncertainties in some fields (e.g. public budget and municipal law, questions regarding securities and ownership)

Additional barriers for public lighting improvement were analysed in the frame of the EnLight-project. A following summary (abstract) can be found on the project webpage[5]:
The major barriers, why innovative outdoor lighting energy saving concepts have not been developed to the same extend as in the field of indoor lighting are:

- Lack of promotion of best practise examples
- Proof of energy savings and subsequently cost reductions through new outdoor lighting concepts
- Lack of appropriate cost/benefit analysis and planning instruments for outdoor lighting
- Lack of appropriate resources in city administrations to elaborate and implement energy saving measures to improved outdoor lighting concepts"

The public owner of the street lighting has to follow the public procurement rules for awarding Contracting services, he has to organize a competition of the bidders to find the most economic solution. Besides the tender and awarding procedure the public owner has to make an assessment of the economy of the several offers in comparison with solution in own direction. There might be some uncertainties regarding the use of the procurement rules, the economic assessment methods etc., and frame conditions in the European countries are different.
Before that will be outlined for some countries, the typical key barriers and issues for the main Contracting models shall be described.

F.5.1.2 Lighting Contracting

This Contracting form is a simple model, if there is a proper contract between client and ESCO for such services like single refurbishment measures including maintenance key barriers shouldn't exist. The most typical barriers are **human**. Street lighting owners and administrators (in most cases municipal staff) lack know-how and understanding of energy services. The operational staff which needs to be directly involved in the preparation and

[5] www.eu-enlight.org

implementation of an Contracting project is very often afraid of outsourcing, which is perceived as a threat of losing job and position. Other barriers could be such issues like the price adjustment for the performed services with regard to changing conditions (salaries, material prices etc.), no clear definition of interfaces with regard to the maintenance of parts or the whole systems, the scope of maintenance measures and the risk sharing.
If the ESCO is assuming the financing of the modernisation measures, it needs a subsidy for the most expensive measures on the part of the client to prevent too long contract duration with extraordinary high Contracting rates. The public client has to observe the **public budget legislation rules**, e.g. the approval and budgeting necessities before the contract can come into force.

F.1.6 Light supply Contracting

Light supply Contracting is more complex than Lighting Contracting, most of the typical barriers are similar. But it is not such a complex model like EPC, the contract model and risk structure is easier. Critical features of the contract are the realistic definition of the energy demand for the street lighting by the client (with forecast of the future traffic necessities), the exact definition of delivery borders or interfaces and the price adaptation formulas. Main obstacles could be especially problems of re-financing of necessary expensive modernisation measures and renewing of parts of the systems, in some cases necessary after first contract period, additional wishes by the client etc.
All costs for the supplied light, that means for the services refurbishment, operation, maintenance, purchasing of energy and in most cases financing of the project must be covered by the Contracting rate with basis and working price. Critical issues are especially price adjustment rules, ownership of the street lighting system/new installed parts of the system. The public client has to observe the **public budget legislation rules.**

F.6.1.1 Performance Contracting

There are **minor technical barriers**, such as difficulties in putting the necessary solid data basis. It is indispensable, that the public owner of street lighting – very often assisted by energy agencies or consulting companies – prepares the basic data on the system (energy consumption and costs, status of the system). In practice, this is a time consuming process.
Legal barriers, such as the provision of a secure and fair contract basis and the definition of the procurement scheme for a functional description of targets and services, are usually of minor importance for projects in the public building sector of countries with a developed EPC market, too, since the necessary model contracts and standards have been already

developed and need usually only adaptation to the concrete project conditions. Additionally, the EU directives referring to public tendering give enough flexibility related to the characteristics of EPC projects. Now it is necessary to adapt the standards for EPC in buildings to the street lighting sector necessities.
Besides there are some differences in the legal framework for the public sector of different countries, e.g. the rules regarding the ownership on the energy efficiency equipment after installation by the ESCO, the commitment for comparison with own direction before the contract conclusion and opportunities and conditions to implement such financing instruments like forfaiting in a Contracting project.

In general there are **financial** and **economical barriers** based in the following aspects:

- Some energy efficiency measures (e.g. retrofitting the whole lighting system) need comparably long contracts or need an additional budget.
- Some municipalities want to be more flexible and do not want to fix contracts with a duration of more than 5 years.
- In some countries the public sector has a low credit rating by private banks with risk of stopping payments for the ESCO – in this case, access to cheap credits for a comparably high investment by the ESCO becomes difficult
- In other countries like Germany and Austria the public sector has a high credit rating, they can get low interest rates for Energy Efficiency investments – and for ESCOs it is difficult to underbid these rates.

Besides the most typical barriers are also **human** (see above). A general mistrust in a third party can be observed frequently with such typical questions like:
- Why should they know something which I do not know by myself?
- Are long-term contracts a risk for the building owner?
- Does the purchasing of energy management services mean staff reduction?

F.6.1.2 Frame conditions in countries with developed Contracting markets

Financing
Financing by third parties is not a problem in Germany, Austria and other developed Contracting markets with banks which are experienced in TPF. ESCO's have to provide the concept for the planned Contracting project together with feasibility investigations with rough and/or fine analysis of street lighting data and saving potential, energy efficiency measures and economic calculations with different assumptions (sensivity analysis).

Standards and frame contract models were developed from some actors like energy agencies and ESCOs, but a general standard like the Hesse Energy Saving Guarantee Contract for public buildings[6] is needed for EPC for street lighting.
In connection with financing of EPC the ESCO for himself as financing institution may take into account the aspects of capital procurement, securities, accounting and tax effects. If tools like forfeiting are used, the % of the total contract value for which this is used has to be balanced (i.e. 70 % of basis remuneration) and properly linked to securities to offer the benefits of using such ways. These issues must be considered in the model contract.

Admissibility with regard to budget law

For **EDC** and also for Lighting Contracting and Light supply Contracting there don't exist real obstacles, contracts of such kind are "transactions of day-to-day administration" (e.g. in Germany).
EPC as type of financing is **admissible pursuant to budget law** in Germany (and also in Austria). It is rated by the supreme municipal supervisory authority as a "transaction resembling loan", because the alternative of internal financing by municipal loans, regardless of the profitability of the energy saving measures financed through them, means borrowing. **As profitable measures** energy saving guaranteed contracts or adequate saving contracts are **not** counted under the **credit limit** which some municipalities have **already reached**.

Public Procurement

Lighting Contracting contains mainly construction services, the price (value of the contract) can be estimated, the services are being given by the client. Therefore the procurement rules for construction works and the open or restricted tender procedure must be used. **Light supply contracting** contains in most of the cases the main service light supply. Because the price (value of the contract) can be estimated, the procurement rules for services and the open or restricted tender procedure must be used.
EPC projects need mixed contracts with a combination of works and services, in most cases the main part are the services. In such cases the procurement rules for services must be used, in other cases the procurement rules for construction works. The negotiation procedure is allowed, because there is only a functional description of the services by the public owner as client/orderer (and not the estimation of the price) possible in the frame of tender.

[6] "Contracting guidelines for public buildings", Hesse Environmental Ministry, 2003

F.6.1.3 Frame conditions, market overview other European countries[7]

Sweden

Sweden has an immature and relatively conservative market with a history of less successful EPC projects, but also a striving and emerging market mainly driven by foreign companies. The main obstacles for developing the market for EPC are today the limited know how and experiences within the public and private real estate sector, causing the ESCO companies, difficulties in convincing the customers and explaining the contractual benefits. The difficulties is only partially connected to legal issues such as public procurement and accounting rules etc., the main problem in Sweden, is the insufficient experience and lack of credible and highly visible reference cases, preventing a wider development.
There are no energy efficiency standards of norms for municipalities on public lighting and no obligation for local authorities to meet energy efficiency public lighting standards.
Examples of other barriers are lack of finances, lack of time, calculating with to short payback time and limited technical progress within the lighting area, besides there exist also informational and technical barriers.

France

The main legal barrier arises from the fact that it is not possible to conclude a global contract covering the works, the services (operation and maintenance) and the funding. Article 10 of the Code of Public Contracts allows, however, a single contract to be concluded which covers both works and the provision of services, in which case the contract must show separately the respective prices of works and operation or maintenance. The remuneration of operating or maintenance services must never contribute to the payment for works. Furthermore, the payment for works cannot be deferred. Funding can be done by leasing by means of a separate item. An EPC is therefore legally possible on condition that the funding arrangement is covered by a separate item, which further complicates a type of approach that is already complex.

Greece

The core ESCO business, via the implementation of EPC, has not yet deployed, neither in the public nor in the private sector despite the objective conditions of the local energy market

[7] abstracts from SAVE project “Clearcontract” (see country reports under www.clearcontract.net), IEE projects “EUROCONTRACT” (see market development under www.eurocontract.net), EnLight (see foot note 5) and “PU-Benefs” (see foot note 4, www.pubenefs.org)

that would favour the wide outsourcing of energy saving projects under a guarantee of performance and of service quality.
Main reasons for the above situation are 1) the lack of a positive institutional environment for the support of initiation and viability of commercial operation of ESCOs, 2) the absence of a clear and helpful procurement, contractual and administrative procedure for the selection, control and repayment of the integrated energy service provided by an ESCO on the principle of contract negotiation procedures and competitive dialogue with the client, and 3) the absence or weak application of energy management procedures which would otherwise promote the interconnection of activities of on-site expert personnel with top decision makers as well as the involvement of external contractors-suppliers for efficient facility management, including EPC.

United Kingdom

Currently, UK local authorities do not have express planning powers to stimulate commercial energy efficiency in use. There are currently 12 registered ESCO's, operating within varying aspects of the energy industry.
There are some key barrier issues for local authorities to use Contracting services, e.g. lack of a legal framework for local authority participation in ESCOs and regional/ local authority structural differences hence responsibilities.

Hence it is currently very limited experience of Energy Performance Contracting (EPC) in the UK. The term EPC is not used, and the concept is poorly understood, and so it is often difficult to determine from published information whether a contracts is in fact EPC or not. There has been considerable experience of energy delivery Contracting, particularly relating to CHP installations in the health and commercial sectors. This experience has been mixed, resulting in a certain amount of caution in the market, particularly in the health sector.

Finland

In Finland the ESCO procedure is considered, more or less, as a tool for the implementation of energy saving measures identified and reported in the energy auditing reports. A lot of energy audits have been carried out in Finland during the past ten years in different client categories linked to the voluntary Energy Conservation Agreements. ESCO business has been growing in Finland but not to the extent that was expected, even though the state gives financial support to the ESCO investment projects. The reasons for that are e.g. lack of knowledge, slowness in adapting new methods. Even more obstacles, real or imagined, have been noticed to prevent a more rapid expansion of the Energy Performance Contracting and ESCO procedures.

Most of the ESCO projects implemented so far have been individual energy conservation measures in building technologies or process industry. Some EPC agreements have integrated several saving measures but they have been a minority among all the ESCO projects.

Norway

In Norway the EPC market is immature, even if there have been sporadic cases of EPC or similar projects the last fifteen years. The municipalities of Fredrikstad and Hvaler have about ten years of experience as clients. Different companies have since 1990 offered different versions of “energy saving with guaranteed results”, but the market response has not been overwhelming.

3 municipalities went in 2003 – 2004 (as probably the first in Norway) through a public procurement procedure on EPC, and are now in the implementation phase. One additional municipality also has signed an energy performance contract.

Today there are too few contractors and too little demand to constitute an effective EPC market. The procurement, contracts and implementation is very heterogenous and partly unprofessional from both sides. There is a need for development of guidelines and standards to secure quality projects, as well as a need for more training and active marketing of the EPC concept.

Czech Republic

There are some obstacles for developing the market for EPC, e.g. the limited know-how and experiences within the public and private real estate sector, although such actors like the Energy Agency SEVEn have supported the development and implementation of several EPC pilot projects.

Predominantly some financial and motivation barriers could occur on the Czech market which could prevent the expansion of new technologies for saving operating and maintenance costs. First of all, initial investment costs, investment costs return and operating price of these technologies are significant factors. Supervisors of public lighting network has to solve still essential problems and application of hi-tech technologies is not first rate matter. Also current maintenance systems are functional and their complexity has reduced operational costs in the past. One of the problems is conservatism on the side of energy providers having their own policy in the field of public lighting networks.

Slowakia

Slovakia has a general **legal framework** for the energy sector, but this focuses largely on supply–side issues. Very little attention has been paid to demand side and energy savings issues. The knowledge base concerning commercial financing through bank loans, leasing, and obligation bonds is higher, but municipalities still lack experience in project financing and alternative financing (i.e. EPC).

There are also **technical barriers**, that means the lack of technical background by public lighting owners, operators and investors with regard to

- Preparation of proposals and projects for implementation
- Preparation of audits and feasibility studies
- Negotiation skills with potential investors
- Preparation of business plans
- Cost benefit analysis – analysis of energy savings
- Preparation of tendering procedure and definition of technical selection criteria

Institutional barriers concern the implementation of energy policy and the management of energy programmes by public or even private institutions.

*The main **informational barriers** are:*

- Lack of targeted information on savings from new available technologies
- Lack of information among users about consumption and energy costs
- Lack of information on the availability and reliability of energy efficiency technologies
- Lack of awareness of additional benefits of public lighting reconstruction projects
- Lack of information on available funding opportunities (at national and European levels)

CEEC in general

The market for ESCOs and TPF services is on a low developed level in most of the CEEC (Central and East European Countries), the general barriers for using of Contracting models especially in the municipal sector (and in this connection also for the street lighting sector) are similar like from the introduction (chapter 5.1) and from the example Slowakia.

The improvement of frame conditions must be supported with the following main focus:

- **Financing sector** (better conditions for energy efficiency projects with TPF; e.g. longer duration of the credits; fair risk sharing between ESCO, bank, better credit rating)
- **Public procurement** (possibilities to invite TPF partner with its financing into the tender for contract; general possibility to use negotiation procedure for EPC projects)
- **Public budget and municipal law** (municipalities should get allowances for TPF projects also if the total annual debts representing due to instalments to the contracted and/or

guaranteed loans exceeds limits of the total income; municipalities/public institutions should can benefit from savings of funds for energy and water costs, there budget for this budget item shouldn't be reduced in the following year, because the energy cost savings must be used for payment of the Contracting rates to ESCO)

- **Capacity building** (improvement of knowledge, implementation of efficiency programmes, Know-how-transfer and training programmes, adaptation of standards and model contracts, providing technical assistance)

F.1.7 Conclusions

The public owners of street lighting systems have the duty to keep the systems in order to ensure road safety and to fulfil the other functions of public lighting. Because of increasing energy prices, restrictions of the public budgets and necessities of modernization and refurbishment there is a "drive" towards cost reductions and outsourcing of these services, and such Public-Private-Partnership (PPP) models like Contracting and especially Performance Contracting can be successful tools to save energy costs and guarantee quality standards and maintenance of the street light systems.
In the lighting sector there is a large energy saving potential, the EU could save 4.3 billion euro in running costs through energy efficient lighting each year. In Germany in total 9.125 Mio. lighting points illuminate the public streets of the 14,000 municipalities.
Besides the existing saving potential the development of the ESCO market including the clearance of obstacles of frame conditions and the providing of standards and model contracts are crucial for the implementation of Contracting solutions in the European countries.

Germany and Austria are growing markets for Energy Services and are pioneers for developing the European market for Contracting and especially EPC in the building sectors. But important parts of potential for Energy services and increasing energy efficiency in the street lighting sector are only partial opened until now. Therefore the efforts for developing new standards with implementation of new technical specifications and norms, the convincing of the public owners of street lighting, transfer of Know-how and dissemination of information and experiences should be intensified. The experiences and adapted standards from the "pioneer countries" including the Netherlands should disseminated to the other European countries, best practice examples will support the development of ESCO market for street lighting in such countries.

Energy agencies, other experts and mediators can support the public owners in the decision process to start with project preparation for street lighting Contracting projects EPC and

during preparation and implementation phase. For such countries with low level of ESCO market development and experiences in this field like the CEEC it is necessary to start with capacity building measures and first easy pilot projects for street lighting contracting, e.g. using of Lighting Contracting model.

Annex: List with European street lighting Contracting projects

No	Project	Country	Contact for information
1	Gunskirchen	Austria	Oberösterreichischer Energiesparverband www.esv.or.at
2	Traun	- „ -	- „ -
3	Kematen/Krems	- „ -	- „ -
4	Bad Schallerbach	- „ -	- „ -
5	Schärding	- „ -	- „ -
6	Scharnstein	- „ -	- „ -
7	Rohrbach	- „ -	- „ -
8	Freistadt	- „ -	- „ -
9	Bad Goisern	- „ -	- „ -
10	Gerasdorf	- „ -	Ökoplan GmbH www.oekoplan.at
11	Sitzenberg-Reidling	- „ -	- „ -
12	Rum	- „ -	- „ -
13	Absdorf	- „ -	- „ -
14	Hainburg	- „ -	- „ -
15	St. Koloman	- „ -	www.stkoloman.at
16	Tukums	Latvia	www.ekodoma.lv
18	Bremen	Germany	www.swb-gruppe.de
19	Berlin	- „ -	www.nuon-stadtlicht.de
20	Prague	Czech Republic	www.eltodo.cz

F.2 Pilot cases financial instruments in Germany

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F.3 Pilot cases financial instruments in the calculation model

The market analysis in the report of chapter 1 shows, that there are only a few pilot cases in contracting. For these cases it is difficult or impossible, to get further detailed information's.

In the consequence this chapter covers pilot cases of telemanagement additional to WP 6.1 Performance contracting in street-lighting. The following example illustrates a planned reconstruction of street-lighting in Schleswig-Holstein (Germany)
A consulting company made the data base available. The reduction by telemanagement is pointed up by changing the averaged lighting hours (in this case 36% savings).

The calculation model shows the employment of telemanagement. The reconstruction is financed by annuity- credit.
Also it is demonstrated performance contracting examined by an ESCO:
Investment for new installation = credit (from sight of ESCO)
Investment costs for refurbishment
Running costs for processing contracting, risk sharing, etc.
The annuity = contracting rate of End-user

The rules to use the calculation model are described in the manual.

Investitionsbank Schleswig-Holstein

Project:	Intelligent Road and Street lighting in Europe
Acronym of Project:	E-Street - WP 6.3 pilot cases
Agreement N°:	EIE/05/157/SI2.419662
Work Package 6:	**Financial Instruments**
municipality:	in nothern part of Germany
object:	employment of telemanagement

please choose your currency €

Basics

Data from the electricity bill of the last year:

Electric power consumption and costs for electric work
from the energymanagementsystem
or from the electricty bill of the last year

	[€/kWh]	[kWh/a]	[€/a]
HT	0,100	97.500	9.750,00
NT	0,090	32.500	2.925,00
total average	0,098		
total		130.000	12.675,00

Total costs for electric power (exclusive VAT) 14.365,00 [€/a]

VAT: 16,0 %

Total costs for electric power (inclusive VAT) 16.663,40 [€/a]

Costs for luminaire wattage

Basic costs [€/a]

luminaire wattage (relevant for costs) 32,0 [KW]

averaged costs for luminaire wattage [€/kWa]

total costs for power 0,00 [€/a]

Taxes

tax 1 0,0130 [€/kWh]
tax 2 [€/kWh]
tax 3 [€/kWh]

Σ 1690,00 [€/a]

average costs for electric power
exclusive VAT 0,111 [€/kWh]
inclusive VAT 0,128 [€/kWh]

Project: Intelligent Road and Street lighting in Europe

Acronym of Project: E-Street - WP 6.3 pilot cases

Agreement N°: EIE/05/157/SI2.419662

Work Package 6: Financial Instruments

municipality: in nothern part of Germany
object: employment of telemanagement

Investitionsbank Schleswig-Holstein

Actual - group of consumption: existing installation

description of lamp	type of lamp (international)	Luminaire wattage (system)	number	total Luminaire wattage (system)	average lighting hours (100% power)	operation hours (100% power)	electric work (100% power)	reduced power	average lighting hours (reduced power)	operation hours (reduced power)	electric work (reduced power)	total electric work (without cable loss)	cable loss	total electric work
		[W/unit]	[unit]	[kW]	[h/d]	[h/a]	[kWh/a]	[%]	[h/d]	[h/a]	[kWh/a]	[kWh/a]	[%]	[kWh/a]
	HME 125	142	172	24,42	11,20	4.088	99.845,31					127.267,62	3	131.085,64
	TC - LE 36	39	172	6,71	11,20	4.088	27.422,30							
	total		344	31,13			127.267,62					127.267,62		131.085,64

Actual - maintenance costs

description of lamp	type of lamps (international)	operation hours (100% power)	operation hours (reduced power)	nominal life of lamp	exchange cycle	price per lamp	labour costs lamp exchange	costs lamp exchange	total exchange costs
		[h/a]	[h/a]	[h]	[unit/a]	[€/unit]	[€/unit]	[€/a per unit]	[€/a]
	HME 125	4.088		8.000	0,51	3,02	30,00	16,87	2.902,19
	TC - LE 36	4.088		8.500	0,48	5,85	30,00	17,24	2.965,58
	total								5.867,77

Actual - electric power costs

description of lamp	type of lamps (international)	Luminous flux	spec. costs	electric power costs	electric power costs	Actual [€/a] sum costs maintenance+el. Power [€/a]
		[lm]	[€/1000 lm]	[€/a unit]	[€/a]	
	HME 125	6.500	11,79	76,64	13.182,12	16.084,31
	TC - LE 36	2.900	7,26	21,05	3.620,44	6.586,02
	total				16.802,56	22.670,33

Project: Intelligent Road and Street lighting in Europe

Acronym of Project: E-Street - WP 6.3 pilot cases

Agreement N°: EIE/05/157/SI2.419662

Work Package 6: Financial Instruments

municipality: in nothern part of Germany

object: employment of telemanagement

New - group of consumption: existing installation

description of lamp	type of lamp (international)	Luminaire wattage (system)	number	total Luminaire wattage (system)	average lighting hours (100% power)	operation hours (100% power)	electric work (100% power)	reduced power	average lighting hours (reduced power)	operation hours (reduced power)	electric work (reduced power)	total electric work (without cable loss)	cable loss	total electric work
		[W/unit]	[unit]	[kW]	[h/d]	[h/a]	[kWh/a]	[%]	[h/d]	[h/a]	[kWh/a]	[kWh/a]	[%]	[kWh/a]
	HME 125	142	172	24,42	7,20	2.628	64.186,27					81.814,90	3	84.269,34
	TC - LE 36	39	172	6,71	7,20	2.628	17.628,62							
	total		344	31,13			81.814,90					81.814,90		84.269,34

In that case the refurbishment works by the reduction of the average lighting hours. It is more correct to reduce the luminaire wattage to simulate the installation of a telemanagement system.

New - maintenance costs

description of lamp	type of lamps (international)	operation hours (100% power)	operation hours (reduced power)	nominal life of lamp	exchange cycle	price per lamp	labour costs lamp exchange	costs lamp exchange	total exchange costs
		[h/a]	[h/a]	[h]	[unit/a]	[€/unit]	[€/unit]	[€/a per unit]	[€/a]
	HME 125	2.628		8.000	0,33	3,02	30,00	10,85	1.865,70
	TC - LE 36	2.628		8.500	0,31	5,85	30,00	11,08	1.906,44
	total								3.772,14

New - electric power costs

description of lamp	type of lamps (international)	Luminous flux	spec. costs	electric power costs	electric power costs	New [€/a] sum costs maintenance+el. Power
		[lm]	[€/1000 lm]	[€/a unit]	[€/a]	
	HME 125	6.500	7,58	49,27	8.474,22	10.339,91
	TC - LE 36	2.900	4,67	13,53	2.327,43	4.233,87
	total				10.801,64	14.573,78

Project: Intelligent Road and Street lighting in Europe

Acronym of Project: E-Street - WP 6.3 pilot cases

Agreement N°: EIE/05/157/SI2.419662

Work Package 6: Financial Instruments

municipality: in nothern part of Germany
object: employment of telemanagement

Investitionsbank Schleswig-Holstein

Savings- Summary

Saving of el. Work and power	Actual		New		Savings	
	total Luminaire wattage (system)	total electric work	total Luminaire wattage (system)	total electric work	total Luminaire wattage (system)	total electric work
	[kW]	[kWh/a]	[kW]	[kWh/a]	[kW]	[kWh/a]
total	31,13	131.086	31,13	84.269	0,00	46.816

Cost- saving by maintenance	Actual[€/a]	New [€/a]	Savings [€/a]
	exchange costs for the total installation	exchange costs for the total installation	exchange costs for the total installation
total	5.867,77	3.772,14	2.095,63

Cost- saving by el. Work and power reduction	Actual [€/a]	New [€/a]	Savings [€/a]
	costs for energy	costs for energy	costs for energy
total	16.802,56	10.801,64	6.000,91

Total cost savings			
	savings maintenance [€/a]	savings el. work& power [€/a]	SUM - total savings [€/a]
total	2.095,63	6.000,91	8.096,55

choose: Average useful life of reconstruction: 15 a

Efficiency (static calculation)	Investment costs			Payback period
	excl. VAT	VAT	incl. VAT	
	[€]	[%]	[€]	[a]
total	44.720,00	16,00	51.875,20	6,41

Financing of reconstruction by annuity- credit

Investment for new installation	51.875,20	[€]
duration	12	a
rate of interest %	4,00	[%]
rate of payment in %	10,66	[%]
annuity (rate of payment) in €	5.527,42	[€]
Date of out- payment	2006	[yyyy]

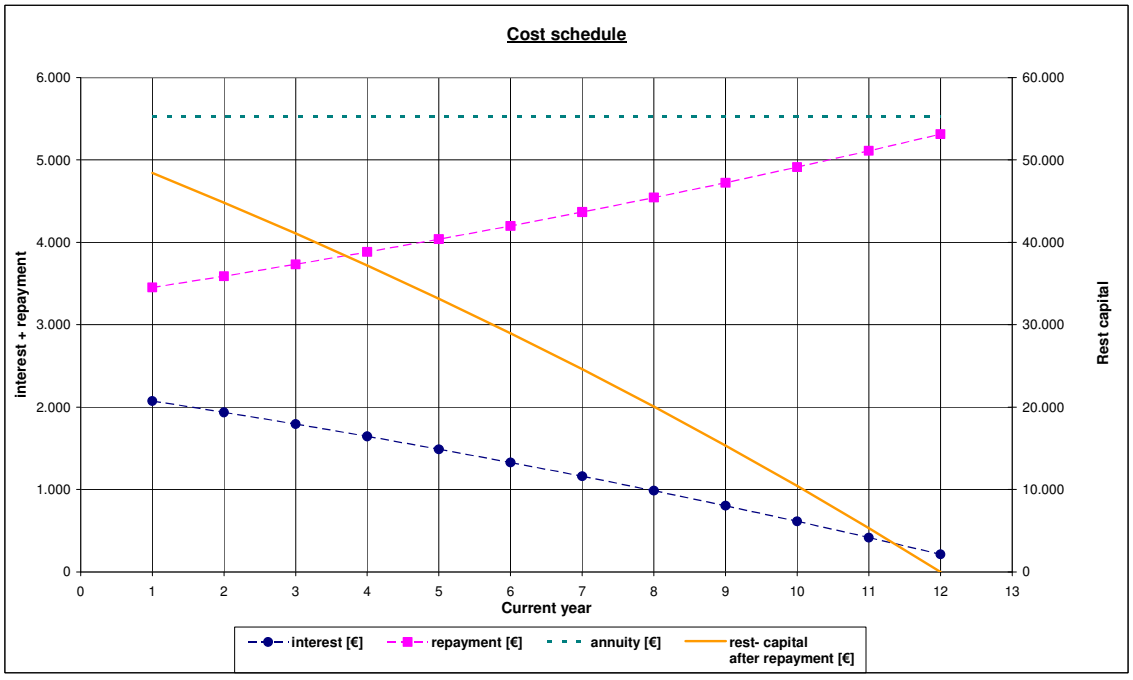
current year	rest- capital previous period [€]	interest [€]	repayment [€]	annuity [€]	rest- capital after repayment [€]
Year 1	51.875,20	2.075,01	3.452,41	5.527,42	48.422,79
Year 2	48.422,79	1.936,91	3.590,50	5.527,42	44.832,29
Year 3	44.832,29	1.793,29	3.734,12	5.527,42	41.098,17
Year 4	41.098,17	1.643,93	3.883,49	5.527,42	37.214,68
Year 5	37.214,68	1.488,59	4.038,83	5.527,42	33.175,85
Year 6	33.175,85	1.327,03	4.200,38	5.527,42	28.975,47
Year 7	28.975,47	1.159,02	4.368,40	5.527,42	24.607,07
Year 8	24.607,07	984,28	4.543,13	5.527,42	20.063,94
Year 9	20.063,94	802,56	4.724,86	5.527,42	15.339,08
Year 10	15.339,08	613,56	4.913,85	5.527,42	10.425,23
Year 11	10.425,23	417,01	5.110,41	5.527,42	5.314,82
Year 12	5.314,82	212,59	5.314,82	5.527,42	0,00
total		14.453,78	51.875,20	66.328,98	Payment

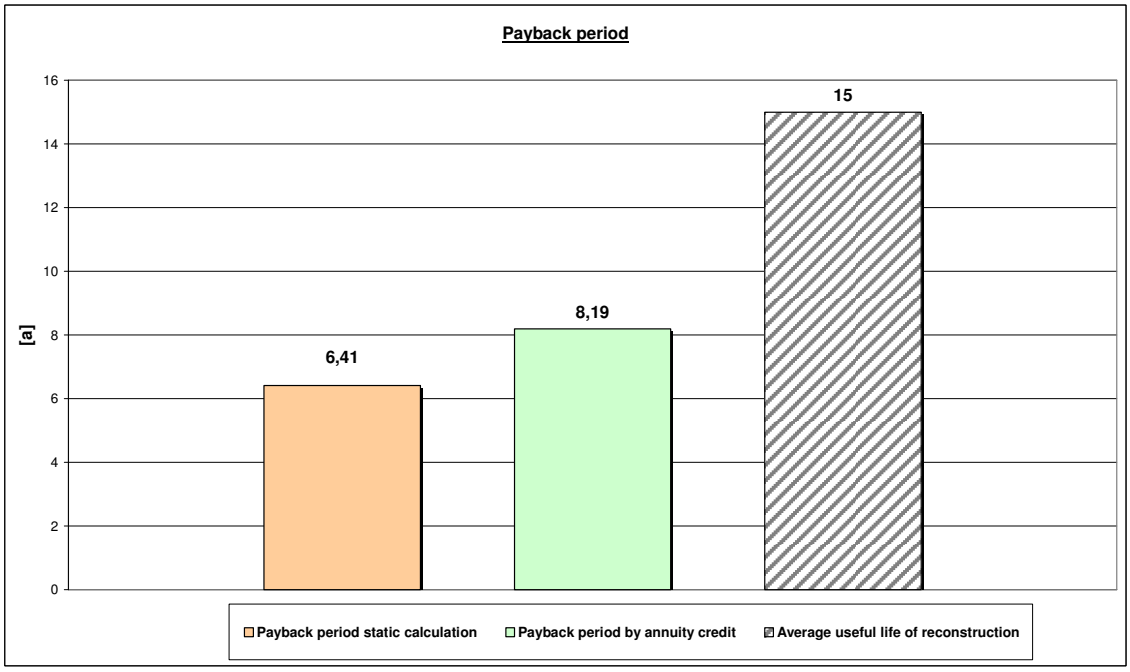
Payback period static calculation (interest = 0)	Payback period by annuity credit	Average useful life of reconstruction
[a]	[a]	[a]
6,41	8,19	15

Project: Intelligent Road and Street lighting in Europe

municipality: in nothern part of Germany

object: employment of telemanagement

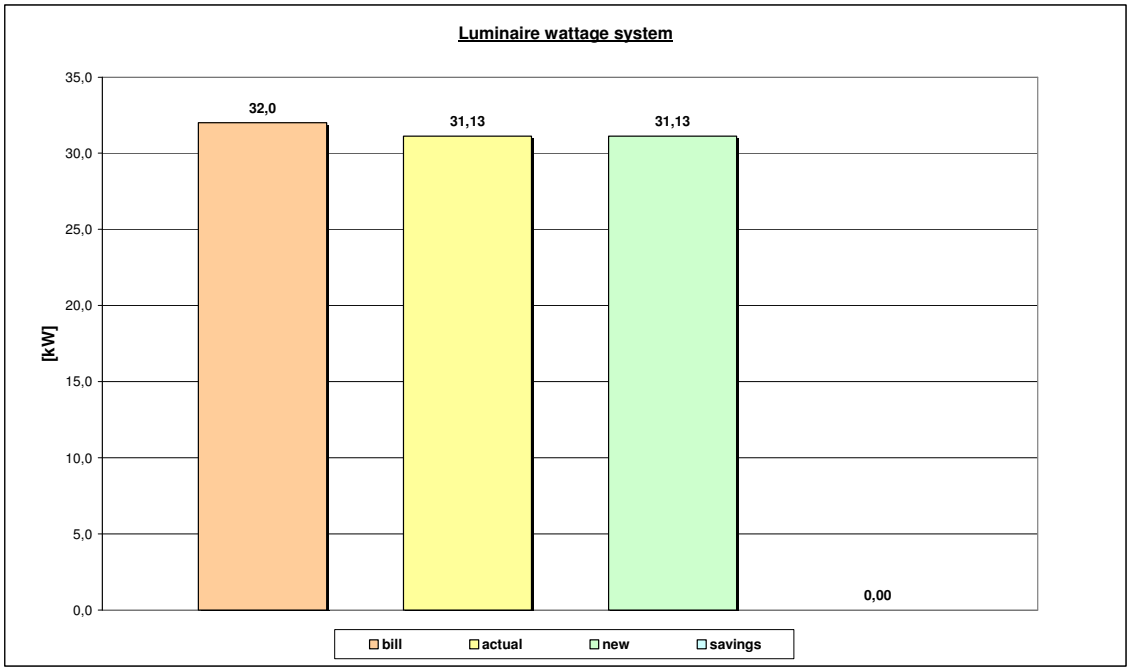


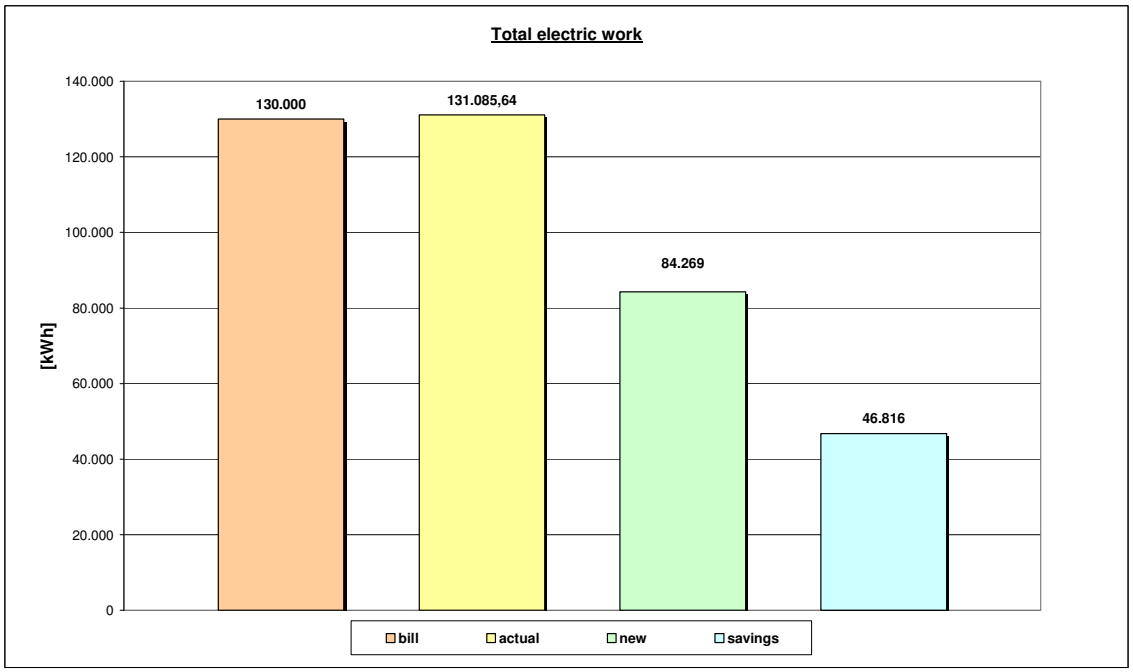


Project: Intelligent Road and Street lighting in Europe

municipality: in nothern part of Germany
object: employment of telemanagement

Investitionsbank Schleswig-Holstein

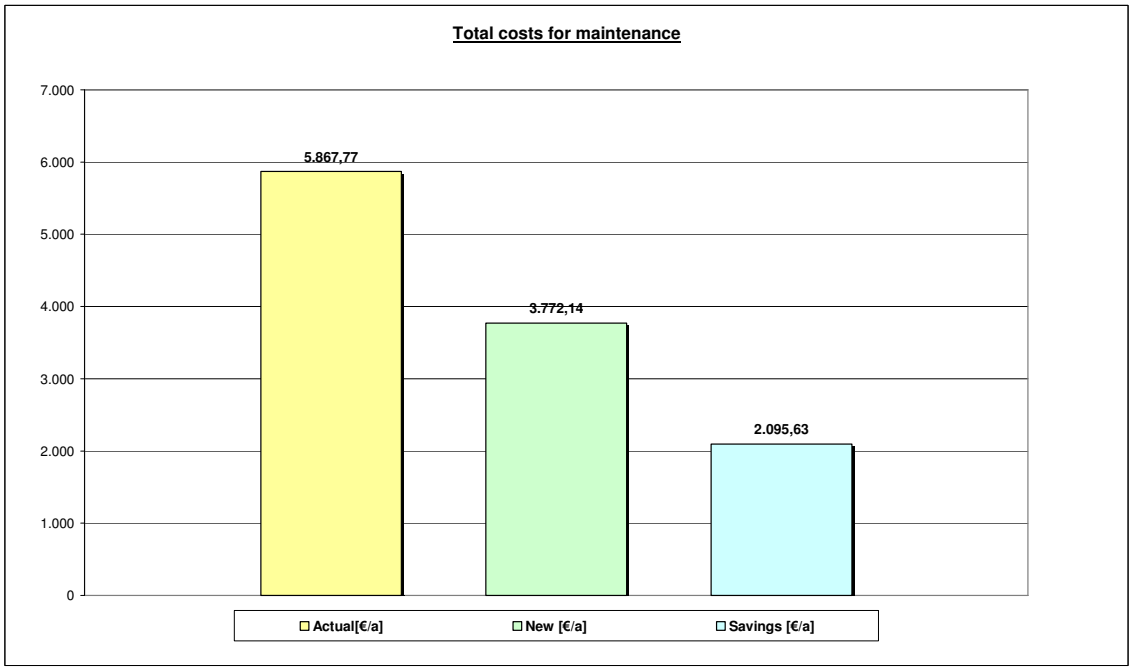


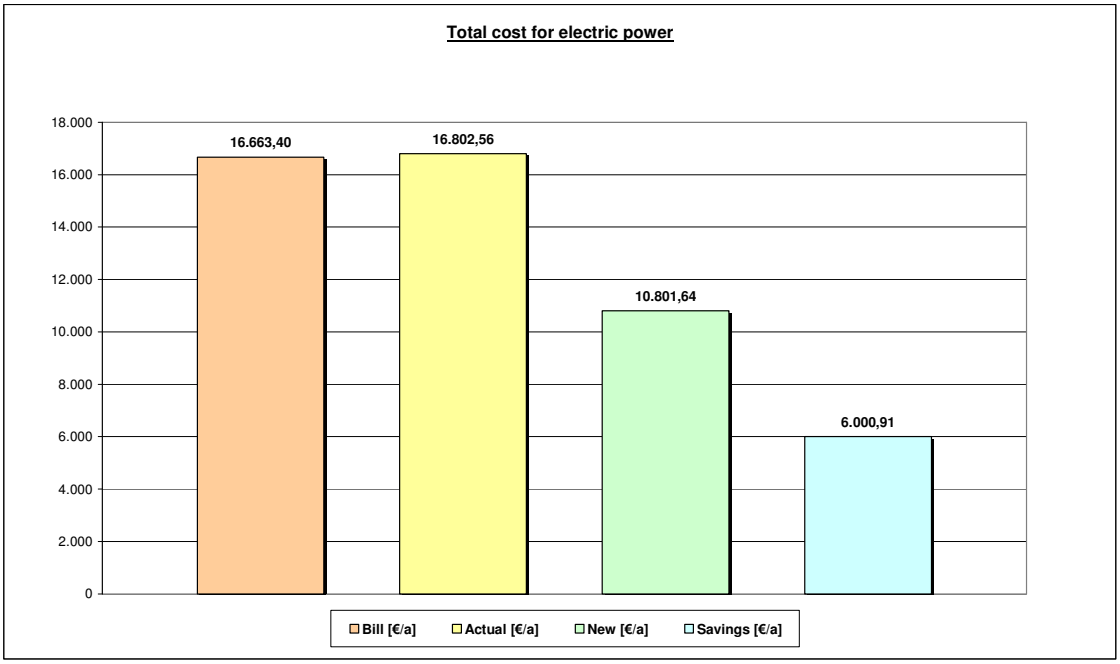


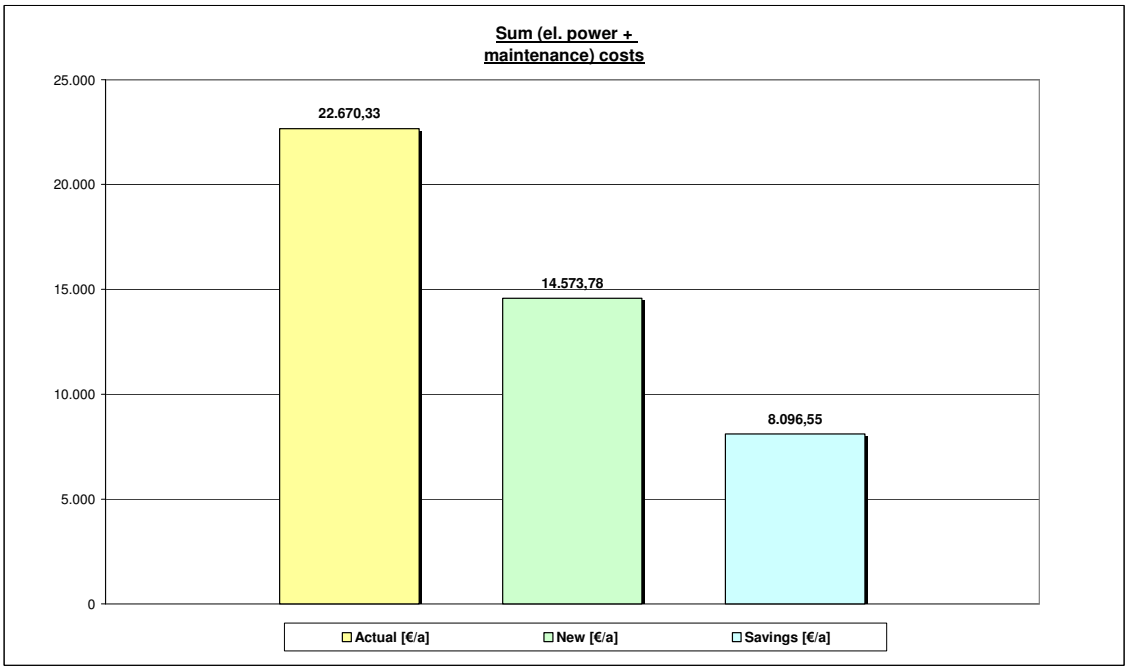
Project: Intelligent Road and Street lighting in Europe

municipality: in nothern part of Germany
object: employment of telemanagement

Investitionsbank Schleswig-Holstein




Total cost for electric power
18.000
16.000
14.000
12.000
10.000
8.000
6.000
4.000
2.000
0
16.663,40
16.802,56
10.801,64
6.000,91
Bill [€/a]
Actual [€/a]
New [€/a]
Savings [€/a]


Sum (el. power + maintenance) costs
25.000
20.000
15.000
10.000
5.000
0
22.670,33
14.573,78
8.096,55
Actual [€/a]
New [€/a]
Savings [€/a]

F.4 Pilot cases of telemanagement

There are only a few cases of telemanagement in Germany. The result of an inquest of manufactures was not really successful. So telemanagement finds its employment in countries near Germany.

Telemanagement- projects from Philips:

- Erlebniswelt Allerpark Wolfsburg
- Boehringer Ingelheim Pharma GmbH Werk Biberach
- Stadt Böblingen Breitensteiner Straße

F.5 Conferences and workshops

The Investitionsbank Schleswig-Holstein planned, arranged and realized the stated below conferences and workshops. The presentations could be found on the E-street-Website.

- Conference EU-work group in Kiel (27th of March 2006),
- IEE-workshop in Kiel (13th of June 2006),
- work group energy agents in Schleswig-Holstein, accomplishment of E-street-workshop (14th of December 2006).

G. Annexes and data sets

G.1 Saving Guarantee Contract for the lighting of streets, roads and places, Guideline for saving contracting in street lighting and Annexes (templates) (6.1)

Guideline for saving contracting in street-lighting (long version)

➔ ***060816 manual_PC_streetlighting_long_version***

Guideline for saving contracting in street-lighting (short version)

➔ ***060816 manual_PC_streetlighting_short_version***

Saving Guarantee Contract for the lighting of streets, roads and places
(With metering energy consumption)

➔ ***060623 SGC streetlight_with_metering_energy_consumption***

Saving Guarantee Contract for the lighting of streets, roads and places
(Without metering energy consumption)

➔ ***060623 SGC streetlight_without_metering_energy_consumption***

Saving Guarantee Contract - Annexes

➔ **060623 Annexes complete**

G.2 Manual and Excel-Worksheet: "Calculation model for evaluation of economic efficiency" (6.2)

Manual ➔ ***070702 WP6.2 Report (Final)***

Excel-Worksheet ➔ ***070424 WirtFin (final ver 1.2)***

G.3 Pilot cases financial instruments (6.3)

Report ➔ ***070702 report WP 6.3 pilot cases***

short study: ➔ ***060719_study status quo_BE_final***

Status quo on Street Lighting Contracting in Europe

G.4 Presentations of the meetings

- Ammersfort, 01/06: Kick off meeting
- Berlin, 03/06: Co-operation idea E-Street & ENERLIN
- Berlin, 03/06: Third Party Financing for Street Lighting Systems - Possibilities and Requirements
- Kiel, 03/06: work group - Intelligent Road and Street lighting in Europe
- Prague, 06/06: Status of work package 6 - financial instruments
- Kiel, 06/06: workshop IEE, E-Street, etc.
- Berlin, 11/06: results of work package 6.1 - Street Lighting Contracting : Status quo analysis, manual for Saving Contracting projects and adapatation of a standard contract model
- Berlin, 11/06: overview of the results of work package 6 - financial instruments
- Kiel, 12/06: work group energy agents of Schleswig-Holstein in Germany - Intelligent Street lighting: possibilities and effects of refurbishment
- Oslo, 05/07: calculation model: intersections and possibilities of financing reconstruction

Presentations ➔ ***070710 WP6 presentations***