Energy Performance Contracting Plus

Technical Toolbox for Technical Measures for use in SPIN-constellations

Indoor Lights: LED and control system

April 2016

Co-funded by European Union

Contact information

Reinhard Ungerböck
Grazer Energieagentur GmbH
Kaiserfeldgasse 13/1
A-8010 Graz
T: +43 316 811848-17
E-Mail: ungerboeck@grazer-ea.at
Website: www.grazer-ea.at

Content and tool prepared by:

ASEW

This document has been elaborated within the *Energy Performance Contracting Plus* (EPC+) project and is available on the project website.

www.epcplus.org

Task: 4.2.
Deliverable: 4.2.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 649666.
The content here included reflects only the authors' views and the EASME is not responsible for any use that may be made of the information it contains.

Content

1. General description and explanation how-to-use

EPC+ aims at standardizing technical measures in order to make them predictable for other SPIN members (including the SPIN coordinator) and thereby to reduce transaction costs.

The toolbox can serve as a guide for the providers of EPC+-services for the standardization of the measures (design parameters, calculation method, process flow) and defines quality standards for the M&V-method. Text-modules of the descriptions may also be used for the communication with the client in order to create trust into the proposed measures.

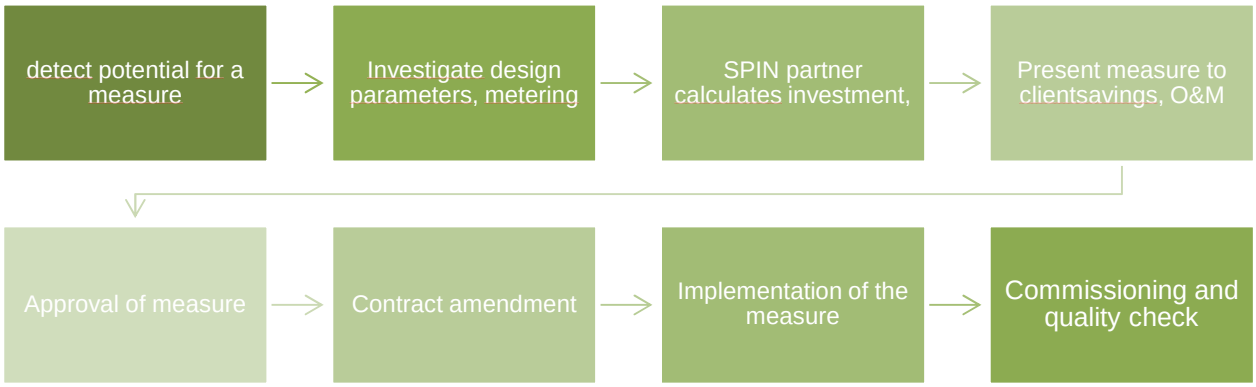
Each measure applicable for EPC+ is described on a general basis. Moreover the design parameters and the possibilities for application are defined, last but not least including a list of situations, where the specific measure is not applicable.

Calculation method

For the facilitation to introduce the measures for a SPIN the generic method of calculating effort for implementation, O&M and savings is described, ideally in form of a product-unspecific, open-source calculation tool that can be found in the zip-file.

Process flow

The generic process flow is identical for all measures. Therefore it is also part of the business model of EPC+, variations might be necessary for specific business cases, i.e. if measures interact with each other during their implementation or in their performance phase. See therefore also the interaction matrix of EPC measures, which serves as a quick indicator in which way measures might interact.



1.1. Toolbox

Each measure is being described in general and in detail. The measures are categorized in energy-efficiency and renewable energy measures. All measure descriptions can be downloaded at http://epcplus.org/energy-service-packages/. Here is an overview of all measures that have been elaborated:

Energy-efficiency-measures:

1. Indoor lights: LED lights + control system
2. Hydraulic adjustment of heating system
3. Energy efficient pumps
4. Modernization of electrical motors
5. Night cooling
6. Optimising parameters of HVAC systems
7. Managing and metering systems for buildings
8. Renovation/replacement of heating boilers
9. Efficient windows
10. Industrial steam boiler blowdown heat recovery

Renewable energy measures:

1. Solar Thermal Domestic Heating Water
2. Biomass for heating and/or domestic hot water
3. Combined Heat and Power (CHP)
4. PV-panels
5. Wind-power
6. Heat pumps

2. Indoor lights: LED lights + control system

2.1.1. Technical description

2.1.1.1. General description

In the field of lighting for buildings and halls lies an enormous saving potential. This potential can be fully exploit through the exchanche of the existing lighting system via LED-technology and efficicient control systems.

In the framework of this concept existing illuminants will be replaced by modern LEDs and complemented with control units (as far as it is useful) like motion detectors.

The customer participates from the savings in the way that he hasn't to carry out the investment costs and lowers on top with the exchange of the illuminants his future energy costs. For this purpose, the current costs for indoor lighting have to be determined (definition baseline).
The provider calculates the costs for the new lighting system, including the investment, maintenance and the exchange of illuminants for the whole contract period (e.g. 5 years). Arithmetically he further determines the energy costs for the new system (installed power and operating life time). In that way, the energy saving potential can be specified.

2.1.1.2. Design parameters necessary to survey the installation

Basic requirements for a successful implementation of the concept are on the one side the fact that with the modernization / exchange of the illuminants enough energy will be saved and on the other side that measuring devices will be installed or transparent calculations can be realized in order to make the reduction of the usage verifiable and transparent. Significant is also the amount of usage hours of the lighting system in order to realize a short amortization time.

Usage hours per year	**Profitability assessment**
More than 5000 hours/year	Absolut profitable including a short amortization time
Between 3500 – 5000 hours/year	A profitability with an amortization time less than 5 years is possible, a single analyses of the project is necessary
Less than 3500 hours/year	A profitability can only be realized with an amortization period over 5 years

Measure suitable for

- SMEs; Craft businesses
- Lighting for halls
- Lighting structure must be constructed in a way, that centralized measuring devices can be installed
- Predictable and comprehensible usage structure
- Office buildings with a high amount of usage hours of the lighting systems (see table above)

2.1.1.3. Measure not suitable for

- Offices, conference rooms with an irregular usage structure and small usage hours (see table above)
- Objects without the metrological preconditions for the instalment of measuring devices
- Objects without a significant impact of the lighting structure

2.1.2. Calculation method

2.1.2.1. Expected consumption and cost savings

The provider collects all existing illuminants and develops a concept for the lighting modernization.

In the standard case it has to be expected that in the current situation no measurement of the actual energy use for the lighting takes place. In this case the actual energy use will be calculated on the base of the usage hours and with the help of the installed power of individual points of light. This determination serves as basis for the baseline definition. Point 2.1.3. implies temporary measurement actions which can be easily realized.

If measuring devices for the determination of the energy usage for lighting has been installed already (or if these devices can be easily installed without any significant effort), the prognosticated energy savings can be validated based on these devices. In this case, for the determination of the baseline, a comparison takes place between the estimated and in the future correctly measured lighting duration periods.

The provider determines the possible energy saving potentials and examines if the change to the LED technology amortizes itself according to a certain time period.

The maximum cost savings can be determined via the following formula:

Savings = Ec – (Ec new + Ic + Oc)

Ec = Current energy costs for lighting (= Baseline)

Ec new = Energy costs after the modernization

Ic = Investment costs (on annuity basis over a period of 5 years)

Oc = operational costs (annuarly)

During the contract period over 5 years the contractor guarantees a saving – related to the overall costs for the lighting today (Basis : baseline and the current energy prize) of e.g. 10%. The contractor receives a compensation (contracting rate), which added to the real costs of the energy use for lighting (after the modernization) lies 10 % below the current costs for the lighting. (Baseline as basis).

After the contract period the customer takes over the technology and benefits 100% from the reduced energy costs for lighting.

Therefore, the customer pays also further on the energy costs as well as the calculated costs for investment and operation. At the same time the contractor guarantees, that the sum of the payments lies x% below the current costs. In case that the savings are lower, the contractor has to reduce his contracting rate.

With the help of the measurement of the usage period (see below) an annual verification of the underlying assumptions for the determination of the baseline or rather the deviation from the “initial values” (especially the usage period) takes place.

Verification Baseline = Usage period (old) / usage period (new)

If usable measuring devices for the measurement of the energy use for indoor lighting exists already (or will be installed) the verification of the saving guarantee takes also place on the basis of the energy use.

The saving potential will be determined on the basis of a spatial planning. Collected will be the installed power as well as the usage periods. The contractor plans the whole lighting concept and determines via the calculation the contracting rate.

With the help of an annual measurement of the lighting periods the real savings from the modernization can be determinate.

If applicable, a continuous measurement of the energy use will be realized, as far as useful measuring devices are installed or can be realized with minor technical and financial efforts.

Furthermore, an efficiency consulting can be offered, which demonstrates saving potentials easily.

2.1.2.2. Investment costs

Within this concept all investment costs for the installation of new illuminants as well as the integration of useful measuring devices have to be included.

2.1.2.3. Running costs

Costs for the operation of the lighting systems

- maintenance / operation
- energy use

2.1.3. Options on measurement & verification in order to evaluate the performance in relation to the given performance guarantee [1]

The savings will be determined on an annual basis under the consideration of the real measured lighting periods and the installed power.

The values of the first measurement cycle will be taken into account for the validation of the calculated usage periods and the definition of the baseline. During the validation process, a possibility exists for the correction of the baseline definition.

- Agreement with the client about a reference room where the performance measurement takes place. The result will be multiplied with the estimated (beforehand) usage hours and transferred to the other rooms.
- In case presence detectors are installed, the measurement should take place over a period of at least one week in order to determine the operating hours and power of the old lighting system.
- In case that the luminous flux will be hold constant , the user should adapt the M&V (see IPMVP option A or B)

In the following years, the measurement of the usage periods can be used for the adaptations of the aviation's of the values from the baseline in relation to the calculated savings. The savings will be referred to the basis definitions.

[1] Criteria: minimum effort, but still a proper qualitative proof for solid implementation and a considering performance, not installation only