

## ENERGY AUDIT PROCEDURES – AN INTRODUCTION

The prevailing condition of a public building can be considered e.g. base on the following classification:

1. Operational condition
2. Technical condition
3. Economical condition

Operational condition of the facility is good if the use of the building still satisfies the requirements of customer service, many years after it has been completed. Technical condition is the factor that generally launches the renovation. When the technical condition degrades to the level the building can not be run by reasonable costs. Good economical condition requires the proper economical facts. The economical analysis must be based on life cycle procedure in which the maintenance and renovation costs have been taken into account. It is possible to increase the performance level equal to the recent requirements by refurbishments. Without resource limits we could develop the facility over that level.

Based on the condition survey one can determine the technical performance, remaining service lives and the possible needs of repair of the structures and building services. The condition survey needs special expertise and special devices. The methods can be divided into destructive and non-destructive methods.

### ENERGY AUDIT MODEL

The energy audit model is based on the procedure created by MOTIVA that is public organization under Ministry of Trade and Industry. MOTIVA controls the energy audits in Finland. Before energy audit a benchmarking study can be carried out -comparison between the analysis target and the statistics based on the results of benchmarking, one can make conclusions if energy audit is needed or if only some targeted measurements or checking's must be done.

The energy audit includes the following steps:

The evaluation of the present state of the energy use

#### 1. Starting meeting

The energy audit will be launched by starting meeting, in which the representatives of the target and the energy auditors agree on the details and the focus of the realization. The following topics dealing with the audit will be agreed:

- Mapping the goals and the needs of the customer
- The timetable of the realization
- Contact persons and contact information
- Movement and traffic inside the target building
- Limitations for the field work
- The special needs for the audit and reporting

#### 2. Collection of the initial data

Before the start of field works the initial data will be collected. Based on this information we create an overall view from the energy economy of the target and from the probable saving objects. The field work and the measurements will be planned. The initial data includes

- Energy and water consumption in 3 - 5 years period
- Design-, operation- and maintenance records
- The studies and surveys done in the target

### 3. Field work and measurements

During the field work all the energy production-, transfer- and supply devices and all the systems consuming heat, fuels, electricity or water will be charted. In this charting all essential technical information and specifications of the systems and equipments will be registered. Also the possibilities to improve the energy economy of the target by different use, by repairs and investments or by purchasing new equipments must be evaluated. The goal of the field work is to find out all the measures with less than 10 years payback time, by which the use of energy or water can be reduced, intensified or recovered.

To map the saving potential we must have adequate amount of measurements. The following measurements must be carried out in all the targets:

- Ambient indoor temperatures by adequate samples (the average indoor temperature, temperature levels and stability, considering the impact of external and internal loads)
- The flow of water fittings (to determine the saving potential)
- The efficiency of the ventilation heat recovery units, by accuracy we can check the possible deviations from the normal or planned level
- The supplied air temperatures in normal conditions
- The efficiency of boiler unit, the calculation of annual coefficient of efficiency is recommendable
- The lighting level in typical rooms
- The ratio of the night-time and day-time electricity
- In the audit targets in which the labor costs of the audit exceed a certain sum, the active power must be measured during a day, or during a week period including working days and weekend

#### Analyze of the saving potential

The distribution of the water and energy consumption will be evaluated according to each system and also according to biggest single consumers that we could ensure the right magnitude when counting savings. Based on initial data, on the observations and measurements carried out and on the interviews of the user's one can analyze the level of the energy use and saving potential of the target.

The savings to be achieved and also needed investment costs will be calculated for the energy saving measures found. The realistic and valid measures must be prepared for the report in a way that the customer can make decisions for investments or further planning. The suggestions must cover the requirements for indoor air quality and working environment.

#### Proposals for actions and reporting

The essential part of the energy audit is to introduce the result clearly in the form of a compact written report. The proposal for actions and the savings potentials must be presented in illustrative tables. The budget of the proposed actions must be presented, as well as an evaluation of the effects for the energy, water and costs savings and the payback-time.

The energy audit conclusions are based on calculation tool created by MOTIVA. The procedure contains the tables which must be filled. The report must follow the instructions and the form for energy audit.

#### Implementation of the proposed actions

The implementation phase includes the following steps:

1. Delivery of the report
2. The operational measures
3. Investments and other measures in the continue

The results of the audit report must be presented to the customer in a special event. The energy auditors examine all the topics dealing with energy economy with the managers and the personnel, such as possible changes in controls and in timing.