Energy Audit Overview

What does it mean to perform an energy audit?

To perform an energy audit means to analyze energy flows in a building or an energy system (e.g. a district heating system). The goal of conducting an energy audit is to assess energy performance of the systems (building) and to identify possible ways of saving energy. Energy saving measures are proposed, based on the energy audit results, and the energy efficiency of the system can be improved. The majority of conducted energy audits concerns buildings since the buildings in developed countries account for more than one third of primary energy use and the building sector is the number one consumer of electricity.

Energy audits and the EPBD

Most of the countries in the European Union already have legislation dealing with the building energy audits. These countries also have a broad base of the professionals conducting energy audits (energy auditors). The existence of the legislation and the availability of the trained professionals is an advantage in the implementation of the Energy Performance of Buildings Directive (EPBD). The EPBD makes the assessment of energy performance of buildings mandatory as part of the building energy certification process. The development of the methodology for the assessment of energy performance of buildings is done by each member state. There are usually 7 energy classes (A to G), where A refers to the most energy efficient building and G to the least energy efficient building. The threshold energy consumptions for each energy class vary from country to country.

Types of energy audits

There are several types (or levels) of energy audits differing in “sophistication” of the procedures used in the process. Strictly speaking, an “energy audit” is a set of procedures described in legislation dealing with energy audits (if a country has such legislation). Therefore, not all three types (levels) of an energy audit described below can be allowed in every country.

• **Walk-through energy audit** includes a visual inspection of a building and building energy systems, and a review of energy usage data (energy bills, water consumption, etc.). Findings are compared to benchmark data or requirements of building standards or regulations. This type of audit can identify simple operation and maintenance improvements and also helps determine if a more comprehensive audit is needed.

• **Standard energy audit** assesses all equipment and operational systems, and creates a more detailed calculation of energy use. This audit identifies potential technical improvements, and makes recommendations based on their projected energy and cost savings. The calculation techniques and procedures used in standard can vary from coutry

• **Energy audit involving computer simulations** predicts system performance using transient approach (time dependants of parameters such as weather, occupancy, etc.). The simulation time step is usually one hour but sub-hourly simulations can be performed for some detailed analyses. This audit is suitable for more complicated systems and facilities, new construction designs and low energy and passive buildings where the “traditional” energy assessment procedures might fail.

Steps of an energy audit

- Setting the goals of the audit with the client (reflecting the requirements of the property owner, building users, legislation, regulations, etc.).
- Setting the timetable of the realization of the energy audit
- Establishing communication with the responsible people at the audited building (usually facility managers or other people in similar positions)
- Acquiring and analyzing data about the energy consumption in previous years, adjustment of measured consumption to weather conditions and building user profile
- Inspection of the building and the building systems (thermal properties of the building envelope - calculation of the transmission and ventilation heat loss, inspection of the HVAC systems, domestic hot water heating, artificial lighting and other systems)
- Economical analysis - annual operation costs and the trend of their increase with the increasing costs energy
- Proposal and evaluation of energy saving measures (additional insulation of the building envelope, improvement of air-tightness of the envelope, better control of the HVAC systems, thermal insulation of the piping of the heating/cooling system, and heat storage tanks, application of renewable energy sources)
- Completion of the energy audit report

Documentation and inputs for the building energy audits:

The accuracy of the energy audit results depends on the amount and accuracy of the inputs used in the energy performance assessments. It is not rare that there are big discrepancies between the design technical documentation and actual building and its systems.

- Drawings and technical reports regarding the building and the information about its location including the local weather data
- Technical documentation of the building energy systems (drawings, technical reports)
- Information about purchased energy from previous years (for existing buildings)
- Information about energy produced from own energy sources (photovoltaic systems, wind turbines, combined heat and power systems, etc.)
- All available studies on energy performance of the building previously performed
- All available information about the tests and inspections performed on the building and the building systems (air leakage measurements, boiler inspections, air-conditioning inspections, etc.)
- Costs of purchased energy, maintenance costs of the HVAC systems, other costs related to the energy performance of the building.

Documenting and reporting

The energy audit report is a very important deliverable of the energy audit. The report should clearly describe all steps of the energy audit, the inputs and procedures used in energy performance assessments and the obtained outputs. A missing piece of important information in the energy audit report can make the results of the audit merely useless. The energy audit report will probably be used as a source book on the issues related to the energy performance of the building for many years and it should therefore be very comprehensive.