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Energy Saving and Energy Audit

The total energy system of a country includes elements: production, distribution and consumption of energy. Energy saving is reduction the energy consumption, but it does not imply that the project is economically profitable. Energy conservation, however, is saving energy with an economical and environmental profit. It is possible to reduce energy costs drastically by implementing different energy conserving solutions. Additional insulation of the building envelope, sealing of doors and windows, automatic control and balancing of the heating system [1, 2] are examples of such.

The energy consumption of a building is influenced by many elements:

- the building envelope (quality of insulation, windows, building materials);
- the building service systems (heating, ventilation hot water , lighting);
- operation and user pattern.

For each element, some basic questions should be answered when evaluating the energy conservation potential of the building: which measures are relevant? (What can be done to save energy? How much energy can be saved? What are the investments needed? What is the profitability?).

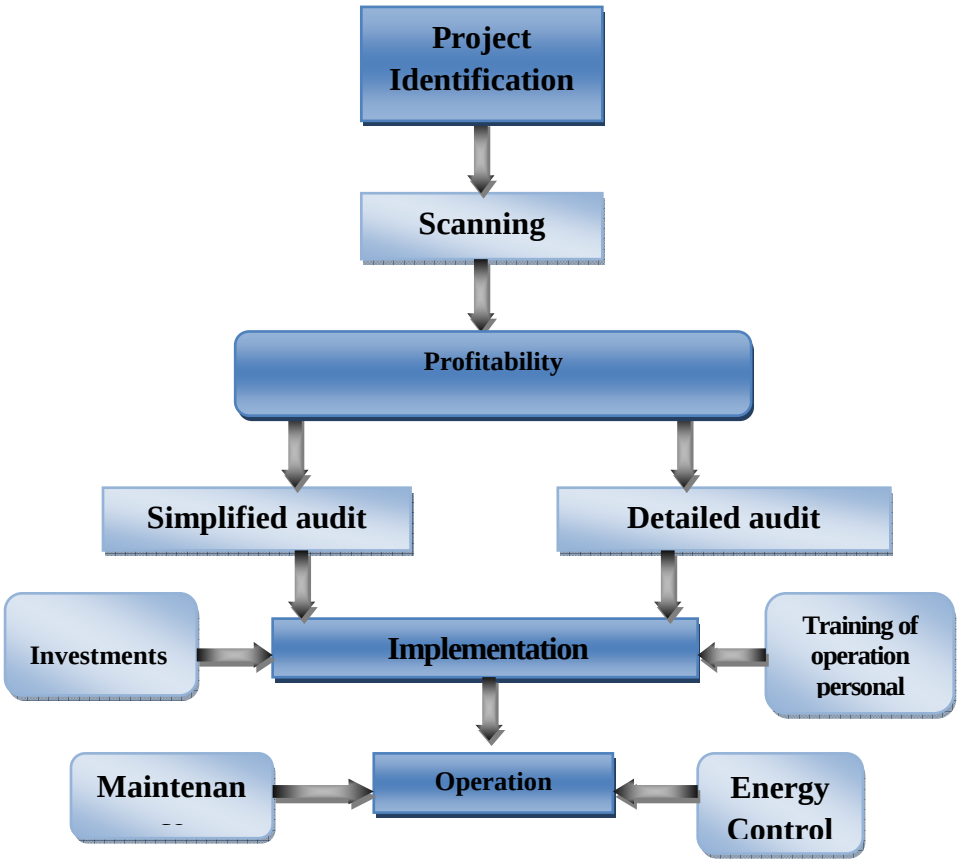
After having identified all the relevant measures and set a priority, the measures must be installed in the building. The most profitable energy conservation measures should be implemented first.

In order to do so, the operation personal must be well trained and motivated for their job. Unskilled personal and the lack of appropriate operation and maintenance routines could lead to increased energy consumption, despite the installed energy conservation measures. Energy control systems (manual or computer based) are impotent tools for keeping the energy consumption on a low, permanent level.

Quality assurance is a necessary and essential part of the whole energy conservation project, assuring the right quality at the right time, at the right place.

Every building is unique, and each building must be treated separately in order to find the energy saving possibilities for the actual building. The building owners might also have various plans for renovation and different requirements for the profit of energy conservation measures (maximum Pay-Back). It is necessary to find the possibilities and the economical consequences of the project before using a lot of time on investigating all the details.

The energy conservation process is divided into five main activities (pic. 1).



Pic. 1. Energy conservation process

If the information gathered during the **Project Identification** phase reveals an interesting energy conservation project, a **Scanning** is carried out in order to find out whether profitable energy conservation installations can be made or not.

The scanning report contains: the total energy saving potential; the total investments required; the total Pay-Back time (profitability).

If the owner of the building finds the saving possibilities interesting, the process will continue with an **Energy Audit**, which may be detailed or simplified. The energy conservation measures, the savings and the profit are the same regardless of audit method, but the level of accuracy of the figures in the energy conservation report differs. During the Implementation period, the operation personal is given thorough training on all systems and equipment. The training ensures an energy efficient **Operation** of the building. After having implemented the energy conservation measures, the installed systems for **Maintenance** and **Energy Control** will contribute to keeping the energy consumption at a permanent, low level.

The project identification phase includes: dialogue with the building owner; collection of main technical information and energy consumption statistics from previous years; evaluation of the owner's business possibilities and interest for doing a total project implementation.

When doing a scanning, the following procedure is used: preparations; inspection for specification of the present situation; make building state description; energy calculations by key numbers; economical estimations/calculations; make scanning report; presentation and discussion with building owner.

The complete scanning report includes: total energy savings and profit; total required investments; proposals for energy conservation measures; proposals for other relevant, but non-profitable measures; evaluation of indoor climate and maintenance; present energy consumption and energy prices; general conditions and assumptions.

Depending on the building owner's needs and financial abilities, he has two alternatives for an energy audit:

- simplified audit: it is cheaper than a detailed audit, and the accuracy of the given figures is ±10 – 15 %;
- detailed audit: extensive and more costly, but it includes guaranteed energy savings, ± 5 – 10 % deviation.

Both types of energy audit lead to an energy conservation report including: specification of the existing situation; proposal of energy conservation measures with detailed description; proposal for renovation measures; total required investments; energy savings and profit; criteria for energy guarantee; financing possibilities and criteria; proposals for training program for operation personal; time schedule for implementation; additional details to be added to the contract concerning implementation and operation.

As opposed to the scanning report, the investment costs, the savings and the profitability (pay-back/pay-off) are listed for each energy conservation measure in an energy audit.

Alter the energy audit has been presented for the building owner, the contract for implementation and operation can be signed, including the following activities: design/planning; project management; implementation; control of delivery; training of operation personal; as-built documentation; energy management, monitoring and guarantee; assistance/service during the operation period.

REFERENCES

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2. Kuznetsov N. M., Samsonov A.V., Bebikchov Y.V. Calculation of hydraulic regimes of heat-and-water supply systems in conditions of far North. International Journal of Experimental Education, № 3, 2012, P.29.