Information technology to calculate energy savings using solar panels and home appliances

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Abstract – In this paper describes the algorithm of the program that was developed to determine the assessment of energy savings using solar panels and home appliances. Amount of energy saved in one year is calculated by a formula specified in methodology. The evaluation of the energy savings is done by measuring and/or estimating consumption before and after the implementation of the energy efficiency measure.

Keywords – energy savings, program algorithm

I. INTRODUCTION

To achieve energy efficiency in the installation of solar collectors for domestic hot water and replace existing or purchase new appliances in residential and public buildings are required to select optimal process a certain quality at minimum energy consumption.

Reducing the energy consumption can be achieved by using new technologies. Energy efficiency may be achieved by applying intelligent management systems and the use of renewable energy sources.

II. ASPECTS IN THE EVALUATION OF ENERGY SAVINGS

The data availability and the ability of recovery is essential for precise and accurate assessment of energy savings in methodologies for energy efficiency. It is important to be provided most accurate information and a set of necessary data before any assessment . It should be borne in mind that the evaluation of energy service or measure energy efficiency is usually not possible to rely on specific measurements.

It is necessary to distinguish between methods for measuring energy savings and methods estimating energy savings, the latter are more common and are associated with much lower costs.

Energy audit is to determine the level of energy consumption to identify opportunities to reduce it and to recommend measures to improve energy efficiency.

Methods have developed that aim to demonstrate the implementation of individual measures or groups of measures

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³Veselin Nachev, Department Automation and Control Systems University of Food Technologies, 26 Maritsa Blvd, Plovdiv, 4002 Bulgaria, e-mail: v_nachevbg@yahoo.com to improve energy efficiency in various sectors of economic and social life [4, 6].

Energy savings are determined by measuring and / or estimating consumption before and after the implementation of the energy efficiency measure. The amount of the saved energy is equal to the difference between the energy used before the introduction of the measure or program to improve energy efficiency and use of energy, measured after administration.

The developed methods include the following directions [3, 6]:

- Replacement of equipment with energy efficient one. In this direction the baseline is the specific energy consumption of existing equipment before replacement, if there is evidence of this. In the event of no evidence that consumption as a baseline can be used for data average specific energy consumption of similar existing equipment.

- Updating equipment or building. The baseline in this direction is the specific energy consumption before the modernization of equipment or building. If there are no specific data on the consumption of the equipment average consumption of such existing equipment can be used for data . In the absence of specific energy consumption of the building prior to the implementation of energy saving measures the baseline can be used for specific consumption of buildings built according to the design standards for the year of construction of the building.

- Acquisition of energy-efficient equipment or building. In this direction the baseline is the specific energy consumption of older equipment before replacement. In the absence of baseline data average specific energy consumption of new equipment sold in the country as the base year, or the rules for the energy performance of buildings existing in the base year are considered.

III. ADVANTAGES AND DISADVANTAGES OF THE ALGORITHM

Information technology assessment of energy savings and its algorithm have advantages and disadvantages. Some of the advantages are:

- in the accumulation of sufficient data base the real impact of energy savings in the industry can be assessed very accurately;

- using the database a complete analysis can be made and the planned project and the achieved energy performance in the real operation can be compared

- certificate issued within the period provided by law for energy efficiency would have a solid justification of factual data. - it is easy to handle and calculate the data required for the application of the methodology, which aims to demonstrate the implementation of individual measures or groups of

measures to improve energy savings in the industry with information technology.



Fig. 1. Block - diagram of the algorithm

IV. DESCRIPTION AND IMPLEMENTATION OF ALGORITHM FOR ENERGY SAVINGS

Developed a computer program to calculate energy savings using solar collectors for domestic hot water and replace existing or purchase new appliances in residential and public buildings, whose algorithm is described with a block diagram (fig. 1).

The program is implemented in two versions. The first option is a programming language MatLab [1, 2, 7]. The second option is to use the spreadsheet capabilities of MS Excel. After starting the program chooses one of two options:

1. Calculation of energy savings using solar collectors for domestic hot water in residential and public buildings.

2. Calculation of energy savings when replacing existing or purchase new appliances (refrigerators, washing machines, televisions, etc.) in buildings.

To calculate energy savings using solar collectors for domestic hot water in residential and public buildings to input data:

1. USAVE - average annual saving specific heat of 1 m² solar collector [kWh/m²];

 n_c - efficiency replace existing hot water installation (for new plant is assumed to average performance ratio of marketable plants in 2007);

 F_{cp} - collector area $[m^2]$.

2. Calculate:

 $\ensuremath{\text{FES}}_a$ - saved energy by installing solar panels for hot water for one year [kWh / year].

3. Display: FES_{cc}.

To calculate energy savings when replacing existing or buying new appliances (refrigerators, washing machines, televisions, etc.) in buildings input:

1. AEC_c - the replacement of an existing device - an average annual energy consumption of the old appliance or average consumption of commercially available devices in 2007 [kWh/year];

 AEC_h - when buying a new appliance, the average energy consumption of new equipment $[kWh\,/\,year].$

2. Calculate:

 FES_a - Save energy by replacing an old or buy a new household appliance $[kWh\,/\,year].$

3. Display: FES_a.

All information on working with the program and all variables are stored in a file. The file can be opened, viewed and printed.

The program for energy saving is a modern tool for data processing, calculation of results, control and objective analysis of the impact of implementation of energy efficiency measures.

V. CONCLUSION

Information technology assessment of energy savings and its algorithm have advantages and disadvantages.

Information technology, data processing, evaluation and calculation of energy savings is a good and convenient way to control and give objective analysis of the impact of the application of energy efficiency measures in industry. In applying such information technology for calculating the energy savings in the industry high reliability, easy transfer and data processing can be achieved.

The availability of data and the possibility of collecting and processing them is essential for accurate and fair assessment of the energy savings in the developed methodologies. It is important to have most accurate information and data before any assessment.

Information technology should be used in each of the methodologies for energy savings. Energy saving systems are focused on efficient energy use through innovative technologies. Due to modern industry it combines flexibility, functionality, aesthetics, environmental and energy efficiency.

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