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Benefits Management in Energy Efficiency Projects in Serbian Public Buildings

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Implementation of energy efficiency projects in public buildings can contribute to achieving many benefits for the community. Some of these benefits are energy savings, greenhouse gas reduction, comfort improvement, etc. The implementation of energy efficiency measures in public buildings creates the opportunities for benefits achievement, but in order to actually achieve them, it is necessary that the project management process be conducted together with the process of benefits management. The thesis intended to be proven in this paper is that energy efficiency projects management in public buildings which is integrated with benefits management, guarantees the achievement of maximum benefits for the community. This paper focuses on the description of phases and activities of an integrated model of project management and benefits management. The aforementioned model is described taking into consideration the energy efficiency situation in Serbia as well as project management practices in the respective area.

Key words: energy efficiency, project management, benefits management, public buildings, community.

1. Introduction

Global problems, such as rapid depletion of nonrenewable energy sources and uncontrolled emission of “greenhouse gas” are some of the major reasons for the generation of economic crisis in the world. When it comes to energy consumption, energy-poor countries, such as Serbia, in addition to the global, are faced with a number of local issues. In 2009, Serbia spent about 2.6 billion U.S. dollars for energy imports, which was then 16.9% of total imports [1]. Most of the funds were spent to import oil and gas, because 80% of the demand for oil and about 90% of demand for gas are supplied from imports [2]. Energy consumption in buildings is among the largest in Europe, which significantly affects the efficiency of the economy and living standard. For example, energy consumption in public buildings in Serbia is over 200kWh/m², while the consumption in Sweden, with a colder climate, is much lower and is 60-80kWh/m² [3]. In addition to the problem of excessive energy consumption, considerable attention should be paid to the high level of air pollution, which is particularly acute in large cities. The cause of this problem, among other things, are the emissions of harmful gases and particles, which is the result of energy consumption in public buildings.

An unfavorable energy and environmental situation in Serbia is partially possible to repair using measures of energy efficiency in public buildings. The measures for improving energy efficiency represent the procedures which increase the degree of efficiency and reduce losses during the operation of electrical devices and hot water installations, but also prevent excessive heat swelling through the exterior walls and holes in the building. Opportunities for improving energy efficiency in public buildings in Serbia are great. Public buildings occupy an area of over 40 million square meters, but many of them are below the energy efficiency standards [4]. The benefits of applying measures of energy efficiency can be enjoyed by both the employees in public buildings and the community as a whole.

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Energy efficiency projects in public buildings are mainly, directly or indirectly, financed with taxpayers' money. That is why the realization of the projects of this type should be coordinated in order to achieve the maximum benefit for the community. However, the realization of projects does not mean that benefits will automatically be realized in the proper manner. To achieve the benefits of energy efficiency projects in public buildings, it is necessary to implement the process of benefit management, before, during and after the project realization. This process should be an integral part of project management process, because it is in this way that the results of the project will contribute to the community development.

2. Energy efficiency projects in public buildings and benefits management

An energy efficiency project in buildings could be defined as a complex, unique venture of implementing energy efficiency measures in the given building, which is realized within the stipulated time and the projected costs, in order to achieve energy savings retaining the same or better living conditions for the users of the building [5]. Energy efficiency projects belong to the group of investment projects. The realization of energy efficiency projects in public buildings is not simple. The implementation of energy efficiency measures can be complicated, lengthy and require significant financial resources. Also, according to [6], the projects in the public sector are more complex than the projects in the private sector due to numerous limitations and difficulties. The objectives of each project may be general or specific [7]. The general objectives of energy efficiency project in public buildings are an expression of contribution of the project to the community development, primarily in the areas of improving the country's energy balance, environmental protection and higher level of social welfare. Specific objectives are primarily related to the realization of the project within the given constraints: duration, resources, costs and quality of energy efficiency measures.

The recent history of the realization of energy efficiency projects in Serbia dates back to the year 2002, when the Serbian Agency for energy efficiency was established. Energy efficiency projects in public buildings in Serbia in the period since 2002 till today have been carried out by other state, provincial and municipal institutions, besides the Agency. The funding for these projects has usually been provided from the budget of the Republic of Serbia, provincial and municipal budgets and international credits and donations. Investors are trying to allocate these funds to dozens (or hundreds) of projects spread across the country. This method enables a large number of users of public buildings and citizens to enjoy the benefits of energy efficiency projects. The mentioned projects have been organized into portfolios [8]. Project management portfolio is the discipline of project management that includes knowledge, skills, tools and techniques for managing an appropriate set of projects which is aligned with the strategy and objectives of the organization [9].

The effectiveness of the energy efficiency projects portfolio in public buildings represents the degree to which the results of the portfolio correspond to the objectives of users and employees in both public buildings and the community. The mentioned effectiveness depends on the choice of public buildings where the projects will be realized as well as on the choice of energy efficiency measures to be used in these projects. Considering that investors have limited resources, their interest is that the projects they invest in contribute in the best way to meeting the needs of users, employees and the community. In this context, it is necessary that the benefits of the projects should be properly assessed and, therefore, the projects that will ensure the achievement of maximum benefit should be selected and conducted.

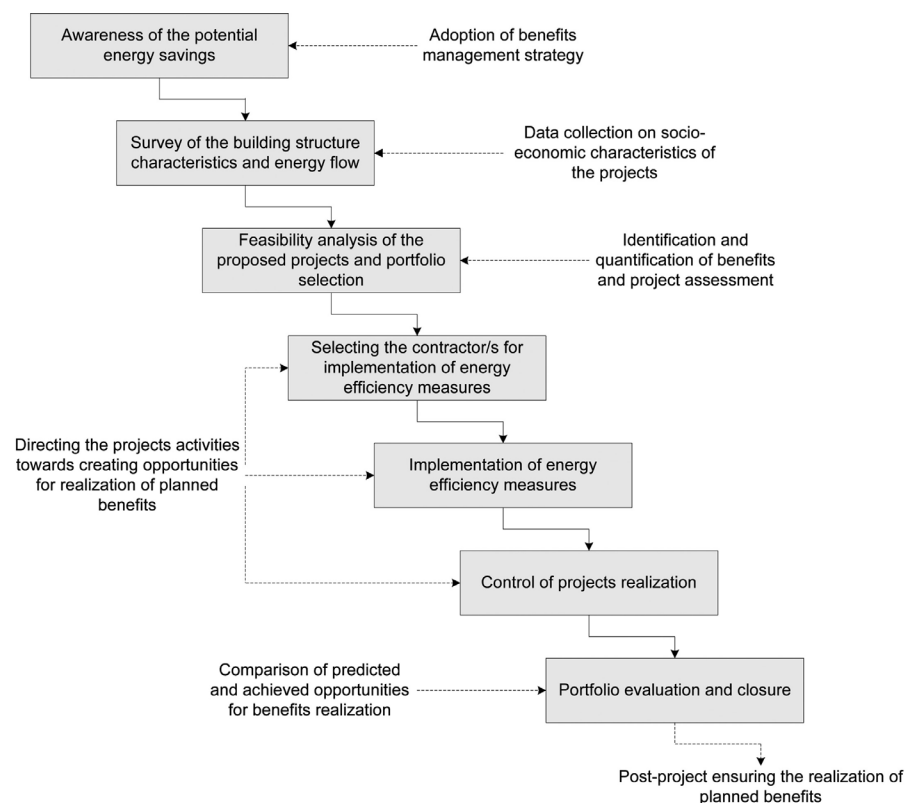
The realization of energy efficiency projects in public buildings provides an opportunity to achieve savings in energy consumption. However, whether savings will be actually realized, largely depends on user behavior in the period after the implementation of energy efficiency measures. These measures can reduce energy losses and improve the efficiency of the installation, which will in turn result in lower energy prices. In this situation, consumers are often motivated to increase rather than reduce consumption. In this way only a part of the planned savings is realized. This phenomenon is called the "rebound effect" [10]. The extreme form of "rebound effect" is called "Jevons' paradox". This is a phenomenon when the level of consumption after the application of energy efficiency measures exceeded the level before the application [11]. The increase in the energy consumption in the period after the application of measures is justified because users tend to use a positive difference in the price of energy to raise the level of comfort, the purchase of new or better use of existing electrical devices (if the object of application of the measures was saving energy) [11]. However, it should be noted that the reasons for an increase in consumption are not always rational. Space heating above the optimal temperature, leaving the windows open in the rooms that are heated / cooled for

too long or failing to switch off the lights in empty rooms are just some examples of poor energy management, which may arise as a result of lowering energy costs and insufficiently developed awareness of social objectives [12].

In the energy efficiency projects in commercial and public buildings in Norway at the end of the last century, due to the “rebound effect”, 90% of planned energy savings was achieved [13]. Considering that substantial resources were invested in the realization of these projects and that significant effects were expected to be gained, 10% of unrealized savings can represent the amount of several million euro of losses in the period of the exploitation of the investment. Serbia has not yet done any research on the impacts of the “rebound effect” in the energy efficiency projects in public buildings. However, the Norwegian experience can clearly prove that in the projects in this country appropriate measures should be taken to ensure the full realization of planned benefits.

In many areas, the achievement of specific objectives of the project results into the realization of common objectives. However, in the energy efficiency projects in public buildings, it may not be the case. It can be said that in some projects of this type there is a gap between the achievement of specific objectives and the goals, which must be overcome by appropriate activities. The management discipline that deals with defining, evaluating and providing the expected benefits is called benefits management [14]. Besides the efforts aimed at achieving the expected benefits, the benefits management process attempts to identify and ensure the realization of those benefits that were not previously in the plan of the project.

The benefits management process should be an integral part of project management or of the portfolio of projects. This process allows for the project team to understand the reasons why the project is implemented, as well as to understand the importance of the project for achieving the overall goals of the organization or community. An integrated model of the project / portfolio management and benefits management in the case of energy efficiency projects in public buildings is shown in picture 1.



Picture 1: Model of benefits management of energy efficiency projects in public buildings

Benefits management on the project should be effected in the same way as that in which it works with all nine knowledge areas of the project management concept. These areas include the management of integration, scope, time, costs, quality, human resources, communication, risk and procurement for the project [15]. Somehow, the benefits should be seen as a tenth area of knowledge which should be managed in the project. In the presented model the direct impact of the activities of benefits management upon the course and outcome of the project phases can be seen. The activity of post project providing achievement of planned benefits is, unlike the others, carried out after the closure of the project, because the course and the outcome depend, to some extent, on the project results.

The shown model will be described in more detail hereonafter.

3. Adoption of benefits management strategy

Awareness of potential benefits represents the initial phase of the project. In this phase, users become aware of energy wastage, as well as of the situation in which it would be preferable to establish the energy system of public building. The project team, based on a defined preferable state of the energy system, defines a few project goals. The first step in achieving these goals is adopting benefits management strategy at the level of public building, which will represent a framework for improving the energy system. The benefits management strategy in energy efficiency projects in public buildings represents the direction in the creating of benefits process before, during and after the implementation of projects of a given type, and in the context of fulfilling general social objectives related to economic development, environmental protection and achieving higher level of social welfare. This strategy describes how and to what extent benefits will be identified and quantified, which funds for its implementation will be used and who is responsible for the implementation [14]. In accordance with the strategic aspects of project management [16], it is important that the benefits management strategy corresponds with the national and international strategies and objectives in the areas of energy and ecology, as well as with other common social objectives.

4. Data collection on socio-economic characteristics of projects

A correct analysis of the characteristics of the structure and energy flows can help determine the deficiencies in the energy system and recommend appropriate measures to improve energy efficiency. By examining the physical characteristics of the building it is possible to determine the level of energy losses and the efficiency of energy installations. Based on the collected data, the indicators of energy performance are calculated, which represent the quantitative expression of the state of building energy systems [17]. Through a comparison of determined indicator values with reference values, it is possible to estimate potential energy savings, and also the possibility of achieving other benefits. However, the total level of potential benefits depends on other factors, primarily on the narrower and wider socio-economic context of the project realization.

The analysis of a broader socio-economic context of energy efficiency projects in public buildings should include the information on the gross domestic product in the municipality, region or country, environment, transport and energy infrastructure, the number and structure of buildings, the unemployment rate, the demographic situation, the average salaries, the educational structure, energy consumption per unit, natural resources, national and international regulations in the field of energy and perspectives for further economic development [5].

To analyze the narrower context of the project, it is necessary to collect information, such as: the use to which the building is put, the number and behavior of users and employees in the building, the use of the existing knowledge in the project, the readiness to implement the project, the complementarity with other projects, developing human resources in the local community through participation in the project, etc.

The possibility of complete consideration of future benefits and costs significantly relies on the accuracy of the estimation of all economic, environmental and social factors that affect the project. Therefore, the information is used as the basis for the identification and quantification of potential benefits.

5. Identification and quantification of benefits and project assessment

In the preparation of the realization of energy efficiency projects in the public building, the development of feasibility analysis is one of the most important phases. Feasibility analysis analyzes and develops technical, energy, economic, environmental, social, political and other conditions relevant to the assessment of investing resources from the aspects of an investor and the community. Based on this elaborate, a decision is made on whether the realization of a project is justified, [18]. Also, comparing the results of feasibility analysis of several individual projects, it is possible to select some of the best and create an optimum portfolio. As mentioned before, energy efficiency projects in public buildings are often part of a set of tens or hundreds complementary projects aimed to achieve a maximum benefit for the community. In this context, in a portfolio of energy efficiency it is necessary to include those projects that will best contribute to social development.

Energy efficiency projects in public buildings may affect the development of the broader community - a city, region or country. The method which is usually implemented in the evaluation of projects of great social importance is the Cost-Benefit analysis. It is a method whose implementation starts from the fact that we should identify and quantify all the costs and benefits, no matter whether they are economic or noneconomic in nature [19]. With an adequate detection and quantification of costs and benefits, the investor can evaluate the contribution of individual projects to achieving overall objectives and on such a basis the investor can select projects that will be part of the portfolio.

It is necessary that the Cost-Benefit Analysis include all the benefits of the project, even those intangible. Benefits such as satisfaction with comfort in the building are quantified by method of added value for the user (consumer surplus) [20]. This method is based on the theory of utility. According to this theory, the utility indicates satisfaction, subjective pleasure or benefit that user has consuming some good or service [21]. Users, depending on the situation in which they are, have different subjective feelings about the same tangible or intangible goods. If users do not have certain tangible or intangible goods, they can be asked about how much they are willing to pay to possess it (willingness to pay - WTP) [20]. In the case of energy efficiency projects in public buildings, the WTP indicates the amount of funds that the users of building are willing to allocate to solve the problem of inadequate conditions for living and working in the building [22]. The sum of individual WTP values per user makes a total WTP for the entire building. The amount of total WTP often deviates from the market value of energy efficiency measures. This deviation can be positive or negative. If it is a negative deviation or if the market value is greater than the total WTP, then according to this criterion it is not justified to realize the project. When the total WTP is higher than market value, a positive deviation in this case represents an additional value for users and the size of the intangible benefits that users can enjoy after project realization [20].

The benefits that energy efficiency projects in public buildings earns to the community can be classified into the following categories:

- Economic benefits;
- Environmental benefits;
- The benefits that are related to improving the conditions of living and working in buildings.

The economic benefits make the biggest part of the total benefits of energy efficiency projects in public buildings. For this reason, all the attention is exclusively paid to this type of benefit, in the feasibility analysis. The economic benefits are realized in the form of cash value savings in energy consumption in projects of this type. These values can be achieved when the difference between the current and future, estimated (less) energy consumption is multiplied with energy prices. The savings in energy consumption provide an opportunity to improve the energy balance of the country and reduce imports or increase exports of individual energy sources.

In Serbia, a huge part of energy is produced from nonrenewable sources, which results into large emissions of "greenhouse" gas and other gases and particles that are harmful to human health and the ecosystem. It can be expected that due to reduced energy consumption by applying energy efficiency measures, it comes to reducing pollution. Quantified monetarily environmental benefits in the energy efficiency projects in public buildings are calculated when the difference between the current and future, estimated (less) emissions of harmful gas is multiplied with the price of gas in the world market. Harmful gas is traded on special

exchanges that exist around the world [23].

The benefits related to improving the conditions of living and working in the building include: preventing the causes of health problems, improving productivity of employees and a higher degree of comfort. Low temperature, humidity and draft in the public building are often the cause of a number of health problems for users and employees. Creating optimal conditions for living and working results into a reduced the number of patients, and therefore the savings in state expenditures for health. Applying energy efficiency measures leads to the improvement of working conditions, and therefore to an increase in productivity, which can be measured and financially expressed by standard methods [24]. Satisfaction with living and working conditions in the building is quantified by method of added value for the user, which was previously described.

In the energy efficiency projects in public buildings there are benefits that are very important, but difficult to quantify. By meeting international obligations as regards the implementation of directives and protocols related to energy efficiency, the countries that aspire to Euro-integrations become closer to the EU membership. Also, a country that dedicates considerable attention to energy efficiency proves that its citizens have developed their awareness of sustainable development, and therefore, enjoys a higher reputation in the world. Energy efficiency projects in public buildings may have an impact on raising awareness of rational consumption of energy and environmental protection. Alongside the rise in the awareness of energy efficiency, grows the number of realized projects of this type, which create the new benefits.

All collected information about the expected benefits need to be documented. For this purpose a benefit profile is created for each benefit. It is a document that shows all relevant information for achieving certain benefits. A benefit profile should contain the following information: category and description of benefit, part of the organization or environment that will be affected by the benefit, relationship with other benefits, a dynamic plan of benefit realization, activities, responsibilities, risks, stakeholders, indicators for monitoring benefit realization, the way and frequency of reporting in the process of benefit realization, etc. [14].

The Cost-benefit analysis should cover the costs that arise in connection with the project. The realization of energy efficiency projects in the public building requires significant financial resources. The amount of those resources primarily depends on the type and number of energy efficiency measures that are used and also depends on the characteristics of building, climatic conditions, available energy infrastructure, etc. In most of energy efficiency projects, there are different types of costs that are related to:

- Analysis of the characteristics of public buildings;
- Preparation and development of project documentation;
- Provision of approvals and permits;
- Supply of material, equipment and human resources;
- Provision of equipment, material, device, installation, work, etc;
- Rates on taken loans for the project realization;
- Promotional activities for raising public awareness about energy efficiency;
- Maintaining in the period of project exploitation;
- Certification of the energy system of public building etc.

In the feasibility analysis, assessment of projects is carried out by appropriate indicators. There are different types of indicators, including financial, economic, social, technical indicators, etc. For the needs of projects evaluation from the aspect of community in energy efficiency projects in public buildings it is necessary to use indicators of cost-benefit analysis. The basis of these indicators is the comparison between predicted benefits and costs. The portfolio of energy efficiency in public buildings includes those projects where the benefits outweigh the costs to a greater extent than it is the case with other projects.

As mentioned above, it is difficult or impossible to quantify some benefits, and therefore those benefits cannot be included in the process of calculating the indicators. In spite of that, in deciding on the selection of projects to be entered into the portfolio, it is possible to take into account the immeasurable benefits. In this case, it is necessary to rely on the subjective assessment of decision makers about the importance of these benefits for achieving common social objectives.

6. Directing the project activities towards achieving maximum benefit

Directing the project activities towards achieving maximum benefit requires that the project team should focus on achieving overall objectives during the project realization.

The selection of contractors to improve energy efficiency in public buildings is carried out through a restrictive procedure of public supply. The general steps in this process are the following: defining the conditions for bidders, advertising and collecting the bids and finally the selection of the best bidder. The project team should prescribe the conditions for bidders taking into account the predicted benefits of the project. These conditions are primarily related to the quality of construction works in terms of future realization of energy savings, of reducing the emissions of harmful gases and improving conditions for living and working in the building. Also important conditions are the amount of the implementation measures costs and project exploitation. The project team can define additional conditions for bidders, but the previously mentioned conditions are considered as most important for the realization of predicted benefits. After the collection of bids, and according to defined conditions, the project team selects bidder / s who can best contribute to the achievement of specific and general objectives of the project.

A phase in the project realization is related to the direct implementation of energy efficiency measures in the given public building. The activities in the implementation measures are meant to contribute to achievement of predicted benefits in the long-term. To make a stronger connection between these activities and the benefits, it is necessary to use the benefit matrix. This matrix connects activities of the project realization with the appropriate benefits that should be achieved through these activities [25]. In that way, in the energy efficiency projects in public buildings it is possible to ensure the management of implementation of measures in line with the predicted benefits for the community.

The control phase is related to the monitoring of project realization and periodical project management reporting about the work progress. The project management receives reports from the field about time, costs, resources and quality of implementation measures. The information presented in the reports will be considered in the context of predicted benefits, and an estimate will be made on whether the current realization guarantees the achievement of specific and general objectives of the project.

7. Comparison of predicted and applied measures for the benefits realization

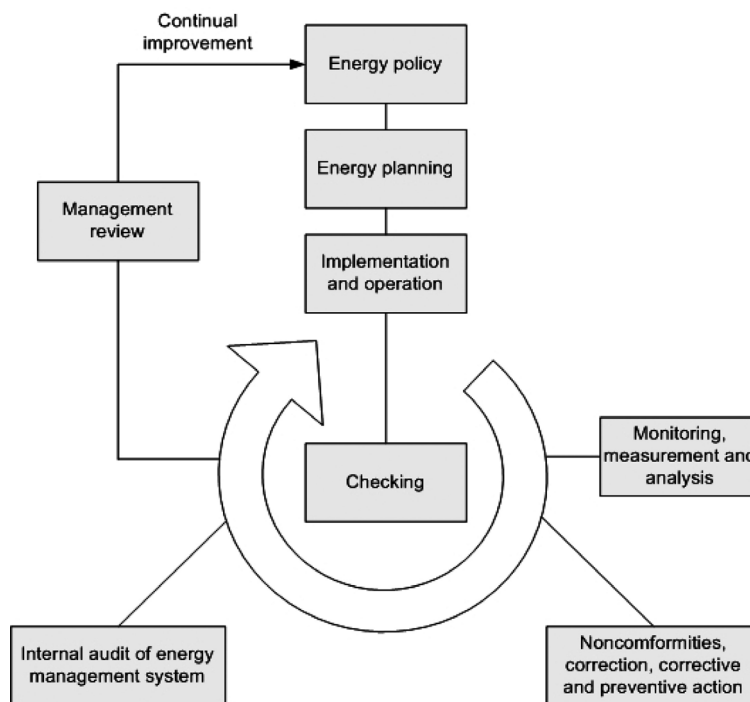
The evaluation and closure is the last phase of the project. In this phase it is necessary to determine to what extent the specific project objectives are achieved. The evaluation of the project includes the analysis of the quality of the applied energy efficiency measures. The quality of the evaluation process can be defined as the extent to which the contractor complies to contractual obligations to improve the energy efficiency in the public building. By recalculating the energy performance indicators and through the survey among the users and the staff it is possible to quantitatively compare the planned and the achieved results of the project. Based on the collected information, it is possible to perform a new assessment of energy savings and other benefits. By comparing the projected and actual quality of the implemented measures, it is possible to notice a need for a possible correction of the expected benefits. Evaluation results are collected in a special evaluation report, which serves as a platform of providing post-project benefits. Evaluation reports of individual projects are collected into a unique evaluation report of the entire portfolio.

8. Post-project providing of planned benefits realization

A successful implementation of the project, i.e. achievement of specific project objectives, creates the conditions for achieving common objectives. Unlike the costs, which are tangible and direct, the benefits are achieved only after the realization. As mentioned before, the "rebound effect" and the increase in the irrational energy consumption after project implementation can lead to a failure to achieve the benefits to the extent to which they are anticipated. To avoid this, it is necessary to implement the process of post-project realization of planned benefits. This process is focused on establishing an efficient system of energy management in the organization, which, in the period after the implementation, will guarantee the achievement of overall project objectives.

Developed countries apply regulations on energy certification of public buildings, which confirms that the technical characteristics of certain public building meet the specified conditions of energy efficiency. However, in addition to the technical characteristics of the building, it is necessary to certify an associated organization. This would allow for an effective and efficient management of energy systems in the public building. In June 2011, the International Organization for Standardization published a standard related to energy management system, the ISO 50001:2011 standard, Energy Management Systems - Requirements with guidance for use [17]. The requirements of this standard can be successfully applied in the process of ensuring the realization of planned benefits after the implementation of energy efficiency in public buildings.

The ISO 50001:2011 standard is an international standard that provides guidelines for the implementation of strategies for improving energy efficiency, cost reduction and continuous improvement of energy performance of all types of organizations. The standard assumes that the energy management system can integrate with other parts of the management organization. The ISO 50001:2011 standard can be applied to all organizations regardless of their type, size, or geographic, cultural and social conditions [17]. The standard follows the PDCA (Plan-Do-Check-Act) process for continual improvement of energy management system and it is shown in figure 2.



Picture 2: Model of energy management in ISO 50001:2011 Standard [17]

The process of ensuring the realization of planned benefits should be the responsibility of the organization management in the public building, regardless of whether the investor is the organization or the government institution. Achieving effectiveness and efficiency of energy efficiency systems is possible by using the ISO 50001:2011 standard and it is an obligation of all customers and employees of organizations in public buildings. For this purpose, this International Standard should be adopted and declared the national normative document and it should be used as a national standard. The organizational certification in accordance with this Standard provides that energy efficiency projects bring all anticipated benefits. In this way, the investor, the state or the appropriate institutions create the confidence that the implementation of the project is justified. The project budget should provide funds for the implementation of this standard.

It is necessary that the public administration authorize body for conformity assessment of organizations with the requirements of the ISO 50001:2011 Standard. These appointed bodies are meant to check and evaluate the energy system of organizations in public buildings where the project of energy efficiency is conducted within the portfolio. The certification of organizations in public buildings proves the orientation of the public administration towards achieving maximum benefits from energy efficiency projects.

Conclusion

The realization of energy efficiency projects in public buildings represents is an appropriate way in which energy-poor countries, such as Serbia, can achieve a number of benefits for the community. However, achieving the full potential of projects depends on many factors. Based on valid estimates of benefits and costs, it is necessary to make a portfolio of projects that can bring the most benefits in relation to investment. It is necessary to establish an efficient portfolio management towards the realization of specific and general objectives, and then it is necessary to prevent the negative impacts of the “rebound effect“ and ensure the realization of planned benefits. Based on the previously mentioned, it becomes clear that achieving a maximum impact of energy efficiency projects requires a systemic approach to the process of benefits management in projects. The integration of processes of project management and benefits management in one system is the best solution for efficient benefits management. Benefits management should be embedded throughout the project and through all the phases, and in that way it should enable the project to contribute to social development. An adequate benefits management means due responsibility to taxpayers, whose funds are implemented in many energy efficiency projects in public buildings in Serbia.

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