PROMISING PROJECTS OF ENERGY SAVING IN HOUSING AND COMMUNAL SERVICES OF UKRAINE

B. Hevko
Ternopil National Economic University
11, Lvivska Str., Ternopil 46020 Ukraine
240615@ukr.net

Abstract. The article analyses the projects that help conserve energy for general use (lighting staircase, entrances to the staircases) in apartment buildings of the city district. It is established that a promising project, which provides power savings is the use of motion sensors and led lamps. The project allows to save hundreds of thousands of kilowatts of electricity and to ensure its efficient use. It reduces the load on the internal electrical network (especially in winter) and the rent for the residents of the apartments. The pilot project of involving the application of nanolamps in housing and communal sphere deserves a lot of attention. They put lighting on a new energy efficient level, compared to existing led lamps. Nano bulbs provide uniform light distribution and maximum coverage. The frequency of switching on and off does not affect their functional characteristics. During operation they emit 50% less heat than led lamps and are safer for use in enclosed fixtures (devices).

Keywords: electric power, led light bulbs, motion sensors, light sources, energy efficiency, energy conservation, enclosed fixtures, project, lighting.

Introduction

The consumption of energy by housing and communal services of Ukraine belongs to energy-intensive industries. That is why the implementation of measures on energy saving and increasing energy efficiency is an important issue. It should be noted that there are a number of fundamental works, in particular (Zhovtjanskyj, 2006; Shydlovskyj, 1998; Razumnyj, 2008; Makagon, 2012), devoted to the problem of energy saving. However, in these studies, insufficient attention is paid to energy savings in the housing sector. Today there is a small number of works that investigated the energy consumption by the residents of the city district and the ways of its saving (Dziadykevych and Hevko, 2011, 2014). In fact, there is a need to explore the possibilities of application of modern-saving energy projects in the housing and utilities sector and its efficient use. As it is established, that nearly 350 thousand kW of electrical energy is spent on lighting of common areas in multi-storey buildings, a number of questions arise:

– do the residents of a city district need such a large amount of electricity for lighting common areas?
– do they use this energy effectively?
– is it possible to improve the efficiency of its use?

World experience shows that it is possible to find positive answers to these questions.

Method

Methodological basis of the study is the dialectical method of scientific knowledge, analysis and synthesis, abstract-logical, deductive, and the method of system theoretical generalization and comparison. The abstract-logical method has enabled to establish the logical relationships between the different components of the researched projects and determine their impact on the amount of electricity consumption for lighting of common areas. Using synthesis the individual components of projects were investigated which contribute to energy saving in housing and communal services. The use of induction and deduction enabled us to study the influence of the constituent elements of projects on increasing energy saving of general use. The method of generalization enabled us to make a conclusion about the influence of promising projects on energy saving use of electricity by the residents of the neighborhood as well as improving its efficiency.

Results

One of the most efficient projects that guarantee energy saving in common areas is the use of motion sensors. They are reliable, easy to maintain; are widely used in the cities of Europe and the USA. The motion
sensor, installed on the staircase, sees a person, leaving the lift or the apartment, and switches on the light only on this floor. The light doesn’t switch on the other floors. If a person leaves the sensor field of view, the bulb switches off. Thanks to microprocessor technology motion sensors are resistant to optical, acoustic, and electromagnetic interference and have a high sensitivity to people thermal radiation. Electronic sensor is equipped with a light sensor; as the day light is sufficient, the sensor switches off. In practice, different brands of motion sensors are used. They all are resistant to thermal noise, have multichannel sensitive heads, a complex signal processing system. The sensors differ from each other only in size, weight and radiation pattern.

The motion sensors Grow SRP-600 were selected for the experiment taking into account the analysis of technical characteristics of different types. One sensor is supposed to be installed at the entrance and one on each staircase. The object of the study was 89 multi-storey buildings of the city, in which amount of electricity consumption for lighting of common areas was pre-determined (Dziadykevych and Hevko, 2011). It is established that in the manual regulation of the electricity consumption (the residents switch the light on and off) the annual consumption of electrical energy reaches 345 thousand kilowatts, while with the use of motion sensors it doesn’t exceed 16050 kilowatts. The use of motion sensors enables 20 times to reduce the annual consumption of electricity and save 187 thousand UAH. The cost of installing motion sensors will pay off 1.3 years.

During operation of motion sensors paired with incandescent bulbs, it was found that frequent switching on and off of the light source leads to their failure. It causes inconvenience and dissatisfaction among the residents of the house. Burn-out of incandescent bulbs takes place due to the fact that the tungsten spiral operates in the mode of thermal cycling (heating-cooling). During heating of the tungsten the penetration of impurities (carbon, nitrogen, oxygen) which the metal contains, diffuse from the depth of the metal on the grain boundaries to its surface, forming carbide and nitride compounds. They have different coefficients of thermal expansion and thus micro-cracks in the base metal are formed which leads to the destruction of the tungsten spiral (Dziadykevych, 1996).

As the life of light bulbs with tungsten spiral is low and requires frequent replacement, the search for new projects that would not have these disadvantages and would save electricity for general use is an important task.

The promising project, which saves energy that is not used for lighting staircase and entrances to apartment buildings, is the use of led lamps (Kozhushko and Basova, 2008a; 2008b). These are energy-efficient lighting products, which are based on led lamps with advanced luminance. The main elements of each led is artificial semiconductor crystal that converts the electric current into the light. Led lamps can save up to 90% energy compared to incandescent bulbs. Compared to incandescent bulbs led lamps have several advantages, such as economical use of electricity (operation life is 30 times higher than that of the lamp with a tungsten spiral), small size and safe operation, no ultraviolet radiation, safety and comfort for eyes (Kozhushko and Basova, 2008c). However, their high cost (up to 50 times higher than conventional incandescent bulbs) inhibits a wide application in housing and utilities sphere.

In order to identify the economic feasibility for common areas lighting in apartment buildings of the city district energy consumption of led lamps was calculated. It is established that the led sources allow the residents of the neighborhood to save nearly 300 thousand kilowatt a year (Dziadykevych and Hevko, 2014). This will reduce the load on the internal network, as well as will contribute to the reduction of rent paid by the residents of the neighborhood. Noteworthy is the project of saving electricity for general use proposed by the private company “Sirius” which provides use of 7W led lamps for staircase and entrance lighting. In the project due to the high lighting performance led lamps are used not as separate light sources, but as core elements of lighting products calculations showed that for lighting common areas led 7W lamps consume only 40 thousand kilowatt of electricity. Annual energy saving is 304262 kW (Dziadykevych and Hevko, 2014). We can conclude that the use of 7W led lamps for lighting staircase and entrances is promising, because it will save a significant amount of electricity, as well as prevent possible damage to led lamps. However, it should be noted that when applying the above mentioned projects (led lamps, 7W lamps), light sources are working almost around the clock, especially in winter, because they are switched on and off by the residents. In this case the energy efficiency drops sharply.

Analyzing the above projects we can conclude that the perspective of an innovative project, which will provide energy saving and efficient use for lighting common areas, is the use of led lamps and motion sensors. Calculations showed that with the joint use of led lamps and motion sensors annual energy saving of lighting...
staircases and entrances to apartment buildings reaches 343 thousand kW. Motion sensors provide economical and efficient use of electricity for general use. This project will pay for itself in 3 years.

The United Nations development program in Ukraine and the market transformation towards energy efficient lighting provides a number of pilot projects, in housing and communal sphere in particular, using nanolamps, which display the lighting to new energy efficient level, compared to existing led bulbs. Using only 12W power nano bulbs generate light brightness of 1,600 lumens, which is equivalent to the 100W incandescent light bulbs. In contrast from led bulbs, nano bulbs emit a bright, colorful light in all directions. It provides uniform light distribution and maximum coverage. The frequency of switching on and off does not affect the functional characteristics of the light bulbs. In addition, the nano bulbs emit 50% less heat that led ones and are safe for use in enclosed fixtures (devices). At the same time led bulbs in enclosed fixtures overheat, which leads to the failure of the led lamps before the end of their service life. The cost of the nano bulbs is in the range from 50 to 400$.

Therefore, only the organic combination of the constituent elements of the pilot project (nanolamps and motion sensors) will provide a significant saving of electrical energy and its effective use during the lighting of the common areas in the sphere of housing and communal services.

Conclusion

Thus, applying modern lighting and automatic devices, you can save a large amount of electricity for lighting common areas of housing and public utilities, as well as improve the efficiency and reduce the load on internal electrical network, especially in winter.

References