ENERGY EFFICIENCY AS AN ESSENTIAL COMPONENT OF COMPETENCE OF FUTURE SKILLED WORKERS HAVING MACHINE-BUILDING PROFILE

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The article identifies factors that determine importance of skilled workers training, who are competent on the issues of efficient use of energy resources. Attention is drawn to the fact that the problems of energy efficiency are considered at the international and national levels in legal documents, projects, and strategic programs of development hence emphasizing their importance and relevance. The author explains the work of the All-Ukrainian Centre "Energy efficiency in vocational education and industry" of the Institute of vocational education and training of the National Academy of Pedagogical Sciences of Ukraine on questions of vocational training of future specialists and increase of teachers’ level of readiness to use knowledge concerning efficiency foundations in their professional activity. The author formulates a definition as to energy efficient competence of metalworker-electricians on electrical equipment repair. This competence involves the awareness, understanding and comprehension of the importance of rational energy consumption; the feasibility of theoretical knowledge acquisition concerning efficient use of electricity, practical skills, values, and competences; the availability of appropriate personal qualities. The use of a workbook with tasks, tests, technical dictations, and exercises regarding the efficient use of electricity in vocational training of skilled workers is considered to be one of the options to solve problems concerning the filling of majors' content and on-the-job training with energy efficiency materials. A description of the above mentioned workbook, which was developed according to the content of a Standard curriculum on the subject "Electrical engineering basics of industrial electronics", is given. The author describes its structure and content and concludes that it is reasonable to consider the formation of the energy efficiency competence of skilled workers employed in a machine-building industry as a continuous process.

Introduction. Mechanical engineering is one of the leading, highly sophisticated and quite energy-intensive industry that defines the country's economic development. The demand for energy is increasing, despite the fact that some of them are not renewed and have a pretty limited supplies. What makes the problem more complicated is the fact that human impacts on the natural environment aggressively. The demand for products with low energy consumption and production, which saves energy resources increases in our society. Today's factories and plants are focused on reduction of energy intensity in the processes of production and in manufacturing industry, due to the efficient use of energy resources, renewable energy, materials with high efficiency, new energy-saving technologies, equipment, etc. These factors determine the need for skilled workers, which provide energy saving and rational energy consumption, that is competent in matters of energy efficiency.

The problems, that are listed, and the possibility of more efficient use of energy resources are considered at the international level, particularly in the strategy "Europe 2020" (2010) [5]. In Bruges Communiqué (The Bruges Communiqué on enhanced European Cooperation in Vocational Education and Training for the period 2011-2020) (2010) draws attention to the need to create specialists of working trades with skills of energy efficiency [6, 3].

Legal, economic, social and environmental pillars of energy conservation at the state level are defined by the Law of Ukraine "About Energy Saving" (1994) [2]. The document "Energy Strategy of Ukraine for the period up to 2030" (2006), the problem of efficient use of energy resources is a priority [4].

With the help of TACIS (Technical Assistance for the Commonwealth of Independent States), a project of creation of the National Network for energy efficiency, businesses and citizens will be able to obtain information on the implementation of the state policy on energy efficiency in Ukraine, there is the introduction of modern low-cost technologies, advanced equipment with a reduced density power consumption, etc. [3].

The aim of Ukrainian Center "Energy Efficiency in Vocational Education and in Manufacturing" is to introduce the ideas of efficient use of energy resources in the system of vocational education and training at the Institute of Vocational Education, National Academy of Pedagogical Sciences of Ukraine. So, a course called "Fundamentals of Energy Efficiency", was developed by the scientists of the Institute in 2010 and the Ministry of Education and Science of Ukraine from 13.10.2010, № 947 listed it as "The basic structure of the curriculum for the training of skilled workers in vocational schools". These
important steps towards the improvement of the educational process are difficult to overestimate, because in today's manufacturing and engineering area energy-efficient professional competence accounts for his professional excellenee.

Taking into account the diversity of approaches to the definition of competence in scientific and methodical literature, energy-efficient competence of plumbers, electricians, repairers of electrical equipment, is considered to be a meaningful ability and willingness of the individuals in terms of reality, within their duties and professionally perform production tasks rationally and economically justified using energy resources with maximum eco-safety for the environment.

Energy efficient competence involves awareness of economic, environmental and social benefits of prudent use of energy resources; understanding the mechanisms of preventing loss of electric power, as well as cause-and-effect relationships in the process of inefficient use of energy resources; accounts factors that affect the strength of the electric current; awareness of electrical specifications (e.g., conductivity, heat resistance of insulating materials class, the temperature coefficient of electrical resistance material and cross sections of conductors, etc); possession of the techniques of work; identifying interdependencies existing electrical parameters; determine the optimal effective mode energy sources, in particular on the basis of mathematical calculations, including use of the existing regulatory documents; increases efficiency of energy sources, consumers and electricity networks; establishes the causes of potential and existing power losses in electrical equipment operating conditions and identifies opportunities to minimize these losses, the economic feasibility of repairing damaged parts and units of capacity; complies the national standards for energy efficiency. Experts who are competent in the effective use of energy resources in their professional activity, move quickly in unusual situations; are responsible and conscious of the adoption, if necessary, make their own decisions regarding to the conservation of energy resources; actively take the initiative regarding the improvement of technological processes, taking into account energy efficiency; perform environmentally friendly jobs, providing a rational energy consumption.

Given the interpretation of the term "rational" as such, that is based on the requirements of the mind, logic [1, 1017], rationality in the consumption of energy resources has a direct, in our view, a manifestation of a certain level of professional education. The greater the volume of theoretical knowledge and practical skills own future professionals are, the more perfectly their logical thinking formed, the easier they prevent economically unjustified costs of energy resources.

Among the factors that affect the quality of the formation of energy-efficient competence of future professionals in the sphere of vocational education, there are important pedagogical conditions, in particular the content of filling special items and industrial training materials with energy efficiency. Thus, according to the content of the Model program on the subject "Electrical Engineering with the basics of industrial electronics," we have developed a collection of problems relating to energy efficiency. The collection includes the topics which, in author’s opinion, are the most potentially revealed high possibility of efficient use of electrical energy. Namely: DC and DC electrical circuits; electromagnetism; AC and AC electrical circuits; transformers; direct current machines; asynchronous machines; synchronous electrical machines; electric drive; production, distribution and consumption of electrical energy; power factor for the economy of production.

Each of the themes contains test questions, tests, dictations and technical sums. In control tasks and tests, for example, it is proposed to build the right algorithm of technical operations, formulate unfinished determining the physical nature of the concepts of the proposed statements to choose such that are the answers to the questions, etc.

Tasks and sums proposed in the collection tasks are focused on the development of the students logical and variative thinking, the ability to analyze the causes of the formation of the existing and potential loss of electrical power in terms of its operation and to eliminate the effects of these losses.

For ease of use of the collection, its structure consists of a list of abbreviations used in the title of the book, dictionary of technical terms, a list of character values and their units, as well as applications. In the table of symbol quantities and their units the names of variables are given in alphabetical order, their basic notation, the names of letters of the Greek and
Latin alphabets, which represent values, names of units, their designation for the International System (SI - System International Units) and the Ukrainian language. Symbols quantities and their units meet the standard of the International Electrotechnical Commission (International Electrotechnical Commission) - IEC 60027-1. The basic values provided in the table significantly simplify the use of technical terms. Applications allow you to select the required electrical parameters in solving problems.

It is important to emphasize that the formation energy efficient competence of future professionals for machine building should be viewed as an ongoing process. Achieving a high level of competence of a person at a certain stage of his/her career does not mean the end of his/her professional development. The demand for a specialist in the modern labor market provides a continuous mastery of new knowledge and production techniques, focused on the efficient use of energy resources.

References


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Literature


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Energy efficiency – necessary composition of professional competencies of future skilled workers in the field of construction. The article identifies factors that contribute to the energy efficiency of professional training. It highlights the importance of energy efficiency in the future of the construction industry.

KEY WORDS:
energy efficiency, effective use of energy resources, technical competence, professional training.