The Study of Philosophy in Innovative Power Engineering
Post-graduate Course

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Abstract. Training of highly qualified personnel for the innovative high-tech fields of power engineering is one of the most important tasks of modern education. A number of special features of modern power engineering necessitate not only a highly specialized training but a wider approach in teaching postgraduate students of this field. These special features include a high degree of integration of science, industry, economic and social spheres, and the breadth of interdisciplinary connections in high-tech industries. The postgraduate philosophical training plays an important role in the educational process. The breadth of the problem field and the universality of philosophical knowledge reveal the methods and mechanisms of integration of such sub-disciplines that have significant methodological and structural differences: science, logical-mathematical, socio-economic, technological and human knowledge. Appeal to the philosophy at the stage of postgraduate training has a number of reasons. First of all, it is aimed at integrating of the specific content of different areas of knowledge into a holistic worldview. Secondly, it contributes in developing a critical attitude towards reality and science. What is more, the study of philosophy helps young researches to acquire the definition of their ideological position.

1. Introduction
Modern heat power engineering is a complex high-tech field of human activity, characterized by a large degree of integration of science, industry, economics and social sphere. The above features of modern power engineering determine the specific approaches to the training of highly qualified personnel for this field of science and production.

Postgraduate education for high-tech innovative industries is one of the most important tasks of modern education. The nature of the development of the scientific and technological environment today indicates the strengthening of system-integrative trends [1]. The breadth of interdisciplinary ties, intrinsic to modern science-intensive industries, is typical for heat and power engineering. This causes the inadequacy of narrowly specialized approaches in training highly qualified personnel for this sphere.

2. The role of philosophy in the post-graduate power engineering education
The post-graduate philosophical training is one of the important aspects of the educational process, fulfilling a number of important tasks. Thanks to the study of the Philosophy of science, a generalized view of the methodology of scientific cognition as a whole, the boundaries of science, the ways of
interaction and interpenetration of individual scientific fields, the understanding of the modern scientific paradigm, the ethos of science is formed, that is, the young scientist's scientific outlook develops. All this contributes to overcoming the narrowly specialized approach in the energy sector.

The specific nature of power engineering as a science, economic and production sphere of human activity is that all sections of modern scientific knowledge play a certain role in its functioning and development. As power engineering encompasses the generation, transmission, distribution and sale of electric and thermal energy to the consumer, the knowledge that a specialist in this field must possess is very wide.

Natural sciences form the basis of knowledge about natural processes and phenomena, that is, they lie at the base of power engineering. Logical and mathematical training provides a tool for calculation and forecasting in the energy sector. Socio-economic knowledge is necessary for setting tasks, understanding social processes, and the economic success of power engineering projects. In addition, power engineering plays an important role in public policy today, that is, it requires the specialist to understand geopolitical trends.

Engineering and technology, as a dynamically developing field of applied scientific research, play one of the key roles in modern power engineering. Knowledge of the spiritual, intellectual, moral, cultural and social activities of man, represented by the humanities, helps to determine the tasks of the modern power engineering and to understand the specific effects of complex power engineering systems on man.

Thus, knowledge of various fields of science, humanities, engineering and technology is necessary for a specialist in the field of power engineering (figure 1).

![Figure 1. Kinds of knowledge required in power engineering.](image)

Each area of scientific knowledge has its own range of research questions, and, accordingly, its structure and its methodological methods. The breadth of the problem field and the universality of philosophical knowledge make it possible to integrate the achievements of various scientific fields. Philosophy identifies methods and mechanisms for the integration of such branches of science that have significant methodological and structural differences: science, logic, mathematics, socioeconomic, technological and humanitarian knowledge. That is, the study of philosophy at the stage of postgraduate training provides the formation of a general scientific worldview approach that makes it possible to use the achievements of various fields of knowledge in power engineering.
3. Requirements for the content of the educational program on “History and Philosophy of Science”.

To ensure the successful philosophical postgraduate training, the formation of the substantive part of the program on “History and Philosophy of Science” must meet a number of requirements (figure 2):

1) give an exhaustive picture of the development of science historical stages, introduce modern philosophical concepts of science;
2) take into account the peculiarities of scientific fields;
3) acquaint postgraduate students with the latest achievements of innovative fields of science, technology and industry.

If we look in more detail at each of the aspects, then we can say the following.

1) Analysis of the historical stages of the development of science. Introduction to modern philosophical concepts of science.

The first aspect ensures that the postgraduate training gives a holistic view of the development of science in the historical perspective. This is achieved through an analysis of the features of science at various historical stages: from its beginnings to the present day, which helps to understand the mechanisms of interaction between society, science and industry, to comprehend the system-integrative tendencies of modern scientific research, to study ways of incrementing different types of knowledge.

Attitude to science and technology at different stages of the development of mankind had its own historical features. So, in ancient times, scientific and technical knowledge was of a magical, ritual character, which was a reflection of the mythological consciousness and world view of the ancients. In antiquity, one can see the first approach to rational understanding of science and technology, technology is considered in the fundamental categories of antiquity: knowledge and being, and science has acquired an independent and free character.

In the Middle Ages, monasteries played a special role in the development of science and technology. Monasteries became centers of education and spiritual culture, centers of production and experimentation, and the application of new technical solutions. Syncretic way of life of monks (that consisted of both spiritual and physical labor) gave a special character to the way of accumulation and transfer of knowledge. The emergence of European universities is another important stage in the development of science. In the period of the Renaissance and the New Time, the concepts of “engineering” and “engineering activity” arise, the attitude towards technology and its creators is...
changing. At this time, functional connections are formed between engineering creativity and experimental natural science.

In the XIX century, mathematization and ontologization of natural science takes place, which represents a new stage in the development of science. Then begins the process of formation of technical sciences and engineering education. So education in engineering becomes a definite link between natural science and engineering practice. In the second half of the XIX century, the philosophy of science is formed as an independent division of philosophy, beginning with the twentieth century, many concepts of science and technology are emerging. The study of modern interpretations of science, engineering and technology and their role in human life helps post-graduate students not only to comprehend the phenomena of science and technology, but also to predict the nature of their development in the future.

2) Orientation to a particular scientific field.

The orientation of the contents of the program “History and Philosophy of Science” to the particular scientific field of a post graduate student is very important. This allows the postgraduate student to see clearly the place of modern power engineering in the system of scientific knowledge and correctly assess the role of power engineering in the economic and industry structure of the state. The study of the history of the development of power engineering by a young specialist provides an understanding of the current power engineering challenges facing humanity. The problem of finding and using various energy sources has a long and interesting history. The history of using energy begins with the history of mankind. The search for new sources of energy is due to the constant increase in energy consumption by the growing population of the earth.

The power engineering problem is one of the modern global problems of mankind. The intensive growth of power consumption and the increase in the population of the Earth aggravates the situation in the power engineering sector. Today, the power engineering problem has a number of aspects:

- energy shortage,
- depletion of the Earth's energy resources,
- search for new sources of energy,
- irrational use of energy resources,
- harm to the environment,
- adverse effects of changes in the natural environment,
- ethical problems of power engineering,
- energy security of the state [2].

The depth and global nature of the energy problem inevitably leads us to a philosophical level of comprehension.

3) Study of modern achievements of science and technology.

This aspect of the substantive part of the program requires constant revision and making changes. The relevance of the materials being studied is very important. The study of modern research results and their implementation in the field of power engineering enables the postgraduate student to get acquainted with the current state of affairs in this sector and related fields of science and industry. The study of modern achievements of science and technology is designed to ensure the strengthening of links between education sector, science and industry. This is the key to the success of a specialist in the field of power engineering in the future. Besides, it strengthens the relationship between training and practice [3].

Modern science and industry makes certain demands for the training of future specialists. These requirements determine the specifics of training, the tasks of educational programs, the range of knowledge, skills and abilities that a postgraduate student should have by the time of the end of training. On the other hand, the quality and level of education of highly qualified personnel directly affects the features of the scientific and technology development. The relevance of the content of the educational program ensures the integration of the educational, scientific and production spheres.

4. Conclusion
1) The study of philosophy in innovative power engineering postgraduate course is one of the important parts of the educational process.

2) The appeal to philosophy at the stage of postgraduate training is aimed at integrating the specific content of various fields of knowledge into a universal system of concepts of the scientific worldview. The study of the philosophy of science helps to strengthen the unity of the “education-science-production” system.

3) Philosophy as a universal critical knowledge forms the worldview of a young scientist, helps to develop a critical attitude to reality, to understand the universal humanistic orientations of science.

References

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