

UKRAINIAN STATE UNIVERSITY RAILWAY TRANSPORT



SYLLABUS **from the discipline** **"ENERGY SAVING"** **for the II semester of the 2022–2023 academic year**

Level of higher education – second (master's)

Field of knowledge – 15 "Automation and instrumentation"

Specialty – 151 "Automation and computer-integrated technologies"

Time and audience of classes - according to the class schedule

<http://rasp.kart.edu.ua>

TEAM OF TEACHERS

Lecturer, head of practical classes:
Ananieva Olga (Doctor of Technical Sciences, Professor)
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Consultations: 14.00-15.00 Tuesday-Thursday
Location of the department: Kharkiv, Maidan Feyerbacha, 7, building 2, auditorium 2.107.
Information resources:
1. http://metod.kart.edu.ua/
2. https://wwfeu.awsassets.panda.org/downloads/energyefficiency.pdf
3. https://ela.kpi.ua/jspui/bitstream/123456789/21708/1/EnergySaving%20I.pdf

COURSE COMPETENCES

The course aims to form and develop such competencies of students.

1. Value-semantic competence (formation and expansion of the student's worldview in the field of energy resources, the ability to understand the importance of using alternative energy sources and the impact of energy on the environment).

2. General cultural competence (understanding of cultural, historical and regional features that have developed in Ukraine and abroad in the field of automation of railway rolling stock).

3. Educational and cognitive competence (formation of the student's interest in the state and prospects for the development of non-traditional and renewable energy sources, environmental problems of their use with the aim of developing the creative component of competence; mastering measurement skills; the student's ability to form research goals and, in order to solve them, the ability to find solutions in non-standard situations in the context of ensuring the electricity supply of railway transport of Ukraine).

4. Information competence (development of the student's ability to independently search, analyze, structure and select the necessary information in the field of investing in energy saving using new technologies and calculation methods).

5. Communicative competence (the student's development of teamwork skills through the implementation of group projects in the field of energy saving, the ability to present one's own project and competently lead a discussion in the researched field).

6. Competence of personal self-improvement (elements of spiritual and intellectual self-development; support of constant thirst for self-improvement and self-knowledge by constantly searching for non-traditional approaches to the problem of energy security of the state).

WHY SHOULD YOU CHOOSE THIS COURSE?

If you are interested in renewable or so-called "green" energy and are concerned about the impact on the environment, this is what you need!

Applicants are expected to have a basic understanding of physics, the basics of converting technology, as well as knowledge of traditional sources of electrical energy.

One-third of the course content is devoted to the efficient use of energy resources (including policy and regulatory decision-making; environmental, health and safety, and economic considerations), and two-thirds of the course covers the comparative analysis, technical and engineering aspects of alternative and renewable sources of electric energy (technological innovations, formation and potential of resources, conversion processes, dynamics and modeling of energy systems) with their integration into the power supply system of electric transport of Ukraine, issues of technological energy saving and methods of investing in energy saving.

By diligently studying this course, you will become an expert in energy conservation issues, and the team of teachers during your studies will be able to provide you with any kind of advisory help from the course of the academic discipline in person or by e-mail at the specified consultation time. The program of the academic discipline consists of the following content modules:

1. Energy saving strategy. Development of energy-saving technologies.
2. Organizational and legal bases of energy saving. Economic aspects of energy saving. Unconventional energy sources.

90 hours / 3 ECTS credits are allocated to the study of the academic discipline.

COURSE OVERVIEW AND OUTLINE

The problem of energy conservation has turned into one of the most important universal human problems at the turn of the millennium. Rational and economical use of natural resources, reduction of harmful emissions into the atmosphere, and efficient use of electrical and thermal energy are extremely important in modern society.

Ukraine meets its needs in natural energy resources at the expense of its own extraction by approximately 45%. In most countries of the world, the level of energy self-sufficiency is the same or lower.

The problem lies in something else – the unacceptably low efficiency of fuel and energy resource use. The energy intensity of the gross domestic product (hereinafter – GDP) in Ukraine is 3-5 times higher than in economically developed countries. This indicator in our country is 0.93 kg of U.P./dollar. USA, for comparison – in Austria it is equal to 0.21 kg U.S./dollar, the average indicator in the world is 0.39 kg U.S./dollar. USA. This situation is a consequence of the deformed structure of production and energy consumption, the use of outdated production energy funds, the slow implementation of energy-saving measures and technologies, as well as a number of other reasons. In addition, it should be noted the poor quality of the legal framework in this area.

The need to increase the level of energy security is one of the main tasks of our state at the current stage of its socio-economic development.

In the conditions of significant dependence of the Ukrainian economy on the import of energy carriers, this direction of the state economic policy is no less important than increasing the volume of own extraction (production) of energy resources. Energy conservation is not only decisive, but also the cheapest source of meeting the needs of the economic complex in energy carriers, because the specific capital costs for energy conservation are significantly lower than the costs for increasing extraction and production of energy carriers.

Energy conservation – measures aimed at saving thermal and electrical energy, as well as the use of alternative energy sources. Using different energy

sources and technologies, it is possible to achieve a beneficial effect in different ways (reducing energy losses during its transformation and reducing the negative impact of energy consumption on the environment).

The purpose of teaching the educational discipline "Energy Conservation" is to get acquainted with the current state of global and domestic energy, analysis of reserves and resources of energy carriers, the impact of energy on the environmental state of the environment, the study of the latest technologies of energy conversion, energy conservation, and the use of non-traditional energy sources.

The main tasks of studying the discipline "Energy conservation" are the formation of students' theoretical foundations and the acquisition of practical skills in the application of theoretical knowledge to solve possible engineering tasks.

PLAN OF LECTURES AND PRACTICAL LESSONS

Specialty – 151 "Automation and computer-integrated technologies"

II semester of the 2022-2023 academic year

Week	Number of hours	The topic of the lecture	Number of hours	Topic of practical, seminar and laboratory classes
1	2	Lecture No. 1. Introduction. Energy conservation as a science. The current state of global and domestic energy. Resources and reserves. Classification of energy resources. Biomass. Combustible minerals. Peat and coal. Oil and natural gas.		
2			2	PR-1 Forecast of the development of production and consumption of fuel and energy resources. Issuance of essay topics.
3	2	Lecture No. 2. Energy resources of the planet: energy of the Sun, tides, heat of the Earth. Wind energy and ocean energy. Nuclear distribution energy.		
4			2	PR-2 Energy passport of the enterprise. Protection of essays.
5	2	Lecture No. 3. Analysis of energy saving potential. Intensive energy saving.		
6			2	PR-3 Design of the heat-insulating shell of buildings with heat-technical indicators of its elements. Protection of essays.
7	2	Lecture No. 4. Technological energy saving. The main features of the new norms. Reduction of heat losses due to external enclosing structures of buildings.		
8			2	PR-4 Design of the heat-insulating shell of buildings with heat-technical indicators of its elements (finish).
		Modular control of knowledge		
9	2	Lecture No. 5. Technological energy saving. Heating. Boilers Disadvantages and advantages of different types of boilers. Electrode boiler (ionic). Condensing boilers. Pipelines. Heating devices (radiators). Warm floor.		
10			2	PR-5 Net present value method. Profitability indicator. Payback period.

				Assignment of homework
11	2	Lecture No. 6. Technological energy saving. windows Heat recovery system. Heat pump. Heat pump efficiency. Advantages and features of a geothermal heat pump. Practical aspects of using a heat pump. Thermodome		
12			2	PR-6 Method of internal rate of return. Financial leverage.
13	2	Lecture No. 7. Passive house. Active house. Smart home. Planning capital investments for the development of energy sources. Types of investment projects. Methods of evaluating investments in energy saving.		
14			2	PR-7 Summarizing lesson on semester material.
15	2	Lecture No. 8. Organizational and legal foundations of energy saving. General characteristics of legislation on energy. State control in the sphere of efficient use of energy carriers. Legislation on heat energy. Unconventional energy sources. State support for their use.		
		Modular control of knowledge		

Plan of lectures and practical classes (correspondence study)

Week	Number of hours	The topic of the lecture	Number of hours	Topic of practical, seminar and laboratory classes
1	2	Introduction. Energy conservation as a science. Resources and reserves. Classification of energy resources. Biomass. Combustible minerals. Peat and coal. Oil and natural gas. Energy resources of the planet: energy of the Sun, tides, heat of the Earth. Wind energy and ocean energy. Nuclear distribution energy.	2	П.3. 1 Energy passport of the enterprise. Planning capital investments for the development of energy sources. Types of investment projects. Methods of evaluating investments in energy saving.
2	2	Technological energy saving. The main features of the new norms. Reduction of heat losses due to external enclosing structures of buildings. Heating. Boilers Gas boilers. Disadvantages and advantages of different types of boilers. Ecological aspects of energy saving. The Kyoto Protocol in Ukraine.		

INFORMATION SUPPORT FOR THE INDEPENDENT WORK OF HIGHER EDUCATION ACQUIRES

Main literature literature

1. Collection of normative documents on energy saving: Order of Ukrzaliznytsia 18.12.2007 No. 597-II. – K.: "Inpress" LLC, 2008. – 278 p.
2. Fuel and energy complex of Ukraine in the context of global energy transformations. – K.: Ukrainian encyclopedic knowledge, 2004. – 468 p.
3. Innovative priorities of the fuel and energy complex of Ukraine / Under general ed. A.K. Shidlovsky – K.: Ukrainian encyclopedic knowledge, 2005. – 512 p.
4. Bakalyn Y.I. Energy conservation and energy management: Education. manual. – Kharkiv: KhIU, 2002. – 200 p.

Supporting literature

1. Energy management. Energy conservation: Education. manual / A.V. Prakhovnyk, V.P. Rosen, O.V. Razumovskyi et al. – K.: Kyiv. sheet music f-ka, 1999. – Book. 3. – 184 p.

REQUIREMENTS OF THE TEACHER

The study of the educational discipline "Energy conservation" requires:

- performance of tasks according to the curriculum (individual tasks, independent work, etc.);
- preparation for practical classes;
- work with information sources.

Preparation for practical classes involves: familiarization with the program of the academic discipline, questions that are presented in classes on the corresponding topic; study of methodical material. The solution of practical tasks must meet the requirements (have all the necessary components) put forward for the solution of the corresponding task, testify to its independence (demonstrate signs of independence of the applicant's performance of such work), absence of signs of repetition and plagiarism.

At the practical classes, the presence of students of higher education is mandatory, and their participation in the discussion of all issues of the topic is also important. Missed classes must be made up. The same applies to students who did not complete the task or showed a lack of knowledge on the main issues of the topic.

PROCEDURE FOR ASSESSMENT OF LEARNING RESULTS

Control methods: oral survey, ongoing control, modular control (tests), final testing, assessment. When evaluating learning outcomes, be guided by the Regulation on control and evaluation of the quality of students' knowledge at UkrDUZT (<http://kart.edu.ua/images/stories/akademiya/documentu-vnz/polojennya-12-2015.pdf>).

According to the Regulation on the introduction of the credit-module system of the organization of the educational process, a 100-point rating scale is used.

The principle of forming an assessment for the module as part of credit credits I and II on a 100-point scale is shown in the table, which shows the maximum number of points that a student can score for different types of study load.

Maximum number of points per module		
Modular control	Modular control (Tests)	Sum of points for the module
Up to 60	Up to 40	Up to 100
Current control		1 semester
Attending classes. Activity in classes (Lectures, practical).		18
Submission of practical works within the term		42
Sum up to 60		до 60

When filling out the credit and examination information and the credit book (individual study plan) of the student, the grade given on a 100-point scale must be transferred to the state scale (5, 4, 3,) and the ECTS scale (A, B, C, D, IS).

Determination of the name according to the state scale (estimate)	Determination of the title according to the ECTS scale	On a 100-point scale	ECTS rating
PERFECTLY – 5	<u>Excellent</u> – excellent performance with only a few minor errors	90-100	A
GOOD – 4	<u>Very good</u> – above average with a few faults	82-89	B
	<u>Good</u> – generally correct work with a certain number of gross errors	75-81	C
SATISFACTORY - 3	<u>Satisfactory</u> - not bad, but with a significant number of shortcomings	69-74	D
	<u>Sufficient</u> – performance meets minimum criteria	60-68	E
UNSATISFACTORY- 2	<u>Unsatisfactory</u> – you need to work before getting a credit or exam (without re-studying the module)	35-59	FX
	<u>Unsatisfactory</u> – serious further work is required (re-study of the module)	<35	F

LEARNING RESULTS

As a result of studying the "Energy Conservation" course, the student of higher education will:

1. Know the regulatory framework for energy saving; the main types of losses of energy carriers, tasks of the country's energy sector, methods of obtaining energy, environmental problems of energy sector; main issues related to climate change and ways to mitigate climate change; means of reducing energy consumption;
2. Know the requirements of regulatory documents for power supply, energy quality and services, energy efficiency; requirements for building and functioning of energy management systems, methods of evaluating investments in energy saving.
3. To be able to develop the necessary regulatory documentation on energy saving in practice; identify the main problems associated with the processes of energy production, distribution and consumption; identify places of overspending and choose measures to improve energy efficiency; work with scientific and technical literature.
4. Be able to evaluate investments in energy saving.

CODE OF ACADEMIC HONOR

The teaching team expects you to unconditionally comply with the Code of Academic Integrity. The code is available at the following link: <http://kart.edu.ua/documentu-zvo-ua>

In particular, compliance with the Code of Academic Integrity of UkrDUZT means that all work on exams and tests must be done individually. During independent work, students can consult with teachers and other students, but must solve tasks independently, guided by their own knowledge, abilities and skills. References to all resources and sources (for example, in reports, independent papers or presentations) should be clearly identified and properly formatted. In the case of joint work with other students on individual tasks, you must indicate the degree of their involvement in the work.

INTEGRATION OF STUDENTS WITH LIMITED OPPORTUNITIES

Higher education is a leading factor in raising social status, achieving spiritual and material independence and socialization of youth with limited functional capabilities and reflects the state of development of democratic processes and humanization of society.

To integrate students with disabilities into the educational process of the Ukrainian State University of Railway Transport, a distance learning system was created based on modern pedagogical, information, and telecommunication technologies.

Access to distance learning materials from this course can be found at the following link: <http://do.kart.edu.ua/>