



MINISTRY OF EDUCATION AND SCIENCE OF
UKRAINE
CENTRAL UKRAINIAN NATIONAL
TECHNICAL UNIVERSITY



Department of Electrical Systems and Energy Management

SYLLABUS OF THE EDUCATIONAL DISCIPLINE

Course Name	Energy Efficiency Assessment Methods
Instructor	Kateryna PETROVA, PhD in Engineering, Associate Professor, Associate Professor of the Department of ES & EM
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Volume and characteristics of the discipline	Elective discipline, content modules - 2. Form of control: pass/fail (credit). Total number of credits 4, hours 120. Format: offline (face to face) / online. Language of instruction: English.
Consultations	Consultations are held according to the schedule posted on the moodle.kntu.kr.ua information resource; via Zoom video conferences, email, Viber, Telegram by appointment.
Prerequisites	There are no special requirements, however, the effectiveness of mastering the discipline content will significantly increase if the student possesses basic knowledge of the fundamentals of energy saving and energy efficiency.

1. Goal and tasks of the discipline

The **purpose** of studying the educational discipline "Energy Efficiency Assessment Methods" is to form theoretical knowledge and practical skills regarding the efficiency control of processes of production, transmission, distribution, and consumption of fuel and energy resources (FER) based on the specific fuel and energy consumption rate setting methodologies currently in force in Ukraine.

The tasks of studying the discipline are aimed at forming students' knowledge, abilities, and skills regarding:

- methodology for controlling the efficiency of FER use, methodology for setting specific fuel and energy consumption rates (technological, general production, end-to-end), principles of building operational energy consumption control systems, application of probabilistic-statistical methods in controlling energy costs;

- calculation of normative and end-to-end FER consumption rates; \
- determination of technological and general production rates;
- implementation of operational control of energy consumption efficiency;
- allocation of costs among departments and types of products;
- establishment and monitoring of energy consumption "standards";
- practical use of the specific electrical energy consumption rate setting methodologies valid in Ukraine;
- determination of "simple" and end-to-end rates of specific electrical energy consumption for complex productions with a wide range of products;
- application of a probabilistic-statistical approach for operational control of the efficiency of electrical energy use by technological and power plants;
- carrying out professional communication, effective explanation and presentation of material, interaction in project activities;
- participating in events aimed at increasing the level of energy efficiency and energy-saving attitude towards energy resources.

2. Learning outcomes

As a result of studying the educational discipline, a higher education student must **know:**

- methodologies for controlling the efficiency of fuel and energy resources (FER) use;
- methodologies for setting specific fuel and energy consumption rates (technological, general production, end-to-end) valid in Ukraine;
- principles of building systems for operational control of energy consumption;
- probabilistic-statistical methods in controlling energy resource costs;
- fundamentals of regulatory support and energy efficiency requirements in production processes;
- modern approaches to enterprise energy efficiency management.

be able to:

- calculate normative, general production, and end-to-end FER consumption rates;
- determine specific fuel and electricity consumption in production processes;
- conduct operational control of enterprise energy consumption efficiency;
- allocate energy resource costs among departments and types of products;
- establish and control energy consumption standards;
- apply probabilistic-statistical methods to control energy consumption efficiency;
- use methodologies for setting specific electrical energy consumption rates for complex productions;
- carry out professional communication, preparation, and presentation of energy analysis results;
- participate in project activities aimed at increasing energy efficiency and energy saving.

acquire social skills (soft-skills):

- communication skills and presentation (ability to carry out professional communication, prepare reports, effectively explain and reasonably present the results of energy analysis and research to an audience);
- teamwork and leadership (ability to effectively interact in project activities, work in a team during the development and implementation of measures aimed at increasing the enterprise's energy efficiency);
- analytical thinking and decision-making (ability to analyze complex situations, form one's own position and make reasonable management decisions regarding the optimization of fuel and energy resources (FER) costs);
- environmental and social responsibility (readiness to promote an energy-saving attitude towards energy resources, awareness of the importance of rational resource use for society and the environment).

3. Course policy and academic integrity

It is expected that higher education students will adhere to the principles of academic integrity and be aware of the consequences of violating it. During the organization of the educational process at the Central Ukrainian National Technical University, higher education students, teachers, and administration act in accordance with: Regulations on the organization of the educational process; Regulations on the organization of studying elective educational disciplines and forming a student's individual study plan of the Higher Education Institution; Code of Academic Integrity of CUNTU.

4. Discipline program

Content module 1. Energy Conservation, Efficiency Indicators, and Energy Balances.

Topic 1. Energy Conservation. The Energy Infrastructure of an Industrial Enterprise and Indicators of Its Energy Supply and Consumption Efficiency

Topic 2. Energy Balances and Energy Characteristics of Power Installations

Topic 3. Energy Efficiency of Operation of Energy-Consuming Units

Content module 2. Normalization and Energy Characteristics of Power Installations

Topic 4. Energy Efficiency of Energy-Consuming Units

Topic 5. Normalization of specific energy consumption by process facilities

Topic 6. Normalization of Specific Energy Consumption by Utility Facilities

Topic 7. Monitoring compliance with established specific energy consumption standards

5. Criteria and means of evaluation

Methods of control: observation of students' educational activities, oral questioning, test control. Form of final control: pass/fail (credit). The criterion for successful learning is the achievement by a higher education student of minimum threshold grade levels for each learning outcome. Ensuring the objectivity of evaluating

higher education students is carried out by applying a cumulative point-scoring system for evaluating learning outcomes for each topic of the educational component throughout the semester. During the semester, a higher education student can receive a maximum of 100 points, including: the first milestone control - 50 points, the second milestone control - 50 points. Under current control, a student can score points for activity in lecture and practical (seminar) classes, laboratory work execution, revealing the level of students' preparation on a specified topic during questioning, testing, presentation of individual tasks, solving practical problems and cases, etc.

Points calculation scheme for the educational discipline

Topic Name	Forms of assessing learning outcomes of higher education students				Total
	Laboratory work execution	Solving tasks	Questioning	Tests execution	
Content module 1. Energy Conservation, Efficiency Indicators, and Energy Balances.					
Topic 1. Energy Conservation. The Energy Infrastructure of an Industrial Enterprise and Indicators of Its Energy Supply and Consumption Efficiency	5	3	4	4	16
Topic 2. Energy Balances and Energy Characteristics of Power Installations	5	4	4	4	17
Topic 3. Energy Efficiency of Operation of Energy-Consuming Units	5	4	4	4	17
Total for content module 1					50
Content module 2. Normalization and Energy Characteristics of Power Installations					
Topic 4. Energy Efficiency of Energy-Consuming Units	5	2	3	2	12
Topic 5. Normalization of specific energy consumption by process facilities	5	2	3	2	12
Topic 6. Normalization of Specific Energy Consumption by Utility Facilities	5	2	3	2	12
Topic 7. Monitoring compliance with established specific energy consumption standards	5	3	4	2	14
Total for content module 2					50
TOTAL FOR THE SEMESTER	35	20	25	20	100

Evaluation of types of work

Type of work	Maximum points per single assignment
Execution of laboratory work	5
Solving tests	0.1...0.2 per 1 correct answer
Questioning	3...4
Execution of independent work assignments	2...4

Grading scale: national and ECTS

Sum of points for all types of educational activities	ECTS Grade	Grade according to the national scale for	
		exam, course project (work), practice	pass/fail (credit)
90-100	A	Excellent	Credited (Passed)
82-89	B	Good	
74-81	C		
64-73	D	Satisfactory	
60-63	E		
35-59	FX	Unsatisfactory with the possibility of retaking	Not credited (Failed) with the possibility of retaking
1-34	F	Unsatisfactory with mandatory restudy of the discipline	Not credited (Failed) with mandatory restudy of the discipline

6. Recommended sources of information

Main

1. Pleshkov, P. H., Serebrennikov, S. V., Sirikov, O. I., & Savelenko, I. V. (2018). *Energy engineering and management: in 3 parts. Part 1. Design of efficient energy systems*. Kropyvnytskyi: CUNTU. 156 p. [in Ukrainian]. Available at: <http://dspace.kntu.kr.ua/jspui/handle/123456789/8074>

2. Borychenko, O. V., & Nakhodov, V. F. (Comps.). (2023). *Methods of measurement and verification of company's energy performance: textbook for master's degree students under the educational program "Energy Management and Energy Efficient Technologies", specialty 141 "Electric Power Engineering, Electrical Engineering and Electromechanics"*. Kyiv: Igor Sikorsky KPI. 101 p. [in Ukrainian]. Available at: <https://ela.kpi.ua/server/api/core/bitstreams/cd7e0e70-f0b2-4c02-9be6-7c1b35583976/content>

3. Pleshkov, P. H., & Petrova, K. H. (Comps.). (2020). *Energy-saving power supply modes: methodological guidelines for the execution of a course project for applicants of higher education of the second (master's) level in specialty 141 "Electric Power Engineering, Electrical Engineering and Electromechanics"*. Kropyvnytskyi: CUNTU. 77 p. [in Ukrainian]. Available at: <http://dspace.kntu.kr.ua/jspui/handle/123456789/9672>

4. Pleshkov, P. H., Orlovych, A. Yu., Serebrennikov, S. V., Behun, A. P., Rizunenko, A. O., Harasova, N. Yu., & Zinzura, V. V. (2018). *Energy-efficient lighting systems for industrial and communal-household consumers*. Kropyvnytskyi: CUNTU. 246 p. [in Ukrainian]. Available at: <http://dspace.kntu.kr.ua/jspui/handle/123456789/8074>

5. Solovei, O. I., Rozen, V. P., Pleshkov, P. H., Serebrennikov, S. V., Tkachenko, V. F., & Petrova, K. H. (2015). *Fundamentals of efficient use of electrical energy in power consumption systems of industrial enterprises: textbook*. Cherkasy: Publisher Chabanenko Yu. 316 p. [in Ukrainian]. Available at: <https://dspace.kntu.kr.ua/items/6943f6f0-d7a2-414b-8864-c7936efc4d04>
6. International Energy Agency (IEA). (2025). *Energy Efficiency 2025*. IEA, Paris. Available at: <https://www.iea.org/reports/energy-efficiency-2025>
7. ISO 50001. *Energy management systems — Requirements with guidance for use*. Available at: <https://www.iso.org/iso-50001-energy-management.html>

Additional

1. Petrova, K., & Bondarenko, V. (2025). Evaluation of energy efficiency of a dairy processing enterprise using the CUSUM method taking into account production and climatic factors. *Bulletin of Kremenchuk Mykhailo Ostrohradskyi National University*, 3, 281-288. [in Ukrainian]. DOI: <https://doi.org/10.32782/1995-0519.2025.3.31>. Available at: https://visnikkrnu.kdu.edu.ua/statti/2025_3_281.pdf
2. Tretiak, V. V., Yatsun, V. V., Petrova, K. H., Savelenko, I. V., & Kotysh, A. I. (2023). Building an electricity consumption model for a compressor station of a dairy production enterprise. *Central Ukrainian Scientific Bulletin. Technical Sciences*, 8 (39), Part II, 57-64. Kropyvnytskyi: CUNTU. [in Ukrainian]. Available at: [http://mapiea.kntu.kr.ua/pdf/8\(39\)_II/9.pdf](http://mapiea.kntu.kr.ua/pdf/8(39)_II/9.pdf)
3. Kotysh, A. I., Savelenko, I. V., & Petrova, K. H. (2022). Excessive technical losses of electricity in electrotechnical systems of power consumption. *Bulletin of Khmelnytskyi National University. Series: "Technical Sciences"*, 6(2)(315), 69-73. [in Ukrainian]. Available at: <http://surl.li/kylmc>
4. Pleshkov, P., Zinzura, V., Petrova, K., & Soldatenko, V. (2026). Energy-efficient system for automatic control of educational institutions lighting based on the method of multicriteria optimization. *Herald of Khmelnytskyi National University. Technical Sciences*, 365(3), 87-94. [in Ukrainian]. DOI: <https://doi.org/10.31891/2307-5732-2026-365-12>. Available at: <https://heraldts.khmnu.edu.ua/index.php/heraldts/article/view/2631>
5. Serebrennikov, B. S., Petrova, K. H., & Sliuta, D. I. (2023). Differentiation of power consumption mode management methods across structural levels of the electric power system. *Proceedings of the International Scientific-Practical Conference "Electric Power Engineering, Electromechanics and Technologies in Agro-Industrial Complex"*. State Biotechnological University. Kharkiv: FOP Brovin O.V. 250 p. [in Ukrainian]. Available at: <https://biotechuniv.edu.ua/wp-content/uploads/2023/12/conf-9-11-23-tezy.pdf>
6. Miroshnichenko, A. M., Sulym, M. Yu., & Petrova, K. H. (2025). Regional energy complexes of Ukraine: integral assessment of energy efficiency for sustainable development. *Energy management: state and development prospects PEMS'2025: Proceedings of the XI International Scientific and Technical Conference (Kyiv, November 18-20, 2025)*, 67-68. Kyiv: KrNU. [in Ukrainian].
7. Timofieieva, K. O., & Petrova, K. H. (2025). Intelligent forecasting of electricity consumption of industrial objects taking into account external impact factors.

Energy management: state and development prospects PEMS'2025: Proceedings of the XI International Scientific and Technical Conference (Kyiv, November 18-20, 2025), 69-70. Kyiv: KrNU. [in Ukrainian].

Information resources

1. Central Ukrainian National Technical University: Department of "Electrical Systems and Energy Management". (2026). Kropyvnytskyi: Department of ES and EM, MES of Ukraine. [in Ukrainian]. Available at: <http://etsem.kntu.kr.ua/>
2. Energy supply company PrJSC "Kirovohradoblenergo". (2026). Kropyvnytskyi: PrJSC "Kirovohradoblenergo", Ministry of Fuel and Energy of Ukraine. [in Ukrainian]. Available at: <http://kiroe.com.ua/>
3. NPC UKRENERGO. [in Ukrainian]. Available at: <https://ua.energy/>
4. National Commission for State Regulation of Energy and Public Utilities (NEURC). [in Ukrainian]. Available at: <https://www.nerc.gov.ua/>