

Name of subject	Energy management (ECTS 10 )
Subject/module code	EMEN14510
Science taught semester (s).	3 <sup>rd</sup> and 4 <sup>th</sup> semesters
Responsible teacher	Olimov Orif Nosirovich, senior teacher.
Education language	Uzbek
Connection to the curriculum	Compulsory
Training hours (this including independent education)	<b>Total hours - 300 .</b> 3 <sup>th</sup> semester <b>Contact hours - 60.</b> Lecture training hour - 30 Laboratory training hour - 15 Practical training hour - 15 <b>Independent education - 120 hours</b> 4 <sup>th</sup> semester <b>Contact hours - 60.</b> Lecture training hour - 30 Laboratory training hour - 15 Practical training hour - 15 <b>Independent education - 60 hours</b>
ECTS	10
The purpose and tasks of subject / learning outcomes	<p><b>The purpose of teaching the subject</b> The purpose of the course is to teach students the parameters and conditions of Energy Management, to master the methods of calculating and analyzing the conditions of electrical networks and systems, to teach the basics of designing electrical systems, to teach measures to increase the efficiency of electrical networks, and to acquaint them with the main parts of electrical networks and mechanical electrical networks. their calculation.</p> <p><b>The task of the subject</b> Students will build switching circuits of electrical network elements and determine their parameters, calculate the electrical states of open and closed electrical networks of varying complexity, study the characteristic operating states of electrical networks and systems and evaluate them, learn to control and adjust in electrical networks and systems; to teach the main criteria for designing electrical networks, improving and ensuring the efficiency of electrical networks.</p> <p><b>Learning outcomes:</b></p> <ol style="list-style-type: none"> <li>1. The concept and structure of energy management</li> <li>2. The importance of how to form an energy passport</li> <li>3. General information on energy saving.</li> <li>4. Types of energy waste in the power supply system and their connection.</li> <li>5. Forecasting and standardization of electricity consumption.</li> <li>6. Fundamentals of energy audit.</li> <li>7. Energy monitoring.</li> <li>8. Knowledge of the main legal and regulatory documents in the field and their use</li> <li>9. Activities of energy services.</li> <li>10. Energy management of investments in energy saving.</li> <li>11. Measures to increase and popularize energy efficiency and marketing support.</li> <li>12. Technical and economic energy efficiency of energy saving measures.</li> </ol>
Course content (topics)	<b>I. Main Theoretical Part (Lecture Sessions)</b> <b>Topic 1:</b> Goals and objectives of science. Concept and structure of energy management. Energy management as a special type of management activity <b>Topic 2:</b> Energy resources of industrial enterprises: Types and classification. <b>Topic 3:</b> ISO-50001 international energy management standard. ISO-50001

- International standard. ISO-50001 software manual.

**Topic 4:** General information on energy waste. Types of energy waste.

**Topic 5:** General information on energy waste. Types of energy waste.

**Topic 6:** Measures to reduce energy waste in the power supply system..

**Topic 7:** General information on regulating electricity consumption. General information on forecasting electricity consumption

**Topic 8** Types of regulating electricity consumption.

**Topic 9:** Types of electricity consumption forecasting

**Topic 10:** Energy audit and structure. Energy balance and its types

**Topic 11:** Provision of energy audit services. Instrumental inspection

**Topic 12:** Energy monitoring of calculations.

**Topic 13:** Stages of energy monitoring. Stages of energy monitoring and verification of indicators..

**Topic 14:** Acceptance of energy services. Public-Private Partnership services.

**Topic 15:** Features of energy supply contracts with energy services.

**Topic 16:** Fundamentals of project management.

**Topic 17:** Management of changes in energy efficiency. Risks of starting energy efficiency.

**Topic 18:** Promotion of energy efficiency in industrial enterprises. Motivation of employees in the field of energy efficiency.

**Topic 19:** Information and marketing management of energy management. Orientation of services in the field of energy efficiency and energy efficiency.

**Topic 20:** Efficiency indicators of energy saving projects. Practice of evaluating energy saving projects.

**Topic 21:** Fundamentals of assessing the technical and economic efficiency of energy saving measures.

## **II. Instructions and recommendations for organizing laboratory exercises.**

In laboratory classes, students develop practical skills and competencies in various indicators of processes in electrical networks and systems, conducting experiments, calculating and drawing tables and graphs. The proposed topics are selected based on opportunities and conditions..

### **Recommended topics for laboratory work:**

1. Study of the working process of devices for measuring the flux density of solar radiation;
2. Study of the structure and operation of the luxmeter RS 180-7133;
3. Study of the working process of a thermal imager;
4. The principle of operation of a motion sensor and analysis of types of motion sensors;
5. Schemes of motion sensors and their principle of operation, connection schemes;
6. Study of the working process of a small paraboloid-type solar concentrator;
7. Determination of the temperature at the focus of a small paraboloid-type solar concentrator with a diameter of 80 cm;
8. Study of the temperature regimes of a solar photovoltaic module;
9. Study of the working process of active solar water heaters;
- 10 Study of the working process of active solar water heaters;
11. Fundamentals of investment project management and management of project changes in energy efficiency.;
12. Study of information and marketing management of energy management and economic assessment of energy efficiency.

## **II. Instructions and recommendations for organizing laboratory exercises.**

In laboratory classes, students develop practical skills and competencies in

calculating and drawing tables and graphs, conducting experiments, and analyzing various indicators of electrical energy management processes. The proposed topics are selected based on opportunities and conditions.

**Recommended topics for laboratory work:**

- 1 Calculation of energy indicators in the formation of energy management.
2. Calculation of electricity consumed by consumers at established prices.
3. Calculation of power and energy waste in the power supply system.
4. Calculation of standard indicators of electricity at industrial enterprises.
5. Calculation of forecast indicators of electricity consumed in the future.
6. Calculation of waste when conducting audits at industrial enterprises.
- 7 Calculation of energy indicators in the formation of energy passports of industrial enterprises and buildings.
8. Calculation of energy indicators in energy monitoring at industrial enterprises.
9. Formation of energy service at industrial enterprises
10. Calculation of electricity waste.
11. Calculation of energy savings through the use of non-traditional energy sources in the energy supply of consumers.
12. Definitions and prices in energy. Cal

**III. Practical training instructions and recommendations**

The teacher's preparation for a practical training session begins with the study of preliminary documents (curriculum, thematic plan, etc.) and ends with the development of a lesson plan. The teacher should have an idea of the goals and objectives of the practical training session, the amount of work that each student must perform.

Methodological guidelines are the main methodological document of the teacher in preparing and conducting practical training sessions.

The purpose of the practical training session is to understand the theory, acquire skills. It is to consciously apply it in educational and professional activities, and to develop the ability to confidently form one's own point of view.

**The following topics are recommended for practical training:**

1. Calculation of energy indicators in the formation of energy management.
2. Calculation of electricity consumed by consumers at established prices.
3. Calculation of power and energy waste in the power supply system.
4. Calculation of standard indicators of electricity at industrial enterprises.
5. Calculation of forecast indicators of electricity consumption in the future.
6. Calculation of waste when conducting audits at industrial enterprises.
7. Calculation of energy indicators in the formation of energy passports of industrial enterprises and buildings.
8. Calculation of energy indicators in energy monitoring at industrial enterprises.
9. Formation of energy service at industrial enterprises
10. Calculation of electricity waste.
11. Calculation of energy savings through the use of non-traditional energy sources in the energy supply of consumers.
12. Definitions and prices in energy. Calculation of the amount of payment for the forms of energy consumed.
13. Settlement with consumers for electricity according to a differentiated definition
14. Calculation of electricity waste in lines and transformers
15. Calculation of electricity waste at industrial enterprises
16. Calculation of energy savings at household consumers

17. Energy-economic indicators for the regulation of fuel and energy resources
18. Calculation of quantities characterizing electrical load graphs.
19. Calculation of the calculated load using the main and auxiliary methods.
20. Calculation and selection of the amount of compensated reactive power.
21. Project management. Project scope and objectives. Network analysis. Engineering support tools, operations and task planning.
22. Impact of environmental factors. Impact of external factors on the activities of engineering organizations, issues of ethics and corporate social responsibility.

#### **IV. Independent learning and independent work.**

Independent learning competence serves to support students' independent self-development and increase the effectiveness of professional activities. Students perform independent work on their mobile devices under the guidance of a teacher in a traditional or electronic form.

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  2. Calculation of energy savings through the use of non-traditional energy sources in the energy supply of consumers.
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  5. Calculation of electricity waste in lines and transformers
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  9. Calculation of quantities characterizing electrical load graphs.
  10. Calculation of the calculated load using basic and auxiliary methods.
  11. Calculation and selection of the amount of compensated reactive power.
  21. Project management. Project scope and objectives. Network analysis. Engineering support tools are planning operations and tasks.
  22. The influence of environmental factors. The influence of external factors on the activities of engineering organizations, issues of ethical and corporate social responsibility.
- Practical classes are held in an auditorium equipped with multimedia devices by one professor per academic group. Classes are conducted using active and interactive methods and, accordingly, it is desirable to arouse students' interest in the possibilities of deepening knowledge through the use of appropriate pedagogical and information technologies, to provide the opportunity to independently obtain results, and to prepare them theoretically and methodologically.
- 2.4. Instructions and recommendations for laboratory work
- The following topics are recommended for laboratory work: 1. Study of the working process of devices for measuring the flux density of solar

	<p>radiation;</p> <ol style="list-style-type: none"> <li>2. Study of the structure and operation of the luxmeter RS 180-7133;</li> <li>3. Study of the working process of a thermal imager;</li> <li>4. The principle of operation of the motion sensor and analysis of the types of motion sensors;</li> <li>5. Schemes of motion sensors and their principle of operation, connection schemes;</li> <li>6. Study of the operation of a small paraboloid-type solar concentrator;</li> <li>7. Determination of the temperature at the focus of a small paraboloid-type solar concentrator with a diameter of 80 cm;</li> <li>8. Study of the temperature regimes of the solar photovoltaic module;</li> <li>9. Types of energy-saving and sound-insulating materials;</li> <li>10. Study of the operation of active solar water heaters;</li> <li>11. Fundamentals of investment project management and management of project changes in energy efficiency.</li> <li>12. Information and marketing management of energy management and economic assessment of energy efficiency.</li> <li>13. Assessment of the economic efficiency of investments in energy saving measures.</li> <li>14. Calculation of energy consumption when conducting an energy audit.</li> <li>15. Study of graphs of electrical loads of industrial enterprises.</li> </ol> <p>In the process of laboratory work, students develop skills in studying automated energy accounting and control systems in the power supply system, studying the principle of operation of single- and three-phase meters, testing energy testing devices, and studying methods for automatic adjustment of reactive power.</p> <p>Laboratory work should be conducted by one teacher in a laboratory auditorium equipped with devices representing the topic, with the number of students per academic group being up to 15.</p> <p>2.5. Instructions and recommendations for course work (project) Course work (project) is not included in the curriculum.</p> <p>2.6. Independent study and independent work Recommended topics for independent study:</p> <ol style="list-style-type: none"> <li>1. The role of energy in Uzbekistan;</li> <li>2. The history of the development of electric power in Uzbekistan;</li> <li>3. The role and current state of energy management in Uzbekistan; 4.</li> </ol> <p>Requirements for international energy management standards;</p> <ol style="list-style-type: none"> <li>5. Energy resources and their types;</li> <li>6. Definitions and prices set for electricity in foreign countries;</li> <li>7. Experience of foreign countries in energy conservation;</li> <li>8. Waste in the power supply system;</li> <li>9. Norm and its types;</li> <li>10. Forecasting and its types;</li> <li>11. Experience of foreign countries in regulating electricity;</li> <li>12. Stages of conducting an energy audit at industrial enterprises;</li> <li>13. Formation of an energy balance at industrial enterprises;</li> <li>14. Energy audit and its types;</li> <li>15. Energy passport of energy installations;</li> <li>16. Energy passport of industrial enterprises;</li> <li>17. Energy monitoring and its types;</li> <li>18. Conducting energy monitoring at industrial enterprises;</li> <li>19. Formation of energy services at industrial enterprises;</li> <li>20. Energy indicators at industrial enterprises and their calculation;</li> <li>21. State of energy services of foreign countries;</li> </ol>
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	<p>22. Investment and its types;  23. Formation of investment projects;  24. Energy efficiency  25. The concept of energy efficiency;  26. Information management of energy management;  27. Marketing management of energy management;  28. Methods of energy efficiency management;  29. Evaluation of energy efficiency projects;  30. Performance indicators of energy efficiency projects.</p>
Exam form	Written
Teaching/learning and examination requirements	<p>Complete mastery of theoretical and methodological concepts and practical knowledge of the discipline, the ability to correctly reflect the results of analysis, independently reason about the processes being studied and carry out tasks in the current, intermediate forms of control and independent work, pass written work on the final control.</p> <p>When drawing up final exam questions, deviations from the content of the discipline program are not allowed. The bank of final exam questions for each discipline is discussed at the meeting and approved by the head of the department.</p> <p>No later than 1 week before the start of the final control, tickets signed by the head of the department, enclosed in an envelope, are sealed by the Dean's office and opened 5 minutes before the start of the exam in the presence of students. Final exam duration is 80 minutes. Answers to final exam questions are recorded in copybooks with the seal of the Dean's office. After completion of the final work, the work is immediately encrypted by a representative of the Dean's office, and the copybooks are handed over to the commission for verification. From the moment of completion of the final exam, a period of 72 hours is allotted for checking and posting the results on the electronic platform.</p> <p>The teacher who taught the students in this discipline is not involved in the process of conducting the exam and checking the students' answers.</p> <p>Student(s) who are dissatisfied with the final exam results may submit a written or oral appeal within 24 hours of the publication of the final exam results. Complaints submitted after 24 hours from the publication of the final exam results will not be accepted.</p>
Scope of assessment criteria and procedure	<p><b>CURRENT CONTROL</b></p> <p>Purpose: Determining and assessing the student's level of knowledge, practical skills, and competencies on course topics.</p> <p>Instructions: The student's activity in daily classes is assessed through the student's mastery of course topics, as well as constructively interpreting and analyzing the educational material, developing module-specific skills, acquiring practical skills (in terms of quality and the specified number) and competencies, solving problem situations aimed at applying professional practical skills, working in a team, preparing presentations, etc.</p> <p>Current control form: Activity in lessons Preparing educational materials Working with sources within the subject Using educational technologies Working in a team Preparing presentations Working with projects.</p> <p><b>MIDTERM CONTROL</b></p> <p>Purpose: Assessing the student's knowledge and practical skills and level of mastery of lecture material after completing the relevant section of the course.</p> <p>Form and procedure of intermediate control: Midterm examination is held during the semester during the training sessions after the completion of the relevant module of the curriculum of the subject.</p>

Midterm examination is held once in written form within the framework of this subject. Midterm examination questions cover all topics of the subject.

#### INDEPENDENT LEARNING

Purpose: Independent learning is aimed at fully covering the content of this course, expanding the theoretical knowledge acquired, and establishing independent learning activities for students.

Form and procedure of independent education: independent work assignments are completed in the form of an educational project, presentation, case study, problem solving, information search, digest, colloquium, essay, article, abstract, etc. Completed assignments for independent study are placed in the electronic system and checked based on the anti-plagiarism program and evaluated by the subject teacher.

In this case, the uniqueness of the completed assignment should not be less than 60%, otherwise the assignment will not be accepted for assessment. The number of independent work assignments, depending on the nature of the subject, should not be less than 3 for one subject (module). Independent work assignments account for 60% of the points allocated for current and intermediate control.

#### FINAL CONTROL

Purpose: The final examination is held at the end of the semester to determine the level of mastery of the student's theoretical knowledge and practical skills in the relevant subject. The final examination is held at a specified time according to the examination schedule created by the Registrar's Office on the electronic platform.

Requirements: The student must have passed the current control, intermediate control and independent learning assignments by the deadline for the final control type in the relevant subject. A student who has not passed the current control, intermediate control and independent learning assignments, as well as who has received a score in the range of "0-29.9" for these assignments and control types, is not included in the final control type. Also, a student who has missed 25 percent or more of the classroom hours allocated to a subject without a reason is excluded from this subject and is not included in the final control type and is considered not to have mastered the relevant credits in this subject. A student who has not passed or was not included in the final control type and has received a score in the range of "0-29.9" for this type of control is considered to be an academic debtor.

Final control form: The final examination in this subject will be conducted in written form. If the final examination is conducted in written form, the requirements for assessment must also be reflected.

Criteria for assessing student knowledge	5 grade	100 points		Assessment criteria
	5	90-100	Excellent	When a student is considered to be able to make independent conclusions and decisions, think creatively, observe independently, apply the knowledge he has gained in practice, understand, know, express, and narrate the essence of the subject, and have an idea about the subject.
	4	70-89,9	Good	When the student is considered to be able to observe independently, apply the knowledge he has gained in practice, understand, know, express, and narrate the essence of the subject, and has an idea about the subject.
	3	60-69,9	Satisfactory	When the student is found to be able to apply the knowledge he has gained in practice, understands, knows, can

				express, and narrate the essence of the subject, and has an idea about the subject.	
	2	0-59,9	Unsatisfactory	When it is determined that the student has not mastered the science program, does not understand the essence of the subject, and does not have an idea about the science.	
Course assessment criteria and procedure	Assessment type	Total points allocated	Control (task) form	Distribution of points	Qualifying score
	Current assessment	30 points	System tasks	20 points (divided by the number of tasks)	18 points
			Student activity (in seminars, practical, laboratory classes)	10 points	
	Midterm assessment	20 points	Supervision: Written work	10 points	12 points
			System tasks	10 points (divided by the number of tasks)	
	Final assessment	50 points	Written assignment (5 questions)	50 points (10 points per question)	30 points
	* Note: 60% of the points allocated for current and intermediate control are allocated to independent work assignments. Independent work assignments are evaluated as system assignments through the electronic platform.				
Recommended Literature	<p><b>Main literature:</b></p> <ol style="list-style-type: none"> <li>1. Barney L. Capehart, Wayne C. Turner, William J. Kennedy. Guide to Energy Management. 2020.</li> <li>2. Wayne C. Turner. Energy Management Handbook. 2015</li> <li>3. International Organization for Standardization (ISO). ISO 50001: Energy Management Systems. 2018.</li> <li>4. Steve Doty, Wayne C. Turner. Energy Management Handbook (8th Edition). 2018.</li> </ol> <p><b>Additional literature:</b></p> <ol style="list-style-type: none"> <li>5. O'zbekiston Respublikasini yanada rivojlantirish bo'yicha Harakatlar strategiyasi to'g'risida. - T.:2017 yil 7 fevral, PF-4947-sonli Farmoni.</li> <li>6. Amit K. Tyagi. Handbook on Energy Audits and Management</li> <li>7. Saidxodjaev A.G., Saidxodjaeva M.A. Energiya tejamkorlik asoslari fanidan amaliy va mustaqil ishlar uchun uslubiy qo'llanma. – T.: ToshDTU, 2015.</li> </ol> <p><b>Information sources:</b></p> <ol style="list-style-type: none"> <li>8. <a href="http://www.gov.uz">www.gov.uz</a> – Government portal of the Republic of Uzbekistan.</li> <li>9. <a href="http://www.catback.ru">www.catback.ru</a> – International scientific articles and educational materials.</li> </ol>				