

Ministry of Education and Science of Ukraine
Sumy National Agrarian University
Faculty of Food Technology
Nutrition Technology Department

WORK PROGRAM OF EDUCATIONAL DISCIPLINE (SYLLABUS)

**SC 5 Energy management and energy audit of processing plants
and food industry**

**It is implemented within the educational program
of ED "Master's degree"**

specialties 181 "Food Technologies"
Faculty: Food Technologies

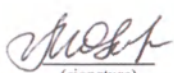
at the second (master's) level of higher education

Developer:



Maryna SAVCHENKO

Ph.D., Associate Professor of the Nutrition Technology Department

Considered, approved and approved at the meeting of the nutrition technology department	protocol No.19 from 31.05.24
	Head department  Oksana MELNYK (signature) (surname, initials)

Agreed:

/ Guarantor of the educational program  Fedyr PERTSEVOY
(signature) (surname)

Dean of the Faculty,
where the educational program is implemented  Natalia BOLHOVA
(signature) (surname)

Review of the work program (attached) provided by:  Oksana MELNYK
(surname)

 Natalia BOLHOVA
(surname)

Methodist of the Education Quality Department,
licensing and accreditation  
(signature) (surname)

Registered in the electronic database: date: 24.06. 2024.

Information on viewing the work program (syllabus):

The academic year in which the changes are made	The number of the annex to the work program with a description of the changes	The changes were reviewed and approved		
		Date and number of the protocol of the meeting of the department	Head of Department	Guarantor of the educational program

1. GENERAL INFORMATION ABOUT THE EDUCATIONAL COMPONENT

1.	The name is EC	Energy management and energy audit of processing and food enterprises			
2.	Faculty/department	Food technology / Nutrition Technology			
3.	The status is EC	Selective			
4.	Program/Specialty, the component of which is EC for (for obligatory EC)				
5.	OK can be offered for (to be completed for selective ECs)	Educational program: Food technologies/specialty: 181 "Food technologies"			
6.	NRK level	7th level			
7.	Semester and duration of study	Semester two The duration of study is 15 weeks			
8.	Number of ECTS credits	5 credits			
9.	The total number of hours and their distribution (full-time study/part-time study)	Contact work (class)			Independent work
		Lectures	Practical/seminar	Laboratory	
		2	14		134
10.	Language of education	Ukrainian			
11.	Teacher/Coordinator of the educational component	The teacher is Ph.D., associate professor of the Nutrition Technology Department, Savchenko Maryna Yuriivna			
11.1	Contact Information	Auditorium of the department 314m, building #4, phone: 0993834398, E-mail: marina.saw4encko2011@gmail.com, consultation hours: every Monday from 1 to 2 p.m.			
12.	General description of the educational component	Familiarization with methods of assessment, analysis and planning in energy use, development of energy-saving measures at the enterprise, drawing up and development of energy-saving programs that take into account technical, economic, financial and administrative factors. Students should also familiarize themselves with the problems of choosing and justifying a more rational type of energy carriers, investing and financing in energy saving, the energy load of the enterprise, issues of information support for energy management; providing future specialists with knowledge of calculation methods and conducting energy audits of technological equipment, power supply systems, refrigeration equipment, pumping, compressor, lighting, electrothermal and other installations, and heat-using systems.			
13.	The purpose of the educational component	Formation of the volume of theoretical and practical knowledge and skills necessary in the professional activity of future highly qualified specialists in the field of energy management, energy saving and energy audit in the food industry.			
14.	Prerequisites for studying EC, connection with other educational components of EP	The educational component is connected with other educational components "Automation of production processes", "Processes and devices of food production", "Technological equipment of food production", "Innovative engineering"			
15.	Policy of academic integrity	If the fact of writing off is discovered during the exam, the student's work is canceled and the exam is retaken. Code of academic integrity (http://surl.li/khyd)			
16.	Link to the electronic resource	Link in Moodle: https://cdn.snau.edu.ua/moodle/course/view.php?id=3693			

2. LEARNING RESULTS UNDER THE EDUCATIONAL COMPONENT AND THEIR RELATIONSHIP WITH PROGRAM LEARNING OUTCOMES

The results study for EC: After studying the educational component, the student is expected to be able to..."	Program learning outcomes, which the EC aims to achieve (indicate the number according to the numbering given in the EP) ¹					The result of learning the discipline is evaluated
	PLO 1	PLO 2	PLO 5	PLO 6	PLO 10	
DLO1. Find information about the essence of energy management, energy enterprise strategy in the matter of energy efficiency, implementation energy management systems at the enterprise; energy management matrix, management energy use, methods research on the efficiency of the use of energy resources	x					Control work on theoretical material. Execution and protection of practical works.
DLO2. Be able to justify the method of thermal calculation of technological heat-consuming equipment of the food industry; methods of determining energy characteristics of equipment and technological processes; Methods calculation of energy consumption for the equipment of processing enterprises.		x				
DLO3. Develop methods for determining heat balances of food industry enterprises; methods calculation loss of energy resources; basics rational operation of heat and power supply systems.			x			
DLO4. Implement types of energy audit; main stages of energy audit; methods of determining and reducing losses of various types of energy in technical and technological objects.				x		
DLO5. Conduct research on methods of using secondary energy resources and alternative and renewable energy sources; energy saving methods; a general approach when conducting an energy audit.					x	

¹It must correspond to the Matrix of ensuring the programmatic learning outcomes by the relevant components of the educational program, it is specified for the compulsory educational components of EP I and II level, for all (mandatory and selective EC)

3. CONTENTS OF THE EDUCATIONAL COMPONENT (CURRICULUM PROGRAM)

Topic. List of issues to be considered within the topic	Distribution within the general time budget		Recom- mended Books	
	Auditory work			Independ- ent work
	Lc	Pc		
Topic 1. Concept of energy management. Energy conservation and energy audit. Introduction to energy management. Concepts and objects of energy management. Basics of energy saving and energy audit. Legislative basis of energy survey.	2	2	26	[1-4; 8-20]
Topic 2. Energy management. Energy consumption accounting. The essence, purpose, tasks, functions, principles of energy management. Matrix of energy management. The procedure for conducting an energy audit of the energy management system.	-	2	26	[5-9; 22-33]
Topic 3. Conducting an energy audit. Assessment of energy saving potential. Main stages of energy audit. The cost and duration of the energy audit. Energy audit report. Assessment of energy consumption. Analysis of the efficiency of energy use. Environmental aspect of energy audit.	-	4	28	[10-14]
Topic 4. Use of secondary energy resources and alternative and renewable energy sources, as a way of saving energy and increasing energy saving of enterprises. Criteria for rational operation of heat and power supply systems. Methods of energy supply from the point of view of energy saving. Evaluation of the efficiency of energy use. Characteristics of secondary energy resources. Characteristics of alternative and renewable energy sources.	-	4	28	[15-19]
Topic 5. The method of thermal calculation of technological heat-consuming equipment of the food industry. Calculation of the heat balance of heat-consuming devices of meat and milk processing enterprises. Determination of the heat transfer coefficient. Calculation of coolant consumption. Calculation of heat-consuming devices of periodic action.	-	2	26	[21-26, 30-37]
In total	2	14	134	

4. TEACHING AND LEARNING METHODS

DLO	Teaching methods (work to be carried out by the teacher during classroom classes, consultations)	Number of hours	Teaching methods (what types of educational activities should the student perform independently)	Number of hours
DLO 1. Know the essence of energy management, the energy strategy of enterprises in the matter of energy efficiency, implementation of the energy management system at the enterprise; matrix of energy management.	To analyze the ways of selecting the necessary information regarding innovations in energy saving using the examples of scientific and technical literature	4	Preparation for the lecture by familiarization with the lecture material. Search for technical solutions in information sources. Studying the material for independent mastery. Preparation of theoretical material in the form of publications. Completion of tasks of practical work, the implementation of which began in the practical session.	26
DLO 2. To know the method of thermal calculation of technological heat-consuming equipment of the food industry; methods of determining energy characteristics of equipment and technological processes.	Giving examples and techniques using an interactive method	2		26
DLO 3. To know the methods of determining heat balances of a food industry enterprise; methods of calculating energy resource losses; basics of rational operation of heat and power supply systems.	Demonstration of examples of solving production problems using an interactive method in lectures and practical classes	2		28
DLO 4. Know the types of energy audit; main stages of energy audit; methods of determining and reducing losses of various types of energy in technical and technological objects.	Demonstration of examples of work in applied software products	4		28
DLO 5. Know ways to use secondary energy resources and alternative and renewable energy sources; energy saving methods; a general approach when conducting an energy audit.	Demonstration of examples of solving production problems using an interactive method in lectures and practical classes	4		26

5. EVALUATION BY THE EDUCATIONAL COMPONENT

5.1. Summative assessment

5.1.1. To assess the expected learning outcomes, it is provided

No	Summative methods assessment	Points/ Percentage in the overall assessment	Compilation date
Module I			
1.	written control work on theoretical material	20 points / 20%	In the sixth week
2.	Implementation and protection of practical	30 points / 30%	Until the next laboratory session
Module II			
3.	Written control work on the theoretical material	20 points / 20%	In the fourteenth week
4.	Implementation and protection of practical works	30 points / 30%	Until the next laboratory session

5.1.2. Evaluation criteria

Component¹	Unsatisfactorily	Satisfactorily	Fine	Perfectly²
<i>Written control work on the theoretical material</i>	<12 points	13-16 points	17-19 points	20 points
	<i>Task requirements not met</i>	<i>Answers to all questions are given, but individual components of the answers are missing or insufficiently disclosed, there is no analysis of other approaches to the question</i>	<i>All questions are answered</i>	<i>Answers to all questions are given, creativity and thoughtfulness are demonstrated, and one's own solution to the problem is proposed</i>
<i>Implementation and protection of practical works</i>	<12 points	13-20 points	21-29 points	30 points
	<i>Task requirements not met</i>	<i>Answers to all questions are given, but individual components of the answers are missing or insufficiently disclosed, there is no analysis of other approaches to the question</i>	<i>All questions are answered</i>	<i>Answers to all questions are given, creativity and thoughtfulness are demonstrated, and one's own solution to the problem is proposed</i>

5.8. Formative assessment:

¹Specify the summative assessment component

²Specify the distribution of points and the criteria determining the level of assessment

To assess the current progress in learning and understand the directions for further improvement is provided

No	Elements of formative assessment	Date
1.	Written survey after studying topics 1-5	according to the study plan
2.	Verbal feedback from the teacher while working on the control work	according to the study plan

Self-assessment can be used as an element of summative assessment and formative assessment.

6. EDUCATIONAL RESOURCES (LITERATURE)

- Utility model patent 136539 Ukraine, IPC: F03D 3/06 / Hybrid power plant // Rozhkova L.G., Savchenko-Pererva M.Yu., Radchuk O.V., Sabadash S.M./applicants and patent owner Sumy National Agrarian university - No. u 2019 01908; statement 25.02.2019; published 27.08.2019. Bul. No. 16.- 4p.
- L. Rozhkova, M. Savchenko-Pererva, O. Radchuk, S. Sabadash and E. Kuznetsov (2022). Innovative Hybrid Power Plant Design. Lecture Notes in Mechanical Engineering. Proceedings of the 5th International Conference on Design, Simulation, Manufacturing: The Innovation Exchange, DSMIE-2022, June 7–10, 2022, Poznan, Poland – Volume 2: Mechanical and Chemical Engineering, V. Ivanov et al. (Eds.): DSMIE 2022, LNME, pp. 299–308, 2023 https://doi.org/10.1007/978-3-031-06044-1_29
- M. Savchenko-Pererva & O. Radchuk (2022) Ways to improve energy conservation in educational institutions. In: Journal of Agriculture Innovation, Technology and Globalization, Vol. 3, No. 1, pp. 73-86. <https://doi.org/10.1504/IJAITG.2022.126866>
- Savchenko-Pererva M., Radchuk O., Rozhkova L. et al. (2022). Determining heat losses in university educational premises and developing an algorithm for implementing energy-saving measures. Eastern-European Journal of Enterprise Technologies, 6/11 (114), pp. 48-59.
- Savchenko M.Yu. Energy management and energy audit of processing and food enterprises: a study guide for students of the 1st year of the specialty 181 "Food technologies", full-time and part-time forms of education of the Master's degree / M. Yu. Savchenko. – Sumy, 2024. – 213c.
- Energy conservation and energy management: Study guide / Bakalin Yu.I. – Kharkiv: BURUN and K, 2018. – 320 p.
- Nightingale O.I. etc. Energy audit: Training manual / O.I. Solovei, V.P. Rosen, Y.H. Lega, O.O. Sytnyk, A.V. Chernyavskiy, G.V. Toad – Cherkasy: ChDTU, 2019. – 299 p.
- V.V. Prokopenko, O.M. Zakladnyi, II.V. Kulbachnyi Energy audit with examples and illustrations: Study guide. - K.: Education of Ukraine, 2018. - 438 p.
- Bulyandra O.F. Teplotekhnika: / Bulyandra O.F., Draganov B.H., Fedoriv V.G. etc.-K: Higher education institution, 2018.-336 p.
- Pavelko V.I. Heat supply of enterprises of the meat processing and milk processing branches of industry. Tutorial. – Vinnytsia: New book, 2017
- Guly I.S. Equipment of processing and food industry enterprises. – Vinnytsia: New Book, 2021.
- Law of Ukraine "On Energy Saving" dated 01.07.21 No. 74/94-BP, with amendments and additions.
- DSTU 4065-2001 Energy saving. General technical requirements. – Valid from 01.07.22. - K.: State Standard of Ukraine.
- DSTU 4713:2007. Energy saving. Energy audit of industrial enterprises. Procedure and requirements for the organization of work. – Valid from 01.07.07. - K.: State Standard of Ukraine.
- DSTU 4081-2002. Energy saving Energetic marking household electrical equipment. General technical requirements. Valid from 01.05.02. - K.: State Standard of Ukraine.

16. DSTU 2339-94. Energy saving. Substantive provisions. – Valid from 01.01.95. - K.: State Standard of Ukraine.
17. DSTU 2420-94. Energy saving. Terms and definitions. – Valid from 01.01.95. - K.: State Standard of Ukraine.
18. DSTU 2155-93. Energy saving. Methods of determining the economic efficiency of energy saving measures. – Valid from 01.01.95. - K.: State Standard of Ukraine.
19. DSTU 2804-94. Energy balance of an industrial enterprise. Terms, Terms and definitions. – Valid from 01.01.96. - K.: State Standard of Ukraine.
20. DSTU 4110-2002. Energy saving. Methodology of analysis and calculation of specific consumption of energy resources. – Effective from 01.07.03. - K.: State Standard of Ukraine.
21. DSTU 4714:2007. Fuel and energy balances of industrial enterprises. Methodology of construction and analysis. – Valid from 01.07.07. - K.: State Standard of Ukraine.
22. DSTU 4715:2007. Energy saving. Energy management systems of industrial enterprises. Composition and content of works at the stages of development and implementation. – Valid from 01.07.07. - K.: State Standard of Ukraine.
23. DSTU 4472:2005. Energy saving. Energy management systems. General requirements. – Valid from 01.07.06. - K.: State Standard of Ukraine
24. Resolution of the Cabinet of Ministers of Ukraine "On approval of the state target economic program of energy efficiency and development of the sphere of production of energy carriers from renewable energy sources and alternative types of fuel for 2010-2020" [Electronic resource]. – Access mode: <http://zakon2.rada.gov.ua/laws/show/243-2010-%D0%BF>
25. Afonchenkova T.M. Formation of the economic mechanism of energy saving by agricultural enterprises: autoref. thesis / T.M. Afonchenkov; PVZ Europe University of K., 2008. – 22 p.
26. Bevs V.V. The development of the energy-saving mechanism at food industry enterprises / V. V. Bevs // Scientific notes: coll. of science works - K.: KNEU, 2021. - No. 13. - P. 169-173.
27. Geets V.M. Development and interaction of economic and energy policy in Ukraine / V.M. Geets // Bulletin of the National Academy of Sciences of Ukraine. – 2021. – No. 2. – P. 46-53.
28. Jejula V.V. Energy conservation of industrial enterprises: formation methodology, management mechanism: monograph / V.V. Jejula – Vinnytsia: VNTU, 2019. – 346 p.
29. Dokunina K.I. Theoretical aspects of the formation of the economic mechanism of energy saving / K.I. Dokunina // Municipal management of cities - 2022. - No. 106. - P. 341-350.
30. Ippolitova I.Ya. Formation of the organizational and economic mechanism of energy saving at the enterprise / I.Ya. Ippolitova, K.S. Sorokotyazhenko // Global and national economic problems. – 2020. – Issue 8. – P. 406-411.
31. Mykhaylenko I.D. Energy saving policy, potential energy saving opportunities in Ukraine / I.D. Mykhaylenko // Energy saving. – 2021. – No. 1. – P. 3-8.
32. Nemish P.D. The essence, assessment and directions for improving the efficiency of the energy saving mechanism of the agricultural industry / P.D. Nemish // Innovative economy. – 2016. – No. 7 (45). - P. 46-53.
33. Serdyuk T.V. Organizational and economic mechanism of energy saving in industry: monogr. / T.V. Serdyuk – Vinnytsia: UNIVERSUM-Vinnytsia, 2015. – 154 p.
34. Chistov Yu.I. The essence of the energy saving mechanism and its multifaceted nature / Yu.I. Chistov // Bulletin of the Khmelnytskyi National University. Economic sciences. – 2020. – No. 5. – P. 341-44.

35. Kals J., Würtenberger K. IT-unterstütztes Energiemanagement in: HMD - Praxis der Wirtschaftsinformatik HMD, Heft 285/2018. - P. 73-81.
36. Gnidy M.V. Methodology for determining the theoretical potential of energy saving at different levels of economic management / M.V. Hnidy, O.E. Malyarenko // Problems of general energy. – 2017. – No. 15. – P. 1-21.
37. Yu. Vovk. Organizational and economic mechanism of managing the rational use of resources [Electronic resource] / Yu. Vovk // Socio-economic problems and the state. – 2011. – Issue 1 (40). - Access mode:<http://sepd.tntu.edu.ua/images/stories/pdf/2011/11vyyrvr.pdf>.