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

Work program (syllabus) of the educational component

SC 2 Energy management and energy audit of processing and food enterprises

Specialty	G 13 "Food Technology"
Educational program	"Food Technologies"
Level of higher education	second (master's)

Sumy– 2026

Developer: _____ **Maryna SAVCHENKO**
Candidate of Technical Sciences, Associate Professor of the
Nutrition technology Department

Reviewed, approved and approved at the meeting of the Nutrition technology Department	Protocol No. 21 dated 02.06.26
	Head of the Department _____ **Oksana MELNYK** (signature) (surname, initials)

Agreed:

Educational guarantor programs _____ Maryna SAVCHENKO

Dean of the Faculty,
where the educational program is
implemented _____ Nataliia BOLHOVA
(signature) (Full name)

Review of the work program (attached): _____ Oksana MELNYK

_____ Nataliia BOLHOVA

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

Registered in the electronic database: date: 18.06. 2026.

Information about reviewing the work program (syllabus):

Academic year in which changes are made	Number annex to the work program with a description of the changes	Changes considered and approved		
		Date and the number of the department meeting minutes	Head of the Department	Educational program guarantor

1. GENERAL INFORMATION ABOUT THE EDUCATIONAL COMPONENT

1.	Name EC	SC 2. Energy management and energy audit of processing and food enterprises			
2.	Status EC	Selective			
3.	Educational program	Food technology			
4.	Unit implementing EC	Food technology/nutrition technology			
5.	NRC level	Level 7			
6.	Semester of study	Second semester Study duration – 15 weeks			
7.	Volume EC	5 credits			
	Total number of hours and their distribution (full-time/part-time)	Contact work (classes)			Independent work
		Lectures **14/6**	Practical/seminar **60/6**	Laboratory	**76/138**
8.	Language of instruction	English			
9.	Limitation	without restrictions			
10	Communication with other components	"Automation of Food and Restaurant Production Processes", " Food Machinery and Equipment", "Innovative engineering"			
11.	Purpose of the educational component	Formation of the volume of theoretical and practical knowledge and skills necessary for the professional activities of future highly qualified specialists in the field of energy management, energy conservation and energy audit in the food industry.			
12.	Study prerequisites	The educational component is based on the previously studied disciplines "Processes and devices of food production", "Automation of Food and Restaurant Production Processes", " Food Machinery and Equipment", "Innovative engineering"			
13.	Academic Integrity Policy	If plagiarism is detected, the test paper will be retaken. Code of Academic Integrity (http://surl.li/khyd)			
14.	Keywords	Energy management, energy audit, measurements, food enterprises			
15.	Course number on the Moodle platform	Moodle link: https://cdn.snau.edu.ua/moodle/course/view.php?id=3693 Savchenko Maryna Yuriivna			

2. LEARNING OUTCOMES BY EDUCATIONAL COMPONENT AND THEIR RELATIONSHIP WITH PROGRAM LEARNING OUTCOMES

Results training for EC: After studying the educational component, the student is expected to be able to...	Program learning outcomes,which the EC is aimed at achieving (indicate the number according to the numbering given in the EP)[13]					The result of learning the discipline is evaluated
	PLO 1	PLO 3	PLO 5	PLO 10	PLO 15	
DLO1. Analyze the essence, strategies and systems of energy management; apply the matrix and methods of managing and assessing the efficiency of energy use.	x					Test work on theoretical material/certificate of completion of non-formal education courses. Completion and defense of practical work.
DLO 2.Analyze the methodology for thermal calculations of technological equipment, determining the energy characteristics of processes and calculating energy consumption at processing enterprises.		x				
DLO 3. Develop methods for determining heat balances of food industry enterprises; methods calculationenergy losses; basics rational operation of heat and power supply systems.			x			
DLO4. Select research on methods of using secondary energy resources and alternative and renewable energy sources; methods of saving energy; general approach when conducting an energy audit.				x		
DLO 5. Analyze the types of energy audits; the main stages of an energy audit; methods for determining and reducing losses of various types of energy in technical and technological facilities.					x	

[13]Must comply with the Matrix of ensuring program learning outcomes by the relevant components of the educational program, indicated for mandatory educational components of EP I and II levels, for all (mandatory and selective EC)

3. CONTENT OF THE EDUCATIONAL COMPONENT (COURSE PROGRAM)

Topic. List of issues to be addressed within the topic	Distribution within the overall time budget			Recommended literature[1]
	Classroom work		Independent work	
	Lc	Pc		
Topic 1. The concept of energy management. Energy conservation and energy audit. Introduction to energy management. Concepts and objects of energy management. Fundamentals of energy conservation and energy audit. Legislative framework for energy inspection. Main energy problems in Ukraine.	2	8	8/20	[1-13,22-26]
Topic 2.Energy management. Accounting for energy consumption. The essence, purpose, tasks, functions, principles of energy management. Energy management matrix. Procedure for conducting an energy audit of an energy management system.	2	8	10/20	[14-21,27-30]
Topic 3. Conducting an energy audit. Assessing energy saving potential. Main stages of an energy audit. Cost and duration of an energy audit. Energy audit report. Assessment of energy consumption. Analysis of energy efficiency. Environmental aspect of an energy audit.	2/2	8/2	14/20	[3-5,12,13, 31-35]
Topic 4. Use of secondary energy resources and alternative and renewable energy sources as a way to save energy and increase energy efficiency of enterprises. Criteria for rational operation of heat and power supply systems. Energy supply methods from the point of view of energy saving. Assessment of energy efficiency. Characteristics of secondary energy resources. Characteristics of alternative and renewable energy sources.	2/2	8/2	8/18	[14-21,36-40]
Topic 5. Heat balance of food industry enterprises. The main components of heat balances and their definition. Analysis of heat balances.	2	8	12/20	[10-12,14-17,41-45]
Topic 6. Methodology for thermal calculation of technological heat-consuming equipment in the food industry. Calculation of the heat balance of heat-consuming devices of meat and dairy processing enterprises. Determination of the heat transfer coefficient. Calculation of coolant flow. Calculation of heat-consuming devices of periodic operation.	2/2	10/2	12/20	[1, 10,11,14, 17,46-50]

[1]Specific source from the main or additionally recommended literature

Topic 7. Algorithm for calculating energy costs by energy audit objects of processing enterprises. Calculation of energy consumption by scalding tanks. Calculation of energy consumption by boilers for cookingProduction of meat broths. Calculation of energy consumption by steam cooking chambers. Calculation of energy consumption by autoclaves. Calculation of energy consumption by vacuum horizontal boilers.	2	10	12/20	[1,14-21,51-52]
Total	**14/6**	**60/6**	**76/134**	

4. TEACHING AND LEARNING METHODS

DLO	**Teaching methods** (work that will be carried out by the teacher during classroom lessons, consultations)	**Number of hours**	**Teaching methods** (what types of learning activities should the student perform independently)	**Number of hours**
DLO 1. Analyze the essence, strategies and systems of energy management; apply the matrix and methods of managing and assessing the efficiency of energy use.	Analyze, using examples from scientific and technical literature, ways to select the necessary information regarding innovations in energy conservation	18/2	Preparing for the lecture by reviewing the lecture material. Searching for technical solutions in information sources	22/28
DLO 2. Analyze the methodology for thermal calculations of technological equipment, determining the energy characteristics of processes and calculating energy consumption at processing enterprises.	Providing examples and techniques interactively	20/4	Preparing for the lecture by familiarizing yourself with the lecture material. Studying the material for independent mastery. Completing the practical work tasks, the implementation of which was started during the practical lesson.	22/28
DLO 3. Develop methods for determining heat balances of food industry enterprises; methods calculation of energy losses; basics rational operation of heat and power supply systems.	Showing examples of solving production problems using an interactive method during lectures and practical classes	12/2	Preparing for the lecture by familiarizing yourself with the lecture material. Studying the material for independent mastery. Completing the practical work tasks, the implementation of which was started	12/28

			during the practical lesson.	
DLO 4. Select research on methods of using secondary energy resources and alternative and renewable energy sources; methods of saving energy; general approach when conducting an energy audit.	Demonstration of work examples in applied software products	12/2	Preparation for the lecture by familiarizing yourself with the lecture material. Studying the material for independent mastery. Formatting theoretical material in the form of publications.	12/28
DLO 5. Analyze the types of energy audits; the main stages of an energy audit; methods for determining and reducing losses of various types of energy in technical and technological facilities.	Showing examples of solving production problems using an interactive method during lectures and practical classes	12/2	Preparing for the lecture by familiarizing yourself with the lecture material. Studying the material for independent mastery. Completing the practical work tasks, the implementation of which was started during the practical lesson.	8/26

5. EVALUATION BY EDUCATIONAL COMPONENT

5.1.Summative assessment

5.1.1. To assess the expected learning outcomes, there are

No.	Summative methodsevaluation	Points/ Percentage in the overall score	Date of compilation
	Module I		
1.	Writtentest paper on theoretical material/ certificate of completion of non-formal education courses	*20 points / 20%*	In the sixth week
2.	Completion and defense of practical work	*30 points / 30%*	Until the next practical lesson
	Module II		
3.	Written test on theoretical material/certificate of completion of non-formal education courses	*20 points / 20%*	At the fourteenth week
4.	Completion and defense of practical work	*30 points / 30%*	Until the next practical lesson

5.1.2. Evaluation criteria

Component[2]	Unsatisfactorily	Satisfactorily	Good	Perfectly[3]
Written test on theoretical material	*<12 points*	*13-16*points	*17-19 points*	*20 points*
	Task requirements not met	*Answers to all questions are provided, but individual components of the answers are missing or insufficiently disclosed, there is no analysis of other approaches to the question.*	*The answers to all questions are given*	*Answers to all questions are provided, creativity and thoughtfulness are demonstrated, and one's own solution to the problem is proposed.*
Completion and defense of practical work	*<12 points*	*13-20*points	*21-29 points*	*30 points*
	Task requirements not met	*Answers to all questions are provided, but individual components of the answers are missing or insufficiently disclosed, there is no analysis of other approaches to the question.*	*The answers to all questions are given*	*Answers to all questions are provided, creativity and thoughtfulness are demonstrated, and one's own solution to the problem is proposed.*

5.8. Formative assessment:

To assess current progress in learning and understand areas for further improvement,

No.	***Elements of formative assessment***	***Date***
1.	*Written survey after studying topics 1-4, 5-7*	*Week 7, Week 14*
2.	*Verbal feedback from the teacher while working on the test paper*	*11 weeks*

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

6. LEARNING RESOURCES (LITERATURE)

Main sources

1. Savchenko M.Yu. Energy management and energy audit of processing and food enterprises: a textbook for 1st year students of specialty 181 “Food technologies” of the “Master” degree. – Sumy, 2024. – 213 p.
2. Law of Ukraine "On Energy Saving" dated 01.07.21 No. 74/94–VR (with amendments and supplements).

[2]Specify the summative assessment component
[3]Indicate the distribution of points and the criteria that determine the level of assessment

3. DSTU 4065-2001. Energy saving. General technical requirements. – Effective from 01.07.22. – Kyiv: State Standard of Ukraine.

4. DSTU 4713:2007. Energy saving. Energy audit of industrial enterprises. Procedure and requirements for the organization of work. – Effective from 01.07.07. – Kyiv: State Standard of Ukraine.

5. DSTU 4081-2002. Energy saving. Energy labeling of household electrical equipment. General technical requirements. – Effective from 01.05.02. – K.: Derzhstandart Ukrainy.

6. DSTU 2339-94. Energy saving. Basic provisions. – Effective from 01.01.95. – K.: Derzhstandart Ukrainy.

7. DSTU 2420-94. Energy efficiency. Terms and definitions. – Effective from 01.01.95. – K.: Derzhstandart Ukrainy.

8. DSTU 2155-93. Energy saving. Methods for determining the economic efficiency of energy saving measures. – Effective from 01.01.95. – K.: Derzhstandart Ukrainy.

9. DSTU 2804-94. Energy balance of an industrial enterprise. General provisions. Terms and definitions. – Effective from 01.01.96. – K.: Derzhstandart Ukrainy.

10. DSTU 4110-2002. Energy efficiency. Methodology for analysis and calculation of specific energy resource costs. – Effective from 01.07.03. – K.: Derzhstandart Ukrainy.

11. DSTU 4714:2007. Fuel and energy balances of industrial enterprises. Methodology for construction and analysis. – Effective from 01.07.07. – Kyiv: State Standard of Ukraine.

12. DSTU 4715:2007. Energy saving. Energy management systems of industrial enterprises. Composition and content of works at the stages of development and implementation. – Effective from 01.07.07. – K.: Derzhstandart Ukrainy.

13. DSTU 4472:2005. Energy saving. Energy management systems. General requirements. – Effective from 01.07.06. – Kyiv: State Standard of Ukraine.

14. Savchenko M., Radchuk O., Melnyk O. (2026). Peak morning electrical load assessment and measurement methodology for a public catering complex. Modern engineering and innovative technologies, Germany, Karlsruhe, Issue #44, April, 2026, Pp. 128-137. https://doi.org/10.30890/2567-5273.2026-44-01-038

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18. Savchenko-Pererva M., Radchuk O. Ways to improve energy conservation in educational institutions // Journal of Agriculture Innovation, Technology and Globalization. - 2022. - Vol. 3, No. 1. – P. 73–86. DOI: 10.1504/IJAITG.2022.126866.

19. Savchenko-Pererva M., Radchuk O., Rozhkova L. et al. Determining heat losses in university educational premises and developing an algorithm for implementing energy-saving measures // Eastern-European Journal of Enterprise Technologies. - 2022. - Vol. 6/11 (114). – P. 48–59.

20. Savchenko M. et al. Development of a methodology for calculating the consumption of a combined renewable energy source for a mini-workshop // IOP Conf. Series: Earth and Environmental Science. - 2024. - Vol. 1429. – 012018. DOI: 10.1088/1755-1315/1429/1/012018.

21. Rozhkova L., Savchenko-Pererva M., Radchuk O. et al. Innovative Hybrid Power Plant Design // Lecture Notes in Mechanical Engineering. Proceedings of DSMIE-2022. - 2023. - Vol. 2. – P. 299–308. DOI: 10.1007/978-3-031-06044-1_29.

Additional sources

22. Bańkowska B., Dzik M. Challenges of energy management in the food industry in Poland in the context of the objectives of the European Green Deal and the "Farm to Fork" strategy // Energies. - 2023. - Vol. 15(23). – 9090. DOI: 10.3390/en15239090.

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26. Mykhailenko I.D. Energy saving policy, potential opportunities for energy saving in Ukraine // Energy Saving. – 2021. – No. 1. – P. 3–8.

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35. Wilson A., Kumar V. Energy audits for transitioning to renewable energy in food processing: A case study approach // Journal of Food Engineering. - 2023. - Vol. 372. – 111567. DOI: 10.1016/j.jfoodeng.2023.111567.

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37. Lopez A., Fernández J. Thermal balance analysis for energy efficiency in food processing: Audit-based approaches // Applied Energy. - 2023. - Vol. 352. – 122013. DOI: 10.1016/j.apenergy.2023.122013.

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