

## The Profile of the Educational Program “Unconventional and renewable energy sources” in Specialty 141 Electrical power engineering, electrical engineering and electromechanics

<b>1 – General information</b>	
<b>Full name of higher education institution</b>	O. M. Beketov National University of Urban Economy in Kharkiv
<b>Name of qualification and title conferred in original language</b>	Bachelor Bachelor of the Electrical power engineering, electrical engineering and electromechanics
<b>Official name of educational program</b>	Unconventional and renewable energy sources
<b>Type of diploma and scope of educational program</b>	Bachelor’s diploma, single, 240 ECTS credits, 3 year 10 months
<b>Accreditation availability</b>	
<b>Cycle/level</b>	First (Bachelor) level the National Qualification Framework – level 7 FQ-EHEA – first cycle EQF-LLL – level 6
<b>Access requirements</b>	Having a Junior Bachelor’s degree General rules for entry requirements
<b>Language(s) of instruction</b>	Ukrainian
<b>Official length of program</b>	5 years
<b>Internet address for the permanent description of the educational program</b>	<a href="http://toe.kname.edu.ua">http://toe.kname.edu.ua</a>
<b>2 – Purpose of educational program</b>	
Mastering the skills to solve specialized tasks and practical problems in the field of electrical engineering, which involves the application of the theories and methods of modern science of electrical power engineering, related to unconventional and renewable energy sources, electrical engineering and electromechanics and is characterized by the complexity and uncertainty of the conditions.	
<b>3 - Educational program specifications</b>	
<b>Subject area</b>	<p><i>Objects of study and activities:</i></p> <ul style="list-style-type: none"> <li>– enterprises of the electric power complex, electrical engineering and electromechanical services of organizations;</li> <li>– the production, transmission, distribution and transformation of electricity at power plants, power grids and systems; electrical engineering equipment, electromechanical and switching equipment, electromechanical and electrical engineering complexes and systems.</li> </ul> <p><i>The purpose of training:</i> training of specialists capable to solve specialized and practical problems of electric power engineering, electrical engineering and electromechanics, involves the application of theories and methods of physics and engineering sciences and is</p>

	<p>characterized by complexity and uncertainty of conditions.</p> <p><i>Theoretical content of the subject area:</i> basic concepts of the theory of electric and electromagnetic circuits, their application for modeling, optimization and analysis of operation's modes of power stations, networks and systems, electric machines, electric drives, electrical and electromechanical systems and complexes using traditional and renewable energy sources.</p> <p><i>Methods, tools and technologies</i> – analytical methods for calculating electrical circuits, power supply systems, electrical machines and appliances, control systems for electrical and electromechanical systems, electrical loads with specialized laboratory equipment, personal computers and other equipment.</p> <p><i>Tools and equipment</i> – controls, electrical and electronic devices, microcontrollers, computers.</p>
<b>Educational program orientation</b>	Educational and professional
<b>Main focus of educational program and specialization</b>	<p>Special education in the subject area of unconventional and renewable energy sources.</p> <p>Keywords: unconventional, renewable energy sources, wind power, solar thermal power, photovoltaics, hydrogen energy.</p>
<b>Program features</b>	–
<b>4 – Professional status of graduates and access to further study</b>	
<b>Professional status</b>	<p>Occupations, professional titles of works (according to the current version of the National Classifier of Ukraine: Classifier of professions (ДК 003:2010).</p> <p>Technical electrical specialists (3113):</p> <ul style="list-style-type: none"> <li>- power plant manager;</li> <li>- site electrician;</li> <li>- shop electrician;</li> <li>- power engineer;</li> <li>- power engineer of the production;</li> <li>- power engineer of the site;</li> <li>- power engineer of the shop;</li> <li>- energy dispatcher;</li> <li>- technician for operation of bioenergy installations;</li> <li>- technician for operation of hydropower plants;</li> <li>- technician for operation of wind power plants;</li> <li>- technician for operation of PV power plants;</li> <li>- technician -electrician;</li> <li>- technician-power engineer;</li> <li>- specialist in the operation of electrical stations, power plants and networks;</li> <li>- specialist in the energy management</li> </ul>
<b>Access to further study</b>	Master study.
<b>5 – Instruction and assessment</b>	
<b>Teaching and learning</b>	Lectures, laboratory work, practical classes, independent work on the basis of textbooks, tutorials and lecture notes, consultations with teachers, preparation of qualification work.

<b>Assessment</b>	Written exams, lab reports, presentations, current control, protection of qualification work.
<b>6 – Program competencies</b>	
<b>Integral competence</b>	The ability to solve specialized problems and solve practical problems during professional activities in the field of electrical engineering, electrical engineering and electromechanics or in the process of education, involves the application of theories and methods of physics and engineering sciences, characterized by the complexity and uncertainty of the conditions.
<b>General competencies (GC)</b> defined by the higher education specialty standard	<p>GC 1. The ability to think abstractly, analyze and synthesize.</p> <p>GC 2. The ability to apply knowledge in practical situations.</p> <p>GC 3. The ability to communicate in the official language, both orally and in writing.</p> <p>GC 4. The ability to communicate in a foreign language.</p> <p>GC 5. The ability to search process and analyze information from various sources.</p> <p>GC 6. The ability to identify, ask and solve problems.</p> <p>GC 7. The ability to work as a team.</p> <p>GC 8. The ability to work autonomously.</p> <p>GC 9. The ability to realize their rights and responsibilities as a member of society, to realize the values of civil (free democratic) society and the need for its sustainable development, the rule of law, the rights and freedoms of man and citizen in Ukraine.</p> <p>GC 10. The ability to preserve and multiply moral, cultural, scientific values and achievements of society on the basis of understanding of history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technology, to use different types and forms of motor activity for active rest and healthy living.</p>
<b>Professional General competencies (PGC)</b> defined by the institution of higher education	<p>PGC 11. The ability to use the core of conflictology and conflict management technology in conflict analysis.</p> <p>PGC 12. The ability to formulate a system of knowledge about the city as a whole organism, spanning three subsystems: environmental, technical and social.</p> <p>PGC 13. The ability to analyze and solve problems in the field of economic and social-labor relations.</p> <p>PGC 14. The ability to identify knowledge and understanding of the fundamentals of the modern economy at the micro, meso, macro and international levels.</p> <p>PGC 15. The ability to use rational-critical thinking to analyze political events of today.</p> <p>PGC 16. The ability to protect intellectual property.</p> <p>PGC 17. The ability to analyze social reality through the lens of sociological rational thinking.</p> <p>PGC 18. The ability to understand the principles and norms of law and apply them in professional practice.</p> <p>PGC 19. The ability to protect the rights and legitimate interests of participants in economic relations.</p> <p>PGC 20. The ability to perform engineering calculations of modern typical</p>

	<p>electronic devices of the information electronics and conversion technology, to make the choice of electronic devices for them, to use programmable (microprocessor) control devices, to analyze the physical processes occurring in the devices.</p>
<p><b>Specialty competencies (SC)</b> defined by the higher education specialty standard</p>	<p>SC 1. The ability to solve practical problems using computer aided design and calculation (CAD) systems.</p> <p>SC 2. The ability to solve practical problems involving the methods of mathematics, physics and electrical engineering.</p> <p>SC 3. The ability to solve complex specialized and practical problems related to the operation of electrical systems and networks, the electrical part of stations and substations and high voltage engineering.</p> <p>SC 4. The ability to solve complex specialized and practical problems related to problems of metrology, electrical measurements, operation of devices of automatic control, relay protection and automatics.</p> <p>SC 5. The ability to solve complex specialized problems and practical problems related to the operation of electric machines, apparatus and automated electric drive.</p> <p>SC 6. The ability to solve complex specialized and practical problems related to the problems of production, transmission and distribution of electricity.</p> <p>SC 7. The ability to develop projects of electric power, electrical engineering and electromechanical equipment in compliance with the requirements of legislation, standards and terms of reference.</p> <p>SC 8. The ability to perform professional duties in compliance with the requirements of safety, occupational, industrial and environmental regulations.</p> <p>SC 9. Awareness of the need to increase the efficiency of power, electrical engineering and electromechanical equipment.</p> <p>SC 10. Awareness of the need to constantly expand our knowledge of new technologies in power electrical engineering, electrical engineering and electromechanics.</p> <p>SC 11. The ability to quickly take effective measures in the event of emergencies in power and electromechanical systems.</p>
<p><b>Professional Specialty competencies (PSC)</b> defined by the institution of higher education</p>	<p>PSC 1. The ability to use professional knowledge in designing bioenergy, thermal power, photovoltaic and wind power plants and hydrogen energy systems to solve practical problems in the field of power electrical engineering.</p> <p>PSC 2. The ability to apply knowledge of conversion technology, digital control and programming of microcontrollers to meet the needs of unconventional and renewable energy installations.</p> <p>PSC 3. The ability to design renewable energy plants in intelligent power systems.</p> <p>PSC 4. The ability to design energy storage and transmission systems for different types of renewable energy plants.</p> <p>PSC 5. The ability to use special electric machines in alternative power plants.</p> <p>PSC 6. The ability to perform engineering calculations of modern typical electronic devices of information electronics and conversion technology, to make the choice of electronic devices for them, to use programmable</p>

	<p>(microprocessor) control devices, to analyze the physical processes occurring in the devices.</p> <p>PSC 7. The ability to calculate and design power supply systems to meet the challenge of using computer skills and information technology for design industrial and civilian enterprises and constructions.</p>
<b>7 – Program learning outcomes</b>	
<p><b>Program learning outcomes (PLO)</b> defined by the standard</p>	<p>PLO 1. To know and understand the principles of operation of electrical systems and networks, power equipment of power plants and substations, protective grounding and lightning protection devices and be able to use them to solve practical problems in professional activity.</p> <p>PLO 2. To know and understand the theoretical basics of metrology and electrical measurements, the principles of operation of automatic control devices, relay protection and automation, have the skills to make appropriate measurements and use these devices to solve professional problems.</p> <p>PLO 3. To know the principles of operation of electric machines, apparatus and automated electric drives and be able to use them to solve practical problems in their professional activities.</p> <p>PLO 4. To know the principles of bioenergy, wind power, hydropower and solar power plants.</p> <p>PLO 5. To know the basics of electromagnetic field theory, methods for calculating electric circuits, and be able to use them to solve practical problems in your professional activity.</p> <p>PLO 6. To apply application software, microcontrollers and microprocessor technology to solve practical problems in professional activities.</p> <p>PLO 7. To carry out the analysis of processes in the electric power engineering, electrical engineering and electromechanical equipment, corresponding complexes and systems.</p> <p>PLO 8. To select and apply suitable methods for the analysis and synthesis of electromechanical and power electrical engineering systems with specified parameters.</p> <p>PLO 9. To be able to evaluate the energy efficiency and reliability of power electrical engineering, electrical engineering and electromechanical systems.</p> <p>PLO 10. To find the necessary information in the scientific and technical literature, databases and other sources of information, to evaluate its relevance and reliability.</p> <p>PLO 11. To communicate freely with professional problems in the state and foreign languages orally and in writing, to discuss the results of professional activity with specialists and non-specialists, to substantiate their position on discussion issues.</p> <p>PLO 12. To understand the basic principles and objectives of technical and environmental safety objects of electrical engineering and electromechanics, take them into account when making decisions.</p> <p>PLO 13. To understand the importance of traditional and renewable energy for the successful economic development of the country.</p> <p>PLO 14. To understand the principles of European democracy and respect for citizens' rights and take them into account when making</p>

	<p>decisions.</p> <p>PLO 15. To understand and demonstrate good professional, social and emotional behavior, adhere to a healthy lifestyle.</p> <p>PLO 16. To know the requirements of regulatory acts relating to engineering activities, protection of intellectual property, labor protection, safety and industrial sanitation, and take them into account when making decisions.</p> <p>PLO 17. To solve complex specialized tasks in the design and maintenance of electromechanical systems, electrical equipment of power stations, substations, systems and networks.</p> <p>PLO 18. To be able to learn independently, acquire new knowledge and improve the skills of working with modern equipment, measuring equipment and application software.</p> <p>PLO 19. To apply suitable empirical and theoretical methods to reduce electricity losses in process of its production, transportation, distribution and use.</p>
<p><b>Program learning outcomes (PLO)</b> defined by the institution of higher education</p>	<p>PLO 20. Designing skills of thermal power, bioenergy, photovoltaic and wind power plants and hydrogen energy systems.</p> <p>RLO 21. The ability to solve problems of reconciliation of unconventional and renewable power sources with consumers of electric energy and with industrial power supply network by use of conversion devices technology based on knowledge of the general principles of construction of systems of unconventional and renewable power sources.</p> <p>PLO 22. Design skills for renewable energy plants in intelligent power systems.</p> <p>PLO 23. The ability to design energy storage and transmission systems for different types of renewable energy plants.</p> <p>PLO 24. Skills of applying knowledge of functioning of special electric machines for their work in alternative power plants.</p> <p>PLO 25. Skills in the use of semiconductor electronic devices and integrated circuits in power devices and systems; possession of methods of calculation of typical devices of conversion engineering and information electronics including on the basis of microprocessor devices.</p> <p>PLO 26. To apply professional conflict management skills, tools and strategies for managing and resolving them.</p> <p>PLO 27. To analyze the role and importance of the modern city in the context of global and local challenges.</p> <p>PLO 28. To analyze the processes of legal and market regulation of socio-economic labor relations.</p> <p>PLO 29. To communicate effectively in a foreign language in a business environment.</p> <p>PLO 30. To understand the principles of economic science, especially the functioning of economic systems.</p> <p>PLO 31. To apply the basic principles of political science in solving professional problems.</p> <p>PLO 32. To apply language, linguosocultural and communication skills to communicate effectively in a foreign language.</p> <p>PLO 33. To possess basic methods of intellectual property protection; to apply the rules of registration of intellectual property rights.</p> <p>PLO 34. To apply the basic principles and methods of sociological science in solving professional problems.</p>

	<p>RLO 35. To use normative and legal acts for professional activity regulating.</p> <p>RLO 36. To be able to use normative and legal acts for regulating the legal support of economic relations.</p> <p>PLO 37. To improve professional skills in the installation, adjustment and operation of electrical equipment.</p> <p>PLO 38. To be able to search and analyze input data for the calculation and design of consumer power supply systems, operation of automatic control devices, relay protection and automation.</p>
<b>8 – Resource support for program implementation</b>	
<b>Staffing</b>	The educational program is provided by scientific-pedagogical employees of the department of alternative power electrical engineering and electrical engineering: 2 Doctors of Sciences (one – Professor), 5 PhD. All teachers of the profile graduation department have undergone scientific-pedagogical training for a few weeks to 6 months.
<b>Logistics</b>	<p>At the department of alternative power electrical engineering and electrical engineering 5 specialized laboratories of modern level were created and successfully functioning:</p> <ul style="list-style-type: none"> <li>- laboratory of the basics of metrology and electrical measurements;</li> <li>- laboratory of electric machines;</li> <li>- laboratory of theoretical foundations of electrical engineering;</li> <li>- laboratory of industrial electronics, microcircuitry and microprocessor technology;</li> <li>- laboratory of the alternative power energy, that provides laboratory workshops on the selective professional disciplines of the educational program and contains the laboratory stand for the study of the rational use of solar energy by the solar battery (SRUSESB); the laboratory stands for the study of the rational use of wind energy (SRUWE); the laboratory stands for the study of the rational use of solar energy by the solar energy collector of (SRUSESEC), the laboratory wind generator "Leleka".</li> </ul>
<b>Information and methodological support</b>	All academic disciplines with educational and methodological literature are provided. The course equipment is computerized, widely implemented distance learning system, courses are certified or under certification.
<b>9 – Academic mobility</b>	
<b>National credit mobility</b>	Possibility to participate in programs of national credit mobility in other higher educational establishments of Ukraine, in which bachelors are trained in the specialty 141 Electrical power engineering, electrical engineering and electromechanics, within the framework of educational trainings for acquisition of professional competences, with the possibility of crediting educational achievements in the programs of production and pre-diploma practices (up to 11 ECTS credits)
<b>International credit mobility</b>	Opportunity to participate in Erasmus + International Credit Mobility international credit mobility programs with Middle Eastern University of Technology (Ankara, Turkey), Lodz Technical University (Lodz, Poland)
<b>Training of foreign higher education applicants</b>	