



ENTREPRENEURIAL COMPETENCE IN THE PROFESSIONAL DEVELOPMENT OF RENEWABLE ENERGY SYSTEMS SPECIALISTS: CONTENT AND STRUCTURAL COMPONENTS

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Abstract

Relevance. The relevance of the study is determined by the need to overcome key contradictions in the professional training of renewable energy systems specialists; there is a dissonance between the growing demands of the energy market for the comprehensive competence of specialists and a certain fragmentation of entrepreneurial activity training; the dynamic development of the renewable energy sector enhances the topicality of the problem, requiring continuous improvement of vocational education to ensure the compliance of graduates' competencies with new technological and market realities; the need to expand methodological approaches to forming entrepreneurial thinking in technical specialists remains relevant, which will correspond to the innovative nature of renewable energy technologies; global challenges of energy security, decarbonization of the economy, and the need for accelerated implementation of renewable energy technologies actualize the formation of a fundamentally new type of professional – a specialist capable not only of performing certain technological processes but also of successfully commercializing innovative projects in a highly competitive environment; the transformative processes of the modern energy sector require an in-depth analysis of the content and structural components of entrepreneurial competence, which will allow for the creation of a theoretical and methodological basis for anticipatory professional training that will correspond to current trends in industry development, technological shifts, and dynamic changes in the energy market.

The purpose of the article is to highlight conceptual approaches to defining the essence of entrepreneurial competence and its structural components in the context of the professional development of renewable energy systems specialists, to reveal the substantive characteristics of entrepreneurial competence in the energy sector, and to substantiate the methodological foundations for integrating technical and entrepreneurial components in the professional training of renewable energy specialists, considering current trends in its development and transformative processes in the energy sector of the economy.

Methods: studying the scientific source base for systematizing conceptual approaches to studying the content and structure of entrepreneurial competence, identifying theoretical and methodological foundations for researching its structural components; theoretical analysis and synthesis, systematic review of the investigated problem – to define and substantiate the main components, content, and structure of the defined competence of renewable energy specialists, determining the interrelationships between its components; generalization and systematization – to substantiate the methodological foundations of its formation, determining promising directions of development.

Results: the theoretical and methodological foundations for the formation of entrepreneurial competence in renewable energy systems specialists have been substantiated, revealing its essential characteristics, substantive dominants, and functional structure in the context of systemic transformations of vocational education and sectoral features of alternative energy sources; the critical importance of developing entrepreneurial competence in future specialists for ensuring sustainable development in conditions of constant transformations of the energy sector has been proven; approaches to understanding the nature of entrepreneurial competence as one of the tools for professional self-realization have been defined.

Conclusions: entrepreneurial competence of renewable energy systems specialists is a dynamic formation that develops both during professional training and in the process of direct professional activity; it is characterized by a complex structure that integrates individual-personal and professional qualities into a holistic system of interconnected components; the results of the study confirm that this competence is one of the main components of professional development, which transforms a technical specialist into an active participant in economic processes in energy, as it involves the ability to analyze market opportunities, assess one's own potential, and develop business strategies and plans; the specificity of professional activity in the energy sector requires the simultaneous application of technical knowledge, economic literacy, legal awareness, readiness for risk, and innovation; two main approaches to understanding entrepreneurial competence have been identified: as a system of professional characteristics and as a complex of personal qualities, the combination of which provides a holistic understanding of its importance for the professional development of a specialist; a specialist with developed entrepreneurial competence contributes to the implementation of environmentally friendly technologies, ensuring both technological and socio-economic transformations of the energy sector.

Keywords: *entrepreneurial competence, renewable energy, professional training, structural components, systemic approach.*

Introduction. The modern state of vocational education in Ukraine is characterized by significant transformations, driven by the modernization of socio-economic relations and the reform of the educational sector. The updating of vocational training content is influenced by integration processes, technological changes, and labor market needs, which necessitates a re-evaluation of the essence of professional competencies of skilled workers.

Of particular importance is the training of skilled workers for the renewable energy sector, which is recognized as one of the key areas of economic development and strengthening of Ukraine's energy independence in modern conditions (Timashov & Hubii, 2024). The expansion of enterprises for the production, installation, and maintenance of renewable energy systems leads to an increased demand for qualified specialists capable of working effectively in the dynamic changes of the industry. The intensification of technological innovations in solar, wind, bioenergy, and other areas of renewable energy sources is accompanied by a diversification of professional functions of workers and increased demands on their professional competence. The accelerated implementation of technological innovations in the field of "green" energy supply is accompanied by a diversification of professional functions of workers and increased demands on their professional competence (Humenyuk & Novak, 2020).

European integration processes in Ukraine's vocational education system actualize the issue of aligning the training of skilled workers with European standards, where entrepreneurial competence is considered one of the key competencies for specialists in various economic sectors. Its formation becomes critically important for ensuring the competitiveness of graduates of vocational (vocational-technical) education institutions in the dynamic labor market related to renewable energy systems. The ability to engage in entrepreneurial activity for such specialists gains particular importance in the context of the decentralization of the energy system in Ukraine, the development of small and medium-sized enterprises in the industry, and the increase in the volume of service and consulting services in energy efficiency and environmentally friendly technologies. The entrepreneurial aspect of professional training becomes especially relevant in the context of Ukraine's post-war recovery, when skilled workers with developed entrepreneurial competencies should become key agents in rebuilding damaged or destroyed energy infrastructure. The ability to quickly make decisions regarding the choice of optimal technological operations, effectively use limited resources, interact with various stakeholders, and implement innovative approaches to restoring energy supply in affected regions makes such specialists indispensable participants in the reconstruction processes and ensuring the country's

energy stability in crisis conditions (Melnychenko, 2022).

Structural changes in the energy sector significantly transform the requirements for the professional profile of a modern renewable energy systems specialist. There is a gradual transition from training highly specialized technical specialists to forming multifunctional specialists with an expanded range of professional tasks. A specialist who is limited to only basic functionality does not meet the demands of the labor market and is unable to fully realize their potential. The synergy of technological, economic, and managerial skills creates a fundamentally new quality of professional readiness – the ability to act not only as an executor but also as an active subject of innovative energy solutions, a generator of added value in the industry, and a catalyst for its modernization. In such conditions, entrepreneurial competence transforms from an additional element into a system-forming factor of professional development for skilled workers, ensuring their adaptability to rapidly changing technological trends and the ability to turn industry challenges into opportunities for professional self-realization and self-reliance.

In this context, the issue of forming entrepreneurial competence as a necessary component of the professional development of energy sector specialists is actualized. The practical significance of researching the content and structural components of entrepreneurial competence is due to the need to modernize the system of professional training for renewable energy systems specialists in accordance with modern technological and economic trends in the development of this economic sector.

Sources of Research. A comprehensive analysis of the scientific literature on the problem of forming entrepreneurial competence in vocational education indicates the multifaceted nature of research into this phenomenon. The theoretical and methodological foundations of entrepreneurial competence are thoroughly developed in the works of H. Matukova (2016), V. Maykovska (2021), and R. Pryma (2021), who consider it as an integrative quality of personality that combines knowledge, skills, experience, and

personal qualities necessary for effective entrepreneurial activity.

Of fundamental importance for our research are the scientific investigations of V. Radkevych, O. Radkevych, and M. Pryhodiia (2022) regarding practice-oriented training of specialists in the field of renewable energy, which create a methodological basis for understanding the specifics of professional activity in this sector. In particular, the authors substantiate the need for implementing project technologies in the training of skilled workers, which directly correlates with the formation of entrepreneurial competence. This understanding is complemented by the research of L. Markina, O. Savina, S. Ushkats, and N. Zholobenko (2021) on forming human potential in resource-saving technologies and alternative energy sources. The authors emphasize that to ensure innovative development in the context of resource-saving technologies and alternative energy sources, highly qualified specialists are needed who integrate general and professional competencies necessary for solving issues of development, implementation, and improvement of resource and energy-saving technologies, methods, and mechanisms in combination with the possibility of entrepreneurial activity. An important conceptual basis for understanding the industry context of entrepreneurial competence formation is also the scientific research of Yu. Bashynska (2017), dedicated to the organizational and economic foundations of regional utilization of renewable energy potential. The researcher defines, in particular, ways of developing public-private partnerships in the field of renewable energy, and also emphasizes the staffing of such partnerships with appropriate, including entrepreneurial, training.

Didactic and methodological aspects of integrating the entrepreneurial component into vocational training in vocational (vocational-technical) education institutions are revealed in the works of L. Bazyl, I. Hrytsenok, D. Zakhatnov, L. Yershova, V. Orlov, and others. Researchers analyze various institutional, socio-economic, and pedagogical factors in the formation of entrepreneurial competence in the vocational education system, emphasizing its actualization in modern socio-economic conditions: perspectives of

preparing youth for entrepreneurial activity in the post-war period are considered, and the influence of the country's youth policy on preparing vocational education seekers for entrepreneurial activity is analyzed, which creates a methodological basis for understanding the socio-economic context of entrepreneurial competence formation (Yershova, 2022, 2023); realities and prospects of preparing future specialists for entrepreneurial activity are highlighted, as well as features of youth entrepreneurship development and vocational education in Ukraine in conditions of martial law, which expands the understanding of institutional mechanisms for ensuring the entrepreneurial component of vocational training (Bazyl, 2021, 2023); the methodology for developing entrepreneurial activity of students by means of project activities is substantiated, which allows conceptualizing practice-oriented approaches to forming entrepreneurial competence (Hrytsenok, 2022).

However, despite the significance of these studies for the methodological understanding of the problem of forming entrepreneurial competence in students, particularly in vocational (vocational-technical) education, the issues of the sectoral specificity of renewable energy open up additional prospects for scientific analysis, taking into account the innovative nature of the industry and the peculiarities of the professional activities of skilled workers. At the same time, the analysis of scientific sources reveals a lack of systemic research on the content and structural components of entrepreneurial competence in the context of the professional development of alternative energy specialists, which confirms the relevance of our study.

The aim of the article is to theoretically analyze conceptual approaches to the essence of entrepreneurial competence in the professional development of renewable energy systems specialists, to substantiate its structural-component composition taking into account industry specifics, to identify the substantive features of entrepreneurial activity in the energy sector, and to develop methodological foundations for integrating vocational-technical and entrepreneurial training in the context of transformative processes of the modern energy market.

Research Methods: studying the scientific literature to systematize conceptual approaches to studying the content and structure of entrepreneurial competence, identifying theoretical and methodological foundations for researching its structural components; theoretical analysis and synthesis, systematic review of the researched problem – to define and substantiate the main components, content, and structure of the defined competence of renewable energy specialists, determining the interconnections between its components; generalization and systematization – to substantiate the methodological foundations of its formation, determining promising directions of development.

Results and Discussion. Regulatory documents at European and national levels in the field of education clearly define the importance of forming key competencies in students, where entrepreneurial competence occupies a special place alongside career competence. These documents emphasize their crucial role in the development of a successful individual ready to work effectively in modern economic conditions and contribute to strengthening the country's competitiveness in the global market.

At the same time, in the Ukrainian system of vocational (vocational-technical) education (hereinafter: V(VT)E), there is a significant gap between the declared goals regarding the development of entrepreneurial competence and the real conditions for its formation, especially for specialists in the field of renewable energy. The issue of effective training of future skilled workers for the rational use of their own resources and economic planning in the dynamic development of the modern energy sector, which requires new approaches to the structure and content of vocational training, needs to be resolved.

The primary challenge in vocational education remains the development of students' ability for strategic management of their own potential – personal resources (creative abilities, self-organization, emotional intelligence, leadership qualities) and time opportunities. Studies of educational practice demonstrate that the integration of effective use of individual abilities with rational time management forms the basis of professional success and the development of

entrepreneurial potential of future specialists in the dynamic conditions of the modern labor market (Yershova, 2019).

European and domestic scientific sources offer a wide range of interpretations of entrepreneurial competence, reflecting the multifaceted nature of this phenomenon and the variety of methodological approaches to its conceptualization. A review of these interpretations allows for the identification of both common features and differences in understanding the key characteristics of the entrepreneurial component in various educational systems and scientific schools.

The European Reference Framework of Key Competences for Lifelong Learning defines entrepreneurial competence as one of the key educational priorities. In the European tradition, this component is interpreted as a holistic set of knowledge, skills, and attitudes necessary for transforming ideas into practical action and developing an entrepreneurial mindset. Importantly, such an interpretation goes beyond the purely economic plane of creating and conducting business and acquires the meaning of a universal life skill that contributes to personal growth, professional development, and the formation of an active civic position. The European conceptual model of entrepreneurial competence emphasizes the importance of initiative, creativity, confidence, and the ability to implement one's own ideas as fundamental qualities of a modern specialist. The multidimensionality of this concept is manifested in the integration of various knowledge, skills, and attitudes necessary for the successful implementation of entrepreneurial initiatives, promoting innovative processes, and adapting to dynamic market conditions. Such an understanding of entrepreneurial competence reflects its key role in forming a competitive and dynamic economy, as well as its significance for the personal development of a professional (Ovcharuk, 2025).

Entrepreneurship acts as one of the fundamental characteristics of a modern specialist, including in the field of renewable energy, combining a complex of interconnected qualities – from creativity and innovation to risk orientation, analytical thinking, and leadership skills. Despite the recognition of the critical importance of this multifactorial competence for effective

professional activity and the detailed study of its structural components, there is a lack of a systemic approach to its formation in the V(VT)E system (Popova & Zolotukhina, 2020). Educational programs for various professions demonstrate fragmentation and unsystematic inclusion of entrepreneurial components, and a single conceptual framework that would define the goals, content, methods, and forms of learning aimed at developing entrepreneurial competencies remains unformed, which significantly limits the possibilities of their purposeful development.

Studies by domestic scholars consider entrepreneurial competence as: a level of readiness to solve real business problems based on economic, legal, and managerial knowledge and practical experience; the ability to consciously take risks, assume responsibility, analyze problems, and make informed decisions; a set of individual-personal qualities and behavioral models that ensure the effective execution of business tasks; an integrated formation that combines goal-setting, a positive attitude towards entrepreneurial activity, the ability to plan activities and forecast results, and to apply innovative approaches in entrepreneurship.

In her research, Yu. Bilova (2015) defines entrepreneurial competence as a complex psychological characteristic of an individual, manifested through the ability to creatively seek and implement new economic ideas for solving various life, professional, and social problems. The researcher focuses on leadership qualities, the ability to resolve conflict situations, make decisions, work effectively in a team, motivate personnel, and form effective organizational structures. The proposed interpretation reflects the multidimensional essence of entrepreneurial competence, which combines personal qualities, professional skills, and organizational abilities. Such an understanding emphasizes the significance of entrepreneurial competence for overcoming diverse challenges and lays a theoretical foundation for further scientific inquiries.

M. Strelnikov (2016) considers entrepreneurial competence as an integrative combination of personal and business qualities, practical skills, theoretical knowledge, and a specific behavior model that together ensure the effective solution of business problems. The

researcher attributes the following key components to this competence: personal qualities (initiative, perseverance, willingness to take risks, creativity); business qualities (strategic thinking, managerial and communication skills, financial literacy); practical skills in implementing ideas and making decisions; theoretical knowledge in economics, management, and law; and an appropriate behavior model. This approach demonstrates the comprehensive nature of entrepreneurial competence and creates a theoretical basis for studying methods of its formation in the educational environment.

According to H. Nazarenko (2014), the formation of entrepreneurial competence is a complex and contradictory process of personal development that goes beyond the mere acquisition of theoretical knowledge. The researcher identifies three interconnected components of this process: entrepreneurial knowledge (economics, management, marketing, finance, law), entrepreneurial consciousness (a specific worldview, values, and motivations characterized by initiative, innovativeness, and willingness to take risks), and entrepreneurial behavior (the ability to act effectively in a business environment, make decisions under uncertainty, establish communications, and manage resources). Importantly, these components function as a single system, where the presence of theoretical knowledge alone without appropriate consciousness and behavioral models does not ensure the formation of full-fledged entrepreneurial competence.

These theoretical approaches allow us to state that for masters in the installation and maintenance of renewable energy systems, entrepreneurial competence is not an additional advantage but an important component of their professional training. The formation of entrepreneurial skills in such specialists creates double value: on the one hand, it opens opportunities for independent entrepreneurial activity and ensuring their own economic well-being, and on the other hand, it significantly strengthens the potential of industry enterprises by increasing the efficiency of employees' professional activities in the energy sector of the economy.

A defining specific feature of the entrepreneurial competence of masters in the installation and maintenance of renewable energy systems is the integration of knowledge components from various fields. Research into this phenomenon indicates the need for a comprehensive approach to forming the professional profile of such a specialist, which is due to the diverse nature of professional tasks requiring the simultaneous application of technical, economic, legal, and managerial approaches (Institute of Renewable Energy of the National Academy of Sciences of Ukraine [IRE NASU], 2020).

Technical training forms the basis of professional activity and includes knowledge of the principles of operation, installation methods, and operating rules for various types of energy systems – from solar power plants to bioenergy installations. Ensuring the technical reliability and safety of renewable energy systems requires a thorough understanding of technological processes and the specifics of the equipment used. At the same time, economic knowledge allows specialists to analyze the market situation, plan business processes, and rationally use available resources. Understanding pricing mechanisms and methods for evaluating the investment attractiveness of projects is a necessary condition for making informed decisions in entrepreneurial activity. Legal awareness includes knowledge of regulatory documents governing the renewable energy sector, peculiarities of contract conclusion, and ways to protect the rights of all project participants. Knowledge of environmental legislation and principles of sustainable development ensures the environmental safety of entrepreneurial activity. The managerial component of competence involves mastering methods of organizing work processes, coordinating personnel activities, and controlling project implementation. Effective team management and the ability to resolve conflict situations contribute to the productivity and effectiveness of entrepreneurial activity. Additional components of professional training include knowledge of computer science, mathematical statistics, and strategic planning. The use of digital tools and analytical methods, the ability to forecast risks, and adherence to principles

of professional ethics create a basis for successful entrepreneurship development in the renewable energy sector.

Structural and substantive design of entrepreneurial competence for future specialists in the installation and maintenance of renewable energy systems should be based on the results of comprehensive scientific research aimed at analyzing the individual and personal characteristics of successful entrepreneurs in the energy sector. A systematic approach to forming the specified competence involves integrating theoretical and practical components, taking into account current trends in renewable energy development.

At the same time, a set of individual-personal characteristics inherent in representatives of the entrepreneurial environment can be identified. Among the leading qualities, it is worth noting the ability to act effectively in situations of uncertainty and show resistance to physical and psycho-emotional loads. Successful entrepreneurs are characterized by a tendency towards calculated risk and a willingness to take responsibility for management decisions, combined with optimistic expectations regarding the results of activities and a desire to minimize the probability of failure as motivational determinants. Defining personal traits include perseverance in achieving goals, adaptability to changing conditions, energy, and a developed sense of personal responsibility. Essential components of an entrepreneur's psychological profile are confidence in one's own potential and competencies, based on continuous professional development, communication skills, the ability to form business networks and convincingly argue one's position, as well as rational thinking, the ability to make informed decisions under various circumstances combined with purposefulness and unwavering determination in implementing set tasks. It is precisely the integration of these characteristics that forms the psychological profile of an effective entrepreneur, the development of which is a prerequisite for the successful implementation of business initiatives and the sustainable functioning of entrepreneurial structures.

At the same time, a complex of individual-personal characteristics inherent in representatives

of the entrepreneurial field can be identified. Among the key qualities, it is worth noting the ability to work effectively and show resilience to physical and psychological stress. Successful entrepreneurs are characterized by a tendency towards reasonable risk and a willingness to take responsibility for their decisions, combined with an optimistic outlook on the results of their work and a desire to avoid failure as key motivators. Important personal traits include perseverance in achieving goals, flexibility in changing conditions, energy, and a strong sense of personal responsibility. Important components of an entrepreneur's psychological portrait are confidence in their abilities and skills, based on continuous learning, the ability to communicate, build business contacts, and convincingly convey their opinion, as well as practical thinking, the ability to make informed decisions in various situations along with purposefulness and strong determination to achieve set goals. It is the combination of these qualities that creates the psychological profile of a successful entrepreneur, the development of which is the basis for effective implementation of business projects and ensuring stable entrepreneurial activity (Tanklevska & Tanasychuk, 2024).

The formation of entrepreneurial competence in energy sector specialists involves the systematic development of specific and professional abilities necessary for the effective implementation of entrepreneurial initiatives. This approach ensures the integration of specialized technical knowledge with entrepreneurial thinking, which is a prerequisite for professional autonomy and self-reliance in modern economic conditions. The design of a competence model for an energy sector specialist requires a comprehensive approach that harmoniously combines the development of professional tools with the formation of personal qualities that determine the success of entrepreneurial activity. It should be noted that the quantitative composition of the structural elements of entrepreneurial competence varies depending on the scale of professional tasks faced by specialists in the installation and maintenance of renewable energy systems. However, regardless of this variability, the formed entrepreneurial component is characterized by the

presence of an integrated set of qualities and skills, including: the ability to harmonize economic interests with available resource opportunities and societal needs; the application of resource monitoring methods to ensure environmental sustainability; analytical assessment of professional potential in the context of market demands; project skills (development, implementation, and evaluation of business projects); algorithmic processes of making economically sound decisions; organizational and managerial skills in the context of collective activity; legal awareness regarding labor relations; communication skills for presenting the results of economic activity (Moldavan, 2020). A deficit of any of these components in the structure of a specialist's personal and business qualities significantly reduces the overall level of entrepreneurial competence. Conversely, the comprehensive formation of all structural elements increases the specialist's potential for effectively solving diverse professional tasks in the energy sector.

In modern scientific research on the problem of entrepreneurial competence, two main approaches to its study can be traced. The first approach considers it as a component of professional competence, borrowing its structural elements from a more general model of professional development. The second approach focuses on the specific features of entrepreneurial activity, considering its unique requirements and characteristics. Researchers are unanimous that entrepreneurial competence is a complex formation that combines professional knowledge, practical skills, motivational orientation, and personal qualities necessary for successful entrepreneurial activity.

In the modern world, the profession of a master in the installation and maintenance of renewable energy systems is becoming increasingly in demand and promising. This is due to several determining factors: the need to reduce harmful environmental impact, the desire to ensure the country's energy security, and the rapid development of "green" technologies. The labor market needs specialists capable of comprehensively solving problems in the field of alternative energy: from design to installation and

maintenance of solar, wind, geothermal, and other types of energy systems. Given the global trends of decarbonization of the economy and the transition to a sustainable energy consumption model, the importance of this profession will only grow. Ukraine has significant potential for the development of renewable energy sources. The main advantages of such sources are their inexhaustibility, environmental friendliness, and compliance with modern technological standards (Dobryanska et al., 2020). Especially promising areas are solar energy, wind energy, and biogas production, which open up wide opportunities for the professional realization of future specialists.

The uniqueness of entrepreneurial competence of masters in the installation and maintenance of renewable energy systems lies in the exceptionally close interrelationship between diverse professional components that cannot be considered in isolation. Each component of such competence is in constant dynamic interaction, complementing and reinforcing each other. The specificity of the structure is determined by the multifaceted nature of professional tasks in the field of renewable energy, which requires the specialist to be able to quickly integrate knowledge from different fields, making a traditional approach to structuring professional competence by clearly defined separate components impossible. The formation of such a component requires a comprehensive approach that ensures: flexibility in adapting to market changes, the ability to generate innovative ideas, the possibility of creating and developing one's own business, and a focus on sustainable industry development. The ultimate goal of training is to educate specialists capable not only of professionally performing technical tasks but also of actively influencing the development of renewable energy as a promising economic link. This involves forming entrepreneurs who understand the complex challenges of the industry, can independently generate business solutions, and contribute to the country's environmental safety.

The study of the entrepreneurial component of masters in the installation and maintenance of renewable energy systems reveals a complex scientific problem of training relevant specialists, as we have two fundamentally different approaches to understanding the nature of this competence,

each of which has its own methodological features and explanatory potential. The first approach considers this competence as a holistic system of professionally important characteristics. The focus is on diverse knowledge, skills, abilities, and personal qualities necessary for successful activity in the field of renewable energy. This approach combines technical, economic, legal, and environmental components of professional activity, creating a multidimensional model of competence. An alternative approach focuses on the individual psychological characteristics of the personality. It emphasizes the master's internal reserves, their ability for innovative and risky activities. Key elements are motivation, individual attitude towards entrepreneurship, and personal qualities that ensure the overcoming of professional challenges. Both approaches are not mutually exclusive but, on the contrary, complement each other. They reveal different facets of entrepreneurial competence, demonstrating its complex, multi-layered nature. Technical skills, economic thinking, and legal literacy are combined with personal dynamics, the ability to innovate, and overcome barriers. The practical significance of such a comprehensive approach lies in understanding entrepreneurial competence as a dynamic system of professional development. This involves forming a specialist capable not only of performing professional tasks but also of actively influencing the development of the energy sector.

Conclusions. Transformational processes in the energy sector of Ukraine, associated with the development of alternative energy sources, necessitate specialists who possess a complex of diverse knowledge, skills, and abilities (Radkevych, Kravets, Sali, & Radkevych, 2023). This issue gains particular relevance for the post-war reconstruction of the country, where such specialists become key participants in the restoration of energy infrastructure. The intensive development of various areas of renewable energy – solar, wind, bioenergy – creates diverse niches for entrepreneurial initiatives, and decentralization of energy supply opens up opportunities for creating local energy projects, the implementation of which requires a combination of technical expertise with entrepreneurial abilities.

The entrepreneurial competence of renewable energy systems specialists is a dynamic formation that develops both during professional training and in the process of direct professional activity. It ensures readiness to effectively solve professional tasks, adapt to changing labor market conditions, and choose optimal strategies for conducting entrepreneurial activity, taking into account specific situations. In the conditions of the transforming energy sector of Ukraine, this adaptability gains special significance, as it allows for prompt reaction to technological innovations and changes in industry legal regulation.

Analysis showed that the entrepreneurial competence of masters in the installation and maintenance of renewable energy systems is characterized by a complex structure that integrates individual-personal and professional qualities. These components are not a mechanical merger of separate elements but constitute a holistic system of interconnected components. Only their comprehensive integration ensures the effectiveness of the specialist's entrepreneurial activity. The importance of such a systemic approach is confirmed by the practice of successful enterprises in the industry, where technical excellence is combined with business strategies and innovative approaches to organizing work processes.

The essence of entrepreneurial competence of future specialists in alternative energy sources lies in the integration of personal and professional qualities, inextricably linked with socio-economic and psychological characteristics. It is concretized by the specialists' value orientations, specific ways of their activity, models of entrepreneurial behavior, and a set of professionally significant personal qualities. The synergy of these elements creates a unique professional profile that meets the requirements of the modern labor market in the energy sector and contributes to the formation of competitive advantages both at the individual level and at the enterprise level.

The research results confirm that entrepreneurial competence in the context of renewable energy is not an additional but one of the main components of professional development, which transforms a technical specialist into an active participant in relevant economic processes in

the energy sector, as it involves the ability to analyze market opportunities and demand for services in the field of renewable energy, objectively assess one's own professional and entrepreneurial potential, and develop business strategies and plans. This necessitates the implementation of appropriate changes in the system of specialist training, including the integration of economic disciplines, entrepreneurship courses, and project management into the curricula of V(VT)E institutions. At the same time, the study of the structure of entrepreneurial competence of renewable energy specialists confirms the close interrelationship of all its components. The specificity of professional activity in the energy sector requires the simultaneous application of technical knowledge, economic literacy, and managerial skills. The industry specifics of renewable energy – a high level of innovation, dynamic changes in technologies, complexity of regulatory frameworks, and significant initial investments – create additional requirements for entrepreneurial training of specialists and necessitate continuous updating of educational content.

Two main approaches to understanding entrepreneurial competence have been identified: as a system of professional characteristics and as a complex of personal qualities. It is precisely this combination that ensures a holistic understanding of its meaning and significance for the professional development of a specialist. This integrated approach allows for the development of comprehensive methodologies for forming the entrepreneurial component, which take into account both the objective requirements of the professional environment and the subjective factors

of personal development. This is especially important for young specialists who face the need for rapid adaptation to a changing labor market and self-determination in the professional environment.

A renewable energy systems specialist with developed entrepreneurial competence contributes to the implementation of environmentally friendly technologies through their practical application and commercialization. This expands their professional role from an executor of technical tasks to a leader of innovations in the industry. Given global trends in decarbonization of the economy and the priority of environmentally friendly technologies, such specialists become important agents of sustainable development, ensuring not only technological but also socio-economic transformations of the energy sector. At the same time, the importance of entrepreneurial competence is actualized in the context of implementing local energy initiatives, developing energy cooperatives, and implementing models of energy self-sufficiency for communities, which requires specialists not only technical knowledge but also social entrepreneurship skills and communication with various stakeholders, which can be directions for further research into the content and structural components of the entrepreneurial component of renewable energy specialists. Promising areas also include research into mechanisms of interaction between V(VT)E institutions and industry enterprises to ensure the practical component of training, the development of tools for diagnosing the level of entrepreneurial competence formation, and the creation of individual trajectories for its development depending on the initial level and professional needs of students.

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ПІДПРИЄМНИЦЬКА КОМПЕТЕНТНІСТЬ У ПРОФЕСІЙНОМУ СТАНОВЛЕННІ ФАХІВЦІВ СИСТЕМ ВІДНОВЛЮВАЛЬНОЇ ЕНЕРГЕТИКИ: ЗМІСТ І СТРУКТУРНІ КОМПОНЕНТИ

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Реферат:

Актуальність дослідження зумовлюється необхідністю подолання ключових суперечностей у професійній підготовці фахівців систем відновлювальної енергетики; спостерігається дисонанс між зростаючими вимогами енергетичного ринку до комплексної компетентності фахівців і певною фрагментарністю підготовки до підприємницької діяльності; актуальність проблематики посилює динамічний розвиток галузі відновлювальної енергетики, що вимагає постійного вдосконалення професійної освіти для забезпечення відповідності компетентностей випускників новим технологічним і ринковим реаліям; актуальною залишається потреба розширення методологічних підходів до формування підприємницького мислення у технічних фахівців, що відповідатиме інноваційному характеру технологій відновлювальної енергетики; глобальні виклики енергетичної безпеки, декарбонізації економіки й необхідність прискореного впровадження технологій відновлювальної енергетики актуалізують формування принципово нового типу професіонала – фахівця, здатного не лише виконувати певні технологічні процеси, але й успішно комерціалізувати інноваційні проекти в умовах висококонкурентного середовища; трансформаційні процеси сучасного енергетичного сектору вимагають поглибленого аналізу змісту та структурних компонентів підприємницької компетентності, який дозволить створити теоретико-методологічне підґрунтя для випереджувальної професійної підготовки, що відповідатиме актуальним тенденціям розвитку галузі, технологічним зрушенням і динамічним змінам енергетичного ринку.

Мета статті полягає у висвітленні концептуальних підходів до визначення сутності підприємницької компетентності та її структурних компонентів у контексті професійного становлення фахівців систем відновлювальної енергетики, розкритті змістовних характеристик підприємницької компетентності в енергетичній галузі та обґрунтуванні методологічних засад інтеграції технічної та підприємницької складових у професійній підготовці фахівців відновлювальної енергетики з урахуванням сучасних тенденцій її розвитку та трансформаційних процесів в енергетичному секторі економіки.

Методи: вивчення наукової джерельної бази задля систематизації концептуальних підходів до вивчення змісту та структури підприємницької компетентності, виявлення теоретико-методологічних засад дослідження її структурних компонентів; теоретичного аналізу і синтезу, системного огляду щодо досліджуваної проблеми – для визначення й обґрунтування основних складників, змісту і структури визначеної компетентності фахівців відновлювальної енергетики, визначення взаємозв'язків між її компонентами; узагальнення й систематизації – для обґрунтування методологічних засад її формування, визначення перспективних напрямків розвитку.

Результати: обґрунтовано теоретико-методологічні засади формування підприємницької компетентності фахівців систем відновлювальної енергетики, що розкривають її сутнісні характеристики, змістові домінанти та функціональну структуру в контексті системних трансформацій професійної освіти та галузевих особливостей альтернативних джерел енергії; доведено критичну важливість розвитку підприємницької компетентності майбутніх фахівців для забезпечення сталого розвитку в умовах постійних трансформацій енергетичного сектору; визначено підходи до розуміння природи підприємницької компетентності як одного з інструментів професійної самореалізації.

Висновки: підприємницька компетентність фахівців систем відновлювальної енергетики є динамічним утворенням, що формується як під час професійної підготовки, так і в процесі безпосередньої фахової діяльності; вона характеризується складною структурою, що інтегрує індивідуально-особистісні та професійні якості в цілісну систему взаємопов'язаних складових; результати дослідження підтверджують, що ця компетентність є однією з основних складових професійного становлення, яка перетворює технічного спеціаліста на активного учасника економічних процесів в енергетиці, оскільки передбачає здатність

аналізувати ринкові можливості, оцінювати власний потенціал, розробляти бізнес-стратегії та плани; специфіка професійної діяльності в енергетичному секторі вимагає одночасного застосування технічних знань, економічної грамотності, правової обізнаності, готовності до ризику й інновацій; виявлено два основні підходи до розуміння підприємницької компетентності: як системи професійних характеристик і як комплексу особистісних якостей, поєднання яких забезпечує цілісне розуміння її значення для професійного розвитку фахівця; фахівець з розвинутою підприємницькою компетентністю сприяє впровадженню екологічно чистих технологій, забезпечуючи як технологічні, так і соціально-економічні трансформації енергетичного сектору.

Ключові слова: *підприємницька компетентність, відновлювальна енергетика, професійна підготовка, структурні компоненти, системний підхід.*

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