

## Article

# Employment and Competencies of Employees in the Energy Sector in Poland

Marzena Kacprzak <sup>1,\*</sup> , Agnieszka Król <sup>2</sup>, Izabela Wielewska <sup>3</sup>, Anna Milewska <sup>1</sup>  and Zbigniew Ciekanowski <sup>4</sup><sup>1</sup> Institute of Economics and Finance, Warsaw University of Life Sciences, Nowoursynowska Street 166, 02-787 Warsaw, Poland<sup>2</sup> Institute of Management and Technical Sciences, Warsaw Management University, Kawęczyńska Street 36, 03-772 Warsaw, Poland<sup>3</sup> Faculty of Agriculture and Biotechnology, Bydgoszcz University of Science and Technology, Kaliskiego Street 7, 85-796 Bydgoszcz, Poland<sup>4</sup> Faculty of Economics, John Paul II University of Applied Sciences in Białą Podlaską, Sidorska Street 95/97, 21-500 Białą Podlaską, Poland

\* Correspondence: marzena\_kacprzak@sggw.edu.pl

**Abstract:** Employment and the competencies of employees in the energy sector are coming into particular prominence in economies around the world. It is one of the few sectors positively affected by the COVID-19 pandemic. As a result, a significant global change in the awareness of society occurred in favor of increasing pro-health and pro-environmental activities, which can be seen in the green transformation. Poland can also boast such changes in recent years, as evidenced by the dynamic development of renewable energy sources (boom for photovoltaics) and the increase in prosumption. Correlated with this is the increase in demand for employees with specific competencies, the so-called multi-competencies that are a compilation of technical, business, and soft and hard competencies, as well as interdisciplinary ones. The paper emphasizes the need to better adjust the education system to the real needs of the labor market in a turbulent environment with the use of the Sectoral Qualifications Framework in Energy, developed in cooperation with stakeholders from the industry. Therefore, the authors analyzed the employment structure in the energy sector in Poland, with particular emphasis on the factors and conditions of this structure and made an attempt to identify and create a competency profile of employees in this area. For the purposes of this article, two key research problems were formulated: What are the key competencies of employees in the energy sector? How is employment changing in this area? The following research hypothesis was also put forward: The transformation of the energy sector towards green energy affects the increase in employment in this area and the increase in the demand for soft competencies. The analysis was based on statistical data, reports, job advertisements, and a review of the results of empirical research to date.

**Keywords:** energy; green transformation; green energy; energy transformation; low-carbon economy; competencies; sectoral qualifications framework for energy; employment; labor market in Poland



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## 1. Introduction

Energy shapes all economic and living activities of all humankind. Nature provides inexhaustible energy resources, such as water, wind, solar radiation, geothermal energy, biomass, biogas, and biofuels, which constitute ecologically beneficial alternatives to the ever-exploited resources of coal, oil, or gas [1].

The energy sector is one of those few “immune” to the effects of the COVID-19 pandemic. As shown by statistics and scientific research, employment in this area is systematically increasing all over the world. The pandemic significantly changed and increased social awareness and increased empathy and sensitivity to both health and the natural environment.

Therefore, the development of the energy sector and the ensuing increase in employment result mainly from the green transformation and are related to the development of such energy branches as solar energy (photovoltaic installations, solar collectors, heat pumps) and an increase in the use of biogas, hydropower, wind energy, or biomass. The support offered by the European Union for green energy is also crucial. It has already contributed to the accelerated modernization of the existing energy systems in Europe as well as the emergence of new products and services in this area.

The changes in employment caused by technological and technical changes triggered by the necessity to transform the energy system (particularly the electricity sector) into a post-coal one remain the focus of many studies. However, only a handful of the researchers work with forecasts or provide detailed information at the country or sector level while reporting the results broken down by competency level and capital expenditure. It must be noted that it is worth distinguishing between these categories in order to obtain a more differentiated picture of the demand for labor in various stages of transformation. This approach to the problem enables an early and appropriate response to future labor demand. Therefore, an attempt can be made to rationally plan appropriate expenditure for a given phase with the help and characteristic intensity of appropriate measures related to employment, retraining, education, and vocational training. This helps to address persisting or potentially worsening labor market imbalances and inequalities and to create a post-carbon transformation in line with the principles of fair transition [2].

The development of the energy market is associated not only with the aforementioned increase in employment (creation of new positions and jobs) but primarily with the formation of new employee competencies in the labor market. These currently include multidimensional, interdisciplinary, and specialist competencies as well as soft competencies.

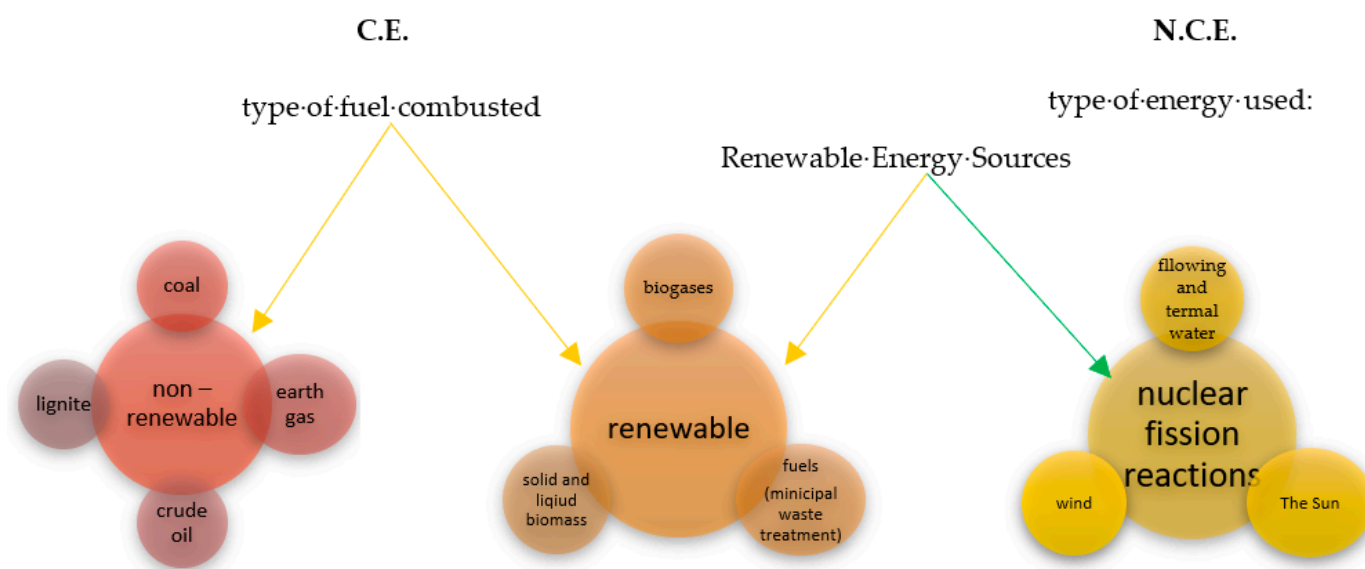
The aim of this article is to analyze the employment structure of employees in the energy sector in Poland, allowing for the factors and conditions of this structure, and to attempt to identify and create a competency profile of employees in this area. The authors have formulated the following research inquiries: What are the key competencies of employees in the energy sector? How is employment changing in this area? A research hypothesis was formulated: The transformation of the energy sector towards green energy affects the increase in employment in this area and the increase in the demand for soft competencies. The analysis was based on statistical data, reports, job advertisements, and a review of the results of empirical research to date.

## 2. Energy in Poland

One of the principal problems for the countries of the European Union and the world is climate change and the deteriorating condition of the natural environment. In order for technological progress not to endanger the health and life of the population, it has become necessary to pursue an appropriate environmental policy [3]. The action plan called “The European Green Deal” is intended to make Europe a neutral continent in terms of greenhouse gas emissions by 2050 while maintaining a competitive, modern, and sustainable economy. The possibilities of implementing this new strategy in the European community are being awaited in all economic and social areas, including the energy sector [4,5]. This sector plays an important role in the economy, and energy and its resources are becoming strategic products that have a real impact on almost all elements of the proper functioning of the state [6].

Energy is currently considered to be one of the key industries all over the world. It covers the production and distribution of both electrical and heat energy. There are two key types of energy production, i.e., conventional energy, C.E. (fuel combustion), and non-conventional energy, N.C.E. (alternative sources), which are presented in Figure 1.

Compared to traditional (fossil) sources, obtaining energy from renewable sources is more environmentally friendly. The escalation of the use of renewable energy sources reduces the harmful impact of energy on the natural environment, mainly by reducing the emission of harmful substances, particularly greenhouse gases [8].



**Figure 1.** Classification of Energy Production. Authors' own study based on Source: [7].

The “Polish Energy Foresight” report presents the results of the research based on the Delphi method that is used to predict long-term processes and phenomena. The aim of this research was to capture the way the energy transformation in Poland is shaping up. Among the formulated theses, the researchers indicate the following four key ones, i.e.,

- (1) Withdrawal from hard coal mining for energy purposes is of the greatest importance for the energy transformation in Poland (93% of experts);
- (2) A conducive factor for the development of the energy transformation in Poland is the level of domestic and EU funding (73 points per 100);
- (3) The key barrier to the development of the energy transformation in Poland is the instability of its political situation and authority structures;
- (4) The experts formulated the conclusion that the building of a nuclear power plant in Poland and an increase in gas consumption are both very unlikely ever to happen (26% of the experts) [9].

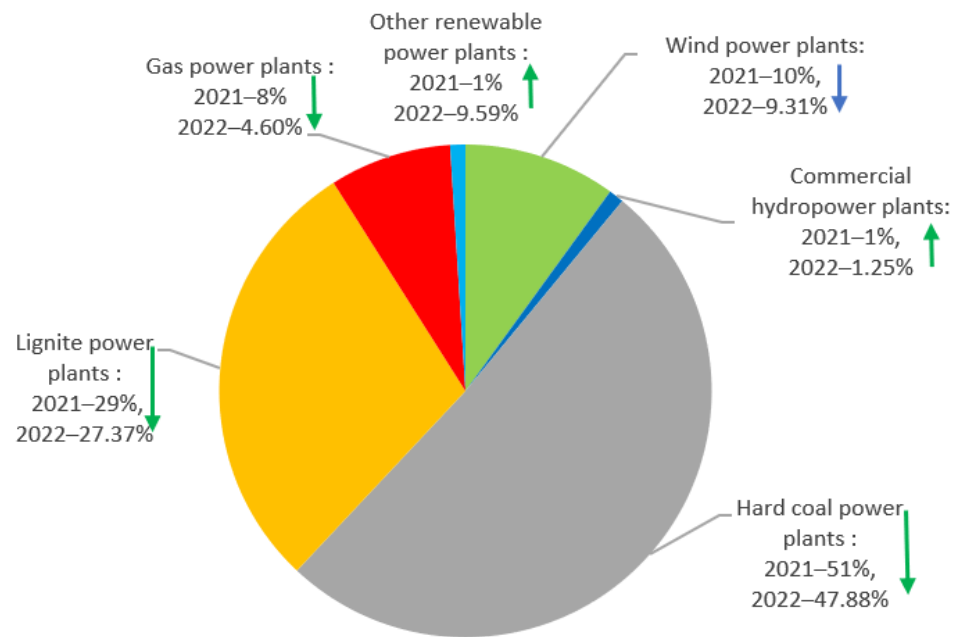
For several years now, the global economy has seen a steady increase in the use of non-conventional energy. The precursors to the development of this energy sector are mainly those European Union countries that first ratified the Kyoto Protocol—an international treaty on an agreement to combat global warming [1]. Additionally, comprehensive statistics in the field of renewable energy are systematically developed by the International Renewable Energy Agency (IRENA). Globally, the share of renewable energy is growing at an average of 7.6% per year, with the exception of Asia, where it has reached 54%. As shown in IRENA reports, Poland follows global trends—solar and wind energies currently take the strongest position [10].

A draft of Poland’s Energy Policy by 2040 was presented In September 2020 (PEP 2040).

The share of coal in the energy consumption structure will reach no more than 56% in 2030, and with increased prices of CO<sub>2</sub> emission allowances, it may even drop to 37.5%. In 2040, the share of coal will drop to 28%. Currently, coal-fired power plants produce approx. 70% of electricity.

The share of renewable energy sources will inevitably increase in all sectors and technologies (Figure 2), and in 2030 this share will amount to at least 23% of the gross final energy consumption:

- not less than 32% in the power industry (mainly wind energy and photovoltaics);
- 28% in heating (increase by 1.1 percentage point, year to year);
- 14% in transport (with a large contribution of electromobility).



**Figure 2.** Electricity production structure in Poland as of December 2021 RE and July 2022. Authors' own study based on Source based on PSE (Polish Power Systems) data. Source: [11].

In addition, there will be a significant increase in installed capacity in photovoltaics: approx. 5–7 GW in 2030 and approx. 10–16 GW in 2040.

Offshore wind energy will be implemented from 2025, and the installed capacity will reach approx. 5.9 GW in 2030 and approx. 8–11 GW in 2040. On the other hand, onshore wind energy will reach approx. 8–10 GW in 2030.

In 2033, the first nuclear unit with a capacity of 1–1.6 GW will be launched, and the following ones will be put into operation within 2–3 years—the entire nuclear program assumes the construction of 6 units by 2043.

The most anticipated innovations in the energy sector include:

- energy storage technologies;
- smart measurement and energy management systems;
- electromobility and alternative fuels;
- hydrogen technologies [11].

Polska Grupa Energetyczna (PGE) is involved in investments and projects related to the green transformation of the energy sector in Poland toward low-emission. Examples include the construction of offshore wind farms in the Baltic Sea, two gas-and-steam units at Dolna Odra Power Plant, and photovoltaic farms (currently, around 3000 ha of land have been allocated for this purpose) [12].

The analysis of the Polish energy market, carried out by Forum Energii (Energy Forum) and presented in the “Polish energy sector 2050. 4 scenarios” report, outlines four possible paths of development of the sector in the context of EU obligations in the perspective of up to 30 years, including the economic and environmental effects as well as the impact on the national economy.

Scenario 1, “The Coal Scenario”, assumes the construction of new mines (predicted RES share in 2050: 17%).

Scenario 2, “The Diversified Scenario With Nuclear Energy”, is a mix of energy technologies (predicted RES share in 2050: 38%).

Scenario 3, “The Diversified Scenario Without Nuclear Energy”, is an increased production of natural gas and renewable energy sources (predicted RES share in 2050: 50%).

Scenario 4, “The Renewable Scenario”, is the withdrawal from coal energy (predicted RES share 73%).

Comparing the above scenarios, their total system costs are similar—approx. 6%. The significant differences are in the level of CO<sub>2</sub> emission reduction (scenario 1 by 7%, 2–65%, 3–68%, 4–84%), and the level of providing energy security (the renewable scenario has the highest level of independence) [13].

### 3. Employment of Workers in the Energy Sector in Poland

The number of jobs in the broadly understood energy sector (electricity, heating, transport, water desalination) is likely to increase worldwide to 134 million in 2050 (57 million in 2020), assuming that 100% of the energy in the world will be obtained from renewable sources by then, which is one of the goals of the Paris Agreement (a climate agreement, which assumes that the European Union's economy will become climate neutral by 2050). Such a transformation of the energy market will definitely require more qualified and competent employees, e.g., in the field of specialist servicing of renewable energy sources [14].

The changes brought about by individual countries' efforts to achieve the climate neutrality in question will have both positive and negative consequences. The first one will be a decline in demand for high-carbon products and services and the related changes in capital allocation, and the second key consequence will be changes in global labor markets. On the one hand, there will be a decline in employment in sectors that are directly and indirectly related to the extraction of fossil fuels, and on the other hand, an increase in the demand for employees in sectors related to renewable energy, hydrogen, and biofuels. According to forecasts, there will be an increase in the demand for around 200 million jobs and a decline for around 185 million jobs worldwide [15].

Shifting resources from high-carbon to low-carbon activity, therefore, requires flexible labor and product markets. Efficient financial markets that will support the withdrawal from fossil fuel energy and the linking of physical capital with low-carbon products, as well as restructuring and manufacturing processes, are also important. Additionally, an effective framework, such as good research conditions, the adaptation of new skills in the workforce, and a favorable environment for the construction and development of new technologies (including through R&D subsidies), will facilitate the structural changes required to implement green production practices [16] and creation of new jobs.

At present, when entering one of the largest advertising portals in Poland—[www.pracuj.pl](http://www.pracuj.pl) (accessed on 2 April 2022) and searching for *energy*, there are nearly 600 job offers for various positions in this area in companies throughout the country. These offers include energy advisor, assistant designer, project manager, photovoltaics specialist, energy documentation specialist, (energy) technological expert, renewable energy consultant, cost estimator in the energy department, heat and process energy engineer, energy efficiency manager, emission measurement coordinator, and many more. For example, Polska Grupa Energetyczna PGE is currently looking for employees for 25 jobs (as of 2 April 2022). Another large company, Tauron Polska Energia S.A., has as many as 147 job offers [17].

The increase in employment in the energy sector in Poland has been systematically noticeable for several years. Admittedly, the employment structure is changing in connection with the green transformation and modernization of this area. The transition from a coal-based economy to a low-carbon economy requires retraining employees and creating new, green jobs.

The energy transformation in the world, including Poland, has become a fact. It has and will continue to have a significant impact on the increase or decrease in employment in particular sectors and groups of employees in the coming years. The modernization of the energy sector in Poland, which is aimed at low-carbon emissions, is related to the withdrawal from the coal economy, where employment in the country amounted to 77.7 thousand people as of the end of 2021, and at the end of June 2022, this number was 74.8 thousand [18].

The impact of the energy transformation on the increase or decrease in employment in individual sectors and groups of employees in Poland is a dynamic phenomenon. Currently, the energy market in Poland is experiencing a noticeable increase in the demand



for employees, for example, in the area of traditional energy sources. This is happening, most of all, in connection with the need to modernize or replace the energy infrastructure. On the other hand, there is a noticeable decrease in the demand for employees operating energy installations based on mine raw materials, coal mining, and operating and servicing mining machines. In addition, along with a significant reduction in coal extraction and the liquidation of mines, specialists will be in demand, for example, in the rehabilitation of post-mining areas or workers performing fieldwork. Focusing the energy policy on low-carbon emissions is and will also be associated with the need to develop offshore and onshore wind farms or photovoltaics, so designers, producers, installers, service technicians, and advisers in this area will also be sought after. In connection with the energy transformation, the construction sector will also look especially for manufacturers of thermal insulation products, contractors, energy auditors, and energy advisors. On the other hand, agriculture is gradually moving away from cattle breeding and feed production in favor of plant cultivation, organic food production, nutritional consulting, dietetics, or food processing. The impact of this energy transformation is also noticeable in the transport sector. The departure from passenger cars and trucks with traditional drives in favor of electric vehicles and the development of public transport will increase the demand for specialists in this area, including specialists for the repair of electric passenger cars working in the construction and operation of charging stations, battery disposal specialists and bus drivers, tram drivers, train drivers, logisticians of journeys and parking systems, specialists in servicing equipment and managing the placement of vehicles [19].

A great deal of recent research and reports on the performance of the energy sector has focused on employment generated by investment. When planning their energy future, governments are also interested in the benefits of job creation and the possible identification of skill shortages that could arise from a large energy program. Employment created or supported by the energy sector is often a problem when government support is considered or provided [20]. The energy transformation affects the labor market not only directly in the energy sector but also in other related sectors, such as the mining industry, transport, construction, and agriculture. The increase in demand for employees is noticeable and understandable, primarily in connection with the development and formation of new offshore and onshore wind farms, photovoltaic farms, electrical vehicles, low-emission machinery and equipment, or the production of ecological food. In turn, the decline in the demand for employees mainly affects traditional power engineering based on fossil raw materials or the coal mining sector and other branches of the economy based on it. On the other hand, it stimulates an increase in the demand for employees, e.g., for reclamation of post-mining sites, and creates considerable opportunities for retraining and changing the employees' professional profiles, which will, in turn, enable balancing the demand and supply for employees on the labor market and minimizing the negative effects of the energy transformation. The RES sector creates a variety of jobs in production, services, and construction which require a range of qualifications and skills. Its development not only increases the number of jobs but also improves their quality in the industry. The increase in employment requires a new investment momentum, which will be determined by the dynamics of jobs created by, e.g., the wind energy industry in the next decade; this dynamic will largely be determined by the amount of expenditure for the building of offshore wind farms [21].

Before 2016, the location of many wind farms was acceptable because these structures were built prior to the adoption of the Act of 20 May 2016 On Investments In Wind Farms [22]. The provisions of the introduced act stipulated that the distance of wind farms from residential buildings and any forms of environmental protection may not be less than "ten times the height of the wind farm measured from the ground level to the highest point of the structure, including technical elements, in particular the rotor with blades"—the so-called Rule 10H. Therefore, newly located windmills (or wind farms) should be located at a distance of about 1.5–2 km from residential buildings and protected natural areas or reserves. That rule basically limited or halted any investments in this area. The situation

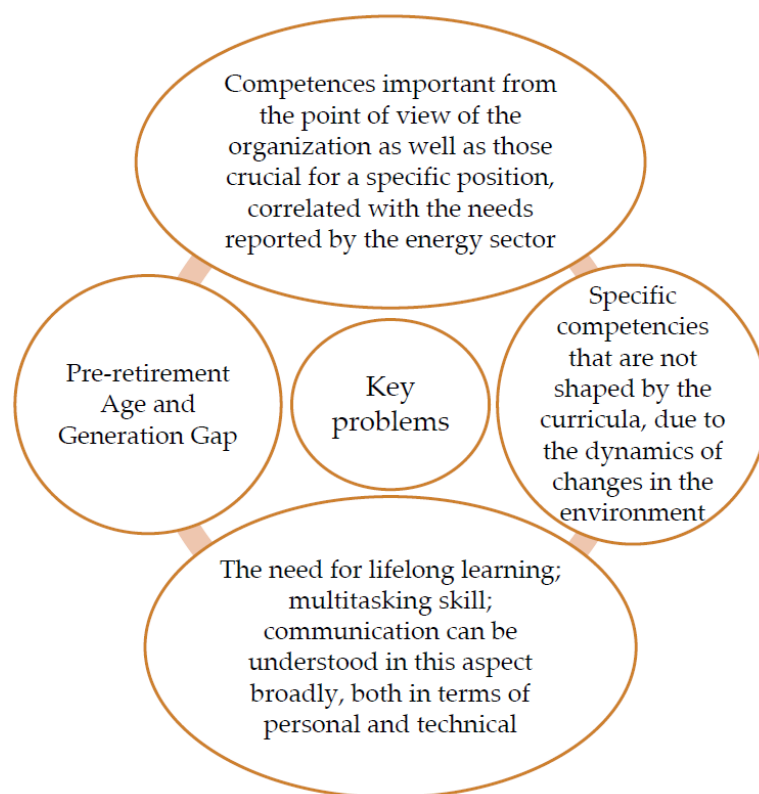
changed on 5 July 2022, when the Polish government adopted a bill that amended the above-mentioned legal act. This was dictated by the state's energy policy related to the diversification of energy sources. Rule 10H is supposed to continue to maintain the basic rule for locating a new wind farm (exclusively on the basis of the Local Zoning Plan—LZP). Pursuant to this provision, the local zoning plan can determine a different distance of the wind farm from residential buildings considering the range of the wind farm's impact while maintaining the absolute minimum safety distance specified in the draft amendment. The removal of the 10H barrier for wind farms will contribute to “unblocking” the wind industry and creating new jobs, but certain “support” in stopping such a strong dynamic of energy price growth is also to be expected.

#### 4. Competency Profile of Employees in the Energy Sector

Production of clean energy is expected to continue to grow in the coming years, but it has been observed that the supply and demand for labor in the energy sector are not consistent. According to estimates, there are and will be recorded surpluses and shortages in certain important skills in the labor market in the energy sector. They are caused by the lack of specialization in workers or the location of the available labor supply and the required location of the labor demand. These situations often do not coincide [23]. Although the mobility of employees or the desire to retrain or acquire new skills is no longer as significant a limitation as it was several years ago, due to wages, social, and family conditions, it may regionally constitute a barrier to development.

The adjustment of the knowledge, skills, and competencies of employees in the context of dynamic changes taking place in the labor market in a situation of uncertainty, e.g., the current pandemic, poses a real challenge for the education system. The idea of lifelong learning is also becoming more and more rooted in Poland's and other countries' realities. This idea is related not only to the development and deepening of existing knowledge and skills but also to the need to acquire and shape new competencies and even retrain employees in accordance with market trends. In accordance with the Act of 22 December 2015 on the Integrated Qualifications System IQS (i.e., Journal of Laws 2020, item 226), it is implemented in Poland, and its key tool is the Polish Qualifications Framework (PQF), analogous to the European Qualifications Framework (EQF). Under PQF, first and second-degree characteristics are in force, which are determinants of curricula that indicate key qualifications obtained in general education, university education, and vocational education and training. Additionally, in order to better allow for the specificity of a given industry or sector, the Sectoral Qualification Framework (SQF) was introduced in Poland as part of the characteristics of the second level PQF, and this is also the case in the energy sector. Its essence comes down to allowing for industry-specific terminology and language, which significantly improves communication with market entities. The great value of SQF is that stakeholders from a given sector or industry participate in its creation (high level of practice) [24]. Moreover, according to the authors, the analysis of competencies and qualifications, as well as employment determinants in the energy sector, indicates several key problems that are presented in Figure 3.

Summarizing the competency profile and factors determining employment in the energy sector, the issues of gender equality and the remuneration system should also be emphasized. Including the gender factor in personnel selection, employment, upgrading qualifications, and employment restructuring would increase the level of women's representation in the energy sector [25]. With regard to remuneration for all employees, it would be helpful to define a standard that should be subject to evaluation and result from the current conditions of the company and employee development.



**Figure 3.** Identification of employment problems in the energy sector—selected aspects. Source: authors' own study.

### 5. The Use of SQFE

Sectoral Qualification Framework for Energy is a response to the needs reported by the broadly understood participants of the energy market (from producers, through the education system, to energy recipients). It concerns the identification and cataloging of competencies and professional tasks in the areas of production (generation), conversion, transmission, storage, and distribution of energy. These issues relate to energy obtained using conventional methods and that from renewable sources

SQFE is used in four main areas and includes:

1. HR processes (job descriptions, recruitment process, selection, assessment and development of competencies, relocation of employees within company structures);
2. education and training (diagnosis of competencies, better adjustment of curricula, internships and courses to the expectations of the labor market, increased flexibility);
3. public orders (including competency requirements in administration);
4. balance of competencies.

According to SQFE, the competency profile of an employee in the energy sector in Poland includes knowledge, skills, and competencies. They are used primarily in main focus areas, i.e., design and planning, infrastructure building and maintenance, manufacturing, storage and delivery of energy, customer needs, energy carriers, and working media, environment, and safety. Their importance is particularly emphasized in the areas of social competencies such as communication, ethics, decision-making, responsibility for quality and safety, and responsibility for the environment [24].

As pointed out by experts, professions that will emerge as new or those with increasing popularity (hence the need to shape new competencies) will concern the employees in the fields of green economy and green energy, the so-called 'green jobs'. These include the aforementioned renewable energy, nuclear energy, recycling and rational waste management, as well as the production of structurally new materials. Therefore, the need for the creation of jobs and competencies in professions related to infrastructure investments



and those in the construction sector, as well as urban planners, energy system strategists, specialists in digital infrastructure, and geo-engineers [26], will also remain correlated. Furthermore, it is estimated that the labor market (and even more so its individual sectors) will see an increase in the importance of soft skills related to the creation of new services, including creativity, communication skills, ability to work in a group, and self-awareness of the impact of one's actions on team performance as well as effective time management. They are now gaining in importance, especially now that the organization of work after the COVID-19 pandemic is different and will continue to evolve (increasing use of remote work, data digitization, updating, and security).

The changes in the labor market caused by the COVID-19 pandemic were pointed out by, e.g., Lu, Ma, and Ma [27], Adamowicz [28], Eichhorst, Marx, and Rinne [29], and Ciolek [30]. When analyzing the aforementioned job offers in the energy sector on [www.pracuj.pl](http://www.pracuj.pl), several key competencies expected by employers from job candidates can be noticed. These include technical secondary or university education, experience in the industry, personal culture, communication skills, relationship building, teamwork, including team management, design, planning, and good command of computer skills and engineering programs. Additionally, hard and technical competencies are, of course, expected, depending on the specifics of a given position. In conclusion, knowledge, skills, and competencies have been included in the SQFE.

## 6. Conclusions

The energy sector in Poland can undoubtedly see visible changes related to the inevitable need to modernize its individual areas. The COVID-19 pandemic did not slow this process down—quite the contrary. The public awareness of the need to undertake more and more efforts for a healthy lifestyle and care for the natural environment has increased. There is a development of areas related to pro-environmental activities, which is noticeable in the domestic market, e.g., in recent years' photovoltaic boom. Prosumption, the production of electricity and its consumption by single-family households and farms, has gained importance. The development of the energy sector is correlated with the growing demand for employees with specific competencies. These include the so-called multi-competencies that combine technical, business, soft and hard competencies, and also interdisciplinary ones. Employees with expertise in investment, team management, and communication are needed. Graduates of energy industry schools and technical secondary schools, as well as specialists with higher education, including engineers, are highly sought-after. In order to better adjust the education system to the real needs of the labor market in a turbulent environment, the Sectoral Qualifications Framework in Energy was developed in cooperation with stakeholders from the industry.

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