The green energy industry: current challenges and trends in the development of professional qualifications in agricultural specialists

I I Shirokorad, O M Fadeeva and E G Pafnutova
State University of Land Use Planning, 15, Kazakova str., Moscow, 105064, Russia
E-mail: shirokoradii@guz.ru

Abstract. Human activities require energy. However, widely used non-renewable sources are becoming exhausted. Currently, Russia does not have an acute shortage of energy resources; therefore, the issue of renewable energy is rarely discussed. However, in Russia one of the urgent problems is urban and agricultural waste management. Agriculture, like other industries, produces products and waste (crop and livestock wastes). Straw, stalks of corn and sunflower, dung – dried manure were used to produce thermal energy. Today, there are technologies used to extract energy from agricultural illiquid assets. Producing energy from agricultural waste allows us to solve two problems – to get rid of some of waste and help the mining industry. The green energy industry is becoming a major employer. To provide it with personnel, qualitative changes in the training system are required.

1. Introduction
For several decades, the green energy industry has evolved from an expensive, inefficient and unstable toy into a full-fledged industry that can compete with oil and coal power plants.

The green energy industry is a young sector of the national economy aimed at obtaining a synergistic effect from solving environmental problems and obtaining alternative renewable energy sources, including from biomass.

Over the past five years, the discussion about prospects of development of the agro-industrial complex has shifted from the financial agenda to high technologies. In the near future, the biogas market will develop steadily. The use of tidal energy and geothermal technologies is promising. Such projects may be funded by the government.

Futurologists note that in 2020–2030 there will be an increase in demand for agricultural products from the chemical and construction industries, which become completely “green”, as well as most countries will use alternative energy sources, which will lead to an increase in demand for biofuels [1].

2. Materials and methods
The energy sector plays an important role. World energy consumption and production are growing annually. In 2018, global energy demand increased by 2.3 %, which was the highest level for ten years. According to the authors of the REN21 report, the cause is steady growth of the global economy (by 3.7 % per year) and hot summers and cold winters in some areas, which required additional energy costs for cooling and heating [2].
The growth in the use of energy from renewable sources is ahead of the demand for energy in general. From 2006 to 2016, this share grew by 0.8 % per year. There is a chance to reverse the trend, given that since 2015 the volume of newly commissioned green energy capacities has consistently exceeded the volume of new capacities using traditional sources [2]. Figure 1 shows the Trends in Electricity Production by Sources – G20

![Trends in electricity production by sources – G20](image)

**Figure 1.** Trends in electricity production by sources – G20 [3]

There is an annual significant increase in energy produced from biomass and modern renewable energy sources. In recent years, green energy has become a priority for many large global energy companies. This is due to several reasons: accelerated implementation of renewable energy production technologies through their improvement; adoption of incentive measures for installing production capacities that ensure the supply of electricity along with the reduction of polluting gas emissions.

The breadth of global energy needs means that simple and unambiguous solutions do not exist. A sharp reduction in emissions is achieved through the use of various fuels and technologies that provide efficient and cost-effective energy services. Figure 2 presents a comparative analysis of energy production in 2000 and 2018.

For most developed countries paying significant attention to local consumption and energy dependence, green energy is an important part of the energy industry [4].

Electricity produced from renewable sources is becoming cheaper and more affordable, more and more new capacities are being used, but the green energy industry cannot attract much investment [2].

Both by the number of workers and power plants, the renewable energy industry is experiencing a stable moderate growth. For 2018, the total capacity of renewable energy installations increased by 181 GW, or 8 %. Half of the growth can be attributed to the solar energy industry [2].

An analysis of statistical and forecast information indicates that renewable energy used for heat production will grow by more than 40 %, which will be similar to bioenergy, which will account for one fifth of global renewable energy consumption by 2024. This increase is mainly due to an increase in the share of renewable energy sources and greater electrification of end applications. By 2024, modern bioenergy will remain the largest source of renewable thermal energy. More than two-thirds of bioenergy growth is in the industrial sector of India, China and the European Union (Figure 3) [5].
In Russia, the biofuel industry is in its infancy. The relevance of the issue of waste energy seems far-fetched. But energy sources can become depleted.

In addition to irreplaceable energy sources, agricultural waste is an environmental problem. The disposal of agricultural waste is becoming more and more relevant.
This method is relevant for countries that do not have gas reserves. Moreover, there are areas where gas pipelines will not be extended in the near future. Autonomous energy sources using agricultural waste solve many problems.

Outside Russia, anaerobic biogas digestion plants are located in Europe – 44%; USA – 14%; China – 12%.

The remaining 30% of plants are unevenly distributed throughout the world. In all countries except for Austria, there are government programs supporting the implementation of bioenergy. But in Austria, it is supported by the Ministry of Agriculture and Ecology. In Russia, such programs have not yet been developed, although there is an urgent need for them.

At the end of 2018, nearly 11 million people were employed in the renewable energy industry. Most jobs (about 3.6 million) were created in the solar energy, bioenergy (using biofuels from plant or animal raw materials) and hydropower sectors. The largest employer is China with 4 million employees, it is followed by Brazil with 1.1 million employees [2].

As technology plays an increasingly important role in the energy industry, enterprises need “technical brains”; and new skills. At the same time, employees lack required skills.

3. Issues of developing professional qualifications in agricultural specialists

Effective and successful development of bioenergy is possible using high-quality staffing at all stages of the production process. At the same time, production and use of biofuels from agricultural waste should meet specific requirements due to the technologies and equipment used. The production and use of biofuels is a complex multi-stage process with pronounced seasonal fluctuations. Its simplified perception can lead to the economic collapse, despite the fact that it would seem that all the essential prerequisites for the successful development of the enterprise (raw materials, production facilities, consumer) are available [6].

At present, Russia has a significant number of projects for biofuel production and application. But the staff is a crucial component [7].

The multifunctionality requirement is a system of factors associated with a small size of production, a small number of teams and territorial dispersion of production sites. The high level of automation requires professionals.

The existing staffing system for bioenergy projects is based on the technical and technological support of equipment manufacturing enterprises. This support, which includes the training of technical staff, is not a core business for equipment suppliers (manufacturers and dealers). The functions of technical consulting and training are an additional burden to customer or technical service. On average, these functions are performed by these services and are of poor quality [6].

The system of vocational education is being reformed. The university curricula should include bioenergy disciplines.

It is necessary to train engineers able to deal with bioenergy. The state policy in the field of vocational education pursued by the Ministry of Education and Science involves creating centers of professional competence.

The material and technical base of these centers, their personnel potential and an effective system of interaction with enterprises allows the implementation of an effective system of training staff for the agro-industrial complex and agricultural bioenergy enterprises.

The implemented system is based on modular educational courses corresponding to the developed table of qualification and competency requirements and professional suitability testing according to objective psychophysical indicators.

The centers are implementing innovative teaching methods, based on the widespread use of computer simulators and simulation stands. The results achieved show the effectiveness of the approaches implemented by the centers, and determine the potential for further development of professional standards for bioenergy, implementation of public certification mechanisms and mechanisms for certification of both educational programs and specialists in the bioenergy industry.
4. Conclusion

Non-renewable energy sources are depleted. Humans are exploring deserted and uninhabited areas such as the Arctic. At the same time, there are renewable energy sources – agricultural waste. Their disposal is a relevant task. This industry is promising, technologies and profitability can be improved. Those who have previously occupied this niche will be able to expand it in the future, diversify the business.

Energy-efficient projects appear in almost all sectors of agriculture. In this case, all types of renewable resources are used – from solar energy to geothermal sources. The use of alternative sources will ensure non-volatility for farmers and allow them to earn on surplus generated energy. A careful attitude to the issues of staffing in bioenergy projects is a crucial condition for their effectiveness. It is the neglect of the staff component that increases costs and makes bioenergy projects inefficient. The staff structure in bioenergy projects is quite complicated both in terms of specialties and training levels. In addition, bioenergy production has a number of special requirements for qualifications and competencies of workers due to the specifics of technologies and equipment used [8].

The current system of professional training for the bioenergy industry is based on graduates from universities and workers trained by equipment manufacturers. This system does not meet modern requirements neither by quality, nor by quantity or efficiency. The issue of creating a single center of professional competencies in the field of bioenergy is relevant. The functions of such a center are as follows: effective and high-quality training of staff for bioenergy projects; development of professional standards; certification of educational programs and specialists, streamlining and structuring of the labor market in the bioenergy industry.

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