Renewable energy engineering solutions

J N Hojiev¹, D E Morkovkin², V G Starovoitov², A A Gibadullin³, A V Dubrovsky² and I A Boldyreva⁴

¹ The Tajik state university of finance and economics, 64/14, Nahimova Street, Dushanbe, 734055, The Republic of Tajikistan
² Financial University under the Government of the Russian Federation, 49, Leningradsky avenue, Moscow, 125993, Russian Federation
³ State University of Management, 99, Ryazan Avenue, Moscow, 109542, Russian Federation
⁴ Novocherkassk Engineering Institute reclamation Don State Agrarian University, 111, Pushkinskaya Street, Novocherkassk, 346428, Russian Federation

E-mail: 11117899@mail.ru

Abstract. As part of the study, engineering solutions in the field of creating power plants based on renewable energy sources were analyzed. The work revealed that in Russia the level of development of renewable energy sources is ten times lower than in the world, and renewable energy potential is not used. An engineering solution was proposed in the work, which consists of the stages of analysis, design, construction and commissioning of a power plant based on renewable energy sources. At the end of the study, a scheme was proposed for introducing wind power plants into the energy system in order to maintain the stability and reliability of power supply to consumers and meet the demand for electric energy.

1. Introduction
One of the main advantages of modern electric power industry is the possibility of using clean technologies, which reflect the level of efficiency and progressiveness of the national electric power industry [1-3]. Number of energy complexes have already abandoned the use of polluting and inefficient technologies several times and switched to new technologies for generating electric energy [4].

In the global energy sector today, the issues of transition to environmentally friendly and safe technologies are being actively discussed; in this regard, various engineering solutions are being developed to ensure the transition of national energy companies to renewable energy sources. In Russia, the issues of switching to renewable energy sources were laid bare back in the 2000-s. At the same time, for example, a completely different situation is observed in European countries, where about 10% of all capacities operate based on renewable energy sources and at the same time, there is a rejection of traditional power plants [5].

The heterogeneity in the development of renewable energy sources on the territory of the world justifies this study in order to identify the possible development of renewable energy sources and to search for the most optimal engineering solutions to create a new electric power potential of the Russian electric power industry.
2. Materials and methods
The aim of the study is to assess the potential of renewable energy sources in Russia and to develop an engineering solution aimed at the development of renewable energy. The following tasks were formed:

- Assess the level of use of renewable energy;
- Development of engineering solutions in the field of energy.

Scientific research was based on an assessment of engineering and design decisions of various organizations in the field of energy. In the work, various scientific approaches and methods were used.

3. Results
Currently, energy development is uneven, individual states have come forward in terms of these indicators, which reach 20-30% of the total installed capacity, other states only adopt directives for the development of renewable energy. The power industry of Russia developed during the period of the USSR, and today in all the republics that are members of the Soviet Union, the same problems have been revealed, among which are the high level of moral and physical deterioration of equipment, a decrease in efficiency and resource saving in the industry, a high proportion the use of obsolete technologies, a low share of the introduction of innovative and advanced technologies in the industry, a high share of the environmental load on the environment and other problems. Can solve problems by modernization and renewal of the capacity of power plants or the creation of a fleet of electrical installations operating on renewable energy sources [6-8].

Assess the use of renewable resources for the electricity industry (figure 1) [9].

![Figure 1](image_url)

**Figure 1.** The share of energy generation at different types of stations.

Figure click that the level of development of the world renewable energy is several times higher than the indicators of the Russian electric power industry, which is associated with the presence of excess capacities and low level of use of renewable energy sources.

Consider the potential of renewable energy in the European part (figure 2) [10].

From the presented figure it can be seen that the number of sunny and clear territories in the European part is not more than 20%, and the wind force reached 18 meters per second is observed in a separate area, while the average wind speed in the European part is 9 meters in give me a sec [11-13].

It should be noted that it is advisable to install wind farms in territories where the wind speed exceeds 18 meters per second, which will allow the most efficient use of production capacities. It is
advisable to place solar power plants in areas where the number of sunny days reaches maximum values [14].

Figure 2. Renewable energy potential.

Thus, in Russia this type of energy is not developed and requires the development of engineering solutions to increase the importance of using renewable energy.

4. Discussion
Engineering decisions in the field of development of renewable energy sources for the Russian Federation should be based on the following special principles [15-18]:

- Assessment of the level of reliability, stability and uninterrupted operation of the current generation;
- Analysis of the level of depreciation, renewal and retirement of production facilities, the volume of planned projects to upgrade energy equipment;
- Search for the most vulnerable and emergency areas where frequent power outages occur;
- Decision-making on the construction of a station based on renewable energy sources;
- Assessment of capital and operating costs;
- Development of design solutions in the field of station construction;
- Carrying out the construction of a power plant;
Commissioning and maintenance.

Thus, the engineering solution for the construction of power plants based on renewable energy sources for the Russian Federation should contain a similar principle for the construction of project activities, in which all the necessary measures are carried out from the substantiation of the decision to the commissioning of the constructed station.

However, that such projects in the field of construction from power plants based on renewable energy sources will ensure the stability, reliability and safety of the entire electric power complex. It is possible to achieve such stability in the prism of the energy system due to the convergence of power plants based on renewable energy sources into a common electricity system (figure 3).

**Figure 3.** The system of interconnection of renewable energy sources with the energy system.

Thus, in order to maintain the power system in a stable state, it is necessary to converge power plants operating on the basis of renewable energy sources into a single system in order to achieve a balance in the production and consumption of electric energy, both in the normal mode and in the mode of disruption of the power supply system.

5. Conclusion

The analysis in the field of renewable energy development showed that the design and construction of such power plants should be based on taking into account the amount of the missing system load, assessing the level of reliability, uninterrupted operation and stability of electric power facilities and depreciation of production capacities. However, the study suggested that renewable energy facilities should be included in the Unified Energy System to ensure the sustainability and reliability of the entire electricity industry.

References

[1] Davnis V V, Tinyakova V I, Blinov A O and Volodin Yu V 2019 Combined Modeling of Projected Evaluation of the Regional Socio-economic Development International Journal of Economics & Business Administration (IJeba) 0 1 348-54

[2] Kobtseva O N, Novoselova N N, Novoselov S N, Shichiyakh R A, Morkovkin D E and Sidorchukova E V 2017 Organizational and economic features of import substitution formation and realization in the conditions of spatial restrictions International Journal of Applied Business and Economic Research 15(23) 25-35
[3] Ivanova I A et al 2020 IOP Conf. Ser.: Earth Environ. Sci. 421 032039
[4] Yakunina G E 2019 Research of digital communications models within organizations and at the state level in the countries-leaders in the use of digital communication technologies E-management 24 41-50
[5] Tolkachev S A et al 2020 IOP Conf. Ser.: Earth Environ. Sci. 421 032041
[6] Zakharov V N, Linnik V Y, Linnik Y N and Zhabin A B 2019 Classification of coal seams by features of geological structure and characteristics of breaking Mining Informational and Analytical Bulletin 5 5-12
[7] Bryukhovetskaya S V et al 2020 IOP Conf. Ser.: Earth Environ. Sci. 421 042018
[8] Sadriddinov M I et al 2020 IOP Conf. Ser.: Mater. Sci. Eng. 734 012051
[9] Russian statistical yearbook 2018 (Moscow: Rosstat) 694
[10] Ministry of Energy of the Russian Federation Retrieved from: https://minenergo.gov.ru
[11] Ustuzhanina E, Evsukov S and Komarova I 2018 Network economy as a new economic system European Research Studies Journal 21(3) 77-89
[12] Romanova Ir N et al 2020 IOP Conf. Ser.: Mater. Sci. Eng. 734 012166
[13] Sozontov A, Ivanova M and Gibadullin A 2019 Implementation of artificial intelligence in the electric power industry E3S Web of Conferences 114 01009
[14] Gibadullin A A et al 2020 IOP Conf. Ser.: Mater. Sci. Eng. 734 012170
[15] Linnik Y N, Linnik V Y, Zhabin A B and Polyakov A V 2019 Integrated estimation of strength properties of complex-structure coal seams Mining Informational and Analytical Bulletin 8 33-41
[16] Gibadullin A A et al 2020 IOP Conf. Ser.: Earth Environ. Sci. 421 032051
[17] Zakharov V N, Linnik V Y, Linnik Y N and Zhabin A B 2019 Classification of coal seams by features of geological structure and characteristics of breaking Mining Informational and Analytical Bulletin 5 5-12
[18] Morkovkin D, Lopatkin D, Sadriddinov M, Shushunova T, Gibadullin A and Golikova O 2020 Assessment of innovation activity in the countries of the world E3S Web of Conferences 157 04015