WEB OF SCIENTIST: INTERNATIONAL SCIENTIFIC RESEARCH JOURNAL
ISSN: 2776-0979, Volume 4, Issue 4, April., 2023

SOLAR IN AUTONOMOUS ELECTRICAL NETWORKS AND USE OF WIND ENERGY SOURCES

Suyarov A.O.,
Sorimsokov U.S.,
Narimanov B.A.
Olimov O.N
Assistant Teacher, Jizzakh Polytechnic Institute,
Department of "Energy"

Annotation

The article discusses issues related to the use of solar and wind installations as primary sources of energy, which make it possible to create completely autonomous power plants that provide guaranteed year-round coverage of electrical loads in various climatic conditions.

Keywords: renewable energy sources, autonomous networks, solar installations, wind installations, energy characteristics.

INTRODUCTION

In many countries of the world, powerful renewable energy systems are based, as is known, on the use of mono-wind, mono-solar photovoltaic or mono-solar heat generating complexes. At the same time, there are numerous examples of the simultaneous use of two or more types of RES. In Canada, to provide power to remote villages, hybrid schemes are used - wind-diesel and wind - driven. Hydrogen is used to generate electricity in internal combustion engines. The wind-generating scheme is being applied at the Prince Edward Island Wind-Hydrogen Village and in the city of Ramea. The power of the hydrogen generator is 250 kW. It saves 120 thousand liters of fuel annually, thereby preventing emissions into the atmosphere: CO_2 – 320 т, NO_x– 6,8 т, SO_2 – 0,6 т [1].

Experience in operating complex renewable energy systems abroad

The TAFE Tasmania Institute (Australia) has a complex consisting of two wind turbines, an electrolyzer and a diesel plant, which is adapted to work with hydrogen.

An example of the effective use of a wind-diesel energy complex: on Fair Island (Scotland) for a village with a population of 70 people, a power plant with two diesel power plants was built, the first (power - 20 kW) was sufficient for electricity supply in summer, and the other (50 kW) - for electricity supply in winter (see Table 1)[2].

WEB OF SCIENTIST: INTERNATIONAL SCIENTIFIC RESEARCH JOURNAL
ISSN: 2776-0979, Volume 4, Issue 4, April., 2023

Wind conditions on the island are very favorable. The average wind speed is 9.6 m / s. In June 1982, a 50 kW wind farm was installed there. Since then, energy production has increased 3.7 times. The operation of the VDU on Fair Island showed that the cost of electricity received from the diesel power plant was 8 cents / kWh, and from the wind farm 3.5 cents / kWh. A special device was developed for this station, which showed when the energy meter switched to a higher tariff[3].

Table 1 Energy production at an integrated wind-diesel plant (WDP) (Fair Island) for a year of operation

Energy production on Fair Island in one year	Power generation	
Power plant	abs. number, kW h	Relative quantity, %
Integrated VDU	185 024	100,00
Wind farm	168 895	91,28
DES	16 147	8,72

The study found that the most likely hours of sunshine are distributed symmetrically around noon [4].

Analysis of complex renewable energy systems

In the course of the study, scientists established the averaged values of the intensity of solar radiation h_s with the distribution of the duration of sunshine *(S)* symmetrically relative to noon. It is proposed to determine the intensity of solar radiation as

$$h_S = h_0 \cdot b_S \cdot exp\left(-0,25\frac{S}{S_0}\right) ,$$

Where, h_0 = 1360 Вт/м^2 – solar constant; b_s– coefficient depending on the season is given in table. 2; S_0 – possible duration of sunshine (day length), [h].

Coefficient b_s shows the fraction of the solar constant arriving on a horizontal surface at noon. The product of the coefficient b_s by the solar constant allows you to determine the intensity of solar radiation at noon. Coefficient b_s has a pronounced annual course and is of greatest importance in the summer [5].

Tab 2 Parameter of the equation of the intensity of solar radiation "within the day" in the southern Urals

Parameters	Monthly											
	1	2	3	4	5	6	7	8	9	10	11	12
b_s	0,3	0,4	0,45	0,5	0,55	0,6	0,55	0,5	0,45	0,4	0,3	0,2

From the average intensity of solar radiation, given for the corresponding duration of sunshine, it is easy to determine the solar radiation for a given time S: $H_S = h_S S.$
For an objective assessment of the incoming solar energy, it is necessary to know the probability of the appearance of the sunshine duration, which characterizes its supply *p(S)*. The probabilistic characteristic of the daytime sunshine duration is determined for each month according to the observations of the meteorological service[6].

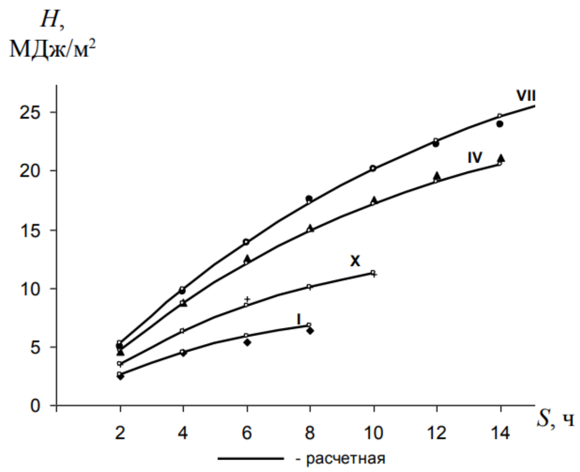

Figure 1. Dependence of total solar radiation on the duration of sunshine within the day

It is known that the specific power of the wind flow is represented as an average value for the calculation period and it is necessary to know the average value v^3. This requires knowing the distribution of the frequency of the wind speed, which can be determined for each month from the observation data[7].
It is known that the specific power of the wind flow is represented as an average value for the calculation period and it is necessary to know the average value v^3. This requires knowing the distribution of the frequency of the wind speed, which can be determined for each month from the observation data. Then, by empirical repeatability $(t_{*(v)})$ or the differential function $f(v)$ of the wind speed distribution, you

can determine the expected average power of the wind flow for the design period, W /м² [8],

$$\overline{N}_0 = \frac{1}{2}\rho\int_0^\infty v^3 f(v)dv = \frac{1}{2}\rho(v^3)_{\text{ср}}$$

It is recommended to determine the average value of the wind flow power per day. Then the wind speed at which the average daily wind power is expected is presented as the energy characteristic of the wind. The dependence of the energy characteristic of the wind flow on the average wind speed (see Fig. 2) is well approximated by an equation of the form

$$v_{\text{ср.м}} = 1,4 + 1,1 v_{\text{ср}},$$

Where $v_{\text{ср.м}}$ – average wind speed per month, м/с

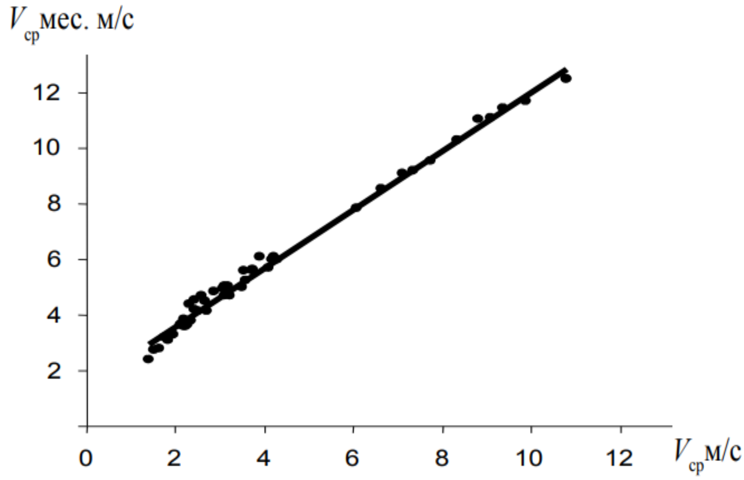

Figure 2. Dependence of the energy characteristics of the wind flow on the average wind speed

The lack of research was the lack of an implemented system for the integrated use of various types of RES for a full-scale approbation of theoretical calculations [9].

CONCLUSIONS

In general, the complex use of renewable energy sources has been limited until recently due to objective circumstances and the uncompetitiveness (high cost) of equipment for large-scale use. However, the increase in tariffs for energy services and fossil fuels brings the issue of increasing the efficiency of using available renewable resources to a new level. In connection with the above examples, the problem arises of continuing research and finding optimal solutions for the complex application of renewable energy sources proposed in this study.

Based on this, the following conclusions can be drawn:

- the use of solar and wind installations as primary energy sources makes it possible to create fully autonomous power plants that provide guaranteed year-round coverage of electrical loads, at least for small consumers, in various climatic conditions;
- the most effective are combined installations that optimally (depending on climatic conditions) combine solar and wind installations;
- development of work is required on experimental development and further improvement of mathematical models of autonomous power plants on renewable energy sources, which are the necessary basis for substantiating their optimal configurations, taking into account significantly different real climatic operating conditions and consumer characteristics.

REFERENCES

1. Suyarov A. Power Loss Minimization in Distribution System with Integrating Renewable Energy Resources //International Journal of Engineering and Information Systems (IJEAIS). – 2021. – Т. 5. – №. 2. – С. 37-40.
2. Hasanov M. et al. Optimal Integration of Photovoltaic Based DG Units in Distribution Network Considering Uncertainties //International Journal of Academic and Applied Research (IJAAR), ISSN. – 2021. – С. 2643-9603.
3. Boliev A. M. INCREASING THE ECONOMIC EFFICIENCY OF THE RENEWABLE ENERGY SYSTEM IN UZBEKISTAN //Journal of Academic Research and Trends in Educational Sciences. – 2022. – Т. 1. – №. 4. – С. 130-135.
4. Джуманов А. Н. и др. ИЗМЕРИТЕЛЬНЫЕ ТРАНСФОРМАТОРЫ ТОКА //World science: problems and innovations. – 2021. – С. 76-78.
5. Mamasaliev O. Theoretical Foundations of Energy Saving //International Journal of Engineering and Information Systems (IJEAIS) ISSN. – 2021. – С. 293-296.
6. Tanirbergenov R., Suyarov A., Urinboy J. Application of Solar and Wind Units as Primary Energy Sources in Autonomous Networks //International Journal of Advanced Research in Science, Engineering and Technology. – 2020. – Т. 7. – №. 9.
7. Hasanov M. et al. Optimal Integration of Wind Turbine Based Dg Units in Distribution System Considering Uncertainties //Khasanov, Mansur, et al." Rider Optimization Algorithm for Optimal DG Allocation in Radial Distribution Network." 2020 2nd International Conference on Smart Power & Internet Energy Systems (SPIES). IEEE. – 2020. – С. 157-159.

8. Absalamovich N. B. Research on the use of alternative energy sources in Uzbekistan: Problems and prospects //ACADEMICIA: An International Multidisciplinary Research Journal. – 2020. – Т. 10. – №. 11. – С. 763-768.
9. Narimanov B. A. FORECASTING OF PROCESSES THE TURNOVER AND STRUCTURE OF THE FINANCIAL RESOURCES OF THE BANKING SECTOR //Academic research in educational sciences. – 2021. – Т. 2. – №. 4. – С. 1980-1991.
10. Olimov O. Basic Ways to Improve Efficiency Operations of Asynchronous Electric Drives //International Journal of Engineering and Information Systems (IJEAIS) ISSN. – 2020. – С. 107-108.
11. Nosirovich O. O. Energy saving and application of frequency converters and soft start devices //ACADEMICIA: AN INTERNATIONAL MULTIDISCIPLINARY RESEARCH JOURNAL. – 2021. – Т. 11. – №. 2. – С. 1232-1235.
12. Sorimsokov U. Use of alternative energy to reduce power losses and improve voltage //Gospodarka i Innowacje. – 2022. – Т. 23. – С. 20-25.
13. Suyarov A. O. et al. Renewable energy research in uzbekistan: prospects and challenges //Web of Scientist: International Scientific Research Journal. – 2022. – Т. 3. – №. 5. – С. 1490-1498.
14. Suyarov A. O. et al. Use of solar and wind energy sources in autonomous networks //Web of Scientist: International Scientific Research Journal. – 2022. – Т. 3. – №. 5. – С. 219-225.
15. Suyarova, M. X. (2019). Teaching physics in a technical university. Экономика и социум, (12), 123-125.
16. Иняминов, Ю. А., & Суярова, М. Х. (2021). Принципы построения индивидуальных радиоприёмных устройств спутникового телевидения. Science and Education, 2(11), 342-349.
17. KHUSANOVNA, S. M., & GULNOZAALIEVNA, A. ADVANTAGES AND DISADVANTAGES OF USING MULTIMEDIA IN TEACHING FOREIGN LANGUAGES. XORIJIY TILLARNI O „QITISHNING DOLZARB MASALALARI: MUAMMOLAR VA YECHIMLAR, 170.
18. Суярова, М. Х. (2021). УСПЕШНОЕ РАЗВИТИЕ И ЭФФЕКТИВНОЕ ФУНКЦИОНИРОВАНИЕ ТЕЛЕКОММУНИКАЦИОННЫХ СИСТЕМ РЕСПУБЛИКИ УЗБЕКИСТАН. In НАУКА, ОБРАЗОВАНИЕ, ИННОВАЦИИ: АКТУАЛЬНЫЕ ВОПРОСЫ И СОВРЕМЕННЫЕ АСПЕКТЫ (pp. 67-69).
19. Суярова, М. Х., & Мустафакулов, А. А. ТВОРЧЕСКИЕ ЗАДАЧИ ПО ЭЛЕКТРОМЕХАНИКЕ. «ИННОВАЦИОН ИҚТИСОДИЁТ: МУАММО, ТАҲЛИЛ ВА РИВОЖЛАНИШ ИСТИҚБОЛЛАРИ» Халқаро илмий-амалий анжуман илмий мақолалар тўплами 20-21 май 2021 й., 418.
20. Суярова, М. Х., & Джураева, Н. М. (2018). Динамическая модель по электротехнике. In Передовые научно-технические и социально-гуманитарные проекты в современной науке (pp. 53-54).