eISSN: 2349-5715 pISSN: 2349-5707

Volume: 11, Issue 12, December-2024 SJIF 2019: 4.702 2020: 4.737 2021: 5.071 2022: 4.919 2023: 6.980 2024: 7,662

Associate Professor ***Sharipov Farhodzhon Fazlitdinovich***
Namangan Engineering-Construction Institute

CALCULATION OF THE MAIN ELEMENTS OF WIND POWER PLANT AND THEIR PARAMETERS

Abstract. In the article, since the use of wind power plants is considered a pressing issue, wind power plants consisting of DC and AC generators of varying power are offered by many European manufacturers, its disadvantage is the relative cost of DC generators and high reliability. during operation, it is scientifically substantiated.

Keywords:DC generator, wind power plants, wind turbine, wind energy, windmill.

Annotatsiya. Maqolada shamol elektr stansiyalaridan foydalanish dolzarb masala hisoblanganligi uchun, ko‘pgina evropalik ishlab chiqaruvchilar tomonidan turli quvvatdagi o‘zgarmas va o‘zgaruvchan tok generatorlaridan iborat shamol elektr stansiyalari taklif qilinganligi, uning kamchiligi, o‘zgarmas tok generatorlarining nisbatan qimmatliligi va ekspluatatsiya jarayonida yuqori ishonchlilikka ega emasligi ilmiy asoslangan.

Kalit so‘zlar:o‘zgarmas tok generator, shamol elektr stansiyalari, shamol turbina, shamol energiyasi, shamol tegirmoni.

Аннотация.В статье, поскольку применение ветроэнергетических установок считается актуальным вопросом, ветроэнергетические установки, состоящие из генераторов постоянного и переменного тока различной мощности, предлагаются многими европейскими производителями, ее недостатком является относительная стоимость генераторов постоянного тока и высокая надежность. во время работы это научно обосновано.

Ключевые слова:генератор постоянного тока, ветряные электростанции, ветряная турбина, ветроэнергетика, ветряная мельница.

Mankind used wind energy long before hydroelectric power and steam engines. In England, Germany, France, Denmark, Holland, the United States and other countries, wind energy has become widespread in industry and agriculture. Current work on the use of wind energy consists of creating individual high-power wind generators and connecting them to existing power grids and using them as the main grid.

Wind energy technology has advanced significantly in the last few years, with electricity demand set to increase sharply in 2023.

Innovative wind turbine increases the efficiency of wind energy use. A Russian company has created a two-rotor wind turbine that has no analogues in the world in terms of efficiency – Saudi Arabia and Vietnam have already ordered it.

eISSN: 2349-5715 pISSN: 2349-5707
Volume: 11, Issue 12, December-2024 SJIF 2019: 4.702 2020: 4.737 2021: 5.071 2022: 4.919 2023: 6.980 2024: 7,662

1-Picture Two rotor Wind generator

According to the electronic database, the average annual wind speed in the Namangan region is approximately 6-7.5 $\frac{m}{c}$;

$C_B = \frac{S_V}{v_C}$

C_V – standard deviation of the current wind speed from the average; v_c – average wind speed for the time under study.

The average wind speed serves as a guide. This value, which describes the possibility of installing a wind power plant, is its speed.

The criterion is the wind speed value at which modern wind turbines begin to rotate and the nominal power they develop. Determination of the average daily, average monthly and average annual wind speed based on meteorological observations over 5-10 years:

Diameter of the pipe column- d=185mm ;

Column height - h=12m ; sliding angle =30 ^{0}

C_M – area ; C_p – Determine the area occupied by the resistance symbols .

This is the sum of the cross-sectional areas of the lower base of the column and the area occupied by opposite signs .

square, With $_M = \frac{P*d^2}{4} = \frac{3.14*1.85^2}{4} = 2.7$ m2 ;

Determine the area occupied by the symbols of relative resistance C_M

Let's calculate the outer diameter of the rotor : $D_p = 2$ h sin a = 2: 12: 0.5 = 12 m.

To establish the relative resistance symbols, the area is the circumference of a square with equal sides :

$C_P = C_{KB} = L^2_{KB} = \frac{K_{OKP}}{P*0.5} = \frac{P}{P*4*0.5} D_P{}^2 = \frac{D^2{}_P}{2} = \frac{12^2}{2} = 72 \text{ m}^2$

Aerodynamic power is the energy of the oncoming wind flow transferred by the wind turbine in one second :

$PA = \frac{psv^3}{2}$; WP=1.2041 $\frac{kg}{m^3}$;

Nominal power of the SHES - 5000 Bt; Nominal wind speed - 10 m/s

From the formula we saturate the ideal aerodynamic power. According to Zhukovsky, with an ideal wind utilization coefficient :

eISSN: 2349-5715 pISSN: 2349-5707

Volume: 11, Issue 12, December-2024 SJIF 2019: 4.702 2020: 4.737 2021: 5.071 2022: 4.919 2023: 6.980 2024: 7,662

$P_A = \frac{P_E}{J} = = \frac{5000}{0.593} 8432$ W.

we find the swept area of the rotor :

$S = \frac{2P_A}{PV^3} = \frac{2*8432}{1.2041*10^3} = 14\ m^2$;

$S_{actual} = S * 1.33 = 18.6\ m^2$;

From the formula we find the rotor diameter? $D = \frac{4S}{P} = 4.9$m;

The outer diameter of the circle is filled according to the following formula;

$_{Height}D = \frac{8N}{C_P PV^3 PN_{EL} N_{MEX}} = 3.63$ m; $_{Height}D = 4$ m

Wind wheel radius; P=2 m

Thus, the developed wind turbine has the following aerodynamic characteristics:

Aerodynamic power $P_A = 8432$ W;

Wind turbine suction area S=18.6 ^{m2};

Rotor diameter D=4.9 m;

External diameter of the wind wheel $_{Drush} = 4$ m;

Maximum power per day $P_B = 64900$ W.

Thus, the daily power is 65 kW.

Active power P=5000 W;

Output voltage U=220 V;

Frequency of alternating current f=50 Hz;

$C_a = \frac{D^2 l_b n}{P} = \frac{6.1}{a_b k_f k_o B_b a}$;

This value should be taken into account when selecting wind power equipment and calculating the capacity of the battery.

These parameters are determined from the basic equation.

$C_a = \frac{D^2 l_b n}{P} = \frac{6.1}{a_b k_f k_o B_b a}$;

a_b - coefficient of utilization of the calculated column $a_b = 0.8$;

k_f - area form factor $k_f = 1.11$;

to $_o$ - winding coefficient of the stator winding $k_o = 0.92$;

Linear load of the A-stator $A = 220 \cdot 10^2$ A/m;

B_b is the maximum value of induction in the air gap at a nominal B_b of -0.8 T;

The estimated power can be determined using the following formula.

$P = \frac{k_e p_n}{\cos\varphi}$; $k_e = 1.2$; $P_{1f} = 0.7R_{3f}$; $R_{3ph} = \frac{P_{1f}}{0.7} = \frac{5000}{0.7} = 7142.8$ W.

Usually, with a delay current we get cosf=0.8;

$P_w = P = \frac{1.2*7142.8}{0.8} = 10714.2$ W.

The number of pairs of supports is determined from the ratios depending on the value of the calculated coefficient of support utilization :

$p = \frac{60f}{n} = \frac{60*50}{250} = 12$.

Ratio of the main dimensions of the synchronous generator:

$l = \frac{\ell_b}{\tau}$; $t = \frac{\pi D}{2}$;

If we combine these relations, we get the following expression;

$l = \frac{2l_b}{\pi D}$; l=1.5? ; $\ell_6 = \frac{\lambda \pi D}{2p}$;

eISSN: 2349-5715 pISSN: 2349-5707

Volume: 11, Issue 12, December-2024 SJIF 2019: 4.702 2020: 4.737 2021: 5.071 2022: 4.919 2023: 6.980 2024: 7,662

If we replace this expression with the machine constant equation, we get the following expression : $D=\frac{6.1*2P^2{}_W}{\lambda\pi a_b k_f k_o B_b An}$

$$D=\frac{6.1*2*12*10714.2}{1.5*3.14*0.8*1.11*0.92*220*10^2*0.8*250}=0.4525 \text{ m}$$

Approximately D=0.45 m

Calculate the polar division using the formula : $t\frac{\pi D}{2p}=== \frac{3.14*0.45}{2*12}0.0589$ m.

Calculate the approximate stator length using the formula below;

ℓ_b=lt=1.5*0.0589=0.0883 m ; rounding ℓ_b=0.08 m.

To calculate the rotor we need to fill in the following values from the expression;

1. The air gap between the stator and the rotor is assumed to be equal. d=0.6 mm.

2. Calculate the outer diameter of the rotor : D_p = D-2d?

Here D is the internal diameter of the generator, D=0.45 m;

D_p = 0.45 - 2 * 0.0006 = 0.4488 m. rounded D_p = 0.45 m.

3. Let's calculate the support utilization factor:

and $_I = a_p + \frac{4}{\frac{\tau}{\delta_p}+\frac{6}{1-a_p}}$;

Here is $a_p$the design coefficient of pole matching; α_p = 0.68 ;

Substituting the values, we get the following :

and $_I = 0.68 + \frac{4}{\frac{0.0589}{0.6384*10^{-3}}+\frac{6}{1-0.68}} = 0.716$;

4. Using the formula, we calculate the width of the column;

b_m=a $_p$:t, b_m =0.68*0.0589=0.04 m.

The calculated length of the rotor is equal to the length of the stator, i.e.

$\ell_m = \ell_\delta$=0.08 m;

Outer rotor diameter D ' = 0.45 m;

The calculated coefficient of support utilization was determined as a_i = 0.716 ;

Support width b_m =0.04 m, Rotor length ℓ_m = 0.08 m,

This formula includes the power factor of the wind turbine, the value of which is nonlinearly related to such coefficients;

The following are known from the main data of the wind generator:

Power utilization factor C_p = 0.4 ;

Wind wheel radius R=3.2 m;

Nominal rotation speed ω=25.12 rad/s (240 rpm);

Maximum wind speed v=20 m/s;

Air density r=1.25 kg/ m^3 ;

M_b =rpR ^{3} n ^{2} C=1.25*3.14*3.2 ^{3} *20 ^{2} *0.4=20578.3 ;

The total cost of investment is equal to the sum K=K $_{UST}$ +K $_R$ +K $_{ST}$;

K $_{UST}$ – price of complete equipment; K $_R$ – cost of design work to determine the installation location; K $_{ST}$ - the cost of construction and installation works for the installation of a wind turbine; E $_H$ =1/T – standard rate of return; Economic service life of T-equipment, years; C-annual operating expenses C=C $_{EKC}$ +C $_{EM}$; C $_{EKC}$ - annual costs of using electricity supply; C $_{EM}$ — annual costs for scheduled maintenance .

The price of 1 kW of electricity is calculated using the following formula :

$C_{EL} = P_H K + \frac{C}{W}$(sum/kW*s);

eISSN: 2349-5715 pISSN: 2349-5707
Volume: 11, Issue 12, December-2024 SJIF 2019: 4.702 2020: 4.737 2021: 5.071 2022: 4.919 2023: 6.980 2024: 7,662

W – total volume of electricity produced per year;

It takes two people to operate a wind farm. The average salary is 25,000,000 sums per month and 300,000,000 sums per year.

The cost of current maintenance can be deducted at the rate of 1%. The price of the equipment is 19,168,000 sum per year;

The total amount of annual operating expenses is calculated using the formula;
C=19168000+300000000=319168000sum;

Calculate the annual costs per 1 kW of installed capacity;

$Z=E_H K+\frac{C}{P}=\frac{0.05*2300112+319168}{15}$=28945 rubles, 4920650 sums;

The price of the generated electricity is calculated as follows :

With $_{EL}=\frac{0.05\cdot 2300112+319168}{33075}$13 rubles 15210 sum;

Next, we naturally calculate the energy savings per year using the following formula : $E_H = p\cdot n\cdot N_{CH}$;

E_H - energy savings in natural form per year, kW; p - installed capacity of the equipment, kW; n – number of electrical appliances; H_{SN} - The average duration of the working hours of a wind power plant per year is determined as the number of days the wind power plant worked in one year, multiplied by the number of hours per day (315 days 7 hours) :

$E_H=15\cdot 9\cdot 2205=297675$ kW·s.

Annual savings on fuel consumption will be:

$E_{H\,TIT}=297675\cdot 0.3=89302.5$ TIT

The money saved is calculated as follows:

$E_{DEN}=E_H\cdot T_E$;

TE - electricity tariff, rubles. In our region, the average price of electricity is 4 rubles/kW s ha en;

E_{DEN} = 297675 4 = 1190700 rubles , 297675 295 = 87814125 sum;

The payback period is calculated as a ratio to the total amount of investment in savings per year in the form : $T_{bag}=\frac{K}{E_{kun}}==\frac{2300112}{1190700}$1.9 years;

It is recommended to round the payment period to whole numbers, that is, in this case the payment period is 2 years, the warranty period of the wind turbine is 20 years;

The book of economic calculations showed that the capital costs for the construction of wind power plants during installation amounted to 2,300,112 rubles. organizes;
407 Uzbek soms 119 824 sum;

When we were building a mathematical model of innovative systems, we were surprised at how high the efficiency was: 70-80%, taking into account losses in electrical networks – wires, converters, etc.

"The main increase in productivity in our wind generator occurs precisely due to the two-rotor mechanism filled with additive and a multiplier," says Anton Tikhonov. "Thanks to these devices, the rotor increases the received power. Also, our installation captures 80% of the wind, unlike three-barrel windmills.

Almost everything that enters our windmills is converted into electricity. In addition, our twin-rotor wind turbines are specially designed to operate at low wind speeds. The higher the efficiency of the installation and the more realistic the wind is used, the higher the productivity of the wind turbine and the significantly lower the cost of the electricity generated.

eISSN: 2349-5715 pISSN: 2349-5707

Volume: 11, Issue 12, December-2024 SJIF 2019: 4.702 2020: 4.737 2021: 5.071 2022: 4.919 2023: 6.980 2024: 7,662

References:

1. Даминов А. А., Махмудов Н. М., Шарипов Ф. Ф. Применение бесконтактных аппаратов и логических элементов в схемах управления электроприводами //Science Time. – 2016. – №. 11 (35). – С. 143-147.
2. Атамирзаев Т. У. и др. Modern technologies and devices with use of secondary energy sources in uzbekistan and in the world //Научное знание современности. – 2019. – №. 2. – С. 39-43.
3. Sharipov F., Omonboyev R. GIDROENERGETIKA SOHASIDA ELEKTR ENERGIYASI OLISHNING AFZALLIKLARI //Академические исследования в современной науке. – 2023. – Т. 2. – №. 3. – С. 38-44.
4. Sharipov F., Omonboyev R. ENERGY EFFICIENCY IS AN IMPORTANT FACTOR OF SUSTAINABLE ENERGY SUPPLY //Theoretical aspects in the formation of pedagogical sciences. – 2023. – Т. 2. – №. 2. – С. 211-215.
5. Мамаджанов А. Б., Шарипов Ф. Ф. EFFICIENCY IN THE INTRODUCTION OF AUTOMATED SYSTEM OF CONTROL AND ACCOUNTING OF ELECTRIC POWER SUPPLY SYSTEMS //Міжнародний науковий журнал. – 2016. – №. 1-1. – С. 76-79.
6. Zokirova D.N., Turdiboev U.Sh. AVARIYA REJIMIDA ENERGIYA TIZIMINING O’TKINCHI JARAYONLARINI MATLAB SIMULINKDA TADQIQ QILISH // Экономика и социум. 2023. №5-2 (108).
7. Атамирзаев Т. У. и др. Энергосбережения при внедрении в производство асинхронных двигателей с совмещёнными обмотками (адсо) //Экономика и социум. – 2019. – №. 3 (58). – С. 125-128.
8. Tillanazarovich S. F. F. K. M. DEVELOPMENT OF EFFECTIVE COMPOSITIONS OF COMPOSITE MASSES FOR THE MANUFACTURE OF SANITARY WARE CONSTRUCTION PRODUCTS WITH HIGH PHYSICAL AND MECHANICAL PROPERTIES //Confrencea. – 2023. – Т. 2. – №. 02. – С. 22-32.
9. Zokirova D.N., Qosimov M.U. SANOAT KORXONALARINI ELEKTR BILAN TA'MINLASH UCHUN ENERGIYA TEJAMKOR TAQSIMLOVCHI TRANSFORMATORLARNI TAHLIL QILISH // Экономика и социум. 2023. №5-2 (108).
10. Otamirzaev O. U., Zokirova D. N., Sharipov F. F. USE OF ENERGY SAVING CABLES IN ELECTRIC ENERGY TRANSFER //Научное знание современности. – 2019. – №. 3. – С. 92-96.
11. Зокирова Д. Н. Integration Of Professional And Educational Disciplines Into Training Of Self-Learning Motivated Students //Современное образование (Узбекистан). – 2021. – №. 6. – С. 24-28.
12. Zokirova D. N. OLIY TA’LIM MUASSASALARINING TALABALARNI KASBIY-INNOVATSION FAOLIYATGA TAYYORLASH BO ‘YICHA PEDAGOGIK VOSITALARI TIZIMI VA TASHKILIY SHAKLLARI: OLIY TA’LIM MUASSASALARINING TALABALARNI KASBIY-INNOVATSION FAOLIYATGA TAYYORLASH BO‘YICHA PEDAGOGIK VOSITALARI TIZIMI VA TASHKILIY SHAKLLARI. – 2023.
13. Зокирова Д. Н. МУҲАНДИСЛАРНИ КАСБИЙ ИННОВАЦИОН ФАОЛИЯТГА ТАЙЁРЛАШДА МУСТАҚИЛ ТАЪЛИМНИНГ ЎРНИ //Экономика и социум. – 2023. – №. 3-2 (106). – С. 505-512.
14. Бекваевич У. Қ. и др. The use of Interactive Methods in the Formation of Independent Thinking of Students and Their Analysis //Telematique. – 2022. – С. 7026-7032.

eISSN: 2349-5715 pISSN: 2349-5707

Volume: 11, Issue 12, December-2024 SJIF 2019: 4.702 2020: 4.737 2021: 5.071 2022: 4.919 2023: 6.980 2024: 7,662

15. Usubovich O. O., Ne'matillaevna Z. D. INTERFAOL USULLARDAN FOYDALANIB TALABALARNING MUSTAQIL FIKRLASHLARINI SHAKLLANTIRISH //E Conference Zone. – 2022. – C. 101-105.
16. Usubovich O. O. et al. Problems Arising From the Use of the Case-Study Method and Methods of Their Prevention //CENTRAL ASIAN JOURNAL OF SOCIAL SCIENCES AND HISTORY. – 2022. – Т. 3. – №. 6. – С. 5-10.
17. Nematillaevna Z. D. Problems in providing independent learning education and ways to prevent them //Academicia: An International Multidisciplinary Research Journal. – 2021. – Т. 11. – №. 1. – С. 1431-1436.
18. Zokirova D. N. Goals And Objectives Of Organizing Independent Work Of Students //The American Journal of Social Science and Education Innovations. – 2021. – Т. 3. – №. 01. – С. 179-182.
19. Sayfullayeva, D. A., Tosheva, N. M., Nematova, L. H., Zokirova, D. N., & Inoyatov, I. S. (2021). Methodology of using innovative technologies in technical institutions. Annals of the Romanian Society for Cell Biology, 7505-7522.
20. Отамирзаев, О. У., & Шарипов, Ф. Ф. (2017). Методика проведения лабораторных занятий с интерактивными методами. Science Time, (2 (38)), 270-273.
21. Даминов, А. А., Атмирзаев, Т. У., Махмудов, Н. М., & Шарипов, Ф. Ф. (2017). Перспективные направления автоматизированного управления процесса производства, передачи и потребления электроэнергии. Актуальные проблемы гуманитарных и естественных наук, (2-3), 59-62.
22. Мамаджанов, А. Б., & Шарипов, Ф. Ф. (2016). Электр таъминоти тизимига энергия назорати ва хисоблашнинг автоматлаштирилган тизимларини жорий этишнинг самарадорлиги хакида. International scientific journal, (1 (1)), 76-79.
23. Tillanazarovich, S. F. F. K. M. (2023). INVESTIGATION OF THE STRUCTURE, COMPOSITION AND PHYSICO-CHEMICAL PROPERTIES OF NAVOI BENTONITE. Confrencea, 2(02), 14-21.
24. Sharipov, F. (2022). PEDAGOGIK YONDASHUVLAR INTEGRATSIYASI VA ULARNI TA'LIM JARAYONIDA QO'LLASH. Theoretical aspects in the formation of pedagogical sciences, 1(6), 78-81.
25. Fazliddinovich, S. F., & Odiljon o'g'li, Z. S. Gas Turbine Units Hydraulic Power Stations. Academicia Globe, 2(07), 1-5.
26. Fazliddinovich, S. F. Odiljon o'g'li, ZS (2021). USE OF ELECTRICITY IN THE NATIONAL ECONOMY. ResearchJet Journal of Analysis and Inventions, 2(07), 1-5.
27. Fazliddinovich, S. F. Odiljon o'g'li, ZS (2021). GAS TURBINE UNITS HYDRAULIC POWER STATIONS. Academicia Globe: Inderscience Research, 2(7), 1-5.
28. Sharipov, F. F. (2024). SFERIK KO 'ZGULAR YORDAMIDA QUYOSH ENERGIYASINI ELEKTR ENERGIYASIGA AYLANTIRISH.