Achievement Of Energy Saving When Operating Equipment for Livestock Feed

A.T. Panoev[1]

[1] - doctor of philosophy in technical sciences, associate professor. Head of the Department "Electric Power and Electrical Engineering" Bukhara Institute of Natural Resources Management of the National Research University of Tashkent Institute of Irrigation and Agricultural Mechanization Engineers, Uzbekistan.

M.B. Bozorov[2]

[2]- doctor of philosophy in technical sciences, associate professor of the Department of Electromechanics and Technology, Bukhara Engineering and Technology Institute,Uzbekistan.

ABSTRACT

This article provides information on the series and ratings of three-phase squirrel-cage asynchronous motors used in an agricultural enterprise. The amount of active and reactive power consumed by an agricultural enterprise in 2023-2024 was also analyzed, and a proposal was made to compensate for reactive power.

Keywords: asynchronous motor, active, reactive and apparent power, power factor, load

Introduction

During the rapid development of electric power, which is considered one of the important sectors of the national economy in our republic, the process of starting feed grinding devices in agricultural enterprises, achieving energy and resource savings and quality products through the method of controlling the speed of asynchronous motors of feed grinding devices based on new technologies production is one of the pressing problems of today. Many decrees and decisions have been adopted by the President of our Republic regarding the development of this sector [1,2,3,4].

Of these decrees and decisions PQ-2692 dated December 22, 2016 "On additional measures related to the early renewal of physically worn-out and obsolete machinery of industrial enterprises, as well as additional measures to reduce the cost of production", Decree of the President of the Republic of Uzbekistan, dated August 23, 2017 No. PQ-3238 "On measures on the further implementation of modern energy-efficient and energy-saving technologies", No. PF-4947 dated February 7, 2017 "On the strategy of actions for the further development of the Republic of Uzbekistan", The issues and ways to solve them are considered, including in the field of energy and economics, reducing resource potential, widespread use of new energy-saving technologies in production, and increasing production productivity.

In addition, the law of the Republic of Uzbekistan "rational use of energy" (№412-1),

adopted in April 1997, "PQ-3012"of the president of the Republic of Uzbekistan dated May 26, 2017 –2021" on measures to increase energy efficiency in the social sphere and industry, to further expand the use of renewable energy sources", as well as the implementation of tasks set out in other regulatory legal acts related to this activity will serve to a certain extent. It is known that at the present time the agricultural sector in our Republic has improved and developed more and more. The use of feed grinders, which are now used in agriculture, as well as the needs for it, is increasing from year to year. It is known that 70-80% of the electricity consumption generated by power plants corresponds to electric motors .

Therefore, in the process of exploitation of em crushing devices through energy-efficient methods, exploitation is considered one of the current pressing problems. With this in mind, increasing cos ϕ in the asynchronous motor used in feed grinding devices being used in agriculture is considered one of the most basic problems [5,6,7,8].

Materials And Methods

The dynamics of the change in reactive power is expressed through the coefficient of reactive power:

$$tg\phi = \frac{Q}{P},$$

(1)

here, $Q = U \cdot I \cdot sin\,\phi -$ reactive power, $P = U \cdot I \cdot cos\,\phi -$ active power, $\phi -$ angle between Voltage and current vectors. Although$tg\phi$ electr consumer services for a long period of time, described by the bridge of the power of the coefficient of the national economy:

$$cos\,\phi = \frac{P}{U \cdot I},$$

(2)

here, $S = U \cdot I$ – full power.

The force coefficient of tightening the wing part of the foil is spent by a difficult coefficient representative. Consumable forces are the coefficient of the pass, the avalanche of the ball of the force of the oshadi, i.e.:

$$S_T = \frac{P_P}{cos\,\phi},$$

(3)

here, $P_p -$ consumption of active power and U in fixed values of the exponents

$$I_P = \frac{P_p}{\sqrt{3} \cdot U \cdot cos\,\phi}$$

(4)

reactive current value increases, this leads to an increase in operating costs, that is, the waste of electricity on the network increases:

$$\Delta P = 3 \cdot R \cdot I_P^2 = \frac{R \cdot P_P^2}{U^2 \cdot cos^2\,\phi},$$

(5)

here, $R -$ active resistance of one phase of a three-phase device [9,10,11,12].

Determination of the power coefficient of the asynchronous motor of the Em grinding device.

The power factor of the asynchronous motor of the EM grinding device is determined by the following expression:

$$cos\,\phi = P/S = P/\sqrt{P^2 + Q^2}$$

(6)

From this $P = M \cdot\ \omega_0 + 3 \cdot I_1^2 \cdot R_1$- active power;

$Q = 3 \cdot I_\mu^2 \cdot x_\mu + 3 \cdot I_1^2 \cdot x_1 + 3 \cdot I_2^2\ \cdot x_2$ - reactive power;

$S = \sqrt{P^2 + Q^2}$ - full power. (7)

To achieve $cos\,\phi$= 1,0, it usually has to connect an additional battery of capacitors. The calculation of the capacitance of capacitors, which will be necessary in compensing reactive power, is carried out by the following formula:

$$\mathrm{C} = \frac{\mathrm{P}}{\omega \cdot U^2} \cdot (tg\phi_1 - tg\phi_2),$$

(8)

Here, $P = I_a \cdot U -$ electric consumer's active power, $\omega = 2\pi f -$ angular frequency, $U -$ network voltage, $\phi_1, \phi_2 -$ current vector before and after compensation of reactive power $\dot{I}$ and network voltage U angles between. The capacity of capacitor batteries is determined by the following formula:

$$Q = P \cdot (tg\phi_1 - tg\phi_2).$$

(9)

Example. The power factor of the asynchronous motor of em grinders being used in agricultural enterprises is cosϕ = 0.76 to determine the power of the compensating device consisting of capacitors required to bring the power factor of the electric consumer industrial device to cosϕ = 0.93. Network voltage 380 / 220V year-long active energy consumption Wy = 1300,000 kWh, t_Y = 4100 h.

Solution. Average active capacity throughout the year P = W_y /t_y =1300000/ 4100 = 317,1kWh. Power of reactive power compensating device $Q = P(tg\phi_1 - tg\phi_2) = 31701(0{,}85 - 0{,}39) = 145{,}9kvar$.

From the catalog 150 kvar a power-complete capacitor device is selected [13,14,15].

For each individual consumer, its calculated 1 – reactive power in the installation of compensating devices relieves the electric power supply networks of excess reactive power loading and has maximum economic effect. The installation of capacitor batteries calculated for several consumer groups leads to the efficient use of these capacitors [16,17,18].

Results

Comparative descriptions of the energy performance of standard and new series induction motors with a power of 0.75 kW and 18.7 kW are given. This is achieved due to the increase in fig in asynchronous motors to reduce Chuck resistance and power losses in the magnetic system. Stator and rotor cores are made of high quality steel; stator and rotor cores have increased copper and aluminum content; the dimensions of the lamellas and the dimensions of the air groove between the stator and the rotor are given to optimal values [19,20,25,26].

Table 1. An analysis of power losses in standard and new series asynchronous motors used in agriculture is presented

No	Basic energy waste	Standard asynchronous motor(%) AIR71A2, AIR160M4	New series asynchronous motors (%) M2AA, EFF3, EFF2, EFF1
1	Stator and rotor losses	50	47
2	Waste in the magnetic field	30	25
3	Mechanical power losses	5	5
4	Additional power consumption	15	8
5	Full power consumption	100	85

Table 2. Comparative characteristics of the energy indicators of standard and new series asynchronous motors used in agricultural enterprises are shown

Nominal power of the motor, kW	Standard asynchronous motor AIR71A2, AIR160M4		New series of asynchronous motors M2AA, EFF3, EFF2, EFF1	
	FIC, %	$\cos^{\varphi}$	FIC, %	$cos\ \phi$
0.75	75	0.76	81.5	0.84

18.7	89	0.86	91.0	0.865

In addition to the high energy performance of these engines, it heats up less (which extends the life of the engine), makes less noise during operation, and the power factor does not depend on the quality indicators of the voltage. True, the price will be higher than standard engines, but it will pay for itself in two years of electricity saved [27,28,29].

Currently, the French Jeumont-Schneider company produces FNBB, TNBB, RNBB, ISTAND, TNCB, PNCB series asynchronous motors, as well as DSOR, DKOK and other series asynchronous motors manufactured by Helmke and Brown. The German company Boveri, as well as dozens of leading companies in the field of electromechanical production, for example, Companysal Electric (USA), have 7-8% and 18-21% higher than the standard coefficient motors [21,22,23,24].

Table 3. Reactive power in asynchronous motors of agricultural enterprises statement of measures for compensation

Results	**Q. kVar 1st month**	**cos 1st month %**
Reactive power when the compensation device is not installed results	49920	0.85
Reactive power results after installation of the compensation device	32 777	0.93

Disscusion

The purpose of using controlled capacitor batteries is not only to compensate the reactive power, but also to maintain the set value of the voltage transmitted from the network without changing during maximum and minimum loads

Conclussion

In conclusion, it can be said that the purpose of applying controllable capacitor batteries in the asynchronous motor of em grinding devices used in agricultural enterprises is not only to compensate for reactive power, but also to maintain the installed value of the voltage transmitted from the network during maximum and minimum loads without changing it.

References

1. Н.Н.Садуллаев., А.Х.Шобоев., М.Б.Бозоров., А.Т.Паноев. Система мониторинга электропотребления предприятия на основе коэффициента эффективности системы электроснабжения. Europaische Fachhochschule. Volume: 08 / 2016. P.40-43. **URL: https://www.elibrary.ru/item.asp?id=27542999 e- ISSN: 2195-2183**
2. Н.Н.Садуллаев., А.Х.Шобоев., М.Б.Бозоров., А.Т.Паноев. Оценка эффективности системы электроснабжения методом многокритериального анализа. Europaische Fachhochschule. Volume: 08 / 2016. P.36-39. **URL:**

https://www.elibrary.ru/item.asp?id=27542998 e- ISSN: 2195-2183

3. Н.Н.Садуллаев., М.Б.Бозоров., Ш.Н. Нематов. Контроль эффективности функционирования промышленной сети по обобщенному показателю эффективности системы электроснабжения. Проблемы информатики и энергетики. Volume: 03 / 2018. P.57-62. **URL: https://assets.uzsci.uz/edition/file/5e43dd733cce7.pdf#page=57**
4. M.B. BOZOROV., I.I. XAFIZOV., J.M. ZOIROV., F.R. KAYIMOV., B.S. XAMDAMOV., D.A. ORIPOV., SHARIPOV A.SH. Forecasting electricity consumption of industrial enterprises using excel program. JournalNX- A Multidisciplinary Peer Reviewed Journal. Volume: 07 ISSUE 2 / 2021. P.346-350.
5. **URL: https://media.neliti.com/media/publications/342773-forecasting-electricity-consumption-of-i-ab0342bf.pdf e- ISSN: 2581-4230**
6. Х.И.Хафизов., М.Б.Бозоров. Разработка метода комплексного исследования энергоэффективности системы электроснабжения промышленных предприятий. Сборник статей Международного научно-исследовательского конкурса. Петразаводск, Россия (2021). P.10-19. **URL:http://is.nkzu.kz/publishings/%7BC1D6204A-6585-4F17-B6ADE67180342C1C%7D.pdf#page=12**
7. М.Б. Бозоров., И.И. Хафизов., А.Т. Паноев., Ж.М. Зоиров., Ш.К. Ергашев., Ф.Р. Кайимов., Б.С. Хамдамов., Д.А. Орипов., А.Ш. Шарипов. Разработка метода оценки эффективности системы электроснабжения промышленных предприятий. Сборник научных статей по итогам международной научной конференции. Казань (2021). P.42-45. **URL: https://www.elibrary.ru/item.asp?id=44776698**
8. Бозоров М. Б. ИССЛЕДОВАНИЯ ЭНЕРГОЭФФЕКТИВНОСТИ СИСТЕМЫ ЭЛЕКТРОСНАБЖЕНИЯ ОБЪЕКТОВ ЭНЕРГОСИСТЕМ НА ОСНОВЕ ОБОБЩЕННЫХ ПОКАЗАТЕЛЕЙ ЭФФЕКТИВНОСТИ //Российская наука в современном мире. – 2018. – С. 69-71. **URL: https://www.elibrary.ru/item.asp?id=36354438**
9. Sadullayev N. N., Bozorov M. B., Nematov Sh N. Research of Efficiency of Functioning of System of Electro Supply of the Enterprise by Method Multi-Criterial Analysis //Journal of Electrical & Electronic Systems. – 2018. – Т. 7. – №. 2. – С. 18-20. **URL: https://www.hilarispublisher.com/open-access/research-of-efficiency-of-functioning-of-system-of-electro-supply-of-the-enterprise-by-method-multicriterial-analysis-2332-0796-1000257.pdf**
10. Садуллаев Н. Н., Шобоев А. Х., Бозоров М. Б. ИССЛЕДОВАНИЕ ВЛИЯНИЯ РЕГУЛИРОВАНИЯ ПАРАМЕТРОВЭЛЕКТРОЭНЕРГИИ НА ВЫБОР ОПТИМАЛЬНОЙ СХЕМЫ ЭЛЕКТРОСНАБЖЕНИЯ //Современные инструментальные системы, информационные технологии и инновации. – 2014. – С. 28-32. **URL: https://www.elibrary.ru/item.asp?id=22546679**
11. Bozorov M. B. et al. USE OF RENEWABLE ENERGY SOURCES FOR LOW-POWER ENTERPRISES IN UZBEKISTAN //British View. – 2022. – Т. 7. – №. 3. **URL: https://britishview.co.uk/index.php/bv/article/view/120**
12. Bakhshiloevich B. M. et al. Development of A Method for A Comprehensive Study of the Efficiency of the Power Supply System of Industrial Enterprises //Open Access Repository. – 2022. – Т. 8. – №. 04.

– C. 71-77.
URL:
https://oarepo.org/index.php/oa/article/view/553

13. Bakhshiloevich B. M., Rasulovich Q. F., Akmalovich O. D. Development of a combined method for forecasting electricity consumption of an industrial enterprise llc evrosnar //World Bulletin of Social Sciences. – 2022. – T. 8. – C. 57-64.
URL:
https://www.scholarexpress.net/index.php/wbss/article/view/715
14. Panoev A., Bozorov M. Compensation of Reactive Power in Asynchronous Motors of Agricultural Enterprises //Eurasian Journal of Engineering and Technology. – 2023. – T. 16. – C. 8-**URL: https://www.geniusjournals.org/index.php/ejet/article/view/3568**
15. Abdullo Panoev, & Makhsum Bozorov. (2023). ACHIEVING ENERGY SAVING BY COVERING THE REACTIVE POWER IN THE OPERATION OF ASYNCHRONOUS MOTORS USED IN AGRICULTURAL ENTERPRISES. *European Journal of Agricultural and Rural Education*, *4*(3), 14-22. Retrieved from https://scholarzest.com/index.php/ejare/article/view/3378
16. Bozorov, M. B., Hafizov, I. I., Panoev, A. T., Zoirov, J. M., Ergashev, S. K., Kayimov, F. R., ... & Sharipov, A. S. (2021). Razrabotka metoda otsenki effektivnosti sistemy elektrosnabzheniya promyshlennyx predpriyatiy. In *Sbornik nauchnykh statey po itogam mejdunarodnoy nauchnoy conference. Kazan* (pp. 42-45).
17. Hafizov, Kh I., and M. B. Bozorov. "Razrabotka metoda kompleksnogo issledovaniya energoeffektivnosti sistemy elektrosnabzheniya promyshlennyx predpriyati." *Sbornik statey Mejdunarodnogo nauchno-issledovatelskogo konkursa. Petrazavodsk, Russia* (2021): 10-19.
18. Hafizov, Kh I., and M. B. Bozorov. "Razrabotka metoda kompleksnogo issledovaniya energoeffektivnosti sistemy elektrosnabzheniya promyshlennyx predpriyati." *Sbornik statey Mejdunarodnogo nauchno-issledovatelskogo konkursa. Petrazavodsk, Russia* (2021): 10-19.
19. Sadullaev N. N. et al. Evaluation of the effectiveness of the system of electrical supply by the method of mnogokriterialnogo analysis //Europaische Fachhochschule. – 2016. – T. 8. – C. 36-39.
20. Sadullaev N. N. et al. Sistema monitoringa elektropotrebleniy predpriyatiya na osnoe koeffitsienta effektivnosti sistemy elektrosnabzheniya //Europaische Fachhochschule. – 2016. – T. 8. – C. 40-43.
21. Sadullaev N. N., Kh S. A., PARAMETROVELEKTROENERGII B. M. B. I. V. R. NA VYBOR OPTIMALNOY SCHEMY ELEKTROSNABJENIya //Sovremennye instrumentalnye sistemy, informatsionnye tehnologii i innovatsii.-2014.-S. – C. 28-32.
22. Xafizov Islam, Bozorov Maxsum, & Ahmadov Elmurod. (2023). SANOAT KORXONALARI ELEKT ENERGIYADAN FOYDALANISH SAMARADORLIGINI BAHOLASH. *Innovations in Technology and Science Education*, *2*(9), 1918–1929. Retrieved from https://humoscience.com/index.php/itse/article/view/936
23. Хафизов Ислам, Бозоров Махсум, & Жабборов Азизбек. (2023). ИССЛЕДОВАНИЕ ПРИМЕНЕНИЯ СОЛНЕЧНЫХ ПАНЕЛЕЙ ДЛЯ ПИТАНИЯ КАТОДНОЙ СТАНЦИИ МАГИСТРАЛЬНОГО ТРУБОПРОВОДА ГАЗЛИ-КОГОН. *Innovations in Technology and Science Education*, *2*(9), 1907–1917. Retrieved from https://humoscience.com/index.php/itse/article/view/935
24. Panoyev A.T., Bozorov M.B., & Ahmadov E.K. (2023). MEASURES TO SAVE ELECTRICAL ENERGY IN STATIC AND DYNAMIC MODES OF ASYNCHRONOUS MOTORS USED IN AGRICULTURE.

https://doi.org/10.5281/zenodo.7926025

25. Panoyev A.T., и др. MEASURES TO SAVE ELECTRICAL ENERGY IN STATIC AND DYNAMIC MODES OF ASYNCHRONOUS MOTORS USED IN AGRICULTURE. Zenodo, май 2023 г., doi:10.5281/zenodo.7926025.
26. Садуллаев, Н. Н., А. Х. Шобоев, and М. Б. Бозоров. "Информационная инфраструктура «интеллектуальной» сети на основе коэффициента технической эффективнос ти системы электроснабжения." *Узбекский журнал Проблемы информатики и энергетики* 1-2 (2014): 92.
27. ПАРАМЕТРОВЭЛЕКТРОЭНЕРГИИ, НАВО. "Садуллаев Насулло Нематович, д. т. н., доцент, проректор по научной работе." *Шобоев Алишер Хикматиллаевич, докторант, Бозоров Махсум*
28. *Бахшиллович, докторант*.
29. Bozorov, M. . (2023). FORECASTING ELECTRICITY CONSUMPTION OF MERGANTEX ENTERPRISE. Modern Science and Research, 2(5), 605–612. Retrieved from https://inlibrary.uz/index.php/science-research/article/view/20323
30. Xafizov Islam, Bozorov Maxsum, & Zaripov Shaxzod. (2023). SANOAT KORXONALARI TRANSFARMATORLARINING SAMARADORLIGINI BAHOLASH. *Innovations in Technology and Science Education*, *2*(9), 1930–1942. Retrieved from https://humoscience.com/index.php/itse/article/view/937
31. Panoev, Abdullo, and Makhsum Bozorov. "Indicators of Electricity Consumption in Asynchronous Motors Used in the Agricultural Industry." *Eurasian Journal of Engineering and Technology* 19 (2023): 1-8.