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COMPENSATION OF REACTIVE POWER THROUGH AUTOMATIC CONTROL OF CAPACITOR BATTERIES IN TEXTILE ENTERPRISES

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ABSTRACT	*KEYWORDS*
It is known that today the number of industrial enterprises is increasing and the majority of energy consumers in them are the main part of the demand for asynchronous motors and valve transformers used in automated systems. The increase in the demand for reactive power has a negative effect on the indicators of the quality of electricity. Considers the problem of selecting reactive power compensation devices in distribution networks. Today, ensuring the quality of electricity is a very important task. One of the ways to achieve electricity parameters from consumers that meet the regulatory requirements is to install reactive power compensation in the network.	Textile enterprises, reactive power, quality indicators, compensation, capacitor batteries, power factor, PFR-12

Introduction

The growth in electricity consumption leads to the creation of ever stronger energy interconnections, which require the transmission of electricity and the accompanying reactive power from sources to consumers through power grids. The production of reactive power does not require direct fuel consumption, but its transmission through the network causes active power consumption in the form of electricity loss and additionally loads the elements of the power grid, reduces their overall permeability[1]. In this regard, it is not appropriate to increase the production of reactive power by generators in order to deliver it to the consumer.

The increase in the active load of the electric networks of industrial enterprises is accompanied by the consumption of reactive power. An increase in its network elements leads to an increase in the intervals of voltage changes at its various points. Compensation of reactive power should be solved at

the same time as the problem of voltage regulation in the textile enterprise network. For these purposes, capacitor devices are widely used in networks with a voltage of 0.22-10 kV in networks with high reactive power demand [2]. At the same time, autotransformers regulated under the load can be completely abandoned or their regulation range can be significantly reduced, which leads to reduction of energy losses in networks and improvement of voltage quality of electrical consumers[3].
To compensate for the reactive power of the capacitor, industrial enterprises, centralized, group and individual types of compensation were distributed in networks (Fig. 1.2). Centralized compensation for high voltage (Fig. 1.2, a) is connected to the 6-10 kV buses of the transformer substation when there is a capacitor unit. Thus, capacitors are used well, less of them are required, and the installed power of 1 kvar is relatively minimal[4].
With centralized compensation installed on the lower voltage side (Fig. 1.b), when the factory is a capacitor connected to the 0.4 kV busbars of the transformer, reactive power is used not only in 0.4 kV internal distribution networks, but also in high-voltage 6-10 kV networks . Group compensation (Fig. 1.c). Centralized rectification is recommended only in distribution networks where step compensation devices are common in personal power receivers, and in this case, reactive power consumption in the distribution networks of textile enterprises is more than half of the full power consumption.

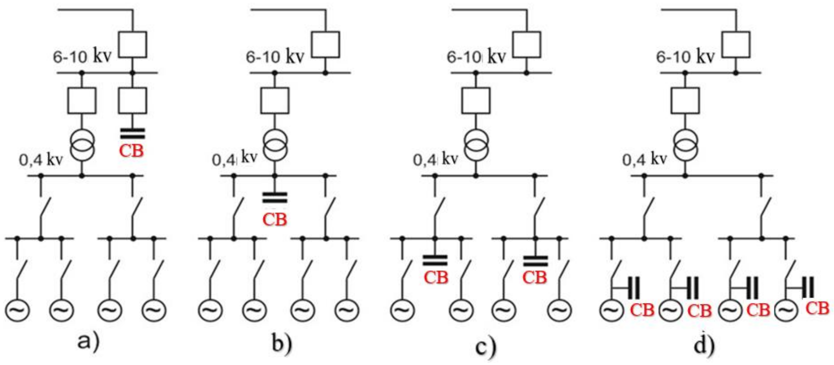


Figure 1. Reactive power compensation methods in networks of industrial enterprises. a) centralized high-voltage busbar; b) centralized low voltage bus; c) grouped; d) individual;

Individual compensation (Fig. 1.d), in this method, the reactive power consumer is installed on the reactive power consumers directly connected to the same bus with the capacitor battery, because in this case, the losses in the reactive power transmission produced reduction is expected. This method is used in heating devices in textile enterprises [5]. If the load of the enterprise is variable, it is possible to regulate the reactive power by installing automatically controlled capacitor banks for significant fluctuations of the reactive power. Compared to other electrical equipment, capacitors have small specific losses: 0.3-0.45% of the nominal power, that is, 1 kVAr per 3-4, 5 watts, and are almost constant in the zone of normal temperatures. Active power losses in capacitors are determined by the formula [6].

$$\Delta P = tg\delta \cdot Q, \quad (1)$$

where Q-capacitor power, kvar; specific losses for tgd voltage capacitors.

Table 1.1 Active power losses in capacitor devices

0.4 kV			6-10 kV		
Reactive power (kVAr)	It's a waste of comparison (kVt/kVAr)	A general waste of active power (kVt)	Reactive power(kVAr)	It's a waste of comparison (kVt/kVAr)	A general waste of active power (kVt)
75	0.0045	0.34	300	0.003	0.9
100	0.0045	0.45	450	0.003	1.35
150	0.0045	0.68	600	0.003	1.8
200	0.0045	0.9	750	0.003	2.25
300	0.0045	1.35	900	0.003	2.7
400	0.0045	1.8	1050	0.003	3.15
500	0.0045	2.25	1200	0.003	3.6
600	0.0045	2.7	1500	0.003	4.5
800	0.0045	3.6	2000	0.003	6.0
1000	0.0045	4.5	2500	0.003	7.5

0.003 for capacitors above 1000V ,0.0045 for 1000 V capacitors ,For example, for a 3-10 kV capacitor device, the loss of 600 kVAr is 0.003·600 = 1.8 kW.

Ensuring standard values of quality indicators of electricity for consumers of textile enterprises reduces product defects, increases the productivity of technological equipment and reduces the possibility of its shutdown. In addition, it reduces the normal operation of automatic control systems and the level of wear and tear of technological equipment. The economic efficiency in electric power networks can be expressed in the reduction of the cost of damage compensation, renewal, planned preventive and restorative maintenance from ensuring the quality of electricity [7]. Below are currently paid additional capacities of light industrial enterprises in Fergana region for non-compensation of electricity demand and reactive power in Kvar value.

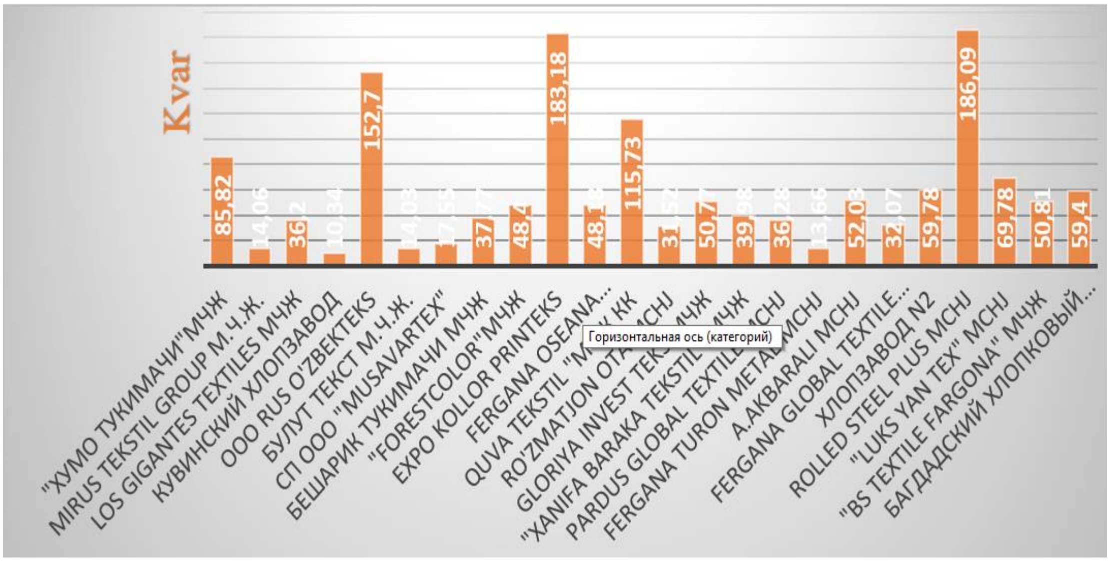
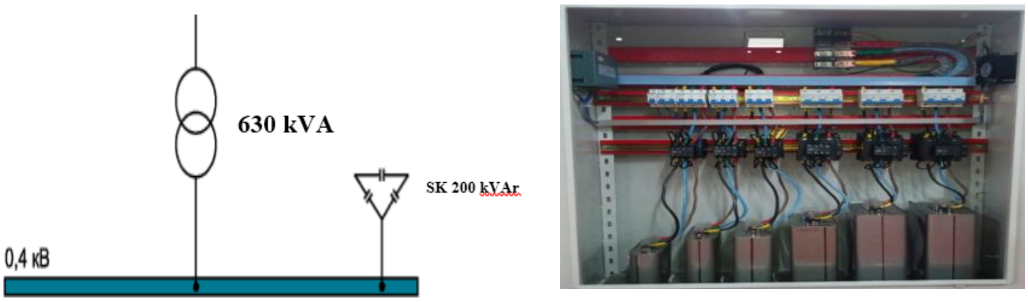


Figure 2. Demand for reactive power in light industrial enterprises that did not compensate for reactive power in Fergana region is listed.

The capacity of the 630/10/0.4 transformer of the private light industrial enterprise "Botirov Rakhmatillo Botirovich" in Yozyovon district was studied and measurement work was carried out on the device "Malika-01". The power consumption was studied and a 200 kVar 6-step (10/20/30/40/50/50 kVAr) compensation device was installed on the 0.4kV bus of the transformer [8]. The built-in capacitor batteries are controlled by the PFR-12 controller.



a) b)

Figure 3. a) Place of installation of compensation and b) condenser cabinet.

In the capacitor battery above, the PFR-12 controller device connects the required capacity to the network depending on the power demand situation in the network and thereby adjusts the reactive power in steps. The capacity steps of capacitor banks are shown in the table below.

Table 2 The number of steps and power of the compensating device

№	Powers on the steps	General reactive power (kVar)
1	10	200
2	20	
3	30	
4	40	
5	50	
6	50	

Figure 4 below shows the power consumption of the left half of the graph before the installation of the compensating device and the power consumption of the right half after the compensating device is connected.

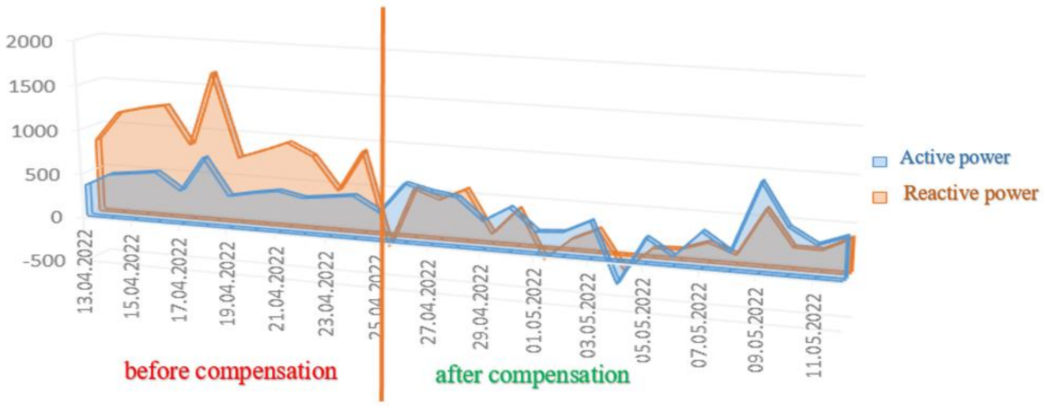


Figure 4 Power consumption of a light industrial enterprise before and after compensation.

If we conclude from Figure 4, it is possible to observe a non-linear fluctuation in the reactive power demand range between 700 kW and 1660 kW before the compensation is set, and the active power demand change accordingly.

CONCLUSION

After the compensation of reactive power, the demand for reactive power has decreased significantly, and not only supply of consumption, but reactive power is being transmitted to the network, respectively, due to the decrease in the value of the current flowing in the network, due to the decrease in the value of the current flowing in the network. The 10-day reactive power demand before compensation is 11666.4 kvar, and the 10-day consumption after compensation is 2276 kvar. By compensating the reactive power, the light industrial enterprise is producing 9390.4 kvar power value in the capacitor units.

REFERENCES

1. Kamoliddinov S. et al. РЕГУЛИРОВКА ИЗМЕНЕНИЯ НАПРЯЖЕНИЯ В УСТРОЙСТВЕ АВТОКОМПЕНСАЦИИ (НА ПРИМЕРЕ ОДНОЙ ФАЗЫ) //Главный редактор: Ахметов Сайранбек Махсутович, д-р техн. наук. – 2022. – С. 49
2. Xolidinov I. X., Qodirov A. A., Kamoliddinov S. Kuchlanish o ‘zgarishini reaktiv quvvatni avtomatik kompensatsiyalash qurilmasida rostlash //Academic research in educational sciences. – 2022. – Т. 3. – №. 3. – С. 973-981.
3. Zoxidov Iqboljon Zokirjonovich MOYLI KUCH TRANSFORMATORLARNI KOMPLEKS DIAGNOSTIKA ZARURATI // Ta’lim fidoyilari. 2022. №Special issue. URL: https://cyberleninka.ru/article/n/moyli-kuch-transformatorlarni-kompleks-diagnostika-zarurati (дата обращения: 13.04.2023).
4. Abdullayev K. et al. PROTECTIVE PROTECTION AGAINST ELECTRIC SHOCK DURING REPAIR OF ELECTRICAL NETWORKS //Студенческий. – 2019. – №. 6-2. – С. 61-63.
5. Abdullayev A. A. et al. Asinxron dvigatellarda yuqori garmonikalar tasiridan kelib chiqqan isroflar //Involta Scientific Journal. – 2022. – Т. 1. – №. 6. – С. 278-285.
6. Исмоилов И. К., Халилова Ф. А. Регулирование активной и реактивной мощности синхронного генератора при подключении к сети //Universum: технические науки. – 2021. – №. 1-3 (82).
7. Ma'Dievna Y. S. et al. Developing reading comprehension skills of learners //Вопросы науки и образования. – 2019. – №. 7 (53). – С. 193-195.
8. Zokhidov Iqboljon Zokirjonovich ҚИШЛОҚ ХЎЖАЛИГИ МАШИНАЛАРИНИ ЭЛЕКТРЛАШТИРИЛИШИ // Ta’lim fidoyilari. 2022. №. URL: https://cyberleninka.ru/article/n/ishlo-h-zhaligi-mashinalarini-elektrlashtirilishi (дата обращения: 13.04.2023).
9. Bokiyev A. A., Zokhidov I. Z. MOBILE ENERGY TECHNOLOGICAL TOOLS BASED ON RENEWABLE ENERGY SOURCES //INTERNATIONAL JOURNAL OF RESEARCH IN COMMERCE, IT, ENGINEERING AND SOCIAL SCIENCES ISSN: 2349-7793 Impact Factor: 6.876. – 2022. – Т. 16. – №. 09. – С. 10-15.

10. Boqiev A. A., Zoxidov I. Z. BOG'DORCHILIK VA ISSIQXONALARDA O 'SIMLIKLARGA PURKAB ISHLOV BERUVCHI ELEKTR MEXANIK QURILMA //Eurasian Journal of Medical and Natural Sciences. – 2022. – Т. 2. – №. 11. – С. 232-235.
11. Комолддинов С. С. Ў. Кодиров Афзал Ахрор Ўғли, Ашуров Абдулахад Валижон Ўғли, & Тухтасинов Саидисломхон Хасанхон Ўғли (2022) //РЕГУЛИРОВКА ИЗМЕНЕНИЯ НАПРЯЖЕНИЯ В УСТРОЙСТВЕ АВТОКОМПЕНСАЦИИ (НА ПРИМЕРЕ ОДНОЙ ФАЗЫ).,(5-9 (98)). – С. 49-54.
12. Akmaljon o'g T. A. et al. Analysis Of Dynamic Stability Of Synchronous Generators In Hydro Power Station In The Electrical Energy System In The Matlab Software //Eurasian Journal of Engineering and Technology. – 2023. – Т. 18. – С. 1-5.
13. Исмоилов И. К., Турсунов Д. А. Применение методов робастного управления в системах регулирования синхронных генераторов //Universum: технические науки. – 2020. – №. 12-5 (81). – С. 28-31.
14. Эралиев Хожиакбар Абдинаби Угли, Латипова Мухайё Ибрагимжановна, Бойназаров Бекзод Бахтиёрович, Абдуллаев Абдувохид Абдугаппар Угли, Ахмаджонов Аббосжон Эркинжон Угли Восстановление разреженного состояния в сравнении с обобщенной оценкой максимального правдоподобия энергосистемы // Проблемы Науки. 2019. №12-2 (145).
14. F.A.Xalilova. Effective Organization of Laboratory Exercises in Teaching the Science of Electrical Technical Materials in Technical Higher Education Institutions //Eurasian Journal of Learning and Academic Teaching. – 2022. – Т.. – С. 82-87.
15. F.A.Xalilova. Ta'limda zamonaviy raqamli texnologiyalaridan foydalanib "Elektr texnik materiallar" fanini o'qitishda amaliy mashg'ulotlarni samarali tashkil etish. Academic research in educational sciences 2 (CSPI conference 3), 414-419.
16. Холиддинов И. Х. и др. АНАЛИЗ СНИЖЕНИЯ ПОТЕРЬ В ЭЛЕКТРИЧЕСКИХ СЕТЯХ ПРИ ИСПОЛЬЗОВАНИИ СОВРЕМЕННЫХ ЭЛЕКТРИЧЕСКИХ КАБЕЛЕЙ //Главный редактор: Ахметов Сайранбек Махсутович, д-р техн. наук. – 2022. – С. 26.
17. Домуладжанов Ибрагимжон Хаджимухамедович, Домуладжанова Шахло Ибрагимовна, Латипова Мухайё Ибрагимжановна, Махмудов Содир Юсуфалиевич ХАРАКТЕРИСТИКА ВОЗДЕЙСТВИЯ МИНИ - ЦЕХА КОНСЕРВАЦИИ НА ОКРУЖАЮЩУЮ СРЕДУ // Universum: технические науки. 2021. №11-1 (92). URL: https://cyberleninka.ru/article/n/harakteristika-vozdeystviya-mini-tseha-konservatsii-na-okruzhayuschuyu-sredu (дата обращения: 22.05.2023).
18. Abdullaeva.M.A., . (2022). IMPROVEMENT OF TRAINING OF SEMICONDUCTOR RELAY PROTECTION DEVICES BY NEW INTERACTIVE METHODS. CURRENT RESEARCH JOURNAL OF PEDAGOGICS, 3(10), 28–33. https://doi.org/10.37547/pedagogics-crjp-03-10-05
19. Абдуллаева , М. (2023). МИКРОПРОЦЕССОРЛИ РЕЛЕЛАРНИ ЎҚИТИШДА ИННОВАЦИОН ЁНДОШУВЛАРДАН УНУМЛИ ФОЙДАЛАНИШ. *Engineering Problems and Innovations*. https://fer-teach.uz/index.php/epai/article/view/111
20. Xakimovich E. A. et al. Automatic adjustment of voltage changes using reactive power //Gospodarka i Innowacje. – 2022. – Т. 29. – С. 277-283.
21. Yulbarsovich, Usmonov Shukurillo. "SUBSTATION AUTOMATION USING IEC61850 STANDARD." American Journal of Technology and Applied Sciences 11 (2023): 27-32.