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MODES OF ENERGY CONSUMPTION OF SUBSUBSCRIBERS ON JSC "KRYVBASZALIZRUDKOM"

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Abstract. The modes of active and reactive energy consumption on the substations of JSC "Kryvbaszalizrudkom", obtained with the help of automated systems of commercial energy measurement are considered, operation modes of the pumping stations of subsubscriber of JSC "Kryvbasvodokanal" are also analyzed. It is recommended to use soft starters and frequency converters for the pumping units.

Keywords: energy consumption, energy measurement, operation modes, pumping stations.

Introduction. The problem and its relation to scientific and practical tasks. Substations of city production enterprises supply power both to the enterprises, and to different subsubscribers. Subsubscribers with considerable energy consumption include electric transport, urban electric networks, urban water and sewage pumping stations.

Increase of energy cost sets the task of optimization of energy consumption not only for the enterprises-owners of automated systems of commercial energy measurement, but also for their commercial subsubscriber.

If the production enterprises actively use monthly and daily graphs of active, reactive energy and account, the subsubscribers not always able to receive such information. It doesn't allow to respond in a timely manner to the deterioration of energy and economic indicators.

Analysis of research and publications. In order to solve the energy saving problems, it is necessary to search for organizational and technical measures mainly in the centralized power network points without clear considerations of features of formation of quantitative and qualitative energy consumption indicators by individual energy-intensive units, i.e. at technological levels. When upgrading the electrical equipment the subsubscribers begin to use the adjustable electric drive based on thyristor (transistor) converters of low and medium power for pumping stations, which allow to optimize technological and power modes.

Setting of the task. The aim of the article is to analyze the features of the modes of active and reactive energy consumption on the substations, which supply power to consumers of subsubscribers, determine the power factor and economic argumentation of putting into operation of reactive power compensating devices.

Presentation of the material and results. In order to analyze the modes of active and reactive power of consumers of substations of the pumping of JSC "Kryvbasvodokanal", the daily and monthly graphs of active and reactive power were examined.

Figure1 shows the graphs of active and reactive power of the water pumping station No. 1 as per 18 of December 18 2013, and Figure 2 shows graph of the power factor *cosφ*. The graphs show that the consumption of reactive power at the substation of water pumping station constitutes a large amount, therefore, the power factor is below the optimal values (0.95 - 0.98).

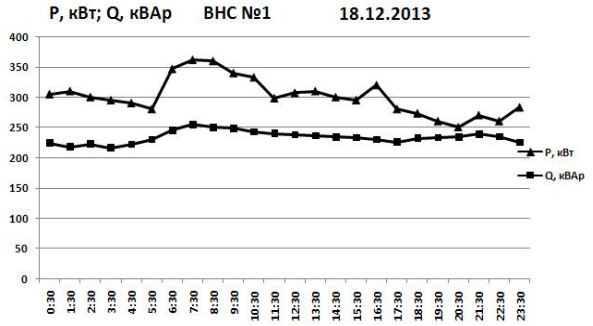

Figure 1. Graphs of active and reactive power in substation WPS №1.

Also, it appears that increasing consumption of water in the morning leads to increased consumption of active power. The reduction of the reactive power in the evening is insignificant; therefore, one can observe a

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significant reduction in the power factor (Fig.2) of substation of water pumping station No 1.

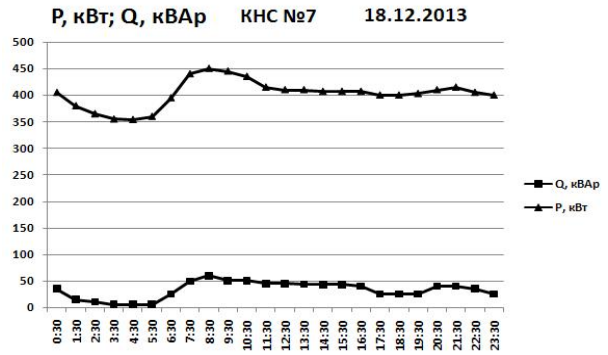

Figure 2. Graph of the power factor *cosφ* at substation WPS №1.

For energy saving it is necessary to analyze the energy consumption modes of each customer on the substation to determine consumer of increased reactive power and to develop the appropriate measures to reduce it. The energy consumption on the sewage substation sewage pumping station No. 7 as per 18 December 2013 was also analyzed.

Figure 3 shows the graphs of the active and reactive power, and Fig. 4 shows graph of the power factor *cosφ*. The graphs show that in the morning there is the increase in the active energy consumption due to the increase of sewage outlet. But due to the high-quality maintenance of the reactive power balance, the high power factor value is observed, and it has insignificant range of fluctuations (0,992 to 1.0).

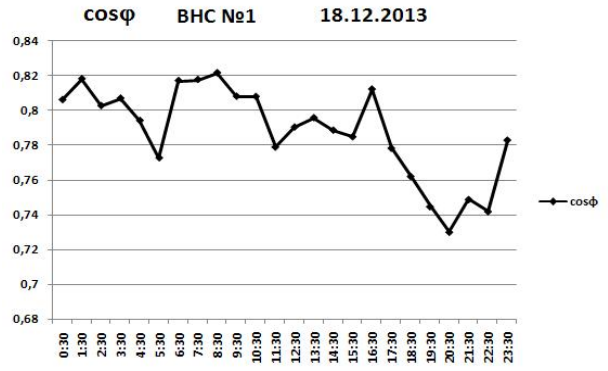

Figure 3. Graphs of the active and reactive power in substation SPS №78.

Thus, the proper design of the power supply system and usage of energy efficient equipment allows to reduce the influence of work modes on energy indicators. During the inspection of electrical equipment of water and sewage pumping stations of JSC "Kryvbasvodokanal" it was established that non adjustable electric drive with asynchronous and synchronous electric motors as well as adjustable electric drive with Lenze frequency converters is used for the pumps to maintain the required pressure in networks, which it is used for starting the pumps on sewage pumping station for pumping water.

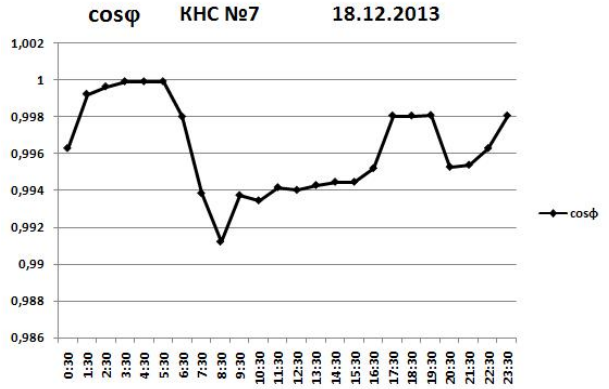

Figure 4. Graph of the power factor *cosφ* at substation SPS №78.

The conducted analysis of use of converters for start-up of asynchronous motors in other regions and cities shows that for reduction of expenses on purchase of such equipment it is possible to use cheaper soft starters, which work at the time of starting, and then power to the motor is supplied though the direct connection to the supply network. All pump motors of the station can be started by such soft starter.

The researches were conducted on the energy parameters of the pump electric drive with direct start and with the soft starter based on thyristor voltage regulator through modelling in MATLAB environment. The model of the pump electric drive with thyristor voltage regulator is showed on the figure 5.

The figure 6 shows the graphs of power factor for direct start-up of the pump electric drive and for start-up with thyristor voltage regulator.

The graphs show that the usage of thyristor voltage regulator for start-up reduces from 15 up to 20 % of increase of reactive power consumption and thus reduce the impact on the supply network.

Thus, the usage of frequency converters and thyristor regulators reduce the influence of pump electric drives on supply network and improve their energy indicators.

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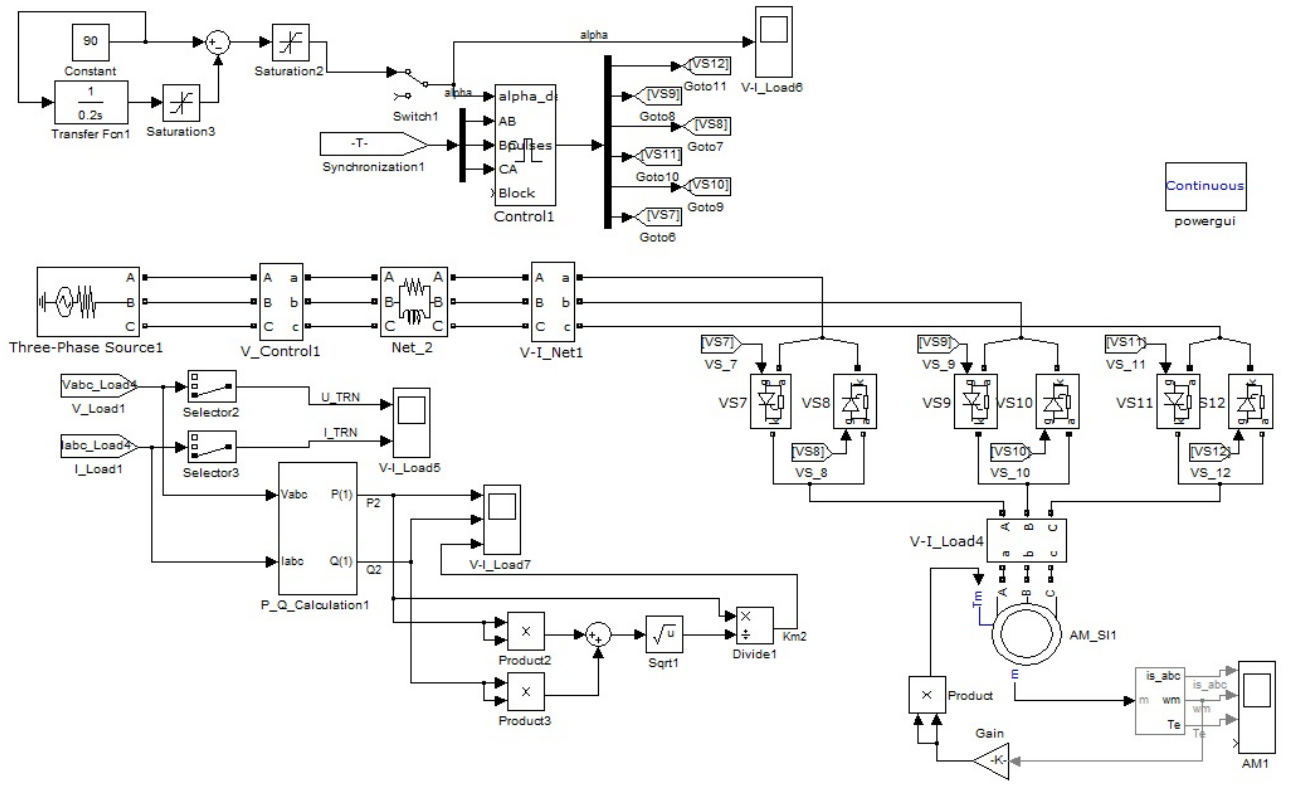

Figure 5. Circuit model of the electric pump at substation SPS №78.

Conclusions. Constant analysis of daily and monthly graphs of consumed active and reactive powers with the study of specific costs per volume unit of drinking and waste waters will allow to timely detect power imbalance and reduce the losses of active and reactive power. Implementation of frequency converters and soft starters on pumping stations network will lead to reduction of reactive power consumption and improve energy performance of pump electric drives.

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