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Using Alternative Energy Sources - Way to Intellectualization and Greater Energy Efficiency in Modern Industrial Enterprises

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ABSTRACT
The article is devoted to the development of energy saving measures in the power supplof industrial enterprises using non-traditional energy sources.

KEYWORDS: *production, transmission of electricity, change, storage and transmission to consumers, distribution of electricity, automatic control system, reliability, energy saving, power plants*

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INTRODUCTION:

A distinctive feature of the modern stage of development of society is the increasing contribution of information and communication technologies to accelerating the development of science, technology, economy, social sphere and various industries. In recent years, in world practice, the most general principle for the development of management systems at various levels (from national-scale management systems to corporate and individual enterprise management systems) is the focus on the creation and use of a single information communication space (SICS) [1,2].

The modern business world and the masses of the population are increasingly saturated with computer and electronic equipment. Therefore, electricity consumers have increased requirements for the reliability of power supply. In turn, the reliability of power supply depends both on the correct design and operation of electrical equipment (EE) of power supply systems (PSS), on rational power consumption (PC), and on the correct design and operation of heat engineering equipment (HEE) and heat use (HU), that is, from rational heat supply (RHS).

Currently abroad has been a shift to the next generation of digital protection relay and automation devices (RAD) with integration within a single information complex relaying functions, measuring and commercial electricity metering (E), regulation and control of an electrical installation [2,4]. From the standpoint of automatic process control (APCS) of an energy facility, such devices are terminal devices for collecting information, that is, terminals. Let us dwell briefly on the problem of retrospective analysis of the ACS of power systems in Russia and abroad.

- ➢ The use of personal electronic computers (PC), which have high performance and cost, gave impetus to the spread of real-time control systems (SCADA) both in electric power systems (EPS) and in electrical installations of consumers. SCADA servers provide:
- ➢ reception / transmission of tele-information in any protocols;
- ➢ reception / transmission of data from the daily dispatcher's list (DL);
- ➢ processing the incoming information, the formation of the database (DB) real time (DBRT) archiving;

- management of dispatcher board (digital devices, symbols, graphic, information boards);
- cyclic copying of DBRT to file servers of the local network (LAN);

The computers perform all SCADA functions, except for the organization of the dialogue, which is carried out on the PC of the local network. To increase the reliability of information services for PC dispatchers installed at workstations, in addition to being connected to a LAN, they have a radial connection with a UNIX computer. The choice of the UNIX-computer type is primarily determined by the presence of programmable channel adapters in the computer. The most widespread are SCADA, developed by specialists of the Ural GDC and LLP "Interface" (Yekaterinburg), VNIIE (Moscow), Komienergo (Ukhta), SISTEL, KONUS (Moscow), etc.

In the literature [3], the high efficiency of automated control systems implemented in EPS and in electrical installations of US consumers is noted. The following data are indicated: reduction of the maximum load - due to automatic voltage regulation up to 8%, load control up to 15%; reduction of electricity losses in the electrical network by - 1-1.5% due to the regulation of cosφ; reduction of fuel consumption - by 0.2-2% due to optimization of the mode in terms of active power, by 0.01-2% due to the choice of the composition of the operating equipment, by 0.01-1% due to the prompt recalculation of loss coefficients, by 0, 1-0.5% due to optimization of the reactive power mode, by 0.01-0.1% due to optimization of the main equipment repair schedules; reduction by 10% or more in the number of emergency violations due to real-time assessment of possible emergency situations.

US power company pay great attention to the management workload. Consumers with a total capacity of more than 16 thousand MW are connected to the load control systems, which is 4% of the national uncombined maximum load [4]. In the energy company "Clay Electrik Cooperative" serving 87 thousand consumers with a maximum load of 340 MW, an ADCS was put into operation, which, along with traditional functions, carries out the functions of automated control and management of energy consumption (ACMEC) [1,4]. With the help of ACMEC, load control is carried out - disconnection - switching on of consumers. The controllers control such electrical receivers - load regulators as electric water heating, air conditioning, central heating installations. The commands to turn off the power consumers are issued by the dispatcher's instructions automatically when the set maximum value is reached or according to a predetermined program.

Studies carried out in industrialized countries have shown that the potential for saving fuel and energy resources is enormous. The European Economic Community (EEC), the International Energy Agency (IEA) and the Organization for Economic Cooperation and Development (OECD) estimate that 70% of energy is wasted between extraction and extraction, but only 30%.

The main advantage of the automatic control system developed by the authors of the complete automated transformer substation (KATS) is the use of programmable logic controllers (PLC), which, unlike electromechanical relays and electronic devices for automatic control of the KATS, since the control circuit consists of low-power electronic devices, including PLC [5-9]. Energy saving is achieved due to the automatic control of the KATS using a PLC.

In addition to increasing the reliability of power supply for categories 1 and above critical consumers, it is possible to provide high energy savings through the use of non-traditional energy sources, in particular solar power plants (PP), especially PP, connected in parallel with the main inputs from KATS transformers.

For this, it is clear that in the KATS circuit shown in Figure 1, installing PP instead of ADES as a third independent power supply and, in turn, using PP in parallel with the main inputs from the transformers will give the expected results. Figure 1 below shows the schematic diagram of the KATS.

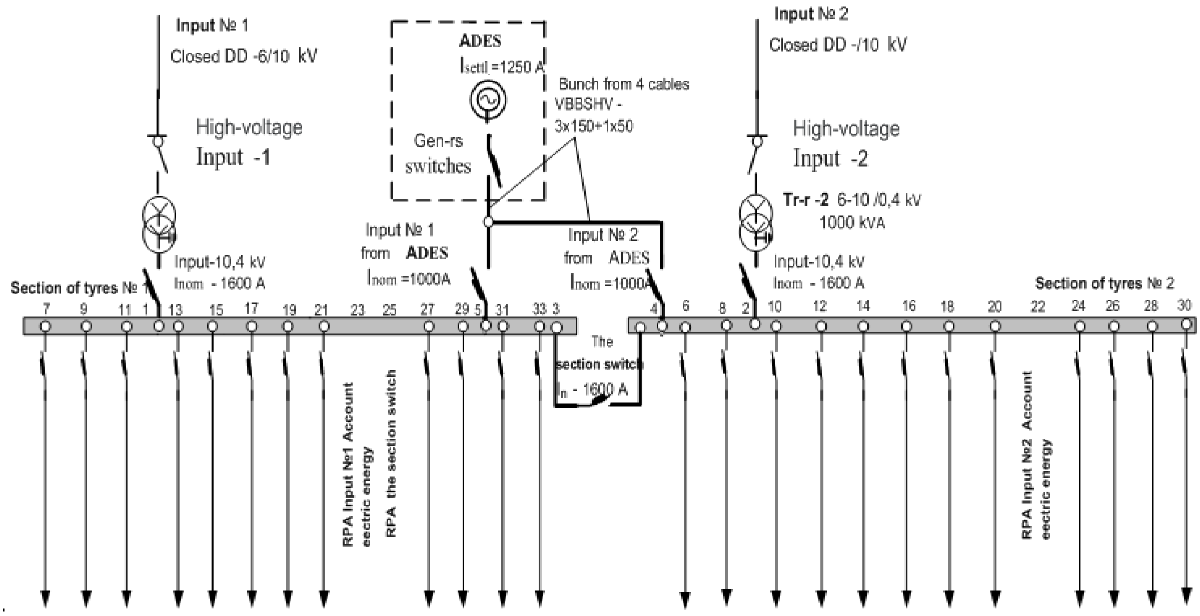

Fig 1 Schematic diagram of the KATS

On the KATS-0.4 kV, the following automation algorithm was implemented for the KATS (Figure 1). The sectional switch (SS) automatic backup connection implemented (ABCI) - in normal mode, the input circuit breakers from both transformers are on, the SS is off. In the event of a voltage failure at one of the inputs (voltage regulation is carried out directly on the busbars of the KATS-0.4 kV) - the corresponding input circuit breaker is turned off according to the patient's time.

There are two types of synchronizers: constant switching angle, communication pulse - is transmitted when a certain constant value is reached; constant switching angle, impulse for connection - б is given when the switch reaches a value equal to the connection time. Widespread synchronizers fixed angle with higher accuracy. This type includes synchronizers AST-4, UBAS, SA-1.

Below we will consider a UBAS type synchronizer. An automatic synchronizer of the UBAS type with a constant switching angle (contactless-automatic synchronization device) consists of six main parts (Figure 2).

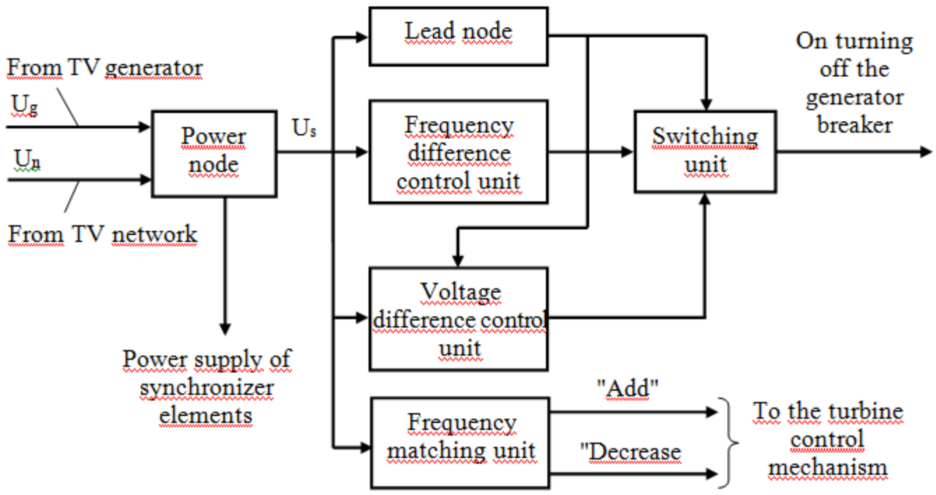

Fig 2 Block diagram of the UBAS type synchronizer

power supply unit - providing the consumption of semiconductor elements included in the synchronizer, and at the same time generating the oscillatory voltage U_s;

shutdown unit - forming a pulse to overlap the generator with respect to the phase correspondence of the vectors U_g and U_n;

frequency approximation unit - brings the frequency of the connected generator closer to the frequency of the operating generators, acting on the turbine control mechanism;

connection node - emits a pulse of a certain duration to connect the switch;

The intermediate switching node (Fig. 3) consists of a TL4 transformer, rectifier elements VS, 3V filters, a differential element EL, a zero point EA1 and a relay KL1-KL3. An oscillatory voltage is applied to the node input, created by the difference between the generator voltage U_g and the mains voltage U_s. To generate a voltage equal to the difference between two voltages, the two voltage systems must have a common point in the circuit. Therefore, in synchronization circuits, the common points B of the phases of the secondary circuits of the generator and the voltage transformers of the network are interconnected.

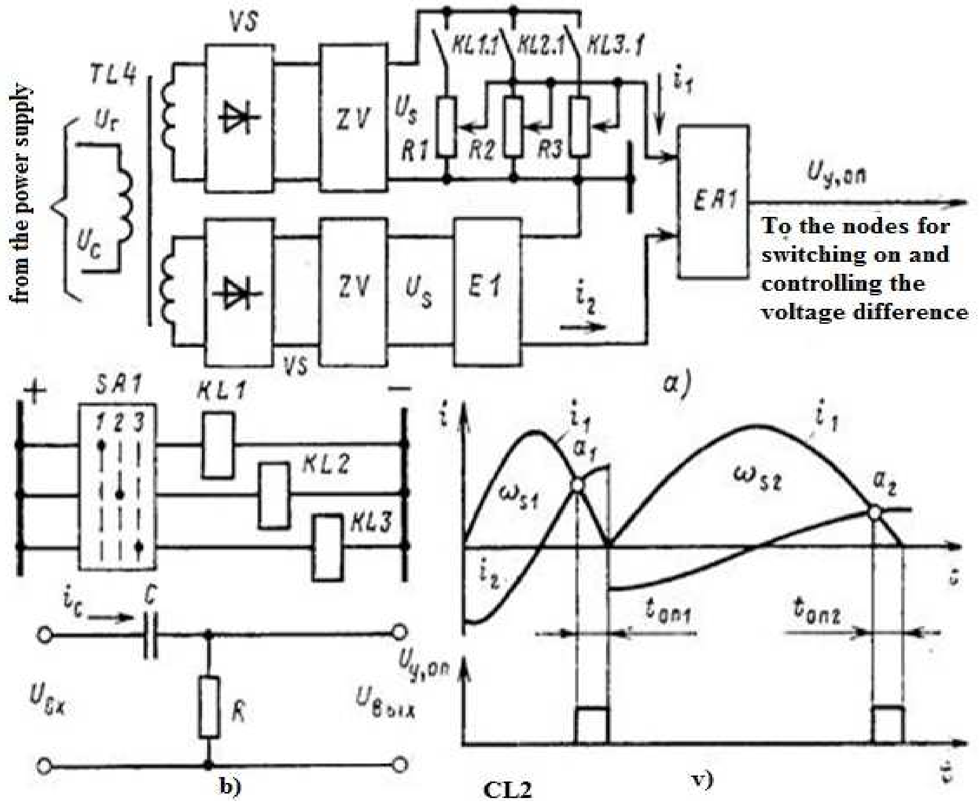

Fig 3 UBAS synchronizer breakout assembly:
a - functional diagram; b - E 1 diagram of the differentiating element; v-time work schedule

In order to ensure high efficiency at transformer substations of industrial enterprises through the analysis of unconventional energy sources, Uzbekistan has developed a technique for applying automation using modern programmable logic controllers (PLC) with the best energy characteristics, the latest advances in science and technology. In the scheme of the KATS operation, practical recommendations have been developed for the parallel use of PP with the main inputs from transformers, with the installation of PP instead of ADES as a third independent power source [1,4].

To control power consumption, manage power consumption, accumulate information about the loads of the busbar sections of the KTS, integrate the Masterpact NT H1 circuit breaker into the dispatching system, /5/ an additional communication bus function COM is used, implemented in the sectional, input cells from the transformer and from backup source, AB Masterpact NT. For these withdrawable units, an additional data transfer function is provided by:

- communication module, installed in an apparatus provided with the group of sensors (microcontacts OF, SDE, PF, CH) and a set of communication with electromagnets XF and MX control;
- communication module installed in the chassis, supplied with the sensor group (pins CE, CD, CT).

Each installed device has an address that can be assigned to it using the Micrologic control unit keypad (Modbus) or remotely (Batibus). Thus, when creating an automated control system of an energy enterprise, it is possible from the top-level information control systems, for example, from a mini-computer CR of the enterprise, to control (either through a PLC, or bypassing it) installed on the supplying substation AB, transfer measurement data, signaling, automation, registration to the upper level, monitoring of harmonics in the voltage curve, as well as other necessary information, for example, the state of AS switches in various KATS connections, the presence of voltage at the inputs and sections of the KATS buses, etc. [1,4].

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