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Use of renewable energy sources for power supply of control and relay protection systems of pumping stations of main Irrigation Systems of Uzbekistan.

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ABSTRACT

Now, all Power Systems are fitted by highly sensitive control systems will appear the problem of influence of electromagnetic disturbance to operating processes of control system. The solving of this problem is very actual now. The experience show, that the nature of this disturbances may be various, but basicly this disturbance will appearance as a result of transient processes in power network. In content of this article we showed the results of passed analysis. Finally, we suggested to use the renewable source of electrical energy, like a sun battery connected to invertor. The main reason for this solution is that renewable source operating separately from Power Network and by this reason, there are absolutely clear from any types of electromagnetic disturbances. In according to our reckoning, installation of renewable source of energy, give the possibility to do operation reliability of water pumps control and protection systems higher.

Keywords: Power System, Electromagnetic disturbance, control system, renewable source, reliability, transient process, the source of power supply without failures, high voltage breaker

Introduction

When we talking about the quality of electric energy, we are particularly interested with the indicator of the non-sinusoidality shape of the voltage and current curves as well as the presence of higher harmonics. All these deviations fall into the category of electromagnetic interference. Very often they can become a source of false signals for triggering or disabling control and protection systems. According to the theory of electromagnetic compatibility [1], which deals with the problems of “false” responses, the basic concepts in theory are the concept of a transmitter and a receiver electromagnetic energy (electromagnetic interference) in their expanded sense.

Methods

At electric power facilities, transmitters of electromagnetic effects that can affect automatic and automated process control systems for electrical facilities are:

1. Transient processes in high voltage circuits during switching by power switches;
2. Transient processes in high voltage circuits at short circuits, tripping of arrester or surge arresters;
3. Electric and magnetic fields of industrial frequency, created by power equipment of stations and substations;
4. Transient processes in circuits of various classes voltage during lightning strikes directly to or near an object;
5. Electromagnetic disturbances in operational current circuits.

Thus, an electrical device is considered compatible if it, as a transmitter, is a source of electromagnetic interference no higher than admissible, and as a receiver has an acceptable

sensitivity to extraneous influences, i.e. sufficient noise immunity. Table 1 provides examples of the most common damage caused by electromagnetic interference

Tab1

	Event,	Consequences,	Reasons
1	Switching at a Transformer Substation with a gas-insulated(SF6) switchgear	False operation of relay protection and automation systems. 110kV line disconnected	Bad charger. High level of impulse noise.
2	Switching 10kV circuit breaker on Transformer Substation with enclosed switchgear	False operation of relay protection and automation systems. 110kV line disconnected	Impulse noise in a direct current network more than 2 kV
3	Switching at a Transformer Substation with a gas-insulated(SF6) switchgear	electronic relay damage	High level of impulse noise. Low noise immunity of the relay
4	Switching at a Transformer Substation with a gas-insulated(SF6) switchgear	Automatic gas density control system malfunction. 110kV circuit breaker control system is blocked	low noise immunity of the equipment.
5	Switching at a Transformer Substation with aopen switchgear	false shutdown of 220kV switch	impulse noise in operating current circuits

In addition to the causes of electromagnetic noise shown in Table 1 and characteristic for power distribution networks of electric energy, electromagnetic interference is very common and the sources of which are the environment, in particular: atmospheric electricity, radio and television networks, working electric motors and finally electromagnetic waves from nearby power waves systems. Figure 1 shows the distribution diagram of external electromagnetic noise affecting the control and protection systems of the electric drives of pumping units.

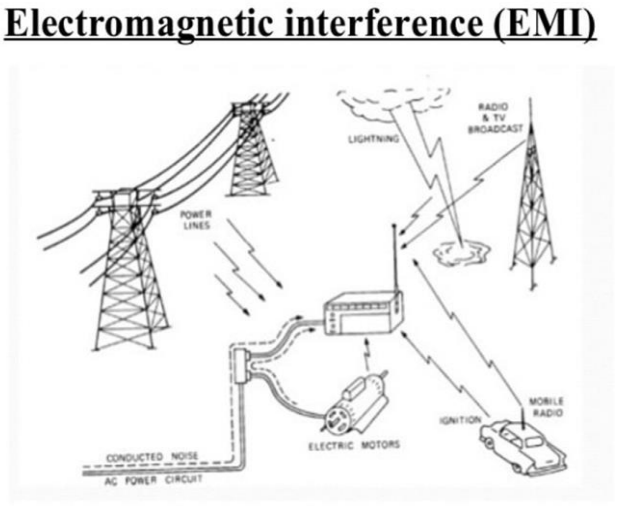

Fig1. The sources of EMI out of Power system

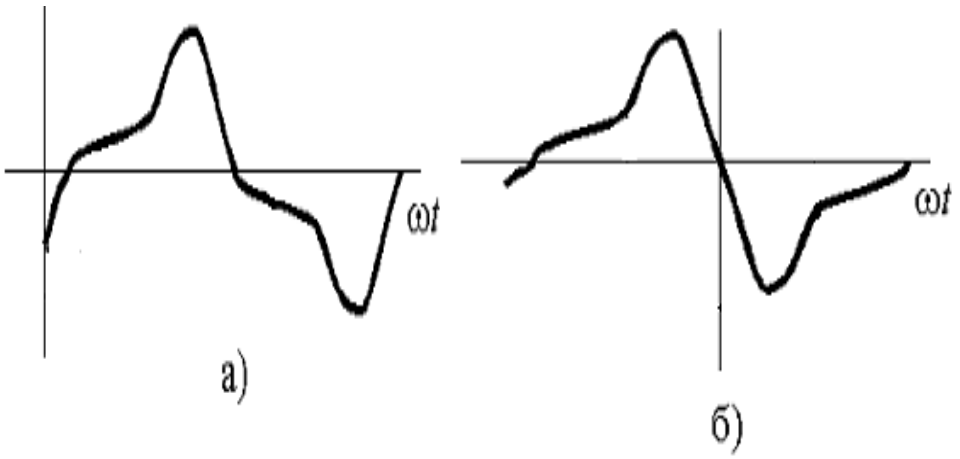

Fig.2 Forms of EMI

Figure 2 shows the most common forms of electromagnetic interference. To reduce the likelihood of unauthorized operation of the protection and control systems of the pump unit, it is proposed to use as a backup, a completely independent source that minimizes damage from electromagnetic interference, which according to statistics (Tab1) are the consequences of accidents and abnormal modes, the so-called Uninterruptible Power Supply (UPS) is used. [6] The main purpose of the UPS is the generation of electricity, the quality indicators of which, transients in the power system have practically no effect, that is, the UPS cannot be a transmitter of electromagnetic interference. According to [6], an uninterruptible power supply consists of:

1. Independent energy source
2. Energy converters,
3. switches;
4. electricity storage devices (e.g. rechargeable batteries

UPS requirements:

1. The UPS must provide power to an electrical load critical to the presence of power with normal power supply parameters, for example, control circuits of automation control systems.
2. The UPS must be able to adjust its output parameters.
3. The scheme for constructing the UPS should minimize the switching time [5] of the load on the power from independent sources.

The use of the UPS must guarantee the following standards in the power supply:

voltage 220 V ± 5% (limit values ± 10%); frequency50 Hz ± 0.2 Hz (limit values ± 0.4 Hz); coefficient of non-linear distortion of voltage shape less than 8% (continuous) and less than 12% (short-term).[6]

Sources of electrical energy,which fully comply with the above requirements, as well as guaranteeing the absence of electromagnetic interference, may be renewable sources , like solar battery, wind generator, etc. [3].

In our case, at the Amu-Zang pumping station, located in the Surkhandarya region of Uzbekistan, with a capacity of 6X12.5mW, it receives power from a transformer substation with a capacity of 2x40mW, 110 / 10kV voltage. There are 2 sets of Control LCD 10s cabinets to control the operation main pumps and relay protection cabinets type SHELT. Both systems have a high degree of reliability and are equipped with 2-sided power supply in conjunction with ATSS (Automatic Transfer Switching System).

Based on the foregoing, as well as the amount of solardays a year to power control and protection devices at the Amu-Zang pumping station, as a UPS, we propose to install a set of

Solar battery-network Inverter. General view of the UPS (Solar Battery-Inverter) and block diagram are shown in Figs3.

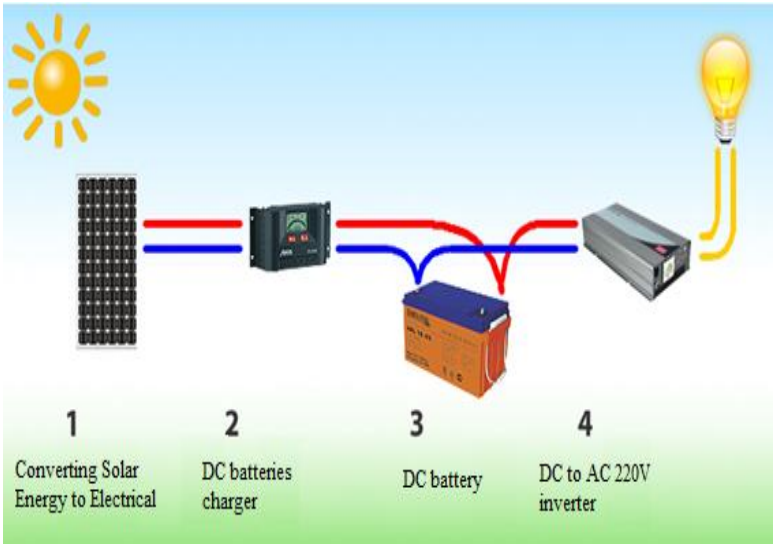

Fig. 3 UPS Solar Battery Inverter

The main indicator of the operation of inverters is the shape of the output voltage and current curves, and most importantly, complete independence from the main electrical networks. Depending on the shape of the curve, inverters are: with a "pure sine wave" at the output and with a "quasi sinusoid" at the output. Inverters with a "pure sine wave" are used to power measuring instruments of high accuracy, because the shape of the current and voltage curves of the inverter is much cleaner than in the general network and is not affected by electromagnetic interference, which is very much in the network. From this point of view, they are suitable for powering the protection and control systems of our pumping station.

Conclusion:

1. The problem of electromagnetic interference for powering control and protection systems is relevant and its relevance increases as systems improve.
2. Today, the use of uninterruptible power supplies (UPS) is the most effective method to improve the reliability of power systems.
3. Using a renewable, non-traditional source of energy to power control and protection systems, we certainly win:

3.1. Increasing the level of reliability due to the guaranteed absence of electromagnetic interference.

3.2. Saving electric energy by supplying control systems during daylight hours from a renewable energy source. Our calculations show a saving of 180 kW / hour of electricity daily.

3.3 To obtain the maximum effect, it is recommended to use a UPS (solar inverter) in the daytime as the main source, in the dark as a backup source. It should be noted that it is in the daytime (working) time that a lot of electromagnetic interference appears in the supply network. In this case, the effect of using the UPS is greatest.

Acknowledgements

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