Methods Of Reactive Power Compensation In The Load Of Photoelectric Installations In Central Asia

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ABSTRACT

In this article, opinions and feedback on DC converters and reactive power compensation at their load, photoelectric sistems and its results are discussed, which determine the advantages and energy and economic efficiency of energy efficient unchanging current exchangers for solar batteries.

Keywords: photoelectric solar battery, energy efficient, constant current converter, reactive power, compensating device, compensating devices, inductive loading, energy and economic efficiency.

The multi-purpose approach based on the proposed optimization methods discussed in this paper presents a variety of reactive power management strategies, taking into account resource savings and planning in the distribution network.

Thus, in photovoltaic cells, the energy of light radiation is converted into electrical energy. Mono or polycrystalline silicon was the first to be used in the manufacture of photovoltaic cells. Today, cells made from this element make up 80 percent of all systems installed worldwide. Recently, photoelectric cells are made of thin films of amorphous silicon, cadmium – telluride or copper – indium-selin.

Their efficiency is very low, but they are cheaper to make than photovoltaic cells made of mono or polycrystalline silicon. Currently, research is being conducted to increase the efficiency of photovoltaic cells by 30 ÷ 60%. To do this, you need to install the films on top of each other 4 ÷ 8 times. As a result of these studies, the capacity of the device will be increased and the cost of production will be sharply reduced. Reactive power is one of the most important parameters for controlling the load on the load of DC converters.

Along with capacitor batteries to compensate for sharply changing reactive power, it is also characterized by its high body cost and low strength of the mechanical circuit breaker. In addition, the high-frequency switching shocks that occur when switching capacitor batteries in the supply network and the high-frequency harmonics that occur at nonlinear loads are explained by unfavorable conditions for capacitor banks. High harmonics in supply networks are of practical importance in the study of the working processes of condenser batteries, especially in the use of condenser batteries in electrified railway networks using fan converters.

The average load current in the capacitor is allowed to increase up to 30% and the voltage up to 10%. In practice, the load current can be increased from 400% to 500% at the expense of rezanas. When choosing the capacity and installation location of capacitor banks, it is necessary to take into account the resonant voltage and current generated by the nonlinear load. When considering the operation of capacitor batteries under nosinusoidal voltage conditions, it is necessary to take into account the compatibility of the capacitor bank with the high harmonics of the supply network.

Experience has shown that capacitor batteries used in non-sinusoidal voltage networks often fail due to corrosion and corrosion. Rapid failure of capacitors occurs due to changes in the frequency response of the capacitor bank network, as their currents provide high harmonic loads. For each case, the group is required to calculate the rezanas harmonic batteries for the load. Such calculations should be carried out with high accuracy, especially in the case of small capacitors of capacitor batteries.

When calculating the required power of compensating devices and choosing them, one should proceed from the normative values of the weighted average power factor. The required power of compensating devices is determined based on the following relationship:

$$Q_{ку} = K_{м} P_{сг} (tg\varphi_1 - tg\varphi_{н})$$

(1.1)

where: - the maximum load factor determined by the standard:

$P_{сг}$ - the average annual active power consumed by electrical equipment, kW (the value of R is determined by the calculated);

$tg\varphi_1$ - tangent of the phase shift angle, which is determined by the following formula and corresponds to the approximate average power factor for the year: .

$$tg\varphi_1 = (W_{рг} - W / рг) / W_{и}$$

(1.2)

With:

$W_{рг}$ - annual consumption of reactive energy without taking into account the operation of synchronous drives;

$W / рг$ - reactive energy produced by synchronous drives in a year when tgφ (cosφ) is most convenient;

$W_{и}$ - annual electricity consumption (determined by calculating the values used in the formula);

$tg\varphi_{н}$ - standard value of the tangent of the phase shift angle corresponding to the post-compensation power factor.

Compensating devices should be located directly next to electrical equipment that consumes reactive power.

They are mainly high voltage power converters, two-level converters such as high voltage and power level, with good output voltage waveform, less electromagnetic external influences, etc., the control system is much more complex. Because the main goal of this project is to store and use energy connected to the permanent direct side of the converters and to apply voltage source converters to the storage interface.

Filters are needed to prevent harmonics from spreading to the network. It is also loads that are part of the various test systems connected to the PCC. The system configuration is shown in the figure

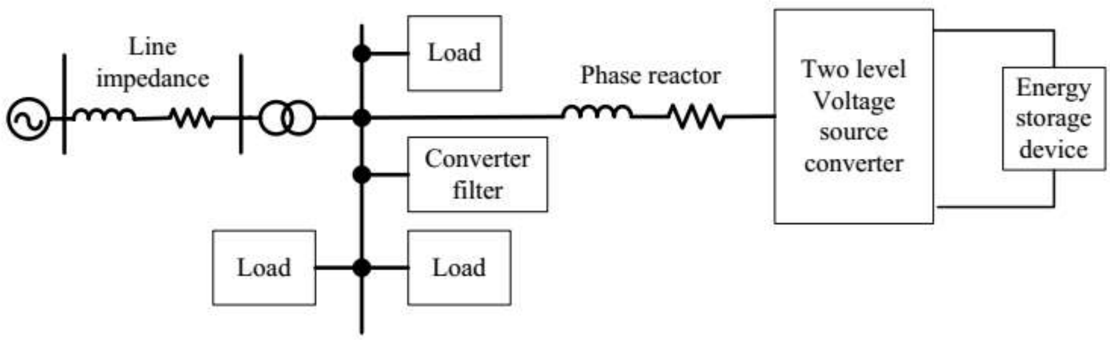

Figure 1. System overview

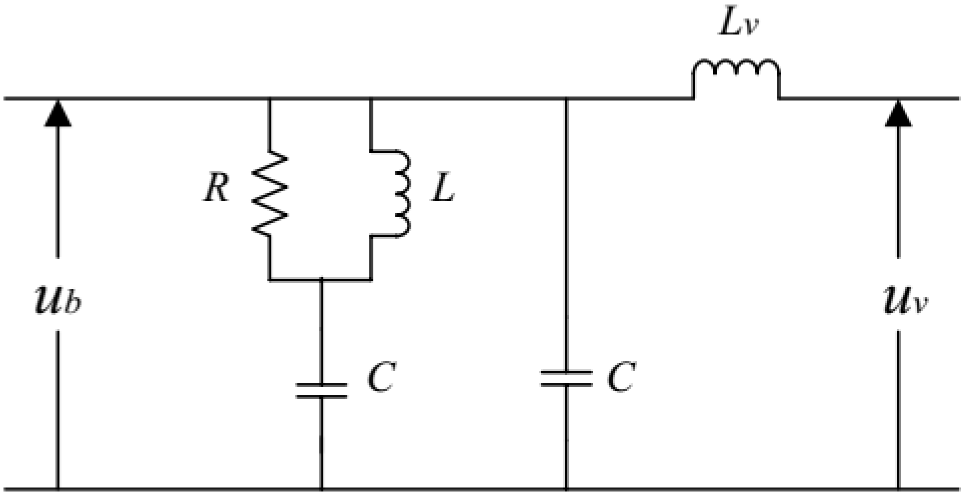

Figure 2. Converter filter

The fast switching of the converter bridge creates high frequency harmonics in the converter output voltage. To prevent these harmonics, it is necessary to properly design and use a network access filter. Series f01 is chosen as half of the resonant frequency and resistance 0x .442 01. With x01, which is the reactivity of the phase reactor at the frequency f01. The switching frequency is 1350 Hz (“triangle frequency”), i.e. always in simulations and in the real-time simulator.

In the project, the first set of harmonics generated by the converter has the orders n = p ± 2m, m = 1,2,3, ..., where p = 1350/50 = 27 is the frequency modulation factor. The resonant frequency of the f01 series of 350 Hz is chosen for the harmonics in order to obtain sufficient reduction for the lower order.

The frequency response of a filter designed for this switching frequency is shown in fig. 2.3. The gain at the base frequency and at the switching frequency is 1.03 and 0.08, respectively.

If the annual check by the Energy Security Organization or the inspection of Uzdavenergonazorat reveals a decrease in cosph from 1 to 0.8, then the losses will increase by 1/(0.8) 2 = 1.56 times, and vice versa – will amount to 0.8. . increased from 1 to 1, which reduces power losses in the network by more than 50 percent

The following table shows the percentage difference between capacity before and after compensation.

Cosφ before compensation	**Cosφ after compensation**	**Percentage drop at full power %**	**Percentage reduction in power losses %**
0,5	0,9	44	48
0,5	1	45	55
0,6	0,9	33	50
0,6	1	40	58
0,7	0,9	22	39
0,7	1	30	51
0,8	1	20	36

Values have been calculated based on the table above. Based on the results obtained, the resulting values of the total power losses and power losses before and after compensation are given.

Cosφ before compensation	Cosφ after compensation	Percentage reduction in power losses	Reduced power loss is worth it
0,5	0,9	718,5	344,8
0,5	1	734,5	403,9
0,6	0,9	538,8	269,4
0,6	1	653,2	378,8
0,7	0,9	359,2	140
0,7	1	489,9	249,8
0,8	1	326,6	117,5

Based on the above considerations and calculations, the use of photovoltaic solar cells and their compensation of reactive power on a variable load with a DC converter through compensating devices can save a lot of electricity and additional funds, as well as efficiently and reasonably use them.

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