Solar Panels to Improve Reactive Current Compensation in Load Photoelectric Systems

A.A. Rakhimov — Assistant, Fergana Polytechnic Institute, Fergana, Uzbekistan
E-mail: abdurahmon.talaba@gmail.com

Z.B. Khaydarov — Assistant, Fergana Polytechnic Institute, Fergana, Uzbekistan

ABSTRACT

This article photoelectric solar panels, photovoltaic systems opinions and feedback on DC converters and reactive power compensation electricity energy and economic efficiency is devoted to the improvement of the device controlled reactive current in the load of photovoltaic solar systems electricity energy and economic efficiency are presented in the table.

Keywords: Photovoltaic solar battery, energy efficiency, constant flux converter, jet power, compensation device, compensation device, constant current converter, capacitor batteries, inductive load, active power consumption, energy efficiency.

Introduction

All countries are trying to implement many good energy use and saving initiatives, and economic methods are always being sought. A noteworthy aspect, many countries can improve energy efficiency and become self-sufficient in energy. Important aspect compensation process, energy losses that occur during the production of electricity in networks are reduced, and therefore more energy is achieved. At the same time, excessive heat losses are prevented by compensation. Due to the presence of excess energy, the selling price of energy is reduced and a very economical level for the country is reached.

There are several ways to compensate for reactive power in the power grid. One is to install a traditional (contactor) compensation system using contactors and capacitors. In addition to them, it is preferable to use a reactive power control relay. The reactive power control relay receives and regulates some data from the current transformer. Cosφ by calculating the value, you can easily and quickly open or close contactors.

The main part

Thyristor-based with compensation, the system has two types: thyristor and triac. Triacs are usually used for single-phase loads with a power of not more than 25A. In addition, thyristors are preferable to use in power consumers with extremely high loads. Sophisticated modern technologies are used today to improve the reliability, safety and profitability of power systems, thereby improving the quality of electricity. It is necessary to constantly improve the voltage stability, voltage safety and power mode. To achieve optimal indicators of power consumption and power consumption, it is necessary to control the reactive power flow of the power system.

Sophisticated modern technologies are used today to improve the reliability, safety and profitability of power systems, thereby improving the quality of electricity. It is necessary to constantly improve the voltage stability, voltage safety and power mode. To achieve optimal indicators of power consumption and power consumption, it is necessary to control the reactive power flow of the power system.

The main results of the study are adapted to the reliable integration of photovoltaic systems into smart grids for efficient energy planning and management for arid and semi-arid regions. Large-scale photovoltaics can typically maximize solar energy conversion and are located in semi-arid lands or deserts, along with compensating devices. Data collection begins with a remote photovoltaic panel with photovoltaic panels installed to ensure that it is free from shadows due to obstructions to ensure maximum exposure to sunlight. Given the response time of the equipment, periodic reception is usually performed within 15 minutes to ensure uninterrupted wireless transmission from the photoelectric panel remote site to the research laboratory site. The system characteristics of each sensor are listed separately. This includes the actual parts number of the finished sensors along with the manufacturer and operating range.

Selection and placement in the network of electrical energy obtained on the basis of a photovoltaic system based on autonomous photovoltaic solar cells and reactive power compensation devices in normal and post-emergency modes while maintaining the required voltage level, type of device to achieve the maximum effect of power implementation based on economic feasibility.

To control the photovoltaic system, analog, digital and optoelectronic measuring instruments of varying complexity, various solar devices have been developed. In particular, the article presents a measuring information system designed to automate the process of studying the energy parameters of solar devices, that is, for continuous monitoring of their parameters. The proposed information-measuring system is developed on the basis of the software and hardware of this system.

After installing compensation devices for automatic regulation of electricity received by autonomous solar panels, we can observe less than 5% change in the nominal voltage value of electricity consumers. Before installation, it can be seen that the overvoltage value is reduced to 10% of the nominal value. One can observe a decrease in power consumption while maintaining the active power factor almost constant and equal to its nominal value.

The module is equipped with a temperature sensor to monitor the temperature of the solar photovoltaic power plant device. Continuous monitoring of the electricity generated by the station allows you to measure the voltage and current of the constant load fed from the station, and get their value in a constant working state.

Photovoltaic solar cells can handle 530W and 12.6A current. In total, the power is 60kWh. Therefore, load reactive power compensation, low risk of equipment damage due to electrical resonance, stable and relatively long service life, and high reliability are very important.

In this method, the active power is controlled by the load and the reactive power is controlled by the output voltage of the inverter. The controller supplies the maximum active power to the network with a power factor equal to one, and also allows adjustment of the reactive power supplied to the network.

Table 1. Voltage and current autonomous photovoltaic system

PV system voltage U (V)		Current in the photovoltaic system I (A)	
V1	**383.8**	**(I) 1**	**0.89**
V2	**383.8**	**(I) 2**	**0.99**
V3	**381.6**	**(I) 3**	**0.66**
V4	**381.6**	**(I) 4**	**0.76**
V5	**382.6**	**(I) 5**	**0.67**

V6	**382.6**	**(I) 6**	**0.80**
V7	**380.1**	**(I) 7**	**0.80**
V8	**380.1**	**(I) 8**	**0.72**
V9	**382.1**	**(I) 9**	**0.67**
V10	**382.1**	**(I) 10**	**0.82**
V11	**379.3**	**(I) 11**	**0.63**
V12	**379.3**	**(I) 12**	**0.65**

The actual values in the table are listed separately. Separate voltage and current values are given for each section. When designing any power supply system, it is planned to connect to this system; schedules of daily, weekly, monthly, annual load changes are very important. In practice, the collection of such information requires a lot of effort and time resources, in this case, the designer has to work with estimated values, as a result of which the energy supply systems are designed either to have excess power, or in constant voltage mode, or work with a shortage of energy.

Table 2. Consumption is a separate voltage and current in the network.

The voltages in a three-phase electrical network are U (V).		
Ua	**Ub**	**Uc**
245.4	**235.6**	**228.9**
Currents in a three-phase electrical network I (A).		
Ia	**Ib**	**Ic**
10.73	**10.57**	**10.61**

The operating power of the photovoltaic system, power factor, frequency, active power, reactive power, individual values of body temperature are presented. A control algorithm for a photovoltaic system initially connected to a single-phase network is presented. An inverter designed for grid-connected photovoltaic arrays can synchronize the output sinusoidal current with the grid voltage. This active and reactive power is controlled beyond the maximum by the series load angle and the inverter output voltage.

Table 3. The daily active, reactive, power coefficients, frequency, body temperature

Current Power (KW)	2.864
Peak power of the current day (W)	**27.061**
Income today (kWh)	**76.43**
General income (kWh)	**432.83**
Input Power (KW)	**7.592**
Power factor	**1.000**
Mains frequency (Hz)	**50.01**
Active Power (KW)	**7.413**
Reactive power (kvar)	**-0.038**
Case temperature (C)	**24.2**

A control algorithm for a photovoltaic system initially connected to a single-phase network is presented. An inverter designed for grid-connected photovoltaic arrays can synchronize the output sinusoidal current with the grid voltage. This active and reactive power is controlled beyond the maximum by the series load angle and the inverter output voltage.

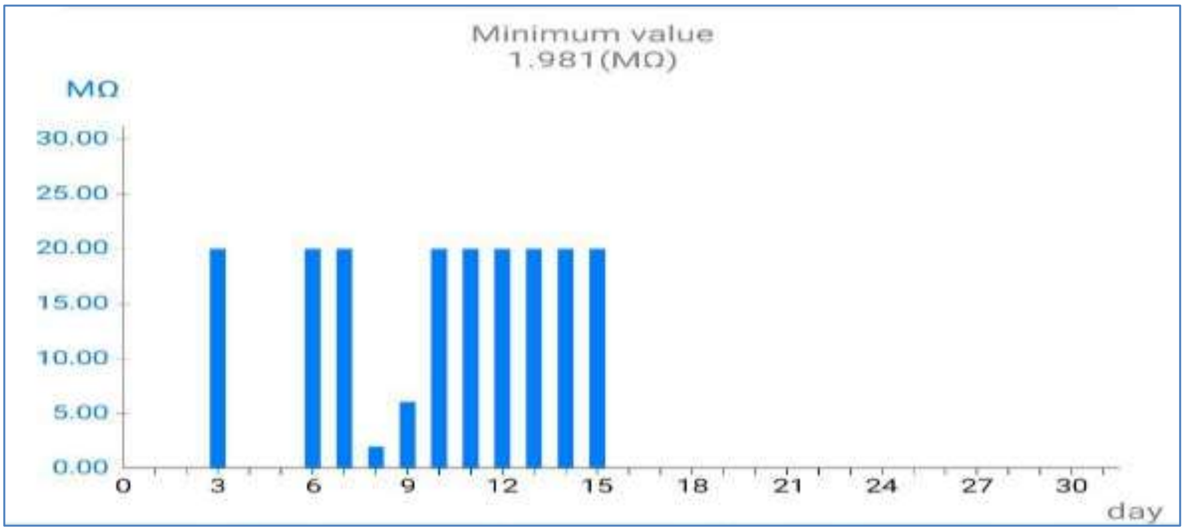

Fig 1. Individual resistances for each section and their total value.

In a photovoltaic system based on photovoltaic solar cells, we can also see the daily impedance values, the impedance values are given for individual circuits for each section. Reactive power control in a photovoltaic system is an important part of voltage level control in a power system.

When designing any power supply system, schedules of daily, weekly, monthly, annual changes in loads planned to be connected to this system are of great importance. In practice, the collection of such information requires a lot of effort and time resources, in this case the designer has to work with calculated values, as a result, the designed power supply system either has excess capacity, or operates in constant voltage mode or with a shortage of energy.

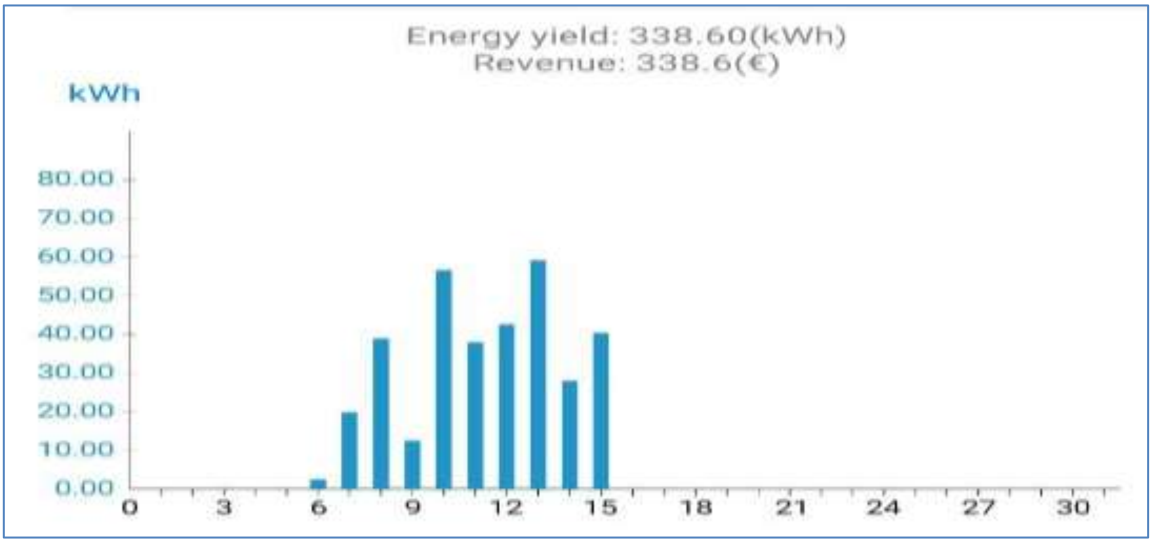

Fig 2. Monthly PV solar cell data (kWh)

This inverter control strategy is capable of not only controlling active power, but also dynamically reconfiguring to change the amount of reactive power injected into the grids.

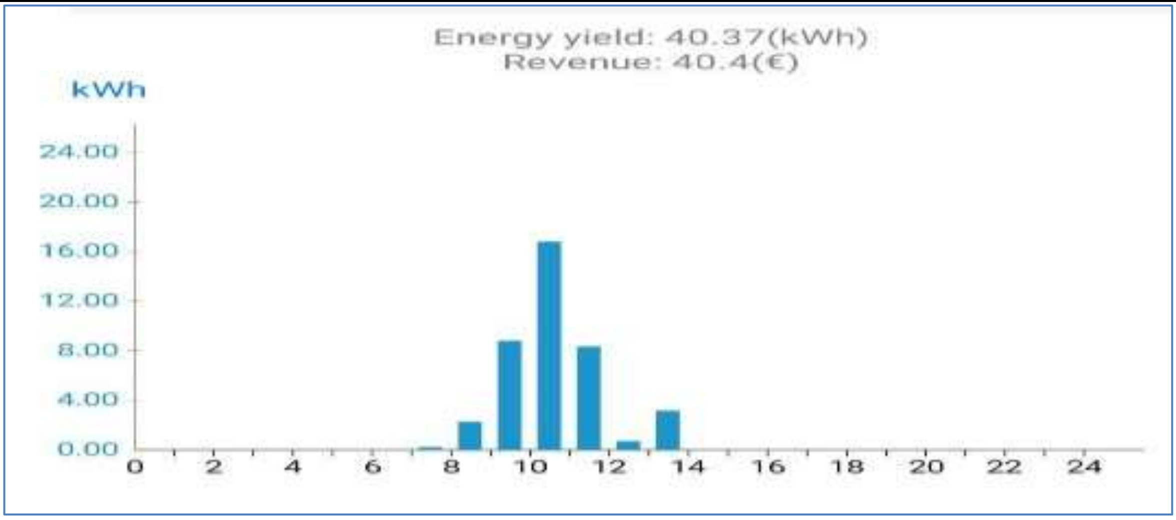

Fig 3. Solar PV Daily Data (kWh)

Schedules of daily, weekly, monthly, annual changes in loads planned to be connected to this system are very important when designing many power supply systems. In this case, the designer has to work with the calculated values, as a result of which the designed power supply system will either have excess capacity, or be in constant voltage mode, or the energy work will be diligent. This system is mainly designed to measure the actual energy consumption of individual loads of photovoltaic plants for a given time at a fixed interval and record it in a special database.

The photovoltaic solar panel generates electricity per hour (8.17) kW per month (245.1) kW per year (2941.2) in real time, and the economic efficiency is 295 sum per kWh of electricity and (72304.5) sum per year (867 654) allows you to save a thousand soums.

In order to analyze and study the efficiency of the reactive power compensation device, the electrical indicators of power and current in the object were taken from the electric meter using a special program with the device turned off and during its operation, and they are as follows:

By developing a software algorithm for remotely estimating the load distribution in a photovoltaic solar plant, we will be able to monitor their load distribution continuously and automatically. Using the information presented in the table above and a special program (SUN 2000), we can see the power and current consumption of daily electricity received by photovoltaic solar panels and a graph of their change. This monitoring process is shown in Figure 4.

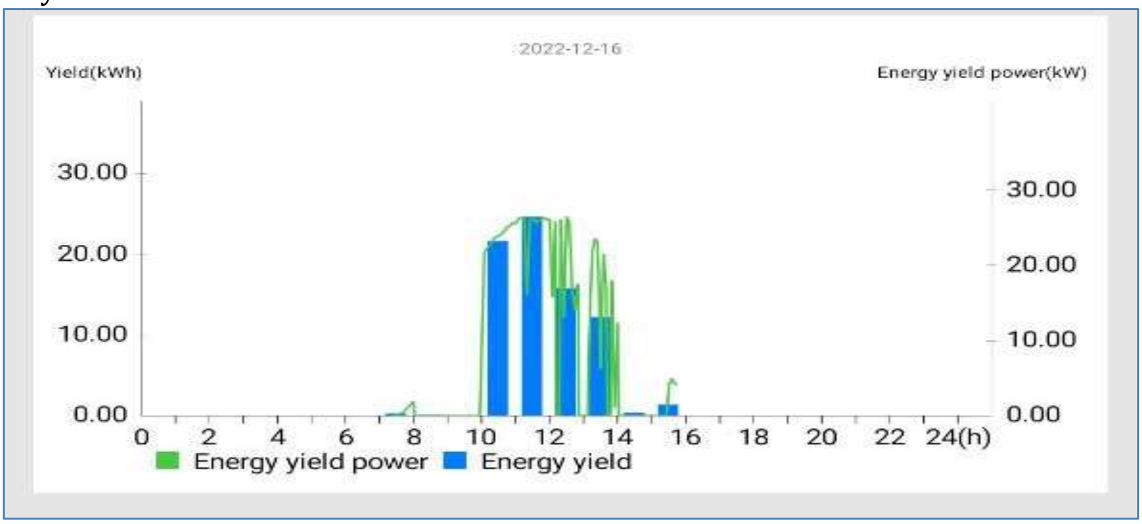

Fig 4. Daily power generation monitoring power output power.

With the above photovoltaic monitoring system, it is possible to make the most of the active power by compensating for the electrical energy obtained with photovoltaic solar panels and the reactive power in its load.

Conclusion

Based on the real-time values determined in the above daily monitoring chart, you can get a lot of electricity from PV solar cells and get daily, weekly, monthly, yearly data through the monitoring system. In this way, it is possible to save overall money on energy consumption and use it in an efficient and sensible, environmentally friendly and safe way. Except for that the ideas and considerations, based on the data presented in the scientific thesis and a number of advantages, we can balance the electric energy balance of the photovoltaic system and keep the load distribution at a constant level and obtain constant information from it. also allows you to stand.

References.

1. R. C. Bansal, "Automatic reactive power control of isolated wind–diesel hybrid power systems," IEEE Trans. Ind. Electron., vol. 53, no. 4, pp.1116–1126, Jun. 2006.
2. Reactive Power Compensation. Kimberly Meyers Santa Clara University. Martin Prado Santa Clara University 6-8-2016.
3. Andey Leon: 'Reactive Power Compensation for Solar Power Plants' , IEEE PES Chicago Chapter , 12th Dec 2018.
4. Jeyraj Selvaraj and Nasrudin A. Rahim, "Multilevel Inverter For Grid-Connected PV System Employing Digital PI Controller", vol.56, no.1, pp.149-158, Jan. 2009.
5. Yusupjon, Mamasadikov, and Alixonov Elmurod Jamoldinovich. "Photoelectric methods for automatic linear density control cotton tapes." International Journal For Innovative Engineering and Management Research 9.12: 2021. 82-87.
6. Reactive Power Compensation. Kimberly Meyers Santa Clara University. Martin Prado Santa Clara University 6-8-2016.
7. А.А.Рахимов, Д.Р.Отамирзаев. "Состояние и перспективы развития солнечной энергетики в узбекистане". Eurasian journal of academic research, 2(5), 2022, 170–173.
8. А.А. Рахимов. Программы распределения нагрузки и дистанционной рассеивание
9. реактивной мощности в фотоэлектрической солнечной станции. Scientific-technical journal FerPI, T. 26. №11, 2022.
10. A.A. Rakhimov."Methods Of Reactive Power Compensation In The Load Of Photoelectric Installations In Central Asia". Eurasian Research, 2022. 50-55.
11. Рахимов А.А., Холматов Э.С., Хамдамов Д.Х. "Способы компенсации реактивной мощности в нагрузке фотоэлектрических установок." Scientific-technical journal FerPI, T. 26. №15, 2022.
12. A.A. Rakhimov. Electrical energy efficiency and reactive power monitoring system based on photoelectric solar batteries. II Международная научная конференция «современные тенденции развития физики полупроводников: достижения, проблемы и перспективы»
13. Ташкент, 2022 г, 27-28 декабрь.
14. I Amiel, Shailendra Rajput, Moshe Averbukh, "Capacitive reactive power compensation to prevent voltage instabilities in distribution lines" Electrical Power and Energy systems 131, 2021.
15. Kodirov A.A. "Reactive power source compensation through automatic control". Scientific-technical journal FerPI, T. 26. №15, 2022.
16. Robertas Damaševičius, Vytautas Štuikys, Jevgenijus Toldinas, "Methods for measurement of energy consumption in mobile devices" Metrol. Meas. Syst., Vol. XX (2013).
17. Tran Cong Binh, Mai Tuan Dat, Ngo Manh Dung, Phan Quang An. "Active and Reactive Power Controller for Single-Phase Grid-Connected Photovoltaic Systems"Electronics Engineering 2009.
18. I Amiel, Shailendra Rajput, Moshe Averbukh, "Capacitive reactive power compensation to prevent voltage instabilities in distribution lines" Electrical Power and Energy systems 131, 2021.