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"STAFF TRAINING IN SOLAR ENERGY: TECHNOLOGIES, METHODS AND INSTRUMENTS"

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DETERMINATION OF VOLTAGE DROP IN A PHOTOVOLTAIC SYSTEM USING ETAP SOFTWARE

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Abstract. This article analyzes the operation of the photovoltaic plant (PVP), installed on the roof of Building 3 of the Namangan city Namangan Engineering Construction Institute, connected to the ongrid system, for the period 2022-2024, as well as the operating modes (voltage drop) using the Electrical Transient Analyzer Program (ETAP) program.

Keywords: PVP, network modes, ETAP, solar photovoltaic station, CO_2

1 Introduction

The rapid development of the world economy is causing an increase in the demand for electricity. The year-to-year increase in electricity consumption assumes the satisfaction of energy demand by installing new capacities. In particular, global electricity consumption in 2010 was 106,389 TWh, which recorded 122,778 TWh in 2022. Based on a prediction given by the International Eneregetics Agency (IEA), electricity consumption is 133,889 TWh as of 2030, and nearly 148,889 TWh in 2050 [1].

This leads to an even greater use of various energy resources in electricity generation-specifically renewable and non-renewable energy reserves. The share of natural fuel energy reserves in electricity production still remains high compared to other energy resources [2].

In 2023, the proportion of coal (35.2%) and gas (22.5%) remains relatively high compared to the remaining energy resources within fuel resources in electricity production worldwide. A further increase in energy demand in turn will further increase the share of the use of these natural reserves. But one of the negative aspects in the use of these natural reserves is the negative impact on the environment, that is, on a global scale, 74% of CO_2 gases are generated from burning natural fuels coal and Natural Gas [3]. In 2022 alone, the volume of CO_2 gases was 36.3 Gt worldwide. In the same year, an increase in the volume of CO_2 gases caused the global temperature to rise by 2 °C. [4].

As a result of various activities, the Sustainable Development Goals (SDG) program has been adopted by the UN in order to reduce the amount of CO2 gases produced by humanity to ecology, as well as the "greenhouse effect", which provides for the introduction of global CO_2 emission restriction policies for the purposes of program 7 (ensuring the use of affordable, reliable, sustainable and modern Based on this concept, UN member states are seeking to increase the share of renewable energy sources (QTEMS) in energy systems. Also, the importance of kata is being paid to the large-scale use of solar and wind energy in order to reduce the negative impact on ecology. In the last decade, many countries around the world have been implementing potential projects aimed at generating electricity using solar energy.

The need for renewable energy sources is increasing day by day, and the demand for energy is increasing as researchers adopt new methodologies. Now it is very well known that renewable energy sources occupy decisive positions in the future energy system. This increasing demand and the future plan for a new energy system prompted scientists and engineers to conduct research on a hybrid energy system. Due to the environmental impact and implementation of energy

conservation policies, measures are being taken to reduce fossil fuel use and reduce greenhouse gas emissions by all countries. In addition, when there are many other natural resources that photovoltaic stations can be used as renewable energy sources, the sources are distributed unevenly on Earth and where they are located in particular. As a result, researchers are considering using and mixing renewable and non-renewable resources to meet the growing energy demand, so the idea of a hybrid energy system has emerged [6].

A hybrid system can have a number of power generation resources, such as wind turbines, solar photovoltaic cell, small hydro system, diesel generator, etc. The hybrid system is able to power a small system, very large areas, including a Long Island network. Recently, the hybrid energy system has become popular in many remote communities in developing countries due to the limitation of remote transmission of electricity. Expansion of transmission and distribution in remote areas is very expensive, as well as transportation of diesel fuel, coal, gas transmission is very expensive, so conventional energy sources cannot provide remote areas with cheap electricity [7]. The production of renewable energy and the use of a distributed energy system offer a solution to this problem, which can reduce the use of fossil fuels, clean production and cheap electricity. However, various renewable sources and diesel systems provide electricity at different prices. By combining all these sources, there is a need for optimization and unit commitment methodology to obtain cheap electricity based on the availability of energy sources [8]. Wind sources and the solar system change in time, so it does not provide for the constant presence of an energy system. As a result of the lack of renewable resources, the hybrid grid sometimes has to rely on fossil sources.

In our country, during January-July of this year, 4 thousand 986 individuals generated electricity from solar panels installed in their apartment and sold 4 million 815 thousand 922 kWh of the increased consumption to the enterprise of regional electricity networks. This volume, which is purchased every kWh of electricity for 1000 sums, amounted to a total of 4 billion 815 million 922 thousand sums, and the corresponding amount was transferred to the bank plastic

cards of the above citizens through the “tax” mobile application of the state tax committee [9].

In July alone, 3,759 households that installed solar panels and sold part of the electricity produced from them to the state were paid 1 billion 399 million 564 thousand sums.

2 Methods

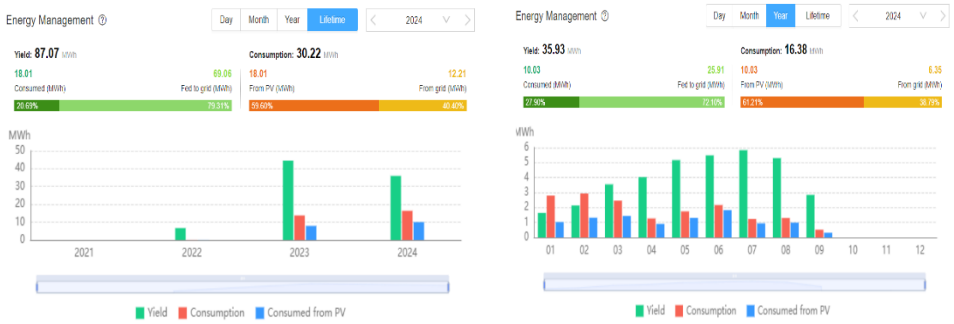
This 30 kW photovoltaic power plant, installed on the roof of Building 3 of the Namangan Institute of Civil Engineering of Namangan region, is installed to provide electricity to building 3 of the Institute. An overview of the installed PVP from above is shown in Figure 1.

Figure 1. Top view of the 30 kW power plant installed in building 3 of the Institute.

Initially, this PVP was installed at the Institute experimentally to ensure its effectiveness, then PVP were additionally installed on the roof of the institute's gyms.

3 Results and Discussion

Based on the figure below, it is possible to evaluate the mode of operation of the PVP in the cross section of years and months. In 2022, the main reason for low electricity production is due to the launch of PVP in the late autumn season. In July of this year, PVP produced nearly 939.64 kWh.



a) b)

Figure 2. The PVP has electricity generation (b) over the period 2022-2024 (a) and the current year months ' cross section.

In figure 3, we can see that the amount of electricity generated by PVP during the day is naturally not the same. Of course, this is influenced by several factors (solar radiation, clouds, wind speed, etc.). That is, the influence of these factors has led to a decrease in daily electricity generation by almost 2 times this year.

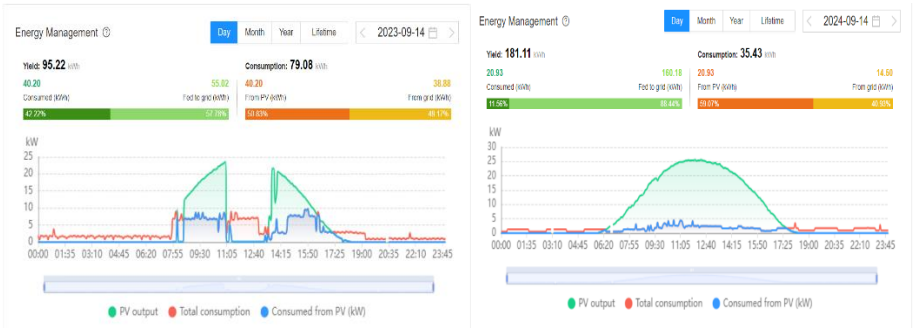


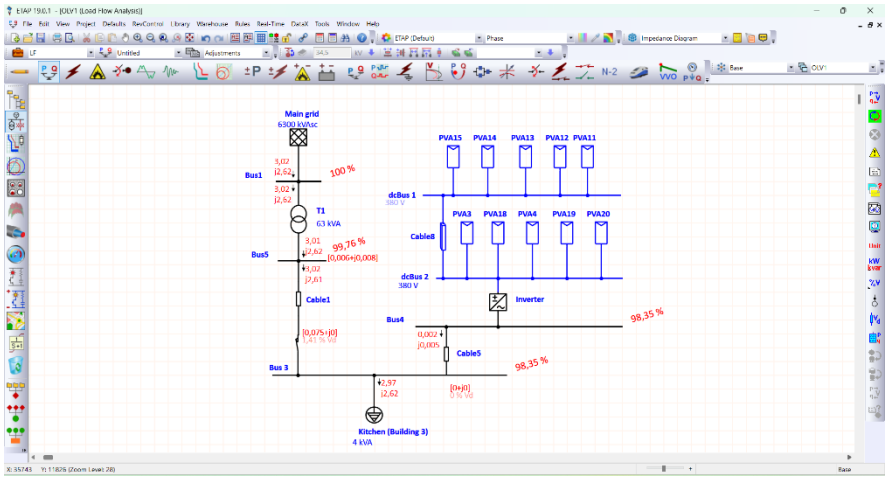
Figure 3. In PVP’s generation of electricity (b) over the 2022-2024 period (a) and the current year months ' cross section.

One proprietary SUN2000-30KTL-M3 inverter is installed at this photovoltaic plant. These integrated software systems have the ability to carry out calculations during design, as well as for the efficient operation of electric power systems and planning modes of the electric network. ETAP is a comprehensive analytical platform for the design, simulation, operation, and automation of generation, distribution, and industrial power systems. ETAP is designed to meet established requirements and is used worldwide as highly efficient software [10].

In figure 4, ETAP, one of the modern simulation applications, was used to analyze the operating modes of an integrated photovoltaic plant, that is, to

determine the voltage drop in the networks, and the voltage drop in the network was analyzed.

ETAP libraries (databases) provide a complete set of verified and validated data based on publications from equipment manufacturers. Thus, you can simply select equipment and use the typical values of a particular piece of equipment for analysis without the need to collect additional data, which makes the entire simulation process more efficient and convenient.



4-расм. PVP model in the ETAP program.

The results obtained revealed that the voltage drop does not meet the specified standard requirements - that is, does not exceed ±10%.

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4 Conclusion

Installed on the roof of building 3 of the Institute, PVP is almost completely covering the electricity consumption in building №3 during the day. Electricity, which has also grown from consumption over the weekend, is being transmitted

to the central power transmission network. The voltage drop in the network was found to be ΔU = -1.65%.

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USE OF INNOVATIVE TECHNOLOGIES IN THE PROCESS OF STUDYING PROBLEMS OF ALTERNATIVE ENERGY SOURCES IN PHYSICS LESSONS

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Abstract. This article provides effective teaching opportunities in higher education for the formation of concepts related to non-conventional energy sources, using methods that facilitate analysis and comparison.

Key words: alternative energy, solar photovoltaics, Venn diagram, concept chart, organizer, education.

Introduction

In the following years, major reforms were implemented in the field of higher education. In particular, it should be noted that new buildings are being built for universities, old ones are being reconstructed, the material and technical base is being formed, modern educational, laboratory and experimental buildings are being provided. With modern equipment and facilities. All of these are considered as necessary conditions for students to acquire knowledge based on the requirements of the time for solid and perfect learning of academic subjects. The gradual implementation of the National Personnel Training Program and the Law "On Education" into the educational process has begun to yield its high results, and these documents are timely, accurate and far-reaching. we are witnessing that it was created in view. From this point of view, formation of knowledge and skills of students based on the latest achievements of science and technology is one of the most important problems of the present era [1, p. 18]. In

Содержание

Секция 1