

# IMPROVING THE EFFICIENCY OF THE POWER SUPPLY SYSTEM OF POLTAVA MINING AND PROCESSING PLANT BY CREATING A SOLAR POWER PLANT ON THE TERRITORY OF THE TAILINGS POND

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**Introduction.** In modern development of electricity in general and in Ukraine as a pan-European electricity network, there are a lot of problems that need to be resolved. Among them is important to use large amounts of renewable energy (Ukrenergo (2021)).

The main purpose of this research is to propose a possible project for the use of renewable energy sources to solve the problem of industrial enterprises due to the lack of electricity for their own needs. The object of our research is the possibility of locating a floating solar power plant in non-standard industrial conditions. The subject of the study is the tailings pond of the Poltava Mining and Processing Combine, located in the town of Goryshny Plavni.

**Presentation of the main research.** Implementation of renewable energy sources in industrial enterprises, including mining and gas-processing plants, has three main barriers (Pouan, 2018):

- high cost of components (e.g., solar panels, inverters, generators for VES, etc.);
- unpreparedness of the general network to connect and receive a significant number of “green” watts of electricity;
- poor manoeuvrability of the power supply network (significant changes in consumption/delivery, depending on the season, the time of the day, and others).

However, an important problem today is that enterprises cannot effectively move to the use of any renewable energy (sun, wind, and biogas) without foreign investment, even including the benefits of the green tariff. The negative side of the green tariff is that the state now

cannot provide it in an appropriate way through a number of economic, administrative and structural crises, once to satisfy the interests and wishes of investors in this area. It is important for foreign investments to find privatization in investing in Ukrainian energy projects. Even the green tariff is more of a negative factor than a positive one, if we consider the problems of its receipt and compliance with the obligations of the state on payments, as well as the low level of payment ability of the population.

However, in spite of these problems, an important argument for the development and implementation of projects on renewable energy sources is the expected indicators of the quality and quantity of additional electric power receipt, as well as their combined positive impact on the decentralization of energy supply sources.

Examining the potential of Ukraine in terms of increasing the use of renewable sources of energy, we can conclude that even taking into consideration today's military conflict there is a great number of territories that are suitable for the construction of CES. For the location of CES industrial purpose often allocated areas that are not suitable for agrarian processing, on which for over 4 years was not carried out farming works, land impregnated with various pollutants, which inhibit its fertility, abandoned areas.

The usual solar power plant, as a rule, is located on the surface of the earth and is mounted on special supports or trackers. An alternative project could be a floating solar power plant, which is a complex of solar panels secured on floating platforms. Such a station can be a drifting platform, or the usual floating mass on pontoons (Goswami, Sadhu, Goswami, Sadhu, 2019).

The main limitations for floating SECs are the state and type of water smoothness. Inland waters with minimal pressure during the year are the best for the construction of floating solar power plants. In our case, the particular advantage of pontoon construction of solar power plants is that they can be used in such areas as: flooded pits, tailings ponds of mining and enrichment facilities, areas that remained after the completion of extractive activities.

As we know, the area of the pits can be up to hundreds of hectares. Thus, their tailing pits can be considered as a nice backdrop for the construction of floating CES. After the end of exploitation the quarries often remain in private ownership, but there are cases when

the quarries are transferred to state control and form protected areas in them. The state ownership is the main problem during the development of the CES project, because it is problematic and expensive to find compromises and get the opportunity to use the land for the capacity of the solar station. Also, a long time abandoned production land often converted to the area of residence or migrations of various species of flora and fauna, which limits the number of possible sites for the construction of CES.

According to the idea of the proposal, the solar power plant is planned to be built in non-standard industrial conditions, which is the area of the Poltava Mining and Processing Plant's tailings pond in the city of Goryshny Plavni.

The Poltava Mining and Processing Combine (Poltava GOK) is part of the "Ferrexpo" group of companies located in Goryshny Plavni, Poltava region. Goryshny Plavni, Poltava region. The company is the largest Ukrainian exporter of iron ore pellets, the main products are delivered to Europe (Poltava GOK, 2021).

The capacity of the tailings ponds of the Poltava GOK is 510 million cubic meters; the dam has the following parameters: maximum height 100 meters, length 4 km (see Figure 1).

**Figure 1**

*General view of the tailings ponds of the Poltava GOK (Poltava GOK, 2021)*



This means that the CES needs to be positioned so that it is within the GZK facility itself and becomes part of its technological process and sanitary area. For this reason, the best option is to locate the floating CES in the Poltava GZK tailings pond and integrate it into a single process line of the facility (see Figure 2).

**Figure 2**

*Schematics of the Tailings Facility for Planning the Cascade of Solar Panels at the Poltava GOK*

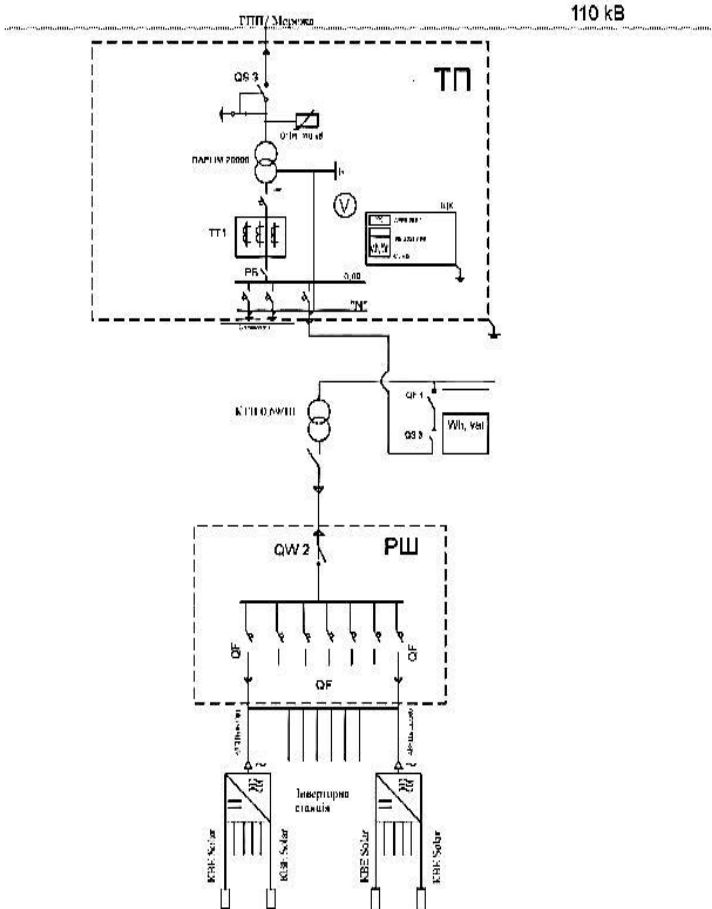


In our view, for this enterprise the project does not have an adequate alternative location. The total area for the construction of SES will be 2,938 square kilometers. As a result of the calculations the electrical scheme of the plant was determined (see Figure 3) and the equipment was selected. The payback period of the project is expected to be 3.5 years.

Thus, the importance and actuality of the project consists in using non-specified industrial areas of Ukraine as a potential for renewable energy, first of all, solar energy, reducing the construction of new solar power plants in non-standard conditions, particularly, floating CES.

**Figure 3**

*Scheme of the hybrid connection to the main step-down substation in mountain concentrating combine*



Also, the analysis showed the following: local territories, which are limited by certain geographical, physical and industrial objects, are promising for the creation of effective autonomous systems of energy supply with the use of electric photomodules,

which produce electricity from the solar shining. In the future, these projects will not only increase the production of electricity, but also improve its quality through the introduction of ecologically safe technologies, to influence the effect of decentralization in the energy sector.

**Conclusions.** Therefore, the use of floating CES at industrial facilities is useful for increasing the share of energy generation from renewable sources, both local and global positive impact on the environmental and social situation in the region and the country as a whole. In our situation, the proposal to use floating CES at industrial facilities allows to solve the problem of entering into the exploitation of large capacities with already installed capacities at large mining and gas extraction complexes. However, the project causes certain conditions, including the requirement to modernize the existing equipment and technological processes.

In summary, we consider that the use of similar projects, of course, leads to improvement of the system of energy supply, at least locally; also we can assume a positive impact of the "green" source of energy for "greening" of the poor sectors of industry, which are mining activities.

### References

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