

USE OF QUARRIES FOR THE PLACEMENT OF SOLAR POWER PLANTS IN URBAN ENVIRONMENTS

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Lecture of the department of "Architecture"

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Annotation: *This article examines the potential of using abandoned quarries for the placement of solar power plants in urban and suburban environments. The study highlights the relevance of integrating renewable energy solutions with the reuse of disturbed lands formed as a result of mining activities. Special attention is given to the characteristics of quarries that make them suitable for solar energy development, including large unused areas, favorable topography, and proximity to existing infrastructure. The paper analyzes different types of solar power installations applicable to quarries, such as ground-mounted, terraced, and floating systems. Environmental benefits are discussed, including reduced land degradation, lower dust emissions, decreased water evaporation, and mitigation of greenhouse gas emissions. In addition, the economic advantages of utilizing quarries are considered, such as reduced land costs and lower infrastructure investments.*

Potential risks and limitations are also identified, including geological instability, accessibility issues, and environmental constraints. The study further explores the prospects for implementing such projects in Uzbekistan, given its high solar energy potential and availability of quarry sites.

The results demonstrate that the transformation of quarries into solar power generation sites is a sustainable and efficient solution that contributes to environmental protection, energy security, and rational land use.

Аннотация: *В данной статье рассматривается потенциал использования заброшенных карьеров для размещения солнечных электростанций в городской и пригородной среде. Обоснована актуальность интеграции возобновляемых источников энергии с повторным использованием нарушенных земель, образованных в результате горнодобывающей деятельности. Особое внимание уделяется характеристикам карьеров, которые делают их пригодными для развития солнечной энергетики, включая наличие больших неиспользуемых территорий, благоприятный рельеф и близость к существующей инфраструктуре. В работе анализируются различные типы солнечных электростанций, применяемых в карьерах, такие как наземные, террасные и плавучие установки. Рассматриваются экологические преимущества, включая снижение деградации земель, уменьшение пылеобразования, сокращение испарения*

воды и снижение выбросов парниковых газов. Также оцениваются экономические преимущества использования карьеров, в том числе снижение стоимости земли и уменьшение затрат на инфраструктуру.

Определены возможные риски и ограничения, включая геологическую нестабильность, проблемы доступности и экологические ограничения. Кроме того, рассматриваются перспективы реализации подобных проектов в условиях Узбекистана с учётом высокого потенциала солнечной энергии и наличия карьерных территорий.

Результаты исследования показывают, что преобразование карьеров в площадки для генерации солнечной энергии является устойчивым и эффективным решением, способствующим охране окружающей среды, энергетической безопасности и рациональному использованию земельных ресурсов.

Characteristics of Quarries as Sites for Solar Power Plants

Quarries possess several features that make them attractive for the installation of solar energy facilities. First, they offer large areas of unused land that are generally unsuitable for agriculture or residential development, reducing competition for land use. In addition, quarries are often located near urban or industrial areas, which facilitates connection to existing energy infrastructure. This is an important factor, as long-distance energy transmission is associated with additional costs and losses. The topography of quarries is also significant. The presence of slopes and terraces allows solar panels to be installed at optimal angles without extensive ground modification. In some cases, this can even enhance the efficiency of solar installations. Furthermore, the use of quarries does not require the allocation of new land resources, which aligns with the principles of sustainable development and rational land use.

Types of Solar Power Plants Used in Quarries

Depending on the condition and characteristics of a quarry, different types of solar power plants can be implemented.

The most common option is ground-mounted solar power plants installed at the bottom of the quarry. These systems typically consist of fixed or tracking solar panels.

In quarries with complex terrain, terraced solar installations can be developed, where panels are placed along slopes. This approach allows for more efficient land use and improved solar exposure. Floating solar power plants installed on water surfaces in flooded quarries represent a particularly innovative solution. Such systems offer advantages such as reduced water evaporation and increased panel efficiency due to the cooling effect of water. The selection of a specific type of installation depends on geological, hydrological, and climatic conditions.

Environmental Benefits

The use of quarries for solar power plants provides significant environmental benefits. First, it reduces pressure on natural landscapes, as no additional land development is required.

The installation of solar panels can also help reduce dust generation, particularly in arid regions. By partially covering the quarry surface, panels contribute to soil stabilization and reduce wind erosion. In flooded quarries, floating solar systems can decrease water evaporation, which is especially important in regions with limited water resources. Additionally, the generation of clean energy leads to a reduction in greenhouse gas emissions. Thus, quarries can be transformed from environmentally problematic areas into components of sustainable infrastructure.

Economic Efficiency

The economic attractiveness of using quarries is determined by several factors. Firstly, the cost of such land is typically lower compared to land suitable for construction. Secondly, site preparation costs are relatively minimal.

Another advantage is the possibility of utilizing existing infrastructure, including roads and power lines, which reduces capital investment and shortens project implementation time.

In the long term, solar power plants provide a stable source of energy with low operational costs, making such projects economically viable and attractive for investors.



[photo-1]



[photo-2]

Risks and Limitations

Despite the numerous advantages, the use of quarries for solar power plants involves certain risks. One of the main concerns is geological instability, which may lead to landslides and damage to equipment.

There may also be challenges related to site accessibility and the need for infrastructure upgrades. In flooded quarries, additional assessment of water quality and its impact on equipment is required.

Climatic conditions, including solar radiation levels and seasonal variations, must also be taken into account.

Addressing these challenges requires a comprehensive approach involving engineering, environmental, and economic assessments.

Prospects for Implementation in Uzbekistan

Uzbekistan has significant potential for the development of solar energy due to its high level of solar irradiance. The country also has numerous quarries formed during the extraction of construction materials, which can be repurposed for solar power generation.

Particularly promising is the use of flooded quarries for floating solar installations, which can simultaneously address energy production and efficient water resource management.

The development of this approach could become an important step toward establishing a sustainable national energy system.



[photo-3]



[photo-4]

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