

SAFETY MEASURES DURING THE INSTALLATION, MAINTENANCE AND OPERATION OF SOLAR PANELS

*Mitiuk L. O., Ph.D., Ass. Prof. (Dep. LPICS of Igor Sikorsky Kyiv Polytechnic Institute);
Burlaka D. V., stud. (gr. ED-11, Faculty of Electrical Power Engineering and Automatics of Igor
Sikorsky Kyiv Polytechnic Institute)*

Abstract. Issues of emergency situations during installation, maintenance and operation of systems of renewable energy sources (solar panels) are considered. Proposed measures to eliminate violations and prevent emergency situations.

Keywords: solar panels, solar radiation, danger, risks, alternative energy sources, ultraviolet radiation.

Анотація. Розглянуті питання надзвичайних ситуацій під час монтажу, обслуговування та експлуатації систем відновлюваних джерел енергії (сонячні панелі). Запропоновані заходи для ліквідації порушень та унеможливлення надзвичайних ситуацій.

Ключові слова: сонячні панелі, сонячне випромінювання, небезпека, ризики, альтернативні джерела енергії, ультрафіолетове випромінювання.

Introduction. Solar energy is one of the most promising areas of development in modern energy and alternative energy sources. Its importance today is due to many factors related to both ecology and economics. The use of solar collectors for hot water supply, heating, and solar panels to provide buildings with their own electricity has become a common phenomenon in both Europe and Ukraine.

The installation and operation of solar panels (photovoltaic modules) require certain safety measures for workers, as working with them can be quite complex and hazardous. This is because the installation of solar panels involves direct work with electrical equipment. Carelessness can lead to fatal consequences for the worker. Additionally, the installation of solar panels takes place on the roof of a building, which means working at height and poses a certain risk of injury to the entire crew of workers.

The main safety hazards when working with solar panels include:

- physical;
- mechanical;
- emergency situations.

Analysis of the state of the issue. There are various reasons for the occurrence of these safety hazards and risks. One of the main risks is associated with electrical current. Solar panels generate direct current (DC), which can be hazardous to people, especially during installation, maintenance, or repair. Electrical shocks, short circuits, and even fires can occur as a result of improper handling of electrical components. The impact of ultraviolet radiation must also be taken into account, as solar panels are exposed to constant direct sunlight. This factor can affect the skin and eyes of workers when working with panels. Additionally, as mentioned earlier, the installation of solar panels usually takes place on the roof of a building to allow direct sunlight to reach the

photovoltaic modules, which means that all workers are working at height and in a high-risk zone.

The purpose of the work. Develop a comprehensive set of safety measures for workers during the maintenance and operation of solar panels.

Methods, materials and research results. Before installing a solar panel system, specialists should visit the site and assess it. This step is necessary to determine the best location for installing solar panels and other related systems (inverter, battery, mounts, etc.), as well as to identify potential hazards at the site. A solar energy installer who spends time assessing the safety of the site is prepared for any surprises. A detailed workplace plan helps address issues before they arise.

Since the most common location for installing solar panels is the roof, the installation of ladders and their safety is a mandatory requirement. The installer must choose the best models for workers to use. The main safety rules in this regard are as follows:

- Adequate length: Ladders should extend at least 90 cm beyond the step on which the worker is standing. This requirement applies to step, straight, or extension ladders. The installer should determine this during the site assessment visit.
- Choice of location: Placing ladders on wet or unstable ground is prohibited.
- Selection of appropriate materials: When working on energy facilities or near power lines, it is best to use ladders made from non-conductive materials.

In addition to ladder safety measures, the lifting of panels to heights must also be considered, as they can be somewhat heavy to lift. Therefore, the loading and installation of panels on a construction site can result in a variety of injuries, including sprains, strains and even fractures. Furthermore, it's important to consider that panels can heat up when exposed to sunlight, and touching them can cause burns to workers. To avoid these hazards, it is necessary to:

- perform any operations with panels with at least two people to avoid any injuries or damage;
- avoid using ladders to lift panels (alternatively, use a crane, lift, or winch system);
- wrap solar panels with opaque paper to reduce heat accumulation on the surface;
- use certain technical protective equipment such as safety helmets, gloves, and special footwear.

When it comes to workers working on a roof, their safety must be ensured during the installation of panels at height. Work at height can be extremely dangerous due to limited space during the installation of solar panels.

Therefore, to avoid accidents, it is essential to study the workplace during the initial stages of the site assessment. In addition, any obstacles must be removed from the roof, and any existing holes in the work area must be filled. When working at height above one and a half meters, guardrails should be installed around the edges.

Employees should use safety harnesses and stretch protective nets around the perimeter of the work area.



Fig. 1. The installation of solar panels (worker uses a safety harness for secure work at height)

Solar electric systems come with various components. When these components are energized, the generation of solar energy can lead to electrical shock, burns, and other injuries to the worker. Therefore, as a precaution, workers should use certain opaque materials to cover the panels after unpacking them. Any work on live electrical equipment is prohibited. Additionally, all workers must be equipped with appropriate personal protective equipment (PPE) for electrical safety.

Although fires caused by photovoltaic panels are still rare, the consequences of such an event can be extremely devastating. As mentioned earlier, the installer prepares for any surprises, and fire is one of them. First and foremost, the risk of overheating must be minimized. Overheating of solar panels may be related to a network failure, poor wiring, or incorrect installation procedures. Careful monitoring and regular maintenance, including meticulous tracking of panel and system component temperatures, are essential to detect hazards early and prevent fires in the first place.

An important aspect of maintenance is ensuring the proper functioning of solar water heating systems, which help regulate panel temperature and prevent overheating. Including solar water heating systems in the maintenance plan can significantly reduce the risk of fire. Dangerous situations can be avoided throughout the operational lifespan of the solar system.

Conclusion. All risks and dangers to human life and workers that may occur during the installation and operation of solar panel systems have been analysed. This includes eliminating the risks of electric shock, burns from solar ultraviolet radiation, injuries from transporting and handling electrical equipment, ensuring safety when working at height, and protecting electrical equipment from overheating and fire.

References

1. Safety measures working with solar panels and batteries. [Electronic resource]. Access mode: URL: <https://vinur.com.ua/ua/aboutus/usefull-info/articles/zahody-bezpeky-pid-chas-roboty-iz-sonyachnymy-panelyamy-ta-batareyamy>
2. Understanding solar panel safety: Risks and Precautions. [Electronic resource]. Access mode: URL: <https://www.beny.com/solar-panel-safety-risks-and-precautions/>
3. Law of Ukraine “On Alternative Energy Sources”. [Electronic resource]. Access mode: URL: <https://zakon.rada.gov.ua/laws/show/555-15>