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Glare Factor: Solar Installations And Airports


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The FAA is looking into how PV arrays affect pilots and air traffic control operations.

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The success of the solar industry as a whole has obscured a small but impressive and growing business in solar photovoltaic projects at airports. The partnership between airports and solar is a logical one, given the open landscape, availability of buildings and land to site projects, and proximity to large electricity loads that airports provide. Airport managers have also recognized the business advantages of solar power as an alternative revenue source and in providing long-term cost savings. In addition, public policy benefits to municipal, county and state government agencies that manage airports and have set greenhouse gas reduction goals offer a real and purposeful basis for these projects.

But airports, as entry points for world air travel, present very unique challenges to solar developers. The Federal Aviation Administration (FAA) must ensure safe and efficient air travel. Safety is paramount, and some aviation interests have questioned whether solar projects are in direct conflict with the FAA's primary purpose. Recent observations of glare from solar projects have ushered in an increased level of scrutiny from the air traffic safety division of the FAA, which has been typically less receptive to solar.

The central question for the FAA when ruling on a proposed solar project is: Will it pose a glare impact?

Over the past few months, the FAA, with support from the U.S. Department of Energy (DOE), has developed a protocol to analyze the potential impacts of glare. This article reviews the FAA's regulatory authority over solar projects and existing the requirements for conducting glare modeling and presents an example demonstrating how projects are being approved.

Regulatory authority

Solar developers working at or near an airport might wonder whether they need FAA approval at all. The answer is not always clear.

When a project is proposed on airport property, the FAA has broad authority. The airport, as recipient of FAA funds for infrastructure improvements, is responsible for presenting information so that the FAA can assess a project's compliance with airspace protection laws (referred to as Part 77) and environmental laws (e.g., National Environmental Policy Act).

If a private developer seeks a long-term lease of airport land, additional requirements will apply, including assessing the project's compatibility with the airport master plan and documenting that lease payments meet the FAA's fair market value test.

The FAA's airspace review has traditionally focused on whether or not the project presents a physical obstruction of airspace, which has been a permitting challenge for the wind power industry, but not for solar. Instead, large ground-mounted solar projects have largely been subject to broader environmental regulations under NEPA, including impacts on wildlife habitat and archaeological resources. Potential non-physical impacts from solar projects - such as glare and radar interference - were examined during the earliest airport solar projects in 2007 and 2008, and questions were summarily answered, given a lack of empirical evidence.

The FAA's regulatory authority over projects located outside airport property is not as clear. Structures rising 200 feet or more above ground, such as wind turbines and some solar power towers, penetrate the nation's airspace layer and automatically trigger FAA review.

Concerns about glare are specific to on-airport activities, but "how close is too close" has not been defined. Because answering this question will be case-specific, a developer should contact the airport as a part of its stakeholder outreach program. If the airport expresses concern about aviation impacts that cannot be readily answered through the general stakeholder coordination process, then the developer may consider consulting with the local FAA office.

Really a problem?

With good reason, people have asked if glare from solar panels is a real problem. To maximize electricity generation, solar PV modules are designed to absorb light, and reflections are contrary to its central purpose. The industry has focused a significant amount of effort on increasing solar technology efficiency, which has included minimizing the amount of light that is not absorbed by the modules.

However, panel glass remains relatively smooth and homogenous and, as such, is physically capable of producing a concentrated reflection, just as a calm lake can on a wind-free day.

Moreover, the percentage of reflection off of a solar panel significantly increases as the sun moves away from perpendicular to the panel. It is at glancing angles, when the sun is low on the horizon (toward sunrise and sunset), that glare is most problematic because the solar panel is absorbing much less of the incoming light, and sensitive receptors (e.g., control towers, arriving aircraft) are located close to the ground, where they can directly view the glare.

In February, the FAA made available a beta version of the Solar Glare Hazard Analysis Tool (SGHAT), developed by the DOE's Sandia National Laboratories, for assessing potential glare impacts from individual projects.

SGHAT determines when and where solar glare can occur throughout the year from a PV array as viewed from specified observation points. The tool employs an interactive map for specifying solar project sites and observer locations. Latitude, longitude and elevation are automatically recorded through the map interface, providing necessary information for sun position and vector calculations. The user enters in the project-specific decision parameters, such as height of the panels above ground, orientation and tilt angle.

If glare is found, the tool calculates the retinal irradiance and subtended angle (size/distance) of the glare source to predict potential ocular hazards, ranging from a temporary after-image to retinal burn. It produces a color-coded display of the potential for the glare to result in an ocular impact.

Upon completion of the initial results, the model can also be used as a planning tool to alter the project's design characteristics (including footprint, orientation and tilt angle) and evaluate the potential reflections produced and the opportunities to minimize or eliminate the effects of glare on sensitive receptors.

Guidelines

The FAA has established informal guidelines for how SGHAT should be used so that the agency can determine how glare affects controllers who are working in air traffic control towers (ATCTs) and pilots who are arriving at the airport on final approach.

Once the area of the solar project is located and its design characteristics recorded, information on each of the glare-sensitive receptors must be input. The ATCT is identified on the same map as the solar project as an observation point, and the height on the tower is inserted. At remote airports that do not have a tower, this observation point can be skipped, and an analysis of impacts on the ATCT is not necessary.

The SGHAT analysis for aircrafts arriving on final approach is a bit more complicated. The FAA is interested in the potential effects of glare on pilots from two miles away from the runway to touchdown. Because SGHAT only analyzes specific points and not lines, observation points along the final approach path must be selected. Aircrafts on arrival fly along a three-degree glide slope. Current FAA guidance indicates that points should be established at quarter-mile increments out to two miles, resulting in eight observation points for each runway end. The observation points are located based on distance from touchdown and height above ground when traveling on the glide slope.

The FAA has established performance standards to guide its determination of the significance of a glare hazard. For the ATCT, the project must produce no potential for an ocular hazard or glare. For aircrafts on final approach, the project must produce a low potential for a temporary after-image (i.e., brief loss of vision when exposed to glare), although exceptions may be made based on the location of the glare source relative to the pilot's straight-on view to the runway.

Any project not meeting these standards will be objected to by the FAA and will receive a "determination of presumed hazard."

Case in point

One of the first solar projects to be approved using SGHAT was a 1 MW solar facility at the corporate offices of Bidart, an agricultural company, in Shafter, Calif. The corporate facilities are located on private land directly across the road from Shafter-Minter Field, a relatively small general aviation facility.

Due to the close proximity of the solar project to the airfield, which is also in the flight path of arriving aircrafts, the applicant prepared a reflectivity analysis of the potential impacts of glare on aircrafts on final approach to the airfield. The analysis showed that while there is a potential for an after-image, that effect occurs when aircrafts are perpendicular to the glare source and would be a brief occurrence in the pilots' peripheral view. The FAA issued a "determination of no hazard to air navigation" for the project in March.

With over 30 solar projects operating at airports in 15 different states, the success of the airport-solar partnerships has been well established. Evolving FAA requirements over the past year have introduced uncertainty to the approval process, which has caused project proponents to question if the FAA would stop approving projects altogether due to its concern about the potential impacts of glare.

Projects have continued to be approved, and the recent introduction of the SGHAT model as an FAA-recommended method for assessing glare impacts has provided the solar industry with specific direction on how the issue must be assessed. With clear guidance for glare modeling in place, it should be smooth flying for future airport solar projects.

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