PHOTOVOLTAIC SOLAR FARM

VEGETATION MANAGEMENT BEST PRACTICES

Climate change has created an unprecedented challenge for the photovoltaic solar industry regarding the management of vegetation at solar farm sites. Longer rainy seasons and hotter dry seasons have created the need to re-evaluate existing vegetation management programs, and adaptability has become critical to preventing wildfires that could cause significant property damage and business interruption losses. In this material, we will cover some generic best practices. Appropriate steps to manage vegetation will vary depending on location and particular conditions of each solar farm.

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THE CHALLENGES OF VEGETATION MANAGEMENT

- As of 2018, it has been reported that 64.2 GW of solar was installed in the United States, with an additional 15% of capacity installed each year. This represents hundreds of millions of panels covering 3.2M acres over 5,000 square miles—four times the size of Rhode Island.
- With solar farms now located in most states, the challenge of managing vegetation and ground cover is one that requires a flexible approach, with continual review and modifications that address changes in weather and conditions.
- The COVID-19 pandemic might have impeded the ability to perform routine landscaping maintenance duties at certain sites. This has heightened the need for contingency plans that address unforeseen events.
- Historical schedules can be used as a starting point to create a Vegetation Management Plan, but the plan needs to be revisited and modified on a regular basis to address changing site conditions. These changes can include revising maintenance schedules and/or bringing in extra resources to prevent dangerous overgrowth during dry periods.
- Some counties and states have developed guidelines for vegetation management for solar farms in their jurisdiction.
- Services that are performed by company employees or contractors need to be backed-up by additional resources in the event that changes occur to the manpower or equipment availability and need.
- Ultimately, the responsibility for vegetation management lies with the local site manager, who must understand the risks and take necessary actions to maintain the site at a safe and low exposure level.

SOLAR FARM SITE CONDITIONS

LOW VEGETATION

Some solar farm sites, by design, local climate, or native vegetation cover, require little vegetation management. A site that has been designed for bare earth, or where local soil and weather do not support plant growth, simply needs to be monitored to ensure that conditions do not change dramatically.

Sporadic plant growth can be addressed by pre-emergent or herbicide, which may negate the need for mowing.

Areas of more substantial growth need to be monitored, so, they do not spread and increase the need for additional maintenance activities.

GROUND COVER

The vast majority of solar farms have ground cover vegetation that needs to be actively managed.

- **OVERGROWTH:** **Grass that has been permitted to grow during the wet season and becomes dry and a greater risk for wildfires.**
- **UNDER PANEL GROWTH:** **Grass that has been cut between strings, but the underside of the panels remain exposed. The vegetation under the panel is of greater concern than vegetation between the strings, but both must be adequately maintained.**

CONSISTENT RAINFALL

In areas of consistent rainfall and moderate temperatures, such as the southeastern United States, the steady growth of grass requires a year-round approach. While abundant green grass presents a much lower risk to catch and propagate wildfires, poor management with an unexpected dry period could present a high-risk situation.

VEGETATION MANAGEMENT PLAN COMPONENTS

One of the most important aspects of a vegetation management plan is that it has the complete support of upper management and is considered as important as all other maintenance and inspection efforts. The potential for a wildfire to cause multiple millions of dollars of property and business interruption loss can far exceed the loss of a single inverter outage from a failed board.

The asset management group involving the operations and maintenance departments need to meet regularly to review every site and the adequacy of the program as it pertains to each site.

EMERGENCY SERVICES & PRE-EMERGENCY PLANNING

Pre-emergency planning is critical to prevent a small event from becoming a disaster. As sites have been trending larger, often spanning many roads and with fencing that limits access **points, there should not be a delay in contacting first responders once an event is in motion.**

As sites are built, the operations team must meet with the local fire departments and provide maps with access points clearly marked. While the smoke may be seen from miles away, navigating to the right location could waste valuable time and allow the fire to spread to more areas.

All persons working at the site should carry at least one means of contacting the local first responders at all times so that they do not need to go to the O&M Building. Anyone on site should also be able to identify exactly where they are at all times.

MANPOWER & EQUIPMENT

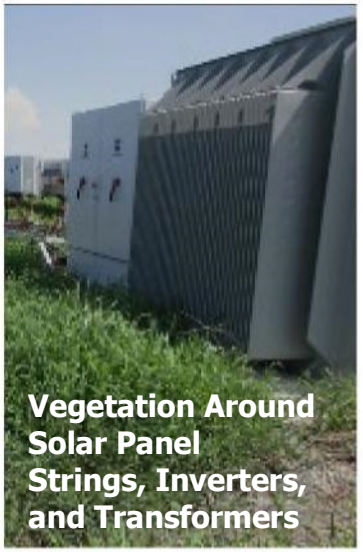
As a solar farm operator adds more solar farms to their portfolio, the landscaping department resources need to stay ahead of the additional demands on their ability to adequately maintain the solar farms.

Contract services in the surrounding area that can assist with landscaping should be investigated and formalized if the need arises to activate those services.

SITE VEGETATION & FIRE PREVENTION BEST PRACTICES

The commitment of management to adhere to these guidelines must be demonstrated by the recording of the inspections of the vegetation management program. A work order system that contains photos of the solar farm is considered the most transparent method to record results. Inspections should be conducted on a quarterly basis at minimum and made available upon request.

Sites that have demonstrated a very low vegetation wildfire risk (gravel, sand, etc.), can typically be documented annually to show that conditions have not changed.



EQUIPMENT & EMPLOYEES

- Employees should be trained in the proper use of handheld fire extinguishers as part of their annual employee training. The training should consist of actual fire extinguisher discharge to put out a small fire in a controlled environment and under the supervision of adequately trained instructors. Video training is not acceptable.
- Smoking by employees should never be permitted while performing landscaping duties.
- Refueling of gasoline-fueled equipment should always be done in a safe location with no combustibles (grass) in the area in the event of a spill or contact with hot parts of the equipment. A fire extinguisher should always be present during refueling activities.
- Equipment needs to be adequately maintained and cleaned during operation by removing cuttings away from hot parts such as mufflers, belts and pulleys to avoid friction and fires.
- At sites where the risk of wildfire is higher due to high grass and dry conditions, a 30-minute period should be observed after the mowing has ceased for the day to observe the site for any issues before the team leaves the site.
- Fire extinguishers should be carried on all powered wheeled equipment.
- Conduct annual inspections of surrounding land to make sure the vegetation is maintained.
- Combustible and flammable waste should not be allowed to accumulate in any work area.
- Scrap and combustible materials generated as part of O&M must be removed from work areas as soon as they are generated.
- Rags, fabric and timber contaminated with any hydrocarbon product will be contained in a closed metal container and removed daily from the workplace to a safe disposal area.
- During periods of elevated fire danger, efforts should be made to limit activities with inherent fire risks, including hot work (grinding, cutting, welding).
- Smoking should only be allowed in paved areas or areas cleared of all vegetation. Smoking will be strictly prohibited in specific areas, including wild-land areas, inside all buildings, and within 30 feet of any combustible material storage area. These areas should all be clearly identified.
- Open fires should be prohibited on site.
- Driving off-road should only be allowed when absolutely necessary to complete a required task. For example, repairing array fencing, managing vegetation, or other outside tasks.
- A water system for water supply and safety should be maintained on site.

BOUNDARIES & FIRE BREAKS

- Fire breaks, the best method of preventing the spread of fire between areas, generally consist of an area of non-combustibles such as a road or bare ground space between the blocks and site fence. These passive protections can isolate the fire and minimize damage.

- The fire break should be wide enough to interrupt the continuity of combustible material that would allow a fire to spread. If the break is a roadway, between blocks or as site configurations allow, use the following widths:

    - Noncombustible width of at least 30 feet (9 meters).

    - Adjacent woodlands (exterior exposure): Noncombustible width of at least 50 feet (15 meters).

VEGETATION IN AND AROUND THE SOLAR PANEL STRINGS, INVERTERS AND TRANSFORMERS

- Bushes and larger plants should *never* be allowed to grow under solar panels.

- Vegetation will be maintained less than 12 inches (240 mm) high below fixed tilt and tracker system panels, between strings, around inverter/ transformers, and 30 feet from strings. In cases where the lower edge of fixed tilt panel or the tracker maximum angle is closer than 15 inches to the ground, the grass should be cut as low as possible (for normal climate conditions). *Dry grass conditions must be closely monitored.*

- In cases where the panels are fixed tilt and the clearance is less than 12 inches, the grass should be kept as low as possible.

O&M BUILDINGS AND STORAGE AREAS

- All buildings on site should be of non-combustible construction. Vegetation around buildings and structures should be kept mowed to a height of 3 inches or less and extend 35 feet from the building. Dirt and gravel are also acceptable ground cover.

- Storage should never be allowed next to buildings.

- Storage areas and Conex Trailers should be treated as buildings and kept in dirt/gravel areas or areas with grass under 3 inches to prevent the needless loss of the contents.

TRANSMISSION AND DISTRIBUTION LINES AND POLES

- All collection or transmission poles should be made of non-combustible material.

- If wooden poles are used anywhere on the site, grass needs to be cut to the standard of the rest of the solar farm.

- Consideration should be given to coating wood poles with an outdoor-rated 30 min fireproof coating to protect the wood poles up to a height of 6 feet.

- Alternatively, the bottom of the poles can be wrapped in a thermal blanket to protect them from fire.

CONTRACT SERVICES

- Obtain contingency contracts with local vendors to supplement management efforts on an as-needed basis, reducing the time from inspection to landscaping

- Ensure that all contract service companies follow all owner rules relating to equipment and employees.

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