HAILSTORM EFFECTS ON SOLAR STRUCTURES

5/12/2024

INTRODUCTION

Many renewable energy installations were built across the state of Texas which has championed clean energy projects in recent years while benefiting the most from federal tax credits and incentives under the Inflation Reduction Act.

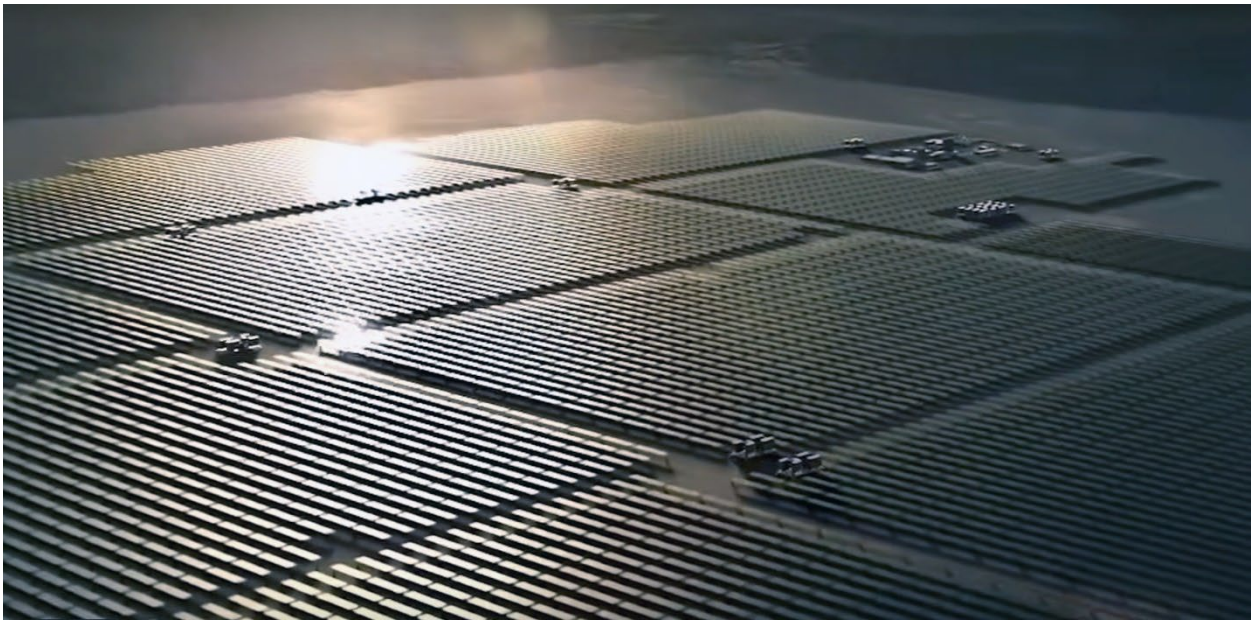

Figure 1. Photovoltaic flat panels power plant.

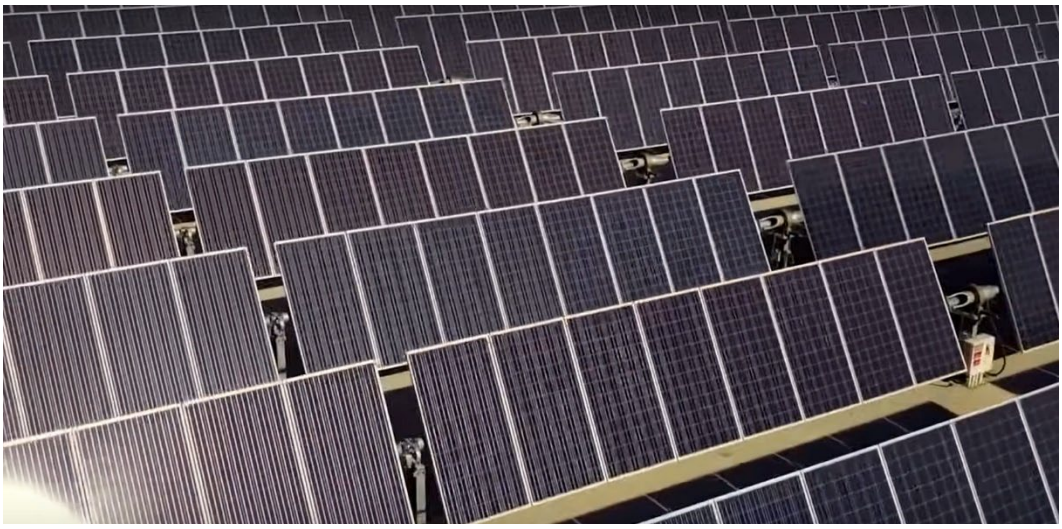

Figure 2. flat solar panels in photovoltaic solar plant.

Photovoltaic panels on a solar farm southwest of Houston, Texas, were damaged by a powerful hailstorm on March 15, 2014. Rows of cracked photovoltaic cells at the Fighting Jays Solar Farm near Needville in Fort Bend County. Baseball-sized hail stones were observed falling in the area overnight, as per the Houston Chronicle.

The solar project, which began producing power for Texas's energy grid in 2022, generates 350 MWs of electric power across 3,300 acres of land and is powering 62,000 homes.

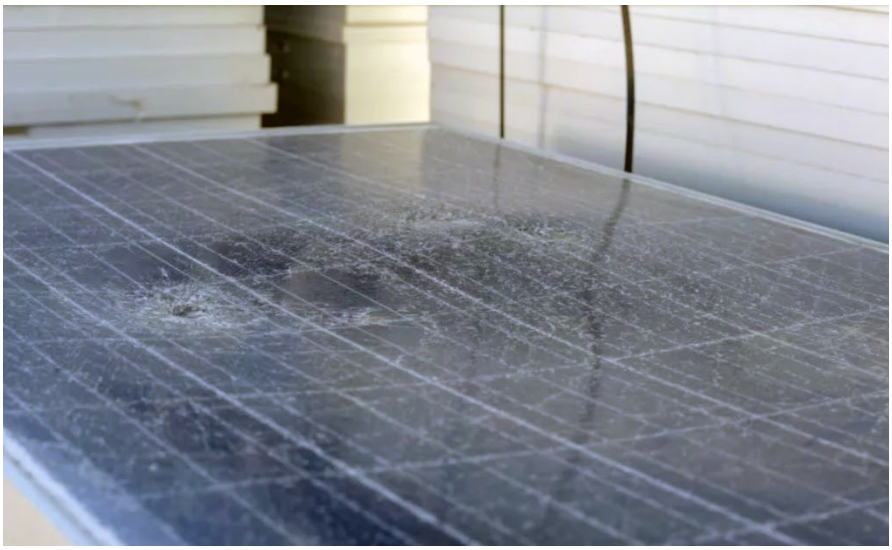

Figure 3. Hailstorm effect on solar panel. A damaged solar panel set to be recycled is pictured at the We Recycle Solar plant in Yuma, Arizona, on December 6, 2023.

SOLAR PHOTOVOLTAIC PANELS CONSTRUCTION

Solar panels are built to be fairly durable to the elements and can continue to produce energy even if partially damaged. Research by the National Renewable Energy Laboratory NREL suggests that hail-cracked panels have less than four percent energy loss. However, the Department of Energy DOE notes that baseball-sized hail can have enough kinetic energy to fully break the glass on solar panels.

A spokesperson for Copenhagen Infrastructure Partners (CIP), one of two companies behind the solar farm, confirmed to Newsweek that the hailstorm had damaged some of the solar panels on the site: "We are currently assessing the extent of the impact of the storm on the generation of the project, while the plant continues to safely operate at a reduced capacity." AP Solar Holdings is another company involved in the project.

MATERALS LEACHING CONCERNS

Residents expressed concerns that the damaged panels could leach chemicals into the surrounding environment. A resident, Nick Kaminski, said that he was worried about chemicals potentially leaking into the groundwater, which his house uses as its water supply.

While solar panels can contain toxic substances such as cadmium telluride and copper indium gallium diselenide, in solar cells they are found in solid form in a thin film that usually only becomes an environmental concern when disposing of them. The CIP spokesperson said that "the silicon-based panels contain no cadmium telluride and we have identified no risk to the local community or the environment."

Experts have said that solar panels have several protective layers to avoid any substances being exposed through damage. County officials told local news outlets that hazardous materials crews had so far found no contamination in the area.

MUSCOVITE AS A CANDIDATE PANEL MATERIAL

Other than the use of flexible film constructed so;ar cell, the use mica based materials can that are shatter resistant such as Muscovte may be suggested. According to Wikipedia:

"Muscovite (also known as common mica, isinglass, or potash mica[6]) is a hydrated phyllosilicate mineral of aluminum and potassium with formula $KAl_2(AlSi_3O_{10})(F,OH)_2$, or $(KF)_2(Al_2O_3)_3(SiO_2)_6(H_2O)$. It has a highly perfect basal cleavage yielding remarkably thin laminae (sheets) which are often highly elastic. Sheets of muscovite 5 meters × 3 meters (16.5 feet × 10 feet) have been found in Nellore, India.[7]"

"Muscovite can be cleaved into very thin transparent sheets that can substitute for glass, particularly for high-temperature applications such as industrial furnace or oven windows. It is also used in the manufacture of a wide variety of electronics and as a filler in paints, plastic, and wallboard."

DISCUSSION

Hailstorm damage to the glass solar panels is an aspect of the struggle between efforts to combat climate change and extreme weather events that global warming is predicted to increase the frequency and severity of. Droughts linked to climate change have previously led to a reduction of hydropower capacity in California, while a winter storm in Texas in 2021 crippled its power grid. Fossil fuel production in the state was also impacted by a cold snap being pushed farther south than usual in 2022.

Materials that are resistant to hailstorms damage need to be sought in the implementation of solar photo-voltaic where such storms are frequent. Muscovite is such a candidate material as well as film flexible configurations.

REFERENCES

1. https://www.newsweek.com/thousands-solar-panels-texas-destroyed-hailstorm-1883546