NEGLECTING RESIDENTIAL SOLAR MAINTENANCE MAY HAVE MORE SERIOUS CONSEQUENCES THAN THE UPTICK IN FIRES

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Introduction

Solar energy provides many opportunities for homeowners: cheaper electricity, a reduction in their carbon footprints, and rooftop systems comprised of complex components which can be hazardous if left unattended. Data provided by the U.S. Fire Administration indicates there will be an increase in the number of fires caused by solar energy facilities from year to year. With hundreds of fires on the horizon, our industry must now reconsider assumptions that were made early on regarding the hands-off approach to residential solar maintenance or accept explosive consequences.

Risk of ~~Fires~~ Explosions

Preliminary analysis of data provided by the U.S. Fire Administration , indicates an uptick in the number of fires caused by solar from year-to-year. This trend coupled with lessons learned in Japan [1] and Australia [2], tell us to *anticipate hundreds of fires caused by solar* in the very near term.

The recent battery explosion injuring four Peoria firefighters at one of APS' power plants, and a lack of root cause [3] spurs additional concerns. This is not an isolated event. Recent energy storage projects in South Korea have had more than 20 battery fires [4]. This is especially troublesome when considering the new normal of wildfires, the explosive nature of gases produced during a lithium (Li) battery fire [5], and the hundreds of thousands of Li batteries being installed [6].

Where and when will this happen? In Japan, many failures were systemic of age and poor quality [1]. Intuitively, in the U.S., we might anticipate a different set of common failure points since we have different equipment suppliers and codes. However, a lack of quantitative data for failures on the DC side of system components makes it difficult to anticipate exactly where the problem will be.

Missing data is a function of missing service documentation. This gap suggests that although the proper maintenance is required by most residential Interconnection Agreements (IA)(s) we're familiar with [7-11], it is not being done and there is no field data that points to the actual reliability and safety of dc system components for residential rooftop systems.

Preventative Maintenance for Residential Solar

Homeowner's typically purchase a system with the notion that if there were any problems, their installer would fix them (i.e. maintain the system). The reality is very different. An installer's warranty is usually only for one to two years and although some contracts do allow for service, this is usually only for unplanned inverter outages. We have yet to encounter a residential contract where the installer is obligated to complete Preventative Maintenance (PM). That said, in the wake of more solar related fires, prominent installers like Tesla are reportedly recommending completion of PMs to their customers [12].

What scope of services should a PM include? Unfortunately, IA language is typically pretty vague on this point. For example, PG&E's Rule 21 guidance states: "A Producer shall operate and maintain its Generating Facility and Interconnection Facilities in accordance with Prudent Electrical Practices…" [7]. Digging a bit further, we can see there are no details clarifying what this entails given the definition provided for Prudent Electrical Practices: "Those practices, methods, and equipment, as changed from time to time, that are commonly used in prudent electrical engineering and operations to design and operate electric equipment lawfully and with safety, dependability, efficiency, and economy" [7]. Currently this is open to interpretation and, in our opinion, our industry sorely needs a standard written for the Preventative Maintenance of residential photovoltaic systems.

In spite of vague industry definitions, the goal of reducing fires and increasing the safety of solar systems installed on people's homes, helps flesh out certain relevant components of a PM scope. Faults within a major subset of PV module defects, "electrical mismatches and degradation," have been shown to pose "increased failure and safety risks for the whole PV installation" [13]. The bulk of these faults will become hotspots which can be identified, and quantified with infrared (IR) imaging [13]. It would therefore behoove residential system owners to have annual Preventative Maintenance for their system that includes a visual inspection, and IR scans to identify PV module safety defects (at least 25 have been defined in literature [14]) to catch hotspots before they become more serious in nature.

Conclusion

Notwithstanding the current trend to have a hands-off approach in the residential solar space, completion of Preventative Maintenance would result in safer systems. Hotspots in a system which may lead to fires or explosions can be identified using infrared imaging in tandem with visual inspection methods. This should be a component of an annual PM scope notwithstanding the fact that industry needs a standard that further clarifies and defines what this should entail. Should the trend of neglect continue, the push to transition to energy storage, and initiatives to have solar on all new construction homes [15], will leave homeowners and their families vulnerable to fires and explosions.

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