

Firm shifts focus to fire prevention in PV systems

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Management Sciences Inc. is well-known for creating novel monitoring systems for military vehicles, but the company is now breaking into the solar photovoltaic market with new technology to prevent fires.

The Albuquerque-based engineering company created a system to constantly monitor the electric connections in PV panels to detect dangerous temperature levels that sometimes cause fires, and then automatically shut the faulty panels down before one happens. The system also immediately pings PV owners or managers to alert them about the problem.

MSI developed its patented, Solar Guardian technology over three years to provide the solar industry with an inexpensive way to deal with the potential for “arcing,” or sparking, in PV systems.

Sparking can occur when air gaps form between electrical conductors. Those air gaps often form from things such as faulty manufacturing, installation error, or the aging and corrosion of connectors and other parts of PV systems. As temperatures rise in those faulty areas, the electrical current across the loose connections can produce the sparking, or arcing, that leads to fires.

It’s a latent danger that doesn’t happen often. But with solar rooftop systems spreading across the U.S., the National Fire Protection Association added a new article to the National Electric Code a few years ago that requires solar arrays to include methods to detect and interrupt arcing faults.

“It’s very unlikely, with only a few recorded incidents, but it has high consequences,” said Jay Johnson, a mechanical engineer at Sandia National Laboratories who studied the problem and potential solutions. “Rooftop fires like that are the kind of thing the media picks up on fast, and it can be a black eye for the industry. It caused quite a bit of interest from firefighter organizations a few years ago to make sure solar systems are not causing fires.”

Apart from potential public backlash, installers must now meet the new National Electric Code requirements or insurance companies won’t pay for damage, said Ken Blemel, MSI vice president for research and development.

“Installers need something to stop this before it happens,” Blemel said. “We created a system that places detectors in the connections themselves and disrupts power to turn the faulty part of a solar system off before a fire happens.”

Most arc-detection systems on the market today are connected to PV inverters, which invert direct current (DC) to alternating current (AC) for use in homes and buildings.

“Those are arc-fault circuit interrupters that shut down the whole system by disconnecting it at the inverter level to prevent any power generation,” Johnson said.

In contrast, MSI’s system is embedded directly in connectors and other junctions on solar panels. It detects faults

through a rise in temperatures among connections before arcing occurs. It shuts down only those panels where the faults are located, allowing the rest of the system to continue functioning, Blemel said.

The detectors, which are as small as a person's thumb, contain a liquid polymer that immediately expands, or puffs out, when heat reaches a certain level, disconnecting the circuits where the fault is occurring. A companion fiber-optic alert box then warns system owners or managers about the problem.

The detectors cost under 40 cents to produce, Blemel said. And with only two connectors needed per panel, the system can offer an affordable alternative for installers to retrofit current systems, or to include them in new ones, compared with other technologies on the market today.

The Solar Guardian represents a sharp shift in MSI's business focus. The company, which launched in 1976, has dedicated the past two decades to developing smart monitoring systems for real-time assessment of electronics and other equipment on military aircraft and vehicles.

It received more than \$20 million in small business research grants from different branches of the military to develop those systems and adapt them for use in different settings. To date, it's been deployed on only a few Navy aircraft and some ground vehicles.

The company continues to develop the system for current military needs, with new contracts to begin deploying it in some army helicopters and surveillance drones, and more recently, to assist in monitoring soldiers' health on the battlefield.

But the Solar Guardian thrusts MSI into commercial markets for the first time and could generate a substantial revenue stream for the company beyond the SBIR funding that has sustained it in recent years.

The company received technical help from the state's national laboratories, and from New Mexico Tech in Socorro and the University of New Mexico, under the New Mexico Small Business Assistance program, said MSI project manager Kenny Blemel, Ken Blemel's son. The labs have tested the technology extensively, NM Tech provided critical input on the liquid polymer used in the arc detectors, and UNM's Anderson School of Management helped with market studies.

The company is now talking with local venture investors to raise funding to go to market.

"The industry raced to create products a few years ago that don't fully resolve the problems, and now many are working to improve them," Kenny Blemel said. "We believe our technology offers a more reliable and affordable solution than current technologies on the market today."