



U.S. Energy Plants *Fend* Off Hackers with Low-Cost Cybersecurity Device

With more solar energy and other high-value assets going onto the electric grid, protecting the nation's power system is a priority for the U.S. Department of Energy (DOE). So, when Fend Incorporated's CEO, Colin Dunn, wanted to domestically develop and manufacture a device that protects large-scale photovoltaic (PV) control systems from hacks, DOE awarded Fend \$1.2 million in SBIR awards. As Dunn puts it: "I saw the need from an infrastructure perspective to improve energy efficiency and resilience. To do that, a lot of folks were turning to the cloud. We brought the ability to meet legacy equipment where it is by providing an innovative way to bring those systems online in a secure way."

In 2018, Fend received \$150,000 from DOE in a Phase I SBIR award under Topic 12b: *Cybersecurity for Solar Energy Devices* funded by the Solar Energy Technologies Office (SETO) within the Office of Energy Efficiency and Renewable Energy (EERE). The goal of the award was to prove that Fend's idea for a low-cost, easily installed device that enhances the security of critical energy assets could work in the solar environment. The device that Dunn and his team at Fend developed is in a class of hardware known as data diodes. Though data diodes have been around for a while serving government agencies, Fend innovated by applying the technology to PV systems communications and control. Fend's innovations also significantly reduced the cost and improved ease of use, compared to competitive products. Generally speaking, data diodes are hardware devices with two nodes - one send-only and one receive-only - that allow the flow of data in one direction only, from a source to a destination. One can think of data diodes as one-way valves for data, allowing data to flow out, without a way back in. Data diodes are so effective that the U.S. Cybersecurity and Infrastructure Security Agency [recommends using them](#). Fend's implementation of the data

Fend, Incorporated FAST FACTS

LOCATION

Arlington, VA

PHASE III SUCCESS

Awards: 1 DOE SBIR Phase I and II

Commercial sales: energy, water, manufacturing, transportation

Employees: 10 workers plus Virginia-based manufacturing

IMPACT

Securing the nation's high value energy assets

DOE PROGRAM OFFICES

Solar Energy Technologies Office (SETO)

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<https://www.fend.tech/>

diode collects data from solar equipment and sends it to a network or the cloud for real-time monitoring. Fend's solution contains proprietary optical isolation technology to physically block inbound cyberattacks and is rugged enough to withstand extreme weather conditions.

Fend used the DOE Phase I funding to build a prototype and then to install the device with customers who had solar energy systems – including local government buildings. These installations provided Fend valuable feedback to incorporate into the product design. Based on those customer experiences, Fend made the diode more rugged and easier to install. The company also added battery backup to enable data transmission during power outages and established a cloud-based platform to collect data. “The Phase I SBIR award enabled Fend to hire an engineer, bringing on the expertise to turn the concepts that I had as a mechanical engineer into prototype hardware,” states Dunn. On a scale from 1 to 10 for how important the award was to getting the company started, Dunn says, “we’ll give it a nine, though it’s probably more.”

The product insights gathered in Phase I led to a DOE SBIR Phase II award in 2019 for \$1,050,000 to advance and commercialize the prototype and cloud platform. In addition to the funding, the award opened the doors to resources such as the the national labs that were very willing and happy to advance the SBIR mission. Dunn says that “The experts in the labs were very happy to share their thoughts with us and gave some great technical advice.” The SBIR award opened the doors to both outside investment and a contract with the DoD Environmental Security Technology Certification Program which enabled Fend to obtain the most rigorous testing the nation has to offer. For that testing, Fend turned to the U.S. Army and Navy, which attacked the device in different ways to see how it responded. The evaluation of Fend's devices was successful and the company's hardware is in use by several Federal agencies today.

Customer feedback and prototype development obtained through Fend's participation in the DOE SBIR program better positioned the company for rapid market entry. The Fend device has been on the market since 2020 and has attracted dozens of paying customers in the energy, manufacturing, water treatment, and defense sectors. Through the Fall of 2022 (the publishing date of this article), Fend has:

- Broken into 7-figure revenues
- Raised over \$2M
- Grown to 10 employees and contractors as a small business in Arlington, Virginia

The extended Fend team includes manufacturing partners in the Mid-Atlantic, with additional capacity scaling up production to meet increasing demand.

As for the future of Fend, Dunn says, “Our hardware plus software solution provides a compelling value proposition. People are really excited to get on board. It's a matter of protecting the equipment that makes modern life possible.”

Learn more about DOE's [solar cybersecurity research](#) and [small-business support programs](#).