In Focus

Spotlight Interview: Radiant

US-based clean energy startup Radiant is building a nuclear microreactor as a climate friendly alternative to diesel generators. Kaleidos, a 1 MW portable microreactor, will be factory-constructed and capable of operating anywhere, bringing power to remote regions around the world and providing backup power for life-saving applications in hospitals or disaster-relief scenarios. The company plans to test its development reactor by 2026 and, if successful, it will be the first new commercial reactor design in the USA to achieve a fueled test in over 50 years.

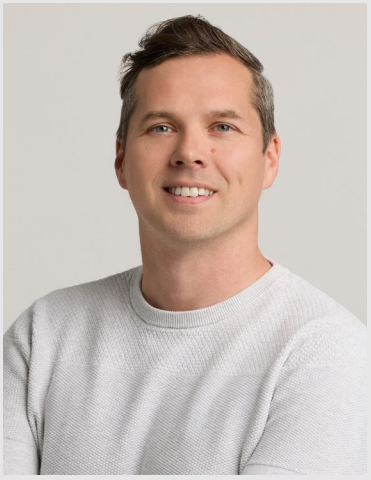
In this article, TradeTech's "Nuclear Market Review" talks with Radiant CEO Doug Bernauer, who highlights the company's nuclear power activities and goals.

NMR: *What is Radiant's background, where and when did it all begin?*

Bernauer: I started thinking about nuclear while I was still at SpaceX. I began my career there just working on rockets … I started as an electrical engineer and designed all the avionics systems on Grasshopper, the first reusable rocket with landing legs. Grasshopper was really one of Elon [Musk's] side projects, with a very small resource pool and herculean goals. I worked also on Hyperloop and Boring Company when they were ideas within SpaceX, but one of his side projects was figuring out how to power a colony on Mars.

To build a colony, we would need to be able to send supplies and then get our rocket back to Earth. Ideally, fuel would be produced from CO_2 and water on Mars, but you need to have enough power to refuel gigantic Starship-sized vehicles. I looked at solar first, but we'd need three football fields of panels to generate enough power. During a meeting with Elon, he suggested nuclear. The further I looked into it, the more I realized that the first step to bringing nuclear power to Mars is to mass produce nuclear reactors on Earth right now. About three years after that I left to found Radiant, in 2019, in El Segundo California. The trigger for me leaving was the US Department of Defense's (DOD) announcement of the "Pele" Program—a portable nuclear microreactor for defense use.

NMR: *Radiant recently completed the front-end engineering and experiment design phase to test a prototype of the Kaleidos microreactor at Idaho National Laboratory. What are the next steps in the demonstration process?*



Doug Bernauer, Radiant CEO

Bernauer: We're planning to fuel and operate our nuclear prototype at Idaho National Laboratory's DOME facility in 2026. The DOME facility is literally an 80 foot dome, which is a containment that protects against weather, aircraft strike, or unmitigated releases that could occur in testing.

There are a series of design reviews and US Department of Energy (DOE) authorization steps that need to happen leading up to it, but since no commercial reactor has ever followed this process, it is a massive challenge to identify all roadblocks ahead of time. The facilities and staff at the lab must be ready also, and there are multiple planned projects all planned for the same facilities.

We have a talented group of engineers and have built camaraderie with the lab staff such that we share the mission and have been able to find flexible ways to keep schedule without impacting the quality of the design. We already have a number of critical components on order, picture many tons of moderator and pressure vessel steel. Once we've operated in the DOME—and operated with a full-scale prototype, not a derivative version of our reactor—the focus turns to commercialization.

NMR: *In November, Radiant secured US$100 million in Series C Funding. How will this funding support development and advancement of the Kaleidos design?*

Bernauer: We raised our Series C to get all the way through DOME testing. So, there's the hardware for our prototype, our team continuing to grow, land for our factory, and US Nuclear Regulatory Commission (NRC) licensing. We're fortunate to have a great team of investors backing us, like DCVC, Andreessen Horowitz, Union Square Ventures, and Chevron Technology Ventures, and we have partnered with DOE and DOD on several contracts. It's exciting that all these groups believe in a future where reactors are manufactured on assembly lines just like a Ford car or a Tesla EV would be today.

NMR: *The Kaleidos microreactor has been described as a "plant in a box." What does the delivery and set up process involve?*

Bernauer: With a 1 MW output and a small footprint, Kaleidos is a very flexible product. It's a high-temperature gas-cooled reactor, so it doesn't require any water source for cooling. Site prep is also minimal—assuming level ground, install the prefabricated concrete operational shielding, and build a fence. Then, the reactor is delivered on the back of a semitruck, slides into the operational shielding, and is integrated with the local energy infrastructure.

NMR: *With its flexible design, which applications are best suited for a Kaleidos microreactor?*

Bernauer: Kaleidos is for communities, businesses, and government agencies, which need power that is not readily available from the grid. A single unit can power 1,000 homes, or 2,000 servers, or charge 480 electric vehicles, or desalinate 1.8 million gallons of water, and it replaces 1,200 gallons of diesel per day. In situations where consumers need reliable, long-lasting megawatts, a portable microreactor is an ideal solution.

Remote towns in Alaska, mining, and oil and gas operations would all benefit from the sustained, clean power that a microreactor provides. Project Pele, the DOD's project to demonstrate a portable microreactor, was an early indication that there would be demand for a product like Kaleidos from the military.

Kaleidos will be great for data centers that are desperately seeking extra capacity and is the right size for the coming wave of edge data center construction (**Figure 1**). We are not perfect for everything, but in situations where consumers need reliable, long-lasting megawatts, a portable microreactor can be the ideal solution.

NMR: *What are the advantages of the Kaleidos plant design compared to other microreactors being developed today?*

Bernauer: Flexibility and safety, primarily. We're building a 1 MW portable microreactor. It is a single container and can be transported via land, air, or sea. One MW will be plenty of power for customers at

Figure 1 **Illustration of Kaleidos reactors attached to a data center**
Source: Radiant

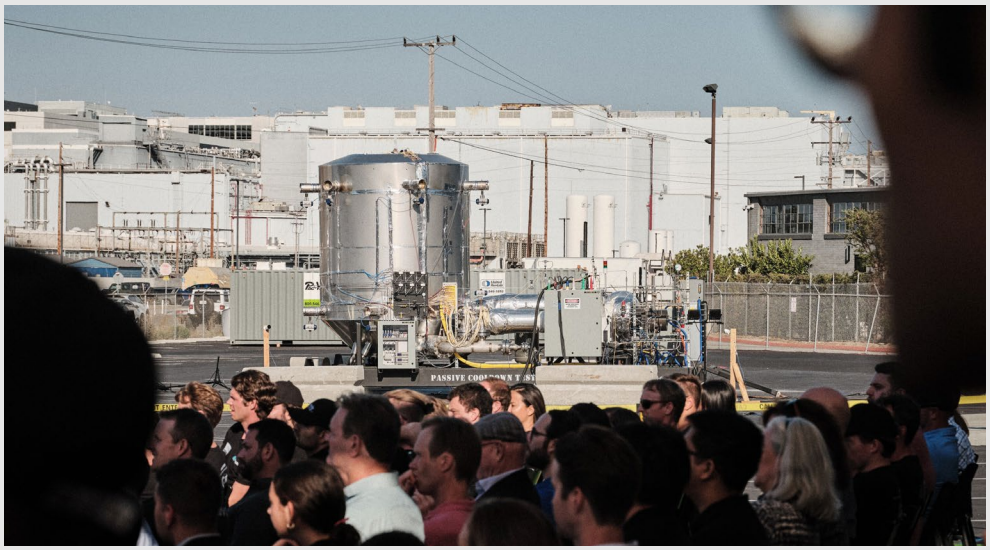


Figure 2 **Kaleidos Passive Cooldown Demonstration, 2024**
Source: Radiant

the edge or requiring critical backup, but most other planned microreactors are larger than Kaleidos.

It's important to recall context here: there are no commercial nuclear microreactors today, no one has built or even fueled a prototype of any new reactor design, even at the small modular reactor size (50 MW+).

Kaleidos is small enough to be built on an assembly line, and we intend to deploy hundreds of reactors in the 2030s. Mass-manufacturing reactors will not only allow Radiant to apply the learning curve benefits of repeated operations—these same benefits will flow down to an American supplier base that has been constricted by the stagnation of our nuclear industry. We also recognize Radiant cannot do this on our own. We rely on the expertise of a number of critical partners and are excited to expand those relationships as we move towards commercialization.

With regard to safety, reactors are already safe enough, but Kaleidos uses meltdown-proof TRISO fuel, helium coolant that doesn't become radioactive, and utilizes a passive cooling system that means an unplanned electrical grid outage will not impact safety.[1]

Passive cooling is a crucial safety function, and we've already operated an over 20 ton electrically heated reactor test at full temperature and pressure last fall (**Figure 2**).

NMR: *With demonstration reactor testing scheduled for 2026, how and when does Radiant plan to introduce the Kaleidos plant design to the global market for commercial power reactors?*

Bernauer: We're actively engaging with customers now and can deliver our first unit in 2028. We announced a Memorandum of Understanding with Idaho Strategic Resources a while ago as part of our Kaleidos Frontier Program, and that program has since filled up. We actually have over 10 production commitments for Kaleidos through 2030.

The 2026-2028 time frame is a quick turnaround, so we're already doing some commercialization work in parallel to our prototype development. Radiant is in pre-application with the NRC, and we'll make an announcement soon on the location of our reactor factory. International deployments will likely start in the early 2030s, though we have already begun initial conversations in this area too.

Editor's Note:
[1] TRISO stands for TRi-structural ISOtropic particle fuel. Each TRISO particle is made up of a uranium, carbon, and oxygen fuel kernel. The kernel is encapsulated by three layers of carbon- and ceramic-based materials that prevent the release of radioactive fission products.