RAJANT

CASE STUDY

Rajant Technology Delivers Critical Communication for Novel Solar Thermal Energy Solution

Heliogen has designed a modular renewable energy solution to replace fossil fuel use in industrial processes. The technology uses advanced computer vision software to precisely align an array of mirrors, called heliostats, to reflect sunlight to a target atop a tower. Powered by artificial intelligence (AI), the system is designed to produce cost-efficient and dispatchable renewable energy in the form of heat, steam, power, or hydrogen fuel.

This breakthrough technology, proprietary to Heliogen, uses cameras to focus and reposition the heliostats as the sun's angle changes. The system requires robust, reliable communication to ensure that the heliostats are continually and accurately focused on the tower.

A survey of available technologies led Heliogen to Rajant and the use of its proprietary BreadCrumb® technology to deliver uninterrupted communication.

The Challenge

In Heliogen's process, a field of mirrors reflects sunlight toward the top of a tower to generate high-temperature heat at the receiver. The heat is accumulated safely in a thermal energy storage system. From there, it can be dispatched at a range of temperatures for carbon-free energy when needed, with minimal interruption.

Heliostats can generate temperatures up to 1,000°C at the receiver – enough heat to enable industrial activities such as steel and cement production. Consistently delivering this performance requires continuous and flawless mirror positioning, which relies on unconditionally dependable communication between the software and the heliostats. It was imperative that the company find a reliable and resilient communications system that could ensure each heliostat achieves maximal reflection and be robust enough to work in extremely exacting environments.

Testing Location

- Heliogen solar thermal energy plant in Lancaster, California.

The Partners

- **Rajant:** Pioneers of peer-to-peer radio communications enabling real-time voice, video, and data to connect machines, robots, and people together as part of a secure private mobile network.
- **Heliogen:** A leading provider of AI-enabled concentrating solar energy technology, delivering low-cost renewable energy in the form of steam, power, or green hydrogen fuel for industrial customers.

Kinetic Mesh Components: ES1-2450R

- 2 Rajant Hawk radios support a maximum combined data rate of 1.7 Gbps
- 12 Rajant ES1 radios installed on 12 heliostats

Outcome

- Replaced wired solution with a wireless technology without requiring software rewrites Rajant Kinetic Mesh solution optimizes power generation by enabling seamless, continuous communication at 100 bytes/10 seconds to and from each heliostat

The Solution

Without the time and resources to develop its own solution, Heliogen began looking for a communications system that could meet its rigorous requirements and be deployed quickly.

Using a Rajant Kinetic Mesh® network with BreadCrumb nodes enabled the continuous communication required. Working wirelessly, the system delivers reliable and adaptable broadband connectivity, rerouting on the fly when interference or signal blockage occurs. Powered by InstaMesh® networking software that dynamically routes communications via the next-best available path, the system guarantees there are no disruptions. The network is inherently redundant because the BreadCrumbs automatically form multiple connections with other nodes within the mesh.

The control tower is at the center of Heliogen's solar energy production system. Using real-time information gathered by four cameras mounted on the tower, proprietary software communicates continually with every heliostat in the array, pinpointing the exact orientation of each mirror and telling each one the adjustments needed to ensure optimal sunlight reflection onto the collector mounted on top of the tower.

For this installation, two Rajant Hawk radios were installed in each tower. Each dual-transceiver industrial-grade, high-performance BreadCrumb supports a maximum combined data rate of 1.7 Gbps and up to 6X enhanced throughput performance over the original BreadCrumb design. Using two radios provides redundancy. If one radio stops working, the second radio takes over, and the rest of the Kinetic Mesh immediately and seamlessly works with it.

Radio installation was straightforward, with field workers simply bolting them on the tower, plugging them in, and using Rajant software to configure them.

The original system arrangement included 12 heliostat distribution boxes, each with a Rajant ES1 radio, designed for use in potentially hazardous environments. Once all 12 heliostat distribution boxes were built, they were configured and attached to a power source, then tested by spreading them out across a nearby golf course and rapidly sending a series of signals. The radio positions were then clustered together to test

> "The choice to use Rajant is an easy one. Reliability is job one. We needed something solid that works every time."
>
> **— Wally Barnum,**
> Heliogen Engineer

for interference. Performance was unimpeded by the distribution, and communication between the controller and radios continued without disruption.

In this installation, Rajant radios communicate with one another and the tower, with the mesh ensuring every command is sent and received as intended. Control software sends a signal out over an RS485 bus, which allows the heliostats to be daisy chained. Each HDB unit has up to 80 heliostats connected to it, which in effect, distributes the cost of a single radio over 80 heliostats.

The successful test laid the groundwork for a full installation at the test site as well as the development of a communications configuration that Heliogen will use as a template for future solar energy production installations.

The Results

Rajant technology takes Wi-Fi to the next level, enabling simple, straightforward installation on sites like Heliogen's that include hazardous work areas and providing seamless, steady communication via leading-edge technology.

For Heliogen, no other affordable, industrial-strength Wi-Fi options could withstand its solar energy production plant's required level of heat and vibration. And none of the systems available could replace a wired solution without necessitating software rewrites.

By capitalizing on Rajant's technology, Heliogen gets performance and reliability with minimal subsequent support required. It secures continuous connectivity for its entire local solar energy production plant and can replicate this system in the field.

Tel: 484.595.0233 | **www.rajant.com**

20+ Years OF GAME-CHANGING WIRELESS

RAJANT
INTELLIGENT EDGE
Enabling Industrial AI