CASE STUDY

Securing high-voltage substations with advanced LiDAR-based 3D surveillance

EG.D | *Czech Republic*

Industry

- Security

Solution

- Octave Coda Spatial

Challenges

- Safeguarding unmanned substations with traditional forms of perimeter protection
- Keeping unauthorized people out, locating intruders and protecting maintenance personnel

Results

- Strategically placed LiDAR sensors enable virtual creation of secure, safe, sterile zones
- Authorized personnel and trespassers automatically monitored and tracked
- Can create a digital twin for every substation

EG.D, part of the E.ON group, supplies electricity to 2.7 million people in the southern regions of the Czech Republic, on the borders of Austria and Germany. The company operates and maintains infrastructure including power lines and high-voltage transformer substations.

According to the International Energy Agency (IEA), in 2024, global electricity consumption increased nearly two times the annual average of the past decade. At the same time, new regulations such as the Critical Entities Resilience (CER) Directive, which will come into force across all European Union Member States in July 2026, and Germany's KRITIS Umbrella law, are being introduced to guide organizations responsible for national critical infrastructure in ensuring their resilience in the face of existing and emerging threats.

A longtime Octave customer, EG.D wanted to assess how volumetric and LiDAR technology could be used to bolster the physical security of its substations. For this, it chose Octave Coda Spatial (formerly HxGN dC3 LidarVision).

Ensuring the resilience of critical infrastructure

For energy providers, transformer substations are an integral component of the energy grid, securely and reliably transmitting electricity to homes, businesses, schools, hospitals, etc., at the correct voltage. Major incidents involving substations are rare, due to the rigorous monitoring, maintenance, safety and security measures in place. However, when a situation arises, it can cause significant problems, as was highlighted in early 2025 when a fire at a site in the UK interrupted power to 5,000 homes and affected a large international airport.

Until recently, best practice for safeguarding unmanned substations focused on traditional forms of perimeter protection using fencing (typically steel and passive infrared sensors), alarms, remote monitoring via CCTV cameras and an access control system (often operated via a card or biometrics to manage authorized entrance). However, EG.D decided to embark on a pioneering pilot project that would test the capabilities of the very latest in LiDAR-based 3D surveillance technology.

"The response of the management team to the pilot operation has been overwhelmingly positive and we highly recommend Octave to other organizations."

Tomáš Sofka
Security Technologies
EG.D

A pioneering pilot project for improved substation safety and security

Tomáš Sofka, security technologies at EG.D explained, "We have partnered with Octave for many years in the field of GIS and were particularly impressed by their innovative solutions in volumetric detection and LiDAR technology. We wanted to assess how the technology could be used to provide stronger security to keep unauthorized people out of substations, locate intruders and improve safeguards for maintenance personnel while they are working on-site near high-voltage equipment."

Coda Spatial was chosen for the project. This advanced 3D surveillance software solution is based on volumetric detection technology and is designed to secure entire sites, unlike traditional perimeter protection systems, which tend to concentrate only on the fence line.

The project uses five strategically placed LiDAR sensors that enable the virtual creation of secure, safe and sterile zones (including the perimeter fence). Crucially, these zones can be switched on and off or changed at the click of a button or drag of the mouse. For example, when maintenance is being carried out, the zone in which the work is taking place can be deactivated. Meanwhile, other areas remain live to prevent workers from straying into an unauthorized or potentially hazardous area.

Authorized personnel and trespassers can also be automatically monitored and tracked via a live, real-time feed into EG.D's security control room. Furthermore, the system recognizes the number of people and their precise positions, along with their speeds and directions of movement (if walking or running) and even their projected trajectories. This can be augmented further with PTZ cameras, alarms and speaker systems to communicate with the person(s) in question.

Another significant advantage of this type of system is the ability to create a digital twin for every substation. In doing so, scenarios can be played out virtually to test the resistance and resilience of safety and security measures. Essentially, it creates a 3D representation / map of the entire facility that you can interact with. It enables the positioning of LiDAR sensors and cameras to be optimized to mitigate potential blind spots or poor viewing angles before anyone steps on site.

The system can be enhanced further using thermal sensors and cameras that monitor the temperature of designated areas and raise an alert if it deviates from the norm. This is valuable for intrusion detection (whether human or animal) and the early detection of fire, before it begins to smoke or ignite.

Setting a new standard that is gaining worldwide attention

"Our experience working with Octave has been exceptional. The collaboration was exemplary and professional throughout all phases of the project," said Sofka. "The response of the management team to the pilot operation has been overwhelmingly positive and we highly recommend Octave to other organizations."

As a result of the pilot's success, EG.D and Octave are working together on a plan to roll out Coda Spatial to other energy facilities across the grid. The company is also actively sharing its knowledge with other national energy companies, including those in the U.S. and Asia-Pacific region, which are considering this new approach as the possible gold standard for substation resilience, safety and security.

About Octave

Octave is a leader in enterprise software, turning data into decisive action and intelligence into your edge. Our software solves for and simplifies complexity, from the design and build to operations and protection of people, property and assets – for any scope, at any scale. For decades, we've partnered with customers to sharpen performance, elevate efficiency and amplify results. From factory floors to entire cities, our solutions are tuned to scale up what's possible from day one onward.