

Case Study: Securing Critical Infrastructure with Modern Gunshot Detection

Essential services form the backbone of daily life. Power, water, and transportation systems rarely draw attention until something interrupts them, and when that happens, the consequences are felt instantly. For individuals who rely on electricity for medical care at home, a brief outage can quickly become dangerous.

Over the past few years, utilities across the United States have faced a troubling trend: gunfire directed at electrical substations and other energy assets. Whether the intent is vandalism, sabotage, or reckless target practice, the results are the same. A single rifle round can destroy a million-dollar transformer that could take months to replace. This happens when the cooling fluid drains from the transformer. Once the fluid is lost, the unit quickly overheats and frequently ignites.



A recent DHS Homeland [Threat Assessment](#) concurs, stating, “We assess that domestic and foreign violent extremists will continue to call for physical attacks on critical infrastructure in furtherance of their ideological goals...” The [NERC 2025 RISC Report](#) also highlights that the potential for critical infrastructure attacks is increasing and that infrastructure vulnerability remains a top national concern.

One of the largest electric power and natural gas utilities in North America recognized this risk after a number of gunshot attacks on substations disrupted power to tens of thousands of customers. In one case, power was not restored for days, and a person dependent on life support equipment tragically lost their life.

The Challenge

Before implementing a new solution, the utility needed to reassess how its security technologies worked together. Traditional security cameras were excellent for documenting clearly visible problems, but they could not reliably detect something as small as a bullet hole in a damaged transformer, leaving a critical awareness gap. The company's challenge was not only detecting a gunshot but doing it fast enough to act before cascading failures occurred.

Threats outside the perimeter

In many cases, gunfire at substations originates from hundreds of feet outside the fence line. The sound of the muzzle blast may never reach the site, leaving only the supersonic ballistic wave as evidence of incoming rounds. A system limited to triangulating muzzle blasts within a perimeter would miss these long-range threats entirely.

Integration with Security Cameras and VMS

Facing these unique requirements, the utility sought a technology that could provide instant notification with video and audio verification. This capability was essential to confirm whether an event was malicious or accidental. Integration with the utilities existing video management system (VMS) was a requirement, while direct control of a pan-tilt-zoom (PTZ) camera would allow operators to focus immediately on the source of the gunfire and determine if an actual threat existed.



“We needed immediate, accurate alerts to prevent catastrophic damage,” said the utility’s physical security program manager. “Whether a threat is close-range or from a high-powered rifle fired from hundreds of feet away, we needed a modern, self-contained, highly accurate system to provide a full picture.”

The Requirement of a Closed, Secure Network

Cybersecurity was another defining requirement for this utility. The company prohibits internet connectivity within its operational network, a strict “air-gapped” policy that rules out any cloud-based system. For these secure environments, any new security technology must operate entirely on-premises, integrating directly with existing video and access control platforms.

Finding the Correct Solution

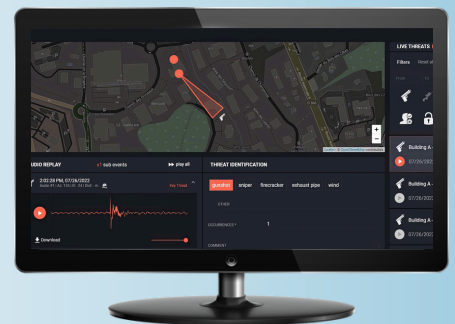
To address the complex nature of the threats and meet these stringent demands, the utility required a specialized solution that avoided a full infrastructure overhaul. After extensive testing, the utility selected Acoem’s ATD (Acoustic Threat Detection) system.

The company has now deployed numerous detection systems across multiple states and regions, with new installations continuing every week as part of an ongoing modernization plan.

A principal reason behind choosing the Acoem ATD system was based on how the system works compared to legacy solutions. Instead of sending audio data from multiple sensors to a remote server, the Acoem sensor processes detection right on the device. When a gunshot occurs, it detects both the muzzle blast and the ballistic wave, confirming the event and calculating its location instantly.

Processing analytics on the edge is instant and gives operators the time they need to respond. That might mean rerouting power, isolating a substation, or taking a transformer offline before it fails. Having that situational awareness can make the difference between a quick repair and an extended regional outage.

Acoem developed an on-premises version of its Cadence software specifically to meet the utility's cybersecurity requirements of restricted internet access. The platform displays live maps, sensor health, and provides audio verification clips that allow operators to hear what the sensor heard while viewing the shooter's position overlaid on the map. Cadence integrates directly with the utility's Avigilon video management system.



“Running software on-premises was non-negotiable,” said the utility’s program manager. “We needed the benefits of automation and analytics without exposing operational systems to the internet.”

Situational Awareness with Eyes on Target

Detection is only half the story. Integration with a PTZ camera on site provides immediate visual confirmation. When a gunshot is detected, the sensor automatically commands the camera to pivot to the coordinates of the source. Operators can see what happened as it happens, even if the shooter is several hundred yards outside the fence line.

In some locations, thermal or infrared cameras may complement the acoustic sensors to detect movement in tree lines or along rights-of-way. This pairing of acoustic and visual intelligence transforms response operations, allowing the utility security team to verify alarms in real time and coordinate with law enforcement or maintenance crews as needed.

Hunters or Vandals?

In one recent example, the utility’s Acoem ATD system detected gunfire at a remote substation. Through the linked PTZ camera, operators quickly confirmed that the shots came from hunters outside the perimeter and that there was no threat to equipment or

personnel. The team was able to assess the situation instantly without dispatching crews or contacting law enforcement.

Scalability and Integration Flexibility

The utility required open standards and interoperability. They did not want a proprietary system that locked them into a specific platform. The Acoem ATD system met that demand, integrating through APIs with their existing Avigilon infrastructure. Whether a site runs on VMS's such as Avigilon, Milestone, or Genetec, the ATD sensors connect seamlessly within the same ecosystem.

Just as important, the solution had to scale. The utility began with a few high-risk sites and has expanded steadily without redesigning its network. This “start small, grow fast” approach aligns with how the organization evaluates, validates, and then standardizes new technologies.

CIP-014 Compliance and Beyond

The North American Electric Reliability Corporation's CIP-014 standard mandates physical security measures for critical transmission substations, including threat detection. The utility wanted to go further. It set a new benchmark for awareness, resilience, and uptime. Acoustic threat detection is now a key component of its operational strategy, providing actionable intelligence that prevents damage rather than documenting it after the fact.

A Smarter Path Forward

Protecting critical infrastructure today means recognizing that not every threat is digital. A single bullet can cause as much disruption as a cyberattack. The key is giving operators the real-time data they need to act quickly and decisively.

By combining edge-based AI, on-premises software, and open integration with existing security systems, Acoem's ATD system has given the utility company the situational awareness it needed to protect its assets and its customers. The system keeps vital equipment online, strengthens compliance, and helps safeguard the communities that rely on uninterrupted service.



“Securing the grid now demands both digital and physical vigilance,” said the utility’s program manager. “Gunshot detection has become a critical layer of defense for the infrastructure that powers our daily lives.”



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