Transmission Line Security Monitor: Detecting threats, tampering and terrorist activity around high-voltage support towers

America’s electrical infrastructure has about 158,000 miles of high-voltage transmission lines with almost 800,000 towers that are vulnerable to terrorism, vandalism and nature.

Repair of this critical infrastructure is expensive, as recorded with the huge power loss experienced in August 2003.

Idaho National Laboratory inventors have developed a unique, inexpensive and effective technology to monitor and defend against damages to this infrastructure from human mischief or natural conditions.

"The Transmission Line Security monitor, or TLS, is a device that's installed on electric power transmission lines," said INL engineer Robert Polk. "It detects, monitors and responds to operational events, which may include human tampering from a terrorist or vandalism. But it also provides temperature information, line sag, also movement of conductors that provide an operator with the ability to respond from power loading and other things to protect that transmission line.

"It also may provide information such as human presence around the transmission line or fires in the area, so there's a lot of situational awareness that this device provides the operators. So he can either provide a response from an electrical perspective or provide maybe a law enforcement response."

TLS is a monitor housed in a small, weatherproof and corona-resistant enclosure that one person can safely clamp onto a transmission line conductor. It is inherently tamper-proof because it is located on the high-voltage conductor about 100 feet in the air. Plus, it can be disguised as a vibration damper.

“Our flashlight-sized TLS monitor uses wireless communications to relay threat information in real time to other monitors along the line to quickly reach control room operators,” said INL engineer John Svoboda.

To achieve this level of performance, INL inventors developed custom software signal-processing algorithms and secure packaging to integrate an array of advanced sensors and communications technologies. The TLS monitor can classify and report threats that require immediate attention, or discern non-threats, which can be ignored.

Far exceeding all current monitoring technologies, the TLS monitor offers revolutionary safeguards and operational information to electrical grid operators with key competitive advantages, including:

- No special power requirements, as transformer coils in the monitor tap the magnetic field surrounding the conductor to power the unit;
- Instant threat characterization, localization and warning using wireless communications for immediate action;
- Wide area security at each support tower using infrared sensing and advanced algorithms to classify human and naturally-occurring activities;
- An excellent value and extremely affordable, as each TLS costs about $400 for these enhanced capabilities; and
- Versatile sensor configuration that uses special software to integrate
    - infrared reporting,
    - two-axis accelerometers with built-in tilt function,
    - solid state temperature sensor,
    - and more, if desired.

In a tense 21st century, constant monitoring and instant response capabilities to safeguard America's critical infrastructure are necessities. The TLS monitor offers heightened security, sophisticated data classification at each tower, monitoring of operational conditions, instant reporting for response, and a tremendous value for a modest investment. No matter the source of a potential threat, TLS is a sophisticated technology needed to safeguard disruption of the vulnerable power grid and avoid the enormous economic and social consequences caused by a loss of electrical power.