

# APPLICATION STORY

## Sensei Solutions Relies on Thermal Automation Cameras for Fail-Proof Condition Monitoring

*When electric utilities experience a breakdown, there is not only a problem for end consumers faced with loss of electricity, but also for the electric utility company that bears the cost of component failures, unplanned maintenance, and loss of productivity. Fortunately, there are smart ways to prevent costly disasters. Sensei Solutions LLC, a North Carolina based provider of smart grid solutions, relies on a combination of thermal imaging temperature sensors and intelligent software to detect possible failures at an early stage before they result in high economic loss.*

Condition monitoring is all about identifying problems before failure occurs in order to prevent costly service outages. Typical equipment that is monitored by electric power utilities includes bushings, breakers, capacitor banks and high-voltage switchgear. Electric utility companies pay attention to this because they know that a critical component failure may cascade into series of failures. If they don't, getting their systems up and running again usually involve enormous costs.

### CONVENTIONAL CONDITION MONITORING

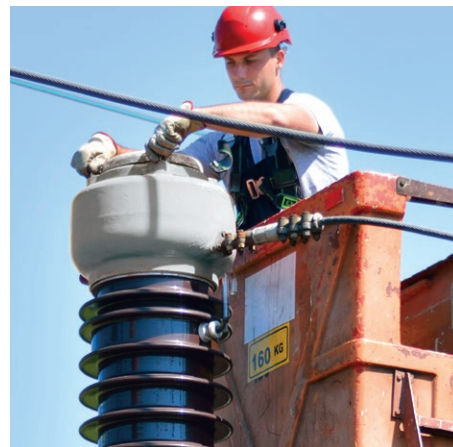
Utilities are looking for ways to address these issues in order to improve the reliability of

electric power delivery while at the same time reducing costs. There are a number of conventional instrumentation and measurement methods available. Most of these solutions are invasive and complicated, and require an outage to install. And since every component needs a separate sensor, these solutions often tend to be expensive as well.

According to Robin Thompson, founder and CTO of Sensei Solutions LCC, there is another, more effective approach to condition monitoring: "Electronic equipment and components will heat up before they break down. That is why we use thermal imaging cameras to detect the rise in temperature at an early stage. This way,



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By combining fixed network thermal imaging cameras and intelligent automation software, impending equipment failures can be detected anytime, day or night, at a remote monitoring location and without any human intervention.

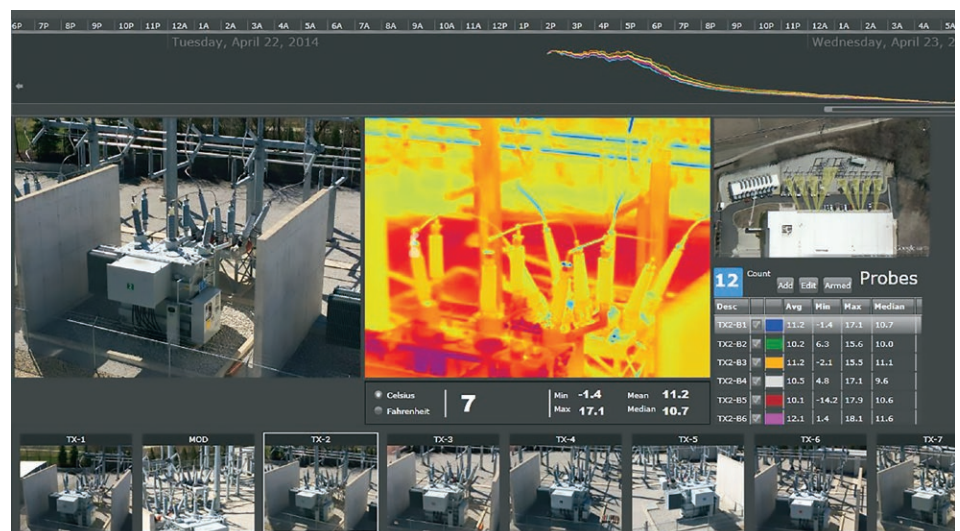
it is possible to plan maintenance more effectively and to prevent costly outages.”

Thompson’s company specializes in radiometric solutions for measurement of high-voltage equipment, and he clearly understands how thermal imaging technology can improve the reliability and security of electric substations. All objects emit thermal radiation in the infrared spectrum that is not seen by the human eye. Thermal imaging cameras convert that radiation to crisp images from which temperatures can be read.

In fact, electric utilities have been using handheld thermal imaging cameras to monitor substations for many years. Periodic inspections are critical to ensuring equipment is functioning at optimal efficiency, and to find potential points of failure before they cause an outage or equipment shut-down. However, these scheduled inspections don’t provide 24-hour coverage. Continuous monitoring and analysis can help utility companies track temperatures—and the “health” of equipment—over a long period of time. Potential problems can be noted even earlier. In addition, this continuous analysis can indicate for inspectors which components require immediate attention. Last but not least, continuous, automated cameras can be a safer alternative for monitoring critical asset malfunctions.

## CONTINUOUS AUTOMATED THERMAL IMAGING

The true win lies in automation. By combining fixed network thermal imaging temperature



The SensEye AVR analytic video recorder simultaneously records colored JPEGs as well as frame-by-frame radiometric data coming from thermal imaging cameras, allowing for precise pixel-by-pixel measurements.

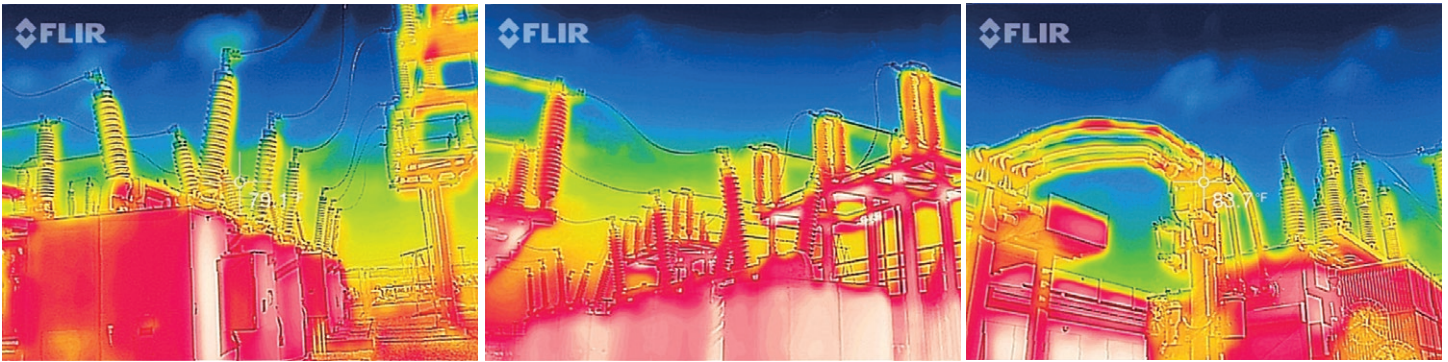
sensors with intelligent automation software, impending equipment failures can be detected anytime, day or night, at a remote monitoring location and without any human intervention. Whenever a predefined temperature threshold is detected by the thermal imaging camera, an alarm can be generated to a remote operator. The net effect is increased reliability and reduced cost.

“Continuous automated radiometry has many benefits,” Thompson explains. “This method is non-invasive and eliminates human errors and mitigates the risk of greater failures.” Due to their 24/7 usage, thermal automation cameras result in a higher amount of samples. Also, one camera is able to monitor several critical assets at once. This increases the reliability of thermal imaging as a method of automated condition monitoring.

## RADIOMETRIC ACCURACY, REAL TIME AND RETROSPECTIVE ANALYSIS

Sensei Solutions LLC brings over a decade of experience to the task of automated analytic thermography and can help electric facilities design a custom solution for the protection of critical assets. The company’s SensEye AVR analytic video recorder solution simultaneously records both the colored JPEG as well as the frame-by-frame radiometric data coming from thermal imaging cameras, allowing for precise pixel-by-pixel measurements. SensEye AVR quickly and easily captures, stores, and analyzes on-line data from virtually any substation device, automatically alerts and notifies on critical changes in any reading or combination of readings, and delivers data to SCADA and enterprise historian servers.

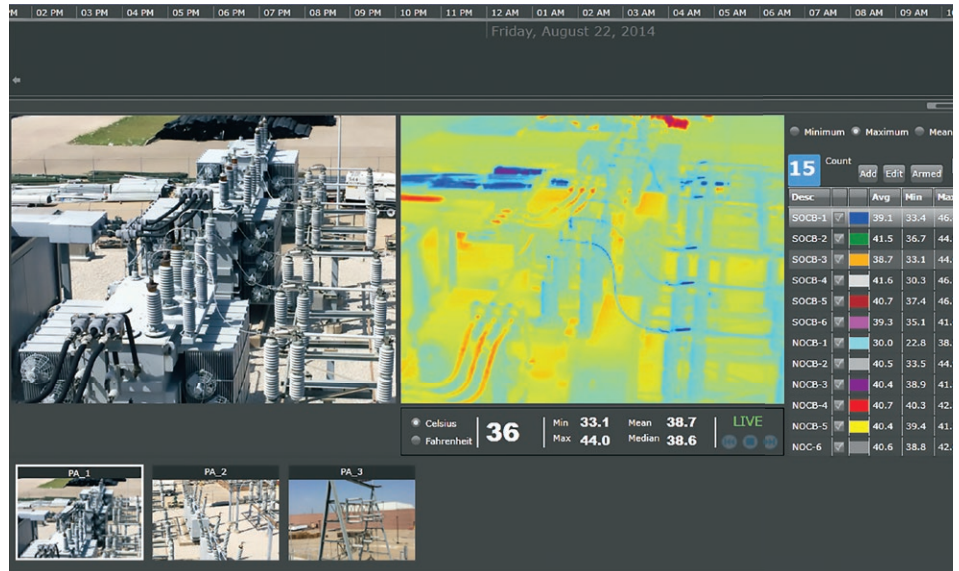




### TEMPERATURE MEASUREMENT AND INTRUSION DETECTION

"We have offered our solutions to several electric utilities and commercial operators of high-voltage equipment across the US, with great success," says Thompson. "In fact, we were first approached by an electric utility customer to provide a solution for intrusion detection. The company experienced a recurring problem of security breaches and copper thefts. We proposed an intrusion detection solution around thermal imaging cameras, but we quickly realized that we could do more for this customer."

Thermal imaging cameras are commonly used for intrusion detection. They can recognize the heat signatures of intruders and thus detect intruding persons or vehicle in an instant. After a thorough assessment of several technologies, Sensei Solutions realized thermal imaging was also an ideal solution to read the temperatures of bushings, breakers, and capacitor banks. Combined with Sensei's recording and analysis solutions, the fixed automation thermal cameras quickly became the company's preferred solution for electric substation condition monitoring.



A Texas manufacturer with its own electric substation engaged Sensei to install three thermal cameras. These cameras provide continuous monitoring for transformer and circuit breaker bushings, switch gear jaws, and manually operated disconnectors.

### THERMAL SUCCESS STORIES

For a large data center that owns its own electric substation, based in the Midwest, Sensei installed nine fixed thermal imaging cameras to monitor eight transformer-circuit breaker pairs and one manually operated disconnector. The cameras were connected to the Sensei AVR software to monitor 12

"probe points" in each camera's field of view. An image sample is collected every 20 minutes, securing high, low, mean and median temperatures for each measuring point. "Not only did this customer increase its security level by increasing the thermographic sampling from four times per year to over 26,000 times per year, it also received a



A large Midwestern data center with its own electric substation increased its security level by increasing the thermographic sampling from four times per year to more than 26,000 times per year.

significant insurance premium discount because of this increased reliability," Thompson explains.

An automated thermal inspection solution not only increases the reliability, it also can have a significant positive impact on public relations. For a large Texas manufacturer with its own electric substation, Sensei installed three thermal cameras to monitor transformer and circuit breaker bushings, switch gear jaws, and manually operated disconnectors. Sensei AVR software monitors between 12 and 16 probes in each camera field of view. In this case, Sensei's continuous AVR Console display, located at the customer's corporate headquarters, serves as a reference for executive and high value customers, as it demonstrates the reliability on plant inspections.

But sometimes, the benefits of an automated thermal monitoring system are so manifest that they are hard to ignore. For a large East Coast steel manufacturer, Sensei installed four thermal cameras, two of which were installed in the Melt Room and focused on melt container to provide a live feed of current temperature to prevent catastrophic failure, and two of which were installed in the on-premise transformer vault. Says Thompson: "Our customer already discovered three issues in the switch gear within the first day of AVR monitoring. This prevented imminent failure and allowed for the maintenance team to resolve the issues immediately.



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