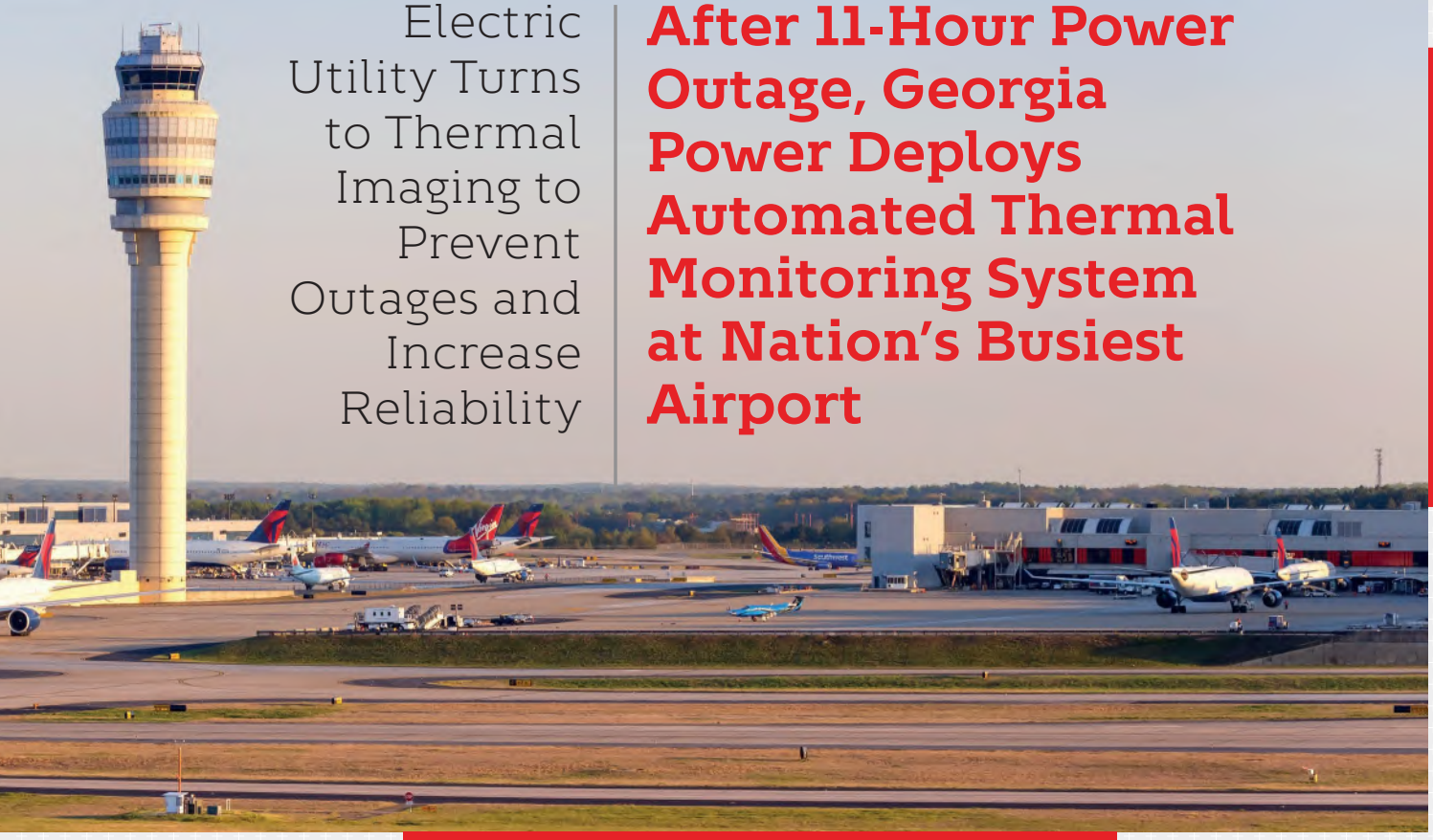
POWER INTELLIGENCE

Electric Utility Turns to Thermal Imaging to Prevent Outages and Increase Reliability

After 11-Hour Power Outage, Georgia Power Deploys Automated Thermal Monitoring System at Nation's Busiest Airport



Executive Summary

On December 17, 2017, at Hartsfield-Jackson Atlanta International Airport, a component failure in the airport's extensive underground power delivery network coupled with HJAIA's backup generation not working resulted in an 11-hour outage delaying hundreds of flights.

To help prevent similar outages, Georgia Power[1] selected a continuous surveillance and early warning system from Power Intelligence, LLC[2] that uses thermal imaging cameras and advanced image processing software.

Over 100 cameras continuously measure hundreds of critical components and connections running beneath the airport's 4,700-acre footprint. Specialized software interprets the images with algorithms that provide advanced warning of degrading conditions and failing components.

About Georgia Power

Electric utility serving over 2.6 million customers in the U.S. southeast region

Contributors:

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Georgia Power, Operations and Reliability Team Leader

Challenges

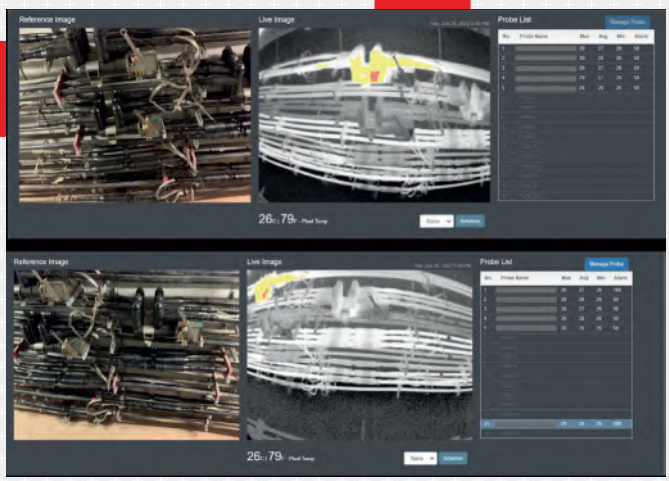
Georgia Power, a Southern Company subsidiary, serves over 2.6 million customers and is responsible for 77,094 miles of distribution lines and 12,531 miles of transmission lines powering the state of Georgia. Underground networks of redundant feeders cover the main grids of transformers powering Atlanta, Valdosta, Athens, Augusta, Gainesville, Columbus, Macon, and Savannah.

Atlanta consists of several large spot networks with multiple circuits feeding a customer with numerous transformers tied together on the secondary side to avoid power disruptions to the customer if a circuit faults.

HJAIA is served from multiple substations with multi-circuit networks feeding the domestic & international terminals and the gate concourses.

[1] *Georgia Power, https://www.georgiapower.com/company/about-us/facts-and-financials.html*
[2] *Power Intelligence, LLC, https://power-intelligence.com/about-power-intelligence/*

Photo: Markus Mainka - stock.adobe.com; Georgia Power



The most common failures in these underground networks occur at the connections and splices rather than the primary cable itself. Additional challenges included: A lack of a continuous equipment health monitoring system to identify component issues that could result in future failures and the airport backup generation systems failing.

Traditionally, electric utilities perform periodic maintenance of critical components typically based on scheduled intervals and expected service life. Condition-based maintenance practices deliver improved reliability because continuous monitoring provides earlier detection and opportunities for remediation.

Missing the warning signs of equipment malfunction or failure could result in considerable financial loss and damage a company's credibility and reputation.

Objectives

Following a major outage event, most utilities conduct a post-mortem review. Learning from these outages to prevent similar future outages paves the way for implementing industry best practices.

Georgia Power sought to do the following:

- Choose a continuous monitoring solution to meet the company's needs and end goal
- Leverage technology to proactively monitor equipment to reduce the duration & frequency of outages and to prevent catastrophic failures
- Shift from interval-based maintenance to condition-based maintenance monitoring
- Evaluate additional types of monitors and sensors to determine provided benefits
- Find a company with a lasting solution that allows for expansion and enhancements

Condition-based monitoring (CBM), a strategy comprised of the real-time monitoring of equipment and key metrics, such as temperature, is used to determine when to perform maintenance.

This proactive monitoring approach involves the installation of cameras or sensors, trending the collected data, and acting when metrics exceed thresholds.

Solution

Once Georgia Power decided to deploy a thermal monitoring solution, they did a small pilot with one vendor's solution. This solution had several limitations and would not meet their needs. Georgia Power learned about an EPRI project to evaluate thermal cameras and thermal monitoring solutions. EPRI provided their list of potential thermal monitoring solution vendors to Georgia Power.

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Why Power Intelligence, LLC

They were collaborative, thorough, and provided evidence-backed information for all questions.

The R&D team tested and evaluated cameras and supporting technology until they found the right solution to meet the needs of each situation.

"Educational, knowledgeable, and backed up with documented facts, even with ideas."

Eric S. Smith
Georgia Power, Operations and Reliability Team Leader

Based on what they learned in the first pilot, Georgia Power researched and interviewed these vendors. They decided that the solution provided by Power Intelligence, LLC looked the most promising and decided to pilot this solution.

The Power Intelligence team presented a solution encompassing the features that appealed to Georgia Power and worked closely with the team to deploy over 100 thermal cameras and a monitoring solution that met their needs:

- Cameras, sensors, and device configuration tools support secure remote connections
- Thermal image collection needs to work over wide area networks
- Uses a relational database to store trending temperatures
- Supports interface for SCADA polling & alarming
- Software is more developed and contains more functionality out-of-the-box

Once Georgia Power decided to deploy a thermal imaging solution, the managers compiled a list of vendors while attending an EPRI conference to provide to EPRI. EPRI began testing and evaluating the thermal imaging companies to determine if they were a fit.

Georgia Power began a pilot in conjunction with EPRI's project. The solution provided by Power Intelligence, LLC stood out above the rest and surpassed expectations through each step of the process.

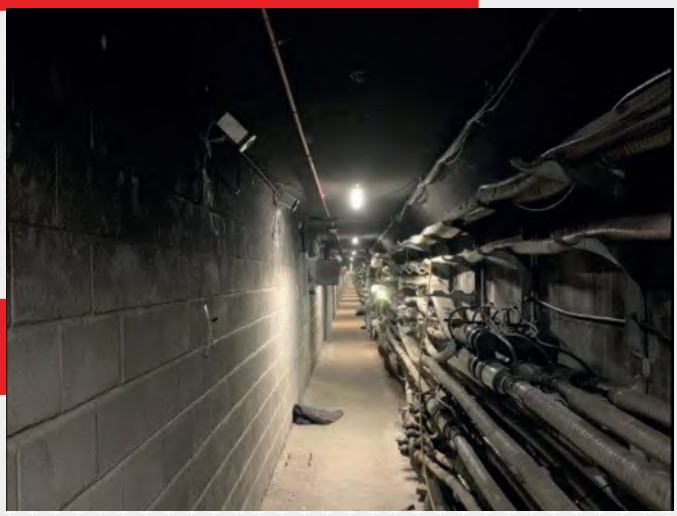
The Power Intelligence team presented a solution encompassing the features that appealed to Southern Company and worked closely with the team to deploy over 100 thermal cameras and a monitoring solution that met their needs:

- Configuration tools connect remotely
- Cameras push image files through SFTP to the server
- Uses a relational database to store trending temperatures
- Supports Modbus enterprise interface
- Mastermind software is more developed and contains more functionality out-of-the-box

Notable features:

- Live feature shot depicts changes in real-time
- Comparison tool compares a group of trending readings to another group
- Warning emails triggered with an early detection system
- Monitors 24/7 for any drastic changes to allow them to take immediate action
- Integrate with corporate security and identity management via Active Directory

Photo: Markus Mainka - stock.adobe.com; Georgia Power



Considerations

Organizations that want to install an effective thermal monitoring system should evaluate several issues that Georgia Power considered when they developed this solution, including:

- **Goals:**
  What does the company want to achieve with the thermal monitoring solution?
  - Examples:
    - Implement condition-based maintenance monitoring
    - Prevent catastrophic equipment failures
    - Reduce/eliminate unplanned equipment downtime
    - Reduce personnel exposure to high-risk environments
- **Communication Infrastructure:**
  How does the company want to collect, store, and manage the data and thermal images?
  - Can involve:
    - Many cameras and deployment locations on a site
    - Camera and sensor remote management
    - Camera power options
- **Thermal camera selection:**
  Try different cameras in the environment
- **Solution architecture:**
  - Communication options
  - End-to-end data flows and protocols used
  - User access
  - Vendor remote access for support
  - Security requirements
- **Understand how**
  the granular details play into the bigger picture
- **Vendor risk assessment:**
  Assess vendor's security posture to determine their ability to predict, prevent, and respond to cyber and physical threats

Georgia Power recommends partnering with a company that can provide a lasting solution that allows for expansion and enhancements as industry and organizational knowledge of thermal analytics matures.

Results and Future Plans

Power Intelligence's thermal imaging monitoring and advanced analytics solution is meeting Georgia Power's expectations. Since deployment, it has identified locations to investigate. Proactively monitoring in real-time allows Georgia Power to schedule shutdowns and make corrections.

Making repairs before a catastrophic failure occurs avoids unplanned costs and customer outages. Preventing major outages at high-profile venues maintains a company's credibility and reputation.

When the continuous thermal monitoring solution identifies a reading beyond the threshold, Georgia Power sends a technician to check with a handheld thermal camera and has found that the accuracy and reliability of the continuous thermal monitoring system's data is consistent with the field technician's handheld readings.

Georgia Power plans to evaluate deploying thermal monitoring systems at other high-profile venues.

https://www.power-intelligence.com