

# Intuitive AMI Analytics for Greater Reliability and Efficient Operations





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# Intuitive AMI Analytics for Greater Reliability and Efficient Operations

## Introduction

Without analytics, public power and electric cooperative utilities have been blind to much of what's happening on their distribution networks. Even with advanced metering infrastructure (AMI), a team of data scientists was required to turn power-quality data into actionable insights for improving grid reliability or business operations. Until now.

A [primer](#) published several years ago by an IEEE Working Group explains that power quality data analytics is what will enable “killer applications” of AMI data.

“It is just a matter of time that large-scale waveform-level data will be made available to utility companies,” the presentation summarizes. “It is likely that the waveform monitoring networks will emerge as a powerful platform for power system monitoring, in parallel with SCADA, WAMS and AMI.”

That time has arrived for Tantalus customers. TUNet Grid Reliability Analytics performs advanced waveform monitoring to provide community-owned utilities with easy-to-understand recommendations for:

- Improving operational efficiency and cutting costs
- Increasing customer satisfaction
- Reducing regulatory and hazard risks
- Informing strategic decision-making

## Key Takeaways

- A rapid solution to meet rising expectations for power quality
- A prioritized approach to preparing the grid for future extreme weather events
- An intelligent system for optimizing the work of limited staff and field crews
- A simple way to present compelling data for infrastructure investments



## Utilities Deserve This Help

The work of public power and electric cooperative utilities is more challenging than ever as budgets and staff are squeezed, the distribution grid becomes more complex, and service expectations continue to rise. Sustained outages receive the most urgent attention, but the cumulative impact of momentary outages is [arguably more problematic](#). In 2005, researchers at Lawrence Berkeley National Laboratory estimated momentary outages of less than five minutes cost the U.S. economy \$52 billion—twice the impact of sustained outages.

Since 2005, the number of outages and the economic costs have only increased. For instance, a [Ponemon Institute study](#) estimated the per-minute cost of a power outage at a U.S. data center increased from \$5,617 in 2010 to \$8,851 in 2016. Traditional manufacturing industries like plastics, semiconductors and perishable foods also stand to lose thousands of dollars in product as the result of momentary outages. As a result, economic development in a community is linked to the utility's ability to provide uninterrupted service.

Advanced home electronics mean a community's residential customers are also more sensitive than ever to minor power blinks. With millions of customers working and schooling from home because of the COVID-19 pandemic, disrupted Internet connections have become more than just a minor inconvenience. The power needs of community hospitals are even more critical. Back-up generators kick in to power medical equipment during sustained outages, but just a 30-second outage can be dangerous to a patient on a ventilator.

Utilities propose capital investments to upgrade equipment, but they often lack the data necessary to convince budget-minded city managers and coop boards. Then there's the challenge of fixing aging infrastructure. Utilities often find themselves stuck in a reactive cycle—patching up one problem before scrambling to cover the next—while doing their best to get ahead of never-ending maintenance cycles. It doesn't help that staff numbers are constrained, and baby boomers are retiring, taking their skills and network knowledge with them.

**“We designed TUNet Grid Reliability Analytics to give the benefits of advanced smart grid operations to utilities that don’t have a dedicated team of data scientists and engineers to perform analytics.”**

**Frank Geiger,  
Product Owner,  
Tantalus Systems**



**Email notifications link to anomaly reports like this one with all the necessary information for quick investigation or assignment.**

Distributed generation promises to complicate the distribution network further, while also cutting into revenues, and a string of equipment failures, storms or other problems can cause overtime costs to get out of hand quickly. As if these problems weren’t enough, increasing wildfires and extreme weather events have caused an intense new set of worries for distribution utilities who desperately need solutions for mitigating legal and catastrophic risks.

## **Fortunately, We Can Work Smarter**

Data analytics is the key to addressing the array of challenges utilities currently face. Tantalus developed a simple analytics solution for public power and electric coops that don’t have the same financial and human resources of large corporate utilities. It can be used to quickly investigate one-off distribution problems, or employed comprehensively to optimize the work of every field crew and justify every strategic investment.

“We designed TUNet Grid Reliability Analytics to give the benefits of advanced smart grid operations to utilities that don’t have a dedicated team of data scientists and engineers to perform analytics,” said Frank Geiger, the Tantalus engineer who led the development of the tool. “Backoffice staff and field crews can use the tool to make day-to-day investigative and maintenance tasks simpler. Or they can just set it and forget it.”

The TUNet analytics tool continually monitors power-quality in concert with all TRUEdge-enabled meters and devices. When a branch touches a line, or equipment begins to malfunction, the system registers even small anomalies in the waveform data. When a pattern is detected, the system sends an email notification with a link to all the information necessary for quick investigation. This means the tool begins delivering actionable recommendations to a utility from day one, even before staff members integrate its other capabilities into their daily routines.

# Get Ahead of the Work

TUNet Grid Reliability Analytics enables proactive planning and decision-making. It provides a new perspective of a utility's distribution network that is inherently forward-looking. That said, its historical-data visualizations also can demonstrate the before-and-after effects of capital projects. Other advantages include:

- Reduce overtime by fixing emerging problems during business hours
- Prioritize work by tracking MAIFI and CEMI scores for individual feeders
- Set it and forget it with automated alerts for emerging blinks and flickers
- Perform quick investigations through seamless integration with TUNet Insight
- Collaborate efficiently by assigning reports for investigation or resolution
- Quickly find problems in the field with geospatial mobile support
- Avoid wasted truck rolls by easily validating meter groupings

## A Proactive Perspective on the Grid

TUNet Grid Reliability Analytics gives utilities a new perspective on their distribution networks that can fundamentally change how they approach business. The tool drives improvements in system reliability and operations that can be grouped broadly into four areas.

### 1. Getting Ahead of Equipment Failures

Distribution equipment produces tell-tale signs of emerging problems long before failure. Corroded meter sockets and splices, cracked insulators, failing transformers, and other latent equipment problems all become visible with TUNet Grid Reliability Analytics. In the past, customer complaints were the only indication that equipment on the edge of the grid was about to fail. Now, software algorithms spot flickers in power quality that customers might not even notice.

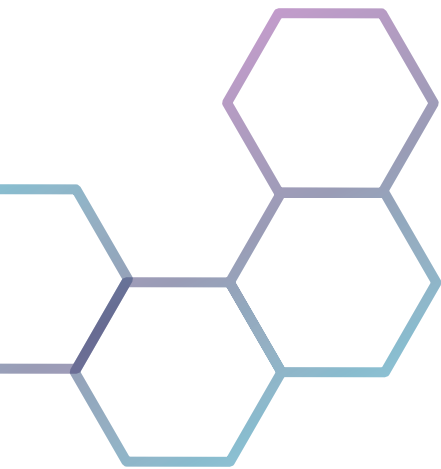


Problem areas of distribution reliability

Crow Wing Power is a member-owned cooperative utility based in Brainerd, Minnesota with around 43,000 meters and 100 employees. Many of the co-op’s members own vacation homes in the rural service territory but live most of the year in metropolitan St. Paul. The analytics tool enables Crow Wing to spot problems and perform repairs when members are away. “Now we can chase down blinks on our timeline instead of when members call about them,” said Crow Wing System Operator, Bill Swenson.

Upon implementing the tool in September 2020, Crow Wing found numerous faulty meters that needed to be swapped out, as well as loose connections at transformers and meter bases. Field crews addressed the problems while out on line patrols, which they regularly perform during the slower, off season. With time, this proactive approach to fieldwork will reduce the amount of overtime required to respond to outages in the middle of the night and on weekends. Plus, by replacing or repairing equipment before a failure occurs, the utility will avoid more costly damage and outages.

“It opens up lots of opportunities for us, and there’s definitely savings from the cost of line crews,” Swenson said. “Overtime hours, mileage on trucks, maybe even having to call an operator in during the middle of the night—it can exponentiate really fast in terms of savings.”





## 2. Raising Operational Awareness

The primary benefit of TUNet Grid Reliability Analytics is a new, more-granular perspective on grid performance. The ability to zoom in or out on any element in the distribution network can drastically simplify operations and customer service. For instance, if a customer calls to complain about a persistent power blink, staff can use the tool to quickly determine whether the problem is on the utility's side of the meter, or the customer's. In the past, that important determination might require numerous truck rolls and hours of field work.

If the source of a blink is on the utility's equipment, the analytics tool can be used in the back office, or by crews in the field, to pinpoint the location. This is particularly valuable in large, rural territories where visual inspections can take hours if not days to complete—often across rugged terrain. Plus, the tool can be used to validate whether or not the cause of a blink is within a substation or further upstream on other equipment that may not belong to the utility.

With integrated weather and microclimate analysis, TUNet Grid Reliability Analytics also can rule out isolated weather events or guide the installation of lightning arrestors in vulnerable locations. The tool's high resolution weather visualizations reveal lines that are regularly affected by high winds where additional tree work might be required. The tool notices anything that faults a power line even briefly, so it can even be used to test the effectiveness of animal guards against yearly bird migrations or squirrel activity.

Matt West, Manager of Engineering for Crow Wing Power, said ultimately the tool is beginning to change the operational stance of the organization. "Now, we can be more proactive," he said. "We're not just reactive, especially in the eyes of our co-op members."



### 3. Orienting to Equipment in the Field

Geospatial awareness is key to the intuitive user interface of TUNet Grid Reliability Analytics. What that means is the tool provides contextual information about the distribution equipment surrounding a user's actual location in the field with a mobile device, or a virtual location selected on a map by a user in the back office.

With tablet in hand, a crew member can step out of the truck and walk straight to a meter that's indicating a problem, greatly improving the speed of field work. The tool's map will follow the tablet's location in the field, giving quick and easy access to satellite views and overlays of surrounding meters, transformers, phases and other mapped assets. That means no more exploring from house to house and pole to pole, trying to determine what equipment is where.

In the back office, the same geospatial awareness determines what data appears across charts, graphs and other data-fields on the TUNet dashboard. When an engineer clicks on a meter or other mapped device, all visible charts and tables automatically update with the data relevant to that device and location on the grid. This simple, but powerful feature allows for quick and intuitive investigations of anomalies or strategic questions.

"We wanted the tool to anticipate the investigation a person is trying to perform and populate the necessary information with a single click," Geiger said about designing the user interface for TUNet Grid Reliability Analytics. "By making the tool as intuitive as possible, the user can actually learn the tool and the grid's performance characteristics at the same time."

Because TUNet Grid Reliability Analytics tracks a high volume of minor outages and anomalies all over the distribution network, it's also the ideal tool for auditing meter metadata. Using the tool's data visualizations to validate and cleanup mislabeled meters will put an end to wasted truck rolls caused by grouping errors in a utility's outage management system (OMS) or other source of truth.



*“We’re using the tool to prioritize capital project planning. Now, I’ll be able to show before and after data shots to our town manager to demonstrate how tax dollars are being spent effectively.”*

**Sarah Clark,  
Power and Communications  
Administrative Assistant,  
Town of Estes Park,  
Colorado**

#### **4. Strategic Planning and Reporting**

Scheduling equipment replacements and tree trimming based on demonstrated need instead of time, is the most obvious benefit of TUNet Grid Reliability Analytics. But it’s just the start of how the tool can be used to prioritize and justify field work and capital projects. After TUNet analytics have revealed problem locations and suggested their likely causes, a utility can rank the severity of the problems by generating index scores like MAIFI or CEMI for each discrete problem-section of the grid.

Alternatively, the analytics tool can help a utility prioritize upgrades based on the business impact of a particular part of the distribution network. It does this by determining and displaying what types of customers are on each feeder. TUNet’s analytics can differentiate the locations of industrial, commercial and residential customers, enabling the kinds of strategic decisions and information-sharing that make communities more attractive to businesses and directly impact economic development and future revenue.

Due to the increase in solar power and energy efficiency technologies, electricity demand in the U.S. could drop by as much as 15% in the U.S. by 2025, [according to Accenture](#). The loss in utility revenues was calculated at between \$18 billion and \$48 billion, but individual utilities—particularly in under-developed communities—can offset the losses by prioritizing infrastructure that enables economic development and growing their commercial and residential customer bases.

“We’re fortunate not to have a big issue with blinks, so we’re using the tool to prioritize capital project planning,” said Sarah Clark, the power and communications administrative assistant for the Town of Estes Park in Colorado. “Now, I’ll be able to show before and after data shots to our town manager to demonstrate how tax dollars are being spent effectively.”

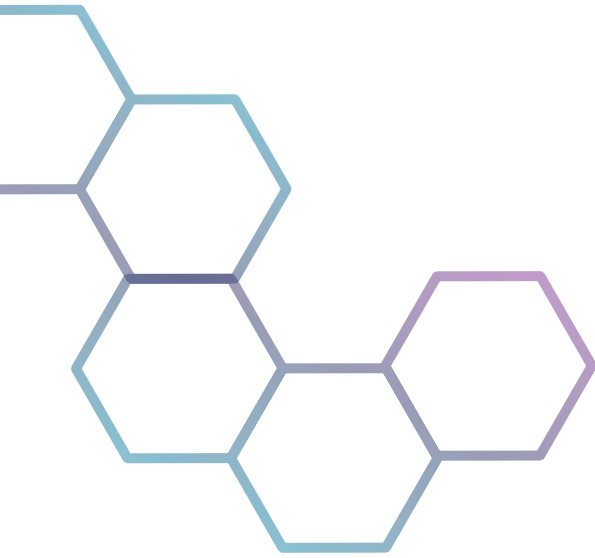


TUNet Grid Reliability Analytics is built around powerful data visualizations that make investigations and reporting more intuitive to the average user or layperson. Utilities can use the tool to make compelling, visual presentations with historic data from days, weeks or months in the past. In addition to measuring the impact of their work on sustained outages, with TUNet's analytics they finally have a tool to quantify the impact on momentary outages as well.

A 2016 [study in the Proceedings of the National Academy of Sciences](#) estimated that climate change has caused an extra 4.2 million hectares of wildfire damage in the western U.S. since the 1980s—nearly double the amount that would otherwise have been expected. PG&E declared bankruptcy as a result of wildfires in 2017 and 2018 that claimed the lives of 86 people and generated the potential for \$30 billion in legal liabilities.

On January 28, 2020, John J. MacWilliams, a senior fellow at Columbia University's Center on Global Energy Policy and former Chief Risk Officer for the U.S. Department of Energy, [testified](#) before the U.S. House of Representatives Committee on Energy & Commerce on what he called the first "Climate Change Bankruptcy."

He noted that while other factors contribute to the ignition of wildfires, the power sector can be expected to both cause more intense wildfires in the future, and be susceptible to them. "This can occur when distribution or transmission lines fail in high wind or other harsh weather conditions, igniting nearby vegetation and sparking rapidly spreading wildfires," he said. "However, wildfires can also be damaging to electric utility companies by causing physical damage to energy infrastructure, disrupting power service, and even leading to severe financial distress."



In conclusion, he recommended “thoughtful investment in technology and infrastructure” that can modernize the grid to make it more intelligent and responsive in the face of climate threats. TUNet Grid Reliability Analytics is such an investment. Utilities deploy reclosers on distribution lines to limit the length and scope of outages caused by faults. While this has been a valuable tactic, it inherently reduces a utility’s awareness of where vegetation is encroaching on power lines. TUNet’s analytics restore that visibility and much more. In preparation for fire season—or even in the middle of it—a utility can correlate historic data on wind and anomalies to identify exactly where tree work is urgently needed. In doing so, they can also reduce the fire risk associated with using reclosers and reduce the need for pre-emptive blackouts.

## How to Seize the Advantage of Analytics

TUNet Grid Reliability Analytics is simple to set up for a utility on the TUNet platform. Within hours, it will be monitoring all the high-resolution interval data produced by every TRUEdge-enabled device in their network. From day one, the tool will reveal equipment in the early stages of failure and other emerging problems, and with time, the reliability and cost benefits will deepen as the utility integrates TUNet’s analytical capabilities into day-to-day operations.

To learn how simple it is to launch TUNet Grid Reliability Analytics, or to schedule a demo, contact a Tantalus salesperson.

LaCommare, Kristina Hamachi, and Joseph H. Eto. "Cost of Power Interruptions to Electricity Consumers in the United States." Energy, Vol. 31. Elsevier: April 7, 2005.



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