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NRECA

America's Electric Cooperatives

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Using NRECA's RBG WebApp To Improve Reliability & Efficiency

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NRECA
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Introduction

Distribution Reliability – *Just the facts Ma'am*

Many Rural Electric Cooperative mission statements read something like: Our "Rural Electric Cooperative" provides its members safe, reliable electricity at the lowest reasonable cost.

However, reliability is much less intuitive than either safe or low cost. Reliability is measured in cryptic indices like SAIDI, SAIFI and CAIDI. These indices are not only cryptic, but they are also calculated in what is sometimes confusing mathematics. Few people understand terms like 2½ Beta method or the difference between IEEE 1366 compliant scores and regular scores. Add to that confusion the concepts of Major Event Days and 5-minute exclusion and you've got a perfect storm of confusing terminology.

Let's start by defining the basics:

SAIDI – System Average Interruption Duration Index

This is the amount of time the system is without power over a period of a year. This is measured in minutes. A SAIDI score of 50 tells us that, on average, the distribution system has been unable to deliver energy for 50 minutes in the past year.

SAIFI – System Average Interruption Frequency Index

This score tracks the number of outages an average customer has experienced in the previous year. This score is measured in incidents. If the SAIFI score is 1.37, this means that the average consumer has experienced just over 1 outage incident in the previous year.

CAIDI – Customer Average Interruption Duration Index

This is the amount of time an average customer is without power over a period of a year. This is measured in minutes. A SAIDI score of 25 tells us that, on average, any given customer has been without power for 25 minutes in the past year. Of course, your individual experience may be different.

5-Minute Exclusion

Outages under 5 minutes are considered momentary and are not counted in the above indices.

IEEE 1366 Standard

This is the standard that is applied to distribution reliability. This standard governs how we calculate SAIDI, SAIFI, CAIDI as well as Major Event Days. It is a bit complex, so let's just agree that if you have questions regarding IEEE 1366 you are welcome to contact me (Tony Thomas Tony.Thomas@nreca.coop 703.850.4718)

Major Event Days (MED)

Major Event Days are calculated as described in IEEE 1366. If you've heard of the "2½ Beta method" this is where that calculation is found. Don't worry, we use a specially constructed

software to do this calculation as it is famous for breaking Excel. In essence, the Major Event Day calculation tries to tease out the days that should be excluded from SAIDI, CAIDI and SAIFI due to the unpredictable nature of nature. Think hurricanes, floods and tornados. These types of events occur on an infrequent basis. MED is calculated on a 5-year rolling basis.

OK, now we know the basics. And, we have a better understanding of the complexity of the scores and their underlying calculations. But, what does this mean? How do I interpret the scores?

To better understand the meanings of the scores and enable us to interpret what the indices are telling us, let's look at our friends in the manufacturing business. Specifically, let's take a look at quality control practices. We all know that quality control is important, and we can learn a great deal about managing distribution reliability by leveraging some quality control techniques. Quality control techniques teach us to interpret data over time. It is critical to see how our product changes over time. In this case our product is the delivery of energy to our consumers.

The first thing to understand is that SAIDI, CAIDI and SAIFI are snapshots in time. Without context, these snapshots don't tell us much. It's much more effective to consider these indices as data trends over time.

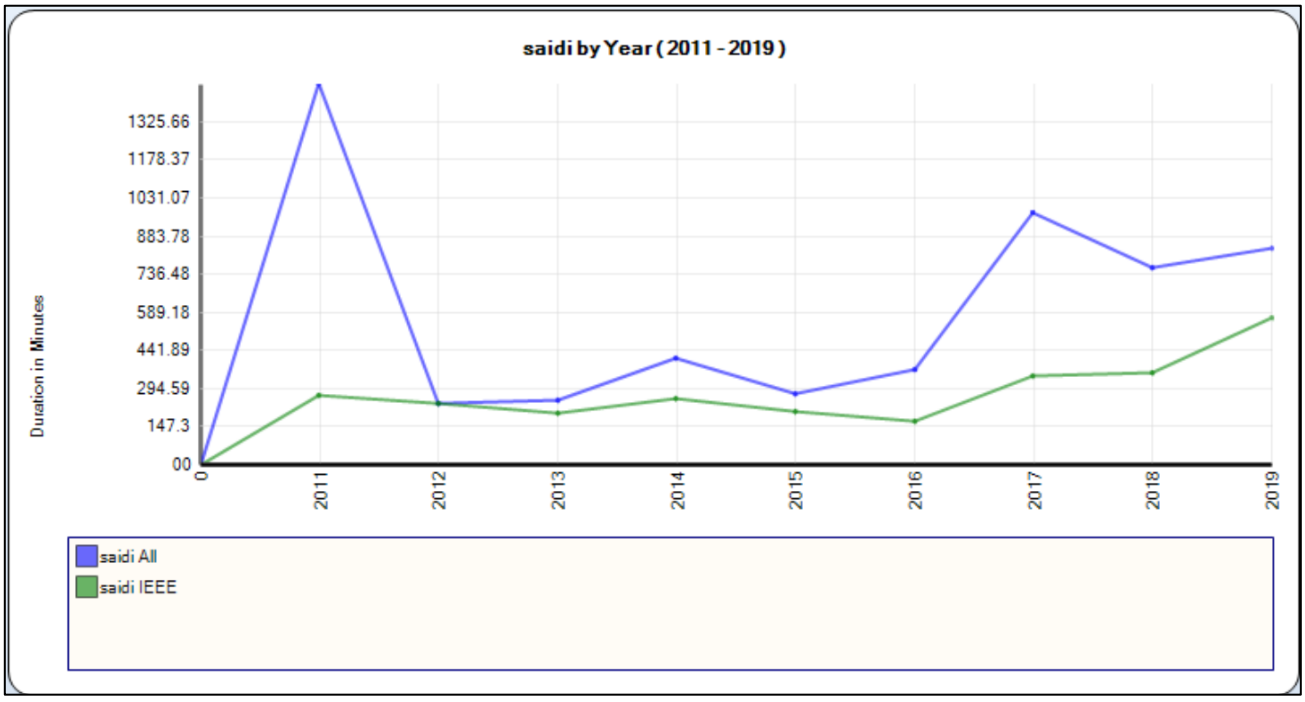

Figure 1: Example of Trends of SAIDI and IEEE SAIDI

The above graph tells us a great deal about this cooperative. The blue line is what I will refer to as "raw SAIDI" and the green line is "IEEE SAIDI." The difference between the raw SAIDI and IEEE SAIDI is the smoothing effect of removing Major Event Days. We want to remove those unpredictable events, so that we can see the underlying reliability trend.

Note that in 2011, this cooperative had a series of major events that negatively affected the ability to deliver energy. However, the Major Event Day calculation smoothed out the IEEE SAIDI score, so that 2011 is essentially consistent with the next several years. Also, note that the IEEE SAIDI score is fairly consistent from 2011 to 2016. Then something happens in 2017 and the IEEE SAIDI score jumps. Then it jumps again in 2019. We know something is wrong… We don't know what's wrong, but the data trend is rising. Constant or a dropping score is what we're looking to achieve. SAIDI is like golf. What we want is a low score.

Looking at this graph we can tell instantly that something has affected this cooperative's ability to consistently deliver energy to consumers. Let's take a look at the SAIFI graph for clues as to the problem.

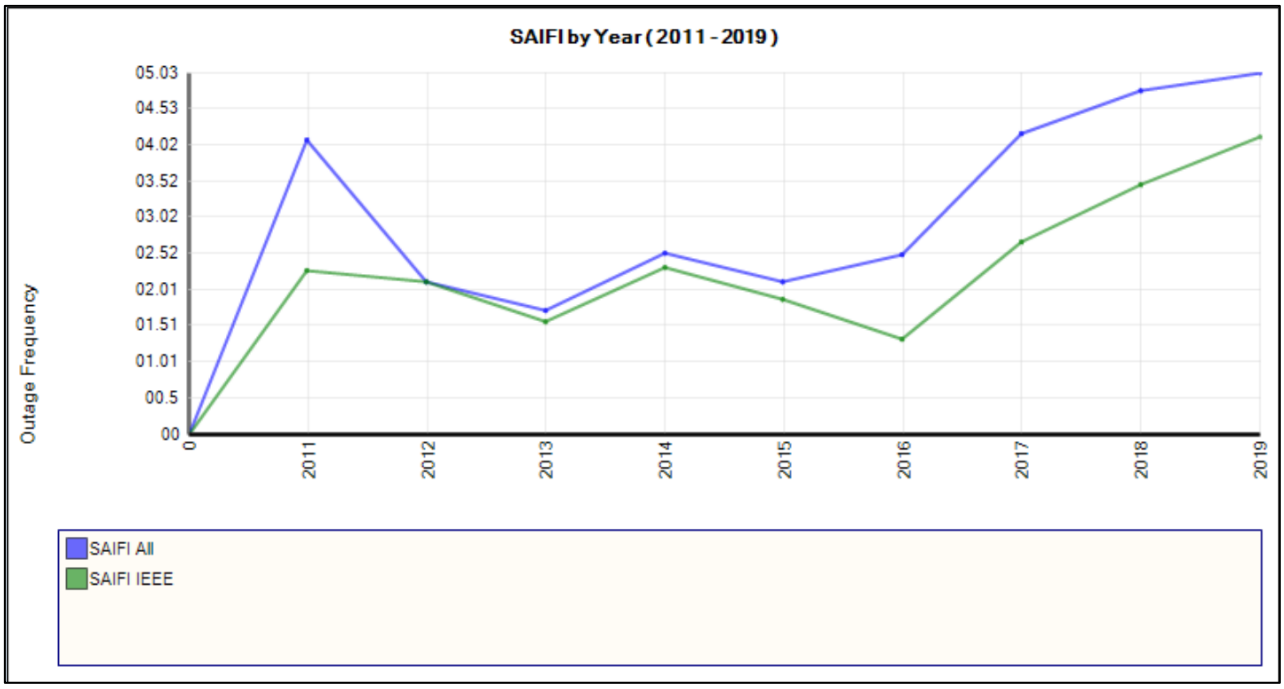

Figure 2: Example of Trends of SAIFI

Again, we see that the years between 2011 and 2016 the SAIFI score is relatively consistent. Then there is a rise in SAIFI in both 2018 and 2019. Again, we don't know exactly what has happened, but we do know that the frequency of outages is increasing, and that increase isn't tied to unforeseen events like we see in 2011. What we see is a constant rise in outages and this should be cause for alarm.

I show you these graphs because, as you can see, an individual score without context is basically meaningless. You really need to see the data as it trends over time to understand how the system is performing.

Here at NRECA, we understand that this is both a difficult subject and even more difficult to manage, so we do an annual Distribution Reliability Study to help members better understand how reliability affects the operations of the utility and, ultimately, the bottom line. To that end, we provide participants in the

annual Distribution Reliability Study access to the best distribution reliability calculation software on the market today. Did I also mention that we pick up the tab? Yes, access to the basic version of this software is free. NRECA pays for your access.

You've heard from me, but what are your peers saying?

Keep reading to find out about the experiences and insights from four co-op collegues on how the use of advanced analytics is transforming their management of outages and reducing costs.

Case Study 1: Wheat Belt Public Power District

In January 2020, Wheat Belt Public Power District, a 5,016-member utility headquartered in Sidney, Nebraska, joined the **NRECA Reliability Benchmarking Group (RBG)**. While viewing a demonstration of NRECA RBG WebApp (powered by PwrMetrix) functionality in late 2019, Wheat Belt CEO, Tim Lindahl, quickly recognized that the tool could improve his decision-making and help his utility maintain quality service in a more cost-effective manner.

"I'm a firm believer in data analytics, it's part of my background [in information technology]. As a small utility, the only way to survive the pressures we face is to become more efficient – and data is a key to that efficiency," says Lindahl. "Small utilities have tended to fly by the seat of the pants – with a tool like this, we all can make better decisions."

Wheat Belt found value in RBG WebApp's core attributes: one, as a tool that can help utilities improve the process of calculating SAIDI (System Average Interruption Duration Index) and other reliability indices, and two, for the opportunity it provides to see how Wheat Belt's reliability stacks up against other utilities.

"I feel that, in the way we have historically been collecting and reporting on our outages, we've been missing key aspects that could make the information both more accurate and more valuable," says Lindahl. He hopes that the use of RBG WebApp will resolve what he believes is a ***misrepresentation of his utility's reliability***. Wheat Belt serves slightly more than two meters per mile over a huge (3,600 square miles) and sparsely settled section of the Nebraska panhandle. A good portion of its services are irrigation pumps and stock wells. When winter storms sweep across the panhandle, Wheat Belt crews concentrate on first restoring power to homes. "We'll get service restored to our residential accounts in 12 hours or less, and leave the irrigation sets and other seasonal accounts until later. But those still count as outage hours in the overall data and it reflects poorly on us in the reliability indices," says Lindahl.

Since 2011, NRECA RBG WebApp supports a growing national reliability database for electric cooperatives (with detailed but anonymous data reported on each participating utility). This database allows co-ops to compare their reliability to other cooperatives anonymously by size, state and region. Lindahl sees similarities to the National Rural Utilities Cooperative Finance Corporation (CFC) key ratio trend analysis of financial health. "***If I can get an apples-to-apples comparison to systems similar to us, our true peers, we can identify areas where we can improve***."

"One thing that ***RBG WebApp has invalidated is a perception held by our Board of Directors that our reliability had decreased***. Looking at the information, we are now obtaining from RBG WebApp we can show that the actual trend is completely the opposite. It can seem like we are battling outages all the time. But, when you normalize the major weather events we have been hit with, the data shows that the frequency of major outage events have gone down over time."

Overall, Lindahl says "the ***greater value may be in correcting misperceptions or shining a light on issues that were overlooked***. It may allow us to reverse course [in some areas] and ***make more prudent investments in future***."

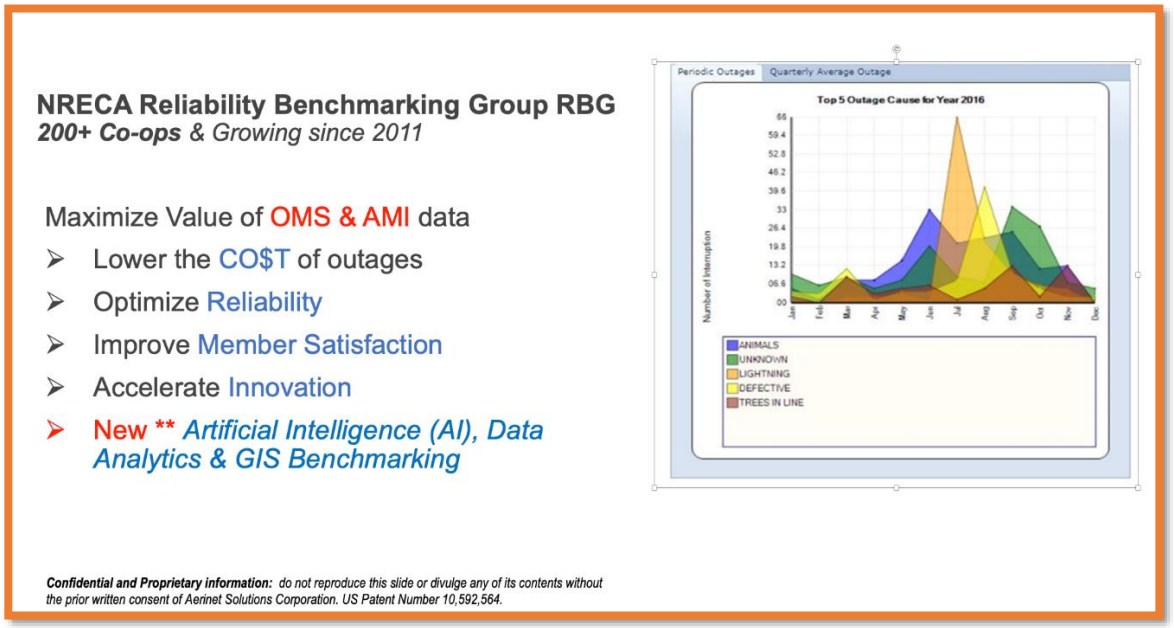

Figure 3: Presentation Slide of the the Benefits of the Reliability Benchmarking Group

Case Study 2: Homer Electric Association

Maintaining accurate and useful reports on reliability was long a source of frustration at Homer Electric Association, a 32,000-member cooperative in Homer, Alaska. Jim Cross, Homer Electric's engineering supervisor, notes that over the years the cooperative had difficulty extracting data from various outage management software and then faced a manually intensive means of calculating reliability using Excel and Visual Basic. "We were struggling with our calculations," he says.

Cross also says that Homer Electric was not unlike a lot of cooperatives across the country when it came to making productive use of the information it did collect. "It seems to be a common practice," he says. "Co-ops calculate their SAIDI and CAIDI (Customer Average Interruption Duration Index) every few months. We show them to the Board and then it gets filed in a cabinet."

Two years ago, in a meeting with other co-ops and members of the research program at **NRECA's Business and Technology Strategies (BTS) department**, Cross found inspiration. "**Tony Thomas (of BTS)** said to us – '***There is all this amazing information that you can coax out of your system data – why aren't you doing it?***'" That led to Homer Electric deciding to try the RBG WebApp tool to calculate reliability.

The difference was immediately apparent. "I know firsthand how many hours I used to spend coming up with our reliability numbers using that old spreadsheet. RBG WebApp has taken care of the backend reporting. ***I don't have IT guys tied up four hours a month uploading data – it's done quickly and in a more timely manner through RBG WebApp. I don't have to wait to the end of the month for the data I need – I have it ready to use the next day***."

It is delivered in a format that is effective when sharing with senior management and the board of directors. "We now have the ability to use geographic data and display it graphically," says Cross. "When you put a table of numbers up on the screen, frankly that doesn't engage decisionmakers. But, if you can display the data in a visual format, where you can see the feeders throughout our service territory color-coded depending upon the relevant conditions, you get their attention."

Homer Electric is starting to use data to "***geographically target where we'd be better off spending our dollars***." Cross notes that "in cold weather we experience a high failure rate with porcelain, with cut-outs in particular. Our typical way of addressing these failures in the past was to change out equipment here and there as it failed. Now, I'm starting to take our outage data and attach it to maps, so we can determine where would we be better off replacing cut-outs as preventative maintenance."

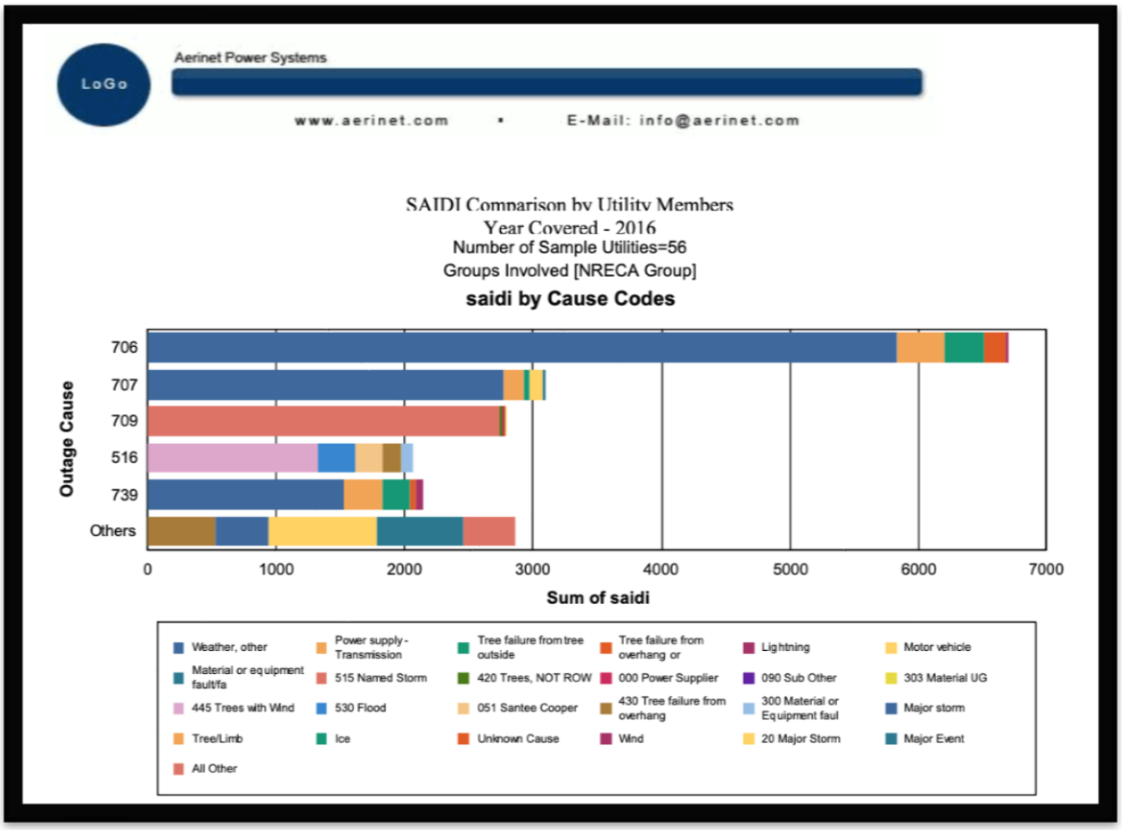

Figure 4: Example Graphic from RBG WebApp for Homer Electric Association

Case Study 3: Heartland REMC

Before Heartland REMC, a 17,400-member cooperative in Markle, Indiana became a RBG WebApp user in 2014, Mike Kelsey, operations supervisor, had a different view of the task of calculating reliability. The reports coming out of the co-op's outage management system were "a bunch of numbers that were boring to look at, especially if you tried to show them to senior management or the Board," he observes. "And if you are not looking at them every day, they were rather intimidating."

With RBG WebApp, "***the tool puts those numbers into graphs that are much more visually appealing. Our CEO shows them to our Board and they clearly tell a story***. I can compare our reliability to other co-ops, to investor-owned utilities, here in the Midwest or in other regions," says Kelsey.

Heartland REMC is using RBG WebApp to identify problem areas within its utility system, pinpoint the causes of outages, and undertake a preventative maintenance program. "We discovered that the top cause of issues on our worst-performing feeders was animal-caused outages, usually from squirrels," he says. In 2019, Heartland REMC crews "blanketed those feeders with animal mitigation," says Kelsey. That included placing black wrap on poles to prevent claws from gaining grip, squirrel guards on bushings, and coated jumpers on pole top devices.

"By this summer, we'll be able to evaluate the impact of our measures – Has the dynamic shifted? Have we reduced animal outages?" He says that the co-op will continue to track its reliability reports to identify issues and plan for future changes.

In January 2020, the process of migrating data from the outage management system to RBG WebApp was made much easier with the establishment of a ***MultiSpeak® integration of Milsoft's OMS and RBG WebApp***. Inspired by their success with RBG WebApp, Heartland and several other Indiana electric cooperatives launched an Indiana reliability benchmarking group in 2019 to share experiences and discuss ways to expand the use of operational data. The group has now had three "roundtable" calls with from six to 12 co-ops participating in each call. "We talk about how we used the software to pinpoint issues, how we focused our dollars on solutions. We have more co-ops interested in joining in us in future meetings," says Kelsey.

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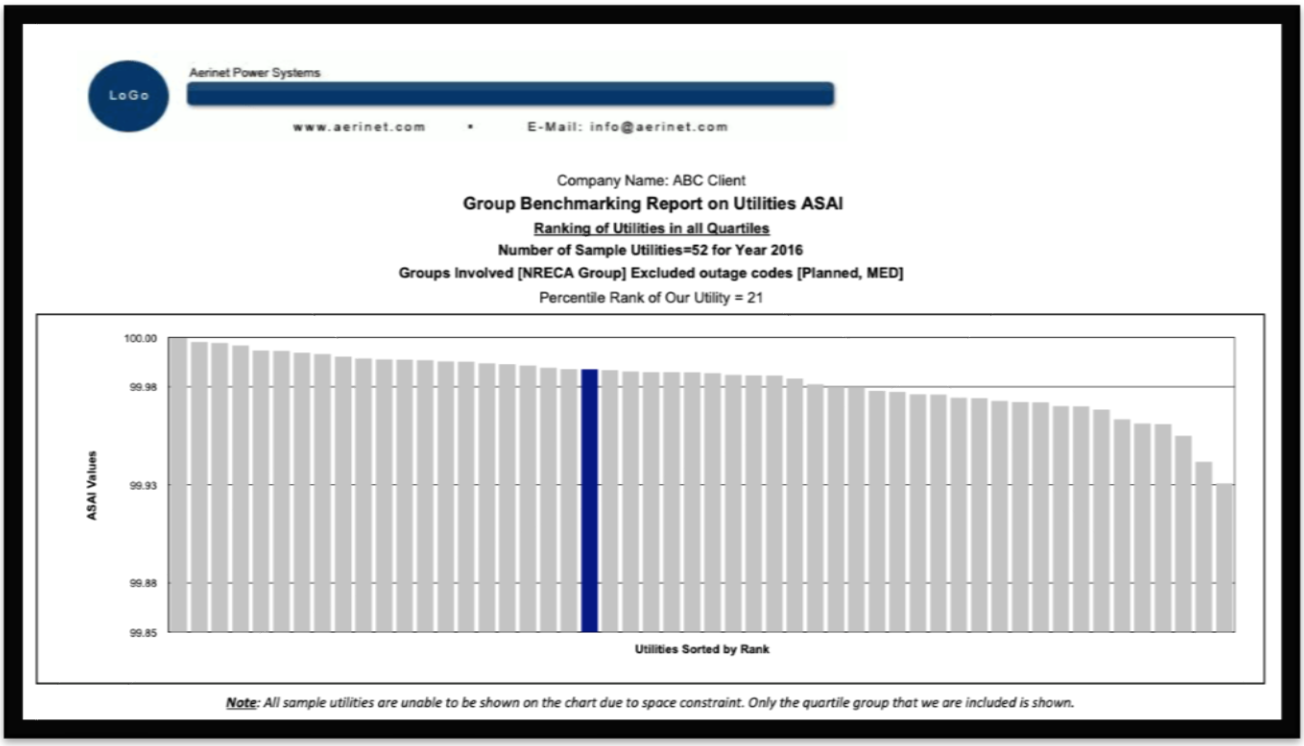


Figure 5: Example of Ranking Analysis Available Through the RBG WebApp

Case Study 4: Cobb EMC

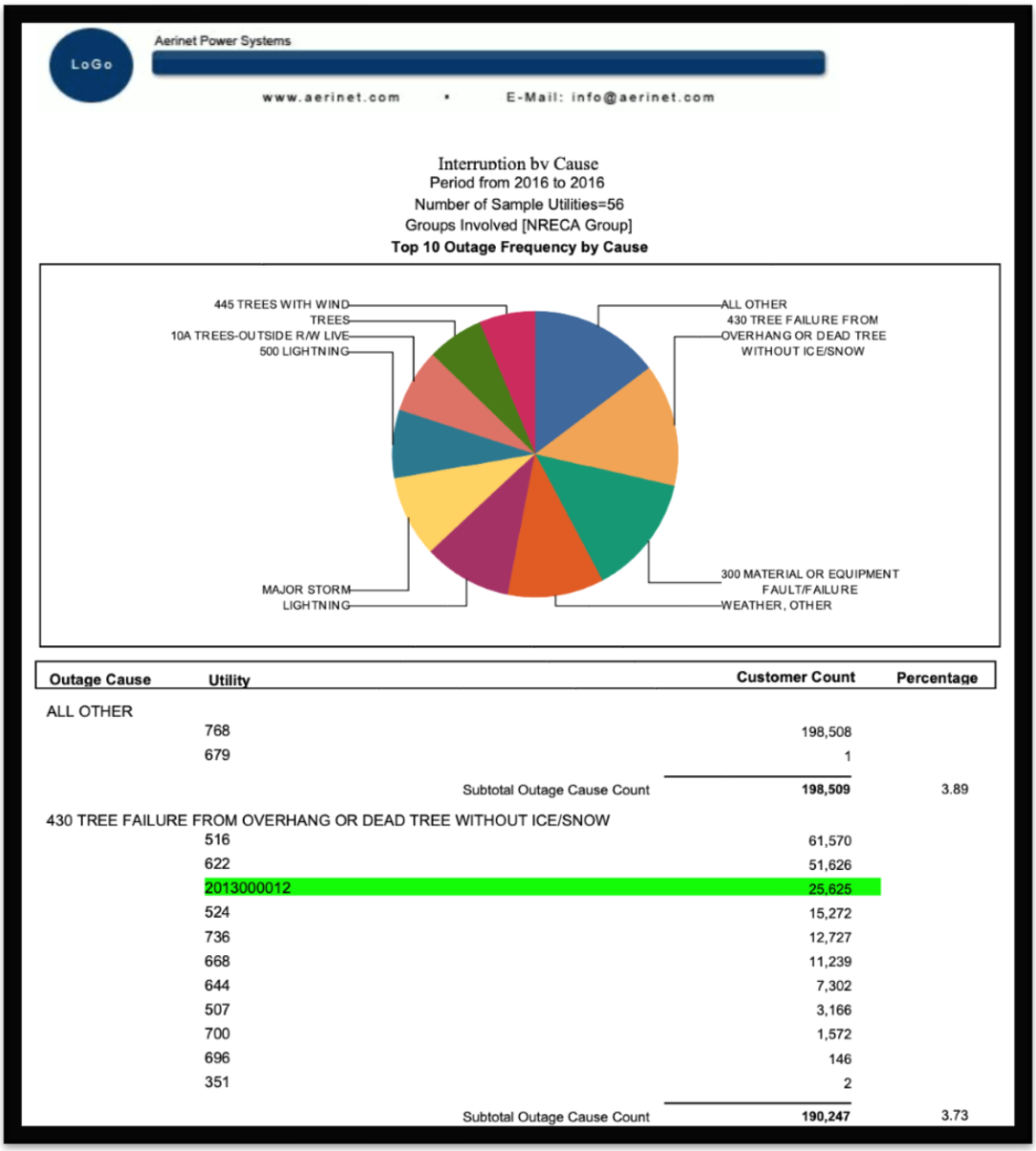
Cobb Electric Membership Corporation, a large (206,000-member) cooperative serving just outside Atlanta, Georgia, received positive attention recently for its innovative use of data in a practice called **consumer segmentation**. With segmentation, Cobb EMC can accurately assess the preferences of different groups of consumers for products and services. But, Cobb EMC has also been addressing consumer service through data analysis in another way in recent years, through its use of the RBG WebApp software to address outages and improve reliability.

Before a recent promotion to manager of distributed energy resource strategies at the cooperative, Manish Murudkar oversaw distribution system protection and planning at Cobb EMC for six years, which included the introduction and initial use of RBG WebApp in the task of calculating and addressing reliability.

Before using RBG WebApp, Cobb EMC experienced annual outages per consumer of more than 40 minutes, according to the SAIDI calculations. ***With the proactive system maintenance undertaken as a result of the information obtained through RBG WebApp, the SAIDI numbers have dropped into closer to 30***. Murudkar notes that this has moved the co-op into third in the nation among utilities participating in distribution reliability benchmarking by IEEE.

"The use of RBG WebApp improved our productivity in calculating reliability, "says Murudkar. ***With analytical reports "delivered with a flash of your fingers,"*** Cobb EMC is able to drill down into the causes of outages. He says that RBG WebApp "helped us identify the major issues – animal-caused outages, storms and vegetation – and pinpoint which feeders are the worst performing." With this information, Cobb EMC made changes to its vegetation management program, designing and implementing a right-of-way program that covers all cooperative feeders on a five-year cycle.

"Our industry is changing, and using and understanding data is becoming more important to our future," says Murudkar. "Benchmarking is one of the keys to tracking our reliability. A tool like NRECA RBG WebApp ***helps us understand where we need to direct our resources to make a positive difference in our service and in the eyes of our consumers***."



Outage Cause	Utility	Customer Count	Percentage
ALL OTHER			
	768	198,508	
	679	1	
	Subtotal Outage Cause Count	**198,509**	3.89
430 TREE FAILURE FROM OVERHANG OR DEAD TREE WITHOUT ICE/SNOW			
	516	61,570	
	622	51,626	
	2013000012	25,625	
	524	15,272	
	736	12,727	
	668	11,239	
	644	7,302	
	507	3,166	
	700	1,572	
	696	146	
	351	2	
	Subtotal Outage Cause Count	**190,247**	3.73

Figure 6: Example of Graphic from the RBG WebApp Showing Outage by Cause

Conclusion

The four case studies within this report are among many examples of how an advanced analytics tool provided to participants of NRECA's Relibility Benchmarking Group are is being used to increase reliability and decrease costs.

You too, can join NRECA's Relibility Benchmarking Group. It's easy, and there is no cost to NRECA members.

For more information or to join the NRECA Relibility Benchmarking Group, please contact:

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Visit our website at: https://www.cooperative.com/programs-services/bts/Pages/Secure/Reliability-Benchmarking-Group.aspx

Additional Resources

- **NRECA Reliability Benchmarking Group Website**
- **RBG Overview**
- **RBG Benefits Overview**
- **Tech Advisory: The Importance of SAIDI Number** (Sept. 2017)
- **Tech Advisory: Distribution Optimization: It's Not Your Grandfather's Distribution Cooperative Anymore** (Oct. 2017)

WEBINARS:

- **SAIDI and RBG Webinar Slides** (June 2018)
- **RBG Webinar Video Recording**