IMPLEMENTING A SUCCESSFUL VEGETATION MANAGEMENT PROGRAM ON AN AI-DRIVEN TECHNOLOGY PLATFORM

By Brian Flage, Business Manager and Hari Vasudevan, Founder and CEO, Think Power Solutions

Vegetation management (VM) is often the single largest line item in a utility maintenance budget. There are 5.7 million miles of transmission and distribution cables across the U.S., and controlling the growth of trees and plants around them is necessary for ensuring uninterrupted utility service. It is estimated that U.S. utilities spend billions of dollars each year to maintain vegetation located near utility infrastructure.

According to Edison Electric Institute, the size of the investor-owned utilities' Industry Capital Expenditures was valued at $139.8 billion in 2020. Another report published by FTI Consulting, Inc.—through its work for the National Rural Electric Cooperative Association and National Cooperative Services Corp.—found that electric cooperatives contributed $60.3 billion of capital investment between 2013 and 2017. Based on past performance, expectations are that these numbers will grow at a rate of 15–20% each year. Any additional capital investment in the country's infrastructure could significantly increase the size of the VM budgets and, hence, the market for the relevant technology platform to manage these services.

Despite the billions of dollars that utilities spend on VM programs, trees and plants continue to be a primary challenge for utilities globally.

VEGETATION MANAGEMENT AND ITS CHALLENGES

Outside influencers of a VM program—budget, severe weather, fire concerns, public and political pressures, labor issues, and regulatory requirements—can quickly cause a program to deviate from its intended track. The more pressure these outside forces exert on the program, the easier it is to lose sight of the fundamentals. Over time, utility vegetation managers can find themselves busy with a flurry of activity and still without the desired impact. Regardless of whether a utility is on a cycle, budget, or compliance-based program, each has a desired goal for the year (call it "the plan"), and being able to continually monitor the progress of the plan is crucial.

This is where a robust technology platform can provide continuously updated insight. By properly documenting the details of work being performed, along with frequent checks of system vegetation conditions, it is possible to maintain the necessary awareness of how work is progressing against the plan. This data coupled with powerful analytics tools, and more recently supplemented by AI and machine learning, helps the modern manager schedule "just in time" work by identifying areas of elevated risk, factoring in current vegetation conditions, weather, and other location specific dynamics.

POWER OF THE TECHNOLOGY PLATFORM

Despite the billions of dollars that utilities spend on VM programs, trees and plants continue to be a primary challenge for utilities globally. Vegetation may account for more than half of externally initiated power interruptions. This shows a need for better collaboration and data-gathering platforms tailored to the workflows in infrastructure-related industries such as utilities, telecom, and construction.

A technology platform that enables stakeholders to rapidly gather critical data, perform business analytics, and present the findings in a dashboard to allow executives to manage projects and risks in real time is mission critical. Dashboards,

data grids, mobile connectivity, and analytics allow real-time tracking of VM engagements both for on-site project managers and off-site program oversight personnel.

From an operational perspective, VM data tends to fall into two general categories: (1) system vegetation condition data and (2) work activity data.

1. SYSTEM VEGETATION CONDITION DATA

Data pertaining to the vegetation on the system can be obtained from various sources. This type of data is used to set budgets and priorities, plan what type of work is needed, and decide where it needs to be done.

OUTAGE RECORDS

Most outage management systems provide useful information about interruptions that have occurred. Since this is an existing system at most utilities, it is commonly used to help make VM program decisions.

PROS:

- As an existing system, it is essentially "free" to use
- Data helps quantify the impact that vegetation is having on overall system reliability

CONS:

- Details are often lacking (e.g., "Tree in line" is a comment that is often used in an outage report, but lacks specificity—perhaps it was a grow in or fall in, alive or dead, in ROW or out.)
- Trees are frequently over-blamed when true root cause cannot be determined
- Outages only relate to problems that have already occurred—of little use for prevention

LIDAR

Captured via helicopter, fixed-wing plane, or UAS (unmanned aircraft systems), LiDAR (Light Detection and Ranging) can provide a very detailed assessment of vegetation conditions.

PROS:

- Direct measurements obtained via LiDAR are highly accurate
- LiDAR data, once collected, has uses beyond VM

CONS:

- LiDAR data acquisition and processing tends to be quite expensive, which can limit its use
- LiDAR measuring equipment and data processing is all highly specialized and is therefore not a "do-it-yourself" solution

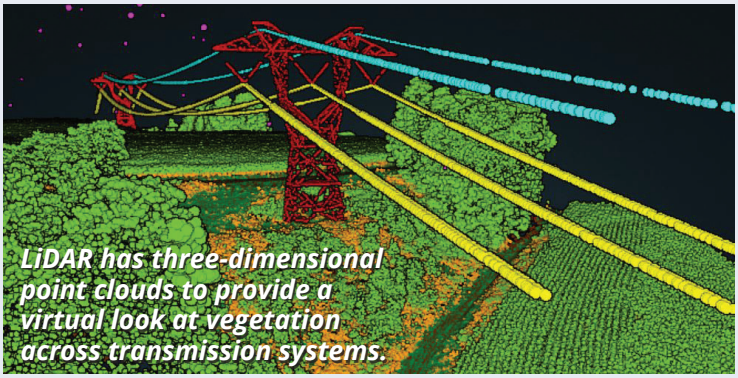
SILVER LEVEL

FirstEnergy

LiDAR Supports Vegetation Management at FirstEnergy

FirstEnergy operates nearly 300,000 total circuit miles of transmission and distribution lines that serve more than six million customers in five states, which makes pruning trees and controlling vegetation vitally important. FirstEnergy's vast footprint requires managing vegetation across a large territory, including the norther Ohio farmlands, the Pennsylvania woodlands, the mountains of West Virginia and Maryland, and the wetlands of New Jersey—each region with unique challenges.

In 2010, FirstEnergy began using Light Detection and Ranging (LiDAR), a remote sensing application that utilizes infrared light from lasers to measure distances and identifies potential clearance concerns along transmission lines. FirstEnergy's familiarity with LiDAR, plus advancements in data analytics, prompted their vegetation management (VM) group to explore the feasibility of integrating LiDAR into its existing program. Today, LiDAR provides critical data to support the company's VM program, collecting and processing data on more than 13,000 corridor miles ranging from 69–500 kV.



LiDAR has three-dimensional point clouds to provide a virtual look at vegetation across transmission systems.

VM has integrated aerial imagery, vegetation clearance information, and LiDAR three-dimensional point clouds to provide a virtual vegetation clearance "understanding" across the transmission system. These data sets provide numerous benefits, such as enhancing worker safety—a core value. LiDAR helps pinpoint vegetation that requires immediate attention, reducing field inspections for foresters, and it identifies field conditions before forestry workers arrive. Dead trees are identified through imagery and an artificial intelligence algorithm to reduce manned helicopter vegetation patrols.

FirstEnergy's transmission department is also utilizing the engineering grade LiDAR data acquired by the VM group. Fewer data-acquisition flights reduces both exposure to personnel and costs.

Going forward, FirstEnergy's VM staff plans to utilize LiDAR as a springboard, looking forward to advancements in LiDAR technologies, imagery resolution, artificial intelligence, satellite imagery, and predictive modeling to optimize a cycle-based approach to maintenance work that will provide customers with safe, reliable, and affordable electricity. ■

SATELLITE IMAGERY

The commercial availability of high-resolution (sub-meter) stereoscopic and multispectral imagery now provides a new source of information to the utility vegetation manager.

PROS:

- Faster and cheaper than LiDAR in collecting data for large areas
- The speed of acquisition and relatively low cost can allow for more frequent data capture

CONS:

- The image processing used for VM is still an emerging technology and the results are often not as reliable as those from LiDAR
- Areas of potential concern often must be field verified prior to sending a crew to perform work

FIELD SURVEY

Utilities can still acquire condition data by sending people to the field to collect it.

PROS:

- Can be part of a formal work pre-planning program
- Offers a great deal of flexibility
- Easier to complete in-house
- With a good data acquisition tool, work can be completed quickly
- Can be less expensive than other options

CONS:

- Large projects may still require contract resources
- Field survey reliability is limited by perspective (i.e., what they can see from where they are)

2. WORK ACTIVITY DATA

Once work commences, it is important to document the work and monitor progress of the plan. This is a crucial but often overlooked step. Outside forces will almost certainly begin to pull resources away from their planned activities as budgets change, unanticipated tree growth or mortality occurs, or political pressures require dropping everything to relocate and perform work in a new area. Information collected about work activities help a manager determine if and how severely these changes have impacted the overall progress on the plan.

There are several ways to acquire data about current work activities:

Information collected about work activities help a manager determine if and how severely these changes have impacted the overall progress on the plan.

WORK INVOICES

When contractors are performing the work, there is often useful information in the invoices about what was done.

PROS:

- There is no additional cost for this information

CONS:

- Invoices may not contain a great deal of detail
- Invoices often require manual entry of the desired information into another system
- Time lag between when the work is performed and when the information is available
- Detailed locations of where work was performed will generally not be available

POST-WORK FIELD SURVEY

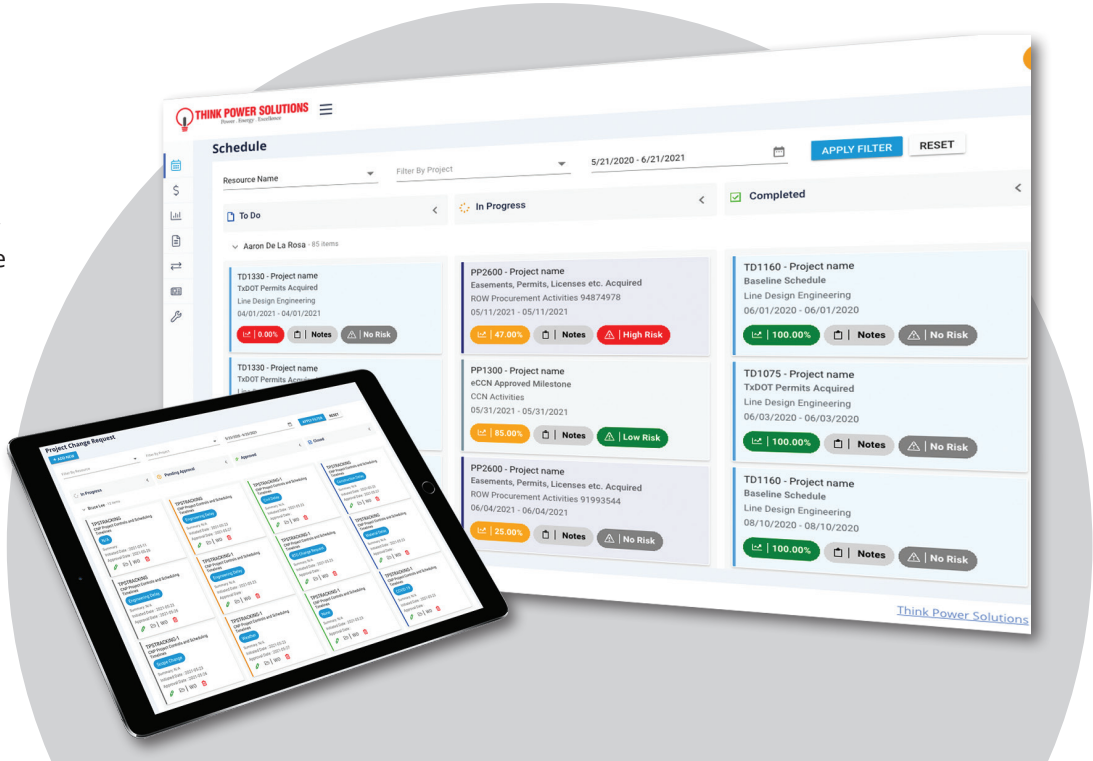
The utility can conduct field surveys of completed work and document the details needed.

PROS:

- This effort can be combined with QA/QC (quality assurance/quality control) inspections

CONS:

- Keeping up with the pace of work completion may be difficult
- Not all work details may be evident to the auditor
- This method often requires extra time and expense



Having a reliable technology platform helps vegetation managers keep track of progress and know when to deploy crews based upon risk level.

CONTRACTOR-REPORTED DATA

Contractors can use a utility-provided mobile software solution to capture details of work performed as they are performing it.

PROS:

- Provides real-time information
- Allows for accurate and detailed reporting of work as it is being completed

CONS:

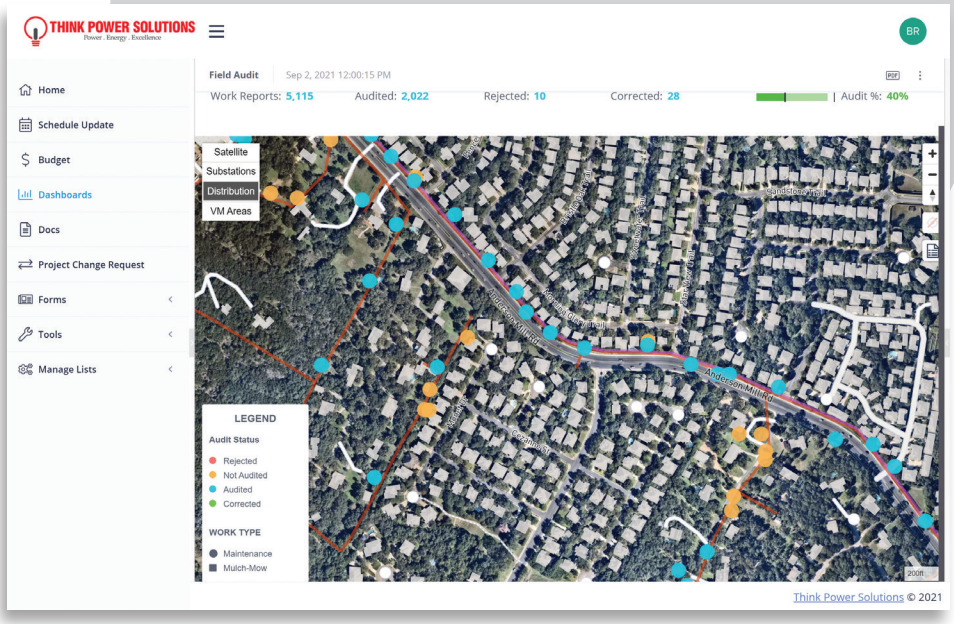
- Some systems can be cumbersome and difficult for field workers to use
- May require purchase of additional hardware, although some systems allow reporting via a phone app

TECHNOLOGY PLATFORM WITH MOBILE DATA COLLECTION, DATA GRIDS, AI, AND DASHBOARDS BRINGS RESULTS

It is safe to say that Microsoft Excel is the most widely used software solution in the VM world. However, to manage large or complex data relationships, make direct updates from the field, or perform in-depth analysis or reporting, Excel is not the best choice. Data alone has limited value. It is the insight that can be gained through analysis of that data that allows a manager to make better decisions. A comprehensive solution built on a powerful technology platform can create real value for a program by extracting useful intelligence from all the data that exists.

VM-related technology is becoming a must-have for utilities, telecom, and other mission-critical industries. Modern software platforms provide real-time project

Data findings presented in a dashboard help executives to manage projects and risks in real time.



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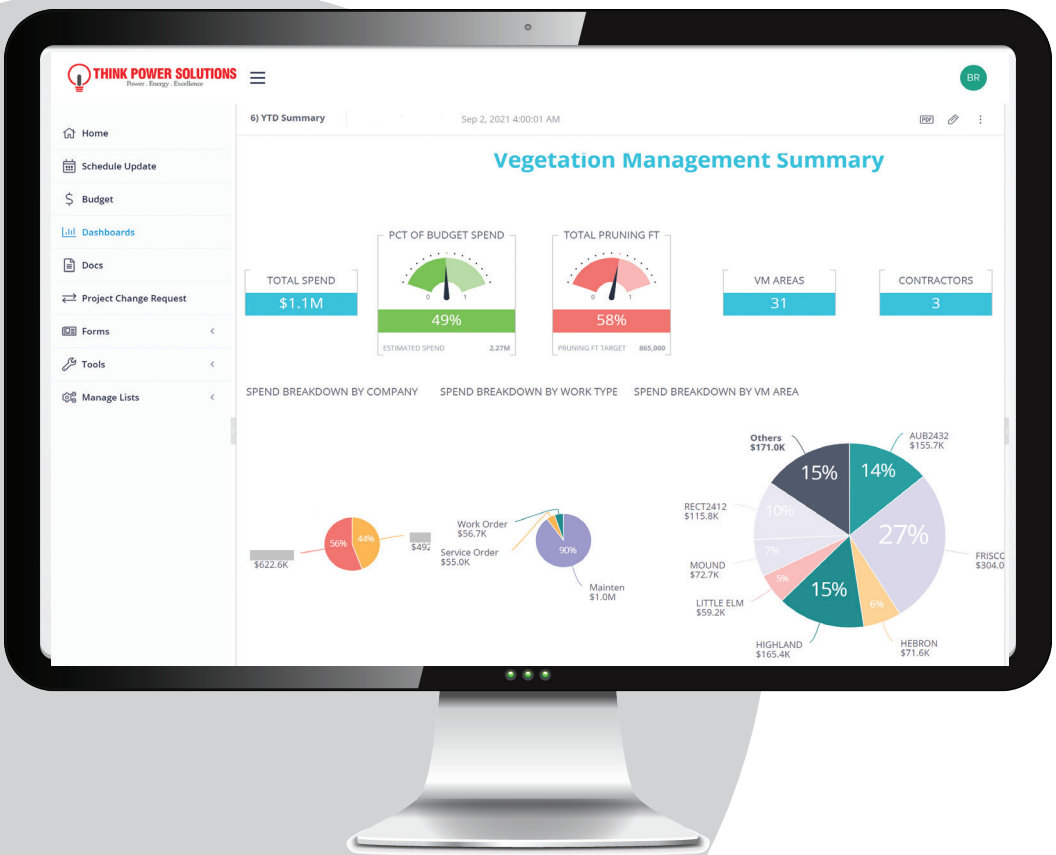

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updates, and AI for business intelligence can provide utilities, telecoms, and other mission-critical industries with documentation that ultimately leads to more effective initiatives. Data security should always be a leading priority and is best achieved by combining several steps, beginning with highly secure logins on devices out in the field and multifactor authentication.

A powerful technology platform goes a long way in capturing, storing, archiving, and retrieving the VM data needed for successful program execution. Digitally capturing all relevant information of a VM situation reduces data inaccuracies, redundancies, and assists with proper archiving after the project is finished. Historical data provides context about the resources, risks and decisions made, and provides a precedent that can help justify the case for future VM program approaches.

AUTHOR BIOS

BRIAN FLAGE, BUSINESS MANAGER

Brian Flage is business manager at Think Power Solutions where he manages field service and technology clients in the electric utility industry and leads the company's VM efforts. Flage identifies new opportunities to improve customer processes using creative technology and field service solutions and has designed custom software solutions and work with development group to deliver projects.

HARI VASUDEVAN, FOUNDER AND CEO

With more than a decade in the industry, Vasudevan has established, led, and managed program teams that provide all engineering, environmental, construction, O&M, asset management, and program management services and support on transmission, distribution, and substation projects across the U.S. He led the identification, bid, capital program management, and execution of the Texas Competitive Renewable Energy Zones (CREZ) program for several utilities. He is also Vice Chair and Strategic Advisor of Edison Electric Institute's (EEI) Transmission Subject Area Committee (TSAC). Vasudevan holds a bachelor's and master's degree in civil engineering and is a registered Professional Engineer in multiple states. ■