

Technology Advances Vegetation Management

Software solutions significantly advance Progress Energy's transmission right-of-way management processes.

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TREES AND THEIR LIMBS MAKING CONTACT WITH HIGH-VOLTAGE TRANSMISSION CONDUCTORS have been a contributing factor in several major power system disturbances in the United States in recent years. These tree contacts have resulted in the loss of multiple transmission circuits in several of the outages, causing cascading events and further weakening of the systems they serve, including shutting down generation capacity.

The Energy Policy Act of 2005 changed the way vegetation managers manage transmission or high-voltage (200 kV and higher) corridors in the United States. A partial intent of the legislation was to ensure that transporters of high-voltage energy identified and eliminated the causes associated with preventable tree-related outages, with the specific goals of preventing line outages from vegetation located on transmission rights-of-way (ROW) and minimizing outages from vegetation located adjacent to ROW. The North American Electric Reliability Corporation (NERC) now tracks and enforces standards related to inadequate vegetation management. Failure to comply with NERC standards could result in fines up to US \$1 million per day for the non-compliant entity.

NEW APPROACHES FOR NEW STANDARDS

Progress Energy (Raleigh, North Carolina, U.S.) recently completed a transmission vegetation management project that was a partnership between its IT department, its transmission vegetation management departments in the Carolinas and Florida, and a third-party contractor, Powel Inc. (St. Paul, Minnesota, U.S.). Because of the new NERC standards in place regarding the management of vegetation on transmission ROW, Progress Energy's transmission was in need of an automated vegetation management system to replace its manual processes. The old paper-based processes required an extensive amount of time and labor to manage. An automated system was needed to more effectively administer the vegetation management program in general, and to more quickly and accurately produce regulatory reports for NERC and audit compliance purposes.

To satisfy this need, Progress Energy purchased a suite of software products from Powel:



ROW maintenance shown in sequence of before, during and after.

ROW Management



Vegetation managers could take vacations if they all looked like this.

- Work management and tracking and scheduling system, Maintenance Manager
- Vegetation work-order management system, StakeOut, which was recently renamed WorkStudio
- Field data-collection tool, service entry sheet (SES), for entering historical system data into Maintenance Manager
- Web-based reporting tool, InfoCenter.

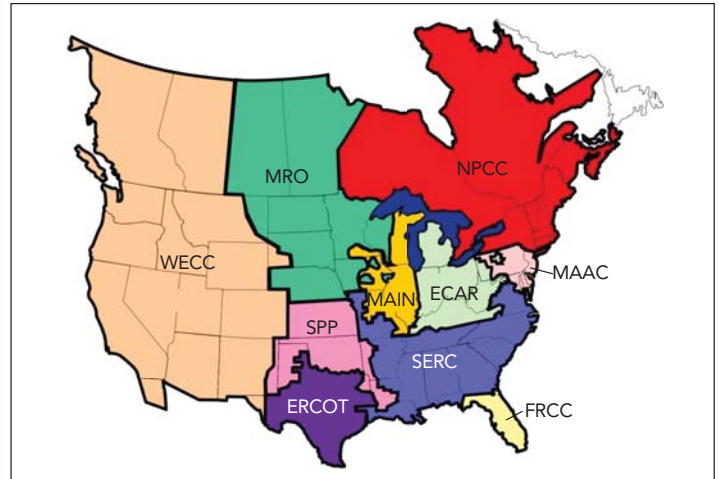
InfoCenter enables an interested party or auditor to retrieve information about Progress Energy's vegetation management program without having access to the other aforementioned software. Access can be limited to the Web-based tool, so contractors who use it only have access to the data, work orders and other information they need to complete their work.

Progress Energy launched the transmission vegetation management project in 2007 to purchase, install, test and deploy the software products. The project also included integrating Powel's software with existing applications used by the transmission department, such as the encroachment tracking system, transmission outage management system and PassPort. Furthermore, Powel's software products also needed to be integrated with the enterprise geographic information system (GIS) data repository maintained by the distribution department. Progress Energy's IT department worked closely with the distribution GIS support team to map data between the GIS data repository and the Powel products, modify the GIS data repository structure as needed and populate the GIS data repository with the requisite data. This part of the project was conducted as part of a separately funded IT initiative.

MULTIPLE CHALLENGES

Most vegetation managers of transmission line ROW have experienced, or know of a colleague who has experienced, a grow-in or a tree-related outage during their career. Many causes contribute to or factors lead up to this type of event, including but not limited to the following:

- Prohibition of the use of herbicides
- Helicopter patrols sometimes fail to identify imminent threats to facilities
- Cycle-busting tree species that grow abnormally fast
- Environmental factors such as nutrient-rich soil types or above-average soil moisture



NERC's Regional Reliability Organization boundaries.

- Transmission tree maintenance operations who fail to identify the imminent threats
- Distribution trimming operations who ignore the need for transmission clearance or maintenance while performing their responsibilities
- Failure to properly identify causal factors for momentary operations or faults that occur on troubled circuits before a major or sustained outage occurs.

Needless to say, vegetation managers face many challenges today. With limited resources and changing regulations, everything associated with their ability to do their jobs is scrutinized when other maintenance organizations that play a similar, or sometimes more important, role with system reliability do not receive the same attention or regulatory scrutiny.

PROGRESS ENERGY'S SOLUTION

With a dynamic staff of utility line clearance and forestry professionals and a new software suite of management tools in place today,



Aerial patrols are the quickest way to inspect transmission line ROW. Progress Energy does most of its aerial inspections with a helicopter.



Arborists inspect ROW with their new rugged Xplore tablets, documenting vegetation issues from the field.



Arborists no longer have to pull tape to measure distance to edge of ROW or a tree. The Trupulse 200 is now a popular tool of choice.

Progress Energy now feels it has the ability to effectively manage its vegetation management program. The Powel tools provide the ability to create and manage cyclical action plans that automatically produce work orders on set intervals. Through the Maintenance Manager system, production and cost data can be captured on a span-by-span basis. Maintenance Manager also tracks expenses for work orders and projects, reports on the completion or status of a work order or project, tracks production data as it relates to reactive and cyclical data by span, and captures reactive and storm expenses with relative ease.

This data-collection process is important because many transmission providers have experienced, or are experiencing, NERC investigations related to an outage caused by vegetation. The first request for all maintenance records pertaining to an area in which an outage occurred (span specific) usually comes from the Regional Compliance Corporation, the regional regulatory arm of NERC and the Federal Energy Regulatory Commission (FERC). Up until this year, Progress Energy manually kept maintenance records in its regional offices. The ability to produce such historical data upon request would take a significant amount of time and effort to gather manually. Furthermore, the existing data (sitting in file cabinets) does little to help prevent an event in the first place.

The Powel tools ultimately will help to schedule and plan all future work regardless of cycle length, location or the forestry staff tenure. They track the actual amount of work performed, on a span-by-span basis, and all costs associated with the work performed. Last but not least, they should ease or increase management's concerns about the program's status, as it pertains to system reliability, by putting real-time reports at their fingertips regarding the status of vegetation maintenance cycles or the amount of reactive work occurring on reportable or critical circuits.

TECHNOLOGY FOR GROUND PATROLS

In addition to the software acquisitions, a new piece of hardware has been introduced to foresters and arborists in the utility field. Xplore Technologies (Austin, Texas, U.S.) was selected to supply a ruggedized pen-based tablet for the collection of field data as it relates to ROW condition. The pen-based iX104C4 Dual Mode tablet comes equipped with an Intel U2500 (1.2 GHz) dual-core microprocessor, 3G memory, and an attached GPS unit enabling the identification of real-time position in relationship to specific structures any-

where on the system.

Powel's StakeOut software on the Xplore tablet gives the integrated ability to use multiple sets of data (GIS, asset, GPS and system-specific historical data) to accurately rank and prioritize work on every span in the system. Previous inspection patrols were done by helicopter three times a year. Recently, Progress Energy replaced one of these aerial patrols with a ground patrol this spring using the new Xplore tablets and software. The information was a little more costly in terms of money and time to generate; however, it was significantly more accurate (three to four times) in identifying tree issues that could potentially become reliability issues.

IMPORTANCE OF ACCURACY

Why is accuracy so important? Recall that failure to comply with NERC standards could result in fines up to \$1 million per day. Aerial patrols typically take place at an altitude of 200 ft to 300 ft (61 m to 91 m) above ground and a speed of about 40 mph to 60 mph (64 kmph to 97 kmph). Visibility of vegetation management issues from the air to the trained eye can often be taxing at best. A blink of the eye or turn of the head even for just a few seconds means a high probability something worth noting may have been missed. Furthermore, it is nearly impossible to get a 360-degree view of how the undesirable vegetation is growing in relationship to the conductors the utility is trying to protect. For example, this early summer ground inspection, as opposed to the spring aerial patrol, found that, on average, three to four times more trees were identified by the assessor as requiring attention within the next 30 days. Progress Energy's conclusion was that an annual ground patrol was well worth the investment.

Additionally, the Xplore tablet and software package gave ground patrols the ability to:

- Collect and share access data with other work units as it pertains to ingress and regress to specific structures
- Document and map encroachments (for example, tennis courts, sheds, mobile homes and fences) that could inhibit accessibility to a specific structure, interfere with the reliability of a specific circuit or add to the utility's liabilities with its mere existence at that location
- Note customer issues or concerns from the field that other work units or contractors should be aware of
- Prepare a more accurate assessment of field conditions for



Knowing what vegetation you have on a ROW and how to access it, day or night, could make the difference between having a safe maintenance operation, or not having one.

contractors to evaluate when bidding on maintenance projects, also known as prescriptions

- Track contractor performance through field audit forms stored within the tablet
- Potentially accept field data (work-type locations of trees on or off the ROW) as an attribute or observation from Laser Technology's (Centennial, Colorado, U.S.) TruPulse 200 laser measurement tool.

ENSURING ACCURACY

The software solution being used also contains an audit process. In order to ensure the data being collected in the field is accurate, the Maintenance Manager automatically creates work orders that require the area forester, or contract arborist, to randomly look at a percentage of the work that was reported complete by contractors during any given quarter. If discrepancies occur with what was found in the audit versus what was originally reported by the contractor, the forester has the option to review more of that contractor's or foreman's work. The audit's objective is threefold:

1. Simply ensure there is consistency from those who collect data in the field
2. Verify that data is complete and accurate to the best of anyone's knowledge
3. Give the ability to compare, evaluate and contrast the contract workforce.

The randomness of the audit is out of the forester's control. This

ensures audits will include all work types being performed in the field and will prevent anyone from cherry-picking contractors or work locations that are easy to get to or evaluate.

LOOKING FORWARD

Although there is no crystal ball to look into to see what the future holds, a couple of things are certain. First, the current regulatory environment is not going away. The NERC standards are almost guaranteed to periodically change and possibly even expand below the current 200-kV and higher threshold under which vegetation managers are currently required to work. Forgiveness for multiple events over time is really not an option. Multiple events impacting service reliability will most certainly be frowned upon by regulators. Now more than ever, vegetation managers must be on top of their game.

The information required for regulators and management alike will require more detailed explanations of issues, field condition and production history down to the span level. Reports must be easily accessible and conform to a multitude of parameters and, most importantly, all data should be verifiable and able to stand up to scrutiny. On average, outages have not decreased throughout the United States since the 2005 energy legislation was enacted. With that being said, vegetation managers should have a competitive advantage to ensure their vegetation management program is world class, and saves their rate payers and investors money. **TDW**

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