

2017 Operations and Construction Highlights



Board of Directors
December 7, 2017

Health & safety

- **Zero** employee lost time injuries in 2017 YTD
- **Safety accident**—Nov. 2, while installing a fiber optic cable on a 115 kV structure in Rutland, a Eustis cable line worker was injured following an apparent electrical contact or near contact—an RCA is under way
- **Three** minor (no injuries) at-fault vehicle incidents in 2017 YTD (~1.9M miles traveled by year end)
- **Third-party review**—ongoing contract with independent third-party safety inspector helps ensure continuous improvement by integrating emerging best practices from across all relevant industry sectors—85 audits conducted in 2017
- **Good catch/near miss** program—employees actively report on “operational experiences”—end-of-day reviews capture work practices identified as needing improvement, efficiencies gained through new and better practices, and hazards to avoid when performing similar work—information is consolidated in a database, cataloged and referenced by job type—data broadcast via email to all frontline supervisors and managers—capturing these experiences is critical to creating a proactive safety improvement program—104 YTD in 2017 (48 good catches 56 near misses)

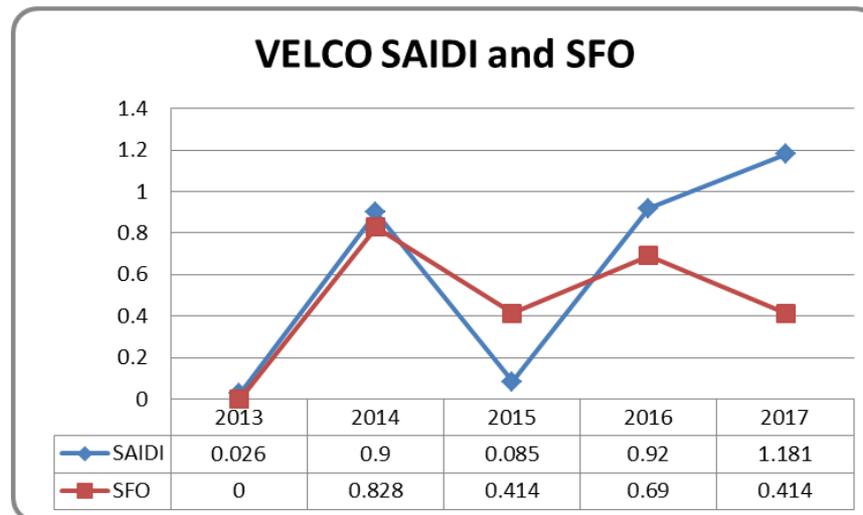
System performance 2017

Three outages impacted distribution customers in 2017 YTD (**SAIDI KPI = Distinguished**)

- Lyndonville, transformer 115 kV lightning arrester failure (5,700 customers for up to 62 minutes)
- E. Avenue, squirrel contact on 13.8 kV bus (1,268 customers for up to 51 minutes)
- North Rutland to West Rutland K37 115 kV line, line worker accident (1,651 customers for up to 34 minutes)
- To mitigate animal outages, 11 animal fences were installed and 5 stations will have “Green Jacket” protection installed in 2018

Three forced outages impacting transmission reliability in 2017 YTD (**SFO KPI = Target**)

- Cold River K32 115 kV line, circuit breaker low air requiring deenergization temporarily
- Chelsea to Granite K51 115 kV line, conductor splice high temperature readings
- North Rutland to West Rutland K37 115 kV line, line worker contact



NERC GridEx IV exercise

- Large-scale electrical grid security and crisis response exercise conducted Nov. 15-16, 2017
- Simulated severe cyber and physical security attacks in North America that created many operational challenges
- VELCO participated utilizing its Emergency Response Plan
- Exercise was months in planning with local and regional entities
- Exercised vulnerabilities for NE natural gas supplies along with loss of several other critical interdependencies such as telecommunication systems
- One quarter of VELCO staff participated, with observers from State Police Vermont Information Center (VIC), VT Bomb Squad, FBI, VT Army National Guard, VT Air National Guard, VT Emergency Management and Dept. of Homeland Security
- Very good observations and feedback with lessons learned
- Next steps: develop an after-action report with identified corrective actions

Live line work capability increase



Transmission line maintenance outages

Maintenance is critically important to reliability

Outages are becoming increasingly difficult to schedule

Main drivers for outage constraints:

- Competing outages with neighboring utility projects
- Stakeholder concerns affecting customers
 - Some outages set system up for single contingency loss of load
- Increased reliability concerns due to recall time of equipment
- Increased number of internal outage/work requests
- Impact to generation
- Weather concerns

What is live line work?

Live line work involves replacement of transmission structures and components without removing line from service

Two methods used to perform this work on VELCO system: **live line stick work** and **bare handing**

Live line stick work

- Linemen climbs pole and uses hot-line stick to control energized conductor allowing for replacement of cross arms and insulators
- Stick work ***has limitations*** based on structure configuration, steel cross arms, conductor weight span and pole conditions
- Extensive rigging is required to perform energized stick work—very time consuming
- Can be accomplished without aerial equipment
- Minimum approach distance must be maintained at all times
- VELCO line crew has 30 years experience and presently replaces 25 to 30 cross arms a year using this method

Live line stick work



Bare hand live line work

- Uses aerial equipment to assist the linemen in replacement of transmission line components
- Bare hand work limited by structure configuration. ***Not all VELCO structures can be replaced with line energized***
- Conductors are controlled with machinery requiring less rigging and less time than hot stick work
- Smaller minimum approach distance allows line workers to touch energized conductor with approved high-voltage suits and tested equipment
- Steel structures and components can be replaced safely using this method
- This is common practice within the industry and many utilities are moving in this direction
- Presently this type of work is only performed by contracted resources
- Requires extensive training, changes in work methods and safety practices, and specialized equipment

Bare hand live line



VELCO bare handing plan

- VELCO is planning to train line crew to become certified in bare handing practices
- Enlist certified trainers to educate VELCO line crew in all aspects of bare handing work techniques and best practices
- Certify all VELCO linemen as bare hand specialists
- Retrofit existing track machinery with all protective measures for bare handing
- Purchase a track machine fully equipped with protective measures for bare handing to replace a 2006 track machine—budgeted for 2018

2018 program development schedule

Q1—Develop VELCO engineering and management criteria and policies for bare handing

Q2—Enlist qualified trainer to work with management and line crew to establish training procedures based on VELCO transmission system—start classroom training with VELCO line crew—begin to retro fit aerial equipment to class “A” rating

Q3—Continued classroom training with line crew and begin actual field training—would also embed VELCO crew with contracted resource for proficiency training

Q4—Receive new class “A” rated aerial bucket—continue proficiency training with contractors—if all goes well, VELCO crew will plan to replace first 115 kV structure using the bare hand work practice

Other operations highlights

- Managed vegetation on approximately 2,500 right-of-way acres and removed over 4,000 danger trees
- Fall windstorm damage on system was minimal—one tree caused a reclose on K24T line—line cleared with no outage
- Continue to support structure maintenance program by constructing access roads including use of construction mats to support access needs and reduce costs
- Continue to secure updated easements on Derby to Highgate line that clarify landowner/VELCO rights and responsibilities, with several significant easements obtained
- Drafted comprehensive business continuity plan that details actions necessary following catastrophic event that impacts daily business operations—includes provisions to ensure continuity of key business processes during recovery operations



2017 capital project program overview

Financial/schedule performance

- Placed capital assets > \$100M in service to improve transmission network reliability
- Completed implementation of PowerPlan to improve project financial and asset tracking and management

Capital project program improvements

- Leveraged features of PowerPlan to evaluate impacts to capital project plan from independent transmission projects
- Continued to advance project staffing strategies to standardize management tools and practices
- Developed “products and services” process, including rates to execute work on billable projects



PV20 Directional Drill

Significant project accomplishments

Line work

- Completed 16 mile K31 line reconstruction
- Replaced over 150 substandard transmission structures
- Completed drilling work and installed PV20 cables in Lake Champlain
- Re-established over 10 miles of corridor access roads

Substation work

- Completed Newport Substation Refurbishment Project
- Completed Hartford Substation Project
- Completed Essex STATCOM Refurbishment Project
- Completed Ascutney Bay Addition
- Completed construction of new Redmond Road support facility
- Significant progress on Chelsea Substation, Ascutney SVC and Pinnacle Data Center projects

Regulatory accomplishments

- Submitted CPG petition for Saint Albans, with petitions for Barre and East Ave and Queen City Projects targeted for December 2017
- Received significant amendments to state permits as well as CPG to allow for necessary schedule recovery work on PV20 project



Significant project accomplishments



Redmond Road support facility—Williston



Newport

Significant project accomplishments



K31 valley view from structure 117



K31 line pulling pad view of structure 124

Significant project accomplishments



Essex Statcom



System planning accomplishments

- Completed the 2018 VT Long-Range Transmission Plan analysis
 - Transmission system able to serve load reliably for next 15 years
 - High-load scenario will not affect load growth for next 10 years
 - High solar PV scenario will cause serious concerns, including thermal and widespread high voltages
- Determined NW VT import limit with Essex STATCOM out
- Completed Ascutney SVC model update analysis
- DU Support
 - Completed Ben & Jerry's load addition analysis
 - Evaluated options to increase Sheffield-Highgate export limits (SHEI)
 - Operational, transmission, subtransmission, energy storage
- Project support for St. Albans, Barre, Essex, Ascutney & PV20
- Worked with ISO-NE on independent generation/ETU projects that may affect VT

Telecommunication & cyber security

- Cyber security enhancements
 - CIP Audit
 - 17 positive observations, 1 recommendation, 0 compliance findings
 - Integrated best practices from EMS/SCADA environment into corporate enterprise network
 - Increased end point desktop security
 - Increased real-time network monitoring capability
- Fiber
 - Replaced leased lines at five sites with fiber, which saves >\$100,000
 - Completed Highgate to Newport link achieving ring protection
- Radio
 - Acquired 750 kHz additional spectrum
 - Rebuilt four existing sites
 - Added Hebron NY site for southwest VT coverage
 - Two system loading tests completed
 - Radio performance during November wind storm would have been excellent except several sites were off line due to FairPoint fiber cut (rodent issue)
- Microwave—upgraded microwave backhaul at 13 radio sites

Conclusion

- 2017 was a productive year but not finished
- Contractor safety has become a major priority
- K31 line completely rebuilt
- Permit applications submitted for St. Albans, and targeted for Barre, East Ave and Queen City Projects
- 2017 challenges—major construction projects
 - PV20
 - CRVP (K31, Ascutney SVC, Chelsea, Hartford)
 - SCI continues through 2018 (Phase 1)
 - Essex Statcom replacement was a great accomplishment and added much capability
- Redmond Road Facility—adds a major storage facility in Burlington area
- Data center work continues
- Developed formal plan to operationalize Vermont Weather Analytics Center features
- Will increase live line capability in 2018
- Engaged on New England Clean Power Link (TDI) and Granite State Power Link (GSPL) Projects to generate revenue/further strategic goals