Georgia Tech NEETRAC
National Electric Energy Testing, Research and Applications Center

NEETRAC NEWS

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In This Issue...

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Cable System Rejuvenation

Cable system rejuvenation technology has been deployed as a lower cost alternative to full cable system replacement for the last three decades. However, utilities would like to better understand the true efficacy of this technology.

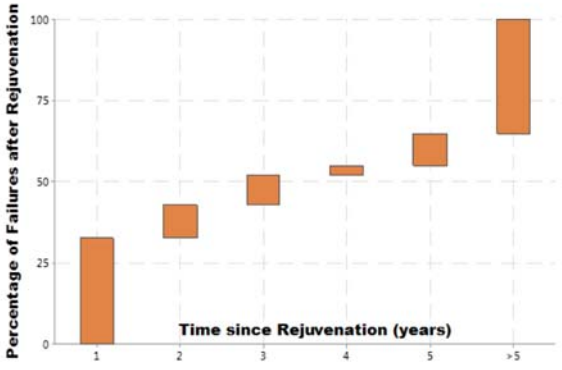
NEETRAC Baseline project #16-048: *Cable System Rejuvenation Forum* provides a novel platform to Members where they can collaborate by raising, sharing, and discussing experiences with cable rejuvenation technology. This is being accomplished via surveys with regular monthly feedback to the participants. The project goals are:

1) Capture the latest experience
2) Expand understanding
3) Update knowledge and data on cable rejuvenation technology
4) Disseminate collected information to NEETRAC Members

Cable system rejuvenation is more than simply injecting the cable with a solution able to permeate through the bulk cable insulation and “repair” water-treed damaged areas. In reality, rejuvenation is a sequential process that requires the successful completion of several steps .

Recent information from the project Technical Advisors and others has enabled NEETRAC to obtain a unique, industry wide understanding of service performance after rejuvenation:

- Approximately 46% of utilities report experiencing a low level (1.7% median) of failures in service after rejuvenation.
- There is a range of times, after rejuvenation, that these utilities start seeing these failures (see figure), however the typical time is around 2.5 years after rejuvenation.



It is estimated that the project contributors have rejuvenated at least 25,500 miles of cable systems in North America.

To participate or learn more, please contact a member of the project team: anil.poda@neetrac.gatech.edu, jean.hernandez@neetrac.gatech.edu, nigel.hampton@neetrac.gatech.edu.

Baseline Projects Recently Completed

The following Baseline project closeouts were presented at the May 2019 Management Board Meeting. The reports will be finalized and distributed to eligible Members in the coming months.

Online Condition Monitoring of Transmission Assets - Scoping Study

Baseline Project Number 17-204

Failure of transmission equipment can cause significant and widespread grid instability or outages. Although many technologies exist for conducting "online" condition monitoring of transmission assets (i.e., OH and UG lines, transformers, GIS, etc.), it is unclear how they are presently being utilized by utilities for condition monitoring and decision making. This project identified the technologies currently available to utilities and surveyed member utilities to determine the technologies that are being used. Case studies of the benefits and issues found by utilities that use the technologies were compiled. A spreadsheet with the details of the available technologies was provided as an interim deliverable to the project Technical Advisors.

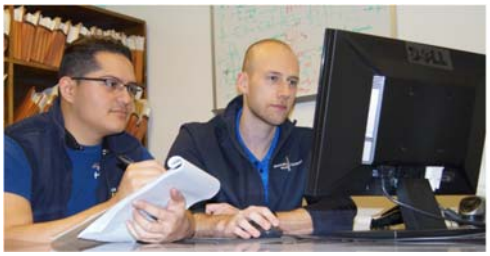
Update of Energy Storage in the Future Grid

Baseline Project Number 17-033

This project reviewed available public domain information and provided an updated overview of energy storage technologies, their performance, and applications. The review included the status of research and development on new storage technologies. Additionally, the business case tool developed in Baseline project 09-126 that examines pricing, applications, and cost information was updated. The new tool developed in this project, NEETRAC Energy Storage Evaluation Tool (NESET), includes multi-objective analysis of storage services and was used to analyze business case scenarios of interest to the project Technical Advisors.

Bus Ampacity & Temperature Prediction Software - Phase II

Baseline Project Number 12-202



NEETRAC developed a new bus ampacity calculation method that will be adopted in the 2021 revision of IEEE 605. This new method is incorporated into NEETRAC's bus ampacity modeling software, BUSAMP. BUSAMP Version 3.0, released in May 2019, now includes web bus and universal angle bus in addition to round, single rectangular and double rectangular bus. BUSAMP 3.0 also includes additional transient analysis functionality, including the ability to continuously vary solar radiation, ambient temperature, current, and wind speed.

Medium Voltage Joints - Research into Endurance in Wet Environments

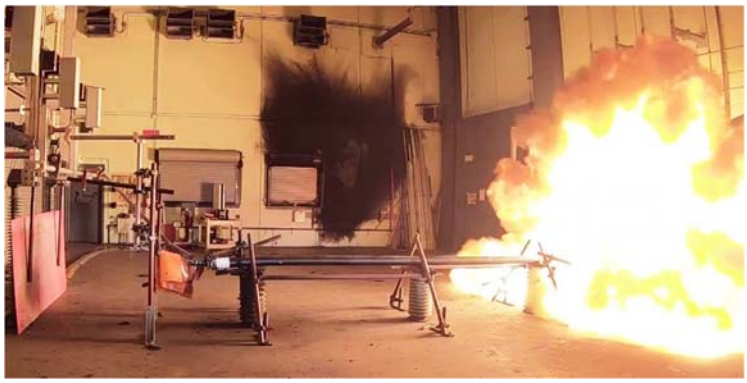
Baseline Project Number 16-061

The standards that govern the qualification test for underground distribution cables insulated with EPR or TRXLPE include a one-year accelerated wet aging test. However, the standard that governs the qualification of underground cable joints includes only a 30-day accelerated wet aging test. Because these two components of an underground cable system are expected to have similar long-term performance characteristics, NEETRAC conducted a one-year accelerated aging test on one underground cable joint design using an aging protocol similar to that used for cable qualification. The results of the joint aging test program were compared to that of typical cable aging qualification results and showed that the two underground system components age differently – at least for the joint type evaluated. This led the NEETRAC Management Board to consider further tests on other joint designs to gain a more in-depth understanding of joint performance under long term accelerated aging test conditions (project #19-091).

Baseline Projects Recently Completed - Cont'd

Arc Fault Resistance of HDPE and PVC Conduits

Baseline Project Number 17-046



Concrete-encased Polyvinyl Chloride (PVC) conduits have been the utility cable duct-bank design of choice for many years. However, directionally drilled cable/conduit systems are increasingly used in place of concrete-encased systems. The NESC requires that duct materials, the construction of the conduit, or both shall be designed so that a cable fault in one duct would not damage the conduit to such an extent that it would damage cables in adjacent ducts. It is accepted that the concrete encased ducts meet this requirement but it is not known if that is true for directionally bored systems that do not utilize concrete or grout. The purpose of this project was to conduct tests to determine if an arcing fault in one cable / conduit assembly can easily propagate through to adjacent conduits and cables. High power fault tests were conducted to determine if directionally drilled cable systems could meet the NESC requirement.

Cable System Fire Proofing Test Program Development

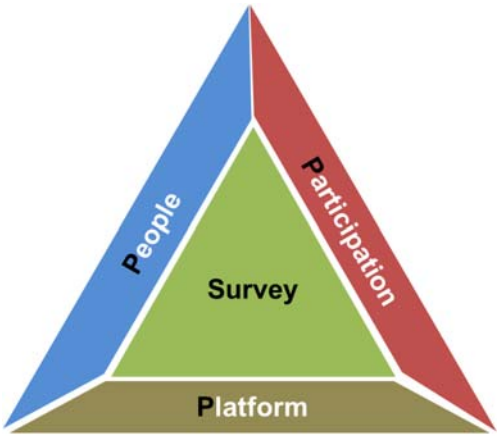
Baseline Project Number 18-032

When an underground cable system fails, the resulting plasma can cause the faulted cable to ignite. In vaults / manholes / tunnels, this resulting fire can damage adjacent cables and equipment. Many different approaches can be used to protect cables from fire; however, currently there is no systematic technique for evaluating the efficacy of those approaches. In this project, NEETRC worked with the project Technical Advisors to develop a test protocol that can effectively be used to establish fire ratings for different cable system fire protection techniques for use in utility cable vaults, manholes, and tunnels.

Optimized Methodology for Collecting Topical Information for NEETRAC Members

Baseline Project Number 18-056

Knowing what other companies are doing with respect to operating practices, material applications, or problem resolution can help Members stay abreast of new technologies and practices or find optimal solutions to everyday operational problems. Many companies do not have the resources to perform benchmarking activities. NEETRAC, with its broad array of Members and contacts, is ideally suited to perform benchmarking surveys. This project developed a methodology for quickly gathering information / data from NEETRAC Members (and others) by utilizing the Subject Matter Expert (SME) database created during this project. The database consists of individuals who have a targeted interest / expertise and can provide Members with meaningful information on a specific topic of interest.



Baseline Projects Recently Completed - Cont'd.

Design Elements for High Reliability Underground Distribution Systems

Baseline Project Number 17-047

Utilities install underground distribution systems as one way to improve reliability (SAIDI / SAIFI). Each use different system design characteristics and industry and NEETRAC data show that reliability improvements vary widely. Thus, it is unclear which strategies a utility could employ to obtain optimal improvements. This project used innovative surveying techniques combined with published studies to identify a number of important design / installation features that utilities use to increase their system reliability while also taking cost into consideration. Manufacturers also benefit from these activities by gaining a deeper understanding of utility experience directly from practicing engineers, which can help them implement new products or system design features.

The major project findings provided:

- A ranking of utility improvement strategies based on SAIDI / SAIFI impact
- Qualitative reliability rankings for different component types (joint, terminations, cables switches, etc.)
- Semi quantitative failure rates for underground components
- User experience (>25) of improvement strategies for the last 5 years
- Utility perspective (20) for likely important trends in the coming 5 years

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Management Board Meetings

The next three Management Board meetings have been scheduled for the following dates:

September 18 - 19, 2019

January 21 - 22, 2020

May 20 - 21, 2020

For details, please visit the Member Section of the NEETRAC website at www.neetrach.gatech.edu.

2019/2020 NEETRAC Member Management Board Representatives

1. 3M……. Mark Hoisington
2. ABB……. Gary Haynes
3. Alumaform……. Pete Landsgaard
4. Ameren……. James Huss
5. American Electric Power……. Jim Salerno
6. BC Hydro……Fred Dennert
7. Borealis Compounds, Inc.……Susan Song
8. Consolidated Edison……. Frank Doherty
9. Dominion Energy……. Bobby Moorhead
10. Dow Chemical Company……Brent Richardson
11. DTE Energy……Najwa Abouhassan
12. Duke Energy……Chris Fletcher
13. Eaton……. Alan Yerges
14. Exelon……. Lisa Perrone
15. FirstEnergy……Randy Coleman
16. Gresco Utility Supply……Brad Schafer
17. Hubbell Power Systems……Jerry Goolsby
18. LS Cable & System……Tim West
19. NRECA……Reed Cooper
20. Pacific Gas & Electric……. Rudy Movafagh
21. PacifiCorp……Douglas Marx
22. PPL Corporation……Emily Haelsig
23. Prolec GE……. Carlos Gaytan
24. Prysmian Group……Bill Temple
25. Public Service Electric & Gas……. Ed Gray
26. S&C Electric……. Salvador Palafox
27. San Diego Gas & Electric……. Christian Henderson
28. Smart Wires……. Haroon Inam
29. Southern California Edison……Herbert Martinez
30. Southern Company……. Michael Pearman
31. Southern States, LLC……. Joe Rostron
32. Southwire Company……. Sherif Kamel
33. Tacoma Power……Joe Rempe
34. TE Connectivity……Brian Ayres
35. TVA……. David Smith
36. Viakable……Raul Garcia
37. WEC Energy Group……Michael Smalley