

Continuous Improvement

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Long Lead Time Spare Equipment The Journey to Reliability, Resilience and Security

Due to challenges like supply chain disruptions, pandemics and security risks, spare equipment has never been more important than the times we live in now.

The loss of long lead time equipment can severely impact an Entity's operations with delays in the supply chain. NERC's annual document (2021 ERO Enterprise Compliance Monitoring and Enforcement Program Implementation Plan, Version 2.0, November 2020¹) discusses potential reasons for long lead times, such as the pandemic, aging infrastructure and others. "The failure to properly commission, operate, maintain, prudently replace, and upgrade BPS assets generally could result in more frequent and wider-spread outages, and these could be initiated or exacerbated by equipment failures."² The purpose of the NERC CMEP IP is to tie risk to the NERC standards.

What are ways to plan for and mitigate spare equipment challenges? This article will provide some insight with several references and organizations you can use to learn more.

NAESB

The North American Energy Standards Board (NAESB) wrote a guide called "ERO Reliability Risk Priorities RISC Recommendations to the NERC Board of Trustees November 2016." Risks that may impact industry's ability to replace or repair critical transmission equipment include natural events and physical security vulnerabilities.

Natural events, such as storms, are impactful, probable, and provide a challenge with spare equipment strategies. NAESB discusses the risk of

equipment damage during these events and warns, "the industry does not have full knowledge or coordination in accessing the existing spare equipment inventory." To mitigate this risk, they suggest, "the Department of Energy, the industry, trades, and forums should identify appropriate mitigations to prevent spare equipment gaps and improve transportation logistics."

Furthermore, the risk of physical security vulnerabilities also may be aggravated by industry's spare equipment inventory and strategy. The NAESB suggests mitigations, such as initiatives to develop a robust spare equipment strategy.

NATF

Regarding ties to NERC standards, the North American Transmission Forum (NATF) ties spare equipment strategy to the NERC standards and starts with TPL-001. Requirement 2.1.5. states, "when an Entity's spare equipment strategy could result in the unavailability of major Transmission equipment that has a lead time of one year or more (such as a transformer), the impact of this possible unavailability on System performance shall be studied."

NATF recommends "strategies for consideration may include but are not limited to One-for-one (i.e., in-kind) for one spare transmission equipment in stores and their availability/mobility, the ability to temporarily move/transfer redundant transmission equipment (i.e., a substation in which no TPL-001-4 system performance deficiencies are caused by temporary movement or transfer of the transmission equipment) until ordered replacements arrive, and available partnerships with neighboring Transmission Planners to cover each other for certain types of transmission equipment."³

¹<https://www.nerc.com/pa/comp/CAOneStopShop/ERO%20CMEP%20Implementation%20Plan%20v2.0%20-%202021.pdf>

² 2021 ERO Enterprise Compliance Monitoring and Enforcement Program Implementation Plan, Version 2.0, November 2020

³ NERC Standard TPL-001-4

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After identifying critical equipment (e.g., power transformers) through analysis and studies, it is helpful to develop field expertise in storing, transporting and implementing a spare.

For example:

- Would removing an old and installing a new transformer require emergency bus outages for clearance?
- Would mobiles be needed during the time-delta, and do you have documented plans on where the mobile would be staged during the work?

These are all important considerations beyond being able to locate the spare equipment. You don't want to be developing the plan in the middle of the emergency.

In addition, the voluntary NATF RESTORE Program⁴ helps ensure that long lead time spare equipment is available when needed. Although voluntary, this program has formal initiatives, such as transmission owners committing to own, maintain and sell to one another available spare equipment (e.g., transformers and potentially other transmission equipment), for an event that results in major damage to the transmission grid.

This program is supplemental to, and not intended to be a replacement for, any current industry programs, such as EEI's Spare Transformer Equipment Program (STEP) or Grid Assurance.⁵

Collaboration

Over the last several years, there has been much collaboration among industry representatives and other agencies through sharing of best practices around spare equipment programs. It is recommended that your organization get involved in this collaborative approach to increase your knowledge and learn from industry peers. Collaboration includes partnering with "key suppliers and customers to synchronize operations to priorities within constraints, deploy an

extended network beyond tier 1 suppliers, and determine levels of collaborative intensity."⁶

Utility Dive recently discussed an initiative by Grid Assurance to ensure spare equipment supplies, especially long lead equipment such as transformers, are "stockpiled" and ready for installation, particularly during urgent and emergency grid reliability situations.

Grid Assurance is an industry initiative to have adequate spare parts inventory on critical long lead equipment. "The U.S. Department of Energy released its Strategic Transformer Reserve Report last year, recommending an industry-led approach. In total the companies involved represent 31 transmission-owning affiliates."⁷

Maturing your Spare Parts Program

Keys for maturing your spare parts program include defining your spare parts requirements and maintaining appropriate spare parts inventory. After an organization identifies its list of historical trends and emerging trends in equipment failure modes, it can adjust or supplement its maintenance program to best prevent the occurrence of these equipment failure modes. It can also use the lists of historical and emerging trends to help define its spare part requirements.

It is important to maintain an appropriate spare part inventory. To do this, an organization can establish a process to purchase the spare parts it needs for the future to maintain the spare part inventory pursuant to the spare part requirements.

Additionally, spare parts can age in inventory, so it is important to track the age and maintenance records for those parts. This will help the organization avoid the unfortunate scenario where a spare part is installed and does not function properly.

⁴ <https://www.natf.net/docs/natf/documents/natf-restore-program-overview.pdf>

⁵ <https://www.natf.net/docs/natf/documents/natf-restore-program-overview.pdf>

⁶ Resilient Spare Parts Management: [Click Here](#)

⁷ <https://www.energy.gov/ceser/downloads/strategic-transformer-reserve-report-congress-march-2017>

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Conclusion

A robust spare part equipment strategy will increase the reliability and resilience of the grid. This takes planning, testing the plan, checking your current state from results of testing the plan, and then acting on any gaps in your strategies (Plan, Do, Check, Act [PDCA], Deming Wheel). Using tips in this article on maturing your spare equipment strategy program will build your program to mitigate the effects of long lead time equipment. Also, collaboration is important to share best practices and lessons learned from your peers and other governmental agencies. Lastly, there is a plethora of articles, guides and white papers developed by NERC, NAESB, NATF and others that will provide more detailed insight on spare equipment strategies. Some are found in this article's footnotes plus the **Learn More** section.

Thank you for reading our CI articles this year. As we ring in the New Year, I hope all of our readers have a happy and safe holiday season!

Learn More

Utilities join grid recovery initiative to stockpile transmission equipment, May, 2018:

<https://www.utilitydive.com/news/utilities-join-grid-recovery-initiative-to-stockpile-transmission-equipment/523709/>

EPRI- Development of Substation Equipment Spares Strategy Methodology, Analytics, and Guidelines, April 2016:

<https://www.epri.com/research/products/3002008655>

MLGW Eliminates Long Lead Times, Dec. 23, 2013, Jason Simon:

<https://www.tdworld.com/overhead-transmission/article/20963909/mlgw-eliminates-long-lead-times>

Grid Assurance Announces Major U.S. Utilities Sign on to Transmission Grid Resilience Solution, May 16, 2018

[:https://www.prnewswire.com/news-releases/grid-assurance-announces-major-us-utilities-sign-on-to-transmission-grid-resilience-solution-300649354.html](https://www.prnewswire.com/news-releases/grid-assurance-announces-major-us-utilities-sign-on-to-transmission-grid-resilience-solution-300649354.html)

Utilities subscribe to Grid Assurance transmission spare parts joint venture, Clarion Energy Content Directors, 5.16.2018:

<https://www.power-grid.com/td/utilities-subscribe-to-grid-assurance-transmission-spare-joint-venture/#gref>

Enhancing the Security of the North American Electric Grid, March 2020:

<https://www.cbo.gov/publication/56254>

