



Long Mountain Substation – 345kV Breaker Replacement, Cable Separation, and Shielding

George Wegh, Eversource Energy

Planning Advisory Committee Meeting

March 24, 2026

Project Summary

Project Drivers

- Two HICO circuit breakers with pneumatic tripping mechanism asset condition concerns
- Existing System 1 (S1) and System 2 (S2) cable systems are not physically separated in the relay & control enclosure, the switchyard trench, and conduit systems. Additionally, cables predate industry design practices for cable shielding and flame-resistant cable materials

Alternatives Considered

Alternative	Description	Cost Estimate
Alternative 1 (Base Alternative)	Replace two HICO 345 kV circuit breakers and install new System 1 cable trenches and new P&C cables from control house to the switchyard. System 2 cables replaced and routed via existing trench system	\$18.48 M (-50%, +200%)
Alternative 2	Replace two HICO 345 kV circuit breakers and install new System 1 and 2 cable trenches and P&C cables from the control house to the switchyard	\$17.55 M (-25%, +50%)

Preferred Alternative

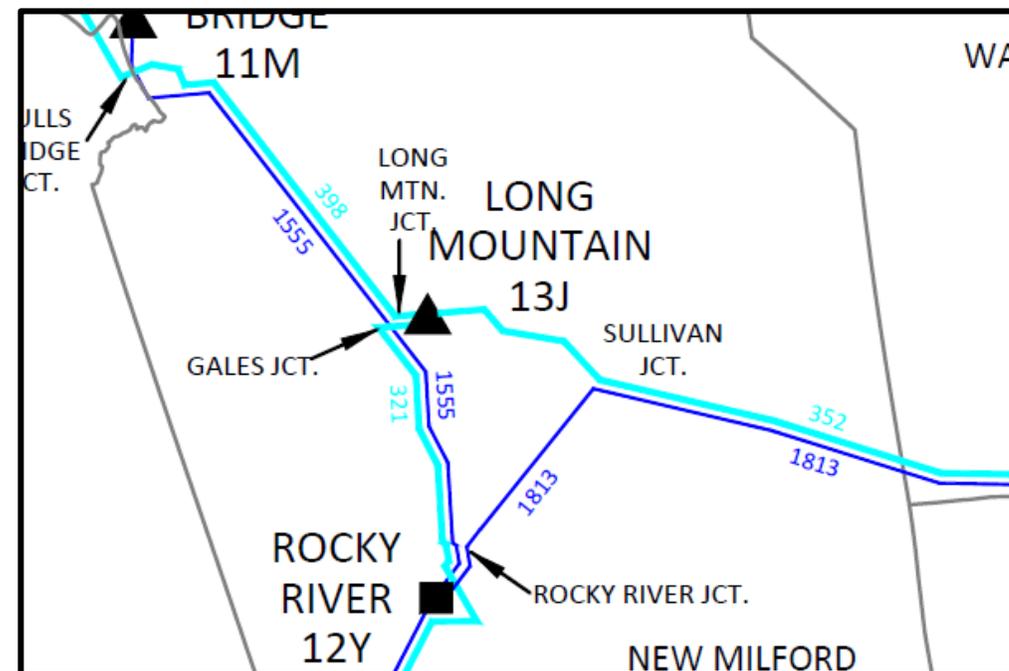
Alternative	Reason for Recommendation	Cost Estimate
Alternative 2	<ul style="list-style-type: none"> • This alternative comprehensively addresses the asset condition concerns with the 345kV breakers and electrical and physical separation and grounding and shielding concerns with the S1 and S2 cable systems • By utilizing a design with a new trench system, the majority of construction can occur without station outages and can reduce cutover times 	\$17.55 M (-25%, +50%)

Outline

- Project Background
- Project Needs
- Alternatives Analysis
- Project Summary

Project Background

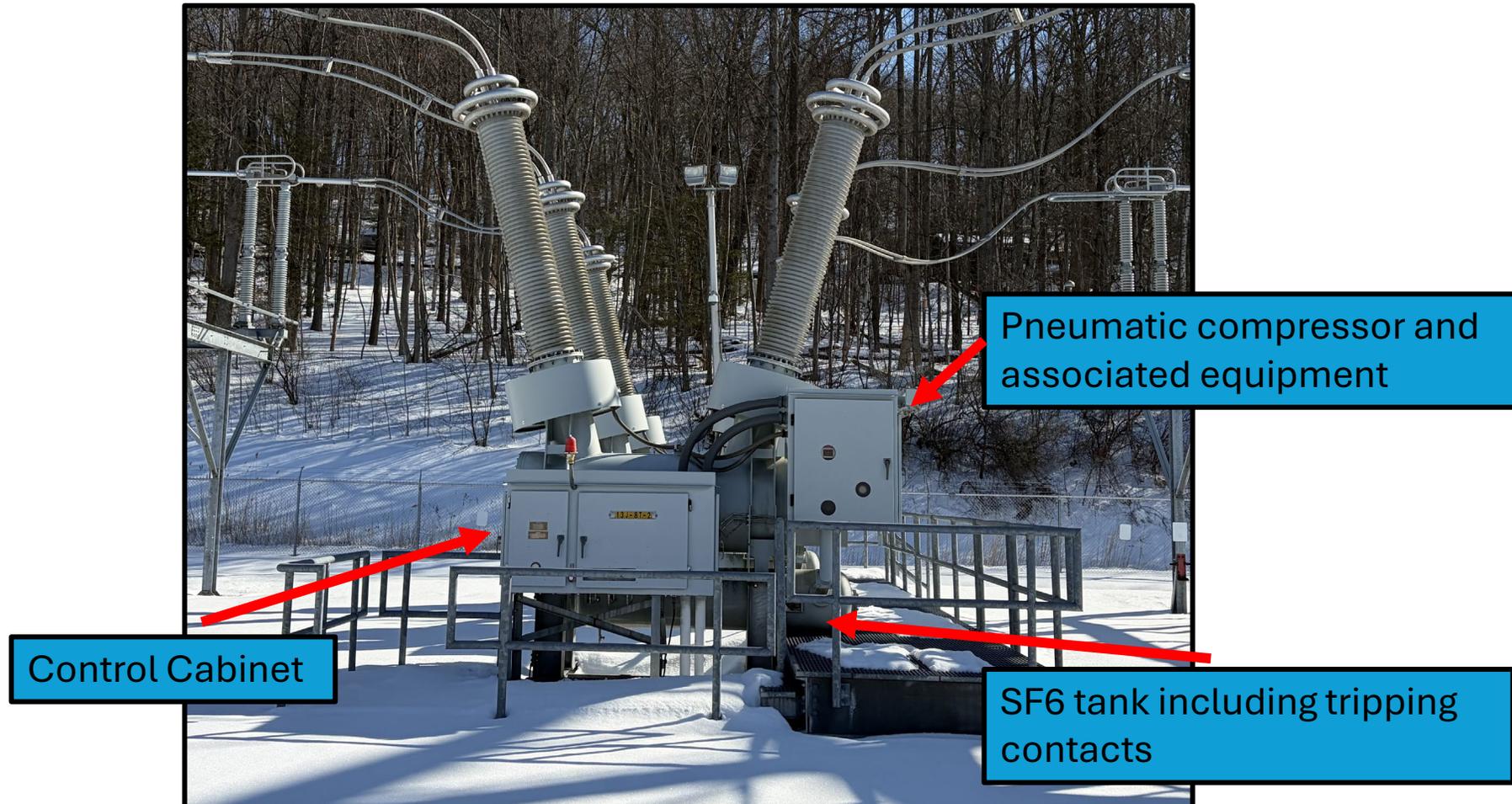
- Long Mountain substation is a 345 kV station in New Milford, CT, with three line terminations
 - 345 kV lines 321, 352, and 398
 - Line 398 is a tie line New York (Con Ed)
- The substation was built in the 1980s



Project Needs – 345kV Circuit Breaker Replacements

- Eversource has experienced frequent failures associated with the air compression systems on pneumatically operated breakers, including:
 - Failures of the desiccant (air dryer) systems leading to failures of the entire compressed air system
 - Air system leaks
- Eversource is no longer able to source replacement compressors or replacement parts/components for compressors and desiccant systems
- Failures within pneumatic air systems have resulted in breakers not operating properly, including:
 - Delayed or incomplete opening of electrical contacts (i.e. failure to trip)
 - Trips under no-fault conditions due to low air pressure resulting in unplanned outages and emergency repairs
- Circuit breakers that fail to trip or trip unintentionally present serious reliability risks to the 345 kV transmission system
 - Failure-to-trip will delay clearing of 345 kV transmission system faults and increase the risk of cascading transmission outages
 - Unintentional trips can threaten integrity of 345 kV transmission network
- Some pneumatically-operated 345 kV circuit breakers also have history of SF6 leaks and other mechanical issues
 - SF6 is a potent greenhouse gas
 - Loss of SF6 gas may require emergency outages and repairs

Project Needs – 345 kV Circuit Breaker Replacements (cont.)



Project Needs – Cable Separation and Shielding

- A primary driver for this project is to ensure system reliability of switchyard systems to avoid mis-operations such as the Ludlow 19S substation mis-op event
 - The Ludlow event was previously discussed with PAC on [February 17, 2021](#)
- Portions of existing P&C cable systems precede current design practices such as use of cable shielding and flame-resistant cable insulation/jacket materials
- Age and environmental-based degradation of cable insulation, lack of cable shielding, and inconsistencies with existing grounding practices increase the probability of protection system mis-operations resulting from electromagnetic interference (EMI) and voltage stresses during electrical system transients
- The existing cable designs pre-date the physical separation specifications required by NPCC Directory 4 criteria
 - Upgrades to this station's protection system will result in full separation of all 345 kV System 1 and 2 redundant protection system elements and will bring the substation into NPCC Directory 4 compliance resulting in increased reliability

Evaluated Solution Alternatives

Alternative 1

Alternative 1 (Base Alternative)	
Description	<ul style="list-style-type: none"> • Replace two HICO 345 kV circuit breakers • Install new System 1 cable trenches and new P&C cables from control house to the switchyard • System 2 cables replaced and routed via existing trench system • Provides electrical and physical separation in the switchyard, increasing reliability • Completes the necessary upgrades to bring the station to meet Eversource standards and NPCC Directory #4 standards • Replace obsolete relays and upgrade protection system components associated with cabling
Primary needs addressed	<ul style="list-style-type: none"> • Yes
Secondary needs addressed	<ul style="list-style-type: none"> • Yes
Advanced transmission technologies to be considered	<ul style="list-style-type: none"> • None
Cost estimate and accuracy	\$18.48 M (-50%, +200%)
Longer-term transmission needs addressed	<ul style="list-style-type: none"> • N/A
Key standards or criteria affecting design if different than current design	<ul style="list-style-type: none"> • Northeast Power Coordinating Council, Inc (NPCC) Directory #4

Evaluated Solution Alternatives

Alternative 2

Alternative 2 (Base Alternative + New System 2 Trench System)	
Description	<ul style="list-style-type: none"> • Replace two HICO 345 kV circuit breakers • Install new System 1 and 2 cable trenches and P&C cables from the control house to the switchyard • New conduits are required for connection between the switchyard equipment and the new cable trenches • Provides electrical and physical separation in the switchyard, increasing reliability • Completes the necessary upgrades to bring the station to meet Eversource standards and NPCC Directory #4 standards • Replace obsolete relays and upgrade protection system components associated with cabling
Primary needs addressed	<ul style="list-style-type: none"> • Yes
Secondary needs addressed	<ul style="list-style-type: none"> • Yes
Advanced transmission technologies to be considered	<ul style="list-style-type: none"> • None
Cost estimate and accuracy	\$17.55 M (-25%, +50%)
Longer-term transmission needs addressed	<ul style="list-style-type: none"> • N/A
Key standards or criteria affecting design if different than current design	<ul style="list-style-type: none"> • Northeast Power Coordinating Council, Inc (NPCC) Directory #4

Substation Overview



- New cable trenching configuration is represented in red
 - System 1 and System 2 cable trenches will be separate and run parallel to each other within the substation yard
- 345 kV circuit breakers targeted for replacement are highlighted in blue

Comparative Analysis of Alternatives

Comparison		
Key Criteria	Alternative 1	Alternative 2 (Preferred)
Addresses primary need	Yes	Yes
Addresses secondary need	Yes	Yes
Cost	\$18.48 M (-50%, +200%)	\$17.55 M (-25%, +50%)
Constructability concerns or advantages	<p>This alternative would require additional outages and would plan to utilize existing legacy trench for System 2 . During construction the legacy trench system conduits may be found to require repair and replacement due to asset condition concerns and inability to accommodate larger modern cables with flame-resistant cable insulation/jacket materials.</p> <p>These concerns lead to a higher risk of project delays, extended outages, and cost.</p>	Majority of the installation can be completed without station outages and limited cutover times.
Siting, environmental and regulatory issues	None	None

Conclusion	
<ul style="list-style-type: none"> Both Alternative 1 and 2 address the asset condition concerns, electrical and physical separation, and grounding and shielding in the switchyard, improving reliability Alternative 1 requires station outages and poses more constructability and execution risk for unknowns which will not be fully identified until active construction during outages, which could have a cascading impact on outage duration and cost mitigation Considering the risks identified with Alternative 1, Alternative 2 has been selected as the preferred solution 	

Schedule

Planned Schedule

Start of Major Construction	Q2 2026
Project in Service	Q1 2027

Comment Submission

Comment Deadline	April 8, 2026
ISO-NE Contact Email Address	pacmatters@iso-ne.com
Transmission Owner Contact Name	Dave Burnham
Transmission Owner Contact Email Address	PAC.Responses@eversource.com

Questions



Appendix: Substation Cable Shielding and Trenching Projects

- Eversource has identified a total of 46 substations with legacy control cable materials and designs (e.g. lack of shielding, grounding, and physical separation) and present a higher risk for misoperation
- Comprehensive site reviews are being performed to identify grounding and shielding concerns, and to identify locations where cable separation is appropriate
- Preliminary findings have determined:
 - Issues at 50% of the substations reviewed can be addressed with low-cost targeted grounding and shielding upgrades
 - 17 substations may require more significant upgrades (new cabling, trenches, etc.) to address these issues
- Eversource will continue to provide updates to the PAC on specific cable and shielding projects as the individual projects progress
 - These projects will be coordinated with projects to address other asset condition needs where applicable

Appendix: 345 kV Pneumatic Circuit Breaker Replacement Program

- Eversource currently has 123 345 kV circuit breakers with pneumatic tripping systems in-service across 28 substation in CT, MA, and NH which are under review
 - At the [May 18, 2022](#) PAC meeting Eversource presented 23 breakers across four stations for replacement
 - At the [September 18, 2024](#) PAC meeting Eversource presented 12 breakers across two stations for replacement
- Eversource intends to gradually replace the remaining pneumatically operated 345 kV circuit breakers over time
 - Eversource will prioritize replacement at substations with higher-than-normal rates of corrective maintenance or at substations with opportunities for coordination with other projects