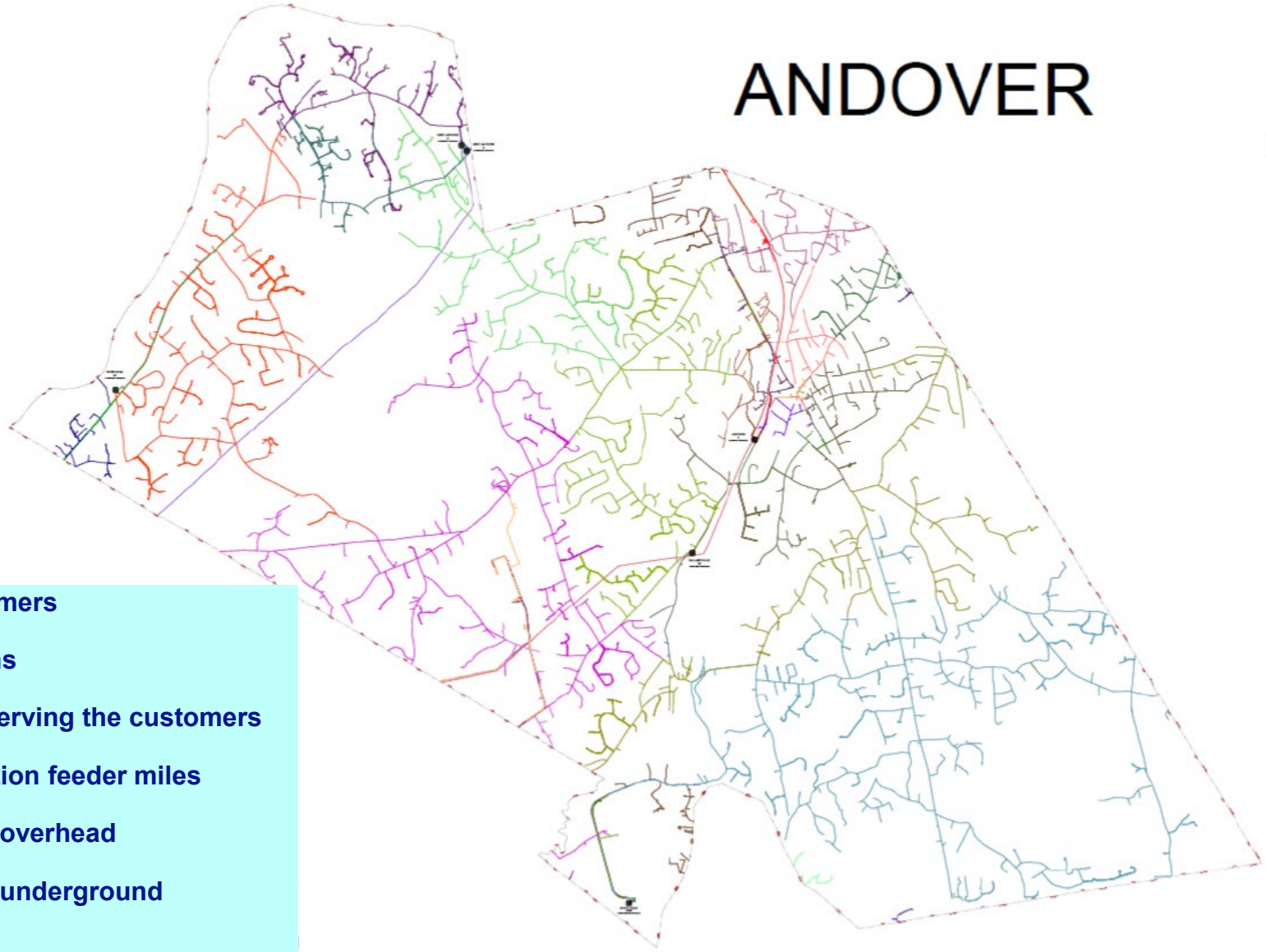
Andover Reliability

November 12, 2025

nationalgrid

Andover Electric System Overview



14625 customers

5 Substations

33 feeders serving the customers

356 distribution feeder miles

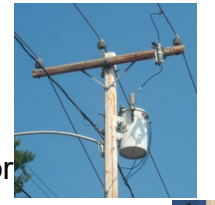
- **198 miles overhead**
- **157 miles underground**

Distribution Circuit Overview

Substation
Equipped with transformers, feeder breakers, voltage regulators, disconnect switches and control house

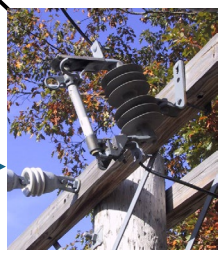
Reclosers
Reclose after first trip
In 5 and 10 sec cycles
Per 500 customers

Voltage regulating devices
Step down transformers, voltage regulators, capacitor banks (reactive power)
Regulate the voltage between +/-5% of the nominal voltage



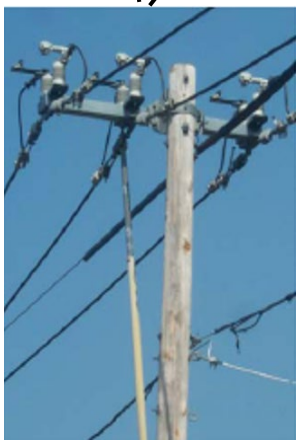
Feeder tap

Underground feeder sections



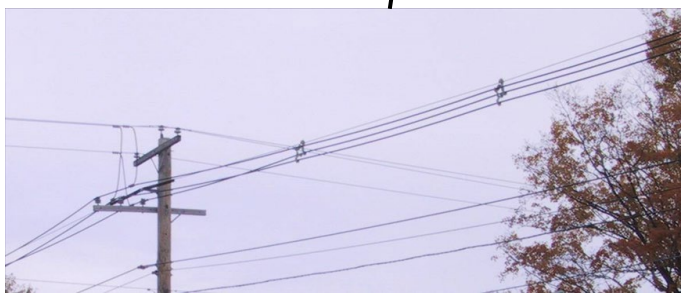
Fuse

Electric load and Distributed Generation



Loadbreak Switch
Sectionalize the feeder
Per 200 customers

Feeder ties
Connection to other nearby feeders



Distribution Feeder
- Cross arm construction
- Spacer cables

What is an Outage?

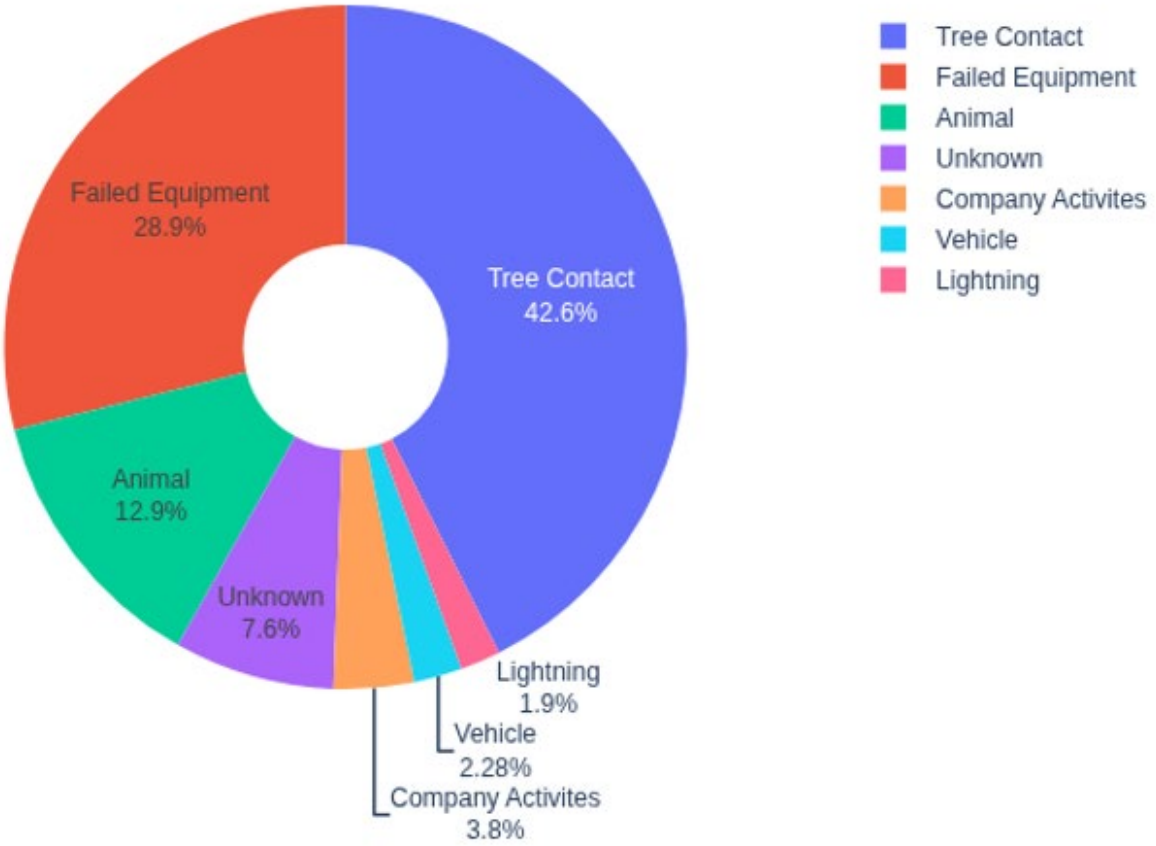
Definition of an Outage

A reportable outage is when electric service is interrupted to a customer for over **one minute.**

Common Causes

- Weather events- Lightning
- Equipment failures
- Vegetation
- Vehicle accidents
- Animal contacts
- Company activities:
  - planned work
  - maintenance work
  - emergency repairs

Reasons for Andover Outages - 2024



How National Grid Measure Reliability

Number outages is not indicative of the quality of reliability on the system nor an industry standard. One outage can affect a large number of customers and multiple outages could affect very few customers. The impact depends on the location of the fault.

Reliability Indices

SAIDI (System Average Interruption Duration Index)

- **What it measures:** Average outage duration per customer over a year. Lower SAIDI means customers experience shorter outages on average and reflects the average restoration time for interrupted customer.

$$\text{SAIDI} = \frac{\text{Total number of customer outage durations (minutes)}}{\text{Number of cusotmers served}}$$

SAIFI (System Average Interruption Frequency Index)

- **What it measures:** Average number of interruptions per customer. Lower SAIFI means fewer outages per customer.

$$\text{SAIFI} = \frac{\text{Total number of customer interruptions}}{\text{Number of cusotmers served}}$$

CKAIDI (Circuit Average Interruption Duration Index)

- **What it measures:** Average outage duration per customer on a particular circuit.

CKAIFI (Circuit Average Interruption Frequency Index)

- **What it measures:** Average number of interruptions per customer on a particular circuit

Reliability Data

National Grid reports system level SAIDI, CKAIDI and CKAIFI values to the DPU annually. SAIFI and SAIDI values for the Town of Andover were estimated for comparison.

Reliability Matrix	2022	2023	2024
SAIFI - Target	1.372	1.372	1.372
SAIFI - System Level	0.864	0.700	0.908
SAIFI – Town of Andover	1.065	0.586	1.425
SAIDI -Target	140.761	140.761	140.761
SAIDI - System Level	96.557	97.348	125.045
SAIDI - Town of Andover	127.126	88.810	270.600

Note: Calculating these reliability indices using the data from the service quality filing yields significantly different results. Since feeders cover multiple towns, many of the large outages reported do not primarily affect customers in Andover. Therefore, we utilized our Interruption Data System (IDS) data to produce more accurate values that better represent the experiences of Andover customers.

How National Grid Responds to Outages

National Grid employs a multi-layered protection system and restoration process to minimize customer disruption while maintaining safety and reliability.

Fault Detection Devices

Protective devices such as substation breakers, reclosers, and fuses detect faults and disconnect affected sections to ensure safety and prevent damage.

Automatic Reclosing

Automatic reclosing restores service after temporary faults preventing temporary faults becoming prolonged outages. Substation breakers, reclosers and cutout mounted reclosers are capable of reclosing.

Advanced Automated Restoration

FLISR (Fault Location Isolation and Service Restoration) and loop schemes automatically detect faults, isolate sections, and reroute power from nearby feeders to restore service efficiently.

Remote Monitoring and Field Response

System operators monitor grid continuously and dispatch field crews promptly for repairs and outage restoration.

What National Grid does to Improve Reliability

Vegetation Management

Maintenance Pruning

- Consistent pruning helps maintain service reliability, avoiding potential interruptions from tree contact; resulting in an 11% reduction in average customer interruptions in the year following planned trimming.
- In Andover, National Grid has pruned 156.6 miles over the last two years and has scheduled 66.8 miles for maintenance over the next 2 years.

Enhanced Hazard Tree Mitigation (EHTM)

- Identifies and removes hazard trees that are diseased, dying, or dead and are an imminent threat to power lines and public safety; resulting in a 20% reduction in tree events, a 39% reduction in customers interrupted and a 35% reduction in outage duration.
- In Andover, National Grid has removed nearly 300 hazard trees last fiscal year.

Enhanced Vegetation Management (EVM)

- A storm-resiliency program designed to reduce tree-related damage and interruptions during weather events by increasing clearance between trees and power lines, removing all appropriate vegetation; resulting in a 28% reduction in tree events, a 45% reduction in customers interrupted and a 54% reduction in outage duration.
- In Andover, National Grid has completed EVM work on 4 miles of distribution lines and removed over 300 hazard trees last fiscal year.

What National Grid does to Improve Reliability cont.

Network Improvement Plans

Fault Location Isolation and Service Restoration (FLISR)

- FLISR uses sensors and communication systems to quickly detect, locate and automatically isolate faults and then restore service to non-faulted area, reducing the number of customers impacted by transferring them to adjacent circuits. The company has experienced approximately a 20% reduction in Customer Minutes Interrupted (CMI) and Customers Interrupted (CI) across all circuits where FLISR has been implemented.

- In Andover, currently 7% of customers are on circuits with FLISR schemes enabled. The Merrimack Valley regional FLISR deployment over the next 2 years will include customers on 15kV class overhead feeders.

CMR (Cutout Mounted Recloser) Program

- CMR prevent temporary faults from becoming permanent outages, eliminating the number of customers impacted on the main circuit.
- In Andover, National Grid has (1) CMR in service on Salem St and (1) planned on Rutgers Rd for the next 2 years.
- National Grid has recently kicked off a CMR program that will result in 100s of CMR being installed over the next few years.

Underground Cable Replacement Program

- Underground Cable Replacement Program and the Underground Residential Development (URD) Program address chronic asset condition issues on underground cable systems.
- There has been (10) URD projects completed over the last 5 years in Andover and (8) planned over the next 5 years.

Resiliency Program

- Replace cross arm bare conductors with spacer cables which are more resilient for tree related outages.

Capital Projects

- Multi-year plans identify what investments National Grid needs to make in the next 5-10 years to continue delivering safe, reliable service and enable the commonwealth to reach its electrification goals. These require a large amount of investment and time to complete but will ensure continued safe and reliable service to Andover.

What National Grid does to Improve Reliability cont.

Preventive Programs

Engineering Reliability Reviews (ERR)

Identify opportunities to improve reliability focusing on decreasing duration and /or frequency of outages.

In 2024, ERRs performed on one (1) circuit 3J43 in Andover recommending infrared scan and protective device settings change.

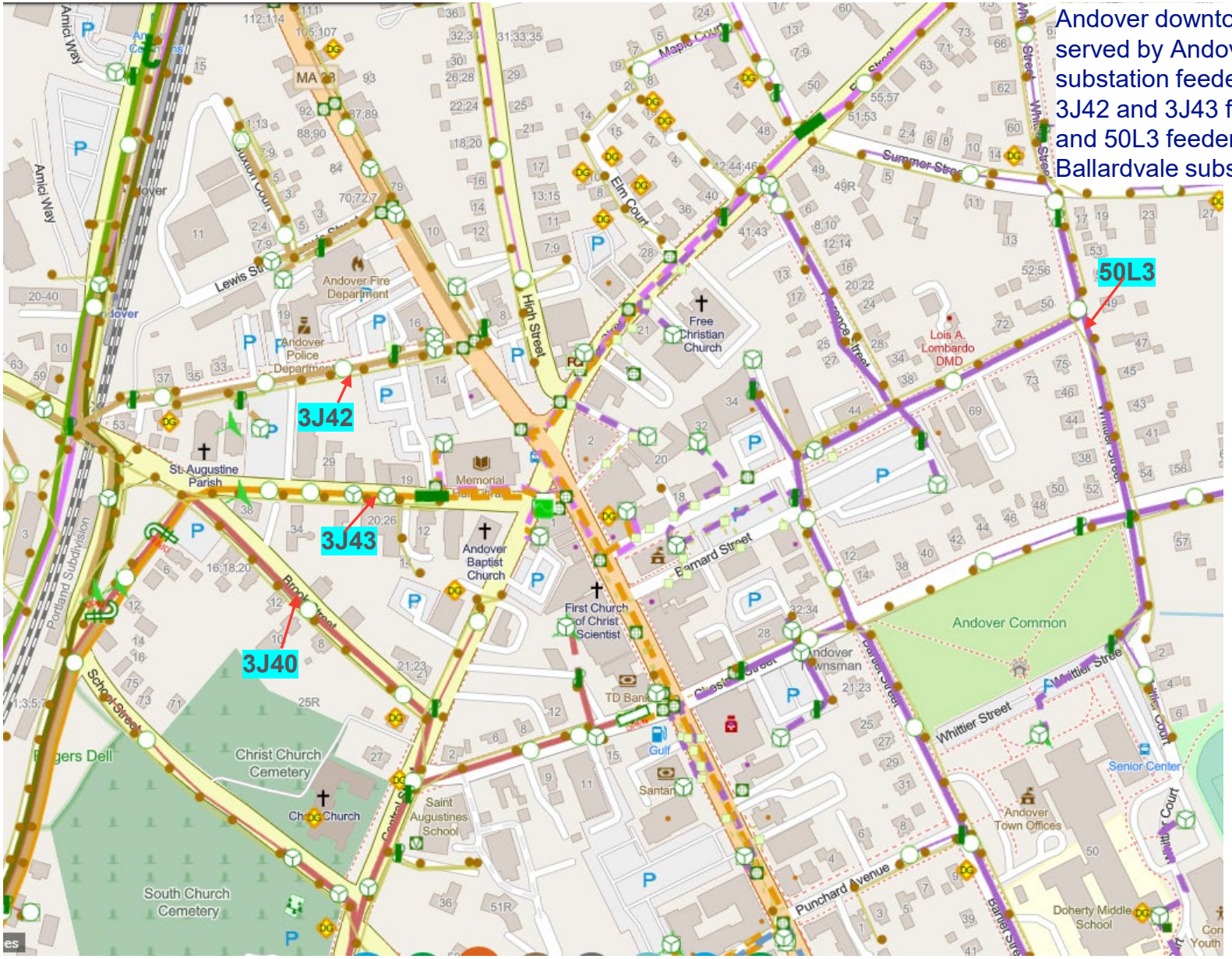
Customers Experiencing Multiple Interruptions (CEMI)

Focuses on customers experiencing the most interruptions over the last 5 years and recommends improvements ranging from technology enhancement to targeted tree trimming.

Other Preventative Actions

- Infrared scans (ground & aerial) – Sub-transmission circuits are flown
- Helicopter inspections (particularly after storms)
- Visual & operational inspections at the substation
- Inspection and Maintenance program (pole by pole visual inspections)
- Weekly circuit patrols
- Track and monitor damaged/out-of-service equipment for repair and/or replacement

Andover Downtown Area



Andover downtown area is served by Andover 3 substation feeders (3J40, 3J42 and 3J43 feeders) and 50L3 feeder out of Ballardvale substation.

Recent Outage History (Past 3 years)

Feeder ID	Date	Time Off	Time On	Total Number of Customers Affected	Cause
3J40	9/8/2023	9/8/2023 14:55	9/11/2023 13:44	130	Tree fell
3J40	11/6/2023	11/6/2023 15:21	11/6/2023 16:43	1	Vehicle
3J40	4/4/2024	4/4/2024 7:31	4/4/2024 12:32	131	Tree fell
3J40	5/11/2025	5/11/2025 15:56	5/11/2025 19:35	9	Deterioration
3J42	9/8/2023	9/8/2023 14:55	9/11/2023 13:44	302	Tree fell
3J42	4/4/2024	4/4/2024 7:31	4/4/2024 12:32	409	Tree fell
3J42	12/10/2024	12/10/2024 13:44	12/11/2024 8:20	300	Insulation failure - cable
3J42	2/4/2025	2/4/2025 8:35	2/4/2025 14:25	35	Planed maintenanace
3J42	2/4/2025	2/4/2025 10:15	2/4/2025 14:50	35	Planned maintenance
3J42	4/1/2025	4/1/2025 5:49	4/1/2025 7:18	3	Insulation failure - cable
3J42	8/25/2025	8/25/2025 10:00	8/25/2025 19:53	118	Vehicle
3J42	9/30/2025	9/30/2025 22:47	10/1/2025 3:53	36	Planned maintenance
3J43	8/18/2023	8/18/2023 10:50	8/19/2023 7:29	146	Device Failed
3J43	9/8/2023	9/8/2023 14:55	9/11/2023 13:44	141	Tree fell
3J43	4/4/2024	4/4/2024 7:31	4/4/2024 12:32	143	Tree fell
3J43	6/21/2024	6/21/2024 18:54	6/21/2024 20:03	22	Tree fell
50L3	2/3/2023	2/3/2023 14:51	2/3/2023 19:34	9	Tree Fell
50L3	5/31/2023	5/31/2023 10:49	5/31/2023 12:06	44	Device Failed
50L3	9/8/2023	9/8/2023 14:55	9/12/2023 18:03	993	Tree Fell
50L3	9/8/2023	9/8/2023 14:55	9/11/2023 13:44	15	Tree Fell
50L3	1/8/2024	1/8/2024 9:08	1/9/2024 5:17	12	Unknown
50L3	5/29/2024	5/29/2024 8:53	5/29/2024 9:15	1006	Manually de-energized for an emergency
50L3	11/10/2024	11/10/2024 6:12	11/10/2024 7:33	12	Animal
50L3	6/12/2025	6/12/2025 16:56	6/12/2025 20:00	1	Tree - Broken Limb
50L3	7/11/2025	7/11/2025 6:40	7/11/2025 7:31	12	Animal
50L3	8/16/2025	8/16/2025 19:57	8/16/2025 21:01	1023	Tree Fell
50L3	8/24/2025	8/24/2025 7:37	8/24/2025 15:28	1022	Vehicle

Plans to Improve Reliability

- There is a capital project to retire Andover 3 substation. We are evaluating the options to rebuild Andover 3 substation with 13.2kV feeders or install 2 new feeders from the Burtt Rd substation to supply Andover 3 load.
- Install a FLISR (Fault Location Isolation and Service Restoration) scheme on 50L3. This scheme will isolate the faulted location and automatically restore the un-faulted sections of the feeder using 59L6 feeder within 1 minute.
- Tree trimming:

  Circuits are evaluated as candidates for National Grid vegetation management programs such as Maintenance Pruning, Enhanced Hazard Tree management (EHTM) and Enhanced Vegetation Management (EVM) work regularly, and additional work is scheduled as needed each year.

nationalgrid