# Los Alamos County

# Department of Public Utilities

## Electric Distribution

## Reliability

November 20, 2024

Stephen Marez

Deputy Utility Manager
Electric Distribution

| Twelve Month History | OCTOBER 24 | |
|---|---|---|
| Total # Accounts | 9045 | |
| Total # Interruptions | 32 | |
| Sum Customer Interruption Durations | 2359:33:00 | hours:min |
| # Customers Interrupted | 1234 | |
| SAIFI (APPA AVG. = 1.0) | .14 | int./cust. |
| SAIDI (APPA AVG. = 1:00) | 00:18:48 | hours:min |
| CAIDI | 2.17 | hours:min/INT |
| ASAI | 99.9999% | % Available |

- **SAIFI - System Average Interruption Frequency Index**
  A measure of interruptions per customer (Per Year)

  SAIFI= (Total number of customer interruptions)
  (Total number of customers served)

- **SAIDI – System Average Interruption Duration Index**
  A measure of outage time per customer if all customers were out at the same time (hours per year)

  SAIDI= (Sum of all customer outage durations)
  (Total number of customers served)

- **CAIDI – Customer Average Interruption Duration Index**
  A measure of the average outage duration per customer (hours per interruption)

  CAIDI= (Sum of all customer outage durations ) = SAIDI
  (Total number of customer interruptions) SAIFI

- **ASAI – Average System Availability Index**
  A measure of the average service availability (Per unit)

  ASAI= (Service hours available) = 8760-SAIDI
  (Customer demand hours) 8760

**Electric Distribution Reliability Study**
**Twelve Month Outage History**

**Prepared by Stephen Marez**
**Electrical Engineering Manager**

| Date | Call Rcd. | Circuit | Cause | Start Time | End Time | Duration | Customers Affected (Meters) | Combined Customer Outage Durations | Total Outage H:M:S | Running SAIDI |
|---|---|---|---|---|---|---|---|---|---|---|
| 12/2/2023 | Utilites | ELK RIDGE | OH Failure | 12:40 | 14:40 | 2:00 | 10 | 20:00:00 | 20:00:00 | 0:00:08 |
| 2/27/2024 | Utilites | 13 | WEATHER | 6:30 | 7:20 | 0:50 | 20 | 16:40:00 | 36:40:00 | 0:00:15 |
| 2/27/2024 | Utilites | 13 | TREE | 6:30 | 12:30 | 6:00 | 16 | 96:00:00 | 132:40:00 | 0:00:53 |
| 3/7/2024 | Utilites | 14 | URD Failure | 22:15 | 0:00 | 1:45 | 80 | 140:00:00 | 272:40:00 | 0:01:49 |
| 3/7/2024 | Utilites | 14 | URD Failure | 22:15 | 1:15 | 3:00 | 7 | 21:00:00 | 293:40:00 | 0:01:57 |
| 3/7/2024 | Utilites | 14 | URD Failure | 23:00 | 2:00 | 3:00 | 9 | 27:00:00 | 320:40:00 | 0:02:08 |
| 3/15/2024 | Utilites | 13 | WEATHER | 11:31 | 12:30 | 0:59 | 7 | 6:53:00 | 327:33:00 | 0:02:10 |
| 3/15/2023 | Utilites | ELK RIDGE | WEATHER | 11:30 | 12:30 | 1:00 | 43 | 43:00:00 | 370:33:00 | 0:02:27 |
| 3/15/2023 | Utilites | 15 | WEATHER | 11:00 | 13:30 | 2:30 | 4 | 10:00:00 | 380:33:00 | 0:02:31 |
| 3/15/2023 | Utilites | 15 | WEATHER | 11:00 | 12:00 | 1:00 | 24 | 24:00:00 | 404:33:00 | 0:02:41 |
| 4/5/2024 | Utilites | WR1 | TREE | 23:30 | 6:00 | 6:30 | 16 | 104:00:00 | 508:33:00 | 0:03:22 |
| 4/16/2024 | Utilites | ELK RIDGE | TREE | 2:30 | 4:30 | 2:00 | 4 | 8:00:00 | 516:33:00 | 0:03:26 |
| 4/16/2024 | Utilites | 16 | TREE | 5:00 | 6:30 | 1:30 | 5 | 7:30:00 | 524:03:00 | 0:03:29 |
| 5/19/2024 | Utilites | 16 | ANIMAL | 10:45 | 11:25 | 0:40 | 10 | 6:40:00 | 530:43:00 | 0:03:31 |
| 5/20/2024 | Utilites | 16 | Unknown | 5:00 | 5:45 | 0:45 | 20 | 15:00:00 | 545:43:00 | 0:03:37 |
| 6/5/2024 | Utilites | 15 | URD Failure | 14:00 | 15:00 | 1:00 | 10 | 10:00:00 | 555:43:00 | 0:03:41 |
| 7/1/2024 | Utilites | 13 | WEATHER | 18:45 | 19:45 | 1:00 | 5 | 5:00:00 | 560:43:00 | 0:03:43 |
| 7/1/2024 | Utilites | 13 | WEATHER | 21:30 | 1:30 | 4:00 | 2 | 8:00:00 | 568:43:00 | 0:03:46 |
| 7/11/2024 | Utilites | 16 | Unknown | 19:15 | 21:30 | 2:15 | 6 | 13:30:00 | 582:13:00 | 0:03:52 |
| 7/12/2024 | Utilites | 15 | ANIMAL | 0:00 | 1:30 | 1:30 | 30 | 45:00:00 | 627:13:00 | 0:04:10 |
| 8/8/2024 | Utilites | 16 | URD Failure | 16:30 | 17:40 | 1:10 | 59 | 68:50:00 | 696:03:00 | 0:04:37 |
| 8/9/2024 | Utilites | WR2 | WEATHER | 18:30 | 20:30 | 2:00 | 5 | 10:00:00 | 706:03:00 | 0:04:41 |
| 8/12/2024 | Utilites | 15 | WEATHER | 4:00 | 6:30 | 2:30 | 30 | 75:00:00 | 781:03:00 | 0:05:11 |
| 8/20/2024 | Utilites | 15 | URD Failure | 16:00 | 22:00 | 6:00 | 8 | 48:00:00 | 829:03:00 | 0:05:30 |
| 8/25/2024 | Utilites | 13 | URD Failure | 11:30 | 15:30 | 4:00 | 317 | 1268:00:00 | 2097:03:00 | 0:13:55 |
| 8/25/2024 | Utilites | WR2 | WEATHER | 18:00 | 21:45 | 3:45 | 46 | 172:30:00 | 2269:33:00 | 0:15:03 |
| 10/2/2024 | Utilites | 14 | URD Failure | 22:30 | 23:30 | 1:00 | 75 | 75:00:00 | 2344:33:00 | 0:15:33 |
| 10/2/2024 | Utilites | 14 | URD Failure | 22:30 | 5:00 | 6:30 | 28 | 182:00:00 | 2526:33:00 | 0:16:46 |
| 10/3/2024 | LANL | EA4 LANL | TREE | 12:19 | 13:05 | 0:46 | 23 | 17:38:00 | 2544:11:00 | 0:16:53 |
| 10/5/2024 | Utilites | 13 | ANIMAL | 11:15 | 12:15 | 1:00 | 29 | 29:00:00 | 2573:11:00 | 0:17:04 |
| 10/13/2024 | Utilites | 13 | Unknown | 19:24 | 20:30 | 1:06 | 99 | 108:54:00 | 2682:05:00 | 0:17:47 |
| 10/14/2024 | Utilites | 16 | URD Failure | 19:02 | 20:00 | 0:58 | 142 | 137:16:00 | 2819:21:00 | 0:18:42 |
| 10/14/2024 | Utilites | 16 | ANIMAL | 2:30 | 2:49 | 0:19 | 45 | 14:15:00 | 2833:36:00 | 0:18:48 |
| | | | | | | | | | | |
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**CIRCUIT SAIDI IS CALCULATED ACCORDING TO THE NUMBER OF CUSTOMERS IN EACH CIRCUIT RESPECTIVELY**

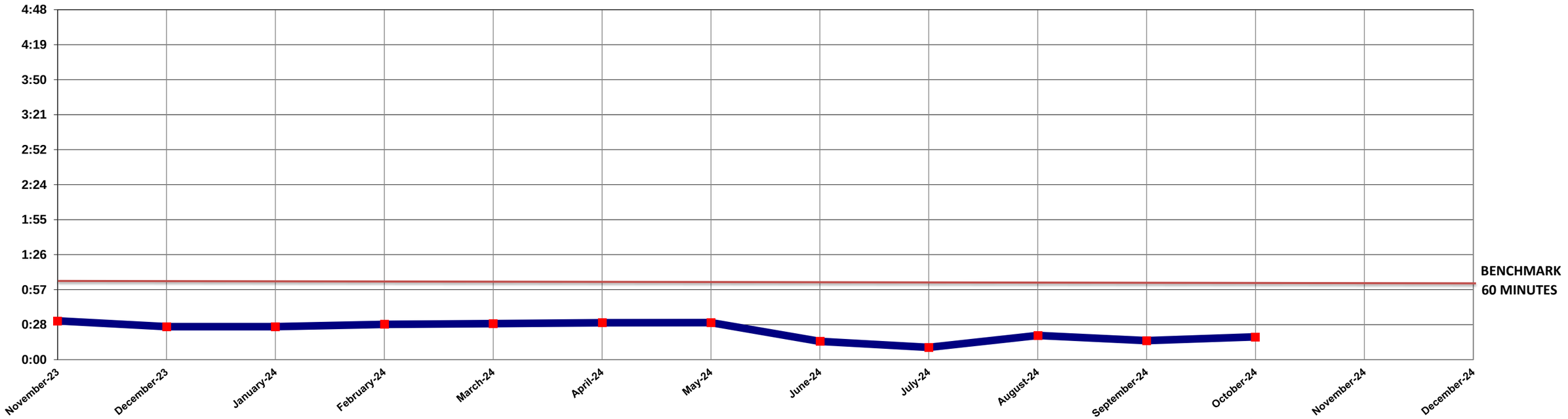
| Running SAIDI Circuit 13 | Running SAIDI Circuit 14 | Running SAIDI Circuit 15 | Running SAIDI Circuit 16 | Running SAIDI Circuit 17 | Running SAIDI Circuit 18 | Running SAIDI Circuit EA4 &ELK RIDGE | Running SAIDI Circuit WR1 | Running SAIDI Circuit WR2 | Monthly SAIDI | | Monthly Customer Minutes out of service | WEATHER SAIDI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 0:07:16 | | | DEC | 0:00:08 | 0:00:08 | |
| 0:00:36 | | | | | | | | | | 0:00:07 | | |
| 0:03:29 | | | | | | | | | FEBRUARY | 0:00:38 | 0:00:45 | |
| | 0:15:35 | | | | | | | | | 0:00:56 | | |
| | 0:02:20 | | | | | | | | | 0:00:08 | | |
| | 0:03:00 | | | | | | | | | 0:00:11 | | |
| 0:00:15 | | | | | | | | | | 0:00:03 | | |
| | | | | | | 0:15:38 | | | | 0:00:17 | | |
| | | 0:00:19 | | | | | | | | 0:00:04 | | |
| | | 0:00:46 | | | | | | | MARCH | 0:00:10 | 0:01:48 | 0:00:33 |
| | | | | | | | 0:03:56 | | | 0:00:41 | | |
| | | | | | | 0:02:55 | | | | 0:00:03 | | |
| | | | 0:00:15 | | | | | | APRIL | 0:00:03 | | |
| | | | 0:00:13 | | | | | | | 0:00:03 | | |
| | | | 0:00:29 | | | | | | MAY | 0:00:06 | | |
| | | 0:00:19 | | | | | | | JUNE | 0:00:04 | 0:01:10 | |
| 0:00:11 | | | | | | | | | | 0:00:02 | | |
| 0:00:17 | | | | | | | | | | 0:00:03 | | 0:00:05 |
| | | | 0:00:26 | | | | | | | 0:00:05 | | |
| | | 0:01:26 | | | | | | | JULY | 0:00:18 | 0:00:28 | |
| | | | 0:02:15 | | | | | | | 0:00:27 | | |
| | | | | | | | | 0:00:37 | | 0:00:04 | | |
| | | 0:02:24 | | | | | | | | 0:00:30 | | 0:00:34 |
| | | 0:01:32 | | | | | | | | 0:00:19 | | |
| 0:45:58 | | | | | | | | | | 0:08:25 | | |
| | | | | | | | | 0:10:46 | AUGUST | 0:01:09 | 0:10:54 | 0:01:09 |
| | 0:08:21 | | | | | | | | | 0:00:30 | | |
| | 0:20:16 | | | | | | | | | 0:01:12 | | |
| | | | | | | 0:06:25 | | | | 0:00:07 | | |
| 0:01:03 | | | | | | | | | | 0:00:12 | | |
| 0:03:57 | | | | | | | | | | 0:00:43 | | |
| | | | 0:04:28 | | | | | | | 0:00:55 | | |
| | | | 0:00:28 | | | | | | OCTOBER | 0:00:06 | 0:03:44 | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **0:55:46** | **0:20:56** | **0:06:47** | **0:08:34** | **0:00:00** | **0:00:00** | **0:32:14** | **0:03:56** | **0:11:24** | **Total** | **0:18:48** | | **0:02:21** |
| **1655** | **539** | **1875** | **1842** | **209** | **213** | **165** | **1586** | **961** | **9045** | | | |

NUMBER OF CUSTOMERS BY CIRCUIT

EACH POINT IS A MONTHLY SAIDI HISTORY
60 MINUTES = LACDPU SAIDI BENCHMARK

SAIDI = STANDARD AVERAGE INTERUPTION DURATION

SAIDI= (Sum of all customer outage durations)
(Total number of customers served)




SAIDI NOW AT
18 MINUTES

**SAIDI CALCULATED TO INCLUDE THIS OUTAGE:**

| Date | | Circuit | Cause | Start Time | End Time | Duration | Number of Customers | Combined Customer Outage Durations | Total Outage H:M:S | Running SAIDI |
|---|---|---|---|---|---|---|---|---|---|---|
| OCT 20 | | WHITE ROCK | 115KV PNM | 21:25 | 1:40 | 4:15 | 2155 | 9158:45:00 | 11992:21:00 | 1:19:33 |

**LANL outage report provided by:**

**Nicole Rivera**

ES-UI, System Engineer, Electrical Team Lead

Based on the evidence that the lightning strike was the cause of the outage, and with PNM holding steady, LANL engineering recommended closing ETA breakers without a line patrol. The risk associated with a single-source configuration was deemed acceptable compared to the risk of leaving the system unclosed and without redundancy. LANL operations agreed with this recommendation. Dispatch attempted to close breaker 17062, but breakers 17062 (ETA), 10962 (ETA), 16162 (Norton), and 15062 (Norton) opened, expanding the outage to ETA T1. The Medium Voltage tie breaker's automatic transfer successfully restored the load via ETA T2.

A breaker failure was identified later as the cause of the expanded outage on breaker 17062, triggered by a standing trip from the ETA NL line GE relays. LANL engineering recommended restoring the PNM end of the NL line and halting further actions at ETA until the following morning. LANL engineering requested confirmation by PNM that they were not receiving a trip from LANL prior to restoring Norton. There were no indications within the substation that the relay was requesting trip at the time. It was discovered that verification of the trip required reporting onsite and live monitoring of relay to find that the Direct Transfer Trip had triggered. PNM attempted to close breaker 16162 or 15062, resulting in another breaker failure at Norton Station, extending the outage further.

LANL engineering reported to the field and confirmed that the breaker failure on 17062 had triggered a Direct Transfer Trip to the Norton end of the NL line via live monitoring, which remained standing at the time of PNM's close attempt, causing the breaker failure scheme to initiate at Norton. It was discovered that the NL GE relays were still calling for a trip at the ETA end, and could not be reset without a power cycle. Substation electricians rebooted the NL line GE relays by pulling fuses, but PNM personnel were unavailable to reset the breaker failure lockout at Norton, which was still sending a Direct Transfer Trip to LANL, preventing any further closing of breakers 11062 or 17062. Substation electricians cleared the Direct Transfer Trip from PNM by disconnecting fiber on the NL GE relays.

A LANL lineman patrol between ETA and White Rock revealed no findings, but patrols past White Rock were restricted. LANL engineering recommended restoring the NL line to White Rock due to patrol limitations, without the fiber in place, despite the fiber's role in providing differential protection. The risk of keeping White Rock blacked out was deemed higher than the potential risk to LANL's system. LANL operations concurred, and White Rock was restored. Breaker 11062 at ETA closed successfully, and LAC performed switching to restore load to White Rock.

Engineering, dispatch, and operations agreed to restore ETA T1 during normal hours, as all load was being successfully served by T2.

The causes of the outage included the appropriate operation of relays due to the lightning strike, a breaker failure initiated by the standing trip on the NL line GE relay (due to a design flaw requiring a relay reboot to reset), and miscommunication between LANL and PNM regarding confirmation of standing trips prior to breaker closures. LANL will conduct a thorough fact finding to determine corrective actions. LANL engineering actions may include restoring reclosing functionality at ETA, fixing the need for GE relays to require a reboot to clear faults, and considering the addition of SCADA signals or status lights to improve visibility of GE relay statuses. Furthermore, during the investigation, it was noted that breaker 17062's opening travel time had failed to meet specifications, prompting a recommendation for refurbishment or replacement of the breaker to prevent further outages.

**Follow on actions discussed:**

1. Review if setting up a calling service to minimize the calls coming into OPS so that the Operator can focus on the restoring power with minimal distractions.
2. Relay actions –
    a. LANL Eng to review settings and implement changes fix trip that does not reset without cycling power on the relay. Implement SCADA to show when trip is enabled/disabled.
    b. If settings cannot be changed, review and at minimum implement SCADA notification to note that trip is enabled so crews can be dispatched to power cycle relay if needed.
    c. If options "a" and "b" cannot be performed, initiate effort to replace relays at both ends of Norton to SELs.