“Diagnosing Power Outrages: A Day in the Life of a Troubleshooter”

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Lightning storms lit up the Dallas sky, prompting a 4:30 a.m. phone call to Oncor Troubleman Terry Eubanks. His shift wasn’t scheduled to begin for another two and a half hours, but scattered **outages** in the area meant he was needed to help quickly restore power to thousands of customers affected by the storm.

**Troubleshooters** are often the first on the scene during a power outage. Their job is to determine its cause and make necessary repairs to restore electricity. When repairs can’t be made, they relay critical information to distribution line crews who then deliver and replace damaged equipment.

“The lightning was bad,” said Eubanks of the July 30 storm. “It struck a power line and the **surge** looked for the weakest point. This was the weakest point.”

Eubanks was helping fellow troubleman Chris Miklis replace a **charred** piece of equipment that was one of two issues interrupting the delivery of electricity to more than 100 customers in a north **Plano** neighborhood. The damaged **probe** and **protective rubber insulator** connects buried high-voltage power lines to [neighborhood **transformers**](http://oncor.com/EN/Documents/Education%20Safety/Electricity/What%20is%20that%20hanging%20on%20the%20pole.pdf)that are responsible for distributing a lower, safer **voltage** of power to a network of homes and businesses.

The first step troubleshooters take to safely address outages is to identify [how power is being **distributed** in a neighborhood](http://oncor.com/EN/Pages/Power-Restoration.aspx). Each neighborhood has its own **electric circuit, or “loop,”** which begins where the [secondary line](http://oncor.com/EN/Pages/Common-Utility-Terms.aspx) drops from an overhead distribution line and ends where it returns back to a distribution line. A loop can contain numerous transformers and provide power to hundreds of homes.

By using their computers to map a neighborhood, troubleshooters can identify where the loop begins, ends and the location of every transformer in between. They can then formulate a plan to restore power to the most customers while isolating damaged equipment for additional repairs.

Work orders can vary, depending upon the number of outages reported in the area. When two or more homes connected to the same transformer report a loss of power, troubleshooters receive a work order to check on the transformer that distributes electricity to those homes. When houses from numerous transformers in the same area report a loss of power, troubleshooters are sent to check on a **blown fuse** at one end of the loop.

“My **trouble ticket** indicates there is another bad transformer in this neighborhood,” Eubanks said. “I’ll need to see if I can repair that before we close the circuit.”

When working on equipment, troubleshooters open the [fuse](http://oncor.com/EN/Pages/Common-Utility-Terms.aspx) on both ends of the loop to safely make repairs, much like how a homeowner would turn off a **breaker** to repair an electrical issue in their home. After repairs have been made, they restore power, or close the loop, to determine if any additional work needs to be done to maintain electric reliability.

By tracing the map, Eubanks could see that the suspect transformer was only a block away. No longer working with Miklis, he drove to the location and opened the metal box to check the customer-side distribution line for voltage. His **volt meter** displayed zero volts, indicating that no power was being transferred to the homes served by that transformer. A bad transformer fuse was likely to blame. He grabbed an eight-foot long **hot stick** off of his truck and removed a one-foot long rod from inside the transformer.

“This fuse should be covered in oil, but it’s not,” he said. “That tells me oil is leaking somewhere within the transformer. The lightning likely just finished it off. The transformer is damaged and will need to be replaced.”

Eubanks called Miklis, who waited at the other end of the neighborhood’s loop.  He communicated the problem and gave Miklis the go-ahead to **close the circuit**, restoring power to a majority of the customers in the neighborhood. Eubanks then reported the location and type of transformer to a crew who could deliver and replace the equipment.

Restoring power isn’t always as complicated as repairing numerous transformers in one neighborhood circuit. Eubanks’s next work order indicated a single blown fuse on an overhead distribution line that fed power to a neighborhood only a couple of miles away. The best case scenario to quickly restore power to a single neighborhood would require replacing a bad fuse with a new one.

Upon arrival at the job site, Eubanks noted a damaged fuse and **lightning arrestor**, two **fail-safes** in place to protect customers and electrical equipment from the extensive dangers of Mother Nature. An arrestor is designed to **dilute** the voltage of a lightning surge before it reaches equipment that powers a neighborhood.

Due to safety **protocol**, troubleshooters work in pairs when interacting with high-voltage. Miklis was there to assist with restoration.

The plan to restore power began with replacing the damaged fuse. They also removed the damaged lightning arrestor to prevent future outage issues. They hoped that was all that was needed to restore power to the area.

“He’s about to close the fuse,” Eubanks said. “If that’s all that caused this outage, then power will return to all of these homes.”

It was possible that additional problems could cause the new fuse to blow again. If it held, it meant no other repairs needed to be made. Miklis closed the fuse. It held. Power restoration was a success.

“I appreciate your help, man,” Miklis told Eubanks.

“Call me anytime,” Eubanks advised. “I’ve been at it a long time – more than 40 years – and believe me, I learn things all of the time. You just got to take it one step at a time.”

Eubanks’ wisdom is noticeable in his preparation. Packed in his truck is a bag that contains two-days-worth of clothes in case he’s called to help restore power in a neighboring city. Like most troubleshooters, he understands that he can be called upon to help at any time and at any location.

“It’s all about getting the customer’s power back on,” he said.

From [rescuing pets](http://thewire.oncor.com/News/Pages/Responding-to-Meows-for-Help-Employee-Rescues-Stranded-Kitten.aspx), to responding to outages caused by wildlife, to identifying and reporting **downed power lines**, troubleshooters live on the front lines of Oncor’s power restoration efforts. Because electricity never sleeps, they’re scheduled to work around the clock and can be called upon at any time to help with power restoration efforts. They are one part of many at Oncor that help keep the lights on in Texas.

List of Power/Energy Vocabulary Words from Text

1. outages

2. troubleshooter

3. surge

4. charred

5. Plano

6. transformers

7. voltage

8. distributed

9. electric circuit, or loop

10. blown fuse

11. trouble ticket

12. “close the loop” or “close the circuit”

13. breaker

14. volt meter

15. hot stick

16. lightning arrestor

17. fail-safe

18. dilute

19. protocol

20. downed power line

List of Power/Energy Vocabulary Words from Text

1. outages-n. times when the power is not working

2. troubleshooter-n. someone who works for a power company to determine the cause of a power outage and make necessary changes or report causes to a crew who can fix the problem

3. surge-n. burst of electricity

4. charred-adj. burned or blackened from fire or intense electricity

5. Plano-n. place in Texas

6. transformers-n. an electromagnetic device for increasing or decreasing electrical voltage

7. voltage-n. a volt is a unit of electrical pressure.120V is standard in U.S.

8. distributed-v. spread throughout

9. electric circuit, or loop-the completed path traveled by an electric current; an overhead line on poles or underground cables that carry power from substation to the customer. Circuit and distribution lines are used interchangeably. A circuit may also be referred to as a feeder.

10. blown fuse-n. a fuse is an electrical device which interrupts current flow to a circuit when the current exceeds a predetermined value. A fuse is used to protect a specific piece of equipment from damage caused by high currents or can be used to segment off smaller distribution lines from main circuits. A blown fuse is one that has been used to stop a surge. It must be replaced after it has been used.

11. trouble ticket-n. list of work orders or jobs that must be completed by a power worker in the specific order.

12. “close the loop” or “close the circuit”-phrase that means restoring the power to the customers who were served by that circuit (they will only have power if the problem has been fixed).

13. breaker-to “turn off the breaker” is to stop the flow of current in an electrical circuit

14. volt meter-n. device that measures the voltage, or electrical pressure

15. hot stick-n. an insulated pole utility workers use to when engaged on live-line working on energized high-voltage electric power lines

16. lightning arrestor-n. device used on electrical power systems and telecommunications systems to protect the insulation and conductors of the system from the damaging effects of lightning

17. fail-safe-n. something added to try to counteract a possible failure

18. dilute-v. to diminish the strength of something

19. protocol-n. a code of conduct of etiquette or behavior

20. downed power line-n. a power line that is no longer hanging from poles