Commercial and industrial electric service

Reliability and power quality at CenterPoint Energy

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Contents

Our business is reliability

At CenterPoint Energy, we understand that our customers demand both reliable and high-quality electric service. Dependable electricity is essential to the bottom line of industrial and commercial businesses as well as a necessity for the productivity and comfort of all our customers. As a result, CenterPoint Energy strives to make reliable power delivery a top priority.

Signs of a possible reliability or power quality issue

Are you experiencing problems with your equipment, or have you noticed any of these occurrences?

- The chillers at your facility frequently trip off-line.
- The variable frequency drives (VFD) in your facility trip off-line at the same time every day.
- The motors in your plant trip off-line when there is a "power blip."
- The uninterruptible power supply (UPS) has frequently been beeping and switching to battery.
- What you consider to be excessively frequent power interruptions are impairing production.

Why is this? Well, events like these are possibly the result of either reliability or power quality related issues. These concerns may be caused by conditions originating from the utility system, from within your facility, or even from the affected equipment itself.

In order to determine the most appropriate solutions to your reliability and power quality problems, it is best to first understand how electricity is delivered from the utility to your business.

How CenterPoint Energy delivers electricity

CenterPoint Energy delivers electricity to over 2.4 million customers across a 5,000 square mile service area which requires an extensive network of transmission and distribution facilities. How extensive? CenterPoint Energy's 28,702 miles of overhead distribution poles and wires is enough to completely circle the Earth. Add to that almost 24,000 miles of underground distribution lines and over 3,700 miles of transmission lines.

The electricity delivered to your business typically goes through the following process as illustrated in Figure 1.

1. Electricity is generated at a centralized power plant.

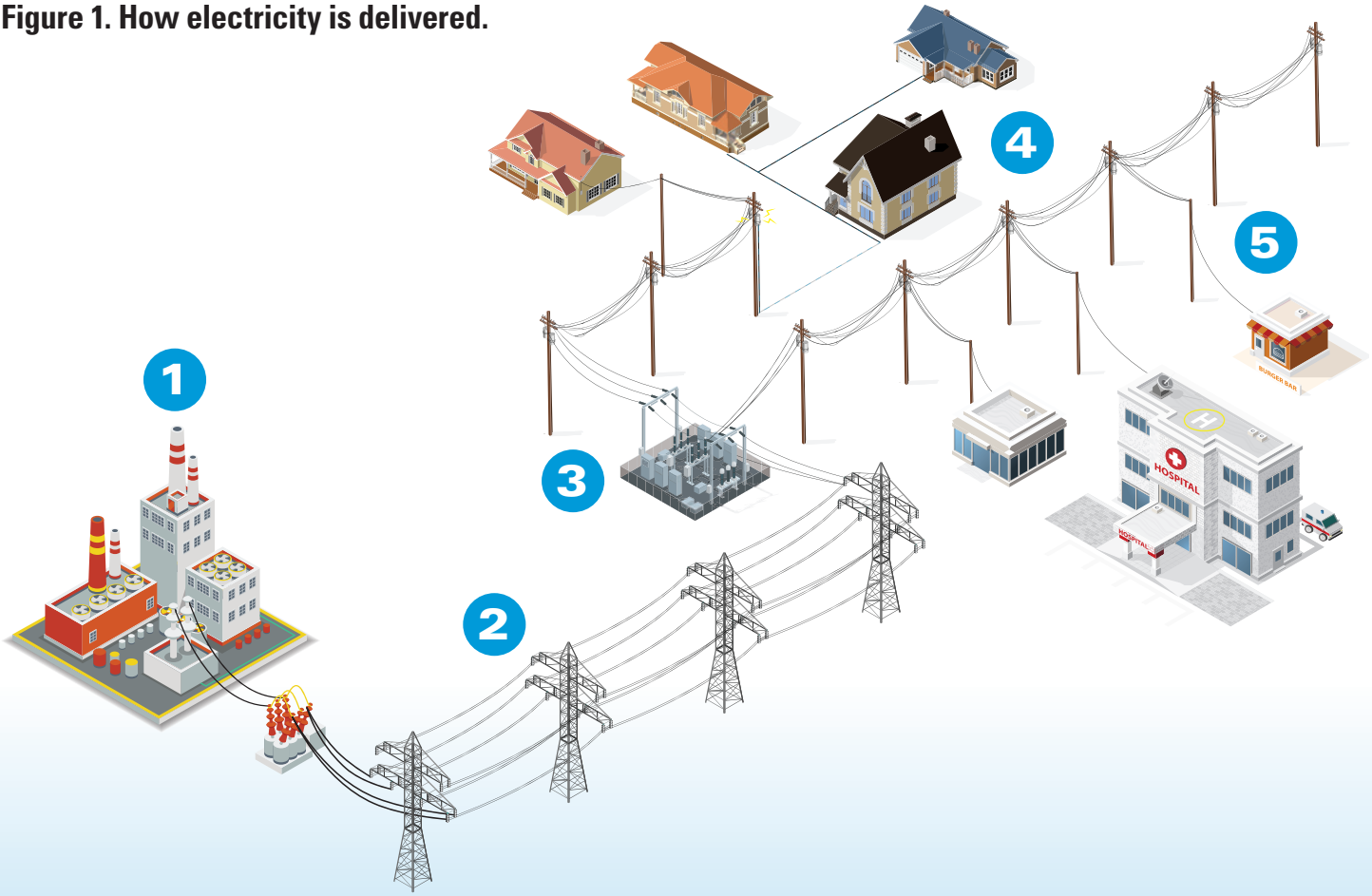
2. Electricity travels over long distances via high voltage transmission lines.

3. From the transmission system, electricity travels to distribution substations.

4. From these substations, distribution lines, operating at a lower voltage, disperse electricity throughout cities and neighborhoods along streets and easements.

5. Electricity then travels from the distribution line through a service transformer located close to your business and finally to your meter.

Figure 1. How electricity is delivered.



What causes reliability issues?

Most power outages and disturbances can be attributed to factors beyond the control of the utility. CenterPoint Energy's system is exposed to environmental influences and normal operational conditions, which can create both power quality and reliability disturbances. Common sources of disturbances include the following as illustrated in Figure 2:

Figure 2. Common sources of disturbances

Lightning

Insulator flashovers

Dig-ins on underground lines

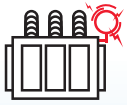
Automobile collisions

Birds and other wildlife

Trees and vegetation

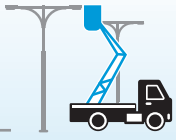
Strong winds

Vandalism



Equipment failures

Operations, adjacent circuits and maintenance



Understanding how reliability is measured

CenterPoint Energy maintains statistics of interruption frequencies and durations for each distribution circuit and for the electric system as a whole. While there is some variation from year to year, the average interruptions that customers may experience are as follows:

Duration of sustained interruptions = 126 minutes per year
Number of sustained interruptions = 2 per year

CenterPoint Energy also maintains statistics of momentary interruption frequencies for each distribution circuit and for the system as a whole. While there is some variation from year to year, the average momentary interruptions that customers may experience are as follows:

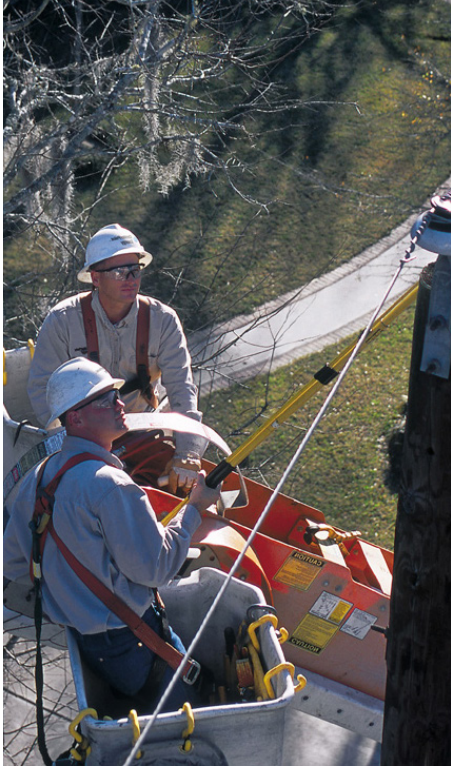
Number of momentary interruptions = 9 per year

Besides momentary interruptions, instantaneous voltage sags are the most common type of utility-related power quality event that adversely affects customers. While CenterPoint Energy does not keep statistics on voltage sags, it did participate in a national power quality survey that accurately reflects what typical customers can experience:

Number of sags below 90% of nominal voltage = 70 per year

Of these 70 sags, 23 will dip below 70% of nominal voltage, which is generally considered the threshold for causing motors and other sensitive equipment to drop off-line. The duration of these voltage sags varies. Customers may see sags lasting between 16- 54 milliseconds.

Customers may experience overvoltages, also known as voltage swells, as a result of lightning strikes on nearby facilities. The magnitude of these voltage swells will vary based off the intensity of the lightning strike. The frequency of these swells is dependent upon weather activity.



What is CenterPoint Energy's responsibility regarding reliability and power quality?

In terms of reliability and power quality, two sections in chapter 5 of the Public Utility Commission of Texas (PUCT) approved CenterPoint Energy Tariff are especially important.

- Section 5.2.1 (Liability Between Company and Retail Customers) states CenterPoint Energy will make reasonable provisions to supply steady and continuous delivery service, but does not guarantee against fluctuations or interruptions.
- Section 5.5.3 (Equipment Sensitive to Voltage and Waveforms) states customers with equipment that may be adversely impacted by voltage fluctuations are responsible for installing the necessary protective equipment to limit the effect of those events.

In addition to the tariff, the PUCT has two specific Substantive Rules addressing reliability and power quality:

Substantive Rule 25.51 (Power Quality) states CenterPoint Energy shall maintain its standard distribution system nominal voltages within the limits specified in the current version of ANSI Standard C84.1. This standard defines the ranges of acceptable service voltages under normal conditions as shown in Table 1. For customers receiving transmission level voltages CenterPoint Energy shall maintain voltages within a range of plus or minus 10%.

Nominal Service Voltage	Minimum Voltage (-5%)	Maximum Voltage (+5%)
120 V	114 V	126 V
208 V	198 V	218 V
240 V	228 V	252 V
277 V	263 V	291 V
480 V	456 V	504 V

Table 1. Service Voltage Limits – ANSI C84.1 Range A

Variations in excess of the limits mentioned above caused by action of the elements and infrequent and unavoidable fluctuations of short duration due to station or system operation are not considered a violation of these limits.

CenterPoint Energy and the customer shall also maintain the harmonic distortion levels within the limits specified in the current version of IEEE Standard 519, IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems. This standard defines the ranges of acceptable voltage harmonic levels as shown in Table 2.

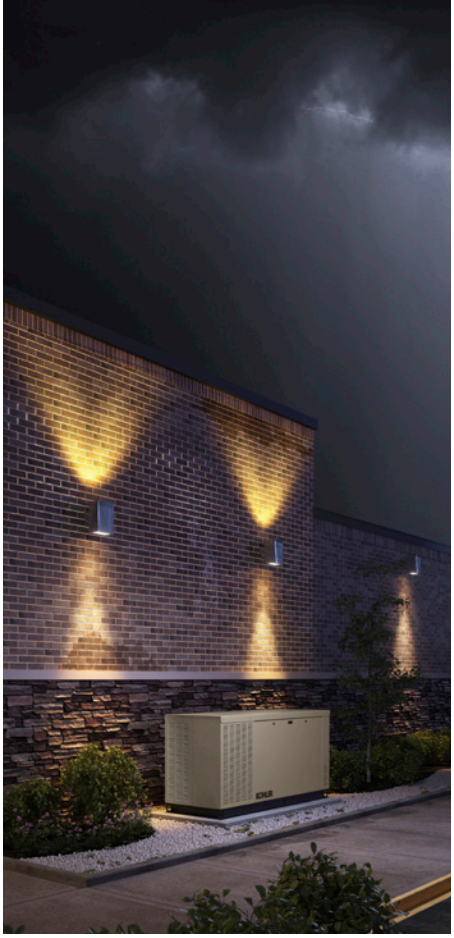
Voltage at Point of Common Coupling	Individual Harmonic (%)	Total Harmonic Distortion (%)
V≤1.0 kV	5.0	8.0
1kV < V ≤ 69 kV	3.0	5.0
69kV < V ≤ 161 kV	1.5	2.5
161 kV < V	1.0	1.5

Table 2. Voltage Distortion Limits – IEEE Standard 519

Substantive Rule 25.52 (Reliability and Continuity of Service) is similar to Section 5.2.1 of the PUCT-approved CenterPoint Energy Tariff. It states CenterPoint Energy will make reasonable efforts to maintain electric delivery service. In the event of an interruption, CenterPoint Energy shall reestablish service as quickly as possible.

CenterPoint Energy shall also maintain the following reliability standards:

- **System Average Interruption Frequency Index (SAIFI)** CenterPoint Energy shall maintain and operate its electric distribution system so that its SAIFI value shall not exceed its system-wide SAIFI standard by more than 5.0%.
- **System Average Interruption Duration Index (SAIDI)** CenterPoint Energy shall maintain and operate its electric distribution system so that its SAIDI value shall not exceed its system-wide SAIDI standard by more than 5.0%.



What are the customer's responsibilities?

Per CenterPoint Energy's Tariff, it's the responsibility of customers with concerns about sensitive equipment in their business that could be affected by power quality issues to install protective equipment in their facilities. Protective equipment to enhance electric service is readily available in the power quality market. Examples of these devices are as follows:

- **Uninterruptible power supply (UPS):** Provides backup power when the primary source is not available. It also provides protection from power surges.
- **Transient voltage surge suppressor (TVSS):** Provides protection against overvoltage, also known as voltage swells.
- **Harmonic filters:** Used to decrease voltage distortion and for power factor correction.
- **Constant voltage transformer:** May be used to control voltage variations.
- **Standby generator:** Provides backup power when the primary source is not available.

CenterPoint Energy recommends customers contact a power quality consultant or electrician to determine the appropriate equipment needed.

How to determine if you have a power quality or reliability issue

Below is a guide to help determine the root cause of your power quality or reliability issue.

Start a log to keep track of the date and time when the issue occurs and a description of what happened. Does the issue occur throughout the entire facility, on specific circuit branches, or just to a particular piece of equipment? Did any protective equipment such as breakers or fuses operate?

1. **Verify equipment is working properly.** If you are having issues with a particular piece of equipment, contact the manufacture to see if they can identify the problem. Check and document any alarms or notifications from your equipment.

2. **Contact an electrician.** Schedule an electrician to check the following:
   - Inspect major electrical equipment such as conductors, transformers, protection devices, and power conditioners for damage.
   - Verify equipment is set to function within CenterPoint Energy's voltage and harmonic limits as described on pages 8 and 9.
   - Verify earth grounding electrode and connections are clean and tight.
   - Verify there is only one neutral-to-ground bond at the main service panel and that the neutral is not bonded to the grounds at any downstream panels or receptacles. The only exception to this rule is that each separately derived system may have one additional neutral-to-ground bond.
   - Verify conductors running to equipment is sized correctly and of proper length to supply adequate voltage.

3. **Contact CenterPoint Energy.** If you have completed the above steps and the problem has still not been resolved, contact CenterPoint Energy. The log sheet you began in Step 1 is now your critical means of communicating the nature of your problems to CenterPoint Energy.

CenterPoint Energy's commitment to improving reliability and power quality

Reliable electricity is critical to the daily life of business owners in Houston and the surrounding communities. With more than 130 years of energy delivery service, CenterPoint Energy employees are always there to maintain the reliability and power quality of the electrical delivery system as well as quickly restore power after outages. And as your trusted energy advisor, we're here to help with information about your electric service or to discuss reliability and power quality in more detail.

Please contact customer service at 713-207-2222 or visit CenterPointEnergy.com/OutageCenter.

CenterPoint Energy. Always There.

Definitions

Adjacent circuits: Two circuits are considered adjacent to one another if they are electrically connected to the same substation transformer.

Harmonic: A component of order greater than one of the Fourier series of a periodic quantity. For example, in a 60Hz system, the harmonic order 3. Also known as the "third harmonic," is 180 Hz. As defined in IEEE std. 519.

Harmonic distortion occurs because electronic equipment draws current from the power line at frequencies which are multiples of 60 Hertz. These harmonic currents create voltage drops in the building wiring which cause harmonic voltage distortion. Electronic equipment which causes harmonic distortion includes rectifiers, adjustable speed motor drives, fluorescent lights, uninterruptible power supplies and computers.

Momentary interruption: Single operation of an interrupting device which results in a voltage zero and the immediate restoration of voltage. As defined in PUCT Chapter 25.52.

Power quality: Typically used to describe the characteristics of power fluctuations, such as momentary interruptions, voltage sags, voltage swells, and harmonic distortion.

Public Utility Commission of Texas (PUCT): The Public Utility Commission of Texas regulates the state's telecommunications, electric, and water and sewer utilities, implements legislation, and offers customer assistance in resolving complaints.

Reliability: Refers to the continuity of power as described by the number and duration of outages.

System Average Interruption Frequency Index (SAIFI): The average number of times that a customer's service is interrupted. SAIFI is calculated by summing the number of customers interrupted for each event and dividing by the total number of customers on the system being indexed. A lower SAIFI value represents a higher level of service reliability. As defined in PUCT Chapter 25.52.

System Average Interruption Duration Index (SAIDI): The average amount of time a customer's service is interrupted during the reporting period. SAIDI is calculated by summing the restoration time for each interruption event times the number of customers interrupted for each event, and dividing by the total number of customers. SAIDI is expressed in minutes or hours. A lower SAIDI value represents a higher level of service reliability. As defined in PUCT Chapter 25.52.

Service voltage: The voltage at the point where the electrical system of the supplier and the electrical system of the user are connected. As defined in ANSI C84.1.

Sustained interruption: All interruptions not classified as momentary. As defined in PUCT Chapter 25.52.

Total Harmonic Distortion (THD): The ratio of the root mean square of the harmonic content, considering harmonic components up to the 50th order excluding interharmonics, expressed as a percentage of the fundamental. As defined in IEEE std. 519.

Voltage sag: A decrease to between 0.1 and 0.9 per unit in rms voltage at the power frequency for durations of 5 cycles to 1 minute. As defined in IEEE Std. 1159.

Voltage swell: An increase in rms voltage at the power frequency for durations from 0.5 cycles to 1 minute. Typical values are 1.1–1.8 per unit. As defined in IEEE Std. 1159.

Always There.®