



S&C's 2018 State of Commercial & Industrial Power Reliability Report

An S&C report in collaboration
with Frost & Sullivan



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INTRODUCTION

In S&C Electric Company's first "State of Commercial & Industrial Power Reliability" report, conducted in collaboration with Frost & Sullivan, facilities and energy managers of commercial and industrial (C&I) businesses across the United States were surveyed regarding their perspectives on power reliability and future energy needs.

Averaging \$4 billion in revenue, these companies comprise the majority of the metered revenue for the utilities serving them. Respondents' opinions authentically portray the industry's current conditions, and their long-term needs heavily influence the future grid.

These respondents are the key decision-makers who select electricity commodity suppliers across the Manufacturing, Data Center, Healthcare, Small Franchise, and Education sectors. They were screened and selected according to their relevance and authority to make power-related decisions and, consequently, 76% come from facilities management, corporate management, or operations. Their companies represent a balance in size, with their monthly energy consumption ranging from 10 MWh to more than 50 MWh. In total, the 251 survey respondents were pulled equally from the four census regions of the United States, and along with their targeted job function, they make up a statistically significant sample size that depicts the true state of C&I reliability.

THE RESEARCH SET OUT TO ASSESS THE FOLLOWING:

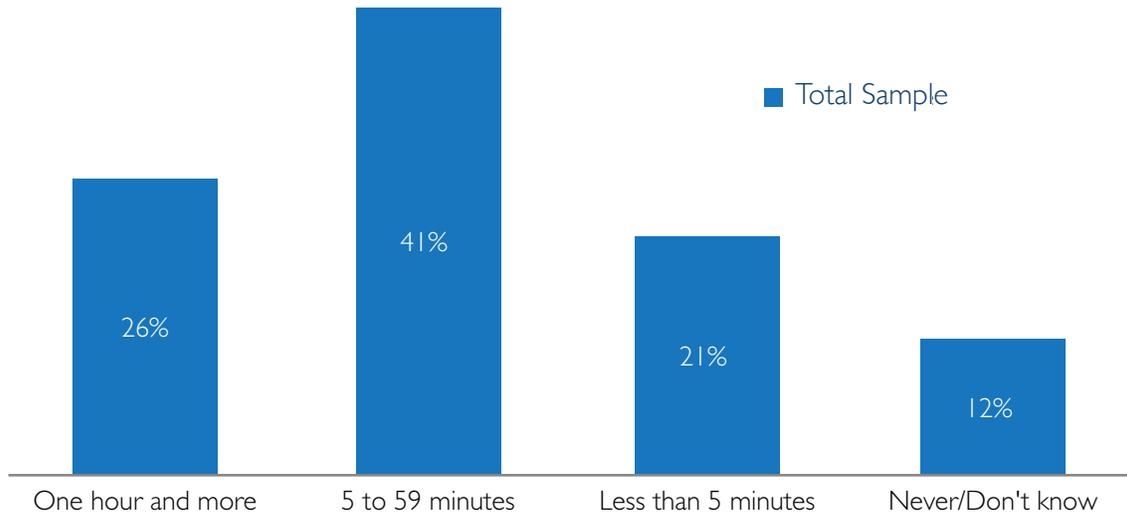
- What has been their experience with power outages, and do outages matter?
- What are the costs and business impacts of outages?
- To what degree do C&I companies accept the existing state of power reliability?
- How receptive are C&I companies to raising the bar for reliability?
- Are C&I companies acting on their own to improve their reliability?

This report discusses findings in detail, particularly the differences observed within five distinct industry categories and by geographic region. Regional breakdowns include:

- **Northeast:** Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, New York, Pennsylvania, and New Jersey
- **Midwest:** Wisconsin, Michigan, Illinois, Indiana, Ohio, North Dakota, South Dakota, Minnesota, Iowa, Kansas, and Missouri
- **South:** Alabama, Kentucky, Mississippi, Tennessee, Arkansas, Louisiana, Oklahoma, Texas, West Virginia, Virginia, District of Columbia, Maryland, Delaware, North Carolina, South Carolina, and Florida
- **Pacific:** Montana, Idaho, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico, Washington, Oregon, California, Hawaii, and Alaska

I. OUTAGE AUDITS: THE TRUTH ABOUT C&I POWER RELIABILITY

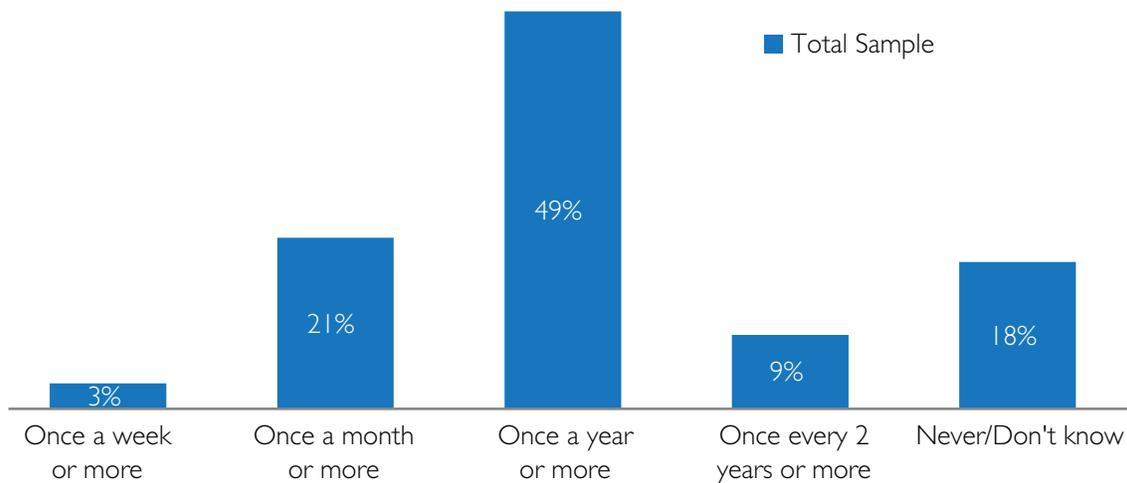
Chart 1: U.S. C&I Average Duration Outage, 2017



n = 251
A9n. On average, how long do your power outages last?

To create a backdrop for the findings in this report, the survey asked respondents about the average duration of their outages. More than a quarter of respondents experienced outages that lasted an hour or more. See Chart 1.

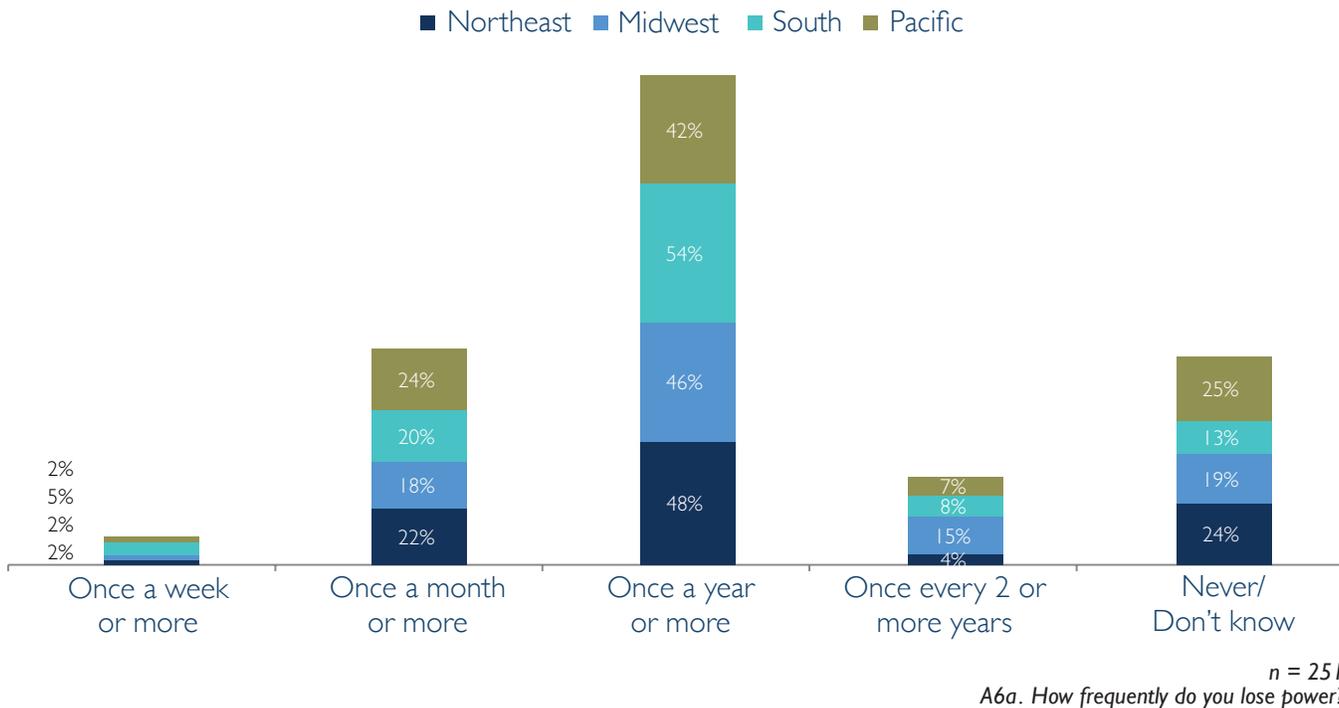
Chart 2: U.S. C&I Outage Frequency, 2017



n = 251
A6a. How frequently do you lose power?

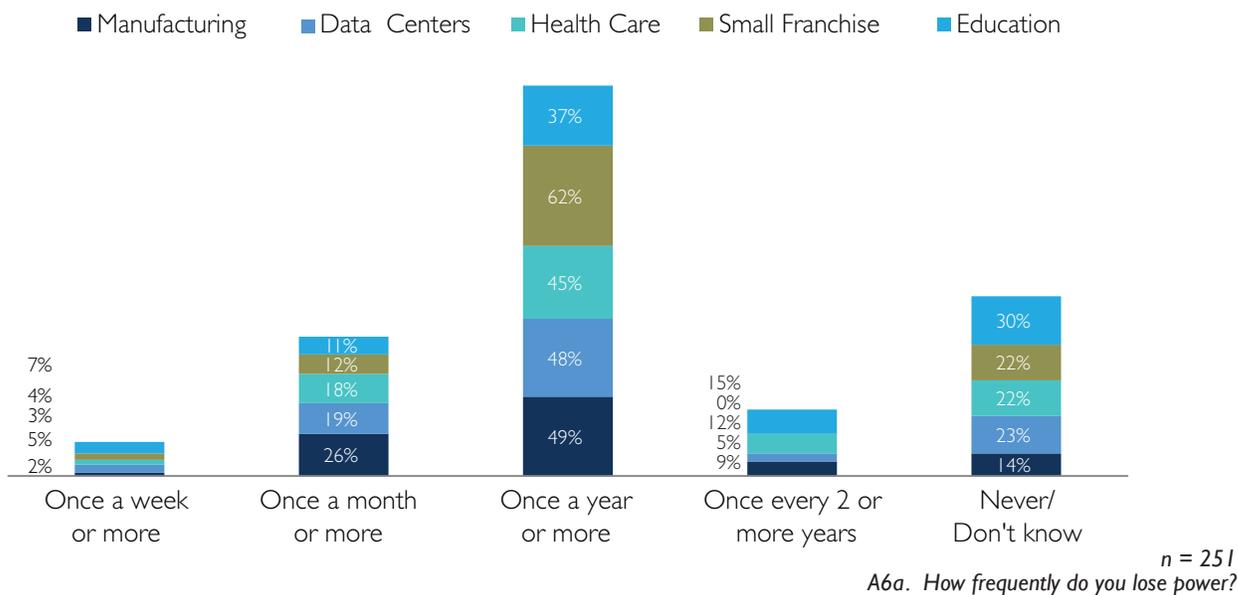
In analyzing how frequently C&I customers lose power, nearly half of C&I customers experienced a power outage at least once a year, and 21% had an outage at least once a month. See Chart 2.

Chart 3: U.S. C&I Outage Frequency, by Region, 2017



For outages once a month or more, this frequency was fairly even regionally across the entire United States, with each region hovering around 20%. See Chart 3. This even split holds true for once-a-year outages or more, but with the South coming in slightly higher and crossing into the majority at 54%. While weekly outages are much less common, this view shows that 5% of C&I customers in the South reported outages on a weekly basis.

Chart 4: U.S. C&I Outage Frequency, by Industry, 2017

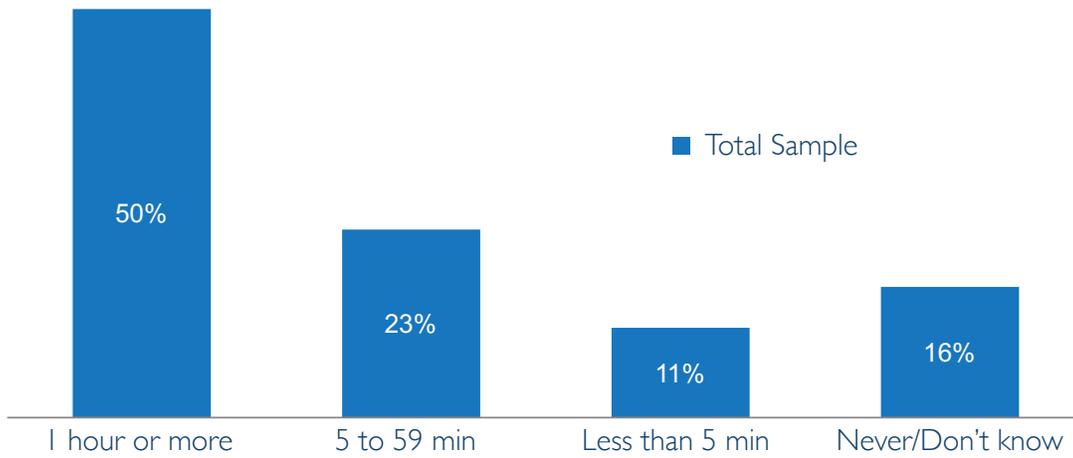


By industry, Education experiences the most in terms of outage frequency, with 7% of that sector encountering an outage once a week. See Chart 4 on page 5. More than a quarter of the Manufacturing industry deals with an outage at least once a month, and Data Centers and the Healthcare industries are not far behind at 19% and 18% respectively.

The majority of Small Franchises are affected by outages once a year, and almost half of the Manufacturing, Data Center, and Healthcare industries are as well.

With this baseline, the survey explored extreme cases, and the results follow.

Chart 5: U.S. C&I Worst Power Outage in the Past 12 Months, 2017

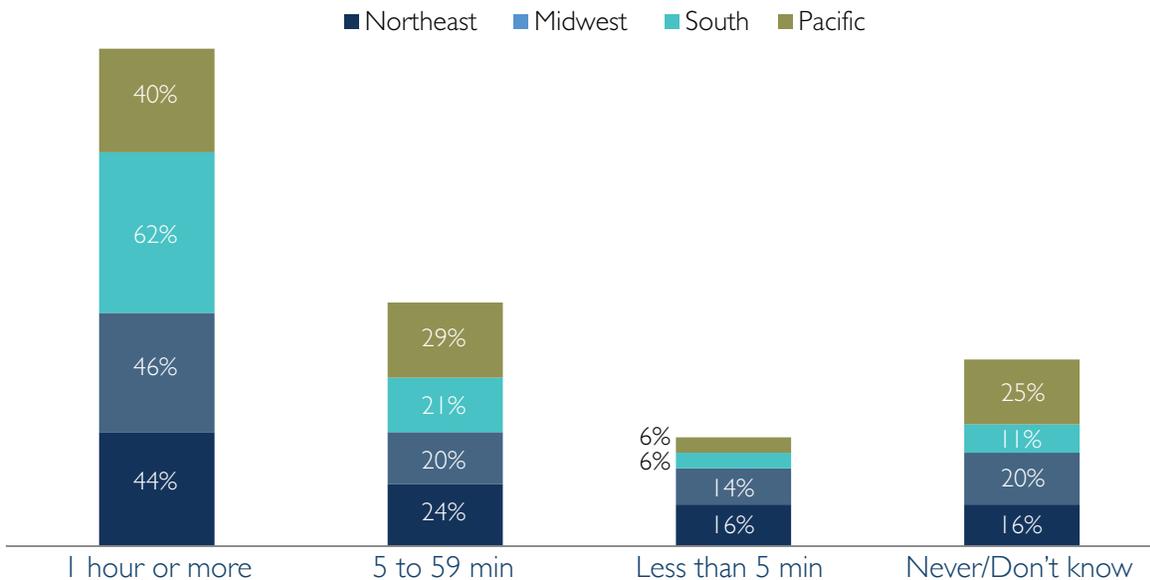


n = 251

A7. What was the duration of the worst power outage that you experienced in the past 12 months?

In 2017, 50% of C&I customers surveyed reported experiencing a power outage that lasted more than 1 hour. See Chart 5. In the previous 12 months, 84% of respondents recalled some form of power interruption.

Chart 6: U.S. C&I Worst Power Outage in the Past 12 Months by Region, 2017



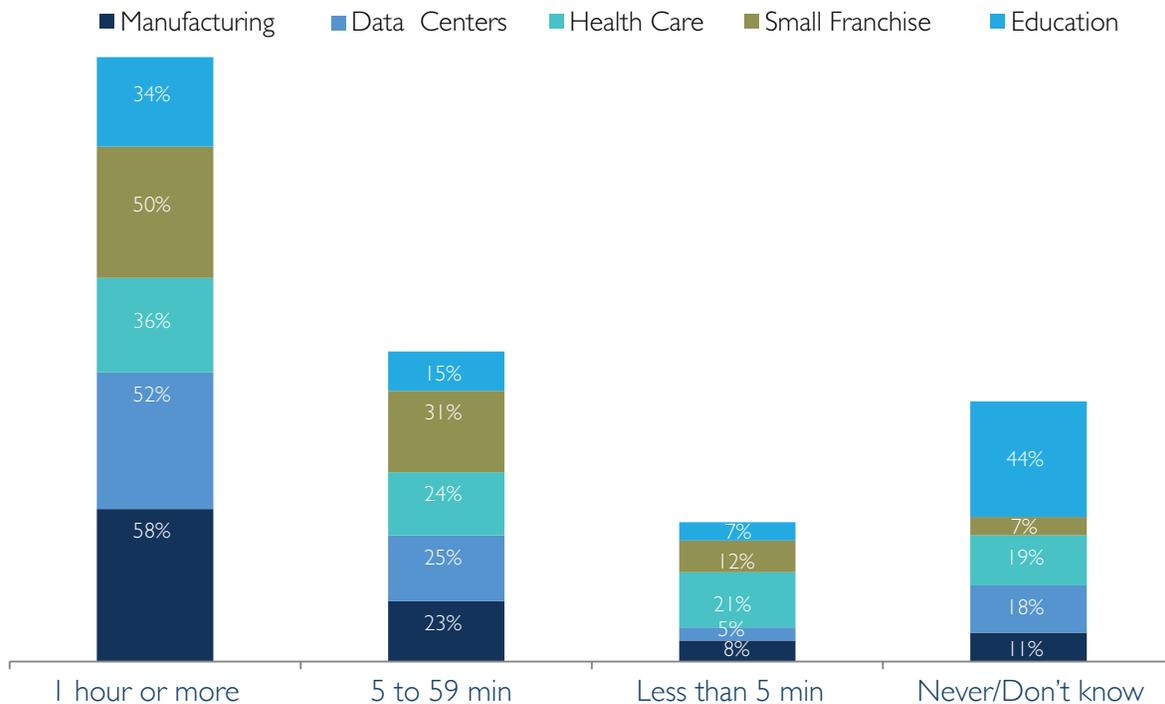
n = 25

A7. What was the duration of the worst power outage that you experienced in the past 12 months?

Regional details of the responses show the South endures the longest power outages, with 62% of respondents affected by an outage lasting more than an hour. See Chart 6 on page 6. Close to a majority of C&I customers in the Midwest also dealt with these long power interruptions. The rest of country registered their outage duration as slightly lower, but still in excess of 40% of customers.

Aging infrastructure and weather-related issues can partially be blamed for these interruptions, as seen later in the report.

Chart 7: U.S. C&I Worst Power Outage in the Past 12 Months by Industry, 2017



n = 251

A7. What was the duration of the worst power outage that you experienced in the past 12 months?

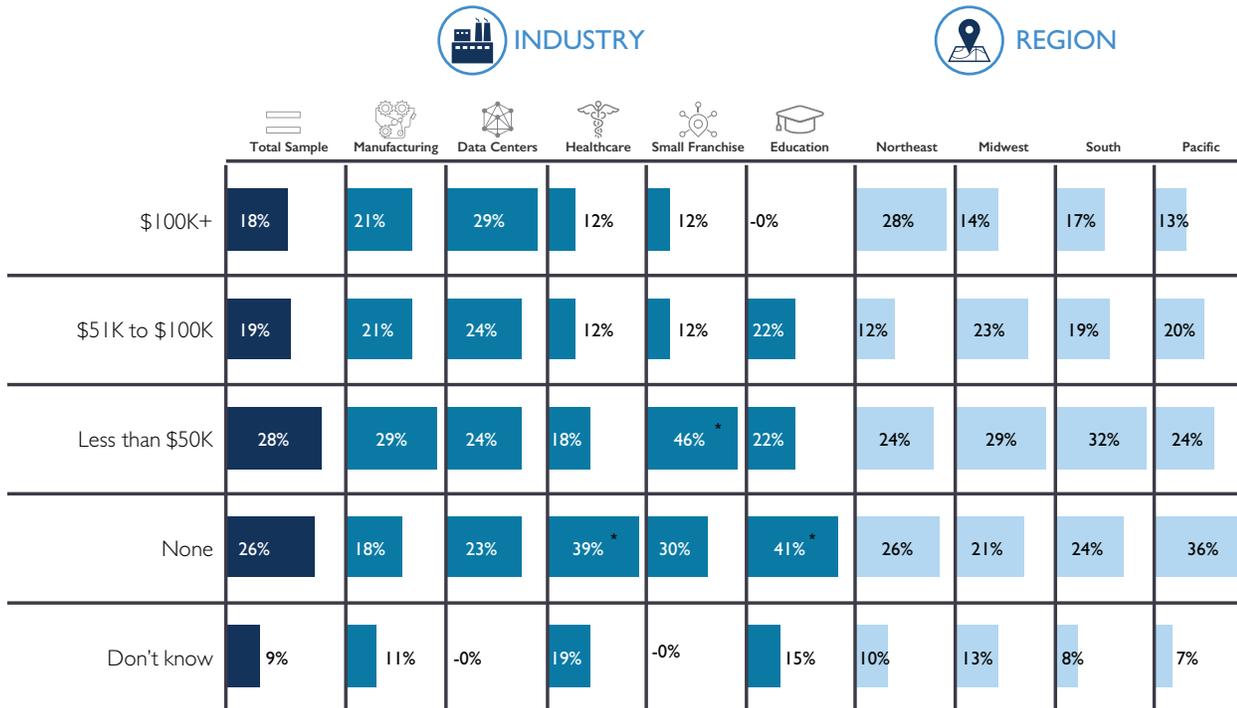
From an industry-segment perspective, long-duration outages were seen most often within the Manufacturing industry in 2017, with 58% reporting an outage of an hour or greater. See Chart 7. Close behind were Data Centers and Small Franchises, the majority of which also experienced outages lasting an hour or more.



At the other end of the spectrum, 44% of C&I customers in Education either were not aware of or reported zero outages.

These interruptions are part of a foundation for strong interest in improving weather resilience and minimizing power interruptions detailed by respondents later in the report.

Chart 8: U.S. C&I Financial Impact of the Worst Power Outage, 2017



A8. What was the financial impact to your business because of this single event?
n = 251
 * Significantly larger at 95% confidence level

Power outages affect businesses in many ways, and most involve unplanned expenses or other costs. Some additional costs remain hidden or otherwise unrepresented in the responses in Chart 8, but the figures serve as a baseline for additional analysis. In examining the resulting costs of outages on businesses, 18% of C&I customers suffered a financial impact of \$100,000 or more. For another 19%, outages inflicted costs of \$50,000 or more.

Of the industries and regions with the costliest outages, 29% of Data Centers and 28% of the respondents from the Northeast lost more than \$100,000. On the other hand, 41% of Education and 49% of Healthcare, as well as 36% of those from the Pacific region, did not encounter any financial loss as a result of an outage.

While this survey did not directly correlate costs to cause, typically financial loss falls in line with the industries' or regions' duration and frequency of outages. For the industries and regions with little or no financial impact, these categories have a tendency to prepare their facilities and systems in the event of an outage, as is explored later in this report.

Section Comments on the Outage Audit

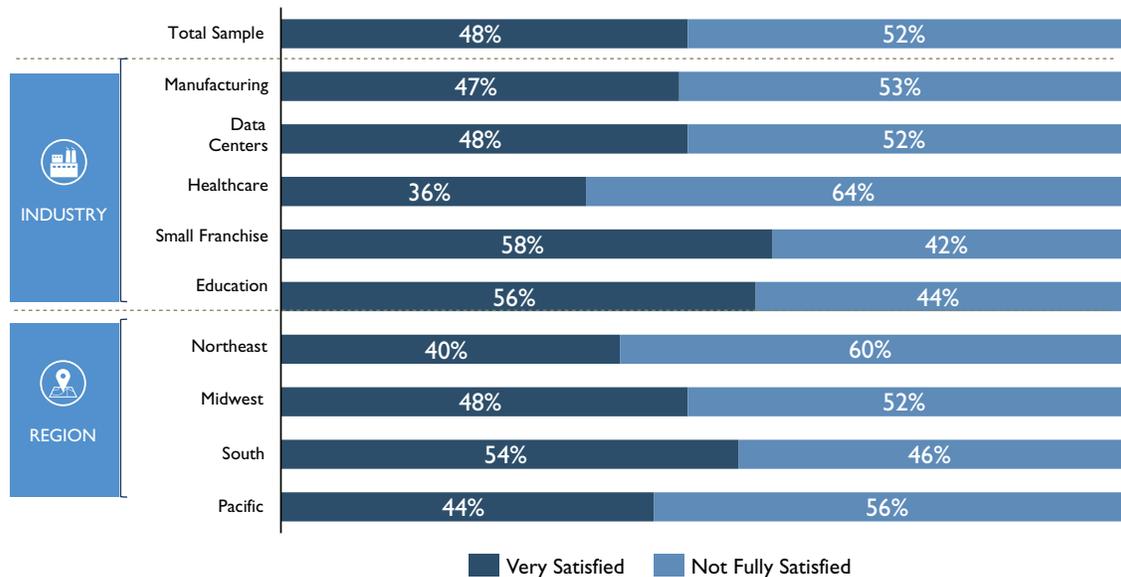
The outage audit of C&I customers' frequency and duration of outages sets a baseline for utility producers' ability to deliver their product: energy. Many of the industries represented in this survey hold a better position, electrically, within the natural hierarchy on a typical utility grid. Their physical location on the grid tends to result in a better service level than an average residential tract. In that light, half of companies experienced a power outage lasting more than one hour, and a quarter of them experienced a power outage at least once a month. The impact of this plays out in subsequent responses.

Disruptions to any process, industrial or in commercial transactions, will cause loss. Indeed, losses ran the entire spectrum, but 18% of the respondents experienced financial loss greater than \$100,000.

II. DRIVERS OF SATISFACTION AND DISSATISFACTION

Although this survey sought statistically to determine the drivers of customer satisfaction and dissatisfaction, the impacts of reliability and costs naturally materialized.

Chart 9: U.S. C&I Customer Satisfaction with Power Reliability, 2017

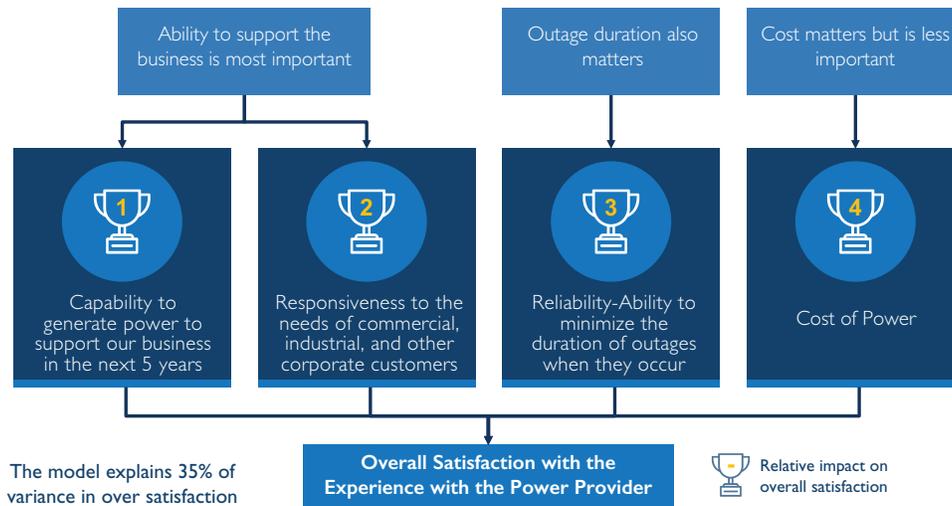


A4_1. How would you rate your power provider in terms of the following? - Overall Reliability of Power n = 251

Asked about their level of satisfaction with their power providers' reliability, 52% of C&I customers stated they are not fully satisfied. See Chart 9. These findings suggest an unmet need or greater expectation of their current service provider.

The analysis also shows variation in responses by region and industry, which is not entirely reflective of their actual experience with power outages. For instance, customers in the Healthcare sector surprisingly jumps up the list in terms of being less fully satisfied with their power reliability, even though other industries, especially Manufacturing and Data Centers, report longer and more frequent outages. Similarly, customers from Small Franchises and those from the South appear more content with their power reliability, even though they typically have longer and more frequent outages, as seen in the previous charts.

Chart 10: U.S. C&I Power Provider Attributes that Drive Overall Satisfaction, 2017



n = 251

The model is the result of a step-wise linear regression to check the impact of various power provider attributes in A4 on the AI Overall satisfaction with company's experience with power provider in the past 12 months. Scores above are the relative impact on overall satisfaction based on the standardized beta coefficients of the predictors derived from linear regression.

Conversations with these customers sought to determine the key drivers for satisfaction with their power provider. The two prevailing attributes were (1) the power providers' ability to support their business in both the long and short term through their capability to generate adequate power over the next five years and (2) their responsiveness to commercial and industrial needs. See Chart 10. Subsequent were power reliability itself and cost of power.



While steady and cost-effective power are logical drivers for C&I customers' satisfaction with their power provider, this reveals that customers value even more highly their power providers' attention to C&I priorities and their ability to evolve alongside their industries.

Chart 11: U.S. C&I Response excerpts about Overall Satisfaction, 2017

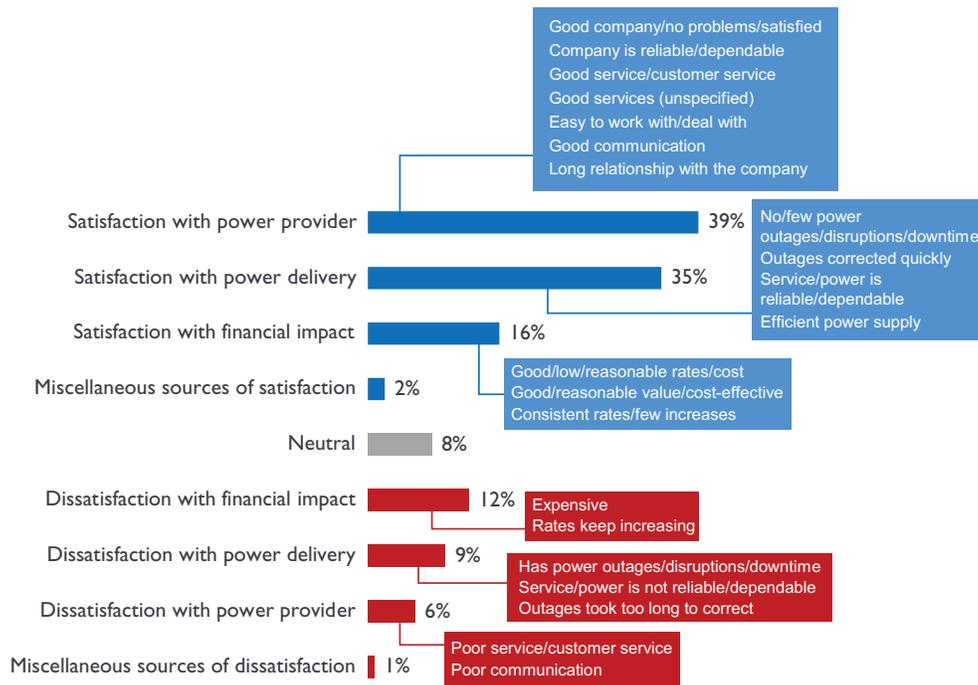
Areas of Improvement	Responses from Customers
1. Infrastructural Improvement and Reliable Service	<p>“Enhance smart automation of power and renewable energy”</p> <p>“Better reliability in bad weather, quicker response to outages”</p> <p>“The biggest issue in my area is power outages, I would hope they would make their services more reliable.”</p> <p>“More fleets to better manage weather-related issues”</p> <p>“More reliable generator during hurricane season”</p> <p>“More money into infrastructure and storm preparedness and better tech to manage usage and savings”</p>
2. Billing and Cost	<p>“Pricing could be better. It’s reasonable, but it could always be better. Their profits are probably more than they need to be.”</p> <p>“Less pricing tiers and less differential between peak and off peak tiers”</p> <p>“Lower cost”</p> <p>“Lower the cost and make it easier to pay”</p>
3. Sustainable and Renewable Options	<p>“Sustainable solutions, enhancing power and energy”</p> <p>“Better efficiency and utilization of renewable resources to be the greatest extent with sustainable and environmental friendly technologies”</p> <p>“I would expect our power provider to focus on using solar power and providing it to customers.”</p>
4. Customer Service	<p>“More centric notification during power interruptions”</p> <p>“Faster fix time; notification of possible downtime; lower prices for heavy users”</p>

Even among those respondents who expressed they were very satisfied, C&I customers recognize key areas of improvement needed from their power providers. Asked to relay their observations, common themes included infrastructure improvements, faster and more transparent customer service, better pricing, and broader sustainability options. See Chart 11.

As C&I customers plan for future growth, they are seeking long-term partnerships with their power provider to ensure continuity in operations. C&I customers’ needs require their power provider to grow with them and adapt to change, necessitating a collaborative and proactive approach to demand that leverages technologies needed to keep pace with rapidly changing industries.

Hence, C&I customers value providers with clear, long-term strategies to modernize their infrastructure and are looking for reassurance and visibility into infrastructure upgrades and power capacity enhancement. As a result, power providers’ investments into grid hardening and modernization will help solidify customer retention and improve satisfaction.

Chart 12: U.S. C&I Satisfaction Level with Power Service Provider, 2017



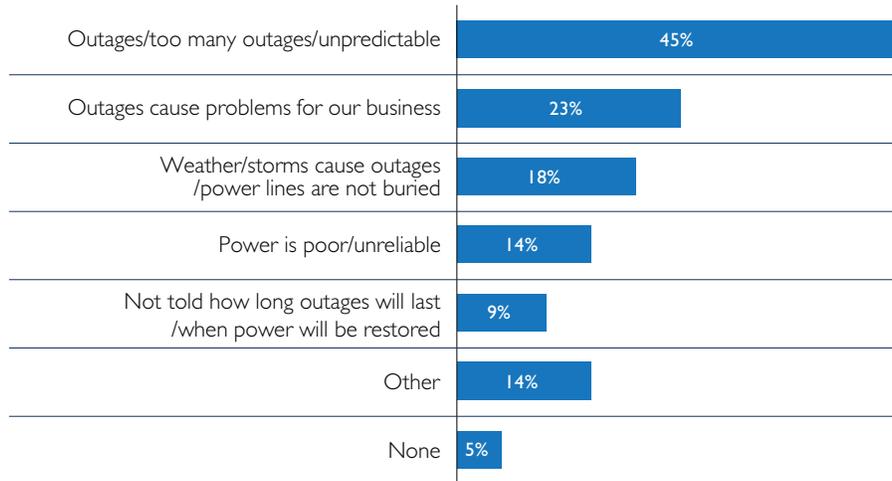
n = 251
A2. Why are you [A1] with your power provider?

Drilling down into these overall drivers of satisfaction, C&I customers were also asked to recall why they were satisfied or dissatisfied with the overall aspects of their power providers’ service.

For the 39% of C&I customers satisfied with business operations, these factors included power providers’ customer service, communication, reputation, and smooth working relationship. See Chart 12. For the 35% of C&I customers satisfied with power delivery, specifics included an acceptable frequency and duration of outages, as well as the ability to restore power quickly. This shows that C&I customers consider both their providers’ system and people skills, assessing both their providers’ capabilities to deliver power as well as the day-to-day management and the long-term strength of their business partnership.

The most common reason for dissatisfaction with overall service from their provider was the financial impact to their business, with 12% of C&I customers citing expensive and continually rising rates as the source of their sentiment.

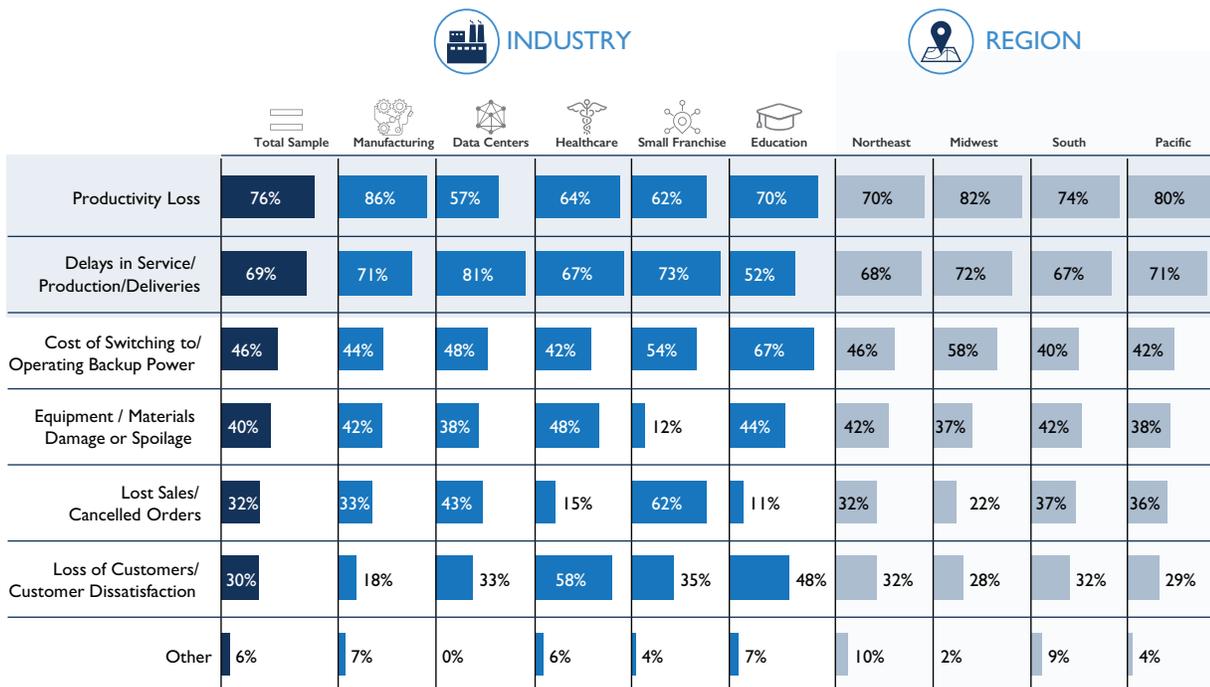
Chart 13: U.S. C&I Reason of Dissatisfaction with the Reliability of Power, 2017



A5. Why are you dissatisfied with the reliability of power? n = 22

Shifting focus to reliability, 45% of customers were dissatisfied with outages that occurred too frequently and with unpredictable power delivery. See Chart 13. Following in line with this sentiment, at 23% the next main cause for dissatisfaction was because power outages caused problems for their businesses.

Chart 14: U.S. C&I Impacts because of Power Outages, 2017

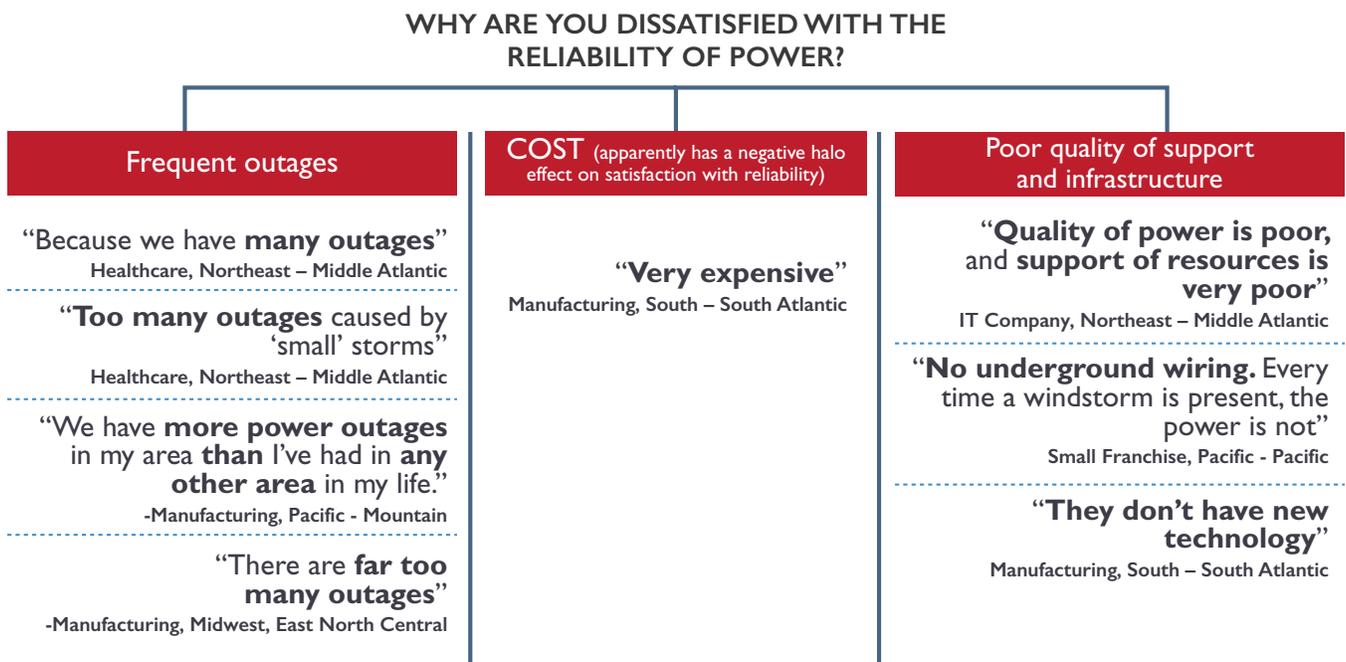


A12. The following are possible types of impact that your company may have experienced due to power outages in the past 12 months. Please select the 3 most significant types of impact that your company experienced. - Ranked n = 251

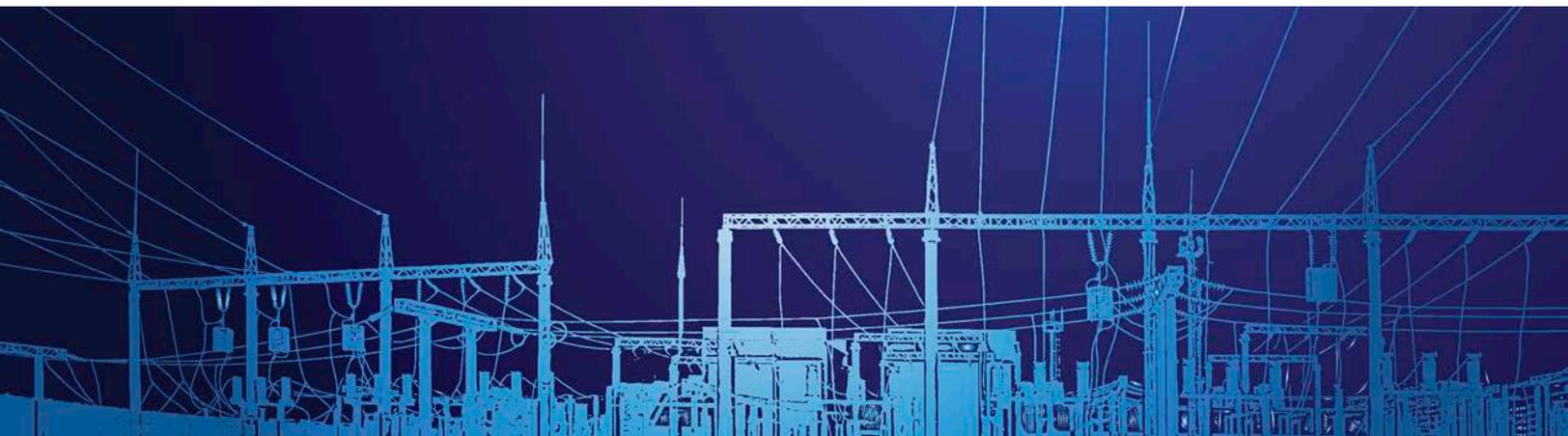
Honing in on the problems outages cause for C&I customers, productivity loss has the greatest impact on 76% of C&I businesses. See Chart 14 on page 13. The next greatest is the delay caused within service, deliveries, and production, which affects 69% of C&I businesses. These two impacts are the top two problems faced by C&I customers in any industry and region.

Other notable reasons for dissatisfaction vary by industry. For the Healthcare industry, 58% of these customers share that outages resulted in losing customers and affecting their patients' satisfaction. For Small Franchises, the aftermath of outages for 62% of these customers meant lost sales and cancelled orders. For Education, 67% faced significant costs from switching to or operating a back-up power system. This issue ranks third for the overall C&I market.

Chart 15: U.S. C&I Customer Anecdotes regarding Dissatisfaction with Reliability of Power, 2017



Customers were asked to recount interactions with their power provider and what caused their dissatisfaction. These anecdotes trended into three themes: outages, cost, and infrastructure. See Chart 15. These quotations bring to light how C&I customers are attentive not only to outages and their cost, but to how power providers approach strengthening and modernizing the grid.



Section Comments on Satisfaction Drivers

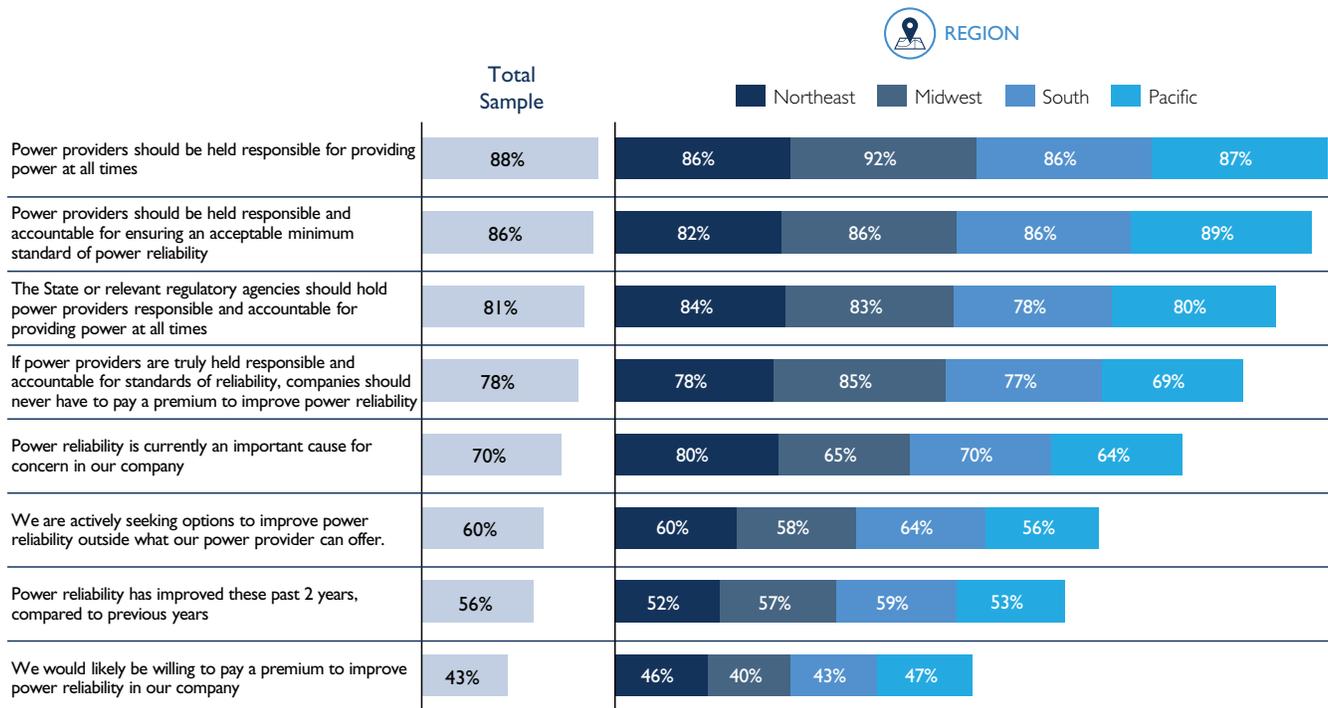
At a high statistical confidence level, this survey identified the main drivers for C&I customer satisfaction with their power provider. Of the respondents surveyed, 52% expressed dissatisfaction with existing power-reliability levels. However, the extent of their dissatisfaction varied, indicating a gap in the overall perception of reliability.

Improving overall satisfaction is driven by a perceived ability of power providers to support the future business needs of the company. This includes an ability to control costs, minimize outages, and upgrade infrastructure—a proactive approach to meeting changing energy demand, weather conditions, and system age.

III. C&I CUSTOMERS ARE LOOKING FOR BETTER RELIABILITY

One additional step this survey took was to determine what, if any, next steps C&I customers are taking given the current state of power reliability.

Chart 16: U.S. C&I Customer’s Review about Power Providers, by Region, 2017



n = 251

A21. Please indicate to what extent you agree or disagree that the following statements represent your company’s view about power providers, based on your company’s experience. - Top two box scores

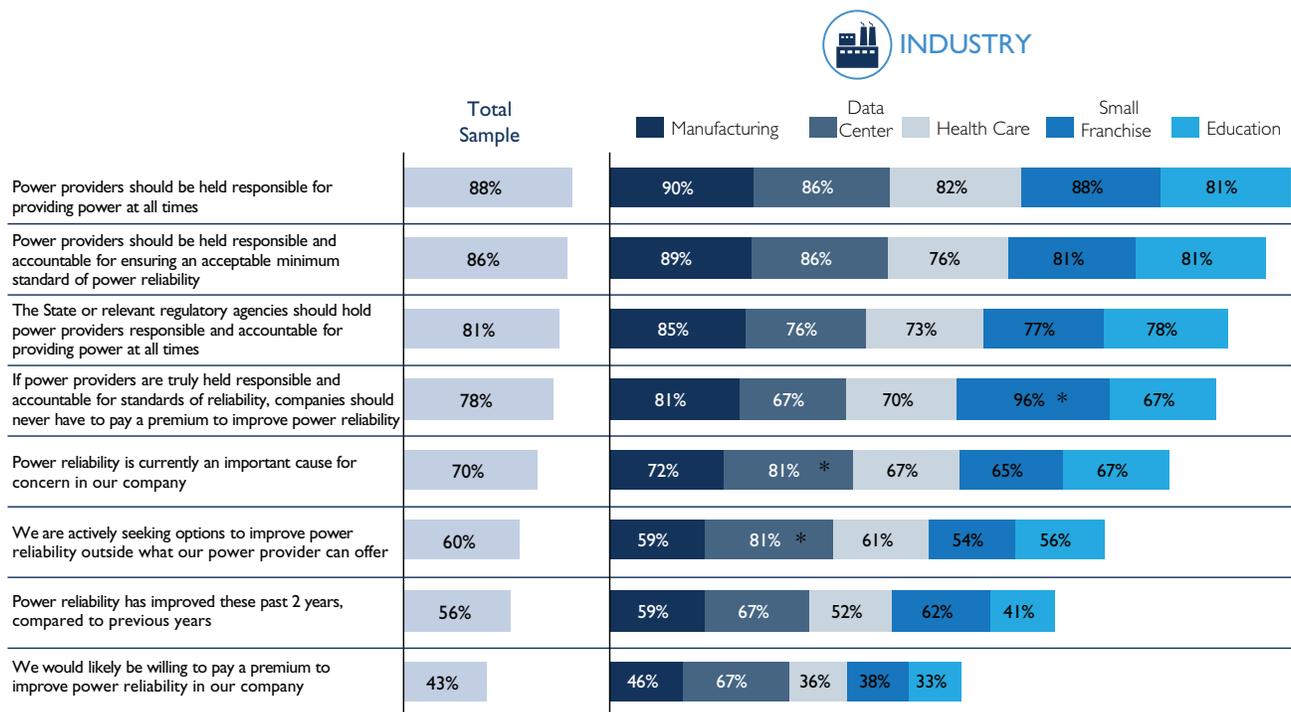
* Significantly larger at 95% confidence level

The vast majority of customers across all industries and regions feel power providers should be held responsible for providing power without interruption, totaling 88% of C&I customers. See Chart 16 on page 15. This sentiment is strong across all regions, but particularly in the Midwest, where 92% of customers felt power providers should be held responsible for providing power at all times. Most also feel strongly about regulatory agencies holding power providers accountable, and if power providers are truly held responsible for reliable power availability, C&I customers should never have to pay a premium for power reliability.

Despite a significant sector of C&I customers who claimed to be satisfied with power reliability in earlier findings in this report, 70% of these same respondents see power reliability as a cause for concern within their companies. Respondents from the Northeast feel most apprehensive about the state of power reliability, with 80% believing their reliability is a concern.

With 60% of C&I customers seeking options to improve power reliability outside of what their power provider can offer, this unveils that their concerns with reliability are far more than alleged; the majority of these customers have determined they need to take their own actions to achieve the level of power reliability they need.

Chart 17: U.S. C&I Customer’s Review about Power Providers, by Industry, 2017



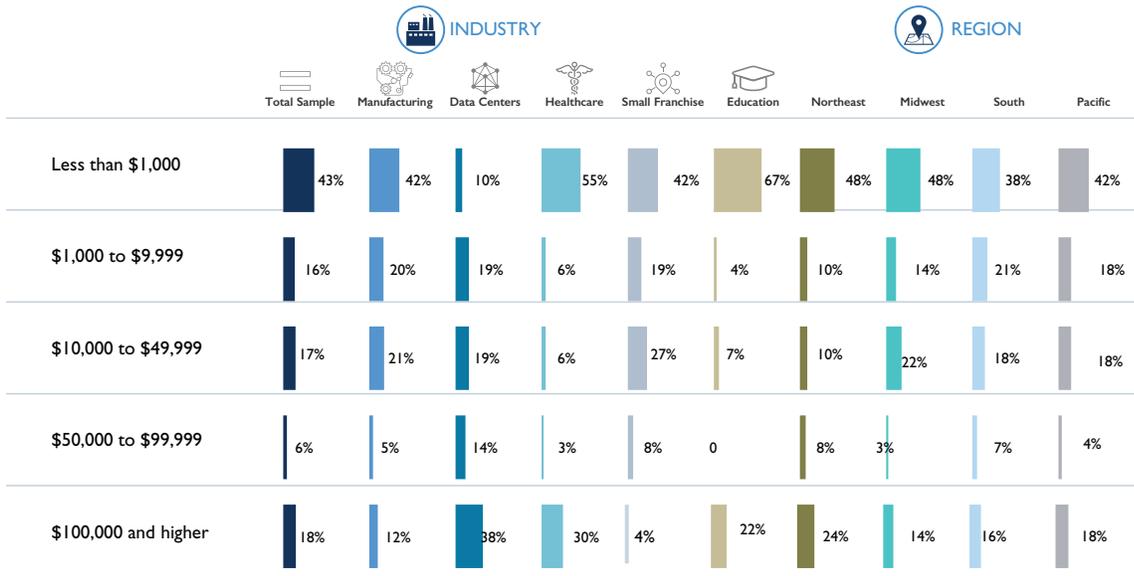
n = 251
 A21. Please indicate to what extent you agree or disagree that the following statements represent your company’s view about power providers, based on your company’s experience. - Top two box scores

* Significantly larger at 95% confidence level

While C&I customer reviews about their power provider were relatively even from region to region, more variance in reviews are apparent across industries. See Chart 17. At 96%, Small Franchises feel very strongly about not having to pay a premium to improve power reliability. At 81%, Data Centers

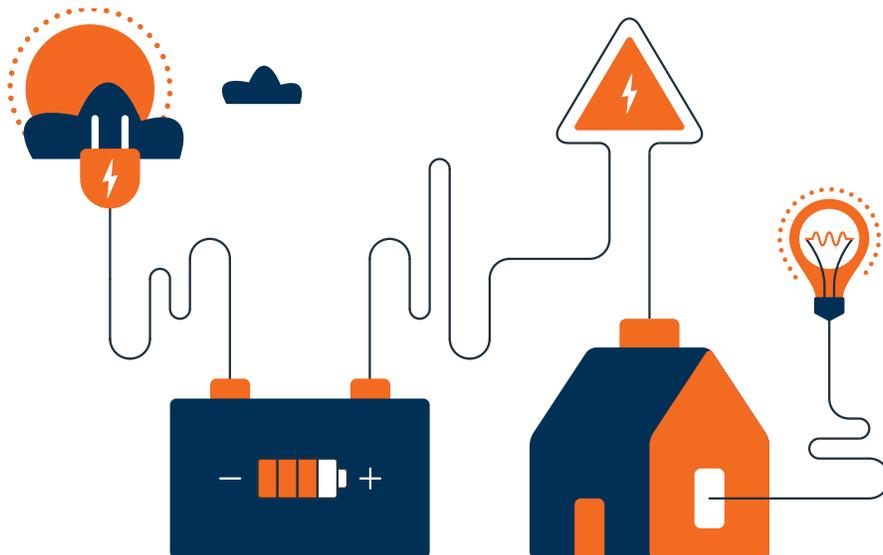
cite that power reliability is a major concern, with the same percentage seeking options to improve power reliability outside of what their power provider can offer—indicating Data Centers are looking for a higher standard for power reliability compared to what they currently experience, and they believe procuring their own solutions will best guarantee the level they need.

Chart 18: U.S. C&I Annual Expense for Guaranteeing Power Reliability, 2017



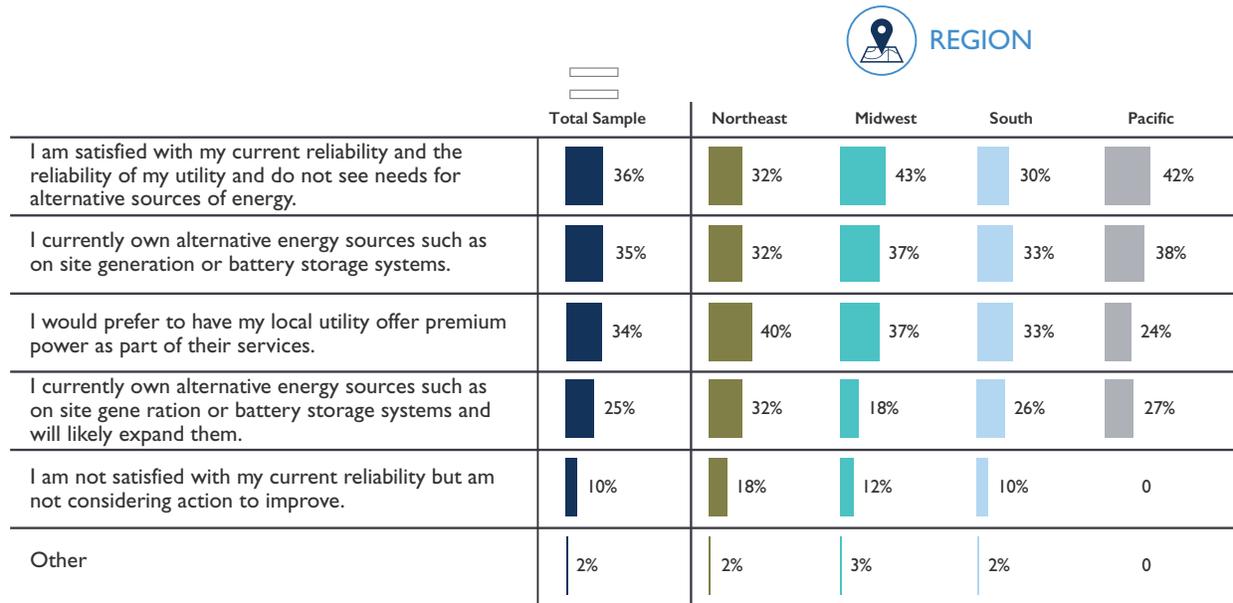
B12. What is your annual expense spent for guaranteeing power reliability? n = 251

Although most C&I customers indicate they would not like to pay a premium to their power provider to ensure better reliability, the majority of respondents still have annual expenses allocated for guaranteeing their own power uptime and availability themselves. See Chart 18. Almost a quarter of respondents spend \$50,000 or more per year, and a third spend between \$1,000 and \$49,000. Data Centers pay the most of any industry, with 52% spending \$50,000 or more for improved power reliability.



While customers do not want to pay premiums, the fact that they are reserving funds to do so shows power reliability is a true concern and priority for their businesses. As mentioned in Chart 8 on page 8 earlier in this report, these measures indicate a preparedness within facilities and systems in the event of an outage.

Chart 19: Choosing Alternative Electricity Energy Providers, by U.S. Region, 2017



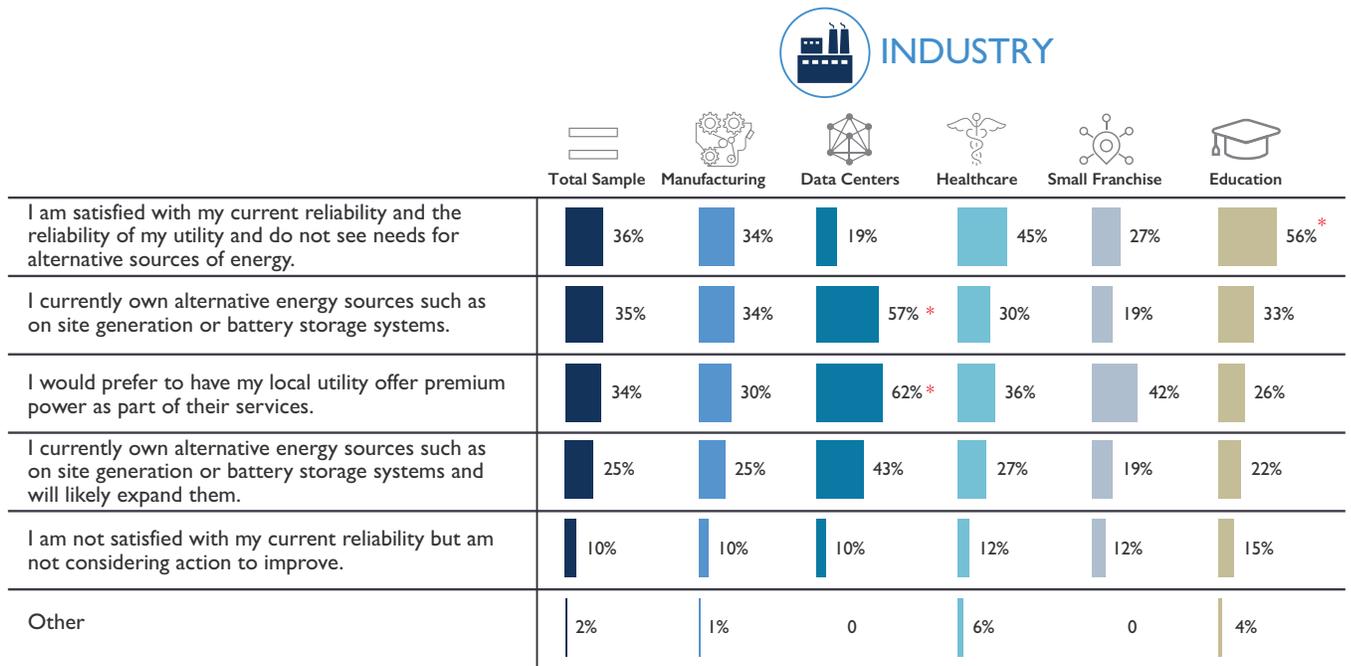
A22. If you had choices, would you choose alternatives to your current electrical energy provider? Select all that apply n = 251

With the majority of C&I customers taking measures to ensure power reliability, 35% currently own alternative energy sources, such as on-site generation or battery energy storage systems. See Chart 19. Another 25% also own these same power-reliability solutions and will likely expand them.



The Northeast ranks highest among the regions in preferring to have local utilities offer premium power as part of their services, as well as plans to grow their own on-site generation.

Chart 20: U.S. C&I Choosing Alternative Electricity Energy Providers, by Industry, 2017



n = 251

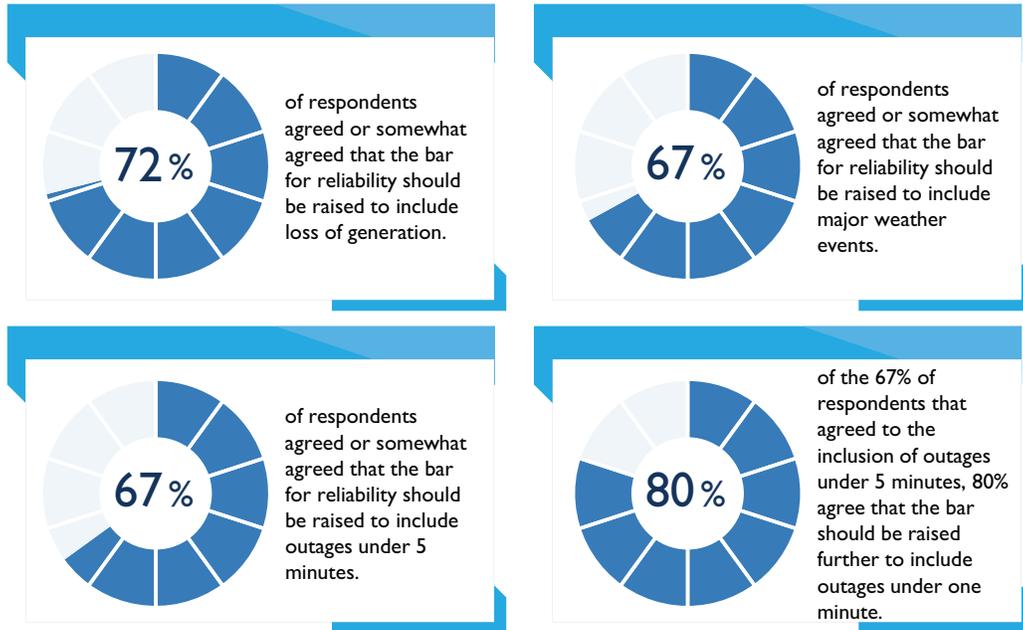
A21. Please indicate to what extent you agree or disagree that the following statements represent your company's view about power providers, based on your company's experience. - Top two box scores

* Significantly larger at 95% confidence level

Looking at alternative energy providers through the industrial lens, there is more variance in responses. See Chart 20. Data Centers take a far more active role in guaranteeing power reliability. The majority, at 57%, own on-site generation, and another 43% own on-site generation and are seeking to expand it in the future. The majority also would like their local utility to offer premium power.



Chart 21: U.S. C&I Measurements to be included for Reliability, 2017



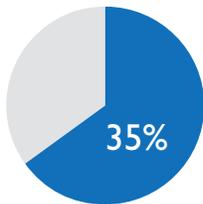
In addition to customers taking on generation sources themselves to guarantee higher power reliability, there is a general consensus to improve overall power reliability measurements and for utilities to take more ownership around the issue.

The U.S. energy industry measures utilities on their ability to provide power. These reliability measurements exclude major events (loss of generation or weather-related issues), as well as outages lasting less than 5 minutes. In this survey, C&I customers were asked whether the industry should take a stricter stance on utility performance. In response, 67% believed the bar for reliability should be raised to include both major events and outages lasting less than 5 minutes. See Chart 21.



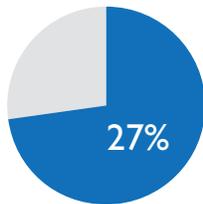
Chart 22: U.S. C&I Reason of Agreement to raise the bar for Reliability Measurements, 2017

- We need consistent/uninterrupted power to operate our business
- Outages slow down/stop production/harm productivity
- Outages cause disruptions/interruptions
- Outages have an impact/a business impact/result in lost business
- Outages have multiple consequences/affect multiple things
- Outages cost us lost time
- Outages can damage equipment
- Outages can cause harm/injury to people
- Outages mean equipment has to be reset/restarted
- Outages can ruin research/controlled experiments



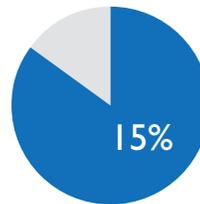
Need/usage

- Power should always be on/should not be outages
- Power provider should be prepared for outages/have a backup system in place
- Power outages should be short/restored quickly
- Power provider should be responsible for any outages
- Weather-related outages should be short/limited
- Problems with power providers/ the grid



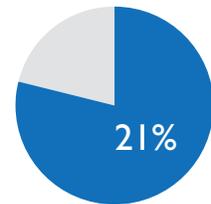
Power provider

- Cost (unspecified)
- Outages cost us money/time is money



Financial

- Major weather events
- Need to keep/have records of all outages
- Good/like the idea
- Clear/precise indicator
- Good measure of reliability
- Good measure of safety/security



Miscellaneous

n = 206

A18f. What are the key reasons why you agree that reliability measurements should include everything that causes outages (loss of generation, major weather events, outages under 5 minutes, outages under 1 minute)?

When asked why, 35% of C&I customers explained that outages are too disruptive and costly to their business. See Chart 22. This supports the earlier findings related to the costs C&I customers incur as a result of outages. See Chart 8 on page 8. Another 27% stated that no-outage goals are the expectation and the responsibility of power providers.



Section Comments and Overall Conclusions:

This survey reveals there is a variance and gap in the services utilities offer today. Key findings within this report include:

OUTAGE AUDITS:

- 50% of companies experienced a power outage that lasted more than one hour in the past year.
- 25% of companies experience a power outage at least once a month, and 86% of respondents have experienced at least one power outage in the last 12 months.
- 18% of companies experienced a loss of more than \$100,000 as a result of the worst outage.

DRIVERS OF CUSTOMER SATISFACTION:

- 52% of respondents expressed dissatisfaction with existing power-reliability levels. However, the extent of their dissatisfaction varied, indicating a gap in the overall perception of reliability.
- Improving overall satisfaction is tied to a perceived ability of power providers to support the future business needs of the company. This includes an ability to control costs, minimize outages, and upgrade infrastructure—a proactive approach to meeting changing energy demand, weather conditions, and system age.

LOOKING FOR BETTER RELIABILITY:

- 71% of companies own or plan to develop alternative energy sources, supplementing their existing provider's generation and power reliability.
- 67% of companies believe major events (weather or generation loss) and outages lasting less than 5 minutes should be included in reliability measurements.
- 70% of companies see power reliability as an existing cause for concern, and 40% would pay premiums to improve it.

Although the majority of C&I customers claim to be content with their power reliability, their behaviors and concerns indicate otherwise, and in the same breath admit that power reliability is a concern. Many are incorporating on-site generation, turning away from their power providers for solutions, and are calling for the industry to take a stricter stance on power-reliability standards.

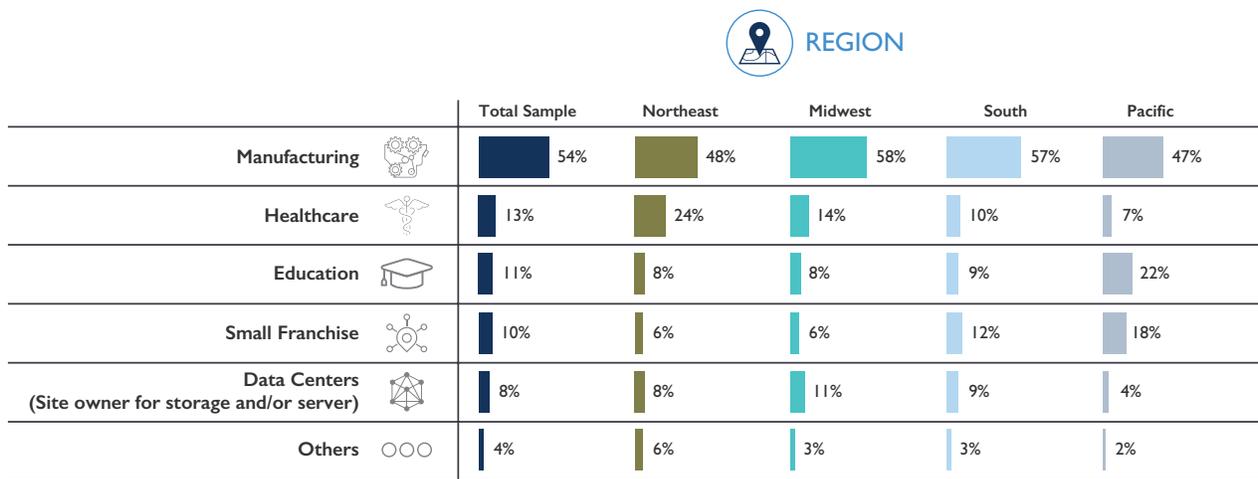
This survey reveals that this so-called customer satisfaction is merely the acceptance of the status quo, when in reality C&I customers need services with higher performance and future-proof technologies. Utilities can no longer afford to continue business as usual but must rise along with C&I customers who aggressively seek survival in their competitive marketplaces.

RESEARCH BACKGROUND AND METHODOLOGY

Between October and December 2017, Frost & Sullivan conducted a customer survey of 251 C&I customers across the United States to determine customer perception of power reliability.

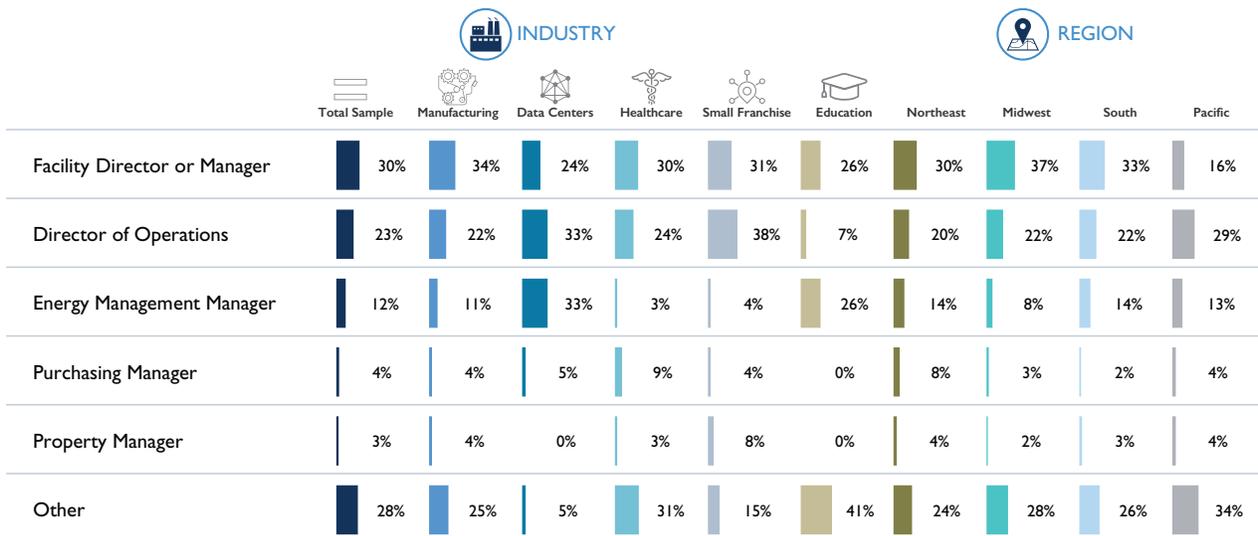
The quantitative and qualitative analysis consisted of telephone interviews across five industries. See Charts 23 and 24. These industries were chosen because of their high energy use.

Chart 23: U.S. Respondent Profile Industry and Region, 2017



n = 251
S1. Which of the following industry sectors best describes your company?

Chart 24: U.S. Respondent Job Title by Industry and Region, 2017



n = 251
S6. Please indicate your job title or position.

About S&C Electric Company

S&C, with global headquarters in Chicago, is applying its heritage of innovation to address challenges facing the world's power grids, thus shaping the future of reliable electricity delivery. The mission of employee-owned S&C is to continually develop new solutions for electricity delivery, fostering the improved efficiency and reliability required for the intelligent grid.

About Frost & Sullivan

Frost & Sullivan, the Growth Partnership Company, works in collaboration with clients to leverage visionary innovation that addresses the global challenges and related growth opportunities that will make or break today's market participants. For more than 50 years, we have been developing growth strategies for the global 1000, emerging businesses, the public sector and the investment community.



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