

# Utilities Technology Council

## Unlocking the Potential of Private Networks: Utility Applications and Network Report

2023 UTC Survey Results Summary

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## Executive Summary

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The Utilities Technology Council (UTC), a global association focusing on the convergence of telecommunications and utility infrastructure, conducted a comprehensive **Utility Applications and Network Survey** (Survey) in May 2023. The Survey aimed to assess member interest in applications leveraging wireless connectivity solutions through private networks or public carrier solutions. This report summarizes the survey results, providing critical insights into utility preferences, current usage, and future interests in private wireless networks. Key findings are summarized below:

### Survey Demographics:

- Investor-owned utilities (IOUs) represented the largest utility type (47.1%), followed by Distribution Cooperatives (17.6%) and Generation and Transmission. Cooperatives, Municipalities, and Others (11.8% each).

### Federal Funding Awareness:

- 82.4% of utilities expressed awareness of federal funding opportunities, with various intentions to apply or not.

### Wireless Network Lifespan:

- 52.9% of utilities anticipate a wireless network lifespan of 20 years or more.
- 47.1% expect a lifespan between 10-15 years.

### 3GPP Spectrum Band Usage:

- 82.4% of utilities reported the use of, or interest in 3GPP spectrum band frequencies for present or future operations.

### PLTE Band Frequencies:

- Commercial carrier solutions and 900 MHz Broadband (b8) garnered the most interest (>50%).
- 800 MHz (b26), Upper 700 MHz A Block (b103) – NB IOT Only, and 1670-1675 MHz (b54) received >20% interest.

### Frequency Strategy Preferences:

- 50% of utilities identified both 3GPP frequencies and commercial carrier solutions.
- 21.4% of utilities identified only 3GPP frequencies.
- 14.2% of utilities identified all three: 3GPP frequencies, commercial carrier solutions, and non-3GPP solutions.

### Wireless Endpoint Solutions Planned for Future Deployment:

- A total of 2,473,861 wireless endpoint solutions are planned for deployment by 2030.
- Deployment rates vary from 7% to 18.4% annually, with a significant surge expected from 2027 onwards.

### Applications for Future Deployment:

- 83.4% of planned devices will serve sensing and measurement applications.

## About UTC

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The Utilities Technology Council (UTC) is a global association focused on the intersection of telecommunications and utility infrastructure. UTC gives voice to the people in the utility workforce who create and maintain critical communications systems that help keep the lights on and the water and gas flowing. We represent the hands-on crews and engineers in the field and control rooms responding to storms, deploying new technologies, and securing energy and water infrastructure from all kinds of threats. UTC sits at the nexus of the energy/water and telecommunications industries, which are rapidly converging and becoming more interdependent.

Embedded throughout utilities' critical equipment is a series of Information and Communications Technology (ICT) networks providing utilities with greater control over, and situational awareness of, their electric grid infrastructure. These ICT networks of critical infrastructure utilities are essential to ensuring the delivery of reliable, robust, always-on services. Most utilities in the U.S. and Canada deploy private ICT networks to control the substations, lines, poles, and meters that make up their infrastructure. ICT networks are critical for day-to-day operational reliability, efficiency, resilience, storm response/recovery, cybersecurity, modernization, situational awareness, and the integration of distributed resources. Not only are these networks vital for the everyday delivery of electricity, but they also represent the core of a transformative industry. This evolution is poised to be more decentralized, efficient, and will include distributed energy resources offering consumers increased control over their usage as the demands of the sector shift.

## Introduction: Utility Applications and Network Survey 2023

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In May 2023, UTC engaged with utility membership to conduct the Survey with the objective of assessing member interest for a wide range of applications, many mission-critical in nature, that leverage or require wireless connectivity solutions through private networks and/or public carrier solutions. For utilities planning to deploy private networks, the Survey also collected information on the current/planned use of wireless frequencies, including those standardized with 3GPP that might facilitate applications using 4G-LTE, LTE-M, NB-IoT, and 5G-NR standards. Respondents were queried across twelve (12) questions for the 'Identification/Demographics' section, twenty (20) questions for the 'Devices' section, and two (2) questions for the 'Private Network Solutions' portion (see Appendix A for the Survey questionnaire).

The results of the Survey provide relevant insights to both UTC members and equipment vendors that seek to deliver chipsets, modules, base stations, and wireless endpoint solutions. **This report summarizes these results to facilitate ecosystem development by gauging utility current utility usage and future interest in applications that require private wireless network solutions.** The increasing demand for reliable and secure network solutions in the utility sector makes it crucial to capture utility present-day usage and additional interest in private wireless networks and aggregate demand for such solutions. In addition, UTC aims to systematically document the aggregate demand from utilities in this regard, which will bolster the business cases of equipment manufacturers. These findings will not only aid utility companies in making informed decisions, they also will empower equipment manufacturers to build compelling business cases, ultimately fostering innovation to support the expansion of the burgeoning ecosystem of stakeholders focused on delivering private network solutions.

The U.S. Energy Information Administration (EIA) Annual Electric Power Industry Report, Form EIA-861, 'Advanced Metering' data, finalized for 2022, estimated over 165 million meters served across more than 2,300 utilities. This report represents utilities serving about 25% of these meters.

## Methodology

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The Survey employed a cross-sectional design and collected responses online from a diverse sample of utility professionals across various geographic regions within UTC's utility membership. The Survey was accessible to respondents through a secure web-based platform. Data collection took place between May 2023 and October 2023 to maximize participation.

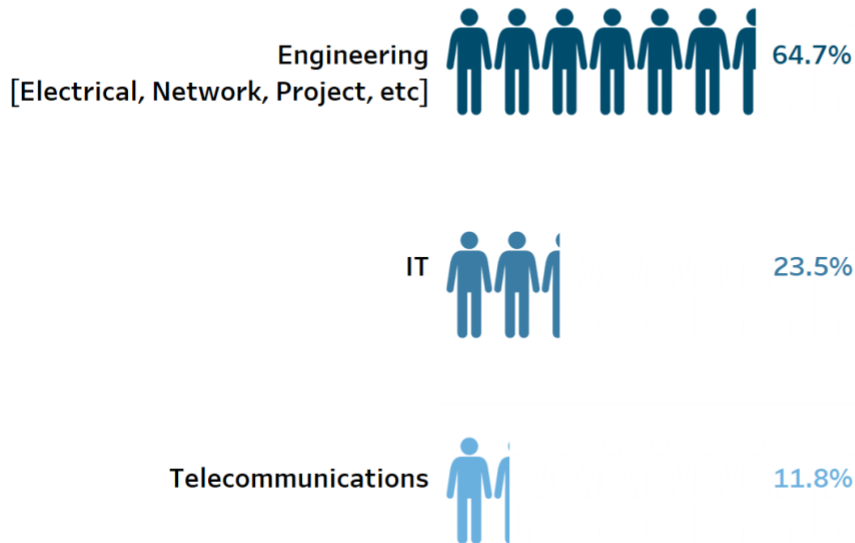
The Survey instrument was created using an online platform and consisted of mostly closed-ended questions, with a small number of additional open-ended questions. Closed-ended questions employed a combination of multiple-choice and "yes or no" questions to gather demographic data, measure preferences, assess awareness, obtain categorical data, and determine the presence and absence of specific conditions. Open-ended questions allowed for both quantitative and qualitative insights. The questionnaire underwent a series of initial pilot tests with a subset of participants to ensure both clarity and relevance. The Survey covered key topics such as utility interest in private wireless networks, specific applications, and the estimated demand.

Several limitations must be acknowledged. Our reliance on self-reported data may introduce response bias. While UTC aimed for a representative sample, there may still be unaccounted variations within the utility industry that our sample does not fully capture. Despite these limitations, UTC has taken measures to maximize data accuracy and comprehensiveness.

## Demographics

### Percentage (%) of Survey Respondents By Job Title/Department

Figure 1. Demographics



### Figure 1. Demographic Composition of Survey Participants by Job Role/Department

The Survey's demographic analysis showed that within the surveyed population,

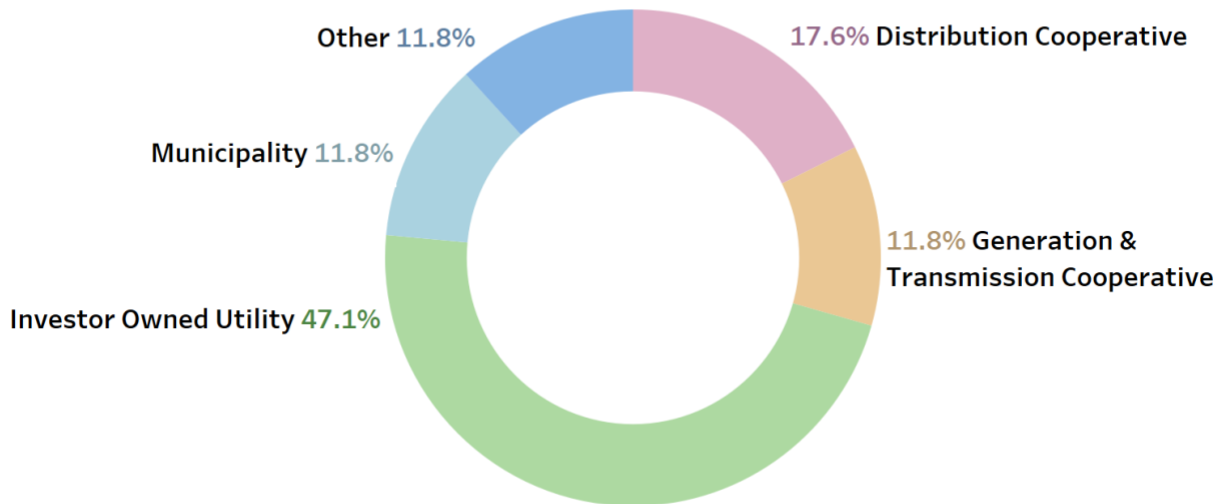
- **Engineers constituted the largest group at 64.7%,**
- Followed by individuals in IT and Telecommunications roles at 23.5% and 11.8%, respectively.

At the Survey's outset, participants provided open-ended information on their current job titles or roles within their respective utility companies. The responses were then categorized into three main departments: engineering, IT, and telecommunications. This distribution underscores a significant technical representation within the surveyed organizations, reinforcing confidence in the accuracy of the Survey results.

**Figure 1** visually represents the breakdown of Survey respondents according to their job titles or departments, providing a clear percentage-based overview of the composition within the surveyed population.

## Percentage (%) of Utilities Surveyed By Utility Type

Figure 2. Demographics



### Figure 2. Types of Utilities Surveyed, By Utility Type

**Figure 2\*** illustrates the distribution of surveyed utilities by utility type, represented as percentages (%), providing insights into the composition of utility types in the surveyed population.

Among the surveyed utilities,

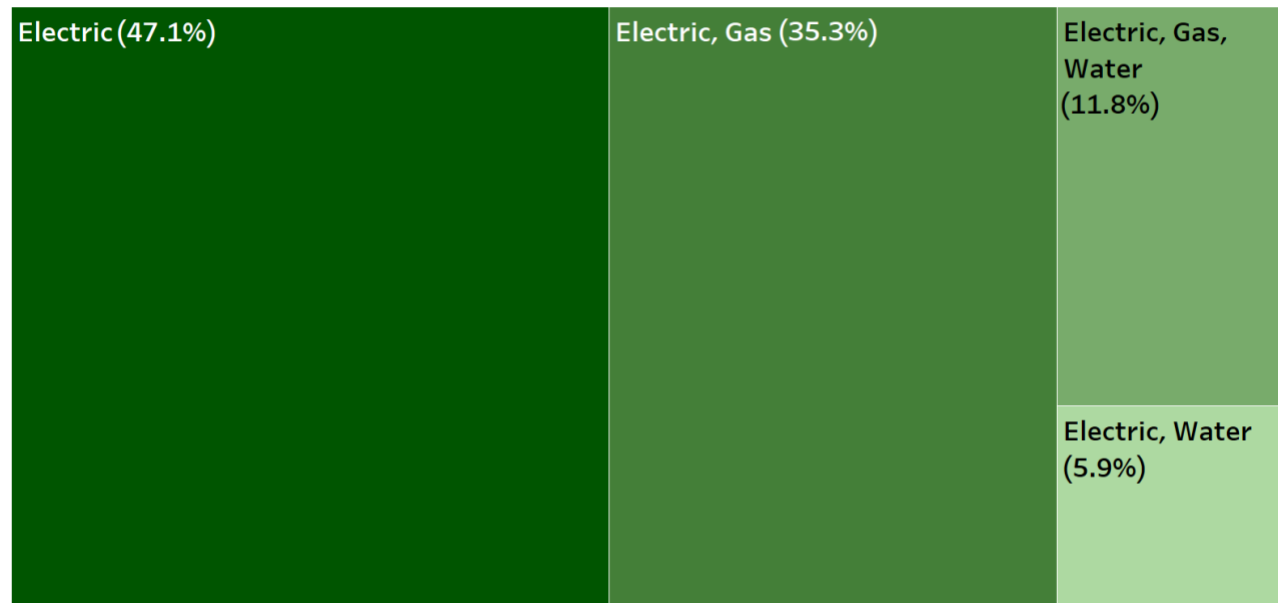
- **Investor-owned utilities (IOUs) stand out as the most prevalent, making up roughly 47.1% of the total utility Survey population,**
- Distribution Cooperatives accounted for 17.6%, and
- Generation and Transmission Cooperatives, Municipalities, and Other categories each represented 11.8% of the total utility Survey population.



\* Percentages may not equal 100% due to rounding.

### Percentage (%) of Utilities Surveyed By Utility Service

Figure 3. Demographics



### Figure 3. Types of Utilities Surveyed, By Utility Service

**Figure 3\*** offers insight into the distribution of surveyed utilities based on utility services they offer, displaying the percentages (%) of each service type within the surveyed population.

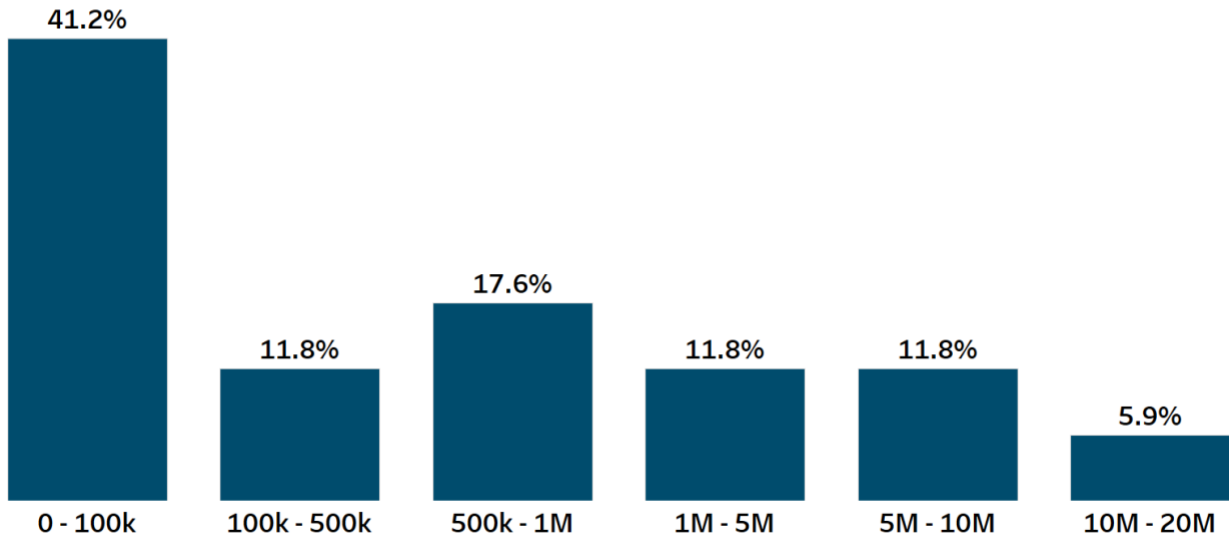
Among the surveyed utilities,

- **47.1% exclusively offer electricity services,**
- 35.5% offer both electricity and gas services,
- 11.8% offer electricity, gas, and water services, and
- 5.9% offer electricity and water services.

\* Percentages may not equal 100% due to rounding.

### Percentage (%) of Utilities Surveyed, By Number of Meters Served [Survey Respondent Estimates 2023]

Figure 4. Demographics



#### Figure 4. Size of Utilities Surveyed, By Number of Meters Served

**Figure 4\*** displays the distribution of surveyed utilities based on the reported number of meters they serve, providing a percentage breakdown of the surveyed population across various meter ranges.

- **A notable portion of utilities, about 29.5%, reported serving over one million meters within their operational jurisdiction,**
- 17.6% reported serving between 500,000 to one million meters,
- 11.8% reported serving between 100,000 to 500,000 meters, and
- 41.2% reported serving 100,000 or less meters

It's important to note that these numbers are self-reported, thus likely containing data quality variations, and subjective interpretations of meter counts by Survey respondents.

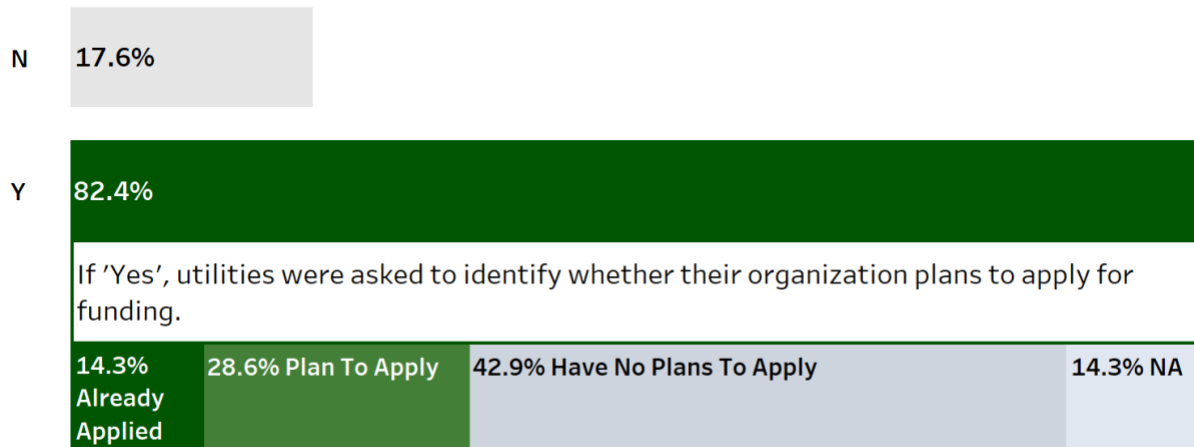
\* Percentages may not equal 100% due to rounding.

## Introductory Questions

### Percentage (%) of Survey Respondents' Federal Funding Awareness & Application Status

Figure 5. Introductory

Utilities were asked to identify their awareness of the federal funding opportunities in The Bipartisan Infrastructure Law ([www.build.gov](http://www.build.gov)) and Inflation Reduction Act.



### Figure 5. Federal Funding Awareness and Application Status

**Figure 5** provides insights into the awareness and application status of federal funding among Survey respondents, offering a percentage breakdown of their engagement with federal funding opportunities.

Concerning federal funding opportunities offered through The Bipartisan Infrastructure Law and Inflation Reduction Act,

- 82.4% of utilities surveyed expressed awareness.** Of these 82.4% of utilities,
  - 14.3% already have submitted applications,
  - 28.6% have intentions to apply in the future,
  - 42.9% expressed there are no intentions to apply in the future, and
  - 14.3% (categorical group labeled 'NA') left the question response blank.

## Percentage (%) of Survey Respondents' Planned Wireless Network Lifespan By Number of Years

Figure 6. Introductory



### Figure 6. Survey Respondent's Planned Wireless Network Lifespan

**Figure 6** presents the expectations of utilities surveyed regarding the longevity of wireless networks, offering a percentage-based breakdown of their anticipated network lifespan. For reference, the data presented in this graph corresponds to responses to the survey question: 'What expectation of longevity does your organization have for a wireless network?' The graph illustrates the distribution of responses among the provided options.

- **52.9% of utilities surveyed anticipate a network longevity of 20 years or more.**
- 47.1% of utilities surveyed expect their wireless network to last between 10-15 years.

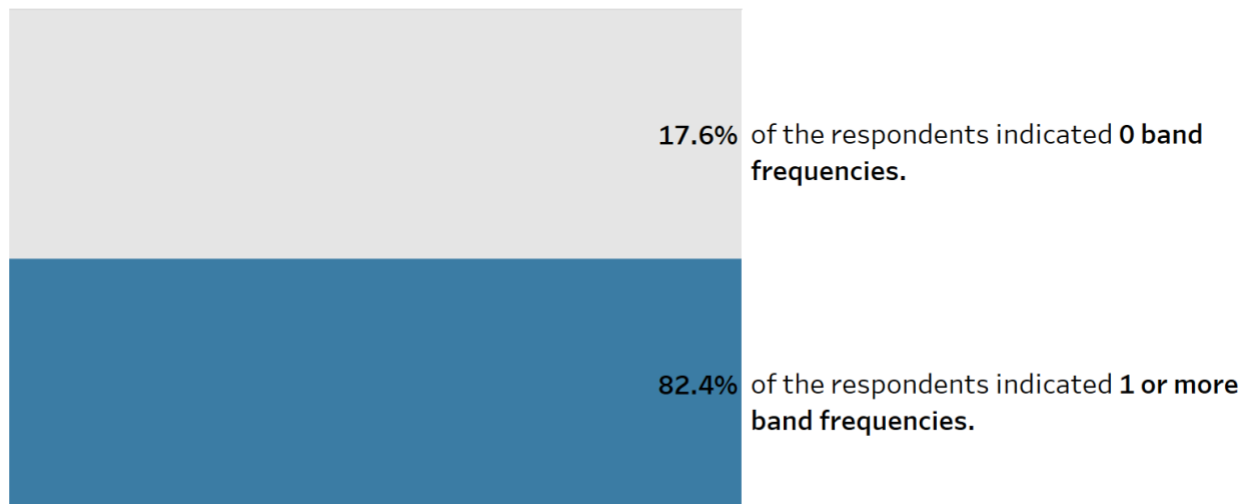
All respondents, therefore, anticipate network longevity of at **least 10 years**

## Private Network Solutions

### Usage of 3GPP Spectrum Band Frequencies for Present and Future Operations

Figure 7. Private Network Solutions

Utilities were asked to identify 3GPP frequencies currently in use, planned for future use, and/or interested in learning about more.



### Figure 7. 3GPP Spectrum Band Frequencies for Present and Future Operations

**Figure 7** provides an overview of the usage of 3GPP spectrum band frequencies for both current and future operations, categorizing respondents into those affirming their use/interest (Yes) and those indicating non-usage (No).

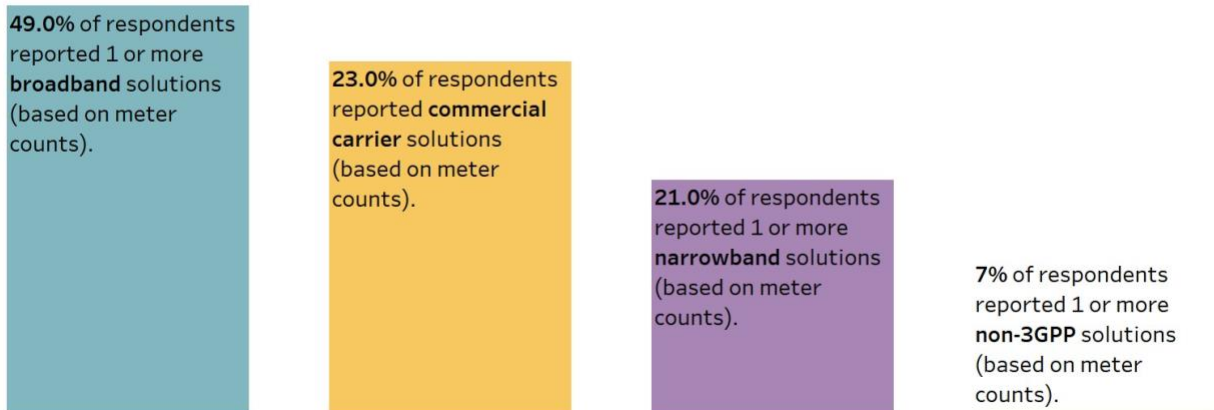
For either present or potentially future private wireless network operations,

- **82.4% of utilities surveyed reported one or more band frequencies.**
- 17.6% of utilities surveyed did not identify any band frequencies, thus falling into the category indicating zero band frequencies are currently in use, planned for future use, and/or interested in learning about more.

## Identification of Solutions: Broadband, Narrowband, Commercial Carrier, and Non-3GPP Preferences Among Utilities

Figure 8. Private Network Solutions

Utilities were asked to identify 3GPP frequencies currently in use, planned for future use, and/or interested in learning about more.



### Figure 8. Preferred Utility Solutions: Broadband, Narrowband, Carrier, and Non-3GPP

**Figure 8** analyzes the frequencies reported by the subset of utilities (82.4%) that identified the use of one or more band frequencies, as illustrated in Figure 7. These frequencies are categorized according to network connectivity types, including broadband, narrowband, commercial carrier, or non-3GPP.

The frequencies that comprise the broadband category include 600 MHz (b71/n71), 1670 – 1675 MHz (b54), Citizens Broadband Radio Service (CBRS) – 3.55-3.70 GHz (b48/n48), 900 MHz Broadband (b8), and 2.4 GHz S-Band (b53/n53). Narrowband frequencies encompass 800 MHz (b26) and Upper 700 MHz A Block (b103) – NB IOT only. Commercial carrier and non-3GPP categories function as standalone capture-all categories.

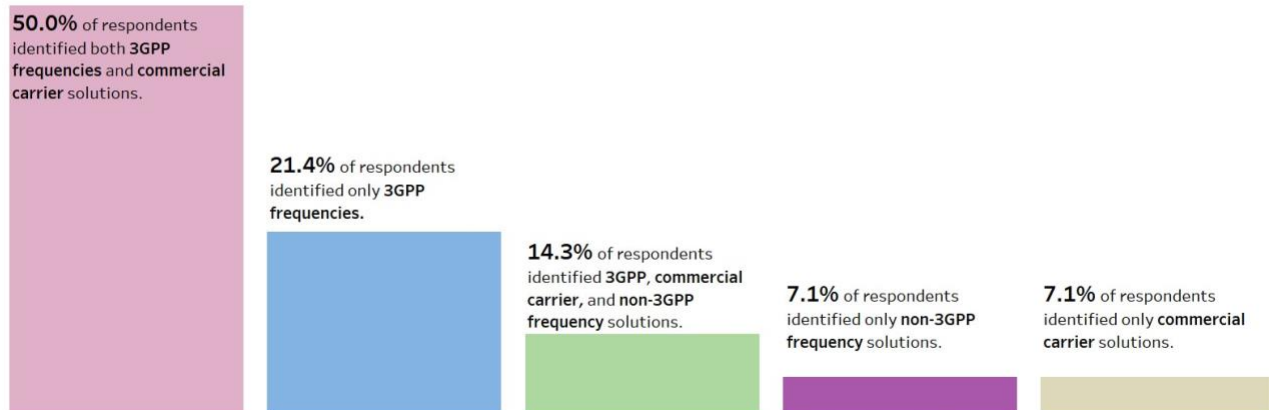
The data yielded the following breakdown:

- 49% of all reported frequencies are classified as ‘Broadband’ solutions,
- 23% of all reported frequencies are classified as ‘Commercial Carrier’ solutions,
- 21% of all reported frequencies are classified as ‘Narrowband’ solutions, and
- 7% of all reported frequencies are classified as ‘non-3GPP’ solutions.

## Comparison of Frequency Strategy Preferences: Seeking Exclusively or in Combination

Figure 9. Private Network Solutions

Utilities were asked to identify 3GPP frequencies currently in use, planned for future use, and/or interested in learning about more.



### Figure 9. Frequency Strategy Preferences: Seeking Exclusively or in Combination

**Figure 9** shows whether frequency solutions are being sought exclusively or in combination with another frequency solution type. The main categories are 3GPP frequencies, commercial carrier solutions, and non-3GPP frequencies along with combinations among the three. *It's important to note the inherent ambiguity in interpreting these results, as they may reflect a combination or complementary approach rather than strict exclusivity.*

The subset of utilities used to generate Figure 9's data is the subset from Figure 7 (82.4%) that identified one or more frequencies. Of that subset,

- 50% identified both 3GPP frequencies and commercial carrier solutions,
- 21.4% identified only 3GPP frequencies,
- 14.3% identified all three: 3GPP frequencies, commercial carrier solutions, and non-3GPP solutions,
- 7.1% identified only commercial carrier solutions, and
- 7.1% identified only non-3GPP solutions.

## Comparison of Carrier and Private Network Solutions: Seeking Exclusively or in Combination

Figure 10. Private Network Solutions

The following data pertains only to the subset of utilities that identified commercial carrier solutions.



### Figure 10. Carrier and Private Network Solutions: Seeking Exclusively or in Combination

**Figure 10** expands on Figure 9 by examining whether utilities seek frequency solutions exclusively from commercial carriers or in combination with private networks. While this chart still focuses on the subset of utilities from Figure 7 (82.4%) that identified one or more frequencies, it zeros in on another subset within the 82.4%: utilities that list commercial carrier solutions among their identified frequencies. The figure illustrates whether the utility identified commercial carrier solutions exclusively or in combination with a private network solution. *It's important to note the inherent ambiguity in interpreting these results, as they may reflect a combination or complementary approach rather than strict exclusivity.*

As revealed in the graph:

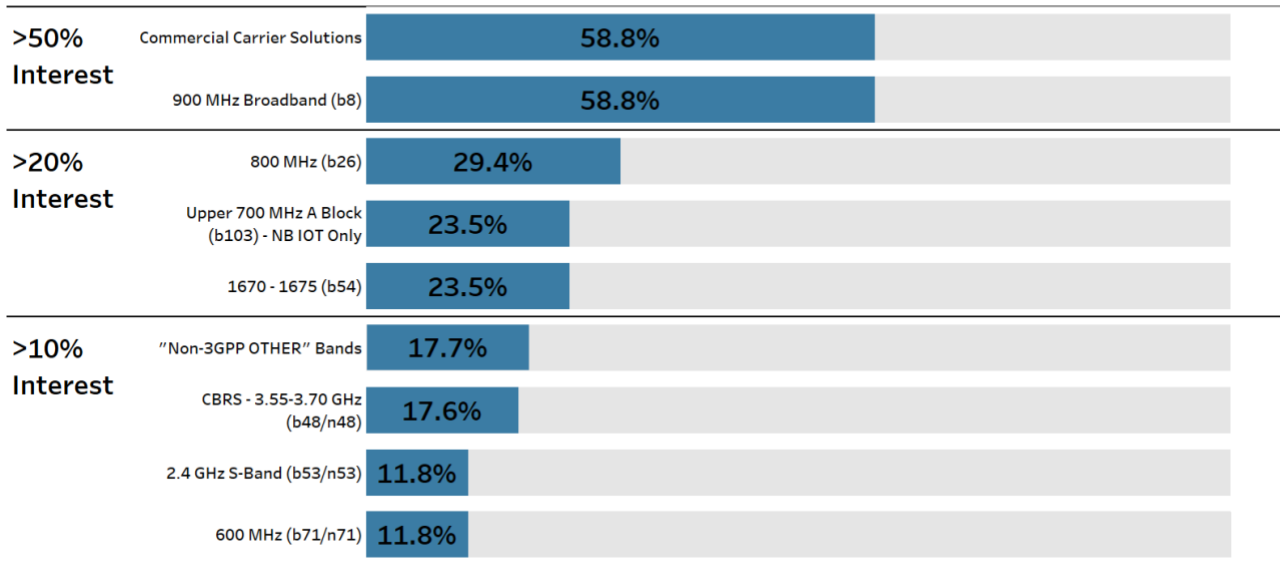
- 90.0% of utilities identified both private network solutions and commercial carrier solutions, and
- 10.0% of utilities exclusively identified commercial carrier solutions.



## PLTE Band Frequencies Identified By Utilities

[For Present and/or Potentially Future Operations]

Figure 11. Private Network Solutions



### Figure 11. PLTE Band Frequencies Identified by Utilities

Figure 11 highlights the PLTE band frequencies identified by utilities, for private cellular networks.

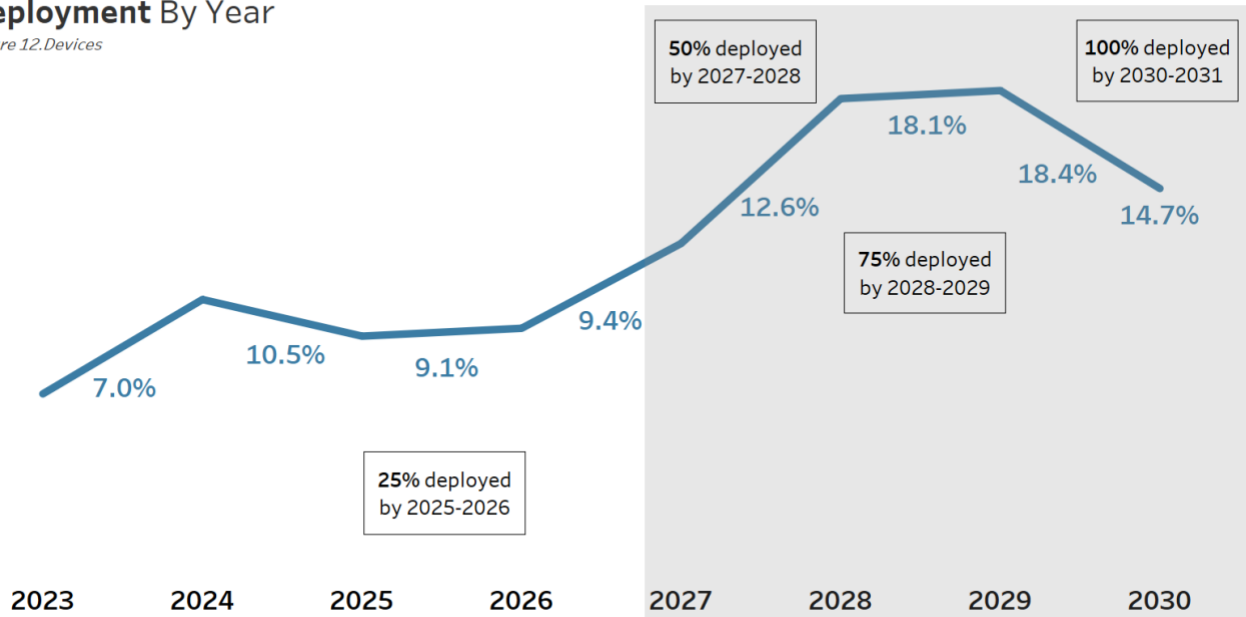
- **Commercial carrier solutions and 900 MHz Broadband (b8) saw over 50% interest from utilities surveyed.** These private network solutions were listed most frequently out of all the PLTE band frequencies,
- 800 MHz (b26), Upper 700 MHz A Block (b103) – NB IOT Only, and 1670-1675 (b54) saw over 20% interest from the utilities surveyed, and
- Non-3GPP/Other bands, CBRS – 3.55-3.70 GHz (b48/n48), 2.4 GHz S-Band (b53/n53), and 600 MHz (b71/n71) saw over 10% interest from the utilities surveyed.

The “Non-3GPP Other” category serves as an aggregate label placed on an open-ended Survey question allowing the respondent to insert any Non-3GPP band answer. While 17.7% of identified bands fall under this category, the individual bands that comprise the category were identified at a much lower frequency compared to the other bands; thus, the category is placed in the bottom tier of identified bands.

## Devices

### Percentage (%) of Total Number of Wireless Endpoint Solutions Planned for Future Deployment By Year

Figure 12.Devices



**Figure 12. Wireless Endpoint Solutions Planned for Future Deployment, By Year**

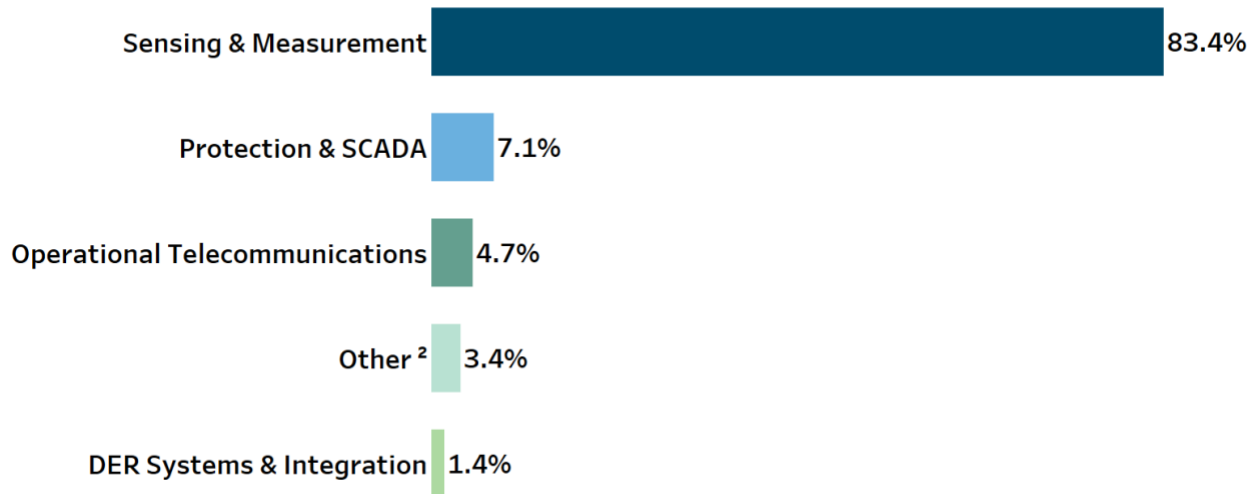
**Figure 12** provides a visual representation of the percentage distribution, from 2023 to 2030, of the total number of wireless endpoint solutions planned for future deployment. The cumulative sum of wireless endpoint solutions planned by Survey respondents for future deployment stands at 2,473,861.

- 36% of these solutions are scheduled for deployment by the conclusion of the first half of the Survey period, spanning from 2023 to 2026,
- An estimated 50% of the total deployment is anticipated between 2027 and 2028,
- About 75% of total deployment is projected to occur between 2028 and 2029, and the entire 100% of planned deployment is expected in 2030.

From 2023 to 2026, the deployment rates indicate that 7% of all wireless endpoint solutions planned for future deployment will occur in 2023, followed by 10.5% in 2024, 9.1% in 2025, and 9.5% in 2026. **From 2027 to 2030, the trend in deployment numbers increases significantly, indicating that a majority of deployment activity is anticipated to occur in the latter half of the specified time frame.** 12.6% of all planned wireless endpoint solutions are estimated for deployment in 2027, followed by 18.1% in 2028, 18.4% in 2029, and 14.7% in 2030.

## Total Number of Devices Planned for Future Deployment By Application <sup>1</sup>

Figure 13. Devices



### Figure 13. Wireless Endpoint Solutions Planned for Future Deployment, By Application<sup>1</sup>

Figure 13 displays the top five intended applications for the total projected deployment of devices.

The data indicate that the **most prominent intended use** for the future deployment of devices is in **sensing and measurement applications**.

- **83.4% of all devices planned for future deployment will serve sensing and measurement applications,**
- 7.1% will serve protection and SCADA applications,
- 4.7% will serve operational telecommunications applications,
- 1.4% will serve DER systems and integration applications, and
- 3.4% will serve 'other' applications.<sup>3</sup>

<sup>1</sup> More information about the application and related technology can be found in [Appendix B](#).

<sup>2</sup> The application labeled 'Other' encompasses the following applications: Distributed Resource Management, IIoT, Smart City, Voice Communications, and Workforce Management.

<sup>3</sup> Ibid

## Conclusion

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The Survey results provide insight into utility preferences and interests in private wireless networks. With a focus on the convergence of utility infrastructure and telecommunications, the report underscores the critical role of wireless networks in ensuring operational reliability, efficiency, and resilience for utilities. As the industry moves towards Utility 2.0, characterized by decentralization and increased consumer control, the insights gained from this Survey are important for both utilities and equipment manufacturers.

This report's findings not only guide utilities in making informed decisions but also enable equipment manufacturers to build compelling business cases, fostering innovation in the private network solutions ecosystem. The increasing demand for reliable and secure network solutions in the utility sector necessitates a continuous assessment of current usage and future interests, driving the expansion of this dynamic industry. UTC's efforts in documenting aggregate demand from utilities contribute significantly to the business cases of equipment manufacturers, ultimately supporting the growth of the private network solutions ecosystem. UTC plans to continue collect data and publish future reports on these topics for the benefit of its members.

## Appendix A

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### Utility Applications and Network Survey Questionnaire

#### Identification/Demographic

1. Entity Name:
2. Estimated Number of Total Meters Served:
3. Utility Type (Select from dropdown):
  - a. Investor-Owned Utility
  - b. Generation & Transmission Cooperative
  - c. Distribution Cooperative
  - d. Municipality
  - e. Power Authority
  - f. Other
4. Utility Services (Check all that apply):
  - a. Electric
  - b. Gas
  - c. Water
5. US State(s)/Territory(s) with Operations (Check all that apply, below):

<input type="checkbox"/> AK	<input type="checkbox"/> AL	<input type="checkbox"/> AR	<input type="checkbox"/> AZ
<input type="checkbox"/> CA	<input type="checkbox"/> CO	<input type="checkbox"/> CT	<input type="checkbox"/> DC
<input type="checkbox"/> DE	<input type="checkbox"/> FL	<input type="checkbox"/> GA	<input type="checkbox"/> HI
<input type="checkbox"/> IA	<input type="checkbox"/> ID	<input type="checkbox"/> IL	<input type="checkbox"/> IN
<input type="checkbox"/> KS	<input type="checkbox"/> KY	<input type="checkbox"/> LA	<input type="checkbox"/> MA
<input type="checkbox"/> MD	<input type="checkbox"/> ME	<input type="checkbox"/> MI	<input type="checkbox"/> MN
<input type="checkbox"/> MO	<input type="checkbox"/> MS	<input type="checkbox"/> MT	<input type="checkbox"/> NC
<input type="checkbox"/> ND	<input type="checkbox"/> NE	<input type="checkbox"/> NH	<input type="checkbox"/> NJ
<input type="checkbox"/> NM	<input type="checkbox"/> NV	<input type="checkbox"/> NY	<input type="checkbox"/> OH
<input type="checkbox"/> OK	<input type="checkbox"/> OR	<input type="checkbox"/> PA	<input type="checkbox"/> RI
<input type="checkbox"/> SC	<input type="checkbox"/> SD	<input type="checkbox"/> TN	<input type="checkbox"/> TX
<input type="checkbox"/> UT	<input type="checkbox"/> VA	<input type="checkbox"/> VT	<input type="checkbox"/> WA
<input type="checkbox"/> WI	<input type="checkbox"/> WV	<input type="checkbox"/> WY	
6. Survey Respondent Name:

7. Survey Respondent Affiliation:
8. Survey Respondent Title/Role:
9. Survey Respondent Email Address:
10. Survey Respondent Phone Number:
11. What expectation of longevity does your organization have for a wireless network? (Please choose the closest option)
  - a. 10 years
  - b. 15 years
  - c. 20+ years
12. Is your organization aware of the federal funding opportunities present in The Bipartisan Infrastructure Law ([www.build.gov](http://www.build.gov)) and Inflation Reduction Act? (Select from drop-down)
  - a. Yes
  - b. No
13. If yes, does your organization plan to apply for funding? (Select from drop-down)
  - a. Yes
  - b. No
  - c. Already applied

**Devices**

About: Wireless solutions deployment estimates.

Over the next seven years (present - 2030), please identify the total number of wireless endpoint solutions planned for future deployment, for the corresponding 'Functionality' category. If a specific number is not available, please submit an estimate.

1. Sensing & Measurement Functionality:
  - a. (Input numeric value)
2. Protection & SCADA Functionality
  - a. (Input numeric value)
3. DER Systems & Integration Functionality
  - a. (Input numeric value)

4. Distributed Resource Management Functionality
  - a. (Input numeric value)
5. Workforce Management Functionality
  - a. (Input numeric value)
6. Operational Telecommunications Functionality
  - a. (Input numeric value)
7. Smart City Functionality
  - a. (Input numeric value)
8. Voice Communications Functionality
  - a. (Input numeric value)
9. IIoT Functionality
  - a. (Input numeric value)
10. Other Functionality
  - a. (Input numeric value)

Based on the estimate of total wireless endpoint solutions planned for future deployment, what are your estimates for the deployment time frame of those devices, listed below?

Note: "Future Deployment" directly pertains to the present (2023) - 2030.

11. Assigned Percentage (%) 2023
  - a. (Input numeric value)
12. Assigned Percentage (%) 2024
  - a. (Input numeric value)
13. Assigned Percentage (%) 2025
  - a. (Input numeric value)
14. Assigned Percentage (%) 2026
  - a. (Input numeric value)
15. Assigned Percentage (%) 2027
  - a. (Input numeric value)
16. Assigned Percentage (%) 2028

- a. (Input numeric value)
- 17. Assigned Percentage (%) 2029
  - a. (Input numeric value)
- 18. Assigned Percentage (%) 2030
  - a. (Input numeric value)

### Private Network Solutions

Please indicate your company's spectrum band frequency usage for present and future operations by checking the appropriate boxes. If a spectrum band frequency is not listed, please add it to the 'comments' box located at the bottom of the page.

1. For your operations, which 3GPP frequencies are used by your company, planned to be used, or interested in learning about more? (Select all that apply)
  - a. 600 MHz (b71/n71)
  - b. Upper 700 MHz A Block (b103) - NB IOT Only
  - c. 800 MHz (b26)
  - d. Citizens Broadband Radio Service (CBRS) - 3.55-3.70 GHz (b48/n48)
  - e. Commercial Carrier Solutions
  - f. 900 MHz Broadband (b8)
  - g. 1670 - 1675 MHz (b54)
  - h. 2.4 GHz S-Band (b53/n53)
  - i. Non-3GPP Narrowband/Broadband Solutions / OTHER
2. If "Non-3GPP...OTHER" was checked, please add a comment identifying the band(s) and why this solution was chosen:
  - a. (Free response text box)



## Appendix B

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More information about the ‘Functionality’ and related technology are listed below. These categories were used in the Devices section of the survey questionnaire and subsequently utilized to generate ‘Figure 13. Wireless Endpoint Solutions Planned for Future Deployment, By Application.’

### Functionality: Sensing, Measurement, & Monitoring

- Advanced Metering Infrastructure (AMI, direct to meter)
- Advanced Metering Infrastructure (AMI, backhaul)
- Production Meters (DER assets)
- Grid Asset Monitoring (Sensing technology for health & maintenance of equipment, e.g., transformer monitors)
- Environmental Sensors (Thermal, weather, solar irradiance, etc.)
- Electrical Parameter/Event Sensors (Line sensors, LIDAR sensors, Satellite/Ariel Imaging and sensing, Drones, etc.)
- Video Monitoring (For security and/or other purposes)
- Remote Fault Indicators (RFI)

### Functionality: Protection & SCADA

- SCADA (Operational & Distribution)
- Advanced Protection Relays
- Advanced Switches, Circuit Switchers, and reclosers (e.g., FLISR)
- Pole Top & Line Mounted DA devices
- Power Flow & Volt-var Controllers (D-STATCOM, Distribution Power Flow Controllers (DPFC), Solid State Transformer (SST), Grid Energy Storage, Cap banks, etc.)

### Functionality: DER Systems & Integration

- PV (Solar Cells) Systems
- Wind
- Hybrid
- Fuel Cells
- Energy Storage
- Microturbines
- Combustion Turbines
- Internal Combustion Engines
- Stirling Engines

#### Functionality: Distributed Resource Management

- Microgrid (Infrastructure, Assets, and Interface)
- Advanced Inverters
- EV Charging Infrastructure

#### Functionality: Workforce Management

- Advanced Safety Tools (VR, AR, MR, etc.)
- Digital Workforce Tools

#### Functionality: Operational Telecommunications

- Wide Area Network (WAN) endpoints
- Field Area Network (FAN) endpoints
- Neighborhood Area Network (NAN) endpoints
- Communications Network Management System endpoints

#### Functionality: Smart City

- Smart Street Lighting (Public Street and/or Highway)
- Smart Buildings
- Smart Parking Management
- Smart Traffic Management

#### Functionality: Voice Communications

- VoLTE endpoints
- VoNR endpoints
- Land Mobile Radio (LMR) / P25
- TETRA

#### Functionality: Industrial Internet of Things (IIoT) devices

- IIoT

## References

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- [1] U.S. Energy Information Administration - EIA - independent statistics and analysis. Annual Electric Power Industry Report, Form EIA-861 detailed data files. (2023, October 5). <https://www.eia.gov/electricity/data/eia861/>