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Bridging Reliability Visibility Gaps Through Data Readiness in Municipal Utilities

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Abstract

Electricity reliability information supports operational response, regulatory oversight, emergency coordination, infrastructure planning, and public accountability. Municipal utilities represent an important segment of the electricity sector, yet their reliability performance is often less visible in reporting and outage-visibility pathways. Georgia provides a useful case for examining how utility-level differences in outage-data systems and operational capacity shape reliability visibility across utility types.

The analysis combines a statewide scan with survey evidence from municipal utilities to assess representation in federal reliability reporting and public outage aggregation systems that compile utility-reported information and website-based outage updates. Results show persistent visibility gaps, with only a small subset of municipal utilities reporting standardized reliability metrics to federal systems and few appearing consistently in outage aggregation platforms used for benchmarking and situational awareness. Survey responses from municipal utilities affiliated with Electric Cities of Georgia identify the operational conditions underlying these gaps. Utilities often rely on customer reports and field crew verification for outage detection, and many do not consistently translate these operational

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data into reporting-ready outputs because of workforce and technical capacity limitations, legacy system integration challenges, and uncertainty about long-term system usability. The findings show that reliability visibility depends not only on monitoring technologies, but also on the operational capacity required to produce decision-ready outage information. Strengthening reliability oversight therefore requires investment in data readiness, workforce capacity, workflow integration, and implementation support alongside technology deployment.

Keywords: Municipal utilities; Outage data; Data readiness

1. Introduction

Electricity reliability oversight depends on the availability of consistent, structured, and comparable outage information across utilities. In practice, reliability information is not produced uniformly. It is shaped by differences in data infrastructure, reporting pathways, and the ability of utilities to translate operational outage records into structured, metric-ready outputs that can support benchmarking, planning, and oversight. These differences matter because reliability information supports multiple policy functions, including regulatory performance assessment, emergency coordination, and infrastructure investment planning. When outage data are incomplete, inconsistently structured, or not fully integrated into standardized reporting systems, reliability visibility becomes uneven across utilities. Incomplete, inconsistently structured, or poorly integrated outage data can limit benchmarking completeness, reduce comparability across oversight processes, and constrain the ability of decision-makers to identify system vulnerabilities consistently.

These challenges are most pronounced for smaller municipal and rural utilities, where outage data may exist operationally but are not always consistently converted into standardized reliability metrics or integrated into widely used reporting and aggregation systems. In these contexts, reliability visibility depends less on the existence of monitoring technologies and more on whether utilities have the capacity to structure, process, and report outage information in decision-ready forms.

National evidence suggests that widely used reliability datasets and outage visibility platforms do not capture all utility types consistently, with smaller municipal and cooperative systems often less represented in standardized reporting and near-real-time aggregation pathways. These utilities warrant closer attention because gaps in outage monitoring and reporting can limit the availability and comparability of reliability data, making it harder to assess system performance and identify opportunities to improve data collection. Georgia provides a useful setting for examining these challenges because its electric utility landscape includes a single investor-owned utility (IOU) alongside a substantial number of electric cooperatives and municipal utilities. This mix provides an opportunity to investigate the barriers these locally operated utilities face in monitoring outages and reporting standardized reliability metrics.

This policy note examines these issues using two complementary evidence sources. First, it draws on a statewide scan of electricity reliability reporting and public outage visibility across Georgia's utility types, focusing on representation in standardized reporting systems and real-time aggregation platforms. Second, it uses a survey of municipal utilities affiliated with Electric Cities of Georgia to characterize outage detection practices, data availability and granularity, and the operational constraints that influence whether utilities can adopt or fully utilize outage tracking and reliability monitoring systems, including cost, staffing, and legacy system integration challenges.

The findings show that reliability visibility is shaped by differences in data readiness and operational capacity across utility types. This note uses these findings to inform how states and funding organizations can design support that strengthens structured outage data capture, improves reporting readiness, and enables more consistent translation of operational data into reliability metrics used for oversight and planning.

2. Why detailed outage and reliability data matter for oversight and policy

Electricity reliability oversight in the United States relies on standardized indicators derived from recorded outage events and structured reporting systems. Utilities translate outage histories into indices including System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI), which support benchmarking, regulatory oversight, and infrastructure investment planning. The visibility of these metrics depends on reporting pathways and institutional requirements, including differences in respondent burden and reporting structure (EIA, n.d.). The U.S. Energy Information Administration Form EIA-861 serves as the primary national reporting mechanism, with results aggregated at state, regional, and national levels. Smaller utilities may instead report through the short-form EIA-861S, which does not collect the detailed outage information required for standardized reliability metrics in most reporting years. Although these utilities periodically complete the long-form version, this reporting structure can create differences in the continuity and consistency of reliability information across utilities.

Complementary reporting pathways support distinct operational and oversight functions. State public utility commissions collect outage and reliability data for regulatory oversight and long-term performance assessment using metrics comparable to EIA-861 (Eto et al., 2012; Larsen et al., 2015; LaCommare and Eto, 2006; LaCommare et al., 2018). The U.S. Department of Energy collects disturbance reports through Form DOE-417 to support situational awareness and emergency coordination under Emergency Support Function 12 (NASEO, 2019). Utilities also communicate outages through public-facing maps and dashboards, while third-party platforms aggregate these data into machine-readable feeds for situational awareness and public monitoring (DOE, 2023; Dunn et al., 2019). These systems expand outage visibility but differ in structure, reporting frequency, and intended use, and they do not consistently align with standardized reliability metric reporting.

Structured outage records support functions beyond compliance reporting. Data that capture interruption timing, location, affected customers, and cause enable operational learning, emergency coordination, maintenance prioritization, and infrastructure planning. These records also support analytical applications including evaluation of vegetation management strategies (Guikema et al., 2006), predictive maintenance planning (Rudin et al., 2011), and assessment of grid vulnerability to severe weather and other hazards (Kankanala et al., 2014; Nateghi et al., 2014; Ji et al., 2016).

Despite these pathways, national reliability datasets remain incomplete and unevenly representative. Brelsford et al. (2024) estimate that roughly 8% of U.S. electricity customers are served by utilities that do not provide near-real-time outage data in formats

accessible to major aggregation platforms. Similar representation gaps appear in empirical reliability studies. Larsen et al. (2015) assembled reliability data for 195 U.S. utilities based on available regulatory filings and utility disclosures rather than a complete national census. Of these, 75% were IOUs, 3% were cooperatives, and less than 1% were municipal utilities, compared to the national utility stock of 192 investor-owned, 2,009 municipal, and 877 cooperative utilities reported by the U.S. Energy Information Administration. These imbalances indicate substantial underrepresentation of municipal and cooperative systems in widely used reliability datasets.

These gaps reflect uneven deployment of digital infrastructure including Supervisory Control and Data Acquisition (SCADA), Advanced Metering Infrastructure (AMI), and Outage Management Systems (OMS) in smaller utilities (T&D World, 2021; Qmerit, 2023; Xtensible, n.d.), inconsistent participation in federal reporting programs (Gilcrease et al., 2022), and persistent resource and staffing constraints that limit structured reliability reporting (APPA, n.d.). These factors shape whether outage events can be consistently captured, standardized, and translated into metric-ready information for oversight and planning.

3. Reliability visibility in Georgia varies systematically by utility type and reporting pathway

Georgia's retail electricity sector includes one IOU, 41 electric membership cooperatives (EMCs), and 52 municipal utilities, including city- and county-owned

systems. Reliability oversight depends on whether outage events are captured, processed, and translated into reporting pathways used for benchmarking, situational awareness, and infrastructure planning. Differences in utility structure and reporting practices therefore shape how performance appears in statewide oversight systems.

The statewide evidence scan shows substantial variation in standardized reliability reporting across utility types. Georgia Power reports annual reliability metrics through the U.S. Energy Information Administration Form EIA-861 pathway (EIA, n.d.). EMC participation is broader but incomplete, with 29 of Georgia's 41 EMCs reporting reliability metrics to EIA-861 in 2023, compared with only five of the state's 52 municipal utilities. Because statewide benchmarking and reliability assessment commonly rely on standardized reporting streams, these differences affect how comprehensively utility performance is represented in oversight processes.

Similar disparities appear in near-real-time outage visibility systems. Utilities increasingly communicate outages through public-facing outage maps and related platforms, while third-party systems aggregate these data to support outage monitoring and situational awareness. As of March 2025, 36 Georgia EMCs appeared in both EAGLE-I and PowerOutage.US (DOE, 2023), although several others maintained utility-specific communication channels. Municipal utilities again showed substantially lower representation, with only two consistently visible in both systems despite some maintaining their own outage maps or communication platforms. These findings align with broader evidence that smaller utilities are often underrepresented in outage datasets used for reliability assessment and research (Brelsford et al., 2024; Larsen et al., 2015).

Because oversight processes depend on consistent, decision-ready information, underrepresentation in standardized reporting and near-real-time outage pathways reduces the visibility of municipal system performance in benchmarking, vulnerability assessment, emergency coordination, and infrastructure planning. Reliability risks affecting municipal and rural communities may therefore be more difficult to identify and compare within statewide oversight frameworks. These conditions also raise equity concerns because modernization and resilience investments may increasingly favor utilities with stronger reporting and data management capacity rather than those facing greater operational or resource constraints.

4. **Municipal utilities rely on heterogeneous outage tracking systems that limit standardized reliability reporting**

The statewide evidence scan identified the largest reliability visibility gaps among municipal utilities. The survey therefore focused on municipal utilities affiliated with Electric Cities of Georgia to better understand the operational conditions shaping outage tracking and reliability-metric readiness. The survey was administered between July and August 2025, and 21 of Electric Cities of Georgia's 52 public power members responded. Most respondents operate distribution-only systems (17 of 21), while four reported operating both distribution and limited transmission infrastructure. Respondents also reported predominantly residential customer bases, commonly between 70% and 90% of total customers. The 21 responses cover approximately 40% of Electric Cities of Georgia's public power membership and provide insight into the outage-data practices and implementation constraints of a substantial subset of these utilities. However, the survey was not designed to produce statistically representative estimates for all municipal utilities in Georgia or other jurisdictions. The findings are therefore interpreted as evidence of the operational challenges experienced by participating utilities, rather than estimates of how prevalent these challenges are across the broader municipal utility sector.

Survey results show substantial variation in outage detection practices, data access, and the extent to which outage information is translated into structured reporting outputs.

- Outage detection remains primarily customer-driven, with partial automation emerging. Utilities continue to rely on customer phone calls and field crew observations, with some integration of SCADA, AMI, dispatch signals, and social media monitoring. Of the 21 respondents, 13 reported access to outage-related data, while 8 reported none. Several utilities are expanding automation and communication systems, but verification and restoration often remain partly manual. One respondent noted that "most of the data is collected manually," while another stated that "tracking and monitoring is not our biggest weak point; outage response is."
- Outage-data granularity and system integration vary widely. Among the 13 utilities with data access, most track outage timing, location, affected customers, and causes. About half reported circuit- or substation-level data, while fewer reported meter- or device-level visibility enabled through AMI. Utilities commonly use SCADA, GIS, OMS, and AMI systems alongside manual logs. One respondent noted that "device and customer level historical outage data are captured through SCADA, AMI, GIS, and OMS, but some data are still manually logged."

- Reliability metrics are unevenly calculated and applied. Not all utilities systematically compute SAIDI or SAIFI, even when outage data exist. Where metrics are used, applications include maintenance planning, outage pattern identification, restoration prioritization, internal reporting, regulatory reporting, and federal funding applications. One respondent stated that outage data support "federal funding applications, EIA reporting, and disaster response coordination, in addition to improving restoration and crew dispatch." Other utilities reported limited familiarity with standardized metrics or limited operational use. Several also expressed interest in linking outage data with predictive analytics and automation tools to improve planning and resource allocation.

These results show that municipal reliability visibility depends on more than technology deployment. Differences in data access, granularity, and workflow integration determine whether outage events can be consistently translated into standardized reporting and operational decision-making, shaping the extent to which utilities can support reliability assessment, system planning, and situational awareness.

5. Implementation constraints limit the transition to structured, decision-ready outage information

Survey responses indicate that barriers to modernizing outage tracking systems are closely tied to whether utilities can convert operational outage data into consistent reliability reporting. Utilities frequently described challenges associated not only with

acquiring new systems, but also with integrating technologies into operational workflows, maintaining staff capacity, and sustaining reporting processes over time. These barriers shape whether outage events can be consistently translated into standardized reliability metrics and incorporated into planning and oversight processes.

- Cost constraints drive incremental and partial system deployment. Utilities consistently identified the upfront and long-term costs of AMI, OMS, SCADA upgrades, and related automation systems as major barriers. Several respondents described phased implementation strategies driven by funding limitations. One utility noted that "Full AMI deployment for fully automated outage reporting has been our most cost-prohibitive project." Limited budgets also constrain system expansion, maintenance, and completion of modernization efforts.
- Staffing and technical capacity limit effective system use. Utilities reported difficulty maintaining personnel with the expertise needed to fully use SCADA, OMS, and AMI capabilities. In several cases, available system functionality exceeded operator familiarity, reducing operational value. Smaller utilities emphasized persistent staffing shortages, turnover, and competing operational demands as barriers to sustained outage tracking and reporting.
- Legacy infrastructure increases integration complexity. Respondents frequently described challenges connecting new outage-management capabilities with existing municipal platforms, billing systems, and operational software. One utility explained that "Due to all of the various legacy systems in place… it is often a difficult conversation to have with potential vendors regarding the

integrations required." These challenges extend deployment timelines, complicate workflow standardization, and increase implementation risk.

- Vendor uncertainty and long-term system manageability affect adoption decisions. Utilities also expressed concerns regarding vendor support, cybersecurity, and the long-term manageability of upgraded systems. These concerns reflect uncertainty about operational sustainability, particularly where limited staff must maintain increasingly complex digital systems.

Survey responses also identified several areas where external support could strengthen outage reporting readiness and operational use of reliability information.

- Support programs should pair capital investment with implementation enablement. Utilities indicated that technology deployment is most effective when financial assistance is paired with support for workforce readiness, integration planning, and workflow adaptation. Respondents emphasized that modernization outcomes depend not only on acquiring systems, but on the ability to operationalize them within existing organizational and technical environments.
- Workforce development and technical training are essential. Utilities highlighted the need for training that improves operational use of SCADA, OMS, and AMI systems and strengthens staff capacity to convert system outputs into reporting and planning workflows. One respondent noted limited operator familiarity with

OMS modules despite system availability, underscoring the gap between deployment and effective implementation.

- Technical assistance and standardized implementation resources can reduce risk. Respondents requested vendor-neutral guidance, peer examples, and standardized templates for outage tracking and reliability reporting. Utilities viewed these resources as important for reducing uncertainty during system selection, integration, and deployment.
- Public communication and interagency coordination remain important operational needs. Utilities emphasized that outage visibility also depends on coordination with local governments, emergency management partners, and customers. Public-facing outage maps and communication tools were frequently identified as valuable complements to internal outage-management upgrades.

These findings indicate that improving outage tracking and reliability-metric readiness requires more than technology investment. Progress depends on aligning funding with workforce capacity, integration support, and implementation guidance that reduces operational risk and enables consistent outage reporting.

6. Conclusion and policy synthesis for states and funding organizations

Reliability visibility in electricity systems depends on the ability of utilities and oversight institutions to consistently observe, compare, and interpret outage performance. As reliability risks increase and reporting systems expand, the value of reliability metrics

increasingly depends on whether outage information can be translated into structured and comparable forms across utility types and reporting platforms. The consistency of reliability visibility has therefore become an important and timely policy issue.

This policy note examines how differences in data infrastructure and operational capacity shape reliability visibility across utility types. Evidence from Georgia shows that municipal utilities are less consistently represented in federal reliability reporting systems and near-real-time outage aggregation platforms than IOUs and cooperatives. Survey results further indicate that many municipal utilities rely on customer reports and field verification for outage detection, and that only a subset routinely produce standardized reliability metrics such as SAIDI and SAIFI. These differences reflect constraints related to cost, staffing, legacy system integration, and uncertainty about system implementation and sustainability. These survey findings characterize the experiences of participating utilities and do not establish the prevalence of these challenges across all municipal utilities. Further research across additional jurisdictions could examine how these reporting practices and implementation constraints vary across different institutional and regulatory settings.

Across both the statewide scan and survey evidence, reliability visibility depends not only on monitoring technologies but also on the ability of utilities to convert operational outage information into structured reporting outputs. Differences in this capacity affect how consistently reliability performance can be observed, compared, and used across oversight and planning systems.

This policy note contributes two related insights. First, it shows that reliability visibility gaps reflect differences in data infrastructure and operational capacity rather than system performance alone. Second, it demonstrates that implementation conditions determine whether outage information becomes structured, oversight-ready data in municipal utility contexts. These findings suggest that reliability visibility should be understood as an operational capability rather than an automatic outcome of technology deployment.

For states and funding organizations, these results imply that reliability improvement strategies should treat data readiness as a foundational capability. Effective support requires alignment across structured outage-event capture, workforce capacity to operate and interpret monitoring systems, and reporting pathways that translate operational data into standardized metrics and communication outputs. Financial investment in monitoring systems can accelerate modernization, but sustained improvement depends on implementation support, technical assistance, workforce development, and peer-learning mechanisms that reduce adoption barriers and improve integration.

Uneven reliability visibility also has implications for benchmarking and infrastructure planning. Gaps in standardized reporting and near-real-time outage visibility reduce comparability across utilities and limit the ability of oversight systems to consistently identify reliability risks. Strengthening data readiness across utilities can improve the completeness and consistency of performance assessment and support more effective infrastructure decision-making.

Data availability statement

Survey response data are available from the authors in an anonymized form upon reasonable request, consistent with respondent confidentiality.

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