Final Report
Utility Distribution Audit of
Consumers Energy

Part Two

Presented to the:

Michigan Public Service Commission

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September 23, 2024

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Chapter I – Distribution System Organization, Management and Processes

A. Background

This engagement's Part 2 consisted of an examination of distribution system management, programs, processes, and standards driving planning and execution of reliability-focused investments, and guiding inspection and maintenance activities. We examined these elements for sufficiency in meeting present and future system safety and reliability needs, and in recognition of changing weather conditions, loads, and the need for equitable treatment among service area communities and regions. The reliability programs captured in the 2023 Electric Distribution Infrastructure Investment Plan ("EDIIP") formed a primary focus of Part 2 work.

This chapter addresses the organizations principally responsible for activities required to maintain a safe and healthy system and for planning additional or changed measures for sustaining and for improving it. We examined their structure, resources, and alignment of responsibilities, and the processes, methods, systems, and activities by which they fulfill those responsibilities, and examined the extent to which they bear strongly on maintaining a safe and healthy system and for planning additional or changed measures for sustaining and for improving it. Securing improvement has particular importance for Consumers, whose plans include very large investments and other expenses designed to move it very far forward in reliability performance. Seemingly modest at first glance, its goal to reach only mid-level reliability performance through 2028 becomes fairly describable as aggressive, given the gap between that target and historical performance and the very large size of the efforts the EDIIP plans.

The organizations, processes, methods, systems, and activities this chapter addresses also play the principal roles required to execute the plans that the EDIIP proposes. Growth in work that drives the increase in expenditures will require carefully designed and rigorously executed means for continuing to inspect, maintain, and repair systems and equipment sufficiently to minimize needs for expensive replacement. These organizations must operate under well-structured means for prioritizing work based on priorities that take measured account of asset health to be effective. These organizations also have significant responsibility for performing reliability program work at levels sufficiently increased to add complexity to already substantial needs for planning and executing field installations.

At the same time, Consumers will need to move at a reasonable pace in introducing and expanding its use of technology growing in use in the industry to provide real time information about system conditions and to control its configurations to perform optimally in normal conditions and respond quickly and effectively in adverse circumstances. Technology introduction challenges also include the development of systems that will support more efficient and timely dispatch of and support for field resources, again in circumstances ranging from the normal to the extreme. Increasing the ability to collect and analyze information about the system and its needs is also important for planning to meet future investment needs and for prioritizing O&M activities to respond first to greatest areas of operational risk.

Even with substantial improvement in reliability performance, responses to upset conditions and outages will remain significant and particularly challenging for an electricity distribution utility like Consumers. The Company faces very substantial exposure from long circuits, spread over a large portion of the state and operating in areas that have more than average tree cover. Compounding these factors is the need to address a number of system areas with low customer densities. Reducing outage durations there may not "move the needle" much when measured by overall reliability indices. Nevertheless, Consumers needs to ensure that it addresses what the industry terms "pocket" circuits or areas where customers experience persistently and particularly high outage numbers or durations.

This chapter describes and presents the results of our review of the organizations that must perform effectively to meet needs like those just described. We focused on the structure and processes for forming plans, making decisions, and conducting utility operations. We considered in performing our examination whether management:

- Provides for adequate responsibility, accountability, and resources for identifying Consumers system reinforcement, addition, and reliability improvement needs
- Assesses the condition, resiliency and reliability of Consumers electric infrastructure and regularly employs comprehensive, objective, and quantifiable performance measures
- Employs sufficient numbers of employee and contractor resources to ensure sufficient attention to the condition of those facilities, their performance, identification of gaps, and planning for means to address such gaps.

The organization responsible for distribution system operations and maintenance should employ a structure, responsibility and accountability alignment, and resources sufficient to support timely and thorough identification, planning, budgeting, execution, control, performance measurement, and other activities required for long-term cost effective, reliable, and safe operation of the system. Leaders, executives and managers, and groups responsible for assessing the condition and needs of electric infrastructure should regularly employ comprehensive, objective, and quantifiable performance measures.

We examined where overall executive responsibility for system needs and operations lies. We assessed specific roles, responsibilities, accountabilities, and resources of groups having responsibility for planning, budgeting, installing, operating, inspecting, maintaining, and retiring system facilities. We learned how operations-related functions are organized and examined the nature and reasons for recent material changes. We charted and reviewed resource levels charted for major functions. We determined the metrics that leadership uses to assess system reliability, performance, and condition in making plans for additions, reinforcements, and enhancements.

B. Executive Oversight

This section addresses the role of overall leadership in ensuring a safe and reliable distribution grid, particularly in developing sound five-year plans, supporting them with sufficient resources, and demonstrating strong commitment and active engagement in overseeing execution of those plans. For any organization that provides electricity distribution service, top leadership needs to provide clear and appropriate overall structure, strong direction, and commitment to performance effectiveness and to the measurements, and the flexibility to adapt to changing circumstances that a massive portfolio of programs necessarily entails.

1. Findings

Cascading executive oversight of the planning, engineering, design, construction, operation, maintenance and restoration for the Consumers HVD and LVD distribution systems is shared between a pair of Consumers Senior Vice Presidents and delegated to a corresponding pair of Vice Presidents ("VPs"). The Senior Vice President ("SVP") of Operations and the SVP of Transformation and Engineering and their direct reports, the VP of Electric Distribution Engineering and the VP of Electric Distribution Operations, collaborate on a continuous and ongoing basis to oversee the planning, engineering, and control room and field operations of the electric grid and the supply of electricity to Consumers' customers. The VPs of Distribution Engineering and Electric Distribution Operations co-lead the assembly and analysis of data that informs the Consumers Quarterly Operating Review process, intended to track the Company's electric distribution system asset health scorecard and guide programs, initiatives and projects designed to improve reliability and resiliency and reduce safety and reliability risk over time. Daily and weekly review sessions with those engineers and project/program managers responsible for asset improvement efforts seek to accomplish the following:

- Review various Key Performance Indicators for initiative progress and success
- Revise and refine workplans to deliver improvement
- Focus on data-driven comparisons and results.

These sessions include program status reports and current metrics addressing safety and reliability issues affecting the HVD (substation, system protection, HVD lines and the Metro subsystem) and LVD (overhead lines, forestry, pole inventory, underground cables, fusing and overload protection initiatives, secondary and customer lines, and subsurface assets.)

2. Conclusions

1. The Consumers leadership organization is appropriately structured and engaged in addressing the reliability challenges that face Consumers.

The alignment of responsibilities at the senior level promotes focus on improving reliability. The daily huddles and weekly reviews at the senior operating leadership levels build to monthly and quarterly review sessions involving top management including the Consumers SVP group and the CEO. In our individual and group interactions, Engineering and Operations executives articulated and demonstrated strategic and process-oriented alignment, integration and cooperative governance in operational and policy-oriented interviews at both the SVP and VP levels of the organization, and a strong alignment with the quarterly review cadence and goals was echoed and demonstrated in Director-level discussions. An organizational focus on visual management, problem solving and continuous improvement was repeatedly demonstrated in interviews at all levels of leadership.

We found the Consumers executive team well informed, knowledgeable and focused on public safety and reliability improvement using a comprehensive set of metrics and frequent, detailed and structured operating reviews to track initiative progress and performance results.

3. Recommendations

We have no recommendations regarding Executive Oversight.

C. Electric Operations Organization

We examined the overall structure of the electric operations organization and changes in resources in recent years. We considered how those changes have corresponded to work level changes in recent years to identify whether there appeared to be any system issues causing or risking resource shortages and to determine whether any apparent areas of likely shortage may occur under work levels contemplated by the EDIIP.

1. Findings

The following table shows that the total number of Electric Operations employees increased from 1,389 in 2020 to 1,734 in 2023, an approximate 25 percent increase. These numbers exclude LVD/HVD Planning and Engineering, Operations Planning and Scheduling, and Training, Health, and Environment employees. Numbers of contractors, expressed on a full time equivalent ("FTE") basis, also increased. The numbers dedicated to HVD Operations decreased. Increases in the number of LVD Operations employees primarily drove the net Electric Operations increase. Consumers has reported that meeting resource needs for proposed 2024 through 2028 workload levels, when considering the backfilling of an estimated 150 positions lost to attrition, will require adding 168 apprentices, 322 line workers, 234 underground workers, and 149 HVD workers (contractors).[,] The totals include a small number of "augmenting" FTEs, professional or clerical contractors who are embedded in Consumers employee working groups.

Recent Operations Resource Counts

Group	2020	2021	2022	2023
Grid Management	151	231	224	207
Operations Performance & Procedures	35	42	39	31
LVD Ops (Employees)	916	1,032	1,132	1,184
LVD Ops (Contractors)	179	207	200	110
HVD/Sub/Metro/EFL Ops (Employees)	287	266	266	263
HVD/Sub/Metro/EFL Ops (Contractors)	192	178	186	163
Forestry (Employees)	*Included in HVD*	63	56	49
Forestry (Contractors)		805	940	942
LVD Planning/Engineering[1]	*LVD/HVD combined*		268	262
HVD Planning/Engineering[1]			216	204
OPs Planning/Scheduling[2]		213	292	221
Training/Health/Environment[2]		42	45	37
Total Electric Operations Employees + Augments[3]	***1,389***	***1,634***	***1,717***	***1,734***
Total Electric Operations Contractors[3,4]	***371***	***1,190***	***1,326***	***1,215***

[1] *2021 entries not provided because they included generation-related personnel*
[2] *2020 entries not provided because they included gas and generation-related personnel*
[3] *Not including Engineering, Ops Planning/Scheduling, or Training*
[4] *Excludes Forestry in 2020*

2. Conclusions

2. Resource increases have been commensurate with increasing work levels.

The remaining sections of this chapter describe recent changes in work levels to date, particularly as Consumers has undertaken measures (*e.g.*, shortened vegetation cycles) to enhance reliability. Chapter VI, *System Comparisons*, of the accompanying Part 1 report provides a series of tables and information that show growth in capital and O&M expenditures over time. The *Findings*

subsections of the remaining sections of this chapter describe significant measures of work levels in recent years. The next chapter, while focusing on EDIIP plans, also addresses changes that have occurred to date. Total resources have grown from 1,750 in 2020 to 2,949 in 2023, with most of that growth in contractor resources, expected given the expansion of field work. However, internal resources have grown as well, accompanied by changes in the distribution of them among groups. This growth and change correspond to increasing needs. Consumers' planning and engineering organization, its field operations, and work management organizations work closely together to achieve timely the Company's workload as dictated by capital and O&M projects, programs and budgets. Their collaborative efforts include inspecting and maintaining the electric grid, addressing reliability issues, managing tree trimming and removal, and addressing overloading issues.

Identification of the need for proposed infrastructure projects begins with local planning engineers and advances up to Directors, and the Electric Vice President for approval, depending on spending level. At the Director level, each project has undergone quantification, has costs and benefits analyzed, and undergoes prioritization based either on cost/reliability benefit ratio or on a ranking among the proposed projects of the "least cost for best fix."

Staffing of managers, supervisors, engineers, and line and substation personnel appears to be appropriate for the current workload.

3. Continuing attention to resource levels will remain critical to efficiently performing the very large work levels contemplated by the EDIIP. *(See Recommendation #1)*

The next chapter of this report recommends significant shortening of forestry cycles in the near term. The levels of work required may highly strain access to resources available on a local level. Even without the cycle shortening we recommend, the large increases in work required to undertake the combined capital and O&M programs, measures, and activities that the EDIIP proposes will require access to significantly more resources.

3. Recommendations

1. Establish a focused effort for identifying required resources and for closely monitoring their effectiveness and efficiency. *(See Conclusion #3)*

We did not find lack of attention to controlling costs at Consumers to date. However, large increases in combined activities necessary for achieving the substantial reliability improvement targeted will add significantly to the need for continuing to assure that program and project management organizations, methods, systems, practices, and resources keep pace with the demands that these increases will pose to performance effectiveness, efficiency, and timeliness. Creating a management and supervisory structure large and well-directed enough to oversee a greatly expanded work level is also critical to managing work timeliness and efficiency.

Much of the work that the EDIIP contemplates has fairly short task durations. Other work drivers, such as reducing the length of forestry cycles, will impose temporary surges in resource requirements. They will, however, very substantially moderate when work to catch up to those cycles ends and maintaining them becomes the need. Such durations complicate the expansion of permanent internal resources as a solution for addressing resource needs. Thus, sound balancing of internal and external resources becomes critical to getting the work done and to doing it most

economically. It is logical to expect large increases in contractor use for field work, particularly for programs with relatively short durations. However, some programs, measures, and activity areas will require long-term continuation. Consumers should ensure that it invests sufficiently in developing internal resources where effective and economical in the longer term.

Close monitoring of efficiency will be critical in preventing the stresses that increased work pace places on efficiency to not degrade it substantially. Particularly as reliance on new outside providers or on existing ones called upon to expand their resources on Consumers work increases, it will be important to monitor performance metrics.

There is a reasonable prospect that increased work levels will, despite best efforts, prove impracticable to achieve in the EDIIP's timeframe, either at all or without significant degradation of efficiency. Consumers needs to ensure that a program and project management group has clear responsibility for performance tracking to ensure that leadership has continual, clear, and comprehensive insight into performance drivers that call for efficiency improvement.

Achievement of its reliability goals will only bring Consumers to mid-level performance in the industry, which underscores the high priority on achieving them. That priority emphasizes the pace at which management must proceed, and that pace poses risk to work performance effectiveness and efficiency. Achieving reliability goals without sacrificing work effectiveness and efficiency materially should remain an important factor in determining the ultimate pace at which to proceed in meeting them, even if it brings risk to meeting target dates for reliability performance. The next chapter of this report addresses the aggressiveness of the target date for reaching mid-level reliability performance across the planning horizon of the EDIIP and the need for considering that date not as firm, but subject to what it will take to get there in terms of costs to the customer, which involves consideration of the ability to move as quickly as planned without sacrificing performance effectiveness and efficiency.

D. Planning

Organizations dedicated to planning have been assigned to an HVD group, which has responsibility for HVD lines, substations (both HVD and LVD), and the Metro distribution system component. A separate group has responsibility for LVD planning. We examined their structure and resources and reviewed their planning practices and methods. We also examined how Consumers incorporates changing weather, load sources, and equity into planning processes.

1. Findings

a. Organization and Resources

The Company reorganized the HVD Planning organization in 2021 to form the HVD System Planning and Electric Reliability & Support organization, comprised of engineers and technical analysts. This group has responsibility for inspecting the HVD lines, all substations and Metro assets, monitoring asset health, identifying HVD system capacity needs, HVD, Substation, and Metro maintenance and reliability work; planning projects; prioritizing and optimizing the work; and overseeing compliant and effective work execution. Responsibility for the Metro system includes all underground lines and substation assets, including cables, manholes, vaults, and Metro substation equipment. Metro system reliability programs include:

- Inspections and repairs
- Civil and electrical projects including replacing obsolete assets
- Vault rehabilitation and replacement of live-front with dead-front switchgear, transformers and modules.

The next table summarizes the resources assigned to this functional area.

HVD Reliability Resources

Group	FTEs
HVD Program Management/Project Engineer	7
HVD System Planning	44
Reliability and Support	0
System Protection	23
HVD Design	80
HVD Engineering	2
Standards and Controls	48
Totals	***204***

LVD planning and engineering operates under two Directors of Planning, one for the eastern and one for the western regions. Circuit Planners and Designers (designers under a separate director of LVD Design) are deployed among the 30 headquarters locations. The next table shows Planning, Engineering, and Design Staffing as of 2023. Consumers believes that locating many of the planning, engineering, and design employees within their geographic areas of responsibility is more effective than centralizing those resources and stationing them all at the general office.

LVD Planning and Engineering Staffing

Group	FTEs
Electric Distribution Analytics	35
LVD Planning East	35
LVD Planning West	31
LVD Engineering	3
LVD Design	141
Grid Modernization	17
Total	***262***

The East and West LVD planning groups identify necessary projects, maintenance and reliability work, prioritize and optimize the work, and oversee programs and projects for effective execution. These organizations operated under a single Director until 2021, when Consumers separated the organization into the East and West LVD Planning groups. Individual LVD Circuit Planning Engineers each have responsibility for a selected numbers of circuits, with staffing and assignment locations of Circuit Planners and Circuit Designers determined by the workload needs of each area. The Grid Modernization group manages engineering of new technologies that can be deployed to improve the operations, such as ADMS, fault sensors, ATR loops, for example.

b. Capital Planning

Consumers scrutinizes proposed capacity and reliability projects using its "Concept Approval Process" for capital infrastructure projects. The process supports identification and analysis of proposed solutions and their estimated costs and benefits in meeting customer needs. For projects that have material community impacts, management engages with the community in several ways including conducting technical conferences, holding community meetings, and working with municipal engineers and other stakeholders such as municipal utilities. The Company's LVD Metro Planning and Design team meets with municipal authorities during the fourth quarter of each year to share upcoming capital workplans to identify ways to coordinate work and obtain permits.

As part of project prioritization, the Company also targets and identifies investments in communities vulnerable to environmental and economic challenges, particularly those experiencing repetitive outages. The Planning organizations prioritize projects based on either least cost per avoided customer minute of interruption analysis or on least cost/best fit analysis.[1] The Company uses the least cost per customer minute analysis for prioritizing reliability projects such as ATR loops and fractionalizing circuits, and it uses the least cost for best fit analysis for capacity projects.

Company Planners identify the need to improve HVD and LVD SAIDI, SAIFI, CEMI, and CELID metrics by mitigating abnormal conditions based on inspections, quarterly asset health review, and outage history. They identify specific target areas, develop solutions, and determine the cost to reliability benefit of solutions. The Company prioritizes proposed reliability projects based on the impact on costs, reliability metrics, customer benefits, and system-wide workload balancing. Solutions may include system protection upgrades, relocating lines, and improving voltage quality. The Company determines the need for infrastructure improvements based on prioritized reliability and safety risks identified by inspections. These projects follow the two-year inspection cycle to replace broken assets, replace obsolete assets, address National Electrical Safety Code ("NESC") code violations, and upgrade deteriorated infrastructure. Repair schedules are based on risk-consequence based priorities. The Planning and Resource Management organization has responsibility for scheduling and resourcing the repair and project work.

c. Consideration of Changing Weather

Consumers considers worsening weather and increasing electrification in planning the Company's distribution system. Management is conducting a program for replacing weaker legacy, small-diameter class 5, 6 and 7 poles with stronger (generally class 2 through 4) poles to reduce the incidence of poles broken by storms, high winds, high ice loadings, and falling trees. Some 62 percent or more of existing legacy LVD poles fall into classes 5 through 7. Of limited strength when new and installed, these smaller diameter poles can weaken further over time and become subject to failure when exposed to harsh environmental conditions.

[1]Benefit/Cost analysis monetizes benefits to enable relating them with benefits, generally concluding that any B/C dollar ratio that exceeds 1.0 demonstrates net benefit. Least Cost, Best Fit does not monetize benefits. It identifies solutions that meet a defined need and compares their costs to determine which best fits the need for the least cost.

d. Electrification-Related Load Changes

Consumers also anticipates increased loads on its circuits due to expansion of customer use of heat pumps and electric vehicle charging. Recent efforts have begun to include these elements into modeling of future LVD circuit peak loads. The Company has reported recent modeling of three risk scenarios and impacts, reflecting electric vehicle and heat pump additions and increased heat, wind, and thunderstorms. It appears, however, that management finds itself at present in a developmental stage of incorporating anticipated climate, electric vehicle, heat pump, and DER impacts into its load forecasts. Management has reported the inception of efforts to enable its power flow analysis tools to account for such effects, with new and updated processes that can better forecast future peak loads under evaluation. New evaluation techniques include the use of smart meter data and consideration of whether to use probabilistic or worst-case peak load scenarios.

e. Equity

Consumers addresses equity in its planning processes. Consumers has for the past five years or so employed what it terms a "Grid Archetypes" approach that uses LVD circuit characteristics other than traditional reliability metrics to identify a series of nine types of designated areas, or archetypes, in its service territory. The Company added flagging to capture environmental justice circuit characteristics in 2023, with plans to add climate flagging this year to identify areas most exposed to weather extremes. It has also added disadvantaged community status in its Forestry model to ensure visibility. The EDIIP notes two groups to which it has directed greater reliability investment, noting that the first has considerable overlap with environmental justice communities:

- Archetype 4 consists of urban customers with long circuits and high customer density more susceptible to outages
- Archetype 7 consists of rural customers with long circuits and poor reliability.

The EDIIP also states that blue sky reliability in environmental justice communities exceeds that of surrounding areas but that all-in (no exclusion for MEDs) SAIDI appears worse in "a few key EJ areas." However categorized, one can expect some circuits in any designated area to perform better or worse than others. To that point, reported SAIDI, SAIFI, and CAIDI for "MiEJ 80" circuits overall as consistently superior from 2018 through 2022 as measured by SAIDI, SAIFI, and CAIDI.[2] Reporting by census tract appears to show the same for 2020 through 2022. The EDIIP acknowledges that it needs to undertake additional work to detail hosting capacity analysis in ways that align with a settlement agreement applicable to future rate filings.

2. Conclusions

4. Planning is appropriately organized and sufficiently staffed.

We found the planning and engineering organizations appropriately organized and operating in a coordinated manner with sufficient resources. Organizational alignment of planning provides a sufficient focus on capital program planning, whose timely and effective performance will prove critical to meeting the large needs the EDIIP proposes to meet. Resources appear sufficient and

[2] MiEJ 80 refers to census tracts above the 80th percentile on the Michigan Environmental Justice Mapping and Screening Tool ("MiEJScreen"), an interactive screening tool that identifies community stressors and demographics.

appropriately aligned to address the broad range of capital planning needs that will exist through the course of the EDIIP. The Company's LVD planning and engineering functions, led by two co-Directors of Planning (East and West) and the LVD Operations Director all work together. We found that these organizations work well together and communicate constantly, including a quarterly system condition presentation that involves all lead personnel.

5. Planning methods, practices, and tools are sound.

They comport with industry practice, use reasonably sophisticated tools, include analysis and prioritization, engage technical personnel early and substantially, and are targeted as required to particular areas, system conditions and circumstances.

Using parallel processes for developing, comparing and selecting engineering solutions to LVD and HVD system issues, engineers and analysts screen proposed reliability and/or capacity improving electric distribution investments by considering an array of alternatives and then choosing an optimal solution and developing a "concept approval" to test and demonstrate why the selected project is reasonable and prudent.

Individual project concepts to improve the capacity, reliability and operability of the HVD and LVD systems - and the full, assembled annual portfolio of improvement projects for the distribution system - are reviewed for technical and financial completeness and efficacy and are approved by escalating levels of management – from System Planning Engineers up to Executive Directors and Vice Presidents – depending on the total cost (dollar value) of the proposed alternative. Approved concepts then enter the budgeting, planning and engineering, installation and construction, completion, and closeout processes. We found need determination, alternatives identification, review, and approval processes consistent with good utility practice.

The Company has developed three scenarios that address a range of expected weather conditions and of penetration of solar distributed generation, EVs, and heat pumps. These scenarios provide planners with a more robust ability to assess the risks that Consumers must plan to address than traditionally employed in the industry in the past. Not atypically, scenario development lies in a relatively early stage here, as it is elsewhere in the industry, emphasizing the importance for management to continue, as it appears ready and intending to do, enhancing the process and testing the meaningfulness of the scenarios developed. The EDIIP describes Company thinking about the likelihood of occurrence of its identified scenarios.

6. From an overall perspective, the Consumers system does not show indications of inequitable distribution of service reliability.

Steps have been taken to identify the intersection between environmental justice communities and the Consumers electrical facilities, which can serve across the boundaries of communities distinguished on that basis. Planning seeks to consider where investment is going and how to balance it across the many communities and Archetypes served. The necessary capability to measure for planning purposes exists, as does the ability to assess results quantitatively using the metrics that typically define the central characteristics of service reliability.

While the data currently reported does not show strong indication of systemic or large variances in service reliability, the relative newness of Michigan Public Service Commission ("MPSC" or

"Commission") directives and Consumers first responses to them in the 2023 EDIIP underscore a need for continuing stakeholder dialogue. That dialogue will inform identification of how reliability differentially affects environmental justice community residents and businesses, and the degree to which added measures should address them, while maintaining an equitable balance of costs and benefits overall. The program for eliminating open wire secondary, addressed earlier in this chapter, provides an example.

For the present, we believe that the Company has shown:

- Willingness to engage in defining the intersection between its distribution system configurations and environmental justice communities
- The capability to design and make measurements needed to assess equity in service provision
- Apparently candid views on where particular aspect of system configuration, condition, or operation may produce more burdensome impacts on environmental justice communities
- The capability to identify the particular facilities involved and the portion of them operating in those communities.

From the perspective of assessing practices and methods as we were engaged to do, these are material factors. It appears that the stakeholders and Commission have continued to engage in refining understanding of particular community service needs, expectations, and consequences of system upset conditions, all necessary to define what equity requires at an executable level. Consumers has shown the capability to respond timely, adequately, and measurably, as those requirements evolve.

7. **The load forecasting and load modeling processes appear adequate for current capacity needs currently identified, and operate under a range of future weather- and electrification-driven scenarios that entail significant uncertainty.** *(See Recommendation #2)*

The data assembled by Consumers for planning purposes shows increasing weather risk over time. Large variability in weather makes prediction over periods with durations like those of the EDIIP uncertain, but we found sound the scenarios that Consumers has considered. The Company's development of electrification scenarios responds to state decarbonization objectives, as it must. At present there is significant uncertainty over issues such as the likely growth in penetration of electric vehicles or the degree to which emphasis on decarbonization will influence the availability and price of energy sources other than electricity for customer use. Nevertheless, it remains sound for Consumers to recognize the need to respond on a timely basis whether objectives prove more or less optimistic over time.

The Company's use of scenarios seeks to preserve its ability to respond timely. Nevertheless, it remains important to match the pace of expenditures with actual changes in electricity demand sources and weather. Data that becomes available over the course of the EDIIP may not much influence weather expectations for the EDIIP's planning horizon. Additionally, the penetration curves used for demand sources like electric vehicles show more moderate growth in earlier years. Nevertheless, Consumers needs to continually re-examine and, as may prove necessary, consider revising the pace of programs, in consideration of the benefits that reducing the impacts of very large EDIIP period investments would have on electricity prices. While it appears less likely as of

the time of this report's completion, Consumers needs to remain aware of data that may accelerate the impact of electrification on capacity-related investments as well.

8. Engineering and construction standards comport with good utility practice.

The Company updates electric construction standards for consistency as newly published revisions of the NESC emerge. Consumers formally notifies and trains its employees and contractors on standards updates. Documents setting forth internal Company standards and work methods documents are properly managed and readily available to employees and contractors. Our examinations of documentation and field inspections did not disclose material gaps in this regard.

3. Recommendations

2. Coordinate the pace of capital program execution with continually updated electrification scenarios. *(See Conclusion #7)*

Consumers recognizes the planning challenges related to weather, in relation to outages during extreme conditions and to events or increased demand due to electrification and warming temperatures in cooling seasons. These evolving factors require modifications to grid modeling methods, and work is underway at Consumers to address these needs. The two-year cycle between 2021 and 2023 EDIIP revision invites revision of scenarios on the basis of enhanced methods and changes in data about load influencing customer uses of electricity. Between those revisions, however, it remains important in optimizing capital resources for Consumers to review constantly the policy changes and market developments that may drive changes in assumptions that can affect the need for the significant investment levels at issue here.

E. Asset Management

A utility must implement well-structured inspection and maintenance programs to guarantee that system conditions allow its safe and reliable operation. Not addressing or deferring necessary repair, renewal, and replacement tasks can lead to significant and recurring service degradation over time. Effective management includes a comprehensive asset management strategy that collects and uses accurate and comprehensive data, sets clear performance goals, and establishes suitable cycles for ongoing activities. Postponing inspections and maintenance prevents management from identifying and rectifying issues before they affect service directly or before equipment degrades to conditions requiring premature replacement. Successful programs ensure that resources are adequate to carry out planned activities as planned and on schedule.

Our examination assessed whether management:

- Follows a suitable asset management approach that sets clear goals and objectives, while integrating real electric system performance data into the creation and prioritization of inspection and maintenance initiatives.
- Implements and routinely evaluates and when needed modifies thorough and efficient programs for regular inspections, maintenance, and management.
- Performs inspection, maintenance, and management tasks in alignment with those established programs.

1. Findings

Consumers does not employ a single, high-level (executive or first level below) organization solely dedicated to grid asset management. Separate functional organizations manage three overall categories of assets: HVD, LVD, and Substations. Each organization manages the multiple asset types that fall under these three overall categories. Each functional organization monitors the assets for which it has responsibility throughout asset life; from procurement to installation, to inspections and maintenance, repair, and replacement. These activities consider regularly performed health scoring.

Consumers has underway a process supported by policy and procedures for formalizing asset management, intended to meet ISO 55000 standards. Consumers identified the changes as responsive to a need for developing a unified approach to electric asset management. Elements of an initiative now underway to formalize and improve management of LVD assets include a Center of Excellence,[3] Asset Repository, Asset Investment Planning, and Asset Performance Management. Electric Distribution has established a Quarterly Operating Review addressing asset health. These reviews provide LVD and HVD groups status and current condition ranking of asset conditions across the grid.

Consumers applies quarterly updated "health scores" for each HVD line and switch. It bases these scores on factors including recent line performance, conditions identified by visual and thermal inspections, numbers of reject poles, insulator issues, and whether lines are un-shielded, radial, or use non-standard conductor. Highest scores indicate highest risk of failing and causing interruptions. The Company also applies health scores for each substation and each major asset in each substation, based on asset performance, visible and thermal inspections, high priority fixes, testing results, and degradation. Substation assets include transformers, load tap changers, regulators, circuit breakers, reclosers, circuit switchers, and batteries. Scoring considers visible condition and the results of the 12-year cycle inspection program for HVD poles. LVD pole scoring considers the two-year cycle pole inspection program applicable to them. However, Consumers does not bore LVD poles and measure them for shell thickness, although it does so for HVD poles.

The Center of Excellence plans to establish a documented standard for integration of distribution assets into new Asset Repository, Asset Investment Planning, and Asset Performance Management software. Efforts currently focus on interconnecting the Asset Repository with internal systems, including the GIS, CASCADE, SAP, and MS Excel files used to manage asset data. Asset Investment Planning will employ a widely-used, third-party provided Copperleaf asset management software suite that supports value-based decision-making. Copperleaf will allow quantifying asset investment and risk mitigation benefits. The Company plans to employ in 2025 a third-party supported Asset Performance Management tool, with a solicitation for third-party support now in preparation.

Consumers makes use of software programs commonly used in the industry to allow those responsible for assets to track their inspection, repair, and maintenance work and to provide for comprehensive and manageable data for a broad array of characteristics; *e.g.*, age, identification,

[3] Centers of Excellence bring together groups of internal personnel whose expertise in a common subject matter allows them to provide focus, leadership, practice improvement, research, support, and mentoring and training.

and serial numbers. The GIS system supports tracking of HVD and LVD line assets, with some HVD line assets still tracked using MS Excel and with some underground LVD asset data remaining for GIS updating. Work continues to complete these gaps in GIS coverage. Management has completed substation CASCADE data, and management uses this software to track inspections and other work and data for substations assets.

The stratified sampling of facilities we performed and described in the accompanying Part 1 report verified the accuracy of GIS and CASCADE data regarding poles and substation assets. We found a small number of mismatches in pole installation dates and substations whose data provided did not include transformers present, which the substation one-line diagrams indicated. Otherwise, the Company's records proved accurate. The Company indicated that the incorrect pole age data was caused when contractors replace poles during storm restoration work.

2. Conclusions

9. Consumers has underway an initiative that will bring more structure, comprehensiveness, and utility to its asset management program, after which it will become timely to address the structure employed to manage it. *(See Recommendation #3)*

Aided by outside expertise, Consumers has been moving from a less centralized asset management approach under which the "owners" of specific assets have responsibility. Development of software aided capabilities and their incorporation into a consolidated program will comprehensively address the full portfolio of electric distribution assets, assessing condition, identifying and evaluating alternative means for addressing conditions affecting equipment reliability and effectiveness, and establishing priorities on a basis that considers the entirety of that portfolio aligned by appropriate category.

The changes that Consumers has made and is continuing to make in methods, tools, reporting, and analysis with respect to asset management move the Company forward. Consumers should continue to pursue them with deliberate speed. Completion of program redesign and content enhancement will undoubtedly bring new and useful insights to management as it becomes more familiar with the information and analysis produced and how to use them most effectively.

We believe that best practice calls for assigning responsibility for ensuring effective application of a sound asset management program to an organization specifically dedicated to that role. Consumers does not follow this practice, but is developing a unified approach to electric asset management. We understand the importance of promoting the accountability of operations personnel making those in operations organizations responsible for operating and maintaining assets by emphasizing their "ownership" of the assets. Diminishing that sense of ownership can substantially mitigate an otherwise effective asset management program.

Others have found it possible to provide an empowered source, for example, in:

- Overseeing effectiveness in applying program elements in the field
- Providing insight into how realignment of resources among many divisions and locations competing for resources can better "level" performance results among them to produce optimized net results

- Providing the experience and insight necessary to continue program evolution as the "science" of asset management advances.

10. Consumers' use of health-based scoring for its electricity distribution assets provides a structured and comprehensive means for identifying system repair and replacement needs, but over-reliance on age as a determinative factor and seemingly high rejection rates diminish its effectiveness. *(See the recommendations of this report's next chapter)*

Consumer's employs a comprehensive and quantified process for assessing the health of its system assets. It relies on objective inspection and testing elements to produce a generally reasonable ranking of asset risks. Such rankings have major value in determining priorities for repair, replacement, and upgrading. However, as the next chapter of this report explains, age plays in a number of cases too great a role in driving replacement at Consumers. As that chapter explains, age should not play the significant role in replacement decisions that it does at Consumers in the case of pole replacements, and substation transformers, for example. Inspection and testing should drive those decisions, again as explained in the next chapter.

In any event, we did not find asset ages out of character with what we have seen at other utilities. Neither did our field inspections give reason to question condition on the basis of age. The Company employs inspection and maintenance cycles and contents that we found strong, save for an aspect of pole inspections. Continuation of those practices, with certain improvements, expansions, and enhancements that the EDIIP plans, gives further assurance that high rates of replacement of poles and substation transformers and equipment have not been shown necessary to maintain and improve reliability.

As the next chapter also details, replacement of poles and substation transformers and equipment rejected on the basis of inspection (excluding age as a factor) or inability to support them with replacement parts is a sound practice. However, the seemingly high rejection rates cited by Consumers does call for a re-examination of the criteria applied in determining rejection.

3. Recommendations

3. With completion of the current changes contemplated in asset management measures, continue to assess the merits of moving to a more empowered organization, led at the director-level, responsible for ensuring optimized execution and continuing development and execution of the program. *(See Conclusion #9)*

Best practice in our view favors such an approach, but we recognize that making it operate effectively requires a supportive culture and prevention of diminishment of asset "ownership" by those who direct and conduct work in the field. It seems clear that the culture of Consumers leans more heavily to localization of responsibility, however, we recognize that recent program enhancements have brought consistency of execution in many important respects. Culture often changes as familiarity with new ways of managing increases. Moreover, the most important things Consumers can do to move its program ahead is to complete and stabilize the changes underway.

It will take some time to enhance and unitize specific elements of asset management. When those stabilize and have reached a level of maturity consistent with the system as it is expanding and changing to improve reliability, we recommend revisiting the alternative of moving to an

organization made responsible and accountable for asset management program design, execution, and development to promote continuous program improvement.

F. Inspection and Maintenance

Reliability of electric service depends on maintaining system equipment in reliable condition. Management should follow an approach that sets specific goals and targets, while integrating actual electricity system performance results into the planning and prioritization of inspection and maintenance programs. It is essential for management to implement, regularly review, and adjust inspection, maintenance, and vegetation management programs. There exist annual and monthly goals for completing program work, with accountability measures in place, tracking conducted, and regular reporting.

Asset management programs play a key role, determining what maintenance activities most effectively prevent and mitigate electric outages and provide acceptable equipment conditions, considering O&M and capital budget limitations. Proactive inspections contribute to reliability by identifying hazardous conditions and defects that may need to be corrected before they cause unplanned outages. Proactive maintenance, including vegetation management should protect assets from encroachment by trees, vines and other vegetation. Effective vegetation management also secures ready access to equipment for operation and servicing. Occasional and limited inspection and maintenance deferrals are not unusual in the industry, occasioned by factors such as transitory financial circumstances or disruptions from outside factors, such as major storms that can impose more imminent needs, for example. Deferrals are generally manageable, if limited and controlled. Our examination of the Consumers inspection and maintenance practices, described in the following sub-sections of this chapter sought both to assess their sufficiency as designed and as executed, including deferrals and backlogs. Our examination included asset management task schedules and vegetation cycles. Experience shows the significant risks associated with such deferrals, particularly those associated with vegetation management.

A sufficient number of trained and qualified inspectors is essential for making accurate observations based on established procedures and checklists. They are responsible for documenting threats and defects and initiating corrective actions by follow-on maintenance crews. Qualified crews for equipment maintenance and vegetation management and their adherence to sound standards and procedures are critical for implementing corrective actions and conducting proactive maintenance. Augmenting O&M teams with specialized contractor crews for inspection and maintenance tasks can be effective, provided there is proper oversight and quality checks.

Assigned resources require work orders, drawings, specifications, permits, materials, tools, and equipment to complete tasks on time and within budget. Electronic systems for work management, maintenance, and vegetation management enhance coordination and efficiency.

We examined the suitability and effectiveness of the schedules and objectives for the completion of the O&M inspection, maintenance, and vegetation management programs. We evaluated whether these schedules are clear and comprehensive enough to support reliability goals and targets. Additionally, we examined how senior management oversees and assesses the performance of O&M management in relation to system reliability targets, and how they utilize

these assessments to modify priorities and focus areas for equipment and vegetation management inspections and maintenance in order to enhance reliability.

1. Findings

a. Outage Causes

Consumers operates under restoration targets that call for restoration of 90 percent of customers within:

- 8 hours under normal conditions
- 24 hours under gray sky conditions
- 36 hours under all conditions, which includes normal, gray sky, and catastrophic conditions
- 48 hours under catastrophic conditions.

The next two tables summarize the number of events reported by causes and percentages. The first table excludes the effects of MEDs and the second does not. Both exclude planned outages. Vegetation (tree contact primarily), followed by equipment failures are the two leading causes. It is likely that tree contacts also cause a number of outages attributed to "Weather" and to those with causes "Unknown." The accompanying Part 1 report observed that use of the cause code "Weather" masks the actual cause of outages such as trees, lightning, or ice, for example. Similarly, the cause "Unknown" accounts for 11 percent of total interruptions (4th leading cause of outages) in years 2022 and 2023. The causes "Weather and "Unknown" diminishes the effective of the analysis of outage causes necessary to identify and optimize solutions to address them.

The EDIIP includes a range of programs and initiatives to address outages. Inspection and maintenance programs provide a foundation for many of them. Forestry programs address risks of vegetation caused outages. Inspection, maintenance, and replacement programs address risks of equipment caused outages. Installation of animal guards at substations address risks of outages from wildlife contacts. Lightning damage is difficult to identify. The HVD system employs lightning location capability to help identify lightning strike locations, but the LVD system does not have that capability. Responding personnel identify burn marks and blown lightning arresters to identify lightning as a cause on the LVD system. Circuit sectionalizing, a material program in the EDIIP, does not reduce outages, but does reduce the numbers of customers affected by outages.

Outage Events by Cause (excluding MEDs)

Cause	2022	Percent	2023	Percent
Vegetation	12,164	31.5%	12,389	32.7%
Equipment	8,483	22.0%	7,295	19.2%
Unknown	4,810	12.5%	4,861	12.8%
Wildlife	4,692	12.2%	4,595	12.1%
Weather	3,329	8.6%	4,220	11.1%
Other	2,853	7.4%	2,640	7.0%
Public	1,330	3.4%	1,157	3.1%
Lightning	768	2.0%	720	1.9%
Supply	182	0.5%	37	0.1%
Total	38,611		37,914	

Outage Events by Cause (All-In)

Cause	2022	Percent	2023	Percent
Vegetation	17,078	35.4%	18,298	36.1%
Weather	6,073	12.6%	9,291	18.3%
Equipment	9,118	18.9%	7,807	15.4%
Unknown	5,340	11.1%	5,664	11.2%
Wildlife	4,870	10.1%	4,678	9.2%
Other	3,057	6.3%	2,811	5.5%
Public	1,368	2.8%	1,195	2.4%
Lightning	1,196	2.5%	918	1.8%
Supply	194	0.4%	39	0.1%
Total	48,294		50,701	

b. HVD Overhead Lines

Consumers annually inspects 4,300 of its 4,600 miles of HVD overhead circuits for defects and tree intrusion via helicopter, using various methods:

- Visual inspection for abnormal conditions
- Infrared for hot connections
- Corona for radio interference frequencies.

The remaining 300 miles do not lend themselves to helicopter patrols. Consumers conducts walking inspections of these lines on two-year cycles and uses drones to provide close views of pole tops when necessary. The next tables summarize planned versus completed inspections for HVD poles, lines, and motor operated air brake switch ("MOABS") inspections.

Planned vs. Actual HVD Inspections

Asset	Inspections	2019	2020	2021	2022	2023 YTD
Poles (number)	Planned	6,688	2,485	7,872	6,963	5,624
	Complete	6021 (90%)	2,632 (106%)	7,465 (95%)	7,213 (104%)	4,377 (78%)
	Success Measure	100% of Plan				
	Variance Reasons	access/some replaced & not tested	n/a	access/some replaced & not tested	n/a	access/some replaced & not tested
HVD Lines (miles)	Planned	4,721.6	4,744.1	4,512.8	4508.2	4692.1
	Complete	4,925.6 (104%)	5,316.3 (112%)	6,704.7 (149%)	6,587.5(146%)	4,551.9 (97%)
	Success Measure	100% of Plan				
	Variance Reasons	Additional ground patrols done with available time	Additional ground patrols done due to COVID-19	Completed 2000 miles of second flyable lines patrol	Completed 2000 miles of second flyable lines patrol	More ground patrol complete by year end.
MOABS Test Operation	Planned	390	389	350	333	329
	Complete	391 (101%)	393 (101%)	344 (98%)	353 (106%)	316 (96%)
	Success Measure	100%	100%	100%	100%	100%
	Variance Reasons	n/a	n/a	Budget constraint	n/a	Budget constraint
MOABS Battery Replace	Planned	115	106	114	147	97
	Complete	129 (112%)	67 (63%)	147 (128%)	141 (95%)	45 (46%)
	Success Measure	100%	100%	100%	100%	100%
	Variance Reasons	n/a	Budget constraint	n/a	Budget constraint	Budget constraint

The Company repairs HVD anomaly conditions based on priorities. Priority 1 items (*e.g.*, a broken pole or crossarm, or a floating conductor) require repair withing 24 hours. Priority 2 items (*e.g.*, cracked crossarms, pin out of a crossarm, leaning pole, or hot connections) require repairs within 14 days. Priority 3 items (*e.g.*, deteriorated crossarms, broken braces or guy wire) require repair within 6 months. Priority 4 items (*e.g.*, deteriorated crossarms or braces, or slightly warm connections) undergo repair when a crew is working nearby. Consumers often bundles lower priority defects into groupings that it schedules together for later repair, to support work efficiency consistently with identified risks. Alternatively, it may schedule them as part of plans for following year inclusion with pole top work or as part of line segment rebuilds. The inspections also identify tree clearance issues. The next table summarizes by priority the HVD line defects identified in recent years.

HVD Line Inspection Defects Identified

Category	2019	2020	2021	2022	2023*
Priority 1	10	8	13	20	16
Priority2	132	95	78	54	51
Priority3	516	563	1,022	731	722
Priority4	53	58	36	53	48
Forestry	250	221	267	120	111

** 2023 data through October 13*

An insulator type made by one manufacturer has proven a repeated cause of HVD outages for Consumers. Management has reviewed about a third of the system using a machine learning program to identify these insulators and plans to complete its review of the rest of the system by the end of 2024. Management will evaluate insulator locations identified in the machine learning model for eventual replacement.

The Company tracks HVD line corrective maintenance ("CM") completions. The next table summarizes them for recent years. We found the reported numbers reasonably low, with only 20 Priority 1 CMs and 54 Priority 2 CMs in 2022. Working down Priority 1 and 2 CMs within 14 days comprises a reasonable approach.

HVD Line CMs

Year	Number
2019	173
2020	119
2021	146
2022	196

Fifteen percent of Consumers' HVD poles are over 60 years old. Some utilities reinforce poles identified as needing attention; Consumers employs only replacement. Consumers conducts a formal HVD pole inspection, strength testing, and chemical treatment program on 12-year cycles. Inspection procedures include sounding poles (thumping with a hammer to identify voids), boring holes below and above ground level, measuring shell thickness at internal voids to determine strength.

Management prioritizes pole replacements based on greatest risk of outage. The Company reports that it annually replaces between 8 and 11 percent of the approximately 6,000 HVD poles inspected each year. The next table summarizes the numbers of HVD pole replacements identified by the HVD pole inspection and testing program for replacement, providing 2023 data through September.

HVD Pole Inspection and Testing Results

Recommendation	2019	2020	2021	2022	2023
Immediate Replacement	1	3	3	1	15
Rush Replacement	216	82	93	4	63
Planned Replacement	400	321	747	13	369

Re-scheduling of 2020 inspections due to COVID-19 circumstances caused the increase for 2021. The low 2022 numbers resulted from a need to re-inspect work undertaken by a new vendor. Re-inspections in 2023 by a different vendor yielded results in line with historical rejection rates. The number of HVD poles identified for replacement by the end of 2023 amounted to 1,003. Consumers replaced 771 in 2022 and 476 in 2023. As of April 4, 2024, Consumers had a backlog of 2,153 HVD pole replacements. It plans to replace all HVD poles on the backlog list by the end of 2025.

c. LVD Overhead Lines

Historically, the Consumers six-year pole inspection cycle for LVD lines covered both poles and pole tops. These inspections included sounding and boring below ground to determine pole strength (termed "ground line" inspection in the industry). Visual pole inspections continued through 2022, but moved to a two-year cycle in conjunction with pole tops. However, the visual pole inspections do not include the boring that accompanied ground line inspection, instead employing sounding, or "thumping."

Consumers prioritizes LVD overhead anomaly conditions differently than it does for HVD:

- Priority 1 items include safety code violations and public hazards
- Priority 2 items include various subcodes for floating conductor, broken pole, crossarm. cutout, or insulator, loose insulator pin, for example
- Priorities 3 and 4 items include defects to monitor at the next inspection
- Priority 5 items indicate out-of-standard components.

By December 2023, Consumers had visually inspected 100 percent of the poles and tops on the LVD primary system. Poles believed to have voids identified through sounding or decayed bases get listed for replacement. The next table summarizes LVD circuit inspections completed in 2022 and the number of high priority, P1 and P2, pole top deficiencies identified.

2022 LVD Circuit Inspections

Targeted Number of Circuits	886
Inspected Number of Circuits	100%
Miles Targeted	35,906
Miles Completed	100%
Priority 1 Findings	89
Priority 2 Findings	4,574
Pole Replacements	831
Forestry Locations	941

The next table summarizes miles of circuits inspected in 2023. In 2022 and 2023, the Company identified 3,758 LVD poles for replacement. Its replacement of 2,759 of them left a backlog of 999 poles by April 2024.

LVD Circuits Inspected

Year	Miles	Number
2022	35,906	886
2023	28,218	1,067

Consumers also plans to replace all poles over 45 years old as part of its two-year inspections. Usual practice calls for replacement of poles on the basis of condition (loss of strength), not simply age. The next chapter of this report addresses the soundness of this age-based replacement plan.

LVD pole inspections identify large numbers of defects slated for correction. Consumers prioritizes them based on risk of system damage and outage causation. The Company corrects high priority P1 and P2 defects as it finds them, tracking and bundling lower priority defects (as it does for HVD defects) for later correction. The next table summarizes LVD line CM completions. Consumers timely repairs of Priority 1 and 2 defects. The numbers shown reflect consistent application of its repair priorities.

LVD Line CM Completions

Year	Number
2019	22,040
2020	18,505
2021	18.013
2022	18,550
2023*	12,907

In addition to two-year-cycled visual inspections of poles and pole tops and strength tests for suspect poles, Consumers conducts a number of other regular LVD equipment activities that conform to good utility practice. They include:

- Remote monitoring of electronic circuit reclosers
  - Battery replacements on four-year cycles
  - Inspections on a six-year cycle
- Capacitor Banks
  - Switched – Remote monitoring for abnormal performance
  - Unswitched – Annual inspection
- Inspection and cleaning of switch contacts on three-year cycles.

d. Underground Lines

The Director of HVD Reliability and Senior Manager of HVD Lines Construction and Maintenance manage the HVD system using contractors to perform all HVD underground work. Consumers limits installation of HVD lines underground, generally to cases of congestion, local restrictions, or terrain limitations. The HVD system employs approximately 22 miles of underground HVD cable direct buried or installed in conduits or duct banks. Since 2019, Consumers has experienced only one HVD cable failure, which it plans to replace with overhead installation. Between 2019 and 2022, the Company replaced less than one mile of HVD cable.

About 2,500 of the LVD system's 9,500 miles of underground primary cable consists of smaller sized, unjacketed 15kV cable typical of that installed in the industry before the mid-1980s. Consumers has used such typically termed Underground Residential Development ("URD") cable to provide lateral primary circuit loops serving residential and commercial customer service transformers. Such older URD cable has experienced very high failure rates in the industry, given

its vulnerability to multiple insulation failures caused by insufficient methods to avoid water intrusion and corrosion of unjacketed neutral conductors over time. Consumers experienced 1,877 direct buried LVD cable failures between 2019 and 2023.

High failure rates have typically led utilities for many years to conduct replacement programs for vintage, direct buried cable. Common practice locates faults on direct buried cable, digs it up, and installs a splice. After a segment has experienced three failures, Consumers turns to replacement, rather than continuing to splice after multiple failures. When doing so, it often replaces other segments in the same loop that employ similar cable type. As of February 29, 2024, the Company had a backlog of 59 LVD cable loop segments awaiting cable segment repairs needed to return redundancy to loops. The Company targets 60 days for LVD cable repair or replacement.

The next table summarizes Consumers LVD direct buried cable-caused outages from 2019 through 2023, categorized by circuit voltage at substation exits. Isolating transformers convert the voltages of circuits exiting substations in some cases. This factor can produce inaccuracies in the identification of outages by circuit voltage level. The last column shows failure rates as a function of miles over the period.

Primary Outages by Voltage at Substation Exits

Voltage	Miles	2019	2020	2021	2022	2023	Total	Failures
11kV delta	24	0	3	1	0	1	5	21%
13.2kV delta	58	3	1	1	7	1	13	22%
14.4kV delta	82	3	6	3	1	4	17	21%
24.9kV wye	1,792	68	60	76	78	99	381	21%
4.8kV delta	16	1	0	2	1	0	4	25%
8.32kV wye	4,805	124	127	95	111	116	573	12%
7.2kV delta	36	1	1	4	1	1	8	22%
12.47kV wye	2,799	157	200	201	165	153	876	31%

The Consumers replacement practices have since 2018 employed, where testing demonstrates it as feasible, a rejuvenation process that seeks to extend the life of direct buried LVD cable of smaller (3/0 or less) size and installed before the mid-1980s. Management considers about 2,300 of its remaining 2,500 miles of such cable as candidates for rejuvenation. It employs a leading cable manufacturer in the conduct of rejuvenation processes.

The contractor first tests the cable for neutral conductor conductivity and verifies whether low pressure air flows through the cable and detects any splices present. Testing determines whether the insulating fluid can be injected under low pressure. The contractor rejuvenates rather than replaces cable that qualifies after testing. The program focuses on particular geographic areas to maximize efficiency. The rejuvenation program also includes replacement of terminations, live front padmount transformers, and switchgear with new safer equipment. In cases where the cable fails rejuvenation-qualification testing, Consumers schedules it for traditional full replacement in the following year.

Consumers rejuvenated 108 LVD cables between 2019 and 2022. COVID-19 constraints on equipment availability (*e.g.*, for padmount transformers) slowed rejuvenation into 2023, but easing of those constraints has led Consumers to expand its use since.

Rejuvenating cable does not represent standard industry practice. Earlier efforts at rejuvenation did not prove successful in the industry. Work in the 1990s and early 2000s by others resulted in application issues, post-application insulation failures, and manhole fires that halted its use. Consumers appears not to have had those experiences with its more current, low pressure injection method. The contractor backs performance under the methods used here with 25-year performance assurances. Consumers reports rejuvenation costs of cable at 40 percent of those of replacement. The work packages include replacement of padmount transformers and other equipment. Management reports no failures since 2018 of any of the 108 cables injected to date.

Consumers plans to continue its rejuvenation program as an option for dealing with poor cable reliability, planning to rejuvenate seven miles of cable in the Grand Rapids area and 5.9 miles in the Flint area in 2024. It plans to replace 1.5 miles of cable where testing under the rejuvenation program did not show rejuvenation as effective. Thereafter, the Company plans to ramp up rejuvenation spending from the planned $3.3 million 2024 level (covering 10 miles), to $25 million in 2025 (at 83 miles), then to $50 million each year for 2026 through 2028 (at 160 miles each year). Management believes that these expenditures will reduce SAIDI by two minutes each year.

Management monitors cable rejuvenation costs monthly, finding that costs fluctuate based on the results of tests to determine whether a cable can be rejuvenated or must be replaced. The Company reviews the program costs annually to refine cost estimates and plans for future years.

e. Padmount Transformers

Consumers' LVD underground circuits provide the connection between substations and the system's 111,611 surface padmount transformers that serve customers. Periodic inspections ensure that padmount transformers and switchgear do not expose the public to electrical hazard. The Company has assigned two non-electrical employees to inspect padmount transformers and electrical personnel to inspect padmount switchgear for proper locks and abnormal conditions, and to apply warning labels where needed. The inspectors also enter geographic locations to update the GIS for each unit. Management halted the inspections during COVID-19 pandemic conditions. Consumers set in March 2022 a two-year cycle padmount inspection program target for its padmount service transformers. The company had completed 80 percent of the work called for by this cycle by October 13, 2023. The following table indicates the numbers of inspection completions by the end of 2023. The LVD Engineering group manages and monitors padmount inspection completions.

Padmount Inspections

Year	Target	Completed	
		#	%
2019	91,953	79,251	86%
2020	0	0	
2021	0	0	
2022	53,902	63,902	119%
2023	53,902	22,815	42%
Total	199,757	165,968	83%

f. Metro System

Consumers has dedicated managers, supervisors, and internal and contractor workers to Metro field operations, including cable repair and substation work. The underground Metro system employs approximately 423 miles of underground cable making up 118 LVD circuits running in conduits, duct banks, and through 1,423 manholes. The Company completed inspecting all manholes and vaults in 2023 under its four-year cycle, including updating data in the GIS.

Eleven percent of the Metro system consists of vintage, obsolete lead sheath PILC cables and infrastructure, such as vaults, manholes, and duct banks, installed between 1910 and 1950. These data place the equipment involved past expected end of life of 45 to 60 years. Inspections have identified that 27 percent of the vaults require mitigation work, resulting in plans to invest up to $10 million per year to repair and upgrade vaults and manholes, and to replace cables. Consumers reported that it includes converting live-front vaults to dead-front vaults with no exposed live parts whenever upgrading the old vaults. The Company also plans to remove vaults not being used, in order to lessen safety risk.

g. Substations

Consumer inspects HVD substations every month and LVD substations every other month. It conducts infrared inspections for hot connections on HVD substations yearly and LVD substation inspections every other year. The Company's time-based substation equipment preventive maintenance practices are consistent with what we have seen elsewhere. When inspections occasioned by preventive maintenance or observed operational issues identify substation conditions that require attention, Consumers responds with condition-based monitoring or with maintenance, repair, or replacement as needed. It applies priority levels, based on criticality, to determine target dates for completing repairs.

Consumers' substation transformer and circuit breaker testing and preventive maintenance program is also reasonably typical. The next table summarizes completed versus planned substation asset inspections in 2022.

2022 Substation Inspections Completed

Task	Completed
NERC Control Circuitry/Sensing Devices	100%
NERC Battery Maintenance	100%
NERC Breaker Test Ops	98%
NERC Infrared Inspections	100%
NERC Sub Patrol Inspections	100%
Substation Patrol Inspections	99%
Substation Infrared Inspections	106%
Equipment Test Operating	104%
Breaker Profile Testing	63%
Transformer Total Combustible Gas Test	107%
Load Tap Changer and Three-Phase Regulator DGA Test	75%
Single-Phase Regulator DGA Test	44%
Breaker Oil Analysis (BOA)	55%

The next table summarizes corrective maintenance items completed from 2019 through October 2023.

Substation CM Completions

Year	Number
2019	618
2020	693
2021	949
2022	680
2023	622

The next table shows the 19 substation transformer failures that have occurred since 2020 either while in-service or following decisions not to return them to service after adverse testing results. Consumers operates 2,261 substation transformers. A total of 19 failures over four years (4.75 per year) yields a low annual failure rate of 0.21 precent.

Substation Transformer Failures

2020	2021	2022	2023	Date	Substation	Type
				1/15/19	Brogan	LVD
				6/7/19	Foreman	LVD
				8/1/19	Burton Pumping	LVD
				8/6/19	Michigan Carton	LVD
1				5/5/20	Jamestown	LVD
1				6/10/20	Jonesville	LVD
1				7/9/20	Dewey	LVD
1				9/23/20	Cannonsburg	LVD
1				9/25/20	Baum Street	LVD
	1			1/27/21	Beals Road	LVD
	1			4/6/21	Alamo	LVD
	1			5/17/21	Tawas	LVD
	1			7/26/21	Leffingwell	LVD
	1			8/12/21	Mckeighan	LVD
	1			8/25/21	Alber	LVD
	1			9/16/21	Hunt Road	LVD
		1		8/1/22	Beechnut	LVD
		1		11/1/22	Standale	LVD
			1	4/19/23	Springport	LVD
			1	6/9/23	West River	LVD
			1	7/3/23	Eaton Stamping	HVD/SEC
			1	8/25/23	Clarksville	LVD
			1	8/25/23	Saranac	LVD
5	***7***	***2***	***4***	***LVD Totals***		
0	***0***	***0***	***1***	***HVD Totals***		

h. Responsibility for Reliability Programs

The HVD Planning and Reliability & Support organization's engineers and technical analysts have responsibility for the EDIIP programs addressing HVD Lines, including:

- Pole top rehabilitation
- Replacing poles
- Line sensors
- Line rebuilds
- Replacing poor performing Victor insulators
- Replacing non-standard conductors.

The HVD organization has responsibility for inspection, maintenance, and repairs of all substations, both HVD and LVD, including:

- Animal mitigation

- Transformers maintenance and replacements
- New substations and substation rebuilds.

The HVD organization has similar responsibilities for the Metro System and reliability programs directed at its facilities and operations.

Separate East and West LVD organizations conduct LVD planning, system design, reliability, inspection and maintenance programs, system asset health, and electric grid modernization in their assigned areas. The East and West Planning Directors have responsibility for reliability programs that include.

- Overhead line inspections and repairs
- Voltage conversions
- Subsurface transformer replacement
- Converting open wire secondary to multiplex overhead conductors
- Targeted circuit improvements – LVD zonal health
- Fusing lateral taps
- LVD pole replacements
- LVD cable rejuvenation
- Pilot program converting overhead to underground
- ADMS & Line Sensors
- LVD Overload Risk Reduction.

i. Failure Analysis

Consumers has a formal "Reporting Defective or Poorly Performing Materials" flow diagramed process that addresses failed or defective components in the field, the evaluation of safety risks by a Safety Field Leader, the storeroom retention of defective component for analysis by the Supplier Quality, Standards, and the laboratory engineering personnel. Management notifies the supplier involved, inviting it to participate in failure analysis. Analysis of field work methods may occur as well.

This process operates under the Consumers Enterprise Corrective Action Program ("ECAP"), which sets forth formal standards for identifying potential and actual non-conforming conditions and for documenting issues and their resolutions. Safety, regulatory, financial, and other identified issues guide the level of root cause analysis performed. The process for addressing high-risk issues includes implementing a long-term corrective actions initiative. Consumers has applied the process, for example, in decisions regarding replacement of failing LVD porcelain cutouts and Victor HVD insulators.

Root cause analysis of events and damage potentially caused by issues in operating the equipment under examination seeks to identify underlying operating issues and consequences, and to determine contributing and root causes. Planning, executing, and documenting corrective actions to prevent similar events from recurring are performed. Retraining and revising work procedure details provide examples of such preventive measures.

2. Conclusions

11. HVD Overhead Line Inspection and Maintenance employs effective methods and cycles to maintain equipment condition.

We found the measures and cycles employed consistent with our experience and sufficient to address the configurations and circumstances of the Consumers system. Performance of activities has reasonably conformed to cycles. The continuation of HVD inspection and maintenance cycles as proposed by Consumers is reasonable and sufficient to maintain fitness of HVD lines for providing reliable service. We did not find pole age out of character with our experience and our field inspections showed no systemic fitness issues.

12. HVD pole top inspection and maintenance employs effective methods and cycles to maintain equipment condition.

We found measures and cycles employed here similarly sound and appropriate to the configurations and circumstances of the Consumers system. Work has proven consistent with cycles. We found plans for HVD inspection reasonable and sufficient to maintain fitness of HVD lines for providing reliable service.

13. Elimination of ground-line inspections of LVD poles has reduced the effectiveness of measures used to reject poles on inspection. *(See Recommendation #4)*

Consumers has eliminated the boring that had previously accompanied its LVD pole inspections. The methods now used to determine whether to reject poles and slate them for replacement are less reliable and tend to increase rejection rates. We found the rejection rates reported by Consumers comparatively high. Our experience indicates more common rates of three or four percent. As described in the next chapter, the 11 to 15 percent projected rejection rate for HVD poles is also high.

14. Consumers applies a sound process for determining whether to repair or replace LVD direct buried cable and has undertaken a rejuvenation process that has significant promise.

Consumers has a need to address about 2,500 miles of direct buried LVD cable of a type and vintage whose high failure rates have plagued the industry generally. Its approach of replacement versus repair of segments after multiple failures (accompanied by replacement of similar type and vintage in the same loop), is both common and sound. Its use of rejuvenation where possible to avoid new cable use for replacement has as yet not been extensive, but its planned expansion has promise. Operational results to date have been satisfactory, costs are much less, operation of rejuvenation testing and performance rests with a leading cable manufacturer, and that contractor has provided long-term performance guarantees.

15. Consumers applies a modest but appropriate level of effort to Padmount transformer inspections but has lagged somewhat in completing planned inspections. *(See Recommendation #4)*

COVID-19 circumstances produced a halt in padmount transformer inspections, but recovery efforts have been underway. Focus needs to remain on completing recovery and then continuing to meet planned inspection levels

16. Consumers has applied appropriate methods, resources, and cycles to inspection and maintenance of Metro System assets.

Maintenance of Metro underground assets occurs predominately on a reactive basis. Its proactive inspection methods for vaults and manholes have been sound and recent completion of its four-year cycle has appropriately identified what are reasonably modest and appropriate replacements and upgrades to address safety and operability issues.

17. Consumers operates an appropriate Substation inspection and maintenance program.

Inspections are reasonably cycled, generally up to date, and designed to address all key equipment and facilities. Testing of transformers is reasonably complete. Substation transformers are of an overall age length and distribution consistent with our experience elsewhere. Substation failure rates are comparatively moderate.

18. Consumers has soundly aligned responsibility for the reliability programs that the EDIIP plans.

Responsibility alignment is clear and consistent with the overall structure of the organization for addressing HVD circuits, substation, Metro, and LVD circuits.

19. Consumers employs reasonably typical practices for conducting analysis of failed materials and equipment.

The practices appropriately retain materials for testing and analysis, which it conducts through an appropriately structured process that engages a range of Company groups and manufacturers and vendors as required. There is a process for follow up and correction, including work methods that may have contributed to failures.

3. Recommendations

4. Reinstate ground-line inspection of LVD poles on a cyclical basis. *(See Conclusion #13 and #15)*

Doing so on the six-year cycle formerly employed or on one extending to 10 to 12 years will restore greater reliability to the process for identifying poles whose strength has weakened enough to justify rejection and replacement. That increased reliability should reduce the number of rejected poles and thus reduce replacement costs.

5. Abandon plans to replace LVD poles on the basis of age.

The next chapter of this report addresses the consequences and costs of the EDIIP plan to replace all poles of greater than 45 years of age when reached under the two-year inspection cycle for poles and pole tops.

G. Operations

Operating an electric utility grid has changed much with the continuing introduction and advancement of technology. Effective operation requires a substantial, trained, and knowledgeable team able to provide routine coverage and to muster additional support required for operations in upset operations circumstances. Effectively operating the grid also requires sufficient numbers of

resources for performing planned and emergent field work and for responding to outage, damage, and safety-threatening conditions. Providing the support needed to ensure sound configuration, operations, and adjustment of system protective systems and devices also takes a substantial and well-trained team. At Consumers, these resources must cover a large expanse of territory and a wide range of configurations and voltage levels.

1. Findings

j. Grid Operations

A Grid Operations group has responsibility for operating, monitoring, and controlling the HVD and the LVD electric systems under normal and adverse weather conditions. Responsibilities include grid operations, operations engineering support, restoration management, metering technology, and product management. Grid Operations personnel work from secure locations at the HVD System Control Center in Jackson, the Distribution Control Center in Grand Rapids, and the Dispatch centers in Grand Rapids and Jackson.

The HVD System Control Center has responsibility for monitoring the HVD and LVD systems, directing operations of the HVD system and substations, operating portions of the LVD substations, performing remote operations of the HVD system, and managing switching, tagging, and electrical safety clearance tasks.

The Distribution Control Centers have responsibility for monitoring the LVD systems and for operating a large portion of the distribution substations and the LVD system. The Distribution Control Center dispatchers perform remote operations and manage switching, tagging, and clearance tasks. The two Dispatch Centers prioritize, schedule, and dispatch Operations Field workers for both scheduled and emergent work. The next table summarizes group resources. We found these resources consistent with the functions they perform.

Grid Operations Management

Group	FTEs
Grid Management	2
Metering Tech Center	48
Products & Reporting	7
Operating Ping	40
Real Time Operations and Support	102
Restoration Management	8
Totals	***207***

Fifteen lead system protection (relay) engineers serve as specialists to support HVD and LVD circuits and substation protection designs, compliance with protection standards, short circuit studies, fault analysis, HVD relay and LVD ATR settings, and circuit operations reviews. These engineers work from Jackson, Traverse City, Grand Rapids, and Alma headquarters locations. System protection engineers support the electric lab relay technicians.

k. LVD Field Operations and Outage Response

The six Consumers LVD Regions divide into 30 LVD Work Headquarters territories. Each LVD region employs an organization responsible for LVD capacity and reliability planning, and an organization for LVD Operations. Consumers also has a company-wide organization for LVD Grid Modernization and Asset Management. Consumers employs its own line workers, stationed at each of the 30 work headquarters, as LVD first responders (termed Electric Service Workers, or "ESWs") and as members of overhead line maintenance work crews. Contractor line workers (normally deployed on capital construction projects) supplement internal Company personnel when critical LVD asset maintenance workload outpaces Company crew resources.

East and West LVD Operations Management have responsibility for conducting LVD system reactive maintenance, upgrades, trouble operations, and new facility construction. The LVD Operations groups work closely with the LVD Planning groups. The responsibilities of LVD Operations functional groups include electric operations, customer field services, underground construction, electric meter operations, and distribution contractor resource management.

It is common for utilities to plan resources to meet baseline work levels and to secure external resources for peak periods or for expertise not continually required. Consumers follows this approach, which generally means that it uses internal employees for most inspection and maintenance work. When emergent work imposes requirements beyond the capability of internal resources, Consumers adds contractor crews. Large-scale replacement and repair needs following major storm events, or surges to shorten cyclical activities provide examples of such emergent work.

The next table shows line worker headcounts. Total line workers, including apprentices, increased by about 23 percent from 2020 to September of 2023 (from 755 to 926.).

Line Workers by Headquarters Location

Headquarters	2020	2021	2022	2023	Headquarters	2020	2021	2022	2023
Adrian	27	30	33	33	Greenville	19	20	26	27
Alma	20	22	23	25	Hamilton	35	38	37	39
Battle Creek	28	32	32	31	Hastings	16	18	21	23
Bay City	18	21	21	21	Jackson SC	44	44	41	42
Benzonia	8	11	15	17	Kalamazoo SC	48	53	50	53
Big Rapids	12	15	16	18	Lansing SC	42	47	48	48
Boyne City	17	22	24	26	Ludington SC	11	13	16	17
Cadillac SC	13	19	19	23	Midland	18	20	22	24
Clare	18	20	24	25	Norton Shores	34	33	33	32
Coldwater	27	29	30	28	North Kent	17	21	26	30
East Kent	17	16	16	18	Owosso	20	25	27	28
East Tawas	17	18	23	23	S. Monroe	14	13	18	18
Flint	67	68	74	78	Saginaw	33	39	43	44
Fremont	11	12	14	16	Traverse City	29	31	31	31
Grand Rapids	49	48	52	53	West Branch SC	26	30	36	35
Total	***755***	***828***	***891***	***926***					

A group of approximately 100 ESWs comprises the line workers assigned to provide assessment and first response to LVD outages and hazards. The next table shows ESW assignments by headquarters location. ESWs work multiple shifts, which together provide overlapping system coverage from 0600 to 2300 on weekdays and from 0600 to 2200 on weekends. Shift staffing and hours vary, depending on weather, operating conditions and system performance data. Each headquarter places one or two ESWs, as available, on call. The ESWs take aerial lift vehicles home to enable them to respond directly to outage locations in call-in situations. The number of ESWs assigned to a headquarters can substantially affect outage response time. As the table shows some smaller headquarters locations have assigned a single ESW.

Electric Service Workers by Headquarters

Headquarters	Number	Headquarters	Number
Adrian	4	Greenville	2
Alma	2	Hamilton	4
Battle Creek	4	Hastings	2
Bay City	2	Jackson	6
Benzonia	2	Kalamazoo	5
Big Rapids	1	Lansing	6
Boyne City	3	Ludington	1
Cadillac	2	Midland	2
Clare	2	Norton Shores	6
Coldwater	3	North Kent	2
East Kent	1	Owosso	2
East Tawas	2	S. Monroe	2
Flint	11	Saginaw	5
Fremont	1	Traverse City	3
Grand Rapids	9	West Branch	4
Total	***101***		

l. HVD, Substation, and Metro Operations and Maintenance

Consumers' HVD organizations include those responsible for reliability planning for HVD overhead lines and substations, for HVD lines capacity planning, for HVD construction and maintenance, and for LVD substations. Company contractors provide line workers to construct, maintain, and serve as first responders for all HVD lines. Consumers assigns the locations of contractor HVD crews in order to enable "demand crews" (first responders) to arrive at work centers within one hour when called by System Control.

Substation Operations and Substation Maintenance Personnel Locations

Location	Number	Location	Number
Adrian SC	4	Kalamazoo SC	13
Battle Creek SC	13	Lansing SC	6
Bay City	5	Ludington SC	1
Big Rapids	1	Midland	9
Boyne City	2	MKG Norton Shores SC	4
Flint	16	Saginaw	7
Grand Rapids SC	29	Traverse City	8
Jackson SC	12	West Branch SC	8
Total	***138***		

The HVD Operations and Forestry Management Organization has responsibility for HVD and LVD tree trimming, brush removal, and tree removal programs. A Senior Manager of Forestry Operations has leadership responsibility for the HVD and LVD forestry operations. HVD Forestry operations are led by a HVD Forestry Manager and four Forestry Supervisors. Four Forestry Managers and 17 Forestry Supervisors lead the LVD Forestry work. The HVD Forestry work is administered by four Foresters and Associate Foresters who act as planners, while LVD Forestry Operations is administered by 15 Foresters and Associate Foresters. Three contract planner supervisors and 23 contract planners support the combined HVD/LVD Forestry mission.

Another 46 personnel (summarized in the following table) staff the Electric Lab organization, whose technicians conduct relay maintenance and electric testing on substation equipment.

Lab Technician Locations

Location	Number
Au Sable River	1
Battle Creek SC	6
Bay City	6
Flint	7
Grand Rapids SC	12
Jackson SC	4
Trail Street	5
Traverse City	5
Total	***46***

m. Work Planning and Scheduling

The Planning and Resource Management organization, working with LVD Scheduling teams has responsibility for planning and scheduling of work and the coordination of materials required for authorized capital projects for both long- and short-term planning horizons, including for four weeks before scheduled work start. Management assigns the staffing levels and work locations of LVD Work Planners by the workload needs of each area.

The Company determines the need for infrastructure improvements based on the prioritized reliability and safety risks identified by inspections. These projects follow a two-year inspection cycle to find and replace broken assets, replace obsolete assets, address NESC code violations, and upgrade deteriorated infrastructure. Repair schedules are determined by a standard set of risk-consequence based priorities. The Planning and Resource Management organization has responsibility for scheduling and resourcing the repair and project work

Part 1 of this report described the Supply Chain organization's formal and automated methods and processes for determining needs for spare assets and parts and for maintaining inventory sufficient to meet normal and adverse conditions, for managing and monitoring distribution of items, and for determining when spare equipment is obsolete.

2. Conclusions

20. It is not clear that field staffing levels are sufficient to support outage response. *(See Recommendations #6)*

Consumers' combined employee and contractor distribution operations staffing increased from 2020 to 2022 as a means to shorten overall vegetation management cycles with more tree trimming personnel. The increase also sought to shorten outage response and restoration times in all types of weather. Despite these recent staffing increases and other ongoing initiatives to improve reliability, Consumers has continued to lag in performance. While combined contractor and employee staffing of distribution operations and tree trimming functions increased in 2021 and 2022, those numbers leveled off in 2023. CAIDI metrics that do not exclude MEDs still exceed three hours.

A study conducted for Consumers by an outside consultant observed that establishing more consistent operational efficiency could resolve the Company's variable restoration performance and that dispatch time, usually driven by restricted crew availability, consumed almost two thirds of long duration outage time. The study noted that the ability to respond to larger than expected weather events or outage numbers and insufficient numbers of crews accepting storm call out exacerbated crew availability issues.

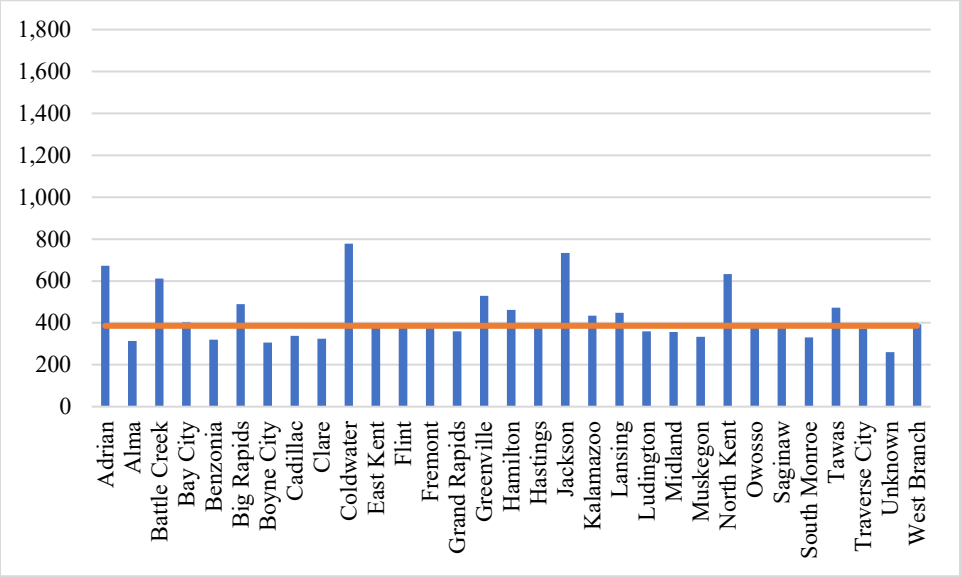
Consumers has indicated an intent to increase combined field resources (utility employees and contractors) to improve emergency response and restoration performance.

21. ESW staffing at some headquarters locations is minimal. *(See Recommendation #7)*

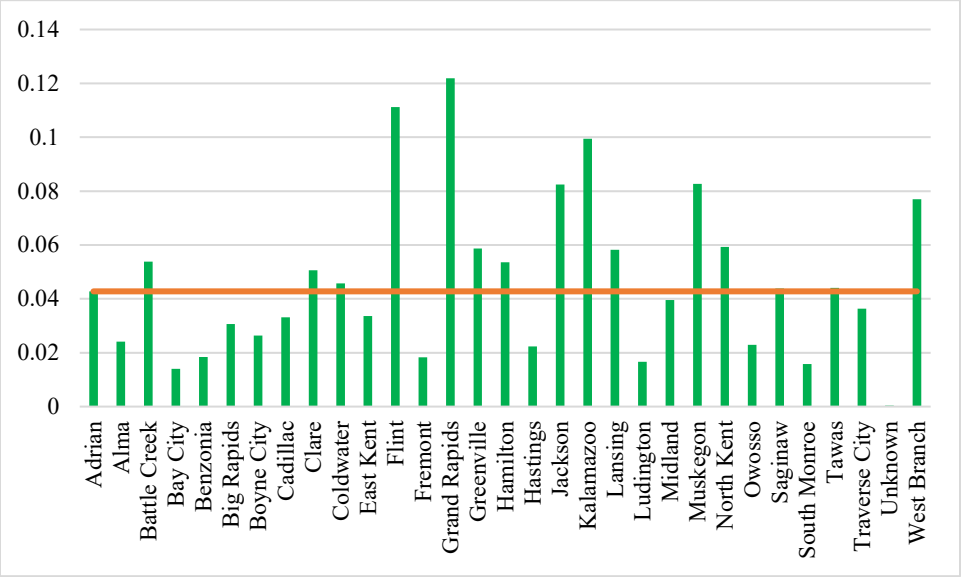
Consumers employs 101 ESWs as LVD circuit outage first responders, with some headquarters locations assigned only one. There are wide variations in response and restoration times among the 30 headquarters locations.

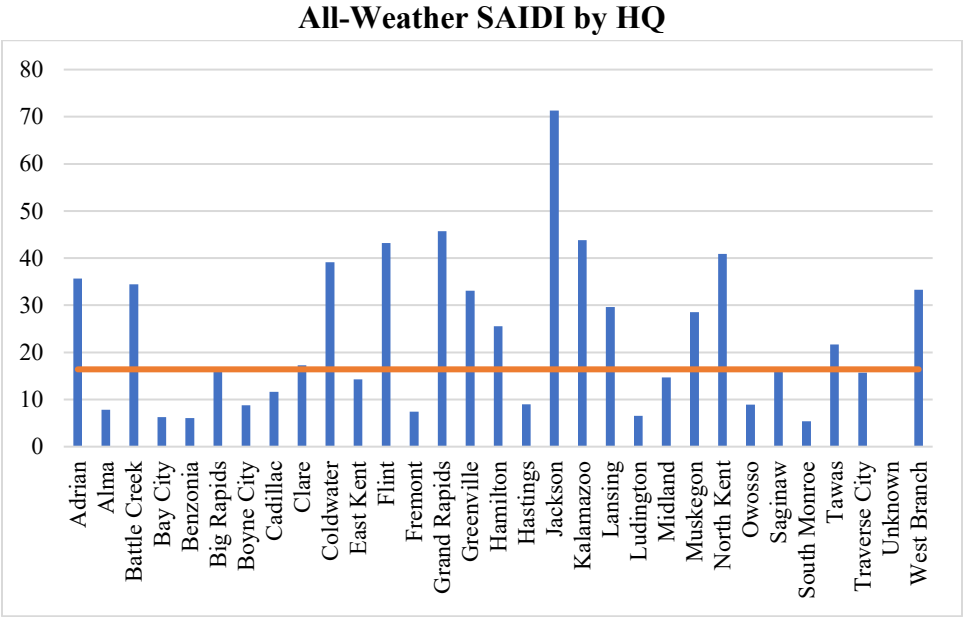
The next tables show wide variation in outage durations as measured by the widely used Customer Average Interruption Duration Index ("CAIDI"), System Average Interruption Frequency Index ("SAIFI"), and System Average Interruption Duration Index ("SAIDI"). The tables show these index values without excluding the impacts of MEDs. Each chart shows the five-year average value for each of Consumers' headquarters ("HQ"), and the median value.

All-Weather CAIDI by HQ



All-Weather SAIFI by HQ





22. The high level of reliance on contractors for HVD line work creates a low probability but high consequence risk of expertise loss. *(See Recommendation #8)*

The Company's HVD lines are constructed, maintained and restored, when necessary, by specially qualified contractor crews from two separate firms who are also qualified to assist in LVD restoration operations should circumstances warrant. The work of these contractors is supervised by their own company leadership but is overseen and coordinated by Consumers management.

Relying on exclusive use of a small number of very well qualified contracting firms for all HVD related construction, maintenance, operations and restoration also offers the availability of additional, qualified contractor resources for storm and other emergency operations. However, the concentration of HVD expertise, skills, tooling, equipment, training and experience in a small number of contracting firms, and the progressive atrophy of internal Consumers experience often resulting among internal personnel, creates a vulnerability.

23. We found a reasonably typical structure and number of resources for planning and scheduling of work and materials availability and for managing spare parts and materials and equipment inventory, but work levels planned under the EDIIP will stretch existing capabilities. *(See Recommendation #9)*

We found group structure and staffing typical and commensurate with current work, and apparently scalable to address expansion as required by the EDIIP. We also found through field inspections and site visits no reason for concern about inventory quality or quantity. The facilities we visited appear to have capacity for expansion sufficient to support increased work levels. However, planning and scheduling and the creation and management of material and equipment vendor relationships can become significantly more complicated when the work they need to support greatly expands.

3. Recommendations

6. Continue to increase numbers of employee and contractor field operations and address non-productive time's contribution to outage durations. *(See Conclusion #20)*

Resource additions have certainly had a beneficial effect on response times and outage durations, but they remain long. Implementing the 2022 consultant study's recommendations to improve non-productive time, such as that lost in the outage job Creation and Dispatch segments of the storm restoration timeline, provides another means for improvement. OMS and ADMS improvements to dispatch accuracy and efficiency should also shorten creation and dispatching segments. With consideration of the system or structural improvements understood (as ADMS improvements come to completion) Consumers should undertake a thorough evaluation of range of multiple alternative resource addition and location change scenarios, address each in terms of costs incurred versus response and outage duration times lessened, and make resource changes determined to be optimum in reducing those times.

7. Reassess the numbers and alignment of ESWs among the headquarters locations. *(See Conclusion #21)*

Consumers should conduct a study of variations in outage durations over time among the 30 headquarters, determine principal root causes for those with anomalously high durations, and evaluate the changes in durations that can be achieved through redeployments or increases in ESW assignment.

8. Conduct a structured analysis and evaluation of re-establishing core HVD construction, maintenance and operations skills, tools, experience within Consumers. *(See Conclusion #22)*

Consumers should, if economical and considering risk level and ability to make economic use of such a capability, provide the capability to avoid transitional disruption from the loss of expertise from its limited group of HVD contractors. Even a moderate cost premium could justify creation of that capability. It would clearly take an ability to find productive use of added internal resources, as opposed merely to creating standby capability, to warrant a change. Consumers should examine what specific needs it would face on contractor loss that it cannot meet without a significant transition time or costs, how it can develop internal capability to meet them internally, what constructive contributions those providing that capability can make, and at what cost. It is certainly not clear what such a study would produce, but its conduct is warranted. If not clearly and materially uneconomic, development of internal capabilities also has the advantage of improving the ability to oversee and manage contractor work effectiveness and efficiency.

9. Continually assess resource levels of groups with responsibilities for work planning and scheduling and for managing material and equipment inventories. *(See Conclusion #23)*

The basic challenges of finding sufficient resources with the experience and skills to plan and schedule work and to provide quality materials and equipment timely and reliably increase. The challenges become more significant when there is material risk that the scope of work eventually accommodated from year to year may become well less than that planned.

Efforts to marshal and train resources and to create or expand supply chain relationships proceed more smoothly and economically when carried out according to multi-year plans. However, factors like failure to produce expected reliability results or major redirection of efforts to work that proves much more beneficial per dollar of expenditure can put even the best of plans out of step with emerging circumstances.

H. Forestry

Tree contacts with overhead power lines, especially during adverse weather conditions, are the leading cause of Consumers power outages. Maintaining sufficient clearance between tree branches and wires is essential during trimming cycles to prevent contact in all weather conditions. Additionally, management must identify and address dead or dying trees both on and off the right-of-way that could fall onto power lines. Fallen trees make a significant contribution to outages during severe storms. Effective grid operation across the Consumers service territory requires comprehensive and effective vegetation management programs aimed at reducing tree contact and ensuring electric reliability.

This section examines the impact of vegetation management programs, HVD and LVD cycle times, management's approach to developing and employing "effective cycle time" calculated by combining different cycles for different voltages into a single metric, and the focus on removing hazardous trees. We also address spending on vegetation management.

We examined whether management has:

- Regularly reviewed and adjusted vegetation management programs as needed to meet customer reliability requirements
- Conducted vegetation management in accordance with program guidelines
- Established and adhered to vegetation management budgets
- Monitored vegetation-related reliability and made necessary adjustments to plans and programs.

1. Findings

a. Tree-Caused Outages and Metrics

The *Findings* sub-section of this chapter's preceding section F observes that the assignment of outage causes to the "Weather" and "Unknown" categories likely understates those caused by vegetation. The next paragraphs use the causal assignments that Consumers has made.

Tree contacts with power lines comprise the most frequent cause of customer interruptions during all-in weather conditions (*i.e.*, without excluding the impacts of MEDs). LVD circuits with three of the thirteen distribution voltages suffer the greatest tree consequences as measured by SAIFI. The next two tables summarize management-reported, tree-caused SAIDI (in minutes) for 8.3kV, 12.47kV, and 24.9kV substation exit circuits. Variations in gray sky events (small storms), in MED weather and under weather conditions more severe than normal but not sufficient to generate MEDs all interact to obscure any trending.

Tree-Caused SAIDI History

All-In				
Exit Voltage	2019	2020	2021	2022
8.3kV	167	143	265	113
12.47kV	58	30	83	30
24.9kV	103	75	171	77
Excluding MEDs				
8.3kV	42	39	51	30
12.47kV	19	10	13	12
24.9kV	29	21	34	22

The next table summarizes numbers and minutes of customer interruption from tree-related causes since 2018. Tree-caused HVD line outages caused fewer than two percent of the customer minutes interrupted ("CMIs") in 2023. Tree-caused outages in LVD circuit primaries caused more than 95 percent of the CMIs. The remaining tree-caused CMIs resulted from trees in contact with service transformers and secondary circuits.

Tree-Caused Incidents (All-in)

Measure	2018	2019	2020	2021	2022	2023
Incident Numbers	16,860	21,830	16,350	24,163	17,134	18,298
Customers Interrupted	872,675	1,163,996	970,924	1,314,220	923,166	1,037,857
Customer Minutes	386,875,285	696,820,062	494,283,127	1,011,992,141	445,313,438	899,755,823

Tree Incidents

Source	2018	2019	2020	2021	2022	2023
HVD Sub	0	2	0	0	0	0
HVD Lines	47	71	35	78	84	65
Dist. Sub	3	3	0	1	2	5
Circuit	219	322	265	335	257	377
Primary	8,223	10,895	9,672	12,330	7,999	8,112
Transformer	2,789	3,498	3,189	3,896	2,306	2,384
Secondary	5,579	7,039	3,189	7,523	6,486	7,355
Total	**16,860**	**21,830**	**16,350**	**24,163**	**17,134**	**18,298**

Customers Interrupted

Source	2018	2019	2020	2021	2022	2023
HVD Sub	0	2	0	0	0	0
HVD Lines	34,524	43,681	73,671	56,108	12,899	36,891
Dist. Sub	2,725	2,348	0	1,483	2,255	2,754
Circuit	172,674	233,220	181,388	247,825	224,746	284,081
Primary	624,584	833,125	672,044	953,346	656,089	685,364
Transformer	28,235	32,788	30,409	37,183	19,760	21,151
Secondary	9,933	18,832	13,412	18,275	7,417	7,616
Total	**872,675**	**1,163,996**	**970,924**	**1,314,220**	**923,166**	**1,037,857**

Customer Minutes

Source	2018	2019	2020	2021	2022	2023
HVD Sub	0	256	0	0	0	0
HVD Lines	7,397,500	10,581,566	23,198,332	46,809,269	3,527,727	17,457,961
Dist. Sub	1,347,524	197,079	0	1,046,000	1,993,739	739,893
Circuit	58,609,938	101,730,166	64,562,897	120,747,766	79,804,033	229,821,130
Primary	295,848,938	554,149,376	381,845,719	799,649,473	345,752,440	626,668,288
Transformer	17,128,358	17,081,473	14,716,860	26,504,020	10,139,352	18,281,331
Secondary	6,543,027	13,080,146	9,959,319	17,235,613	4,096,147	6,787,220
Total	386,875,285	696,820,062	494,283,127	1,011,992,141	445,313,438	899,755,823

b. Trim Cycles

Trimming establishes and then maintains adequate clearances between tree limbs and conductors both at the time of the initial pruning and over time as the limbs grow back between cyclical treatment. If effective clearances cannot be maintained by trim cycles, they should shorten, or the trim clearances (initial distance between the lines and vegetation immediately following trimming) should increase, with overhanging limbs removed. Consumers has cited a benchmarking study promoting the effectiveness of a utility average distribution tree clearing cycle of 4.9 years. Management decided by 2021 to determine optimum cycles for each circuit voltage. It set a 5-year cycle for 24.9kV (3,462 miles per year), a 7-year cycle for 12.47kV (1,413 miles per year) and a 9-year cycle for 8.3kV (3,487 miles per year).

Combined, these targets effectively produce what the Company refers to as an overall 7-year cycle overall. Some LVD circuits share structures with HVD circuits; for those, HVD clearance requirements and a 4.2-year trim cycle apply. Consumers classifies circuit voltages by combining the single phase voltages with the three phase voltages. Its standard voltages are 4.8/8.32kV,

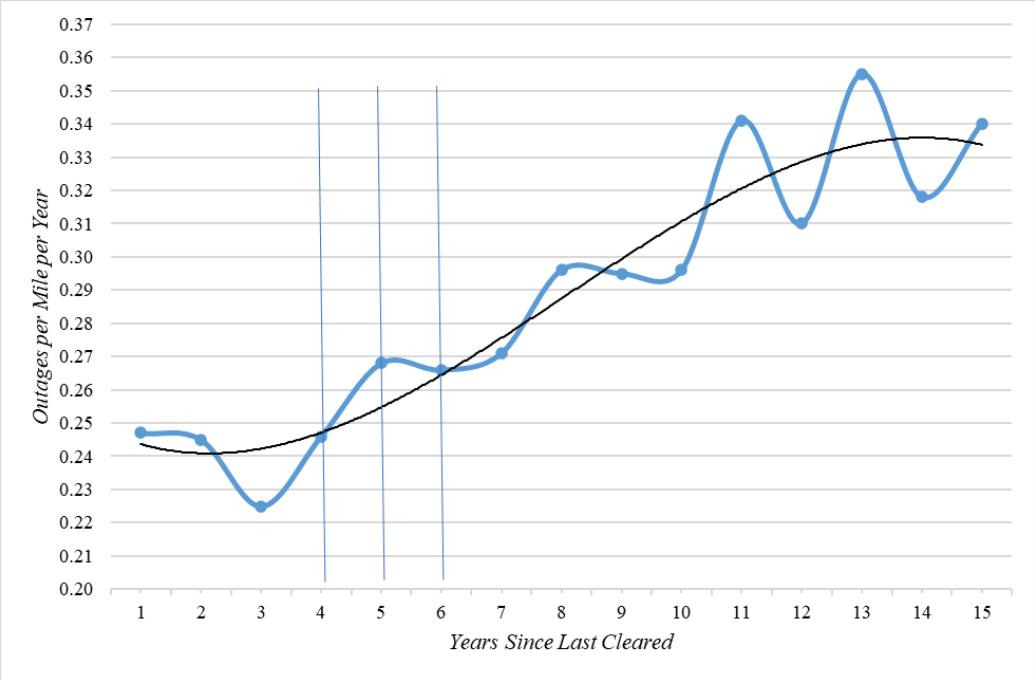
7.2/12.47kV, and 14.4/24.9kV. Utilities usually refer to circuit voltages by their three phase voltage. For simplicity, this report uses only the three phase voltages.

Our experience finds much more typical a shorter, uniform four-year cycle for distribution voltages. Such a cycle would require significantly more vegetation work by Consumers given the increase in number of circuit miles requiring trimming each year. A compounding cost factor arises from the fact that some circuits last underwent trimming some 20 years ago according to data from Consumers. For illustration AIC, which had previously deferred tree trimming costs, had significant added costs for bringing circuits in line with four- or five-year cycle trimming. Following completion of the first accelerated cycle, however, cost decreases on the order of 50 percent occurred and should prove sustainable, given that more frequent trimming leaves less regrowth and new growth to address at each visit.

Apart from targeting much longer than normal cycles, Consumers does not plan to reach even its overall seven-year duration until 2030; *i.e.*, two years after the 2023 EDIIP planning horizon ends. With many circuits so far from last trimming, this approach manages costs, but also delays the production of reliability benefits on many circuits. As late as 2022, 67 percent of the that year's planned miles were in backlog and out of line with the targeted trim cycle. The process of catching up has, however, been reducing effective trim cycle length; *e.g.*, from 16.2 years in 2018 to 12.8 years in 2020. The current overall trim cycle in effect remains at close to 10 years.

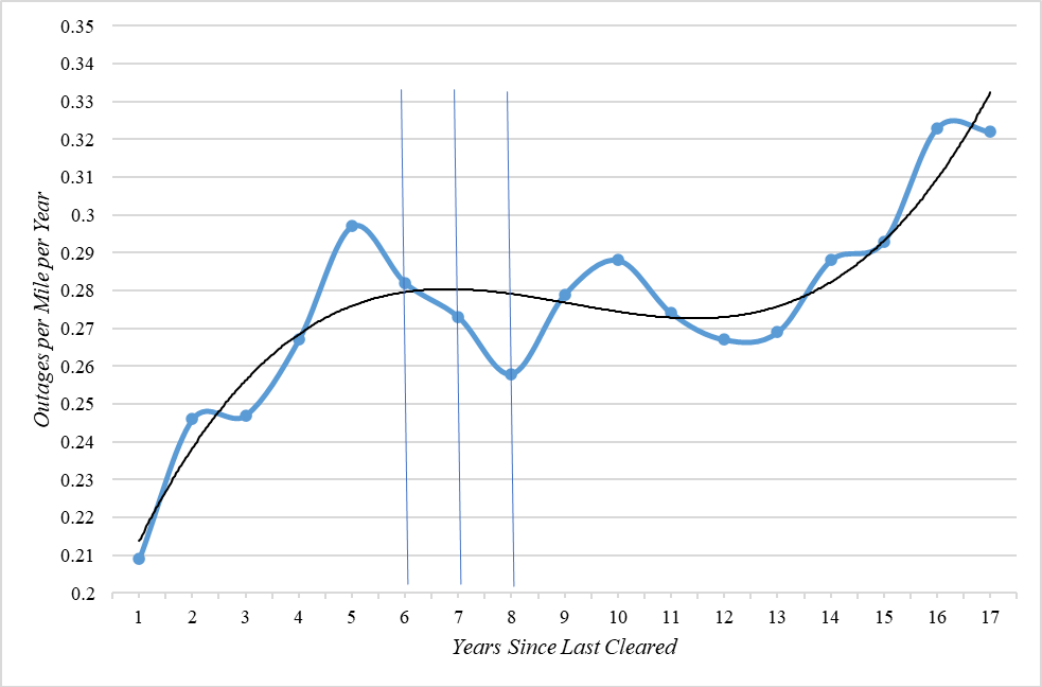
The next series of charts show outage data by major circuit voltage category in relation to years since last vegetation treatment. Consumers provided the following chart highlighting its cycles by voltage level. The Company identified the numbers of outages per circuit mile for each year after a circuit was trimmed for each of the standard voltages.

Post-Trimming 24.9 kV Performance



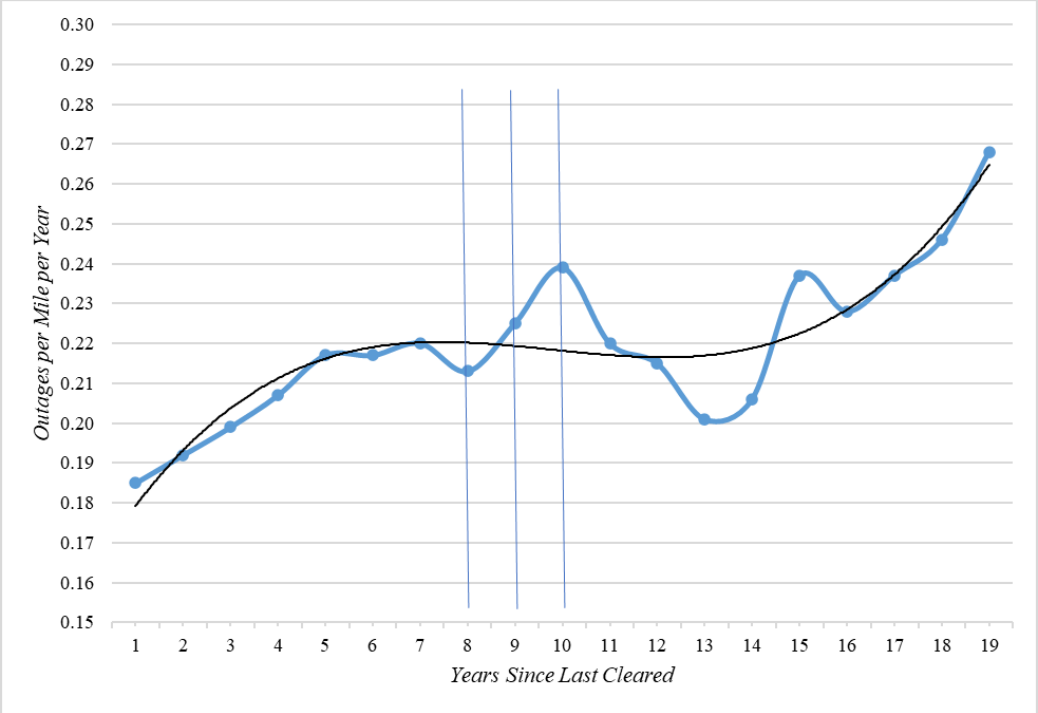
Consumers targets a five year cycle for these circuits

Post-Trimming 12.47 kV Performance



Consumers targets a seven-year cycle for these circuits

Post-Trimming 8.32kV Performance



Consumers targets a nine-year cycle for these circuits

The data show a linear progression of outage numbers as clearing durations extend for 24.9kV circuits, which receive the most frequent treatment. However, the reliability of the data for the two lower (12.47 and 8.32kV) voltages appears questionable given clear, and under the circumstances, dramatic drops in outages as last treatment dates extend into extreme ranges.

For what it is worth, the data does show in all cases that four-year cycles produce materially lower numbers for all three voltage classes than do longer ones. Absent clear evidence to support the counterintuitive notion that outage levels actually decline for 12.47 and 8.32kV circuits, but not for 24.9kV circuits, the data do not present a case for materially different and longer cycles for lower voltage circuits.

c. LVD Forestry

The total length of the LVD system, its many long circuits, and the comparatively dense vegetation across large portions of the service areas all contribute to tree related outage frequency and duration. The historical and continuing application of anomalously long trimming cycles compound the effects. The next table summarizes LVD primary circuit miles trimmed through 2023 and planned for 2024 through 2027.

LVD Circuit Mileage Trimmed

Year	Miles
2021	5,279
2022	6,388
2023	6,365
2024	6,760
2025	7,232
2026	7,449
2027	7,672

Planning and execution of the Company's LVD Full Circuit Clearing Program operates on the basis of primary circuit miles, not on the number of circuits trimmed. In 2022 Consumers developed an in-house forestry analytics program to optimize the yearly LVD full circuit clearing workplan. This Forestry Workplan Intelligence & Strategy Engine ("WISE") tool incorporates the calculated highest reliability and safety benefits achievable for each annual clearing budget. Consumers uses it to identify the greatest trimming reliability benefit for a set budget dollar amount. Forestry WISE calculates a risk score based on weather, voltage, years since last cleared, pole age, delta circuits, and outage history to predict theoretically avoided outages for a given work plan. Management uses risk scores to maximize budget effectiveness. Forestry WISE also supports prioritization of annual program schedules, identifying for earliest trimming the areas that caused the most reliability issues.

Forestry Planners mark trees for trim and for removal on the circuits selected for treatment, classifying them for removal or for maintenance trimming, based on species, health, size, and condition. Property owners receive notice prior to LVD circuit trimming by postcard and letters, with instructions for contacting Consumers, if desired. A Forestry Planner verifies the Company's access rights to trim when a customer raises an objection to tree work. A planner meets with the customer, explains the reasons for trimming or removal, and explains customer rights and options.

Planners contact customers affected by HVD vegetation work in person or by letter. Forestry works each mainline circuit by sections outward from the substation, including lateral circuits, and using six to ten crews at a time per circuit.

The Company's line clearance standards define the vertical clearances required from the conductor to limbs by specific species of trees. The minimum vertical clearing for voltages operating between 750 and 14.4kV is 10 feet. The standards set the minimum vertical clearance at 20 feet for fast-growing species (*e.g.*, silver maple, poplar, willow) to accommodate inter-trimming growth. The standards permit for LVD circuits overhanging limbs that have a minimum clearance above the conductors of 10 feet. This same standard applies for each of the 13 LVD voltages that Consumers currently supplies in various areas of the distribution system. These different voltages may be trimmed at different clearing cycles.

Service wire and secondary conductors operating at less than 750 volts are trimmed to provide two feet of clearance around conductors. Service trimming occurs after notifying the customer. Aerial spacer cable installed in areas of high-density trees requires a minimum clearance of six feet. Larger limbs may remain without trimming if no future trimming is expected to be required in order maintain at least three feet of clearance to conductors. The line clearing specification also requires all vines growing on poles, guy wires and conductors to be cut sufficiently to produce a twenty four inch gap between the aerial portion of the vine and the rooted portion of the vine, with vine stumps treated with herbicide.

The Company has been removing hazard trees, when the customer does not object. These trees consist of those dead, dying, or mechanically stressed trees outside of the right-of-way but within 20 feet of right-of-way edge. The next table summarizes removals by year (with 2023 data through September).

LVD Hazard Tree Removal

Year	Removed
2019	17,881
2020	16,551
2021	20,291
2022	20,292
2023	15,464

d. HVD Forestry

The low numbers of HVD tree-caused CMIs likely results from the loop configuration common to the Company's HVD circuits. HVD assets also benefit from a combination of their shorter, 4.2-year trim cycle, greater clearance distances between trees and conductors, removal of overhead limbs, a wide hazard tree zone, and removal of off right of way-hazard trees. Nevertheless, fallen off-right-of-way trees still comprise a major cause of those relatively few HVD tree outages that do occur.

HVD corridors must accommodate 1,100 overhead circuits, about 4,650 circuit miles, and 1,721 line segments. Management clears these corridors to a width of 80 feet, with 40 additional feet cleared of hazard trees. The 4.2-year HVD clearing cycle leaves no tree limbs overhanging

conductors. The 46kV lines require a minimum of 15 feet of horizontal clearance. A 20-foot minimum applies for circuits operating between 120kV and 138kV. Consumers clears undergrowth brush and applies ground-level herbicide treatments to slow regrowth. HVD facilities operate primarily on recorded easements or Company owned rights-of-way, avoiding the need for pre-trimming notice to customers. The next table summarizes annual HVD circuit miles trimmed through and planned through 2027.

HVD Circuit Mileage Trimmed

Year	HVD Miles
2021	1,178
2022	1,106
2023	1,153
2024	1,166
2025	1,168
2026	1,171
2027	1,173

Consumers began a focused Hazardous Tree removal program in 2016. The Company does not set specific goals for hazard tree removal numbers. Its Hazard Tree Removal Guidelines target off-right-of-way trees both tall enough to strike a line when falling and "dead, diseased, infected with destructive insects, or structurally weakened" trees. The next table summarizes recent removals by year (through September for 2023).

HVD Hazard Tree Removal

Year	Trees Removed
2019	8,110
2020	4,794
2021	5,120
2022	11,465
2023	5,591

e. Forestry Spending

The next table shows that Consumers O&M spending for trimming trees on LVD circuits increased by more than 150 percent between 2019 and 2023. Increased tree crew numbers enabling a move to the new LVD trim cycles predominately drove the $30 million increase in 2021. The Company proposes to make only moderate increases through 2028 in forestry O&M spending.

Historical and EDIIP-Proposed Forestry O&M

Component	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
LVD Miles Trimmed	-	-	5,279	6,388	6,365	6,760	7,232	7,449	7,672	-
LVD Cost (millions)	$41	$46	$76	$91	$98	$105	$113	$113	$113	$114
LVD Cost/Mile (dollars)	n/a	n/a	$14,397	$14,245	$15,397	$15,533	$15,625	$15,170	$14,729	n/a
HVD Miles Trimmed	-	-	1,178	1,106	1,153	1,166	1,168	1,171	1,173	
HVD Cost (millions)	$12	$9	$11	$11	$11	$12	$12	$12	$12	$12
HVD Cost/Mile (dollars)	n/a	n/a	$9,338	$9,946	$9,540	$10,292	$10,274	$10,248	$10,230	n/a

2. Conclusions

24. Assigning "Weather" and "Unknown" as the causes of outages diminishes the ability to analyze those causes. *(See Recommendation #10)*

The need for analysis of the causes of outages calls for more precise and granular identification of them. "Weather" and "Unknown" causal assignments account for a large portion of outage numbers.

25. Right-of-way vegetation clearing and trimming standards and methods conform to industry practice.

Our review of the standards showed them typical for a utility facing the vegetation conditions that Consumers does. We did not find them lacking in any material respect. Similarly, the methods used to control vegetation intrusion are both in conformity with industry practice and suitable to Company circumstances.

26. The addition of a process for removing off-right-of-way hazard trees is sound and should continue as aggressively as possible, consistent with the need for agreements with landowners.

Consumers has used hazard tree removal effectively to maintain and improve overhead circuit reliability. The Company has for some years now identified and, working with property owners, removed trees off rights-of-way where their type, size, and conditions present a threat to circuits. Many utilities have had difficulty in getting such programs established and soundly functional, with major factors including the need for addressing landowner concerns with patience and tact. Like others, Consumers must work within the bounds of access rights, many of them secured long ago, with the securing of enlarged or enhanced rights not feasible to secure economically on a broad scale.

27. Forestry cycles have been too long and remain so for LVD circuits. *(See the Recommendations of the next chapter of this report)*

Regular cycles for treating vegetation on overhead facilities in our experience typically run to four and sometimes five years, even for utilities whose vegetation cover and types bring fewer challenges. We have not seen elsewhere for companies like Consumers cycles as long as the Company has used or now proposes to use in the future. Cycles of four and perhaps as much as five year are typical. Moreover, historical practice has generated extremely long durations between treatment on many circuits, contributing to unreliable performance.

The cycles now adopted show improvement and have and will continue to produce significant reliability performance. However, the proper measure of the effectiveness of the change is not in

how far cycle improvement has come, but in how far it still needs to go, just to reach industry norms. We do not believe that the relationships that Consumers has shown between outage numbers and time since last treatment justify cycles that significantly lengthen as circuit voltage drops. To the extent the data has meaning, it shows that a five and possibly a four-year cycle similar to that adopted for HVD circuits should apply to LVD circuits. While HVD circuits serve significantly more customers, the data shows that the reliability of LVD circuits remains a substantially greater contributor to performance as measured by reliability metrics.

Apart from the matter of optimizing forestry cycles, delaying the time it takes to make execution match targets is also material. Bringing vegetation work into compliance with sound forestry cycles should not be delayed longer than necessary to address resource constraints imposed by additional work requirements.

28. Consumers has developed a series of tools that materially aid in identifying higher risk zones for prioritizing forestry work.

Tools (Forestry WISE for example) to which management has dedicated significant attention reflect sound focus on using data driven analysis of the system's vegetation conditions and their treatment. The Forestry WISE Model uses data such as historical weather data, detailed circuit attributes, tree canopy cover and pole attributes. Consumers has also added disadvantaged community status to its Forestry model, as the next chapter of this report addresses. As we believe management would acknowledge, their present development stage leaves room for enhancement. Nevertheless, their ability to assist in identifying highest risk areas already appears to produce benefit in prioritizing work.

Less clear is the ability to use data to determine forestry cycles. With forestry cycle shortening as only one of a number of measures being undertaken to improve reliability, there is significant complexity in determining how to account for the interplay among them in identifying their individual contributions to reliability changes.

3. Recommendations

10. Substantially reduce the use of general "Weather" and of "Unknown" as outage causes. *(See Conclusion #24)*

Subdividing the "Weather" category or eliminating it in favor of more specific causes will enhance the ability to analyze outage causes and identify measures to address them. Consumers should also eliminate "Unknown" as an entry for first responders. DTE has recently eliminated that cause. The need for commitment to ensuring detailed and accurate cause entries should be regularly reinforced and base and recurring should specifically address means for ensuring accuracy.

Note that the next chapter of this report addresses recommended changes to forestry cycles.

Chapter II – EDIIP Reliability Programs

A. Background

The preceding chapter addressed responsibility for managing distribution grid planning, design, installation, and operation and the major methods and practices employed in doing so. It focused substantially on inspection and testing practices that determine system condition and fitness for service and that respond, either following cyclical inspections and testing or response to emergent conditions, by performing maintenance or repair activities. Those inspection and maintenance activities also provide information that assists management in identifying needs for reliability maintenance and improvement programs, which are substantial given the large gap between historical and targeted reliability performance by Consumers. Inspection and maintenance activities also generate detailed facility and equipment information that assists in prioritizing work under reliability programs once identified.

This chapter addresses those reliability programs, which comprise the principal focus of the 2023 EDIIP. Capital investments drive the majority of the expenditures that the EDIIP describes, but some notable expansions of O&M programs exist as well. It describes a number of areas where, given reliability as the focus, certain programs addressed in Chapter One and the EDIIP could be slowed without substantially impairing progress toward the Company's SAIDI goals. Such deferral should not be read as criticizing the programs involved. Chapter One provides our views of their merits and contributions, which extend past reliability improvement. A close reading of this chapter and the preceding ones will show some differences in data. This chapter's structure largely uses data from the September 2023 vintage EDIIP, which served for us as the benchmark for examining and assessing reliability programs. The work underlying the preceding chapters relies on often later information produced through data requests, interviews, and working sessions with management. Surveying this final report did not find the differences material in affecting conclusions or abnormal in reflecting the effects of updating and evolution. Nevertheless, it remains important for users of this report to remain vigilant in understanding vintage issues important in determining how to use the data reported.

The MPSC first directed the Company to submit a five-year electric distribution investment plan in Case No. U-17990 in 2017. Consumers filed its first *Electric Distribution Infrastructure Investment Plan* ("EDIIP") on March 1, 2018 and a second on June 30, 2021. Consumers filed an updated EDIIP on September 8, 2022, as directed by the MPSC in Case No. U-20147. On September 27, 2023 Consumers filed its most current EDIIP. This plan outlines the approximately $7 billion in investments focused on delivering performance improvements in reliability, resiliency, and safety, and designed to bring service reliability out of the worst third or fourth quartile of reliability performance.

As this chapter will describe, the portfolio of reliability programs that the EDIIP proposes generally encompasses an appropriate range of complementary activities, which, with two principal exceptions described below (forestry cycles and pole and substation equipment replacement overly driven by age) are employed commonly in the industry. The principal question becomes one of balancing resources applied to them in a manner that will optimize reliability and safety performance. The comparatively poor reliability history and current performance levels of Consumers complicate the examination of this question. Consumers has far to go in reaching its

goal of delivering what can be described as only average industry performance. The EDIIP proposes massive investment levels to reach that goal. There is no doubt that large increases from historical expenditure levels will be required to meet the goal by 2028. Our engagement does not include an assessment of electricity price affordability, but the investment levels proposed clearly call for an examination of ways to reduce expenditures, even at the expense of delaying achievement of second quartile reliability performance. Our scope did not include the making of judgments about the optimum balance between electricity price and reliability, but this chapter does seek to provide the Commission with insights helpful in its determination of that balance.

Consumers has still reached comparatively weak reliability performance levels after substantial effort and expenditure and it still has far to go to reach mid-level reliability performance. Many would find such a goal moderate, but for Consumers it is very aggressive, particularly in light of the large costs it will necessarily take to reach it. Even attainment of that goal should be viewed as a lengthy journey. Whether five years sets a realistic length is a function of what levels of rate increases the Commission ultimately finds sustainable. It is equally a function of what results Consumers achieves and what lessons it learns from them year by year as it gains further experience on how initiatives have performed and are trending in terms of reliability. Any plan so dependent as the EDIIP is on major changes and increases in activities and expenditures must be viewed as highly dynamic and uncertain, making critical the ability to readjust efforts and expenditures, and quite possibly target dates as the data needed measure effectiveness of programs and expenditure levels matures.

A major problem attendant to new and much enlarged programs is identifying which are making the most cost effective contribution. A rebuilt circuit also subjected to recent vegetation work, particularly under accelerated cycles, will likely but not necessarily perform better, depending on stresses (like extreme weather) to which it has been exposed. Even where it does perform better, it is no straightforward matter to determine which of rebuilding and vegetation work contributed, or if both did, and in what proportions. This chapter thus approaches the question of balance among a set of reasonable programs, initiatives, and activities on a dynamic basis. It focuses on where first emphases best lie in our judgment, recognizing that constant measurement of results obtained, and the apportioning of results changes among the many contributors to them.

The observations we offer are not intended to set in motion a long-term, static distribution of programs, initiatives, or activities. Instead, they provide a foundation for proceeding now, with regular adjustment as the EDIIP years pass. We also have not offered them under the assumption that it is necessary to construct a portfolio of programs, initiatives, and activities that can be expected to achieve mid-level reliability performance by the end of this EDIIP. It may, but we consider it unlikely, given the overall scope of the efforts required and their expansion under the 2023 EDIIP. In either event, we see our value added in these circumstances as better directed to addressing the cost and reliability consequences of changes in work and expenditure levels among the many categories the EDIIP creates. This approach we believe best suited to producing a plan that balances both major impacts for customers - - reliability and electricity price.

B. EDIIP Summary

1. Reliability Improvement Spending Categories

The EDIIP sets forth principal categories of spending intended to meet Consumers' overall reliability goals:

- *Forestry Line Clearing* makes the largest contribution to improved reliability. It encompasses those activities, whose costs consist predominately of O&M expenditures, performed to maintain appropriate clearances between vegetation and equipment and to support accessibility to lines.
- *Hardening* includes capital costs for repairing and replacing HVD and LVD assets, principally lines and substations. These investments reduce outages from weather risks and also cover proactive measures, such as undergrounding and fractionalization, to enhance system resiliency.
- *Inspections* involved ground and aerial inspections followed by activities designed to correct existing failures, target investments based on risk of future failure, and prioritize work on the basis of potential reliability improvement.
- *Digital Automation* seeks to increase the efficiency of work planning, service restoration, and line clearing operations through the installation of technologically driven solutions.

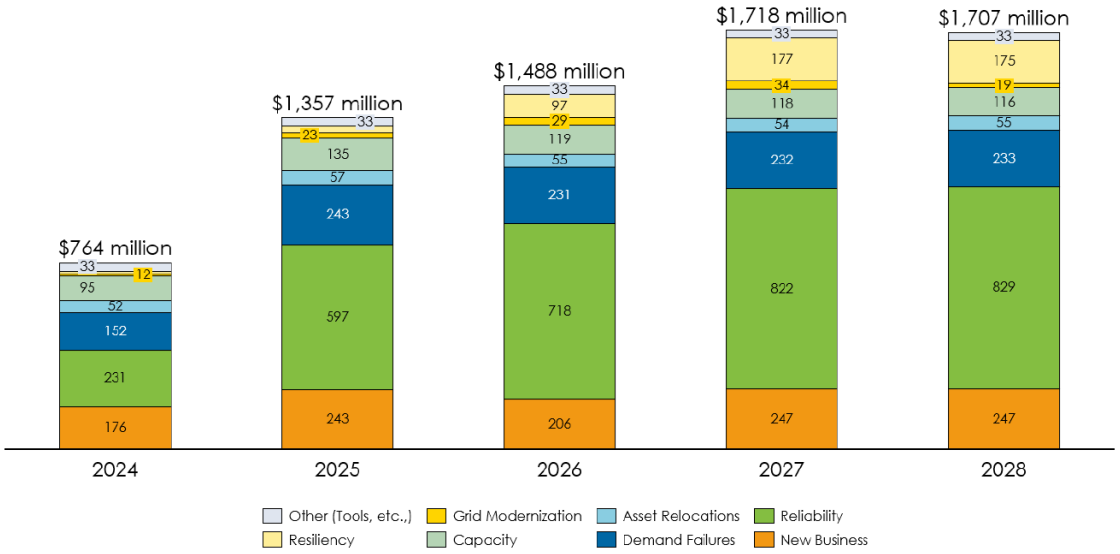
Five "fundamentals" drive the activities and investments the EDIIP proposes to improve reliability:

- **Basic Fundamentals** applicable to all circuits:
  - *Fuse*: To reduce outages sizes, install fuse on all laterals to isolate customers affected to those on the segment involved
  - *Forestry*: Conduct vegetation maintenance on a seven-year overall cycle and optimize it through machine learning
  - *Fix*: Inspect all line miles and make repairs and replacements necessary to restore to healthy status
- **Advanced Fundamentals** for circuits facing comparatively large impacts:
  - *Fractionalize*: break circuits with comparatively large reliability risk into smaller outage-impact sections through looping and automation
  - *Fortify*: Perform measures (*e.g.*, rehabilitation, undergrounding) for circuits experiencing persistent issues.

2. Capital Investments

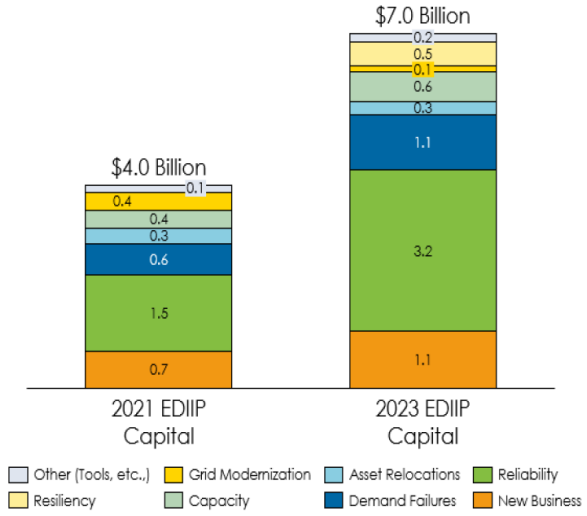
The next chart summarizes the investments the EDIIP proposes by category.

2023 EDIIP Investment Plan



The Reliability, Resiliency, and Demand Failure segments most directly relate to reliability and safety; our review focused on them. The next table, which compares the investment plans of the 2021 and 2023 EDIIPs, indicates that these categories, as the next chart and table summarize, comprise 69 percent of proposed 2023 EDIIP capital spending versus 53 percent of the capital spending proposed in the 2021 EDIIP.

2021 vs. 2023 EDIIP Investment Plans



Category	2021 Plan		2023 Plan		Δ
	$	%	$	%	
Reliability	$1.5	38%	$3.2	46%	113%
Demand Failures	$0.6	15%	$1.1	16%	83%
Resiliency	$0.0	0%	$0.5	7%	
Other	$1.9	48%	$2.2	31%	16%
Total	***$4.0***	***100%***	***$7.0***	***100%***	***75%***

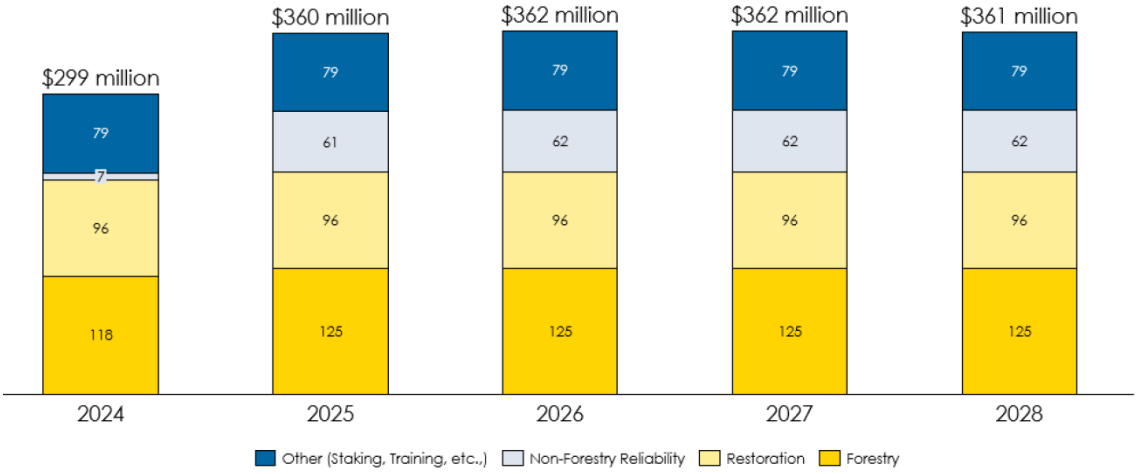
Removing the New Business, Asset Relocations, and Other categories leaves the focus on areas with more direct connections to reliability and resiliency and thus leaves capital values of $2.9 billion under the 2021 plan and $5.5 billion under the 2023 plan, reflecting a roughly $2.6 billion (90 percent) increase between the two plans for more reliability and resiliency focused capital spending. The two spending areas specifically designated as "Reliability" and "Resiliency"

account for $2.2 billion (about 85 percent) of the increase, with capital expenditures in the "Demand Failure" category accounting for essentially all of the remainder ($0.5 billion). The Company has described this category as comprising the capital expenditures incurred in responding to emergent customer interruptions or equipment failures requiring prompt response. One would expect the costs of responding to outages and equipment failures to fall as significant increases of other planned expenditures occur over time, absent a change in the scope of what responsive measures entail. However, the costs of such response increased significantly, by $0.5 billion (over 80 percent) between the 2021 and 2023 EDIIPs.

3. O&M Expenditures

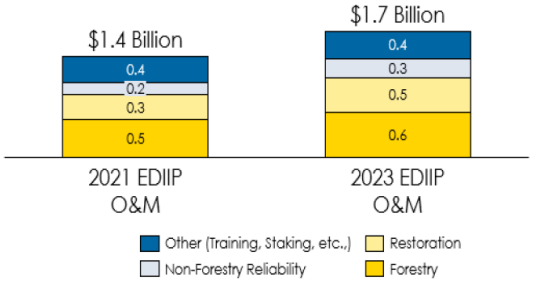
The next chart shows the EDIIP's proposed O&M expenditures.

2023 EDIIP O&M Expenditure Plans



The next table and chart show stability in 2025 through 2028 O&M expenditures, after a 21 percent increase from 2024 to 2025. The changes in O&M expenditures between the 2021 and 2023 plans are significantly more moderate.

2021 vs. 2023 EDIIP O&M Plans



Category	2021 Plan		2023 Plan		Δ
	$	%	$	%	
Forestry	$0.5	36%	$0.6	35%	20%
Reliability	$0.2	14%	$0.3	18%	50%
Restoration	$0.3	21%	$0.5	29%	
Other	$0.4	29%	$0.4	24%	0%
Total	***$1.4***	***100%***	***$1.7***	***106%***	***21%***

The Reliability category addresses reliability spending other than through Forestry. The three categories of focus with respect to reliability include Forestry, Reliability, and Restoration, which account for 73 percent of the 2023 EDIPP planned O&M expenditures.

Expected O&M expenditures increase from $1.4 billion to $1.7 billion (21 percent), driven by $100 million changes in each of the "Forestry" and "Non-Forestry" categories. Projected increases in O&M expenditures for Restoration increased by higher dollar amounts ($200 million) and percentages (about two thirds) between the plans. Consumers has projected in the current rate proceedings a test year expenditure of $133,500,000 for "Service Restoration" O&M. The Company determined this value by escalating its five-year average of historical storm restoration spending and reducing the resulting amount by about $500,000 to reflect forestry program benefits. Applying that amount through 2028 produces a value of about $668 million, which is substantially higher than the amount the 2023 EDIIP projects, even before considering escalation through 2028.

C. Reliability Goals

1. Findings

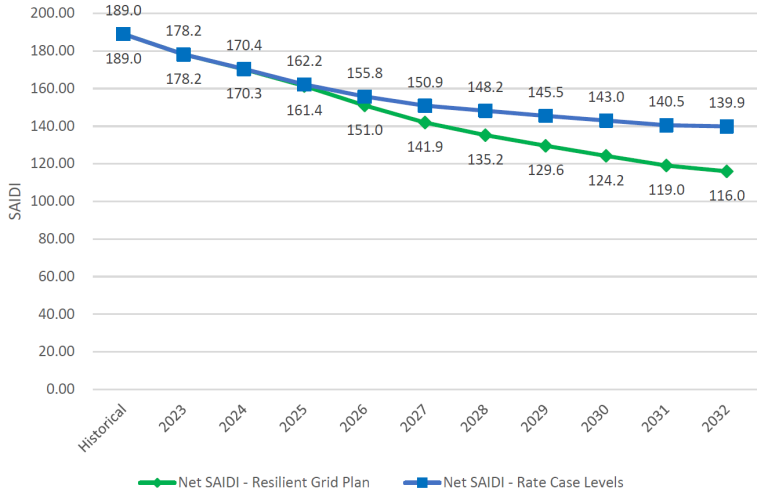
a. Reliability Objectives

The EDIIP lists three reliability objectives:

- Delivering reliability performance into the 2nd quartile of nationwide utilities
- Delivering a grid where no single outage event will affect more than 100,000 customers
- Delivering a grid where no customer will be without power for more than 24 hours following an outage event.

The EDIIP presents a glidepath showing the SAIDI reductions. The glidepath shows (blue line) "the trend being set by recent electric rate case-approved levels of investment" with those of the higher levels of the EDIIP (green line).

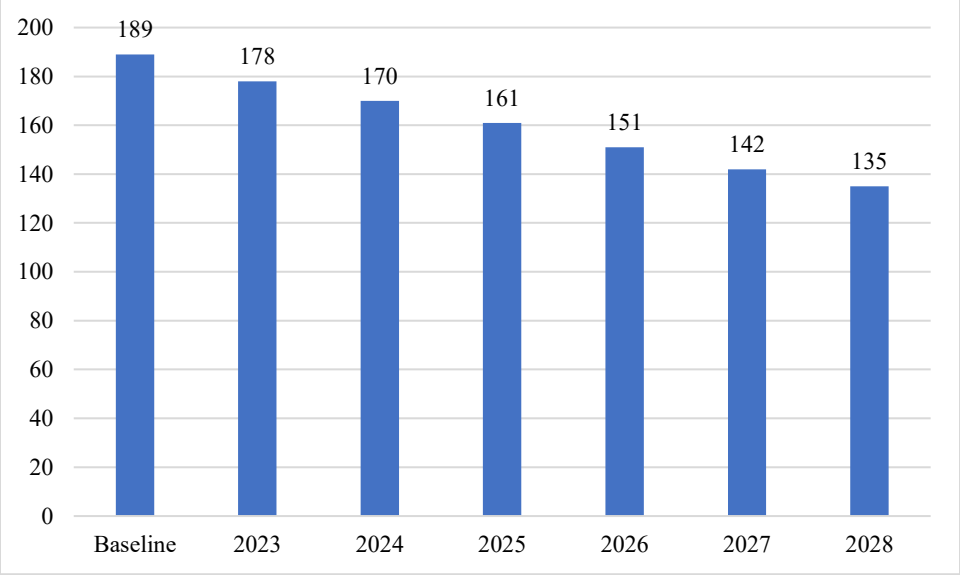
EDIIP vs. U-21389 Rate Case Trended SAIDI Values



Consumers presented in its current rate proceedings a "projected glidepath for SAIDI performance" that assumes "full approval for the spending levels outlined in this case." This glide path shows the same 2028 SAIDI level (135 minutes) that the EDIIP shows, not the higher one indicated in the prior rate proceedings.

The Company employs the System Average Interruption Duration Index ("SAIDI") as its primary measure of reliability performance. It does so after excluding the impact of high impact, infrequently occurring Major Event Days ("MEDs") on the measurement of outage durations in minutes. Days whose SAIDI exceeds a mathematically derived threshold based on historical data qualify as MEDs, generally without regard to their causes. The next graph shows the glidepath through 2028, as calculated by the Company assuming the expenditures its EDIIP incorporates. The yearly improvement rates across the 2024-2028 period range between 4.5 and 6.2 percent and average 5.4 percent.

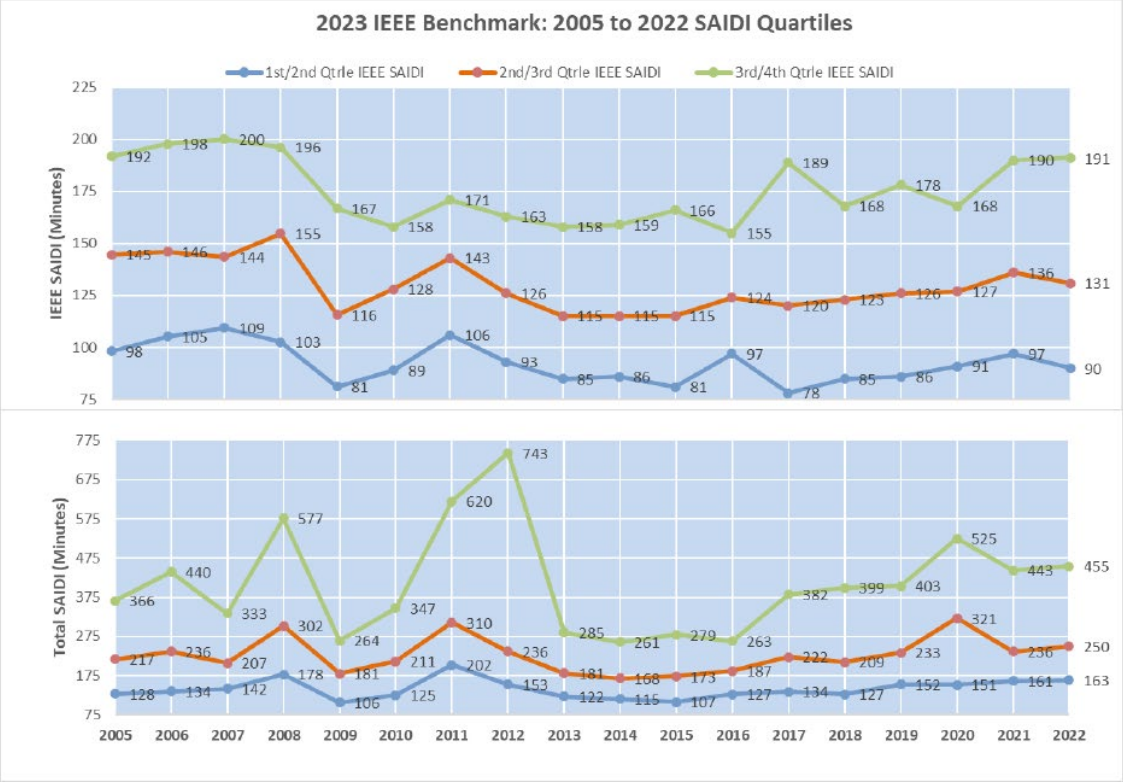
Proposed SAIDI Performance Glidepath (excluding MEDs)



The anticipated 2028 SAIDI value of 135 minutes (after removing the effects of MEDs) does not quite reach, but comes close to the 50th percentile of industry performance, as measured by the Institute of Electrical and Electronics Engineers ("IEEE"). This organization publishes yearly measures of reliability performance for a group of 74 electric utilities under a number of indices, including SAIDI before and after excluding the effects of MEDs.[4] The IEEE annual reporting dated July 19, 2023 pegs the 50th percentile value at 131 minutes. Note, however, that the trend since 2014, with 2022 as an exception, has been one of increasing 50th percentile values, making the Company's 135 minutes for 2028 roughly similar to achieving a median level of performance by that time. The next two charts summarize SAIDI performance as measured by IEEE benchmarking, with the first excluding the impacts of MEDs and the second one expressed on an all-in (not excluding MEDs) basis.

[4] Consumers Energy largely uses the IEEE measurement basis in calculating this glidepath, but employs 24-hour rolling periods as opposed to IEEE use of calendar days.

IEEE SAIDI Summary

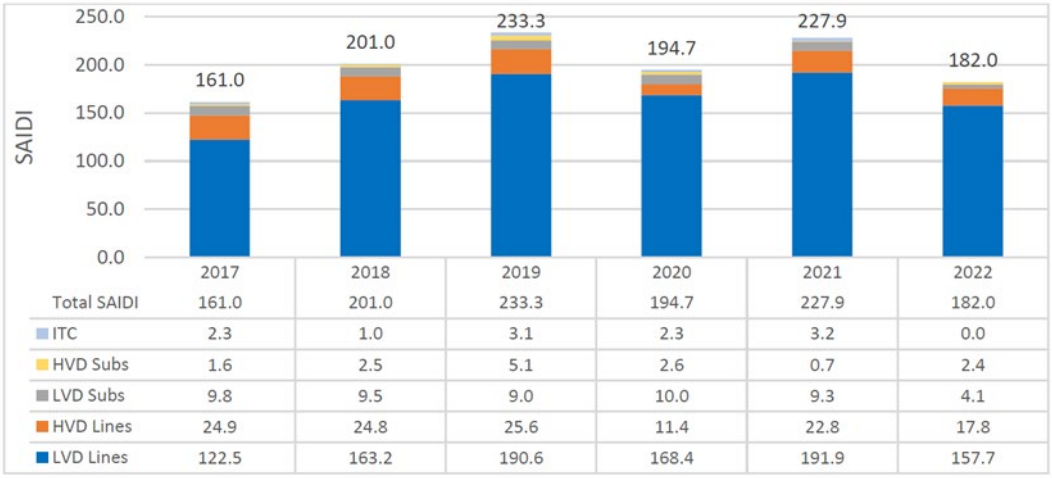


The IEEE data also show the very large gap versus industry performance for Consumers to close by 2028. The 189 minutes of its baseline value and even the 178 minutes Consumers forecasted for 2023 show performance approaching the fourth quartile. LVD lines will clearly have to prove the dominant source of improvement to reach the improvement levels required from the glidepath's baseline value of 189 minutes (54 minutes or 29 percent) or the forecasted 2023 value of 178 minutes (43 minutes or 24 percent). The next chart shows LVD lines contributing a large and growing share of SAIDI minutes since 2017. LVD lines accounted for an average of 83 percent of those minutes since 2017, growing from 76 percent in 2017 to 87 percent in 2022. The next table shows how few SAIDI minutes come from other asset types by comparison.

b. SAIDI Contributors

The EDIIP lists recent-year contributors to SAIDI minutes by asset type. The next chart shows that contributions from ITC and the HVD system component make little contribution, which the next chart illustrates.

SAIDI Contributors



	2017	2018	2019	2020	2021	2022
Total SAIDI	161.0	201.0	233.3	194.7	227.9	182.0
ITC	2.3	1.0	3.1	2.3	3.2	0.0
HVD Subs	1.6	2.5	5.1	2.6	0.7	2.4
LVD Subs	9.8	9.5	9.0	10.0	9.3	4.1
HVD Lines	24.9	24.8	25.6	11.4	22.8	17.8
LVD Lines	122.5	163.2	190.6	168.4	191.9	157.7

Asset Type	2017		2018		2019		2020		2021		2022	
	Minutes	*%*	*Minutes*	*%*	*Minutes*	*%*	*Minutes*	*%*	*Minutes*	*%*	*Minutes*	*%*
ITC	2.3	9%	1	6%	3.1	7%	2.3	8%	3.2	6%	0	4%
HVD Substations	1.6		2.5		5.1		2.6		0.7		2.4	
LVD Substations	9.8		9.5		9		10		9.3		4.1	
HVD Lines	24.9	15%	24.8	12%	25.6	11%	11.4	6%	22.8	10%	17.8	10%
LVD Lines	122.5	76%	163.2	81%	190.6	82%	168.4	86%	191.9	84%	157.7	87%
Totals	***161.0***	***100%***	***201.0***	***100%***	***233.3***	***100%***	***194.7***	***100%***	***227.9***	***100%***	***182***	***100%***

LVD lines have remained throughout the period the dominant source of SAIDI minutes. There is little SAIDI improvement to be gained in regional transmission provider (ITC) or in substations. HVD lines also appear to offer little potential for significant improvement. The EDIIP must provide for expenditures to maintain strong levels of performance in these areas, but it is very clear that the vast majority of improvement must come in the performance of LVD lines, which account for 87 percent of SAIDI minutes, a share that has grown in each year individually (except during 2021) and overall across the 2019 through 2022 period.

c. Projected SAIDI Improvements under the EDIIP

Consumers has estimated SAIDI improvements through 2028 by EDIIP investment type, which the next table summarizes. The table shows that some estimates are by group, rather than by specific program. Asterisks denote programs for which Consumers identified annual values of 0 or <1 minutes.

Projected SAIDI Impacts of EDIIP Capital Spending

Program	Minutes	Program	Minutes
LVD Lines		**Metro**	
Voltage Conversion	*	Replace Obsolete Electrical Assets	*
Subsurface Transformer Replacement	*	Electric Projects	
Converting Open Wire Secondary to Multiplex Cable	*	Civil Projects	
Line Inspections and Fixes	*	Vault Deadfronting	
Targeted Circuit Improvements (LVD Zonal Health)	21.0	Vault Rehabilitation	
Fusing Lateral Taps		Crushed Duct Replacement	
Pole Replacements		**Inspections**	
Cable Rejuvenation	7.0	**LVD Substations**	
Overhead to Underground (Pilot)	*	Animal Mitigation	9.5
ADMS & Line Sensors	15.0	Mobile Substations	
Fractionalization	*	LVD New & Rebuid Substations	
Automatic Transfer Recloser (ATR) Loops	*	LVD Equipment Replacements	
LVD Overload Risk Reduction	10.6	LVD Transformer Replacements	
HVD Lines		**HVD Substations**	
Replace Victor or vintage type insulators	18.0	HVD Equipment Replacements	9.0
Replace non-standard conductors		HVD Rebuilds	
Replace aging or deteriorated poles		HVD Transformer Replacements	
Line Rebuilds		LVD and HVD Substations O&M	
Inspection Pole Top Rehabilitation			
Line Sensors			

Plotting SAIDI minute reductions against the investments planned to achieve them shows wide disparity. Perhaps the greatest lies with LVD Pole Replacements, whose total 2023 EDIIP year expenditures of $921 million are expected to produce SAIDI reductions of 1.44 minutes, each yearly contribution less than one minute as designated by the asterisk in the table. Those values produce a ratio of $641.0 million in investment per SAIDI minute reduction. Other ratios derivable from EDIIP data for LVD programs show the following cost per estimated SAIDI minute reduction:

- $20.7 million for Overload Risk Reduction and Replacement of Components
- $23.8 million for Zonal Health and Fusing
- $26.3 million for Vintage Underground Primary Investment
- $39.8 million for Substations
- $41.3 million for open wire conversions
- Not calculable for LVD Overhead to Underground Conversion Pilot
- Not calculable for voltage conversions.

2. Conclusions

1. The goal of reaching essentially the median industry level for SAIDI performance is very aggressive, given the massive efforts and large expenditure increases needed to meet it; meeting it does not appear highly likely and efforts to pursue it may lead to more costly programs, initiatives, and activities. *(See Recommendation #1)*

Whether or not at levels approximating those planned under the EDIIP, Consumers will have much higher expenditure levels in pursuing that goal. We did not engage the question of whether there

are practical limits to expenditure levels for electricity price affordability and "value," but recognize that the Commission and stakeholders must grapple with the question of how to measure reliability improvements against the costs of producing them.

We consider a five-year plan to reach median industry performance a suitable starting point. However, it should be recognized that Consumers has a long way to go to reach that level. Compression of the time taken to reach the goal will increase the pace of price increases, which need to be addressed by policy makers in the context of all the other factors driving those prices, including, for example, decarbonization and providing the nature and level of customer experience deemed appropriate.

Moreover, time compression also substantially increases the management challenges in securing and in effectively and efficiently managing the resources needed to perform the work required. We did not find a discernibly wide gap between current and needed resource levels, and we did find attention to identifying resource needs to work to the levels the EDIIP plans. Nevertheless, some level of execution risk exists at the work levels the EDIIP plans. That risk primarily concerns the cost and to some degree the time efficiency with which Consumers can execute planned work.

That risk is not overriding taken alone, but is accompanied by another. Consumers is proposing major new or expanded programs, initiatives, and activities that it projects as having beneficial effects on reliability; *e.g.*, SAIDI. It does not appear to us, however, that Consumers has fully vetted means for determining contribution to reliability performance for new initiatives or programs, greatly expanded ones, or for assessing the individual contributions of measures that work together to produce reliability improvements. Therefore, it makes sense to us to concentrate in the immediate term on assets and measures most likely to produce improved reliability performance.

On the whole, we believe that a longer (*e.g.*, seven to ten-year) duration for reaching mid-level performance is more likely to be achievable and productive of cost efficiency. It is also more consistent with the degree of improvement that Consumers needs to achieve to reach such reliability performance. However, it is for the Commission, with the engagement of stakeholders, to determine the appropriate balance between rate escalation and reliability improvement.

3. Recommendations

1. **Restate EDIIP reliability and safety program, measure, and activity scopes to optimize scope and expenditures assuming an extended period to reach second quarter SAIDI performance.** *(See Conclusion #1)*

A goal to reach what is essentially the mid-range of utility industry SAIDI performance may appear moderate. Here, however, it will take extraordinary effort, have major electricity price impacts, and cannot be treated as attainable under EDIIP plans. Even were achievability under the measures and for the expenditures the EDIIP more clear, managing the work involved adds risk. Measures to enhance the ability to manage vastly larger work levels and the resources needed to accomplish them will place great strain on program and project management organizations, resources, methods, and practices. We assume continuation of efforts undertaken so far to scale program and project management to growing needs, actions that Consumers has properly recognized as critical. Even with those efforts, however, we see substantial risk of degradation in work effectiveness and

efficiency from historical levels, along with schedule barriers imposed by threats to resource availability.

We recommend a prompt and careful analysis that treats as variable each of: (a) the SAIDI performance target, (b) the duration for reaching it, and (c) the resulting electricity pricing consequences of adjusting those variables, and (d) realistically assessing the relationship between the amounts and pace of work and their likely impacts on work effectiveness and cost inefficiency. Doing so will allow for more informed decisions about the value of improved reliability by illustrating the costs of achieving it more or less rapidly.

A longer period to reach mid-second quarter SAIDI reliability performance may well prove more realistic in terms of the time it will take to close the reliability gap that now exists when considering the resulting electricity price impacts and management challenges of getting the work done effectively and efficiently. However, we recognize that it will be for the Commission, informed by Company and stakeholder participation, to balance variables like reliability target level and duration to get there against the resulting electricity price consequences they are likely to impose. We consider the analysis we recommend material to informing difficult decisions that lie ahead.

Another factor bears mention as well. This recommendation may not inform decisions about decarbonization, taking them as a given. However, the work to accomplish decarbonization makes grid reliability and safety the principal means for addressing how to create a total electricity price path that is sustainable when the energy side of electricity pricing is added to the delivery element we have examined. This factor warrants a 10-year view of the journey to strong reliability performance with a particular focus on the multiple paths that opening reliability targets and schedules to variation can produce.

D. LVD Reliability/Resiliency Measures

This section addresses EDIIP proposed LVD programs and measures seeking to improve reliability by reducing outage risk reduction, including:

- *Targeted Circuit Health* improvements that identify and address problems with primary conductor, poles, and other components in worst-performing system areas
- *Pole Replacement and Upgrades* that change out deteriorated ones with ones better able to perform in extreme weather.
- *Overloaded Component Upgrades* that prevent load-related outages
- *Vintage Underground Cable* rejuvenation and replacement
- *Metro system Improvement* in safety, efficiency, and aesthetics improvements in Battle Creek, Flint, Grand Rapids, Jackson, Kalamazoo, and Saginaw.

Forestry Line Clearing, addressed in a separate section below, comprises another significant area of expenditure, seeking to mitigate tree-related outages, described by the EDIIP as the biggest external risk factor for LVD Lines. Other LVD line measures to which Consumers has ascribed reliability improvement include conversion of open wire secondary, voltage conversion, fusing, and underground transformer elimination.

1. Findings

a. Forestry

The EDIIP addresses forestry expenditures for HVD and LVD lines. The EDIIP cites trees as the cause of 44 percent of weather outages overall and 38 percent of those that occur on other than Major Event Days. The Forestry Line Clearing Program seeks to minimize such outages and to support access to overhead lines for regular inspection, maintenance, and repair and to respond to outages. Management has introduced a new Forestry Workplan Intelligence & Strategy Engine ("WISE") model to inform creation of its circuit clearing workplans. Incorporating historical weather data, circuit attribute details, satellite-imagery supported canopy cover, pole attributes, and analytic capabilities have, according to management, enhanced predictive outage model modeling used to target clearing work where most beneficial. Consumers has been scaling O&M up to maintain a seven-year overall LVD system cycle. Line clearing under the Forestry Line Clearing Program for HVD lines operates on a four-year cycle. The Company clears vegetation within an 80- to 120-foot-wide right of way, designed to maintain a 15 feet minimum separation for 46 kV lines and 20 feet for 138 kV lines between conductors and vegetation. Vegetation management also seeks to maintain accessibility for line maintenance and repair.

The EDIIP shows it reaching the level it has identified as accomplishing that goal starting in 2025, anticipating total spend of $558 million for the period from 2024 through 2028. The next chapter of this report addresses forestry issues in more detail.

b. Targeted Circuit Health

The EDIIP proposes annual inspection and maintenance cycles and costs under Targeted Circuit Health Improvement, which the following table details. The table shows LVD Line Inspections as the dominant source of costs, with its $34.3 million accounting for 81 percent of the annual total of $42.5 million.

EDIIP LVD Inspection and Maintenance Activities and Costs

Inspection Task	Cadence	Components Checklist	Annual Cost
LVD Line Inspections	2 Years	• Visual Inspection of pole and pole top components. • If a pole is suspected of failure perform test for strength.	$34.3M
Padmount Inspections	Significant Sample Annually	• Visual external safety inspection to identify if secure, holes or leaking.	$709K
Electronic Circuit Recloser	Remote Monitoring	• Monitor for any abnormality in performance and investigate for correction.	$118K
	6 Years	• Inspect reclosers without modems for any abnormality in performance and correct as abnormalities are identified.	$250K
	4 years	• Replace battery	$91K
Switched Capacitor Bank	Remote Monitoring	• Monitor for any abnormality in performance and investigate for correction.	$190K
Unswitched Capacitor Bank	Annual	• Visually inspect for any abnormality and correct as abnormalities are identified.	$73K
Gang Operated Switches	3 Years	• Inspect and cycle the switch to ensure proper performance and correct as abnormalities are identified.	$600K
Disconnect Switches	3 Years	• Inspect, cycle and clean contacts to ensure proper performance and correct as abnormalities are identified.	$6.2M
Total			**$42.5M**

These elements combine to produce about $213 million in EDIIP costs over its duration:

- Line Inspection: $171.5 million
- Disconnect Switches: $31.0 million
- Padmount Inspections: $3.6 million
- Circuit Reclosers: $2.3 million
- Capacitor Banks: $1.3 million.

Consumers has divided its LVD circuits into zones, each consisting of a circuit segment protected by a fuse or recloser. Each circuit has a Zone 1 that consists of the segment between the substation and the first protective device. This zone carries particular importance because a fault on it may cause an outage across the entire circuit, which altogether may serve more than 1,000 customers. The Company has identified approximately 137,000 of these protective circuit zones.

Consumers focuses Targeted Circuit Health Improvement inspections and maintenance activities on the "protective zones," rather than entire circuits, having found that only one quarter of its system miles account for 91 percent of customer interruptions. It assesses the health of the 137,000 zones into which it has divided LVD circuits using four individually scored factors, which can produce a ranking of between zero and 20. The factors and their weights are:

- Total customer numbers per outage (score of 0-8)
- Total years experiencing an outage over last 10 years (score of 0-4)
- Average outage numbers per mile over last 10 years (score of 0-4)
- Total rolling 24-month outage numbers (score of 0-4).

Those reaching a score of 10 begin, in the Company's experience, to experience exponentially increasing outages, with interruptions becoming "particularly severe" at scores above 15. The

EDIIP cites 6,000 zones (4.5 percent of the LVD system) as having a score of 10 or higher. The reliability-enhancing measures taken to address circuit health through targeted circuit improvements include replacing equipment, hardening existing assets, installing fuses or reclosers, and expanding the capability to isolate and transfer load.

Consumers has calculated reliability improvement achieved by comparing SAIDI minutes following improvements with the average minutes for the three years prior to improvement. That improvement has averaged 64 percent when applied to the 831 projects completed from 2017 through 2021. Forestry Line Clearing, acknowledged as the largest contributor to improved reliability, has also been occurring over the relevant period.

The EDIIP investment plan assigns 2024 through 2028 amounts of $489 million to Targeted Circuit Health, as part of a plan to address all zones with scores of 10 or greater, and as part of a 20 year plan estimated to cost $2.3 billion. The EDIIP projects the highest annual SAIDI minute reductions in the initial years, as the work addresses the worst zones first, as the next table summarizes.

Counting 2028, Consumers estimates total SAIDI reductions of 21.0 minutes, which includes the nine minutes for Fusing, addressed immediately below.

Targeted Circuit Health SAIDI Impacts

Year	Zones Addressed	Fusing Projects	SAIDI Benefit
2023	24	901	0.6
2024	95	1,004	1.3
2025	280	44	7.1
2026	280	0	4.7
2027	280	0	3.4
2028	280	0	4.5

c. Fusing

Consumers Energy expects to complete currently planned fusing of its lateral circuits by 2025, with plans to evaluate whether additional fusing will generate reliability gains above the nine-minute SAIDI reduction estimated to result following current program completion.

d. Pole Replacement

Consumers estimates that 150,000 of its LVD poles, about 10 percent of the system, would classify as rejected (per NESC standards, deteriorated to below two-thirds of original install state). The EDIIP proposes replacing all poles rejected as part of its inspections. The EDIIP also proposes to replace as it conducts inspections all poles of greater than 45 years. Historical data shows an average life cycle of 57 years for LVD poles, with the 1.5 million on the system averaging 65 years of age. We do not find that life out of the ordinary, and our field inspections gave no reason to question the health of even the older poles we examined. Together, EDIIP-planned pole replacements will total about 20,000 poles per year at a cost of over $900 million. Program elements include:

- A 12-year pole cycle calling for annual inspection of 125,000 primary and secondary poles and expected to cost $10 million per year
- Replacing all rejected poles, expected to amount to 12,500 per year, based on the 10 percent historical rejection rate
- Replacement of all poles more than 45 years old on a regular two-year circuit inspection cycle to reduce average pole age, and to align with EPRI standards for average pole age.

The next table shows replacement rates and anticipated SAIDI benefits.

Projected Pole Replacement SAIDI Benefits

Year	LVD Poles Replaced	SAIDI Benefit
2023	240	0.00
2024	95	0.00
2025	280	0.15
2026	280	0.31
2027	280	0.49
2028	280	0.49

e. Overload Risk Reduction

LVD Line Capacity capital projects seek to prevent asset damage and forced outages due to overloading. Overloading occurs to particular assets as localized loads increase. The greatest local circuit load increases have been occurring in the Grand Rapids suburbs. The Company has identified that some of its LVD system components can be overloaded by as much or more than 140 percent. These components include cable, fuses, overhead line, reclosers, switches, and isolators. Overloading equipment reduces reliable life and increases the risk of outage causing failures. Large numbers of customers can be affected by the failure of these components. Consumers proposes to replace overloaded components under its LVD Lines Capacity Investment subprogram.

The Company has been operating some circuits and substations to near or above normal ratings. However, as the next tables summarizes, since 2019 the Company has been mitigating the 100 percent or more overload conditions on its LVD circuits and substations.

Mitigated Loading

Type	2019	2020	2021	2022	2023
LVD Circuits >90%	25	25	29	18	14
LVD Circuits >100%	13	9	8	5	6
Substation >90%	42	56	38	26	27
Substations >100%	11	21	10	7	9

The EDIIP employs the criteria shown in the following table for determining LVD system component overloads requiring relief. It describes a 10-year $450 million replacement program for isolators and other components loaded at above the levels the criteria set. Costs for 2024 through 2028 are forecasted at $223 million, starting with $11 million for 2024 then increasing to

$53 million annually through the remainder of the period. An accompanying chart shows expected SAIDI improvements.

LVD Overload Criteria

Device	Loading Criteria
Conductor	115%
Fuse	140%
Hydraulic Recloser	140%
Electronic Recloser	150%
Regulator/Recloser	140%
Isolator	140%

The EDIIP shows SAIDI benefits that total 10.6 minutes for installations from 2025 through 2028. It reports the completion of efforts to determine likely residential EV charging areas and has predicted circuits with highest density of EV adoption through 2028 but appears not to have identified additional overload relief measures as required to address increased EV charging.

f. Vintage Underground Cable

The EDIIP reports that the system's approximately 9,500 miles of underground primary cable, includes an estimated 2,500 miles of 15 kV underground cable installed before the 1980s. As others have commonly experienced, such cable is subject to material degradation that reduces service life and has caused many failures. Replacement has proven the widespread means for addressing such cable. Consumers uses replacement as well, but also addresses some of its aging underground cable through rejuvenation. A contractor used by Consumers begins the process by testing cable, then replacing cable that fails the testing. For the portion that passes testing, the contractor injects "fluid-like" material that acts as insulation after solidifying, then replaces the cable. Consumers reports that rejuvenation costs substantially less than replacement where testing proves it feasible. Management estimates that 2,300 of its 2,500 miles of pre-1980s cable are candidates for rejuvenation. Prioritizing work according to the underground zones with the worst health scores, the EDIIP anticipates a rampup to a sustained level of 160 miles either rejuvenated or replaced per year by 2026, producing an expected cost of $178.3 million from 2024 through 2028. The EDIIP projects reductions of two minutes in SAIDI per year after reaching full scale program operation in 2026, for a total of seven minutes for the EDIIP period.

g. Open Wire Secondary

Open wire configuration accounts for 4,000 miles (about 13 percent) of the Company's total 30,000 miles of secondary circuits. Open wire secondary proves more likely to fail than the multiplex configuration now predominating in the system and difficult to access by bucket truck in many locations. Open wire secondary has higher frequency of interruptions and the longer durations to repair. Consumers plans to replace over the next 10 years 917 miles of open secondary wire on the worst performing circuits. The EDIIP incorporates 2024 through 2028 expenditures that estimated at $121 million. At full scale, estimated SAIDI reductions amount to 0.5 minutes per year. Consumers also cites greater down wire safety risks where it employs open wire secondary. Consumers also notes that open wire comprises about 18 percent of secondary in

environmental justice "EJ" communities, where long restoration durations can have heightened impact.

Company data shows overall that reliability performance in EJ communities is competitive with that of the system as a whole, concluding, however, that, "while *individual* circuits in EJ communities may have poor resiliency in a given year, it is not a systemwide issue, and this holds true whether considering SAIDI, SAIFI, or CAIDI."

h. Voltage Conversion

The system employs 13 different voltages resulting from acquisition of a number of smaller systems over a long history. The inability to interconnect at different voltages complicates making transfers among circuits and modernizing the distribution system. Plans call for converting all LVD circuits to one of three standard voltages over the next 10 years. While comprising only about three percent of LVD system mileage, the 1,640 miles of ungrounded Delta configured lines that remain produce material safety risk, given that they can remain energized following a downed wire until a second phase fault occurs. Converting them to one of the system's three standard grounded configurations will mitigate this risk, while at the same time promoting interoperability and reducing inventory levels required. The Company's plans to spend $33 million per year for the next decade to complete voltage conversions, with $137.8 million of that amount spent through 2028. The Delta conversions comprise the vast majority of the work involved, with other circuits included amounting to about 22 miles. Consumers has assigned no SAIDI minute reductions to voltage conversion.

i. Subsurface Transformers

The 159 remaining subsurface transformers comprise less than one percent of the total transformer numbers serving the underground system. Access difficulties for employees and difficulties for the public to identify their existence cause these transformers to impose employee and public safety risk. Consumers proposes to complete their removal by 2027 at total costs of about $3 million. Consumers has assigned no SAIDI minute reductions to subsurface transformer removal.

j. LVD Resiliency Investments

The EDIIP proposes a number of measures identified as resiliency improving investments. Principal ones include LVD undergrounding, fractionalization (often termed sectionalization in the industry), and automatic transfer recloser ("ATR") loops.

LVD Undergrounding: The EDIIP proposes the undergrounding of some overhead LVD circuits to improve reliability. This EDIIP element proposes a pilot undergrounding of some of the worst performing LVD single-phase overhead lateral circuit zones. Consumers will convert sections generally of back-lot, overhead, single-phase primary to front lot underground circuit sections to addresses reliability issues caused by trees and back lot accessibility limitations. Alternate reliability-enhancing measures may include enhanced tree trimming cycles or installation of jacketed tree wire or bundled spacer cable. However, installing bundled conductor in back lots may not prove universally practical, because of inability to gain access to overhead lines using heavy, line-construction equipment.

Consumers has identified criteria for strategically selecting circuit sections where it believes that undergrounding can prove most effective. Consumers has determined that estimated cost versus benefits for undergrounding selected lateral LVD circuit sections will prove comparable to alternate solutions, while producing reliability improvement of 90 percent or more for the undergrounded section. Consumers plans a pilot program of undergrounding 10.3 miles of overhead lateral circuit sections, with undergrounding projects already queued to begin construction. The pilot program will address older developments with 50 to 100 customers, will convert rear lot overhead to front lot underground, and may run the new circuits in off-road easements.

Directly proposed undergrounding includes 10.3 miles of undergrounding in 2024 and an option for an additional 11 miles if approved by the Commission. Consumers estimates a cost of $4.12 million for undergrounding 10.3 miles of back-lot laterals (*i.e.*, $400,000 per mile). These 10.3 miles of laterals have averaged 11 outages per year.

The EDIIP cites research by WEC, which provides electricity service to about 800,000 customers in Wisconsin and 40,000 in Michigan's Upper Peninsula as supporting a 90 percent or greater improvement in circuit performance after undergrounding. The EDIIP also states that undergrounding costs are comparable to other means for making circuits less susceptible to outage risk during major weather events. The EDIIP reports that planned work will provide "valuable information on reliability benefits and costs, while using a limited scope to minimize electric rate impacts for customers." Undergrounding reduces maintenance and forestry costs. The Company assesses the costs to maintain LVD primary underground facilities at much less than that for overhead counterparts, as described earlier.

The EDIIP identifies 3,200 miles of its system as presenting candidates for "strategic, targeted undergrounding" and cites a rampup of the practice to 400 miles annually, assuming "scalability." The rampup contemplated would reach a 400 mile per year level by 2027 and call for expenditures of $414 million for the 2024 through 2028 period. Consumers expects no material SAIDI improvement.

LVD Fractionalization, or circuit sectionalization, comprises another planned EDIIP resiliency enhancement investment. The system's LVD circuits average 30 miles in length and 1,045 in customer numbers. Sectionalization comprises a commonly used means, particularly for longer circuits, to reduce numbers of customers affected. Sectionalizing also expands the ability to support switching supply sources and to perform restoration faster following outages.

Early fractionalizing focus will fall on the three percent of overhead LVD circuits that serve more than 2,400 customers. The EDIIP anticipates work on 41 circuits from 2024 through 2028, at total costs of $19.5 million. The reduction of SAIDI minutes for 2024 work, which involves five circuits, is marginal, amounting to 0.3 minutes. The 41 circuits the EDIIP proposes for fractionalization from 2024 through 2028 total suggest a possible 2.5 SAIDI minute reduction after completion of fractionalization. Consumers, however, assigns no material, measurable SAIDI minute reductions to fractionalization through 2028.

ATR Loops, comprises another area for which the EDIIP proposes expansion, here for a now decade-long program that has produced the creation of 147 looped circuits by installing ATR devices. These devices enable automatic transfer of customers to another source of electricity when outages occur, thus isolating the circuit section faulted. The EDIIP calls for installing 150 from 2024 through 2028 at a constant rate of 30 per year, at a total cost of $78.6 million. Consumers assigns no less than one minute per year in SAIDI minute reductions to ATR loops.

2. Conclusions

2. The seven-year overall forestry cycle that Consumers has targeted for its LVD circuits is too long to be effective in avoiding interruptions. *(See Recommendation #2)*

Consumers applies to its LVD circuits what amounts in practice to a seven-year overall cycle, which extends well beyond typical industry experience, even for regions less well-forested. Moreover, it appears that some of the Company's circuits have not been trimmed in 20 years and it will take until 2030 according to Company plans to perform work as required by that overall seven- year cycle. The Company employs much shorter and more commonly seen cycles for HVD lines, whose reliability performance has improved significantly and which do not present significant opportunity for further improvement.

LVD lines, however, remain the dominant contributor to SAIDI minutes. Vegetation management comprises the most significant contributor to outage reduction. We believe that reducing the LVD vegetation cycle will add materially to SAIDI minute reduction in a manner that will prove cost effective in the long run.

3. We found the targeted circuit health program appropriately designed and strongly contributory to reliability improvement.

Line inspection and treatment of disconnect switches account for the vast majority of the program's costs. We found methods and cycles for inspections sound. Our field inspections found poles, structural elements, and equipment mounted on them sound and healthy, reflecting proper application of those methods and cycles.

4. We found plans to replace poles that fail condition-based testing reasonable overall but the anticipated rejection rates seemingly high. *(See Recommendation #3)*

The proposed inspection program and costs are sound and not costly, amounting to about $9.7 million annually. The conditions and defects they will identify are material contributors to making repairs and replacements that will avoid outages. A 10 percent expected rate for pole rejection is high, but because it is driven by inspections, should limit replacements to those driven by conditions and surrounding circumstances affecting condition. However, we have not found age-driven replacement used as a determinative criterion for replacement. Replacement should be limited to condition-based factors.

5. We did not find the replacement of poles strictly based on age well justified. *(See Recommendation #3)*

Condition, not age, should drive pole replacement. We did not find Consumers poles to be of an overall age that is out of character with what we have observed elsewhere. Moreover, it employs

sound methods to inspect, maintain, repair, and rebuild them. Our field inspections found no reason to question the beneficial effects of those practices in keeping poles in good condition.

Age-based replacement comprises about 7,500 (38 percent) of the 20,000 the EDIIP plans for replacement. The costs for replacing poles based on age in excess of 45 years amounts to $343 million, as the following table summarizes.

EDIIP LVD Pole Replacement Summary

Poles	Cost Type	2025	2026	2027	2028	Δ'25-'28
Total Replaced	Capital	$104.0	$209.0	$300.9	$300.9	$914.8
	Poles	7,000	14,000	20,000	20,000	$61,000.0
Age-Based	% of Total	38%	38%	38%	38%	
	Poles	2,625	5,250	7,500	7,500	22,875
	Capital	$39.0	$78.4	$112.8	$112.8	$343.1

6. Replacement of overloaded devices of the types the EDIIP addresses is essential to maintaining reliable service, and Consumers applies reasonable overload determination criteria.

Utilities routinely conduct planning studies to determine when system components will suffer overloads at levels that present failure risk under assumed future load levels. The overload percentages that Consumers' criteria for replacement apply are conservatively high enough to conform to industry experience and to moderate replacement levels. It is customary to identify potential replacements over a period consistent with the EDIIP's five-year horizon. However, it is also necessary to ensure current modeling of system conditions, as significant uncertainty can exist with respect to the locations and the amounts of expected load increases, particularly in later years. That uncertainty can have significant implications for a program whose costs may amount to $450 million over 10 years, based on management's current planning.

The $53 million proposed yearly from 2025 through 2028 exceeds the 2023- 2024 yearly average ($9 million) by almost six times. It is surprising to see such a large number of new overloads (as opposed to accumulating historical overloads not currently corrected). Nevertheless, if overloads of the magnitudes identified by the criteria the EDIIP cites remain properly foreseeable, correcting them currently will prove sound from a reliability maintenance perspective. To the extent that continuing system modeling and analysis taking account of changing assumptions about load show lesser needs for replacement to avoid overloads, it would give reason to determine whether to spend less in total for reliability or at least to direct it to areas with greater impact.

7. The Consumers 15-year rejuvenation and replacement program reflects a sound means for addressing vintage underground cable reliability problems.

Replacement of vintage underground cable has been a problem across the industry. Early attempts at rejuvenation as an option did not prove successful, but Consumers has had success to date in using rejuvenation, supported by long-term guarantees of effective operation by the contractor who performs the work. Others have found replacement important in improving reliability. While it is too soon to express very high confidence in a rejuvenation program begun "recently," the plan that the EDIIP presents uses a long enough period to moderate immediate-term costs, test out continuing success with rejuvenation, and take concrete action to reduce SAIDI minutes from a

system component whose inherent unreliability has proven an industry-wide issue of long standing.

8. **Removal of open wire secondary is not cost beneficial from a reliability improvement perspective; other policy grounds need to be considered in justifying it.** *(See Recommendation #4)*

Removing all remaining open wire over the EDIIP period will produce only a nominal change in SAIDI minutes, compared to its over $100 million in costs. Experience at other utilities does not generally command removal of open wire secondary on a programmatic basis for safety improvement reasons. While environmental justice community reliability and resiliency appear very competitive based on information the EDIIP presents, whether the particular duration issue that the EDIIP cites as existing for portions of the communities is a policy matter.

9. **Eliminating the remaining LVD ungrounded Delta configurations serves an important safety objective.**

Delta configurations comprise relatively small part of the Consumers LVD circuits. However, they pose significant safety risk due to the failure to de-energize under many circumstances when downed. It is not clear that lower inventory costs and more efficient interoperability alone would justify the expenditures involved, but they add materially to the justification for the programmatic elimination planned by the EDIIP.

10. **Completion of the current fusing effort in 2025 is expected to make a significant contribution to SAIDI minute reduction; analysis of extending the installation of fuses should form a priority.**

Reasonably common in systems like the Consumers LVD system component, it is not surprising to see material contributors from fusing. While there are points of diminishing return as increasing portions of a system have been protected with fusing, Consumers should, as the EDIIP indicates it will, pursue analysis of additional fusing opportunities.

11. **The inclusion of subsurface transformer removal completion in the EDIIP is sound.**

The costs are nominal for addressing safety implications that the one percent of remaining transformers of this type create.

12. **The limited LVD undergrounding planned will have substantial value in permitting careful analysis of the costs and reliability of benefits of undergrounding, which remain too uncertain at present to support expansion to the potential level the EDIIP includes.** *(See Recommendation #5)*

The company acknowledges the need for more information about both costs and benefits of LVD undergrounding, which the 10 miles planned will assist in providing. The cost of the program may reach $400 million through the EDIIP's planning horizon and perhaps $1.3 billion if extended to the full 3,200 miles identified as candidates. Historic cost differences between overhead and underground construction have traditionally militated strongly against undergrounding, except in special circumstances, although, undergrounding use is expanding as a resiliency measure, particularly in certain areas (*e.g.*, Florida with significant tropical storm exposure, and California with significant wildfire exposures).

Consumers is soundly employing limited scale undergrounding to allow it to gain information about what undergrounding on a larger scale can accomplish and at what cost. However, it is not clear how the results will be forthcoming in a time that supports the significant ramp up be before significant ramp up the EDIIP presents - - from $10 million in 2025 to $80 million in 2026 and to a full-scale $160 million per year thereafter. Selecting circuits to compare with others on the basis of outage length, while not unsound, raises a number of comparison challenges. First is how to extend/adjust results for circuits operating with less severe outage records. Second is determining whether the reason for the outage history of the circuits would be changed by undergrounding. For example, if driven substantially by vegetation conditions, the correct comparison to undergrounding may be simply accelerated clearing, as opposed to substantial hardening.

13. Fractionalization as the EDIIP plans offers an economical means for securing reliability improvement.

Sectionalizing comprises a common industry approach for reducing outage exposure on particularly long circuits in the industry. The costs the EDIIP proposes are small yet sufficient to address the most circuits with the largest numbers of customers exposed.

14. The relatively small EDIIP proposed investment amounts, ATR loops, will, as projected by Consumers, produce only nominal change in reliability measures.

Consumers has been establishing ATR loops for a decade; the EDIIP proposes continuation of their creation at the range of 30 per year through the EDIIP. Consumers expects that its EDIIP-proposed investments for ATR loops would provide less than one minute of SAIDI improvement per year. The ability they provide to transfer load automatically makes it reasonable to conclude that Consumers will continue for the EDIIP period to find sufficiently beneficial use of them, given the fairly low annual expenditures involved.

3. Recommendations

2. Move to a four-to-five-year forestry cycle for LVD circuits overall, completing the first roughly contemporaneously with the 2028 end of the EDIIP period. *(See Conclusion #2)*

Completing the first four to five-year cycle by the end of the EDIIP period may add costs of about $100 million per year to 2025 through 2028 EDIIP O&M expenditures. However, the annual costs to sustain such a cycle can be expected to drop to a level of $100 to $150 million after completion of the first cycle.

Overgrown vegetation encountered during a circuit's first treatment substantially increases the per foot or mile costs, but will not be present thereafter on regularly maintained circuits. Thus, we would anticipate under such a cycle forestry costs in the range of $225 million for 2025 through 2028, as compared with EDIIP annual values of $125 million.

Consumers does not plan to reach its targeted seven-year overall cycle for LVD lines until 2030. The next table shows the expected annual reductions in SAIDI minutes, excluding contribution during MEDs, as it does so. The table shows a deferral of the benefits of the most significant influencer of SAIDI performance. It also indicates the strong likelihood that shortening cycles further, bringing them more in line with those of others will have a more significant impact than

other elements of the EDIIP. The comparatively more challenging vegetation across much of the Consumers territory, compounded by the exposure that its also comparatively greater circuit miles and lengths point to at least an effective five-year cycle, if not a four-year one. The roughly four-year cycle Consumers does employ for HVD circuits provides an indication of the benefits that a shorter cycle can introduce.

SAIDI Reductions from Forestry Cycle Reductions

Year	2023	2024	2025	2026	2027	2028	2029	2030
Minutes	2.6	2.0	1.2	1.1	1.1	1.2	1.2	1.1

It will take significant increases in resources to perform the work needed to achieve a seven-year cycle sooner, let alone to reduce it as we believe Consumers should. It may be that it will take a period extending through and beyond 2028 to "catch up." If so, an important question that arises is whether other, less effective SAIDI-reducing measures should be advanced to shorten the time it takes to reach the goal of achieving mid-level reliability performance. The alternative is to lengthen the time it takes to reach that reliability performance level in order to minimize electricity price impacts.

3. **Eliminate plans to replace all poles found to be more than 45 years of age on inspection and evaluate the conditions required to support replacement on inspection of 100 percent of rejected poles.** *(See Conclusions #4 and #5)*

Use of a 45 year age factor to schedule inspected poles for near term replacement does not comport with industry experience, with our field observations about pole condition, or the reasonably high quality of Consumers' pole inspection and maintenance practices and cycles. Consumers should limit replacements to strictly condition-based factors identified through inspection and maintenance activities. Replacing poles that fail inspection ("rejected poles") is generally appropriate, but leaves for answer the question of defining rejection. A 10 percent rejection rate appears high for what we know about system inspection, maintenance, and repair/rebuild practices, and from what we directly observed in the field. Consumers should review its population of rejected poles to determine whether it would prove cost beneficial to narrow the numbers slated for replacement due to rejection.

4. **Determine whether considerations other than reliability enhancement warrant the EDIIP expenditures associated with open wire secondary removal.** *(See Conclusion #8)*

Removal of open wire secondary does not appear to have a sufficiently large impact on SAIDI minutes to warrant the costs involved. Policy decisions about how to measure the value of open wire secondary removal in terms of service equity and safety considerations, given acceptance of open wire secondary use broadly in the industry.

5. **Delay expansion beyond current pilots for LVD undergrounding, in order to recognize the dependence of that expansion on information and analysis that will take time to evaluate robustly.** *(See Conclusion #12)*

We believe that there are not grounds at present for concluding that undergrounding will prove beneficial at the levels the EDIIP identifies, but consider it sound to undertake limited work at the scope the EDIIP sets forth. The pilots address one segment estimated at 10.3 miles and another at

11 miles. Consumers proposes to use these pilots to develop information necessary for evaluating both costs and reliability index changes resulting. The information learned should be carefully analyzed and the resulting analyses thoroughly vetted before committing to additional LVD undergrounding for resiliency/reliability improvement. We would expect the major expansion in annual expenditures at the least to be delayed by a year or more and potentially reduced materially based on lessons learned.

E. Substations and Transformers

1. Findings

a. HVD and LVD Substations

The Consumers system includes the following array of more than 1,100 substations. These substations include 145 HVD substations that receive power from the transmission system and either reduce voltages for transfer across the 46 kV lines that feed LVD distribution substations or serve single large, industrial customers (termed by the Company as Strategic Electric Customers, or "SECs"). The remainder of the substations include:

- 830 LVD substations
- 164 SEC substations
- 35 substations directly owned by retail customers
- 35 substations whose operation serves municipal or rural cooperative systems (five company-owned and 30 customer-owned)
- 30 mobile substations transported to locations where permanent ones require maintenance or repair or to support HVD line projects.

Considering power transformer, circuit breaker, and switch components, Consumers substations have an average 50-year life span. However, the Company's approach includes extending those lives, subject to regular monitoring, inspection, and maintenance, and timely repair. Given greater redundancy of design for HVD substations, they generate fewer outages, but affect larger numbers of customers when they do fail. The next chart demonstrates that combined HVD and LVD substation SAIDI performance has steadily and dramatically improved over the past decade or so under historic investment in equipment and animal mitigation measures.

LVD and HVD Substation SAIDI Performance

As the next table summarizes, the Company ranks its substations by health concern level, with "highest concern" substations the first repair or replacement priority. Animal and physical security also drive expenditures at substations.

Substation Health

Category	HVD	SEC	LVD
Highest Concern	13%	19%	6%
Moderate Concern	19%	19%	23%
Minor Concern	32%	29%	34%
Acceptable Health	36%	33%	37%

Consumers ranks substation health by performing assessments that include equipment age, condition, and type, visual inspection and infrared inspection data and electrical and oil and gas testing.

The next table summarizes the principal components of substation investment over the EDIIP period and identifies maintenance costs (combined for HVD and LVD substations by Consumers).

EDIIP Substation Projects

Category	2023	2024	2025	2026	2027	2028
HVD Substations						
Substation Rebuilds	1	2	2	2	2	2
Transformer Replacements	4	5	19	19	19	19
Equipment Replacements	122	65	100	100	100	100
LVD Substations						
New and Rebuilt Substations	8	18	18	18	18	18
Transformer Replacements	13	13	30	30	30	30
Equipment Replacements	174	224	244	244	244	244
Mobile Substations	1	1	1	1	1	1

The table shows three principal drivers of a substantial increase in substation work as planned under the EDIIP:

- HVD Transformer Replacements
- LVD Transformer Replacements
- HVD and LVD O&M.

The next table shows these three sources as the largest contributors to very large increases in annual costs as well.

EDIIP Substation Cost Drivers

Category	2023	2024	2025	2026	2027	2028	Total
HVD Substations							
Transformer Replacements	$10.6	$7.2	$42.0	$42.0	$42.0	$42.0	$175.2
Substation Rebuilds	$4.5	$12.5	$15.0	$15.0	$15.0	$15.0	$72.5
Equipment Replacements	$11.8	$13.0	$12.0	$12.0	$12.0	$12.0	$61.0
HVD Subtotal	$26.9	$32.7	$69.0	$69.0	$69.0	$69.0	$308.7
LVD Substations							
Mobile Substations	$2.0	$3.0	$1.5	$1.5	$1.5	$1.6	$9.1
Equipment Replacement	$4.5	$6.0	$7.0	$7.0	$7.0	$7.0	$34.0
New and Rebuilt Substations	$17.3	$30.2	$27.8	$27.8	$27.8	$27.8	$141.4
Transformer Replacements	$15.3	$11.5	$27.0	$26.5	$27.0	$27.0	$119.0
Animals, DSCADA, Clearances	$6.1	$13.6	$13.8	$14.4	$13.7	$13.8	$69.3
LVD Subtotal	$45.2	$64.3	$77.1	$77.2	$77.0	$77.2	$372.8
LVD and HVD O&M							
O&M	$5.1	$5.1	$26.0	$26.0	$26.0	$26.0	$109.1
Total	***$77.2***	***$102.1***	***$172.1***	***$172.2***	***$172.0***	***$172.2***	***$790.6***

The EDIIP cites "continued reduction in SAIDI minutes because of an increased operational focus on preventative maintenance" while observing that increased spending is necessary to continue this improvement trend. The EDIIP also cites the standards driving its O&M increase as increasing reliability and resiliency through equipment failures or mis-operations that cause outages. Significantly, Consumers notes that its O&M plan extends asset life.

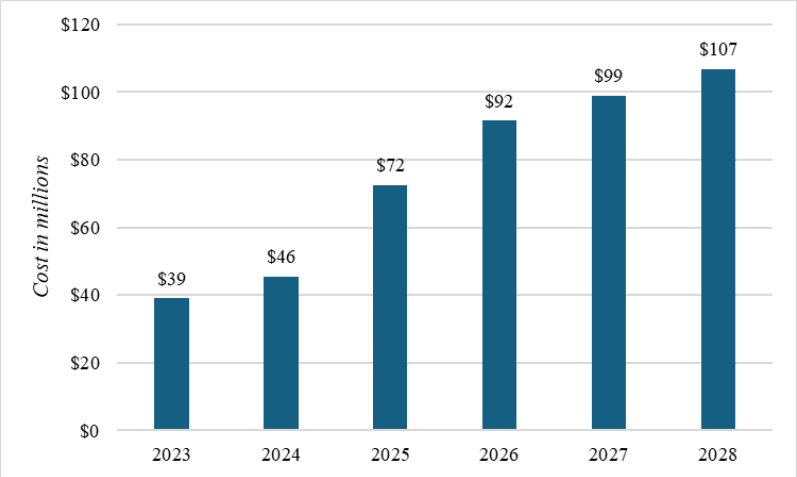
Substation measures include installing standard animal mitigation measures at essentially all the remaining 13.5 percent of substations lacking them. Plans also include installing DSCADA at 40 more substations. DSCADA allows remote substation monitoring and control, which supports security, addressing outages, and the performance of more accurate load flow studies. In total for 2024 through 2028 Consumers projects a 9.5 minute SAIDI reduction for LVD substations and nine minutes for HVD substations.

b. LVD Service Transformers

The Consumers LVD system component employs about 600,000 padmount and pole mount transformers that convert voltages levels consistent with standard customer household and business equipment. One type, Isolators, convert one primary voltage to another primary voltage. Regulators, the second type, keep primary voltage within a desired range across the full length of a circuit. The EDIIP proposes changing out about 83,000, or 14 percent of them, as the next table summarizes. The EDIIP cites a transformer life of 25 years per the manufacturers, but transformers can commonly exceed 30 or 40 years of operation. The EDIIP states that its average transformer life is 47 years.

The EDIIP cites increased loads from EV chargers, heat pumps, and home electrification as requiring more frequent transformer replacement. Meantime, the projected increase the next table shows is driven in substantial part by recovery of purchase volumes to pre-pandemic levels. Increases thereafter are driven by demand increases from increased penetration of electric vehicles ("EVs").

EDIIP-Period Transformer Purchases



Year	Planned Purchases
2023	15,322
2024	20,000
2025	14,000
2026	15,120
2027	16,330
2028	17,363

Pricing has had a significant impact on transformer prices. Anticipated EV-related demand increases are expected to have an impact on transformer costs, but after catchup in restoring transformer levels produced by COVID delays, costs for 2024 are significantly more influenced by unit prices than volumes to be acquired. However, the EDIIP does build in some increases in transformer numbers to accommodate increased EV adoption.

2. Conclusions

15. The already very low contribution that substations make to SAIDI minutes, the Company's strong inspection and maintenance practices, and the lack of high levels of transformer failure make the nearly $800 million in EDIIP substation expenditures appear very high in relation to expected benefits. *(See Recommendation #6)*

Consumers acknowledges the primary contribution that O&M expenditures for HVD and LVD O&M have made to reducing SAIDI minutes resulting from substation equipment issues. Those minutes have been brought to levels that appear to permit little further reduction. Moreover, the EDIIP calls for very significant increases in substation O&M. It is also not apparent that transformer replacements at increased levels will prove necessary to avoid increased failure rates.

Consumers counts age in assessing transformer risk. Its fleet of transformers does not, given our experience, show unusual levels of aging. We consider electrical and oil and gas testing the factors on which repair and replacement should predominately depend. Consumers has a sound inspection and maintenance program that includes such testing and as noted, plans for large increases in O&M expenditures. Our field inspections showed no visual indications of material condition issues and failure rates at Consumers have been moderate.

All told, the EDIIP investment levels reflect increases of more than $250 million over 2023 amounts. Substation equipment replacements and mobile substation costs do not change materially. Animal protection, DSCADA, and clearances work increase by a large percentage, but only by about $39 million in total.

Annual O&M for HVD and LVD substations together increases by a factor of four from 2023 levels, producing an increase value of about $84 million.

16. LVD service transformer purchases appear largely driven by demand from increased EV penetration, making them subject to the significant uncertainties that market has been experiencing. *(See Recommendation #7)*

Apart from recognized supply constraints and price increases well recognized in the market for securing transformers, the EDIIP appears to hinge a significant portion of expected EDIIP increases in LVD transformers on increases in EVs. Clearly, Consumers will have to accommodate EV growth as it occurs, which imposes some degree of risk in that it must make purchase commitments in advance, therefore requiring reliance on estimates of EV growth. The EDIIP makes clear that in addressing transformer health, Consumers places significant reliance on transformer age.

These circumstances present two challenges. First, we believe that, as in the case for lines, health should be determined by inspection and testing, without significant reliance on age. Second, while Consumers must anticipate load growth in securing transformers, it must remain sensitive to the uncertainty in forecasts of demand sources like EV, which have for some time continued to prove optimistic. It appears the growth may account for between $150 and $200 million of the growth in annual planned investments above 2024 amounts for the 2025 through 2028 period. It will remain important for Consumers to continually reassess EV penetration rates to keep transformer purchase commitments in line with them.

3. Recommendations

6. Revisit substation transformer replacement and substation rebuild plans. *(See Conclusion #15)*

Eliminate age as a criterion in assessing risk and to bring planned investments into alignment with revised risk rankings, the effects of planned O&M activities and expenditures, and analytically derived expectations about changes from historical rates of equipment failure. Expectations of savings in the range of $250 to $300 million may be achievable, depending on the results of these activities.

7. Redesign LVD substation transformer health assessment to minimize age as a factor in determining replacement levels and ensure that transformer acquisition commitments remain consistent with current estimates of EV penetration. *(See Conclusion #16)*

This recommendation follows generally the belief that Consumers reliance on age as a material factor in line and transformer health, as compared with the results of the effective and properly cycled testing it does, produces replacement rates higher than necessary to maintain reliability. With respect to EV-related demand, we recognize that Consumers must stand ready to meet goals for expanded use of EVs needs. Preparedness requires procurement in accord with delivery schedules and expectations in the marketplace and conservatism in stocks held to avoid delay in connecting facilities clearly critical to meeting state climate and environmental goals. Nevertheless, where gaps between such goals and progress in meeting them become unbridgeable, proper regard for customer interest in electricity pricing requires flexibility that remains informed by the most current information. Absent a large change between now and 2028, LVD transformer acquisition can become significantly more expensive than necessary both by reason of over-reliance on: (a) age as a health factor that helps drive replacement decisions, and (b) failure to match acquisition decisions with continually updated estimates of demand drivers like EV penetration rates.

Generally speaking, outside of work to address capacity needs, replace oil-filled circuit breakers, enhance automation, extend, animal protection, and address relays, we did not find substantial need or benefit in increasing levels of spending on HVD facilities, given their high reliability performance already and the effectiveness of inspection, maintenance, and repair practices

F. HVD Lines

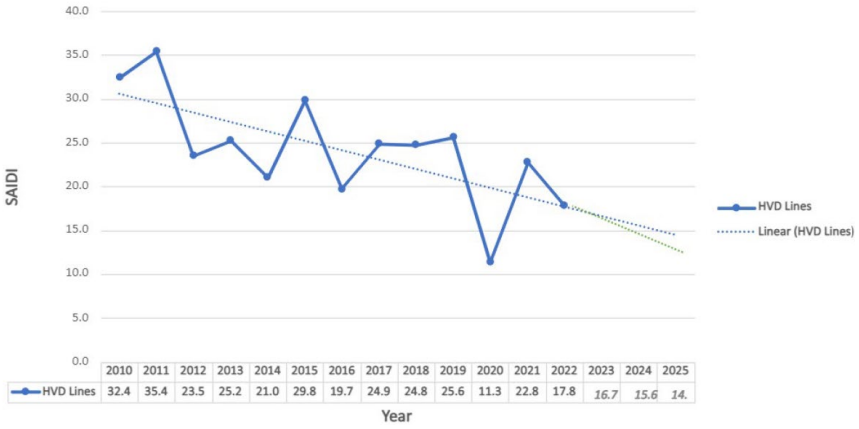
1. Findings

The 4,600 mile HVD system carries electric power at high voltage from a source substation to several substations. Overhead 46 kV and 69 kV lines account for about 4,400 of those miles, overhead 138 kV lines for about 200 miles, 46 kV underground lines for 19 miles, and 138 kV underground lines for four miles.

HVD SAIDI performance has improved steadily and markedly over a period extending as far back as 2010. The HVD system accounted for only 16.7 minutes of SAIDI in 2023. Consumers projects improvement of 18 minutes on HVD lines over 2024 through 2028. This projection includes

insulator, conductor, and pole replacements, line rebuilds, sensors and pole-top rehabilitation combined.

HVD Lines SAIDI Improvement



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
HVD Lines	32.4	35.4	23.5	25.2	21.0	29.8	19.7	24.9	24.8	25.6	11.3	22.8	17.8	16.7	15.6	14.

Year

Cross-arms, conductors, and switches at pole tops comprise the first of two pole components relevant for EDIIP categorical purposes, with the wood or steel pole itself comprising the second category. Pole tops have a 30–35-year life cycle and the poles 60 - 70 years.

Copper and single-layer aluminum conductors with a steel core wire, smaller than 3/0, do not meet the Company's present design standards, given increased outage risk during icing conditions and weather events and tree incidents. The EDIIP treats as a high priority replacement of now obsolete copper, difficult to procure and more lengthy and costly to address following outages. Some unshielded conductor falls into this high priority category, with the remainder classified as a moderate priority. The high priority replacement candidates comprise 14.4 percent of the HVD system's conductors and the moderate category another six percent. Consumers has identified its 30,000 vintage insulators as the largest driver of HVD system outages, classifying them as another high priority replacement category.

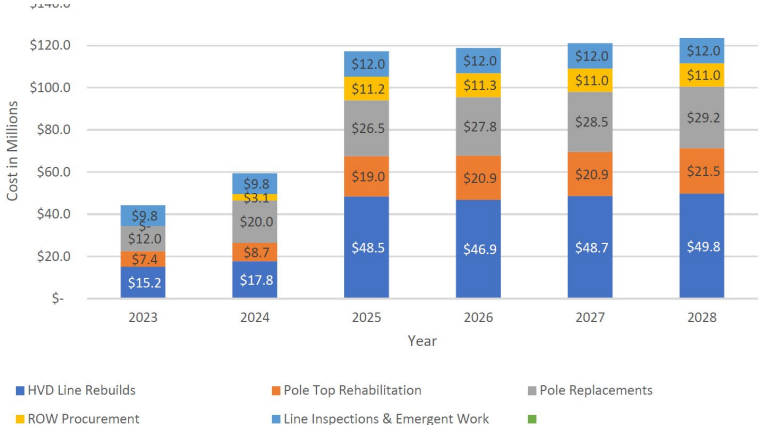
HVD pole inspection employs a 12-year cycle, supplemented by annual helicopter and ground patrol inspections for all of them. The latest pole health assessment shows one third of them over 60 years old and 19 percent at between being 40 and 60. These age characteristics make them a replacement priority for Consumers, using pole inspection results to prioritize them. Historical data indicates that 11 to 15 percent of HVD poles inspected annually will fail, thus qualifying them for replacement.

The EDIIP expresses a desire to "eliminate poles, pole tops, conductors, and switches that have exceeded their life expectancy through fixing and fortifying assets." The Company considers outage history, conductor type, shielding, and potential customer impact from outages to prioritize work, in light of average incident rates and customer outage minutes over a rolling three-year period. The EDIIP calls for annual replacement of about 13,000 insulators, 77 miles of conductor, and 1,500 poles per year. Consumers further proposes the eventual elimination of all non-standard conductors by 2032 and vintage, victor-type insulators by 2042, and poles beyond life cycle in 20 years.

The annual helicopter inspections that supplement 12-year cycle ground inspections permit visual observation and infrared and ultraviolet camera coverage of all but 400 miles of the HVD system. Consumers estimates that completing ground and helicopter patrols will save 10 SAIDI minutes. The EDIIP projects five year costs of $495 million for its HVD Lines work plan, which calls for annual line rebuilds or rehabilitation of 175 line miles per year and replacement of approximately 1,200 poles per year.

The next table summarizes the EDIIP investment plan for HVD Lines.

HVD Lines Investment Plan



2. Conclusions

17. Over-reliance on pole age as a factor driving replacement exists for HVD poles, as it does for LVD poles. *(See Recommendation #8)*

We found sound the EDIIP's pole top rehabilitation plans. However, using age as a factor in determining pole replacements raises the same issues addressed with respect to LVD poles earlier in this chapter. Rejection rates and their application to drive replacement decisions, again as for LVD poles, also appear high.

18. It is not clear that rebuilding lines based on their use of non-standard and obsolete construction or equipment will materially enhance reliability performance. *(See Recommendation #8)*

The EDIIP qualitatively discusses added reliability risks and incremental maintenance costs of maintaining HVD lines that employ non-standard and obsolete construction or equipment. Notably, a number of other measures for which the EDIIP plans work to maintain and enhance HVD reliability can have applicability to such lines as well. These measures include forestry work, pole top rehabilitation, and line inspection and emergent work. As a group, the EDIIP plans material increases in expenditure for these measures. What incrementally rebuilds will accomplish in terms of reliability maintenance and enhancement is not clear. However, it is clear that rebuilds will (including right-of-way needs identified by the EDIIP) consume essentially $400 million of EDIIP investment, compared with total rebuild amounts of only $15.2 million in 2023.

Annual EDIIP pole replacement estimates of $26.4 million are somewhat more than double the 2023 value of $12.0 million, representing across the EDIIP period a difference of about $72 million.

3. Recommendations

8. Eliminate age as a factor in identifying HVD poles for replacement and evaluate the conditions required to support replacement on inspection of 100 percent of rejected poles. *(See Conclusions #17 and #18)*

Use of age as a material in deciding to replace poles does not comport with industry experience, with our field observations about pole condition, or the reasonably high quality of Consumers' pole inspection and maintenance practices and cycles. Consumers should limit replacements to strictly condition-based factors identified through inspection and maintenance activities. Replacing poles that fail inspection ("rejected poles") is generally appropriate, but leaves for answer the question of defining rejection. The Consumers expected rejection rate appears high for what we know about system inspection, maintenance, and repair/rebuild practices, and from what we directly observed in the field. Consumers should review its population of rejected poles to determine whether it would prove cost beneficial to narrow the numbers slated for replacement due to rejection.

Generally speaking, outside of work to address capacity needs and to address as necessary hazard trees, we did not find substantial need or benefit in increasing levels of spending on HVD facilities, given their high reliability performance already and the effectiveness of inspection, maintenance, and repair practices.

G. Metro System

1. Findings

The principal Metro system facilities include conductors in duct banks encased in concrete, transformers and switching points in underground vaults and smaller manholes, and pad-mounted switchgear (switches and fuses) in above-ground steel enclosures. Oil-and-paper-insulated, lead-sheathed conductor that still forms part of the Metro System is no longer manufactured. Consumers assigns expected lifecycles of 45 to 62 years for Metro assets, much of them initially installed from 1910 through the 1950s.

The next table summarizes average lifecycles for Metro assets along with the average ages of assets retired between 2017 and 2021. Many assets are beyond their expected useful life, with some assets functioning for more than double the expected life. Confined spaces, exposed electrical equipment, and lead cable in the system create worker safety risk. Consumers has rated the risk of Metro system locations and facilities using scoring that rates seven civil and 12 electrical factors. Inspections using this scoring system have identified 27 percent of vaults exhibiting moderate or significant deterioration. Unlike health scoring for some other Consumers electrical system assets, the vault assessments do not apply an age factor.

The EDIIP proposes regular inspections on four-year, annual, or as needed cycles, at an annual cost of $1.5 million. The EDIIP proposes annual investments sufficient to rehabilitate four and

deadfront two vaults, and replace obsolete civil and electrical facilities and equipment. These investments total $51.5 million over the EDIIP period, which represents about a 25 percent annual increase above the 2023 level. Consumers does not project material, measurable SAIDI minute reduction from Metro System work.

2. Conclusions

19. The Metro system inspection program and proposed EDIIP investments appear sound in addressing the conditions of a sizeable portion of its vaults, which impose physical and electrical safety risk and access/working condition constraints.

Consumers has identified a quarter or so of the Metro systems vaults as sufficiently deteriorated to warrant vault rehabilitation or deadfronting, replacement of obsolete physical works and electrical equipment, and replacement of crushed ducts. Performing regularly cycled inspections and addressing these conditions and modernizing lead cable are sound and will come at moderate cost.

3. Recommendations

We have no recommendations regarding EDIIP plans regarding the Metro System.

H. Other Measures

This section addresses a number of other EDIIP planning elements, including system protection relays, meters, and streetlights. It also addresses two other groups of measures, Technology, Analytics, and Grid Modernization comprises one and Next Digital Investments the other. The Company initiated its Grid Modernization program in 2011, with the purpose of evaluating industry best practices and replacing obsolete technologies to improve grid operations and reliability. Management approved a new program charter for its Grid Modernization Implementation Program in October 2022. Foreseeing a doubling of customer efficiency programs and increasing renewable energy sources in bulk and at the distribution level, the near term strategy seeks enhancement of the capabilities of its ADMS, including enhanced data management, cyber security, and a DERMS application. After completing these enhancements, Consumers plans investments for business model and platform capacities, operational capacities, infrastructure improvements, engineering and planning capability, work execution capabilities, and data management capabilities. However, the Company did not provide details or specifics related to those enhancements. The third phase of the implementation will focus on integrating, consolidating, enhancing, and balancing the results of these investments to:

- Improve grid resiliency, resiliency, and power quality
- Make new hardware, software tools, and technologies scalable and sustainable
- Optimize management and utilization of electric assets
- Integrate diverse energy resources
- Enhance cost-benefit analyses for program and project initiatives
- Enhance visible management of program's Key Performance Indicators.

Expected benefits include:

- Automated and enhanced outage response to reduce SAIFI and CAIDI and restoration costs

- New and improved grid monitoring and control to enhance situational awareness, asset lifecycle management, and grid modeling
- Greater power quality optimization
- Enhanced protective device interoperability
- Enhanced training and resource deployment processes.

1. Findings

a. System Protection Relays

The Consumers system employs 5,336 relay panels, which house five electromechanical relays and ten solid state relays or two digital relays. Following the occurrence of an electrical fault, protective systems like those these panels comprise seek to isolate the minimum portion of the network. Confining the network portions de-energized reduces outage impacts and prevents broader damage to system equipment. Management has found 82 percent of these relay panels of acceptable health or not at the end of their life cycle, leaving 18 percent "older than the designated design life." Deterioration of relays causes them more frequently to cause outages by operating when they should not or extending outage scale and equipment damage by not operating when they should. Such relays require more frequent testing and calibration to ensure proper operation and non-operation.

Consumers plans to replace all end of life relays with modern versions by 2031. From 2024 through 2028, the EDIIP calls for $20.1 million in total capital replacement costs and a constant $700,000 per year in O&M. These amounts accommodate 42 replacements in 2024 and 50 in each of 2025 through 2028.

b. Meters

The system employs 1.18 million 4G LTE meters installed on the Company system. Consumers plans to replace them with 4G CatM1 or 5G meters prior to a communications network sunset date (as yet not formally announced by the provider). As part of a nine-year, $406.4 million plan to replace 4G meters with 5G compatible meters by 2032, the EDIIP incorporates a total investment level of $169.3 million in replacement costs for about half (500,000) of the 4G meter population now on the system.

The launch of 2G came in 1991. The phase out of 3G began somewhat more than 20 years after its 2001 commercial launch. The launch of 4G came in 2009.

c. Advanced Distribution Management System ("ADMS")

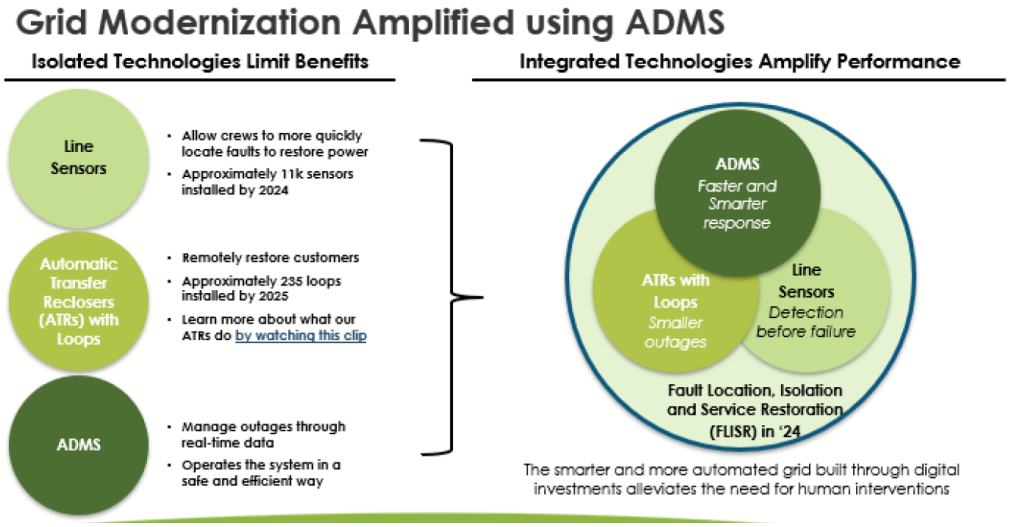
Prior to 2022, Consumers relied substantially on SCADA and its Geographic Information System ("GIS") to manage outages using a conventual outage management system ("OMS") integrated with Customer Information applications and Field Mapping. That mapping gives field resources direct access to grid maps. In 2022, Consumers integrated its OMS with its new ADMS. The first Grid Modernization Program phase involves integrating new applications with the Company's ADMS. The ADMS includes the legacy OMS and its applications, plus a DMS that integrated a Volt-Var reactive current control function. It is working to fully integrate Advanced Meter Infrastructure ("AMI") data, a Distribution Power Flow application to allow grid operators and

engineers to better monitor and study power flows, and the Fault Location Isolation and Service Restoration ("FLISR") application.

FLISR will use line sensor data to better locate faults and for providing automatic or operator controlled switching to restore service to customers not on a faulted circuit section. FLISR will allow grid operators to monitor and control the operation of ATR loops and the control of mid-circuit reclosers that have communications abilities. Grid operators and engineers currently can identify fault locations from line sensor data, but not through ADMS use. Consumers plans full integration and functionality of the applications involved by 2025 in the ADMS. Fault location and restoration by automatic switching will reduce sustained customer interruptions and restoration times, and give field responders direct access to fault location data.

The EDIIP's Technology, Analytics, and Grid Modernization measures include completion in 2024 of in-progress work on its ADMS. ADMS operation supports in real time better informed decisions to improve efficiency and restore service more quickly. ADMS software platforms coordinate operation of distribution and outage management systems, in Consumer Energy's case, its Distribution Management System ("DMS"), Field Mapping Applications, Electra OMS, and related outage tools aggregate outage information. An EDIIP graphic illustrates this coordination.

ADMS Benefits



The Consumers ADMS relies upon its SCADA capabilities, its GIS, and on the capabilities of its Advanced Metering Infrastructure or "AMI" to collect metering information from across the system. The EDIIP describes planned ADMS enhancements as implementing a Field Mapping application and adding Fault Location Isolation & Service Restoration ("FLISR") and Switching Order Management ("SOM") capability.

Field Mapping will improve field efficiency by giving crews real-time circuit maps and damage assessment information, will improve online outage mapping for customers, and reduce restoration times. FLISR will allow electronic reclosers and line sensors to identify fault locations, reroute power areas affected, and reduce downed wire hazards. SOM will allow personnel to generate switching orders that command and verify automatic switching, saving outage response time. The

EDIIP also contemplates secondary enhancements through expanded automation and digital tools. Consumers projects that, on a combined basis, 2024 completion of ADMS work and installation of line sensors (discussed immediately below) will generate SAIDI reductions of 15 minutes on LVD lines.

d. Line Sensors

Line sensors help grid operators identify fault locations indicated by an alarm (in ADMS, when integrated) of low current transient faults before an outage occurs. Such alarms allow system operators to send responders more quickly, which often allows actions that prevent sustained outages. The Company began installing line sensors in 2019, installing 8,145 by the end of 2023. Consumers selects line sensor locations based on historical reliability, fault events circuit length, and the number and types of customers.

The EDIIP's Technology, Analytics, and Grid Modernization category also addresses sensors. The Company's current population of 8,000 LVD system 500 HVD system devices detect faults and their probable locations. These sensors, critical for establishing FLISR capability also provide loading, phase balance, momentary outage, disturbances, alarms, and other information. The information they provide is not only important for operational, but also for planning purposes. The EDIIP plans installation of more than 12,000 LVD system sensors, which will support FLISR.

e. Voltage Regulators

The EDIIP's Technology, Analytics, and Grid Modernization measures also include the installation of voltage regulators. The EDIIP calls for 2024 through 2026 voltage regulator expenditures of $16.9 million. Consumers assigns no SAIDI minute reductions to voltage regulators.

f. Distributed Energy Resources ("DER") Optimization

The EDIIP's Technology, Analytics, and Grid Modernization measures also address DER management. Consumers plans to deploy, along with other hardware and software projects, a centralized DER management system (DERMS) to manage bi-directional power flows, power quality, and third-party interconnections as DER penetration increases. The EDIIP projects DER Optimization expenditures of $39.9 million from 2024 through 2028. As more DERs interconnect with the grid, DERMS will allow grid operators to control DERs to prevent circuit and substation voltage and loading issues. DERMS remains in early planning stages. Consumers assigns no SAIDI minute reductions to DER Optimization.

g. Distribution Asset Management ("DistAM")

The EDIIP's Technology, Analytics, and Grid Modernization measure also include development of a centralized and standardized asset management strategy, in order to apply a unified set of principles and processes to maximize asset usefulness value realization. EDIIP measures call for collecting key asset data to drive a risk-informed and value-based method for managing asset investments. The Company expects the system to reduce capital and O&M costs, outages and restoration costs, power quality issues, and system losses. It also expects increased asset availability, deferred depreciation, and reduced asset degradation. EDIIP costs assigned to DistAM

from 2024 through completion in 2027 total $19.3 million. Consumers assigns no SAIDI minute reductions to DistAM.

h. Next Digital Investments

The EDIIP plans a series of other digital investments totaling $20 million through 2028, projecting material SAIDI reductions following their institution:

- Internally-developed Transformer Analytics modeling it expects to complete in 2024. The Company will use the model to identify imminent transformer failures to permit prior replacement (one minute SAIDI reduction; $4.0 million in expenditures)
- Internally developed a Restoration Wait Time Tracker to support management of storm response (0.5 minute SAIDI reduction; $1.5 million in expenditures)
- Replacing the Catastrophic Crewing ("CatCrew") resource management tool that captures information about resources engaged in restoration, their HQ location, work and rest time periods, and lodging and food requirements (one minute SAIDI reduction; $8.0 million in expenditures)
- A one minute SAIDI reduction from 2025 completion of an Anomaly Detection Analytics capability that will use sensor data to identify conditions likely to cause outages (*e.g.*, asset deterioration, tree branch interference)
- A 1.5 minute SAIDI reduction beginning in 2025 from increased use of technology in the Forestry Line Clearing through Forestry WISE (discussed above); *e.g.*, through use of more granular data in planning and executing clearing work
- A two minute SAIDI reduction from Imagery Analytics, altering drone use and adding automation and machine learning.

2. Conclusions

20. We found the EDIIP treatment of relays sound.

The plans that the EDIIP presents for relays parallels what we have seen at other utilities facing the need for replacing legacy relays with modern versions. The proposed 2024 through 2028 amounts appear moderate under the circumstances.

21. The Consumers plan for completion of 4G to 5G meter replacement is consistent with historical cycles in the industry, but subject to uncertainty. *(See Recommendation #9)*

Consumers needs to plan dynamically when it comes to the sunsetting of communications technology, for which the past has certainly not proven prologue. However, starting with 2G the launch cycle has been about 20 years, which fits with a proposed 2032 completion date for the replacement of 4G meters. The EDIIP shows replacement rates through 2026 that are not out of line with the 20-year replacement cycles that apply to meters generally (*i.e.*, to address factors other than communications technology). The rates rise significantly starting in 2027, which allows for deferral if 4G sunsetting is delayed and leaves time for increase if accelerated. This approach also moderates the already significant electricity price pressure created by other investments in the EDIIP period. However, particularly given those pressures, it will remain important for Consumers to continue to revise later year acquisition levels as more certain information about the end of 4G support emerges.

22. Expected 2024 completion of planned ADMS work for a cost of somewhat less than $3 million comprises a sound investment.

Enhanced ADMS capabilities have become an increasingly widespread means for allowing systems critical to system operations, fault location, damage assessment, remote restoration, field awareness and movement to operate together on a real-time basis. Such capabilities make a material contribution to improving reliability measures and the efficiency of resources who must respond to system upsets.

23. The planned installation of line sensors is sound.

The planned 2024 completion of line sensors on primary circuits for a moderate cost will materially assist Consumers in detecting fault locations. These sensors also provide the capability to track a variety of operating information, such as loads, phase balance, momentary outages, line disturbances, and alarms. They provide more accurate load information for system planning and their provision of real time information facilitates load transfers during outages.

24. The voltage regulators the EDIIP proposes are sound.

The expenditures are moderate and in line with what one can expect for a system like that of Consumers.

25. Addressing DERMS as the EDIIP describes is prudent in light of the state's climate and environmental goals.

There has been significant variability and uncertainty about the pace of DER introduction across the country. However, where clear and strong goals exist, utilities that must accommodate their grid consequences should they come, and need to be prepared to do so. Creating the core systems needed, particularly at the moderate cost the EDIIP indicates, is in keeping with sound planning in this area.

26. The EDIIP's proposal for creation of DistAM comports with our recommendations about enhancing asset management.

The system appears designed to support a programmatic, analytically founded, and data driven asset management strategy, all of which are in keeping with our recommendation.

27. The EDIIP's Next Digital Investments measures reflect a sound and reasonably contained commitment to exploring and developing digitally supported means for grid and personnel management.

Whether each measure will produce projected or even individually any material SAIDI minute reduction, all appear well designed to address factors clearly related to outage prediction, prevention, and response. They warrant the investment proposed and demonstrate a sound commitment to exploring how technology can advance performance in maintaining and improving reliability.

3. Recommendations

9. Perform and continually update 5G transition plans to keep them consistent with 4G sunset expectations in a manner that unburdens EDIIP period expenditures. (*See Conclusion #20*)

We do not question the plan as presented, but recognizing its significant uncertainty (and given the relief that will come if it can be stretched out, and particularly the added stress that will come if it must be compressed) it is important that Consumers continually assess potential movements in this cost area.

Chapter III – Emergency Planning and Response

A. Background

Effective Emergency Planning and Response ("EP&R") for electric utilities involves identifying and planning for weather events and other service disruptions, such as those caused by natural disasters, cyber or terrorist attacks. It includes as well effective, efficient, safe, and timely restoration of customers experiencing outages. It should provide for:

- Continuity of Service: Electric utilities have responsibility for providing reliable power supply to their customers. An effective emergency plan and its execution helps to minimize the impact of power disruptions and provide for quick and efficient service restoration when required.
- Safety: Emergency planning and response should protect the safety of utility workers, who need to perform repairs or maintenance in hazardous conditions, and the safety of first responders and of the public potentially put at risk from downed power lines or other electrical hazards.
- Regulatory Compliance: Most jurisdictions have regulations requiring electric utilities to have an emergency plan in place and many have service quality standards associated with EP&R.
- Reputation Management: A well-managed emergency response helps protect the Company's reputation. On the other hand, a poorly managed response can lead to negative publicity and loss of customer and public trust.
- Risk Management: EP&R assists electric utilities in managing risks associated with significant service interruptions. By planning for these events, utilities can reduce the likelihood of their occurrence and minimize their impact when they do occur.

We reviewed Consumer's EP&R function as it relates solely to weather events, not other potential causes of service disruption, such as cyber-attacks, geo-magnetic events, or attacks on key electric facilities. Our review focused on planning, internal and external communication, processes, tools, and execution underlying this critical function. The organization of this chapter of the report includes a review of the following:

- EP&R Plan and Organization
- Pre-Event Planning
- Event History
- Storm Impact Forecast Accuracy
- Restoration Performance
- Wire Down Processes and Performance
- Restoration Budgeting.

This chapter also includes a section on compliance with MPSC rules and metrics. The next chapter addresses outage communication related topics (*e.g.*, liaison with government officials, development of estimated times for restoration ("ETRs"), and communication to affected customers).

B. Findings

1. Emergency Preparedness and Response Plan and Organization

This Section of the report discusses the emergency planning organization and the major planning document used by Consumers for storm preparation and management. Emergency plans comprise a ubiquitous aspect of every electric utility emergency preparedness toolkit. These plans should provide a ready source of information, direction, processes, procedures, organization, schedule, notifications, and contact data, among other subject areas, to company personnel involved in planning for and executing restoration activities following weather related events that cause service disruptions. Plans should be comprehensive in nature, widely and easily available to affected personnel, well-structured for ease of communication and understanding, and reflect current organizational structures, position roles and responsibilities, reporting requirements, and processes and procedures.

Organization structure and staffing for emergency planning and response (EP&R) groups varies widely among utilities, with key characteristics of successful EP&R organizations including visible and vocal support from upper management, strong leadership, experienced, knowledgeable staff in key roles, communicating planning documents to the wider utility groups and individuals that will assume central roles prior to, during, revising those documents as necessary, and post restoration.

a. Emergency Planning Documentation

Consumer's Electric Emergency Response Plan ("EERP"), also known as the Storm Response Manual ("SRM"), reflects Consumers adoption of the National Incident Management System ("NIMS") and the Incident Command System ("ICS") for electric restoration activities and emergency response. Consumers intends the plan to align with its All-Hazards Emergency Operations Plan ("EOP"). The EOP provides a standardized response process, organization, and terminology for all hazards involving Company electric facilities and/or operations, regardless of event or condition type, size, and complexity. Consumers fully adopted the ICS in 2019 based on the NIMS emergency management structure, concepts, and principles. The two-volume Consumers SRM totals over 1,000 pages, with a table of contents alone that approaches nine pages. Consumers organizes its SRM into the following 11 major chapters:

- High Level Procedures
- Preparedness
- Processes and Work Instructions
- Role Checklists
- User Guides
- Forestry
- Process Maps and Visual Aids
- How to Videos
- Forms
- Damage Assessment
- Electra OMS (ADMS)

Each Chapter has numerous sub-chapters explaining and expanding upon the various aspects relevant to the Chapter's subject matter, including, for example, hyperlinks to forms, contact numbers, and checklists, where appropriate. Importantly, the SRM presents descriptions and details of roles and responsibilities. The SRM addresses development of plans, updates and communication functions during an event for each major ICS module which is "stood up" (or

activated) for a particular weather event. Those modules include Command, Planning, Operations, Logistics, and Finance/Administration.

We found the SRM professionally prepared, comprehensive, detailed, and seemingly up to date. All 1,000 plus pages bear the same October 10, 2023 date. It was not clear, however, if each chapter reflects updates as of that date, or whether only a small (or large) number of chapters were updated as of that date. Critical documents of this type typically include signature box(es) identifying "author" or "reviewer," what was reviewed and updated, review date, a revision history, and an approval box from the individual responsible for maintenance of the document, or sections of the document. The PDF versions of the SRM that the Company provided do not provide that revision history information. Consumers has stated that a web-based application hosts the SRM and that this version provides automated revision tracking and a search function allowing users to type in key words to find content.

The SRM, while thorough and detailed, has a somewhat daunting size that may make it unnecessarily difficult to navigate and absorb for new employees or those of longer tenure but new to a particular emergency role. SRM chapters have sub-numbers, but further detailed taxonomy within each chapter and page numbering would provide greater navigability.

The conduct of drills and exercises form central elements in ensuring familiarity with the SRM and the various roles, responsibilities and processes it details and the manual itself specifies the conduct of an exercise at least annually. The following table provides the dates of exercises undertaken.

Storm Related Drills and Exercises

Year	Month/Day
2019	June 4, 6, 11, 13, 19, 21, 24 25; July 25, 26
2020	December 8, 10
2021	April 14, 21
2022	May 23, 24, 25, 26; June 7,8, 9
2022	September – December (no specific dates)
2023	April – November (no specific dates)

Real world incidents designated level 1 (the highest of four incident levels, as described below) may satisfy the requirement for an annual exercise. The Emergency Management & Public Safety Department works with the business area when these situations arise to complete the required documentation; *e.g.*, Incident Action Plans ("IAP") or After Action Reports ("AARs").

b. Organization

The Consumers Restoration Management ("RM") group serves as the central repository for event-related documentation, and has responsibility for weather monitoring, internal pre-event communication, certain restoration-related communications, and regular review, analysis and coordination of storm related improvement activities. Restoration Management plays an integral role in the effective functioning of Consumer's storm response. A General Manager reporting up to the Executive Director of Grid Management leads this group, with support from six Incident Response Analysts (including a Manager of Incident Response) and a Storm Resource Manager

for a total of eight full-time staff. It has acted as a permanent group since 2014; *i.e.*, unlike an Incident Command organization formed for a particular weather event and then demobilized post event, Restoration Management remains an active unit of the Grid Management organization.

Restoration Management staffing increased from 11 in 2021 to 14 in 2022, before decreasing to the current level of 8 in 2023. Resources outside Restoration Management perform activities and develop capabilities related to event planning and restoration (*e.g.*, a tool such the Live Wire Down Detection application). The group's current light staffing belies its importance and the Incident Response Analyst job title also understates its importance in event management and restoration. Analyst core tasks include:

- Pre-planning storm events
- Running storm events primarily as the Incident Commander
- Coach/Train storm responders both before and during the storm
- Update Work Instructions and create new standards as needed
- Prepare and conduct AARs
- Participate on problem solving teams, lead initiatives, and project management.

Incident Response Analysts execute their emergency responsibilities on a "two weeks on" "two weeks off" schedule to serve primarily in the Incident Commander position for storm response, as necessary. Interestingly, the Restoration Management Analysts serve as Incident Commanders for storm response, but none, except for the General Manager of the group, has served in the role of a state-wide Incident Commander. We found Restoration Management leadership experienced, knowledgeable, and engaged. Senior management demonstrates awareness of and support for keeping Restoration Management an efficient and effective organization. It is not apparent, however, that sufficient bench strength exists to assume the duties of the current Restoration Management leadership and perform at the same level of effectiveness. Consumers has, however a succession plan for this operationally critical role and has identified potential successors.

The Restoration Management team historically had no meteorologist on staff; however, we learned during work on this engagement of the approval in June of 2024 of a meteorological position. Consumers anticipates a late fall 2024 start date for the new hire. No IT specialists or professionals with strategy development as an identified functional responsibility exist within the group either. Given that Consumers has indicated they are now exploring the use of Artificial Intelligence to drive improvements in its storm restoration processes, an IT resource with strategy development expertise embedded within Restoration Management might prove helpful.

No industry standard prescribes types or numbers of staff for a centralized restoration management team. Nevertheless, the emphasis that Consumers placed in its Electric Distribution Infrastructure and Investment Plan ("EDIIP") on climate change and the increasing severity and uncertainty surrounding weather event impacts, warrant a careful and considered review of RM staffing levels and resident expertise within the group.

Consumers stands up an Incident Command Center ("ICC") depending on storm size. Consumers also uses the ICC model at the regional, or Work Management Center level for more localized events within its service territory. The ICC, per Federal Emergency Management Agency

guidelines, establishes five functional areas for ICS-based management of incidents: command, operations, planning, logistics, and finance/administration. In addition, key ICC responsibilities include development of written Incident Action Plans that describe the overall strategy for managing an incident. These plans describe an organized course of events necessary to address all phases of incident control within a specific time. They may include the identification of operational resources and assignments, and attachments that provide direction and other important management information. Consumers storm response organization reflects this structure and those key storm responsibilities.

2. Pre-Event Planning

Forecasting event type, characteristics, magnitude, timing, and potential impacts should result from an interplay of numerous inputs, from hard data, such as weather parameters, which change constantly, to estimates of the downstream storm impacts and the resources necessary to provide adequate, timely, and effective service restoration. Weather forecasting serves as a foundation for event forecasting, which then supports estimates of storm damage and resource requirements, which then provide the basis for appropriate event classification to mobilize and scale Consumer's emergency response teams effectively. This report section discusses weather services organization and functions and use of third-party outage forecasts to provide estimates of the number of outage events and affected customers for a given event. These planning aspects combine to provide the bases for event classification and resource acquisition and deployment.

a. Weather Forecasting

Consumers contracts with two third-party vendors, DTN and IBM, to provide weather forecasting and weather-related services. Both vendors operate as established, well known, and respected providers of these capabilities. The services provided by each vendor include:

- DTN
  - At least a twice daily weather report for Consumer's service territory
  - A daily call with a professional meteorologist and more frequently as needed if increasing or uncertain weather is anticipated
  - 24/7 service if discussions with a professional meteorologist are needed
  - Web based chat feature
  - Weather map showing key weather information
  - Long range forecasts looking out several months
- IBM
  - A weather map showing key weather information
  - An outage prediction model.

Consumers reports that it also uses publicly available resources that include, for example, the National Weather Service stations at Grand Rapids, Gaylord, and Detroit, and its Climate Prediction Center. Generally, Incident Response Analysts in the Restoration Management group have responsibility for daily weather monitoring, communication with vendors, interpretation of input from vendors, and internal alerts and other communication within Consumers. DTN and IBM outage weather maps track and monitor existing storm systems as they approach Consumers service territory and pass. A professional meteorologist from DTN hosts calls with Restoration

Management and operations staff each morning during which the meteorologist covers the forecast for the service territory. The Restoration Management team asks clarifying questions, if necessary, regarding the weather. Depending on the forecast, pre-planning can be triggered to organize a response and to mobilize and pre-stage line crews in areas expected to be affected by an impending storm.

Filling the recently approved hiring of a professional meteorologist should provide a significant upgrade over current internal meteorological expertise and enable more Consumers-specific analysis and interpretation of forecast data. Meteorology involves more than tracking and reporting weather conditions; it can assist in considering the many variables attendant to weather system impacts on specific infrastructure on the ground, analyze previous history for trends and insights into potential future impacts, and work with operations personnel to develop effective regional and system-wide asset management strategies that reflect the changing nature of climate and event impacts on operational decisions.

Weather forecast accuracy has value to the extent that it provides the basis for credible experiential-based decisions or for objectively modeling outages or damages to help in identifying needed resources and restoration times from an anticipated event. IBM's outage modeling platform provides that data and analysis capability.

b. Outage Modeling

While DTN and IBM offer both weather forecasting and outage and damage prediction services, Consumers divides the responsibilities and contracts with IBM (since 2021) to employ IBM's Outage Prediction model but depends primarily on DTN's weather forecasting services. This unusual splitting of the two services, using two models, appears to have the potential for introducing inconsistencies between the weather and outage forecasts, particularly in larger storms with more pronounced weather vagaries.

As described by IBM, its Outage Prediction service combines utility inputs, such as service territory maps, mobilization tiers or levels, and historic outage data, with current and forecasted weather data to create a customized model that makes predictions about outage numbers and outage types. The predicted outages are categorized based on the mobilization tiers of the utility.

The Restoration Management team comprises Outage Prediction's primary users and they interpret the outputs for the operational staff. The results of the model provide the predicted number of outages, indicating the projected size and scale of the storm. The number of outages predicted drives decisions on the number of resources to secure as part of the pre-planning process. The model also offers a storm level classification (discussed below) established in conjunction with IBM. Consumers describes outage prediction as primarily serving to help determine the numbers and types of line crews and field leaders needed to complete restoration activities associated with the storm event and its consequences. The Company's in-house developed Catastrophic Storm Crewing software includes a Crew Projection & Days to Restore Calculator. This calculator allows the Restoration Management team to model projected numbers of outages, broken poles, and crews needed based on a date assigned for completion of restoration. Using that output, Storm Restoration Manual 3-55 guides the determination of the number of field leaders (Circuit Restoration Coordinators) required to manage contractor crews. Notwithstanding IBM's model

predictions, Consumers indicates that it leverages internal experience to test outage model results when going through the preplanning process, comparing the outage forecast with historical information, and adjusting IBM's forecast when appropriate.

While a review of actual versus predictive accuracy provides an important test for any model, Consumers indicated that it has not conducted any analysis of the accuracy of IBM's Outage Prediction model since first contracting for the service. With commencement in April 2024 of the archiving of IBM's predictive data, testing of its predictive accuracy will become available. Notwithstanding the lack of a complete data set, Consumers provided information on predictions of outages and wires down for this year's January 9 to 11 and January 12 to15 storms which the next table summarizes.

Actual vs. Predicted Outages

Condition	1/9/24 to 1/11/24		1/12/24 to 1/15/24	
	Predicted	*Actual*	*Predicted*	*Actual*
Outages	500	1,753	2,500	4,059
Wires Down	300	1,064	2,000	2,821

Data from only two storms will not support strong conclusions about model accuracy. However, the data does at least offer the opportunity to begin to learn about model accuracy. Neither of the two storms proved large; nevertheless, actual numbers of outages and wires down exceeded predicted ones by at least 40 percent and by as much 300 percent. Consumers plans to release this year a request for proposals to review vendor outage prediction model alternatives.

c. Event Classification and Communication

The Consumers Storm Restoration Manual defines the start of a storm event both internally and in reporting to the MPSC as when "the hourly interruption count first exceeds 20 per hour on a sustained basis, for more than 2 hours" The Manual sets storm end time at the "second consecutive hour of less than 20 outages restored." Storm (Incident) classification drives command and control responsibility, as the next table summarizes. Work Management Centers ("WMCs") comprise a regional operating organization described later in this chapter. A centralized Emergency Operations Center ("EOC") has responsibilities for incidents classified above Level 0.

Storm Incident Classification: Command and Control

Incident Level	WMC	EOC	Crisis Management Team
Level 3 – Full Crisis	WMC Incident Commander	Statewide Incident Commander	Officer-in-Charge
Level 2 - Serious	WMC Incident Commander	Statewide Incident Commander	Officer-in-Charge *notified*
Level 1 - Elevated	WMC Incident Commander	Statewide Incident Commander *notified*	
Level 0 - Routine	Dispatcher or Dispatch Team Lead		

Consumers assigns a Level 2 classification when an event affects 50,000 customers and a Level 3, or a Catastrophic classification, as defined by the PSC, when an event affects 10 percent of the

Company's customer base, or approximately 180,000 customers. Consumers also uses a secondary storm classification to aid in storm analysis. The following table depicts this secondary classification.

Secondary Storm Classification

Number of Customers Out	Storm Classification
Less than 10,000	Not Classified
10,000 – 25,000	Small
25,000 – 50,000	Medium
50,000 – 100,000	Large
100,000 – 180,000	X-Large
Greater than 180,000	Catastrophic

Storm Classification should be timely, reflect predicted or actual conditions, and undergo wide communication to allow effective mobilization of Consumers' resources, and for securing any needed external resources, all in the interests of rapid and efficient service restoration. Given the importance of event classification to storm response, we gauged the timeliness of storm event classification by the degree to which it preceded or lagged event start. We made a comparison of event start date with the date of initial storm classification for all classified events from 2017 through April 2024 noting final event classification. During that period, Consumers reported 590 events, 454 of them classified as "Normal" and 136 classified from Small to Catastrophic. The Normal classification does not appear in the above table; it represents events with less than 10,000 customers interrupted.

Analysis showed that management did not classify any of these events prior to event start date. Neither did it change any classification for these events once made. These practices diminish the usefulness of classification as a catalyst for pre-event mobilization. We did not find however that the practices caused failure of internal communications to make information about potential storm size and impact widely known prior to an event. The SRM provides significant channels for information flow prior to event arrival. Rather, the gap exists in the degree to which official storm classification has driven preparation, as opposed to providing a post-hoc designation of what the Company experienced.

Restoration Management did, however, begin in late 2023 to publish a Daily Communication Report that presents a five-day look ahead that contains, among other useful information, outage prediction and resource requirement data and an ICS incident level prediction.

d. Resource Acquisition

Consumers' event level classifications provide no specific guidance as to potential resource requirements. However, outage predictions obtained from IBM, coupled with internal discussions and review and adjustment of those predictions, determines the number of line crews and field leaders needed to be secured to complete the storm event. As previously described, the Company's Catastrophic Storm Crewing software has a Crew Projection & Days to Restore Calculator. This calculator allows Restoration Management to enter the anticipated damage (*i.e.*, number of outages, damaged poles, downed wires) and the targeted restoration duration into the calculator to determine the needed crews. The number of field leaders (Circuit Restoration Coordinators) to

run/manage contractor crews is determined based on factors detailed in the Storm Restoration Manual.

Consumers notes that it makes available under normal operations approximately 140 crews and 60 Electric Service Workers. Vacations, sick leave, and training can cause these levels to vary. Based on their analysis of past operations, these numbers of resources enable effective response to approximately 420 incidents or 20,000 customer outages in a 24-hour period before additional resources are required. The Company made a significant change in how and where it secures external resources, turning away from the Great Lakes Mutual Assistance (GLMA) organization and toward off-system contractors. GLMA offers a means to acquire resources from other investor-owned-utilities in the Midwest area by coordination with other regional utilities. Management brings in non-Company resources when it determines it cannot achieve a targeted restoration duration using internal crews alone. Consumers has executed 43 separate contracts with companies that provide off-system crews, which it considers more cost-effective than using crews secured through GLMA. As Consumers has put it, "Having these contracts in place ensures resources are available for pre-staging in times of need and provides cost transparency that enables the Company to request resources from the lowest cost resources first."

Examining the numbers and source of resources secured over the period from 2017 through 2023 highlights the effects of this change in approach. The following table shows a strong shift in 2020 from GLMA to contractor crews. Consumers has used GLMA crews sparingly since 2019 while increasing contractor use significantly. The table also shows the absolute number of total contractor crews utilized more than doubling from 2020 to 2021 and remaining at a level approximating 1,500 even as numbers of storms storm declined in recent years.

Contractor and GLMA Crew Use

Year	Catastrophic		X-Large		Large		Medium		Small		Total	
	GLMA	Contr.	GLMA	Contr.	GLMA	Contr.	GLMA	Contr.	GLMA	Contr.	GLMA	Contr.
2017	353	95	61	68	--	45	--	53	--	44	**414**	**305**
2018	94	65	99	5	--	26	--	58	--	34	**193**	**188**
2019	505	154	--	31	--	114	--	44	--	80	**505**	**423**
2020	4	377	--		26	128	--	112	3	23	**33**	**640**
2021	37	684	--	151	--	390	--	128	--	225	**37**	**1,578**
2022	0	227	10	483	--	407	--	190	--	10	**10**	**1,317**
2023	35	949	--		2	344	--	283	--	35	**37**	**1,611**
Total	**1028**	**2,551**	**170**	**738**	**28**	**1,454**	**---**	**868**	**3**	**956**	**1,229**	**6,567**

The timing of requests for outside crews can prove critical to restoration duration and efficiency. Consumers does not capture that information, making it impossible to assess the quality of its timing decisions. Such information can provide important insights and lesson learned about how earlier or later external crew acquisition might have affected restoration activities; *e.g.*, through greater use of pre-staging. Such data could also provide insights into differences in responsiveness of GLMA and off-system contractors to Company requests. Contractor responsiveness has greater importance for larger, regional storms, which often produce competition for outside resources with

other utilities affected by the same events. Consumers plans to implement in 2025 an update to its resource management tool (Cat Crewing 2.0), whose enhanced capabilities will include acquisition and management of external resources.

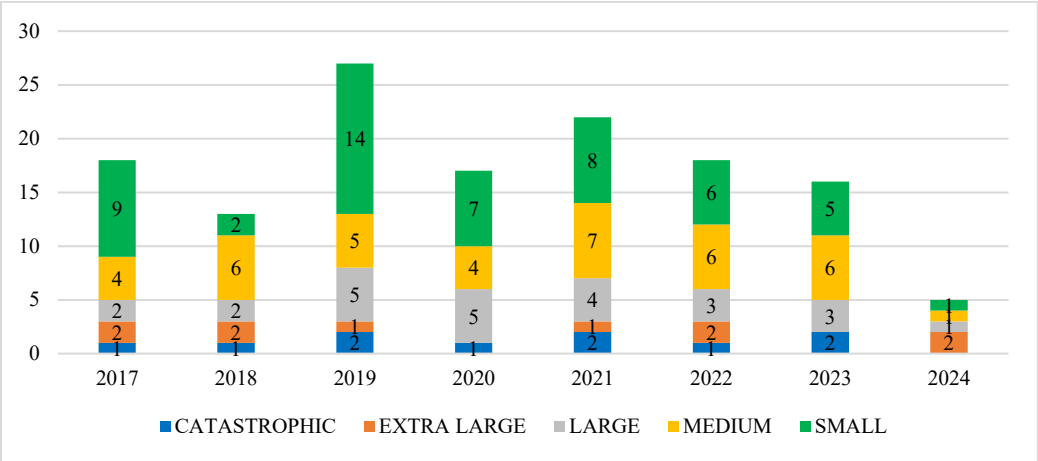
3. *Event History and Restoration Performance*

This Section of the report specifically reviews recent storm trends and the associated restoration performance.

a. *Event History*

The number and severity of storms experienced by consumers have moderated somewhat across the period from 2017 through March 2024. The next table shows uneven but clearly decreasing numbers of classified storm events (excluding storms less severe than the "Small" classification) over the period.

Number of Storms per Classification



Year	Cat.	X-Large	Large	Medium	Small	Total
2017	1	2	2	4	9	**18**
2018	1	2	2	6	2	**13**
2019	2	1	5	5	14	**27**
2020	1		5	4	7	**17**
2021	2	1	4	7	8	**22**
2022	1	2	3	6	6	**18**
2023	2		3	6	5	**16**
2024 (March)		2	1	1	1	**5**
Total	**10**	**10**	**25**	**39**	**52**	**136**

Numbers of total events have declined marginally. Numbers of storms classified as Catastrophic and X-Large have remained reasonably stable at one or two per year. However, the largest "Catastrophic" storm in terms of customers affected occurred in 2023, which left more than 435,000 customers out of service at some point. The largest "X-Large" storm occurred in early 2024, affecting over 190,000 customers. The numbers of "Large" storm numbers have declined

slightly over the past two years from around five events per year to three, while the number of "Medium" sized storms per year has remained relatively stable at about six to seven. "Small" storms, those that affect between 10,000 and 25,000 customers, show the most notable trend, declining from a high of 14 in 2019 to five in 2023.

Regardless of the number and type of classified storms, the annual number of hours with wind gust speeds 35 miles per hour and above have increased substantially. This trend in the need for fewer "Small" storm categorizations is not necessarily unexpected given the improved system performance as measured by SAIDI excluding MEDs since 2019. Consumers presented data in its 2024 rate case filing showing an increasing trend in wind gust speeds over the period from 2014 through 2023. Increasing wind gust speeds have produced a diminished effect on the network infrastructure over this period, resulting in fewer "Small" storm categorizations. However, that effect (*i.e.*, fewer "Small" storms) does not seem to carry over to "Medium" size storms, where the number of yearly "Medium" sized storms has remained stable. We did see a slightly reduced number of "Large" storms, reflecting a similar trend as in "Small" storms.

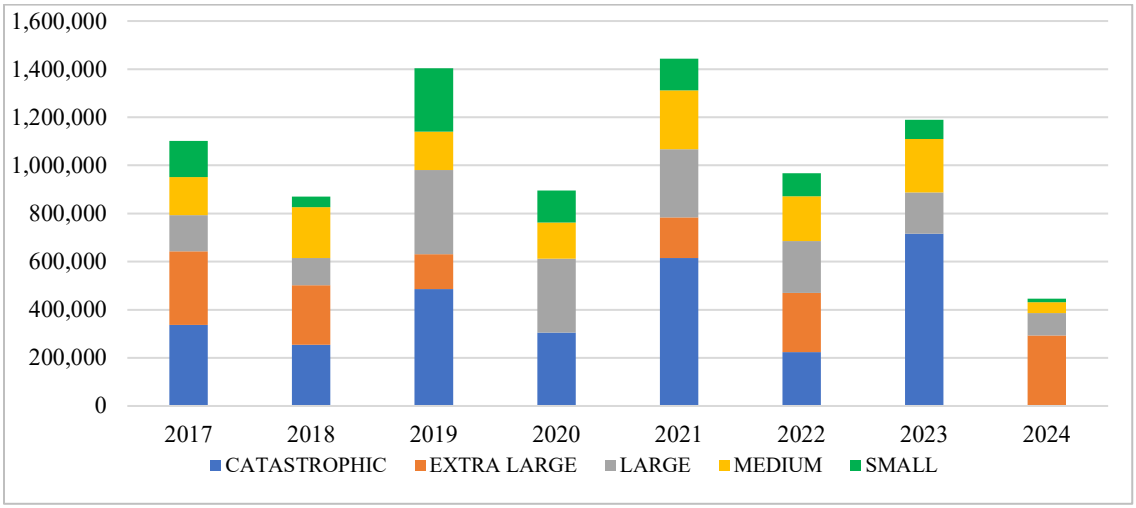
To summarize, the period has witnessed a stable, small number of Catastrophic and X-Large storms per year and similar stability in the number of Large sized storms. The most notable trend is a decline in the number of events that have produced classification as small storms.

b. Restoration Performance

Restoration performance, in terms of the time to restore customers' service, offers a particularly important metric in assessing the effectiveness of storm restoration management. Many factors contribute to this performance, including the ability to effectively pre-plan for events, acquire the necessary resources to meet restoration goals, effectively support, manage, and deploy those resources, and communicate effectively, internally and externally to affected parties.

We first examined the number of customers affected by each type of classified storm, shown in both tabular and graphic form, below. The more customers affected, the longer it will generally take to restore service. Not surprisingly, the largest number of customers affected come with Catastrophic storms. However, even those affect widely varying numbers of customers. Unlike less severe categories, Catastrophic storms have no upper limit on numbers of customers affected.

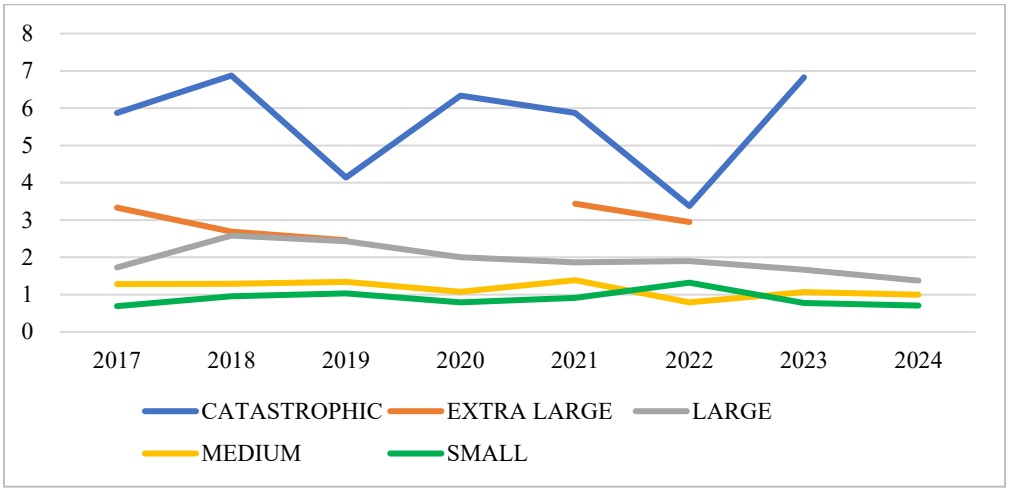
Customers Affected per Storm Classification



Year	Catastrophic	X-Large	Large	Medium	Small	Total
2017	336,745	306,265	149,570	159,326	149,967	1,101,873
2018	254,145	247,482	113,763	211,158	43,879	870,427
2019	486,491	144,674	349,398	159,821	263,033	1,403,417
2020	305,111		307,058	150,740	132,154	895,063
2021	615,218	168,285	283,901	244,854	131,092	1,443,350
2022	224,193	246,376	215,160	185,903	95,724	967,356
2023	716,632		171,030	221,735	80,629	1,190,026
2024		293,020	93,060	45,704	14,605	446,389
Total	**2,938,535**	**1,406,102**	**1,682,940**	**1,379,241**	**911,083**	**8,317,901**

We examined data measuring the length of time from when Consumers declared storms open to when it declared them closed. Consumer provides clear and reasonable storm definitions, but no universal classification exists in the industry. For example, one difference is that some utilities, especially smaller ones, define a storm event as closed only upon restoration of the last customer affected. The next table summarizes storm durations for each classified storm by year.

Average Length of Storm (Days) by Type



Year	Catastrophic	X-Large	Large	Medium	Small	Total
2017	5.88	3.33	1.73	1.28	0.69	1.52
2018	6.88	2.69	2.58	1.29	0.96	2.08
2019	4.14	2.46	2.43	1.34	1.03	1.63
2020	6.33		2.00	1.08	0.79	1.54
2021	5.88	3.44	1.86	1.39	0.91	1.80
2022	3.38	2.95	1.90	0.79	1.32	1.54
2023	6.82		1.67	1.07	0.77	1.81
2024		2.77	1.38	1.00	0.71	1.72

The table most notably shows general improvement in overall restoration durations for Small, Medium, and Large storms. All show restoration durations of two days or less for the 2020 through 2023 period. X-Large storms show improvement during the 2021 through 2022 period, but a moderate decline from 2017 through 2019 performance. Consumers did not experience any X-Large storms in 2020 or 2023. Not surprisingly, Catastrophic storms showed both the longest and greatest variability in storm duration. A Catastrophic storm's defining characteristic, a minimum of 10 percent of customers affected, ensures a longer restoration period as compared with those of smaller storms. The unbounded upper limit on customers affected also tends to produce a much greater variation in numbers of affected customers. The much longer duration of Catastrophic storms and greater variations in duration therefore come as expected.

Consumers met or exceeded the MPSC's restoration performance standards in 2023, except for those associated with Catastrophic storms. As described in the *Compliance with Reliability and Restoration Metrics* Section of this Chapter, Consumers did not meet the standard of 90 percent of customers restored within 48 hours applicable to Catastrophic storms.

We also examined factors that might influence Consumer's storm duration outcome, such as timing and levels of resource acquisition (previously discussed), and logistical considerations. We also examined communications and systems applications, detailed in the *Outage Communications* Chapter of this report.

Importantly, the Company pre-stages crews when conditions warrant, which represents an effective and best practice means of shortening restoration duration. Pre-staging places the crews and other support resources on standby, and at times, on-site in preparation for the event. For example, Consumers reported that in 2022 it pre-staged resources for 13 storms. Management estimates a savings of more than 65 SAIDI minutes through pre-staging and other tactics. However, Consumers has not captured information addressing when it makes calls for outside resources, the number of resources requested, or the number initially provided. Consequently, there is not a practicable way to measure with useful precision or analyze when the Company secures external resources in relation to event start or magnitude. Such data might indicate, for example, that resources could have been obtained earlier than provided and led, possibly, to a shortening of restoration duration.

As discussed earlier in this chapter, management anticipates that deployment of Cat Crewing 2.0 in 2025 will enhance actions identified through AARs and improve resource acquisition data (*e.g.*, when requests were made, how many resources were requested). The Company also began to use in 2022 new software that enables dispatchers to visualize off-system line and forestry crew

locations on a GPS map. This capability enhances the ability to make dispatch decisions more quickly and efficiently.

Response times for wires down for Small, Medium, and Large storms have averaged approximately 5.5 hours, well above the Company's internal target of two hours (discussed later in this chapter).

Examination of potential logistical issues as identified in the AARs for storms showed areas identified for improvement (the purpose of such reports). Those areas appear to have been generally assigned for disposition and appeared to be adequately addressed. We did not observe any material adverse storm to storm trends in these areas.

4. Wire Down Process and Performance

We examined and assessed Consumer's wire down processes and performance. Response to "Wire down" conditions forms a critical element in mitigating public safety risks in all conditions, but particularly when response to major storms stresses resources more acutely. Wires that come down without de-energizing create major electrical shock, fire, and potential injury and fatality risks. Therefore, identifying and responding to wires down events promptly is crucial to ensuring the safety of the community and restoring electrical service efficiently. Additionally, addressing wire down situations quickly also helps prevent potential further damage to infrastructure and minimizes the impact on overall electric utility service. Rapid response and restoration can also minimize complaints, improve the customer experience in difficult circumstances, and prevent damage to utility reputation.

a. Processes

Downed wires are not just a storm phenomenon – they can and do occur at times under "blue-sky" conditions, such as when a vehicle hits a utility pole. Storm conditions, not surprisingly, present additional challenges due to the greater number of downed wires, the increased potential risk to the public, the need to restore orders of magnitude more customers than under "blue-sky" conditions, and the need to identify, contact, and deploy potentially many hundreds of resources to guard the downed wires depending on the severity of the event.

Under "blue-sky" conditions the Company gets alerted to a downed wire generally by a call from emergency services personnel (fire and police) or the public. Consumers is developing a Live Wire Detection tool (discussed below), but has not yet completed it and released it for operation. When Consumers receives a call, it routs the issue to an Electric Dispatcher who then assigns the job to a line crew or an Electric Service Worker, dispatching the selected resources to the downed wire location. Upon arrival, the crew/worker proceeds to make the area safe and then performs the necessary repairs.

Under storm conditions, Consumers activates a separate dispatching function. A WMC may have responsibility for managing this function for a relatively localized storm. The EOC may have the responsibility for storms anticipated to have more widespread effects. As described below, the Wire Down ("WD") operation may activate multiple emergency response roles, depending on the number of wires down. Once Consumers activates the Wire Down operation, management engages ICS wire down roles first to manage and dispatch the work.

The WD roles that storm restoration may include after standing up WD Operations include:

- Statewide wire down resource coordinator: determine Wire Guard and Wire Evaluator resources required to meet anticipated needs
- WMC Logistics Section Chief: activate and track on-call wire down support resources (*e.g.*, WD Supervisors, Dispatchers, Backup Dispatchers, Task Force Leaders)
- EOC WD Personnel Leader: evaluate and manage work assignments for WD Guards and Evaluators
- EOC WD Personnel Specialist: call out (mobilize) WD Guards and Evaluators (this role has been supplemented by the Wire Down app launched in 2023)
- WMC WD Group Supervisor: monitor requested resources as shown in the Catastrophic Crewing Database and assign Guards and Evaluators to WD Task Force Leaders.

Standing up the WD Operation in turn leads to additional assignments, including:

- Data Analysts: monitor the Outage Management System ("OMS") for orders requiring clarification or correction before WD resource dispatch
- WD Dispatch Team (includes both the Dispatcher and Backup Dispatcher): dispatch WD resources
- WD Task Force Leader: assigns work to Guards and Evaluators
- WD Evaluator: verify status (open or closed) of devices outside of a substation; ensures public safety
- WD Guard guards a downed wire; ensure public safety.

A significant number of distinct roles and responsibilities accompanying wire down operations exist at both the EOC and WMC levels. Consumers does not activate them all for every storm. The larger storms, of course, will engage most if not all these positions. Despite the numerous positions involved, role assignments reflect an organizational hierarchy with reasonable oversight, control, dispatch, and span of control (*i.e.*, Guards and Evaluators reporting to Task Force Leaders who report to Supervisors, etc.). However, this structure and resource levels have not always functioned smoothly.

For example, the February 2023 Catastrophic storm proved particularly challenging given the number of wires down (over 11,000). Consumers made the decision to initiate the wire down operation but delays occurred in conducting all necessary Automated Roster Call-Out System ("ARCOS") callouts to secure wire down resources. Consumers attributed the problems to several causes, citing:

- A bargaining unit agreement creating a prescribed order for securing resources
- Employee options to accept or decline callout
- Slow travel due to ice and snow conditions
- Obligation of Wire Guards to remain at guarded locations until relived by a qualified employee

- Extended wait times to assign Wire Guards and Wire Evaluators to their Task Force Leader due to the high numbers called out in this event
- The need to record manually the contact information of Wire Guards/Wire Evaluators who accept an ARCOS callout in the Catastrophic Crewing system.

These reasons, and others, comprise just a few of the challenges affecting the wire down function in that storm along with, of course, the nearly unprecedented number of downed wires. Consumers identified the following process-related corrective actions to address the issues identified in that storm:

- Launch of a Wire Down App in June 2023 to address
  - An easy-to-use user interface for Wire Guards/Wire Evaluators that may not work many storms
  - Additional record keeping on when a Wire Guard/Wire Evaluator secured a downed wire.
- Launch of a Police/Fire Dashboard with an ETA machine learning model with more transparency to Emergency Responders to:
  - Allow for more effective coordination with the local communities on wire downs
  - Generate more accurate estimates on when emergency services personnel standing by a downed wire can expect relief from a Consumers resource
- Allowing ARCOS callouts during normal working hours to eliminate the need to callout Wire Guards and Wire Evaluators manually
- Development of a Live Wire Down Detection module within OMS.

The Live Wire Down Detection tool, a meter-based probing software within the OMS to aid with locating potential downed wires, should prove a particularly useful addition to the wire down function, when implemented. Consumers expects to make this tool, under development since 2022, available later this year (2024).

In conjunction with wire down processes, the identification and prioritization of critical and priority customers proceeds from a two-pronged approach. First, the Company develops and reviews periodically a list of potential critical or priority customers. Critical or priority customers include, for example, hospitals, 911 centers, fire and police departments, water supply and sanitation, nursing homes, and penal institutions. After development of the list, management evaluates each customer or group using the Design Failure Modes and Effects Analysis ("DFMEA") method. DFMEA comprises a statistical methodology for assigning risk values to various parameters (*e.g.*, impact to life, impact to property, community safety, first responder impact).

The process uses standardized, statistically based restoration prioritization, rather than relying on energy use or customer size. Consumers prioritizes critical customers based on its restoration philosophy that emphasizes public safety and a focus on restoring customers that have the greatest impact on public health, safety and business. The ADMS system generates priority numbers to aid dispatchers and the ICS team to assign work to line crews. An ADMS column permits designation of work having a critical or priority customer, to restore them first, followed by work on circuits with the highest interruption numbers.

b. Performance

The Company uses results from the IBM Outage Prediction Model, described previously, for predicting the number of wire down resources required for a weather event. Generally, the number of predicted outages relates directly to the number of expected downed wires. The Company believes that the prediction model provides a reasonable estimate of numbers of predicted downed wires, although the accuracy of the model's predictions can vary significantly from storm to storm and the challenge increases significantly for larger storms. Consumers reports that it does adjust the model's estimates based on historical information.

Two factors principally drive wire down performance: organizational effectiveness in the field and the number of resources management has available to deploy. The following table summarizes the reported number of trained resources potentially available for wire down duty by year and by position from 2019 through 2023.

Potential Resources for Wire Down Duty

Type	Year				
	2019	**2020**	**2021**	**2022**	**2023**
Line Workers	478	486	487	500	516
Contract Line Workers	173	179	207	200	110
Electric Service Workers	98	101	101	104	101
Basic Line Apprentice	0	4	0	0	0
Electric Line Apprentice I	46	24	98	68	61
Electric Line Apprentice II	47	46	45	93	75
Electric Line Apprentice III	8	44	32	50	62
Electric Line Apprentice IV	56	50	65	76	111
Wire Guards Internal	1,804	1,662	1,620	1,614	2,025
Wire Guards External	105	54	50	118	51
Total	**2,815**	**2,650**	**2,705**	**2,823**	**3,112**

Four items stand out from this data. First, as noted above, call-outs are voluntary, leaving it not reasonable to assume that all available trained resources will respond to a call-out. Second, trained resources, even if willing, may simply prove unavailable for wire down duty (*e.g.*, due to vacation, sickness, time-off, childcare). Third, many of the resource types shown (*e.g.*, line workers) comprise individuals best suited for restoration, as opposed to wire down duty. Fourth, Consumers does not use contract labor for wire down duty. Therefore, while the resource base appears large, it does not reflect actual available resources at any given time.

Company data show relatively low "filled" rates for wire down resource mobilizations, measured by the numbers that accepted and responded to callout, as the next table summarizes.

Wire Down Call-Out Response

Year	Filled	Response
2018	9.9%	8.5%
2019	19.2%	14.8%
2020	32.0%	17.1%
2021	22.3%	12.8%
2022	31.3%	10.8%
2023	17.2%	8.3%
2024 YTD	20.2%	8.7%

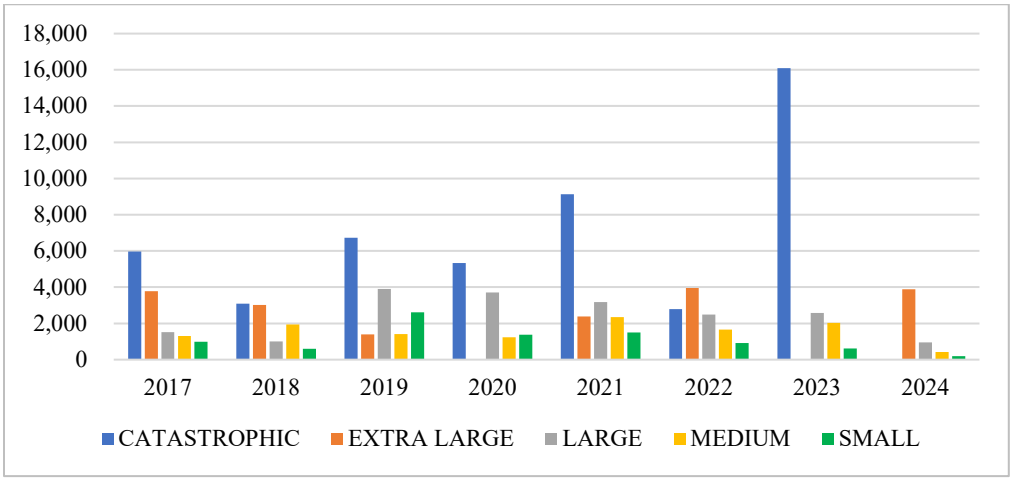
Consumers reports initiating steps in 2024 to increase these percentages by implementing:

- Verification ARCOS data in coworkers' profiles and correcting as necessary phone numbers listed on profiles
- Further training and education on what an ARCOS wire-down call entails, how to accept a callout request, and how to maintain profile/qualifications
- Refining leadership's communication to coworkers and supervisors to emphasize and explain the importance of maintaining ARCOS profiles, correct phone numbers and to respond to ARCOS callouts.

These steps should prove beneficial, but it remains to be seen how effective they will prove. They also do not address the likelihood that the number of resources required by Large to Catastrophic storms will overwhelm the pool of qualified wire down personnel.

The table below also shows that needs for wire down resources can vary significantly by storm type and number of wires down. The annual total number of wires down due to storms varies from year to year, with Catastrophic storms not surprisingly driving most of that variation. Certainly, the two 2023 Catastrophic storms that combined to total over 16,000 wires down placed great strain on the ability to mount a timely and effective wire down operation.

Total Wires Down by Storm Classification

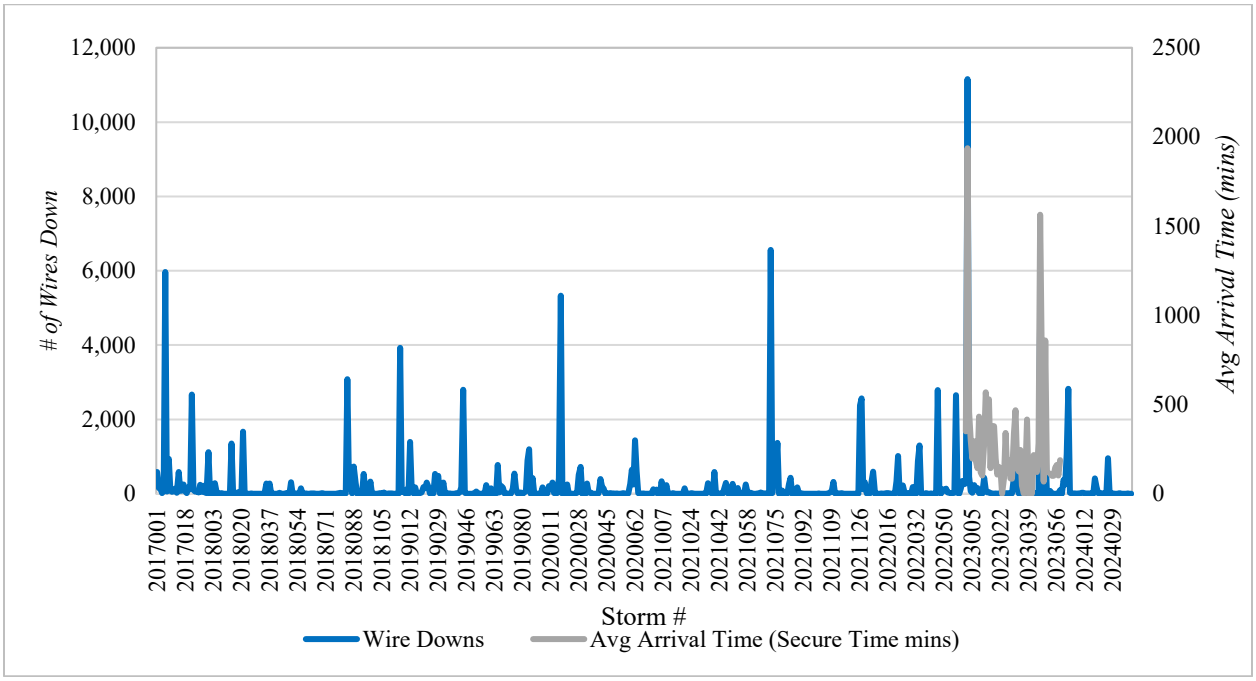


Year	Catastrophic	X-Large	Large	Medium	Small	Total
2017	5,963	3,786	1,518	1,297	990	13,554
2018	3,083	3,019	1,005	1,935	597	9,639
2019	6,729	1,398	3,899	1,408	2,605	16,039
2020	5,326		3,713	1,242	1,368	11,649
2021	9,130	2,381	3,184	2,340	1,505	18,540
2022	2,788	3,956	2,497	1,657	921	11,819
2023	16,086		2,583	2,031	610	21,310
2024		3,885	956	417	193	5,451
Total	**49,105**	**18,425**	**19,355**	**12,327**	**8,789**	**108,001**

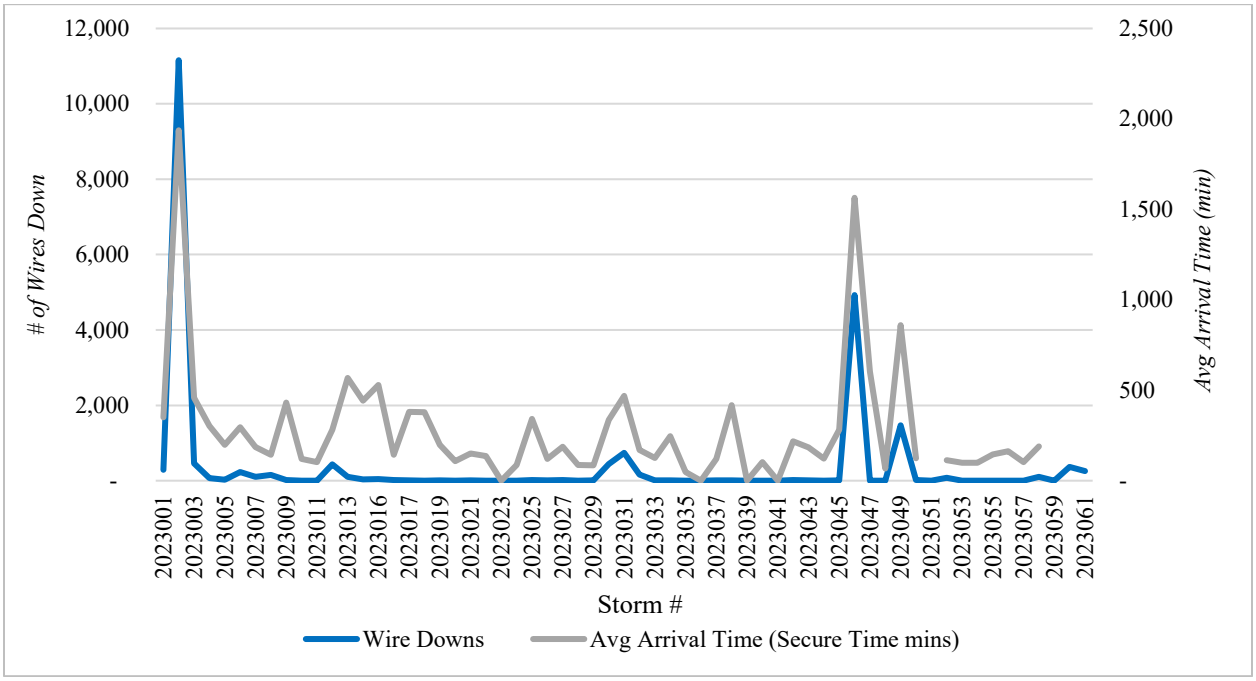
Given Consumers' large, trained wires down resource base, for less than large storms one might expect a reasonably-short wire down response time even allowing for low responsiveness. However, available data shows otherwise. The following two graphs plot the average response time versus the number of wires down.

The first graph shows all storms, including those characterized as "normal" (*i.e.*, essentially "grey" sky conditions) from 2017 through March 2024. However, Consumers did not provide response time data prior to 2023. It shows 2023 response time (*i.e.*, "secure time") largely following the fluctuations in the number of wires down. The second graph shows just 2023 data and proves more informative in terms of the timeliness of response. The graph includes "normal" events, or those with customer outages below 10,000, producing numbers of wires down in the low hundreds in many cases. However, response times show much greater variation, with the average absolute value of the response times in the hundreds of minutes. In fact, the time to secure a wire down under "normal" conditions in 2023 averaged approximately 5.2 hours, well above the targeted arrival time of 2 hours. And if "normal" and "Catastrophic" secure times are excluded (*i.e.*, assuming that they are outliers), the average secure time in 2023 was approximately 8.5 hours, even further at variance from the target.

Number of Wires Down vs. Avg. Response Time (2017 through March 2024)



Number of Wires Down vs. Avg. Response Time (2023)



As discussed in the *Compliance with Reliability and Restoration Metrics* section of this chapter, Consumers did not meet either Wire Down relief metric; *i.e.*, relieving 90 percent of first responder guarded downed wires within 120 minutes after notification in metropolitan service areas ("MSAs"), or relieving 90 percent of first responder guarded downed wires within 180 minutes in non-MSA areas.

Consumers acknowledges a need to improve wire down response time, identifying a number of ongoing initiatives to do so. The initiatives include:

- Increasing the responsibilities and accountability of the EOC Wire Down Resource Coordinator to monitor performance
- Tracking real time performance via visual management
- Developing Wire Down CAPAs in support of Commission performance metrics, such as improving response rates and refresher training to correct inconsistent data entry.

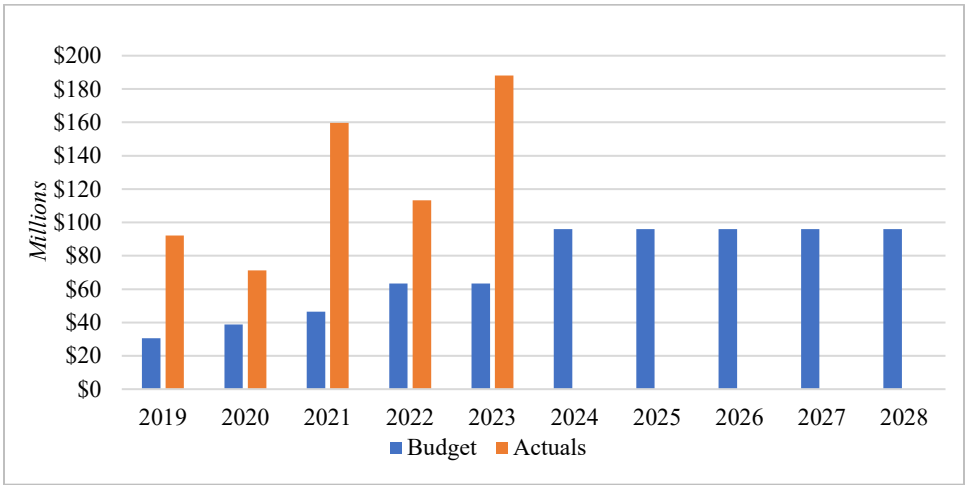
Wire down reports of any type (*e.g.*, including cable and telecommunications) typically go to the electric utility company. Consumers' response to 2022 and 2023 wire down reports, for example, showed 30.5 and 35.8 percent of them, respectively, involving a non-power wire. While the need for Consumers resources to investigate and screen non-electric wires down produces inefficiency in addressing electrical system issues, safety reasons cause Consumers to treat all down wire reports as involving power wires and encourages the public to not attempt to distinguish between power and non-power lines and maintain a safe distance from those wires. Consumers indicates that only a qualified Consumers' employee can determine ownership.

5. Restoration Budgeting

Severe weather and the resulting associated service restoration costs represent a significant albeit uncertain driver of annual O&M expenses and reactive capital investments. We examined the trend of O&M budgets and actual costs associated with service restoration to attempt to discern the leading indicators of future storm costs and to determine whether budget concerns have constrained past restoration efforts.

Actual Consumers Service Restoration costs have trended upwards significantly since 2019. Actual service restoration costs have exceeded budgets, or targets, in every year since 2019 by between, approximately, 175 percent and 300 percent, as the following chart illustrates.

Service Restoration Cost - (LVD) O&M Spend



The 2023 Consumer's EDIIP 2024 through 2028 annual service restoration O&M expenditures rise approximately 50 percent higher than 2022 and 2023 budgets. However, those future levels

reflect only about 75 percent of actual average spend from 2019 through 2023. They come much closer to average historical spend after eliminating the anomalously high 2023 spend.

Consumers reportedly sets budgets for restoration "using a five-year average with a challenge to do waste elimination and reduction in unit costs each year." The EDIIP plans flat annual restoration expenditures of $96 million per year from 2024 through 2028. This amount is marginally lower nominally (more so when adding in consideration of escalation) than the historical average of $98 million after excluding 2023's high spend (*i.e.*, using a period ending with 2022.

Despite this trend of annual actual expenditures far outpacing annual budgets, we found no indication that Consumers has restricted restoration spending due to concern about budget overruns. Consumers has proposed a cost-sharing mechanism that would "share" between the Company and customers amounts spent either below or above the five-year average included in base rates. Consumer plans very large capital and O&M expenditures to improve system reliability and resiliency over the course of five years. It has already achieved improvements to date. Those improvements should, all else being equal, lower restoration costs for a system steadily and materially improving in reliability and resiliency, making historical costs a lagging, and not a leading indicator of likely costs. Factors that make all else unequal include escalation that will affect the unit cost of each piece of equipment installed and each quantity of work performed. Should recent storm frequency and magnitude trends reverse, more extreme weather will also drive costs upward, albeit moderated by an increasingly "strong" system. Storm restoration costs have proven highly volatile throughout the industry. Some other utility regulatory commissions have employed deferred recovery mechanisms to account for those periods when extreme weather occurs. However the Commission may choose to address storm restoration cost volatility, it will remain important to recognize that those costs have comprised between 36 percent and 49 percent of Electric Distribution O&M budgets/actual costs over the period from 2019 through 2023

6. Compliance with Reliability and Restoration Metrics

This section assesses Company performance in complying with Commission reliability and restoration metrics. The Commission found that "the final report form shall replace the current reporting formats and is to be exclusively used by electric utilities and cooperatives to submit their 2023 annual Rule 31 reports in 2024." We reviewed Consumer's 2023 MPSC Service Quality and Reliability Standards for Electric Utilities R460.73 Annual Report, dated April 29, 2024, filed in compliance with the Commission's March 1, 2024 Order in Case No. U-12270 *et al*.

Consumers submitted, via its Annual Report, 2023 performance data and potential corrective action on numerous metrics, such as worst performing circuits by SAIDI and SAIFI, CEMI0 through CEMI10+ statistics, momentary interruption data, and system wide SAIDI, SAIFI and CAIDI information. The Company also provided performance data on major reliability and restoration metrics, which the following table summarizes.

Selected Reliability and Restoration Metric Performance - 2023

Metric	Description	MPSC Standard	2023 Performance	In Compliance (Y/N)
Wire Down Relief Factor	The percentage of the first responder guarded downed wires that are relieved by an electric utility representative **within 120 minutes** after notification in MSAs.	90%	66%	N
	The percentage of the first responder guarded downed wires that are relieved by an electric utility representative **within 180 minutes** after notification in non-MSAs.	90%	79%	N
Outage Restoration	Percentage of customers restored **in 36 hours or less. [All Conditions]**	90%	90%	Y
	Percentage of customers restored **in 8 hours or less [Normal Conditions]**	90%	95%	Y
	Percentage of Customers Restored **in 24 hours or less [Grey Sky]**	90%	95%	Y
	Percentage of Customers Restored **in 48 hours or less [Catastrophic]**	90%	75%	N
Sustained Interruptions	Percentage of Customers Served Experiencing **4 or more sustained interruptions**	6%	11%	N

In terms of corrective actions regarding the major metrics where Consumers fell short of MPSC standards, the Company explained what it considered the driving forces behind its sub-standard performance and outlined several steps in a process to address those issues. Regarding the Wire Down Relief metric, the Company is working to improve data accuracy, automating the process of securing wire down resources, and optimizing call out response procedures, among others. Underperformance in outage restoration under catastrophic storm conditions was attributed to the two large catastrophic storms experienced in 2023. The Company has established a team to identify potential issues and solutions for catastrophic storms, including securing additional crews during large storms, enhancing crew productivity, and an anticipated reduction in outage sizes, as outlined in the Reliability Roadmap strategy. Contributing factors to CEMI underperformance included the impact of catastrophic storms and major event days, while Improvement initiatives include an increased focus on system inspections and system improvements based on the results of those inspections.

C. Conclusions

1. Conclusions – EP&R Plan and Organization

1. Consumers employs a comprehensive, detailed, up to date, and professionally presented Storm Response Manual; however, its size (over 1,000 pages) suggests modifications to improve usability. *(See Recommendation #1)*

The SRM and associated links, forms, contact lists, and responsibility requirements provide a comprehensive platform that assists users in quickly accessing significant quantities of relevant and up-to-date emergency preparedness information. Its size, however, warrants a more user-friendly interface to support navigation (although as a web-based application it does allow for on-line searching).

2. Consumers conducts a sufficient number of annual storm response drills and training exercises to exercise and train resources on SRM uses and storm roles and responsibilities.

Consumers storm response drills and exercises, typically of the table-top variety, appear sufficient in number and content to address fully the effective use of the SRM and the need for ensuring knowledge of storm roles and responsibilities.

3. Leadership of the Restoration Management organization is effective and engaged, but the group's "bench strength" is not apparent. *(See Recommendation #2)*

Consumers' Restoration Management group members appear knowledgeable and engaged in their roles. The low staff levels of the group represent a focusing of skills and experience within the group, and particularly with Restoration Management leadership. Loss of the group manager, notwithstanding apparent succession planning, appears to represent a substantial challenge for Consumers to find a similarly skilled and experienced replacement.

4. Restoration Management's light staffing does not appear to match fully the nature and extent of its responsibilities. *(See Recommendation #3)*

Storm related planning and restoration activities have always been critical to maintaining safe, effective and economical service to customers. But it is becoming even more so now with the increasing digitization and electrification of everyday activities.

2. Conclusions – Pre-Event Planning

5. Consumer's approval of the hiring of a meteorologist will bring useful weather-related expertise in house to provide the Company with tailored forecasts of both weather and potential weather impacts, thereby improving restoration planning and response.

Weather related, company specific expertise is critical in assessing and analyzing storm activity and its potential impacts on Company facilities and customers. Consumers acknowledged that fact with its recent decision to add a meteorologist.

6. Outage modeling results, while limited in number, show a significant level of inaccuracy, thus warranting assessment of other options. (*See Recommendation #4*)

Accurate outage modeling comprises a complex and difficult endeavor. Success in modeling depends upon the expertise of the outside provider, on the quality and completeness of the historical data that a utility can provide, and the descriptive parameters of the utility' system. While simpler than some, the Consumers territory does not find itself without some complexity that modeling needs to address. The current outside provider operates as a well-known and competent weather services provider. However, while limited, the results that Consumers has been able to assess to date give reason for examination of alternatives for assessing weather event impacts.

7. **Consumers does not use Event Classification as a catalyst for organizational mobilization in the event of a weather event.** (*See Recommendation #5*)

Consumers' personnel have substantial storm response experience. Most key personnel interviewed demonstrated knowledge of their areas of expertise and responsibility. The storm team communicates internally to activate the required resources and processes without attaching value or significance to the determination and communication of an event's classification. This view should change. Accurate, early event classification can catalyze wide and consistent communication to all personnel involved about expectations and associated actions prior to event arrival, thus increasing the likelihood that preparations match actual conditions when they occur. Event Classification is as important and sometimes more so for large events which evolve and change over time. Reclassification, also widely communicated, signals clearly and timely for all involved the need to adjust plans and resources as circumstances indicate more or less impactful events.

8. **Consumers has not collected or analyzed data that would better enable it to assess the timing of, and outside resource provider responsiveness to, outside assistance requests.** (*See Recommendation #6*)

Consumers does undertake processes to acquire resources consistently with its evaluation of event impacts. It is not clear how far in advance of event arrival that calls are made to external entities for resources or at what levels. Since such data is not retained it is not clear if earlier or larger resource requests would be more effective in restoration activities.

3. Conclusions - Event History and Restoration Performance

9. **The number of classified storms has declined in recent years, but the severity of larger storms has not declined, and costs have trended upwards significantly since 2019.**

The data present declining annual numbers of total classified storms, particularly among those classified as Small. The annual total number of Large, X-Large, and Catastrophic storms have remained relatively stable but increased in impact. Catastrophic storms disproportionately drive restoration costs and have accounted for 36 percent of the Company's service restoration spending since 2019. The cost for the two catastrophic storms experienced in 2023 was 58 percent of that year's total service restoration spend.

10. **Consumer's restoration performance, measured by the average duration of classified storm types, shows marked improvement in recent years across all storm classifications except for Catastrophic.**

Storm restoration average durations across all storms, except Catastrophic, have improved in recent years largely due to the successful deployment and implementation of the ICS command structure both centrally and at the WMC level. Recent activities, including the hiring of an in-house meteorologist, should bolster Consumer's ability to plan for and respond to weather events more effectively.

4. Conclusions – Wires Down

11. Consumer's employs a highly-structured and flexible Wire Down organization with numerous well-defined roles and responsibilities, activated at varying levels on the basis of anticipated weather event conditions.

The WD organization that Consumers activates for the largest storms may have up to ten distinct roles (*e.g.*, WD guards, evaluators, supervisors, dispatchers, task force leaders, analysts) at both the WMCs and EOC for the largest of storms. Such a structure can prove effective for the largest storms but requires close management to ensure the addressing of quick and effective communication challenges within an organization with so many distinct roles and responsibilities. Consumers appears to be effective at doing so.

12. Consumers employs an objective, transparent, and reasonable process for identifying and prioritizing critical and priority customers.

The process employs a statistical DFEMA method to assign risk values for various parameters (*e.g.*, impact to life, impact to property, community safety, first responder impact) to establish standardized restoration prioritization.

13. Wire Down call out responsiveness has been poor. *(See Recommendation #16)*

Consumers identifies thousands of resources as available for WD duty, but the numbers do not present an accurate depiction of resources on which it can effectively rely. Many resources prove either not available or comprise individuals better used elsewhere (*e.g.*, lineman). The call out responsiveness is low with the percentage of "filled" requests averaging between 20 percent and 30 percent in the past few years.

14. Wire down response time is poor. *(See Recommendation #17)*

Consumers targets two hours to secure a wire down. Performance has fallen well below that target. The time to secure a wire down under "normal" conditions in 2023 averaged approximately 5.2 hours, well above the targeted arrival time of two hours. And if "normal" and "Catastrophic" secure times are excluded (*i.e.*, assuming that they are outliers), the average secure time in 2023 was approximately 8.5 hours, even further afield of the target.

5. Conclusions – Restoration Budgeting

15. Differences among budgeted, actual five-year average, and EDIIP planned O&M expenditures are extreme. *(See Recommendations #18 and 19)*

Annual service restoration costs for the period from 2019 through 2023 have averaged $124.8 million annually. Average annual budgets have averaged a fraction of that amount ($48.5 million). The 2023 EDIIP shows another set of values (a flat $96.1 million per year). Excluding particularly

high 2023 restoration costs, driven significantly by extreme weather events, drops the historical annual average (for 2019 through 2022) to $98 million. That value comes closer to, but still falls below the EDIIP's annual planned amounts, even before considering escalation.

It is not clear how a five-year average serves as a sound basis for setting budgets or a meaningful marker for sharing restoration costs that vary from five-year averages. Absent adjustments to "normalize" weather experienced over the historical measurement period, it is difficult to see how budgets provide to management what they should do, which is to establish both a sound resource planning base and a reasonable means for assessing performance effectiveness.

More importantly, weather does not comprise the only variable of import. The increasing ability of the system to withstand weather has equal importance. With billions spent and proposed to be spent to improve system reliability and resiliency, it would be illogical to conclude that the same, or even worse weather will impose the same level of restoration needs as would a system ever weaker and less resilient the further back through the historical "marker" period one goes.

16. We observed no indication of funding restrictions imposed on efforts to effect safe and rapid restoration when weather events have occurred.

When budgets routinely prove inadequate to match the cost sources for which they are directed, a common response is to restrict the efforts that generate costs in the areas budgets cover. We did not find reason to conclude that management has failed to direct activities and bear the resulting costs required to effectuate safe and rapid restoration.

6. Conclusions – Compliance with Reliability and Restoration

17. Consumers 2023 MPSC Service Quality and Reliability report addressed the filing requirements and identified areas where it failed to comply.

The 2023 MPSC Service Quality and Reliability Standards for Electric Utilities R460.73 Annual Report (dated April 29, 2024) addressed the required subjects and discussed initiatives and activities to close the gaps it identified.

D. Recommendations

1. Recommendations – EP&R Plan and Organization

1. Modify the SRM to allow for easier navigation and to address restoration history and control. *(See Conclusion #1)*

While the SRM is an impressive document and represents a thorough compilation of relevant storm related roles, responsibilities and associated supporting documentation, it is a bit cumbersome to navigate and additional taxonomic structure (*i.e.*, sub-chapter numbering) and pagination (*i.e.*, page numbering) should make for easier navigation and accessibility. Review and update details should be clearly visible in the electronic copies of the documents.

2. Ensure up-to-date succession planning for Restoration Management leadership roles. *(See Conclusion #3)*

As with any small group, the ability to provide for continuity of experienced, effective leadership given a change can be challenging. Given the critical and integral role that RM plays in storm response, Consumers notes that it has potential candidates to fill the current leadership role, if necessary. However, Consumers should focus on expanding the bench strength of its RM group, perhaps by expanding its size and increasing the responsibilities of other staff within the group, thereby allowing for more growth opportunities and providing an adequate backstop for group leadership – an inevitability in any position.

3. Increase the Restoration Management staff level with individuals with specialized expertise and experience. *(See Conclusion #4)*

Consumers recently authorized the hiring of a meteorologist, an important development that recognizes the necessary addition of internal meteorological expertise to its emergency preparedness function. In addition, there are other important skill areas (*e.g.*, strategists, technologists, data scientists, etc.), resident outside of RM (or matrixed from a responsibility perspective) that could enhance Consumers' RM organization, if directly managed. Consumers notes Service Restoration Governance implementation after the February 2023 Ice Storm to accomplish these goals. Notwithstanding this development, consideration should be given to moving that expertise within RM for more direct engagement and oversight.

2. Recommendations – Pre-Event Planning

4. Better assure more tailored and accurate outage modeling results by codifying and analyzing predicted versus actual outage events. (*See Conclusion #6*)

Given the complexities attendant with any outage model, Consumers should continue to evaluate (via its request for proposals) whether a different third-party outage modeling vendor might provide more useful and impactful results. Concurrently, Consumers should consider the internal development (perhaps with third party support) of its own outage model, tailored and designed to specifically represent its service territory.

5. Classify weather events no later than when the decision is made as to whether available field resources will need to be supplemented and as early as data permits a reasonable assessment of a weather event's impact. (*See Conclusion #7*)

The action of event classification should serve as a clear, widely communicated catalyst to groups involved in restoration to be prepared to address the needs associated with the anticipated impacts of the classified event. It needs to comprise more than a post hoc description of what occurred. In addition, event classification should change, as necessary, after storm arrival, with wide communication to reflect new weather-related developments and resultant changes to the restoration plan.

6. Capture and analyze data associated with external resource requests. *(See Conclusion #8)*

During post-event analysis, it is difficult, if not impossible, to know with certainty whether earlier, and greater, resource requests from external entities could have been met and whether such requests would have had a material impact on restoration duration. However, knowing what resources were requested from specific contractors (or mutual assistance), when those requests were made, and what was initially and subsequently provided to Consumers would provide a

wealth of data that would be useful in post-event critiques and in preparing for future storm response. In addition, such information would be memorialized and easily retrievable for use in training others when, at some point, resource acquisition responsibilities are assumed by others in the organization.

3. Recommendations – Event History and Restoration Performance

We have no recommendations regarding Event History and Restoration Performance.

4. Recommendations – Wires Down

7. Identify a call out objective and a time frame to reach that objective. *(See Conclusion #13)*

Without a measurable goal and timeline, evaluation of the effectiveness of any identified improvement efforts becomes uncertain. Consumers has reported a number of steps to increase wire down call out responsiveness, including verification of the accuracy of worker profile data, the conduct of additional training and education regarding how to accept a callout request, how to maintain profile/qualifications, and refining leadership's communication to coworkers and their supervisors to further emphasize and explain the importance of maintaining an ARCOS profile with a good phone number and an employee's responsibility to respond to ARCOS callouts. All the steps represent worthwhile efforts to help enhance call out responsiveness. The Company should subject each to clear implementation steps and schedules.

8. Identify a time frame for reaching the wire down secure time objective of two hours for MSAs and non-MSAs and provide regular reporting to management on the status of improvement efforts. *(See Conclusion #14)*

Consumers has acknowledged that it needs to improve its wire down response time and indicated that it has a number of ongoing initiatives to do so. These efforts appear focused and likely useful, but the degree of improvement needed is substantial and will require management time and attention to ensure measurable improvements in this critical public safety process. Establishing a definitive timeline for securing the needed improvement is necessary to ensure sufficient attention and resources for securing that improvement.

5. Recommendations – Restoration Budgeting

9. Re-baseline restoration budgeting to produce estimates that fully and realistically consider expected needs. *(See Conclusion #15)*

Reliance on five-year historical costs to establish restoration budgets should end. Those responsible for managing restoration cannot be held properly accountable for work or costs performance if established budgets are known to be unrealistic, fail to account for weather volatility, include anomalous weather years within the five-year measurement period, or rely on contributions from other parts of the organization to accommodate not just expected, but essentially certain overruns. Regardless of the means by which Consumers recovers restoration costs from customers or their amounts, realistic budgeting is essential to sound management of the work and costs involved, just as it is for every other function for which management establishes budgets and to which it manages.

Consumers should normalize weather conditions from recent years and generate a reasonable range of expected conditions under at least mild, normal, and extreme weather conditions. This normalization should include historical weather data and specific, quantified, and analytically supported changes that can reasonably be expected to have consequence for system outage and restoration performance and costs.

Next, Consumers should specifically and analytically address how the system's configurations and conditions will change through the EDIIP period and beyond for areas of investment and other expenditures expected to continue past 2028. This analysis should directly and quantitatively address how the system hardness, resiliency, and reliability will interact with assumed weather conditions. In other words, restoration work and cost driving assumptions based on how a system that no longer exists, but that has been improving and likely will improve by greater amounts year by year in the future, will respond under the three or more weather scenarios considered.

It is not possible to foresee that incorporating these elements into near term budgeting and longer term (*e.g.*, five- and ten- year durations) could generate either estimates comparable to those produced by using five-year averages or the flat five-year annual values of the EDIIP.

Changing estimates of future restoration costs as described will provide a basis for assigning accountability for work and cost performance in a way that has meaning for motivating and evaluating those given accountability and responsibility. It will also enhance management's ability to identify where restoration performance has been strong and where it may warrant improvement at a detailed level. It will also end the effective "socialization" of responsibility for consistent overruns in restoration costs among other functions necessary for utility electricity, gas, and corporate operations. Moreover, it will lay a foundation for addressing in a tangible, meaningful, and more accurate way the rate recovery methods, amounts, and sharing of risks and rewards for what will remain a volatile element of the electricity cost structure, however well managed by the Company.

10. Explore means to balance company and customer interests in addressing highly volatile restoration costs following completion of the preceding recommendation addressing budgeting for storm restoration. *(See Conclusion #15)*

Most significantly, the use of five years of historical restoration costs as a benchmark for sharing between the Company and customers ignores the fact that the system will steadily respond better as time passes to outages that require material restoration. It should not be taken for granted that escalation and worsening weather will overcome the reliability and resiliency gained by billions of dollars spent over that historical period or the many more that will be spent through the course of the EDIIP as proposed by Consumers. The analytical foundation proposed by the preceding recommendation should provide a more realistic weather, system strength and resiliency, and cost escalation underpinnings for sound projections of future annual storm restoration costs requirements. Absent those underpinnings, we would not place confidence in concluding that a five-year average cost benchmark balances risks and rewards evenly between the Company and customers.

In the meantime, deferral accounting for excess storm costs may offer a solution for avoiding customer costs for adverse weather that does not materialize, while preventing significant

Company economic loss when such weather requires significantly more than costs included in revenue requirements for ratemaking purposes. Other commissions have found deferral an effective means for permitting recovery following some form of reasonableness and prudence review that considers conditions faced and the effectiveness of efforts undertaken to address them.

6. Recommendations – Compliance with Reliability and Restoration Metrics

See the preceding recommendations of this chapter.

Chapter IV – Outage Communications

A. Background

This Section of the report describes and evaluates event communications, both internal and external, before, during, and after a large storm. We focused on planning and preparation while closely examining the customer experience during significant storms in recent years. The report also reviews modifications or enhancements made to improve communications during this period. The audit objectives sought to:

- Determine if customers could reach the utility during recent storms to report outages.
- Assess whether the Company effectively communicated with their customers during storms.
- Understand if the Company kept key emergency and government officials informed during the storms.
- Evaluate if the Company communicated effectively with the public regarding public safety and expected restoration times.

When the power goes out, most customers use their mobile phones to call, text, or visit the utility's outage website to check the utility's awareness of the outage and to find out when power will be restored. Storms pose unique challenges for utility customer service organizations. Depending on the size and timing of the storm or outage event, thousands of customers can lose power simultaneously, overwhelming the utility with a surge of contacts. During large outages, the volume of customer inquiries can quickly exceed in-house capacity, especially after-hours and weekends when more customers are at home and fewer customer service representatives ("CSRs") are available.

Over the years, technology solutions have evolved to help utilities communicate more effectively with customers during large outage events or storms. Self-service options have become widely accepted and preferred by most customers, allowing them to report outages via the web, mobile applications, or phone using Interactive Voice Response ("IVR") technology. Customers have also embraced outage maps, which most utilities offer to provide information on the extent of an outage and status updates specific to their area, including estimated restoration times. Additional communication channels such as text messaging, social media, and chat provide customers with various ways to interact and receive updates from their electric utility.

Utilities must also be prepared to communicate storm restoration information to the public, as well as local and state officials and community leaders. Even under normal conditions, electric utilities must keep government officials informed about their plans and activities. Utilities share rights-of-way with government services, making their continuous operation essential. Residents, businesses, and institutions expect government officials to stay informed about significant activities, including those related to utilities. Therefore, utilities need a coordinated approach to ensure that government officials know whom to contact with questions or concerns. This need becomes even more critical during major events, as government officials require advance knowledge of potential utility system impacts and need to work closely with utilities to reopen key roads and provide access for emergency operations.

Community relations play a major role during a major storm, especially in keeping state and local officials informed. Community relations officials, often district or division managers, have responsibility for maintaining communication with elected officials, community leaders, and key customers. Before a storm starts, these officials initiate contact to establish communication channels. During the storm, they assist local emergency and governmental agencies by providing critical infrastructure information, offering restoration progress updates, and redirecting resources to address emergency issues and community priorities.

Ongoing education prepares communities for storm restoration needs, practices, and protocols. Hosting community workshops to promote storm response awareness strengthens communication between local officials and the utility and provides an opportunity to gather feedback and understand expectations.

Most utilities leverage technologies such as web portals and mobile applications to facilitate information flow with the community, making it easier for municipal and community representatives to report emergency situations like downed wires blocking roads. Life-threatening situations should always be reported through a dedicated, direct line, but, for less hazardous issues requiring utility attention web-based portals or phone-based interactive applications can provide efficient alternatives.

This section of our report addressing Consumers' emergency preparedness programs and processes focuses on communications in the following areas:

- Call Center and Digital Channels
- Key Accounts
- Corporate Communications
- Community and Government Relations
- Estimated Times of Restoration
- Customer Experience.

B. Findings

1. Call Center & Digital Channels

Consumers provides customer service through phone, field, and face-to-face interactions to approximately 1.9 million electric service customers in Michigan's lower peninsula. Its five call centers operate 24/7 and employ approximately 300 people organized into teams focused on residential, business, workforce management, and quality. Additionally, the Company contracts with an external vendor to support customer service. For several years, Consumers has used a hybrid call center structure, with some employees working remotely and newer agents working in the call centers. This hybrid approach offers staffing flexibility during storms, especially those that occur after hours or on weekends.

Customers have multiple options to report outages and downed wires or to check outage status through phone, website, or mobile app. They can call a toll-free number for IVR self-service or speak with a customer service representative ("CSR"). Customers can self-report outages on the Company's website or app, check restoration status, and access outage maps for detailed

information. They can also opt to receive outage alerts via email or text, providing updates on power status, estimated restoration times ("ETRs"), and other outage details.

The Senior Vice President and Chief Customer Officer of CMS Energy oversees customer service, including the call center, billing, and digital customer channels, both under normal conditions and during storms.

a. Planning and Staffing

The Resource Planning team assesses staffing needs for Residential Call Centers before and during storms. When a storm approaches, the team adjusts staffing by eliminating non-essential tasks, cancelling planned activities, and requesting 25 standby volunteers to bolster the workforce. On-call shifts assigned weekly follow employee seniority. Additionally, the Company has a contract with an external vendor to augment staff during significant outages. If necessary, management can mandate overtime as a last resort, based on call queue lengths and wait times. The team also engages in business continuity exercises and tabletop drills, while the Call Center team conducts After-Action Review ("AAR") sessions after major storms to identify areas for improvement.

b. Accessibility

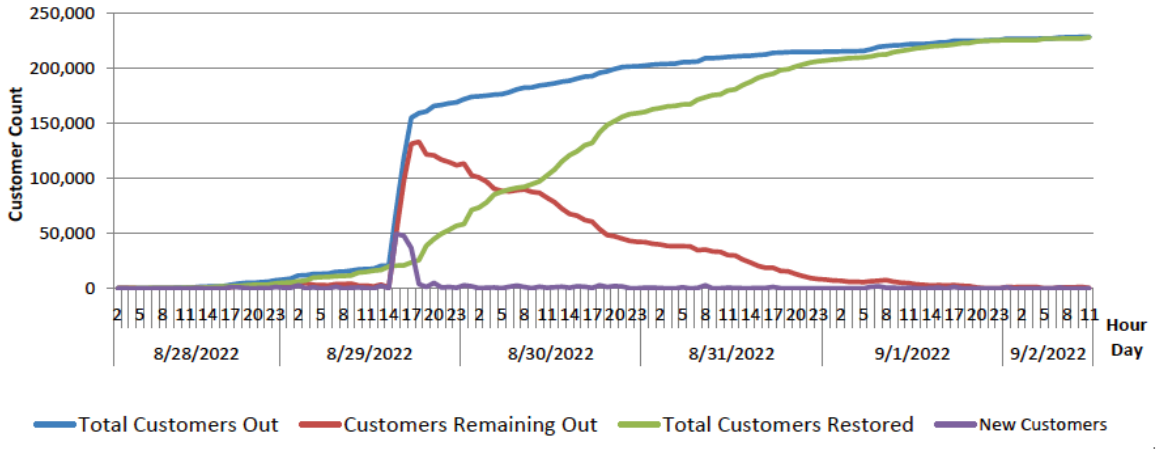
To evaluate whether customers could reach the Company during recent storms to report outages, Liberty reviewed call center staffing and performance through three large storms occurring in the past three years. The following the table summarizes these storms.

Consumers Storm Summary

Storm	Category	Type	Customers Impacted
August 2022	Catastrophic	Windstorms	224,193
February 2023	Catastrophic	Ice Storm	484,557
January 2024	X-Large	Winter Storms	102,590 and 190,430

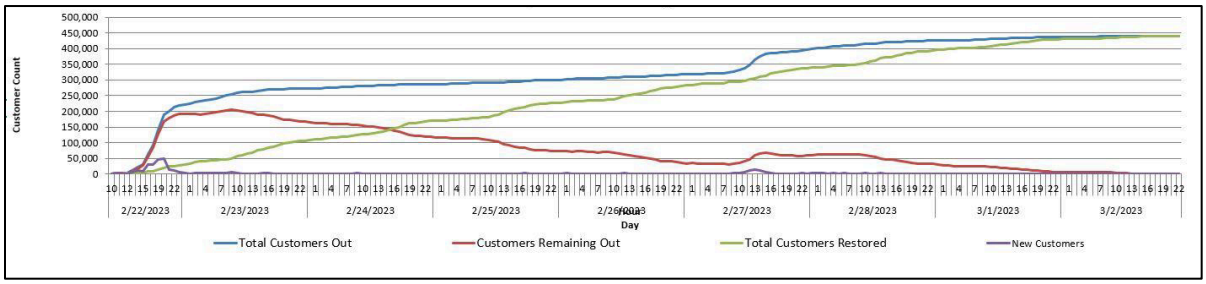
The August 2022 Storm began around 3pm on August 29th, with restoration completed by September 2nd. A total of 224,193 customers were affected by the storm, and the daily outage profile, shown below, indicates that the highest number of reported outages occurred on August 29th.

August 2022 Storm Summary



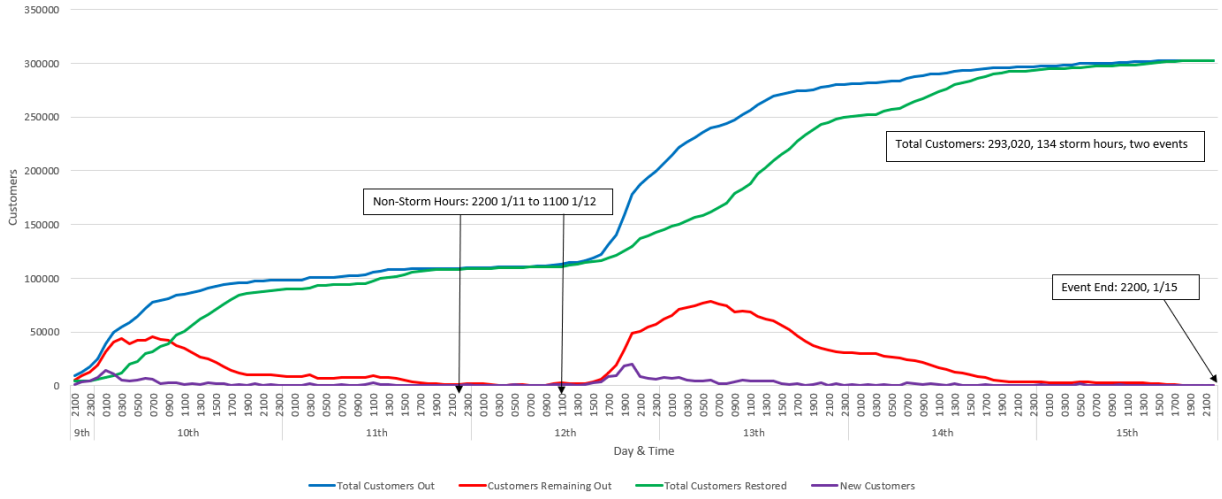
The February 2023 storms started at 2pm on the 22nd and restoration was completed by 3:30pm on March 5th. A total of 484,557 customers were affected by these storms, as shown in the daily outage profile below, which indicates the peak number of customers without power occurred on February 22nd.

February 2023 Storms Summary



The January 2024 storm consisted of two consecutive snowstorms, starting on January 9th at 9pm and officially ending on January 15th at 10pm. The daily outage profile provided below illustrates the impact of each storm, with the highest number of customer outages occurring on January 9th during the first storm and on January 13th during the second. Power was restored to customers affected by the first storm by 10pm on January 11th.

January 2024 Storm Summary

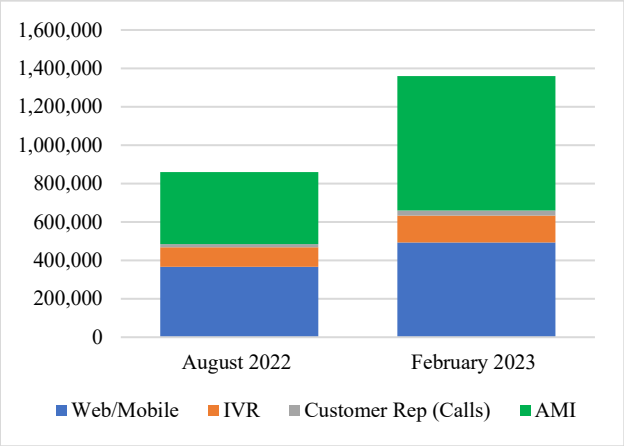


During these three major storms, customers primarily engaged with the Company through its website or mobile app. A smaller group contacted the Company via phone, interacting either with the IVR or with CSRs, as depicted in the following two charts illustrating outage reports and status inquiries received through each channel during the storms.

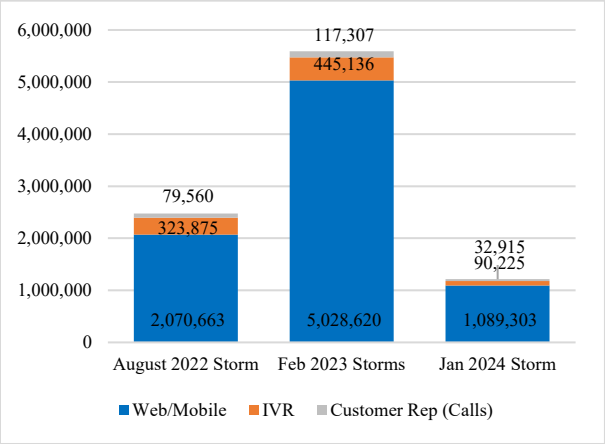
During the August 2022 storm, outages identified by Automated Metering Infrastructure ("AMI") accounted for 44 percent of the total reported outages, while in the February 2023 storm, they constituted 51 percent. When checking restoration status during both storms, most customers (90

percent) favored using the web or mobile channels. Only eight percent of customers opted for the automated phone system, and one percent sought status updates from CSRs.

Reported Outages by Channel and Storm

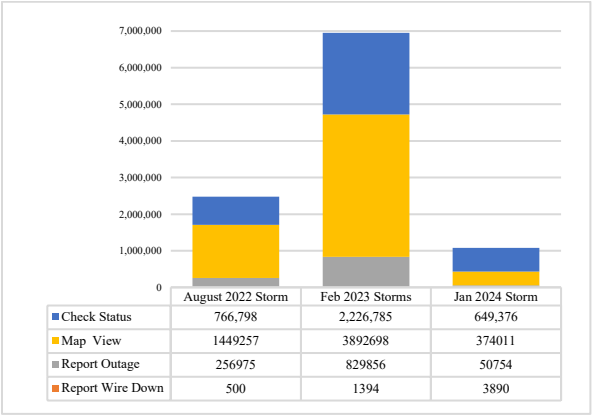


Customer Contacts by Channel and Storm



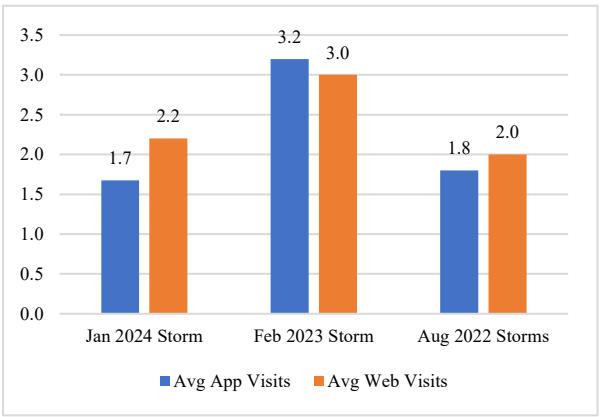
The following chart illustrates website activity for the Company, detailing visits for tasks such as reporting a downed wire, reporting an outage, viewing the outage map, and checking outage status. During major storms, customers predominantly use the outage center and outage map to check the status of outages, averaging two to three website visits per customer. Notably, during the February 2023 storms, customers accessed the website and mobile app more frequently compared to the January 2024 and August 2022 storms. Wire down reports received via the website ranged from 500 in the August 2022 storm to 3,890 in the January 2024 winter storm, as noted in the data table in the chart below.

Website Activity by Storm



	August 2022 Storm	Feb 2023 Storms	Jan 2024 Storm
Check Status	766,798	2,226,785	649,376
Map View	1449257	3892698	374011
Report Outage	256975	829856	50754
Report Wire Down	500	1394	3890

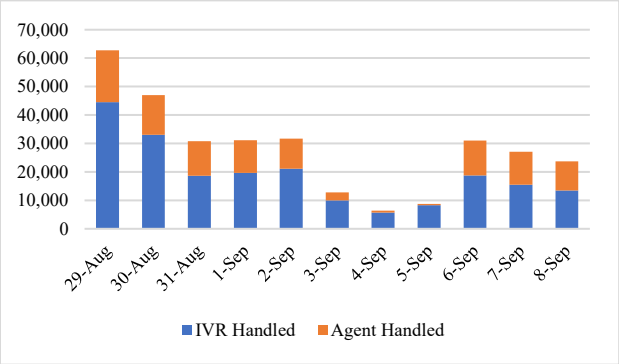
Average Web & App Visits per Customer



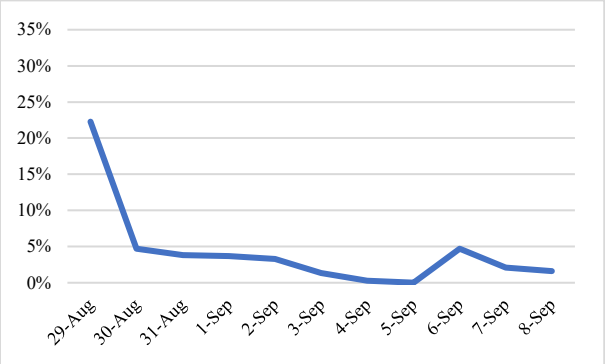
During the storm on August 29th, the Company received approximately 343,558 calls. Of these, the IVR system managed 61 percent and the remaining 132,444 calls (79 percent) by CSRs, resulting in a 21 percent abandonment rate. Most of the abandoned calls occurred on the first day of the storm. The average speed of answer during the August 2022 storm peaked at 89.1 seconds.

August 2022 Storm Call Summary

Calls Handled



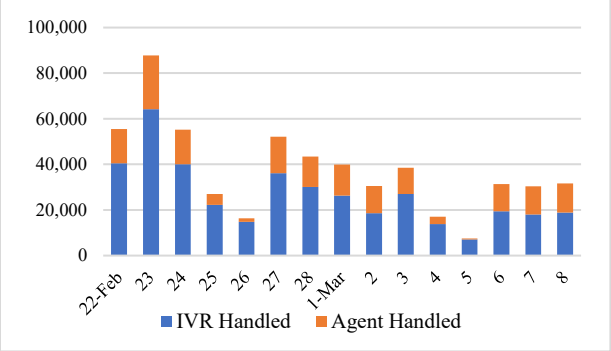
Caller Abandonment Rate



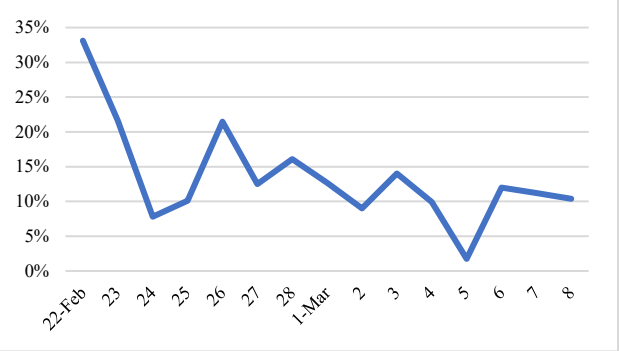
During the February 2023 storms, the Company received 926,502 calls, with 66 percent managed by the automated system (IVR). Of the 198,680 calls directed to agents, an average of 16 percent were abandoned. The two charts below illustrate call volumes and abandonment rates. Abandonments were highest on February 22nd and 26th. The average speed of answer (wait time) during this storm peaked at 83.2 seconds.

February 2023 Storm Call Summary

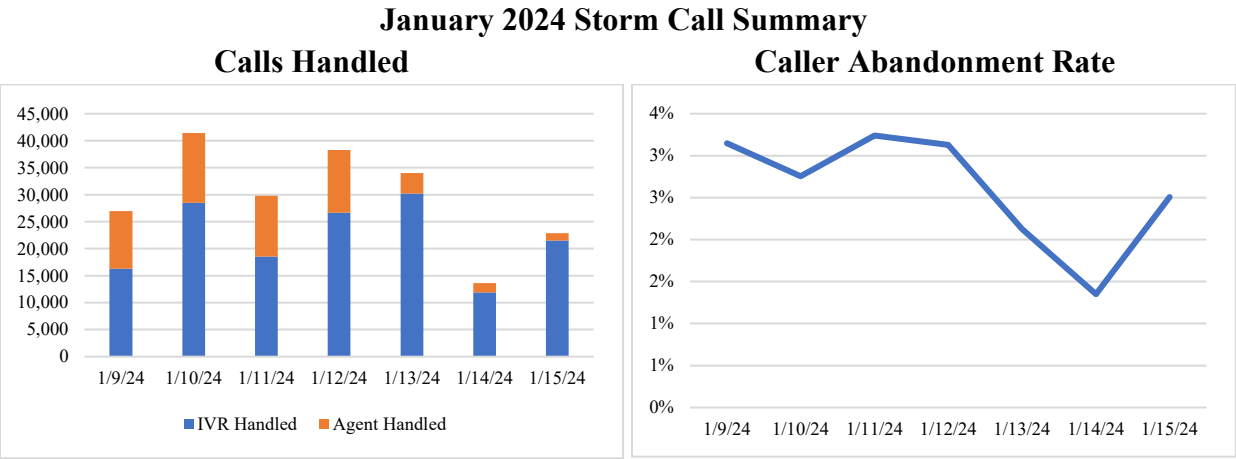
Calls Handled



Caller Abandonment Rate



In January 2024, Consumers face two overlapping storms: Storm 1 from January 9 to 11 (a "grey sky" event) and Storm 2 from January 12 to 15 (a "catastrophic" event). The first storm brought about a foot of heavy, wet snow, while the second added another foot or more, with winds gusting between 35 and 45 mph. The first storm affected approximately 102,400 customers and the second 191,400. Consumers received 86,290 calls during these storms, and over 1.2 million visits to the outage map on the website. The 145 seconds average speed of answer ("ASA") during this period exceeded the Company's goal of 120 seconds.



c. *High-Volume Call Handling*

In 2019, the Company upgraded its telephony infrastructure to a Voice over IP ("VoIP") platform, which enhanced system capacity. In October 2019, the Company, with the help of a third-party provider, tested the new infrastructure, including IVR port availability, sizing, and quality. Over a two-hour testing period, more than 63,000 calls were processed. The satisfactory results confirmed the configuration, capacity, and performance of the IVR technology. Consumers does not have a contract with a third-party service for handling high-volume call overflow, and instead relies upon its own telephony to handle surges in call volume.

d. *Channel Accessibility and Reliability*

The Company's primary outage communication systems and technologies have struggled under the load during major events, as shown in the following table. Between 2021 and 2023, nearly 50 technology incidents related to storms occurred, affecting customers, stakeholders, and Company resources that depend on these systems for outage communications.

Storm-Related Technology Incidents

System/Technology	2021	2022	2023	Total
ADMS		2	2	**4**
OMS	1	1		**2**
Outage Map	1	2	3	**6**
SAP	3	6	2	**11**
Verizon			1	**1**
Website	7	8		**15**
Telephony	3	1		**4**
Website Mobile App		3	1	**4**
Total	**15**	**23**	**9**	**47**

The following sub-sections, organized by major technology or system, expand on many of the technology incidents noted in the above chart.

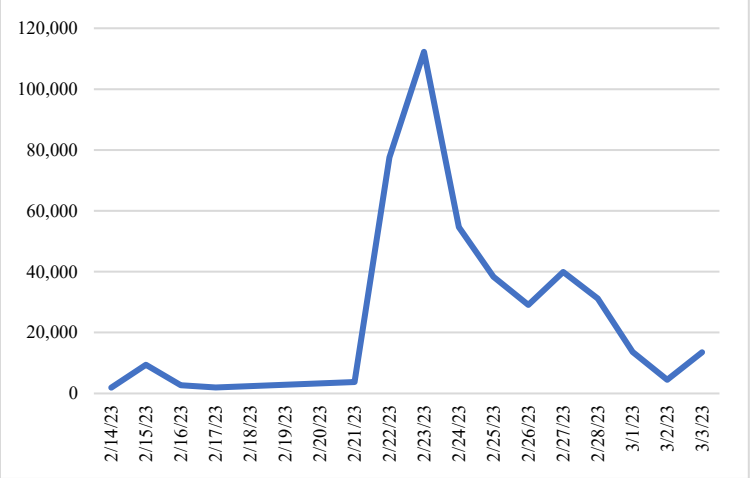
e. Website & Mobile App Performance

As highlighted in a February 2023 After Action Review ("AAR"), systems integrated with the Advanced Distribution Management System ("ADMS") to deliver outage information to the outage map "became out of sync many times". This discrepancy led to differences between the outage map and public-facing communications. Providing accurate outage information to customers comprises a central element in maintaining trust and ensuring effective communication during outages. Inconsistent information can lead to confusion and frustration among customers and other stakeholders who rely on these updates to plan for and respond to power disruptions.

f. SAP System Performance

During the February 2023 storm Consumers' newly deployed mobile app received a large volume of requests to update ETRs overloaded which overwhelmed the Company's systems, degraded performance, and disrupted service. Later investigation by Consumers' Information Technology support group revealed that some customers had placed over 3,000 requests for updated ETRs within seconds, effectively submitting a continuous request of the mobile app to provide an update. The following chart illustrates mobile app usage during the storm, highlighting the unusual peak in ETR requests on February 23rd.

Mobile App Outage ETR Option
(Customer Visits)



While Consumers' website had safeguards against bot-type attacks, the mobile app lacked similar protection. Consumers has since increased the mobile app's capacity and deployed the appropriate protections to prevent such attacks. Ensuring robust protection against malicious bot-type attacks is critical to maintaining the integrity and availability of online services.

g. ADMS and OMS Performance

In 2022, the Company deployed the Advanced Distribution Management System ("ADMS") and expanded its use in 2023 to support field operations. However, when the February 2023 storm hit, issues emerged with the newly enhanced ADMS and mobile app. Review of these issues points to a lack of integrated stress testing of these technologies following deployment and enhancement, discussed in more detail in the following section of this chapter.

The February 2023 AAR highlighted several ADMS issues encountered in the field during the storm, including difficulties in inputting capital materials and following prescribed steps, which led to delays in updating restoration status and tracking work progress. For instance, there was no visibility into repeated visits by "missdig" to a location. The AAR identified two main root causes. First, the Company did not fully grasp the limitations and configuration of the system architecture, leading to unresolved issues. Second, tools and standards had not undergone updating to align with new technology, affecting the accuracy and reliability of restoration data.

During the storm, Consumers discovered that the Outage Management System (OMS) was not accurately reflecting the number of restored customers. A correction created an offset to adjust ADMS output, which updated outage numbers on the Website and Outage Map. The AAR stressed the need to avoid manual ETR adjustments. Since the storms, Consumers has worked with the ADMS vendor to adjust the system configuration to better reflect its system. Moving forward, the Company plans to work with the field to encourage timely updates to the OMS during storms.

During the January 2024 storms, Consumers experienced data sync issues with OMS, PowerBI and the Storm Dashboard, software analytical tools used to communicate outage status internally, with outage data not aligning during the first storm. However, the IT support team reacted quickly, correcting these issues by the second storm.

h. Stress and Load Testing

Over the past five years, the Company has conducted extensive application testing to simulate various storm scenarios and peak loads on critical systems, including ADMS, Outage Apps, the website, mobile app, IVR, and SAP. This “Day in the Life Storm” (“DIL”) performance testing helps identify areas for improvement by revealing opportunities to adjust parameters and streamline storm support processes. Consumers conducted initial DIL testing before the ADMS go-live in June 2022, but performed no additional such testing until after the February 2023 storm. Consumers did not test any changes to resolve issues encountered in the months following go-live before the February 2023 storm.

Following the February 2023 storms, the Company undertook a series of DIL tests to rectify the issues encountered during the storm, conducting five additional tests in 2023 after upgrading outage support systems. In 2024 to date, the Company has completed three DIL tests and has plans to conduct two more by year-end. As part of the after-action review recommendations, the Company considered contracting an external vendor to perform more comprehensive end-to-end testing with higher transaction volumes and integration of systems like the website and IVR. However, Consumers ultimately set aside this approach in favor of focusing on other value-added initiatives.

2. Large Customers

Consumers’ Business Center provides call center support to approximately 200,000 large commercial and industrial customers. The center remains open normally from Monday through Friday from 8am to 4:30pm but will extend hours as necessary during major storm events. During a storm, Consumers proactively calls priority communications customers, typically hospitals,

police, fire, or critical manufacturing facilities, to provide updates on outage restoration efforts impacting their facilities and escalates concerns about storm impacts.

3. Corporate Communications

During a major storm, a utility's Corporate Communications department must efficiently convey storm restoration status to all stakeholders, including state and local government officials, large industrial customers, the media, employees, and the public. Effective communication ensures the sharing of consistent and accurate information across various channels, from press releases and updates to mayors, legislators, and city officials, down to each customer contacting the call center. This consistency helps manage expectations, reduce confusion, and maintain trust. This section explores how Consumers manages communication with all stakeholders during significant storms or outages, emphasizing the critical role of clear and unified messaging in maintaining stakeholder confidence and effective storm management.

a. Crisis Communications and Storm Communication Planning

Consumers' Corporate Communications team, consisting of approximately six employees and supported by external contractors and consultants, plays a central role in storm communications. Their Crisis Communications Plan ("CCP") provides important guidelines for managing communication during emergencies, including power outages. Consumers has designed the CCP to align with its Storm Restoration Manual ("SRM") and Incident Command System ("ICS"), ensuring a coordinated response. The Public Information Officer ("PIO"), who reports directly to the Statewide Incident Commander ("SWIC"), has responsibility for executing this plan, with 24/7 coverage provided by a rotating on-call schedule. The Emergency Preparedness & Response chapter of this report describes our review of the Company's storm restoration process and ICS structure.

Effective storm communications planning requires the maintenance of consistency and coordination across various groups. The Consumers CCP standardizes and coordinates communications across several groups including Customer Service, Operations, Social Media, Community Affairs, and Government Affairs, and internally for all employees. With Emergency Operations Center ("EOC") activation, the PIO mobilizes the Communications Response Team ("CRT"). A member of the Media Relations Team serves as the PIO and engages in pre-storm command meetings to assess weather impacts and in all ICS meetings after EOC activation. The following diagram details the core communications team reporting to the Public Information Office during an ICS event.

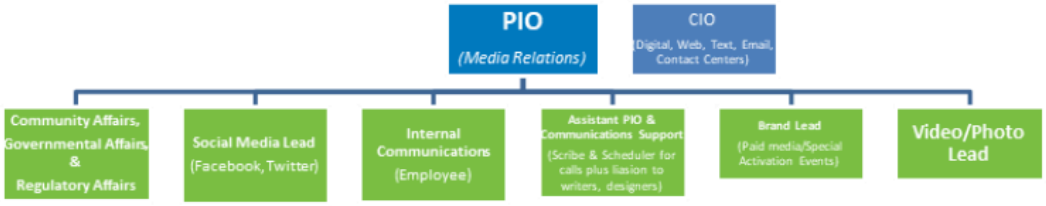
Communications Response Team Reporting to PIO

Figure 2: Communications Response Team Common Participants*
May not be all-inclusive

ORGANIZATIONAL CHART

ICS Levels 0 and 1

ICS Levels 2 and 3: Communications Response Team



The CCP, established in 2017, outlines detailed tactics for pre-storm, during-storm, and post-storm communication, including checklists, templates, examples, and planned messaging tailored to various event impacts. This plan supports all corporate emergencies. Recently, Consumers has begun developing a storm communications playbook to provide a more tactical and daily operational guide, enhancing support for each class of storm.

Before a storm, the storm team conducts pre-planning calls, sharing the resulting documentation on a Microsoft Teams site accessible to all ICS storm responders. Consumers disseminates safety messages through Nextdoor, Instagram, Facebook, and X, and may also email safety information to the media and customers based on the storm's severity.

During the storm, Consumers communicates updates through written advisories or press conferences to the media and stakeholders. Daily restoration management, ADMS, the Storm Dashboard, and the ICS team inform these updates. The PIO reviews draft media releases for accuracy before ultimate approval by the SWIC and the officer in charge before distribution. Corporate Communications logs all internal and external communications issued during the storm and monitors engagement across channels, such as social media, websites, and mobile apps, while also tracking media inquiries and coverage.

During the February 2023 storm, the CRT implemented a new approach to engage proactively with media and other key stakeholders in the hardest-hit areas. This approach included hosting a virtual event with a Consumers Vice President to discuss storm restoration progress and address

questions. Moving forward, Consumers' new storm communications playbook will outline the criteria for conducting such virtual town halls, based on timing and storm severity.

b. Social Media

Consumers manages several social media channels, including Facebook, X, Instagram, LinkedIn, Nextdoor, and its blog, force4michigan, to support outage communications with customers and the public. The Social Media Channel Manager, reporting to the Director of Branding and Creative Services, oversees daily social media operations and leads the team during storm events, with additional support from external contractors. The team monitors and responds to social media inquiries, posts updates about storm conditions and restoration efforts, and uses a process document for coordination with the PIO and the CRT. Prior to and during a storm, the Company posts regularly regarding storm conditions and restoration efforts. Consumers maintains a library of safety tips, photos, videos, and other media materials to facilitate response.

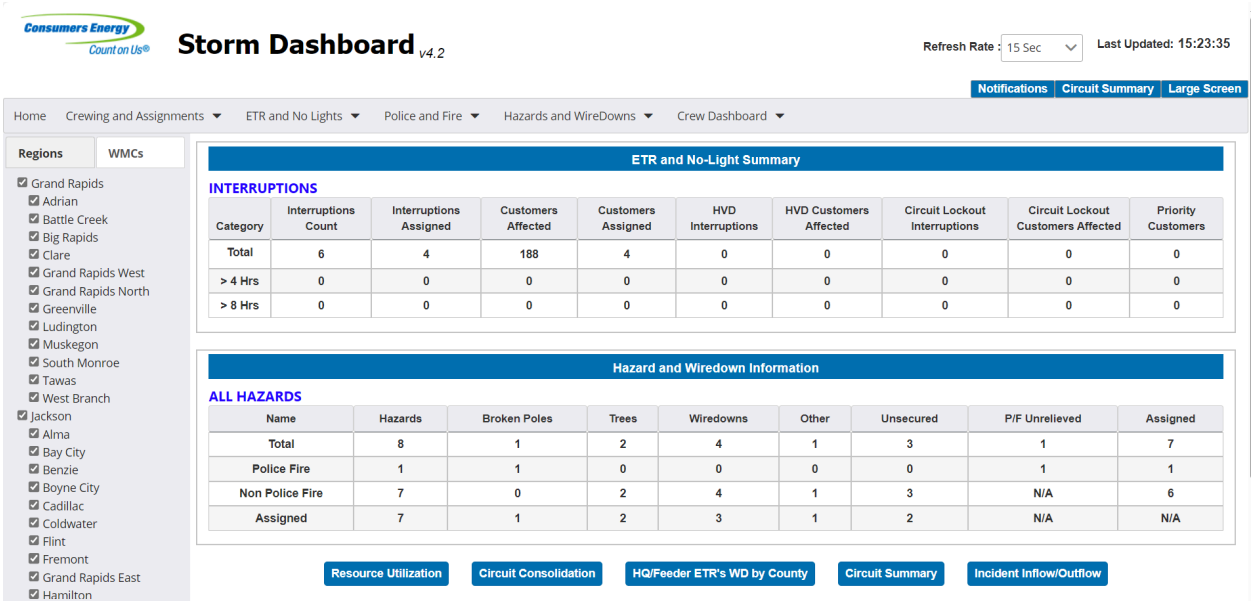
To stay informed about relevant social media discussions, Consumers uses various online tools to track keywords related to outages and storms, even on platforms where Consumers does not have an active presence. Consumers' customer research indicates that while customers prefer safety tips, weather updates, and community event information on social media, they rely on other channels, such as the outage map and website, for updates on outage status and ETRs.

c. Internal Storm Communications

The ICS Communications team convenes twice daily during storms. The communications team offers regular Executive Storm Summary updates to executives, covering proactive media outreach, media interviews, social media sentiment, community engagement, and provides a detailed chronological report of all storm-related communications, including advertising, media recaps, and sentiment analysis, based on the storm's scale.

During the storm, the PIO issues reminders to contact center employees with tips and talking points for customer interactions. Safety Flashes keep field and storm duty personnel informed about status and changes in conditions. Mass emails alert employees about incoming storms and prepare them for storm-related duties. Additionally, a storm dashboard provides employees with real-time updates on impacted customers, system conditions, restoration progress, and other storm-related operations.

Consumers Energy Storm Dashboard



4. *Government & Community Relations*

This section reviews how Consumers ensures effective communication and support for first responders, state and local government officials, and emergency managers before, during, and after a storm. Keeping these key stakeholders informed supports coordinated emergency response and effective management of storm impacts.

a. *Municipal and Government communications*

Consumers' Government Affairs organization oversees relationships with state and federal representatives, including Michigan's Governor, Attorney General, and Secretary of State. Government Affairs activities play an important role in managing communications during outages and storms by coordinating with emergency command centers to ensure effective assistance.

The Community Affairs team, led by Area Managers who handle specific territories, maintains regular communication with local, state, and federal stakeholders, including elected officials. This team acts as the liaison between the Company and local government and community leaders. The Community Response Officer ("CRO"), a role filled by the Principal Community Affairs Manager, a statewide position not specific to one region, coordinates regional relief and community support during power outages. The CRO and their team work directly with the PIO and other ICS officers to synchronize response efforts.

The Community Affairs Team also conduct outreach through various channels, including their website, media, social media, and mail campaigns. Pre-storm emergency preparedness calls with state and local officials review safety protocols and escalation processes. During storms, the Community Response team supports communities through outreach, supports stakeholder groups to open warming and cooling centers as needed, provides frequent updates to key stakeholders, sending emails twice daily with impact, progress, safety messages, and contact details. After the 2023 storms, Community Affairs outreach included briefings with local and state officials in

affected areas and follow-up meetings to discuss lessons learned. This proactive approach ensures all parties remain informed and supported throughout storm events.

During events, the Community Response team proactively reaches out to key stakeholders to provide frequent updates on outages and restoration efforts. Twice daily during storms, the team sends email updates containing information about impact, progress, safety messaging, and relevant contact details, including instructions for reporting issues and locations of heating and cooling centers.

b. Emergency Responders, Fire, and Police Communications

Consumers' Liaison Officer, a critical role within the ICS reporting directly to the Incident Commander, oversees coordination with emergency officials at both the state and federal levels. This includes collaboration with the Michigan State Police, Emergency Management, the Department of Homeland Security, and other relevant agencies. Consumers tasks the Public Safety Outreach team, serving as the Liaison Officer, with managing communication with emergency responders, including police and fire units, to confirm and prioritize on-site support. An eight-person rotating team provides support to this role. The Emergency Management Team organizes public safety events such as hazard awareness training for first responders and school presentations. The Emergency Preparedness & Response chapter of this report describes our review of Consumers' processes for managing downed wires. Consumers holds pre-storm emergency preparedness calls with state and local emergency officials for anticipated large events to review safety considerations, wire-down reporting, and the escalation process.

To enhance coordination, Consumers has implemented a website feature allowing emergency responders to report and check the status of downed wires, along with a dedicated emergency line for urgent communications. Prior to a storm, the Liaison team provides impacted areas with weather updates, safety tips, and emergency preparedness information. During storms, they engage with emergency personnel to assess impacts on critical infrastructure and downed wires.

In 2017 and 2018, Consumers formed a large, cross-functional team dedicated to enhancing communication procedures for emergency responders. By collaborating closely with these responders, Consumers gathered valuable feedback to refine and streamline call handling procedures, aiming to expedite emergency responses. A survey conducted in May 2023 with over 1,200 emergency responders revealed a need for more precise Estimated Times of Arrival ("ETA") and better self-service options. In response to this feedback, Consumers has made significant improvements to its communication protocols and introduced a police and fire hazard dashboard with prioritized settings for emergencies.

c. Regulatory Communications

Consumers' Regulatory Affairs department manages the relationship with the MPSC and oversees storm communications. An MPSC Outage Communications Coordinator operating within that department provides regular updates to the MPSC, typically two to three times daily depending on the storm's severity. This role includes responding to inquiries and delivering information on storm restoration progress, including details on warming or cooling shelters and community engagement events.

d. Communications with Medical Needs Customers

Consumers encourages customers with specialized medical equipment to enroll in the Red Cross Identification program via the Consumers website. Consumers does not offer specialized communications specifically for customers with medical equipment; all customers affected by a storm receive the same level of information.

5. Estimated Times of Restoration (ETRs)

Precise service restoration times may not always be feasible, but providing the best available information provides substantial support for customers and local governments in planning and responding to extended service disruptions. Major storms can impact not just utility services but also local and state government operations, making realistic service restoration estimates vital for effective community response and planning.

Advances in technology have greatly improved communication options for reporting and managing outages. Customers can now use IVR, texting, websites, and mobile apps to report outages and receive updates, while many utilities offer outage maps and self-service reporting. Systems like advanced metering and distribution automation help identify outages more accurately, reducing the need for customer reports. When an outage is reported, a trouble ticket is generated and managed by the outage management or advanced distribution management system, which supports timely and accurate ETRs.

This Section of the report contains the findings, analysis, and detailed descriptions of the systems and processes that support the establishment, updating, and communicating of ETRs during an outage event. The audit's objectives included a review of Consumers' ETR process and performance in recent storms for:

- Establishing ETRs
- Updating ETRs as changes in circumstances develop
- Communicating ETRs initially and on an ongoing basis to customers and local officials.

a. ETR Establishment

Consumers introduced the initial version of the ETR Machine Learning Model (ETR MLM) in 2019. This AutoETR MLM system, originally interfacing with the legacy OMS and since 2022 with the ADMS, aimed to address issues identified through customer satisfaction metrics. Before AutoETR, ETR updates were manually entered into the OMS by field crews or dispatchers. A decline in customer satisfaction, as measured by Consumers' Customer Experience Index (CXI), revealed that ETRs were inconsistently communicated, seldom provided during major storms, and often delivered just minutes before restoration.

The initial AutoETR version used historical data to calculate average restoration times, automatically applying these to "blue-sky" outages (routine, non-storm events). Consumers began tracking ETR accuracy and utilized CXI outage surveys to gauge customer expectations during storms. Version 2 of AutoETR, launched in 2021, was developed with the insight that customers expect timely notifications of outages and a single accurate ETR. Research indicated a 26 percent drop in CXI when customer ETRs expired.

Consumers' standard AutoETR process now predicts restoration times for customers affected by an outage. A Python script runs every five minutes to identify outages needing new ETRs, which then get processed through the AutoETR model. Predicted ETRs are communicated to the OMS (Electra) and stored in a database for integration with other outage reporting systems. Additionally, a separate process runs every ten minutes to update and communicate new or changed ETRs or outage statuses to affected customers.

Consumers launch of ADMS in June 2022 introduced new features and variables to the model. However, it managed outages differently from the legacy OMS, and often canceled and recreated outage jobs or merged jobs based on system model analysis, which resulted in multiple ETRs for customers. The February 2023 storm created many outage jobs in ADMS. Consumers learned from the storm that it did not have a way to control the model to avoid unrealistic ETRs from being generated during these high volumes. Customers received lengthy ETR estimates in the storm's early stages. Many utilities will turn-off the AutoETR functionality at the beginning of a storm to avoid these issues. Consequently, Consumers applied a system-wide ETR cap to the AutoETR process for the remainder of the storm to ensure more realistic estimates.

The Company later identified an ADMS configuration error that caused the inclusion of non-outage jobs in the AutoETR data model, inflating the estimated workload for field operations and resulting in unreasonably high ETRs. Management resolved this issue and re-trained the model using accurate historical data.

To address these problems, Consumers created the ETR Control Panel, allowing for a cap on the ETR process to override any distant future ETRs. Management also instituted a delay option to give ADMS time to analyze and identify damaged devices for better ETRs. Consumers can turn off AutoETR if necessary and manually set ETRs for storms or situations not well-represented in historical data, such as tornadoes and wildfires. This control panel proved necessary because ADMS lacked manual control capabilities, which Consumers discovered during the February 2023 storms, rather than through controlled stress testing.

During the August 2023 catastrophic thunderstorm, customers experienced other ETR accuracy issues. A review revealed that the job-centric ADMS system created inaccuracies due to changing job events as ADMS grouped, canceled, and recreated jobs. Excess and sometimes inaccurate ETR communications occurred through the Kubra alert process. Consumers created a long-term countermeasure to align ETR data across the outage map, IVR, website, and Kubra alerts to a more customer-centric model.

Consumers recently deployed version 2 of the ETR model, which uses variables such as the number of local and statewide incidents, day of the week, hour of the day, and region to estimate restoration times. Consumers does not currently incorporate weather or crewing data into the estimates. Version 3, now under development will further refine the process during catastrophic events, adding variables to consider the number of affected customers and the area of fault. Consumers has a dedicated team of data analysts focused on continually enhancing the model.

Now, the ETR Control Panel is used to prescribe specific directives, as determined by the Advanced Analytics Leader Storm Role, which can be configured for each situation or storm. For instance, the ETR Control Panel can create state-wide, headquarter, and feeder-specific rules. The output of the ETR Control Panel becomes the published ETR that is sent to all outage applications. Non-storm outages generally do not require specific directives in the ETR Control Panel.

During the January 2024 storms, from January 8th through January 15th, Consumers applied Statewide Caps and Delays to ETRs. The delay, ranging from 15 minutes to 2 hours from outage reporting to when an ETR was generated, allowed ADMS to better analyze available information before providing an estimate. Customers received a message indicating that an ETR would come soon. On January 12th, Consumers increased the ETR delay to 2 hours and placed a cap on all ETRs generated by AutoETR. This adjustment coincided with the arrival of the second winter storm and more difficult travel conditions due to heavy snowfall and increased winds.

January 2024 Storm Caps/Delays

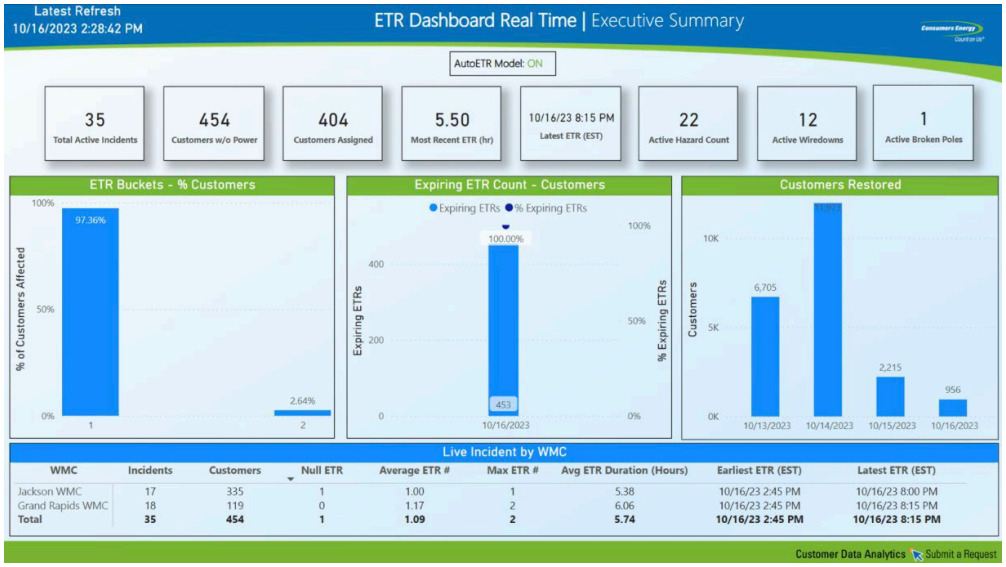
Date	Delay/Cap
January 9th	30 minutes
January 10th	30 minutes
January 11th	60 minutes
January 12th	120 minutes
	Cap - January 15th 23:01
January 13th	60 minutes
January 14th	30 minutes
	Cap removed
January 15th	15 minutes

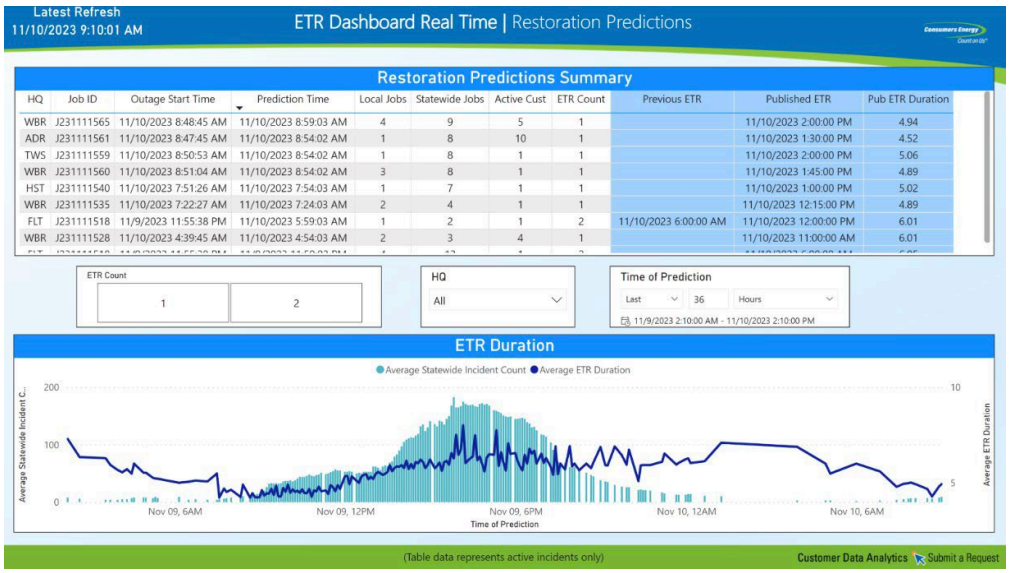
b. ETR Monitoring

The Advanced Analytics Unit focuses on managing ETRs and real-time reporting during storms. This team has responsibility for updating the ETR Control Panel and includes a data scientist and a visualization specialist to support the process. Consumers determines the ETR strategy in consultation with the SWIC and Officer in Charge. The team monitors ETR performance and CXI every 15 minutes, coordinating closely with Corporate Communications on any changes to the ETR Control Panel. During the January 2024 storms, embedding the ETR team within the ICS structure improved communication with the SWIC and the Dispatch and Analytics teams.

Consumers measures ETR Model accuracy using the "percent first ETR met" metric, which tracks the percentage of customers restored before their first ETR expires, ensuring they only receive one ETR. Consumers monitors this metric daily, weekly, monthly, and annually. Additionally, Consumers has developed an ETR Dashboard using Power BI to track various performance indicators, including the number of customers receiving multiple ETRs, expiring ETRs, summaries by work management center, digital Customer Experience scores, average ETR durations by day, predicted versus published ETRs, outage statistics, active outages, and wire-downs. The Executive Summary and Restoration Predictions pages from the Dashboard are provided below.

Consumers Executive Summary and Restoration Predictions Dashboard



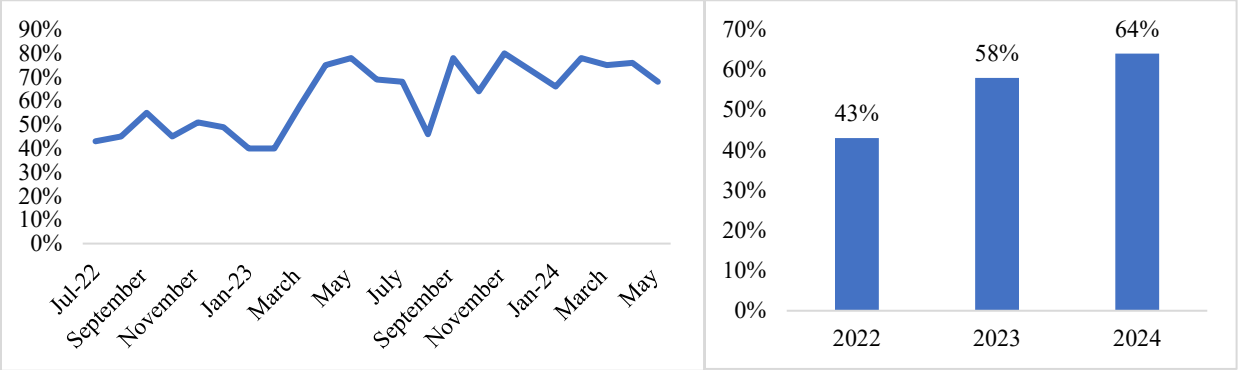


c. *ETR Performance*

The February 2023 storm after-action review identified ETRs as an area for improvement, stating "ETRs were not correct". Additionally, the AAR identified issues with ADMS inflating restoration times and customers-out numbers, as described above.

Since October 2023, Consumers' efforts to improve ETR communications appear to have positively affected monthly and annual First Estimate Accuracy performance, as shown in the charts below:

Percent First ETR Met Annual Performance



Consumers started tracking the percent of customers receiving published ETRs by outage or storm. The following table summarizes Consumers' performance on this metric during the last two catastrophic storms.

Percent First ETR Met Annual Performance

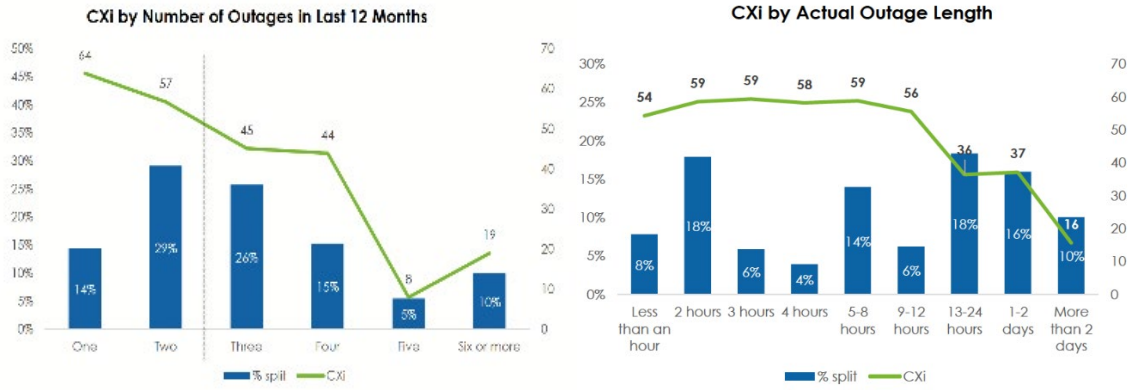
Storm	Type	Date	Zero ETRs	One ETR	Two ETRs	Three ETRs	Four or more ETRs
February 2023	Catastrophic	2/22/23	n/a	n/a	n/a	n/a	n/a
August 2023	Catastrophic	8/23/23	n/a	28%	18%	14%	40%
January 2024	Catastrophic	1/12/24	7%	63%	21%	6%	3%

During the January 2024 storms, 63 percent of customers affected received only one ETR, another 21 percent received two, leaving 16 percent of customers receiving no ETR or more than two ETRs for the storm.

6. Customer Satisfaction

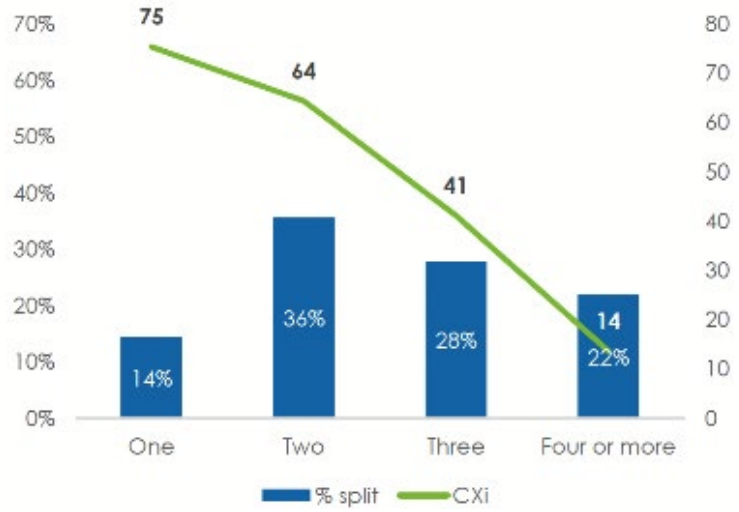
Consumers measures customer satisfaction daily using the Customer Experience Index ("CXi"), a survey conducted after customer interactions. Additionally, Consumers surveys customers who experience outages during major storms. After the 2021 storms, overall customer satisfaction measured using the CXi proved notably low, scoring 46 out of 100. Consumers also found that customer dissatisfaction increased with the frequency of outages within a 12-month period and with longer outage durations, as shown in the following charts:

CXi Results Summary



Survey feedback also highlighted preferences for advance weather information, channels for reporting outages and receiving updates, and ETRs. After the 2021 storms, 78 percent of customers reported receiving multiple ETRs. Generally, receiving multiple ETRs led to higher levels of dissatisfaction, as illustrated in the following chart:

Multiple ETRs Summary



Following the February and August 2023 storms, Consumers conducted extensive research, administering over 10,000 surveys to customers affected by outages and received response rates of 10 percent and 12 percent for each storm, respectively. This research aimed to understand customer needs, expectations, and satisfaction levels. The findings highlighted that accuracy in messaging has extremely high value to customers, who preferred receiving accurate initial ETR even if it meant waiting a few hours. Customers favored receiving updates via text, email, and through Consumers' mobile app and website, with the outage map being the most preferred channel. Additionally, the surveys revealed significant dissatisfaction with incorrect outage status notifications, underscoring the need for precise and reliable communication.

C. Conclusions

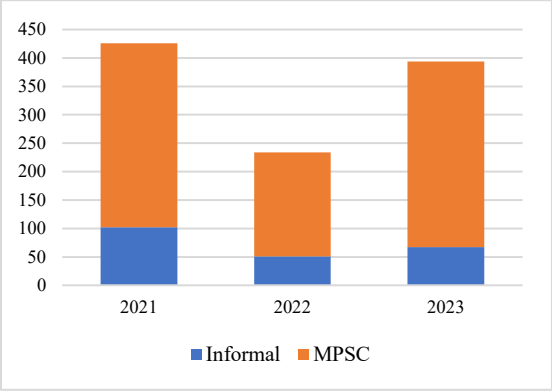
1. Consumers' customer outage experience has proven problematic during recent large storms. *(See Recommendation #1 and #2)*

Customer dissatisfaction with outage communications has been a recurring issue following storms in 2021, 2022, and 2023. Consumers' research during this period highlights ongoing problems with inaccurate ETRs, misleading status notifications, and multiple ETRs for the same outage, all of which contribute significantly to customer frustration. Post-storm surveys and panel research, including those conducted after the 2021 storms, have underscored the critical need for accurate and reliable messaging.

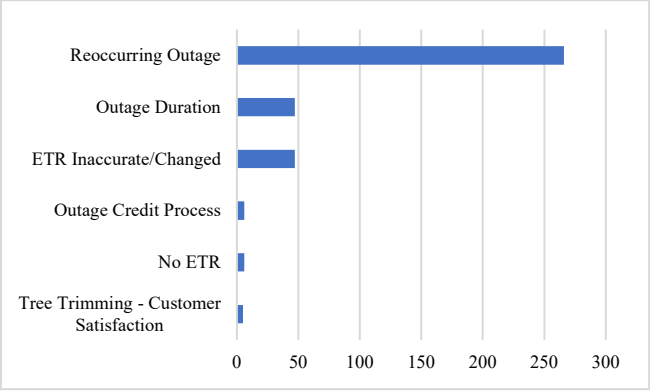
The low CXi scores following these storms have driven efforts to enhance ETR communication, as detailed earlier in this chapter. Additionally, customer complaints, which peaked during the 2021 and 2023 storms, reflect issues related to recurring outages, prolonged outage durations, and frequent changes to ETRs. These complaints and customer dissatisfaction point to the need for Consumers to address these concerns and improve overall customer communication strategies.

Customer Complaint Summary

Storm-Related Complaints by Channel



2023 Storms Complaint Reasons



2. Consumers Community Relations has a sound organizational foundation, good planning processes, and continues to enhance its efforts to keep stakeholders informed of outage response efforts.

Consumers' community and government relations representatives work closely with state, local, and county emergency personnel both daily and during storms. By maintaining regular contact, these representatives build strong relationships with local officials and emergency responders, ensuring effective communication during storm events. Their familiarity with the territory and established connections creates a solid foundation for coordinating responses and addressing key priorities.

Recent storms have highlighted the need to improve protocols based on feedback and lessons learned. To address these challenges, Consumers has enhanced its communication strategies to provide timely and comprehensive updates to community leaders and emergency personnel. This includes sharing information about weather conditions, preparations, and Consumers contacts. For example, since the 2023 storms, Consumers has held multiple briefings with municipal leaders to

discuss storm damage and restoration progress, a practice it plans to continue for future large storms. Post-storm surveys have also been conducted to better understand community challenges and needs during outages.

3. Consumers Corporate Communications has been both proactive and responsive during recent storms.

During a major storm, an electric utility's communication team must proactively engage with customers and stakeholders, ensuring messaging is clear, consistent, and timely. Consumers' Corporate Communications team, guided by a crisis communications plan and a new storm playbook, prepares in advance with the ICS team to evaluate potential storm impacts. The team uses platforms like Microsoft Teams, email, and social media to share pre-storm safety information and engage with the media, customers, and the public. Throughout the storm, the team provides continuous updates to support Consumers' interactions with customers, local officials, emergency personnel, and the media. Executives offer media updates ahead of and twice daily during the storm. Consumers also utilizes a mix of traditional and innovative communication channels to broaden its reach. Overall, the communication systems in place are functioning effectively.

4. The Call Center was substantially challenged by the high volumes of customer calls received during the February 2023 storm. *(See Recommendation #3)*

During the February 2023 storm, Consumers' self-service channels remained unavailable for several hours during the storm, as detailed earlier in this report, causing an increase in the volume of calls to the call centers. The VoIP/SIP infrastructure supported these higher call volumes; however, a high level of abandonment occurred due to longer wait times, with more customers in queue for a Company representative, due to the lack of self-service options.

Call center performance improved significantly during the recent January 2024 winter storm. Consumers' callers averaged a 40 second wait time to speak with a CSR and reported a 77 percent service level performance throughout the storm, indicating proper staffing of the center. Consumers' self-service channels were available throughout the storm.

5. Unfortunately for customers, large storms have become Consumers' default load and stress test of outage communications systems and technologies. *(See Recommendation #3)*

The Company's key outage communication systems and technologies have struggled under the pressure of major events, as detailed earlier in this report. Large storms have become the integrated stress test for these systems.

The AAR of the February 2023 storm revealed that Consumers deployed its ADMS with 500 open issues. Consumers did not provide a list of these issues despite a request for them, stating that "the decision was made to start with a fresh list of defects, with the expectation that issues reported by production users would surface to the top and receive prompt attention." Since the system's launch, Consumers has resolved over one hundred ADMS issues, with about half addressed in the months before the February storm. However, Consumers did not conduct DIL testing either after these changes or prior to the storm. These untested system modifications were put to the test during the February 2023 snowstorm, leading to the problems described earlier. It wasn't until March 7, 2023, that Consumers conducted DIL testing.

Following the February 2023 AAR, which recommended end-to-end stress testing, the Company chose to forego this approach and continue with DIL testing instead.

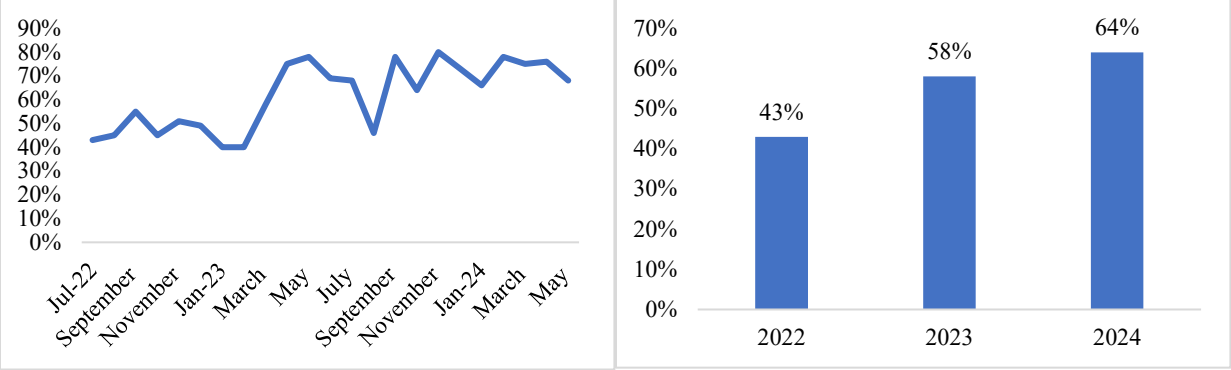
6. The recent approach to ETR improvements is better focused on customer needs and expectations. *(See Recommendation #4)*

The Company has struggled to provide timely and accurate ETRs during large storms in recent years. Customer dissatisfaction, as evidenced by CXi satisfaction survey ratings, has underscored persistent issues with ETR communications, particularly during major storms.

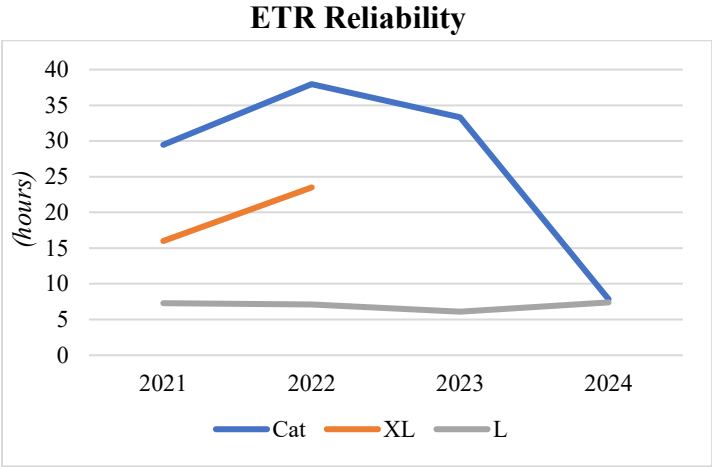
Since launching the AutoETRs machine learning model in 2019, Consumers has aimed to improve the consistency and accuracy of ETRs for both routine and storm events. The implementation of the ADMS system in June 2022 led Consumers to revise its Percent First ETR Met metric, focusing on the overall customer experience rather than individual outage jobs. This metric measures the percentage of customers who are restored before their first ETR expires and who receive only one ETR.

Since October 2023, Consumers has further enhanced its ETR communication processes by introducing the ETR Control Panel and implementing daily monitoring and reporting of Percent First ETR Met performance. These improvements seem to have positively influenced monthly and annual First Estimate Accuracy, as demonstrated in the charts below.

Percent First ETR Met Annual Performance



In addition to tracking the Percent First ETR Met metric, Consumers also monitors ETR Reliability, which measures the difference between actual and estimated restoration times in hours. Improving this metric, alongside Percent First ETR Met, will lead to more accurate and timely ETRs for customers. The following chart demonstrates recent improvements in ETR Reliability, however, it also highlights past challenges, particularly during major and catastrophic storm events before 2024. The chart uses Consumers' definition of storms; large storms are those impacting between 50,000 and 100,000 customers, extra-large storms, 100,000 to 180,000 customers and catastrophic, more than 180,000 customers. However, ETR Reliability has shown significant progress in 2024, with the average difference now around 8 hours, compared to over 30 hours in previous years.



D. Recommendations

1. **Continue to focus on improving ETRs and the customer outage experience.** *(See Conclusion #1)*

To enhance customer experience, Consumers should maintain its focus on improving how it manages ETRs and communicates restoration progress. Over the past several years, Consumers has made significant investments in technology and communication processes to better inform customers, the public, and other stakeholders. Given the evolving expectations of customers, it will remain valuable to seek their feedback and validate their expectations on a continuing basis. Consumers should persist in engaging with customers through post-storm meetings, forums, panels, and surveys to gain insights into their needs and adjust communication strategies accordingly. Doing so will help ensure a better experience for impacted customers and communities.

2. **Communicate with customers requiring medical equipment prior to a storm.** *(See Conclusion #1)*

Consumers currently lacks specialized communication for customers with medical equipment that might be vulnerable during power outages. To address this, Consumers should implement proactive, targeted communication strategies for these priority customers, especially before storms. By informing them about impending weather and ensuring they have appropriate contingency plans, Consumers can enhance their safety and provide a more tailored customer experience.

3. **Verify capacity sufficiency and hardening of outage communications systems and technologies through regular stress and testing.** *(See Conclusions #4 and #5)*

As Consumers continues to upgrade its key systems and platforms, it must ensure these systems have sufficient capacity, resiliency, and redundancy to handle all communication needs, whether on regular days or during storms of any size. Given the history of customer experience challenges, robust stress and load testing is essential, particularly after system upgrades or enhancements, to identify potential failures and minimize the risk of compromising the customer experience.

Consumers has acknowledged the importance of regular DIL testing and is exploring the feasibility of implementing it as a standard practice. Management also reports considering increasing the number of call center transactions included in these tests. The most recent DIL test was completed in May 2024, with plans for additional tests in September and October 2024 to assess SAP and ADMS upgrades. This approach will help ensure that Consumers' communication systems can effectively manage both everyday operations and major events, safeguarding a high-quality customer experience.

4. **Continue to monitor and measure accuracy and reliability in creating, updating, and communicating ETRs.** *(See Conclusion #6)*

As Consumers advances its processes for generating, updating, and communicating ETRs, it needs to maintain a strong focus on performance measurement and monitoring. Consumers should consistently track ETR accuracy and reliability while ensuring that modeling rules are rigorously tested and that appropriate controls are in place to address any deviations during future events. Ongoing feedback from customers, mayors, emergency management personnel, and other stakeholders has high value in refining the ETR process and addressing any issues that arise.

To enhance ETR reliability further, Consumers must integrate weather predictions, crewing data, and damage assessment information into its modeling approach. This comprehensive approach will help improve the precision of ETRs and better meet customer and stakeholder expectations.