FINAL Report on the Resiliency of South Carolina's Electric and Natural Gas Infrastructure Against Extreme Winter Storm Events

Mitigation of Impact of Threats to Safe and Reliable Utility Service

2021-66-A

South Carolina Office of Regulatory Staff | January 14, 2022

Objectives

1) Provide an overview of the Assessment Framework used in the Report

2) Identify the findings

3) Address questions regarding the Report

Jamie Bond, Project Manager

Associate Director responsible for exceptional PMO leadership and overall project delivery

Certified project manager with brings 18 years of technology strategy and regulatory planning experience with a strong focus on grid hardening, resiliency and modernization. She supports facilitation and change management as well as stakeholder engagement activities related to areas of major transformation, such as infrastructure modernization, climate and resiliency planning and new revenue recovery models and rate designs. Jamie's knowledge of the vertically integrated utility model, from generation to customer programs, her extensive background in energy policy, rulemaking and regulatory compliance, and her relationship management roles across various business units and industry groups position Jamie to support utility clients across a range of stakeholder engagement needs.

Guidehouse

Guidehouse Assessment Team

RESILIENCY ASSESSMENT

Core team of subject area evaluators, analysts and dedicated research

Considered insights from multiple sources:

- Lessons learned and best practices from industry
- Winter weather event reports (including recently issued NERC report)
- Docketed comments, discovery request responses and interview responses

Project Delivery & Report Lead

Jamie Bond, PMP
Project Manager
Project Management & Delivery Leader

Evaluation Leads

Electric Utilities

Gene Shlatz
Bulk Electric & Transmission Evaluation Lead

Ed Batalla
Large Electric Distribution Evaluation Lead

Scott Grafelman
Small Electric Distribution Evaluation Lead

Natural Gas Utilities

Keith Lorenzetti
Large Natural Gas Evaluation Lead

Joaquin Iraheta
Small Natural Gas Evaluation Lead

Generation & Fuel Supply

Bob Ruhlman
Generation & Fuel Supply Evaluation Lead

Research & Analysis

Hannah Davis
Guidehouse Insights Research Lead

Juan Jimenez
Electric Infrastructure Assessment Analyst

Ann Thompson
Project Coordinator / Analyst Support

Overall Quality & Oversight

Hector Artze
Partner in Charge
ES&I Resiliency

Approach

ASSESSMENT FRAMEWORK

- Leverages Capability Maturity Model Integration (CMMI) process
- Methodical approach to support credibility and defensibility
- Assessment consistency between evaluators and across utility providers
- Outputs can typically support improvements to processes, productivity and effectiveness

Utility Adverse Weather Assessment Framework

Focus Areas

People | Process | Technology | Data | Governance

11 INDICATOR AREAS

1. Emergency Mgmt Planning
2. Risk Management
3. Staffing & Mutual Asst Support
4. Asset Mgmt & Inspections
5. Operational Protocols
6. System Design & Hardening
7. Stakeholder Engagement
8. Public Communications
9. Automation
10. Situational Awareness
11. Regulatory Compliance

ASSESSMENT FRAMEWORK OUTPUT

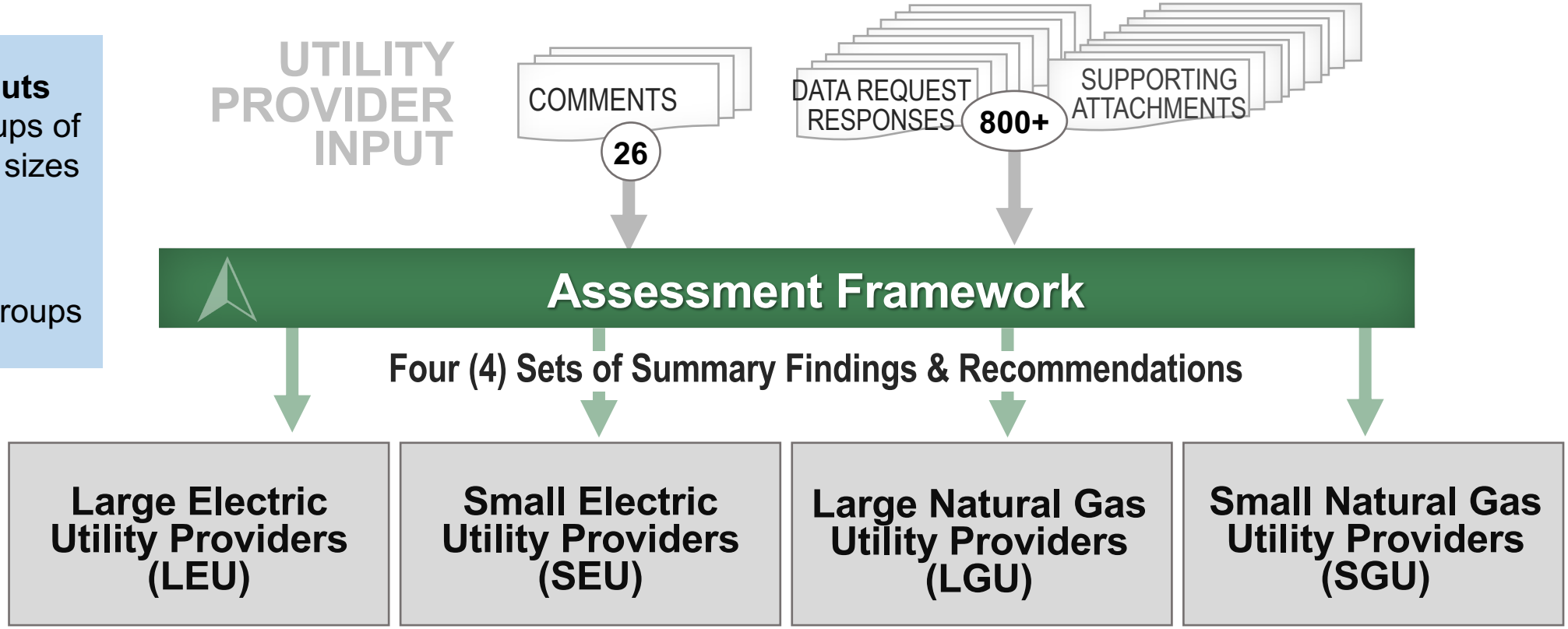
Maturity score for each *Indicator Area*

Advanced | Leading | Foundational | Lagging | Nascent | Insufficient Data

Approach

Assessment outputs categorized to groups of similar utilities and sizes

Findings and recommendations tailored for these groups



Assessment of the Resiliency of South Carolina's Electric and Natural Gas Infrastructure Against Extreme Winter Storm Events

Assessment Findings

Overall Findings

Evaluators conclude that the **South Carolina energy system and Utility Providers are adequately prepared to prevent and respond to outages caused by ice storms and winter weather events**.

- **LEUs and LGUs wield the greatest influence** in state's overall ability to withstand winter weather events and offered sufficient qualitative evidence to illustrate their readiness and ability to respond to winter weather events.
- **SEUs and SGUs pose a much lower overall risk** to statewide infrastructure resiliency

Indicator	LEU	LGU	SEU	SGU
Indicator 1 Emergency Management and Planning	Leading	Leading	Foundational	Insufficient Data
Indicator 2 Risk Management	Leading	Foundational	Foundational	Foundational
Indicator 3 Staffing and Mutual Assistance Support	Leading	Leading	Foundational	Insufficient Data
Indicator 4 Asset Management and Inspections	Leading	Foundational	Lagging	Insufficient Data
Indicator 5 Operational Protocols	Leading	Leading	Foundational	Insufficient Data
Indicator 6 System Design and Hardening	Leading	Leading	Lagging	Lagging
Indicator 7 Stakeholder Engagement	Leading	Foundational	Lagging	Insufficient Data
Indicator 8 Public Communications	Leading	Foundational	Foundational	Insufficient Data
Indicator 9* Automation	Leading	*Not Scored**	Lagging	*Not Scored**
Indicator 10 Situational Awareness	Leading	Foundational	Lagging	Insufficient Data
Indicator 11 Compliance to Regulations	Leading	Leading	Foundational	Foundational

Advanced | Leading | Foundational | Lagging | Nascent | Insufficient Data

Large Electric Utility Providers

Notable Findings

- Fully integrated incident command structures with well trained emergency management teams and personnel
- Well-documented storm plans identifying potential system risks and describing various process for evaluating and mitigating specific risks
- Well established mutual assistance programs and asset inspection programs for critical infrastructure
- Incorporation of supporting technologies for enhanced asset management, damage assessment, grid operations during events, and even in communication planning
- Demonstrated adherence to federal and state resiliency requirements industry-leading and prevalent use of industry leading practices

Indicator	LEU
Indicator 1 Emergency Management and Planning	
Indicator 2 Risk Management	
Indicator 3 Staffing and Mutual Assistance Support	
Indicator 4 Asset Management and Inspections	
Indicator 5 Operational Protocols	
Indicator 6 System Design and Hardening	
Indicator 7 Stakeholder Engagement	
Indicator 8 Public Communications	
Indicator 9* Automation	
Indicator 10 Situational Awareness	
Indicator 11 Compliance to Regulations	

Advanced | Leading | Foundational | Lagging | Nascent | Insufficient Data

LEU-Specific Recommendations

- Assess feasibility of more comprehensive severe weather damage predictive models
- Consider technology solutions for improving mutual assistance crew management
- Investigate integrating mutual assistance crews' information into Outage/Work Management Systems
- Continuous improvement using analytical tools for risk management processes
- Implement robust decision-making processes for long-term investments to reduce risks.
- Conduct transmission physical condition assessment on vulnerable lines and equipment without recent detailed inspections
- Consider integration of enterprise asset management system with asset performance management.

- Review corporate winter freeze preparation procedures which apply to generation assess against plant to ensure that there are no gaps
- For all generation units using natural gas as a primary fuel and fuel oil as a backup fuel, ensure local freeze protection procedures
- Continued development to use collected information from assets
- Consider establishing a centralized network operations center (NOC) specifically servicing operational technology (OT) assets to leverage real-time information and focusing on infrastructure-related events..
- Consider material storage and delivery methods to improve getting materials to the field quicker for repairs.
- Continue to extend these situational awareness tools to use information or data for analytics

Small Electric Utility Providers

Notable Findings

- All conduct some basic level risk assessment activities however none provided vulnerability and risk assessments for cold weather
- Reported use of mutual assistance as a part of overall emergency response plans with third party coordination services for accessing additional resources during emergency events
- Calendar-based inspection programs implemented; limited use of formal asset management software or non-calendar-based approaches
- Lagging in system hardening investment for minimizing the negative impacts of climate change and extreme weather to their customers; some foundational components in place
- Comply with reporting/audit requirements limited requirements imposed for specific operational or performance

Indicator	SEU
Indicator 1 Emergency Management and Planning	Foundational
Indicator 2 Risk Management	Foundational
Indicator 3 Staffing and Mutual Assistance Support	Foundational
Indicator 4 Asset Management and Inspections	Lagging
Indicator 5 Operational Protocols	Foundational
Indicator 6 System Design and Hardening	Lagging
Indicator 7 Stakeholder Engagement	Lagging
Indicator 8 Public Communications	Foundational
Indicator 9* Automation	Lagging
Indicator 10 Situational Awareness	Lagging
Indicator 11 Compliance to Regulations	Foundational

Advanced | Leading | Foundational | Lagging | Nascent | Insufficient Data

SEU-Specific Recommendations

- Consider adopting the higher level of loading for added resiliency.
- Invite outside third parties (e.g., governmental agencies, key customers, etc.) to review to provide feedback on Emergency Response Plan (ERP)
- Ensure documented ERP, communications plans and backup contingency plans for critical facilities, with employee training and annual drills
- Use ice storm prediction tools to better predict ice storm damage and support effective resource management.
- Track restoration reliability metrics for all outages events to gain insight into the effectiveness of response plan.
- Perform basic risk management assessment and identify mitigation strategies for extreme winter events
- Identify and develop mitigation plans for critical assets; develop cold weather performance asset management programs; identify critical customer loads and develop prioritization plans
- Refine mutual assistance plans and look improvement.; formalize and train on mutual assistance procedures to ensure smooth execution when needed.
- Proactively arrange with local hotels for potential number of rooms and restaurants for serving capacity in the mutual assistance part of the emergency response plan.
- Engage vendors to evaluate material specification around withstanding cold weather and extreme ice conditions.
- Formalize a public communications plan to educate the public on the emergency response plan.

Large Natural Gas Utility Providers

Notable Findings

- Fully integrated incident command structures with *demonstrated* use of standardized approach to command, control, and coordination with leading practices in resource planning and acquisition for large events
- Comprehensive Distribution Integrity Management Plans (DIMPs) and Transmission Integrity Management Plans
- Asset management programs for assuring critical infrastructure will operate during adverse weather; inspections that assess vulnerability to extreme cold
- Use of technology for engaging stakeholders before during and after a severe weather event
- Demonstrated adherence to federal and state resiliency requirements industry-leading

Advanced | Leading | Foundational | Lagging | Nascent | Insufficient Data

Indicator	LGU
Indicator 1 Emergency Management and Planning	Leading
Indicator 2 Risk Management	Foundational
Indicator 3 Staffing and Mutual Assistance Support	Leading
Indicator 4 Asset Management and Inspections	Foundational
Indicator 5 Operational Protocols	Leading
Indicator 6 System Design and Hardening	Leading
Indicator 7 Stakeholder Engagement	Foundational
Indicator 8 Public Communications	Foundational
Indicator 9* Automation	*Not Scored**
Indicator 10 Situational Awareness	Foundational
Indicator 11 Compliance to Regulations	Leading

LGU-Specific Recommendations

- Investigate use of analytical tools for risk management processes (quantifying risks and incorporating into plans)
- Continue analysis of operational performance data
- Although need for LGU mutual assistance is low, capability should be periodically assessed
- Continuously improve use of prediction models for preparing from impacts of extreme weather events and to project need for and assign mutual assistance crews
- Evaluate black start capabilities for key purchase points and regulator stations (i.e., for extended electric loss)
- Designation of critical valves for periodic testing as a preparatory action for severe winter weather
- Use of “universal” operating protocols (procedures) to support more cost effective, less burdensome severe winter weather evaluations, documentation, and training
- Use of Knowledge Management System (KMS) to aid in improving training processes
- Develop emergency stock of equipment and parts for a severe winter weather event
- Establish a defined program and annual budget for cold winter weather resilience
- Identifying key internal and external stakeholders related to major events; personalize a communication plan by stages resiliency plan so that the engagement is set earlier on and not only during the event itself
- Analyze customer sentiment during major events for continuous process improvement insights
- Enhance capabilities to extend use of situational awareness tools
- Use of enhanced tools for compliance tracking activities

Small Natural Gas Utility Providers

Notable Findings

- Seven of the ten indicators applicable for NG Utility Providers not fully assessed due to insufficient information available to evaluators
- Adequate risk management processes largely due to the systematic risks and threats evaluation documented within Distribution Integrity Management Programs (DIMPs) and Transmission Integrity Management Programs (TIMPs), -- requirement of the Pipeline Hazardous Material Safety Administration (PHMSA)
- Lagging in system hardening investment for minimizing the negative impacts of climate change and extreme weather to their customers; some foundational components in place
- Adequate Compliance to regulations. Most requirements with which LEUs must comply come from DIMPs and TIMPS which were observed to be comprehensive.

Advanced | Leading | Foundational | Lagging | Nascent | Insufficient Data

Indicator	SGU
Indicator 1 Emergency Management and Planning	Insufficient Data
Indicator 2 Risk Management	Foundational
Indicator 3 Staffing and Mutual Assistance Support	Insufficient Data
Indicator 4 Asset Management and Inspections	Insufficient Data
Indicator 5 Operational Protocols	Insufficient Data
Indicator 6 System Design and Hardening	Lagging
Indicator 7 Stakeholder Engagement	Insufficient Data
Indicator 8 Public Communications	Insufficient Data
Indicator 9* Automation	*Not Scored**
Indicator 10 Situational Awareness	Insufficient Data
Indicator 11 Compliance to Regulations	Foundational

SGU-Specific Recommendations

- Define roles and responsibilities, identify external agencies, and specifies emergency role training and emergency drills and/or tabletop exercises in basic emergency plan.
- Consider natural forces severe winter weather impact in next DIMP.
- Continue to improve extreme weather prediction models to optimize mutual assistance planning
- Include a comprehensive list of severe winter weather risks and risk mitigation actions in DIMPs and TIMPs.
- Develop mutual aid agreement with SGUs, contractors, and LGUs
- Evaluate severe winter weather industry practices for proactive asset management inspections and patrols of critical infrastructure .
- Evaluate implementation of severe winter weather operating protocols.
- Evaluation of the black start capability for extended loss of electric supply for key regulator stations and purchase points.
- Establish specific programs and budgets for severe winter weather risk mitigation programs.
- Begin engaging local stakeholders (e.g., plan emergency drills with local emergency agencies)
- Establish severe weather emergency communications plans.
- Develop situational awareness plans and protocols for gas-adverse weather readiness.
- Document process for meeting peak design day demand during a severe winter weather event.

Assessment of the Resiliency of South Carolina's Electric and Natural Gas Infrastructure Against Extreme Winter Storm Events

Final Recommendations

Final Recommendations

1

Strengthen existing procedures for cold weather preparedness, planning, engineering, operations and coordination to prevent extended interruptions in natural gas and electric service

Procedures should provide **enhanced and enforced operations and maintenance** to mitigate disruption.

For entities that are under the purview of mandatory NERC Reliability Standards, see Recommendation No. 3 for the voluntary adoption of the Public Utility Commission of Texas rules.

Final Recommendations

2

Evaluate BPS reliability under more extreme conditions than required by NERC and SERC. Include:

a. **Extended cold weather conditions** more stringent than SERC's winter criteria (e.g., higher loads and colder temperatures)

b. **Loss of a greater number of transmission lines** than those specified in NERC transmission planning contingency criteria

Final Recommendations

3

Form a task force to evaluate the voluntary adoption of practices comparable to those recently adopted in Texas.

Refer to the legislatively-mandated rules instituted around winter storm planning and requirements for Generation Entities and Transmission Providers.

Final Recommendations

4

Adopt the current codes and industry best practices, hardening for greater storm resiliency, and designing for the future.

Prioritizing systems most susceptible to winter-related outages – **Apply enhanced design standards** for equipment and facilities damaged in the recent storms and/or major events.

To harden the transmission and distribution (T&D) infrastructure, physical and structural improvements to lines, poles, towers, substations, and supporting facilities will be needed to make them less vulnerable to the damaging effects of winter-related events.

a. **Determine and enforce safe loading requirements** for distribution poles based severe winter weather risks – specifically those used to carry both electric and telecommunications infrastructure.

b. **Evaluate strategic, targeted undergrounding** of distribution lines in limited, appropriate circumstances based on the exposure to the threat of severe winter events.

Final Recommendations

5

Consider updates to include specific adverse winter weather risk evaluation and mitigation actions to Distribution Integrity Management Plans (DIMP), Transmission Integrity Management Plans (TIMP), operations and maintenance manuals and design standards.

Final Recommendations

6

Collaborate to develop a set of standard emergency preparedness and operating practice guidelines to provide consistent levels of service reliability to all South Carolina electric and natural gas customers. Guidelines may initially be voluntary and evolve to mandatory, once matured.

Final Recommendations

7

Require Utility Provider participation in adverse winter weather emergency drills and/or tabletop exercises with state and local emergency management agencies in their respective emergency management planning cycles.

The State should **consider including propane providers and petroleum pipeline providers** in adverse winter weather emergency drills and/or tabletop exercises.

Final Recommendations

8

Consider the feasibility of a costs/benefits study of resiliency and reliability enhancements and, as part of that study, consider whether there are any federal funding opportunities.

Final Recommendations

9

Actively participate in regional and national industry groups such as Electric Power Research Institute (EPRI), American Gas Association (AGA), Southeastern Electric Exchange (SEE), Municipal Association of South Carolina (MASC), and Carolinas Public Gas Association (Carolina SPGA).

Final Recommendations

10

Assess the interdependencies between electric power and other key infrastructure (e.g., water, wastewater, telecommunications, transportation, etc.) to identify and address additional extreme cold weather and event response vulnerabilities.

Questions?

Michael Seaman-Huynh

Deputy Director – Energy Operations

South Carolina Office of Regulatory Staff

mseamanhuynh@ors.sc.gov

803.737.0850