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Grid Hardening at Santee Cooper

Strategic Initiatives, Impacts, and Maintenance Evolution

SCAMPS

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Introduction

Grid Hardening and System Maintenance

- Maintenance Programs
 - Cycles, plans, inspections
 - Everyday reliability
- Grid Hardening
 - Infrastructure upgrades
 - Storm response and system resilience
- Best Bang for the Buck
 - What's working
 - Prioritizing wisely

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Retail Service Territory



Distribution System Overview – Santee Cooper's distribution system is comprised of:

- 216,612 retail customers
- 60 distribution substations
- 300 distribution circuits
- 110,118 poles
- 72,784 streetlights
- Primary: 3,195 miles (43% OH and 57% UG)
- Secondary: 2146 miles (36%OH and 64% UG)
- Services: 1417 miles (18% OH and 82% UG)

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Reliability vs Resiliency



Reliability

- Normal conditions (“Blue sky” days) incl small events
- Controllable factors (equipment, vegetation, maintenance)
- Reports exclude
 - Major Event Days
 - Loss of Source, Planned outages
- Why it matters
 - Reflects baseline system health
 - Guides routine maintenance

• Resiliency

- Withstand and recover from major events (hurricanes, ice storms)
- Strength of infrastructure, response time, automated restoration
- Improvements
 - Undergrounding, steel/larger poles
 - Enhanced vegetation mgmt.
 - Smart grid automation
- Why it matters
 - Response and recovery time
 - Public trust



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Distribution – Reliability Metrics



Annual reliability performance index with and without major event days:

SAIDI – System Average Interruption Duration Index

Annual SAIDI (minutes)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Total SAIDI (no excl)	38.5	2137.8	34.5	544.5	135.2	50.6	27.6	223.2	58.7	58.4
SAIDI - MED	37.1	33.2	26.8	30.7	23.6	29.6	27.6	35.8	46.9	55.2
SAIDI all exclusions	23.0	23.5	18.8	20.6	18.9	23.9	20.7	23.7	22.3	25.9

CAIDI – Customer Average Interruption Duration Index

Annual CAIDI (minutes)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Total CAIDI (no excl)	62.5	968.6	64.2	489.8	163.9	80.5	54.7	176.4	73.1	85.0
CAIDI - MED	61.6	58.0	54.5	68.9	65.3	61.6	54.7	51.0	75.6	85.6
CAIDI all exclusions	78.9	59.0	58.0	65.8	71.3	61.4	61.9	52.1	65.5	63.1

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Distribution - Major Events



Impact of
notable
events -
last 10 years

Storm	Year	Customers Out	% Customers Affected	Event Days
Matthew	2016	137,000	77.5%	6.9
Irma	2017	8,344	4.6%	1.1
Michael	2018	7,480	4.0%	0.4
Florence	2018	50,310	27.2%	4.0
Dorian	2019	20,986	11.1%	2.7
Isaias	2020	12,693	6.5%	0.5
Elsa	2021	10,454	5.3%	0.5
Jasper (W)	2022	10,621	5.2%	0.6
Ian	2022	70,000	34.2%	2.9
Idalia	2023	2,709	1.3%	0.8
Finn (W)	2024	4,414	2.0%	1.3
Debby	2024	5,241	2.4%	2.4
Helene	2024	8,811	4.1%	1.1

• Note: Winter storm Elliott (2022) and winter storm Enzo (2025) were not noteworthy events for Distribution.

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Santee Cooper's Approach to Grid Hardening



- Regulatory or internal motivators
 - No regulatory, however...
 - Major events, and winter storms, invite questions and committees
 - Recognition that resiliency goes beyond blue-sky reliability.
 - Hurricane prone
 - Previous slide indicates at least one major event every year
- Philosophy and drivers
 - What did the customer see?
 - Metrics
 - Storm hardening
 - Aging infrastructure

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Distribution - Infrastructure Age



	< 10 years	10-20 years	20-30 years	> 30 years
Poles	13.7%	12.5%	17.8%	56.0%
Transformers	20.2%	22.3%	7.9%	49.6%
Switchgear	19.9%	38.5%	32.0%	9.6%
Subst. Transf.	4.6%	15.9%	15.9%	63.6%
UG Primary	26.0%	25.9%	34.4%	13.6%

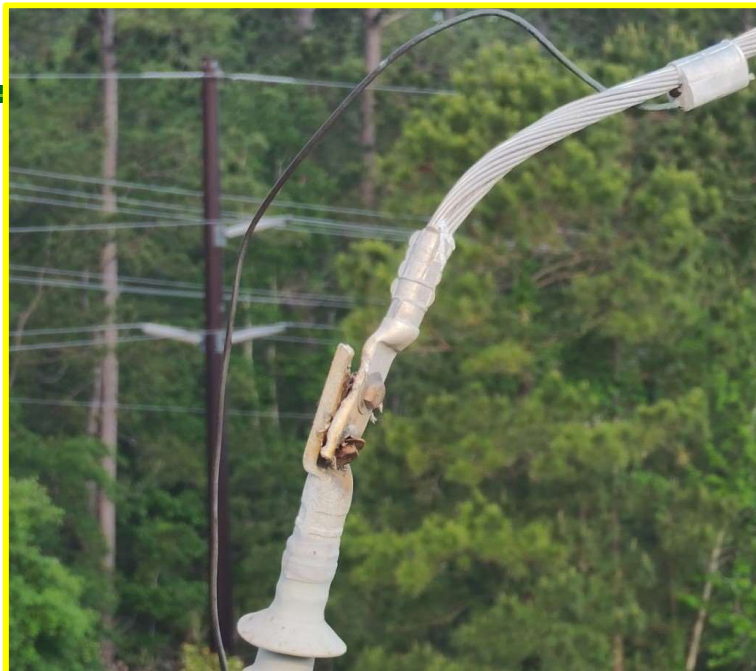
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Distribution - Reliability Initiatives



- **Annual Circuit Reviews:**
 - Worst performing 2 circuits in each Operational Area get full inspection & maintenance
- **Breaker Operations Analysis:**
 - Any circuit with 3+ unexplained breaker trips gets inspected
- **Repeat Outage Evaluations:**
 - Locations with 2+ outages in a year reviewed within 30 days; moving to 36-month review.
- **Corrosion Patrols:**
 - Inspections of coastal circuits for salt-related degradation
- **Annual Overcurrent Protection Review:**
 - Relay settings, along with 1,600 Fuses (15% of total), are reviewed annually
 - Safeguards the system and minimizes customer outage times.
- **Other**
 - Infrared inspections, subsurface switchgear inspection, drone inspections

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Distribution - Maintenance & Inspection Programs



- **Pole Inspection & Reinforcement:**
 - 10% of system inspected annually
 - Reject rate: 5% (1% reinforced)
 - Reject poles replaced within 1 year
- **Padmount Equipment Inspection**
 - Inspected on a three-year cycle (33% per year)
 - Defects handled through replacement or through a contracted field repair
- **Vegetation Management:**
 - 5-year trim cycle
 - Integrated Vegetation Management – includes directional pruning and professional standards
 - Proactive tree clearing and incompatible species removal

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Distribution - Capital Investments & Grid Modernization



- **Completed and Planned Modernization:**
 - 100% AMI (Advanced Metering Infrastructure) deployment – completed 2021
 - Distribution SCADA at nearly all substations (46 customers out of 216,612 customers on SCADA controlled circuits)
 - ADMS Implementation (2025-2026) – Advanced Distribution Management System to replace existing outage management system
 - Will enable FLISR (Fault Location, Isolation & Service Restoration) and additional automation
- **2025-2026 inspections to focus on:**
 - Multi-circuit poles (3-4 circuits)
 - Former 34kV transmission lines now classified as distribution
 - Poles > 50 years old

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Distribution - Reliability/Resiliency Measures



- **Undergrounding Initiatives with municipal partners:**
 - Franchise-funded OH to UG conversions with cities
 - Joint effort between Santee Cooper and Local Government
 - Improves reliability and resiliency
 - 50/50 match \$2.64M collected in 2024
 - Three-year budget: \$6.9M - \$7.2M per year
 - Historical spend: \$96M inception to date (2005-2024)
- **Underground cable replacements**
 - \$600,000 budgeted for underground cable replacement
- **#6 Copper wire conductor upgrades - \$500,000 2025-2026**
- **Substation Asset Management Program**
 - \$1.5M budgeted annual to upgrade/replace aging substation equipment
 - Includes: Automated Circuit Switchers, Distribution Breakers, Distribution Regulators, and Substation Relays

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Substation Asset Management



Pro-active approach

- Some assets are still run to failure (power transformers)
 - Five-year testing
- Breakers
 - We are using 35 years as end-of-life
 - Replacing 8 breakers per year
 - By 2031, all breakers will be less than 35 years old
- Regulators
 - Using 50 years as end-of-life
 - Replacing one bus (12 regs) per year ensures all remain below 50 years
- Relays
 - End-of-life 20-25 years for microprocessor relays
 - Two buses (8 relays) per year ensures they remain below 25 years

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Summary / Wrap-up



Best Bang for the Buck

Strategic Undergrounding

Automation & Smart Switching

Pole Upgrades

Vegetation Management Enhancements

Worst Circuit Targeting

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