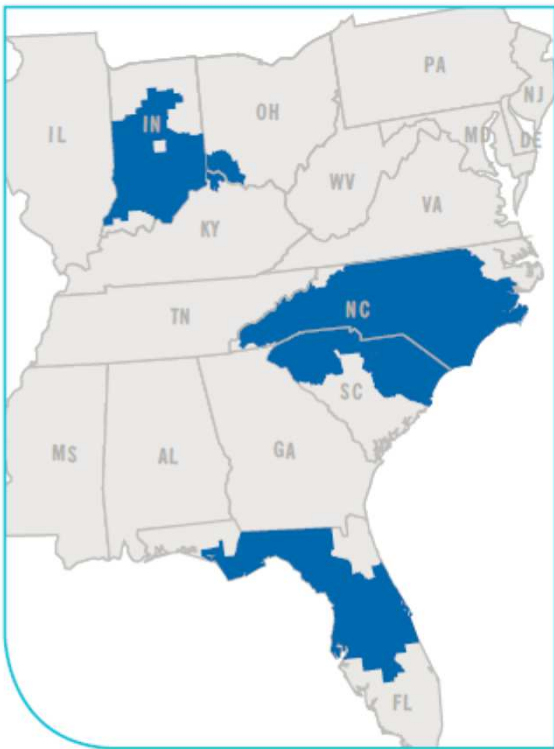




**Update on Grid Security to the
North Carolina Joint Legislative Emergency
Management Oversight Committee** | October 12, 2017



About Duke Energy

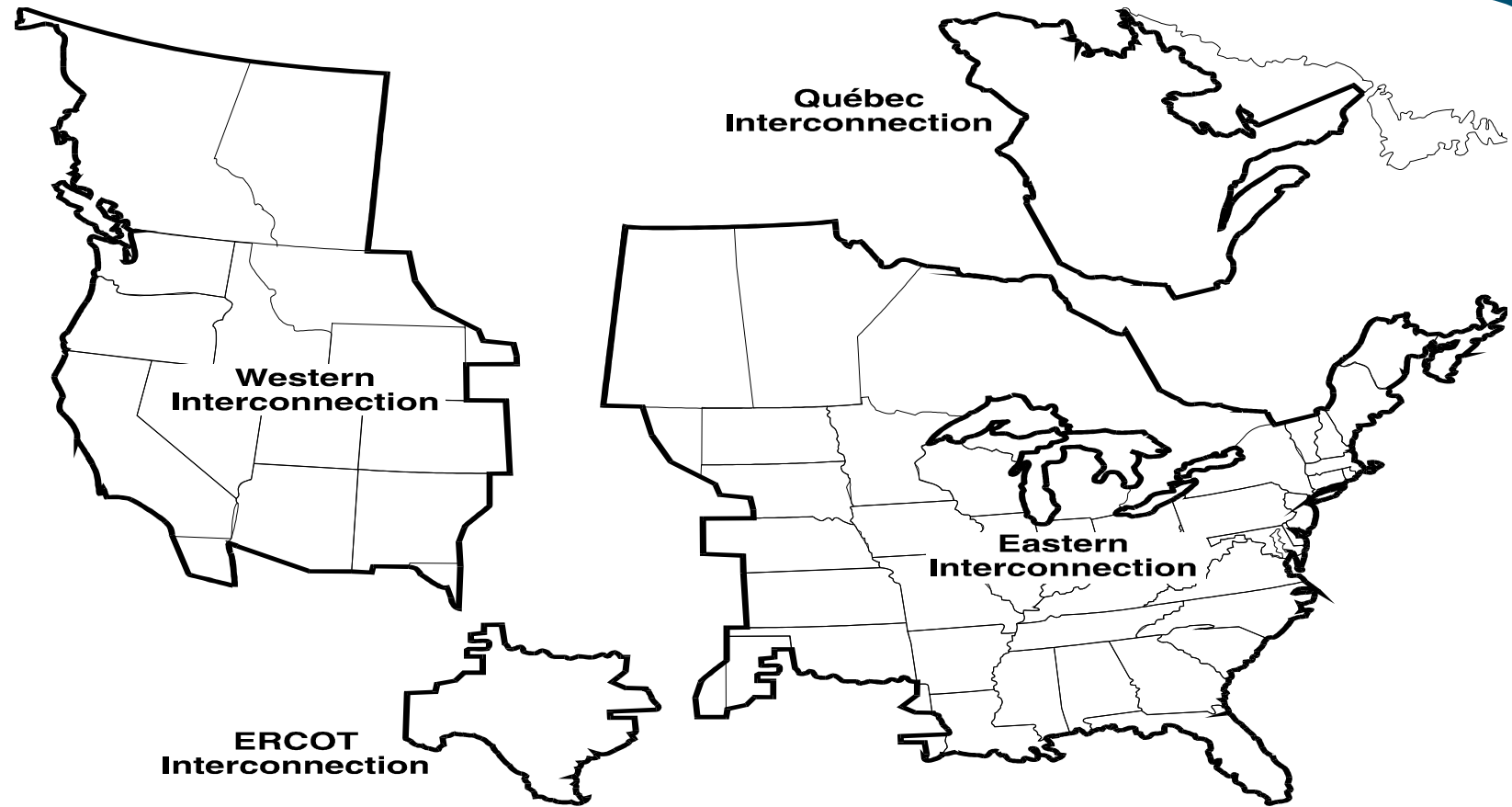


Duke Energy Service Territory

- 150+ years of service
- 7.5 million electric and 1.6 million gas customers
- Fortune 125 company
- \$133 billion in assets
- 49,300 megawatts of generating capacity from a diverse mix of coal, nuclear, natural gas, oil and renewable resources
- Service area covering approximately 95,000 square miles in the Southeast and Midwest

(Source: https://www.duke-energy.com/_/media/pdfs/our-company/duke-energy-fast-facts.pdf?la=en, retrieved 10/10/17)

The North American Electric Grid - Interconnections



Protecting the Electric Grid

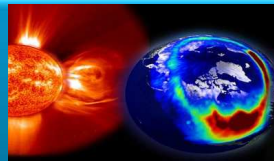
- Protecting the electric grid and maintaining system reliability – **Top Priorities**
- Have made, continue to make, significant investments to protect the grid from disruptions. **An efficient, reliable and safe electric system -- core to all we do.**
- Work with local, regional and national law enforcement and security agencies
- Coordinate with industry peers, research organizations and federal agencies to safeguard these important assets, and to monitor and develop solutions and responses.
- Collaborative relationship -- serves our customers well.
- Ability to share information and review research key to developing effective solutions on a national level across the electric grid.

Prepared For High Impact Low Frequency (HILF) Events

HILF Events occur infrequently, but can have significant effect. These types of events require the appropriate balance of detection, prevention and response mitigations.



Physical/Cyber Security



GMD/EMP



Hurricane/Ice Storms



Tornadoes



Straight-Line Winds



Floods



Seismic



Fires

Protecting the Electric Grid

- Duke Energy -- employs a multi-tiered approach to grid security based on resiliency.
 - Includes elements of prevention and response to system threats.
 - Internal working teams specifically focused on geomagnetic disturbance and physical security threats to the grid.
- No single solution can completely eliminate risk -- We ensure there are contingencies and redundancies in place.
- We must constantly balance threat mitigation with the cost impact to customers....

Grid Security Commitment:

We ensure that every dollar invested is prudent, and addresses all risks, in a common-sense, priority-based manner based on expert knowledge both inside the company and in coordination with industry and government experts.

This is critically important, and we take it very seriously.

Cybersecurity program

Identify – Identify key assets and related cyber security risks

- Critical assets identified
- Risk Management Framework
- Internal and third party penetration testing

Protect – Implement safeguards that protect critical infrastructure

- Perimeter protection
- Network access control
- Data loss prevention
- Enhanced cybersecurity services (ECS)

Detect – Deploy solutions to identify the occurrence of a cybersecurity event

- Intrusion protection systems and monitoring
- Cybersecurity Risk Information Sharing Program (DHS program)
- Collaboration with FBI, DHS, and Electricity Sector Information Sharing and Analysis Center (E-ISAC)

Respond – Take appropriate action regarding a detected cybersecurity event

- Incident response process and communication plans
- Kill chain methodology
- Anti-distributed denial of service attack
- Cyber incident drills: internal and external

Recover – Execute plans to restore all capabilities impaired by a cybersecurity event

- Cyber Incident Response process and communication plan
- Backup and restore process
- Disaster recovery exercise

Protecting the Grid □ Hurricanes

Matthew

- Historical Storm Stats
 - 5th worst storm (Hugo(Cat 4), Floyd, Fran, 2002 Ice Storm)
 - 3rd in # of customers out at simultaneous peak
 - Carolinas Customers Out: Peak - 680K; Total - 1.5M
 - Resource Mobilization: Carolinas Distribution - 10,200, All Transmission - 742, All Customer Service - 754
- What Sets It Apart
 - Large areas had 10-20" of rain in NE SC and E NC, began with saturated ground, and caused significant flooding
 - Healthy (leafed) trees outside ROW toppled with the entire root ball
- Transmission Impacts
 - < 5 structures damaged
 - 115 Substations/58 lines outaged
- Distribution Impacts
 - Customers capable of receiving power restored in 7 days
 - 90% restored (same # of customers as impacted in Floyd) in 4 days – took 6 days for Floyd

Protecting the Grid | Distribution

Grid Investment Plan

- **HARDENING** – Investments that lower system risk and prevent outage events from occurring
 - addresses grid integrity and asset end of life
 - more modern infrastructure & design
 - address root causes of outages
- **RESILIENCY** – Investments that minimize event impacts and improve ability to recover rapidly
 - minimizing number of customers impacted
 - building N-1 capability
 - leveraging analytics to support rapid restoration
- **Examples**
 - **Targeted Underground** – leveraging historic data to strategically move hard-to-access overhead power lines underground
 - **Self Optimizing Grid** – enables multiple ways to backfeed customers during restoration
 - Connectivity: multiple power flow routes for flexibility
 - Capacity: sufficiently sized lines and equipment to support backfeeding
 - Control: intelligent automation to optimize the grid

Protecting the Grid | Physical Security

Current Duke Energy Actions

- Internal working team comprised of security and operations employees
- Meetings with FERC to discuss threats and mitigating actions
- Participation in industry groups – North American Transmission Forum, EEI, GridEx, etc.
- System studies and site reviews
- Emergency response plans, black start plans, system operator training
- Spare equipment plans and programs (EEI STEP, STEP Connect)
- Involvement in development and implementing provisions of FERC-approved NERC physical security standard (CIP-014-1)
- Participation in EPRI research efforts for Transmission Resiliency and Physical Security
- Coordination and information sharing with local, state and federal agencies
- NERC standards for Critical Infrastructure Protection (CIP) and Emergency Operations (EOP)

Protecting the Grid | Electromagnetic Pulse (EMP)

- **Current Duke Energy Actions:**
- Factoring EMP protection into the overall protection plan for some key facilities – design criteria for EMP is location and purpose specific
- Reviewing/refining existing response plans for modifications to incorporate response to widespread EMP impacts, focusing on operating absent SCADA/EMS
- Participated in NC DPS development of NC EMP Readiness/Response plan
 - Basis built largely on NERC and Duke restoration and response plan criteria and intended to include all critical infrastructure sectors
 - Participated in EMP tabletop scenario (Aug 2017)
- Continuing a similar cross-sector response plan effort in South Carolina
- Working with industry organizations (EPRI, NATF, etc.) and academic consortiums (CAPER, CUEPRA, etc.) to research adequate levels of hardening/resiliency of grid elements, components, and facilities and determine best practices
 - EPRI – E3 Assessment of the Continental U.S. Electric Grid (Feb 2017)
 - NATF – Spare Tire Project Report (June 2017)
 - FERC/NERC – PRASE Project Phase II Report (June 2017)

Responding When the Grid Is Damaged

- **Plan, drill the plan, gain feedback/best practices to improve the plan**
 - Duke Energy continually reviews and revises its comprehensive response plan for major events affecting the grid
 - Duke Energy drills the plan to ensure understanding and to determine ways to improve our response
 - Duke Energy participates in industry and regulatory groups (Edison Electric Institute, Southeastern Electric Exchange, North American Transmission Forum, North American Electric Reliability Corporation, Federal Energy Regulatory Commission, etc.) to help us learn and share industry best practices related to response plans, technologies and practices
 - Duke Energy takes a leadership role in the National Response Event (NRE) - a coordinated response plan/structure to national events developed after Hurricane Sandy

Resiliency

Resiliency –The Big Picture:

“.....With finite resources, if we attempt to address all threats and vulnerabilities, we protect against none. Using a comprehensive, risk-based approach, grid security can be addressed in a manner that balances protection with the need to provide affordable energy to consumers.”
Center for the Study of the Presidency & Congress on “Securing the U.S. Electrical Grid”

“.....Recognizing the costs for ratepayers associated with these efforts requires prioritization, along with risk management, to ensure that we are focusing resources on the greatest risks to the reliability of the bulk power system.” *Gerry Cauley, CEO NERC*



Dominion Energy®

EMP / IEMI

Mitigation

A Layered Approach

EMP Mitigation Strategy Being Deployed Across Dominion Energy

Transmission, Distribution, Generation

▮ Fundamental grounding is key for EMP mitigation

- ▮ Bleed the energy into the ground at substations and along transmission lines
- ▮ Use grounding fundamentals for day-to-day grid operations and events, and use as basis for EMP/IEMI mitigation

▮ Layered approach ▮ Cost prohibitive to EMP harden all facilities

Build in layers of EMP/IEMI protection that sequentially reduce the power and threat

Fence → Cable Shielding → Control House → Panels → P&C Devices

Substation Ground Mat
Transmission Line Tower Grounding


Dominion Energy EMP Mitigation

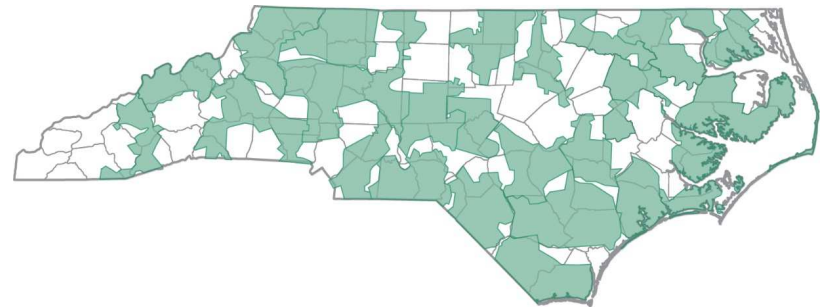
- ▮ Large Power Transformers designed for GMD / EMP withstand
- ▮ Digital protection & control systems designed for greater transient withstand
 - ▮ Helical shielded control cable, grounded on both ends with messenger
 - ▮ Lowers material cost, installation variances and improves overall reliability
- ▮ Lightning protection on our T&D systems help with EMP
- ▮ Primary distribution voltage of 34.5kV is less susceptible to insulator damage from EMP event
- ▮ Additional transmission mobiles and spare power transformers geographically spread to speed restoration, if needed
- ▮ New System Operating Center hardened for EMP
- ▮ Partnering with EPRI on research in this area
 - ▮ EPRI and Defense Threat Research Agency testing support Dominion Energy approach as the most cost effective way to enhance resiliency for EMP

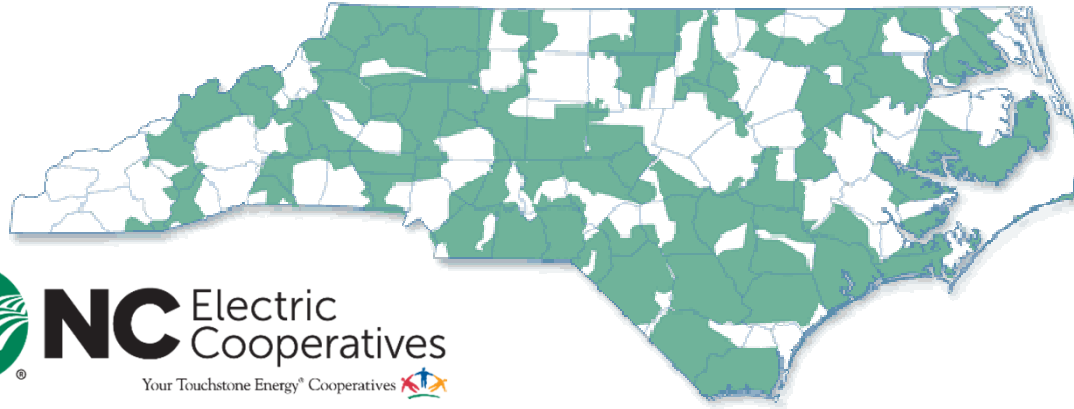
Joint Legislative Emergency Management Oversight Committee



NC Electric
Cooperatives

Your Touchstone Energy® Cooperatives 





POWERING
EVERYDAY LIFE FOR
2.5 MILLION

24% of the population | **45%** of the land mass



Member-owned and governed

Electric co-ops are private, not-for-profit utilities owned by the people they serve. Members democratically elect a board of directors to represent their interests and conduct cooperative business.



Not for profit

Co-ops exist to serve their members and communities. We provide electricity at cost, not for a profit. Revenue collected in excess of expenses is given back to members in the form of capital credits.



Committed to community

Keeping the lights on. Recruiting new industry. Educating the leaders of tomorrow. Electric co-ops take seriously our responsibility to improve lives in our communities.

\$7.9

BILLION

in poles, wires, substations and other infrastructure

24

HUNDRED

employees at the 26 co-ops across the state

\$99

MILLION

in payroll and benefits for thousands of families

\$6

MILLION

paid in taxes to support North Carolina communities

106

THOUSAND

miles of line connecting rural and suburban North Carolina

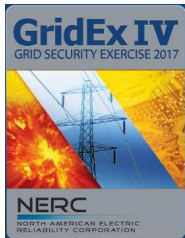


A network of resources

- The Cooperative network



- Coordinate with our peers at Duke, Dominion, ElectriCities
- Active involvement with industry groups




NCEMC Emergency Response Plan

- A framework to respond to emergency conditions arising from
 - Weather
 - CyberSecurity
 - Pandemic
 - Other threats
- Annual review process keeps procedures current
- Table-top exercises allow participants to “Drill the Plan”
- Communication with State and Federal partners



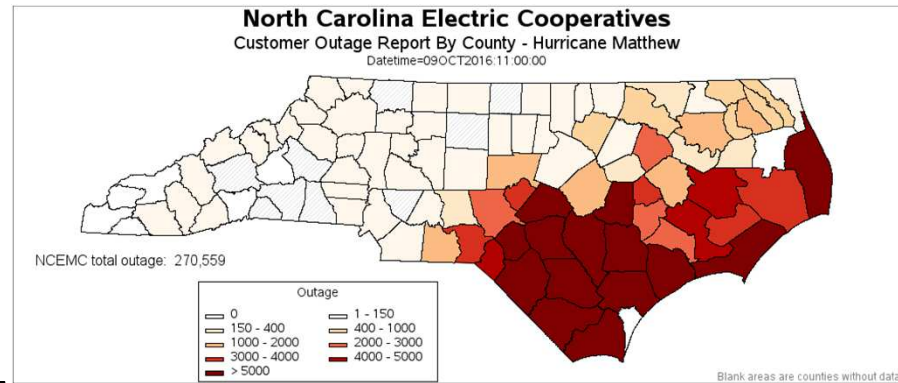
Response to Hurricane Matthew

Tideland EMC @TidelandEMC · Oct 9
Wrapping this workday up. Crews will take a mandatory rest break from 10pm-6am. We'll be joined by Northern Virginia crews tomorrow.



Lumbee River Electric Membership Corporation
added 4 new photos
Published by Kris Aldridge (P) · October 9 at 10:17am

Hurricane Matthew: Sunday mid-morning update
We have 50,000 electric cooperative members without power as of 10 a.m. Robeson, Cumberland, Hoke and Scotland counties were hit extremely hard, and our crews are working hard to restore service to you. Getting your power back on as safely and quickly as possible is our absolute priority. Support crews from Maryland are joining us to help, and we will work hard until every member has the lights back on. These pictures come from all around our service area and show some of the challenges we're working through. Stay safe!

Four County Electric Membership Corporation
October 12 at 10:55am

Crews preparing to head out this morning! Get outage update info here: <http://www.fourcty.org/news.php?id=134&p=1>



3K Views
Like Comment Share

South River EMC @SouthRiverEMC · Oct 14



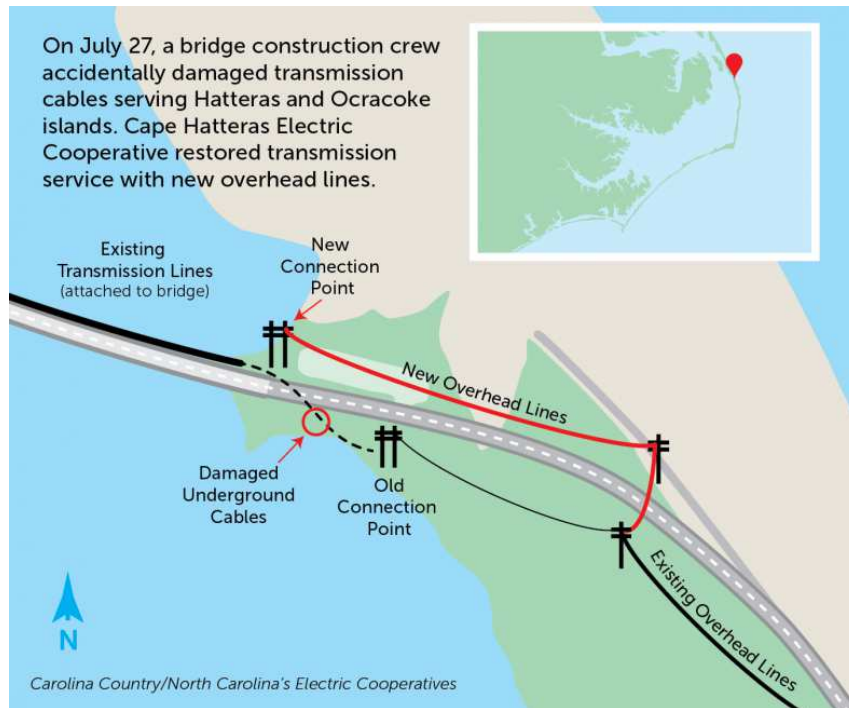
THANK YOU SOUTH RIVER EMC MEMBERS.

South River Electric Membership Corporation
910-892-8071 | www.sremc.com

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Over \$15 M in estimated EMC damages
270,000 outages reported at peak

Hatteras and Ocracoke Outage - 2017



- Approximately, 10,000 meters impacted
 - Limited power was restored in 2 days with local generation, microgrid, and conservation measures in place
 - Service fully restored in 7 days
- County officials evacuated non-residents from Hatteras and Ocracoke Islands for less than a week
- Restoration involved
 - Cape Hatteras EC, Tideland, and NCEMC
 - Additional crews and equipment from Brunswick EMC and Roanoke EC
 - NC DOT and PCL
 - New River, Booth Associates, and Lee Electrical