North Carolina Energy Policy Council

AGENDA

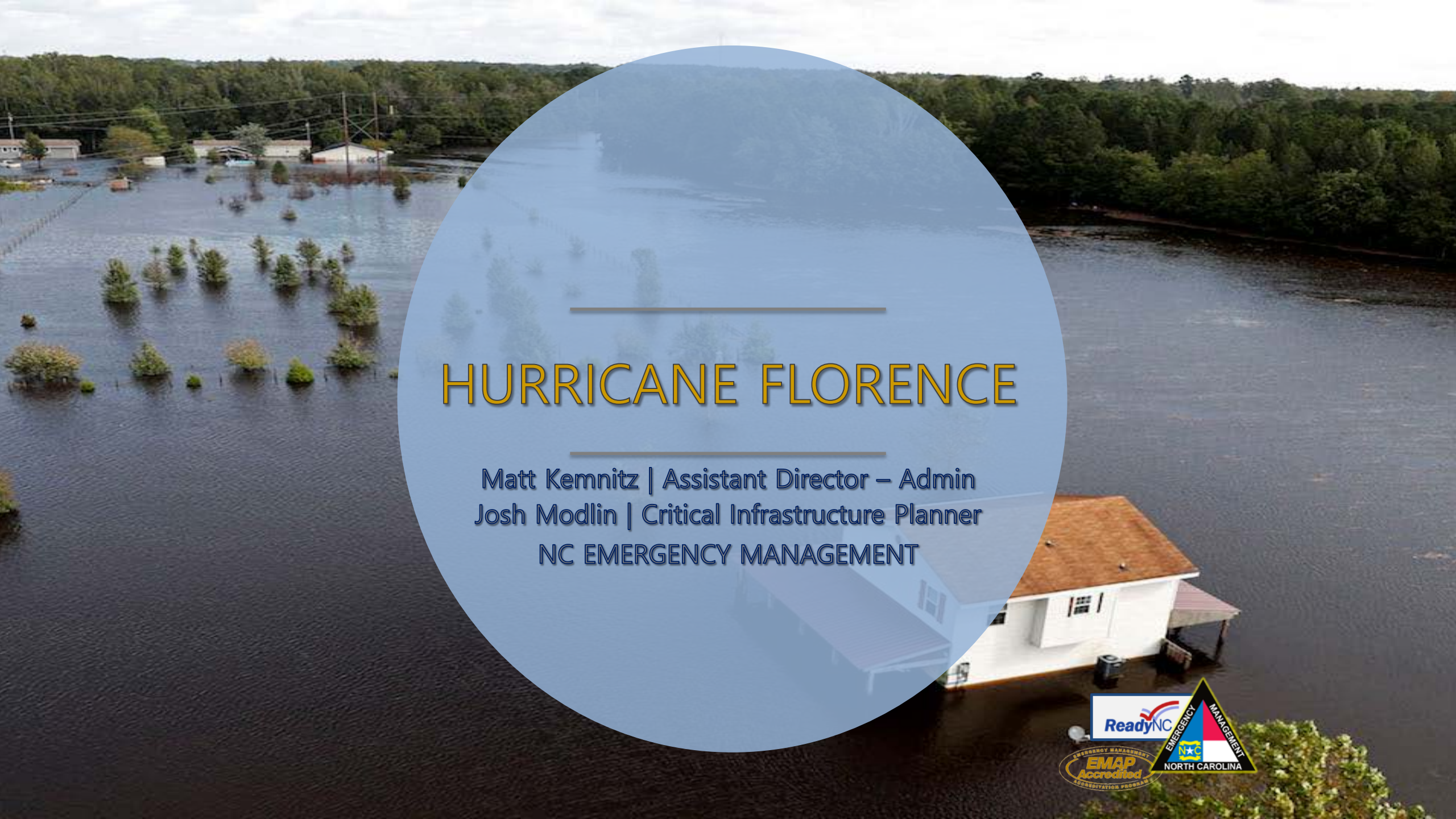
10:00 a.m. Wednesday February 20, 2019
Archdale Building, Ground Floor Hearing Room
512 N Salisbury St, Raleigh, NC 27604

Overview of the Hurricane: Preparation, Response, and Recovery (30 min)

Kinston/RCC-East Energy Resiliency Assessment Study Discussion

Matt Kemnitz, Assistant Director for Administration

Division of Emergency Management, Department of Public Safety

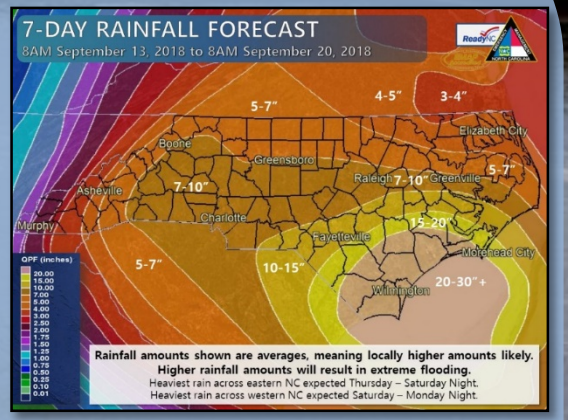


HURRICANE FLORENCE

Matt Kemnitz | Assistant Director – Admin
Josh Modlin | Critical Infrastructure Planner
NC EMERGENCY MANAGEMENT

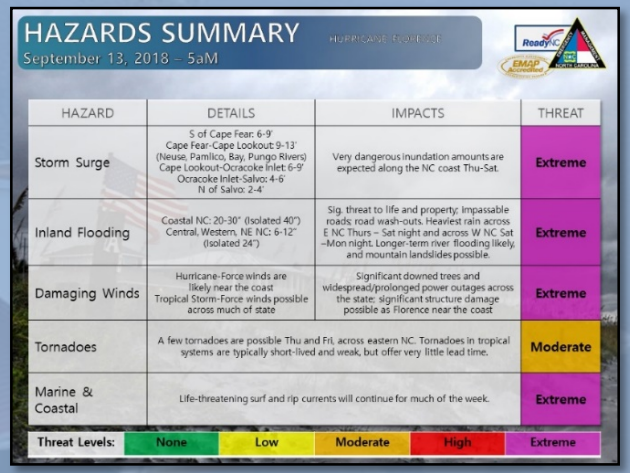
HURRICANE FLORENCE

- **Fri September 7 – Incident Period Begins**
  - State of Emergency Declared
- **Mon September 10**
  - SEOC (L2), RCC-E, RCC-C activated
  - Emergency Declaration Approved (100 counties)
  - World Equestrian Games start (RCC-W supports)
- **Tues September 11**
  - SEOC elevates to Level I
- **Thurs September 13**
  - Governor Cooper requests expedited Major Dec (PA/IA) for 13 counties
- **Fri September 14**
  - Hurricane Florence Landfall
  - Major Disaster Declaration approved
  - IA Registration Begins
  - RCC-E loses power, landline communications (voice & IP)



HURRICANE FLORENCE

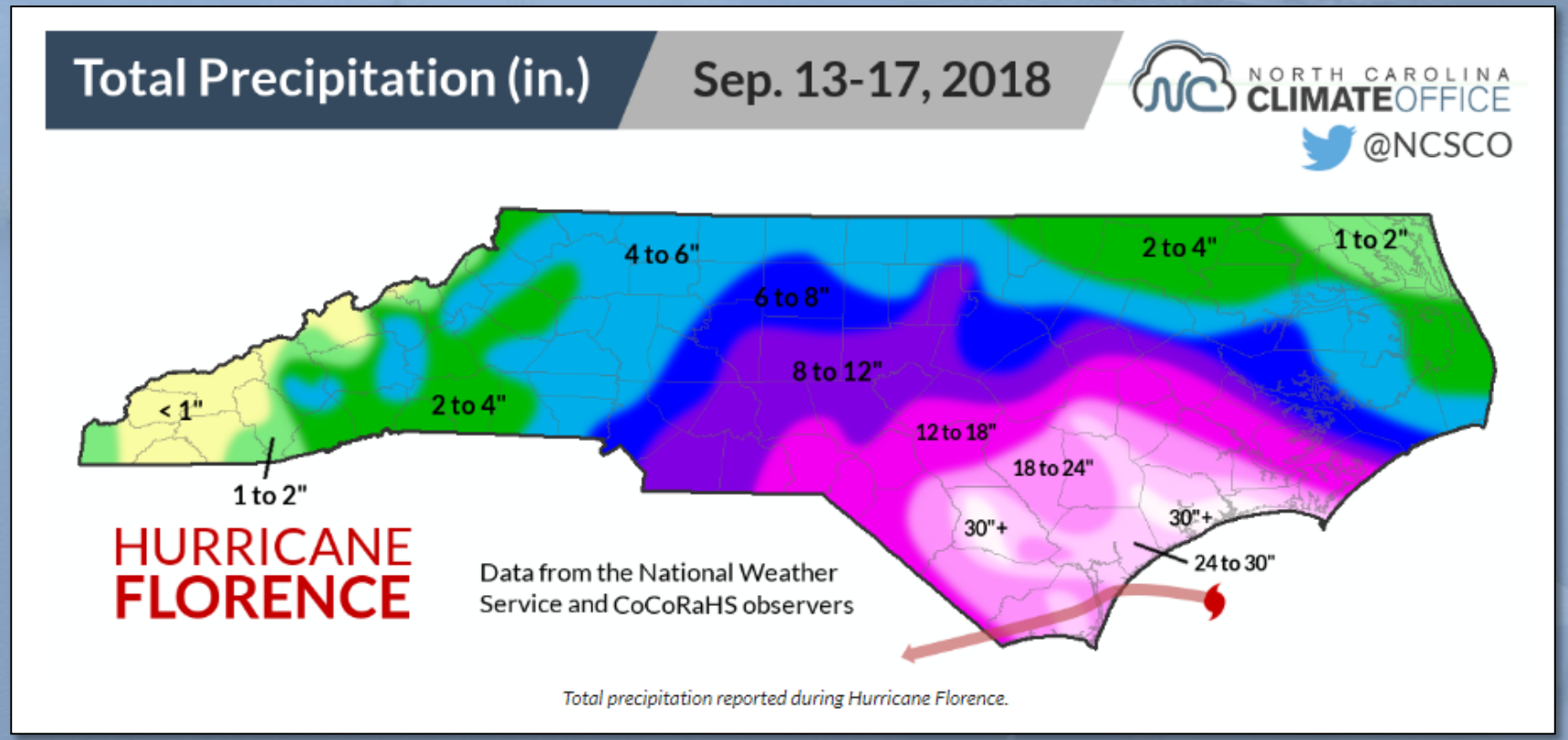
- **Sat September 15**
  - Over 21,272 North Carolinians in shelters statewide S/W
  - 746,751 power outages reported (snapshot)
  - 220 road closures known
  - 4 hospitals operating on generator power
- **Mon September 17**
  - Rocky, Lumber, Lower Neuse & NE Cape Fear rivers exceed record flooding
  - Emergency Declaration Approved (100 counties)
  - World Equestrian Games start (RCC-W supports)
  - Outages at 450,034
- **Wed September 19**
  - President visits affected areas (New Bern & Wilmington)
- **Sun September 23**
  - Outages 14,438
- **Wed September 26**
  - Joint Field Office Opens in RTP
- **Fri September 28**
  - SEOC deactivates
- **Tues October 2**
  - Preliminary Damage Assessment begins



HAZARDS SUMMARY
September 13, 2018 – 5aM

HAZARD	DETAILS	IMPACTS	THREAT
Storm Surge	S of Cape Fear: 6-9' Cape Fear-Cape Lookout: 9-13' (Neuse, Pamlico, Bay, Pungo Rivers) Cape Lookout-Ocracoke Inlet: 6-9' Ocracoke Inlet-Salvo: 4-6' N of Salvo: 2-4'	Very dangerous inundation amounts are expected along the NC coast Thu-Sat.	Extreme
Inland Flooding	Coastal NC: 20-30" (Isolated 40") Central, Western, NE NC: 6-12" (Isolated 24")	Sig. threat to life and property: Impassable roads; road wash-outs. Heaviest rain across E NC Thurs – Sat night and across W NC Sat –Mon night. Longer-term river flooding likely, and mountain landslides possible.	Extreme
Damaging Winds	Hurricane-Force winds are likely near the coast Tropical Storm-Force winds possible across much of state	Significant downed trees and widespread/prolonged power outages across the state; significant structure damage possible as Florence near the coast	Extreme
Tornadoes	A few tornadoes are possible Thu and Fri, across eastern NC. Tornadoes in tropical systems are typically short-lived and weak, but offer very little lead time.		Moderate
Marine & Coastal	Life-threatening surf and rip currents will continue for much of the week.		Extreme
Threat Levels:	None	Low	Moderate	High	Extreme

HURRICANE FLORENCE



Total precipitation reported during Hurricane Florence.

35.93" of rain reported in Elizabethtown

HURRICANE FLORENCE

FLASH FLOODING POTENTIAL

September 14, 2018 – 5AM

NOAA/NWS/NCEP/WPC

High Risk Days are Rare, Dangerous, Significant, and Impactful

Friday

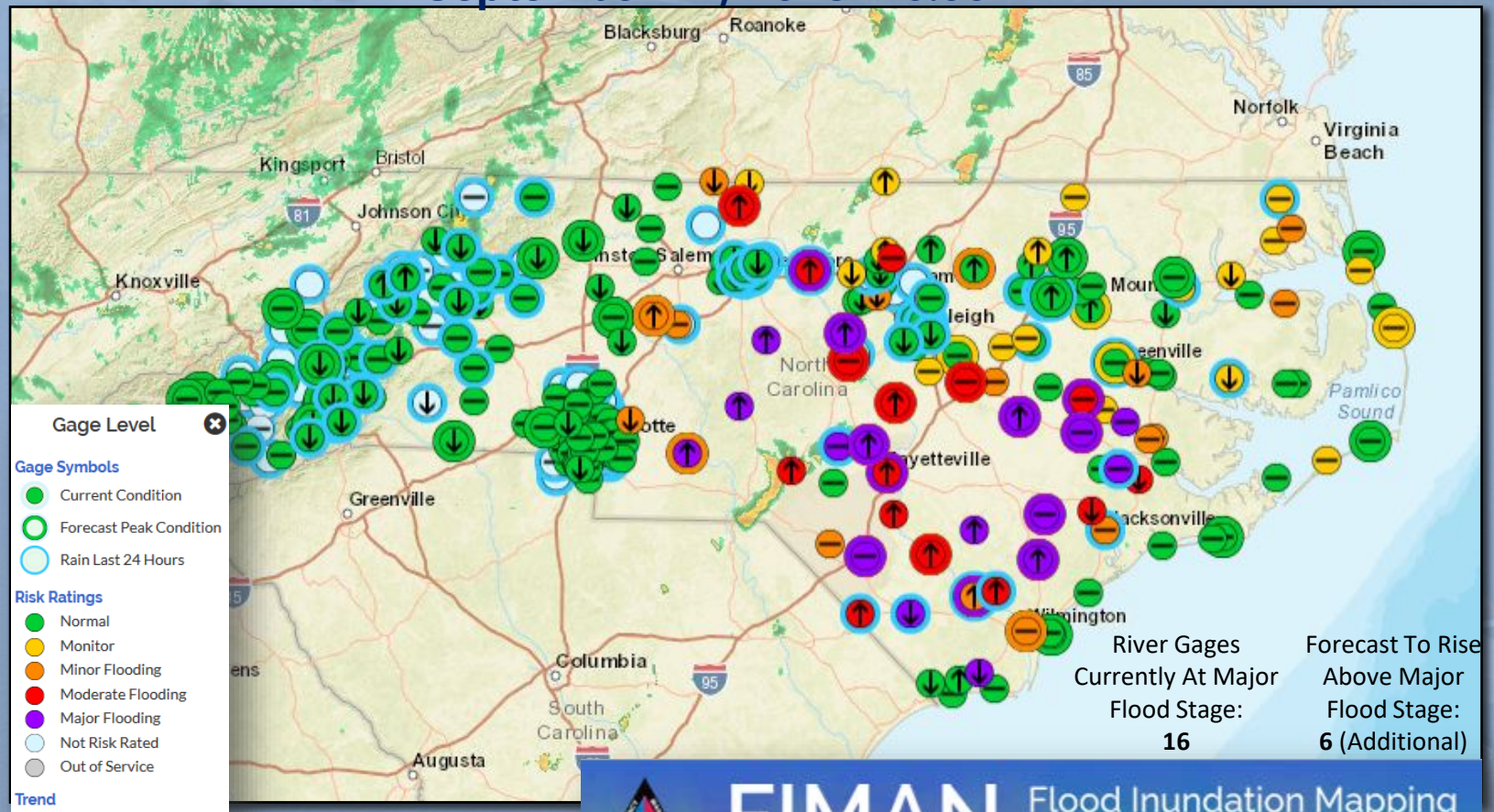
Saturday

Sunday

5%: Marginal	20%: Moderate
10%: Slight	50%: High

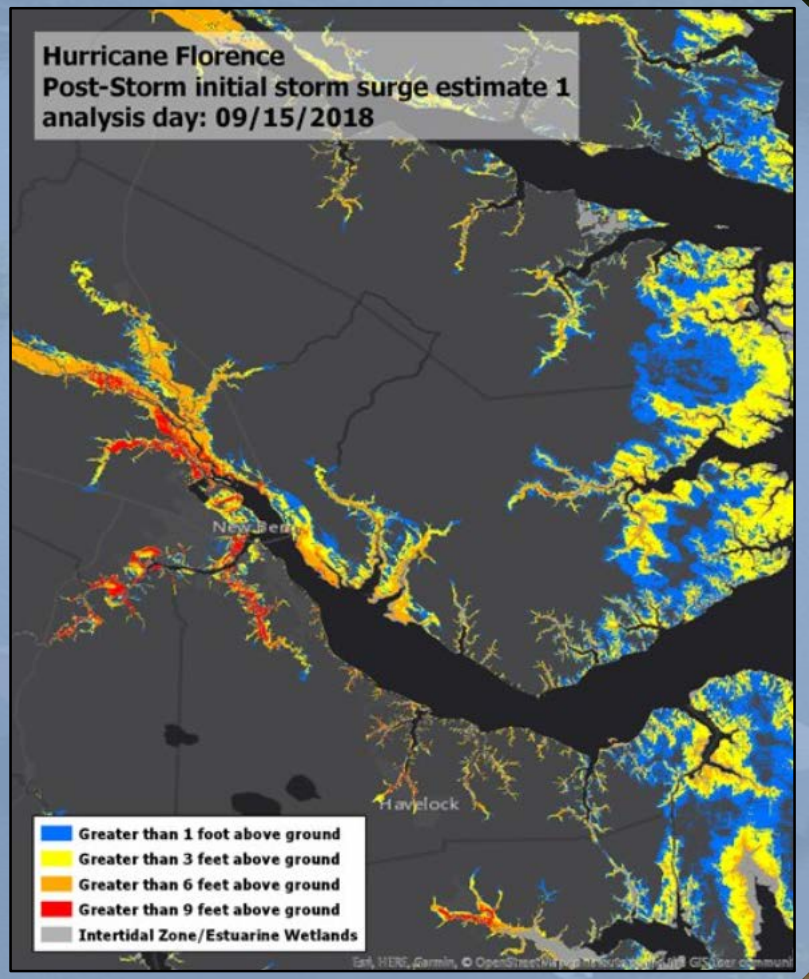
HURRICANE FLORENCE

September 17, 2018 – 6:00PM

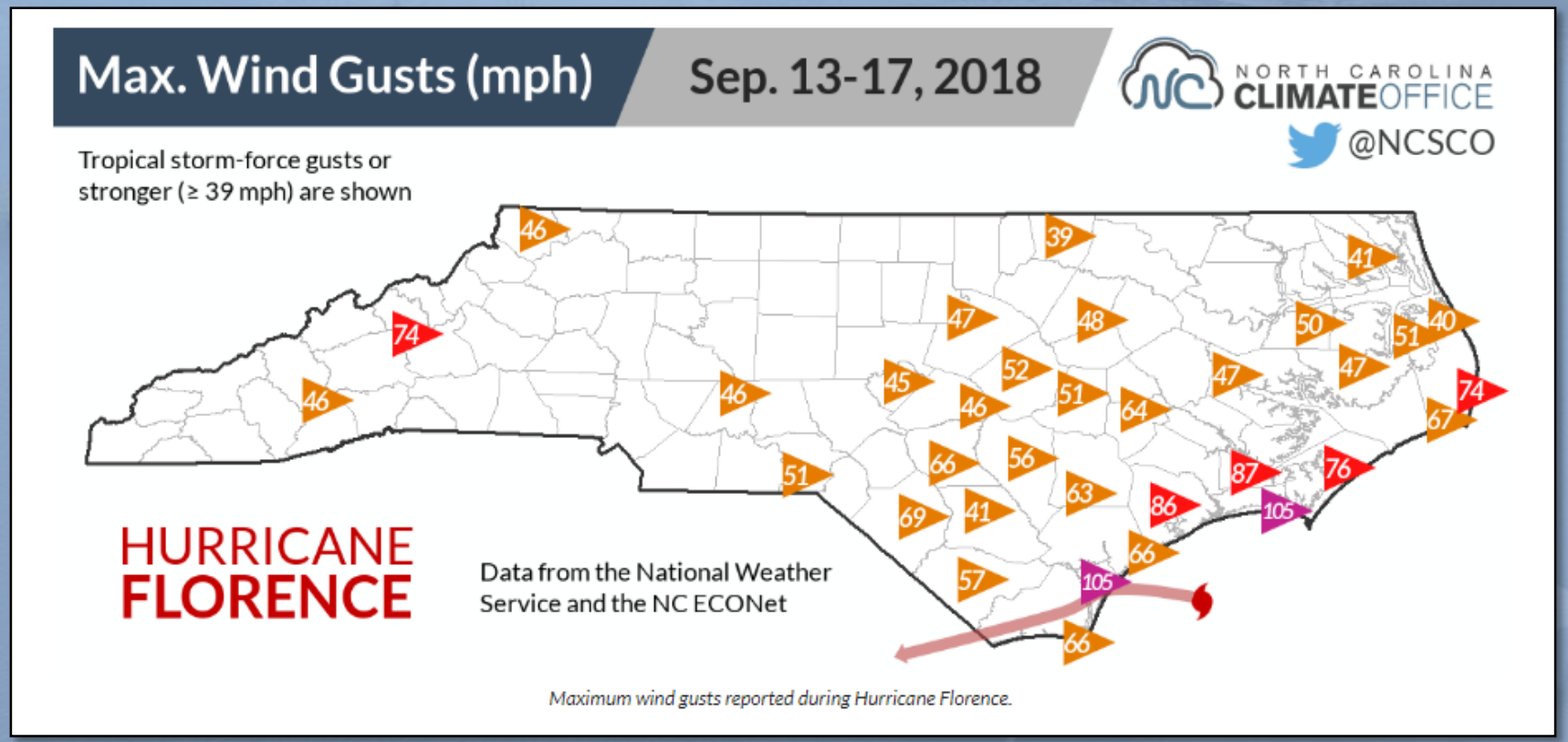


HURRICANE FLORENCE

- 9-13’ of storm surge inundated portions of the coast and areas along the Neuse River and its tributaries



HURRICANE FLORENCE



Wind gusts of 105 mph were reported at Cape Lookout, Fort Macon, and Wilmington

FLORENCE RESPONSE

- **County EOCs Activated:** 62
- **Local States of Emergency:** 90
- **Peak Shelter Count (Population):** 256 (23,000+)
- **NCDOT Road Closures:** 1,200+
- **Peak Power Outages:** 845,922

FLORENCE RESPONSE

- **Search & Rescue**
  - 1,600+ personnel with more than 240 boats deployed
  - 5,214 people & 1,067 animals rescued [State+EMAC]
- **Disaster Medical Services**
  - 4 State Medical Support Shelters (200 patients)
  - 102 Nurses deployed through EMAC
  - 8 Ambulance buses & 20 Ambulance Strike Teams
  - 2 Field Medical Stations (1,000 patients)
- **Law Enforcement**
  - 600+ officers deployed for various missions
- **Air Operations**
  - 60+ aircraft used (local, state, and federal resources)
  - 346 missions flown (1,303 hours of flight time)
  - 441 rescues & 685 people transported

FLORENCE RESPONSE

- **EMAC**
  - 97 Missions
  - 1,108 Responders
  - 35 States
  - Incident Management Teams, Swiftwater Rescue, Firefighters, Nurses (Public Health/Shelter), Mental Health, Functional/Access Survey Teams, BEOC support, Agriculture, and others.
- **NC National Guard**
  - 2,800 personnel activated across the state
  - Logistics support, aviation, engineers, military police, transportation, incident management, and others.

FLORENCE RESPONSE

- **Salvation Army**
  - Mobile Feeding Units: 37
  - Meals Served: 205,714
  - Drinks: 154,756
  - Snacks: 106,642

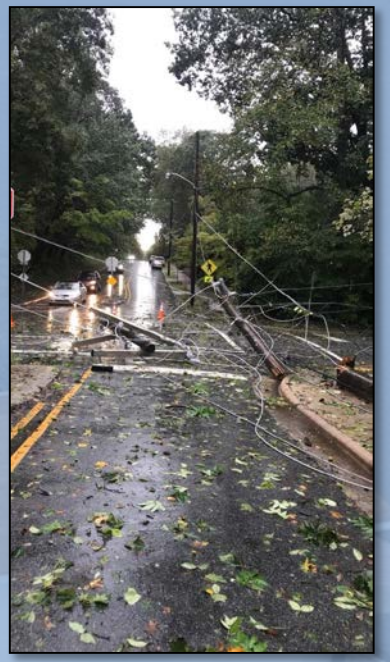
- **Baptists on Mission**
  - Kitchens: 10
  - Meals Prepared: 1,057,236 [est]

FLORENCE RESPONSE

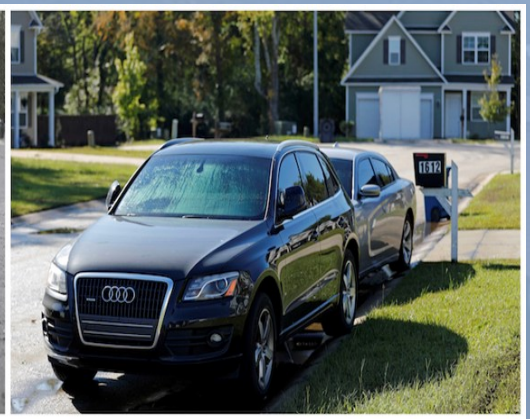
- **NCEM Logistics**
  - 1,700+ resource requests
  - 775+ purchase orders
  - Over 160k "things"
    - MREs, bottled water, generators, shower trailers, laundry trailers, high volume pumps, fire hose, traffic cones, sand bags, earth moving equipment, message boards, tents, tarps, cots, blankets, bathroom trailers, and others.
  - **Emergency Fuel Contract**
    - High clearance/4wd tankers
    - Bobtails
    - Fuel boats

INITIAL LESSONS LEARNED [ESF-12]

- Power restoration happened extremely quickly
  - From peak to under 15k in <7 days
- Value of ESF-12 planning
  - "I enacted my fuel plan and it worked."
- Need for generators on critical infrastructure
- Mobile fueling for responders
- Impacts of mandatory evacuations on retail markets
- Sharing awareness of state contract resources



HURRICANE FLORENCE IMPACTS



Michael A. Sprayberry | Director, Emergency Management

Laura Hogshead | Chief Operating Officer, NCORR

HURRICANES MATTHEW AND FLORENCE RECOVERY UPDATE AFFORDABLE HOUSING #1

REPAY. REPAIR. REPLACE. RECONSTRUCT.

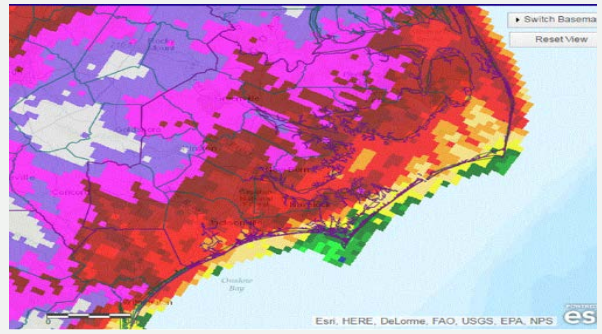
February 18, 2019

UNPRECEDENTED 1-2 PUNCH

HURRICANES MATTHEW AND FLORENCE

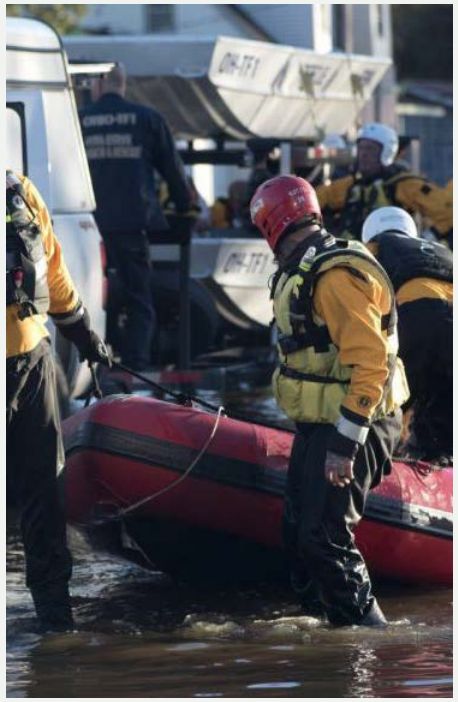
HURRICANE MATTHEW DAMAGES

- 31 fatalities
- 50 Counties declared
- Estimated $4.8 billion in damage
- Nearly 100,000 homes impacted
- Over 4,000 evacuees in shelters
- 660+ roads closed
- 20 dams breached
- 815,000+ power outages
- 2 airports closed
- Over 3,000 families stayed in FEMA transitional sheltering. NCEM assumed responsibility for remaining need



HURRICANE FLORENCE DAMAGES

- 35 inches of rain in places and more than 10 trillion gallons across North Carolina, South Carolina, and Virginia
- The storm was a 1,000-year rain event,
- At least 50 people died as a result of Florence
- Damages estimates run as high as $22 billion
- 34 counties in NC designated for Individual Assistance
- 51 counties in NC designated for Public Assistance



HURRICANE FLORENCE UPDATE

HURRICANE FLORENCE
INITIAL RECOVERY ASSISTANCE

FEMA Individual Assistance

- Total registrations: 138,595
- Individual and Households Program:
  - Approved amount: $127.7 million
    - Other Needs Assistance: $22.7 million
    - Housing Assistance: $105 million

Direct Housing

- 640 total units have been placed: 495 travel trailers and 145 mobile units. Housing currently available for 18 months.

Public Assistance

- Estimate ~2,500 projects for a total of $644 million; 112 projects are obligated for $32.2 million.

National Flood Insurance Program

- 15,014 claims filed and $556.3 million paid

Small Business Administration

- $329.3 million in loans approved for over 8,900 homeowners and renters
- $59.4 million in loans approved for 919 business owners

Disaster Unemployment Insurance

- $1.2 million approved for over 3,000 claims

Transitional Sheltering Assistance (TSA)

- 240 households currently in hotels, sheltering 689 family members. Estimated program close is March 12, 2019.

NORTH CAROLINA SHELTERING AND TEMPORARY ESSENTIAL POWER (STEP)

- For eligible homes affected by Hurricane Florence with minor damage.
- Provides rapid, **partial** repairs that put the home in safe, sanitary and secure condition.
- These are not permanent repairs. They are intended to make the house livable.
- NC STEP allows families to maintain their household routines and allows residents to stay connected to their communities.
- Repairs to flooded homes will be handled by a qualified voluntary disaster relief organization or a contractor, depending on the level of damage to the home. The state will provide the building materials and supplies needed.
- 4,245 Homeowners signed Right of Entries. Estimated Program completion of April 2, 2019.

HURRICANE FLORENCE

HAZARD MITIGATION GRANT PROGRAM

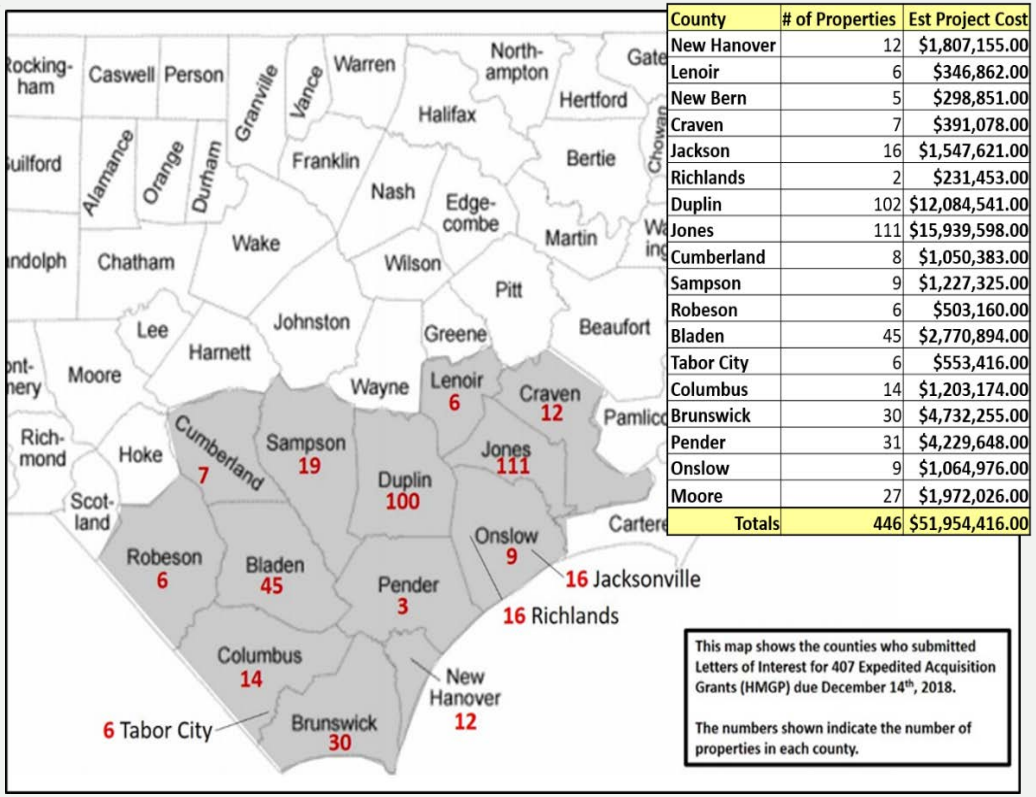
Hazard Mitigation Assistance DR-4393

404/407 Expedited Acquisitions:

- Properties MUST have been Substantially Damaged and/or Condemned
- 18 Counties/Cities/Towns submitted LOIs
- 18 Projects Total
- 443 Properties associated with LOIs
- $77,928,825.53 Requested
- Letter of Interest Review and QC being finalized

404 Hazard Mitigation Program

- Deadline to submit is March 15th
- Project types include:
  - Elevations
  - Acquisitions
  - Mitigation Reconstructions
  - Generators



County	# of Properties	Est Project Cost
New Hanover	12	$1,807,155.00
Lenoir	6	$346,862.00
New Bern	5	$298,851.00
Craven	7	$391,078.00
Jackson	16	$1,547,621.00
Richlands	2	$231,453.00
Duplin	102	$12,084,541.00
Jones	111	$15,939,598.00
Cumberland	8	$1,050,383.00
Sampson	9	$1,227,325.00
Robeson	6	$503,160.00
Bladen	45	$2,770,894.00
Tabor City	6	$553,416.00
Columbus	14	$1,203,174.00
Brunswick	30	$4,732,255.00
Pender	31	$4,229,648.00
Onslow	9	$1,064,976.00
Moore	27	$1,972,026.00
Totals	446	$51,954,416.00

RECENTLY LAUNCHED PROGRAMS

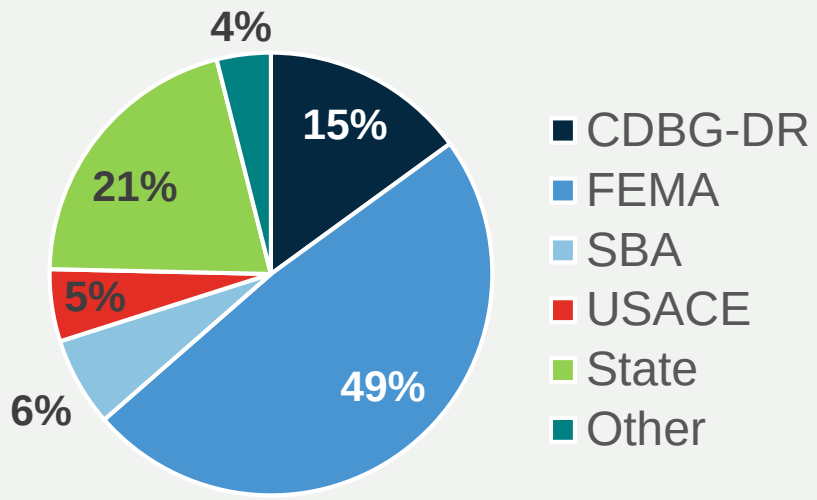
- **State Grant Program for Financially Distressed Local Governments** - Provides grants of up to $1,000,000 to eligible local governments to assist with everyday operating expenses and administrative support costs incurred through their local disaster recovery efforts.
- **State Revolving Loan for Temporary Cash Assistance to Local Governments** - Provides 0% interest loans of up to $2,000,000 to assist eligible local governments in paying for disaster-related expenses while awaiting reimbursement from various federal disaster recovery resources or programs.
- **Applications will be received on a rolling basis, awardees will have 3 years to expend funds.**
- **NCORR has awarded $2.3 million in grants and $3.8 million in loans.**

HURRICANE MATTHEW UPDATE

SUMMARY OF MATTHEW RECOVERY FUNDS BY PROGRAM

Funding Source	Federal
FEMA Individual Assistance	$99 M
Small Business Administration Loans	$102.5 M
National Flood Insurance Program	$196 M
Hazard Mitigation Grant Program	$82 M
Disaster Case Management	$4.5 M
Crisis Counseling Assistance and Training Program	$2 M
US Army Corps of Engineers	$83 M
US Department of Agriculture	$27.5 M
Federal Highway Administration	$23 M
US Department of Labor	$5 M
FEMA Public Assistance	$382 M
Community Development Block Grant – Disaster Recovery*	$236 M
TOTAL	**$1.25 Billion**

State Allocations	
DRA-16	$201 M
DRA-17	$100 M
DRA-18	$25 M
TOTAL	**$326 M**



* Anticipate an additional $168 M.

HURRICANE MATTHEW HMGP SUMMARY

APPROVED:

- **63 Total projects totaling $86.5 million across Eastern NC**
- **680 properties approved**
  - **32 Acquisition Projects 472 structures**
  - **21 Elevation Projects 199 structures**
  - **10 Mitigation Reconstruction Projects 84 structures**

IMPLEMENTATION

Current status at the local level:

- **Appraisals, surveys, deed prep and title work underway**
- **Closings are underway for acquisition in most counties**
- **$290,285 requested for reimbursement by local government**
- **NCEM staff working on additional reimbursements**

MATTHEW FUNDS ARE ON THE GROUND ACROSS EASTERN NORTH CAROLINA

- More than **$850 million** back into our communities for public infrastructure repair, small business recovery and direct payments to homeowners, including over **$98 million paid out to over 29,000 families**
- **$86.5 million awarded to 680 homeowners** to elevate, reconstruct, or buyout through FEMA's HMGP program
- **Over $10 million** awarded from HUD Community Development Block Grant – Disaster Recovery (CDBR-DR) funds to more than **300 applicants**
- **50 counties** have updated redevelopment plans, making them **more resilient for future storm events**

ReBUILD NC

A NEW OFFICE WITH A DEDICATED FOCUS

- Certifying to become the grantee for Hurricane Florence and Hurricane Matthew assistance
- Centralized structure for processing and issuing CDBG-DR awards
- Institutionalizing processes for handling federal grants, resulting in quicker, more efficient assistance
- Joint management of two major recoveries
- Congressional leaders have indicated that North Carolina may receive approximately $1 billion of the $1.68 billion included for disaster recovery in a bill passed last year. Until the awards are made, NC can't predict the total but NCORR is preparing to administer the funds.

NCORR

EASTERN BRANCH ENERGY RESILIENCY

EASTERN BRANCH ENERGY RESILIENCY

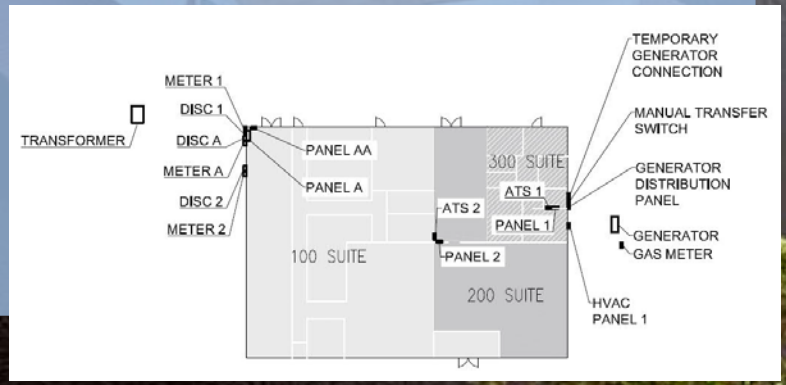
- Facility: NCEM Eastern Branch Office/Regional Coordination Center – East (Leased from NC Global TransPark in Kinston, NC)
- Primary coordination and resource management facility for eastern NC (33 counties)
- 8,800 sqft interior space
- Recently designated as SEOC COOP Site
  - Support up to 100 personnel
- Existing natural gas generator supports <50% of facility
- Facility has lost power during last three major hurricanes

EASTERN BRANCH ENERGY RESILIENCY

- Study – Energy Resiliency
- Funded by State Energy Program, Department of Environmental Quality under a U. S. DOE grant
- Contract engineers tasked to -
  - Evaluate emergency power requirements
  - Identify a broad spectrum of options
  - Perform cost-benefit analysis
  - Develop recommendations

EASTERN BRANCH ENERGY RESILIENCY

- Study included on-site analysis of existing electrical infrastructure & service
- Demand calculations under all weather conditions
- Catalogued neighboring facilities to identify potential for partnerships
- Evaluated 10-year O&M costs
- Solar, Battery, CHP, Demand Reduction



EASTERN BRANCH ENERGY RESILIENCY

Table 1-1. Generator Options and Evaluation Criteria Ranking.

Evaluation Criteria	Option 1 One New 125KW Generator + Existing 60kW Generator	Option 2 One New 200KW Generator	Option 3 Two New 200KW Generators
Initial Cost	3 (Least initial cost)	2	1 (Highest initial cost)
O&M Cost	2	3 (Least O&M cost due to only one generator)	1 (Highest O&M cost due to two large generators)
Total 10 Year Cost	3 (Least total cost)	2	1 (Highest total cost)
Resiliency / Reliability	2 (Partial redundancy)	1 (No redundancy)	3 (Fully redundant)
Disruption to Existing System	3 (Least disruptive)	2	1 (Most disruptive)
Construction Period	3 (Shortest installation duration)	2	1 (Longest installation duration)
Total Score	16	12	8

QUESTIONS

Matt Kemnitz

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Josh Modlin

Critical Infrastructure/Key Resources Planner

North Carolina Emergency Management

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Joshua.Modlin@ncdps.gov

Duke Energy's Hurricane Preparation, Impacts, and Response (20 min)

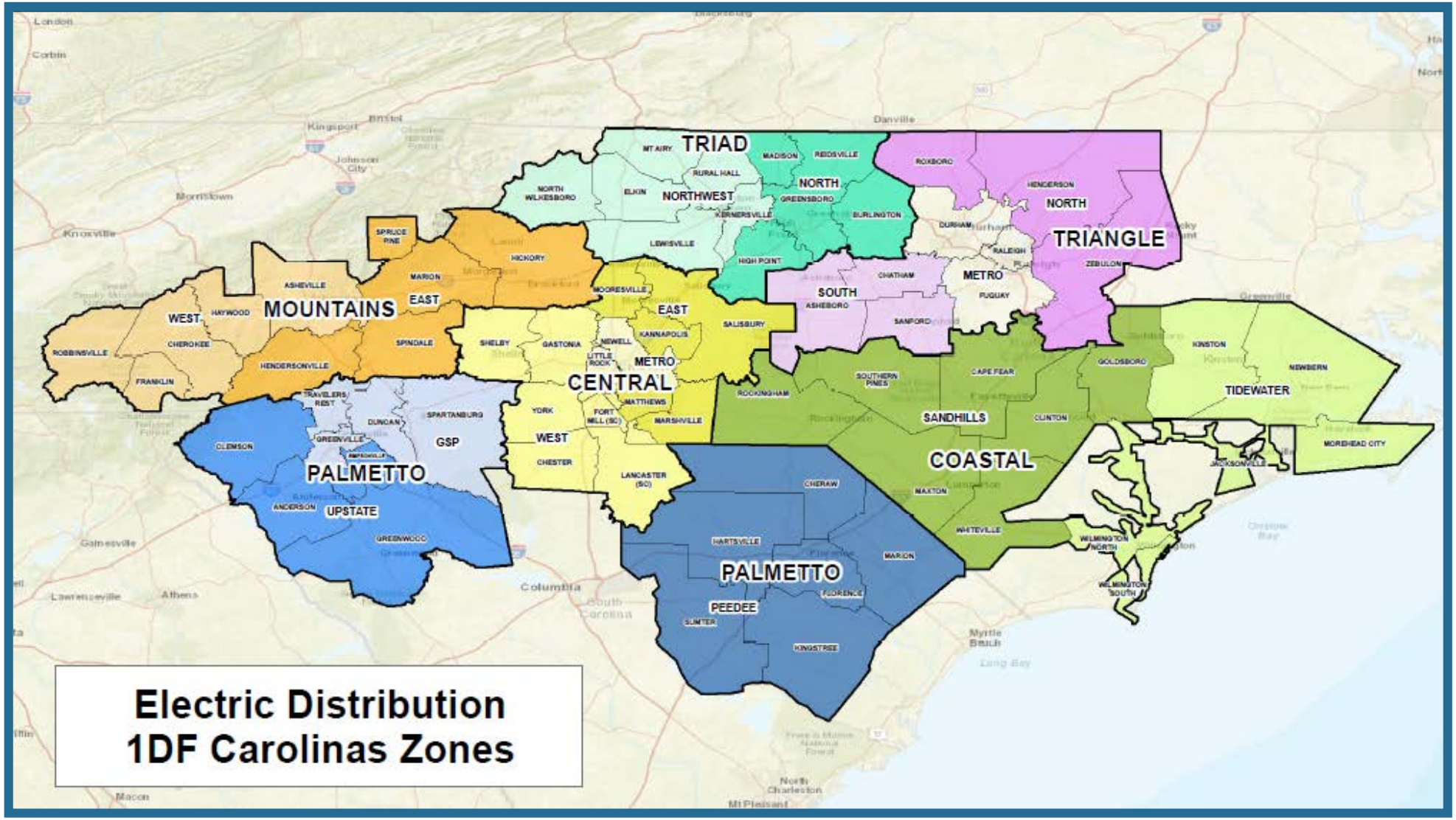
RuDon Showers, General Manager
Rufus Jackson, Vice-President
Distribution Construction and Maintenance, Duke Energy

Hurricane Florence and Michael Storm Response

RuDon Showers: General Manager, Emergency Preparedness
Rufus Jackson; Carolinas Incident Commander, Duke Energy Carolinas

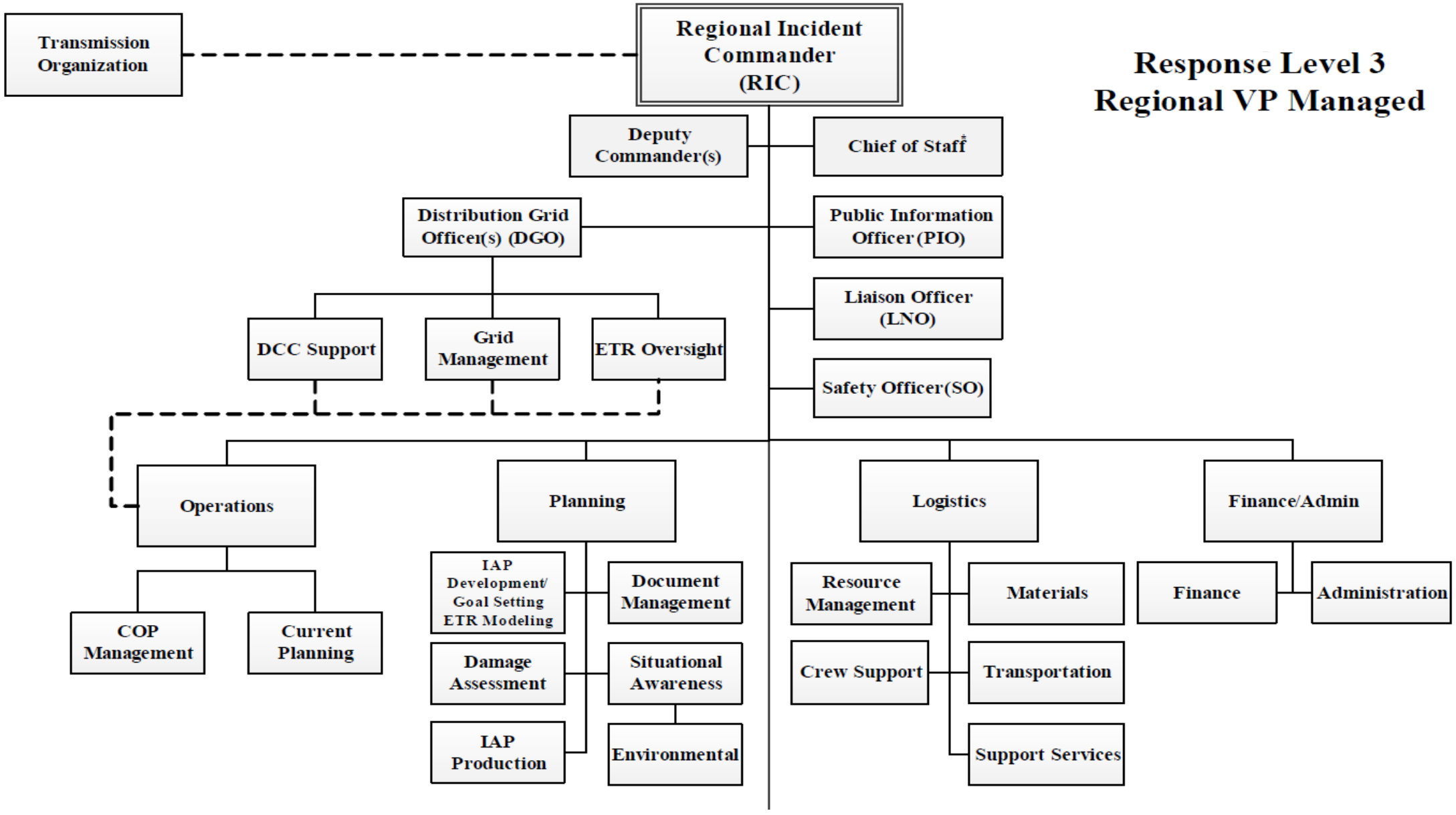
DUKE ENERGY®

Carolinas Region



- Service Territory 56,000 Sq. Mi.
- Duke Energy North Carolina 3.4M Customers
- 5 – Zones
- 65 Operation Centers

Incident Command System – A Disciplined Approach

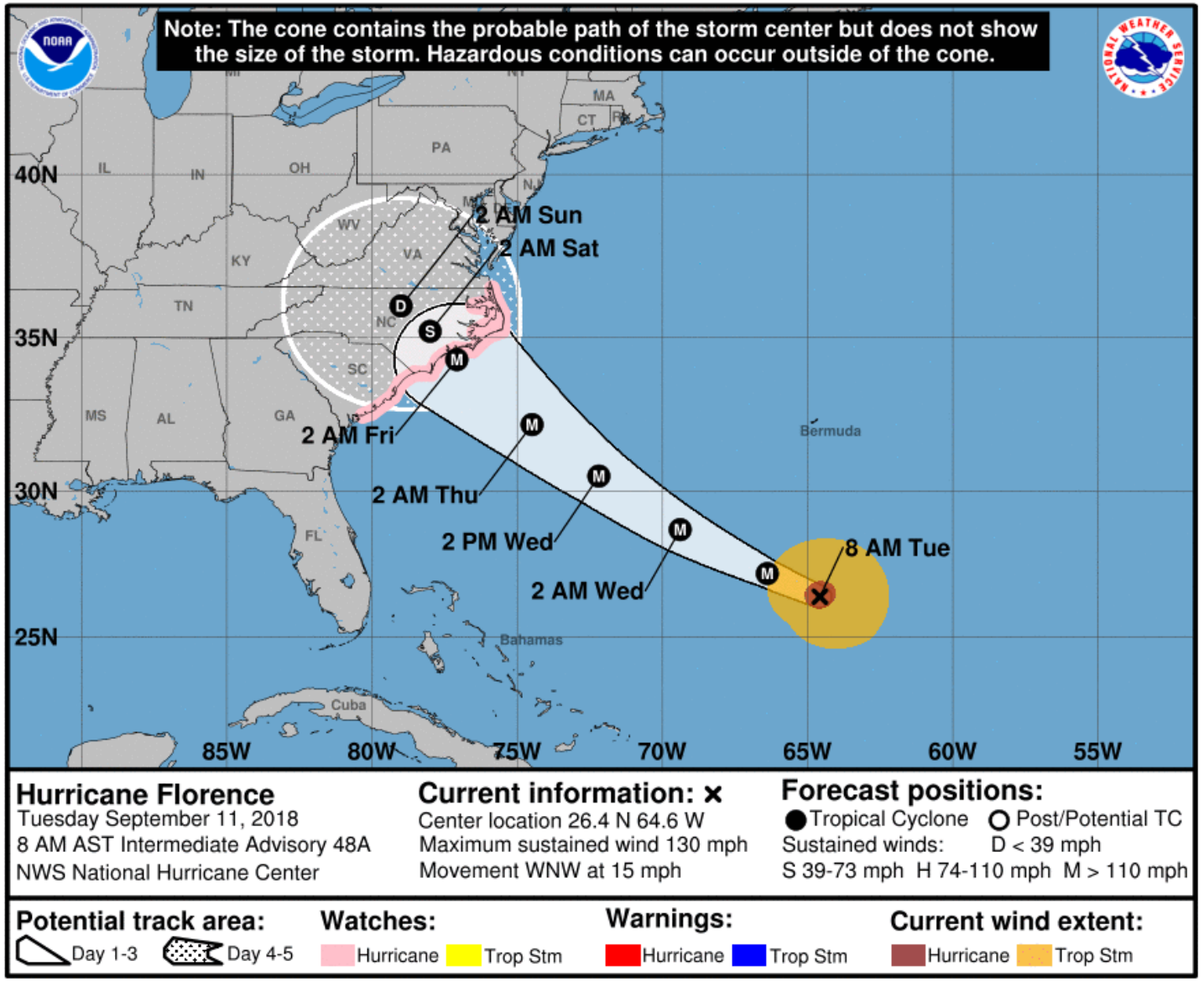


Combined 2018 Storm Season Florence and Michael

- Two major hurricanes making landfall in our service territory with four weeks.
- A workforce of over 35,000 was assembled and mobilized across the three states for these storms. This included our internal resources along with mutual aid utilities from 25 states and Canada. Florence itself was the largest mobilization in Duke Energy storm history. Over 2,000 corporate volunteers performed storm roles in areas that ranged from the call center, social media, to base camps.
- At the peak 33,595 customers in FL, and 1,159,283 customers in NC and SC lost power across these storms.
- Total outages experienced in FL was 70,612 and in NC and SC was 3,031,406. A total of 3,102,018 outages were restored by Duke Energy during these two storms.
- Flooding and wind damage were unpresented in any storm to ever hit Duke Energy.
- 92% of the outages (almost 2.9M) were restored within 3 days of the storms passing our service territory. All customers were restored that could receive power in about a week of the storms passing our service territory.
- A system rebuild project began on October 19th in Mexico Beach to restore power to approximately 3,400 customers in the most devastated areas of Florida. The rebuild was completed November 2nd. Special communications and outreach took place with impacted customers until they were able to receive power.

11 September (D-3) Pre-Landfall Weather Prediction

- Hurricane Florence projected path put landfall between Wilmington and Jacksonville then traveling NW to the triangle and triad area spending 48 – 60 hours in state.
- Expected strength at landfall a Category 4 storm with rainfall upwards of 12” coastal and 6” toward the triangle
- A life-threatening storm surge of 5-10 ft or higher and life-threatening flooding due to rain amounts.



Duke Energy Planning

- Planning team used weather prediction tool determining anticipated number of customers to experience outages given historical modeling
- Customer outages prediction then drove Resource calculations which yielded the personnel requirements to restore power:

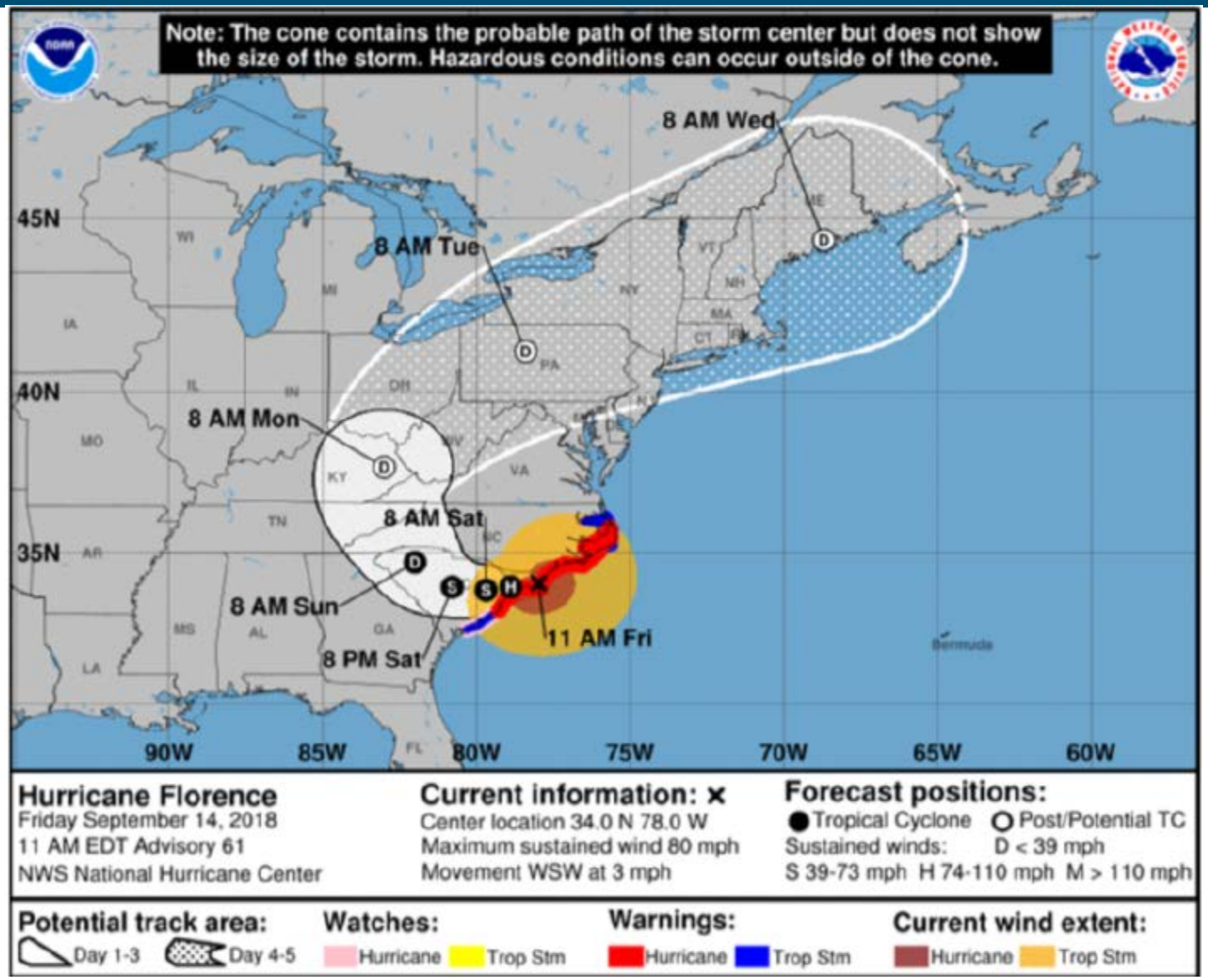
- Based on projections, DE acquired resources as of D-3 listed below and staged them prior to Friday's landfall.
- Support from AL, AR, DC, FL, GA, IL, IN, KS, KY, LA, MD, MI, MN, MS, MO, NJ, OH, OK, PA, RI, TN, TX, WI and Canada

Zone	Customers_ Low	Customers_ Mid	Customers_ High	Line Resources High	Tree Resources High	DA Resources High	Manage ment Resource
Central	17013	50848	204639	238	73	73	22
Coastal	324378	500821	841694	3421	1027	1027	342
Mountains	6961	17685	63691	207	64	64	21
Palmetto	110971	213093	420998	1195	357	357	119
Triad	16568	49993	248582	246	74	74	24
Triangle	339369	604629	1047885	2540	762	762	254
Totals	815260	1437069	2827489	7847	2357	2357	782

	Florence
Duke Lineman & Contractors	2255
Mutual Assistance	6100
Non-Duke Contractors	2293
Vegetation Management	3707
Damage Assessors	1992
Support Personnel	1000
Total Dedicated Effort	17347

14 September (D-Day) Actual Weather

- Hurricane Florence's actual path further south than projected, traveling along or south of the NC / SC border. Florence's forward speed remained less than 3 miles per hour, spending 60 - 72 hours in state.
- Strength at landfall was a CAT 1 storm, but wind field expanded to 150 miles. Actual rainfall amounts of +20" coastal and 6-12" inland
- Multiple Road Closures due to rapidly rising rivers with numerous substations higher flood levels than Matthew



14 – 23 September: Duke Energy Response

- Distributed resources throughout state to respond to an "**all- state**" event.
- Established multiple base camps and staging areas to support a state wide response
- Resource calculation was within the low range of the projected count of 1.3 to 3.3M customers out requiring close to 8000 external resources.
- Focused efforts in Morehead, New Bern, Wilmington, Southern Pines and Maxton.
- Continued collapsing resources into those hard hit areas prior to releasing any resources to return home.
- Due to storms change in track and additional damage anticipated, DE acquired resources released by Dominion and SCE&G:

	Florence
Duke Lineman	2255
Mutual Assistance	6478
Contractors	3133
Vegetation Management	3707
Damage Assessors	2420
Support Personnel	2076
Total Dedicated Effort	20069

Duke Energy Overall Performance: Distribution

Distribution Summary

Restored	Events	Outages
NC	22,604	1,643,762
SC	3,806	177,984
Total	26,410	1,821,746
DEC	5,569	387,791
DEP	21,878	1,448,718
Total	27,447	1,836,509

Duke Energy Overall Performance: Transmission

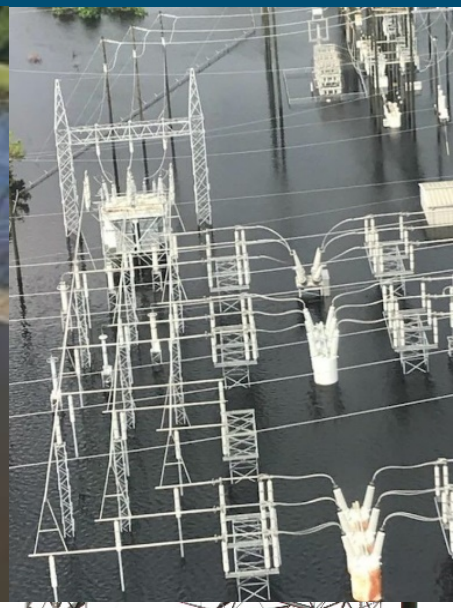
Transmission Summary

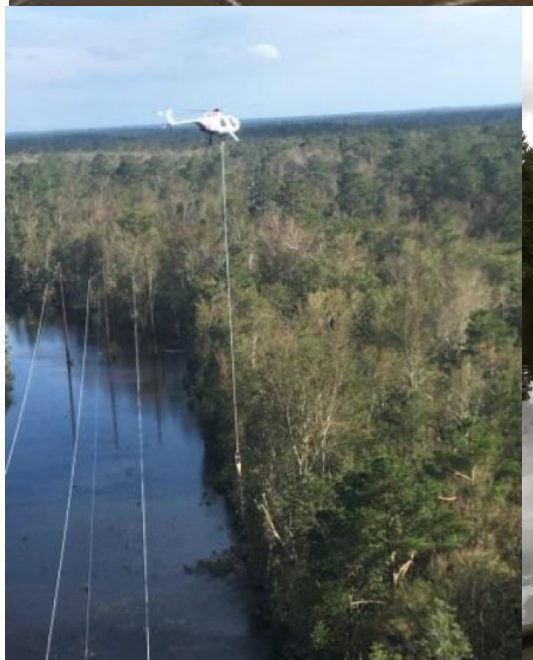
DEP System Outage Information	Lines	Substations	Wholesale PODs
Peak Storm (183)	45	90	48

Tiger Dam Deployment

- Standard tubes are 19” in diameter and 50’ long, made from patented fabric welded along the full length and at the ends.
- The weight of one tube(19”) is 69 lbs. when empty and the tube may be filled within 6-9 minutes(utilizing a fire hydrant). When filled with water, one tube weighs about three tons.
- Tiger Dams deployed at:

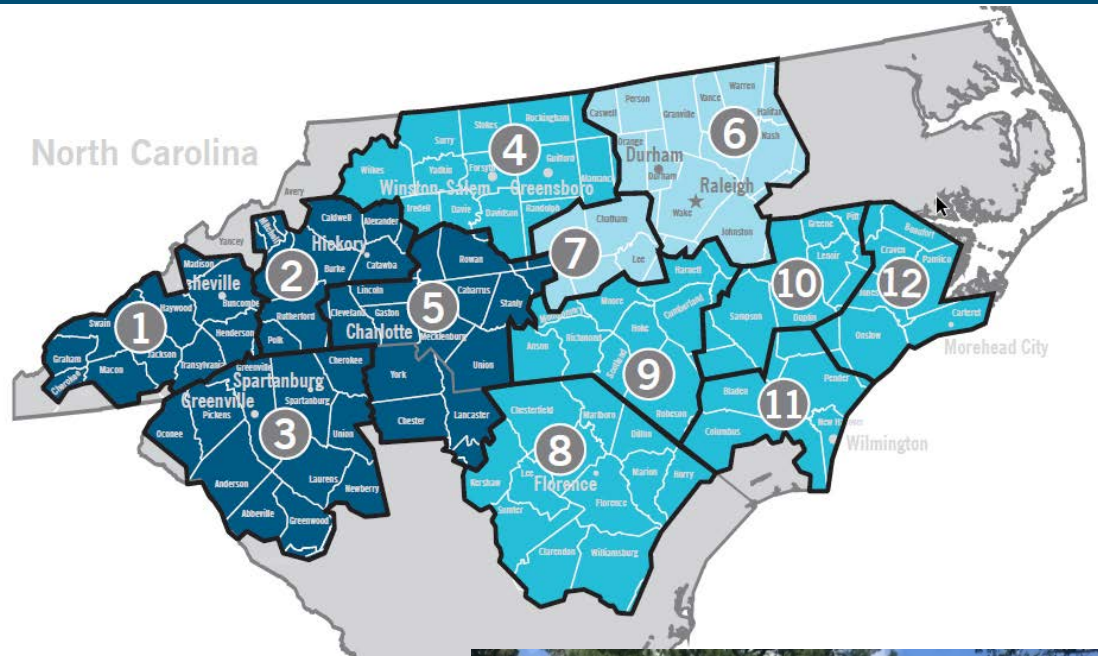
Greenville 230 KV – was not challenged.
Lumberton 115 KV –Mitigated flood waters of 46”
Grifton 115 KV – System overtaken – Waters higher than Hurricane Matthew.
Goldsboro Weil 115 KV – Mitigated flood waters of 28”.
Whiteville 115 KV – System overtaken – Waters higher than Hurricane Matthew.
Nichols 115 KV – System was undermined by floodwaters – foundation/substrate was sand based.





Customer Support: During Restoration

- Since Hurricanes Matthew and Irma ensured every employee has a dedicated storm role that ensures dedicated support to our customers and restoration
- Utilized over 2000 DE employees as call center representatives to minimize customer wait time if/when they called about their outages.
- Prepared and released 17 News Stories, numerous Twitter and Facebook postings ensuring our customers aware of progress
- Created and daily updated a detailed county level ETR map
- Provided numerous outbound customer call campaigns to keep customers informed of restoration progress



Customer Support

- Provided customers outage forms so they can provide to FEMA for needed assistance.
- Posted High Water alerts and boater notification on lakes and rivers.

Hurricane Michael Projected Path

- Hurricane Michael made landfall on October 10, 2018 near Mexico Beach, Florida as a powerful Category 4 Hurricane, just shy of a Category 5. Michael was the most powerful storm to hit the Florida Panhandle in recorded history with maximum sustained winds of 155mph and life-threatening storm surge. Michael weakened to a tropical storm as it entered the Carolinas on October 11, 2018 with sustained winds between 40 - 60 mph and heavy rainfall
- The largest number of Carolinas outages occurred in North Carolina, where damage to Duke Energy's electrical system was widespread and extensive.
- The Triad area of North Carolina took the toughest blow from Tropical Storm Michael, with Guilford, Rockingham, Alamance and Caswell counties among the hardest hit. Rainfall storm totals were between 4 and 8 inches with some areas receiving up to 10 inches from October 10th - 11th.

Storm Response – By The Numbers

	Peak Outages #	Customers Restored	Resources	Customer Calls
Florence – Carolinas	605,000	> 1.81 million	> 20,000	1.1 million
Michael – Carolinas	554,000	> 1.12 million	>10,000	1.6 million
Michael - Florida	33,600	>75,000*	>4,500	170,000
Totals	**>1.1 million**	**>3.01 million**	**>34,000**	**>2.8 million**

*To those that can receive power

More than 90% of customers were restored within three days for both storms.

EEI Award

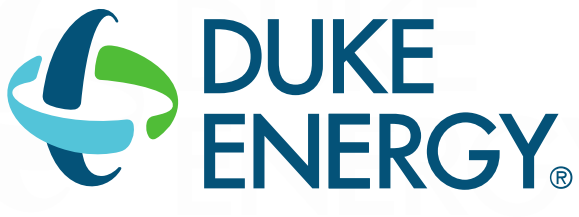
- EEI recognized Duke Energy with the Emergency Recovery Award for efforts to restore power during Hurricane Florence.
- Hurricane Florence caused historic flooding in Carolinas coastal communities with more than 1.8 million customers impacted.
- Restored power to nearly 1.2 million customers in the first three days after the storm made landfall.

December Winter Storm

- From December 8th through December 13th a winter storm system intensified along the coast and generated snow, sleet, and freezing rain across the Carolinas region.
- More than 7,500 resources (linemen, vegetation, damage assessors) were mobilized to begin restoration once conditions supported safe work. The ICS structure was mobilized and fully operational December 7th in Raleigh to support restoration efforts. Crews working in support of Winter Storm Diego were released by December 13th.
- At the peak 305,049 customers in NC and SC lost power during the winter storm.
- Across the Carolinas service area 307 poles were broken and 102 transformers were damaged. Additionally, over 1,100 spans of wire were repaired or replaced.
- Restoration began December 8th once winter conditions supported safe work.
- By December 13th more than 99% of customers in the Carolinas who could receive power were restored.

January Winter Storm

- From January 13 through January 15 a fast moving area of low pressure and cold front bringing rain impacted the Mountain and Triad zones in the Carolinas.
- More than 5,500 resources (linemen, vegetation, damage assessors) were mobilized to begin restoration once conditions supported safe work. The ICS structure was mobilized and fully operational to support restoration efforts.
- At the peak 141,663 customers in NC and SC lost power.
- Across the Carolinas service area over 50 poles were broken and 29 transformers/switches/reclosers sustained damaged. Additionally, over 440 spans of wire were repaired or replaced.
- By January 14th more than 98% of customers in the Carolinas who could receive power were restored.


DUKE
ENERGY®

NC Electric Membership Cooperatives' Hurricane Preparation, Impacts, and Response (20 min)

Overview of the Tideland EMC Microgrid on Ocracoke Island

Lee Ragsdale, Senior Vice President
Grid Infrastructure and Compliance, NCEMC

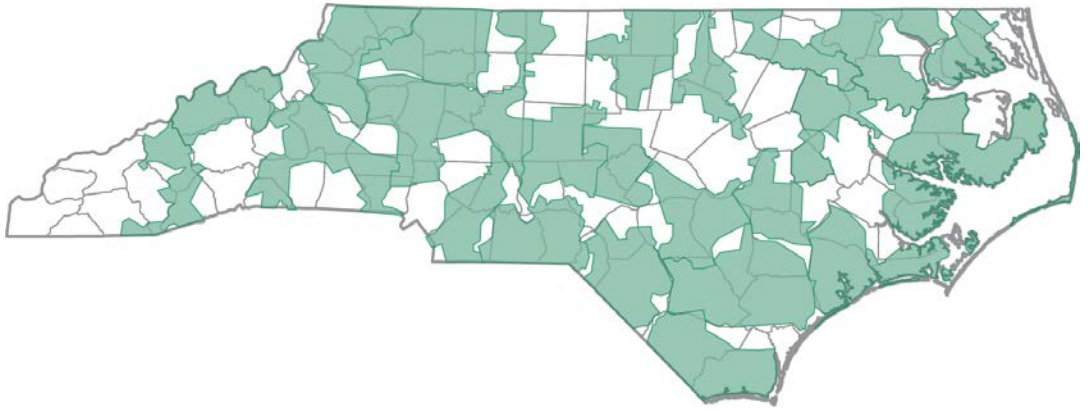
Hurricane Florence & Tropical Storm Michael

Responding the NC Cooperative Way

S. Lee Ragsdale
Senior Vice President,
Grid Infrastructure and Compliance

NC Electric Cooperatives

Your Touchstone Energy® Cooperatives



1 M

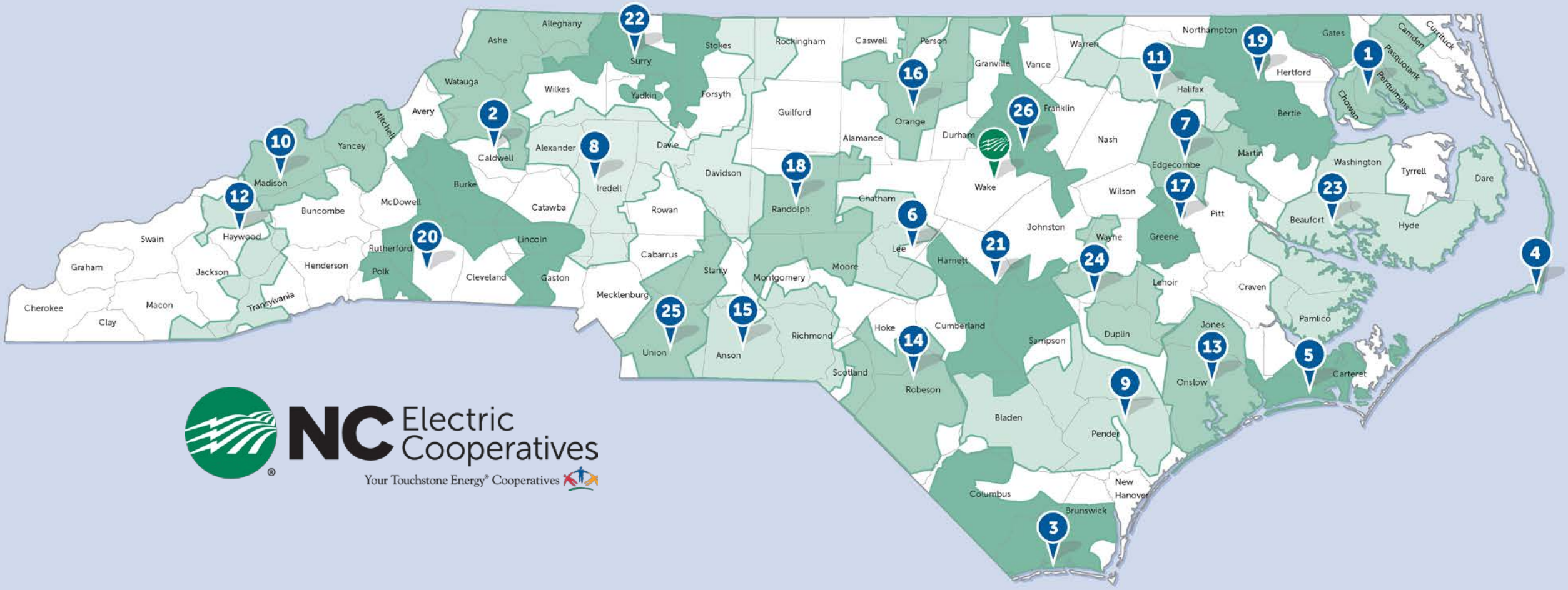
Households and businesses served by NC Electric Cooperatives

93

Counties we work in around the state of North Carolina

26

Distinct member-owned, not-for-profit cooperatives

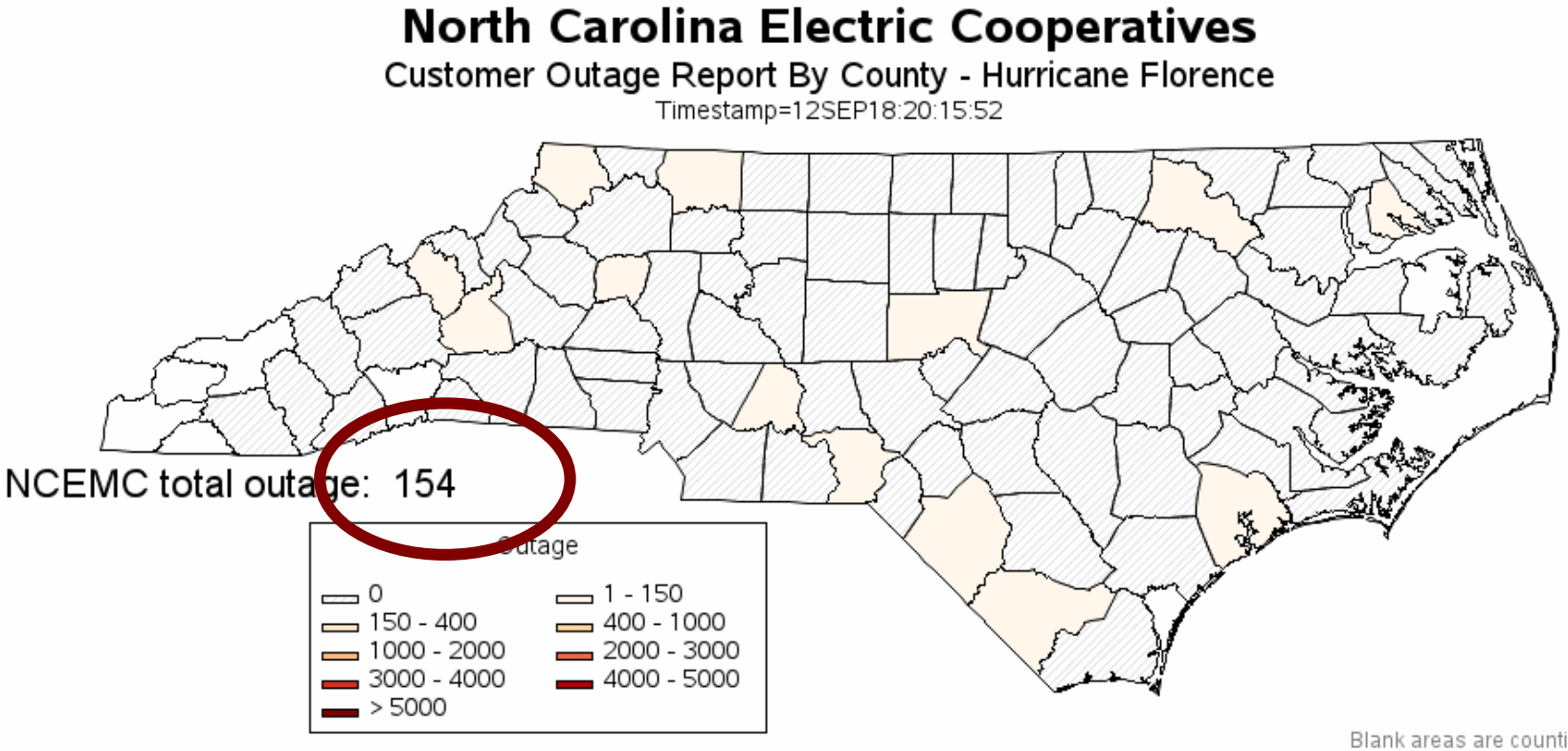


NC Electric Cooperatives
Your Touchstone Energy® Cooperatives

Ready to Respond

Local cooperative line crews are positioned and ready to restore outages as soon as conditions are **safe**…assisted by hundreds of crews from peer cooperatives across the southeast….

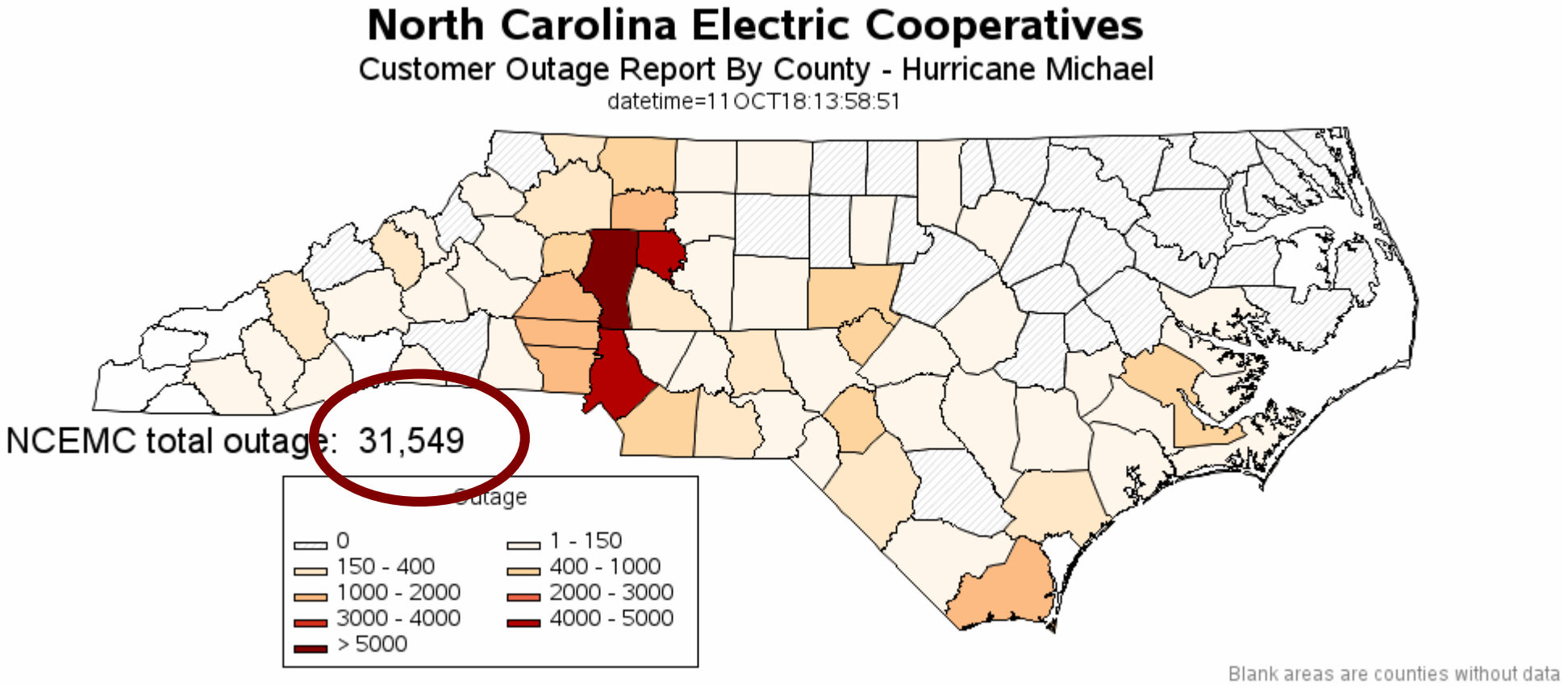
Hurricane Florence Daily Outages



An army…worked tirelessly to restore power… bringing outages from a **historic high** of **326,000**…to **12,700** one **week** later.

https://drive.google.com/open?id=1gd6OrJ4pkTCAL5n8R8fmo_XGyMrmEOye

Hurricane Michael Outages

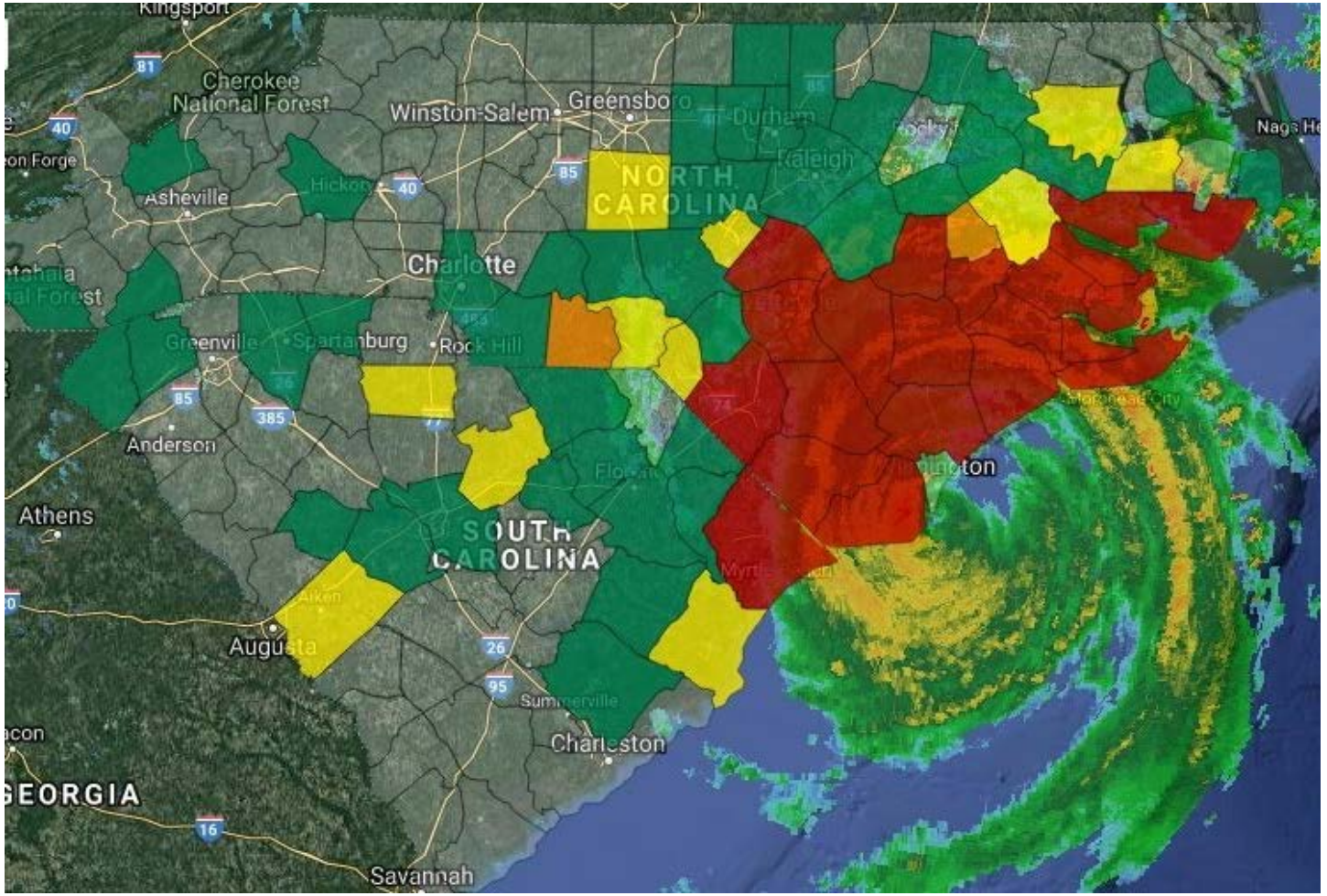


https://drive.google.com/open?id=1b7lON_-skDofa1P9QiqRFhqHGmDyegYa

Cooperation Among Cooperatives

Hundreds of crews from states as far away as Minnesota, comprising **thousands** of additional personnel.

Planning. Preparing. Providing.



Messaging Matters: Social & Electronic Media


Thank you

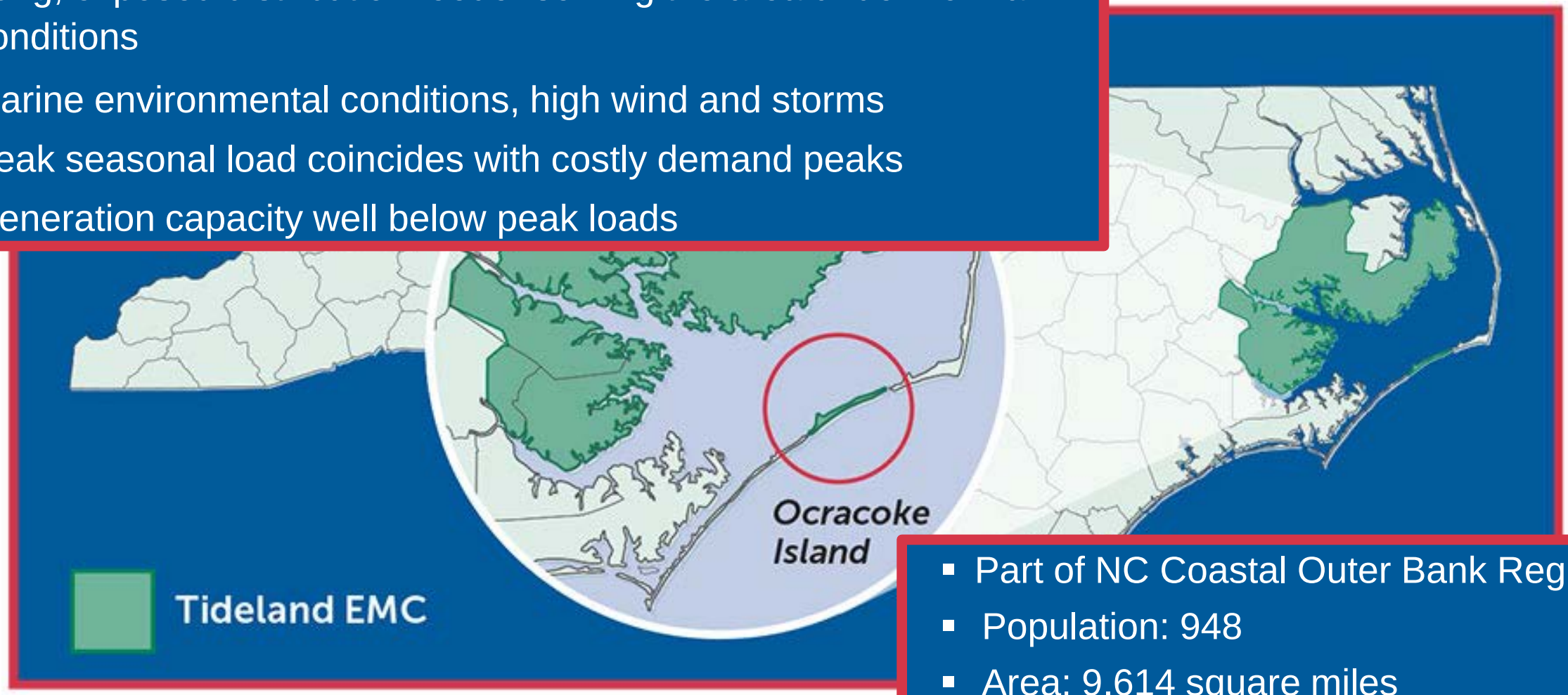
NC Electric Cooperatives' Microgrids

NC Electric Cooperatives

Your Touchstone Energy® Cooperatives

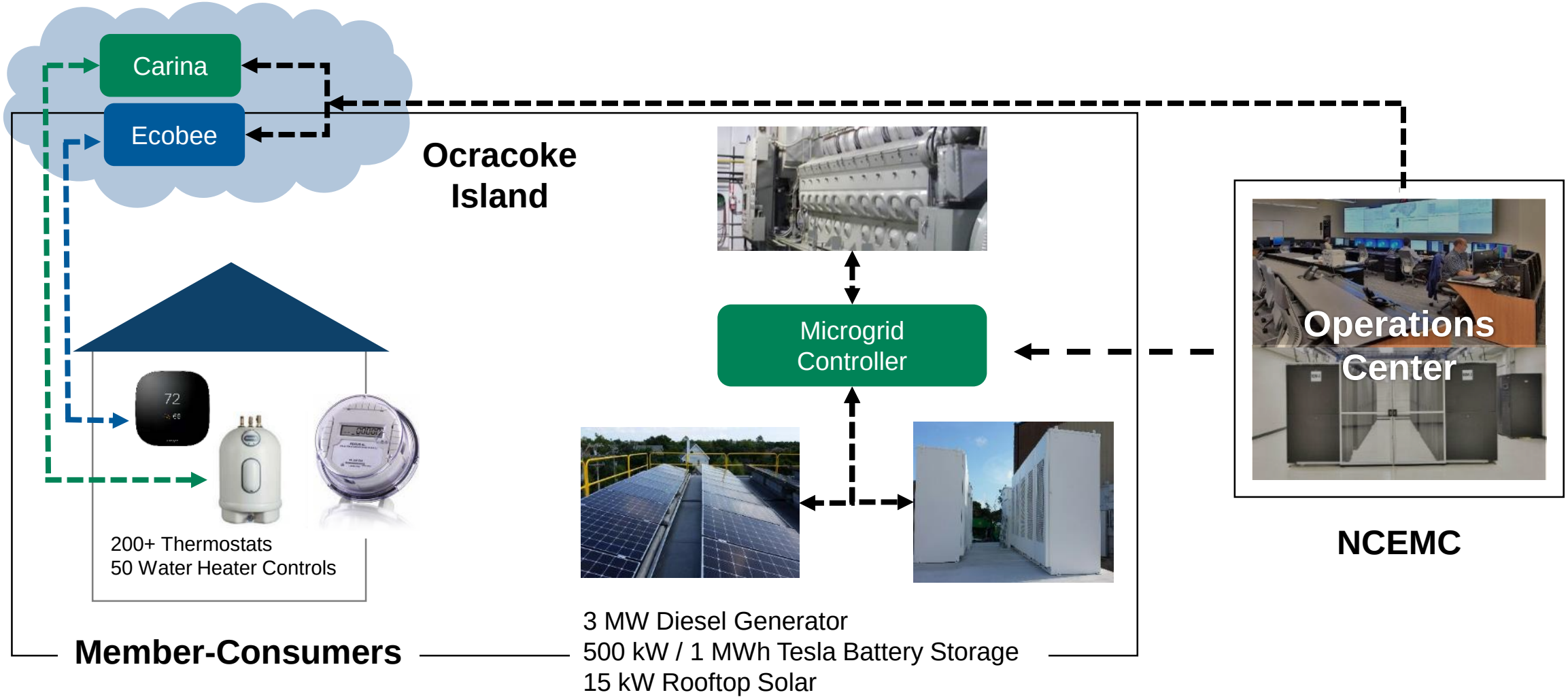
NCEMC System Microgrid Project

- Long, exposed distribution feeder serving the area under normal conditions
- Marine environmental conditions, high wind and storms
- Peak seasonal load coincides with costly demand peaks
- Generation capacity well below peak loads



- Part of NC Coastal Outer Bank Region
- Population: 948
- Area: 9.614 square miles

NCEMC System Microgrid



youtu.be/psMLOWmSFm8

Tom Butler -Butler Quality Pork

DEEP DIVE

Pig-powered microgrid in North Carolina may be the future of rural cooperative supply

The Butler pig farm includes a range of clean energy technologies, and the state's cooperatives see its grid integration efforts as a model that can be replicated.

"We are hoping to build an organization that is **industry-changing** to rural areas."

Biogas microgrids could reduce odors and outages for hog farm neighbors

WRITTEN BY
Elizabeth Ouzts
May 10, 2018

PHOTO BY
Elizabeth Ouzts / Energy News Network

A first-of-its-kind microgrid at a North Carolina hog farm combines solar, biogas and batteries.

Tom Butler admits he was naive back in 1995, when he stopped growing corn, tobacco, and other crops and began raising 8,000 hogs on his farm outside Lillington, North Carolina.

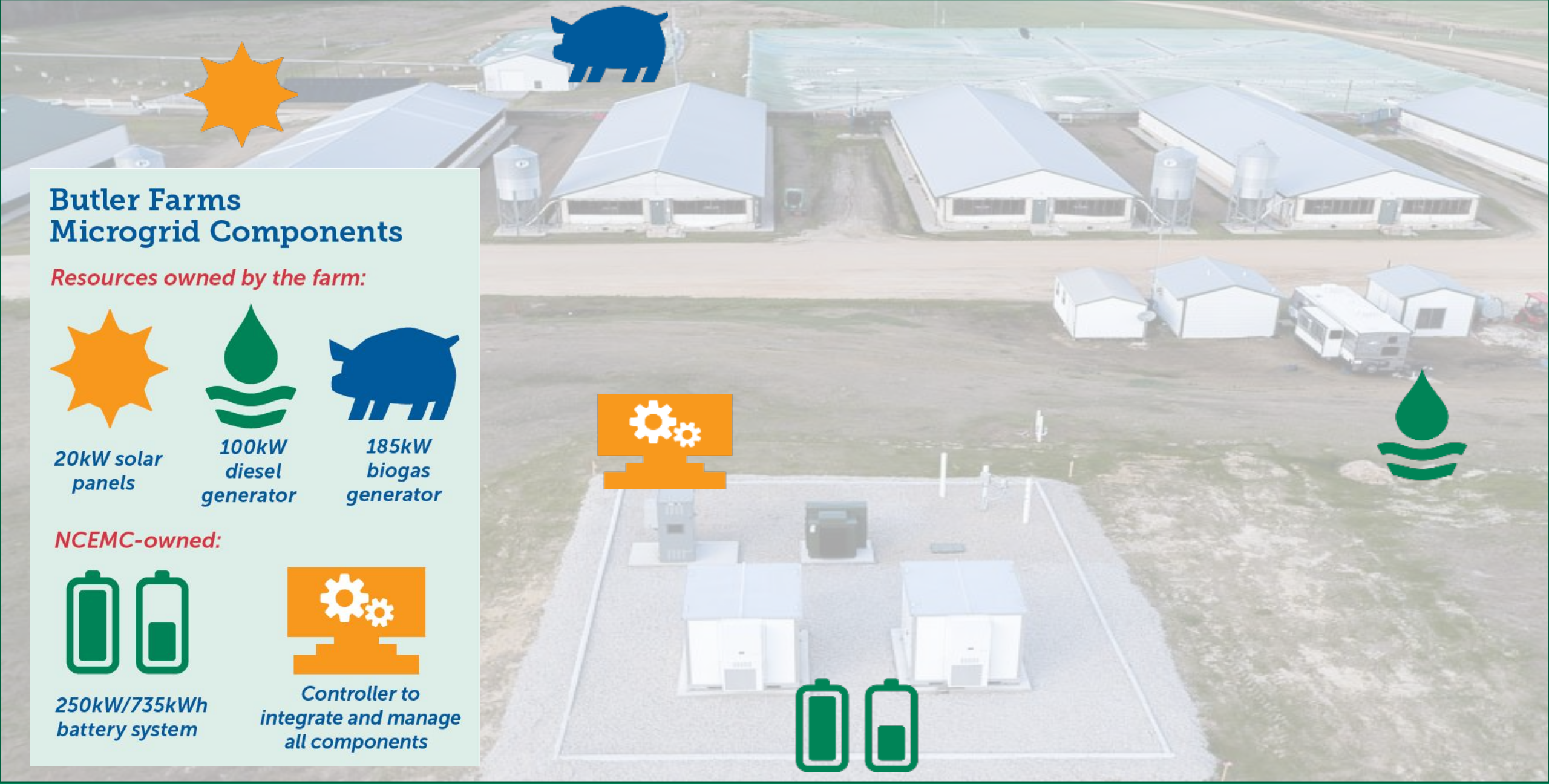
Neighbors – many he'd known all his life – quickly began to complain about the

MICROGRID KNOWLEDGE

Markets & Policy | Players | Microgrids | Infrastructure | Distributed Energy | Re

Rural NC Farm Cooperative Microgrid Increases Local Resilience

May 8, 2018 By Sarah Rubenoff | Leave a Comment



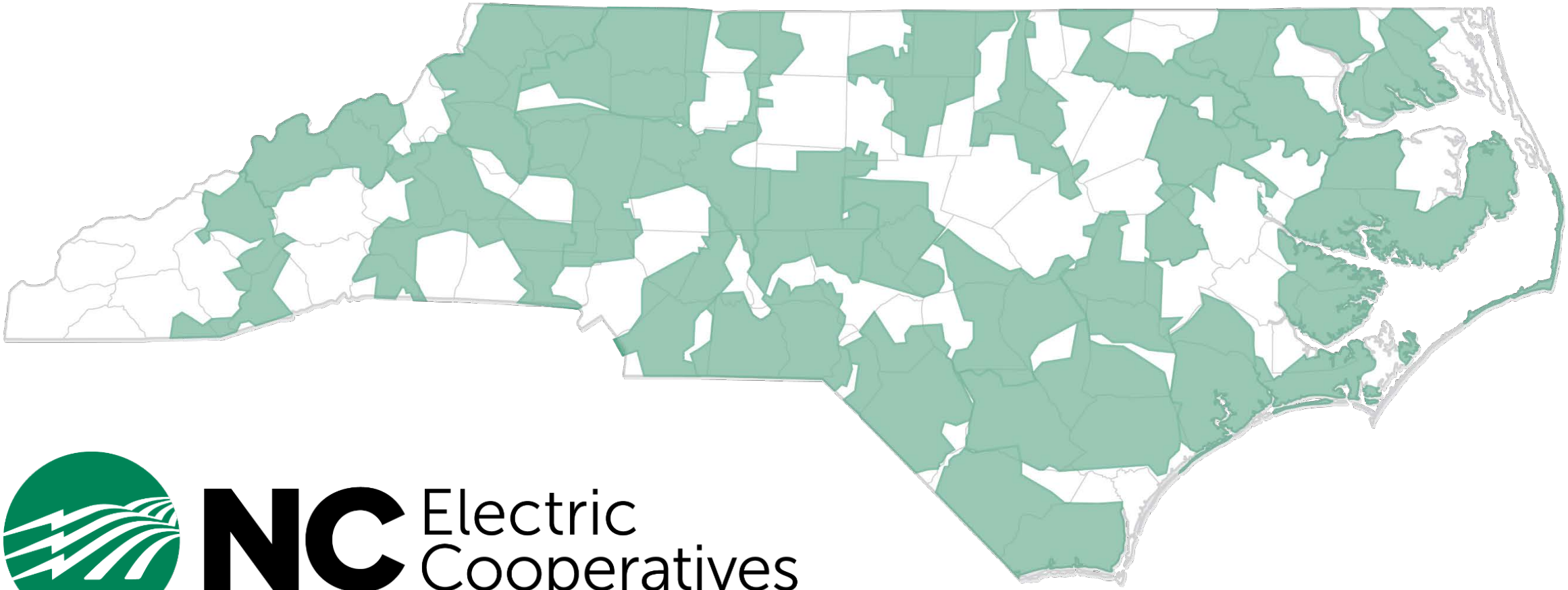
Butler Farms Microgrid Components

Resources owned by the farm:

- *20kW solar panels*
- *100kW diesel generator*
- *185kW biogas generator*

NCEMC-owned:

- *250kW/735kWh battery system*
- *Controller to integrate and manage all components*



NC Electric Cooperatives

Your Touchstone Energy® Cooperatives

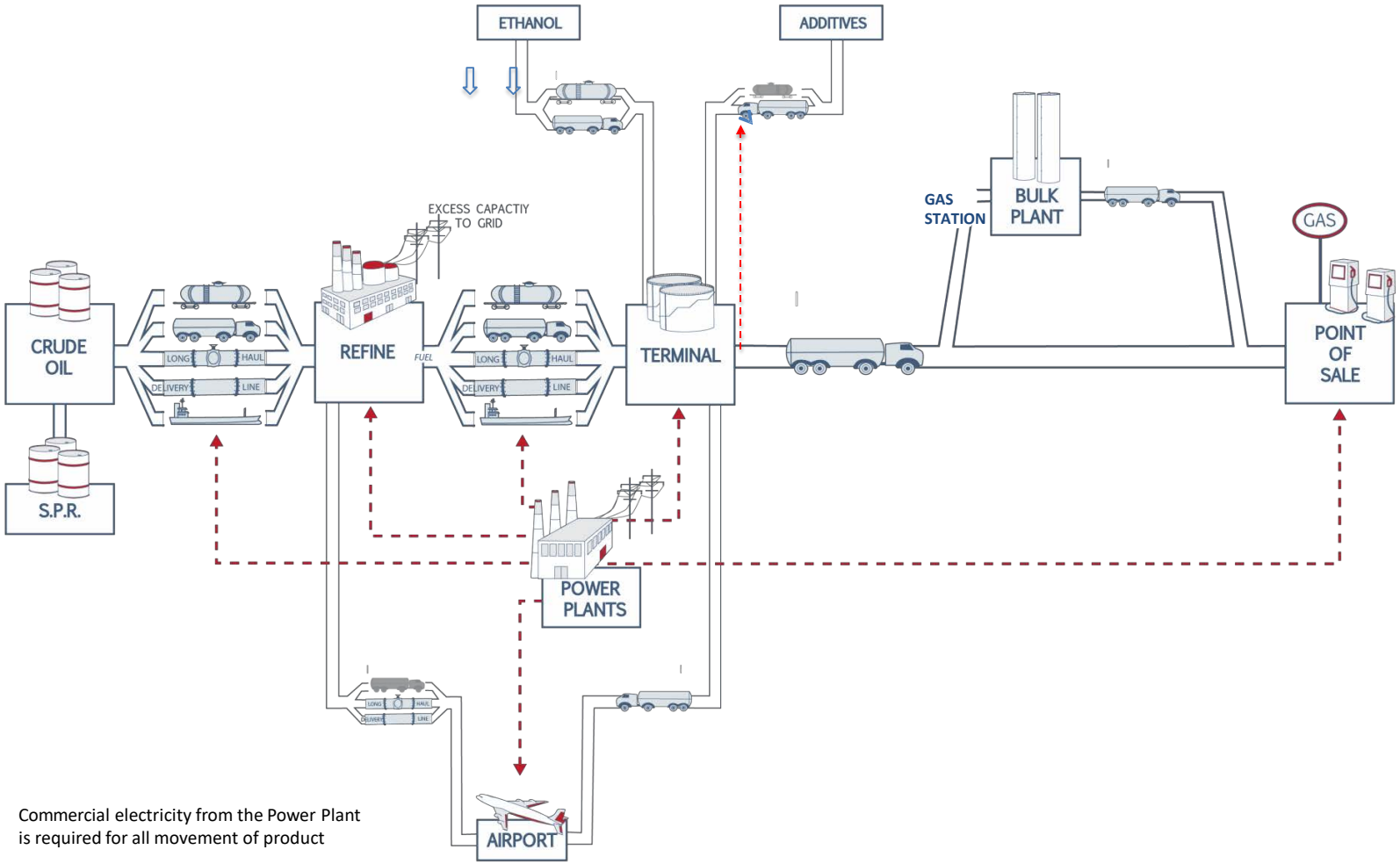
Liquid Fuels – Preparation, Impacts, and Response (10 min)

David McGowan, Executive Director North Carolina Petroleum Council

Petroleum Industry Preparation, Response & Recovery to Hurricane Florence

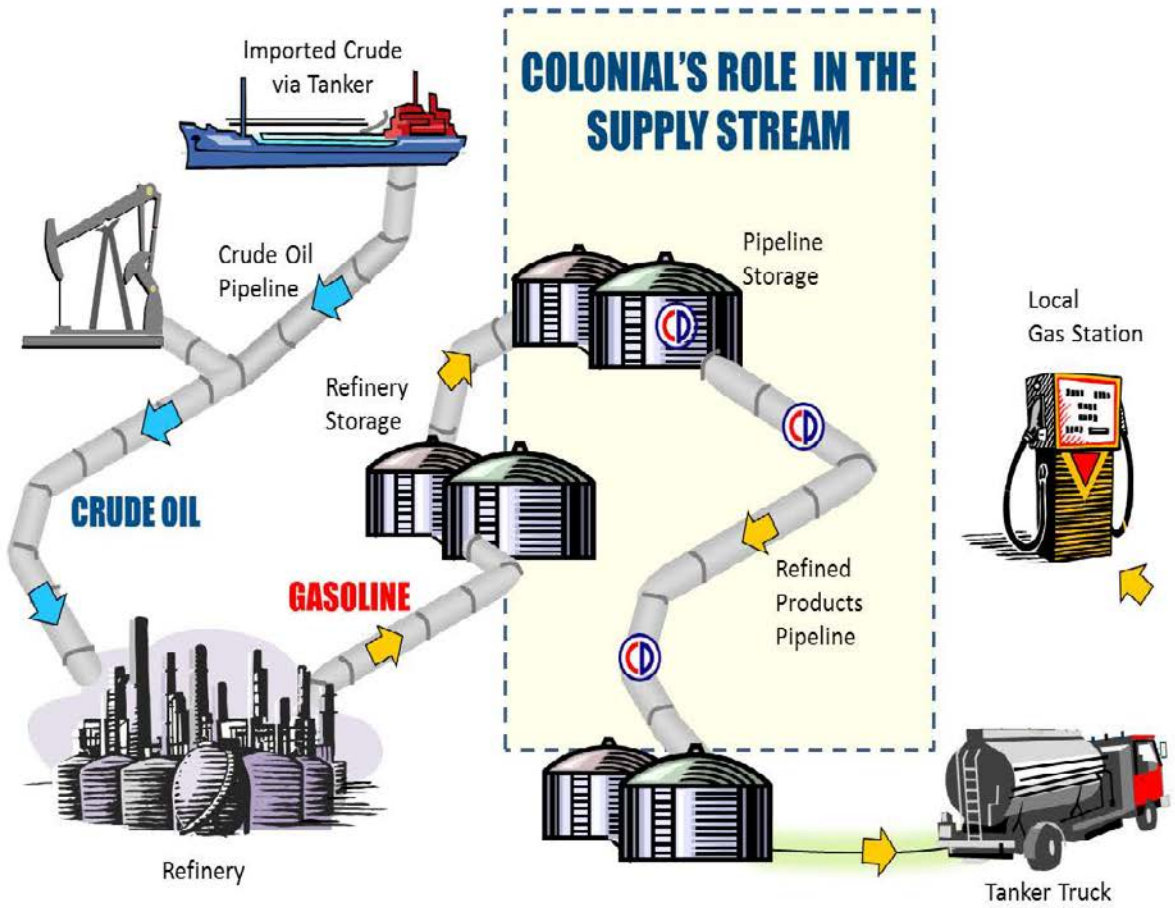
David McGowan
Executive Director
North Carolina Petroleum Council

CRITICAL ELEMENTS OF THE FUEL SUPPLY CHAIN

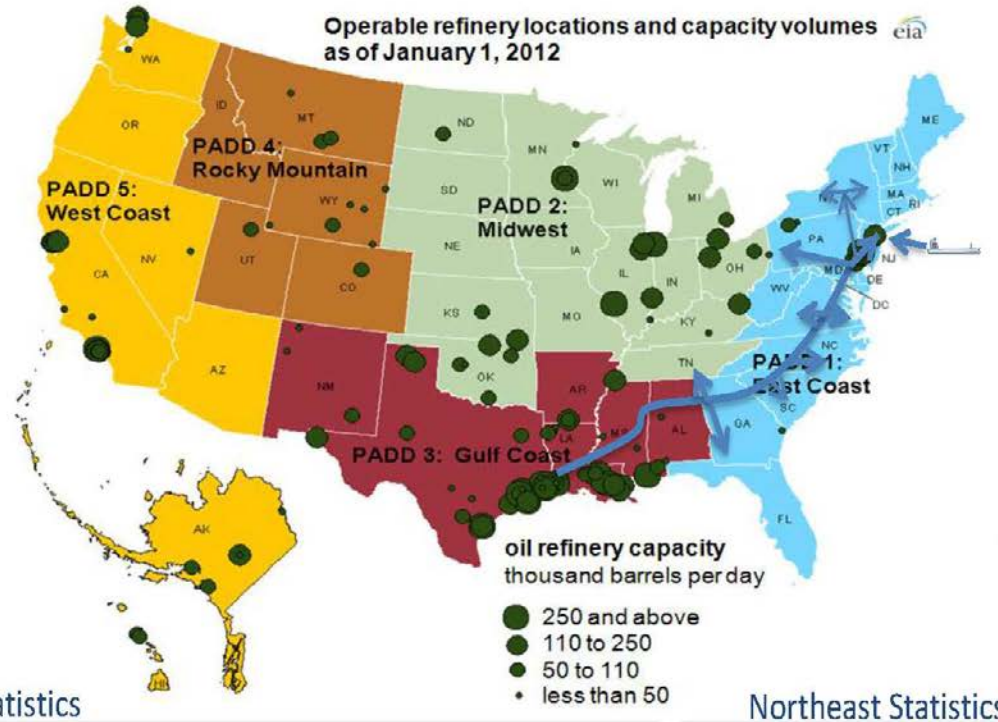


Commercial electricity from the Power Plant is required for all movement of product

How Fuel Gets to You



FACILITIES OVERVIEW



Source: U.S. Energy Information Administration, Refinery Capacity Report, 2012.
Note: Click map for larger image. Refinery locations are approximate, reflecting the coordinates of the refinery's city, rather than the refinery itself. PADDs are Petroleum Administration for Defense Districts.

Blue line was added to show pipelines supplying the East coast.

US Statistics

- US Refineries: 144
- US Terminals: 1,100
- US Bulk Storage Plants: 4,226[1]
- US Gas Stations: 157,000[2]
- Pipelines: 100s

Northeast Statistics

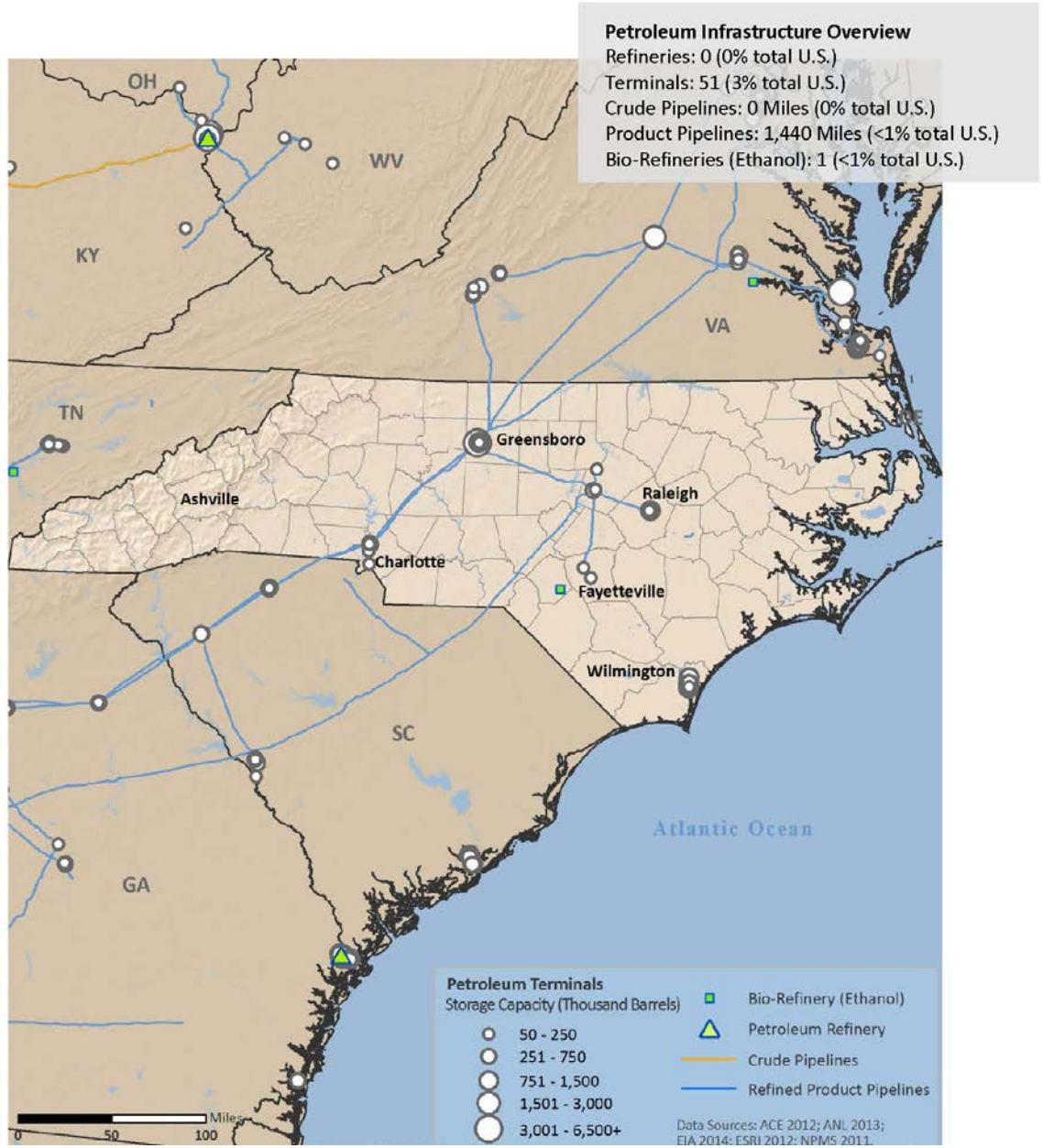
- Northeast Refineries – NY = 0, NJ = 3, DE = 1, PA = 2
- NY, Northern New Jersey, Long Island Area
  - Terminals (NY harbor/NJ): 57[3]
  - Bulk Storage Plants: 71[1]
  - Gas Stations: 3,769[1]
  - Pipelines: 3

Footnotes:

1. US Census Bureau 2010
2. NPN 2011 Statistics
3. DOE Situation Report for Hurricane Sandy

energy API

PETROLEUM

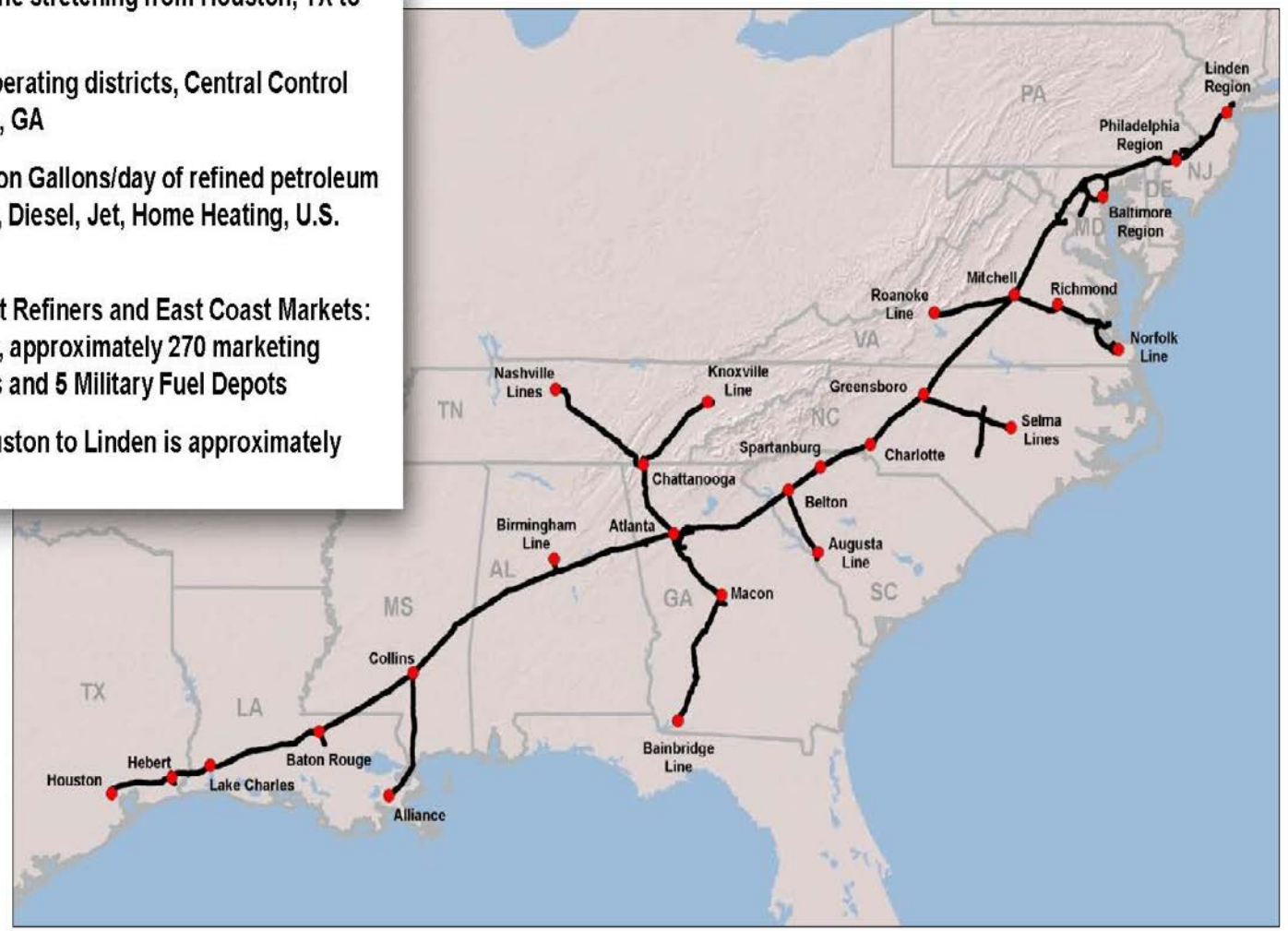


Produced by Department of Energy (DOE), Office of Electricity Delivery & Energy Reliability (OE)

Colonial System Map

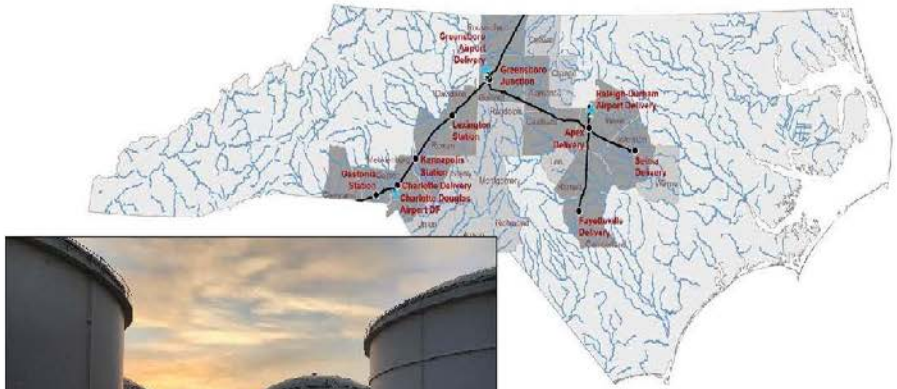
- 5,500 Miles of Pipeline stretching from Houston, TX to Linden, NJ
- 900 employees, 3 operating districts, Central Control Center in Alpharetta, GA
- Transports 105 Million Gallons/day of refined petroleum products: Gasoline, Diesel, Jet, Home Heating, U.S. Military Fuels
- Connects Gulf Coast Refiners and East Coast Markets: Serves 29 refineries, approximately 270 marketing terminals, 7 Airports and 5 Military Fuel Depots

Transit time from Houston to Linden is approximately 20 days



North Carolina Operations (Mainlines)

- Line-1
  - 40" pipe
  - Gasoline
  - 107 miles traversing 7 counties
- Line-2
  - 36" pipe
  - Distillate line (diesel fuel, fuel oil, kerosene, home heating oil)
  - 107 miles traversing 7 counties
- Line-3
  - 36" pipe
  - Mixed fuels
  - 41 miles traversing 2 counties
- Line-4
  - 32" pipe
  - Mixed fuels
  - 41 miles traversing 2 counties



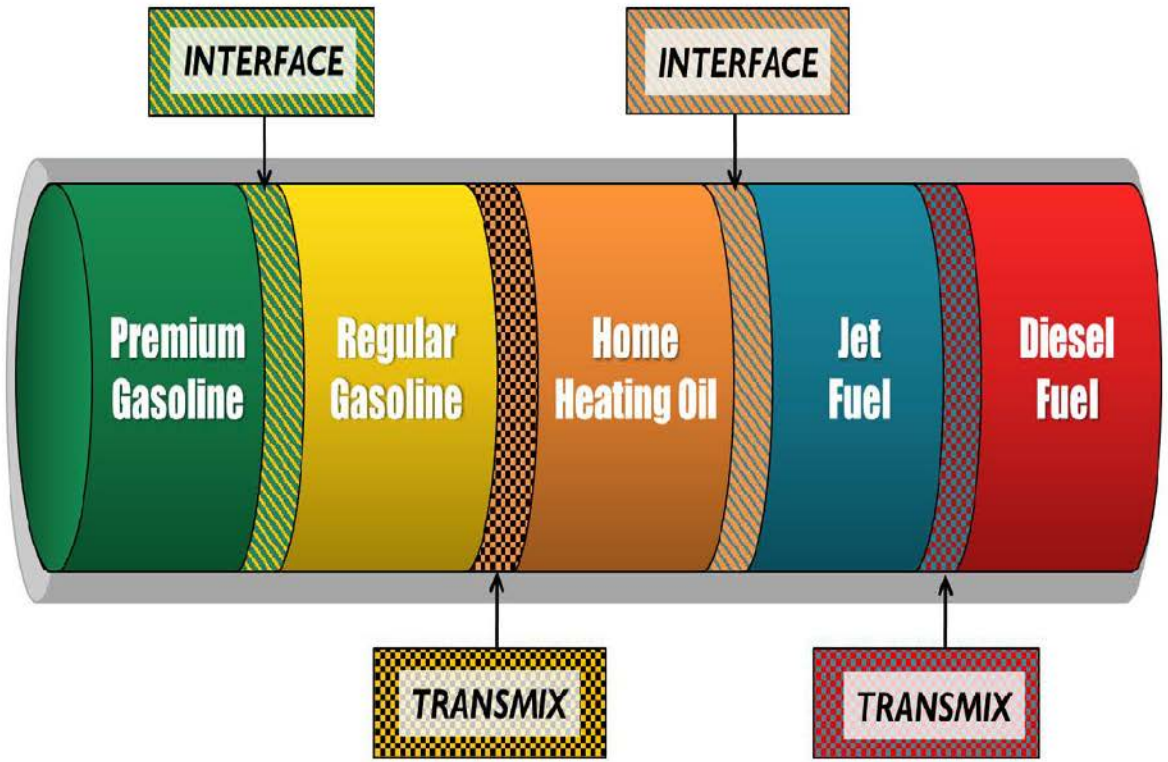
North Carolina Operations (Stublines)

- Line-22 (Apex/Selma)
  - 16" pipe
  - Mixed fuels
  - 107 miles traversing 5 counties
- Line-23 (RDU)
  - 8" pipe
  - Kero
  - 74 miles traversing 4 counties
- Line-24/24F (Fayetteville)
  - 8/6" pipe
  - Mixed fuels
  - 85/45 miles traversing 5 counties

North Carolina Operations

- 2 Tank Farms (CLT, GBJ)
- 5 Delivery Facilities
  - Charlotte
  - Greensboro
  - Apex
  - Selma
  - Fayetteville
- 3 Airport Facilities
  - CLT
  - GSO
  - RDU
- 5 Booster Stations
  - Line 1: Charlotte, Kannapolis, Greensboro
  - Line 2: Gastonia, Charlotte, Kannapolis, Lexington, Greensboro
- 83 Block Valve Sites
  - Facilities and major river crossings

How Product Moves



NC Petroleum System Facts

- 164 million barrels (6.8 billion gallons) of refined petroleum products consumed in NC in 2016; Gasoline, Diesel, Jet A, Av Gas, Kerosene, Heating oil
- Approximately 3% of all US refined petroleum consumption
- NC ranks 7th nationally in total consumption & 9th most populous state
- 2 Refined Product Pipelines:
  - Colonial Pipeline – approximately 70-75% of daily volume
  - Kinder Morgan/Plantation Pipeline – approximately 10-15% of daily volume
- 6 Major Supply Terminal Complexes:
  - Charlotte
  - Greensboro
  - Selma
  - Apex
  - Fayetteville
  - Wilmington
- Approximately 4,550 Filling Stations

Table C2. Energy Consumption Estimates for Major Energy Sources in Physical Units, 2016

State	Coal	Natural Gas [a]	Petroleum							Nuclear Electric Power	Hydro-electric Power [f]	Wind	Fuel Ethanol [g]
			Distillate Fuel Oil	HGL [b]	Jet Fuel [c]	Motor Gasoline [d]	Residual Fuel Oil	Other [e]	Total				
	Million Short Tons	Billion Cubic Feet	Million Barrels							Billion Kilowatthours			Million Barrels
Alabama	19.8	695.5	29.4	2.2	3.2	65.8	1.9	5.9	108.3	39.9	7.0	0.0	6.8
Alaska	1.1	330.6	11.2	0.3	18.5	7.0	0.0	4.4	41.3	0.0	1.7	0.2	0.0
Arizona	16.8	358.3	25.8	2.3	4.4	69.0	0.0	3.9	105.4	32.4	7.2	0.5	7.1
Arkansas	14.3	309.8	19.7	1.8	1.5	36.2	(s)	4.7	63.9	13.4	3.6	0.0	3.7
California	1.4	2,172.3	97.2	15.1	118.6	384.8	23.2	53.0	671.9	18.9	28.9	13.5	37.8
Colorado	16.9	475.3	18.0	4.3	9.3	56.1	0.0	5.4	93.0	0.0	1.9	9.4	5.8
Connecticut	0.1	248.0	16.5	2.8	1.7	35.8	0.1	2.2	59.1	16.8	0.2	(s)	3.7
Delaware	0.3	108.6	2.5	1.1	0.1	11.6	0.2	4.6	20.1	0.0	0.0	(s)	1.2
Dist. of Col.	(s)	28.8	0.5	(s)	0.0	2.8	0.0	0.5	3.8	0.0	0.0	0.0	0.3
Florida	18.2	1,382.3	54.1	5.1	27.4	213.2	9.4	11.0	320.1	29.3	0.2	0.0	20.1
Georgia	19.7	707.4	39.3	4.7	5.2	114.2	1.4	6.5	171.2	34.5	3.4	0.0	10.8
Hawaii	0.8	3.0	4.5	0.8	13.1	11.2	9.7	2.9	42.2	0.0	0.1	0.6	1.2
Idaho	0.1	106.3	12.3	1.4	1.0	18.8	(s)	1.2	34.6	0.0	9.0	2.6	1.9
Illinois	39.0	1,024.3	51.5	20.9	28.4	115.6	0.1	27.8	244.4	98.6	0.1	10.7	11.6
Indiana	42.2	754.4	40.8	4.8	8.9	75.6	0.3	16.8	147.2	0.0	0.4	4.9	7.3
Iowa	16.9	330.2	26.0	19.1	1.0	41.2	(s)	3.0	90.3	4.7	0.9	20.1	4.7
Kansas	14.7	269.0	20.7	2.4	1.5	32.6	0.6	8.3	66.1	8.2	(s)	14.1	3.1
Kentucky	32.9	275.9	27.1	9.5	12.0	53.1	(s)	15.2	116.9	0.0	3.5	0.0	5.1
Louisiana	8.8	1,658.1	33.3	147.8	29.3	54.2	6.0	128.8	399.4	17.2	1.1	0.0	5.6
Maine	0.1	53.1	12.3	3.5	1.2	19.0	0.6	1.1	37.7	0.0	3.0	1.7	1.9
Maryland	6.5	219.1	17.1	2.8	1.5	65.2	0.1	3.6	90.4	14.8	1.4	0.5	6.7
Massachusetts	0.9	429.8	25.1	2.8	10.7	67.1	0.8	3.7	110.1	5.4	0.7	0.2	6.9
Michigan	24.7	891.0	29.8	11.6	4.0	113.5	0.5	12.2	171.7	31.6	1.6	4.7	10.7
Minnesota	14.8	449.9	27.8	9.0	4.8	64.0	0.1	12.7	118.4	13.9	1.2	9.9	8.0
Mississippi	4.5	546.5	21.2	2.5	17.1	41.7	0.6	8.7	91.8	5.9	0.0	0.0	4.3
Missouri	36.4	267.2	32.6	5.7	2.9	76.9	(s)	5.8	123.9	9.4	1.3	1.1	7.5
Montana	9.6	75.0	8.7	2.1	1.0	13.0	0.0	7.0	31.7	0.0	10.1	2.1	1.3
Nebraska	14.2	163.3	19.3	2.3	1.3	21.6	0.0	1.4	45.9	9.4	0.9	3.8	2.0
Nevada	1.5	303.5	11.1	1.0	6.2	28.0	0.0	1.6	48.0	0.0	1.8	0.3	2.9
New Hampshire	0.2	57.8	7.0	4.2	0.4	17.0	0.2	0.9	29.8	10.8	1.1	0.4	1.7
New Jersey	0.7	764.1	30.6	6.1	33.0	99.9	4.0	14.1	187.7	29.9	(s)	(s)	10.4
New Mexico	10.6	248.2	16.0	1.8	1.3	22.9	0.0	3.8	45.9	0.0	0.1	3.6	2.4
New York	1.2	1,291.9	57.2	8.5	35.5	134.8	6.4	10.5	252.9	41.6	26.9	3.9	13.4
North Carolina	**15.4**	**522.0**	**33.1**	**7.9**	**2.6**	**112.2**	**0.1**	**8.1**	**164.1**	**42.8**	**4.4**	**(s)**	**10.6**
Oklahoma	12.8	703.9	30.3	2.8	9.3	47.0	0.4	12.0	101.8	0.0	2.6	20.1	4.5
Oregon	1.1	235.9	17.4	1.7	5.0	38.0	0.1	2.9	65.0	0.0	34.5	7.2	3.9
Pennsylvania	33.4	1,310.1	56.8	12.1	12.2	117.9	0.6	23.0	222.5	82.9	2.4	3.5	11.5
Rhode Island	0.0	86.4	3.7	0.6	0.7	8.9	0.1	1.0	14.9	0.0	(s)	(s)	0.9
South Carolina	9.0	275.9	22.7	2.4	2.1	67.9	1.7	6.5	103.2	55.8	2.2	0.0	6.4
South Dakota	1.6	81.1	7.6	1.8	0.9	11.6	(s)	0.8	22.6	0.0	4.8	3.7	1.2
Tennessee	17.8	329.4	29.0	2.5	13.5	81.6	(s)	12.1	138.6	29.6	6.8	(s)	7.7
Texas	86.8	4,034.6	177.2	550.5	84.2	338.0	30.4	206.4	1,386.8	42.1	1.3	57.5	35.0
Utah	12.6	240.8	14.2	1.1	6.9	28.5	0.0	5.5	56.3	0.0	0.8	0.8	3.0
Vermont	0.0	12.1	4.8	2.4	0.3	7.4	(s)	0.8	15.7	0.0	1.1	0.3	0.7
Virginia	9.5	543.3	32.1	5.6	10.8	96.9	1.2	5.5	152.1	29.7	1.5	0.0	9.6
Washington	3.2	301.4	27.1	4.3	20.8	67.0	17.9	17.5	154.7	9.6	78.3	8.0	6.9
West Virginia	30.6	171.0	13.3	3.4	0.2	19.7	0.1	2.7	39.5	0.0	1.6	1.4	1.9
Wisconsin	19.9	480.8	24.9	8.4	1.8	62.7	0.1	7.2	105.2	10.2	2.8	1.5	6.5
Wyoming	26.1	123.8	13.7	1.1	0.5	8.8	0.0	4.6	28.7	0.0	1.0	4.4	0.9
United States	731.1	27,487.3	1,419.1	828.2	590.8	3,410.1	119.4	738.0	7,205.5	805.7	267.8	227.0	341.8

[a] Natural gas as it is consumed; includes supplemental gaseous fuels that are commingled with natural gas.
[b] Hydrocarbon gas liquids, include natural gas liquids and refinery olefins.
[c] Includes kerosene-type jet fuel only; naphtha-type jet fuel is included in "Other Petroleum."
[d] Motor gasoline as it is consumed; includes fuel ethanol blended into motor gasoline.
[e] Includes asphalt and road oil, aviation gasoline, kerosene, lubricants, petroleum coke, and the "other petroleum products" category. See Technical Notes, Section 4.
[f] Conventional hydroelectric power. Does not include pumped-storage hydroelectricity.
[g] Includes denaturant. Because of differences in data sources and estimation methods, the ratio of fuel ethanol consumption and motor gasoline consumption should not be interpreted as the average ethanol blend rate.

Where shown, (s) = Value less than 0.05.
Note: Totals may not equal sum of components due to independent rounding.
Web Page: All data are available at https://www.eia.gov/state/seds/seds-data-complete.php.
Sources: Data sources, estimation procedures, and assumptions are described in the Technical Notes.

North Carolina
Waivers Requested and Granted for Hurricane Florence

- Transportation Waivers – weights and hours of service (NC & FMCSA regional waiver
- Tank trailer vapor tightness waiver (NC specific with No Action Assurance from EPA)
- Reid Vapor Pressure (Waiver from EPA, NCDAQ & NCDACS to allow 11.5# prior to 9/15)
- Terminal vapor recovery unit waiver (NCDAQ & EPA)
- Dyed Diesel (NCDAQ: No Action Assurance from EPA; IRS No Action Assurance

Other Actions During Hurricane Response & Recovery

- Collaboration with Governor's office, NC Emergency Management, NCDEQ, NCDACS and other state government officials to facilitate fuel availability for storm preparations, evacuations, response & recovery (waivers, etc.)
- Coordinate with federal agencies (PHMSA, FMCSA, DHS, EPA, IRS) on federal waivers, No Action Assurance decisions, port entry, etc.)
- Work closely with NCDOT and rail operators to maintain transportation corridors to and from regional terminal complexes
- Interface with NC Petroleum & Convenience Marketers Association (wholesalers; distributers; retailers)
- Work directly with electricity providers to ensure power supply at critical infrastructure facilities like Colonial Greensboro Junction and regional terminal complexes

Questions?

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Renewables Resiliency (20 min)

Ivan Urlaub, Executive Director North Carolina Sustainable Energy Association

NC SUSTAINABLE ENERGY ASSOCIATION

Renewable Energy, Energy Assurance, and North Carolina Energy Policy

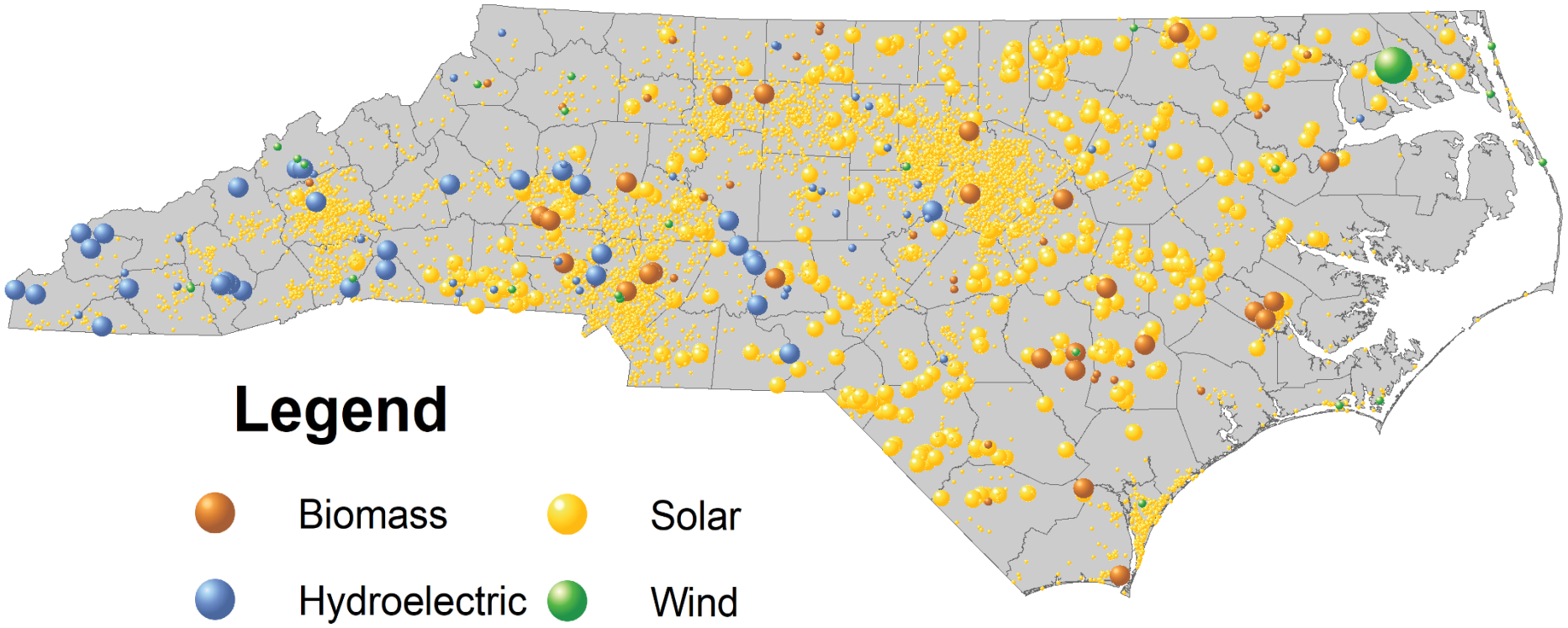
Ivan Urlaub
Executive Director, NC Sustainable Energy Association

Presentation to North Carolina Energy Policy Council, February 20, 2019
(rescheduled from November 2018)

ivan@energync.org (919) 832-7601
www.energync.org

NC Renewable Generation Installed (MW_{AC}) Nov 2018

Florence tested NC's renewables contribution of ~9.7% of generation



System Type	Distributed		Utility Scale		Total	
	Capacity (MW)	Number	Capacity (MW)	Number	Capacity	Number
Biomass	22.1	30	555	25	577.2	55
Hydroelectric	28.6	36	1,730.90	32	1,759.50	68
Solar	302.9	7,519	3,396.10	431	3,699.10	7,950
Wind	0.2	23	208	1	208.2	24
Total	**353.9**	**7,608.00**	**5,890.00**	**489**	**6,243.90**	**8,097**

NC Energy Resources in the News

inside climate news

Solar Energy Largely Unscathed by Hurricane Florence's Wind and Rain

In North Carolina, the #2 solar state, Florence was the first extreme weather test for much of its renewable energy.

BY DAN GEARINO

SEP 20, 2018

Clean Energy Players Weather Through Florence

But with floods expected through the week, installers and utilities say they're still determining the storm's impacts.

Emma Foehringer Merchant September 17, 2018

CBS NEWS

By **IRINA IVANOVA** / **MONEYWATCH** / *September 25, 2018, 9:24 AM*

Hurricane Florence crippled electricity and coal – solar and wind were back the next day

Utility Scale Solar

- In first two days, solar production in storm area was around 25% of average due to clouds, while wind production was around 250% of average due to higher sustained wind speeds

- Obtained report outs from six firms (including Duke) covering 403 of NC's 431 utility scale PV systems in our database
  - 5 systems damaged including 2 by tornadoes (1.2% of systems)
  - Between 0.4 and 4 days production lost at each of these 5 system sites
  - Systems in New Bern area produced throughout Florence and aftermath
  - Some sites required road and fence repair, vegetation clean up, no production impact

- Distribution of systems limited total renewable resource damage, impacts

Rooftop Solar

- Rooftop solar without islanding capability is either tripped offline when grid goes down or proactively taken offline by system owners ahead of an event

- Obtained report outs from firms representing 9MW of the 37MW installed rooftop PV in NC, including Wilmington
  - No wind or flood damages
  - Two tree falls on homes
  - Six inverter problems
  - Numerous inquiries about energy storage

- Rooftop systems usually damaged only if the roof is blown off in part or whole
  - Hearing second hand reports of damaged systems, but none reported to us yet

Wind Power in NC and Hurricane Florence

Amazon Wind Farm US East

- No flooding, damage, or noticeable water or drainage issues
- Winds were below U.S. DOE's 55mph cut off speed
- Sep. 14 production: 4,088 MWh vs. 1,344 MWh average day
- National Control Center in Oregon reliably controlled the project for 48 hours as part of hurricane response procedure implementation

Central Station and Grid Impacts

- Duke's 1,870 MW Brunswick Nuclear plant was operating at 15% of capacity one week after landfall, with one unit still offline as of Nov 28
- Duke's 625 MW Sutton NGCC plant went offline six days after landfall
  - 7 weeks after landfall, not at full operation, unable to function as a baseload serving facility
- On site fuel did not advantage these facilities and did not improve security
- PV systems ready, waiting for grid to come back up

Key Observations for Renewables

- Since 1996, NC has had four 100-year rain events (NC DPS), but this was first to test broadly deployed renewables
- Renewables mostly back online within a day of site access
- Distributed nature of renewables assets provided greater energy assurance
  - Design of using weather and sun for fuel reduces dependence on on-site fuel storage and central station generation
  - Amount and duration of nuclear and natural gas generating capacity offline greater than renewables
- If storm intensity and frequency continue increasing, greater energy assurance could be achieved through further systemic decentralization of generation, storage, islanding
  - DERs serving critical distribution loads available, costs declining
  - Many customers, if allowed, are willing to bare part of the cost, lowering cost of energy assurance further for all ratepayers

Solution Options Now for Critical Loads

Do NC critical loads have resources in place to stay online to maintain safety, security, and social and economic stability? Loads such as…

- Military *(14-day resilience objective)*
- Hospitals
- First responders
- Shelters
- Cell towers & ATMs
- Gas / Diesel / EV charging stations

Residential Solar PV with Energy Storage

Net Zero Buildings

Sandy Grove Elementary School has a 560 kW solar PV system, geothermal ground source heat pump, efficient lighting, and EV charging stations (no storage yet)

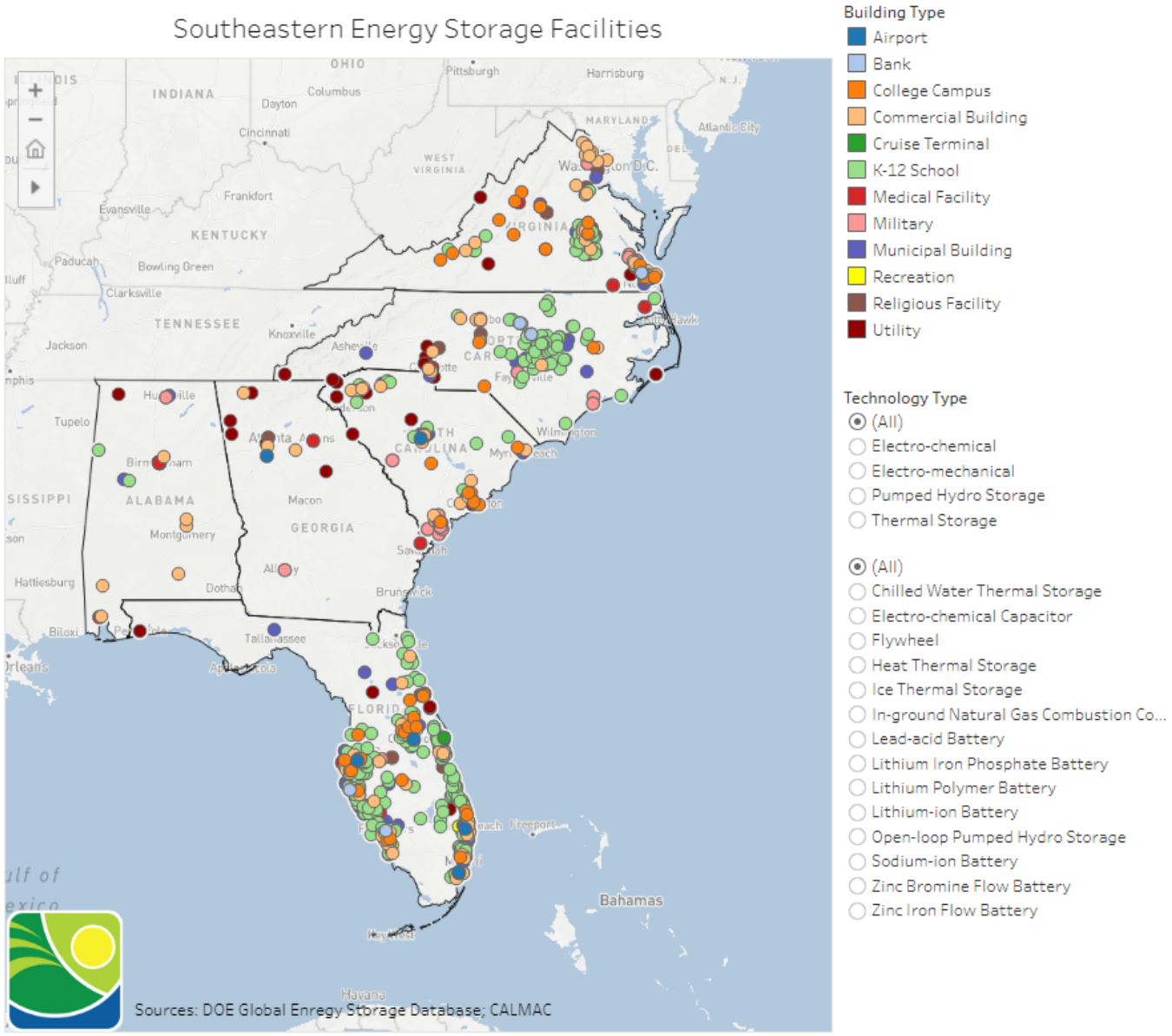
Energy Storage and Solar PV

Brunswick EMC and Cypress Creek's
12 MWh Solar+Storage Project

Microgrids

Tideland EMC's microgrid on Ocracoke Island has a 15 kW solar PV system and 2 500 kW, 1 MWh Tesla Battery Banks

Energy Storage Deployment Accelerating



Source: www.energync.org, non-residential storage assets, not comprehensive yet, Nov 2018

Key Questions for NC Energy Policy

Renewables passed the Florence test. What did we learn for policy improvement?

- How does the performance of renewables for energy assurance inform beneficial changes to energy policy, regulation, business models?
- Does NC electricity policy incent or discourage distributed generation as an energy assurance solution?
- Should NC start requiring integrated distribution system planning?
- Does the current regulated utility business model make more or less money when renewables are deployed for energy assurance?
- What does this mean for Duke Energy's recent $13.8B grid plan?
- Given the near zero damage rates for renewables not owned by Duke Energy, should we evolve NC discussion beyond concept of utility ownership and operation of renewables and storage assets as necessary to ensure reliability and energy assurance?
- Can customers directly improve both energy assurance and affordability for all ratepayers by installing renewables, efficiency measures, beneficial electrification, transportation electrification, and storage?

THANK YOU