DEQ ENERGY

North Carolina Energy Policy Council

Agenda

10:00 a.m. Wednesday, February 19, 2020

Ground Floor Meeting Room, Archdale Building

Raleigh, North Carolina 27699

Discussion of Grid Modernization and Grid Operations Planning (70 mins)

DEC and DEP's Grid Improvement Plans Filed with the NC Utilities Commission (40 mins):

Mr. Jay Oliver, Duke Energy General Manager, Grid Strategy and Asset Management Governance:

Recent EMC Distributed Energy Resources (DER) Initiatives (30 mins):

Mr. Charles Bayless, NC Electric Membership Corporation Vice President, Senior Regulatory Counsel Raleigh-Durham Area

DEC and DEP's Grid Improvement Plans Filed with the NC Utilities Commission (40 mins):

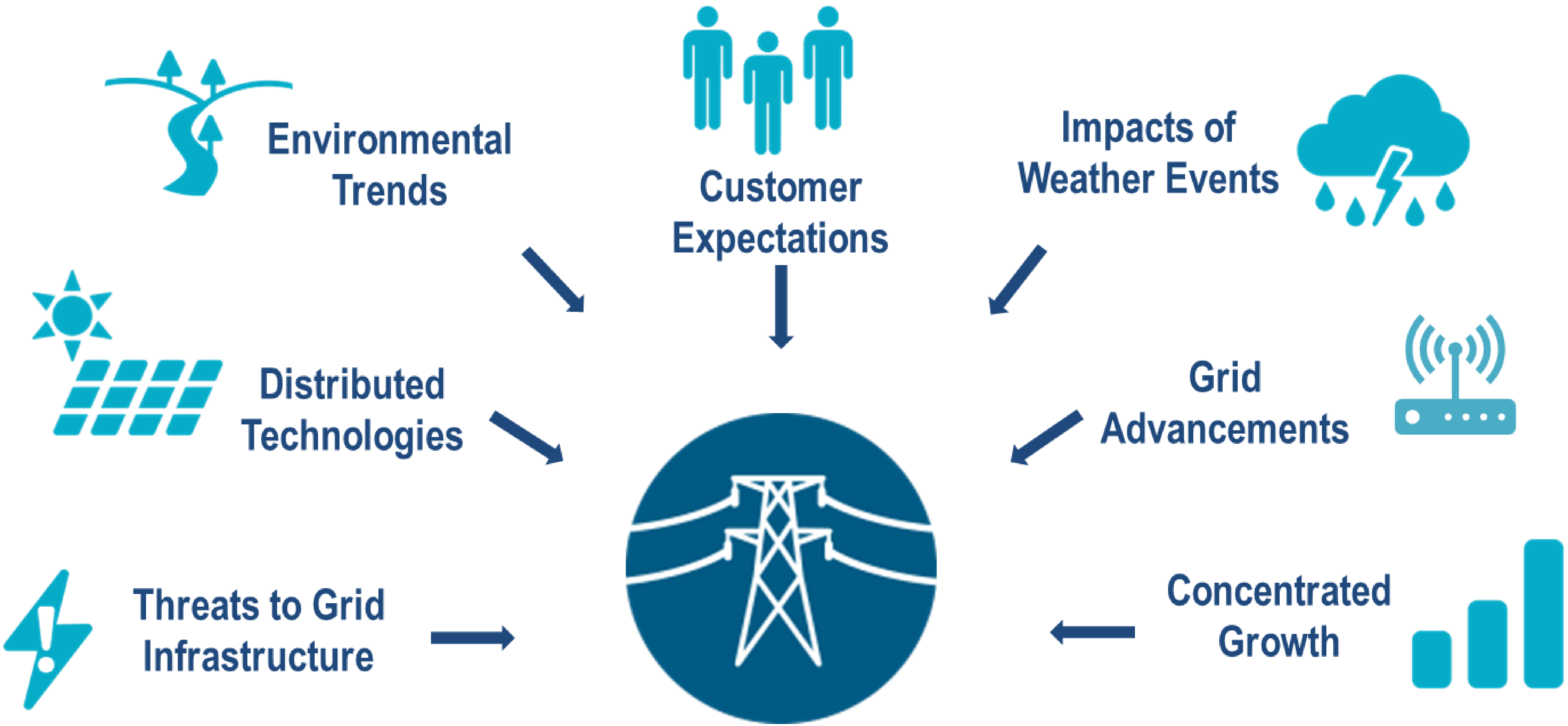
Mr. Jay Oliver, Duke Energy General Manager, Grid Strategy and Asset Management Governance:

Grid Improvement in North Carolina
N.C. Energy Policy Council

February 19, 2020

DUKE ENERGY®

DYNAMIC DRIVERS FOR GRID IMPROVEMENT



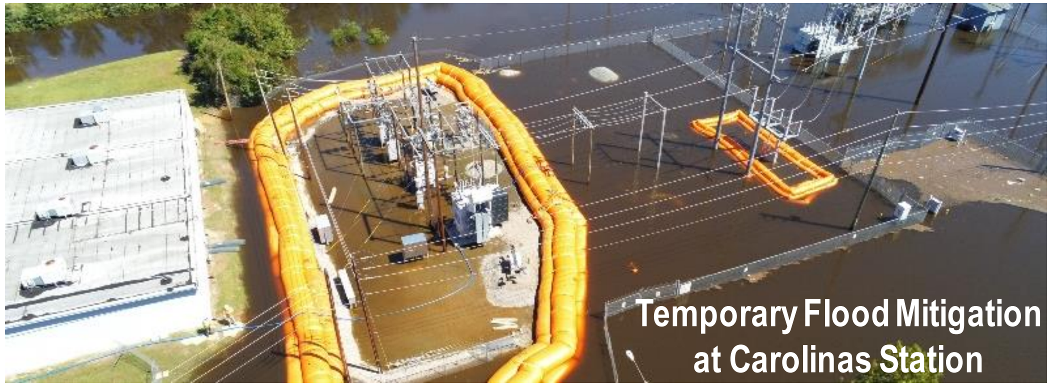
IMPACTS OF WEATHER EVENTS

What is happening?

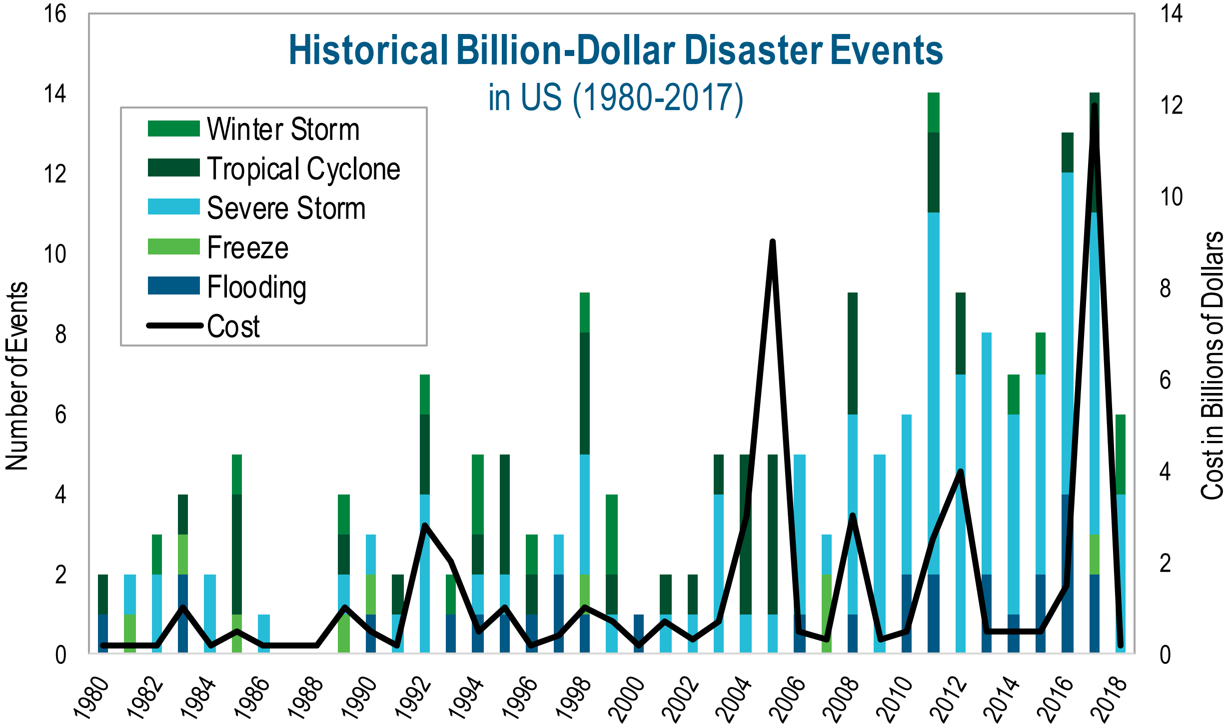
North Carolina has faced major weather events, with Hurricanes Matthew (2016) and Florence (2018), and most recently Michael (2018) illustrating the magnitude of the challenge the grid faces today from weather.

Hurricane Matthew (2016)

Hurricane Michael (2018)

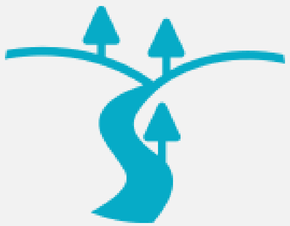


Temporary Flood Mitigation at Carolinas Station



Note: Costs are adjusted for Consumer Price index (inflation)

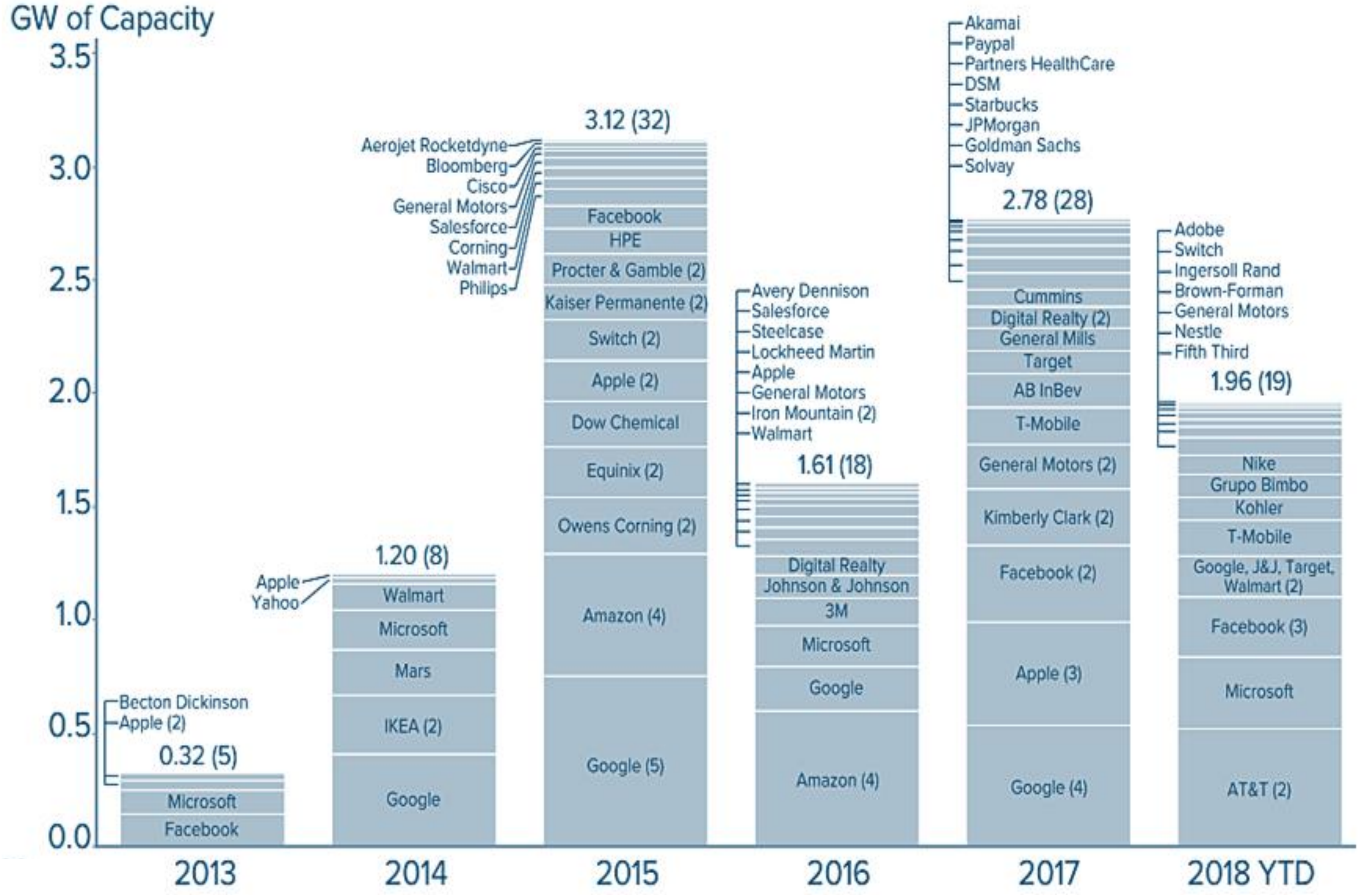
ENVIRONMENTAL TRENDS

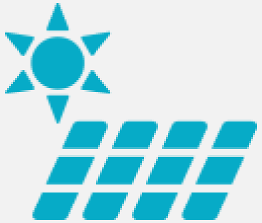


What is happening?

- Broad pressure internationally to reduce carbon emissions
- Corporations making commitments and demanding renewable options
- States and cities setting goals for renewables, low carbon transportation, and energy efficiency

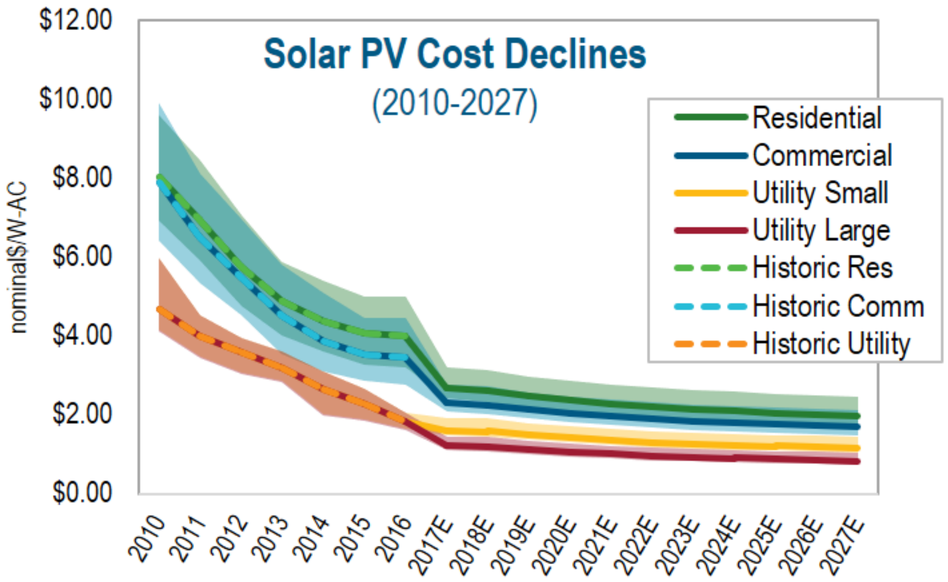
Contracted Capacity of Corporate Power Purchase Agreements, Green Tariffs, and Outright Project Ownership

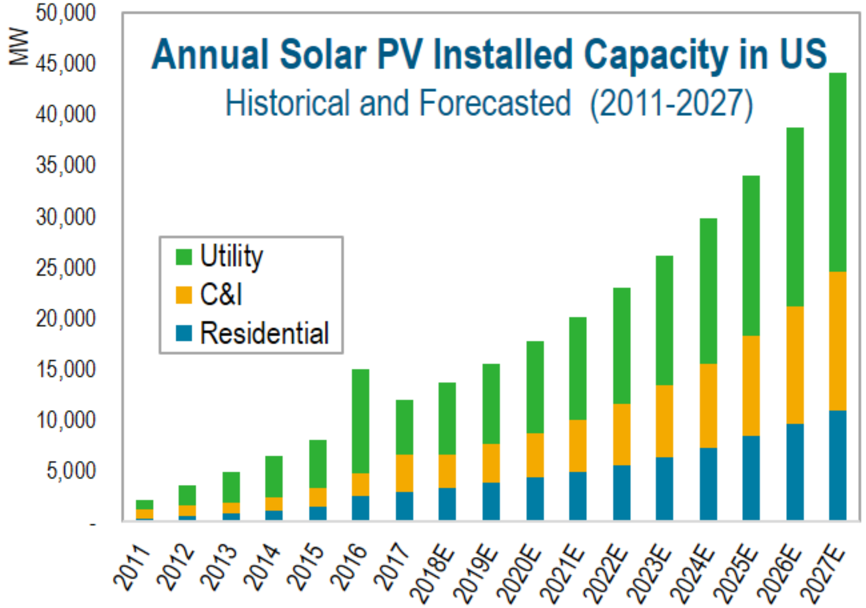


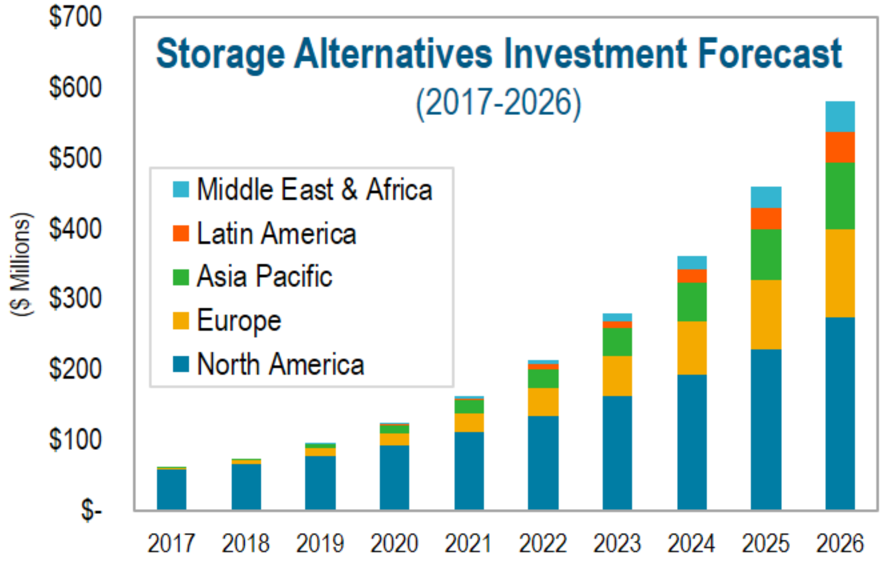


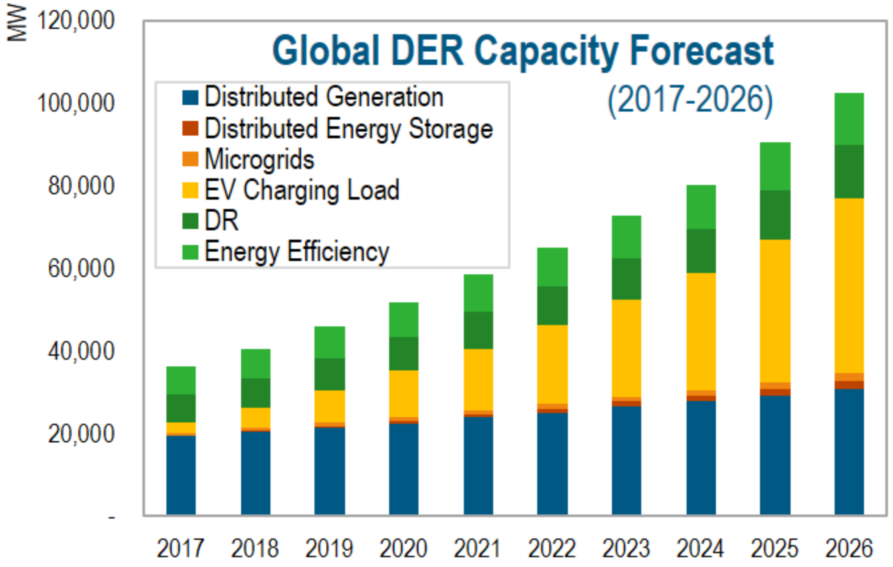
What is happening?

- Solar PV is becoming increasingly competitive
- Spending on energy storage solutions forecasted to increase at annual rate of 18% over next 10 years in North America
- DER expected to grow 8x faster than new centralized generation in the next 10 years globally



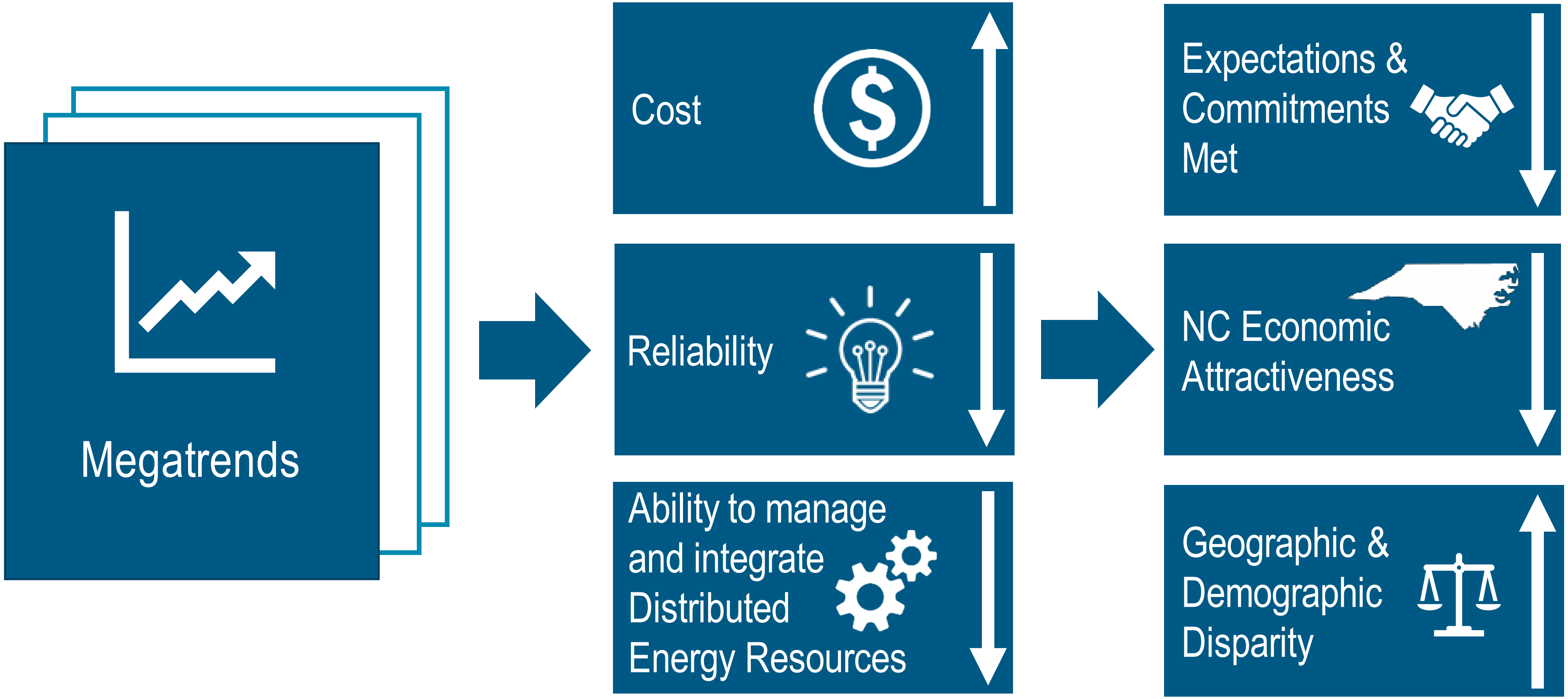






IMPLICATIONS OF MEGATRENDS

In summary, evolving megatrends will have implications on our customers and the state.



Grid Improvement in North Carolina

Building a smarter grid for YOU

IMPROVE RELIABILITY
to avoid outages and speed restoration

STRENGTHEN THE GRID
against physical and cyber impacts

GIVE MORE OPTIONS AND CONTROL
over energy use and tools to save money

EXPAND SOLAR AND INNOVATIVE TECHNOLOGY
across a two-way, smart-thinking grid

Hardening & Resiliency

HARDENING

Improvements that lower system risk and prevent outage events from occurring

RESILIENCY

Improvements that minimize event impacts and improve ability to recover rapidly

Expanding solar and innovative technologies

Private Solar

Microgrids

Battery storage

EV Charging

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TRANSFORMING THE CUSTOMER EXPERIENCE IN NORTH CAROLINA

DUKE ENERGY

Transmission new construction

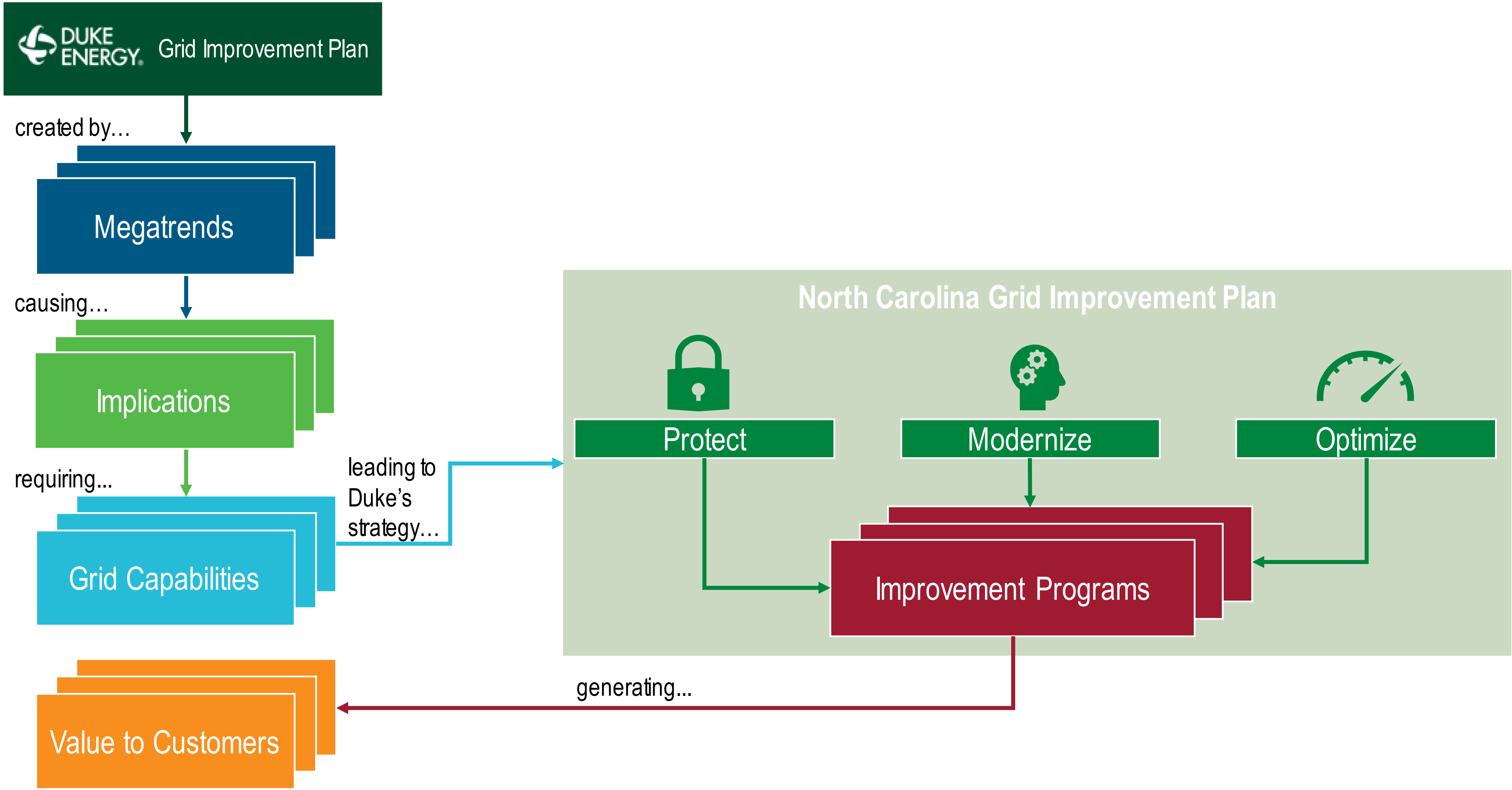
Targeted Reliability improvements

Grid improvement plan

Distribution new construction

Vegetation Management

Improved customer experience



DUKE ENERGY Grid Improvement Plan
created by…
Megatrends
causing…
Implications
requiring...
Grid Capabilities
leading to Duke's strategy…
North Carolina Grid Improvement Plan
Protect
Modernize
Optimize
Improvement Programs
generating...
Value to Customers

DUKE ENERGY'S NC GRID IMPROVEMENT PLAN FRAMEWORK

OPTIMIZE

Optimize the total customer experience

Energy Storage	EV Charging	Hardening and Resiliency [T]	Hardening and Resiliency [D]	Integrated Volt-Var Control	Long Duration Interruptions

Oil Breaker Replacement	Self-Optimizing Grid	Targeted Undergrounding	Transformer Retrofit	Transformer Bank Replacement

MODERNIZE

Leverage enterprise systems and technology advancements

Smart Meters (AMI)	DER Dispatch Tool	Distribution Automation	Enterprise Applications	Enterprise Communications

Customer Data Access	Integrated System Operations Planning	Power Electronics	Transmission System Intelligence

PROTECT

Reduce threats to the grid

Physical & Cyber Security

MAINTAIN[1]

Serve customers in a manner that meets industry safety, reliability and environmental standards

Line Extensions	Capacity Expansions	Substation Additions	Outage Follow-up	Pole Replacements

Vegetation Management	End-of-life Asset Replacement	Equipment Inspection & Maintenance	General System Protection

(1) *Maintain* base work not included in NC Grid Improvement Plan

Benefits from Improving the Grid

Societal

- Lower impact to global environment
- Avoided water impacts
- Avoided land impacts
- Reduced blackouts *(security & well-being)*
- Improved quality of life
- Improved access to data
- Better customer experience

Indirect (to third parties)

- Improved economics for the state
- Increased competitiveness for the state
- Increased employment for the state
- Increased global DER enablement
- Increased transportation electrification enablement

Indirect Value (risk reduction)

- Increased system redundancy
- Improved power quality
- Improved system stability
- Avoided ancillary services
- Improved employee safety
- Reduced chance of environmental incident
- Reduced remediation costs
- Increased public safety

Direct value (captured by customer)

- Avoided business revenue loss
- Avoided equipment damage
- Avoided spoilage
- Avoided ancillary costs *(hotel, generator, lost work)*
- Increased customer-owned DER enablement
- Decreased energy use or use off peak

Direct value (captured by utility)

- Avoided transmission capacity
- Avoided transmission losses
- Avoided distribution capacity
- Avoided distribution losses
- Avoided generation capacity
- Avoided fuel costs
- Deferred capital cost
- Avoided power purchase
- Lower restoration costs
- Theft reduction
- Improved utility operations *(i.e., lower O&M)*
- Avoided CO_2
- SO_2 emission reduction
- NO_x emission reduction
- Hg emission reduction
- Particulate matter emission reduction

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APPENDIX

PORTFOLIO SUMMARY

DUKE ENERGY

OPTIMIZE
Optimize the total customer experience

MODERNIZE
Leverage enterprise systems and technology advancements

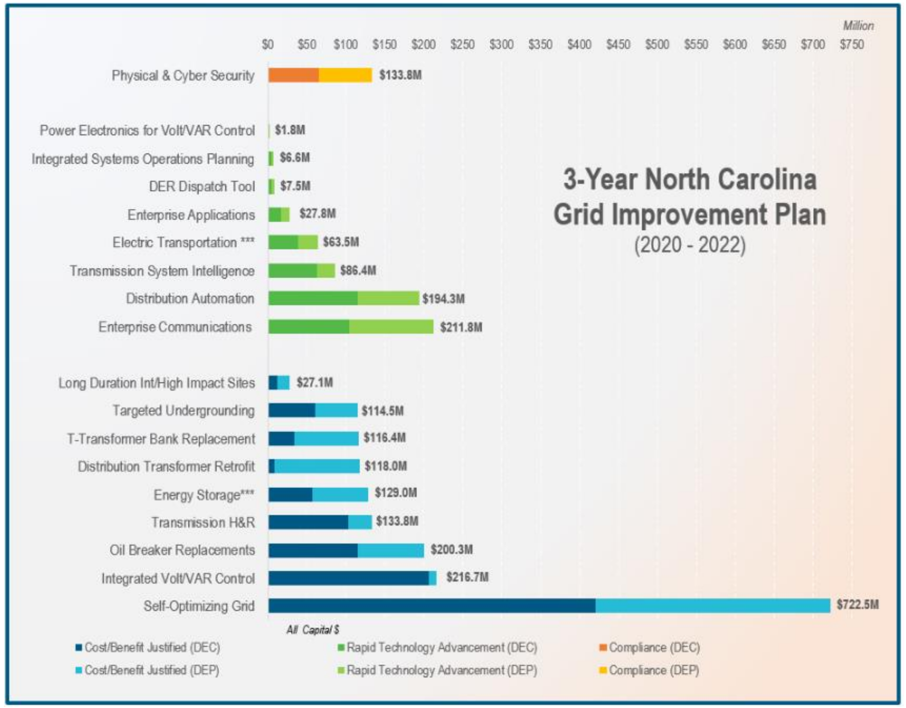
PROTECT
Reduce threats to the grid

Portfolio Methodology

NC Grid Improvement Plan
to begin addressing all 7 megatrends

MEGATRENDS

1. Rise and sophistication of threat of physical and cyber attacks on grid infrastructure
2. Rapid advancement and impacts of technology of renewables and distributed energy resources (DERs)
3. Rapid advancement and new capabilities / functionalities of devices and systems that operate and manage the T&D grids
4. Shifts in customer expectations and use of the grid from generations past
5. Increases in environmental commitments from the international, and customer communities
6. Significant increase in number, severity and impact of weather events
7. Heavily concentrated population and business growth in urban and suburban areas



Megatrends

	GIP PROGRAMS	I - Phys & Cyber Threats	II - Adv Tech (Solar/Battery)	III - Environmental Policy	IV - Weather	V - Grid Improvement Tech	VI - Concentrated Growth	VII - Customer Expectation	NC - DEC Total ($M)	NC - DEP Total ($M)	NC TOTAL ($M)	
Protect	Physical Security	x	x			x		x	$58.0	$64.7	$122.7	
	Cyber Security	x	x			x		x	$7.0	$4.0	$11.0	
Optimize	Self-Optimizing Grid	x	x	x	x	x	x	x	$420.0	$302.0	$722.5	1st
	Integrated Volt/VAR Control	x	x	x	x	x	x	x	$207.0	$10.0	$217.0	2nd
	Harden &Resiliency [T]		x	x	x			x	$102.4	$31.3	$133.7	
	Targeted Underground				x			x	$59.8	$54.7	$114.5	
	Energy Storage*		x	x	x		x	x	$56.5	$72.5	$129.0	
	Transformer Retrofit [D]				x			x	$8.3	$109.7	$118.0	
	Long Duration Interruptions				x			x	$11.3	$15.8	$27.1	
	Transformer Bank Repl [T]		x	x				x	$33.6	$82.7	$116.3	
	Oil Breaker Rpl [T]			x		x		x	$101.6	$42.8	$144.4	
	Oil Breaker Rpl [D]			x		x		x	$13.9	$42.0	$55.9	
Modernize	Enterprise Communications	x	x	x	x	x	x	x	$103.8	$108.0	$211.8	3rd
	Distribution Automation		x	x	x	x		x	$115.4	$78.9	$194.3	4th
	System Intelligence [T]		x	x		x		x	$62.7	$23.7	$86.4	
	Electic Transportation*		x	x					$38.2	$25.2	$63.4	
	Enterprise Applications		x	x		x		x	$17.0	$10.8	$27.8	
	DER Dispatch		x	x		x		x	$4.5	$2.9	$7.4	
	ISOP		x	x		x	x	x	$4.1	$2.5	$6.6	
	Power Electronics		x	x		x		x	$0.7	$1.1	$1.8	
											$2,319.2	

Influence of Stakeholder Input

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CURRENT

Grid Improvement Plan Carolinas (NC)

dollars in (000's)	NC 2020-2022
Compliance: Cost Effectiveness Justified	**$134**
Physical Security	$111
Cyber Security	$23
Cost Benefit & Cost Effectiveness Justified	**$1,649**
SOG	$722
Incremental Distribution H&R	$145
IVVC	$217
Incremental Transmission H&R	$134
TUG	$115
Energy Storage	$129
Transmission Bank Replacement	$116
OIL Breaker Replacements	$200
Rapid Technology Advancement: Cost-Effectivenes	**$536**
T&D Communications	$212
Distribution System Automation	$194
Transmission System Intelligence	$86
T&D Enterprise Systems	$28
ISOP	$7
DER Dispatch Tool	$7
Electric Vehicle Charging	$63
Power Electronics for volt/var control	$2

Total $2.3 billion

PREVIOUS

Power/Forward (NC)

dollars in (000's)	NC 2018-2027	
Compliance: Cost Effectiveness Justified		
Physical Security	$0	*new program*
Cyber Security	$0	*new program*
Cost Benefit & Cost Effectiveness Justified	**$11,804**	
SOG	$1,267	
Incremental Distribution H&R	$3,379	↓ 96%
IVVC DEC	$0	*new program*
Transmission	$2,195	
TUG	$4,962	↓ 98%
Energy Storage	$0	*new program*
Transmission Bank Replacement		
OIL Breaker Replacements		
Rapid Technology Advancement: Cost-Effectivene	**$926**	
T&D Communications	$447	
Distribution System Automation	$140	
Transmission System Intelligence		
T&D Enterprise Systems	$339	
ISOP	$0	*new program*
DER Dispatch Tool	$0	*new program*
Electric Vehicle Charging	$0	*new program*
Power Electronics for volt/var control	$0	*new program*

Total NC $13 billion

Recent EMC Distributed Energy Resources (DER) Initiatives (30 mins):

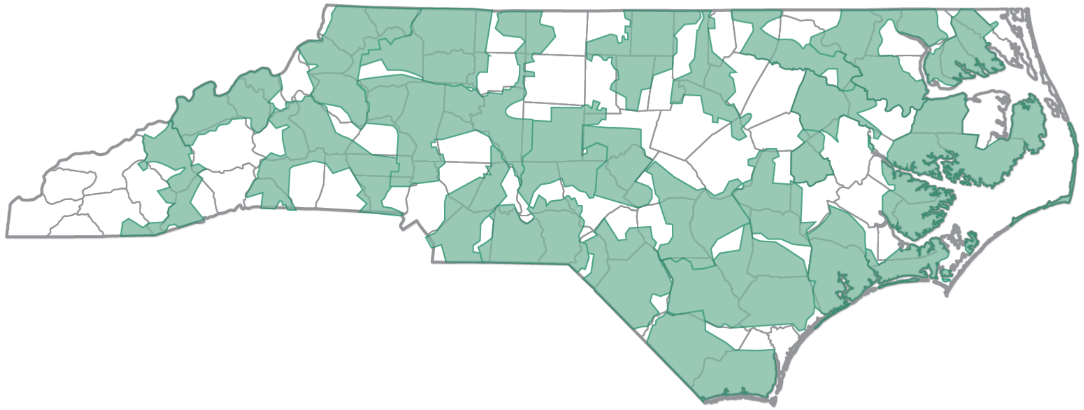
Mr. Charles Bayless, NC Electric Membership Corporation Vice President, Senior Regulatory Counsel Raleigh-Durham Area

North Carolina Environmental Policy Council

February 19, 2020

NC Electric Cooperatives

Your Touchstone Energy® Cooperatives



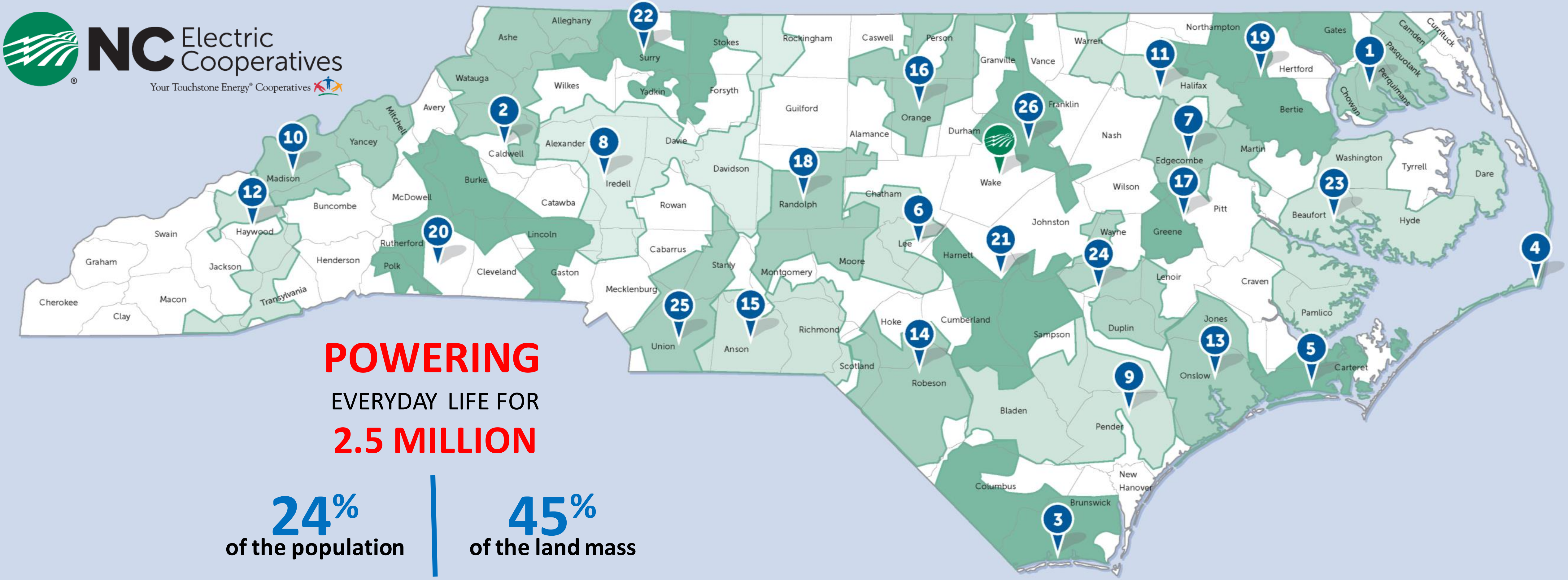
NC Coops

103,000
Miles of Distribution Lines

Duke NC

145,000
Miles of Distribution Lines

NC Electric Cooperatives
Your Touchstone Energy® Cooperatives



POWERING
EVERYDAY LIFE FOR
2.5 MILLION

24% of the population

45% of the land mass

NC Electric Cooperatives
Your Touchstone Energy® Cooperatives

A Brighter Energy Future

Businesses:
- Declaring sustainability goals
- Need to be **"green"**

Consumers:
- Environmentally aware
- Focused on saving money

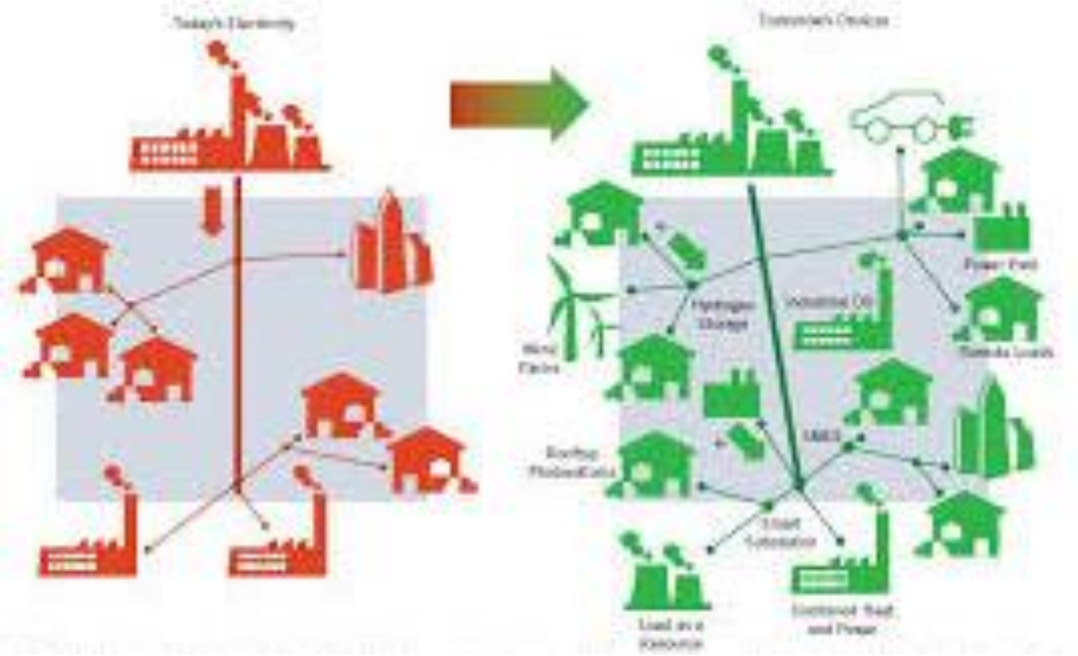
NC Electric Cooperatives
Your Touchstone Energy® Cooperatives

- **Driven by service to our members**
- **Inspired** to be a **leader**

A **Brighter** Energy Future

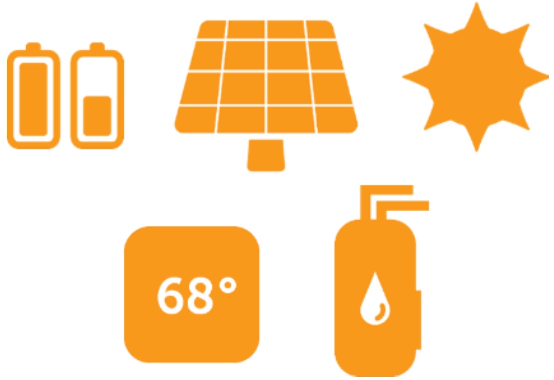
For electric cooperatives and the people and communities they serve.

Transforming Utility Grid



- **Resources are moving to the distribution system**
- **Communication between the TO and DO is needed**

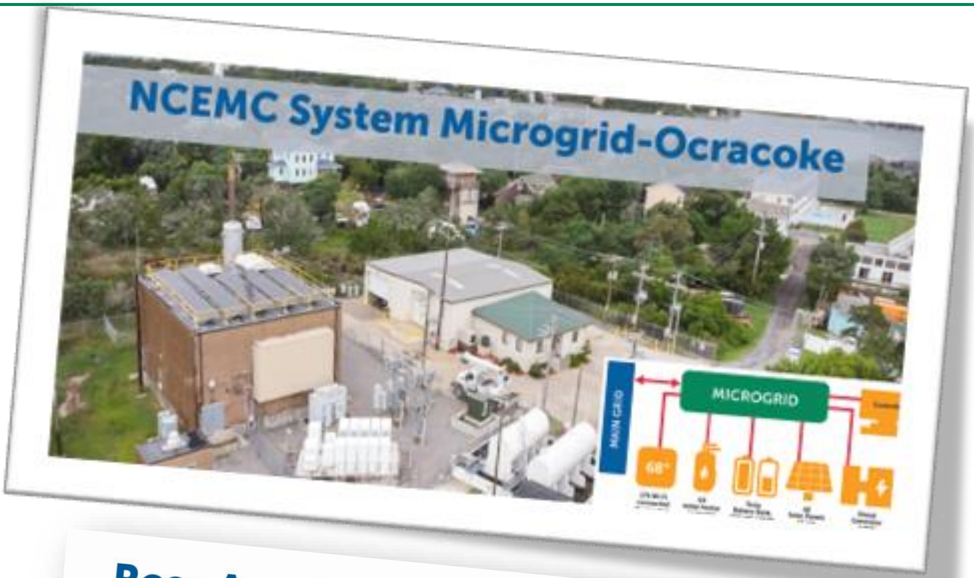
Distributed Energy Resources

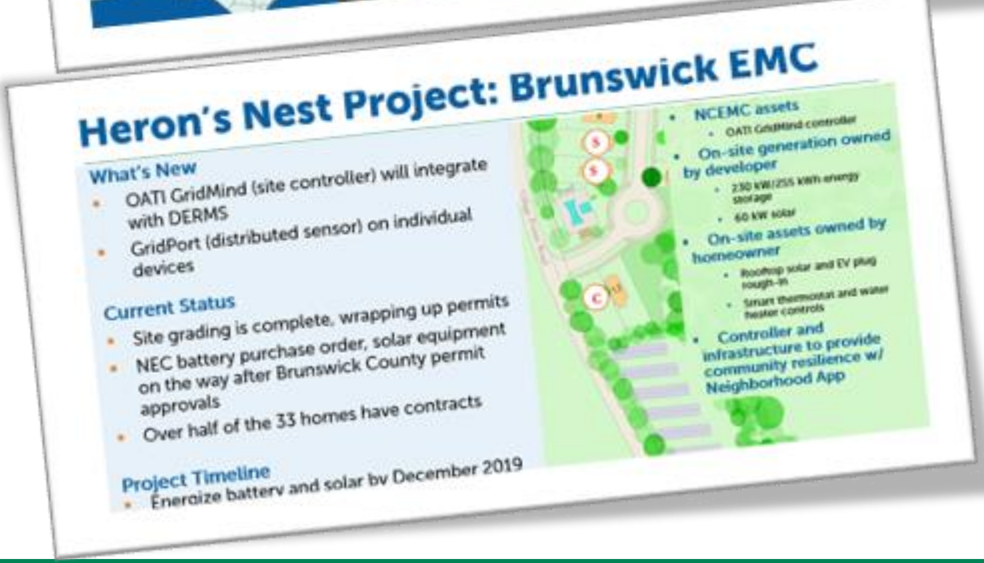


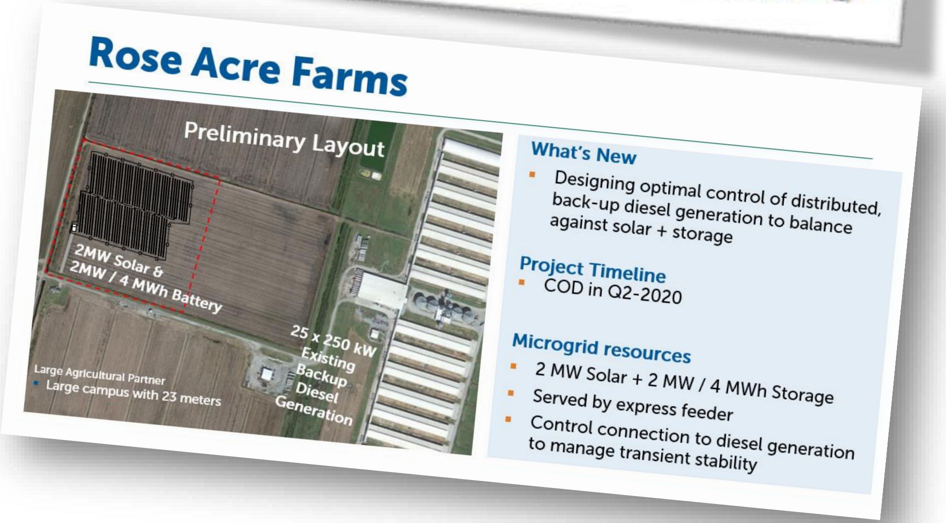
NC Electric Co-ops: 400+ MW of DER

- 18 community solar sites - 2MW
- 260 MW Utility Scale Solar
- 13 MW other Renewables
- 50 MW Conservation Voltage Reduction
- 75 MW Customer-Owned Generation
- 2 battery storage locations
- 4 MW connected thermostats and water heaters

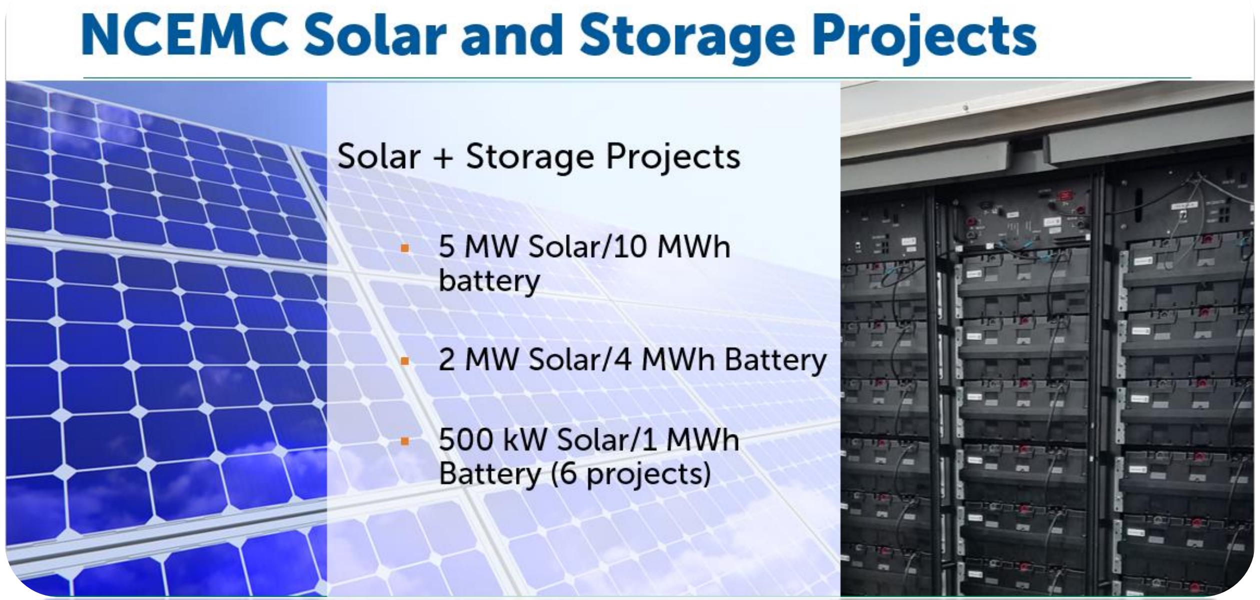
NCEMC Microgrids







NCEMC DER Projects



NCEMC Device Deployment

Member consumers who choose to participate in the demand response program will receive:

- Up to 2 thermostats per home (Ecobee3 lite or Google Nest E) at $25 per device
- Option to upgrade to premium thermostat(s) (Ecobee Smart or Google Nest Learning Thermostat) at $105 per premium thermostat (limit 2 per home)
- Option to add-on a FREE Carina water heater control device with the purchase of any smart thermostat

Plus FREE professional installation of all devices

Customer eligibility

- ☐ Electric heating and air conditioning
- ☐ Electric water heating (to be eligible for Carina water heater control device)
- ☐ Co-op member in good standing

Members cannot be currently participating in their electric cooperative's smart thermostat, net metering, or time-of-use rate programs.

21,000 Thermostats – 25MW
8,000 Water Heaters – 5MW

Member Consumer Enrollment Incentives

$ Thermostat participants will receive a $50 prepaid gift card each year on their enrollment anniversary date

$ Water heater control participants will also receive a one-time $50 prepaid gift card following enrollment

Consumer Journey

High level overview

- Distribution co-op will be featured in branding and marketing of the program
- Enroll via website (Domain is TBD)
- Installation scheduled within 45 days of program enrollment
- ~2 hr appointment for professional installation/consultation
- Participants will be asked to complete a satisfaction survey following installation
- 24/7 customer support will be available

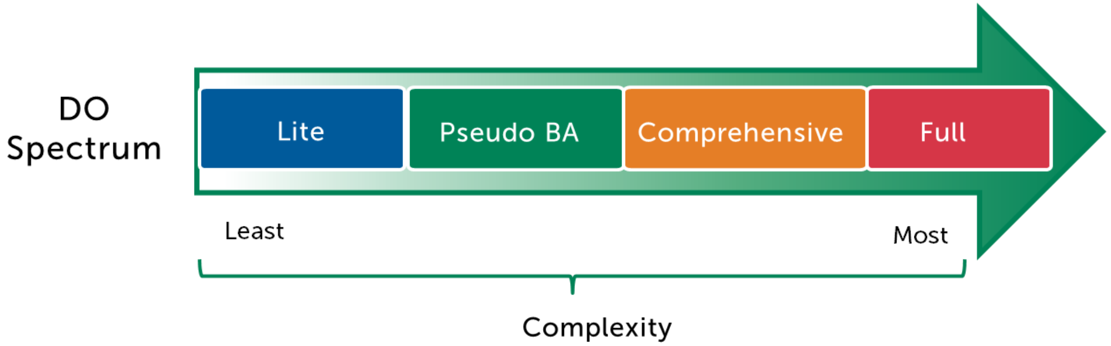
Program design:

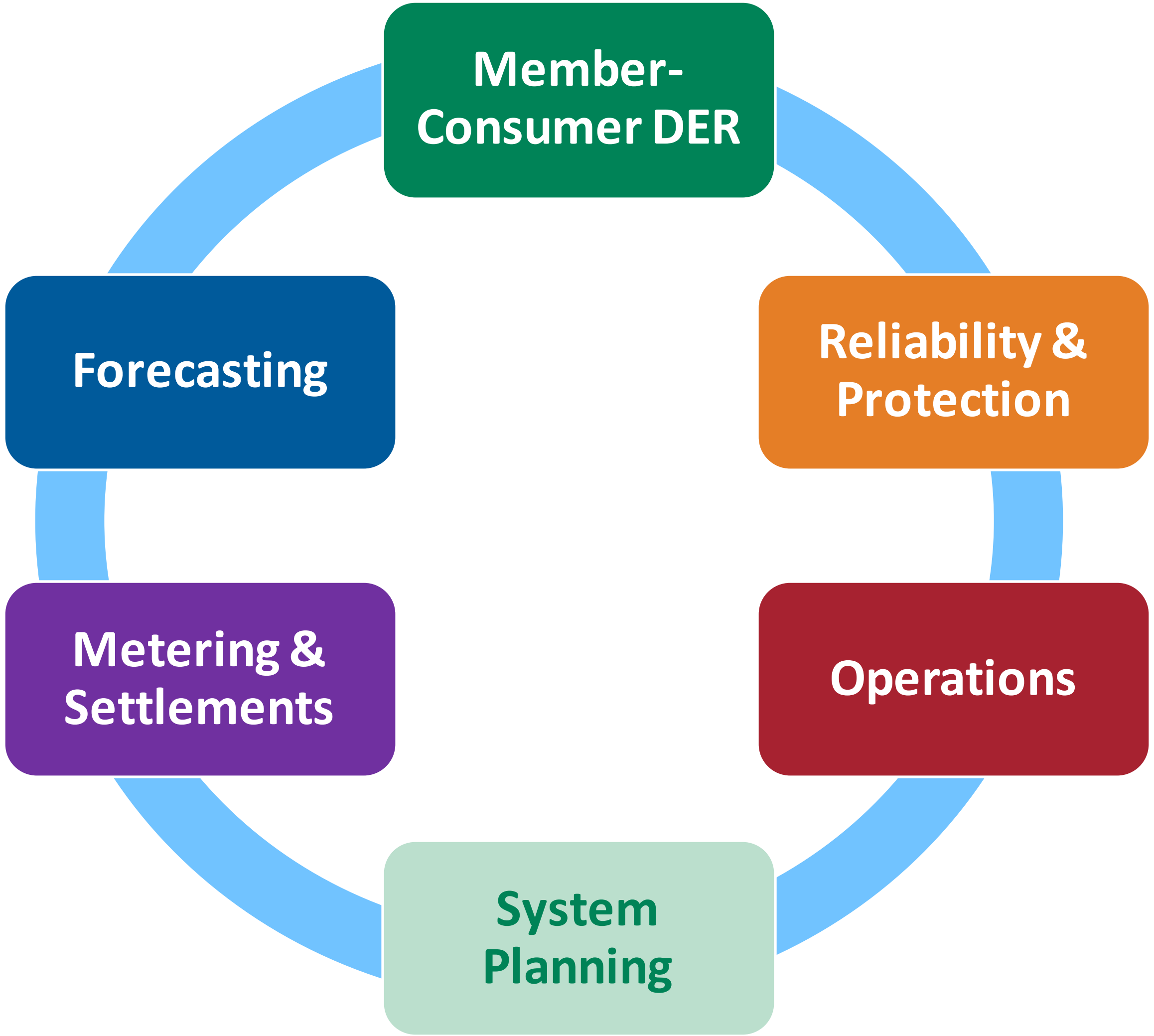
- Up to 48 demand response events per year
- No more than 2 DR event opt-outs per year in order to be eligible for enrollment incentives
- 3 year commitment to the program
- Program availability through Dec. 31, 2021
- Thermostats will not be adjusted more than 3 degrees during DR events
- DR event window no longer than 4 hours
- Generally, winter events will be from 6am-8am and summer events will be from 4pm-6pm

Distribution Operator

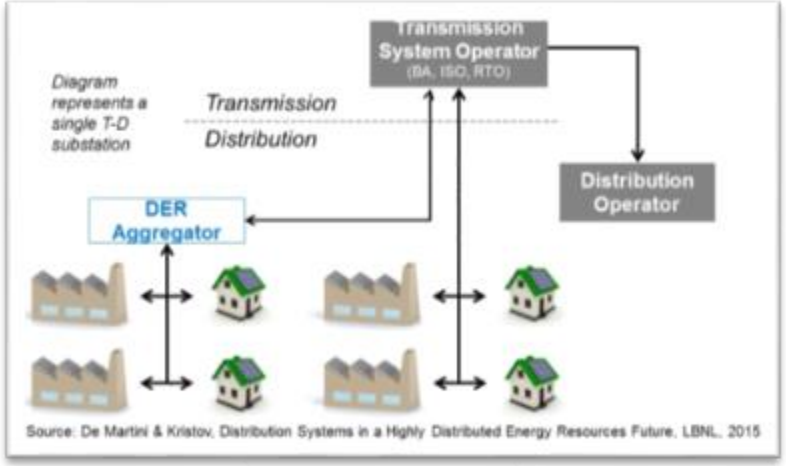
The DO is the entity responsible for and facilitates

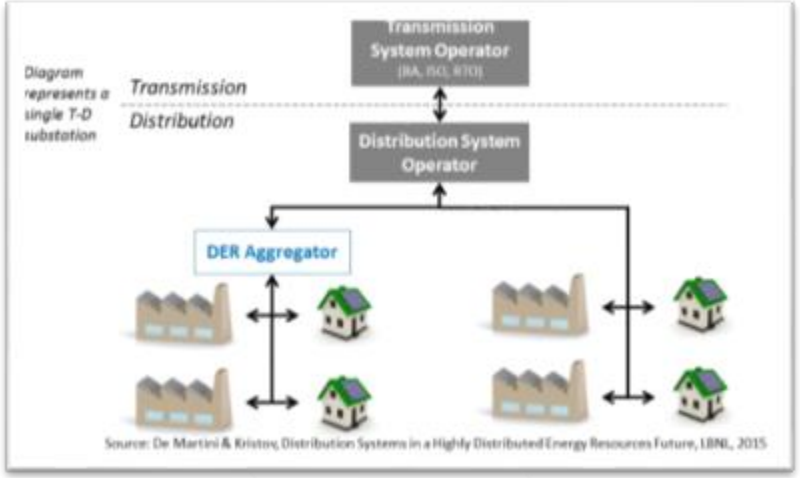
- System operation
- Reliability
- Market activities at wholesale and retail levels





Distribution Operator Platform



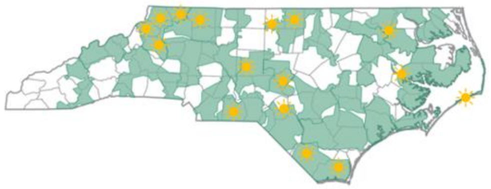


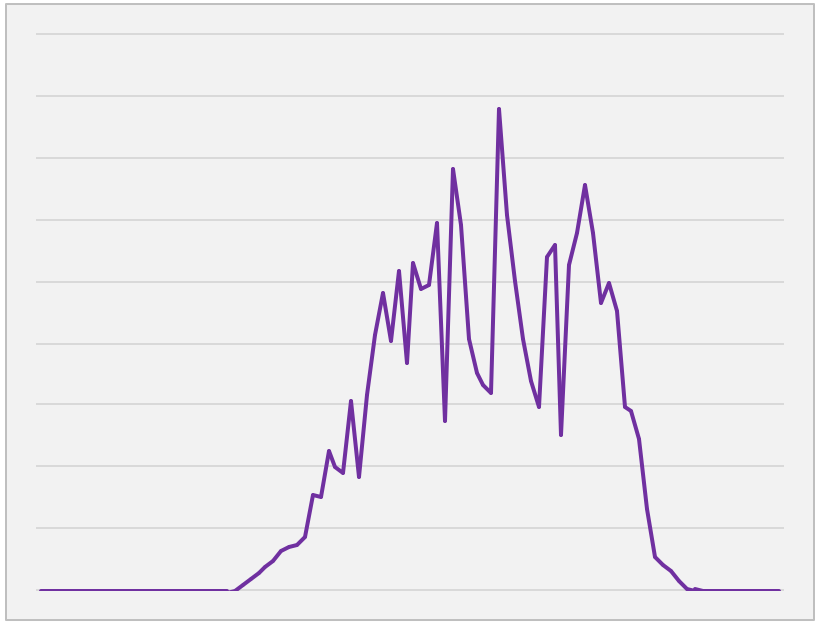
Platform Aggregation

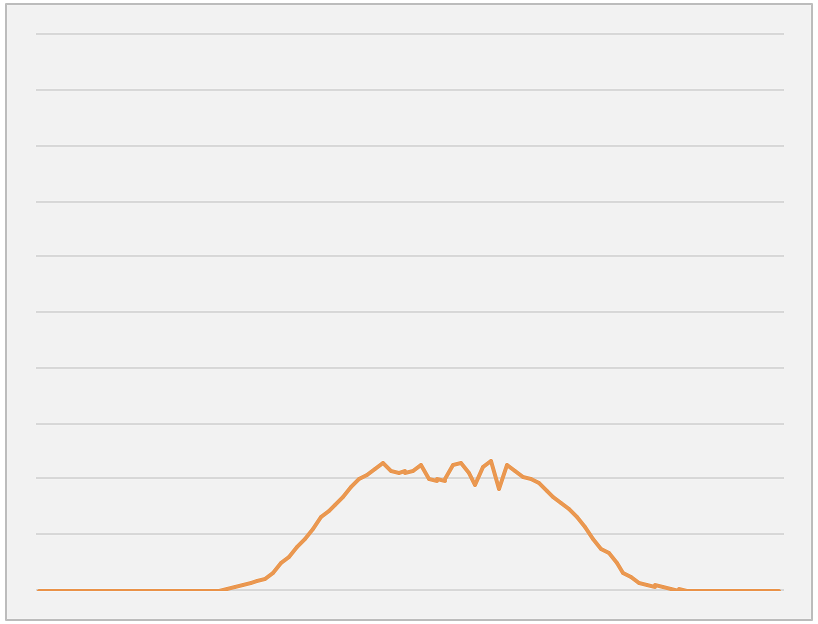
- Service offerings meet consumers where they are
- Involvement level: Aggregator or Virtual Power Plant (VPP)
- Aggregation brings resources to scale

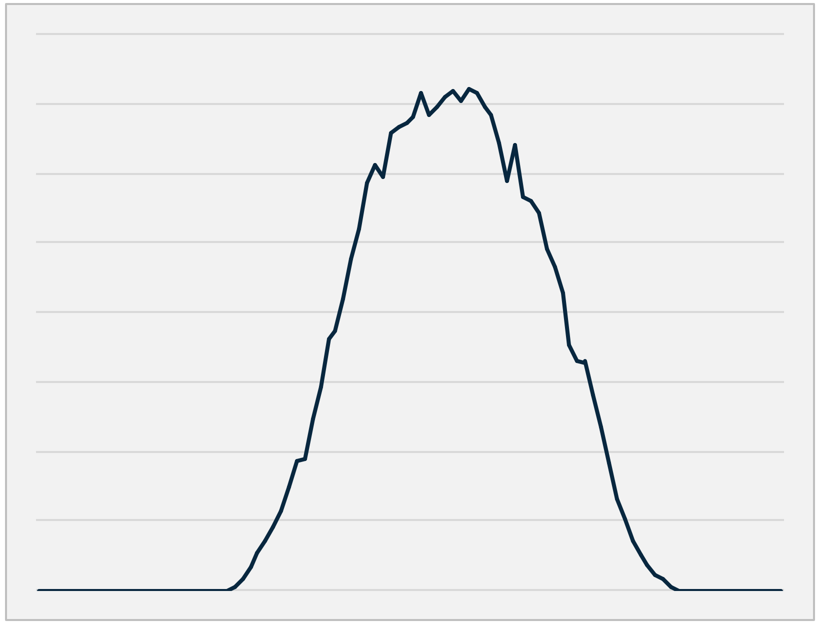
Source: Modernizing transmission / distribution interface coordination for a high-DER future Lorenzo Kristov

The Individual Impact of Solar









Partly Cloudy

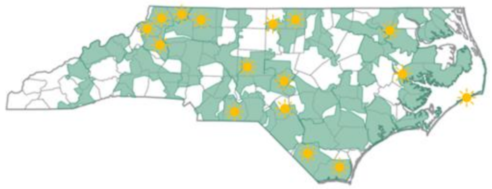
Overcast

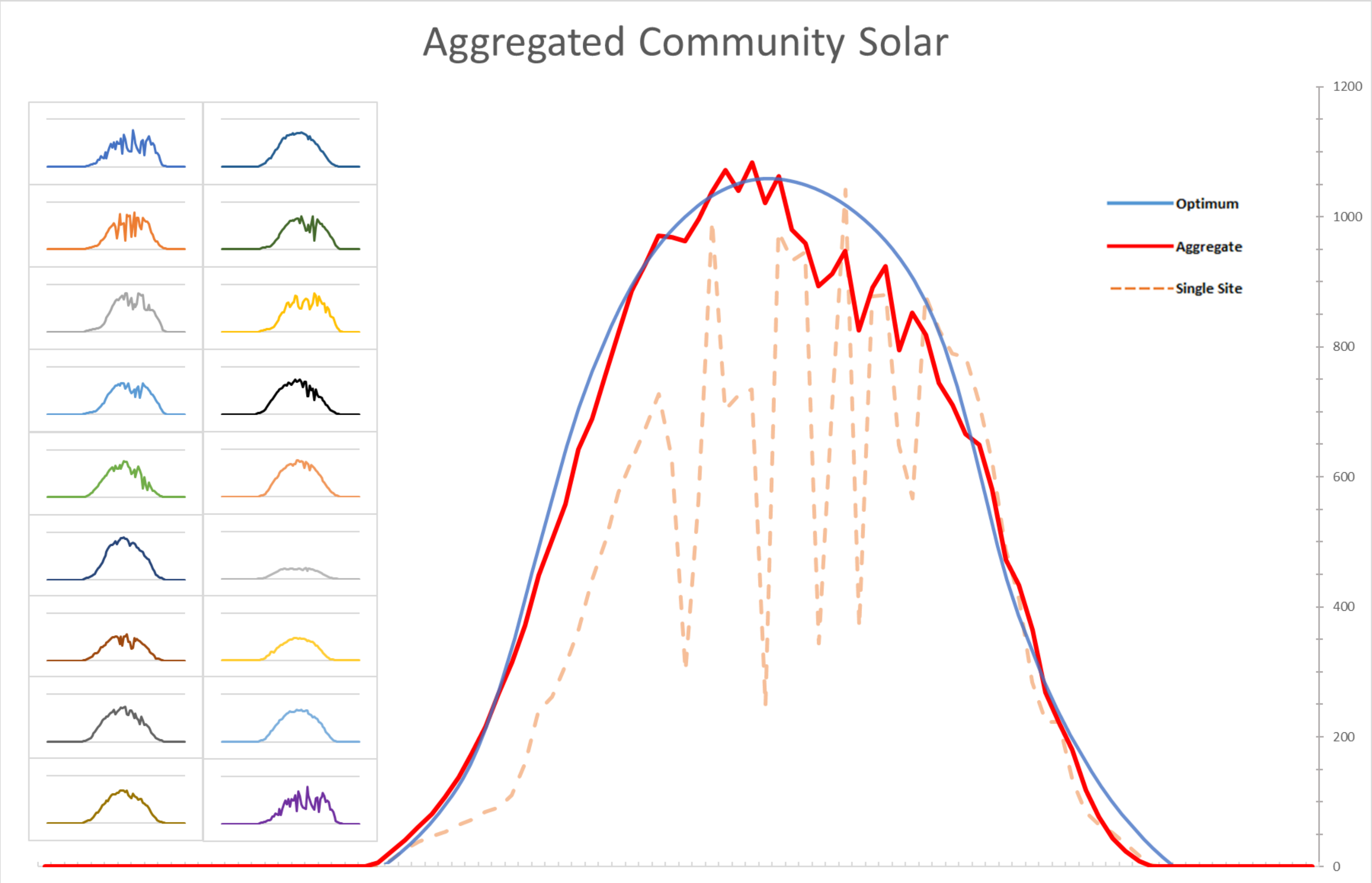
Sunny

Source: NCEMC Community Solar output

25 EMCs: > 120 MW of Renewable DER today
> 400 MW including CVR, COG, DR

As Mitigated by Aggregation

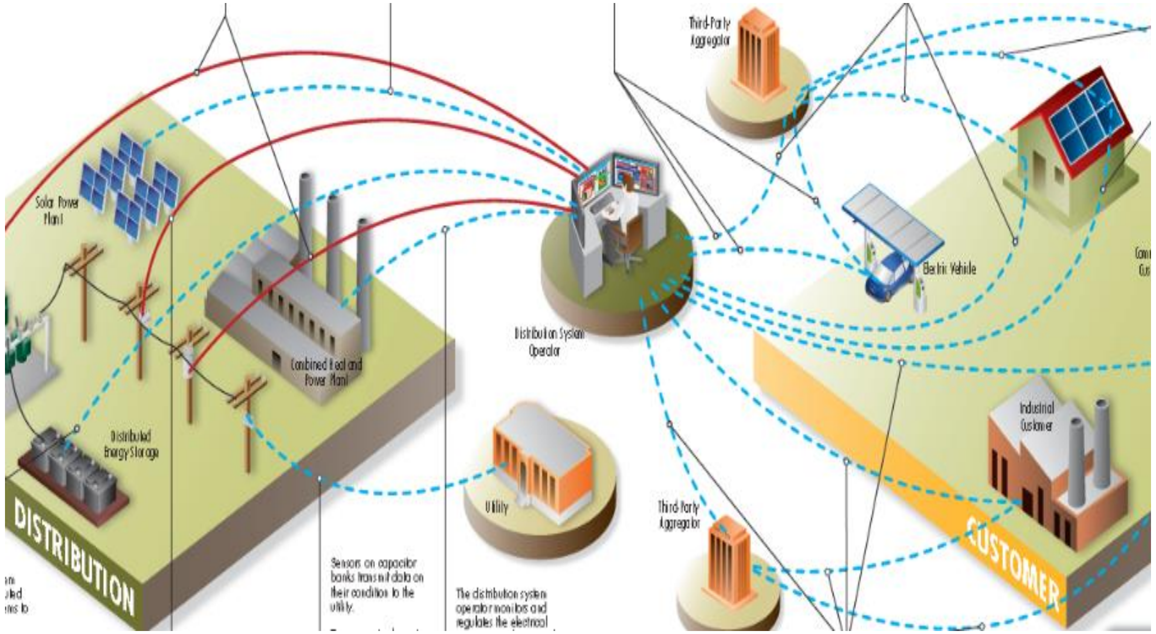




The VPP through our DERMS platform:

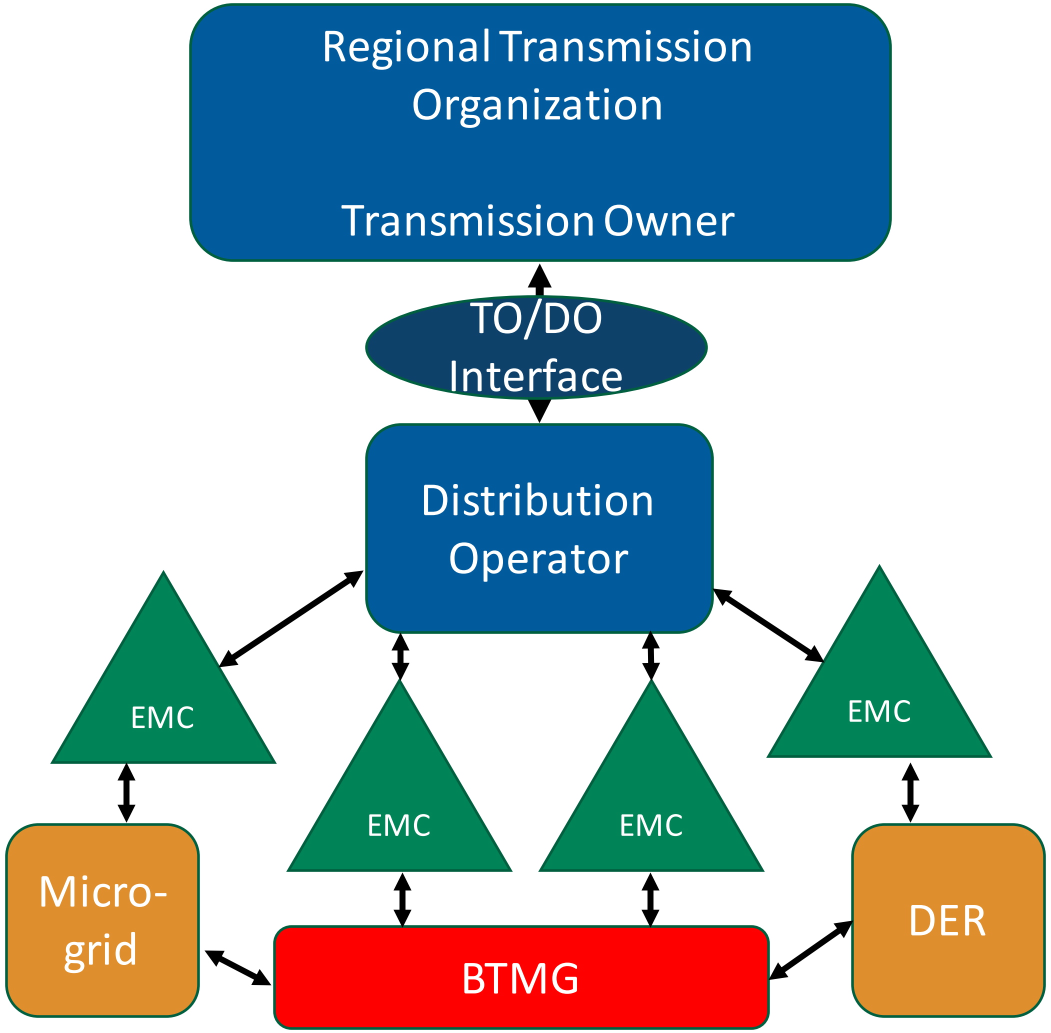
- Aggregate solar output is smoother than individual sites
- Short-term variability is managed best by aggregating sites
- Operational challenges persist with individual sites

DER Positioning



- Coordination is key with higher penetration of DER
- Aggregation brings resources to scale
- Service offerings meet consumers where they are

DO and the Wholesale Interface



- DO-TO communication creates upstream value
- Potential to Defer new investment in transmission and generation
- Provides ancillary services and support grid stability