North Carolina Clean Energy Plan Stakeholder Workshop #1

North Carolina Department of Environmental Quality

February 25, 2019

North Carolina

Clean Energy Plan Development

Process Plan

Department of Environmental Quality

Executive Order No. 80
North Carolina's Commitment to Address Climate Change and Transition to a Clean Energy Economy

- Recognizes that climate change is affecting the health and welfare of our residents, economy, environment and our natural and built infrastructure.
- Recognizes that we must take an active role in combatting climate change and make our state more resilient to its impacts.
- Calls for clean energy technology innovations, workforce development, and a modern, smart electric grid to grow the state's economy while making North Carolina a national leader in clean energy solutions.
- Recognizes that we can protect our communities, grow our economy, and ensure a healthy environment at the same time.

Governor Cooper's Executive Order 80:

- Acknowledges North Carolina's leadership in technology innovation, research and development, and skilled workforce to promote clean energy technology solutions.
- Calls for market innovations that drive economic expansion and job creation.
- Sees an opportunity to produce a smart, resilient, and a modern electric grid while balancing reliability, cost, economic growth, equity, and environmental and public health impacts.

https://governor.nc.gov/documents/executive-order-no-80-north-carolinas-commitment-address-climate-change-and-transition

DEQ Directive

- Develop a North Carolina Clean Energy Plan that fosters and encourages:
  - Utilization of clean energy resources and innovative technologies, and
  - Integration of these resources to facilitate the development of a modern and resilient electric grid.
- Collaborate with stakeholders to increase the utilization of clean energy technologies, energy efficiency measures, and clean transportation solutions.
- Submit the plan to the Governor by October 1, 2019.

Clean Energy Plan Development Process

- Open and inclusive stakeholder driven process
- General Description of Approach
  1. Vision building and assessing current landscape in NC
  2. Examine evolving and changing landscape in the power sector
  3. Develop policy, regulatory, administrative, and program recommendations to achieve the vision

Public Engagement Methods

Method 1. Facilitated Workshops, Raleigh

- Technical guidance and facilitation provided by Regulatory Assistance Project (RAP) and Rocky Mountain Institute (RMI)
- Limited seating to accommodate diverse stakeholder participation
- Request to Participate form required

Method 2. Regional Listening Sessions

- Open to all

Method 3. Combined with Other Statewide Events

Method 4. Online Input

https://deq.nc.gov/cleanenergy

Method 1: Facilitated Workshops

February 25, Raleigh	April 1, Raleigh
Activities: 1. Workshop #1: Stakeholders discuss NC's current energy direction and changing landscape; vision for a clean energy future; current policies, regulatory and business practices; and the ability of current policies/laws/practices to achieve the vision. 2. Develop educational or framing materials 3. Engage stakeholders to present perspectives Milestone: Stakeholders learn and share perspectives on their vision of a clean energy future how well the current system works through facilitated discussion.	Activities: 1. Workshop #2: Stakeholders share views and prioritize ideas from Workshop 1 Milestones: Stakeholders share their positions on issues raised thus far; elements of agreement and disagreement are identified

Vision Building and Current Landscape: What is NC's vision of a clean energy future, how different is it from the current direction, and how well do current policies, regulatory and business practices help achieve that vision?

Method 1: Facilitated Workshops

April 22, Raleigh

Activities:

1. Workshop #3: Identify policy and technology trends that are driving clean energy deployment, the opportunities presented by these trends, and barriers that exist to seizing those opportunities
2. Develop educational or framing materials
3. Engage outside expertise and data on technology trends and opportunities presented
4. Engage stakeholders to present perspectives

Milestone:
Stakeholders learn and share perspectives on the changing technology and policy landscape for clean energy

May 22, Raleigh

Activities:

1. Workshop #4: Stakeholders share views and prioritize ideas from Workshop 3

Milestones:
Stakeholders share their positions on issues raised thus far; elements of agreement and disagreement are identified

Changing landscape: what policy and technology trends are influencing how we foster clean energy use?

Method 1: Facilitated Workshops

June 26, Raleigh

Activities:

1. Workshop #5: Stakeholders identify areas of policy or regulation that need to be developed or updated to overcome rules or practices that prevent NC from achieving the clean energy vision.
2. Develop educational or framing materials
3. Engage outside expertise on policy and regulation
4. Engage stakeholders to present perspectives

Milestones:
Stakeholders better understand the suite of possible options for achieving NC's clean energy vision.

July 24, Raleigh

Activities:

1. Workshop #6: Stakeholders share views and prioritize ideas from Workshop 5

Milestones: stakeholders share their positions on key elements of NC's Clean Energy Plan; elements of agreement and disagreement are identified

Recommendations: What policy or regulatory actions should be taken to achieve the clean energy vision?

Method 2: Regional Listening Sessions

- Statewide outreach events will be organized in metropolitan and rural areas to collect information and provide input on this effort.
- Attendees will be shown pre-recorded segments of the facilitated workshops and asked specific questions to obtain feedback.
- All stakeholders are welcome to attend.

Sessions scheduled from March –May in:

Charlotte	Asheville
Rocky Mount	Wilmington
Hickory	Fayetteville
Elizabeth City	Wilmington

Dates and locations posted at https://deq.nc.gov/cleanenergy

Method 3: Other Statewide Events

- Short presentations or organized events will be held at other planned conferences, events or meetings.
- Audience feedback will be obtained.

April 30

2019 State Energy Conference

North Carolina State University, Raleigh

Method 4: Online Input

- The online public comment period for the N.C. Clean Energy Plan will run from February 25 - July 24, 2019
- Public will be invited to submit written comments related to achieving the stated vision.
- Public may also submit responses to online questions corresponding to facilitated workshop events.

Anticipated Timeline

- Jan. 2019 – Feb. 2019: Strategy Development and Technical Analysis Planning
- Feb. 2019 – July 2019: Workshops and Listening Sessions
- June 2019 – July 2019: Draft plan development
- Aug. 2019: Public comment on draft plan
- Sep. 2019: Revised plan reviewed and approved by the Climate Council
- **Oct. 1, 2019: Final plan submitted to the Governor**

Contacts

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Objectives

- Enable stakeholders to engage with others in the room and share perspectives on their vision for North Carolina’s clean, reliable, and affordable and equitable energy future
- Review the current state of North Carolina's electricity system, including the state's current and expected generation mix, existing regulations and policies, and the markets and programs available to support clean energy technologies and related economic growth opportunities
- Build a shared understanding of what regulatory and policy structures are supporting procurement of clean energy resources and which are not

Agenda

- Welcome and Opening Remarks
- Overview of Clean Energy Plan Process and Workshop Agenda
- Presentations on *North Carolina's Electricity System* and *Regulatory Structures & Barriers*

BREAK

- Presentations on *DERs & Distribution Planning* and *Large-scale Renewable Energy*
- Participant Perspectives Exercise

LUNCH

- Presentations on *Grid Modernization & Resilience* and *Clean Energy's Impacts on Job Growth*
- Guiding Principles Exercise

BREAK

- Small Group Breakouts to Prepare for April Presentations
- Small Group Report Out and Next Steps

Proposed Ground Rules

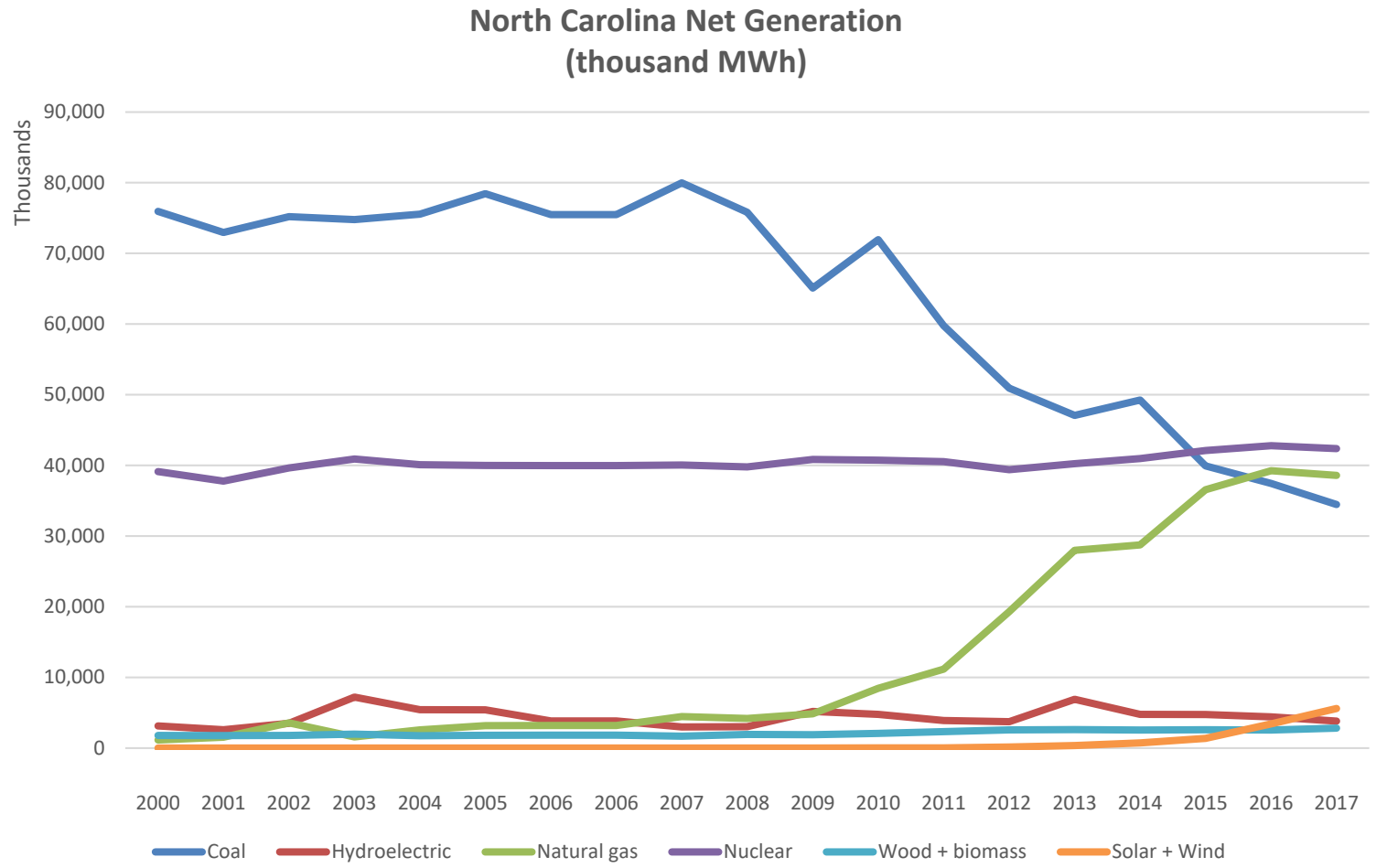
1. Be Present
2. Democracy of time

Check In

In one sentence, what would make this process successful?

North Carolina's Electricity System: An Overview

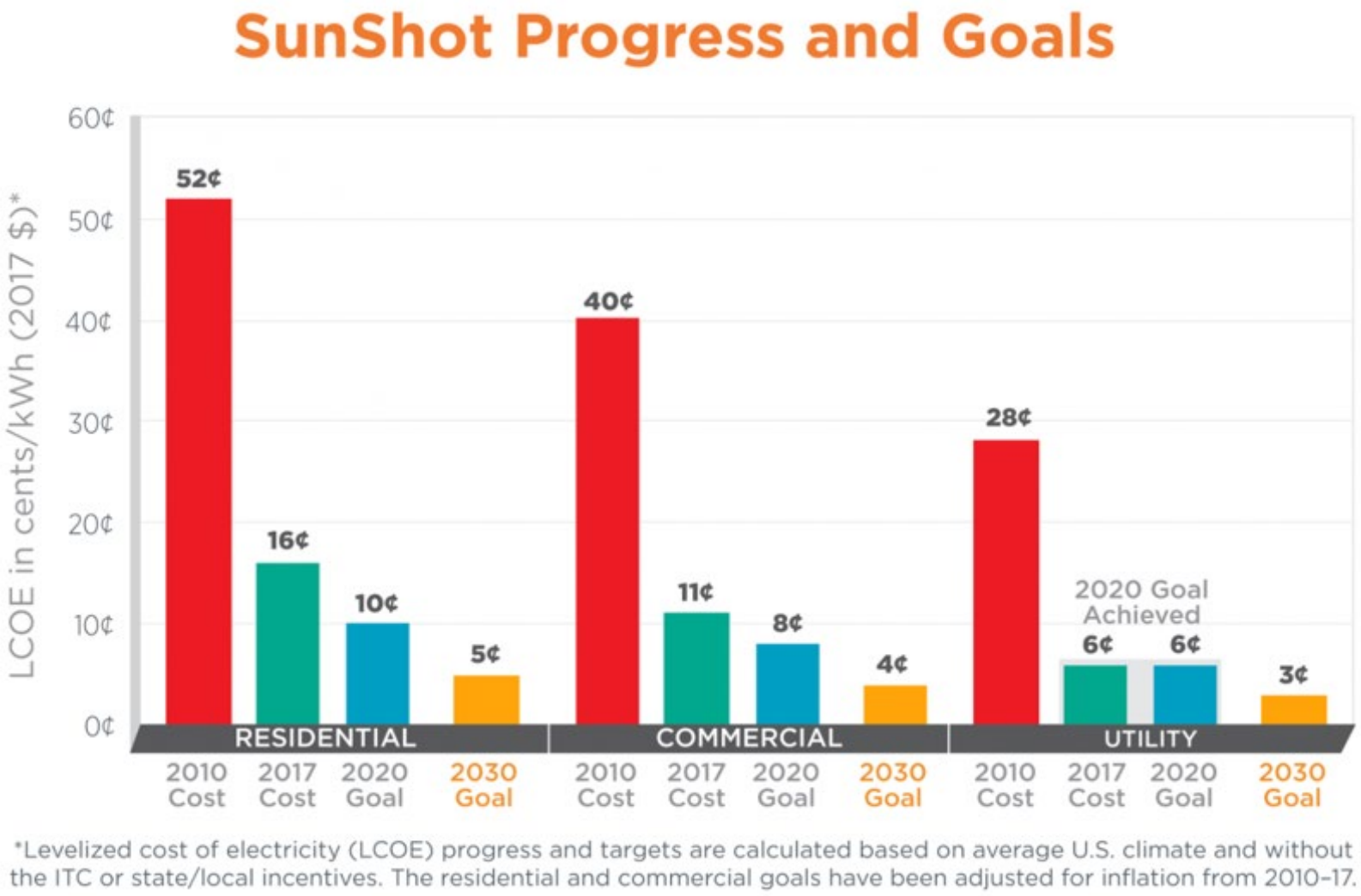
Generation Trends, 2000 - 2017



Market Drivers

- Lower natural gas prices
- Lower renewables prices
- Customer demand for clean energy

Market Drivers: Example

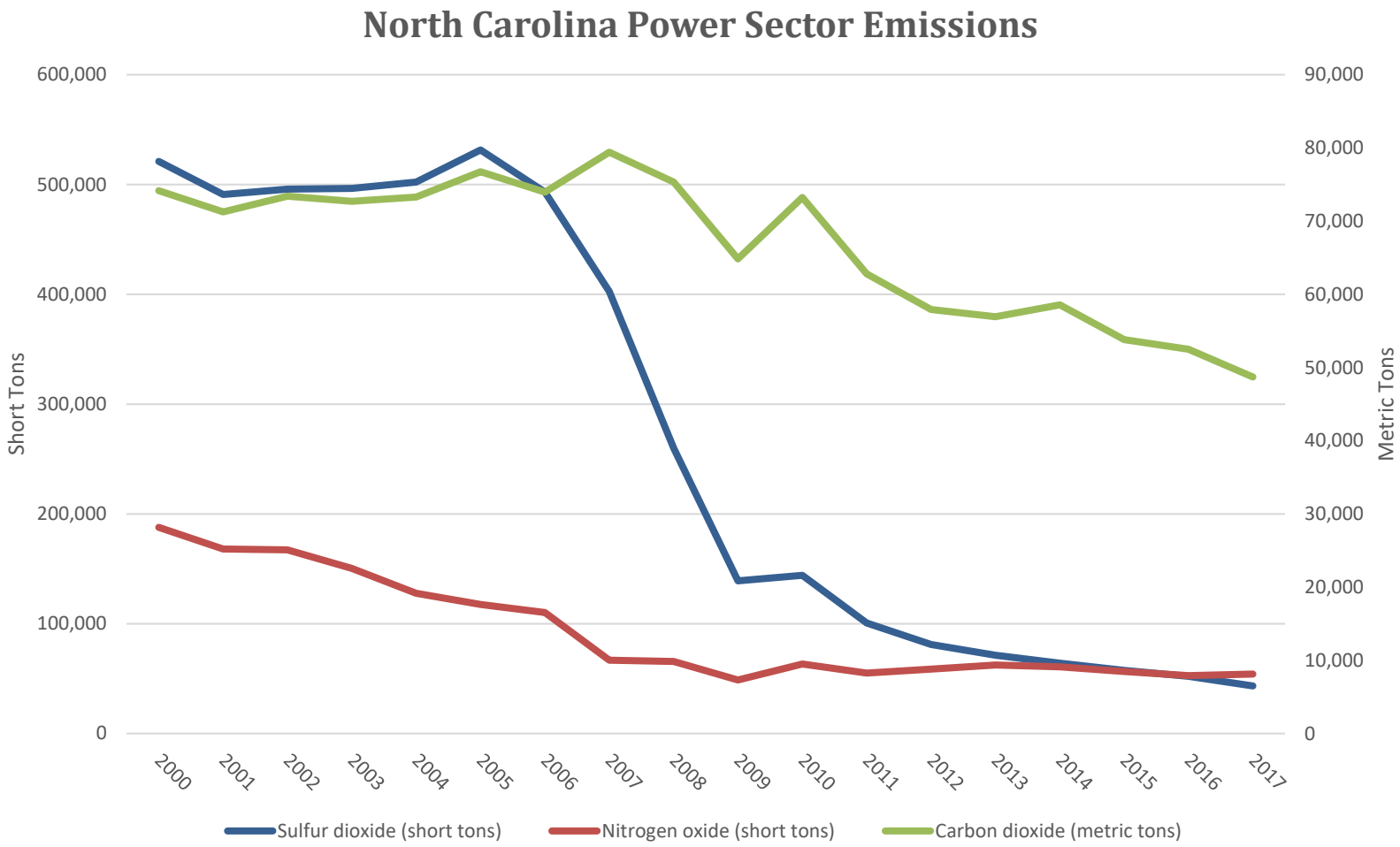


*Levelized cost of electricity (LCOE) progress and targets are calculated based on average U.S. climate and without the ITC or state/local incentives. The residential and commercial goals have been adjusted for inflation from 2010–17.

Policy Drivers

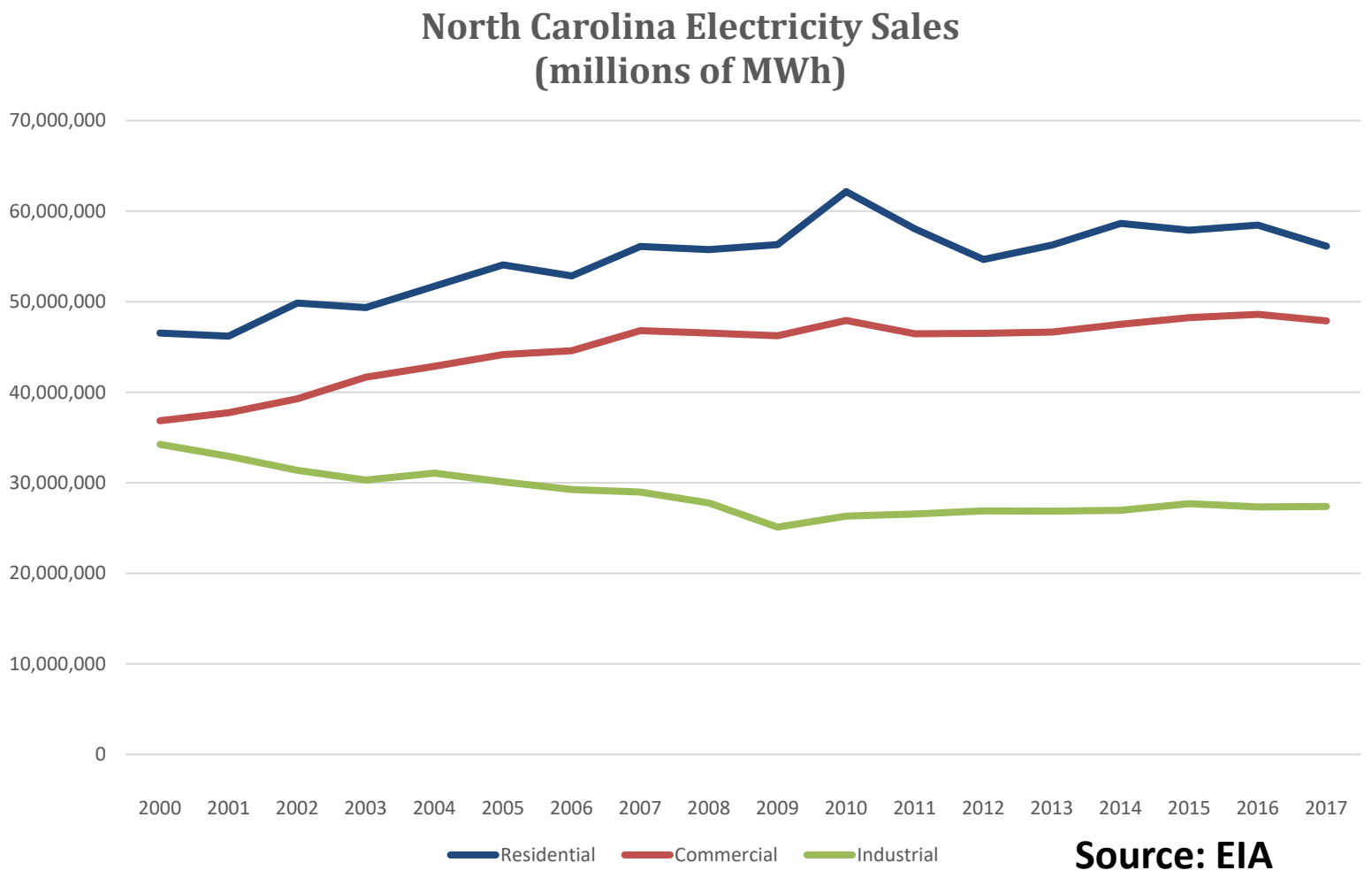
- Clean Smokestacks Act
- New Source Review litigation
- Federal environmental regulation
- Federal and state renewables policies
- Solar tariffs

Emissions Trends, 2000 - 2017



Source: EIA

Demand Trends, 2000-2017



Source: EIA

Energy Efficiency

2016 Electricity Landscape	Investor Owned	Municipal (Public)	Electric Cooperative	Total
Number of entities	3	72	31	106
2016 Number of retail customers	3,433,458	600,689	1,072,046	5,106,193
Percentage of customers	67%	12%	21%	
2016 Retail Sales (GWh)	99,610	16,263	18,525	134,399
Percentage of retail sales	74%	12%	14%	
2016 EE Savings (GWh)	1,061	4	81	1,146
EE Savings as % of Sales	1.06%	0%	0.06%	0.85%

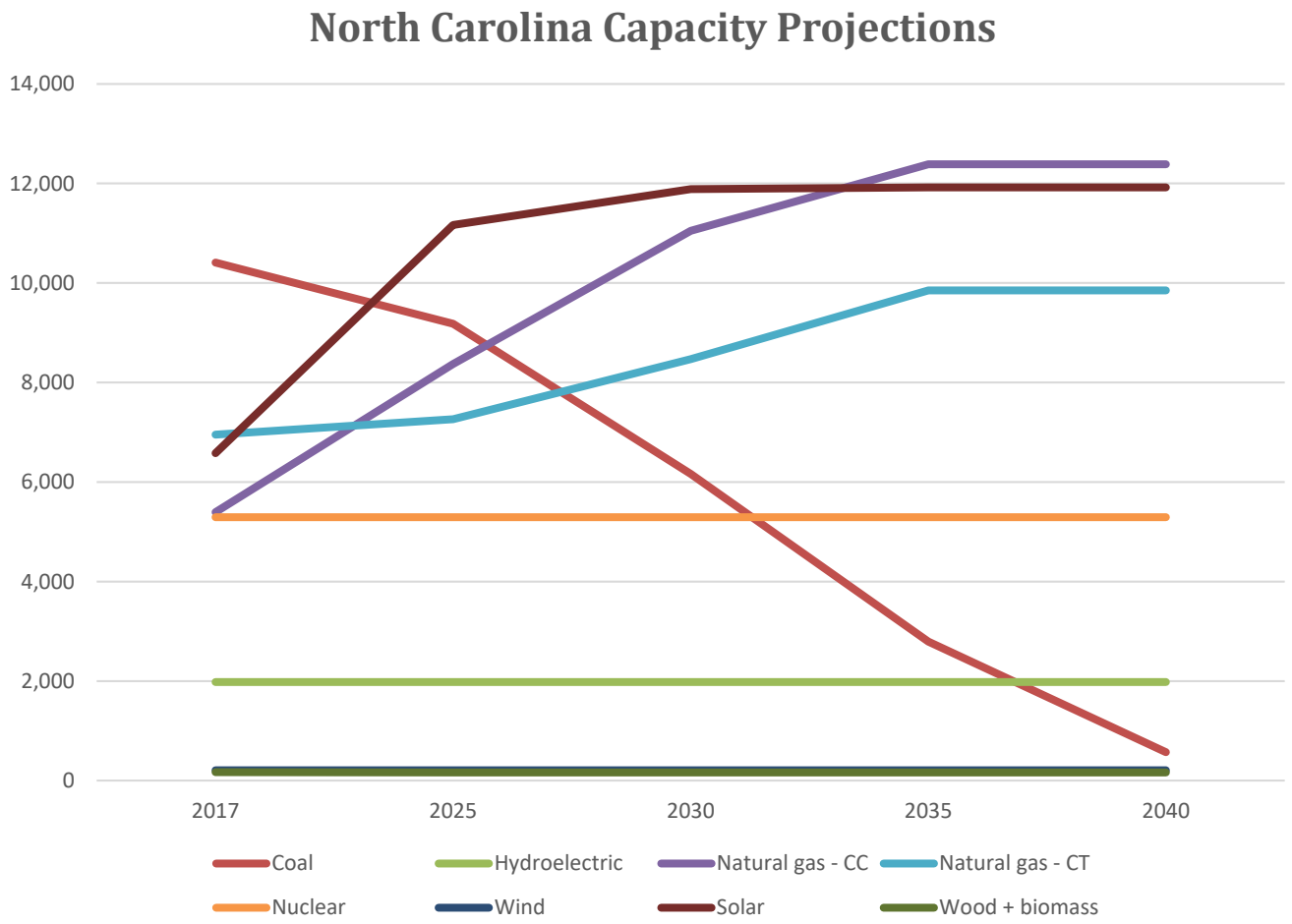
Source: EIA

NC Electricity Rates and Bills

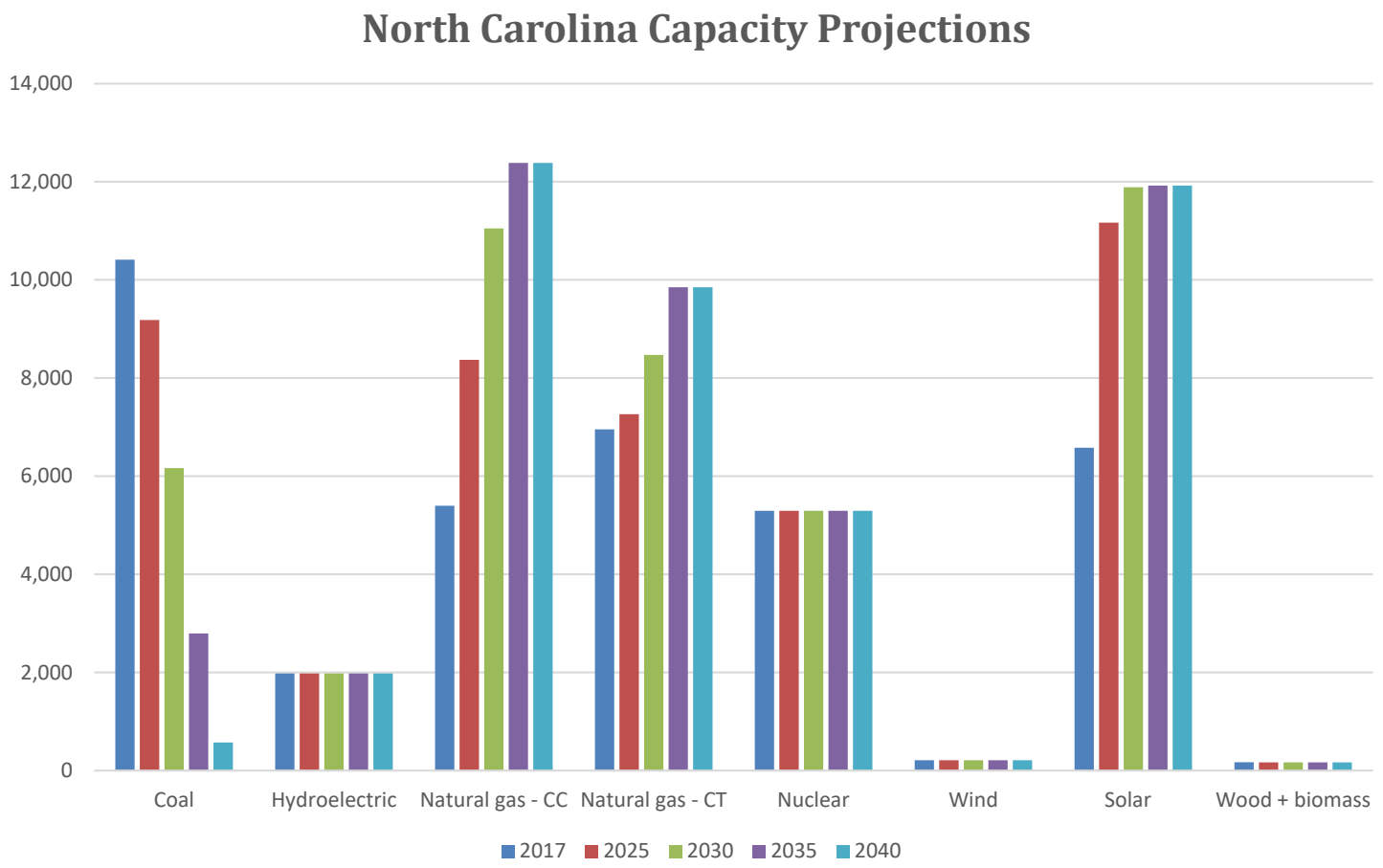
- Average residential rates: 10.94 cents/kWh (#41 in the US)
- Average residential consumption: 1,042 kWh/month (#12 in the US)
- Average monthly bill: $114 (#25 in the US)

Where are we Headed?

2017-2040: BAU



2017-2040: BAU



Coal Fleet - BAU

Units that retired between 2010 and present in NC:

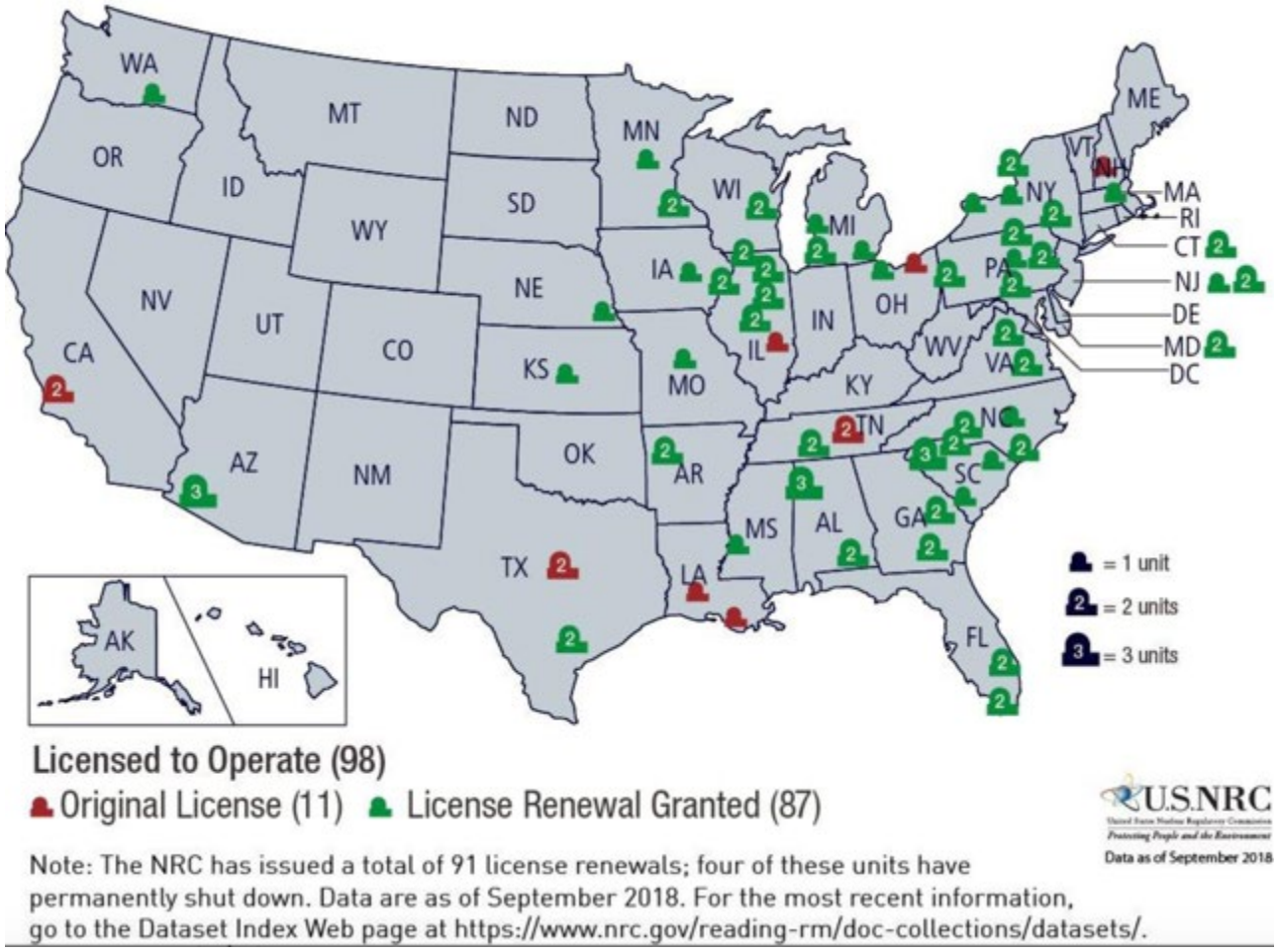
- Average construction year: 1951
- Average capacity: 112 MW

Units still operating in NC:

- Average construction year: 1971
- Average capacity: 348

Oldest (Allen): retiring in 2024. Smallest (Belews Creek): most efficient

Nuclear Fleet - BAU



Renewables - BAU

- HB 589 – 2,660 MW over 45 months
- Ongoing RPS compliance

"[I]nvesting in wind inside of DEP's footprint may be challenging in the short term, primarily due to a lack of suitable sites, permitting challenges, and more modest capital cost declines relative to other renewable technologies like solar." – 2018 IRP

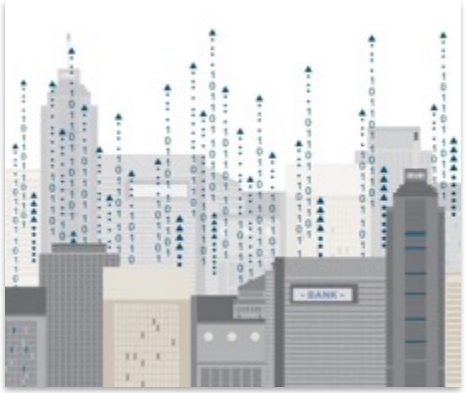
Storage – BAU

North Carolina Projected Storage Capacity

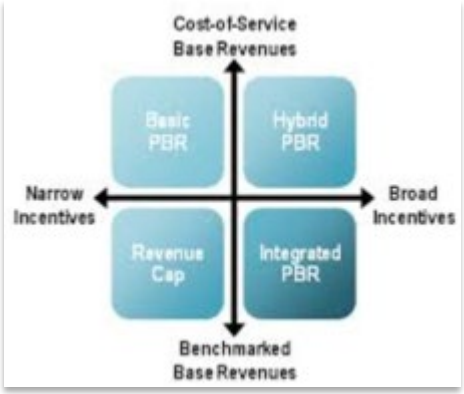
Technology	2017	2025	2030	2035	2040
Battery Storage	1	246	291	291	291
Pumped Storage	68	68	68	68	68

Three Trends to Watch in Electricity

Customer-Sited Solar & Storage



Big Data & The Internet of Things



Performance-Based Ratemaking

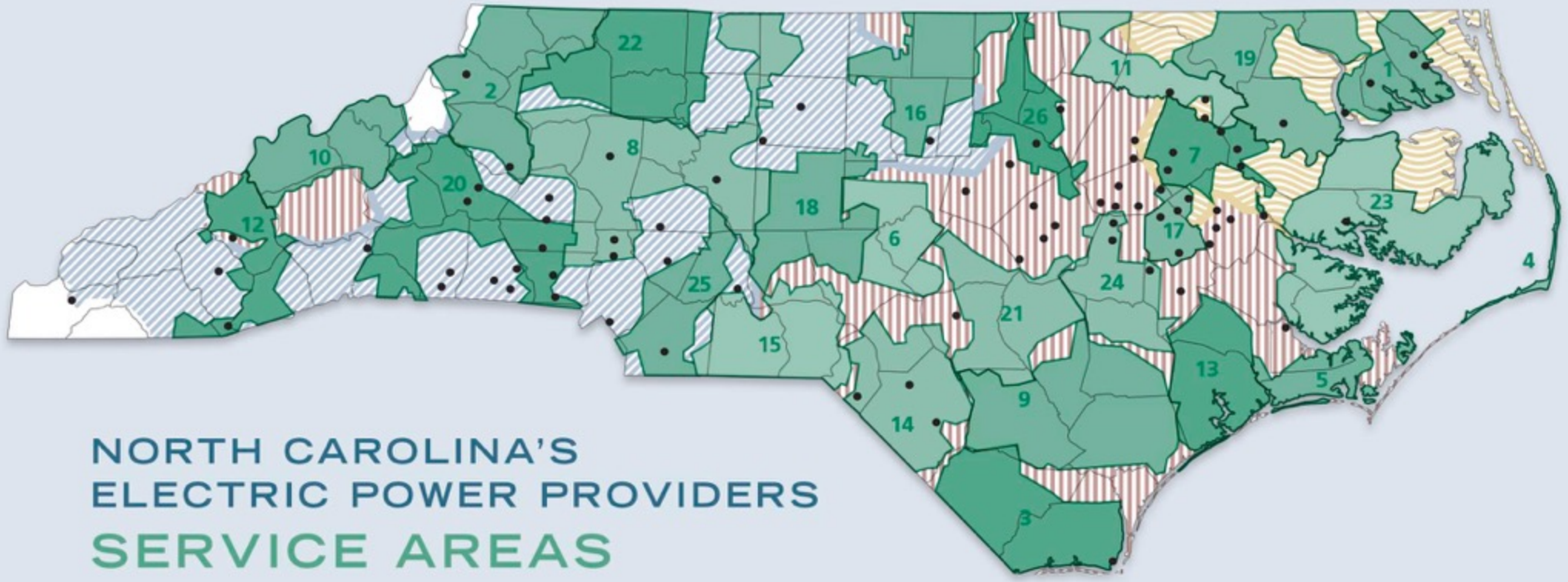
Duke NICHOLAS INSTITUTE FOR ENVIRONMENTAL POLICY SOLUTIONS

Duke ENERGY INITIATIVE

Clean Energy Plan Stakeholder Workshop

Regulatory Structures and Barriers

Jonas Monast
University of North Carolina School of Law
Feb. 25, 2019



NORTH CAROLINA'S ELECTRIC POWER PROVIDERS SERVICE AREAS

Electric cooperatives

1. Albemarle EMC
2. Blue Ridge Electric
3. Brunswick EMC
4. Cape Hatteras Electric Cooperative
5. Carteret-Craven Electric Cooperative
6. Central EMC
7. Edgecombe-Martin County EMC
8. EnergyUnited
9. Four County EMC
10. French Broad EMC
11. Halifax EMC
12. Haywood EMC
13. Jones-Onslow EMC
14. Lumbee River EMC
15. Pee Dee EMC
16. Piedmont EMC
17. Pitt & Greene EMC
18. Randolph EMC
19. Roanoke Electric Cooperative
20. Rutherford EMC
21. South River EMC
22. Surry Yadkin EMC
23. Tideland EMC
24. Tri-County EMC
25. Union Power Cooperative
26. Wake EMC

KEY

- Publicly-owned electric systems
- Electric cooperatives
- Duke Energy Progress
- Duke Energy Carolinas
- Dominion

Source: carolinacountry.com

N.C. Electric Power Providers

Duke Energy Progress

- 1.5 million customers
- Summer generation capacity: 12.8 GW

Duke Energy Carolinas

- 2.5 million customers (~1.8 million in N.C.)
- Summer generation capacity: 19.6 GW

Electric Cooperatives

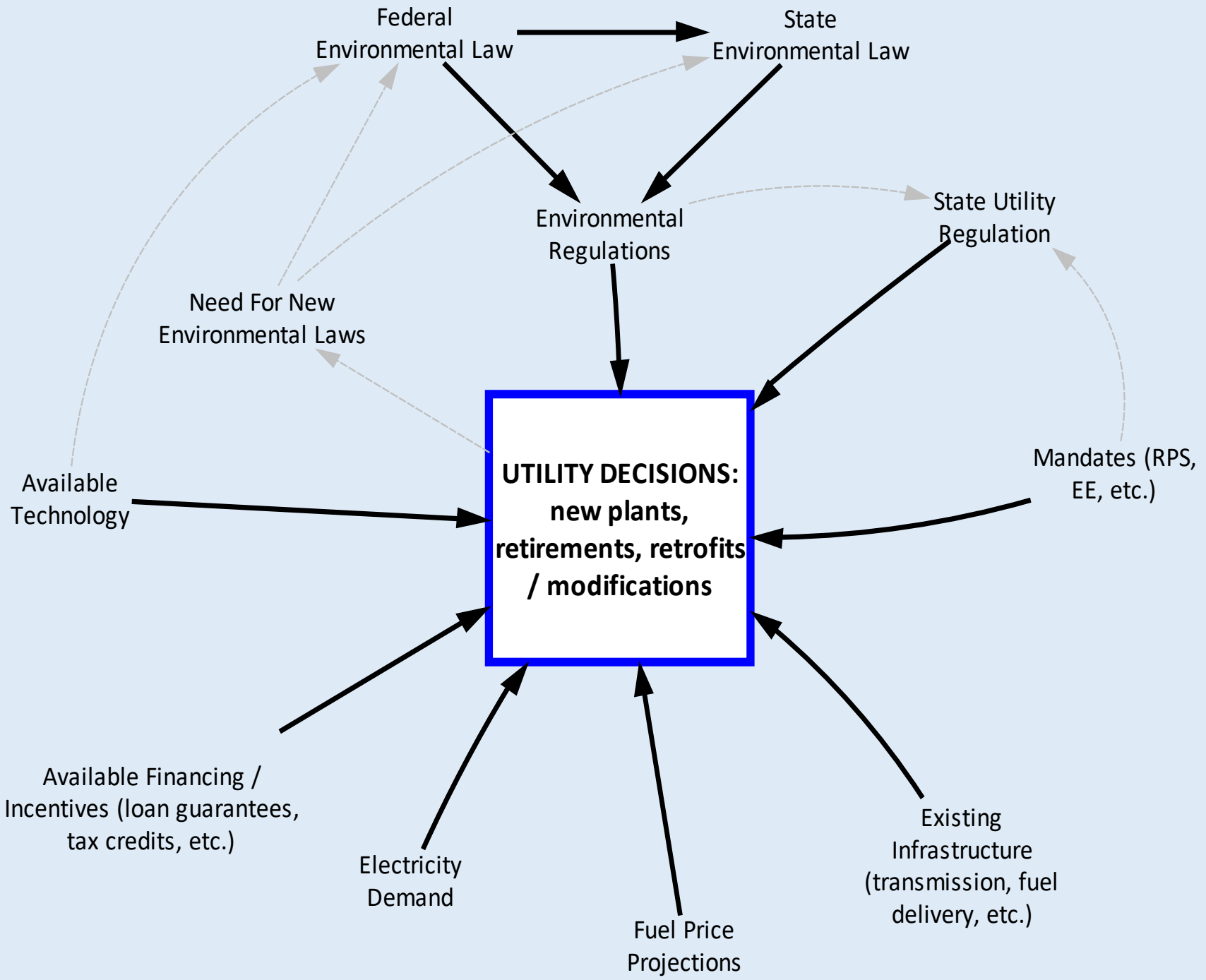
- 1 million customers
- 26 member cooperatives
- NCEMC owns 1.4 GW and purchases 2.1 GW

Dominion

- 120,000 customers in NC

Municipal Systems

- 70 NC communities (500,000 customers)



Factors affecting electricity generation infrastructure.

Traditional regulation

- State's agreement with utilities –
  - Exclusive service territory (i.e., monopoly)
  - In exchange,
    - Must provide reliable and safe service without discrimination AND
    - State PUCs set electricity rates and rate of return on investments
- PUC roles:
  - Ensure investments are prudent
  - Set electricity rates charged to retail consumers
    - Ensure returns on investments so utilities can continue to attract capital
  - Oversee distribution of electricity at retail level
  - Standards for safety and quality of service (reliability)
  - Provide public venue
  - Licensing of new generating plants
  - Licensing construction of new electric transmission facilities >161 kilovolts

PUC Structure and Process

- NCUC
  - NC PUC is an independent body
    - 7 Commissioners
  - Public staff (consumer advocate)
  - PUC hears rate cases
  - Investor-owned utilities submit annual IRPs (integrated resource plans)

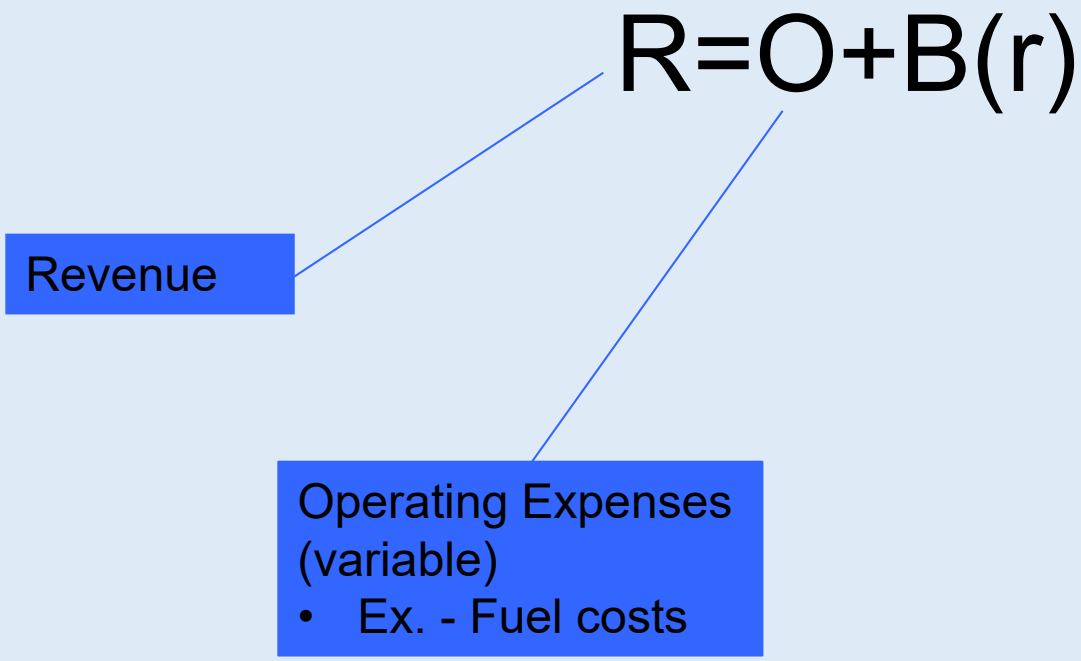
Price regulation

$$R=O+B(r)$$

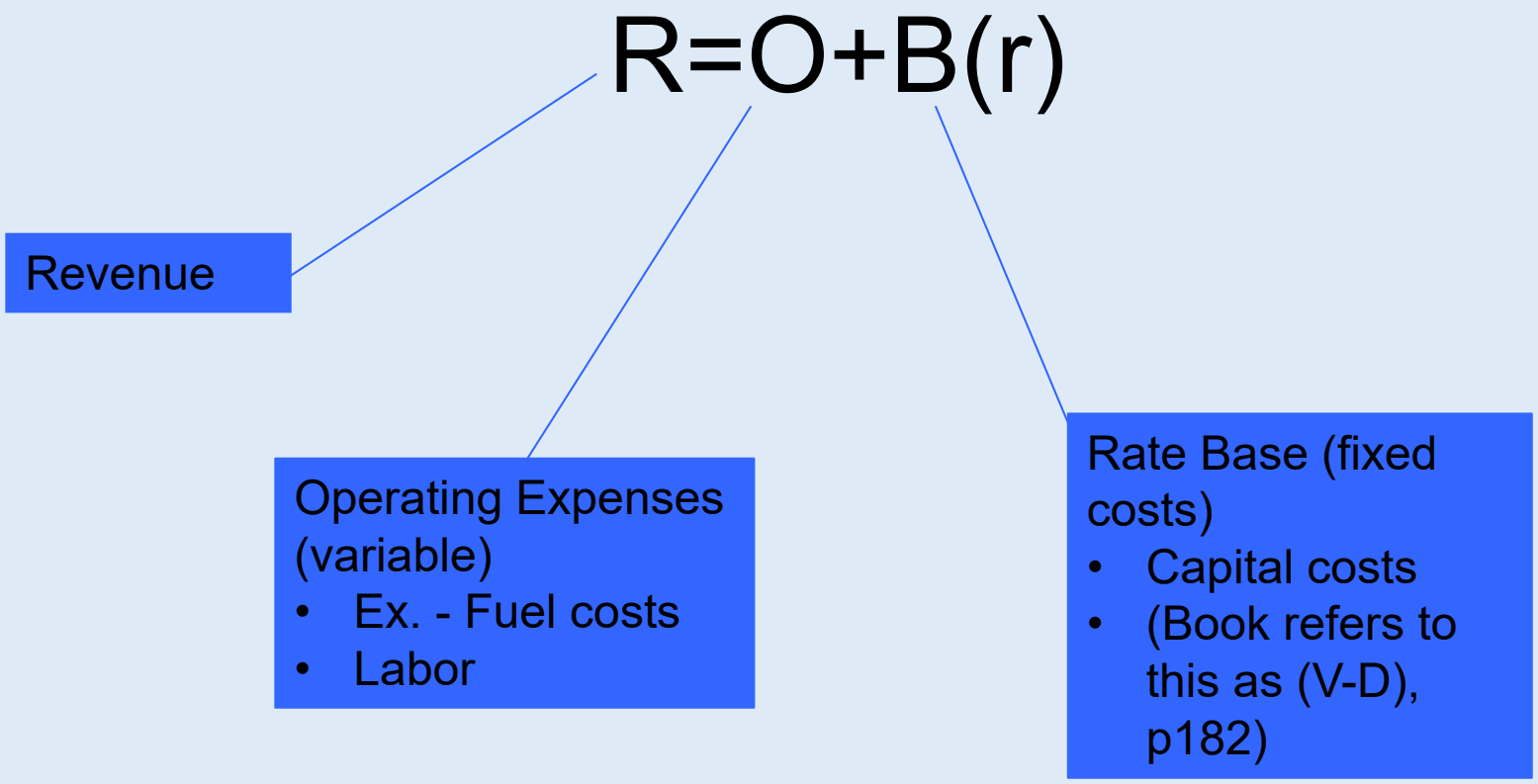
Price regulation

$$R=O+B(r)$$

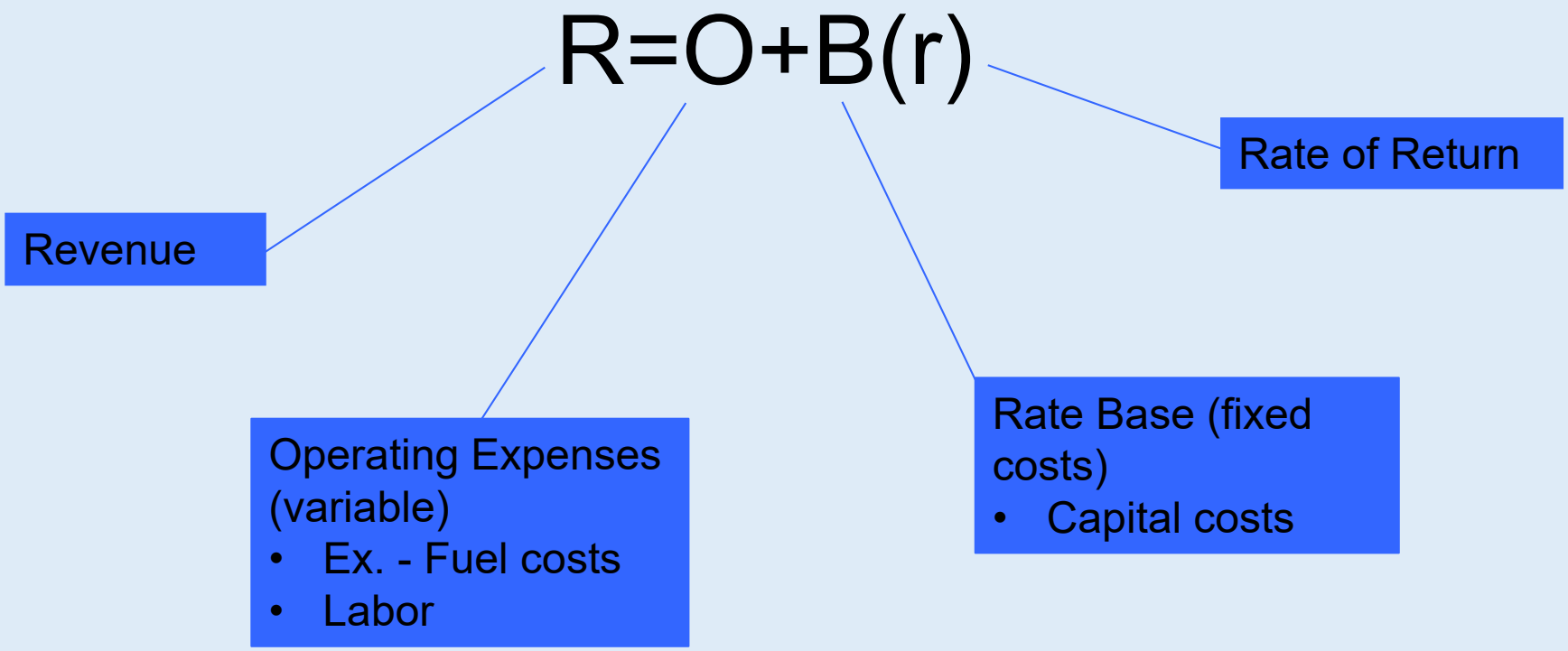
Price regulation



Price regulation



Price regulation



Policies Impacting Clean Energy Investments

- PURPA
- HB 589
- Environmental regulations
- Market competition

NC STATE UNIVERSITY

Distributed Energy Resources & Distribution Planning

Steve Kalland
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NC CLEAN ENERGY TECHNOLOGY CENTER

Major Program Areas:

- Renewable Energy
- Clean Power & Energy Efficiency
- Clean Transportation
- Green Building
- Economic Development
- Energy Policy
- Workforce Development
- Education & Outreach

Mission

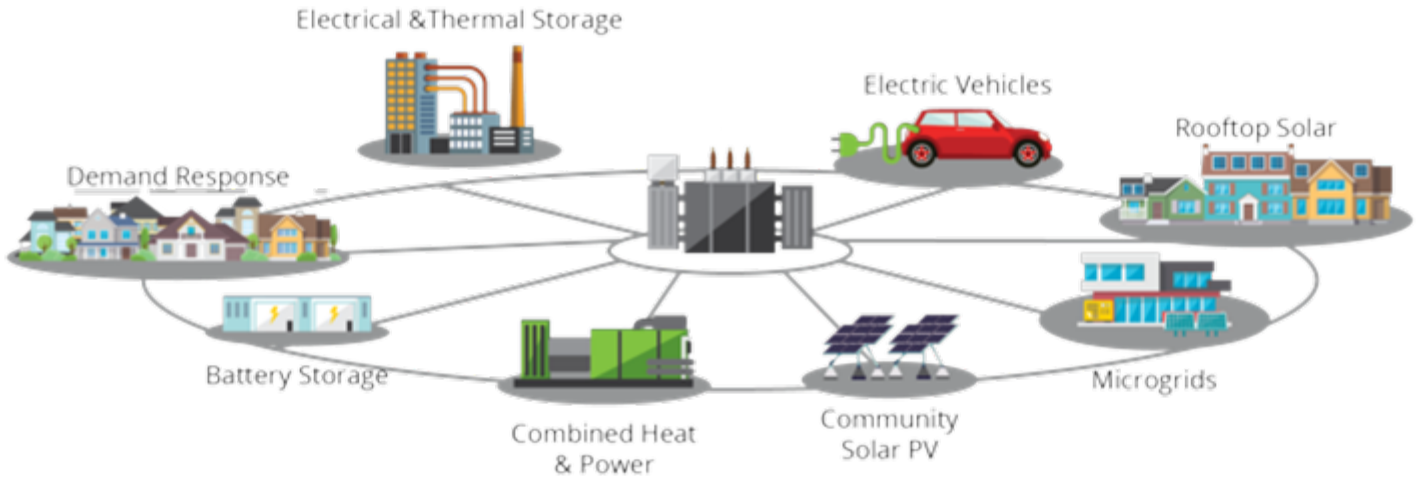
The North Carolina Clean Energy Technology Center advances a sustainable energy economy by educating, demonstrating and providing support for clean energy technologies, practices, and policies.

https://nccleantech.ncsu.edu

NC CLEAN ENERGY
TECHNOLOGY CENTER

Distributed Energy Resources

- **Distributed Energy Resources ("DER")** – Small electrical generators connected to the distribution system at lower voltage levels, typically under 10 MW but generally smaller, not usually scheduled by an RTO or ISO and often located close to customers' premises



Examples of DER include:

- Solar PV
- Combined Heat & Power
- Energy Storage
- Small-Scale Wind
- Microgrids
- Demand Response
- Electric Vehicles

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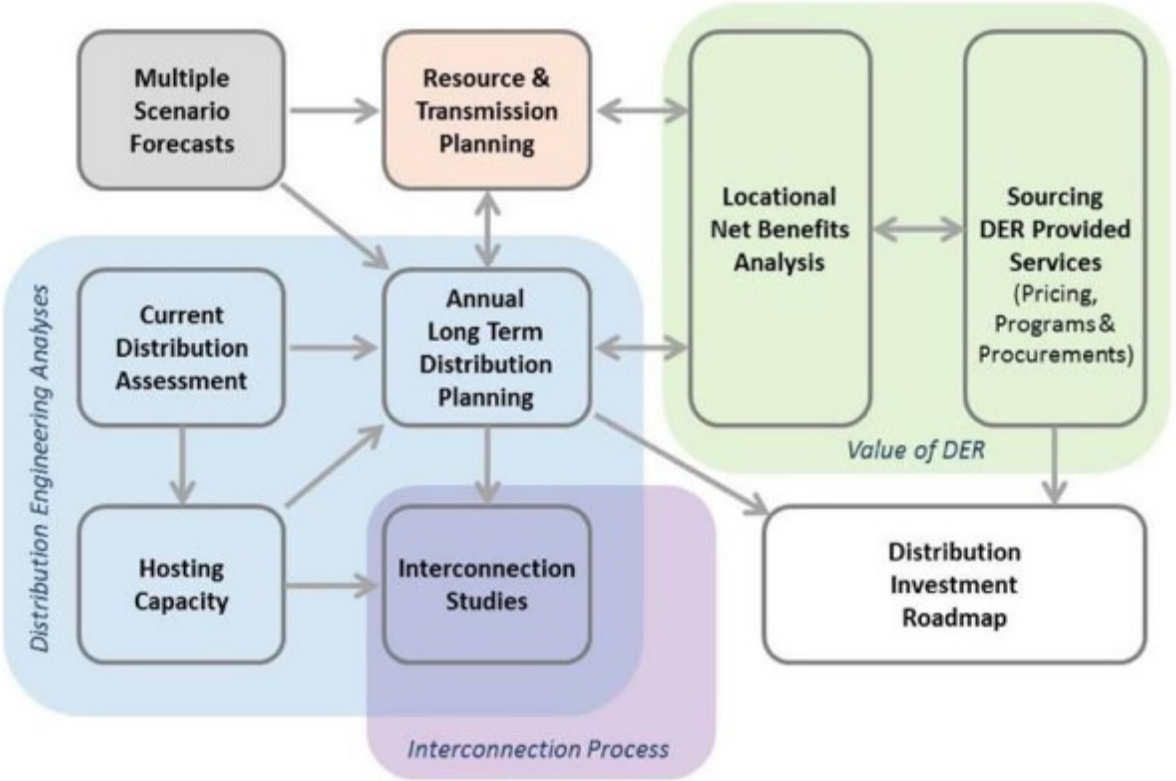
Source: NARUC Manual on DER Rate Design & Compensation

Distribution Planning



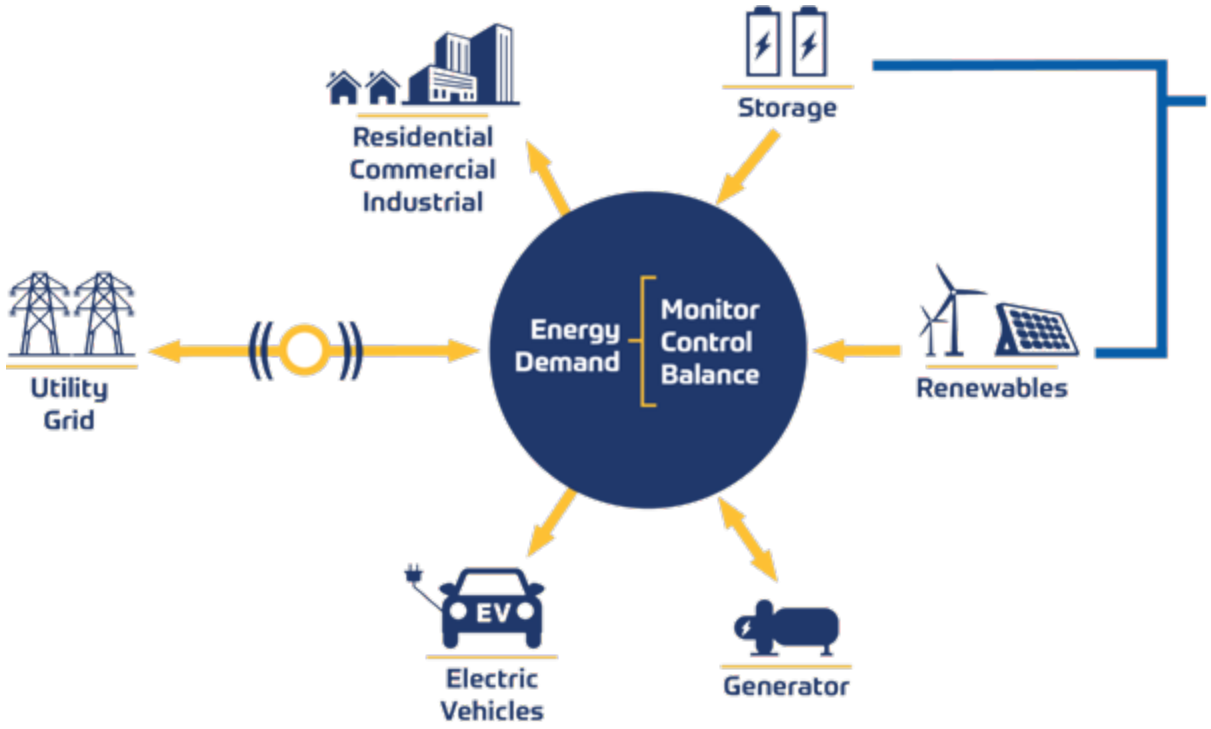
Source: ICF, report prepared for Minnesota PUC

- **Distribution planning** - The process utilities use to analyze and update the electrical distribution network ensuring safe, reliable, and affordable electricity
  - Identify existing system
  - Upgrade ageing infrastructure
  - Accommodate new systems
  - Build for the future
- Often separate from IRP and transmission planning

Value of DERto North Carolina Grid

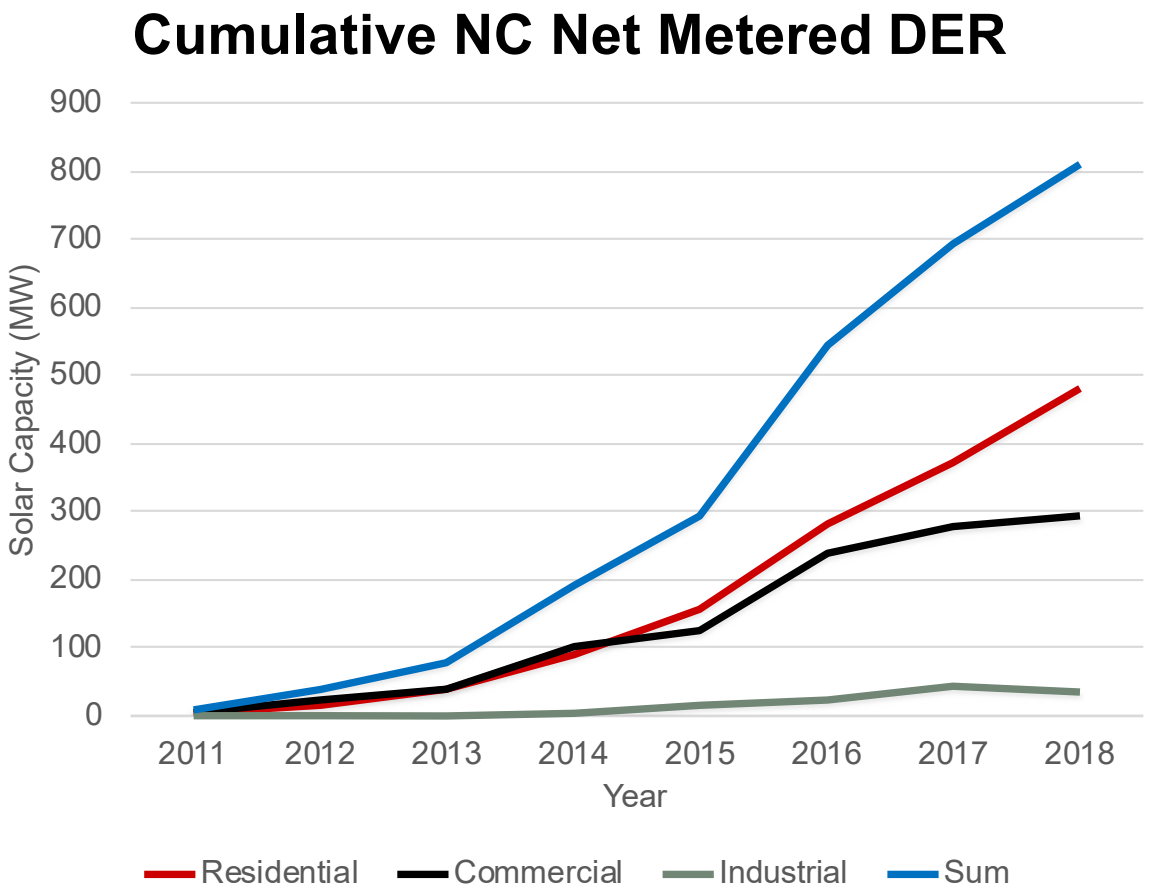
DERcan represent an important "non-wires" alternative

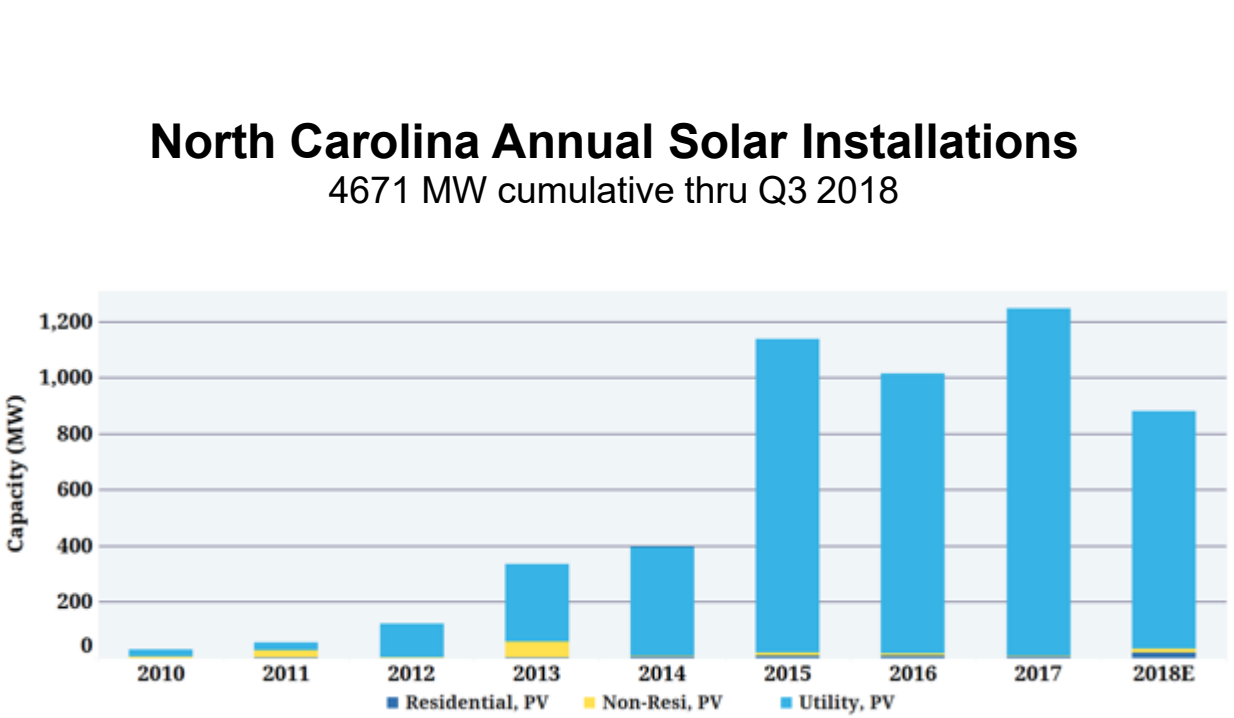
- Customer-sited renewable energy production
- Energy storage for peak demand
- Energy resilience for critical infrastructure
- Ancillary services; voltage support, frequency response



Source: IPS solar

NC Solar DER Penetration Levels





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Left figure: US Energy Information Administration, Form EIA-861M
Right figure: Solar Energy Industries Association

Policies Supporting DER in NC

- **Business Energy Investment Tax Credit** – Federal ITC of 30% in 2019, reducing to 10% in 2022
  - *35% state ITC expired at the end of 2015*
- **Public Utility Regulatory Policies Act (PURPA) Standard Offer** – Standard avoided cost rates for small renewable and CHP generators up to 1 MW *(was available for systems up to 5 MW prior to enactment of HB589 (2017))*
- **NC Renewable Energy and Energy Efficiency Portfolio Standard (REPS)**
  - Investor-owned utilities required to achieve 12.5% renewables by 2021
  - Municipal utilities & co-ops required to achieve 10% by 2018

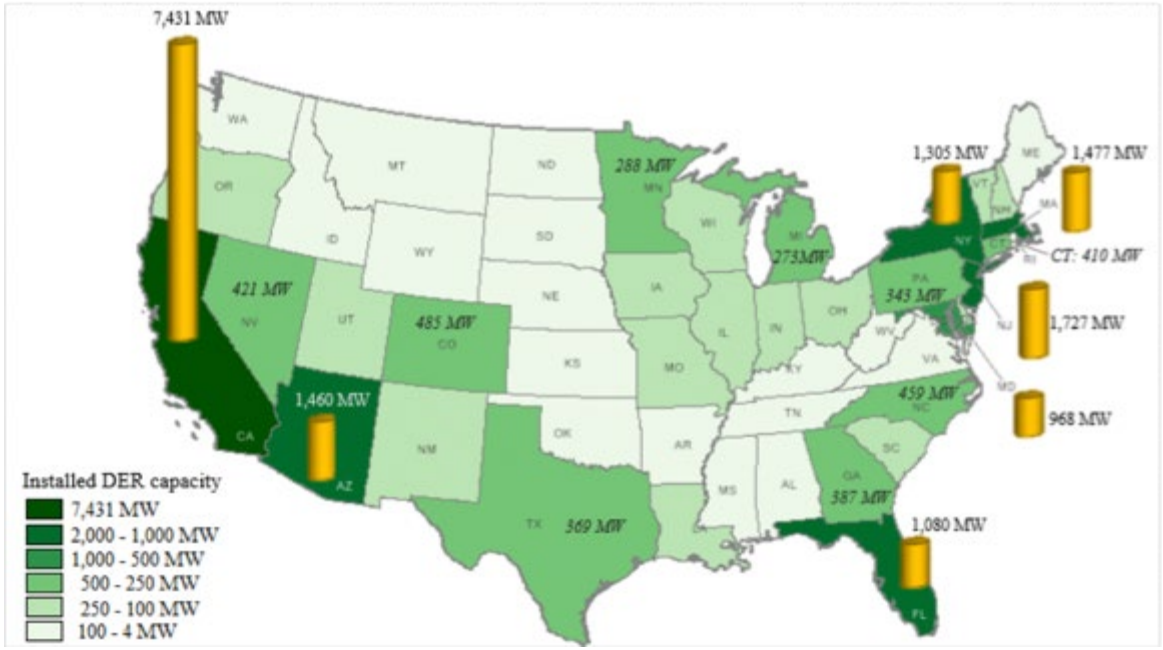
Policies Supporting DER in NC

- **Net Metering** – NC investor-owned utilities offer full retail net metering for renewable energy consumed on site, allowable to 1 MW (*NEG forfeited at end of 12 month netting period) (Most COOP & Muni's don't offer net metering, some offer net billing*)
- **Property tax abatement** – 80% abatement on the property's added value for PV solar
- **Duke Energy Solar Rebate** – HB 589 directed Duke to offer rebates for residential, business, and non-profits (*The program has been fully committed for the residential and business rebates in less than 2 weeks each of the years offered*)

Other Factors Assisting DER Growth

- Declining cost of solar PV
- Increasing cost of electricity
- Customer interest in renewable energy, CHP, and other DER technologies
  - Homeowners: Independence, reliability, bill savings, and sustainability
  - Cities: Local climate & sustainability commitment, resiliency, and cost
  - Companies/Businesses: Sustainability goals, financial advantages, reliability

US Installed DER (2016)



Source: US Energy Information Administration, Form EIA-861M

Limiting Factors Affecting DER Growth in NC

- Low avoided cost rates based on peaker methodology
- Lower PURPA standard offer size limit, contract length, and capacity credits
- Interconnection queue and fees
- Policy uncertainty
  - Lack of clear energy storage policies
  - Net metering uncertainty
  - Lack of regulatory clarity for EV charging stations
  - Tax credit expiration & rebate cap
- Homeowner association restrictions on solar installation

Differing Approaches and Outcomes

North Carolina

Majority utility scale market

Limits on customer sited DER:

- Proposed changes to net metering
- State tax credit expired in 2015
  - Residential prices were higher
- Rebates (residential - $0.60/Watt)
  - Rebate allotments gone quickly (~7days)

South Carolina

More balanced roof-top/utility scale solar adoption

- Retail rate net metering credit
  - Utilities expected to reach required aggregate cap soon
- Ongoing residential state tax credit (25%)
- Rebates (residential - $1.00/Watt)
- H.B.3659 – unanimously passed House last Thursday
  - Eliminate net metering cap (2 year plan extension)
  - Direct bargaining with renewable producers for large consumers
  - Enables 3rd party owned neighborhood community solar

DER Interconnection Process

- The North Carolina Utilities Commission adopted interconnection standards for distributed generation in 2005*
- Updated in 2008 and 2015: Adopted FERC-like requirements
- Process:
  1. File Request & Pay fee (>20kW Queue)
  2. Documentation submittal & Engineering
  3. Interconnection Agreement (>20kW)
  4. Construction
  5. Testing
  6. Connection

Requirements differ by generator size and voltage:

- < 20 kW - Inverter simplified process
- 20 kW-2 MW – Fast track eligible
- > 2 MW (or fast track disqualified systems)– Study on grid impact required

Fast Track Eligibility for Inverter-Based Systems		
Line Voltage	Fast Track Eligibility Regardless of Location	Fast Track Eligibility on a Mainline[2] and ≤ 2.5 Electrical Circuit Miles from Substation[3]
< 5 kV	≤ 100kW	≤ 500kW
≥ 5 kV & < 15 kV	≤ 1MW	≤ 2MW
≥ 15 kV & < 35 kV	≤ 2MW	≤ 2MW

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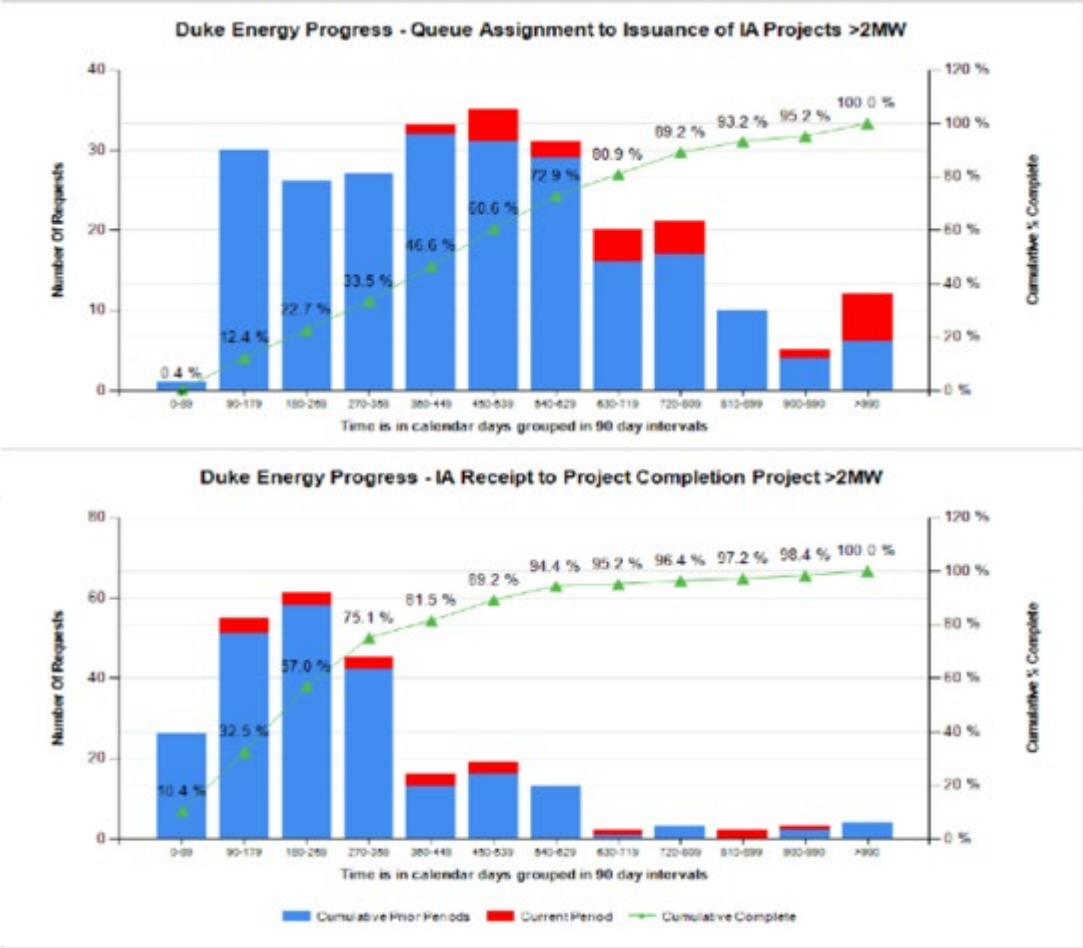
*Exempting municipalities and coops

Queue Issues (Utility Scale)

- Queue length issues
  - "First in first out" method led to large number of filings to obtain a better position
  - Large number of applications (100's/year)
  - Long wait for approval
- Changes to queue
  - Increased engineers reviewing submissions
  - Implementation/increase of fee to reduce place holder filings
  - Extension of system review time
  - Priority for swine waste to energy projects
  - Current open Docket on changes to interconnect



Source: DEP Docket E-100, Sub 101A filing

NC Distribution Planning Progress

NC electrical grid is changing:

- Net additions of DER growing faster than centralized generation
- Competitive Procurement of Renewable Energy requirements (CPRE)
  - questions regarding PURPA compliance
- Energy storage study completed
- Duke Study identified transmission regions constrained by additional large scale DER generation

Responses to these changes:

Duke's proposed Grid Improvement plan includes (DER relevant):

- Smart meter installation (Approved)
- Integrated system operations planning (ISOP)
- EV pilot program – charging rebate programs, infrastructure development
- Energy storage program – deferring line investments and increasing reliability
- T&D – system upgrades/improvements that could enable DER where necessary
- Customer data sharing and access changes

- Ongoing process requiring Utilities Commission approval

Data Access Rules

- **Customer Energy Usage Data:**
  - Commission Rule R8-51 - Requires investor-owned utilities to provide billing information upon request, nothing requiring release to 3rd parties
  - Docket E-100 Sub 147 directed utilities to provide information on release of data to 3rd party
    - Grid modernization report referenced Green Button organization
  - Docket E-100 Sub 161 newly opened to address rule making around customer data access as requested by the Public Staff

- **System-Wide Data:**
  - No existing rules in NC requiring utilities to provide access to system data
  - Data transparency at this level in many other states is highly supportive to DER and ensures installations at the most valuable grid locations

Source: ACEEE State and Local Policy Database & energy.gov

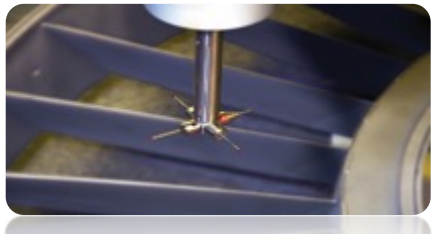
Key Observations

- DER will continue to expand both in NC and the US, offering opportunities and presenting hurdles
  - Can provide a competitive energy market, keeping costs down
  - Can increase reliability, resilience, and grid balancing
  - Complicates grid infrastructure and management
  - Can reduced carbon intensity of electricity
- Distribution system planning would enable more accurate location valuation of all DER resources
- Timing of the interconnection process is hindering deployment of DER and potentially economic development
- Greater transparency in distribution system planning has supported more cost effective DER deployment in other states
  - Many DER stakeholders are actively asking for transparency

Stakholder Perspectives

North Carolina's electricity system as it is now…





Topic 5: Grid Modernization and Resilience

Robert Cox, Ph.D.
EPIC Assistant Director

UNC CHARLOTTE
Energy Production and Infrastructure Center

What is Grid Modernization?

- Greater RESILIENCE to hazards of all types
- Improved RELIABILITY for everyday operations
- Enhanced SECURITY from an increasing and evolving number of threats
- Additional AFFORDABILITY to maintain our economic prosperity
- Superior FLEXIBILITY to respond to the variability and uncertainty of conditions at one or more timescales, including a range of energy futures
- Increased SUSTAINABILITY through energy-efficient and renewable resources

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Power/Forward Carolinas Program

- Proposed programs:
  - Advanced Metering Infrastructure
  - Communications Network Upgrades
  - Distribution Hardening & Resiliency: Replacing cable, physical and cyber security enhancements, adding redundant power sources
  - Advanced Enterprise Systems
  - Self-Optimizing Grids: Improvements to increase connectivity for two-way power flow, improved capacity to allow dynamic switching, and increased automation to improve reliability
  - Targeted Undergrounding
  - Transmission Improvements
- $13B plan

Hurricane Matthew (2016)

South Carolina	% CI Eliminated	% CMI Eliminated	% Outages Eliminated
DEP SC	27%	28%	33%
DEC SC	11%	21%	28%

Example expected impacts in SC with Hurricane Matthew

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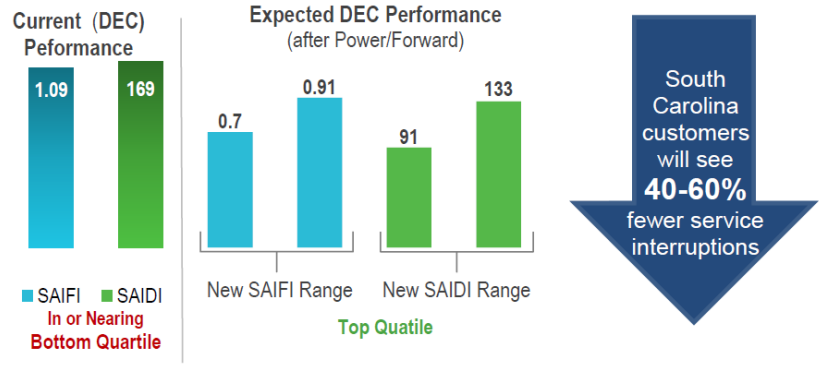
Power/Forward Carolinas Program

- Issues raised by various groups:
  - Minimal oversight by the utility commission – a streamlined process for annual increases to pay for grid upgrades was proposed
  - Plan didn't include a cost/benefit analysis comparing the proposed measures to other possibilities, including demand response, microgrids, and storage
- Duke Energy reached settlement agreement with several environmental groups in NC to develop a $2.5B pilot:
  - Hardening of wires in hurricane-prone areas with select undergrounding limited to five demonstration projects
  - Voltage optimization on approximately 20% of the utility's system distribution circuits
  - Electric vehicle charging infrastructure, which could potentially generate a new revenue stream for the utility
  - Energy storage deployment commitments of 200 MW by 2023 and 300 MW by 2023
- NCUC rejected the plan: "Duke failed to show that exceptional circumstances exist to justify the establishment of the Grid Rider for recovery of its Power/Forward Carolinas (Power/Forward) costs"
  - NCUC felt it lacked statutory authority to approve a grid modernization rider

Resiliency Vs. Reliability

- Reliability:
  - Focuses upon grid disruptions during normal operating conditions
  - Utilizes well-known metrics that describe expected outages
    - SAIFI (System Average Interruption Frequency Index)
    - SAIDI (System Average Interruption Duration Index)
- Resiliency:
  - Focuses upon high-impact, low-frequency events such as hurricanes or attacks
  - Resilience definitions are currently too imprecise “to be used as a regulatory term of art” - National Association of Regulatory Utility Commissioners (NARUC)
  - “The Department of Energy (DOE) should undertake studies designed to assess the value to customers … of assuring the continuation of full and partial … service during large-area, long-duration blackouts.” – National Academies



Example: Duke filings focus on reliability metrics rather than resilience

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Developing a Modern Grid in NC

- North Carolina has the second largest capacity of installed solar generating assets in the United States at 4,491 MW
  - 90+% is third party owned
- HB 589 advances solar to 6,800 MW by 2018
- Recent energy-storage study found relatively limited value for solar in NC, even by 2030

12MWh energy storage project for Brunswick EMC – Allows utility to avoid peaking costs

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Developing a Modern Grid

- Storage is generally cost effective today for one of two reasons:
  - Demand charge reduction in areas with high demand charges
  - Where there is a viable market for the grid services they can provide
- Resiliency can change the game for PV + energy storage:
  - Example: Puerto Rico after Maria was described as “an epidemic of broken generators” and diesel supply issues
  - But, how do businesses and communities value the resiliency benefits?
- NC has led the way in the development of PV for two reasons:
  - Favorable implementation of PURPA
  - Favorable renewable energy portfolio standard
- Third-party asset owners don’t have incentive to add the energy storage in NC
  - ***We risk falling behind***
  - Major area needing investigation – UNCC has partnered with third-party asset owners to address this challenge in application for DOE ASSIST program

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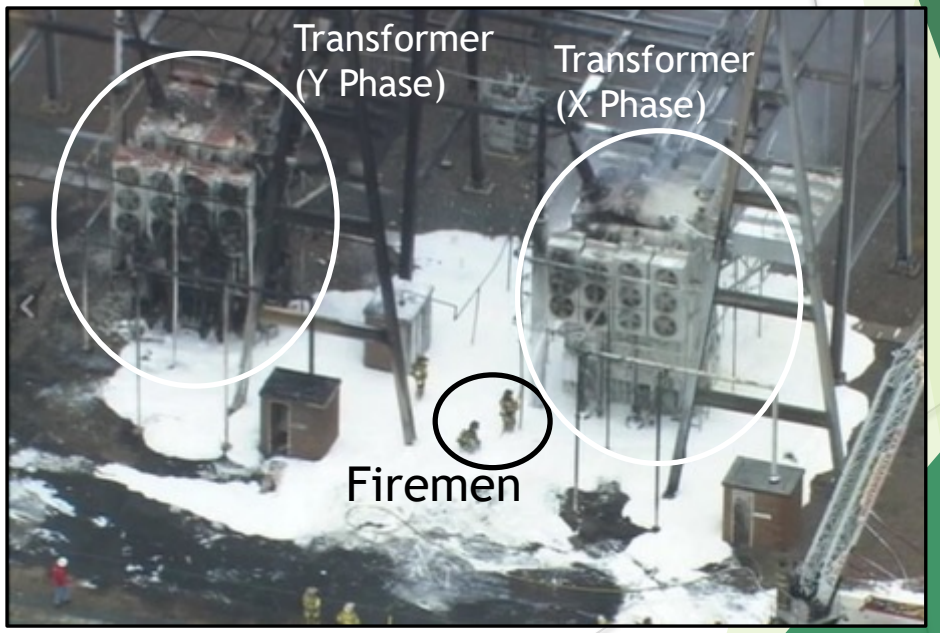
Resiliency Principles Employed:
Redundant and Diverse

Resiliency in Today's North Carolina Electric Grid: An Example of Clean Energy's Impact (coal retirement) on the need for more Redundancy

- What happened: At 8:24 AM on Nov. 8, 2017 a fire in Transformer AT1 at the McGuire Nuclear Substation was reported.
  - No threat was posed to the nuclear plants by the fire.
  - The fire in Y-phase transformer damaged beyond repair the X-phase transformer. Based on reliability metrics, only one transformer spare is on site.
  - Initiated an eight-month repair drama that tested the resiliency of the NC electric grid.
  - After timely action by Duke Energy and contractors at the speed transportation would permit, replacement transformers moved to the substation accepted load on June 6, 2018.
- Why it matters: McGuire AT is a three-phase intertie between the 230-kV and the 500-kV transmission sub-networks.
  - Amount of generation on the 230-kV system reduced by closure of coal plants connected to it. The 500-kV system provides more generation to the 230-kV system than in the past.
  - Studies and expert assessments predicted possible Charlotte area load shedding during projected winter peak and during a Catawba nuclear unit refueling that followed. But that didn't happen because the grid was sufficiently redundant and diverse for those events.

Lessons learned:
1. Better resiliency metrics needed for risk-based management of North Carolina's grid.
2. More redundant interties needed between the 230-kV and 500-kV sub-networks.



Note the scale of the energy system!
Photo credit: wsoctv.com

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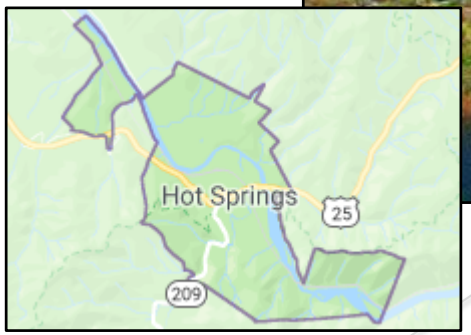
Resiliency Principles Employed:
Flexible, Resourceful, and Agile

Resiliency in Tomorrow's North Carolina Electric Grid: An Example of Clean Energy (PV + storage) contributing to improved service in Hot Springs, NC

- What's proposed: A microgrid that can island when the grid service is disrupted.
  - 2 MW Solar + 4 MW/4 MWh Battery energy storage
  - Safe and coordinated transitions to island mode.
  - With islanding mode Hot Springs will have back-up power from a flexible and agile microgrid.
  - Economically and socially important to a community fed by single distribution feeder prone to being cut off from the grid.
  - Supports deferral of the future Asheville CT unit by freeing up generation capacity to serve winter peak.
- Why it matters: Organizing NC's 6800 MW of solar with storage, advanced relaying, self-optimizing distribution, etc. could enable a higher level of grid resiliency than ever before.
- What could stop it?
  - Regulatory approval. Awaiting Certificate of Public Convenience and Necessity from NCUC
  - Economics. "We're looking for these sorts of use cases where storage can be a more cost-effective solution, or in the case of the Hot Springs microgrid the only real solution." Zachary Kuznar, Duke Energy's director, CHP, microgrid and energy storage development

> The North Carolina town, which has about 620 customers, is served by a single, 10-mile long, high-voltage line that subjects Hot Springs to "long-duration outage events due to its location in rugged mountain terrain" in adverse weather, says Jonathan Landy, a Duke business development manager.
>
> By John Downey – Senior Staff Writer, Charlotte Business Journal



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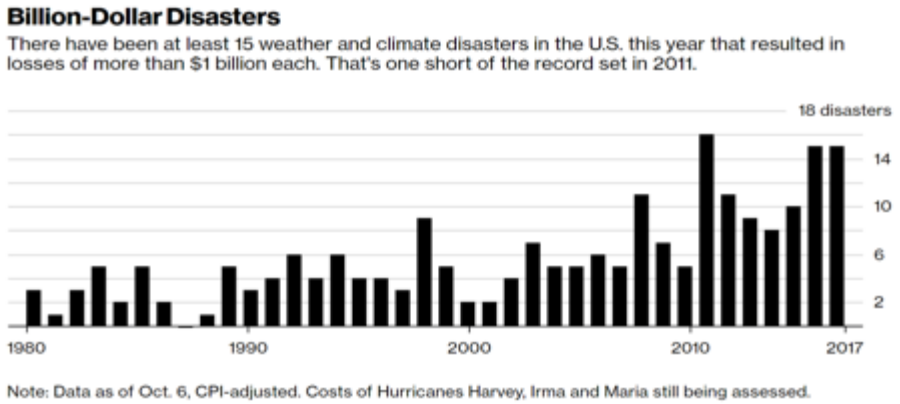
Current Issues

- Resiliency, which deals with high-impact, low-frequency events, is difficult to accurately value
- Resiliency investment does not fall neatly into the current IRP Process
- We need to change the process and thinking around resiliency
- The cost to society for weather-related outages is $25 to $70 billion (Congressional Research Service, 2012)
- The cost to utilities to recover from Hurricane Katrina was less than $1B
- ***Missing Link: The relationship between grid modernization and the resulting economic and social value of avoided lost economic output, reduced societal disruption, and reduced individual harm***



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Approaching Modernization Moving Forward

- Need to address modernization efforts as an insurance policy for society overall, rather than through the traditional lens of utility cost-recovery for added generation and transmission
- Resiliency metrics must consider the value of various investments:
  - Grid hardening
  - Redundancy and Adaptability
  - Decentralized resources enabled by the trend to clean energy alternatives: Renewable generation and storage
  - Microgrids for critical or hard to serve customers
- Some regulatory / policy recommendations:
  - Follow the example of four states that already recognize nuclear as clean energy (Connecticut, Illinois, New Jersey, and New York). Pennsylvania is considering becoming the fifth state by including nuclear generation in their Alternative Energy Portfolio Standard. This will reduce pressure to close zero-carbon-emitting nuclear generation for reasons that are causing coal plants to decommission, which has negatively impacted grid resiliency.
  - Incentivize independent developers of PV + Storage projects similarly to independent PV developers who invested private capital to make North Carolina second in the nation in PV capacity.
  - Legislate authority for NCUC to authorize grid modernization riders.

Economic and Rate Impact Analysis of Clean Energy Development in North Carolina

2017 Update

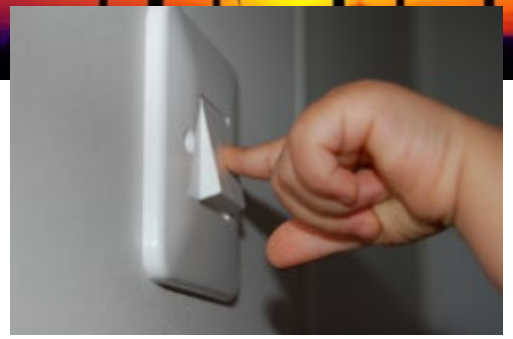
Jeffrey Petrusa

Center for Environmental, Technology and Energy Economics

February 25, 2019

Photo by njaj. Published on 18 July 2013. From freedigitalphotos.net

Background



- In 2007, North Carolina established the Renewable Energy and Energy Efficiency Portfolio Standard (REPS), the first of its kind in the Southeast.
- REPS requires electric power suppliers to meet a increasing amount of retail consumers energy demand through a combination of renewable energy resources and reduced energy consumption.
- RTI International performed an independent analysis of the economic impacts of clean energy development in NC associated with the REPS.

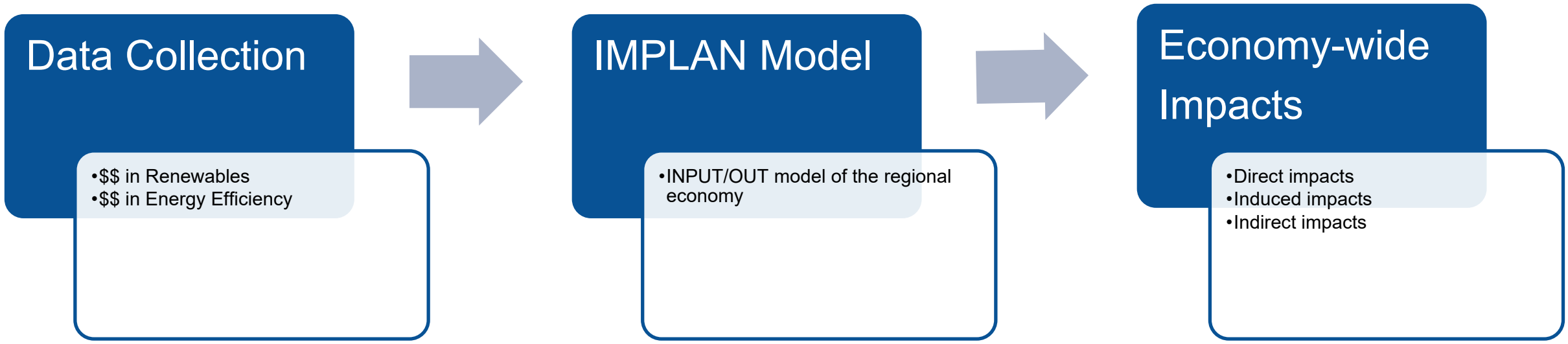
Objectives

- **Retrospective Economic Impact Analysis**
  - Years 2007 to 2016
  - Analyze changes in consumer, utility and government spending.
  - Estimate the direct and indirect economic impacts of clean energy development in North Carolina since 2007.

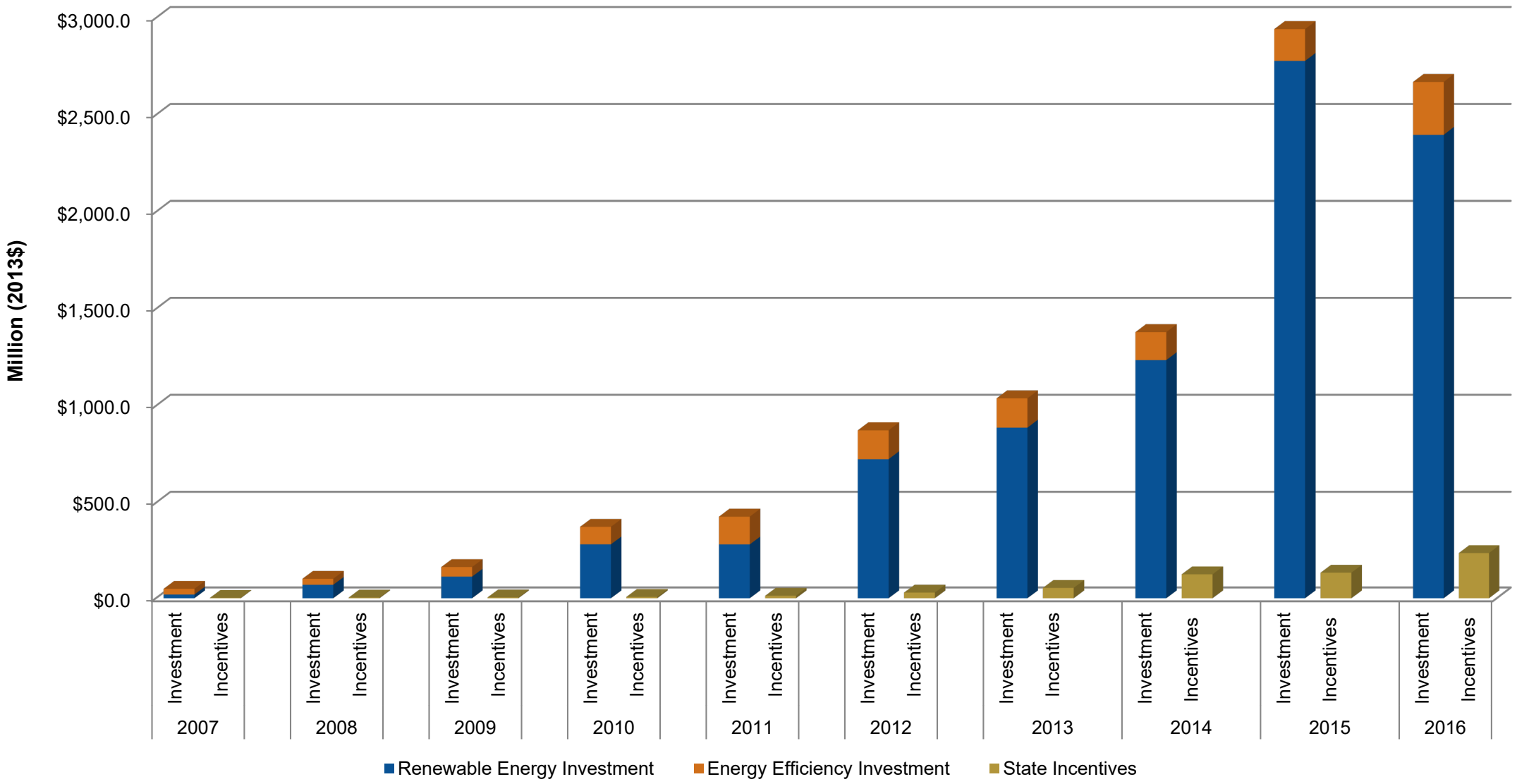
Key Findings

- Total economic impact in NC from clean energy between 2007 and 2016 was $19.9 billion.
- Approximately $10 billion investment in clean energy development over the same time period.
- State incentives for clean energy was $611.7 million.
- Clean energy development contributed $12.2 billion to gross state product between 2007 and 2016.
- Supported 126,440 annual (FTE) full-time equivalents, in employment.

Economic Impact Methodology

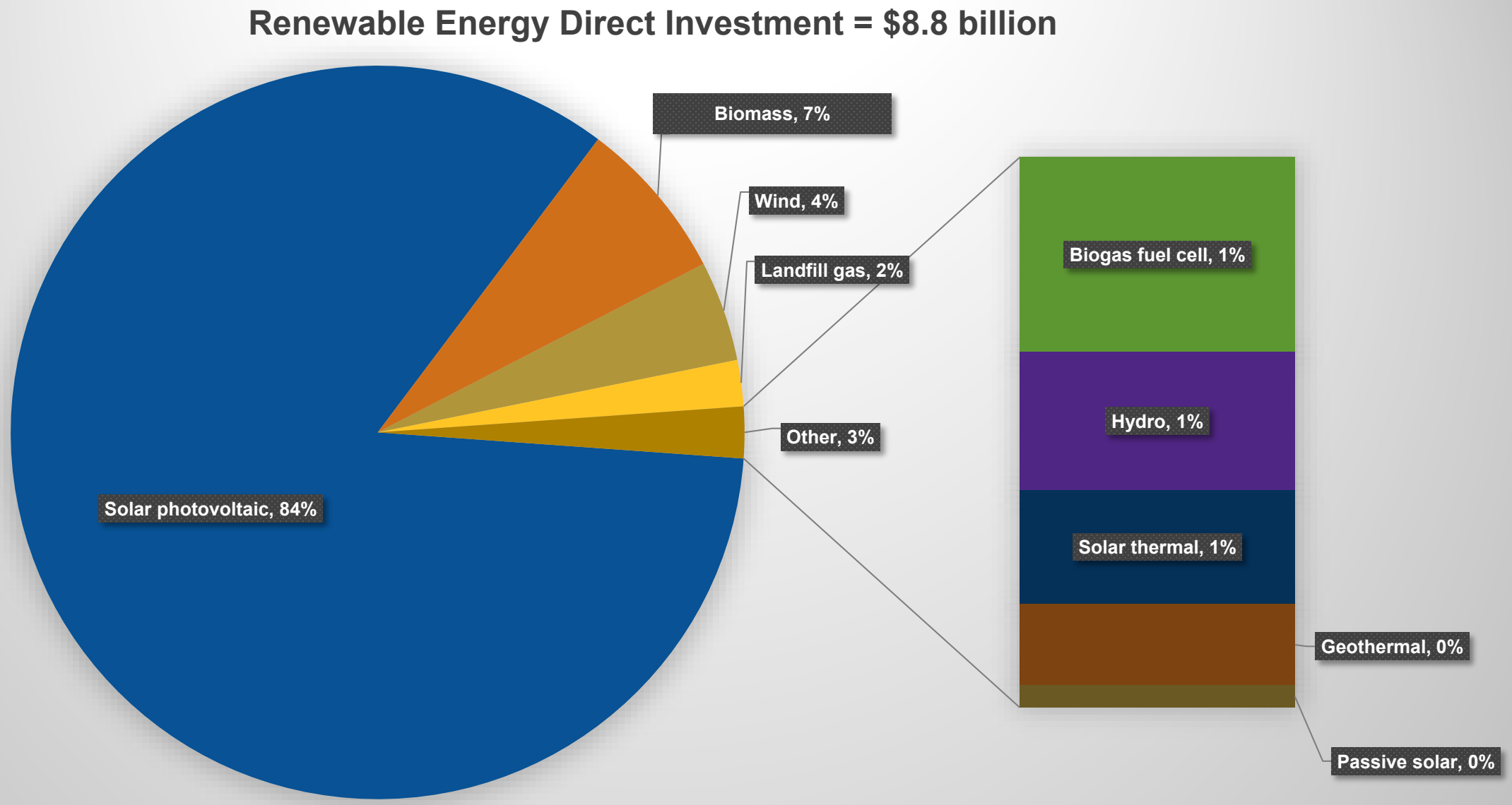


Clean Energy Investment in North Carolina, 2007-2016

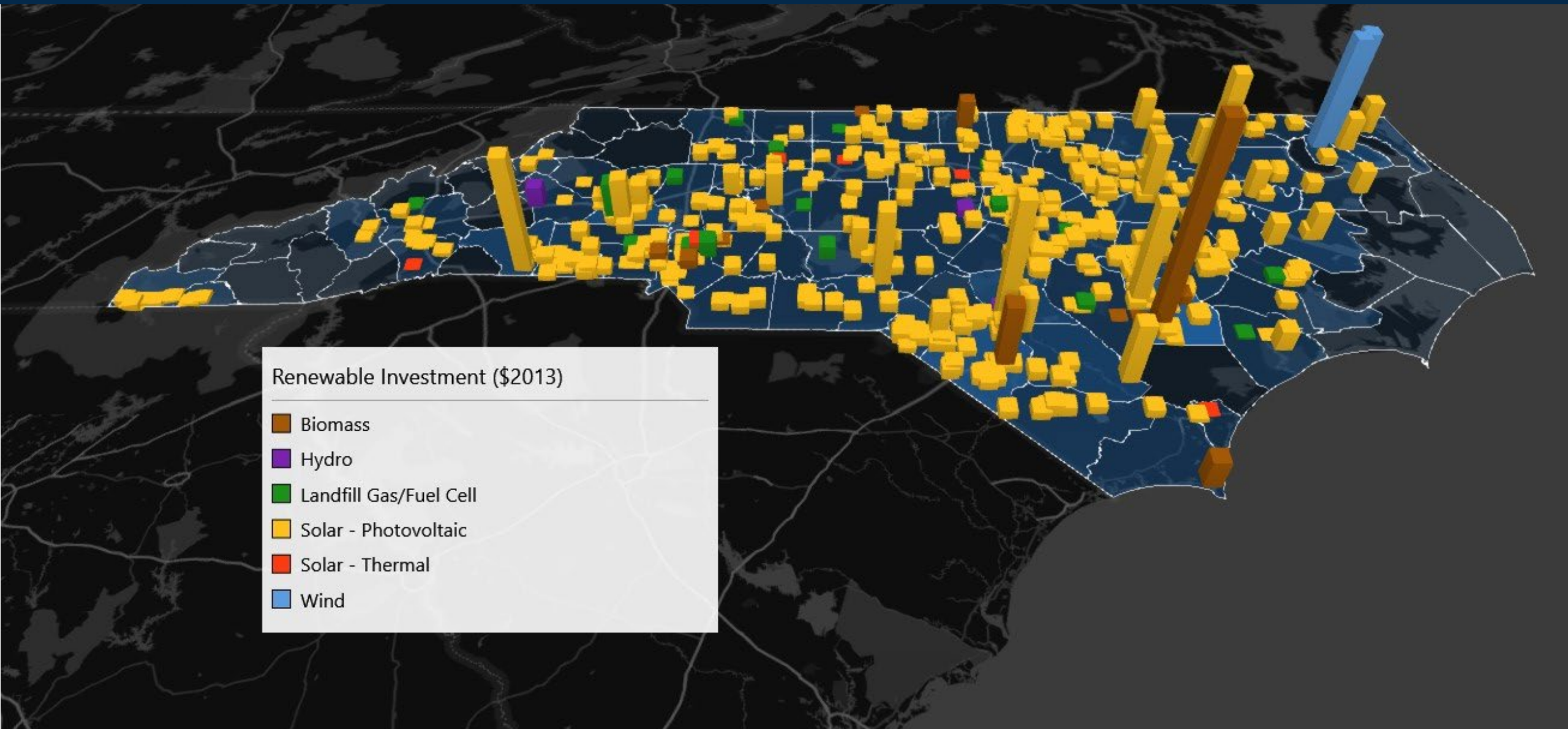


Total clean energy investment = $10 billion
Total state incentives = $612 million (~5% of investment)

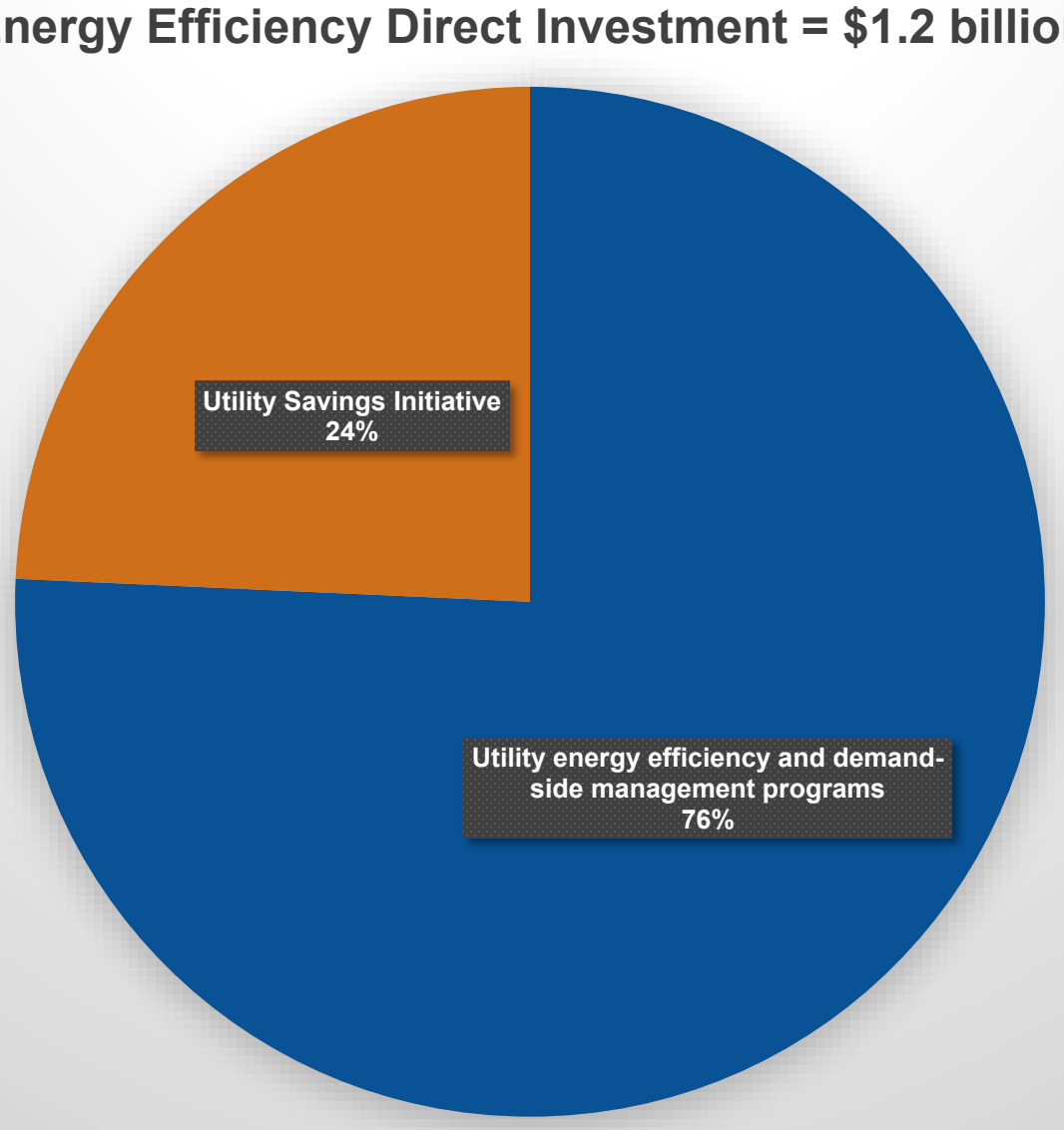
Direct Spending in Clean Energy Development by Technology, 2007–2016



Distribution of Renewable Energy Projects Valued at > $1 Million across North Carolina Counties

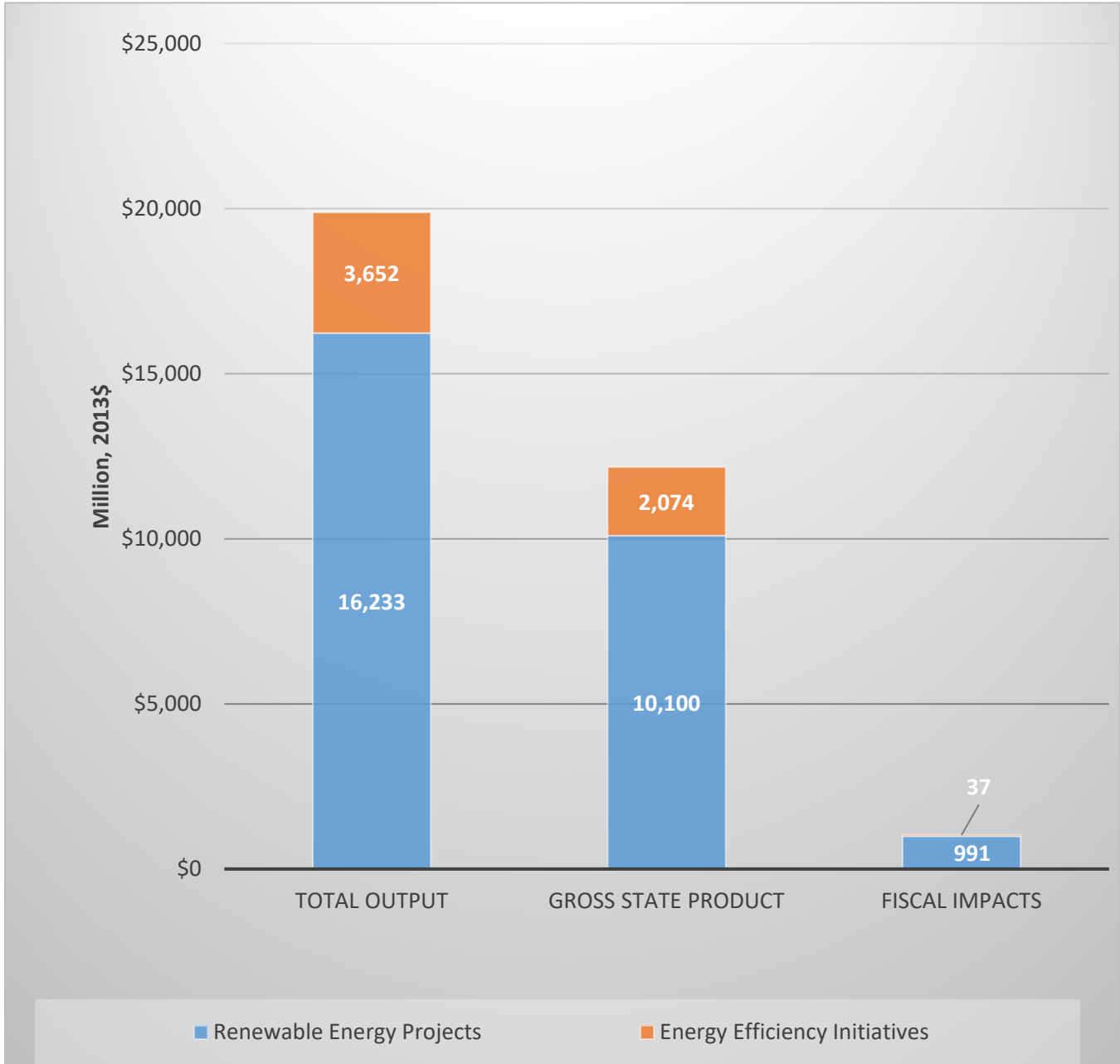


Direct Spending in Clean Energy Development by Technology, 2007–2016



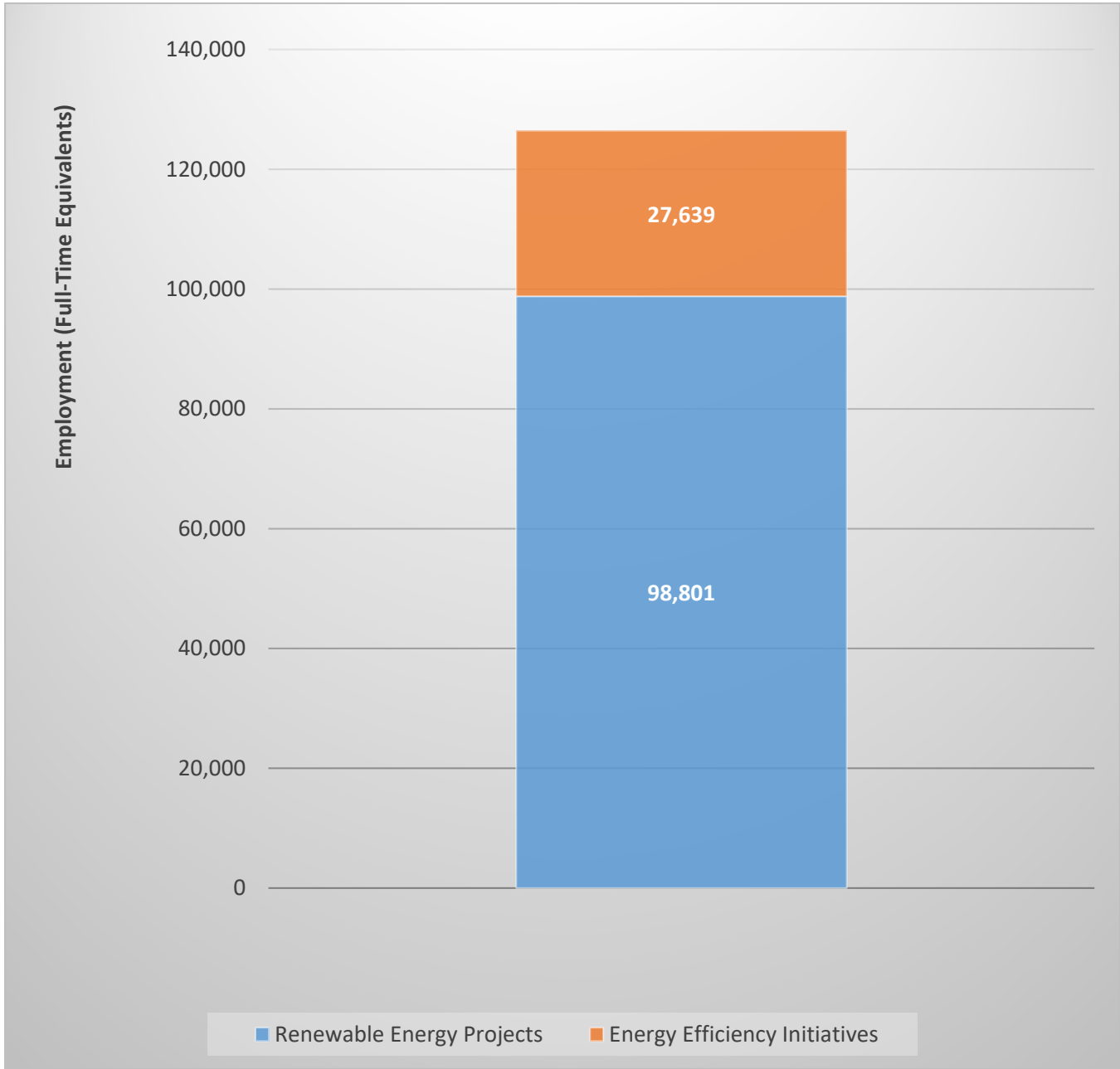
Total Economic Impacts Associated with Clean Energy Projects

- **Total output** refers to revenue received by NC individuals and businesses.
  - $19.9 billion (2007-2016)
- **Gross state product** is the total value added to state economy.
  - $12.2 billion in cumulative gross contribution to the state economy (2007-2016)

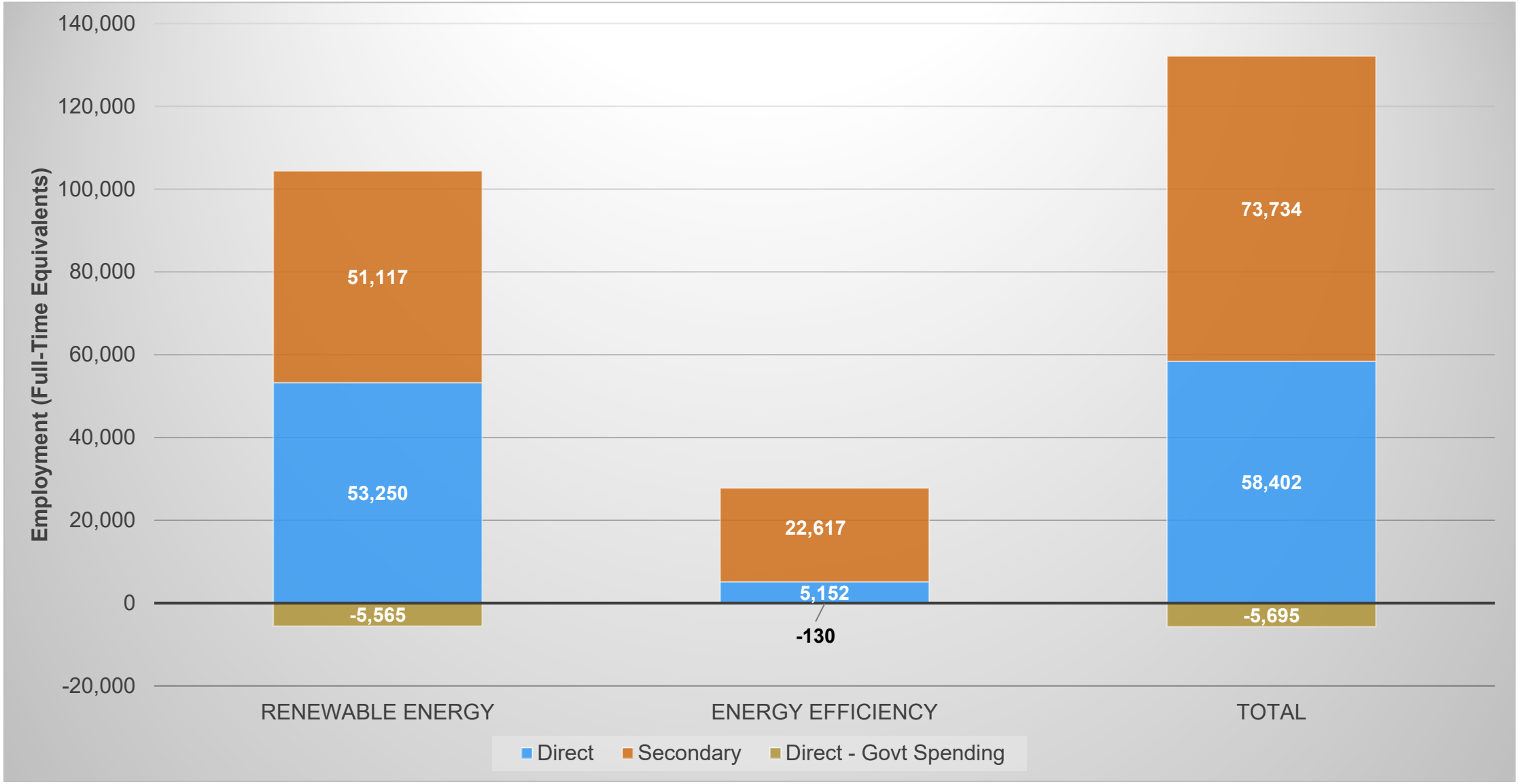


Employment Impacts, 2007-2016

- Employment impacts approximate the number of FTEs required to support the RE and EE investments.
- **126,440 cumulative FTEs** resulting from the cumulative clean energy investment in NC.
- FTE is equivalent to one person working full time for a year.
- Includes employment in:
  - Energy industries; and
  - supporting industries (e.g. service, manufacturing, EPC, transport, hospitality, etc.)



Employment Impacts in Detail



Employment Impacts and Considerations

- What is the professional skill-level required?
  - What's the mix high vs. low skilled employment across the state?
  - What's the spatial distribution of employment across the state?
  - Are there state or local policy options that promote higher paying jobs in economically disadvantaged areas?

- What labor pools are filling these jobs?
  - Existing labor force in the renewable energy industries (expanding job responsibilities for existing employees)
  - Employed workers from other industries (employment shifts, net zero increase in total employment)
  - Unemployed (net increase in total employment but at what skill-level).

- How are the relationships between output and employment changing over time?
  - Production processes may change in response to the energy efficiency initiatives, changing the relationships between output and employment.

- The ratio of in-state to out-of-state employment for may have changed over the last decade – actual employment impacts for NC may be higher or lower than modeled estimates.

More Information

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Guiding Principles

What do you and/or your organization see as the most important values for the electricity system to uphold and promote going forward?

April Presentations

- 15-minute presentations addressing five key questions
- Maximum of 8 slides that will be printed as handouts
- Presentations should:
  - Explain who was in the group and process for collaborating
  - Describe your shared understanding of the answers to these questions; but if there's not a consensus, explain the points of disagreement (or divergent opinions)

Questions for April Presentation

1. What are the group's three priority goals for participating in the Clean Energy Plan process?
2. What are some motivating factors for you, your organization, or the people your organization represents that you would like the state representatives and/or other stakeholders to understand better?
3. What is your vision of a clean energy future for North Carolina? (please state this in 1-2 sentences)
4. What three features of the existing system do you see as challenges to deployment of clean energy resources that should be addressed going forward?
5. What three features of the existing system do you want to ensure are maintained going forward to support deployment of clean energy resources?

Stakeholder Groups

1. Businesses and Corporations
2. Manufacturing Interests
3. Residents and Consumer Advocates
4. Environmental Justice Groups
5. Utilities
6. Environmental Groups
7. Higher Education
8. Local Governments
9. Distributed Energy Resource & Renewable Energy Providers and Advocates

Group Report Outs

- Groups should **discuss**:
  - What is the best way for us as individuals to reach agreement on these questions (or map our differing perspectives)?
  - How can we best coordinate between now and the April meeting?
  - Who will be responsible for organizing group calls or meetings, creating the slide deck, and presenting in the April meeting (can have three different people present)?

- At the end of this session, groups will **report out on three questions:**
  - Who is in your group? Who is your group's main point of contact?
  - What is important to your group that we'll hear more about in April?
  - What are you excited to hear from other groups in April?

Check Out

Fill in the blanks:

“To achieve XX (value), we need to…”