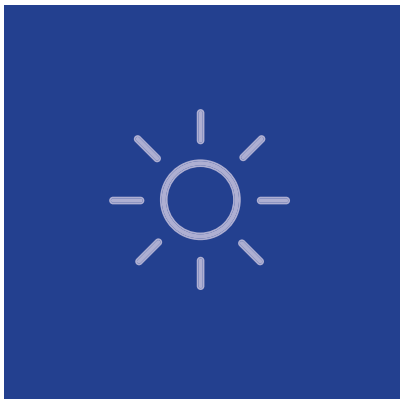
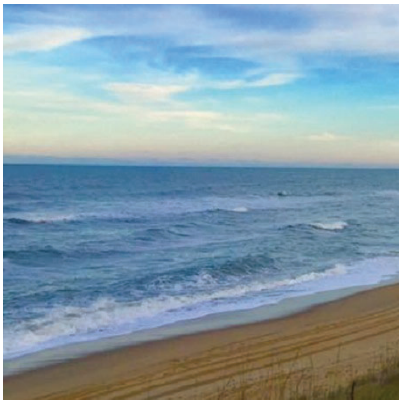
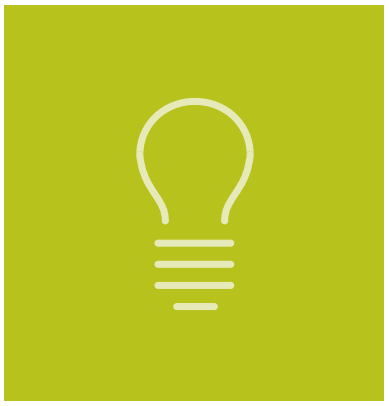
North Carolina

Clean Energy Plan

Transitioning to a 21st Century Electricity System




Policy & Action Recommendations

DRAFT REPORT

THE GREAT SEAL OF THE STATE OF NORTH CAROLINA
MAY 20, 1775
APRIL 12, 1776
ESSE QUAM VIDERI

NORTH CAROLINA
Department of Environmental Quality
DEQ
State Energy Office

A strong clean energy economy creates good jobs and a healthy environment.

Acknowledgements

This North Carolina Clean Energy Plan (CEP) is prepared by the North Carolina Department of Environmental Quality (NCDEQ) to foster and encourage the utilization of clean energy resources and the integration of those resources to facilitate the development of a modern and resilient electric grid as directed in Executive Order 80 which was signed by Governor Roy Cooper on October 29, 2018.

NCDEQ recognizes and thanks representatives of the Regulatory Assistance Project (RAP) and the Rocky Mountain Institute (RMI) for providing technical guidance and facilitation support throughout the CEP development process. Special thanks is extended to the Duke Nicholas Institute for Environmental Policy Solutions at Duke University and North Carolina Clean Energy Technology Center at NC State University for reviewing and providing feedback on drafts of the CEP. Appreciations are also extended to the North Carolina Utility Commission and the Public Staff for providing guidance and perspectives during the development of the CEP.

NCDEQ is thankful to the organizations and individuals that contributed to the development of the CEP through participation in stakeholder engagement activities. Four methods of stakeholder engagement were offered allowing organizations and individuals to contribute to the CEP including: facilitated workshops, regional listening sessions, other statewide events and online input. A complete list of the 166 organizations that participated in stakeholder engagement through these four methods is provided in the Supporting Documents.

NCDEQ is also thankful to contributors who participated in this process in special ways. These special contributors to the CEP development process include the following:

Facilitated Workshop Presenters:
North Carolina Clean Energy Technology Center, Duke Nicholas Institute for Environmental Policy Solutions, UNC Chapel Hill School of Law, Energy Production and Infrastructure Center at UNC Charlotte, North Carolina Sustainable Energy Association, North Carolina Electric Cooperatives, Advanced Energy Economy, Gridlab, Duke Energy, Resources for the Future, Environmental Defense Fund's Cities Initiative, CERES, Litz Strategies and Georgetown Climate Center, Natural Resources Defense Council and E4 Carolinas.

Facilitated Workshop Hosts:
Nature Research Center at NC Museum of Natural Sciences and NCSU's McKimmon Conference and Training Center.

Regional Listening Session Hosts:
UNC Charlotte, The Collider in Asheville, The Rocky Mount Event Center, Fayetteville State University, Western Piedmont Council of Governments in Hickory, Museum of the Albemarle in Elizabeth City, Cape Fear Community College in Wilmington, and NCA&T State University.

Energy Modeling Organizations:
Resources for the Future, Natural Resources Defense Council, NC State University, Environmental Protection Agency, Georgetown Climate Center, NC Sustainable Energy Association.

In addition, other organizations offered technical information and guidance during the development of the CEP such as National Governor's Association, U.S. Department of Energy, National Association of State Energy Officials, Virginia's Department of Mines, Minerals and Energy, Massachusetts' Department of Energy Resources, New Jersey's Department of Environmental Protection and New York State Energy Research and Development Authority.

A very special thanks to all NCDEQ staff that contributed to the development of the CEP.

Preface

This is a draft of North Carolina's Clean Energy Plan (CEP). The public comment period is open from August 16, 2019 through September 9, 2019. Comments may be submitted online at https://deq.nc.gov/cleanenergyplan.

The Clean Energy Plan was written by the Department of Environmental Quality as directed by Executive Order No. 80.[1] DEQ was tasked with the creation of a CEP to encourage the use of clean energy resources and technologies and to foster the development of a modern and resilient electricity system. The purpose of the CEP is to outline policy and action recommendations that will accomplish these goals. The CEP is made up of the main document titled *Policy and Action Recommendations* and six supporting documents.

Part 1: Energy Sector Profile and Landscape

Part 2: North Carolina's Energy Resources

Part 3: Electricity Rates and Energy Burden

Part 4: Stakeholder Engagement Process

Part 5: Energy and Emissions Modeling

Part 6: Clean Energy Jobs and Economic Outlook

The CEP uses best available data, analysis, and stakeholder input to examine what our electricity system should look like in 2030 and what values we must retain moving forward. It identifies achievable goals, proposes modern policies and strategies to achieve the goals, and identifies activities needed to adjust the regulatory framework to accommodate 21st century customer expectations, public policy goals, energy needs, economic development opportunities, and societal outcomes related to climate change.

The policies and strategies identified here are intended to provide policy makers, regulatory bodies, local governments, and others with a high-level implementation plan for achieving the goals and targets set in the CEP. When viewed collectively, these strategies should help develop a broad, clear picture of the actions North Carolina can undertake to maximize energy, economic and environmental benefits.

Promising strategies and actions will require further deeper dives and detailed analysis when considering proposing new legislation or amending existing policies and procedures. The CEP presents short term (less than 12 months), mid-term (1-3 years), and longer term (3-5) actions to ensure the State's energy needs are served in a cost-effective, reliable and sustainable manner. The longer term action (3-5 years) also consists of assessing the accomplishments made, consideration of technology advancements, and a relook at the strategies and actions to take in the future. In summary, these policies and strategies will provide stakeholders a common understanding of the vision and direction which we want to move towards.

[1] https://files.nc.gov/ncdeq/climate-change/EO80--NC-s-Commitment-to-Address-Climate-Change---Transition-to-a-Clean-Energy-Economy.pdf

Contents

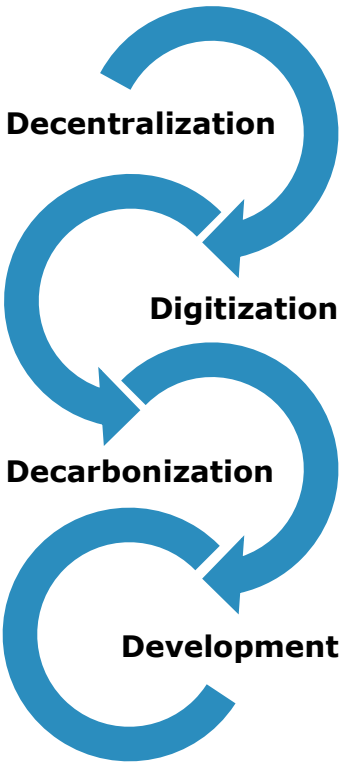
Summary

DRAFT

The Energy Revolution in Process

The energy sector is undergoing a technology revolution across the United States, and is transforming the electricity system as we know it. Similar to the rapid adoption of cell phones, personal computers, internet-based products, smart phones, and TVs, the digital age is creating advances in energy information devices, consumer products, and control technologies used to manage and operate the electric grid. Similar advancements are also occurring in energy generation, delivery, and storage systems, leading to declining costs and increased deployment rates unseen in the industry's history. Together, this transformation is enabling power generation assets and the electric grid to operate in a more efficient and closely coordinated manner. States are recognizing that market forces driving this transformation come with many benefits, but also raise challenges and concerns.

North Carolina is experiencing a power sector revolution: from widespread utility-scale solar installations, unprecedented demand for rooftop solar, the beginnings of electrified transportation, smart thermostats, emergence of microgrids, to a broad mix of energy efficiency (EE) and demand response technologies, and smarter grids. Advanced digital metering and sensors applied across the supply chain, communications networks that allow for more connected systems, and the use of big data and analytics that inform energy development and usage are creating a more diverse mix of resources and serving a variety of consumer needs. Additionally, end-users are demanding a more active role in energy choices and use, and companies are exploring innovative models to save money and produce or use energy in ways that address the challenge of climate change and other forms of pollution. These desires must be balanced with the needs of frontline communities through energy affordability, equitable access, and a just transition to the new energy economy.

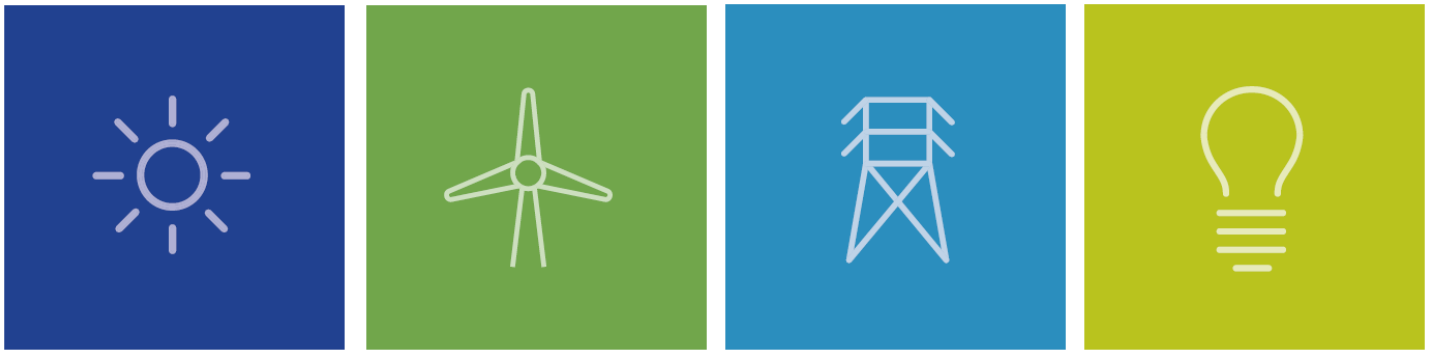


The four D's of the energy revolution

North Carolina's power system is evolving from one reliant on large-scale power plants to a bi-directional, distributed, and connected system. The resulting system will increase the diversity of participating customers, size of distributed energy resources (DERs), and the number of connected digital devices and communications. As new technologies are being adopted quickly, the change brings compelling opportunities as well as concerns and challenges that policymakers will need to address in the coming years.

North Carolina regulators and policy makers will need to adapt to a market in flux and make informed decisions regarding traditional systems on the cusp of obsolescence. Our leaders will also be called upon to create a regulatory framework, incentives, and environment that guides the market and optimizes the possibilities offered by the industry in transition. As North Carolina makes capital investment decisions for future capacity expansions, it will be important to encourage the systems that are most cost-effective yet maintain affordability, reliability, equity, grid efficiency, sustainability, and economic viability for all.

Transitioning to a 21st Century Electricity System



North Carolina's electric grid is more than one-hundred years old. It has transitioned from providing low-wattage electricity to a few incandescent lights for streets, homes and businesses to a complex system of power generation, transmission, and distribution system delivering thousands of megawatts of electricity throughout the state. Today, our electric grid serves over ten million residents through three investor owned companies (Duke Energy Carolinas (DEC), Duke Energy Progress (DEP), and Dominion Energy(DE)), 26 not-for-profit cooperatives serving members in 93 of the State's 100 counties, and more than 70 municipally-owned utilities. The electric grid has been the engine of our economy throughout the 20th century; however, according to the U.S. Department of Energy, "the grid we have today does not have the attributes necessary to meet the demands of the 21st century and beyond."[i]

Today, the demand for electricity remains flat, with 2017 electricity consumption reported at about 90 percent of the 2009 peak due to investments in EE and customer-sited distributed generation systems. The North Carolina Utilities Commission (NCUC) reported that between 2016 and 2017, electricity sales from the State's three investor owned utilities declined by 2.7 percent while the growth rate of new customers increased by 0.34 – 1.57 percent. [ii] An increasing number of customers are generating their own power, technologies are being introduced at a rapid pace, and societal priorities have emerged about addressing, mitigating and adapting to the effects of climate change. A modern grid must meet these demands and North Carolina has the capability.

With progressive energy and environmental policies and a strong history of public and private cooperation, North Carolina has positioned itself as a frontrunner in the clean energy economy space. Today, we have the highest concentration of smart grid companies in the world, are second in the nation for installed solar capacity, and are home to nearly a thousand clean energy companies in North Carolina that generate over $6.4 billion in annual revenue for our state. New technologies and opportunities continue to offer an avenue for creating additional jobs, help North Carolina be globally competitive in the new economy, and help us meet the challenges of climate change.

The rapidly changing market is disrupting the current design of the electricity system and the regulatory processes. It is also placing increasing demands on electric utilities beyond the traditional charge of maintaining safe and reliable operation. North Carolina regulators are already considering the significant shift in generation resources set to come online in the near future. The Annual Energy Outlook (AEO) for 2019 forecasts that nationally, many

existing coal plants and some natural gas plants will retire by 2025.[iii] Regulatory actions taken by several states in recent months and data from several studies indicate that this trend is occurring faster than anticipated. For example, a March 2019 report from Energy Innovation and Vibrant Clean Energy concludes that the U.S. has now reached the coal cost crossover point, where fast-falling wind and solar prices make operating 74 percent of all existing coal generation plants more expensive than building new local renewable energy with an immediate savings to customers.[iv] In the Southeast, all coal plants were found to be substantially at risk to replacement by local solar by 2025, with North Carolina found to be the state with the highest risk. Nearby, both Georgia state regulators and the TVA have recently announced retirement of uneconomical coal units and natural gas-fired combustion turbines in their states.

The opportunity to save money is available and utilities, regulators, policymakers, and other stakeholders are urged by industry experts to take a critical look at plants operating in their jurisdiction and the sources that will replace them. North Carolina will need to design policies that provide certainty in the marketplace with enough flexibility to support innovation and creativity. New technologies must lead to cost savings for customers; incentives and rate structures must keep up with the times.

Working Together to Build a Collective Vision

Polling data indicates bipartisan support in North Carolina for renewable energy policies and investments. The March 2019 Conservatives for Clean Energy survey showed that 76.7 percent respondents, including 66 percent of Republicans, 88 percent of Democrats and 71 percent of unaffiliated voters, believe solar and wind energy should be expanded to help meet North Carolina's future energy needs.[v] The same study showed that 74.7 percent of respondents believe the state needs to modernize its energy system by relying more on microgrids and renewable energy sources.[vi] North Carolina is at a crossroads in maintaining its competitive edge. The century-old regulatory framework must be adjusted to accommodate 21st century technology solutions, customer expectations, public policy goals, energy needs, economic development opportunities in urban and rural areas, and societal demands for addressing climate change. Elected officials, agencies, local governments, utilities, technology providers, consumers, businesses, and others must work together to prepare for a smooth transition, to advance innovation and to preserve the values most important to North Carolinians.

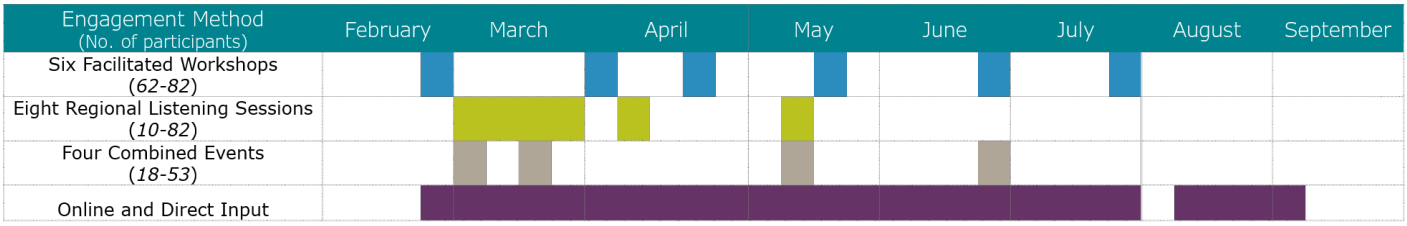
In Executive Order Number 80 (North Carolina's Commitment to Address Climate Change and Transitioning to Clean Energy Economy), Governor Roy Cooper acknowledged the state's history of leadership in education, innovation and research, and he challenged North Carolina to extend that leadership to clean energy. His executive order directed the North Carolina Department of Environmental Quality (DEQ) to develop a North Carolina Clean Energy Plan (CEP) by October 1, 2019. The CEP will encourage the utilization of clean energy resources, including EE, renewable energy (RE) such as solar, wind, and energy storage; other innovative technologies in the public and private sectors; and the integration of these resources to facilitate the development of a modern and resilient electric grid. In the development of the plan, DEQ is directed to collaborate with businesses, industries, power providers, technology developers, residents, local governments and other interested stakeholders to support the emergence of clean energy technologies, energy efficiency measures and clean transportation solutions.

Stakeholder Engagement Process

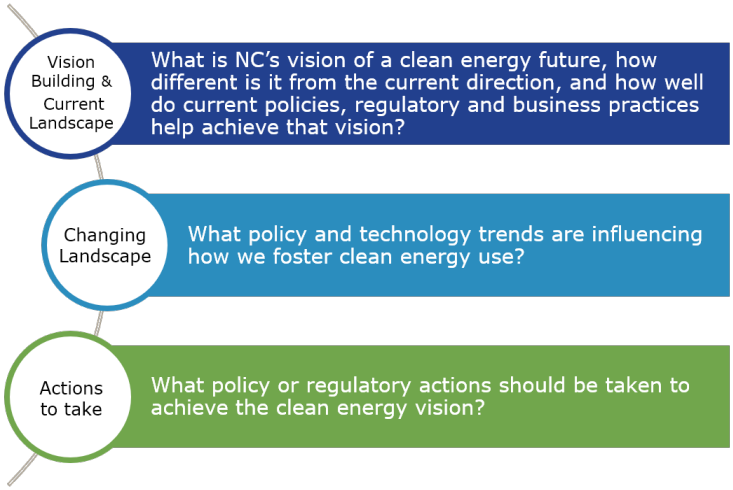
In preparation of the plan, DEQ created an open and inclusive process to engage stakeholders. DEQ sought their input to generate a series of policy recommendations that addresses the needs of North Carolina communities. Participants included elected officials, private citizens, industry groups, utilities, technology developers, businesses, non-governmental organizations, and leaders of the academic and faith communities. All of them offered solutions and a shared vision for North Carolina's energy future.

Four methods of public engagement were used to collect stakeholder feedback: (1) facilitated workshops, (2) regional listening sessions, (3) combined events with other venues, and (4) online/direct input. The process, carried out from February to July 2019, consisted of DEQ staff engaging in facilitated and open discussions with the public.

Stakeholder Engagement Timeline



Six facilitated workshops in Raleigh provided the structural framework for the CEP. The workshops were designed and executed based on successful energy planning activities conducted in other states. Technical support was provided by the internationally-recognized utility regulatory experts, Regulatory Assistance Project (RAP), and facilitation support was provided by the Rocky Mountain Institute (RMI). Each workshop was organized to obtain feedback on specific topics identified by the participants. A three-step "arc" process, illustrated here, was used to engage the stakeholders to assess the current landscape, evaluate trends, and express their own vision of North Carolina's energy future and areas for taking action. State and national experts from organizations were invited to present relevant and current information related to the twelve topic areas. Also unique in the process were the objectives to build a collective understanding of the existing system and vision, and to strengthen the stakeholders' capacity to collaborate in this work.



Stakeholder engagement themes

Stakeholder Engagement Topics

Workshop and public engagement participants shared ideas, discussed challenges and learned about a variety of topics. Topics included:

Facilitated Workshop Raleigh, NC

- **North Carolina's Electricity System**
- **Regulatory Structures and Barriers**
- **DERs and Distribution System Planning**
- **Large-Scale Renewable Energy**
- **Grid Modernization and Resilience**
- **Clean Energy's Impacts on Job Growth**
- **New Clean Energy Opportunities**
- **Evolving Regulatory Structures and Concepts**
- **Grid Modernization and Planning**
- **Energy Modeling**
- **Role of Local Governments**
- **Energy Efficiency Roadmap**
- **Energy Innovation**

Clean Energy Plan Participating Organizations

The following 164 organizations participated in the CEP development stakeholder process through workshops and listening sessions across the state.

1ROK Energy, LLC
350 Wilmington
3DFS Software-Defined Electricity
Advanced Energy
Alexander County
Alliance to Protect Our People and the Places We Live (APPPL)
Ambrose Strategy
Ameresco
Anchor QEA
API
Appalachian Energy Center
Appalachian Mountain Brewery
Appalachian State University+
Appalachian Voices+
Arjuna Capital
Blue Horizons Project
Blue Ridge Community College
Blue Ridge Public Radio
Candidate for NC House of Representatives
Cape Fear Public Utility Authority
CASE Consultants International
Cavanaugh & Associates
Center for Biological Diversity
Citizens Climate Lobby
City of Asheboro
City of Asheville
City of Charlotte
City of Durham
City of Greensboro
City of Raleigh
City of Statesville
Civil Engineers, PLLC
Clean Air Carolina
Climate Listening Project
Climate Reality Project
Council of Governments
Creation Care Alliance
CREE
DECAC
Dogwood Alliance+
Duke Energy+
Duke University
Duke University Nicholas Institute
Durham County
Dynapower
E4 Carolinas
Earth Team Jubilee Church
East Carolina University
Eastern Band of Cherokee Indians (EBCI)
Energy & Environment Innovation Foundation
Energy Innovation Task Force (ETIF)
Energy Intelligence Partners
EnerVision Battery, Inc.
Enpira
Entsorga Group
Environment North Carolina
Environmental Consultant
Environmental Defense Fund+
Environmental Stewardship Greensboro
Enviva
EQ Research
Fayetteville PWC
First Solar, Inc.
Forge Greensboro
Forsyth Tech Community College
Franklin Energy
French Broad River Garden Club
Green Form
Green Saves Green
GreenGo Energy UC, Inc.
Henderson County
Henderson County Democratic Party
Hometown Strong
Ingersoll Rand
Intelli-Products, Inc.
International Brotherhood of Electrical Workers
Interstate Renewable Energy Council
KPMJ
Land of Sky Clean Vehicles Coalition
Land of Sky Regional Council
LaPlaca and Associates, LLC
Mars, Inc.
Mathis Consulting
Mayor of Elizabeth City
Mecklenburg County Air Quality (MCAQ)
Middle Sound Lookout
Mooresville Hydrail Initiative
Mountain Xpress
National Association of Energy Service Companies (NAESCO)
National Hurricane Center
Natural Resource Defense Council
Natural Resources Defense Council (NRDC)
NC A&T State University+
NC Aquariums
NC Biotechnology Center+
NC Building Performance Association
NC Business Council
NC Clean Energy Business Alliance (NCCEBA)+
NC Clean Energy Technology Center
NC Climate Solutions Coalition
NC Conservation Network
NC Department of Commerce
NC Division of Air Quality
NC Electric Membership Cooperatives
NC Environmental Justice Network
NC House of Representatives

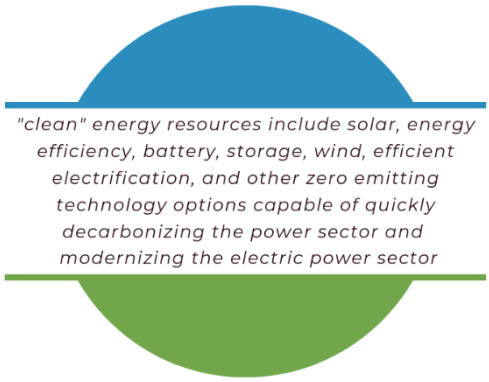
NC Institute for Climate Studies (NCICS)
NC Interfaith Power & Light
NC Justice Center
NC League of Conservation Voters
NC Manufacturers Alliance
NC State AFL-CIO
NC State Climate Office
NC State University+
NC Sustainable Energy Association (NCSEA)
NC WARN
NCUC Public Staff
New Belgium Brewing
New Castle Community Schools
Orange County Commission for the Environment
Orsted
Ovanova
Private Citizens+
Research Triangle Cleantech Cluster
Rivendell Farms
RM Radical Justice Group
SAS Institute, Inc.
Schneider Electric
Self-Help Credit Union and Ventures Fund
Shaklee
Siemens Industry, Inc.
Sierra Club+
Sierra Nevada Brewing Company
South Wings
Southeast Energy Efficiency Alliance
Southeastern Wind Coalition
Southern Alliance for Clean Energy
Southern Environmental Law Center (SELC)+
Southern Forests Conservation Coalition
Sunrise Movement+
Sustainability Advisory Committee on Energy and the Environment
Temple Emmanuel Environmental Movement
The Daily Advance
The Lilies Project
The Nature Conservancy
Town of Carrboro
Town of Cary
Triangle J Council of Governments
UNC Asheville
UNC Chapel Hill
UNC Chapel Hill School of Law
UNC Charlotte
UNC Charlotte EPIC
UNC Greensboro
Unilever
Upper Coastal Plain Council of Governments
US Environmental Protection Agency
US Fish and Wildlife Service
Volvo Technology of America+
Wake Forest University
Waste Reduction Partners
Western Carolina University
Western Piedmont Council of Governments
Williams
Wilson Community College
WNC Renewables Coalition+
Women Organizing for Wilmington

Workshop Presenters:
Advanced Energy Economy
CERES
Duke Energy
Duke University Nicholas Institute
EDF Cities Initiative
E4 Carolinas
Georgetown Climate Center
GridLab
NC Electric Cooperatives
NCSU Clean Energy Technology Center
NCSEA
NRDC
Resources for the Future
RTI International
UNC-Charlotte EPIC
UNC-Chapel Hill
UNC-Chapel Hill School of Law

*bolded names indicate workshop participation
+ Workshop and regional listening session participant

Stakeholder Views, Values and Vision

Throughout the stakeholder engagement process, the participants dedicated significant amounts of time and effort to voice their opinions and to bring new ideas to the discussion. They provided input on what direction North Carolina should take, and what the energy system should look like in 2030 and beyond. They focused the conversation on science, data and the values we must prioritize moving forward.



The stakeholders expressed a desire to be bold, to promote environmental justice and to ensure that the benefits of clean energy are enjoyed by every community in North Carolina. Their views on the current electricity system, priorities for the future system, and the clean energy vision are illustrated below.

VIEWS

Views of the way the current energy and regulatory system works

Successes

- Grid reliability
- Affordability
- Forward looking State policies
- Grid safety
- Past incentives for RE and EE
- Innovation
- Investments in smart grid technologies
- Regional leader in solar energy growth
- Investments in net metering

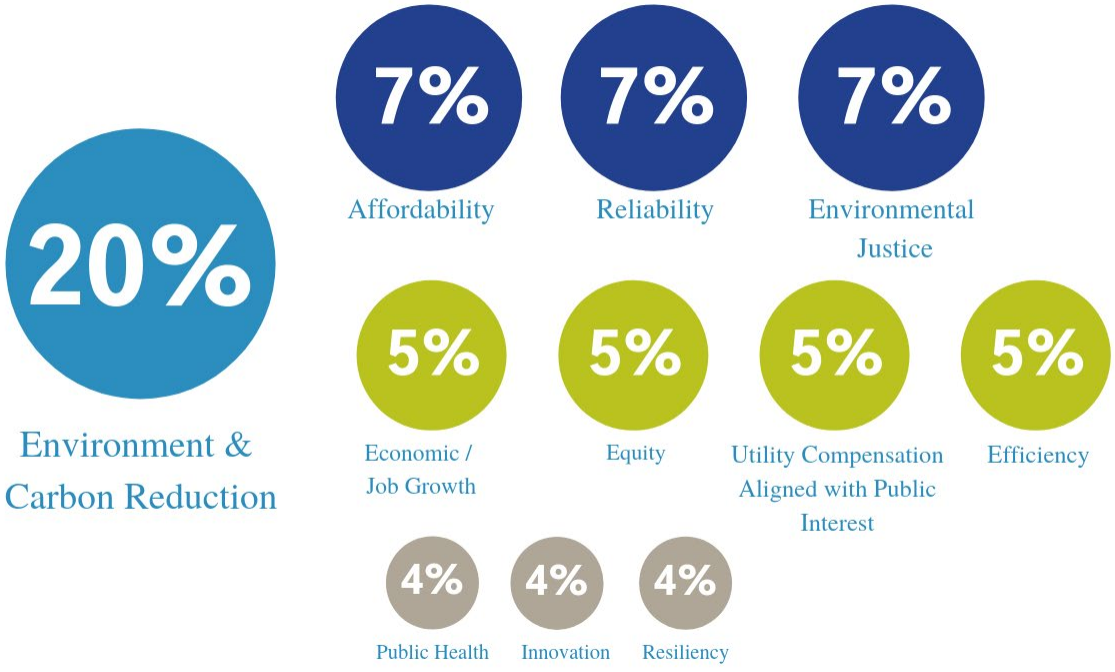
Challenges

- Lack of third party sales
- RE is unable to compete as least cost generation options due to integrated resources planning process (or cost-effectiveness tests)
- Limited financing options for RE and EE investments
- IRP process results in stranded assets
- Long interconnection delays and extensive administrative burden
- Lack of comprehensive energy planning process for generation, transmission and distribution investments
- Lack of transparency to customers
- Disproportionate energy cost and environmental burden to historically disadvantaged communities
- Expensive and complicated RE procurement process
- Decreasing market access
- Urgency to reduce carbon emissions and address impacts of climate change
- Misalignment between utility incentives and public desire for clean and zero carbon energy
- Important changes require legislators to work together to meet people's needs
- Unequitable access to clean energy

VALUES

Stakeholders provided input about key values around which a new electricity system should be centered going forward. Responses were submitted by 459 individuals across all engagement events, who were asked to rank their top three values from a list of 27. Participants emphasized community and social values in many comments and points of discussion during public engagement events, and stressed the need for a CEP that addresses decarbonization of the electricity sector. There was overwhelming consensus around the Environment and Carbon Reduction value; it was ranked in the top three values in all submitted surveys from all events. This value was prioritized by all sectors that were involved in the stakeholder process, including business groups, manufacturing, environmental organizations, educators, and members of the public. Affordability and Reliability were also of high priority to participants.

Values to prioritize going forward

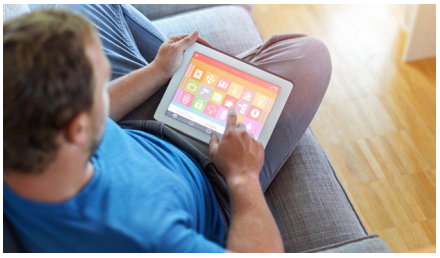


THE VISION

FOR NORTH CAROLINA'S ENERGY FUTURE

The vision of NC's energy future is a system that is clean, equitable, modern, resilient, and efficient, in addition to being safe, affordable, and reliable.

Increase deployment of both grid scale and distributed energy resources such as solar, energy efficiency, battery storage, wind, electrification, and other innovative technology solutions



Give customers more options and control over their energy use and supply

Provide equitable access to renewable energy and energy efficiency opportunities, and offers fair rates for these services.

To help acheive this vision, NC's energy policy and regulations should work toward an integrated energy system that:

Properly incentivizes the utilities, independent powerproducers, and consumers to make this vision a reality

Recognizes the combined benefits of bidirectional flow of energy between the central grid and distributed energy resources

Serves as a catalyst for innovation, newbusiness development, and economic growth in all parts of the state

Invests and retains capital in local communities, createsworkforce of the 21st century, and justlytransitions to clean energy jobs

Strengthens our resiliency to natural threats and decarbonizes the electronic power sector

Policy and Action Recommendations

The CEP examines a time horizon of about ten years, with an outlook to 2030. This period was selected because the availability of technologies and energy resources are generally well known, and market trends can be reasonably predictable. The uncertainty of forecasts increases greatly beyond ten years; it is recommended that a similar planning process be carried out in periodic intervals in the future (e.g., every 3-5 years) as new technologies are developed, cost information is updated, and results of past actions can be evaluated to chart potential paths to take in the future.

The policies and action recommendations identified here are intended to provide policy-makers, regulatory bodies, local governments, higher education entities, and the private sector with a high-level implementation plan for achieving the long-term goals and performance measure targets listed below. The recommendations generally represent the collective input of stakeholders from a wide range of perspectives. When viewed collectively, these strategies should help develop a clear picture of the steps that can be taken to maximize the economic and environmental benefits of clean energy. Decision-makers should use these strategies to inform their policy agendas and their investments. In summary, the CEP serves as a playbook of viable energy policies, and a roadmap to where North Carolina wants to go.

This policy and action recommendations section includes: goals, priority recommendations, and an overview of the five strategy areas, including a detailed look at each area. Each recommendation within the strategies includes a proposed timeline for implementation based on the action schedule.

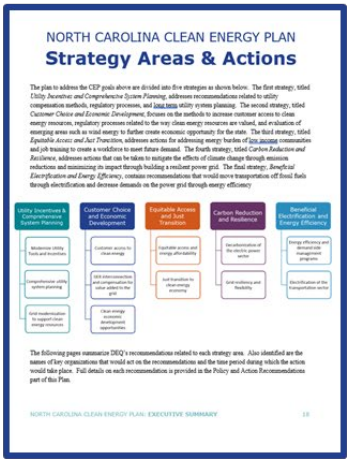
Goals

+

Priority Recommendations

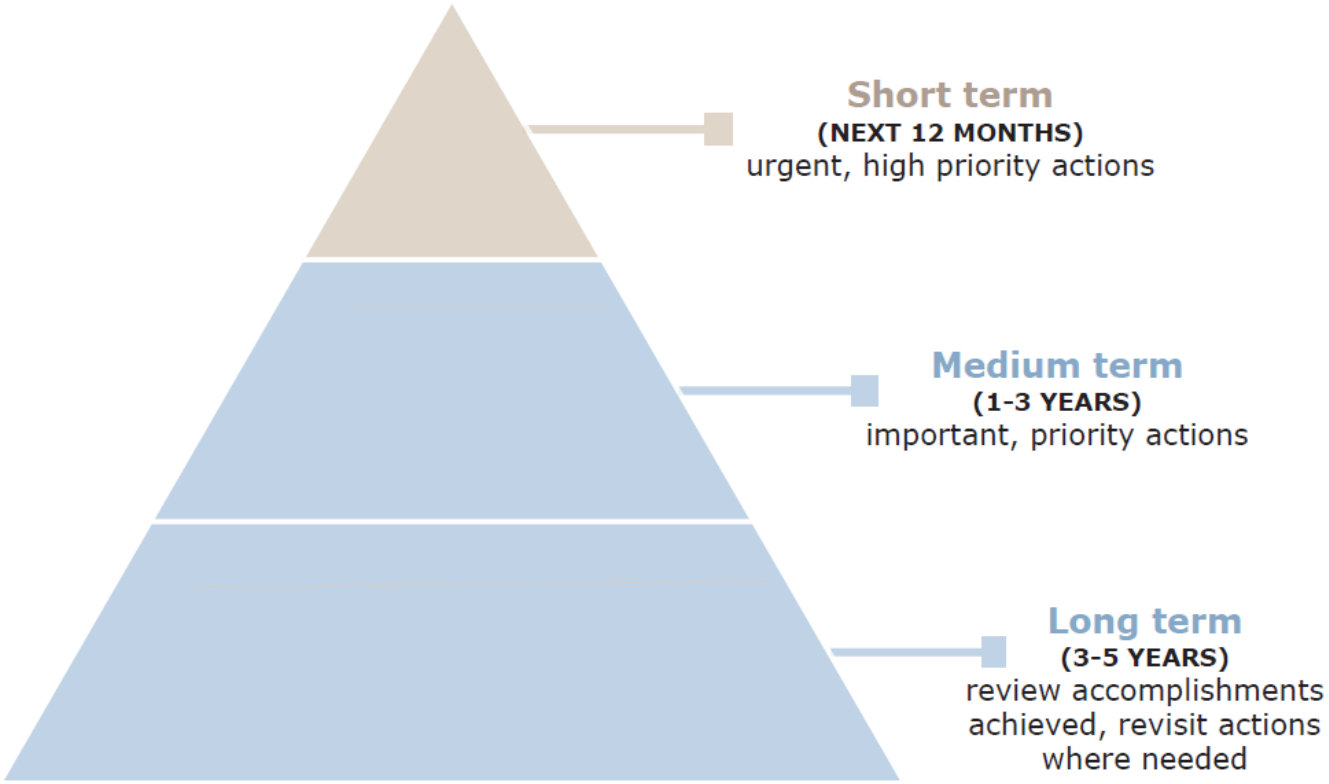
+

Five Strategy Areas & Actions



Action Schedule

The CEP presents short-term (less than 12 months), mid-term (1-3 years), and longer-term actions (3-5 years) to work towards the goals identified above. These timelines serve as indicators of priority items and activities that need to occur before related action(s) can take place. Short term actions are considered essential to enable other positive outcomes to occur and are within the existing ability or authority of the implementing organization. Medium term actions are as important but may take longer to initiate or implement. Actions designated long term are based on the recognition that some of these actions may take several years to take effect due to the level of complexity, difficulty or authority needed to implement. The longer-term actions also consist of assessing accomplishments, considering what new technologies are on the horizon, and revisiting the strategies and actions to take in the future. We recognize that public and private entities called upon to lead some of these actions have many other priorities and busy work loads. It is our intent that they see value in these recommendations and work towards integrating them into existing and future planned activities within their organizations.



NORTH CAROLINA CLEAN ENERGY PLAN

GOALS

Accelerate clean energy innovation, development and deployment to create economic opportunities for both rural and urban areas of the state.

Foster long-term energy affordability and price stability for North Carolina's residents and businesses by modernizing regulatory and planning processes.

By 2030, reduce electric power sector greenhouse gas emissions between 60% and 70% below 2005 levels and work towards zero emissions by 2050.

NORTH CAROLINA CLEAN ENERGY PLAN

PRIORITY RECOMMENDATIONS

MODERNIZE THE UTILITY INCENTIVES AND TOOLS

Launch a stakeholder process to inform future policymaking around tools that better align utility incentives with public interest, state energy and carbon policy, and grid needs, and state energy and carbon policy.

ADDRESS EQUITABLE ACCESS AND ENERGY AFFORDABILITY

Include non-energy equity-focused costs and benefits in decisions regarding resource needs, program design, cost-benefit analyses, and facility siting.

DECARBONIZE THE ELECTRIC POWER SECTOR

Set North Carolina electricity sector carbon reduction goals in policy and legislation.
Conducta comprehensive study on the most cost-effective pathways to reach NC's goals.

REQUIRE COMPREHENSIVE UTILITY SYSTEM PLANNING PROCESSES

Establish comprehensive utility system planning process that connects resource, transmission, and distribution planning in a holistic, iterative and transparent process that involves stakeholder input throughout.
Expand cost-benefit methodologies used to make decisions about resources and programs to include societal and environmental factors

FACILITATE DISTRIBUTED ENERGY RESOURCES (DER) INTERCONNECTION AND COMPENSATE THEM FOR VALUES PROVIDED TO THE GRID

Develop rates that provide accurate price signals to demand-side resources about costs and value to the grid.
Establish new rate and compensation structures for DERs based on the value of grid services that can be provided by DERs.

INCREASE USE OF ENERGY EFFICIENCY AND DEMAND-SIDE MANAGEMENT

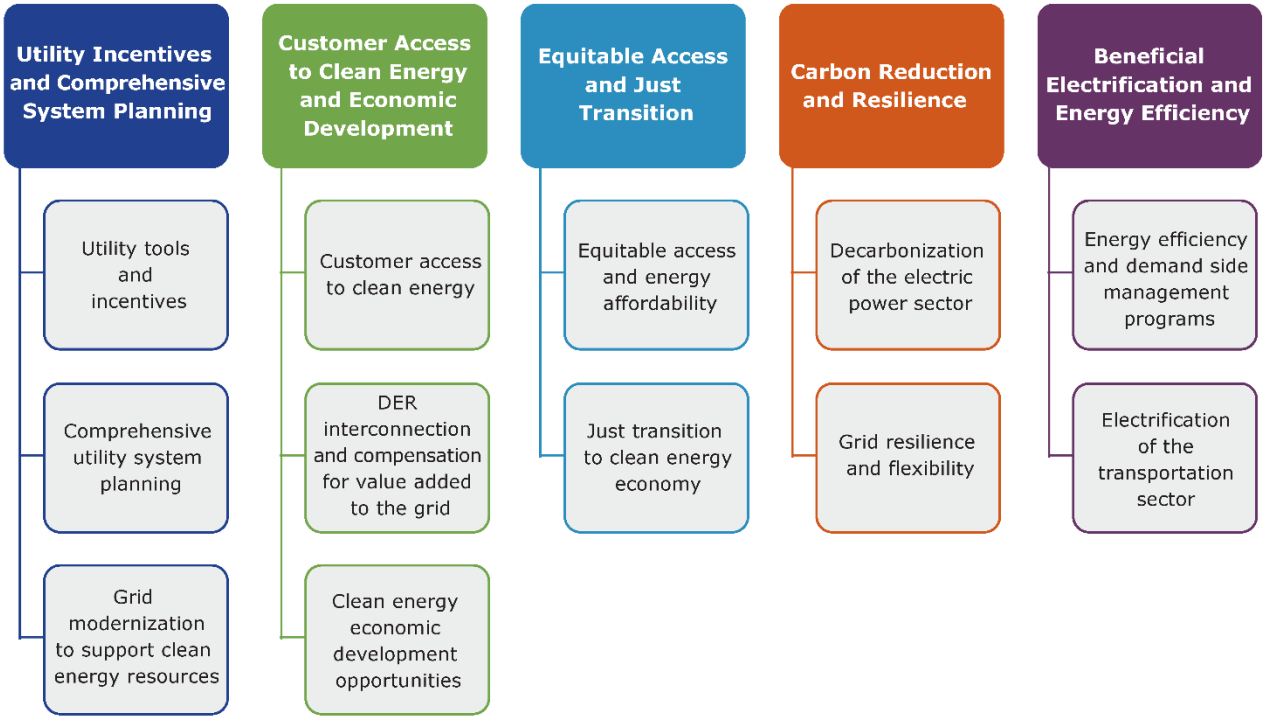
Establish an Energy Efficiency Advisory Council to oversee implementation of the EE Roadmap recommendations

ELECTRIFY THE TRANSPORTATION SECTOR

Require utilities to develop innovative rate design pilots for electric vehicles to encourage off-peak charging and to test effectiveness of different rate structures at shifting customer usage of the grid and encouraging the adoption of electric vehicles.

Strategy Areas & Actions

The plan to address the CEP goals above are divided into five strategies as shown below. The first strategy, titled *Utility Incentives and Comprehensive System Planning*, addresses recommendations related to utility compensation methods, regulatory processes, and long-term utility system planning. The second strategy, titled *Customer Access to Clean Energy and Economic Development*, focuses on the methods to increase customer access to clean energy resources, regulatory processes related to the way clean energy resources are valued, and evaluation of emerging areas such as wind energy, to further create economic opportunity for the state. The third strategy, titled *Equitable Access and Just Transition*, targets actions for addressing energy burden of low income communities and job training to create a workforce to meet future demand. The fourth strategy, titled *Carbon Reduction and Resilience*, addresses actions that can be taken to mitigate the effects of climate change through emission reductions and minimizing its impact by building a resilient power grid. The final strategy, *Beneficial Electrification and Energy Efficiency*, contains recommendations that would move the transportation sector from fossil fuels to electrification and decrease demands on the power grid through energy efficiency



The following pages summarize DEQ's recommendations related to each strategy area. Also identified are the names of key organizations suggested to act on the recommendations and the time period during which the action would take place. Full details on each recommendation is provided in the Policy and Action Recommendations part of this Plan.

Strategy Areas & Actions

Utility Incentives & Comprehensive System Planning

Utility Incentives and Comprehensive System Planning

A. Utility Tools and Incentives

- **A-1** Launch a stakeholder process to inform future policymaking around policies and tools that better align utility incentives with public interest, grid needs, and state energy and carbon policy including (but not limited to):
  - Multi-year rate plans,
  - Revenue decoupling,
  - Shared savings mechanisms,
  - Performance incentive mechanisms,
  - Tools to accelerate retirement of uneconomic generation assets, and
  - New procurement practices/models to incentivize least cost procurement, including non-wires alternatives.
- **A-2** Encourage use of pilot programs or other methods for testing and evaluating components of a performance-based regulatory framework.
- **A-3** Initiate a study on the potential costs and benefits of different options to increase competition in electricity generation, including but not limited to joining an existing wholesale market and allowing retail energy choice.

B. Comprehensive utility system planning

- **B-1** Establish comprehensive utility system planning process that connects resource, transmission, and distribution planning in a holistic, iterative and transparent process that involves stakeholder input throughout, starting with a Commission-led investigation into desired elements of utility distribution system plans.
- **B-2** Expand cost-benefit methodologies used to make decisions about resources and programs to include societal and environmental factors.
- **B-3** Implement competitive procurement of resources by investor-owned utilities.

C. Grid modernization to support clean energy resources

- **C-1** When evaluating proposals for grid modernization, consider whether the following outcomes are supported:
  - Proven net benefits for all proposed investments, including presentation of all costs and benefits used in utility analyses
  - Enhanced transparency of regionally appropriate DERs, grid needs and opportunities for DERs to interconnect
  - Increased customer access to their usage data and sources of energy
  - Facilitation of greater utilization of storage, demand-side resources, grid operation/management devices, and the bi-directional flow of power
  - Measurement of performance to ensure anticipated benefits are delivered and accounted for
- **C-2** Use comprehensive utility planning processes to determine the sequence, needed functionality, and costs and benefits of grid modernization investments. Create accountability by requiring transparency, setting targets, timelines and metrics of progress made toward grid modernization goals.

SHORT TERM MEDIUM & LONG TERM

Strategy Area		Recommendation	Legislature	Utilities Commission	Governor's Office	State Agencies	IOU	CO-OPs / Public Utilities	Local Government	Academia	Businesses
Utility Incentives and Comprehensive System Planning	A. Modernize utility tools and incentives	A-1	●		●						
		A-2		●			●				
		A-3	●								
	B. Require comprehensive utility system planning processes	B-1		●		●	●	●	●	●	●
		B-2		●				●			
		B-3		●							
	C. Modernize the grid to support clean energy resources	C-1		●				●			
		C-2		●				●			

Strategy Areas & Actions

Customer Access to Clean Energy & Economic Development

Customer Access to Clean Energy and Economic Development

D. Customer access to clean energy

- D-1: Consider revisions to clean energy programs authorized by HB 589 to ensure successful delivery of desired outcomes, such as increasing customer access to renewable energy.
- D-2: Enact a statewide commercial Property Assessed Clean Energy (PACE) and Pay as You Save Program
- D-3: Develop a green energy bank or statewide clean energy fund to catalyze the development and expansion of clean energy markets by connecting private capital with clean energy projects.
- D-4: Require utilities to offer virtual or group net metering to enable greater access to community solar.
- D-5: Increase the existing Renewable Energy and Energy Efficiency Portfolio Standard (REPS) or create a new policy with zero-emitting resource targets without carve-outs for specific resources.

E. DER interconnection and compensation for value added to the grid

- E-1: Develop rates that provide accurate price signals to demand-side resources about costs and value to the grid, such as Time of Use (TOU) or real time pricing. Establish new rate and compensation structures for DERs based on the value of grid services that can be provided by DERs, such as a "value of DER" tariff.
- E-2: Consider ways to provide greater transparency of system constraints and optimal locations for distributed resources.

F. Clean energy economic development opportunities

- F-1: Create and foster statewide and regional offshore wind collaborative partnerships with industry, the public, stakeholders, and neighboring states to bring economic growth to NC.
- F-2: Conduct an assessment of offshore wind supply chain and ports and other transportation infrastructure to identify state assets and resource gaps for the offshore wind industry.

SHORT TERM MEDIUM & LONG TERM

Strategy Area		Recommendation	Legislature	Utilities Commission	Governor's Office	State Agencies	IOU	CO-Ops / Public Utilities	Local Government	Academia	Businesses
Customer Access to Clean Energy and Economic Development	D. Enable customers to choose clean energy	D-1	●								
		D-2	●				●	●			
		D-3			●				●	●	
		D-4	●								
		D-5	●								
	E. DER interconnection and compensation for value added to the grid	E-1		●				●			
		E-2		●							
	F. Clean energy economic development opportunities	F-1			●	●	●		●	●	●
		F-2				●			●		●

Strategy Areas & Actions

Equitable Access & Just Transition

Equitable Access and Just Transition

G. Equitable access and energy affordability

- G-1: Include non-energy equity-focused costs and benefits in decisions regarding resource needs, program design, cost-benefit analyses, and facility siting.
- G-2: Examine the feasibility and proper design of a low-income rate class and associated rate structures, including but not limited to the elimination or reduction of fixed charges for ratepayers with high energy burdens.
- G-3: Expand energy efficiency and renewable energy programs specifically targeted at underserved markets and low-income communities.

H. Just transition to clean energy economy

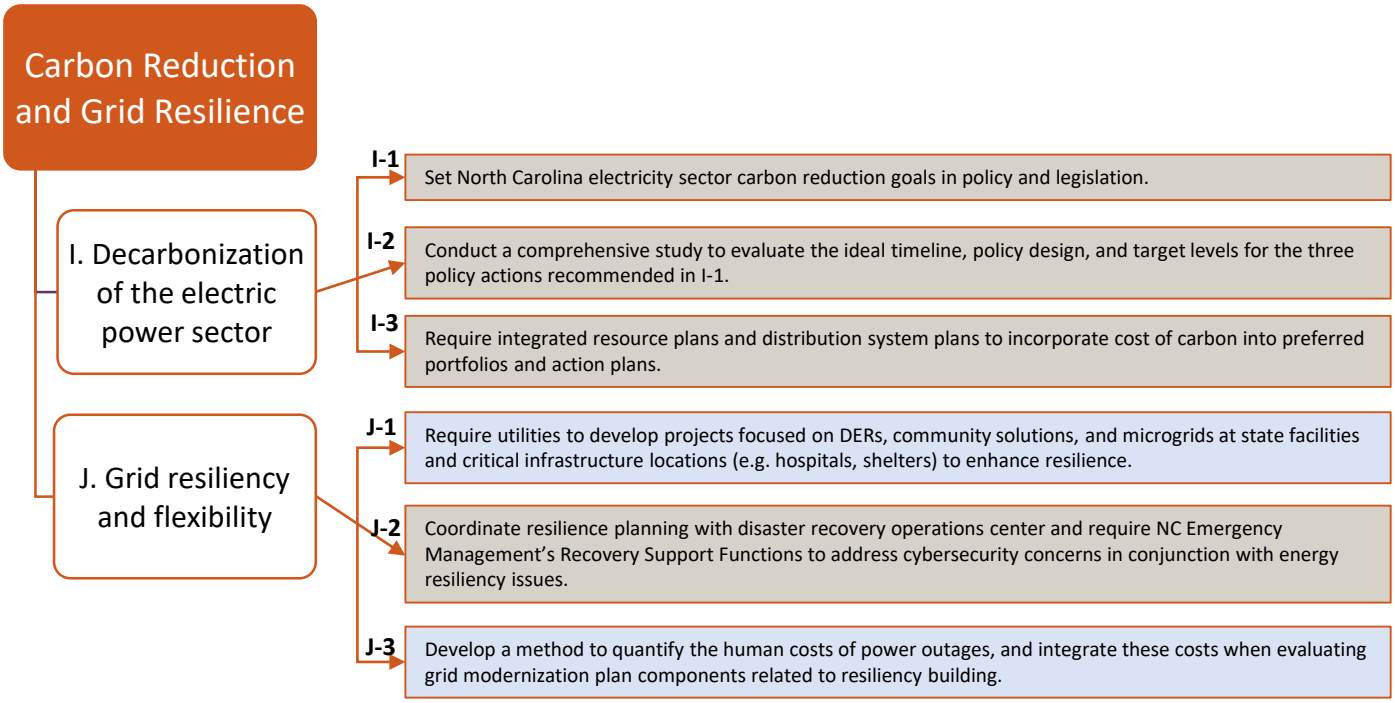
- H-1: Ensure inclusion and meaningful involvement of historically marginalized individuals (people of color and people living in poverty) in decision-making regarding siting generation assets and implementing programs that would affect their rates, health, and access to clean energy and energy efficiency opportunities.
- H-2: Launch an EE Apprenticeship program within Apprenticeship NC to expand access to clean energy careers.
- H-3: Create long term jobs with family sustaining wages and benefits in renewables and grid infrastructure industries for low income communities and workers displaced by a clean energy economic transition.

SHORT TERM MEDIUM & LONG TERM

Strategy Area		Recommendation	Legislature	Utilities Commission	Governor's Office	State Agencies	IOU	CO-OPs / Public Utilities	Local Government	Academia	Businesses
Equitable Access and Just Transition	G. Address equitable access and energy affordability	G-1		●		●	●	●	●		
		G-2			●						
		G-3	●			●	●				
	H. Foster a just transition to clean energy	H-1		●	●	●					
		H-2								●	
		H-3	●		●	●	●	●	●	●	●

Strategy Areas & Actions

Carbon Reduction & Grid Resilience



Strategy Area		Recommendation	Legislature	Utilities Commission	Governor's Office	State Agencies	IOU	CO-Ops / Public Utilities	Local Government	Academia	Businesses
Carbon Reduction and Grid Resilience	I. Decarbonize the electric power sector	I-1	●								
		I-2				●				●	
		I-3		●			●			●	
	J. Strengthen the resilience and flexibility of the grid	J-1		●		●	●	●	●		
		J-2		●		●	●	●			
		J-3		●		●				●	

Strategy Areas & Actions

Energy Efficiency & Beneficial Electrification

Energy Efficiency and Beneficial Electrification

K. Energy efficiency and demand side management programs

- K-1: Establish an Energy Efficiency Advisory Council (EEAC) to oversee implementation of the EE Roadmap recommendations.
- K-2: Enable access to customer data through new functionality such as "download my data" for electric utilities.
- K-3: Establish minimum EE goals within existing REPS.
- K-4: Enhance education and awareness around energy efficiency opportunities in K-12 schools and community colleges through an "Energy Efficiency Everywhere (E3)" project.
- K-5: Require utilities to develop innovative rate design pilots to encourage customer behavior that helps achieve clean energy goals, such as peak demand reduction, better utilization of renewable resources, and strategic storage deployment.
- K-6: Update the NC Building Code for increased energy efficiency, renewable energy, and transportation electrification.

L. Electrification of the transportation sector

- L-1: Require utilities to develop innovative rate design pilots for electric vehicles to encourage off-peak charging of vehicles and to test effectiveness of different rate structures at shifting customer usage of the grid and encouraging the adoption of electric vehicles.
- L-2: Conduct an analysis of the costs and benefits of using electrification to reduce energy burden and GHG emissions in consumer end-use sectors in NC, such as in homes, buildings, transportation and agricultural operations.

SHORT TERM MEDIUM & LONG TERM

Strategy Area		Recommendation	Legislature	Utilities Commission	Governor's Office	State Agencies	IOU	CO-Ops / Public Utilities	Local Government	Academia	Businesses
Energy Efficiency and Beneficial Electrification	K. Increase use of energy efficiency and demand side management programs	K-1			●						
		K-2	●	●		●	●	●			
		K-3	●								
		K-4								●	
		K-5		●				●			
		K-6	●								
	L. Create strategies for electrification	L-1		●				●			
		L-2								●	

[i] U.S. Department of Energy, Grid Modernization Multi-Year Program Plan, https://www.energy.gov/grid-modernization-initiative

[ii] North Carolina Utilities Commission, Major Activities Through December 2018 With Statistical and Analytical Data Through 2017, Volume XLIX, 2018 Report.

[iii] Annual Energy Outlook 2019, Energy Information Administration, https://www.eia.gov/outlooks/aeo/

[iv] The Coal Cost Crossover: Economic Viability of Existing Coal Compared to New Local Wind and Solar Resources. Vibrant Clean Energy and Energy Innovation, March 2019. https://vibrantcleanenergy.com/wp-content/uploads/2019/03/LCOE-Mapping/Coal-Cost-Crossover_Energy-Innovation_VCE_FINAL2.pdf

[v] Conservatives for Clean Energy (2019). Retrieved from https://www.cleanenergyconservatives.com/wp-content/uploads/2019/02/Clean-Energy-March-Presentation-Final.pdf

[vi] Conservatives for Clean Energy (2019). Retrieved from https://www.cleanenergyconservatives.com/wp-content/uploads/2019/02/Clean-Energy-March-Presentation-Final.pdf

Policy & Recommendation Detailed Report

DRAFT

1. Introduction

1.1 North Carolina's Current and Anticipated Energy Landscape

The electricity consumed in North Carolina homes, businesses, and industries is mostly generated at central power stations, transported through a network of high-voltage transmission lines, and distributed via local poles and wires to customers. Figure 1 shows the current capacity levels and electricity generation by resource type. These resources produced 3 percent of the nation's power output, ranking North Carolina as the 8th largest electricity generating state for both 2017 and 2018.[1] Traditional fuel resources such as coal, natural gas, and nuclear stations represented about 90 percent of the annual output. North Carolina's coal-fired and natural-gas fired power plants are ranked 11th and 5th in the nation, respectively, for the amount of electricity generated in both 2017 and 2018.[2]

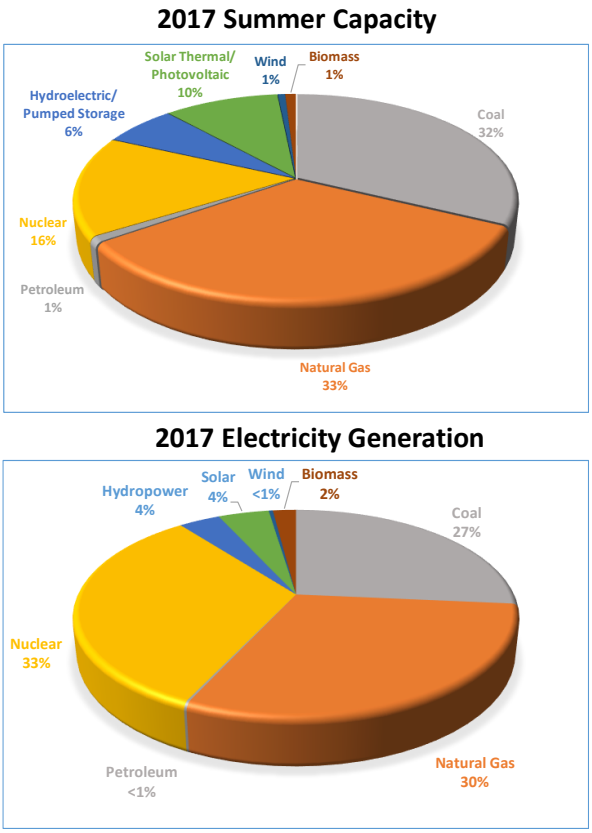


Figure 1: North Carolina's Electricity Statistics by Resource Type

Since the passage of the North Carolina Renewable Energy and Energy Efficiency Portfolio Standard (REPS)[3], the capacity of renewable energy resources has increased dramatically. North Carolina's interpretation of the 1978 federal mandate, the Public Utility Regulatory Policies Act (PURPA), provided historically generous and long term "avoided cost" contracts for utility scale solar projects and is another growth driver of utility-scale solar in the state.[4] North Carolina's Business and Energy Tax Credits provided a 35% state tax credit for renewable energy projects. These credits doubled every year after the REPS was established in 2007 and grew to $245 million in 2016, the last year of the program.[5] When coupled with a 30 percent federal solar tax credit, project developers were able to cut the cost of a renewable facility in half. The collective impact of state and federal policies and precipitous decline in solar costs led to North Carolina being ranked 2nd in the nation for the most installed solar photovoltaic (PV) capacity. This infrastructure produced between 10 and 11 percent of the nation's total solar

[1] U.S. Energy Information Administration, Electricity Data Browser, https://www.eia.gov/electricity/data/browser/
[2] U.S. Energy Information Administration, Electricity Data Browser, https://www.eia.gov/electricity/data/browser/
[3] Session Law 2007-397, "North Carolina's Renewable Energy and Energy Efficiency Portfolio Standard (REPS), August20, 2007, http://www.ncuc.commerce.state.nc.us/reps/reps.htm.
[4] EIA. (2019). Retrieved from https://www.eia.gov/todayinenergy/detail.php?id=27632
[5] NCDOR. (2016). Article 3B – Business and Energy Credits. Retrieved from https://files.nc.gov/ncdor/documents/reports/2-3B-RenEngyProp2016.pdf

electricity output, ranking North Carolina as the 2nd highest solar producing state each year from 2017 through 2019 (as of May).[6] Independent power producers accounted for over 92 percent of NC's solar generation, while utilities represented about 6 percent and commercial sector represented 2 percent of the state's solar electricity generation.

The state subsidy for solar PV expired in 2015 and the federal tax credit is slated to expire in 2021.[7] Going forward, the next phase of growth in the clean energy sector will be determined by a new legislation passed in 2017 called the Competitive Energy Solutions for NC, also known as House Bill (HB589).[8] This bill creates new programs for competitive renewable energy (RE) procurement, solar rebates and leasing, community solar, and special studies related to renewable energy. The solar capacity projected to be added to the system is about 4,000 megawatt (MW) by 2025 (essentially doubling the capacity shown in Figure 1 if all the requirements in the legislation are fulfilled).

The 2018 latest Integrated Resource Plans (IRPs) filed by North Carolina's investor owned utilities (IOUs) indicate that the capacity of solar PV will remain at about the same level from 2025 to 2030. The capacity of energy storage is planned to increase from the current level of 1 MW to 246 MW by 2025 and 291 MW by 2030. The IRPs suggest that an additional 7,200 MW of natural gas capacity will be part of North Carolina's portfolio (18% increase relative to Figure 1) and 4,000 MW of coal capacity will be retired (12% decrease relative to Figure 1).

In the wake of continuing declining costs of renewable generation and battery storage options, North Carolina regulators and policy makers will be called upon to evaluate economic viability of traditional infrastructure projects whose costs will be borne by ratepayers for years to come. As North Carolina makes capital investment decisions for future capacity additions, it will be important to select the cost-effective system that maintains affordability, reliability, equity, grid efficiency, and economic viability. In just the past year, many states and utilities have made groundbreaking announcements, some of which are highlighted below:

- Georgia state regulators approved Georgia Power's long-term IRP, authorizing the utility to own and operate 80 MW of battery energy storage, and add 2,260 MW of new renewables (primarily solar), growing its renewable generation to 5,390 MW by 2024 and increasing the company's total renewable capacity to 22% of its portfolio. The Georgia plan also calls for retiring five coal units, based on its Public Service Commission's analysis on coal units' economics and concluded that keeping them was costly to ratepayers, and reducing its use of natural gas, from almost half to about a third of its portfolio by 2024. Georgia Power's IRP also includes energy efficiency targets 15% above previous IRPs. The utility said it added new programs for both residential and commercial customers, including an income-qualified efficiency pilot designed to help up to 500 residents reduce household energy demand by 20%.
- The Tennessee Valley Authority (TVA) recently published its 2019 Final IRP, calling for up to 14 GW of new solar energy, 5,300 MW of energy storage and 2.2 GW of energy efficiency

[6] U.S. Energy Information Administration, Electricity Data Browser, https://www.eia.gov/electricity/data/browser/
[7] U.S. Department of Energy. (2019). Expired, Repealed, and Archived NC Incentives and Laws. Retrieved from https://afdc.energy.gov/laws/laws_expired?jurisdiction=NC
[8] House Bill 589, Session Law 2017-192, North Carolina General Assembly, 2017, https://www.ncleg.net/gascripts/BillLookUp/BillLookUp.pl?Session=2017&BillID=h589&submitButton=Go

savings by 2038. TVA plans to retire some of its coal plants, and will consider retirement of additional coal and gas-fired combustion turbines if determined cost-effective.

- Southern Company, the third largest utility in the U.S., set a long-term goal of low to no carbon operations by 2050 on an enterprise-wide basis, with an interim goal of 50 percent reduction by 2030. The company also committed to seeking approval of low-carbon and carbon-free resources that are in the best interest of its customers.
- In Colorado, Xcel Energy's recent requests for proposals have set record-low prices, receiving solar-plus-storage bids as low as $36 per MW-hour, compared to $25 per MW-hour for standalone solar. Xcel plans to retire 660 MW of coal capacity ahead of schedule in favor of renewable sources and battery storage options, and reduce costs in the process.
- In the Midwest, MidAmerican will be the first utility to reach 100% renewable energy by 2020 without increasing customer rates. Indiana's NIPSCO will replace 1.8 gigawatts (GW) of coal with wind and solar.
- In Oklahoma, NextEra Energy Resources will develop the largest hybrid renewable project in the United States, a 700 MW facility that will serve 21 utility members and other customers of Western Farmers Electric Cooperative.
- Dominion has expressed the possibility of developing more than 2,000 MW of offshore wind off the Virginia coast. Dominion's Power Generation Group subsidiary plans to invest $1.1 billion through 2023, $300 million of which will be used towards its offshore wind.

As RE and distributed energy resources (DER) costs continue to fall and penetration rises, these assets will reach a point where they can be treated as a true grid resource, providing services that benefit both the customer and the utility. Intelligently managed DERs could offer a vision of a world where demand may be as easily dispatchable as supply. North Carolina regulators and policy makers will be called to 1) evaluate the amount of RE and DERs that can be technologically integrated, 2) resolve grid balancing and operability issues that come with increasing quantities of non-dispatchable generation, and 3) ensure fair and equitable methods to pay for the transitioning power grid. Additionally, the forthcoming utility proposal for smart grid initiatives and grid modernization will require a substantial investment, posing a challenge to keep rates low and still maintain reliability.

Our state enjoys some of the lowest retail electricity prices in the nation, with a ranking in the bottom 10 states for the past several years. North Carolina's average residential rate has been about 6 percent less than the South Atlantic region and about 11 percent less than the nation as a whole since 2015. Despite this benefit, low-income households continue to pay significant portion of their annual income on energy bills. In 2018, 15 percent of North Carolina's residents (1.4 million) were living below 100 percent of the federal poverty level (FPL). On average, these individuals spent 18 to 33 percent of their annual income on energy bills, of which about 20 percent went to pay electric bills. Comparatively, the energy burden for those at 200 percent above the FPL ($50,000) was only 7 percent.[9] Public policy focusing on energy

[9] For more information on energy burden of low-income households, see Supporting Document Part 3: Electricity Rates and Energy Burden.

rates, equitable access, and a just transition to clean energy economy is needed to address the current disparity.

Moving forward, electricity prices for generation are projected to decline rapidly while the transmission and distribution related prices will increase to accommodate both grid scale RE and DERs. According to the Annual Energy Outlook (AEO) 2019 forecast, it is projected that the total electricity price (sum of generation, transmission, and distribution) will decline slightly or remain the same relative to the 2018 levels (see Figure 2).

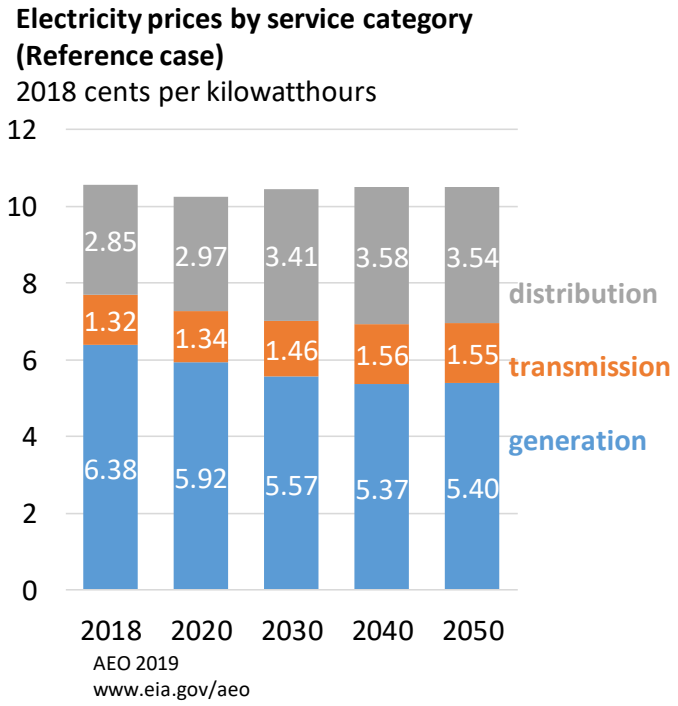


Figure 2: Electricity Prices by Service Category (Reference Case)

In the coming years, our infrastructure will be challenged to deliver smart and resilient energy, due to the technological changes and climate impacts and that are on the horizon. It is neither feasible nor prudent to build out the entire transmission or distribution system simultaneously, but there is a growing recognition that changes are needed sooner than planned, to stay ahead of the rapidly changing industry. Therefore, it is important for North Carolina to establish a vision for what the modern gird should look like for North Carolina. With this vision, we can;

- meet the state's rapidly changing electricity market,
- deploy advanced technologies
- find value in the electric distribution system,
- create additional revenue mechanism for the utilities, customers, and system integrators, and
- develop a competitive and vibrant new energy economy, where jobs of the future are both created and retained.

2. Drivers of Power Sector Transformation

The declining costs of renewable energy generation and rapid advancement of information management, communications, and consumer products is transforming our electrical grid. These forces are leading the decarbonization of the electric power sector while creating economic development opportunities in urban and rural areas of the state. The four key drivers of power sector transformation in the 21st century are described below.

Key Drivers of Power Sector Transformation

1. Decentralization
2. Digitization
3. Decarbonization
4. Development

2.1 Decentralization Driven by Declining Costs

The costs of clean energy technologies have declined rapidly in the last decade. Lazard's latest annual Levelized Cost of Energy Analysis (LCOE 12.0) shows a continued decline in the cost of generating electricity from alternative energy technologies, especially utility-scale solar and wind. In some scenarios, alternative energy costs have decreased to the point that they are now at or below the marginal cost of conventional generation (see Figure 3). Lazard's data shows that solar PV and wind costs have dropped 88% and 69% since 2009, respectively.[10] By 2024, Wood-Mackenzie predicts that wind energy will still cost less than new combined-cycle natural-gas facilities on an LCOE basis in 20 states, with this figure growing to 28 states by 2027. For battery storage, Lazard's latest annual Levelized Cost of Storage Analysis (LCOS 4.0) shows significant cost declines across most use cases and technologies, especially for shorter duration applications such as utility scale solar PV plus storage (see Figure 4).[11] Lazard also projects that by 2020, cost of lithium-based storage could decline by 38%. An overview of key technologies enabling decentralization of the power grid is provided in the discussion below.

[10] "Lazard's Levelized Cost of Energy Analysis – Version 12.0", Nov 2018, accessed at https://www.lazard.com/media/450784/lazards-levelized-cost-of-energy-version-120-vfinal.pdf

[11] Ibid

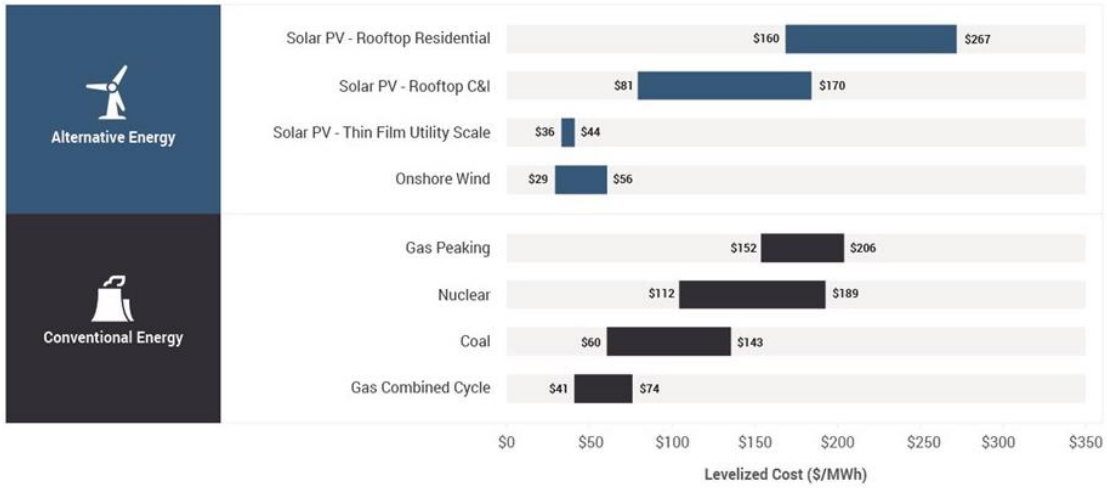


Figure 3: Lazard's Unsubsidized Levelized Cost of Energy for Alternative and Conventional Technologies, version 12.0

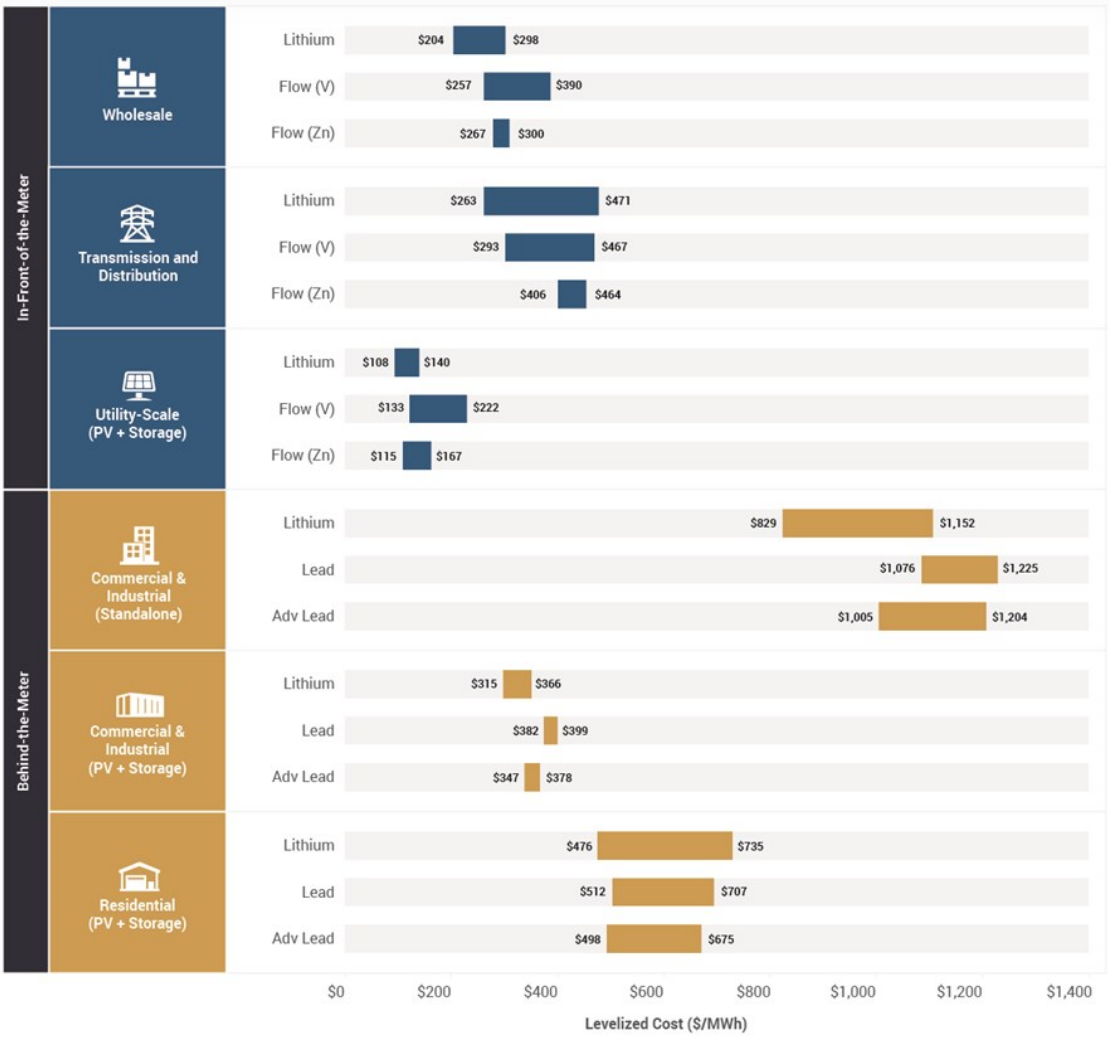


Figure 4: Lazard's annual Levelized Cost of Storage Analysis (LCOS 4.0)

2.1.1 Utility Scale Renewables

The Energy Information Administration (EIA) forecasts that non-hydroelectric renewables will be the fastest growing source of electricity generation. In April 2019, U.S. monthly electricity generation from renewable sources exceeded coal-fired generation for the first time based on data in EIA's Electric Power Monthly. Renewable sources provided 23% of total electricity generation to coal's 20%. EIA's January 2019 Short-Term Energy Outlook (STEO) forecasts that electricity generation from utility-scale solar generating units will grow by 10% in 2019 and by 17% in 2020. Wind generation will grow by 12% and 14% during the next two years.[12]

This projected growth is a result of new generating capacity the industry expects to bring online. In 2017, renewables represented almost 50 percent of the new utility-scale electric generating capacity added to the U.S. power grid. Solar is the third-largest renewable energy source in the U.S. power sector, having surpassed biomass in 2017. The U.S. electric power sector plans to add more than 4 GW of new solar capacity in 2019 and almost 6 GW in 2020, a total increase of 32% from the operational capacity at the end of 2018. There are now more than 2 million solar installations in the U.S., with an additional 2 million coming by 2023.[13] Figures 5 illustrates historical and project solar capacity additions for the U.S.

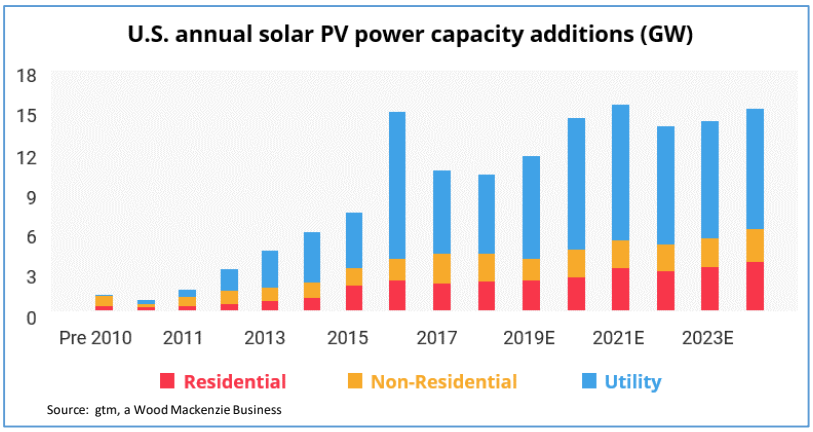


Figure 5: Solar Photovoltaic (PV) Capacity Additions

North Carolina is currently ranked 7th in the nation for most installed solar capacity according to the Solar Energy Industries Association. Figure 6 shows the rise and leveling off of solar installations in the state, with utility scale projects dominating the capacity growth. How the utilities comply with HB 589 will determine the level of solar capacity added in the coming years.

[12] U.S. Energy Information Administration, Current Issues and Trends. https://www.eia.gov/electricity/issuestrends/

[13] https://www.greentechmedia.com/articles/read/how-distributed-energy-is-reshaping-the-energy-landscape#gs.r0dwgu

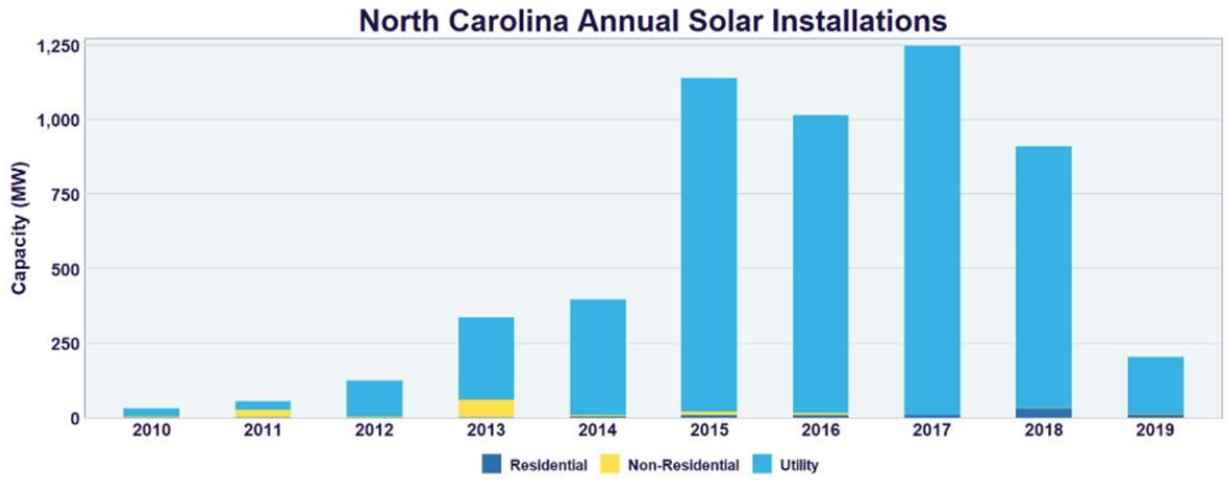


Figure 6: NC Annual Solar Installations

Wind turbines now operate across 41 states and 2 U.S. territories. The U.S. wind industry installed 841 MW of new wind power capacity in the first quarter of 2019, which amounts to a 107% increase over installations in the first quarter of 2018. It is estimated that through calendar year 2019, installed capacity for wind energy generation will grow, likely doubling the installations completed in 2018. This drastic expansion should continue for the next few years as developers install projects prior to the expiration of the Production Tax Credit.[14] The U.S. EIA predicts that U.S. wind capacity additions in 2019 will total 12.7 GW, exceeding annual capacity additions for the previous 6 years.[15] The long-term outlook for offshore wind (OSW) energy generation is similar – the U.S. Department of Energy (DOE) reports a total project pipeline of 25,434 MW as of June 2018, of which 3,892 MW is in project-specific capacity and 21,542 MW of undeveloped lease area potential capacity.[16] As of the date of this Report, only one utility-scale wind energy facility is in operation in North Carolina; the 208 MW nameplate capacity Amazon Wind Farm in northeastern NC.

The states of Virginia, Maryland, Massachusetts, New Jersey and New York are moving to jumpstart offshore wind projects. Dominion Energy began construction of two offshore turbines as a demonstration project[17] in the second quarter of 2019. New Jersey selected a company in June 2019 through a request for proposal (RFP) to build a 1,100-megawatt wind farm off the coast of Atlantic City and New York

[14] The PTC provides operators with a tax credit per kWh of renewable electricity generation for the first 10 years a facility is in operation.
[15] U.S. EIA. Tax Credit Phase Out Encourages More Wind Power Plants to be Added by End of Year. http://www.eia.gov/todayinenergy/detail.php?id=39472#. Accessed on May 17, 2019.

[16] 2017 DOE Offshore Wind Technology Market Update.
[17] Washington Post. Utility taking cautious approach as Virginia offshore wind project gets underway. July 1, 2019. https://www.washingtonpost.com/local/virginia-politics/utility-taking-cautious-approach-as-virginia-offshore-wind-project-gets-underway/2019/06/28/540493c6-99c3-11e9-916d-9c61607d8190_story.html?noredirect=on&utm_term=.ac52d8c0fb89. Accessed July 31, 2019.

State reached an agreement in July 2019 for two large OSW projects to be built off the coast of Long Island[18] the largest combined OSW contracts by any state to date, totaling 1,696 MW[19].

2.1.2 Distributed Generation

Distributed generation represents electricity that is generated on the customer side of the electric meter or near the point of use instead of central power plants. Examples of distributed renewables include small-scale solar systems, rooftop solar, and small wind turbines. EIA forecasts that small-scale solar generating capacity will grow by 44% between 2018 and 2020, or 9 GW. The increased deployment is partly due to the plummeting costs of distributed solar, with residential system prices dropping more than 60 percent since 2010. Additionally, advanced inverters which are devices that convert the direct current that solar panels provide into the alternating current that flows on the power grid, are improving the performance and management of small-scale distributed generation by handling abnormal grid conditions.

2.1.3 Energy Efficiency and Demand Response

Energy efficiency (EE) measures are technologies and processes that use less energy to perform the same function (e.g., energy-efficient lightbulb and major appliances). Demand response are activities performed by the customers to reduce electricity use at times of high-priced peak electricity consumption. Both of these demand side management approaches decrease the overall electricity demand from the grid which in turn avoids the cost of building new generators and transmission lines, saves customers money, and lowers pollution from electric generators. EIA's annual survey of electric utilities tracks the incremental annual electricity savings and costs from utility-run EE programs. Incremental energy savings are the additional energy savings from new participants in EE programs during the current reporting year. The amount of incremental energy saved through EE programs increased from 26.5 million MWh in 2014 to 29.9 million MWh in 2017. At the same time, incremental spending on EE programs has remained essentially flat in recent years.

Demand response programs typically offer customers a rebate or lower energy costs for reducing energy use during specified hours or allowing the utility to cycle their air-conditioning systems when needed. They are increasingly being implemented through price signals and advanced software systems that can automatically recue energy consumption across fleets of buildings at peak energy demand periods.

[18] New York Times. New York Awards Offshore Wind Contracts in Bid to Reduce Emissions. July 18, 2019. https://www.nytimes.com/2019/07/18/business/energy-environment/offshore-wind-farm-new-york.html. Accessed July 31, 2019.
[19] Utility Dive. New York awards record 1,700 MW offshore wind contracts. July 19, 2019. https://www.utilitydive.com/news/new-york-awards-record-1700-mw-offshore-wind-contracts/559091/. Accessed on July 31, 2019.

2.1.4 Battery Storage

Lithium ion batteries are currently the dominating form of advanced energy storage technology. Other forms of storage technologies include compressed air, thermal storage, and pumped hydro storage. Energy storage systems reduce the need for peaker power plants, improve the resilience of the power grid, and can be paired with intermittent renewable generation systems to operate as virtual power plants. The use of utility-scale battery storage units (1 MW or greater power capacity) has been growing in recent years. Operating utility-scale battery storage power capacity has more than quadrupled from the end of 2014 (214 MW) through March 2019 (899 MW). Assuming currently planned additions are completed and no current operating capacity is retired, EIA predicts that utility-scale battery storage power capacity could exceed 2,500 MW by 2023 (see Figure 7). The total deployment of utility and non-utility energy storage is projected to reach 4,500 MW and represent $4.8 billion market by 2024[20].

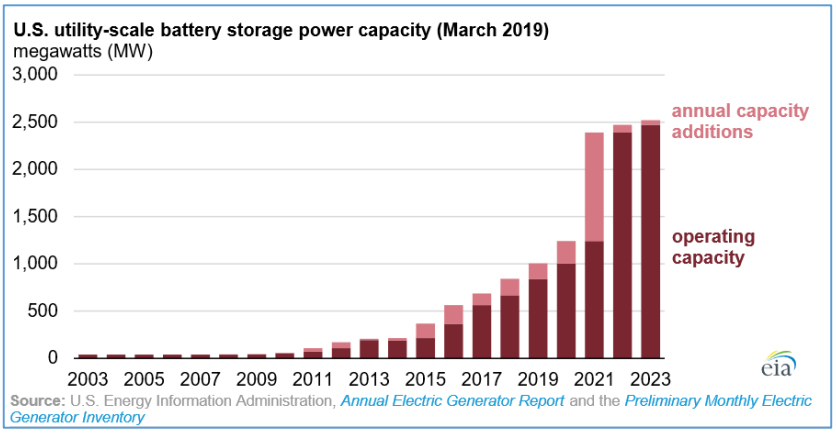


Figure 7: Battery Storage Capacity Additions

The growth in utility-scale battery installations is the result of supportive state-level energy storage policies and the Federal Energy Regulatory Commission's (FERC) Order 841 that directs power system operators to allow utility-scale battery systems to engage in their wholesale energy, capacity, and ancillary services markets. Rapidly declining costs are also increasing deployment.

The largest operating utility-scale battery storage sites in the U.S. as of March 2019 provide 40 MW of power capacity each, and are located in Alaska and California. Based on the current inventory of battery storage projects planned to be constructed, EIA reports that a 409 MW site in Parrish, Florida will start commercial operation in 2021. This project will be the largest solar-powered battery system in the world and will store energy from a nearby Florida Power and Light solar plant.

In North Carolina, only about 1 MW of battery storage capacity has been installed as of 2018 although several battery projects are planned. The 2018 IRPs for Duke Energy Carolinas (DEC) and Duke Energy Progress (DEP) indicate that a total of 291 MW of battery storage is expected to be installed by 2033 for both DEC and DEP combined. A large NC solar developer, Cypress Creek plans 12 MWH of battery storage facilities coupled with solar for Brunswick Electric Membership Corporation. As part of a community solar project, a 500 kW Li-ion battery combined with a 1 MW solar project is planned for Fayetteville Public Works Commission[21]. Another proposed storage project is a Duke Energy solar PV plus storage project in Hot Springs that was approved by the NC Utilities Commission (NCUC) in May

[20] Wood Mackenzie P&R/ESA, U.S. energy storage monitor Q2 2019, https://www.woodmac.com/research/products/power-and-renewables/us-energy-storage-monitor/

[21] North Carolina State University, DeCarolis et al. (2018). *Energy Storage Options for North Carolina.* p.4. Retrieved from https://energy.ncsu.edu/storage/wp-content/uploads/sites/2/2019/02/NC-Storage-Study-FINAL.pdf.

2019. This solar plus storage project will include 2 MW of solar and a 4 MW battery and is intended to improve electric reliability in the town, which is on a constrained transmission line.[22]

NC does not have any programs specifically designed to facilitate energy storage installations. However, there are policy actions underway that have energy storage deployment implications. HB589 has a number of PV deployment program goals for NC.[23] In addition, NCUC dockets dealing with one of HB589 programs – Competitive Procurement of Renewable Energy (CPRE) – have topics relevant to energy storage. One docket in particular deals with energy storage protocol that is a part of the CPRE power purchase agreements. In docket hearings, it was noted that electric grid ancillary services, like frequency regulation and voltage control which are particularly suited to batteries, have no transparent market value in NC, making it difficult to monetize the value of these services for a developer considering installing battery storage.[24] Comments made by the NCUC Public Staff regarding the lack of energy storage market transparency states that market participants and Duke Energy generally agree that energy storage can provide many grid benefits, such as frequency regulation, operational reserves, and firm capacity; however, there is no mechanism to pay market participants for these services. Although price declines will play a role increasing energy storage in NC, policies may also be necessary to integrate energy storage onto the NC electric grid supporting a timely shift to clean energy.

2.1.5 Microgrids

Localized grids that can disconnect or "island off" from the utility power grid are called microgrids. They consist of distributed energy resources (DERs) and control systems that operate autonomously when called upon, increasing grid flexibility and resiliency.[25] The types of technologies used in microgrid applications include solar PV, battery storage, fossil fuel generators, fuel cells, combined heat and power systems and smart controls. The U.S. currently has about 160 microgrids with 1.6 GW of capacity, and is estimated to reach 4.3 GW by 2020. According to the third quarter report, "U.S. Microgrids 2016: Market Drivers, Analysis and Forecast," GTM sees US microgrid market opportunity doubling from $836 million in 2016 to $1.66 billion in 2020.[26]

[22] Utility Dive. (2019). *NC approves Duke's first solar+storage residential microgrid.* Accessed at www.utilitydive.com/news/north-carolina-approves-dukes-first-solarstorage-residential-microgrid/554770/ .
[23] HB589 is discussed in the Clean Energy Plan section NC Energy Policy Landscape.
[24] NC Utilities Commission. May 1, 2019. Docket E-2 Sub 1159, E-7 Sub 1156 Hearing, p. 14.
[25] U.S. Department of Energy. (n.d.). The role of microgrids in helping to advance the nation's energy system. https://www.energy.gov/oe/activities/technology-development/grid-modernizationand-smart-grid/role-microgrids-helping
[26] US Mircrogrid Market Growing Faster than Previously Thought: New GTM Research, August 29, 2016, Elisa Wood, https://microgridknowledge.com/us-microgrid-market-gtm/

Figure 8 shows the owners and application types of microgrid installations. The military is pursuing microgrids for energy security or to achieve RE goals, and is estimated to contribute to 52 percent of microgrid capacity deployed as of July 2019.[27] The second largest users of microgrids are data centers in commercial applications, representing 26 percent of capacity added to date.[28] Community microgrids are also on the rise, especially in the Northeast and Alaska influenced by societal and environmental needs.

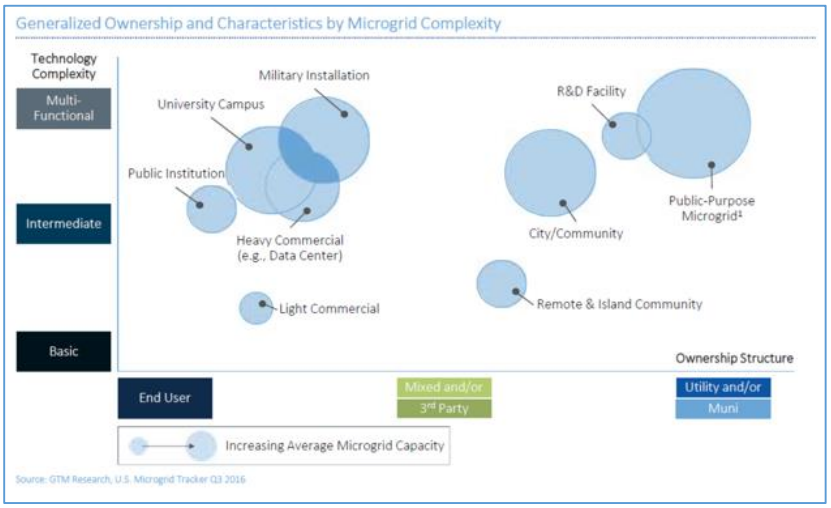


Figure 8: Microgrid Applications and Ownership Types

2.1.6 Electric Vehicles

The car industry is also undergoing a transformation, with almost every automaker planning to introduce more electric vehicle (EV) models and citing 2025 as the tipping point when everything from materials and fuel to cost. The companies that build cars are set to look dramatically different.[29] In 2017, EVs represented 1.1 % of new U.S. vehicle sales or 200,000 vehicles. By 2025, J.P. Morgan estimates that EVs and hybrid EVs (HEVs) will account for an estimated 38% of all new vehicle sales (see Figure 9).[30] The U.S. DOE projects that by 2040, EVs could make up over 50 percent of new car sales driven by plummeting battery costs.[31]

High rates of EV adoption present an opportunity to reduce greenhouse gas (GHG) emissions, grow and smooth electricity demand, and cut fuel costs for consumers. However, there is growing concern that if not managed adequately, accelerated EV growth could significant affect electricity usage and peak demand. Many states are exploring innovative planning approaches to deploy charging infrastructure and develop rates and utility business model to accommodate their residents and business needs.

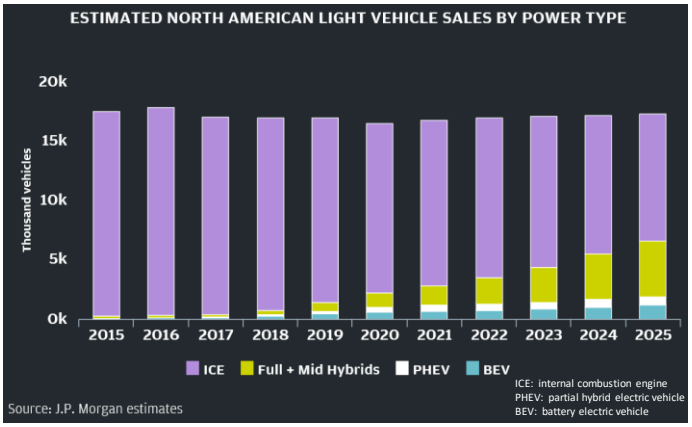


Figure 9: Projected Growth in Vehicle Sales

[27] Ibid.
[28] Ibid.
[29] https://www.jpmorgan.com/global/research/electric-vehicles
[30] Ibid
[31] U.S. Department of Energy. (2014). Evaluating electric vehicle charging impacts and customer charging behaviors—experiences from six smart grid investment grant projects. Retrieved from https://www.smartgrid.gov/files/B3_revised_master-12-17-2014_report.pdf

2.2 Digitization Driving Grid Operations and Grid Flexibility

With the continuous supply of smart devices and digital communications entering the market, a growing number of customers are demonstrating interest in the ability to control their usage, control their bills and source their energy. Technology is enabling participation by customers through new capabilities and controls into homes, buildings and end-use equipment. With the proliferation of electric devices, appliances, heat pumps and EVs, customers can provide a range of services by participating in smart charging programs or shifting their use to off-peak times. This increased use of technologies and DERs is moving from one-way system to one that is bi-directional and more complex. DERs are physical and virtual assets that are deployed across the distribution grid, typically close to load, and usually behind the meter. They include solar, energy storage, EE, combined heat and power (CHP/cogen), and demand management, and can be used individually or in aggregate to provide services to the electric grid.[32]

In a well-designed system, DERs can provide positive net value to the grid, such as avoided infrastructure investments, improved resilience and increased integration of clean energy. Through these capabilities, customers can help mitigate or in certain cases, reduce electricity cost when they offer services to the utility. For example, customers who choose EE measures that shape their load to complement grid resource availability are contributing to keeping costs down for all customers because well-shaped loads contribute to grid infrastructure investment.[33]

At the heart of digitization and DER integration is distribution system planning (DSP). DSP is a process that identifies and characterizes areas of the grid that must adapt to changing technologies and markets, and serves as a valuable planning tool to guide utility investment, foster customer and marketplace activity, and provide value to the grid and the entire system. Utilities are already being asked to use DSP to reveal value opportunities on the system. NC's rural electric cooperatives have been early implementers of advanced technology, and are leading the way to increased reliability, two-way communication, load management, and grid operation. Service providers are also recognizing that new electric loads are flexible, and can be managed as grid resources through right price signals (e.g., customer choosing to use equipment during off-peak hours).

2.2.1 Smart/Connected Devices

Homes and businesses are increasingly connecting devices and appliances to the internet or allowing them to communicate. This function allows for more frequent and user-specified control of the devices—resulting in greater system EE and demand response operation. Over the next few years, millions of new households are expected to install smart thermostats, smart light bulbs, and smart home controllers.

[32] Distributed Energy Resources 101: Required Reading for a Modern Grid, Advanced Energy Economy, February 2017, https://blog.aee.net/distributed-energy-resources-101-required-reading-for-a-modern-grid

[33] Trends in Technology and Policy with Implications for Utility Regulation, Regulatory Assistance Project, C. Linvill, J. Shernot and J. Shipley, April 2018.

Figure 10 illustrates the projected growth for three types of smart devices between 2018 and 2023. The number of households with smart home devices are expected to more than double in the next two years.

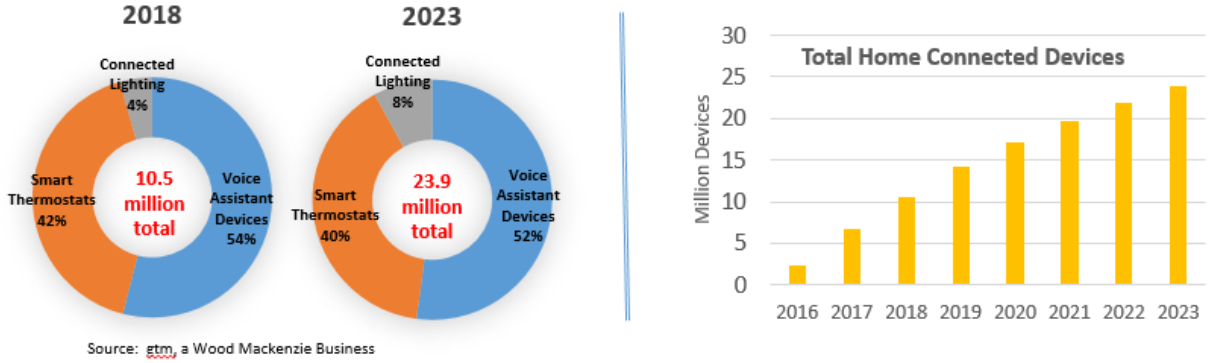


Figure 10: Projected Growth in Smart Home Devices

2.2.2 Smart Grid - Advanced Metering and Sensor Technologies

Throughout the country, advanced metering infrastructure (AMI) is enabling two-way communication between customers using smart devices and electric utilities (or third-party providers). AMI is an integrated system of smart meters and data-management systems. Transmission and distribution automation technologies are using data to change how electricity flows through the power grid, reshaping and modernizing the traditional grid. Figure 11 illustrates the current AMI penetration rates for a few states, including North Carolina. As a result of the trend towards a more customer-centric grid, North Carolina utilities are implementing more AMI and the way these advanced technologies are transmitted, distributed, and managed to accommodate the desire for two-way energy flow.

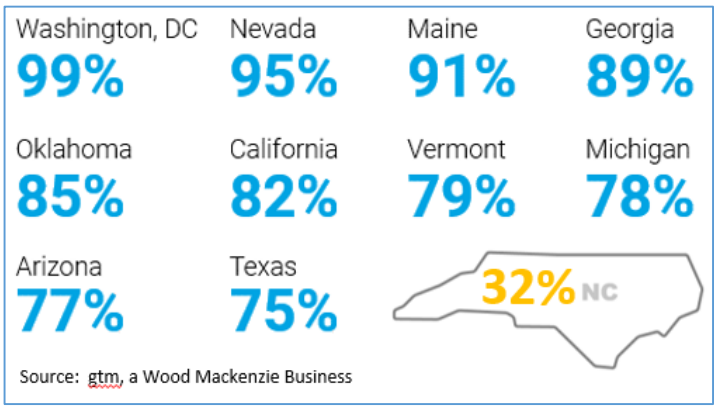


Figure 11: Current AMI Adoption Rates for Select States

Advances in sensor technologies are enabling accurate, real-time conditions of the grid to be monitored, quickly becoming fundamental component of the smart grid. Utilities employ sensors to monitor real-time two flow of electricity on the grid, improve reliability, provide real time alerts about system disruptions, enhance responsiveness to outages and support the integration of clean energy technologies.[34]

[34] U.S. Department of Energy. (n.d.). Synchrophasor applications in transmission systems. Retrieved from https://www.smartgrid.gov/recovery_act/program_impacts/applications_synchrophasor_technology.html; Southern California Edison. (n.d.). Remote fault indicators. https://www.edison.com/content/dam/eix/documents/innovation/RFIFactSheet-R2.pdf

2.2.3 Big Data Systems and Communication Tools

Advanced meters, sensors and devices operating on the power grid generate large amounts of digital data, many transmitting readings in small time intervals and requiring significant volume of data storage capacity. As the number of smart devices increase as discussed earlier, the data collection, management and interpretation of the modern grid will increase the role and value of big data and analytic software systems and services. The economic growth opportunity in North America expected for this transition is estimated to be about $390 million in 2016 to about $1.2 billion in 2025.[35]

Digital communication systems are providing foundational infrastructure to support the technologies in a modernized grid. Advanced communication networks provide not only the capability to use the traditional electric power infrastructure to deliver data, but also enable utilities or grid operators to receive, interpret and act on the data in near-real time. This flexibility enables assets across the grid to communicate with one another and respond to dynamic changes in electricity demand and supply.

[35] Utility analytics. Use cases, platforms, and services: Global market analysis and forecasts. (2016). Retrieved from Navigant Research website: https://www.navigantresearch.com/research/utility-analytics

2.3 Decarbonization Driven by Customer Desires

Scientific consensus supports the fact that emissions of greenhouse gases (GHGs), which include carbon dioxide and methane, are contributing to global climate change. The effects of climate change pose significant risks to the communities, economies, and the environment. In the 2018 National Climate Assessment, 13 federal agencies concluded that: (1) the most recent decade was the nation's warmest on record; (2) human activities, especially emissions of GHGs, are the dominant cause of the observed warming since the mid-20th century; (3) human-induced climate change is projected to continue and it will accelerate significantly if global GHG emissions continue to increase; and (4) the widespread and potentially irreversible impacts of a changing climate require an urgent effort to both reduce emissions and build resilient communities. North Carolinians understand that climate change is occurring and are concerned about the impacts it will have on current and future generations.

The electric power sector is the leading emitter of GHGs in our state, contributing to about 35 percent of statewide emissions in 2017.[36] The power sector will continue to be North Carolina's leading emitter until about 2025 when transportation-related emissions will surpass the power sector. North Carolina's Clean Smokestacks Act, REPS and market drivers have decarbonized the electric power sector at a pace higher than many other states. According to the most recent statewide inventory, GHG emissions from the electric power sector have declined 34% relative to 2005 levels. It is estimated that with full implementation of HB559, the emission reduction level will reach about 50% by 2025 and remain at this level to 2030. To continue on the decarbonization path, many states are adopting aggressive renewable energy and energy efficiency standards. States are also setting 100 percent renewable energy goals by 2040 or 2050.

Recognizing the urgency to take action and the desire to reduce power bills, North Carolinians are asking for more options to procure and deploy clean energy technologies and invest in EE measures. From rooftop solar to electric vehicle chargers, customers have more choices now than ever before – and this technology trend is projected to continue. The appetite for acquiring residential roof top solar continues to be unmet as evidenced by the recent sellout of the rebates within hours of being offered by Duke Energy as part of HB 589.

Corporate priorities have also been driving increased customer demands. Today, 17 of the state's 30 largest private employers have set targets to procure more RE or reduce their energy consumption, and 37 companies doing business in NC have set a goal to be powered by 100% RE. Companies across a wide range of industries have set goals, including major technology, service, and manufacturing companies. These businesses have moved beyond soft factors such as community relations and good publicity, and now state fundamental strategic drivers for their clean energy goals, including customer and shareholder demand, competitive advantage, attracting and retaining talent, operational efficiency, supply chain disruption, lower costs and core values. For example, Apple is driving its entire supply chain to run on clean power, and announced that by 2020, they and 44 of their suppliers will generate or procure at least 5

[36] North Carolina Greenhouse Gas Inventory (1990-2030), January 2019, NC Department of Environmental Quality, deq.nc.gov/GHGinventory

gigawatts of clean energy. In August 2019, Fifth Third Bank announced the opening of its 80 MW Aulander Holloman Solar Facility in eastern North Carolina, adding to the company's announcement at the Nasdaq opening bell on March 7, 2018 to be the first Fortune 500 company to commit to purchase 100% solar power. Providing access to inexpensive, reliable, clean energy is more than ever to impact decisions made by these companies about where they locate and expand, and whether they close existing facilities.

Many cities and local governments across the State are setting environmental goals based on the interests of their local constituents. In 2018, Asheville passed a resolution to transition municipal operations to 100% renewable energy by 2030. The Charlotte City Council unanimously passed a low-carbon resolution in 2018 and approved a Strategic Energy Action Plan to achieve it. In 2019, Raleigh adopted a community-wide goal to reduce GHG emissions 80% by 2050 and began preparing an action plan to support this goal. Over 30 municipalities in the state have made public commitments to GHG reduction goals and/or clean energy targets. Local governments are motivated to reduce their carbon emissions because they see how infrastructure is suffering from being repeatedly battered and flooded during hurricanes. They see how poor air and water quality is triggering health conditions. They also see how transitioning to a clean energy economy can provide a much-needed boost in their areas. Clean energy jobs in North Carolina have been growing at nearly twice the state average and employ veterans at nearly twice the economy-wide rate. The manufacturing industry, especially, shows potential as components of wind turbines and solar panels are constructed here. Cities see how electrifying our vehicles creates opportunity by supporting new business ventures for EV charging stations and other infrastructure and improves local air quality.

Low-income and energy-burdened customers and communities are not able to take advantage of existing programs for clean energy or EE due to up-front costs and financing, physical challenges related to the quality of the building or ownership status of their housing, or simply a lack of access to high-integrity service providers. Energy burdened communities are paying a disproportionately high amount of their income on energy bills and simply struggle to pay unaffordable energy bills. For those living with incomes below 50 percent of the FPL, 33 percent of their annual income is spent on energy bills (energy burden), of which about 20 percent goes to pay electric bills. Many of the energy burdened communities are directly impacted by the health and pollution impacts of energy production, generation, transportation. These compounding factors mean that these communities are the least able to reap benefits of investments in clean energy and EE while being most impacted by the legacy energy industry. Programs such as community solar and home weatherization offer some opportunities to directly reduce electric bill; however, public policy focusing on energy rates and equity and a just transition to clean energy economy is needed.

The agriculture community is also interested in responsible farmland management, creating solar energy benefits education and incentive program, and ensuring value to the farmer to optimize the use and sustainability of farms, forests and solar production/decommissioning in North Carolina. Significant potential exists to increase EE of agricultural operations and buildings, leading to reduced operating costs for North Carolina's farmers.

2.4 Economic Development Driven by the New Energy Economy

NC has experienced rapid population increase (18.5% from 2000 to 2010 and another 10% by 2018) and a large economic shift over the past 20 years from manufacturing towards a more service-oriented industry. These trends are likely to continue. the NC Department of Commerce projects that the service economy will contribute more than 90% of the new jobs in NC from 2017 to 2026.

As the electric power industry evolves from a highly centralized, capital-intensive industry to a more decentralized, distributed industry featuring independent power producers, rooftop solar installers, distributed clean energy aggregators, and other new businesses and business models, economic development can come from both jobs and investments that drive tax revenue in local communities.

NC is one of the 10 top states for clean energy jobs in the nation.[37] According to one of the most comprehensive national energy-related employment survey, NC had a total of 110,913 clean energy jobs in 2018 including solar (8,912), wind (908), clean vehicles (7,280), and energy efficiency (86,559).[38] Energy storage now represents 1,477 jobs in NC and "grid technology/other" claims 7,607 jobs (note some overlap in total numbers).[39] Reflecting national trends, the majority of NC's clean energy jobs are in construction (44%) followed by professional services including education and consulting (21%) and manufacturing (17% of total jobs).[40] In a recent draft report prepared under EO80 by the Department of Commerce, jobs in 2018 related to clean energy industries, energy efficiency industries, and clean transportation industries totaled 59,632, 141,744, and 97,951 respectively.[41]

While jobs are important to all communities, the revenues generated by clean energy investments and infrastructure projects can have even longer lasting benefits in both rural and urban counties. New RE projects and facilities can create ongoing revenue streams in their local communities.

Additional revenue can also be generated from exports. More than 20% of the clean energy goods and services generated in NC are exported to other states or nations, bringing new revenue into our state. Firms engaged in clean energy product manufacturing or production lead out of state exports, with approximately 53% going to other markets.[42] Research and development activities also have a strong out-of-state presence, with 38% of work destined for broader markets.[43] Moreover, NC is able to reduce its energy imports through renewable energy generation and locally-driven energy efficiency projects.

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[37] E2. (2019). Clean Jobs America 2019. Retrieved from https://www.e2.org/reports/clean-jobs-america-2019/
[38] E2. (2019). Clean Jobs America 2019. Retrieved from https://www.e2.org/reports/clean-jobs-america-2019/
[39] EFI and NASEO. (2019). NC State Energy Employment Report, 2019. Retrieved from https://static1.squarespace.com/static/5a98cf80ec4eb7c5cd928c61/t/5c7f41bcee6eb0788d8de498/15518437724/NorthCarolina.pdf
[40] E2. (2019). Clean Jobs America 2019. Retrieved from https://www.e2.org/reports/clean-jobs-america-2019/
[41] NC Department of Commerce, Labor & Economic Analysis Division. Clean Energy & Clean Transportation in NC: A Workforce Assessment, August 2, 2018, DRAFT report. https://www.nccommerce.com/news/current-initiatives
[42] NCSEA. (2016). 2016 Clean Energy Census. Retrieved from https://energync.org/wp-content/uploads/2017/03/NC_Clean_Energy_Industry_Census_2016.pdf
[43] NCSEA. (2016). 2016 Clean Energy Census. Retrieved from https://energync.org/wp-content/uploads/2017/03/NC_Clean_Energy_Industry_Census_2016.pdf

The total economic impact of clean energy development in NC is estimated at $28.2 billion over the period of 2007-2018 including direct impact of $14.8 billion investment in clean energy development (which includes labor costs) and secondary impacts of $14.5 billion which include $2.9 billion in energy costs savings.[44] The cumulative contribution to NC's Gross State Product from 2007-2018 is $16.9 billion, including $1.4B tax revenue over this period.[45]

Going forward, employers in NC are projecting 5% growth in employment over the next twelve months, driven largely by 8.3% growth in the EE sector.[46] Through the CEP stakeholder engagement process and collaborative partnership efforts, businesses have expressed a number of factors they deem important to achieve robust growth of NC's clean energy economy, and the role that clean energy and clean transportation play in attracting talent and industry to the state. With the burgeoning OSW industry comes a new supply chain that is estimated at approximately $70 billion by 2030.[47]

Business interest in clean energy aligns with the need for cost savings, return on investments, risk management, attracting talent, meeting shareholder and customer expectations, driving innovation and staying competitive.[48] Business leaders have called for increased investment in energy efficiency programs, increased customer access to renewable energy, accelerated deployment of electric vehicles and advanced development of energy storage. These companies believe that NC can leverage their recommended actions to attract new investment to the state, spur innovation, save money for ratepayers, attract new businesses and create jobs in NC.[49]

These recommendations must be balanced with maintaining North Carolina's attractive energy costs. The business sector is keen to preserve low energy rates to reduce the cost of doing business in NC, especially energy-intensive sectors such as manufacturing, as the state navigates the path towards a clean energy future.

Today many states are surpassing North Carolina with more aggressive REPS, renewables adoption, EE policies, utility regulatory reforms, and investment activity. North Carolina was one of 21 states to lose solar jobs in 2018 while 29 other states gained those jobs, and now ranks ninth in solar jobs despite the state's top rating in installed solar. Of the state's 30 largest private employers, 17 have set renewable energy or energy conservation targets, and 37 companies doing business in NC have set a goal to be powered by 100% renewable energy. The corporate drivers alongside the national rankings create an opportunity for NC to take new steps to sustain and grow the economic benefits that clean energy can afford, while continuing to attract businesses, talent and investment to the State.

[44] RTI. (2019). Economic Impact Analysis of Clean Energy Development in North Carolina—2019 Update.
[45] RTI. (2019). Economic Impact Analysis of Clean Energy Development in North Carolina—2019 Update.
[46] Wood Mackenzie/SEIA. (2019). U.S. Solar Market Insight Report, Q2 2019.

[47] Special Initiative on Offshore Wind. Supply Chain Contracting Forecast for U.S. Offshore Wind Power, http://www.ceoe.udel.edu/File%20Library/About/SIOW/SIOW-White-Paper---Supply-Chain-Contracting-Forecast-for-US-Offshore-Wind-Power-FINAL.pdf. Accessed on May 31, 2019.
[48] Ceres. (2019, April 2). Letter to Governor Cooper.
[49] Ceres. (2019, April 2). Letter to Governor Cooper.

3. Clean Energy Plan Development: Stakeholder Process

The public engagement process conducted for the CEP development was comprised of four types of events, referred to as methods. Method 1 was a series of facilitated stakeholder workshops, which were day-long events attended by 60-80 experts and key stakeholders with a vested interest in clean energy. Method 2 involved more general public outreach, achieved through regional listening sessions. These events were half-day sessions intended to educate members of the public about the CEP development process and to receive feedback and comments. Method 3 involved combining with existing venues or events to collect feedback. Method 4 was the online comment portal, where members of the public who were unable to attend any of the in-person events could respond to specific questions and submit general comments. This section summarizes the outputs of the facilitated workshops and other engagement methods, and is structured around three central themes shown in Figure 12.

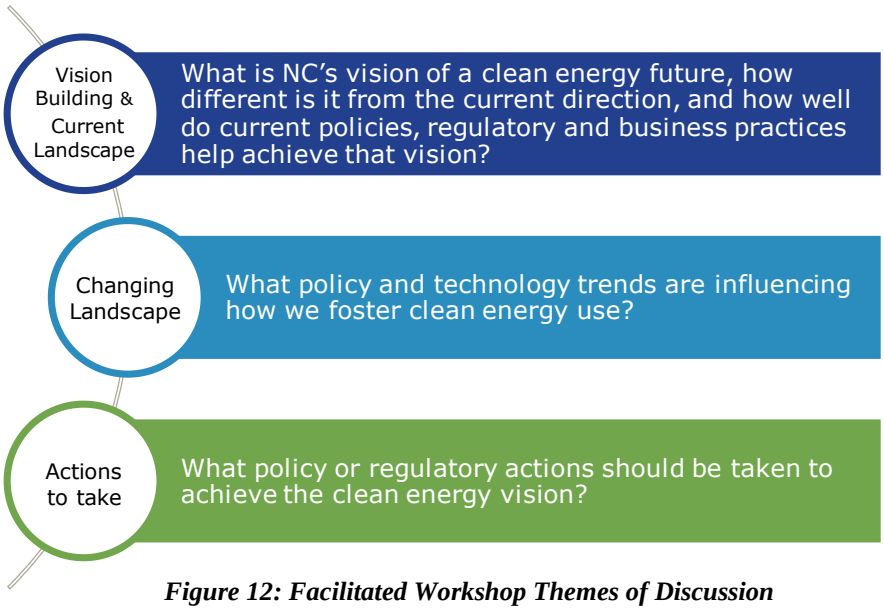
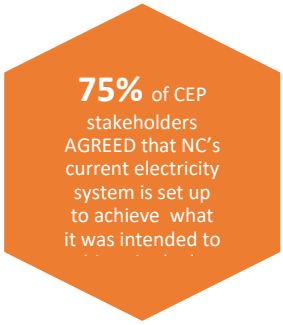


Figure 12: Facilitated Workshop Themes of Discussion

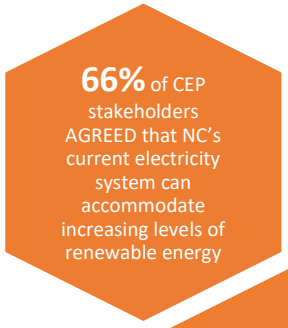
DEQ engaged with stakeholders from a variety of backgrounds and disciplines to understand their vision for North Carolina's clean energy future. Throughout the series of workshops and public meetings, DEQ and participating stakeholders identified needs, issues, barriers, solutions, unrealized opportunities, equity concerns and required actions. Stakeholders and members of the public engaged in the process, which helped DEQ better understand their vision for a clean energy future in NC. Throughout the stakeholder and public engagement process, participants were given information about future energy demand, generation and supply strategies, and national trends in power grid modernization to help frame the discussion around issues relevant in NC. Rate impacts, economic and job opportunities, environmental and health impacts were also considered. The public engagement process culminated with stakeholders recommending and prioritizing policy, regulatory, administrative, local government, public, and business actions for achieving North Carolina's clean energy future.

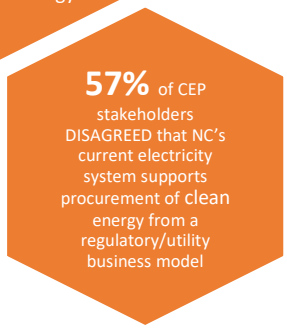
3.1 Stakeholder Views on North Carolina's Electricity System

During the 20th century, North Carolina's electricity system consisted of large, centralized, fossil fuel-based plants that were owned and operated by electric utilities. During this period, strong growth in electric consumption necessitated the investments in continuously operating, large and long-lasting generating assets. The developing electricity system quickly became an essential service affecting the public interest. Under The Regulatory Compact, a single vertically integrated provider who owned and operated all three elements of the electricity system (generation, transmission, and distribution) was allowed to serve all consumers at lower cost with greater efficiency and reliability than multiple competing providers offering the same service. The result was a system of for-profit utilities operating in defined geographic service areas as protected monopolies, serving customers at a just and reasonable price that covered operating costs plus a return on the capital invested in rates set by the NCUC. In return, the utility is required to serve anyone located within its service territory in a manner that is safe, reliable, and nondiscriminatory. The system allows the opportunity to recover reasonable operating costs and to earn a return on prudent capital investment, but not on operating costs. This arrangement has enabled build-out of generation capacity to meet peak-load demand, and a one-way flow of electricity from suppliers to customers.



The 21st century electric grid is seeing declining load growth due to customer-enabled EE measures, demand response measures, shift to less energy-intensive industries, and proliferation of behind the meter generation systems. The average annual growth in electricity consumption in the U.S. has declined from about 10 percent in the 1950s to less than 1 percent over the past decade. Data shows that economic growth indices have decoupled from the electricity generation sector at both state and national levels. This flexibility has opened doors for innovation, energy and environmental policy-making, greater customer choice, and new deployments in RE and DERs. Combined with declining technology prices and societal interests in climate change, social equity and inclusion of underrepresented communities, the new electricity system is becoming much more transactional, bi-directional, and enabling customers to be not only recipients of services, but also suppliers of services to the grid.

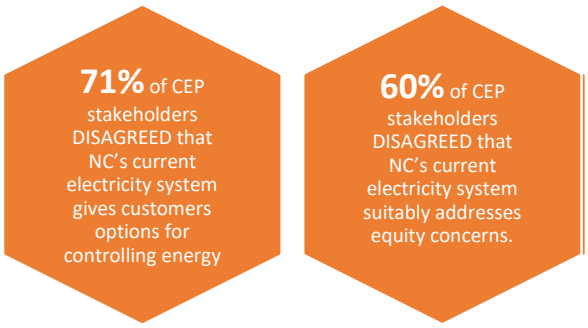




In this new era, the traditional electricity system is facing aging infrastructure, decline in utility revenue linked to generation investments and quantity of energy sales, growing demand for clean energy and data services, and reliability and resiliency concerns due to natural and physical threats such as weather related events and cyber-attacks. There is concern that the traditional regulatory framework will not continue to serve the public interest, could push consumer prices upward without a

corresponding increase in value for customers, and potentially expose the State to excessive risk, costs and environmental damage.

Historically, North Carolina has taken progressive and bold policy actions related to the electricity sector. As one of the first states in the nation to address air pollution from coal-fired power plants in 2002, North Carolina enacted a landmark legislation called the Clean Smokestack Act to cap emissions of nitrogen oxide and sulfur dioxide. The compliance strategy deployed by the affected utilities resulted in the closure of inefficient coal units and the operation of technologically advanced, well controlled and most efficiently operated units in the nation. The legislation provided additional co-benefits such as decreased fine particulate emissions, carbon dioxide emissions, mercury emissions, and other hazardous air pollutants. In 2007, North Carolina became the first state in the Southeast to enact the Renewable Energy and Energy Efficiency Portfolio Standard (REPS).[50] Along with state and federal renewable energy tax credits, and favorable PURPA conditions, the REPS program propelled NC to become a solar industry leader, bringing associated jobs and economic development opportunity in rural areas of the state. In 2017, under HB 589, North Carolina enacted the Competitive Solutions for North Carolina that requires competitive procurement of renewable energy, creates a Green Source Advance program for large businesses, universities and the military to directly procure renewable energy, and creates a solar rebate and leasing programs program among other things.



Through these policy actions, the State has created a robust clean energy industry that continues to evolve. However, despite the planned reforms under HB589, uncertainty exists over increased investments in new natural gas facilities, how solar will be developed in the state going forward, unclear direction on the scale of large scale battery storage, wind generation, and electric vehicle programs, lack of options for rooftop solar, and concerns over inequitable access to clean energy, energy burden to low income facilities, and a just transition from traditional energy jobs. Customers are also raising questions about the power sector being the largest contributor of NC's GHG emissions and how much carbon reduction is technologically feasible while maintaining affordability and reliability.

The CEP stakeholders have communicated that the cost of electricity will continue to increase if nothing changes, while the current regulatory frameworks will inhibit the utility from pursing new technologies and limit the ability of third-party businesses from selling innovative technologies and services to customers. Furthermore, the stakeholders conveyed that a new regulatory framework can change the trajectory of costs by avoiding system costs and by forcing the utility to find more value from the electric distribution system and creating additional revenue streams from innovation and technology deployment.

[50] SB3

3.2 Stakeholder Vision and Values to Uphold in a 21st Century Electricity System

The vision for North Carolina's energy future is a clean, affordable, modern, resilient and efficient energy system, through the increased deployment of both grid scale and distributed energy resources, such as solar, energy efficiency, battery storage, wind, electrification, and other innovative solutions while giving customers more options and control, providing equitable access to renewable energy opportunities, and helping customers reduce and control energy use at fair rates.

In achieving this vision, the stakeholders prioritized the values shown in Figure 13 to uphold and promote going forward. Among 27 values, 400 stakeholders representing business and industry groups, local government sector, private citizens, environmental groups, higher education, utilities, trade associations, and others overwhelmingly selected environmental and carbon reduction as the most important value to uphold, at 20%, followed by Affordability, reliability, and environmental justice at 7%.

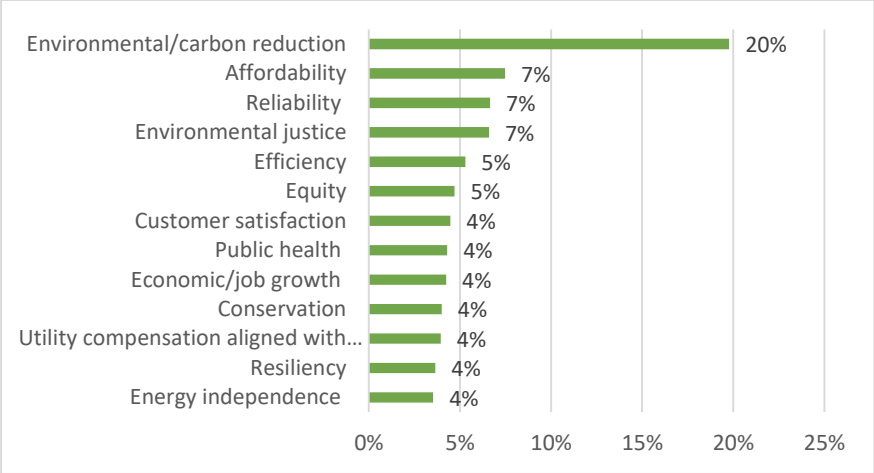


Figure 13: Stakeholder Voting Results on Values to Uphold in the Electricity System
(400 respondents)

To help achieve this vision and maintaining our core values, North Carolina should work toward an integrated energy system that:

1. recognizes the combined benefits of the central grid and DERs,
2. invests and retains capital in local communities,
3. creates jobs of the 21st century, and
4. serves as a catalyst for innovation, new business development and continued economic development in the state.

Future energy policy and regulations should strengthen our resiliency to natural threats, quickly decarbonize the electric power sector, and properly incentivize utilities, independent power producers, and consumers to make this vision a reality.

4. Detailed Policy and Action Recommendations

The CEP defines three goals to achieve as shown in Figure 14. Each of these goals is based on clean energy's ability to grow North Carolina's economy, foster long-term energy affordability, and increase environmental and health benefits for all our residents. Achieving these goals will not come overnight or through one or two actions; rather it will require a collection of actions to set us on a path of modernization that prepares our residents, government, and businesses, to be competitive, proactive, and responsible stewards of our environment.

Accelerate clean energy innovation, development and deployment to create economic opportunities for both rural and urban areas of the State.	Foster long-term energy affordability for North Carolina's residents and businesses by modernizing regulatory and planning processes.	By 2030, reduce electric power sector greenhouse gas emissions between 60% and 70% below 2005 levels and work towards zero emissions by 2050.

Figure 14: CEP Goals

The CEP top recommendations are shown in Figure 15. Each recommendation is divided into five strategies shown in Figure 16 and summarized below.

- Utility Incentives and Comprehensive System Planning: addresses recommendations related to utility compensation methods, regulatory processes, and long-term utility system planning.
- Customer Access to Clean Energy and Economic Development: focuses on methods to increase customer access to clean energy resources, regulatory processes related to the way clean energy resources are valued, and emerging areas that can create economic opportunities
- Equitable Access and Just Transition: addresses methods to relieve the energy burden on low income communities, provide job training, and develop a clean energy workforce
- Carbon Reduction and Grid Resilience: identifies greenhouse gas mitigation methods for the electric power sector and approaches to enhance grid resiliency
- Beneficial Electrification and Energy Efficiency: identifies approaches to electrify the transportation sector and reduce electricity demand through efficiency measures

Each strategy contains a series of recommendations and actions that are divided into short, medium- and long-term actions based on the following reasoning.

- Short term actions: considered essential to enable other positive outcomes to occur and are within the existing ability or authority of the implementing organization.
- Medium term actions: considered just as important but may take longer to initiate or implement.
- Long term actions: recognizes that it may take several years to take effect due to the level of complexity, difficulty or authority needed to implement. Some long-term actions also consider resources required for the implementing organization to carry out the activities.

The remaining portion of this section discusses the five strategy areas in more detail. For each strategy, the following information is provided: Background, Recommendation(s), Action(s) corresponding to each recommendation, Implementing entity, and Action schedule.

NORTH CAROLINA CLEAN ENERGY PLAN

PRIORITY RECOMMENDATIONS

MODERNIZE THE UTILITY INCENTIVES AND TOOLS

Launch a stakeholder process to inform future policymaking around tools that better align utility incentives with public interest, state energy and carbon policy, and grid needs, and state energy and carbon policy.

ADDRESS EQUITABLE ACCESS AND ENERGY AFFORDABILITY

Include non-energy equity-focused costs and benefits in decisions regarding resource needs, program design, cost-benefit analyses, and facility siting.

REQUIRE COMPREHENSIVE UTILITY SYSTEM PLANNING PROCESSES

Establish comprehensive utility system planning process that connects resource, transmission, and distribution planning in a holistic, iterative and transparent process that involves stakeholder input throughout.

Expand cost-benefit methodologies used to make decisions about resources and programs to include societal and environmental factors

DECARBONIZE THE ELECTRIC POWER SECTOR

Set North Carolina electricity sector carbon reduction goals in policy and legislation.

Conducta comprehensive study on the most cost-effective pathways to reach NC's goals.

FACILITATE DISTRIBUTED ENERGY RESOURCES (DER) INTERCONNECTION AND COMPENSATE THEM FOR VALUES PROVIDED TO THE GRID

Develop rates that provide accurate price signals to demand-side resources about costs and value to the grid.

Establish new rate and compensation structures for DERs based on the value of grid services that can be provided by DERs.

INCREASE USE OF ENERGY EFFICIENCY AND DEMAND-SIDE MANAGEMENT

Establish an Energy Efficiency Advisory Council to oversee implementation of the EE Roadmap recommendations

ELECTRIFY THE TRANSPORTATION SECTOR

Require utilities to develop innovative rate design pilots for electric vehicles to encourage off-peak charging and to test effectiveness of different rate structures at shifting customer usage of the grid and encouraging the adoption of electric vehicles.

Figure 15 CEP Top Recommendations

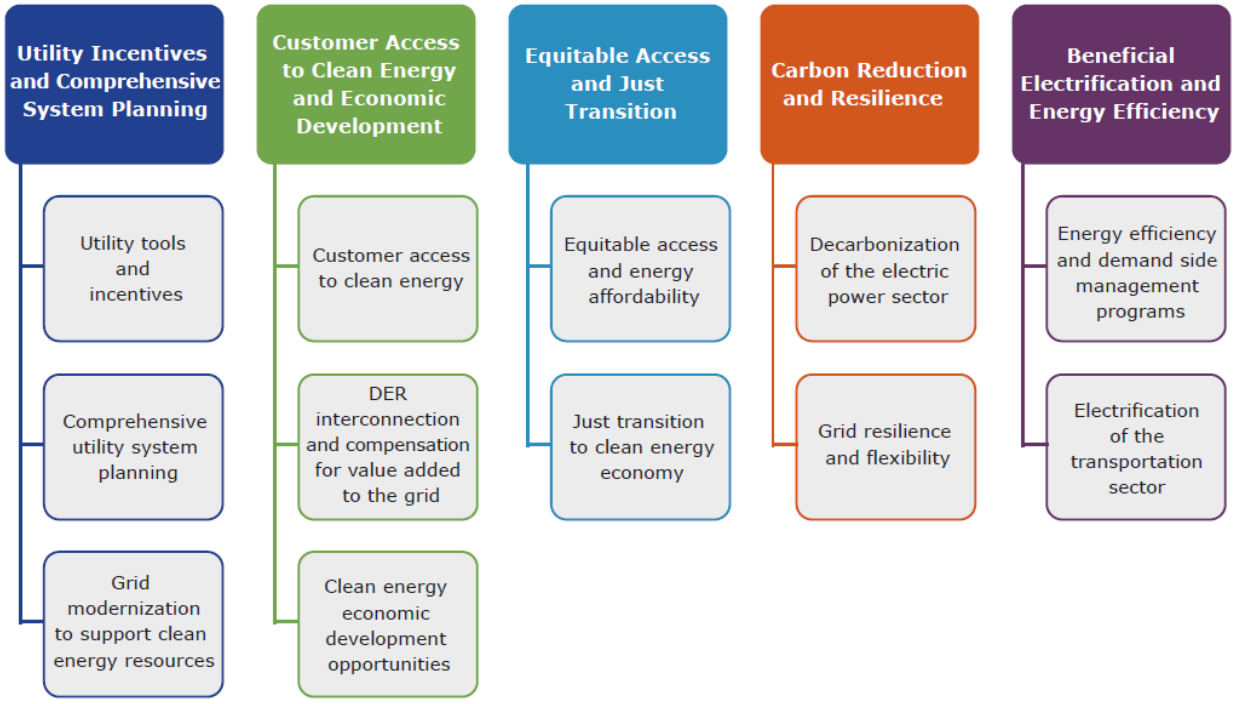
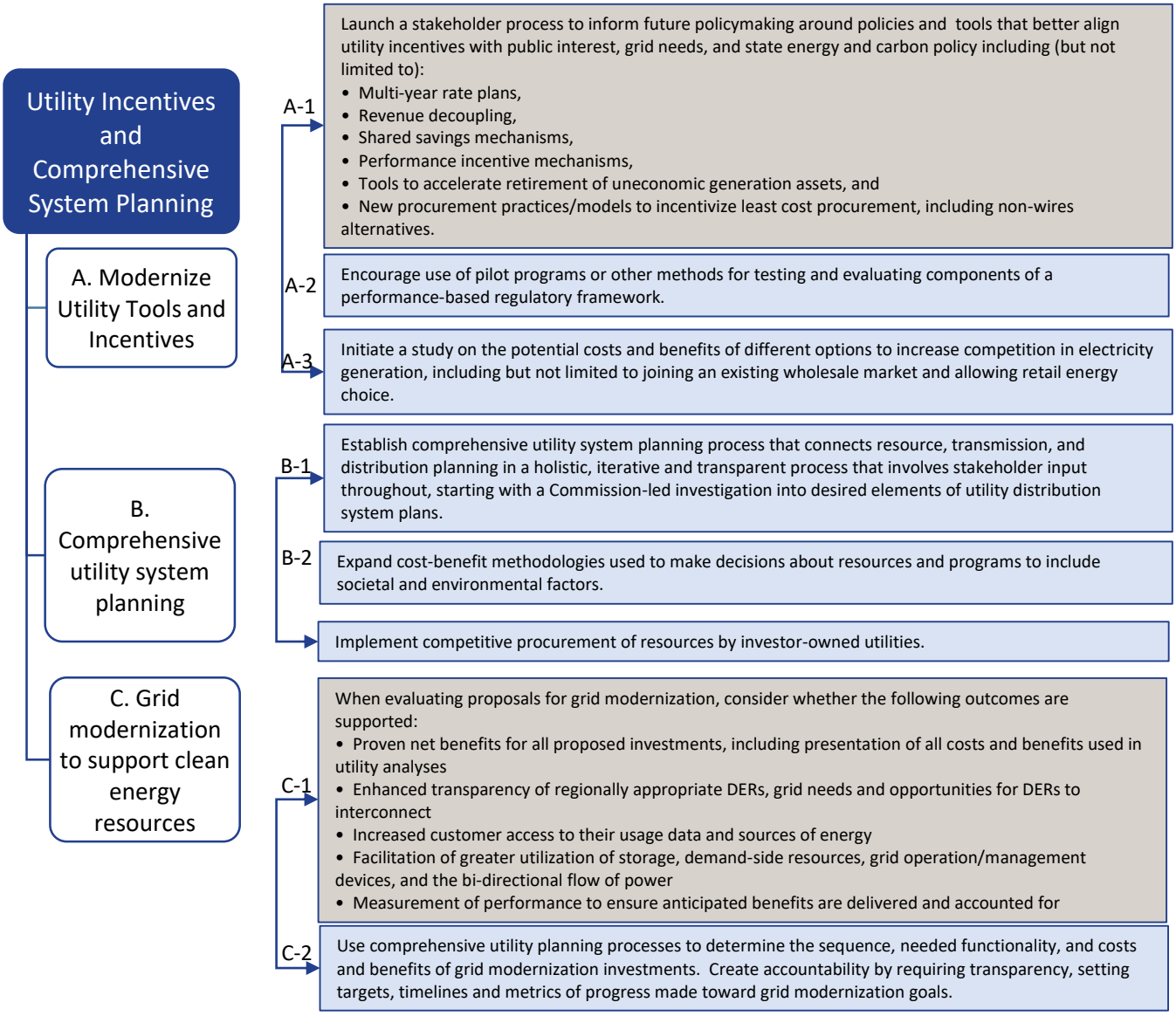


Figure 16: CEP Strategy Areas

4.1 Utility Incentives and Comprehensive System Planning



Strategy Area		Recommendation	Legislature	Utilities Commission	Governor's Office	State Agencies	IOU	CO-OPs / Public Utilities	Local Government	Academia	Businesses
Utility Incentives and Comprehensive System Planning	A. Modernize utility tools and incentives	A-1	●		●						
		A-2		●			●				
		A-3	●								
	B. Require comprehensive utility system planning processes	B-1		●		●	●	●	●	●	●
		B-2		●				●			
		B-3		●							
	C. Modernize the grid to support clean energy resources	C-1		●				●			
		C-2		●				●			

SHORT TERM MEDIUM & LONG TERM

A. Modernize utility tools and incentives

Background and Rationale

The traditional utility regulatory model in the US effectively achieved many of the policy objectives it was meant to. The ability to raise low-cost capital allowed regulated investor-owned utilities to build out a nationwide electric grid, and the regulatory model in use for the past 100+ years has led to reliable, nearly universal service, at generally stable rates. However, new public policy priorities and emerging trends are forcing reconsideration of the utility's long-standing responsibilities, now expanding to include new expectations for environmental performance, carbon reduction, customer choice, resilience, equity, and adapting to (or enabling) sector-wide innovation, among others. These new demands are highlighting the limitations of the traditional utility incentive methods, forcing the industry to rethink how regulations can be updated to achieve new policy goals, as well as meet evolving grid and customer needs.

In North Carolina, as in many other states, the existing regulatory structure encourages utilities to sell more kilowatt-hours of electricity and to invest in utility-owned capital infrastructure. These incentives do not necessarily lead to the least-cost and highest-value solution for customers. For example, distributed technologies now have the potential to substitute for conventional utility infrastructure solutions, but the current utility business incentive structure discourages utilities from selecting those options even if it would save customers money. The combination of declining load growth in the state,[51] significant cost declines for distributed resources, and necessary upgrades to system infrastructure is putting increasing strain on the current utility business incentive structure. The state's utilities need a way to maintain their financial health and ability to access low-cost capital in a future where customers have growing options to reduce energy use, shift to on-site energy production, and are demanding more control over where their energy comes from. For example, in recent years the cost of renewable energy has fallen so much that there is now evidence that existing utility coal assets in North Carolina are no longer economic, meaning that customers would actually save money if the utility was able to accelerate the closure of those units and invest in renewable generation to meet demand instead.[52]

These trends are not unique to North Carolina. A growing number of states are investigating the appropriate steps to take to move toward a regulatory model that better aligns utility profit-making incentives with societal objectives and removes the bias toward capital investments.[53] Revisiting how a

[51] The North Carolina Utilities Commission reported that between 2016 and 2017, electricity sales from the State's three investor owned utilities declined by 2.7 percent while the growth rate of new customers increased by 0.34 – 1.57 percent. North Carolina Utilities Commission, Major Activities Through December 2018 With Statistical And Analytical Data Through 2017, Volume XLIX, 2018 Report.

[52] Gimon, Eric, et al. *The Coal Cost Crossover: Economic Viability of Existing Coal Compared to New Local Wind and Solar Resources*, Energy Innovation and Vibrant Clean Energy, March 2019. Available at: https://energyinnovation.org/wp-content/uploads/2019/03/Coal-Cost-Crossover_Energy-Innovation_VCE_FINAL.pdf

[53] States include Hawaii, Minnesota, New York, Illinois, Rhode Island, Colorado, and Nevada.

utility earns revenues is a foundational step that can impact the successful implementation of all other strategy areas in this report.

Recommendations

A-1. Launch a stakeholder process to inform future policymaking around policies and tools that better align utility incentives with public interest, grid needs, and state energy and carbon policy including (but not limited to):

- **Multi-year rate plans,**
- **Revenue decoupling,**
- **Shared savings mechanisms,**
- **Performance incentive mechanisms,**
- **Tools to accelerate retirement of uneconomic generation assets, and**
- **New procurement practices/models to incentivize least cost procurement, including non-wires alternatives.**

Stakeholder engagement will be necessary to successfully explore new opportunities for updating North Carolina's utility regulatory framework in light of a transforming electric power system. This process should be tightly focused in scope, with clearly defined timeline and deliverables as described below. The process should be convened by an objective third party and limited to persons with expertise and individuals who can provide balanced representation of their respective constituents[54]. The draft work product generated should be opened to a broader, diverse set of stakeholders that can contribute to its refinement before it is delivered to the appropriate entity. The process should include four key steps:

- Identifying common priority goals for utility operations, products, and services;
- Based upon these goals, determine where new or updated regulatory approaches are needed;
- Determining which regulatory mechanisms (e.g., revenue decoupling, multi-year rate plans, performance incentive mechanisms) are best-suited to achieve prioritized goals; and
- Draft specific recommendations for implementing the identified regulatory mechanisms (e.g., draft regulations, legislation, or implementation framework for adopting multi-year rate plans) and submit them to the appropriate entity.

Taking deliberate steps to ensure there is a shared understanding of the needs and objectives for new regulatory tools among stakeholders will lead to more informed policy decisions and increased buy-in from others in the sector. The stakeholder process should explore the following tools, at a minimum:

- **Multi-year rate plans**: fix the time between utility rate cases and compensate utilities based on forecasted efficient expenditures or external market factors rather than historical costs of service;[55]

[54] Examples include representatives from large customers, industry, low-income community, DER provider, environmental groups, and trade associations.

[55] Multi-year rate plans include use of an attrition relief mechanism (ARM) that provides timely, predictable rate escalation during the period between rate cases. This escalation is based on cost forecasts, industry cost trends or both, rather than the utility's specific costs. A forecasted ARM is based

- **Revenue decoupling**: breaks the link between the amount of energy a utility delivers to customers and the revenues it collects;[56]
- **Shared savings mechanisms**: reward the utility for reducing expenditures from a baseline or projection by allowing the utility to retain some of the savings as profit, while passing some savings to consumers;
- **Performance incentive mechanisms**: create a financial incentive for a utility to achieve performance outcomes and targets consistent with customer and public policy interests;
- **Tools to accelerate retirement of uneconomic generation assets**: adjusts rates to speed up the depreciation of an asset so the utility and its customers are not left with stranded costs when an asset retires early; securitization can refinance uneconomic utility-owned assets by creating a debt security or bond to pay down an early-retiring plant's undepreciated capital balance; and
- **New procurement practices/models to incentivize least cost procurement, including non-wires alternatives:** expand utility resource procurement approaches to provide customers with the most cost-effective combination of supply- and demand-side resources.

Table A-1: Actions for Recommendation A-1

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Governor's Office	Convene an investigatory process on utility incentives reform; directive should include at least the tools listed above	Short Term
Legislature	Implement legislation recommended by the stakeholder process	Short to medium term

A-2. Encourage use of pilot programs or other methods for testing and evaluating components of a performance-based regulatory framework.

Shifting to a more performance-based regulatory framework will require some extent of flexibility. Depending on the outputs that result from the investigatory process described in the prior recommendation, pilot programs and phased approaches to policy implementation provide opportunities to test and refine specific regulatory mechanisms. In order to be adaptive, there should be processes for

on multiyear cost forecasts and increases revenue by predetermined percentages in each plan year. An indexed ARM compensates utilities automatically for important external cost drivers such as inflation. "Hybrid" approaches to ARM design use a mix of indexing and other escalation methodologies. See Lowry, Mark, et al. *State Performance-Based Regulation Using Multiyear Rate Plans for U.S. Electric Utilities*, Lawrence Berkeley National Laboratory. July 2017.

[56] Decoupling mechanisms help to remove the utility's current incentive to sell more energy in order to increase revenue by making adjustments based on actual sales to ensure that the utility earns its revenue requirement.

evaluation built in to ensure new mechanisms are working as intended. Performance metrics that measure and track utility data for certain outcomes are a key, no-regrets tool to ensure that utility performance is improving after implementing a given regulatory change. For example, testing a shared savings mechanism before full-scale implementation will provide an opportunity to ensure that the benefits kept by the utility and given to customers are well-balanced. Alternatively, using a phased approach to the development of new performance incentive mechanisms could result in better informed targets and incentive levels that don't under- or over-compensate the utility.

Table A-2: Action for Recommendation A-2

Entity Responsible	Action	Timing (Short, Medium, or Long term)
NCUC	Require Duke Energy to design pilots or other phased approaches to testing regulatory mechanisms that result from investigatory process on utility business model reform*	Medium Term
Duke Energy	Co-develop pilot proposals or phased implementation approaches to test new regulatory mechanisms with NCUC and stakeholders	Medium term

*Depending on the approaches recommended by the stakeholder process, the NCUC may need to be given explicit authority by the legislature to pursue this recommendation.

A-3. Initiate a study on the potential costs and benefits of different options to increase competition in electricity generation, including but not limited to joining an existing wholesale market and allowing retail energy choice.

Since the 1990s, states across the country have been looking at ways that greater competition in electricity generation can provide customers more reliable energy at lower costs. This has led to the emergence of competitive wholesale and retail markets in several regions, sometimes referred to as the movement toward "restructured" or "deregulated" markets. Wholesale markets can be found in Texas, California, the Mid-Atlantic, parts of the Midwest, and the Northeast, covering approximately two-thirds of the US population. At the retail level, thirteen states and the District of Columbia have implemented some form of electricity consumer choice.

However, states do not necessarily need to have both competitive wholesale and retail electricity markets. A number of states that are part of restructured wholesale markets do not have full retail access, such as Kansas, Oklahoma, and Minnesota. It is also possible for states to have retail electricity choice but not participate in a wholesale electricity market. For example, Georgia and Oregon both have retail electricity choice for large commercial and industrial consumers, but those states are not part of any restructured wholesale power market.[57]

Increased competition in the supply of energy could potentially benefit North Carolina's utilities and customers by:

- Driving down electricity prices and generating innovation through increased competition among power generators,
- Maintaining a more reliable grid by expanding generation options, and
- Advancing a cleaner grid by leveraging regionally available renewable resources.

In the 1990s, federal lawmakers introduced wholesale electricity markets following a period of poor generator performance and escalating prices as new, high-cost generating plants came online.[58] The wholesale markets were designed to meet short- and long-term requirements for grid reliability at the lowest cost. Federal policymakers saw competition among electricity suppliers as a means to control prices by attracting new sources of private investment for newer, less expensive technologies.[59] The

[57] https://www.nrel.gov/docs/fy18osti/68993.pdf

[58] A wholesale market refers to the buying and selling of power between generators and resellers. Resellers include electricity utility companies, competitive power providers, and electricity marketers. For most regions within the United States, the operation of and transactions in wholesale markets are regulated by the Federal Energy Regulatory Commission. A wholesale market allows generators to connect to the grid and generate electricity after securing the necessary approval. The electricity produced by generators is bought by an entity that will often, in turn, resell that power to meet end-user demand.

[59] https://www.pjm.com/-/media/about-pjm/newsroom/fact-sheets/the-value-of-pjm-markets.ashx

clearing price for electricity in wholesale markets is determined by an auction in which generation resources offer a price at which they can supply a specific number of megawatt-hours of power. This results in lowest-cost power sources, wherever they are located, providing electricity to wherever it is needed, spanning over a wide region.

Many states that pursued restructuring of the generation aspect of the utility business also required that utilities divest their ownership in generation capacity. That capacity was converted from utility ownership to independent power producer status, effectively transitioning those assets from the traditional cost-of-service regulation model to a market-based model under which they earn a market price for their output.[60] It is not necessary to require divestiture of generation assets by utilities in order for a state to pursue membership in a wholesale market, but it is an option that increases competition.

States and utilities have widely used quantitative assessments to evaluate whether joining wholesale markets could be net beneficial for affected utilities and customers. Examples include:

- The Federal Energy Regulatory Commission (FERC) and Entergy's retail regulators held a technical conference in Charleston, South Carolina in 2009 that was attended by Entergy and many of the entities that purchase and/or sell energy in the Entergy region. FERC agreed to fund a study on the costs and benefits of Entergy and Cleco Power joining the Southwest Power Pool (SPP). The cost-benefit analysis was performed over a seven-month period, and included an open and collaborative discussion with stakeholders on the study framework, modeling approach, input assumptions, interim results, and qualitative issues. Based on the analysis performed, the study concluded that Entergy and Cleco Power joining the SPP RTO will yield significant economic benefits to the collective SPP/Entergy region.[61]
- The Mountain West Transmission Group (MWTG) is an informal collaboration of electricity service providers that are working to develop strategies to adapt to the changing electric industry. Based on the results of extensive evaluations, MWTG decided to focus its attention on seeking membership in an existing RTO. In January 2017, MWTG announced it was entering into discussions with SPP as the next step in exploring potential RTO membership. As part of the 5-stage new member integration process, SPP staff performed an analysis of the costs and benefits resulting from MWTG membership impacts to current SPP members.[62]
- Utility-specific assessments of the costs and benefits of joining the Western Energy Imbalance Market (EIM).[63]

The Legislature could authorize a study that assesses the costs and benefits of different options the state has to increase competition in electricity generation, to determine which if any, could provide greater benefits to North Carolina customers than the status quo.

[60] https://ei.haas.berkeley.edu/research/papers/WP252.pdf

[61] https://www.ferc.gov/industries/electric/indus-act/rto/spp/spp-entergy-cba-report.pdf

[62] https://www.spp.org/documents/56652/mwtg%20cba%20report%20for%20spp%20members%20mar-19-2018.pdf

[63] https://www.westerneim.com/Pages/DocumentsByGroup.aspx?GroupID=7DF86332-C71D-44B7-836B-56181A694C8C

The consultant-led study could also look at other options for increasing competition in electricity supply, such as in retail energy supply. Retail electricity choice in the United States allows end-use customers (including industrial, commercial, and residential customers) to buy electricity from competitive retail suppliers.[64] Similar to wholesale markets, retail electricity choice was introduced with the idea that increased competition would result in lower prices, improved service, and innovative product offerings. Some argue that a competitive environment also results in suppliers offering more renewable energy options to customers as a way to differentiate themselves from their competitors.

Table A-3: Actions for Recommendations A-3

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Legislature	Authorize a consultant-led study that assesses the costs and benefits of different options the state has to increase competition in electricity generation, to determine which if any, could provide greater benefits to North Carolina customers than the status quo	Medium or long term

[64] https://www.nrel.gov/docs/fy18osti/68993.pdf

B. Require comprehensive utility system planning processes

Background and Rationale

Across the country, states are reforming the utility planning process. As the electricity system becomes more dynamic, there is a growing need to move towards more comprehensive planning processes that take into account the different layers of the grid. Streamlining traditionally disparate and serial tasks related to planning and procurement into a unified process can allow system planners to optimize investments in generation, distribution, and transmission.

Utilities and their customers, as well as third parties, can derive substantial benefits from comprehensive planning, including:

- Lowered system costs to reduce rate pressure in a low load growth environment;
- More cost-effective programs and procurements; and
- Enhanced utility, customer, and DER provider relationships as interest in DER continues to grow.[65]

Improved planning can give customers and developers the opportunity to propose, provide, and be compensated for grid services, while experiencing more efficient and predictable interconnection processes. Regulators can benefit from increased transparency and data access for optimal solution identification and more meaningful engagement with utilities and other stakeholders.[66]

North Carolina's current path of incremental improvements to a traditional planning process is not adequate to meet the challenges of integrating high renewable and distributed energy penetrations, which are, in turn, necessary for the state to achieve goals set out in this plan related to economic growth, long term affordability and price stability, and carbon reductions. The state's current integrated resources planning (IRP) process does not include explicit clean energy goals,[67] which could inhibit the ability of the energy sector to achieve clean energy and environmental goals. Additionally, the current IRP process does not include transparency in its goal-setting and lacks rules governing stakeholder involvement prior to IRP submissions.[68] The NCUC is currently looking at ways to expand the scope of utilities' *IRP* processes, but there are more holistic approaches to planning for generation, distribution, and transmission resources that should be considered.

Duke Energy has acknowledged it needs to update its planning processes and has already begun developing an Integrated System Operations Plan (ISOP).[69] Duke Energy has stated that it is important to

[65] Volkmann, Curt. *Integrated Distribution Planning: A Path Forward*, GridLab, April 2019. (Volkmann, Integrated Distribution Planning: A Path Forward)
[66] Id.
[67] Notable legislative exceptions include HB 589 and Clean Smokestacks.
[68] Utility System Planning and Investment Stakeholder Group Memo.
[69] Duke Energy introduced its Integrated System Operations Planning (ISOP) initiative in its 2018 Integrated Resource Plans. ISOP is focused on developing modeling tools and analytical processes that will complement the existing IRP processes and tools and ultimately allow for optimizing capacity and energy resource investments across Generation, Transmission, Customer Delivery and Customer

get input from customers and other stakeholders as they seek to enhance and further integrate planning processes and are working toward launching a stakeholder process focused on an ISOP model, as announced at the Grid Modernization stakeholder webinar in April of 2019.[70]

North Carolina can look to states already developing and implementing holistic planning processes, which balance the goals of the state, utilities, and stakeholders. Key examples include Minnesota, Nevada, and Hawaii:

- In 2015, the Minnesota Public Utilities Commission opened an inquiry into distribution planning (docket 15-556), aiming to incorporate DER with the appropriate optimization tools and create a transparent grid leading to an enhanced grid, reduce costs, and a more flexible and DER capable system. Ultimately, the multi-year process now requires the regulated utilities (Xcel Energy) to develop DER growth scenarios for 10 years, evaluate non-wire alternatives, detail DER queue status, and file annual updates on their 5 and 10-year distribution investment plans.[71]
- Nevada's legislature passed a bill in 2017 (SB 146) to address distributed resources along with their cost, benefits, financial compensation mechanisms, integration, and barriers to adoption. The Public Utilities Commission began the rulemaking process in 2017 (Docket 17-08022) leading to an adopted Distributed Resource Plan regulation. The regulation requires a system load/DER forecast, locational net benefit analysis, hosting capacity analysis, and grid needs assessment, filed every 3 years with the IRP.[72]
- Hawaii's investor-owned utility started developing its Integrated Grid Planning (IGP) process in 2018 (Docket 2018-0165), a program which incorporates generation, distribution, and transmission planning. The IGP process includes utilization of a capacity expansion model, a substation load and capacity analysis, hosting capacity analysis, and extensive stakeholder input. The IGP process will produce a 5-year action plan and a long-term pathway to achieve the legislative goals of 100% renewables.[73]

Solutions. An important objective of this effort is to enhance modeling of non-traditional solutions for Distribution and Transmission Planning so that multiple types of value can be captured. Duke indicates that they plan to hold stakeholder engagement sessions to share information regarding ISOP with stakeholders and gather input regarding the approach, using a third-party facilitator selected jointly by Duke and the NCUC Public Staff.

[70] Utility System Planning and Investment Stakeholder Group Memo, Addendum: Duke Energy's Ongoing Integrated System Operations Planning (ISOP) Efforts.

[71] Minnesota Public Utilities Commission, "Order Approving Integrated Distribution Planning Requirements for Xcel Energy," August 30, 2018 ("Order Approving Integrated Distribution Planning Requirements for Xcel Energy").

[72] Nevada Public Utilities Commission, "Order on Commission's Investigation and Rulemaking to Implement Senate Bill 146." September 6, 2018.

[73] Hawaiian Electric, *Integrated Grid Planning*. Accessible at: https://www.hawaiianelectric.com/clean-energy-hawaii/integrated-grid-planning

Recommendations

B-1. Establish comprehensive utility system planning process that connects resource, transmission, and distribution planning in a holistic, iterative and transparent process that involves stakeholder input throughout, starting with a Commission-led investigation into desired elements of utility distribution system plans.

To respond and adapt to the many trends and forces changing the electricity sector today, it is necessary that North Carolina move to a more holistic, iterative, and transparent planning process that incorporates non-traditional market solutions, which could lower generation and infrastructure costs while still maintaining a clean, reliable, and affordable electricity system. Planning processes should be consistent, data-driven, and involve stakeholders' input and feedback throughout.

An improved planning process could be enabled by the North Carolina legislature and overseen by the NCUC. Legislation could define goals, necessary steps, and what roles the NCUC will play, giving explicit authorization where it is currently vague or lacking under existing law.

One feasible way to get started on a process to move toward a more holistic electricity sector planning process would be to initially begin an investigation into the desired elements of an Integrated Distribution Plan (IDP). The links between IDP, IRP, and transmission planning could be explored throughout this investigation.[74] Best practices for IDP indicate that they should include:

- Explicit consideration of the impacts from all DER types, including energy efficiency and demand response, in load forecasting and transmission, distribution and integrated resource planning.
- Enhanced forecasting to reflect the uncertainties of DER growth and its impact on load and peak demands.
- Analysis of the distribution systems' constraints and needs, as well as the ability to accommodate DER without requiring upgrades (i.e., hosting capacity analyses).
- Identification of locational value for nodes on the distribution system where DER deployment could provide grid services.
- Consideration of third-party DER or portfolios of DER to address grid needs as non-wires alternatives (NWA).
- Acquisition of NWA grid services from customers and third parties using pricing, programs or procurement.
- Active monitoring, management and optimization of DER.
- Streamlined DG interconnection processes using insights from the distribution system capacity analyses.
- Increased external transparency through enhanced data availability and meaningful stakeholder engagement.[75]

[74] The connections between these three types of planning processes, and ways to find synergies and streamline the processes in order to make them more efficient and effective are currently the subject of a Task Force of states convened by NARUC and NASEO. North Carolina's NCUC, DEQ and Public Staff are participants in this Task Force and may have ideas and lessons learned from that process to bring to bear on any IDP process launched by the state.

[75] Volkmann, *Integrated Distribution Planning: A Path Forward*.

Ultimately, the State should move towards an Integrated System Operations Plan (ISOP) approach, which combines resource, transmission, distribution planning. The ISOP processes should include regularly scheduled plan submissions to allow for stakeholder intervention early and throughout the process. These submissions should utilize existing analytical tools, as well as improved data and modeling access for industry and stakeholders.

While the NCUC is addressing some of these new planning approaches in its current IRP proceeding (Docket No. E-100, Sub 157),[76] and the North Carolina Transmission Planning Collaborative (NCTPC)[77] is focusing on enhancing transmission planning in the state, the NCUC should initiate a separate process to create the guidelines for future comprehensive system planning, initially focusing on distribution planning. The outputs of this process can then feed into existing processes, such as NCUC's IRP proceeding, Duke's ISOP efforts, and NCTPC's discussions, as appropriate.

Table B-1: Actions for Recommendation B-1

Entity Responsible	Actions	Timing (Short, Medium, or Long term)
NCUC	Initiate and oversee comprehensive system planning process with meaningful stakeholder participation, starting with integrated distribution planning, including identifying key steps and timelines	Medium term
All	Work with NCUC in designing and implementing comprehensive system planning process	Medium term
Co-ops	NCEMC develop a process and guidance for co-ops to undertake more comprehensive planning	Medium term

[76] NCUC has scheduled a Technical Conference in late August 2019 that will focus on expanding the scope of the IRP process, including ways to identify the locational value of DERs.
[77] North Carolina Transmission Planning Collaborative: http://www.nctpc.org/nctpc/

B-2. Expand cost-benefit methodologies used to make decisions about resources and programs to include societal and environmental factors

State public utility commissions have typically employed a 'least cost' framework for assessing whether a utility's investment is prudent. Under the least cost framework, the optimal choice is the least cost investment after accounting for other factors such as reliability, state renewable energy or energy efficiency mandates, other legal obligations, and a range of risk factors. Least cost is not a rigid standard, however. The approach allows utility regulators to exercise discretion to choose among sources of information, desirable outcomes, and risk assessments. New information, changing market conditions, more stringent regulations, and emerging technologies can all alter the math.

Identifying least cost investment options over the next one to two decades is particularly complex due to the increased level of uncertainty regarding technology, markets, and regulation. Projections may fail to consider the potential cost impacts of changing circumstances and may undervalue non-cost factors, such as greenhouse gas emissions and health impacts. As a result, the traditional application of the least cost framework may undermine the goal of minimizing costs in the long term, as policy shifts to force utilities to internalize environmental externalities or as consumers bear costs in other ways such as medical bills.

To achieve the North Carolina's carbon reduction goals, utilities need to update planning assumptions, as well as program cost-effectiveness methodologies, to allow for more complete quantification of the operational benefits of energy and technology resources, including societal and environmental factors that may be hard to monetize. Benefit-cost analyses also should take into account locational and temporal values, when available, to provide a more granular assessment of proposed investments.

For resources to be more accurately accounted for in utility planning and programs, regulators should consider a range of non-energy benefits, including:

- Increased system resilience, reliability, and safety
- Reduced customer costs; especially low-income, disadvantaged communities
- Increased customer satisfaction
- Health impacts
- Increased customer flexibility and choice
- Environmental benefits, such as avoided greenhouse gas emissions
- Economic development benefits, such as job growth

Rhode Island and California both have recently updated what benefits and costs should be considered in program evaluation and planning:[78]

- In 2016, the Rhode Island Public Utilities Commission opened a docket to get stakeholder input on (a) new rate design principles and concepts, and (b) cost-effectiveness for EE and other types

[78] In addition, Arkansas, Connecticut, Minnesota, New Hampshire, Pennsylvania, and Washington all are exploring how to update current cost-effectiveness procedures to account for an expanded set of benefits and costs. (American Council for an Energy Efficiency Economy [ACEEE], *A New Tool to Improve Energy Efficiency Practices: The Database of State Efficiency Screening Practices [DSESP*], July 2019.)

of DERs.[79] One of the reasons for opening the docket was to develop a cost-effectiveness framework that can be applied consistently across different types of ratepayer-funded resources and programs. After months of stakeholder discussions, the Working Group recommended expanding the Rhode Island Total Resource Cost (TRC) Test to include a broader range of benefits to better align with its applicable state policies. The new cost-effectiveness test was named "the Rhode Island" Test and includes: risk impacts, environmental impacts (including greenhouse gas emissions reductions), jobs and economic development impacts, societal low-income impacts, public health impacts, and energy security impacts. The Commission accepted the recommendations of the Working Group, and directed the utility company to use the new Rhode Island Test, to the extent possible, for evaluating the cost-effectiveness of EE, DERs, other Company investments and spending.

- California utilities' annual Grid Needs Assessment (GNA), which is part of its distribution planning efforts, describes the performance requirements for any DER solution identified, including the magnitude, duration and frequency of resources required to address each grid need. The GNA uses a Locational Net Benefits Analysis (LNBA) framework, which includes a broad range of system and societal benefits as the basis for determining the range of value at each location. These benefits include: reliability and resiliency, avoided GHG emissions, and other safety/societal benefits.[80]

Table B-2: Actions for Recommendation B-2

Entity Responsible	Action	Timing (Short, Medium, or Long term)
NCUC	Initiate and oversee process to update benefit-cost methodologies used in decision-making about resources and programs; this process could be a separate PUC proceeding/investigation or be part of the comprehensive planning process referenced in the recommendation above*	Long term
Co-ops and Municipal Utilities	Initiate and oversee a process involving the public and/or members to update benefit-cost methodologies used in decision-making about resources and programs	Long term

* It is assumed that the NCUC has existing statutory authority to pursue this recommendation. In the event that it is determined that the NCUC does not have sufficient authority, legislation would be needed to provide the appropriate authority.

[79] Rhode Island Public Utilities Commission, Investigation into the Changing Electric Distribution System and the Modernization of Rates in Light of the Changing Distribution System (Docket 4600), "Report and Order 22851," July 31, 2017.

[80] California Public Utilities Commission, Order Instituting Rulemaking Regarding Policies, Procedures and Rules for Development of Distribution Resources Plans Pursuant to Public Utilities Code Section 769 (Rulemaking 14-08-013), "Decision on Track 3 Policy Issues, Sub-track 2," March 22, 2018.

B-3. Implement competitive procurement of resources by investor-owned utilities

Many states, and the federal government through passage of laws like PURPA, the Energy Policy Act of 1992 and the Energy Policy Act of 2005, have recognized that the power generation aspect of electric utility services is a competitive industry, and no longer ought to be viewed as a "natural monopoly." Some states have chosen to deregulate the power generation side of the utility business, which has resulted in the creation of retail energy providers and regional transmission and generation dispatch entities such as PJM Interconnection. Others have modified their integrated resource planning processes to require utilities to consider non-utility generation in their planning processes by conducting competitive procurement of needed resources. In this instance, a completed IRP becomes the precursor for approval of the utility's proposed means for meeting identified resource needs. A competitive procurement model means that utility self-build options will be one option among many, with the utility pursuing the option (which may come from a competitive supplier) that meets the identified need at the least cost. This competition should result in the lowest cost investment being made, ensuring consumers benefit from ultimately lower bills.

Oklahoma and Colorado are two states that have moved to a competitive procurement model for resources. Oklahoma's utility regulations governing IRPs set out procedures for "establishing the need for additional resources serving as the basis for long-term competitive procurement of resources, including, but not limited to, utility construction of new electric generation facilities, the utility purchase of existing electric generation facilities, and the purchase of long-term power supplies.[81]" Similarly, Colorado stipulates that an IRP filed by a utility shall include "the proposed RFP(s) the utility intends to use to solicit bids for the resources to be acquired through a competitive acquisition process.[82]" North Carolina currently does not require utilities regulated by the Utilities Commission to undertake competitive procurement of identified system needs in the IRP process.

Table B-3: Actions for Recommendation B-3

Entity Responsible	Action	Timing (Short, Medium, or Long term)
NCUC	Amend IRP rules to include a requirement for regulated utilities to utilize competitive procurement processes to meet identified system needs	Medium term

* It is assumed that the NCUC has existing statutory authority to pursue this recommendation. In the event that it is determined that the NCUC does not have sufficient authority, legislation would be needed to provide the appropriate authority.

[81] Oklahoma Corporation Commission, Subchapter 37. Integrated Resource Planning.
[82] Colorado Department of Regulatory Agencies, Part 3: Rules Regulating Electric Utilities, 3064. Contents of the Least-Cost Resource Plan

C. Modernize the grid to support clean energy resources

Background and Rationale

Distributed energy resources, including energy efficiency, demand-side management, solar, and storage have the potential to provide valuable services to the electricity grid and lower costs on the system while providing customers with cleaner power and more control over their energy usage. These benefits along with the falling costs of the technologies themselves are increasing customer and third-party interest in purchasing or investing in these resources. In response, utilities across the U.S. are taking steps to modernize their electric grids, which includes augmenting the grid with software and communications technologies to help the grid meet the new customer, technological, and societal demands.

While North Carolina's adoption of distributed solar generation is still at modest levels, there is growing concern that the grid needs to be upgraded and improved in order to accommodate DER growth and new load from the electrification of end-uses in a way that supports what customers want, maintains reliability, and keeps customer costs down. To carry this out, a thoughtful and methodical approach to grid modernization is needed due to the significant capital expenditures and potential risks proposals may carry. While investments to improve grid capabilities will likely be necessary to enable a clean and resilient electricity system, transparency in grid planning processes can help ensure third parties and customers understand why these investments are needed and what added value they provide to the system.

Recommendations

C-1. When evaluating proposals for grid modernization, consider whether the following outcomes are supported:

- **Proven net benefits for all proposed investments, including presentation of all costs and benefits used in utility analyses**
- **Enhanced transparency of regionally appropriate DERs, grid needs and opportunities for DERs to interconnect**
- **Increased customer access to their usage data and sources of energy**
- **Facilitation of greater utilization of storage, demand-side resources, grid operation/management devices, and the bi-directional flow of power**
- **Measurement of performance to ensure anticipated benefits are delivered and accounted for**

Duke Energy is currently working on a Grid Improvement Plan which they intend to file in 2019 alongside their next rate case. The NCUC will be the entity responsible for approving the plan and granting cost recovery. The above outcomes emerged through Clean Energy Plan's stakeholder process as important conditions to consider when evaluating grid modernization plans to maximize the potential benefits of grid modernization investments and to protect against potential utility capital bias.

For an investment to be net beneficial, it means that the benefits (which can include both monetized and non-monetized benefits) from a particular investment outweigh its complete set of costs. Transparency in

cost benefit analyses that shows what costs and benefits are accounted for and their magnitude allows for a more diligent assessment of different technologies' cost-effectiveness.

As customers transform from mere consumers of energy to active participants in the electricity system, utilities are now expected to facilitate additional choices and options for customers as they seek out DER and other services to manage their energy use and costs. Increasing access to data can provide customers with the granular information they need to make more informed decisions about their energy consumption and supply. A more distributed and diverse system will require utilities to seek new ways to integrate both customer- and grid-facing technologies to enable a more dynamic grid, such as storage and programmable thermostats.

Operating a dynamic grid will require an increase in availability of transmission and distribution data to enable adequate system monitoring, control, and protection. Transparency of current and anticipated grid needs can streamline interconnection processes and better ensure that new technologies and distributed resources are connected to the grid in areas that can most benefit from them.

Moreover, grid modernization plans should integrate mechanisms for accountability that ensure new grid investments deliver optimized benefits to the grid, customers, and the industry as a whole.

While the NCUC is responsible for approving Duke Energy's Grid Improvement Plan, the same criteria can be applied to co-ops and municipal utilities, who are beginning to consider what grid modernization investments may be necessary on their own systems.

Table C-1: Actions for Recommendation C-1

Entity Responsible	Action	Timing (Short, Medium, or Long term)
NCUC	Use outcomes listed above to guide evaluation of Duke's Grid Improvement Plan	Short term
Co-ops and Municipal Utilities	Take into consideration the outcomes listed above when developing grid modernization plans	Medium term

C-2. Use comprehensive utility planning processes to determine the sequence, needed functionality, and costs and benefits of grid modernization investments. Create accountability by requiring transparency, setting targets, timelines and metrics of progress made toward grid modernization goals.

Establishing formal procedures and requirements for future grid modernization plans will result in a more streamlined and transparent process. For investor-owned utilities, providing a set of planning requirements prior to the submission of a grid modernization plan will ensure that technologies are deployed strategically and on an as-needed basis. Grid modernization should be directly linked to and informed by the more holistic planning process described above and should include needed improvements to both the distribution and transmission systems. For example, requiring development of different DER penetration scenarios or a more granular system assessment (e.g., at the circuit level) can help identify which new investments are necessary to maintain reliability. Alternatively, improving the linkage between transmission, resource, and grid modernization planning may better identify solutions to transmission system constraints that could be prohibiting greater levels of renewable generation on the system in the eastern part of the state.[83]

Directing utilities to include detailed and clear analysis of cost and benefits in planning processes will ensure approved investments are net beneficial. Making sure utilities establish performance metrics, targets, and accompanying timelines, will allow regulators to hold utilities accountable for plan implementation and new investments are delivering expected benefits in a timely manner. For municipal utilities and co-ops, these methods can be directly integrated into system planning processes.

Other states that are looking for opportunities to better integrate their planning and grid modernization processes include California and Minnesota:

- California has established a Grid Modernization Guidance framework that defines the scope of what can be considered as grid modernization and establishes a structure and timing of grid modernization planning process, including the submission of a Grid Needs Assessment that results from the state's distribution resource planning process. The framework also provides guidance on how to evaluate the cost effectiveness of grid modernization investments and establishes submission requirements.[84]
- Minnesota also has combined their grid modernization and distribution planning processes into one multi-year effort. Xcel Energy is required to file 5-year Action Plans for distribution system

[83] The low cost of land in the eastern part of the state has led to large volumes of solar development to concentrate in one area of the state where the electrical infrastructure is constructed with smaller conductors. The demand for electricity in this area is low due to the absence of large commercial and industrial customers. According to Duke Energy, this has resulted in significant transmission congestion in the eastern area the state and is now causing an expectation for thermal overloads on the existing transmission lines which move power from east to the load centers west of the coast. Duke Energy states that at least 123 substations have the potential to back feed to the transmission system on certain days throughout the year due to solar systems on the distribution system, and 60 percent of the projects queued in the Duke Energy Progress service territory are currently interdependent to required transmission network upgrades. Relieving this congestion will require significant investment in the transmission network system.

[84] Id.

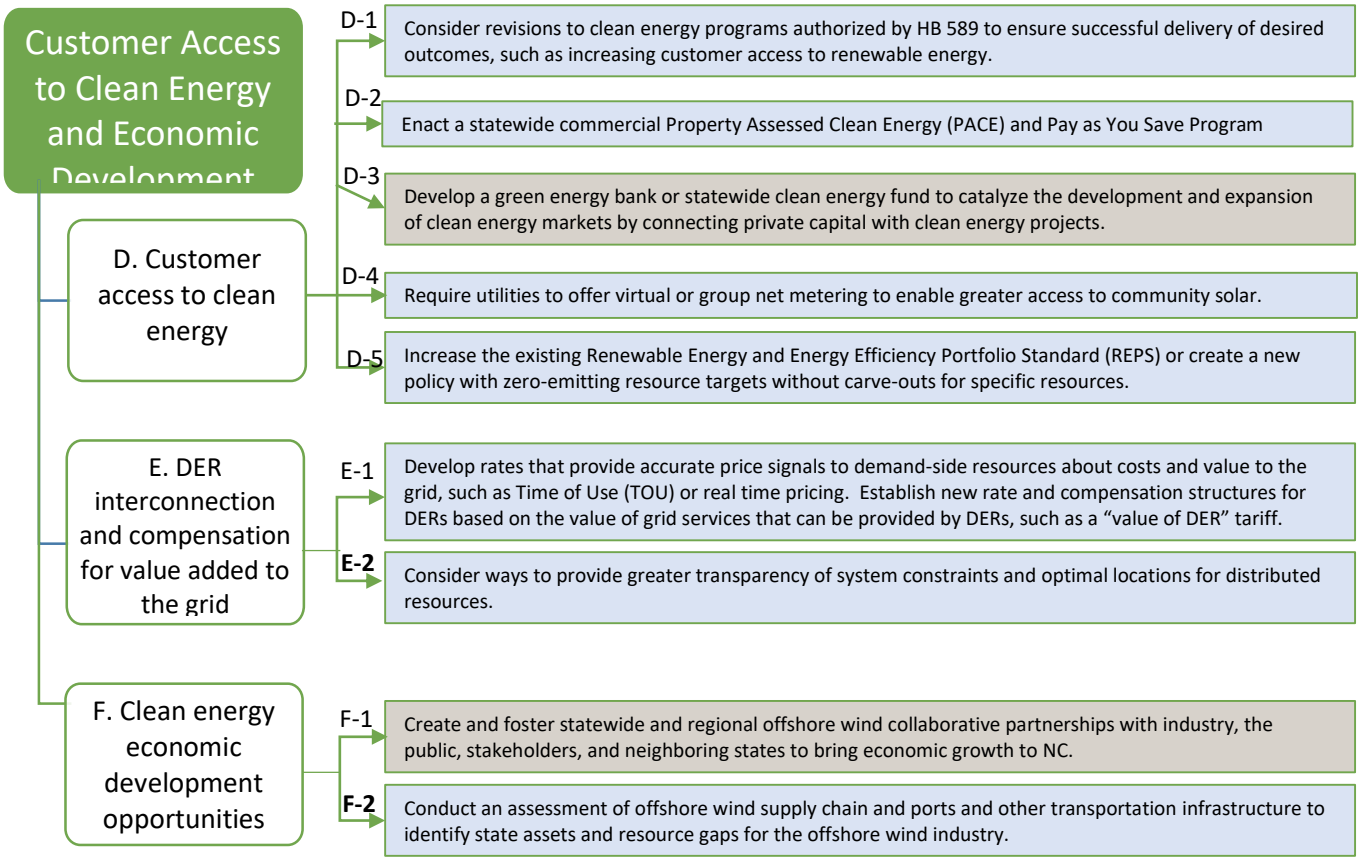
developments and investments in grid modernization based on internal business plans and insights gained from a DER futures analysis, hosting capacity analysis, and NWA analysis.[85]

Table C-2: Actions for Recommendation C-2

Entities Responsible	Action	Timing (Short, Medium, or Long term)
NCUC	Determine how grid modernization can be linked to and informed by comprehensive system planning processes; develop submission requirements, including expectations for grid needs assessments and clear cost-effectiveness parameters.	Long term
Co-ops, Municipal Utilities	Determine how grid modernization can be linked to and informed by other system planning processes	Medium term

[85] Order Approving Integrated Distribution Planning Requirements for Xcel Energy.

4.2 Customer Access to Clean Energy and Economic Development



Strategy Area		Recommendation	Legislature	Utilities Commission	Governor's Office	State Agencies	IOU	CO-Ops / Public Utilities	Local Government	Academia	Businesses
Customer Access to Clean Energy and Economic Development	D. Enable customers to choose clean energy	D-1	●								
		D-2	●				●	●			
		D-3			●				●	●	
		D-4	●								
		D-5	●								
	E. DER interconnection and compensation for value added to the grid	E-1		●				●			
		E-2		●							
	F. Clean energy economic development opportunities	F-1			●	●	●		●	●	●
		F-2				●			●		●

SHORT TERM MEDIUM & LONG TERM

D. Enable customers to choose clean energy

Background and Rationale

Utility customers in North Carolina are increasingly demanding access to renewable energy and energy efficiency options for meeting their electricity needs. Cities and counties across the state have adopted clean energy and carbon mitigation goals. Corporations and businesses continue to push utilities and policymakers to make it easier for them to meet their power needs with clean energy. Throughout the Clean Energy Plan public engagement process, participants reiterated and restated the desire for access to renewable energy in different ways. Participants generally do not feel that the existing regulatory structure in North Carolina gives customers sufficient and equitable access to clean energy.[86]

North Carolina has made progress toward expanding customer access to clean energy in recent years. In particular, the passage of HB 589 created several new programs that have opened up new avenues for customers to choose clean energy, including community solar programs, solar rebates, solar leasing, and the Green Source Advantage program. The Competitive Procurement of Renewable Energy (CPRE) program ensures cost-competitive renewable energy is being brought onto Duke Energy's system which will increase the amount of renewable energy that all of the utility's customers receive through their standard utility service.[87] Participants in the CEP process acknowledged that improvements have been made in recent years to increase customer choice and access to clean energy, while also highlighting areas for continual improvement.

Some of the existing tensions regarding customers' ability to choose renewable energy center around the affordability and accessibility of the existing programs. A couple of examples include:

- Solar rebate program: subscribed very quickly, in order to get a rebate customers had to sign up within a narrow time window which meant that many potential customers were unable to access a rebate.
- Green Source Advantage program: the bill credit that participants receive under this program is revised every 5 years, which can make it challenging for participants to determine the economics of participating in the program. Further, this program is available exclusively to large commercial customers (based on specific demand thresholds), the UNC system, and military installations.
- Businesses do not have the ability to enter into their own on-site third-party PPAs for renewable energy.
- Community solar: HB589 required Duke Energy to develop a community solar program, but there is no statewide program in place meaning that customers of other utilities only have access to community solar if their utility provides it. The state also does not allow virtual net metering, which would expand customer access to shared renewable energy.
-

The upfront cost of investing in customer-sited resources, like solar and energy efficiency, continues to present a barrier to adoption for many North Carolina residents. In particular, low and moderate income residents face many challenges when trying to adopt clean energy. On top of that, many of these same communities face disproportionate burdens from energy production, generation, and use, and would stand to benefit from measures that increase non-emitting sources of energy. Some of the recommendations

[86] See CEP participant survey responses.

[87] The CPRE program is discussed in greater detail in the next section.

included in this section address issues related to access to capital. Other recommendations directed at specifically enhancing equitable access to clean energy are included in the next section.

Customers in areas served by cooperatives and public utilities expressed similar desires to choose clean energy that is affordable. The programs being implemented under HB589 do not apply to these areas, although several cooperatives are creative in developing and implementing community solar programs for their members.

Recommendations

D-1. Consider revisions to clean energy programs authorized by HB 589 to ensure successful delivery of desired outcomes, such as increasing customer access to renewable energy.

HB 589 created new ways for North Carolina customers of Duke Energy to purchase clean energy as the source of their electricity, such as community solar programs, solar rebates, solar leasing, and the Green Source Advantage program. The NCUC has been taking action on utility proposals within each of these programs. Some of the programs are already being implemented, such as the solar rebate program, while others, such as the Green Source Advantage Program, are in the process of being reviewed by the Commission and have not yet been implemented by the utility.

Participants in the CEP process, both within the facilitated workshops and through other means, expressed concern that the manner of implementation of these programs will not achieve the full potential for customers to participate. The reasons for this concern vary by program, and, given the early stage of implementation, it is too early to definitively determine whether changes to the programs are needed in order to achieve successful outcomes. The Legislature can revisit these programs in the future, assess whether the desired outcomes are materializing, and consider revisions if needed.

It should also be noted that successful implementation of these programs could be aided by addressing some of the underlying structural challenges built into the existing utility incentives and tools, as discussed in the prior section. In short, existing utility incentives to increase sales and to build utility-owned generation are in conflict with measures designed to increase customer-, third-party-, or community-owned generation resources or to reduce sales of electricity through conservation or behind-the-meter generation. If entities in the state are successful at implementing changes to address these existing challenges, the underlying incentives of utilities can be better aligned with the overarching goals of clean energy programs.

Table D-1: Actions for Recommendation D-1

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Legislature	Revisit HB 589 programs and consider whether revisions are needed to ensure desired outcomes are achieved.	Medium term

D-2. Enact a statewide commercial Property Assessed Clean Energy (PACE) and Pay as You Save Program

The inability to finance energy efficiency upgrades and distributed renewable energy projects was identified by stakeholders in the Clean Energy Plan process as a major barrier that the state should address. The financing difficulties arise from a number of causes: the split incentive between landlords and tenants means that neither entity has the incentive to invest in energy efficiency or renewable energy; for commercial customers, investments in the core business are often prioritized over energy upgrades even when they are cost effective; and external financing can be hard to come by, particularly for small businesses.[88] For residential customers, particularly lower income customers, the inability or unwillingness to take on personal debt in order to finance upgrades or new measures is a major barrier. Two financing mechanisms, Commercial Property Assessed Clean Energy (C-PACE) and Pay As You Save (PAYS), were identified as promising mechanisms to help address some of the barriers.

Pay As You Save the name of a voluntary program design through which a utility can offer to make site-specific investments in energy efficiency upgrades at a customer's property. The utility recovers its cost for the investment with a charge on the customer's electricity bill, with the charge being lower than the estimated savings that result from the energy efficiency upgrade. As a result, the customer gains the benefit of net savings from the start of the program. A key feature of the PAYS model is that the cost recovery for the upgrades is tied to the meter, rather than an individual person. The PAYS model has been used successfully around the country as a way to remove barriers affecting customer segments that are hard to reach like renters and customers without access to upfront capital. One electric co-op in North Carolina, Roanoke Electric, has been successfully using PAYS to upgrade roughly 200 homes per year. To date, no other NC utilities have offered an on-bill tariffed program like PAYS. Stakeholders identified the need for some kind of loss protection for utilities that might be concerned that their programs would not perform well, and thus they would need risk mitigation in order to offer such a program. A clean energy fund, discussed in the next recommendation, could offer a reserve fund for utility tariffed on-bill programs like PAYS.

C-PACE is a mechanism targeted at the commercial sector and is strictly property-based financing, requiring no personal or corporate guarantees. A property owner works with a contractor to determine which clean energy upgrades make sense, and 100% of the financing (for both hard and soft costs) is provided as a loan through the PACE program. A local government entity (occasionally regional or statewide entities) sets up the program and services the loan, placing an annual assessment on the property for debt collections. With PACE, the financing is repaid as a line item on the property tax bill, which means that the obligation to repay the financing can transfer to a new owner upon sale of the property. C-PACE can remove or greatly reduce several of the barriers that commercial property owners might face to investing in energy efficiency or renewable energy. PACE is already legislatively authorized in North Carolina, but the state does not have any active PACE programs. The North Carolina

[88] Third-party financing often requires personal guarantees and/or some equity investment, both of which can be prohibitively difficult for small business owners.

Cities Initiative identified a few reasons for this: NC local governments have a lack of familiarity with using this kind of financing, and would benefit from the ability to delegate the administration of such a program and the financing mechanism to a central third party. In addition, there is state-level approval needed for all local debt.

Table D-2: Actions for Recommendation D-2

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Utilities (IOU, Co-ops)	Develop voluntary on-bill pay as you save tariff, using Roanoke EMC as an example of what can work in North Carolina	Medium term
Legislature	If needed to ensure access for customers, direct utilities to develop a tariffed on-bill financing program like PAYS and make it available as an option for customers	Long term
Legislature	Consider setting up a loss reserve fund or a revolving loan fund to speed up implementation of PAYS	Medium term
Legislature	Give local governments authority to delegate administration of C-PACE to a statewide or regional third party entity	Medium term
Legislature	Evaluate the feasibility of easing the requirement for state-level approval of local debt	Medium term

D-3. Develop a green energy bank or statewide clean energy fund to catalyze the development and expansion of clean energy markets by connecting private capital with clean energy projects.

Throughout the Clean Energy Plan stakeholder process, a diverse group of individuals and other energy collaborators[89] identified a need for an NC clean energy fund. A clean energy fund could bring capital dollars to clean energy projects in areas and markets that are not yet attractive to large investors. By helping to structure and underwrite deals with a reasonable return, a clean energy fund could simultaneously spur new projects and catalyze investment markets.

Participants in the CEP process identified particular needs for project funding in renewable energy, energy efficiency, electric vehicle infrastructure, and other measures that reduce emissions, particularly in rural and poorer communities of the state that otherwise lack access to necessary capital. Similar funds in other states have supported the installation of residential, community, municipal, and commercial solar systems; energy efficiency upgrades in public schools and homes; and infrastructure deployment for alternative fuel vehicles.

Table D-3: Actions for Recommendation D-3

Entity Responsible	Action	Timing (Short, Medium, or Long term)
NGOs, Academia, and Local Government	Determine how to establish a NC Clean Energy Fund	Short term
Governor's Office	Publicly support a NC Clean Energy Fund if established	Short term

[89] These collaborations included the Cities Initiative and the EE roadmap process. The need for such a fund was also identified by the CEP stakeholder breakout group focused on Equitable Access and Just Transition.

D-4. Require utilities to offer virtual or group net metering to enable greater access to community solar.

Many customers want access to solar energy but they do not have the ability to put solar panels on their roof or property, or they do not have the ability to pay significant upfront costs for an individual solar system. The community solar model allows customers to subscribe to a portion of a solar facility's output through their utility, or be a joint owner of such a facility, without having the facility physically located on their property. House Bill 589 required Duke Energy to offer at least 20 MW of community solar in each of their territories. These programs are under development and review at the Utilities Commission. Eleven of North Carolina's electric co-ops offer a community solar program to their members.[90] Community solar can expand equitable access to clean energy by allowing individuals and businesses to participate regardless of whether they own their home, their income level, or the suitability of their property for solar development. CEP stakeholders attending the workshops as well as private citizens participating in the regional listening sessions expressed a strong desire to make these services available to such communities.

One of the key elements of community solar programs is the subscriber compensation, which determines the value that subscribers are paid for their share of the generation from the project. Typically, this compensation happens through a credit on the electric utility bill. The methodology for determining the credit to subscribers greatly affects the overall economics of the community solar project from the subscribers' perspective, and thus also affects the cost to subscribe and overall market demand for the program. If the result of the crediting methodology is that subscribing to community solar requires paying a premium on electric bills, it will make access to the program much more difficult for low and moderate income customers.

States and utilities are taking a variety of approaches to subscriber compensation within community solar programs but the majority are using some form of retail rate compensation or a value-of-solar methodology.[91] In order for retail rate compensation to be feasible, "virtual net metering" must be available. This means that net metering applies to community solar subscribers in proportion to their subscription to the solar array, and allows customers to receive credits from community solar as though the generation were on site. In North Carolina, customers who have solar on their rooftops are eligible for net metering, meaning that they receive credits for the energy they send to the grid that helps to offset the energy the consume on-site. However, subscribers to a community solar array do not have this option because North Carolina currently does not have a statutory requirement for utilities to provide virtual net metering. Rather, in North Carolina the compensation is based on the utility's avoided cost rate, meaning that the credit received by subscribers is lower than the cost they pay for the energy they consume.

[90] https://www.electric.coop/wp-content/Renewables/community-solar.html?lipi=urn%3Ali%3Apage%3Ad_flagship3_feed%3BQhg%2BM6GlTBW3BEUMJftgjA%3D%3D&utm_source=Insights+Jan&utm_campaign=bd960c642c-EMAIL_CAMPAIGN_2017_12_14&utm_medium=email&utm_term=0_d0de398254-bd960c642c-126666693

[91] https://www.nrel.gov/docs/fy18osti/70663.pdf

It should be noted that some states that offer a form of retail rate compensation for community solar subscribers do not offer the full retail rate to reflect the fact that some elements of the utility's costs to serve subscribers are not offset by the generation from the community solar array. For example, in Delaware the bill credit is based on the full retail rate if the subscribers are on the same feeder as the solar array, otherwise a supply service charge is subtracted from the credit that subscribers receive. It would be sensible for regulators and decision makers to consider the appropriate credit for subscribers in different utility service territories.

Table D-4: Actions for Recommendation D-4

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Legislature	Require utilities to develop virtual net metering for community/ shared solar customers and direct NCUC and other utility governing bodies to oversee appropriate development of compensation rates for subscribers	Medium term

D-5. Increase the existing Renewable Energy and Energy Efficiency Portfolio Standard (REPS) or create a new policy with zero-emitting resource targets without carve-outs for specific resources

North Carolina has been a leader on clean energy policy in the Southeast and is the only state in the region with a renewable energy portfolio standard. This policy has helped to drive much of the renewable energy development in the state and has led North Carolina to a #2 ranking in installed solar capacity. That said, North Carolina's policy is one of the least aggressive in the country, with several states increasing their renewable energy targets to 50% and higher for 2030 and beyond in recognition of the economic and environmental benefits that can be realized. As modeling by DEQ and others shows, the "business as usual" policy landscape in NC is not likely to result in renewable energy development sufficient to increase deployment beyond the amount codified in HB589 or meet the state's GHG reduction goals. In addition, customers are increasingly expecting that the electricity they purchase from their utility will come from clean sources.

Different options for increasing the amount of clean, zero-emitting generation on the grid were discussed by stakeholders in the Clean Energy Plan process. One option is to simply increase and extend the current REPS policy by adding targets for 2030 and 2050, maintaining the current resource carve-outs or adding additional resource carve-outs. Another option is to allow REPS to coexist alongside a new policy that would require a certain percentage of generation to come from zero-emitting resources by 2030 and 2050, without any carve-outs for specific technologies. The latter option would allow all options for zero-emitting generation to compete to be the preferred option for meeting the standard.

Table D-5: Actions for Recommendation D-5

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Legislature	Expand the State's REPS by setting higher targets for 2030 and 2050 while maintaining existing technology carveouts, or develop a technology neutral policy that requires a certain amount of electricity sales to come from zero-carbon emitting sources by 2030 and 2050.	Medium term

E. DER interconnection and compensation for value added to the grid

Background and Rationale

As costs for renewable energy and storage continue to fall, states, regulators and utilities around the country are grappling with ways to facilitate interconnection of these new resources to the electric grid while maintaining reliability and fairly compensating (and charging) distributed resources for the value (and costs) they bring to the grid. These challenges and opportunities are not unique to North Carolina – states and utilities have engaged in dockets and investigations into the value of distributed resources and initiated pilots to test out new compensation structures and rate designs.

There is an interest among North Carolina customers and developers for siting solar projects on the distribution grid and getting compensated by the utility for services provided. While there has been less development of smaller, distribution-connected projects to date, with the continuing cost declines for solar and storage it can be expected that more customers will be interested in installing DERs and interconnecting to the distribution system. If given the opportunity, aggregators could work with multiple customers to create solar, storage and/or demand response programs that can provide value to the utility grid and savings to the participating customers.

North Carolina already has significant amounts of distributed generation, primarily solar. The majority of the solar projects in the state are utility-scale, representing 36% of all PURPA capacity in the U.S from 2008 to 2017.[92] During the early development of solar, utilities were able to study and connect large quantities of projects at low cost to the developer. As development continues, the upgrades necessary to connect new resources increases and, as these costs increase, the economics of solar development become more challenging.

Another issue currently slowing down development of solar is the delay in utility interconnection processes due to interdependencies associated with queueing. As a result of projects concentrating in the same area, a serial study process creates a long line with each subsequent project relying on information related to the completion of the preceding project. Duke Energy states that at least 24 substations have 4 or more large scale projects that are requesting interconnection, with thirteen projects requesting interconnection at one substation. Moving to a grouping study process is currently under consideration by the NCUC. Grouping studies resolve interdependency by studying all projects at the same time, thus eliminating the multi-year delays related to the serial queue studies. It also sets up methodologies for cost sharing between projects which is not permitted today, and may ultimately support the economics of more projects as a result of spreading the cost of upgrades across more volume. For example, when a project triggers an upgrade today, that project is responsible for all of the upgrades which could be tens of millions of dollars. Under the grouping study procedure, numerous projects may share the costs of the upgrades as a whole.

The Competitive Procurement for Renewable Energy Program established under HB 589 (2017) created a competitive bidding process for renewable energy projects. Utilities provide locational guidance, and generators receive payments tied to the utility's avoided cost. This process does not require the developer

[92] Energy Information Administration. August 2018 Monthly Data. https://www.eia.gov/electricity/monthly/

to pay for the network upgrades, as these are funded by the utilities and put into rates. The necessary upgrades are determined by grouping all of the CPRE competitive bidders to be studied together and costs are then allocated to each of the participating projects. Projects receiving awards in this process must meet a two-part test. First, the project price bid added to the levelized cost of system upgrades must be lower than the administratively determined avoided cost. Second, the project price combined with the cost of upgrades must also be among the lowest cost of the suppliers competing for the defined procurement volume. The CPRE process by law is administered by an Independent Administrator selected by the North Carolina Utilities Commission (NCUC). Duke Energy expects that the total amount of projects that will be developed under the CPRE to be in the 4200 – 4700 MW range. Tranche 1 of CPRE was completed in July of 2019 and the median price was about $7 below the administratively determined avoided cost. Duke Energy estimates the expected nominal savings to customers over the 20-year term of these contracts to be over $260 million compared to relying on an administratively determined price.

The recommendations in this section focus on creating opportunities for DERs to access markets and value streams while allowing developers and customers interested in installing DERs to better understand the opportunities and constraints on the grid.

Recommendations

E-1. Develop rates that provide accurate price signals to demand-side resources about costs and value to the grid, such as Time of Use (TOU) or real time pricing. Establish new rate and compensation structures for DERs based on the value of grid services that can be provided by DERs, such as a "value of DER" tariff.

DERs, which include distributed solar, but also things like storage, energy efficiency, demand response and electric vehicle charging, can help make the grid more flexible, resilient, reliable, and clean while also giving customers more control over their energy use. For an efficient deployment of DERs to be feasible in the future, rates and compensation structures will need to be in place that compensate DER customers for the benefits DER provides to the grid, charge those customers properly for their use of the grid, and allow utilities to recover the revenue required to maintain a safe and reliable system. Ideally, these rate and compensation structures would send price signals that encourage customers to install and operate DERs in a way that is beneficial to the system as a whole. Participants in the Clean Energy Plan process identified the development of such rate and compensation structures as important for the cost-effective deployment of these resources in the state.

States and utilities are approaching these issues in different ways. Many, including California, Minnesota, Maryland, and Arizona are moving toward time-varying rates which price electricity higher when demand is greater and when the system is more stressed. These kinds of rate designs more precisely communicate the value of DER services, such as solar or storage that provides power to the grid during peak times, or demand response programs that help shave peaks. Time-varying rates are one way to enhance the potential value that DERs can provide to the system.

Another potentially complimentary approach is to create a separate tariff that creates a value stream for services provided by DERs. Implementation of such a tariff can provide utilities and third parties with more information about areas where energy efficiency and other DERs would be valuable, and send price signals to encourage the development of DERs. Development of such a tariff is a complex and technical process that involves a myriad of considerations. Some of those considerations include:

- how and whether to determine locational and temporal values,
- the number of years to offer compensation under such a tariff,
- what values to include in the methodology, and
- what resources should be eligible for the tariff.[93]

One approach, being taken in New York, bases the value on the utility's avoided costs plus other DER values including wholesale energy and capacity, distribution capacity, and environmental values. Depending on the structure of the tariff, other potential values that could be included are avoided losses, generation capacity, energy, ancillary services, transmission capacity, and distribution services such as voltage support, reliability and resilience.

Table E-1: Actions for Recommendation E-1

Entity Responsible	Action	Timing (Short, Medium, or Long term)
NCUC	Ensure utilities are offering time-varying rates that encourage DER deployment that is beneficial to the system and allows customers to take advantage of cost-saving benefits of DERs	Medium term
NCUC	Open a docket investigating the appropriateness, feasibility, and structure of a "value of DER" tariff	Long term
Co-ops and Municipal Utilities	Encourage DER deployment by evaluating the feasibility and effectiveness of time-varying rates and implement and develop appropriate programs	Medium term

[93] https://www.synapse-energy.com/sites/default/files/ACEEE-Paper-Values-EE-DER.pdf

E-2. Consider ways to provide greater transparency of system constraints and optimal locations for distributed resources

Information and transparency about grid needs and constraints is a foundational requirement in order for non-utility actors to compete fairly in the provision of clean energy and grid services. In the current regulatory framework, information asymmetry means that third party providers of distributed resources like solar, storage, or electric vehicle charging face difficulties in choosing locations, types, and sizes of projects to propose or develop. These resources could provide tangible benefits to the utility system in the form of increased flexibility and cheaper and cleaner generation sources, and to individual customers, in the form of clean energy and reduced bills.

As discussed in the recommendations around comprehensive system planning, analyses to develop more detailed, location-specific information about grid needs and constraints is considered a central feature of integrated distribution planning and in determining grid modernization needs.[94] It not only helps smaller scale developers of solar (under 1 MW) determine the best locations to propose projects, it can help customers who wish to install solar PV better understand the right size of a system to install in their particular location to avoid grid upgrade costs. It can also help third party installers of electric vehicle charging infrastructure determine the best locations for charging stations from the perspective of limiting impacts on the grid. The Commission could consider requiring an assessment of the full costs and benefits of conducting such an analysis in the context of an investigation into distribution system planning, as recommended above.

More detailed, location-specific information about grid needs and constraints also benefits developers and providers of larger scale DERs, such as those entities that wish to participate in the CPRE program. Duke Energy agrees that locational information is important for finding the right place on the grid for a new project, and if done right, this can save customers money.[95] More detailed information about the current capacity of substations and transmission lines to accommodate additional solar development would make proposals to the CPRE more precise and valuable to the utility system, making them potentially more likely to be chosen through the competitive process.

Projects developed outside of the CPRE would benefit from increased transparency about grid needs and constraints. For those projects, the NCUC is currently considering moving to a grouping study process similar to that which is utilized in CPRE. There are likely multiple benefits from moving to a grouping study process, including eliminating multi-year delays and allowing cost sharing between projects.

It may also be worth considering other solutions in areas where the transmission system is so constrained by generation development that neither CPRE nor grouping studies can manage the economics. In this case the legislature could provide guidance to the NCUC to establish a process for utilities to build out renewable energy transmission solutions, which could ultimately be put into rates for all customers while expanding the delivery of renewable energy within the state.

[94] Volkmann, Curt. *Integrated Distribution Planning: A Path Forward*, GridLab, April 2019. (Volkmann, Integrated Distribution Planning: A Path Forward)

[95] See Duke Energy comments to DEQ

Table E-2: Actions for Recommendation E-2

Entity Responsible	Action	Timing (Short, Medium, or Long term)
NCUC	Consider conducting a full assessment of the costs and benefits of requiring utilities to undertake analyses that would provide customers and third parties with greater transparency of grid constraints and needs (e.g. hosting capacity analysis) in the context of distribution system planning	Medium to long term
NCUC	Require Duke Energy to provide more detailed information about the current capacity of substations and transmission lines to accommodate additional solar development in the context of the CPRE program	Short term (e.g. before the next tranche)

F. Clean energy economic development opportunities

Background and Rationale

Similar to the economic growth experienced in the solar sector, significant opportunity exists to build a clean energy economy around wind energy deployment and supply chain development.

Off-shore wind energy (OSW) represents a low cost, clean and relatively reliable potential energy source for NC. OSW development provides an opportunity for tens of millions of dollars in economic development and thousands of new jobs in eastern North Carolina as well as a significant increase in renewable energy generation for the state. NC has the second-highest average wind speeds on the Atlantic coast and is well-positioned to participate in this fast-growing global industry.

Currently in NC, development of OSW energy resources is underway with the first federal lease off the NC coast issued in 2017. Construction and installation of the Kitty Hawk, NC project could begin as early as 2023, and the facility would go into operation in 2025. Two additional potential wind energy areas have been identified by Bureau of Ocean Energy Management (BOEM) in Wilmington, NC. However, there are no incentives in NC for OSW such as a carve out in the REPS or Executive or legislatives mandates.

Incentives such as these do exist in other states, such as New York and New Jersey, Maryland, Connecticut, Massachusetts and Virginia, all of which are setting goals to procure thousands of MW of wind energy. These incentives and state-led procurement requirements create market signals that are attracting investment to these states from the multi-billion-dollar OSW industry.

Notably, the Coastal Virginia Offshore Wind project (CVOW) is one of three demonstration projects selected by the Department of Energy for project development funding to advance the OSW industry in the United States. CVOW is a collaborative effort comprised of public and private partners and negotiated with a range of federal agencies. The project will be owned by Dominion Energy and leased by the Virginia DMME and will be the first project installed in federal waters under the BOEM process. Dominion Energy plans to invest up to $1.1 billion in offshore wind through 2023 (subject to regulatory approvals) – enough to power 500,000 homes in Virginia.

Despite the strong leadership from NC's neighboring state, progress in NC has been stalled by local concerns that wind energy development would negatively impact tourism, as well as lack of onshore transmission infrastructure in NC to bring OSW energy inland. Instead, developers of NC's Kitty Hawk OSW project are seeking to wheel power generated from the project into Virginia, therefore reducing/eliminating any potential advantages to NC ratepayers.

NC is potentially missing opportunities for a low-cost, low-emission energy source that is being exported instead across the state line. In addition, other states are gaining technology advantages and jobs that could be available in NC. To address this opportunity, NC must assess what the state is best situated to provide the OSW industry. NC can plot its own course towards attracting the OSW industry with a market-driven approach and a portfolio of offerings that signal interest in doing business.

Recommendations

F-1. Create and foster statewide and regional offshore wind collaborative partnerships with industry, the public, stakeholders, and neighboring states to bring economic growth to NC

The neighboring states of Virginia and Maryland are in similar points of OSW development ahead of NC, while South Carolina is more similar to NC's early stage of pursing the OSW industry. NC could benefit from a coordinated effort with these regional states to bring together resources to develop a robust OSW industry and energy market in the Southeast. NC and partnering states would need to evaluate their collective assets for OSW development, streamline state regulatory requirements for OSW, collaborate on educational systems and requirements for job training, and create a forum for sharing information and best practices related to OSW development. The partnership could also coordinate on engagement with federal agencies such as BOEM.

Table F-1: Actions for Recommendation F-1

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Governor's Office or Cabinet-level executives	Establish a regional agreement for multi-state cooperation on OSW development	Short term
OEMs, energy developers, IOUs, government entities, research institutions, academic and training entities, etc.	Engagement with industry which may include: regional promotion of OSW assets for supply chain investment; developing and implementing best practices; coordinating communications; and identifying funding streams to facilitate research and other activities that enhance OSW and industry recruitment.	Short term
OSW developers	Location of OSW facility and jobs in NC	Long term

F-2. Conduct an assessment of offshore wind supply chain and ports and other transportation infrastructure to identify state assets and resource gaps for the offshore wind industry.

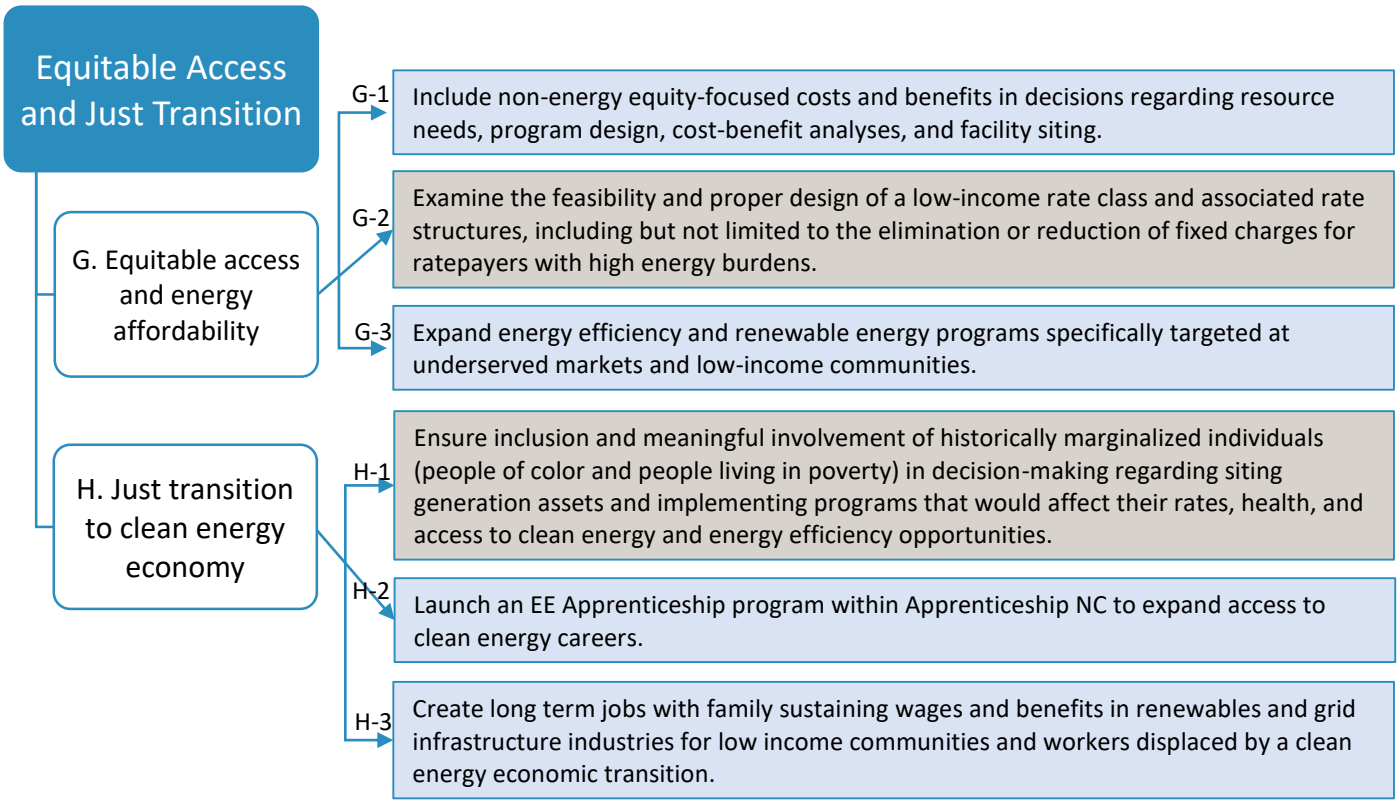
An OSW assets and capabilities analysis would signal to OSW developers and OEMs that NC is interested in participating in this industry. The study would consider existing supply chain and port infrastructure assets, assess NC business advantages and economic climate, evaluate current workforce readiness, and identify potential investments that would help NC provide services for cargo, transportation and trade related to OSW. Outputs of the study could include estimated manufacturing jobs from OSW facilities, opportunities for rural development, benefits to local and state tax base, and other economic benefits. The objective of the analysis would be to determine how NC is best suited to compete in OSW and would help hone NC's ability to attract industry segments, such as blades, towers and/or wind turbines (nacelles).

More specifically, the assessment would look at: (1) NC ports in Wilmington and Morehead City to determine what infrastructure upgrades are needed to support OSW industry; (2) workforce assets in place, expected employment needs and training requirements; (3) needs of industry partners related to manufacturing facilities; and any other items identified by the partnership.

Table F-2: Actions for Recommendation F-2

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Cabinet agency	Select and retain a consultant for an economy-wide OSW industry assessment in NC	Short term
Dept of Commerce, NC Ports, Dept of Transportation, chambers of commerce, economic developers	Engage key players in assessment	Short term
Consulting Firm/Cabinet agencies	Complete assessment	Short term
All	Leverage assessment findings to recruit industry	Medium term

4.3 Equitable Access and Just Transition



Strategy Area		Recommendation	Legislature	Utilities Commission	Governor's Office	State Agencies	IOU	CO-Ops / Public Utilities	Local Government	Academia	Businesses
Equitable Access and Just Transition	G. Address equitable access and energy affordability	G-1		●		●	●	●	●		
		G-2			●						
		G-3	●			●	●				
	H. Foster a just transition to clean energy	H-1		●	●	●					
		H-2								●	
		H-3	●		●	●	●	●	●	●	●

SHORT TERM MEDIUM & LONG TERM

G. Address equitable access and energy affordability

Background and Rationale

Low income and energy-burdened residents often live in older, less efficient housing which requires more energy for heating and cooling than newer homes. In 2018, those living with incomes below 50% of the Federal Poverty level, spent 33% of their annual income on energy bills (includes electricity, gas and other utilities).[96] In North Carolina, low income residents spent between 17% (homeowners) and 21% (renters) of their annual income on electricity bills.[97,98]

Low income households may not be able to take advantage of existing programs for clean energy due to up-front costs and financing, physical challenges related to the quality of the building or ownership status of their housing, or simply a lack of access to high-integrity service providers. Low-income customers may lack savings or access to financing. They often have lower credit scores that may disqualify them from financing or lock them into high interest rates that make the benefits of clean energy less attractive. Many of the tax credits for clean energy, such as the federal solar investment tax credit and the EV tax credit, are nonrefundable, which means that individuals cannot directly benefit from these incentives unless they have a tax liability.[99]

Low income households have fewer choices in regard to housing options, with many low income residents living in homes with structural deficiencies that can make EE upgrades inaccessible.[100] Low income households are less likely to own their own homes, especially in urban areas, which makes it more difficult to install clean energy like solar. These households are more likely to live in multifamily buildings without access to their own roof. They often live in housing stock that is older and may be of poor structural integrity. A roof that needs repair is unlikely to be suitable for solar PV.

Energy burdened households struggle to pay unaffordable energy bills. 1.4 million people in North Carolina are paying a disproportionately high amount of their income on energy bills[101] which makes making any investment in things like EE more difficult. Many of the same communities are directly impacted by the health and pollution impacts of energy extraction, transportation and production. These compounding factors mean that these communities are the least able to reap benefits of investments in clean energy and EE while being most impacted by the legacy energy industry.

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[96] Ibid

[97] Office of Energy Efficiency and Renewable Energy. (2017). Low-Income Energy Affordability Data (LEAD) Tool – OpenEi DOE Open Data (K. Layman, Ed.). Accessed May 2019. https://openei.org/doe-opendata/dataset/celica-data

[98] For more information, see CEP Supporting Document – Part 3: Electricity Rates and Energy Burden

[99] The *Low-Income Solar Policy Guide* provides a compendium of options and reference materials for addressing financial barriers on its "Financing" page. The recommendation included in this report regarding the creation of a green bank focused on financing clean energy projects would also be a way to address some of these challenges.

[100] Drehobl, A., & Ross, L. (2016). *Lifting the High Energy Burden in America's Largest Cities: How Energy Efficiency Can Improve Low Income and Underserved Communities.* Accessed April 2019. https://aceee.org/sites/default/files/publications/researchreports/u1602.pdf

[101] Equitable Access and Just Transition Stakeholder Memo

The recommendations in this section address some of the barriers that low income and energy burdened communities face when it comes to energy affordability and access to clean resources.

Recommendations

G-1. Include non-energy equity-focused costs and benefits in decisions regarding resource needs, program design, cost-benefit analyses, and facility siting.

By including equity considerations in these types of decisions, utilities, local government and state agencies can better reflect broader societal costs and benefits of energy production and use, and of programs like EE or solar investments.[102] For example, in resource planning the Utilities Commission could consider impacts to low-income or historically marginalized communities when deliberating around utilities' IRP filings. Such consideration could lead to future resource decisions that reduce burden and even provide a benefit to these communities. Utilities and state agencies could better incorporate equity into program design, such as EE program design, by adding metrics that track how many low-income residents are enrolled or creating carve-outs designed to ensure certain percentages of program funds are spent in low-income communities. Cost-benefit testing, such as the analysis done to determine how much and what kinds of EE should be implemented, could be expanded to include an assessment of broader costs and benefits, often referred to as "non-energy" costs and benefits. Several states use a variety of methods to place values on societal public health and participant health benefits, and these methods could be explored in North Carolina. Lastly, decisions about siting energy facilities could explicitly include an environmental justice or equity impact analysis.

Table G-1: Actions for Recommendation G-1

Entity Responsible	Action	Timing (Short, Medium, or Long term)
NCUC	Consider impacts to low-income communities in utility resource planning	Medium term
State agencies, NCUC, utilities, Co-ops, public utilities, local governments	Add equity metrics and elements to program delivery, such as EE programs	Short term
NCUC	Consider and evaluate methodology to include broader non-energy equity-focused elements in cost-benefit testing	Medium term
NCUC and DEQ	Explore methodologies for including EJ impact analysis in siting decisions	Long term

[102] Note: elements of this recommendation were discussed in some detail in the section of this report that covers comprehensive system planning.

G-2. Examine the feasibility and proper design of a low-income rate class and associated rate structures, including but not limited to the elimination or reduction of fixed charges for ratepayers with high energy burdens.

Low-income customers face a more significant burden in paying their energy bills than other customers of the same "customer class" with higher incomes. Though "affordability" has been a core tenant of utility regulation and system planning, stakeholders in the CEP process identified that there are segments of customers for whom the cost of energy is not affordable and argued that there should be a more nuanced treatment of affordability in utility ratemaking and rate design. This could be accomplished in a number of different ways, such as through a bill discount, a percentage of income payment program, reduction or elimination of fixed charges, or other ways. The Commission could also consider creating a differentiated service classification for multi-family housing, where costs for the utility to provide electric service could be lower. The details of this recommendation, including the proper design of a low-income rate class and the right strategy for addressing affordability for low-income customers, were not able to be tackled by CEP stakeholders in the limited time available. A higher education institution could establish a follow-up process involving stakeholders to discuss equity issues within utility ratemaking and recommend actions for legislation and for the NCUC to pursue.

Table G-2: Actions for Recommendation G-2

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Academia	Convene a stakeholder process to discuss equity issues within utility ratemaking and recommend actions for legislation and for the NCUC to pursue	Short term

G-3. Expand energy efficiency and renewable energy programs specifically targeted at underserved markets and low-income communities.[103]

Many low-income homes suffer from health, structural or safety issues, such as mold, leaky roofs or faulty wiring, as low-income people tend to live in older buildings and have more limited income to invest in upgrades and repairs. These conditions may prevent the installation of solar or EE measures. Studies have found that a significant portion of low-income homes (more than 10% in one such study) have health and safety issues that prevent providers from delivering weatherization services.[104] Equity-focused policies and programs that address some of these challenges can help ensure that vulnerable communities will benefit from the growing clean energy economy.

There are many existing EE programs in North Carolina, and yet some sectors – including agricultural and multi-family housing – are underserved by these programs. Some existing dynamic incentive programs, such as Duke Energy Design Assistance program, cannot serve multifamily developments due to metering eligibility requirements. Other programs have payback schedules that do not match a sector's situation, or application periods that do not align with complementary funding sources. And although Duke has EE programs specific to low income customers, they do not have a specific target or carve out for how many low income communities get access to funds, so it can vary from year to year how well these programs reach these customers.

Some existing utility EE programs could be tailored to be a "better fit" to address the target markets of agriculture, multifamily, mobile homes, military populations, and houses of worship, and others including small businesses and some industrial customers that are unable to take advantage of utility-offered programs due to the high cost of opting-in to the EE Rider. Fifty percent of low-income populations in NC reside in multifamily residences. However, many developers may not be taking full advantage of existing EE incentive programs in this sector. Opportunities exist to better align multifamily utility EE incentives with new NC Housing Finance Agency projects and their refinancing cycles, and to seek out

[103] Many of the ideas and some of the text for this recommendation were taken from the EE Roadmap's Recommendation #13 and #16. They have been combined with other ideas and shortened for the purposes of this document. More information on these recommendations can be found in the Roadmap.

[104] Refer, for example, to: (1) Carroll, D., Berger, J., Miller, C., and Driscoll, C. (2014). *National weatherization assistance program impact evaluation: Baseline occupant survey; Assessment of client status and needs*. Oak Ridge, TN: Oak Ridge National Laboratory. ORNL/TM-2015/22. Retrieved from: https://weatherization.ornl.gov/wp-content/uploads/pdf/WAPRetroEvalFinalReports/ORNL_TM-2015_22.pdf; (2) Rose, E., Hawkins, B., Ashcraft, L., and Miller, C. (2014). *Exploratory review of grantee, subgrantee and client experiences with deferred services under the Weatherization Assistance Program*. Oak Ridge, TN: Oak Ridge National Laboratory. ORNL/TM-2014/364. Retrieved from: https://weatherization.ornl.gov/wp-content/uploads/pdf/WAPRecoveryActEvalFinalReports/ORNL_TM-2014_364.pdf; and (3) Green & Healthy Homes Initiative (2010, October). *Identified barriers and opportunities to make housing green and healthy through weatherization*. Prepared by the Coalition to End Childhood Lead Poisoning. Baltimore, MD: Green & Healthy Homes Initiative. Retrieved from: https://www.greenandhealthyhomes.org/wp-content/uploads/GHHI-Weatherization-Health-and-Safety-Report1.pdf. The latter report notes (on page 5) that "Health and safety issues render homes ineligible for weatherization work though the degree may vary between [programs]. Overall, the average number of homes deemed ineligible in the pre-auditing or auditing phase was 12.88%; however, there is a wide variance in why programs find those homes ineligible."

complementary funding such as US Department of Agriculture (USDA), state weatherization and other non-regulated sources.

Other unique opportunities exist for targeted sectors, such as a Heat Pump Water Heater (HPWH) rental program for low-income households. The reduction in the upfront cost of the equipment would dramatically increase the adoption of HPWH in low and moderate income communities helping each household significantly reduce energy use for heating water resulting in savings to the resident. In addition, by using HPWH as deployable demand-side management to shift loads off peak through thermal storage, additional utility cost savings and/or funding for programs could be realized.

The NC Weatherization Assistance Program (NC WAP) in partnership with multiple NC utilities is developing a limited community solar pilot for low income households. As discussed in the previous section, community solar allows customers that cannot install solar on their property to benefit from solar energy. Low income households have historically had little or no direct access to solar in NC. This new community solar pilot will give low income households an option to use solar energy to further reduce energy burdens for 15 years or more in addition to having their homes weatherized. The community solar measure is designed to provide each participating low income household an additional $365 in savings per year credited directly to their utility bills. NC WAP is working with its agencies and partner utilities to find approximately 40 eligible low income households within the service territory of the participating utilities. NC WAP plans to expand this low income community solar opportunity to other areas in future years through additional partnerships.

There are existing venues in the state for discussing changes to existing programs in order to better serve low-income and underserved communities. To the extent that new funding is needed to accomplish some of these actions, the legislature or philanthropies could be a source of financial support.

Table G-3: Actions for Recommendation G-3

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Legislature	Direct utilities to work with stakeholders to create carve outs in existing programs to target low-income and underserved communities	Medium term
DEQ	Evaluate outcomes from NC WAP community solar program and determine ways to expand the program to reach more low income customers	Medium and long term
Duke Energy EE Collaborative	Discuss new program ideas, how better to serve underserved markets, and ways to administer new offerings	Medium and long term
Energy Policy Council EE Committee	Discuss new program ideas, how better to serve underserved markets, and ways to administer new offerings and make recommendations for actions through collaborative partnerships	Medium and long term
Low income advocates	Work with utilities to design and implement programs. In the case of IOUs, these programs would need to be approved by the NCUC.	Medium and long term

H. Foster a just transition to clean energy

Background and Rationale

Throughout history as the economy has changed due to varying factors from trade policy to technological innovation, workers have often suffered from these changes. The loss of manufacturing in the textile, tobacco, and furniture industries across NC are prime examples. Poverty and devastation in Appalachia, particularly as the global economy has shifted away from coal, is another case in point. As North Carolina's energy system shifts toward one focused on clean resources, workers currently employed in industries that will be transitioning stand to be impacted. Counties with fossil fuel facilities could lose millions of dollars from their tax base as fossil fuel facilities ramp down, for example. North Carolina should manage this transition, by putting worker protections and oversight by those most affected into the state's plans from the beginning.[105]

These concerns are not unique to North Carolina. The Paris Climate Agreement recognized "the imperatives of a just transition of the workforce and the creation of decent work and quality jobs."[106] The International Labour Organization (ILO), a specialized agency of the United Nations, was charged with developing a framework for implementing this principle. In its 2018 Policy brief on the subject, the ILO states that, "[t]he idea of just transition should not be an "add-on" to climate policy; it needs to be an integral part of the sustainable development policy framework. From a functional point of view, just transition has two main dimensions: in terms of "outcomes" (the new employment and social landscape in a decarbonized economy) and of "process" (how we get there). The "outcome" should be decent work for all in an inclusive society with the eradication of poverty. The "process", how we get there, should be based on a managed transition with meaningful social dialogue at all levels to make sure that burden sharing is just and nobody is left behind."[107]

Recommendations

H-1. Ensure inclusion and meaningful involvement of historically marginalized individuals (people of color and people living in poverty) in decision-making regarding siting generation assets and implementing programs that would affect their rates, health, and access to clean energy and energy efficiency opportunities.

Historically marginalized individuals and communities have largely been left out of decisions that often affect their economic opportunities, environmental quality, health, and wellness. This has led to a cycle of increasing hardship and impacts for these communities, relative to individuals and communities that have greater access and ability to influence decisions. The US EPA defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. It will be achieved when everyone enjoys the same degree of protection from environmental

[105] AFL-CIO comments
[106] UNFCCC "Paris Agreement." https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf
[107] ILO Just Transition Guidelines. https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---actrav/documents/publication/wcms_647648.pdf

and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work."

In North Carolina, as in other states, people of color and low-income people are disproportionately impacted by decisions about siting and operating energy facilities, what types of clean energy and energy efficiency programs will be available, and how those programs will be structured, what utility costs are approved and how utility costs will be recovered from ratepayers, among others. North Carolina must continue to strive for the achievement of environmental justice goals around inclusion and meaningful involvement in decisions like these. Inclusive decision-making processes and meaningful involvement of historically marginalized individuals means seeking input and ideas from the beginning of any given decision process, before options are being developed. It requires concerted effort to reach out to community members to understand how different options will impact them. The Governor's office currently receives regular updates from executive branch agencies regarding environmental justice issues. The Governor's office could use this avenue to ensure that meaningful involvement is being addressed by agencies.

Table H-1: Actions for Recommendation H-1

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Governor's Office	Ensure that executive agencies report to the Governor how they are implementing actions that ensure meaningful participation and inclusion of historically marginalized communities	Short term
NCUC	Consult with stakeholders and explore ways to incorporate environmental justice into decisions and make commission processes more inclusive	Short term
DEQ	Support the Environmental Justice and Equity Advisory Board on energy issues by informing the Board of relevant energy issues and supporting their evaluation of those issues.	Short term

H-2. Launch an EE Apprenticeship program within Apprenticeship NC to expand access to clean energy careers.[108]

Apprenticeships and pre-apprenticeships provide opportunities for experiential learning through paid "on the job" training with real companies in the industry. Allowing for both apprenticeships and pre-apprenticeships would ensure that anyone could participate in the program regardless of education level or background. Part of a just transition to the clean energy economy of the future is ensuring that North Carolina residents of all backgrounds and income levels have opportunities to find and keep jobs that pay family-sustaining wages. Apprenticeship programs can help create a pipeline of skilled workers for businesses in need of good employees, reduce operational costs by establishing a streamlined channel to bring on new workers and advance existing workers, build employee loyalty and reduce attrition, and foster new leaders.

North Carolina is home to a successful state apprenticeship program. Apprenticeship NC is an economic development-focused organization housed within the NC Community Colleges System. The U.S. Department of Labor has described Apprenticeship NC as an agency that works "to ensure NC has an innovative, relevant, effective, and efficient workforce development system that develops adaptable, work ready, skilled talent to meet the current and future needs of workers and businesses to achieve and sustain economic prosperity." However, currently, Apprenticeship NC does not focus on EE as a career path.

Apprenticeship NC already works in collaboration with the NC Community Colleges System, the NC Department of Commerce, and the US Department of Labor's Bureau of Apprenticeship and Training and currently recognizes building trades and energy industries as part of their apprenticeship programs. This partnership could easily expand to include various EE trades. In order for this to happen, specific EE careers would need to be identified and companies would need to be contacted and asked to participate in the program.

[108] This recommendation is part of the Energy Efficiency Roadmap recommendations and the text in this document was largely copied from the Roadmap. More detail on this recommendation is available in the Roadmap.

Table H-2: Actions for Recommendation H-2

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Community Colleges System - Apprenticeship NC	Work with the following stakeholders to coordinate and implement EE apprenticeship programs: • Technical and community colleges • Traditional colleges and universities • Energy efficiency industry employers • K-12 institutions • NC Department of Commerce/NCWorks • Workforce Development Boards • NC Business Committee for Education Navigator Tool • Training institutions • Credentialing organizations such as Building Performance Institute (BPI)	Medium term

H-3. Create long term jobs with family sustaining wages and benefits in renewables and grid infrastructure industries for low income communities and workers displaced by a clean energy economic transition.

Focusing job training and creation on low-income communities and those where workers are being (or likely to be) displaced by a transition away from fossil fuels will help ensure that all parts of North Carolina can thrive in a clean energy future. This focus is important because these communities are at the greatest risk of suffering economic hardship and growing wealth inequality relative to the wealthier parts of the state. A concerted effort must be made by multiple entities to ensure that these communities are made better off with the transition to clean energy.

Stakeholders in the clean energy plan process identified a few key actions to realize this recommendation, including creating more accessibility to the Registered Apprenticeship Programs by establishing pre-apprenticeship programs in partnership with high schools and community colleges. Various entities could help drive up labor standards by prioritizing contractors that provide good wages, benefits and career pathways. Best practices from around the state and the country for displaced workers from the fossil fuel industry could be collected by government and shared in order to encourage private sector action.

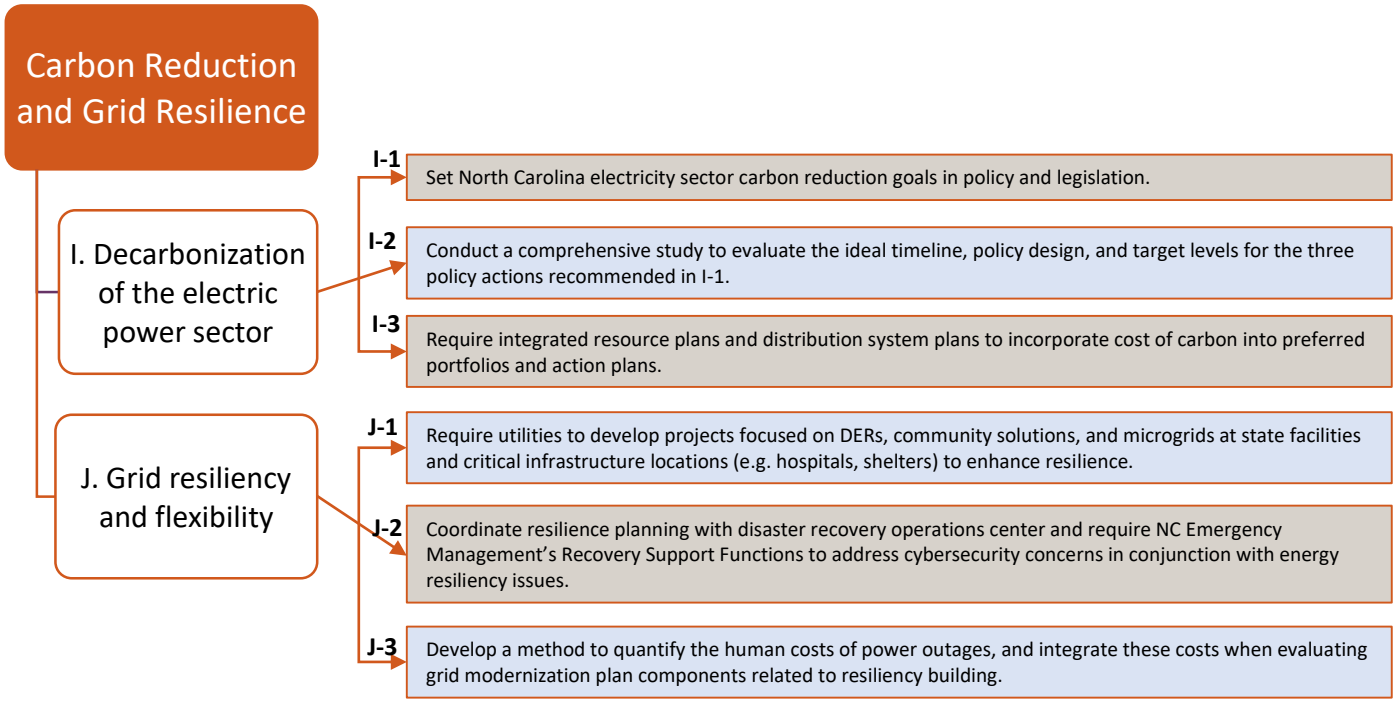
Under direction from EO80, the Department of Commerce completed its Clean Energy and Clean Transportation Workforce Assessment. This assessment identified occupations, number of jobs for each occupation, and the five-year growth rate for jobs related to the clean energy industries, EE industries, and clean transportation industries. The assessment also provided four recommendations for action to develop a future workforce by bringing together employers, workers, and education and training providers to meet changing needs. As these recommendations are being implemented, the needs of

individuals and communities most impacted can be specifically targeted to ensure a just transition is achieved.

Table H-3: Actions for Recommendation H-3

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Utilities (IOUs, Co-ops, Municipal)	Work with "High road" contractors or those that provide living wages and benefits.	Medium term
Legislature	Consider tax incentives to encourage targeted investment in certain communities, and labor standards	Medium term
Department of Commerce	When implementing the four recommendations contained in the EO80 Workforce Assessment, prioritize job placement and training needs of low income communities and displaced workers. Propose strategies to the Governor's office for achieving long term jobs with family sustaining wages and benefits in renewables and grid infrastructure industries for low income communities and workers displaced by a clean energy economic transition	Medium term
Local Governments	Use economic development agencies to direct and prioritize investment, use existing powers to direct use of incentives for development	Medium term
Higher Education	Train contractors and workers in renewable energy and energy efficiency professions, create pre-apprenticeship programs in partnership with the Registered Apprenticeship Programs	Medium and long term

4.4 Carbon Reduction and Grid Resilience



Strategy Area		Recommendation	Legislature	Utilities Commission	Governor's Office	State Agencies	IOU	CO-Ops / Public Utilities	Local Government	Academia	Businesses
Carbon Reduction and Grid Resilience	I. Decarbonize the electric power sector	I-1	●								
		I-2				●				●	
		I-3		●			●			●	
	J. Strengthen the resilience and flexibility of the grid	J-1		●		●	●	●	●		
		J-2		●		●	●	●			
		J-3		●		●				●	

SHORT TERM MEDIUM & LONG TERM

I. Decarbonize the electric power sector

Background and Rationale

North Carolina's greenhouse gas (GHG) emissions goal under EO80 is to reduce emissions by 40% from all economic sectors by 2025. During the CEP public engagement process, North Carolina stakeholders recommended setting an additional goal to "decarbonize" the electric power sector by 2050. While this goal is a steep challenge, many other US cities and states have set this same decarbonization target. In fact, several electric utilities have set this same goal.[109,110] Duke Energy currently has a goal of reducing carbon dioxide (CO_2) emissions from their electricity generation fleet by 40% from 2005 levels by the year 2030.[111]

North Carolina has already reduced significant amounts of GHG emissions from the electric power sector. The State's Clean Smokestacks Act, REPS and market drivers have decarbonized the electric power sector at a faster pace than many other states. According to the most recent statewide inventory, GHG emissions from the electric power sector have declined 34% relative to 2005 levels.[112] These reductions have been achieved in the absence of explicit carbon policies in the State. DEQ estimates that with full implementation of HB589, the GHG reduction level from the electric power sector will reach roughly 50% by 2025 and remain at this level out to 2030.

In order to further decarbonize the electricity generation sector as recommended by the CEP stakeholders, North Carolina could choose (1) clean energy programs that remove uneconomical fossil generation and increase the use of cleaner energy resources, (2) carbon policy driven approaches that include targets for emission reductions and create a market for generating revenue, or (3) a hybrid approach that combines both clean energy and carbon policies. Many states have proposed and implemented similar policies and programs that increase clean electricity generation while also reducing emissions of CO_2.

Table 24 shows the different approaches evaluated in support of the CEP. These approaches are based on the results of high level, predictive, electricity sector modeling exercises conducted by five different organizations. These modeling exercises projected the impacts to the electricity sector from applying five different program and policy scenarios that reduce CO_2 emissions. The scenarios are described in Table 24.

[109] Xcel Energy. (2018). "Xcel Energy aims for zero-carbon electricity by 2050". December 4, 2018. Retrieved from https://www.xcelenergy.com/stateselector?stateSelected=true&goto=%2Fcompany%2Fmedia_room%2Fnews_releases%2Fxcel_energy_aims_for_zero-carbon_electricity_by_2050

[110] Southern Co. (2018). "Planning for a low-carbon future". Southern Company. April 2018. Retrieved from https://www.southerncompany.com/content/dam/southern-company/pdf/corpresponsibility/Planning-for-a-low-carbon-future.pdf

[111] Duke Energy (2018). 2018 Sustainability Report. Duke Energy. April 11, 2019. Retrieved from https://sustainabilityreport.duke-energy.com/

[112] North Carolina Greenhouse Gas Inventory (1990-2030), North Carolina Department of Environmental Quality, Division of Air Quality, January 2019, accessed at https://deq.nc.gov/energy-climate/climate-change/greenhouse-gas-inventory.

Table 4: Proposed Program and Policy Scenarios Modeled for the Electricity Sector

Scenario Type	Scenario Name	Description	2030 CO_2 Emission Reductions from 2005 Levels	2030 Emissions Level
Clean Energy Driven	Accelerate Fossil Retirement	All coal power plants retire by 2030 and the generation shifts to non-emitting sources	68%	25.3 MMT
	Clean Technology Standard or Expand REPS	Requires a certain percentage of a utility's retail electricity sales must come from non- or low-emitting resources.	58%	33.5 MMT
Carbon Policy Driven	Join Trading Program	North Carolina joins the Regional Greenhouse Gas Initiative (RGGI) program and sets an initial CO2 budget which declines each year by 2.5%. Fossil fuel power plant must hold CO2 allowances equal to their emissions and the State cannot exceed its budget.	48%-57%	34.0-41.6 MMT
	Carbon Cap at 25 MMT	A simple mass cap of 25 MMT of carbon on the electricity fleet in 2030 with no increased generation from imports.	68%	25.0 MMT
Hybrid	Carbon Trading Program + Clean Tech	A trading program such as RGGI in a combination with a clean energy technology standard.	62%	29.8 MMT

MMT = million tons of CO_2

Part 5 of the CEP Supporting Documents, titled Energy and Emissions Modeling discusses in detail the electricity sector modeling, the scenarios modeled, and the resulting impacts on the electricity sector. This includes 2030 CO_2 emissions estimates, electricity price impact (where available), and expected renewable energy generation levels for each scenario identified above. Key highlights are discussed below.

Electricity Sector Potential Reductions

Figure 12 presents the GHG emissions from the electricity sector starting in 2005 and going out to 2030. In 2005, North Carolina relied heavily on coal-fired power plants for electricity. Starting in 2010, older coal power plants began to retire and were replaced with lower-emitting natural gas combined cycle (NGCC) plants. Coal plants also began operating less due to the low price of natural gas compared to coal. By 2017, emissions from fossil fuel electricity generation had decreased by 34% to 53 MMT. The DEQ's GHG inventory projection data starts in 2017 and indicates the emissions continue to decrease, due to the retirement of Asheville and partial retirement of GG Allen coal plants between 2017 and 2025.

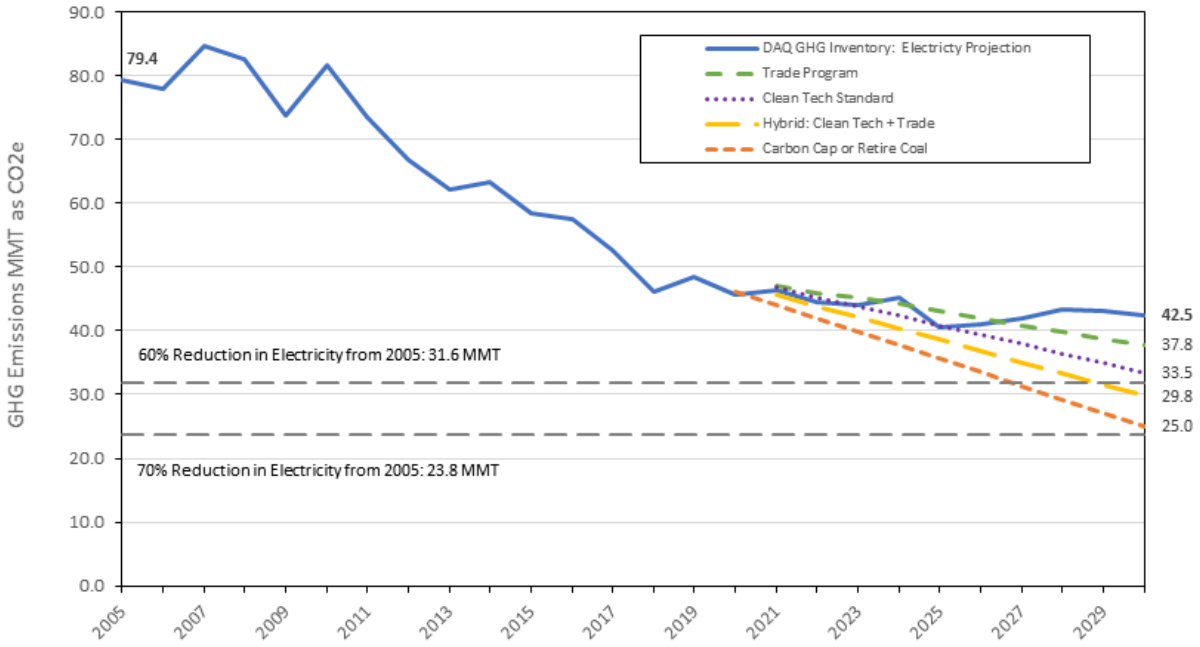


Figure 17: Electricity Sector GHG Emissions: Market Based and Carbon Policy Scenarios

(MMT as CO2e)

Figure 12 also includes four lines which estimate the downward trajectory of GHG emissions based on the outcomes modeled for each scenario in 2030. These lines represent potential outcomes that may occur. These reductions range between 58% to 68% from 2005 levels. Lastly, the figure includes two horizontal lines representing potential reduction goals for the electricity sector, between 60% and 70% relative to 2005 levels.

The largest decrease in emissions occurs under two scenarios: accelerating coal retirements and a carbon mass cap due to their direct impact on fossil fuel use. They also lead to substantial increases in renewable energy (RE) generation, approximately 33,000 GWh or 25% of total projected generation in 2030. These scenarios have the potential to reduce CO_2 emissions by 68% from 2005 levels by 2030.

Based on the modeling results of a Clean Energy Standard (also equivalent to increasing REPS targets), RE capacity expands by over 8,500 MW from what is expected to be built in 2030 under an economic (least cost) scenario. Electricity generation from RE resources more than doubles over the economic case to approximately 18,000 gigawatt-hours (GWh) by 2030. But these scenarios use fossil fuels and imports to supplement RE resources. Therefore, CO_2 emission reductions are more modest than scenarios which limit fossils fuel use. The models project 2030 CO_2 emissions to decrease by approximately 58% from 2005 under the Clean Energy Standard scenarios. These scenarios have the potential to decrease electricity prices projected for 2030 since the operating costs for RE are substantially less than for fossils fuel resources.

Scenarios modeling North Carolina joining a regional trading program may not result in significant emissions reductions beyond what is already expected to occur. Creating a clean technology standard

either with a new program or expanding the State's REPS potentially results in a 58% reduction from 2005 levels. Coupling the clean technology standard with joining a trading program reduces GHG emissions by an additional 6%. The added cost and complexity of joining RGGI should be weighed in when considering this option which may not achieve significant reductions.

The recommendations in this section address the market driven and carbon policy scenarios discussed above.

Recommendations

I-1. Set North Carolina electricity sector carbon reduction goals in policy and legislation.

Based on the electric power sector modeling, DEQ has identified a possible reduction goal to address the recommendation brought forward by the CEP stakeholders. DEQ recognizes the need to proceed with this recommendation in a manner that allows for all aspects of the goal to be studied adequately and build a process to meet this goal that is reasonable for all affected parties and equitable for all citizens of North Carolina. When addressing impacts, North Carolina's values associated with electricity should be considered. One of the most fundamental values is keeping electricity affordable to all North Carolinians. Another is building a clean generation fleet that provides the safety, security, reliability and resiliency that customers depend on.

60-70% Reduction Goal for 2030

Since 2005, North Carolina's electricity sector has reduced CO_2 emissions by 34% and increased electricity generation from clean resources to 9% of total generation by 2017. These successes are not based on a specific carbon policy but were driven by market forces that occurred in conjunction with two North Carolina laws; the Clean Smokestacks Act of 2003 (CSA) and the Renewable Energy and Energy Efficiency Portfolio Standard of 2007 (REPS). These two highly successful laws created economic incentives to build both a least cost and cleaner electricity system through 1) retiring uneconomic coal plants and 2) creating economic incentives to increase the levels of non-emitting RE and EE.

The CEP electricity sector modeling indicates that North Carolina can apply additional market-based approaches to achieve the State's goals of cleaner electricity generation by 2030 coupled with a reduction in CO_2 emissions. The three approaches are 1) accelerate coal retirements, 2) implement a more aggressive clean energy technology standard or expand REPS, and 3) set a CO_2 percent reduction target or mass cap for the electricity power sector. These approaches could achieve reductions on the order of 60% to 70% by 2030. The reduction target or mass cap could include IOUs, as well as rural cooperatives and municipal electricity generators.

Table I-1: Actions for Recommendation I-1

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Legislature	**Clean Energy Standard or Expand REPS** 1. Enact a clean technology standard or expand the existing REPS legislation with specific targets for 2030, 2. Create new incentives and specific targets beyond REPS and HB589, including emerging or more costly technologies (e.g., energy storage) not considered under REPS, and/or 3. Create mechanisms to more effectively utilize EE for all customer classes to meet demand.	Short term
Legislature	**Reduce Fossil Fuel Use** 1. Enact a date by which uneconomical coal power plants in North Carolina, based on current costs to operate, must be retired. 2. Require a more thorough needs analysis, least cost analysis and justification for new fossil fuel power plants that considers carbon impacts prior to gaining approval to avoid stranded fossil fuel assets in the future. 3. Enact a date by which uneconomical peaking power plants in North Carolina must be retired. Create a mechanism for cooperatives and municipalities that operate any of these plants to replace them with peaking power from low or zero emitting resources.	Short term
Legislature	**CO2 Reduction Target for Electric Power Sector** Enact a law that requires CO_2 emissions reductions from the electric power sector by 2030 in the form of either 1) a mass cap limit or 2) a percent reduction target from 2005 levels.	Short term

I-2. Conduct a comprehensive study to evaluate the ideal timeline, policy design, and target levels for the three policy actions recommended in I-1.

The electricity sector modeling that was evaluated in Supporting Document Part 5 was the first step in evaluating possible goals and action pathways for reducing CO_2 emissions. There are a number of important aspects to partial decarbonization that North Carolina needs to examine prior to making decisions on how to create change beyond what is currently happening. This goes beyond an assessment of the generation fleet. It includes understanding the carbon implications of investments in other fossil fuel infrastructure, such as natural gas pipelines that supply fuel to power plants, how remaining fossil fuel power plants are likely to be operated, and whether the full potential of renewable energy will be fully utilized, among other things. The impacts to the electricity sector must be studied to ensure that the values associated with electricity that were identified by stakeholders remain intact or are improved.

While we need to ensure our current values related to electricity are upheld, we also need to address new values and new services that could be provided by the electricity sector. Another forward-looking aspect that must be examined in relation to a CO_2 reduction goal is how to utilize new technologies to reduce emissions, such as distributed energy resources, energy storage, microgrids and an intelligent grid. These systems are not always included in electricity sector modeling tools and their impact on emissions reduction strategies may be important. Lastly, a reduction goal of 70% will require fostering and investing in the growth of innovative technologies.

Table I-2: Actions for Recommendation I-2

Entity Responsible	Action	Timing (Short, medium, or long term)
DEQ / Academia	Conduct a comprehensive study of most cost-effective options to achieve a 60-70% reduction in CO_2 emissions from the power sector by 2030 by considering clean energy driven and carbon policy scenarios applicable to North Carolina and evaluate the ideal timeline, policy design, and levels for the three policy actions recommended in I-1.	Short-medium term

I-3. Require integrated resource plans and distribution system plans to use portfolios and action plans that incorporate a cost of carbon into the portfolio or plan that is selected for use by the utility.

Each year, investor owned utilities in North Carolina must submit an Integrated Resource Plan (IRP). An IRP is a plan for meeting future electricity needs and shows how the resource portfolio for electricity generation, transmission and distribution is expected to evolve over a specified planning period, typically 15 years. The resource portfolio chosen for the plan must result in a least cost system. In other states, utilities have recently begun to develop distribution system plans. These plans examine how DERs, including energy efficiency, demand response, distributed generation, batteries, and electric vehicles, may impact the grid, including providing reliability and resiliency services.

The utilities commissions of multiple states are now requiring the use of a carbon price, a social cost of carbon, or a zero emissions credit in order to facilitate a resource planning process that accounts for the global impact of GHG emissions from fossil fuel combustion. This type of approach allows market based decision making in the resource planning process. States using this type of approach include California, Minnesota, Washington, New York, Colorado, and Illinois. Each state has a different approach to estimating and including these costs.

In recent years, the IRPs submitted by Duke Energy Carolinas (DEC), Duke Energy Progress (DEP) and Dominion have included planning scenarios that contain a cost of carbon in response to proposed federal carbon regulations. Since June of 2014, the US EPA has been in the process of writing and finalizing regulations regarding CO_2 emissions from fossil fuel power plants. The current EPA methods have a very low social cost of carbon, ranging from $1 to $8 per ton. This low cost does not significantly impact the IRP process. When a carbon price of sufficient value is included in the planning process, low-emitting or zero-emitting resources are favored over higher emitting resources.

Duke Energy and Dominion are investing considerable amounts in the construction of new natural gas pipeline infrastructure. The cost of this infrastructure will be passed onto electricity rate payers in North Carolina. These costs are currently not accounted for in the IRP process. Also not accounted for are the costs of carbon emissions associated with the construction and use of the pipeline itself. The IRP process could be modified to include these costs in the costs for building natural gas power plants.

As discussed previously, in 2018 Duke Energy made a commitment to reduce carbon emissions from its fleet of 40% by 2030. In response, Duke Energy developed a company internal CO_2 allowance price, which would lead to the company's CO_2 emissions reduction goals from a 2005 baseline;

1. 40% CO_2 reduction by 2030,
2. 50% reduction by 2040, and a
3. 60% reduction by 2050.

The base price and high price for CO_2 used in the 2018 IRPs for DEC and DEP are as follows:

- Base CO_2 Price – Intrastate CO_2 tax starting at $5/ton in 2025 and escalating at $3/ton annually that was applied to all carbon emissions ($20/ton in 2030).

- High CO_2 Price – Intrastate CO_2 tax starting at $5/ton in 2025 and escalating at $7/ton annually that was applied to all carbon emissions ($40/ton in 2030).

The 2018 DEC and DEP IRPs present two base cases for planning; a carbon constraint resource portfolio and a no carbon constraint resource portfolio. While Duke Energy develops these two different resource portfolios, the NCUC requires a least-cost resource portfolio. The cost of carbon is not consistently incorporated into this least cost planning.

Table I-3: Actions for Recommendation I-3

Entity Responsible	Action	Timing (Short, medium, or long term)
NCUC, Duke Energy, Academia	1) Establish a method to monetize CO_2 emissions to meet a CO_2 emission reduction goal of 70% by 2030. Begin including this carbon cost in IRPs starting in 2021. 2) Require the use of carbon pricing in any selected resource or action plan starting in 2021. This is occasionally being done voluntarily, for example in the 2018 IRP, DEC selected a preferred portfolio with a carbon price, but DEP did not. 3) Include any costs associated with building a natural gas pipeline that will be passed on to North Carolina electricity rate payers by the electric utilities.	Short term

J. Strengthen the resilience and flexibility of the grid

Background and Rationale

New definitions and metrics have been developed to monitor the properties of the electric power systems as it undergoes its dramatic evolution now and into the future. The Department of Energy's Grid Modernization Laboratory Consortium (GMLC) has developed several key indicators.[113] The GMLC defines resiliency as "the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents." Flexibility, on the other hand, is defined as "The ability of the grid (or a portion of it) to respond to future uncertainties that stress the system in the short term and may require the system to adapt over the long term." Flexibility can generally be viewed from two perspectives. First, from an operational viewpoint, flexibility can be thought of as the agility of the electrical network to adjust to known or unforeseen short-term changes, such as abrupt changes in load conditions or sharp ramps due to errors in renewable generation forecasts. Second, from a strategic investment perspective, flexibility can be considered as the ability to respond to major regulatory and policy changes and technological breakthroughs without incurring stranded assets. All of these factors are at play in North Carolina.

In the United States generally and in North Carolina specifically, there is a growing frequency and intensity of weather-related disasters. Between 1980 and 2019, more than 241 separate $1 billion disasters have cost the United States $1.6T, with nearly half of the cost coming in 2005, 2012, 2017, and 2018[114]. North Carolina's distinctive geography – with mountains in the west and the Atlantic Ocean to the east – make it particularly susceptible to weather-related disasters in both the winter and the summer. North Carolina is one of the four states[115] most heavily impacted by hurricanes, with the state impacted by a tropical cyclone every 1.3 years[116].

The state of North Carolina – like any state in the US – is also prone to cyberattack. This is a growing concern as the state becomes more reliant on third-party owned distributed generation.

[113] https://gmlc.doe.gov/sites/default/files/resources/GMLC1%201_Reference_Manual_2%201_final_2017_06_01_v4_wPNNLNo_1.pdf

[114] Bloomberg, "U.S. Hurricane Season Is Unnecessarily Dangerous", 6/11/19, https://www.bloomberg.com/news/articles/2019-06-11/u-s-hurricane-season-is-unnecessarily-dangerous

[115] Hurricane Research Division (2008). "Chronological List of All Hurricanes which Affected the Continental United States: 1851–2005". National Oceanic and Atmospheric Administration., https://web.archive.org/web/20080921102626/http:/www.aoml.noaa.gov/hrd/hurdat/ushurrlist18512007.txt

[116] NC State Climate Office, https://web.archive.org/web/20100330154058/http://www.nc-climate.ncsu.edu/print/8

Recommendations

J-1. Require utilities to develop projects focused on DERs, community solutions, and microgrids at state facilities and critical infrastructure locations (e.g. hospitals, shelters) to enhance resilience.

A microgrid is a small electric system that combines local energy resources and control technologies to provide power to a defined area. Microgrids typically remain connected to the main grid, but they can operate independently. They are typically deployed at critical infrastructure locations such as hospitals, but they can also be deployed for all or part of a community. These microgrids allow entities to operate as small islands when the larger grid is experiencing a major outage, and thus they represent an excellent opportunity for providing greater resiliency in the face of weather-related disasters.

There are several interesting examples in North Carolina. Ocracoke Island, which is accessible only by boat or plane, is powered by a small microgrid connected to the main electrical system through a transmission line fed from Cape Hatteras Electric Cooperative under the Pamlico Sound.[117] If a storm takes down the transmission line for any reason, the island can continue to function. The local microgrid, a cooperative venture between North Carolina Electric Membership Corporation and Tideland Electric Membership Corporation includes a 3-MW diesel generator and 62 rooftop solar panels that have a 17 kW capacity and are built to withstand winds up to 140 mph. Ten cabinets of Tesla batteries sit on a concrete platform built 4-feet high to stay out of the reach of storm surge. Fully charged, the batteries store 1,000 kWh and dispatch up to 500 kW. An inverter takes the DC power from the batteries to AC power for the grid. Homes and businesses throughout the community also have controllable HVAC and water heaters to help curtail and balance load.

Duke Energy was recently approved for a pilot microgrid in Hot Springs, North Carolina, a remote town with a population of about 600 that is served by a feeder with a history of long-duration outages. Given that Duke Energy anticipated high costs for necessary equipment upgrades, it was proposed to construct a small microgrid that would allow the community to be islanded. The Hot Springs microgrid design includes a 2 MW ground-mounted solar array, a 4 MW battery storage system, and a microgrid controller.[118] The battery is sized to meet 100% of the town's peak load and to provide power for the 90th percentile of load for approximately four hours without any contribution from the solar panels.

Microgrids – used for both community-scale applications and critical infrastructure – could have significant benefits in many parts of North Carolina. In many cases, these microgrids can utilize renewable resources and battery-based energy storage. As noted above, there are already excellent examples in which both IOUs and cooperatives have been able to benefit from the distributed resources installed as part of a larger microgrid. The state should encourage its IOUs and co-ops to consider additional microgrid projects to improve recovery from storm-related issues.

[117] https://www.cooperative.com/remagazine/articles/Pages/electric-co-op-transforming-microgrid.aspx
[118] https://microgridknowledge.com/hot-springs-microgrid-approved/

Currently, combined PV and energy storage are probably not economical in North Carolina under most traditional cost-benefit calculations as confirmed by the recent energy storage study in North Carolina.[119] If one places a value on the losses incurred from grid disruptions; however, PV+storage can potentially become a fiscally sound investment.[120] The state should examine the viability and benefit of installing several projects at state or locally owned facilities that are in particularly storm-prone areas. As these projects proceed, the state should disseminate the results to promote similar thinking in the private sector.

Table J-1: Actions for Recommendation J-1

Entity Responsible	Action	Timing (Short, Medium, or Long term)
NCUC	Initiate a docket to require utilities to develop additional projects focused on DERs, community solutions, and microgrids at critical infrastructure locations	Medium term
IOUs, Municipal utilities, co-ops	Consider locations for adoption of microgrids considering factors such as long-term maintenance cost and cost of recovery after major storms	Medium term
Local governments	Consider the full cost of outages when performing cost-benefit analysis for PV+Energy storage. Encourage projects for schools, first-responder facilities, etc.	Medium term
DEQ and Division of Emergency Management	Assist project implementation and leverage federal government infrastructure funding for state projects	Medium term

[119] https://energy.ncsu.edu/storage/wp-content/uploads/sites/2/2019/02/NC-Storage-Study-FINAL.pdf
[120] https://www.energy.gov/sites/prod/files/2018/03/f49/Valuing-Resilience.pdf

J-2. Coordinate resilience planning with disaster recovery operations center and require NC Emergency Management's Recovery Support Functions to address cybersecurity concerns in conjunction with energy resiliency issues.

The North Carolina Disaster Recovery Framework (NCDRF) was developed by North Carolina Emergency Management (NCEM) and is updated on an annual basis. The Framework describes the role of state agencies and their partners in assisting with recovery efforts and is designed to address the complex and unique nature of disasters. Successful recovery efforts rely upon the Whole Community. The NCDRF considers the impacts of grid-related disasters, including threats from tropical cyclones, winter storms, and cyberattacks. The framework is an evolution from the operational plan previously maintained by the state.[121]

The current framework is focused on how the state should respond to and recover from disasters. Inherently, the approach is focused on recovery. Recent studies have shown that every dollar spent on disaster preparedness can offset as much as six dollars spent on recovery efforts.[122] The state should thus consider how to integrate resiliency planning – both for storm-related outages as well as cyberattacks – into its disaster recovery planning, including how assets can best be deployed to reduce recovery efforts.

For example, microgrids installed at critical infrastructure such as hospitals and first-responder facilities can potentially make first response efforts more effective. The state should study the impact of such investments and potentially consider several pilots. Ultimately, such planning should be incorporated into the NCDRF.

Table J-2: Actions for Recommendation J-2

Entity Responsible	Action	Timing (Short, Medium, or Long term)
NC Division of Emergency Management and Office of Recovery and Resiliency NCORR	Investigate the impacts of resiliency planning as part of the North Carolina Disaster Recovery Framework. Determine if appropriate resiliency efforts can offset costs for disaster recovery.	Short term
DEQ, NCUC, Utilities, NCDOT	Participate and support in updating the North Carolina Disaster Recovery Framework as needed.	Short term

[121] https://files.nc.gov/ncdps/documents/files/2018%20NC%20Disaster%20Recovery%20Framework_Final_0.pdf
[122] https://www.bloomberg.com/news/articles/2019-06-11/u-s-hurricane-season-is-unnecessarily-dangerous

J-3. Develop a method to quantify the human costs of power outages, and integrate these costs when evaluating grid modernization plan components related to resiliency.

The economic and human impact of recovery from a major storm can be incredibly significant. It has been estimated, for instance, that the true cost of Hurricane Katrina was over $250 billion once one includes damage and economic impact. Further, Katrina displaced some 770,000 residents.[123] Such events can have an extremely negative long-term impact on the economic health and culture of a region. As recent storm seasons have shown, North Carolina is also prone to potential major impacts as well. The state is also susceptible to potential cyber threats, and the growing deployment of third-party owned, distributed energy resources potentially makes the state more vulnerable to cyber threats.

Investing in resources that provide greater resiliency can be prohibitively expensive. For example, grid-hardening measures and selective installation of microgrids may be excellent for preventing major long-term outages, but the cost must be borne by the ratepayers. Traditional regulatory processes; however, may consider such measures to be too expensive for ratepayers to bear. If one begins to consider the total cost of outage prevention – including the regional economic impact and the impact on individual families that come from large storms – it is possible that the upfront cost of targeted resiliency measures can become more palatable. Similar arguments can be made for efforts to harden the grid against cyber threats. The state should encourage a deeper investigation into this question, and this investigation should be based on the true social and economic impacts of recent events in North Carolina. The study should also include the impacts of potential cyber threats. DEQ has received a recent award from the US DOE that should help in this area.

Table 5: Actions for Recommendation J-3

Entity Responsible	Action	Timing (Short, Medium, or Long term)
DEQ, UNC-Charlotte, NC State University, NCUC	Investigate the inclusion of the impact of storms and cyberattacks on the economy and society as a whole. Determine if this analysis can be used to modify the regulatory structure to encourage greater investment in DERs, microgrids, and grid-hardening approaches.	Medium term

[123] https://www.thebalance.com/hurricane-katrina-facts-damage-and-economic-effects-3306023

4.5 Energy Efficiency and Beneficial Electrification

Energy Efficiency and Beneficial Electrification

K. Energy efficiency and demand side management programs

- K-1: Establish an Energy Efficiency Advisory Council (EEAC) to oversee implementation of the EE Roadmap recommendations.
- K-2: Enable access to customer data through new functionality such as "download my data" for electric utilities.
- K-3: Establish minimum EE goals within existing REPS.
- K-4: Enhance education and awareness around energy efficiency opportunities in K-12 schools and community colleges through an "Energy Efficiency Everywhere (E3)" project.
- K-5: Require utilities to develop innovative rate design pilots to encourage customer behavior that helps achieve clean energy goals, such as peak demand reduction, better utilization of renewable resources, and strategic storage deployment.

L. Electrification of the transportation sector

- L-1: Require utilities to develop innovative rate design pilots for electric vehicles to encourage off-peak charging of vehicles and to test effectiveness of different rate structures at shifting customer usage of the grid and encouraging the adoption of electric vehicles.
- L-2: Conduct an analysis of the costs and benefits of using electrification to reduce energy burden and GHG emissions in consumer end-use sectors in NC, such as in homes, buildings, transportation and agricultural operations.

Strategy Area		Recommendation	Legislature	Utilities Commission	Governor's Office	State Agencies	IOU	CO-Ops / Public Utilities	Local Government	Academia	Businesses
Energy Efficiency and Beneficial Electrification	K. Increase use of energy efficiency and demand side management programs	K-1			●						
		K-2	●	●		●	●	●			
		K-3	●								
		K-4								●	
		K-5		●				●			
		K-6	●								
	L. Create strategies for electrification	L-1		●				●			
		L-2								●	

SHORT TERM MEDIUM & LONG TERM

K. Increase use of energy efficiency and demand side management programs[124]

Background and Rationale

Energy efficiency (EE) is widely considered a least cost option for meeting energy demand, while reducing energy costs and carbon emissions. While EE has experienced slow and steady growth in North Carolina, much more can be done to maximize the full potential of this least cost resource. Total retail electricity sales to North Carolina consumers in 2017 was just over 131,000 GWh. Although the state has realized increasing annual incremental EE savings – exceeding 1,220 GWh in 2017 – annual incremental EE savings from utility programs as a percentage of retail sales is still under 1.0%.[125,126] Each incremental investment in energy efficiency accrues multiple benefits to consumers, including lower energy bills, increased grid reliability and the deferral or elimination of expensive new generation, transmission and distribution infrastructure investments – costs that would otherwise be borne by ratepayers.

Despite bipartisan support for the economic and environmental benefits of EE and an increasing focus by advocates, utilities and big energy users, barriers remain to fully realizing EE's potential. To discuss and start to address these barriers, the Nicholas Institute at Duke University, in partnership with North Carolina's Department of Environmental Quality initiated a process to develop a comprehensive state EE roadmap. This initiative, launched in August 2018, convened stakeholders from separate EE working group discussions to think collectively about this issue.[127] Some of the barriers that the EE roadmap stakeholders identified include:

End-user Barriers

- Lack of reliable information about EE opportunities (particularly in rural and agricultural communities)
- EE is often confused with renewable energy

[124] Much of the background and recommendations discussion in this section is taken from the EE Roadmap, with slight modifications and editorial changes made by DEQ.

[125] North Carolina State Electricity Data, Energy Information Administration, Form EIA-861,"Annual Electric Power Industry Report" for the years 2013-2017. https://www.eia.gov/electricity/data/eia861/

[126] Annual incremental energy efficiency is defined as "The annual changes in energy use (measured in megawatt hours) and peak load (measured in kilowatts) caused by new participants in existing DSM (Demand-Side Management) programs and all participants in new DSM programs during a given year. Reported Incremental Effects are annualized to indicate the program effects that would have occurred had these participants been initiated into the program on January 1 of the given year. Incremental effects are not simply the Annual Effects of a given year minus the Annual Effects of the prior year, since these net effects would fail to account for program attrition, equipment degradation, building demolition, and participant dropouts. Please note that Incremental Effects are not a monthly disaggregate of the Annual Effects, but are the total year's effects of only the new participants and programs for that year." US Energy Information Administration Glossary, accessed 7/3/19. https://www.eia.gov/tools/glossary/index.php?id=I

[127] The EE Roadmap strives to include diverse voices from across the state and identify a variety of paths forward to help all stakeholders seize the EE opportunities in the state. Some of the discussions generated substantial debate and disagreement among various parties that could be impacted by a new paradigm for EE. Much more information about the EE Roadmap collaboration and outcomes, including detailed discussion of the full list of outcomes, can be found in the EE Roadmap document. The recommendations included in the Clean Energy Plan are those that were prioritized as most important by the Clean Energy Plan participating stakeholders.

- Longer payback period for some EE investments as the opportunities for shorter payback investments for "low hanging fruit" (like efficient lighting) have already been realized
- Lack of inclusive financing options

Building Sector Barriers[128]

- NC building code cycle is six years for residential homes, twice as long as best practice in other states, and the state's energy conservation code is falling behind national standards
- Lack of energy managers / EE champions in commercial and small business
- Quantitative analysis (energy audit) of EE opportunities can be expensive

State Regulatory and Policy Barriers

- Federal weatherization funding is limited
- Lack of efficiency mandate for all utilities
- Industrial and large commercial customers are allowed to opt out of utility programs

Utility Barriers

- Perception that the cost per kilowatt hour (kWh) may increase with additional EE utility investment
- Absent incentives or mandates, the current cost-of-service utility business model is not aligned with EE; investments in EE undercut revenue to the utility in the short term and deferred or avoided generation, transmission, or distribution investments—while good for ratepayers—limit opportunities for profits to shareholders in the long term.
- Lower avoided costs and advancement of codes/standards create barriers to utility programs under traditional cost-effectiveness tests
- Failure to recognize all energy and non-energy benefits of efficiency in cost-effectiveness tests

Some of these identified barriers, including those related to the cost-of-service utility business model, cost-effectiveness tests, addressing energy burdened communities and hard to reach sectors, and financing options, have been addressed elsewhere in this report through recommendations related to EE and other topics. Additional recommendations included in this section relate to ensuring implementation of EE recommendations are overseen by an advisory committee, giving customers access to their energy usage data, increasing education and awareness of EE opportunities, increasing the EE targets within the existing REPS, better utilization of load flexibility to meet clean energy goals, and building codes. They largely come from the EE Roadmap process.

[128] According to NCDEQ's 2018 Greenhouse Gas Emissions Inventory Report, commercial buildings sector was the only sector with increased energy usage between 2005 and 2017 compared to residential and industrial sectors.

Recommendations

K-1. Establish an Energy Efficiency Advisory Council (EEAC) to oversee implementation of the EE Roadmap recommendations

Currently, there is no established body that is diverse and inclusive of all the many EE interests in North Carolina that could oversee and guarantee the implementation of the NC Clean Power Plan EE recommendations. The EEAC would fill this gap and track implementation of the approved recommendations as well as the emissions reductions, economic development benefits and other metrics from EE measures. With a diverse make-up, the EEAC would ensure that balanced, consensus-driven recommendations are made, and that new EE policies are implemented as quickly and effectively as possible. The EEAC would help establish better communication between the EE stakeholders, and improve the sharing of best practices to boost adoption of energy efficiency measures within the state.

The NC EEAC could be created within the Executive Branch of NC's government, with a state-wide purview for broadening EE programming.

- The EEAC would target the residential and commercial sectors, but occasionally, could provide oversight to and recommendations for industrial EE initiatives.
- The EEAC could also serve as a resource to the current DEQ Energy Policy Council (EPC) EE Committee members.

The EEAC should be comprised of representatives from utilities, state agencies, higher education, industry, advocates and other EE experts. The EEAC would be responsible for sharing information and best practices between stakeholders in order to increase state-wide EE measures for residential and commercial programs across the state in support of the Governor's Executive Order 80. In the near-to-medium term, the EEAC would oversee the implementation of the recommendations selected for inclusion into the state's Clean Energy Plan and help to monitor and report on the progress of the EE recommendations. Long-term, the Energy Policy Council would be responsible for tracking broad EE efficacy in North Carolina and undertake studies and analyses that can inform future EE recommendations.

Table K-1: Actions for Recommendation K-1

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Governor's office	Establish an Energy Efficiency Advisory Council, appoint a person or entity to chair the council, and align with the activities of the Energy Policy Council EE committee to the extent possible.	Short term

K-2. Enable access to customer data through new functionality such as "download my data" for electric utilities

The ability for customers to easily access their own energy usage data and authorize that data to be provided to third parties is an essential enabling step for identifying energy-saving opportunities. It is often viewed as one of the key customer benefits of advanced metering infrastructure investments. While utilities in the state are currently providing access to some electricity consumption data from smart meters, it is being provided in a variety of formats. Standardizing this data statewide to be consistent with the nationally recognized standard like the Green Button "Download My Data" standard would allow for a more efficient analysis for energy efficiency and demand reduction opportunities by customers and any consultants or third parties they choose to work with. According to MissionData, a nonprofit dedicated to advocating for energy data access, over 55 utilities across the country have adopted the Green Button Download my Data standard. Duke Energy has committed to start implementing a data access program equivalent to Green Button Download my Data beginning in Q3 of 2019. The NCUC has opened a docket to seek information and establish rules related to electric customer billing data, which is an opportunity for utilities, stakeholders and the Commission to have discussions about the desired functionality of a tool like Green Button.

In addition to the Download My Data standard, the Green Button initiative has established the Green Button Connect My Data program that allows customers to provide their chosen service providers with automatic access to their data. While Green Button Connect My Data has been proposed in North Carolina, utilities have continued to express concerns related to customer protections, liability, regulatory cost recovery issues, and implementation cost. Utilities and interested stakeholders should continue to pursue ways to address those issues in addition to exploring other methods for providing automatic energy data transfers to trusted third parties such as Energy Star portfolio manager.

Table K-2: Actions for Recommendation K-2

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Investor-owned, municipal, and co-op utilities	Standardize existing data availability and provide easy access to 24 months of incremental usage data	Short term
NCUC	Ensure streamlined easy access to energy usage data for customers	Medium term
Legislature	Review municipal and co-op utility implementation of Green Button Download My Data standard and determine if legislation is needed to ensure compliance	Medium term

K-3. Establish minimum EE goals within existing REPS

The Renewable Energy and Energy Efficiency Portfolio Standard (REPS allows energy efficiency measures to be used for meeting a portion of the purchase requirements. The ability to use EE measures varies by year and by utility type:

- *Investor-owned utilities*: 12.5% renewable energy (as % of retail sales) by 2021. EE measures can be used to meet up to 25% of this requirement, and up to 40% after 2021
- *Electric cooperatives, municipal utilities*: 10% renewable energy by 2018, and there is no limit on the amount that may be met through EE.

REPS defines "*Energy efficiency measure*" as an equipment, physical, or program change implemented after January 1, 2007, that results in less energy used to perform the same function. "Energy efficiency measure" includes energy produced from a combined heat and power system that uses nonrenewable energy resources; the term does not include demand-side management.

The current REPS Program EE component is voluntary – it allows utilities to voluntarily meet part of their renewable energy targets through use of implemented EE Measures. This could be made more stringent by creating a mandatory minimum for IOUs of 25% of the REPS target to be met with cost-effective EE Measures beginning in 2021. This conservative target is preferred by utilities due to concern that EE opportunities that utilities can influence are declining as more mainstream EE equipment become available to customers outside of the utility EE program. Requiring a minimum EE target ensures that EE remains a valued resource despite the gains in renewable energy and avoided cost comparisons that tend to make EE a less attractive component of the REPS program. Duke Energy Carolinas and Duke Energy Progress are currently meeting the 25% target and this recommendation would ensure their continued compliance. Dominion is not currently meeting a 25% minimum.

Table K-3: Actions for Recommendation K-3

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Legislature	Modify existing REPS statute to require IOUs to meet at least 25% and up to 40% of their REPS obligations with EE measures by 2021.	Short term

K-4. Enhance education and awareness around energy efficiency opportunities in K-12 schools and community colleges through an "Energy Efficiency Everywhere (E3)" project

Although every student in North Carolina is directly impacted by our electricity generation and consumption, many students do not understand the basics of how our electricity is produced, the real environmental costs, and what actions can be taken at home and at school to reduce electricity consumption. Students and young adults are often well versed in everyday technology but unaware of the technologies that produce the electricity that their devices depend upon. An understanding of North Carolina's energy landscape and how consumers influence future decisions will help our students become more environmentally and scientifically literate and thus better prepare them for the careers and jobs of the future. The best way to bring this and similar topics into the classroom is to equip and train teachers through professional development workshops to ensure they are able and willing to teach our students these important topics.

The North Carolina public school curricula for K-12 does not include an energy efficiency component. Nor do schools provide "career awareness" programming for students to learn about careers in energy efficiency. Teachers are left to learn about these issues on their own, should they want to bring energy efficiency into the classroom. Several North Carolina institutions offer energy-focused trainings and certificate programs, including UNC Chapel Hill's Institute for the Environment and NC's Office of Environmental Education (training here earns state teachers Environmental Education Certification credit). The NC Dept of Environmental Quality (DEQ) and the U.S. Department of Energy (DOE) also offer a rich selection of energy-related materials and activities. In addition, broader science and technology curricula and training opportunities have been created in science-based centers[129] and community colleges[130]. However, these opportunities are too scattered and varied for most teachers to look through and evaluate on their own.

The primary goal of the Energy Efficiency Everywhere (E3) project is to support the implementation of EE curriculum programs within the existing educational systems of NC to include K-12 public school systems and county-based community colleges. E3 would foster excitement about energy efficiency, educate students on the electricity consumption and generation in our state, encourage specific actions by individuals and communities to reduce energy usage, and raise public awareness to the benefits of pursuing EE skilled trade careers. The project would launch a professional development training program for teachers as well as other educators in North Carolina, create a statewide EE certification certificate, and establish an online sharing platform for energy efficiency related activities and lessons for teachers to use in their classroom.

[129] The North Carolina Museum of Natural Sciences created the Educators of Excellence Institutes to support continued learning for educators: https://naturalsciences.org/learn/educators-of-excellence-institutes

[130] For example, Wake Technical Community College currently offers a Building Automation Certificate Program: https://www.waketech.edu/programs-courses/credit/credit-programs/air-conditioning-heating-refrigeration-technology/degrees-1

Table K-4: Actions for Recommendation K-4

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Academia or non-profit	Collaborate with the following entities to stand up a program to support implementation of EE curriculum programs within the existing educational systems in NC: • NC Community College Systems Office (NCCCSO) • NC Department of Public Instruction (DPI) • NC DEQ • NC Community Colleges • NC K-12 County School Systems • National Energy Education Development Project (NEED) • NC's EE industry organizations and corporate leaders • Accreditation organizations that oversee curriculum programs in K-12 & Community Colleges • School groups, science educators, state education public information officers, science-based centers and museums, superintendent offices and universities that are already involved in energy education, nonprofits that support this type of work and others.	Medium term

K-5. Require utilities to develop innovative rate design pilots to encourage customer behavior that helps achieve clean energy goals, such as peak demand reduction, better utilization of renewable resources, and strategic storage deployment.[131]

Two trends underway in the electricity sector make better utilization of flexible loads essential: increasing amounts of low-cost, variable generation resources on the grid, and expanding technology options for customer control of energy use. By encouraging or enabling customers to use power at times when clean, cheap energy is available on the grid and avoid using it when the system is under stress, it is possible to reduce overall costs and increase the utilization of low cost renewable resources. Technologies such as programmable thermostats, water heaters, and electric vehicle chargers, and smart appliances that can automatically adjust usage by following a utility or aggregator signal, are giving customers and utilities new tools to easily manage customer energy usage to minimize system costs and save customers money on bills. Rate design, also known as the price that customers pay for electricity at various times of the day, season, and year, is an essential part of making this happen.

Utilities around the country are beginning to experiment with innovative rate structures and accompanying programs to reward customers for shifting their usage in a way that is beneficial to the grid. For example, in July 2019, Portland General Electric launched a Smart Grid Test Bed which will work with 20,000 customers to take advantage of demand-response signals and incentives for using smart-home technologies, helping customers control energy use and greenhouse gas emissions. In this pilot, the utility is automatically enrolling customers in a rate design that will reward them for shifting their energy use during times of grid stress. This approach of combining time-varying rates with technologies and programs that make it easy for customers to shift usage and utilize technologies like storage and smart devices, has proven effective elsewhere as well.[132]

In the general rate case in 2018, the NCUC directed Duke Energy Carolinas to implement innovative rate design pilots to allow customers to take advantage of peak and energy shifting opportunities from the roll-out of advanced meters. The conclusions of the Clean Energy Plan are supportive of the direction the Commission is taking in this instance.

[131] Note: this recommendation is not from the EE Roadmap. It was prioritized by stakeholders in the Clean Energy Plan workshop and is included in this strategy area because of its direct link to demand-side management.
[132] Other utilities with successful programs along these lines include Baltimore Gas and Electric, Oklahoma Gas and Electric, Pacific Gas and Electric, and Hawaiian Electric Companies.

Table K-5: Actions for Recommendation K-4

Entity Responsible	Action	Timing (Short, Medium, or Long term)
NCUC	Require utilities to work with stakeholders to develop proposals for innovative rate design pilots that encourage customers to shift usage and utilize technologies like storage to help reduce peak demand and increase utilization of clean energy	Medium term
Co-ops and Municipal utilities	Work with stakeholders, customers, and member-owners to develop proposals for innovative rate design pilots that encourage customers to shift usage and utilize technologies like storage to help reduce peak demand and increase utilization of clean energy	Medium term

K-6. Update the NC Building Code for Increased Energy Efficiency, Renewable Energy, and Transportation Electrification

The North Carolina Building Code Council (NCBCC) was established to oversee the state's building codes, which include energy code. In addition, the state legislature may update building codes at any time. The Building Code Council is comprised of seventeen members, each representing a different area of expertise or constituent group as detailed in the state law.[133] Currently energy efficiency is not represented on the Building Code Council.

The NCBCC has regulatory control over the sources – buildings – of more than 50% of North Carolina's energy consumption. This control is authorized by law and enacted by setting and managing the minimum energy code standards and voluntary measures for all new and existing residential, commercial and industrial buildings. For the past several years, the 17-member council, whose positions are established via the Legislature and appointed by the Governor, have supported weak increases in energy efficiency minimum code requirements and approved roll-backs of moderate, yet cost-effective, energy code increases. This action has led to North Carolina's energy codes becoming less stringent when compared to other Southeastern states, national and international standards.

Energy codes play a major role in how a state acts on energy efficiency and, because North Carolina is a Dillon Rule state, local jurisdictions are limited in how they can implement increased stringency (above state code) in local codes to support their own climate change and energy goals. To improve local and state support for energy efficiency, establishing greater support, understanding and action of the NCBCC is a fundamental starting point.

Responsible, cost-effective increases to minimum energy efficiency requirements in the North Carolina building code would economically benefit the owners of residential and commercial building and reduce air pollution. Prudent, cost-effective energy code improvements could save up to $10 Billion (NCBPA, 2018) in direct avoided energy costs over the next ten years, offer significant environmental and health impacts to the state, and provide strong economic impacts through improved housing and property affordability, local economic development improvement and workforce development.

Florida is one of the few Southeastern states that has an energy efficiency, clean energy or green building seat on its code council. The Florida Building Commission includes a representative of the "green building industry" as well as from the Florida Office of Energy.

The EE Roadmap stakeholders identified the following actions as important to pursue: Improve the North Carolina Building Code Council (NCBCC)'s support of energy efficiency by updating the energy conservation code to increase the energy efficiency requirements for buildings, modernizing the building code to ensure new buildings are ready for the installation of vehicle charging infrastructure and renewable energy resources (e.g., rooftop solar and battery storage), adding an Energy seat to the

[133] https://www.ncleg.gov/EnactedLegislation/Statutes/PDF/BySection/Chapter_143/GS_143-136.pdf

Council's makeup, and establishing new actionable goals that prioritize energy efficiency in North Carolina's current and future building codes.

Table K-6: Actions for Recommendation K-6

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Legislature	Add Energy efficiency seat to the NCBCC	Short term
Building Code Council	Update the energy conservation code to increase the energy efficiency requirements for buildings	Short term
Building Code Council	Modernize the building code to ensure new buildings are ready for the installation of vehicle charging infrastructure and renewable energy resources	Short term

L. Create strategies for electrification

Background and Rationale

Electrification is the conversion to electricity of end uses of energy that are currently fueled with fossil fuels. Beneficial electrification considers whether, in electrifying, consumers are able to save money on their total energy bills, environmental benefits are achieved, and benefits to the grid are maximized. Beneficial electrification is included in the same strategy area as energy efficiency because, despite resulting in a net increase in *electricity* use, measures that constitute beneficial electrification will result in a net decrease in total *energy* use (in British thermal units, or some other measure of total energy). Participants in the clean energy plan process identified beneficial electrification, particularly of the transportation sector, as a key opportunity for North Carolina to meet its greenhouse gas emission reduction goals, provide North Carolinians with cleaner and cheaper transportation options, and give utilities the ability to manage new flexible loads for the benefit of the electric grid.

As the electricity sector has been becoming less carbon-intensive over the last decade, the transportation sector has become the second largest source of greenhouse gas emissions in the state. In 2017, the sector accounted for 32.5% and emitted 48.7 million metric tons of GHG emissions. Electrification of transportation presents a significant opportunity to reduce energy use and emissions from the sector due to the superior fuel efficiency of electrified transportation.[134] As the electricity sector becomes cleaner, electrification will result in accelerated emission reductions over time. In addition to reducing GHG emissions, electrifying transportation can result in reductions in local air pollutants such as particular matter and NOx. This can make an especially big difference for communities that are most directly impacted by motor vehicle pollution, such as those in urban areas with diesel bus traffic or those located close to freeway corridors.

Electrifying transportation also presents new opportunities for communities and individuals to save money on fuel and operating costs of vehicles. Although the upfront cost of a new EV is still higher than comparable gasoline cars, this is changing quickly as battery technology continues to improve. This trend is occurring in the passenger vehicle market as well as for larger vehicles such as buses and fleet vehicles. North Carolina now allows retail resale of electricity for EV charging stations per House Bill 329 which signed into law by Governor Cooper on July 19, 2019.

Under Executive Order 80, the state's Department of Transportation is developing a North Carolina Zero Emission Vehicle (ZEV) Plan, designed to increase the number of registered ZEVs in the state to at least 80,000 by 2025 and plan for the charging infrastructure needed support this growth. In April 2019, Duke Energy filed a plan with the NCUC for a $76 million investment in electric transportation infrastructure, including a statewide fast-charging station network. That plan is currently under review at the Commission. The recommendations described in this section are focused on how the utility sector can

[134] For example, the average electric vehicle has an fuel efficiency of roughly 30 kWh per 100 miles, which translates to a "miles-per-gallon equivalent" of about 112. This means that the average electric vehicle is 3-4 times more fuel efficient on an energy basis than a typical gasoline-powered vehicle. Note, this only considers the fuel efficiency of the vehicle itself, and not any energy used upstream of the vehicle.

best integrate and encourage the adoption of electric vehicles and how the state can play a leadership role in accelerating transportation electrification.

Recommendations

L-1. Require utilities to develop innovative rate design pilots for electric vehicles to encourage off-peak charging of vehicles and to test effectiveness of different rate structures at shifting customer usage of the grid and encouraging the adoption of electric vehicles.

Rate design, particularly when paired with smart chargers or the programmable charging feature of an EV, can be very effective at encouraging drivers to charge their vehicles at times of the day when it is advantageous to the electric grid to do so. For example, a super-off-peak rate during the overnight hours will entice drivers to program their vehicles to wait to charge until that time period starts, avoiding the early evening hours that might otherwise exacerbate system peak demand. On a utility system that is solar-rich, such as the one in North Carolina, it may be helpful for rate design to encourage workplace charging of EVs.

Not only can rate design help encourage the off-peak charging of vehicles, it can impact the economics of driving an EV as compared to a gasoline-powered vehicle. This is particularly true for charging stations located at commercial sites, such as workplaces, shopping centers, truck stops, etc. The typical rate design structure that utilities use for these kinds of customers can be a major inhibitor to the adoption and usage of charging infrastructure. Utilities are beginning to experiment with new structures that will recover costs from charging stations in a way that is more advantageous to the economics of EV charging.

State public utility commissions have begun to require utilities to employ the kinds of rate designs described above as a condition of approval for rate recovery of electric vehicle charging infrastructure.[135] In reviewing proposals from utilities regarding EV charging infrastructure, the NCUC could ensure that utilities plan to deploy rate designs that will encourage off peak charging and assist with EV adoption.

Table L-1: Actions for Recommendation L-1

Entity Responsible	Action	Timing (Short, Medium, or Long term)
NCUC	Ensure that utility proposals for EV charging infrastructure deployment are accompanied by pilots designed to test innovative rate design that encourages off peak charging and EV adoption	Short term
Co-ops and Municipal Utilities	Implement EV rate designs that encourage off peak charging and EV adoption	Medium term

[135] Maryland, California, Nevada, and Michigan are some of the states that have recently issued orders requiring innovative EV rate designs.

L-2. Conduct an analysis of the costs and benefits of using electrification to reduce energy burden and GHG emissions in consumer end-use sectors in NC, such as in homes, buildings, transportation and agricultural operations.

Clean Energy Plan stakeholders identified the electrification of transportation as a key strategy for reducing emissions from that sector, as more fully discussed in the final section. They also acknowledged that an economy-wide strategy to meet the state's GHG reduction goals would require emission reductions from other sectors in addition to electricity and transportation, such as fuel use in buildings, homes, and agriculture. Many studies have identified electrification of those energy end uses as potentially the most technologically feasible and least-cost strategy to reduce emissions from those sectors. Such a study has not been conducted for North Carolina, and thus this clean energy plan process did not focus specifically on electrification as a GHG reduction strategy. However, given the importance of getting started on emission reductions from all sectors, stakeholders identified such a study as an important next step for the state.

Beneficial electrical has the potential to provide significant financial relief to 30 percent of NC residents living in poverty. Low income households spend a disproportionate percentage of their household income on energy costs relative to their higher income counterparts.[136] For those living with incomes below 50% of the Federal Poverty level, 33% of their annual income is spent on energy bills. Of this amount, about 20% is spent on electric bills while over 60% is spent on natural gas or bottled gas (see Supporting Document-Part 3 for more information).

Table L-2: Actions for Recommendation L-2

Entity Responsible	Action	Timing (Short, Medium, or Long term)
Academia	Initiate an analysis of the costs and benefits of electrification of consumer end-use sectors such as homes, buildings and agricultural operations	Medium term

[136] Fisher, Sheehan, & Colton (2019). Home Energy Affordability Gap. Accessed May 2019. www.homeenergyaffordabilitygap.com/.

NEXT STEPS

Conclusions and Next Steps

An ongoing transformation of North Carolina's electricity system requires ambitious actions at the state and local levels, with active participation from the private sector. To achieve the goals and performance measurement targets laid out in the CEP, a framework is needed that centers on strategic investments that provide long-term energy, economic, and environmental benefits. **Developing modern regulatory tools, market structures and processes to achieve state goals can set us on a path to lower risk, lower-cost and lower-impact energy future.**

In the coming months and years, the entities identified in this plan are called upon to lead this effort by carrying out the stated recommendations or make adjustments within their normal business and operational practices to achieve the collective vision. We recognize that certain strategies and actions will require additional deeper dives and detailed analysis when considering new legislation or amending existing policies/practices. Many experts from within the state and across the country are ready to work with North Carolina leaders to continue transforming our state into a national leader in clean energy economy.