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North Carolina Electricity Planning

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SUMMARY

The electricity system is facing new pressures from a changing generation mix, new technologies, consumer demand, and evolving utility business models. Planning for these changes will require participants in the process—utilities, regulators, consumers, and other stakeholders—not only to engage with these coming shifts but also to think critically and collectively about ways to address them.

In North Carolina, two regulatory bodies share responsibilities for electricity planning: the North Carolina Energy Policy Council (EPC) and the North Carolina Utilities Commission (NCUC). The EPC is responsible for setting the state energy plan; the NCUC approves utility-developed integrated resource plans that forecast future electricity demand and options for meeting it. These two planning processes have different stakeholder-engagement opportunities, forecasting requirements, and outcomes.

Robust electricity planning that is based on a comprehensive and coordinated policy framework across agencies and that creates strong stakeholder alignment has multiple benefits, including increased regulatory certainty, diverse stakeholder engagement in a common goal, and clear understanding among stakeholders and decision makers of electricity generation, transmission, and distribution options. North Carolina has a range of options to institute comprehensive electricity planning that is aligned with effective planning principles and that builds on its past successes.

INTRODUCTION

The United States' electricity system is one of the most reliable and affordable in the world. But new technologies, changing markets, and shifting policies are creating challenges and opportunities for electricity generation, transmission, and distribution. The power system is incorporating new generation sources, such as wind and solar, and innovative grid technologies while responding to changes in consumer demand. The drivers for these changes include low load growth; increasing deployment of both distributed and utility-scale renewables; the development of innovative technologies, like storage options and smart grid services that enable consumers to interact with the grid in unprecedented ways; the rapid increase in the use of natural gas for electricity generation; and evolving environmental and energy policies. These drivers increase reliability, energy efficiency, and consumer choice. But their rapid pace and large scale also increase uncertainty in the traditional electricity generation and utility business model and therefore increase the need for adaptive, comprehensive electricity planning.

Historically, the pace and scale of change in the electricity system has been much slower than over the last decade and a half. Over the course of the last century, the electricity system was built incrementally on one-way flows of electricity from centralized generation stations, and federal, state, and local policies were developed to support the traditional utility model. But now comprehensive energy planning by utilities, decision makers, and stakeholders is needed to respond to the electricity system's rapid and significant change and to navigate increasingly overlapping federal, state, and local policies.

The changing generation mix, potential two-way flow of electricity and information, evolving business models, and other drivers are challenging current grid operations, grid infrastructure, and regulatory frameworks. Planning for distributed generation and storage, for example, will require utilities, regulators, and consumers to coordinate and to integrate generation, transmission, and distribution systems. Many states, analysts, academics, and others are actively engaged in exploring the impacts of and planning for these system changes.[1] Recognizing that the traditional planning model may not be effective for these new challenges, some states have updated their planning processes to account for the unprecedented uncertainties in the sector. Colorado, for example, has created additional oversight from independent third parties and has incorporated significant stakeholder input on electricity planning. States like Colorado can provide insight into new directions for North Carolina's electricity planning system.

North Carolina's electricity system has evolved in a manner similar to Colorado's system—both are based on the same principles of centralized electricity generation and grids designed for one-way electricity distribution to the end-use consumer—and it faces pressures from the same drivers. North Carolina's electricity planning framework co-evolved with the traditional utility model. In North Carolina, two regulatory bodies share responsibilities for electricity planning: the North Carolina Energy Policy Council (EPC) and the North Carolina Utilities Commission (NCUC). Though the EPC is responsible for setting an overall state energy plan, that process must consider and ultimately be consistent with the NCUC's long-range planning process: integrated resource planning. The NCUC depends largely on the state's investor-owned utilities to develop integrated resource plans (IRPs). The IRP process in North Carolina requires that the utilities forecast future demand and evaluate possible scenarios for meeting it using a range of options, including power purchases, new generation, conservation strategies, and efficiency measures. Though there is a public process for consumer and stakeholder input into the IRP process, it is an adjudicatory process and requires consumers and stakeholders to participate in quasi-judicial processes before the NCUC can truly engage in planning. In contrast, the EPC's process has traditionally been conducted by actively including stakeholders and working groups to develop a collective plan to address

[1] *See, e.g.*, Ron Binz et al., *Practicing Risk-Aware Electricity Regulation 2014 Update* (CERES: 2014); Owen Zinaman et al., *Power Systems of the Future: A 21st Century Power Partnership Thought Leadership Report* (Nat'l Renewable Energy Laboratory, Technical Report 6A20-62611, 2015).

the state's energy needs. This process is, however, connected to and potentially limited by the requirement that the EPC's plans be consistent with IRPs.

Planning for dramatic changes in the electricity sector will require participants in the process—utilities, regulators, consumers, and other stakeholders—to think critically and collectively about ways to address them. Current planning processes in North Carolina are ill-suited to render collective decision making and planning. More robust planning processes will allow North Carolina to account for unprecedented uncertainties and opportunities in the electricity sector.

Reliable and affordable electricity has been and will continue to be the foundation for the development of the U.S. and North Carolina economy. The accelerating changes to the electricity system are revealing opportunities and vulnerabilities that necessitate a comprehensive examination of the entire system from generation to end use. Advocacy groups and analysts are engaged in understanding, analyzing, or promoting new utility business models or in tracking the evolution of the utility business model. Ongoing research efforts are examining barriers to clean energy futures, managing the risks arising from uncertainty in regulatory systems and markets, and increasing grid reliability as aging infrastructure is addressed.[2] Federal agencies, primarily the U.S. Energy Information Administration (EIA) and U.S. Department of Energy (DOE), are researching new technologies and providing critical information about the evolution of electricity generation. Some states are considering new regulatory approaches in response to this evolving landscape. Utilities are also making business decisions that reflect their assessment of the importance of these changes. Southern Company, for example, announced in February 2016 that it would acquire a North Carolina-based provider of distributed energy, noting that this "natural evolution of [their subsidiary] companies' business models" will create an entity "particularly suited to address reliability concerns and promote technology advances with a focus on the future."[3]

This paper is intended to facilitate a shared understanding among North Carolina stakeholders of the broad trends affecting electricity generation and planning, North Carolina's position with respect to those trends, and the regulatory and policy structures through which North Carolina conducts electricity planning. Energy planning is a broad and complex topic; capturing all of the complex interactions among markets, policies, and technologies is beyond this scope of this paper. Instead, it focuses on the process by which North Carolina conducts electricity planning in non-transportation sectors, beginning with an exploration of the planning policy mechanisms available to state-level decision makers and how they are used in North Carolina. It continues with identification of emerging challenges and opportunities faced by the state's electricity sector and concludes with a description of good governance and management principles and their use by other states for electricity sector energy planning. The intent is to provide North Carolina with options to consider for its own electricity planning.

PLANNING MECHANISMS FOR THE ELECTRICITY SECTOR IN NORTH CAROLINA

Domestic electricity planning is facing increasingly disruptive trends that challenge the traditional electric utility structure. Utilities, regulators, and consumers are making decisions about grid technology and electricity generation at a pace and shifting geographic scale that pushes the current planning paradigm and that creates uncertainty about the modern grid. Like other states, North Carolina is grappling with these trends both within the traditional electricity planning regulatory frame and within the ever-evolving market.

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[2] *See, e.g.*, Deloitte Center for Energy Solutions, *The New Math. Solving the Equation for Disruption to the U.S. Electric Power Industry* (2014); North American Electric Reliability Corporation, *2015 Long-Term Reliability Assessment* (Dec. 2015); Utility Dive, *2016 State of the Electric Utility* (2016).

[3] Gavin Bade, "Southern Co. Seeks to Bolster Efficiency, DER Offerings with $431M PowerSecure Deal," *Utility Dive,* Feb. 25, 2016, *available at* http://www.utilitydive.com/news/southern-co-seeks-to-bolster-efficiency-der-offerings-with-431m-powersec/414541/.

Electricity planning in North Carolina is nested within energy policy, which as it relates to electricity is a complicated mix of federal, regional, state, and sometimes even local enactments that overlap. At the federal level, much oversight is concerned with regulating interstate electricity markets as well as facilitating investments in technology and innovation through financial and tax incentives. The federal government also provides support to states for their overall energy priorities—not necessarily limited to electricity—through programs such as the DOE's U.S. State Energy Program. This federal support can lead to regional and interstate efforts at planning as well. At the local level, much of the policy activity around the electricity sector focuses on streamlining energy efficiency and implementing renewable energy programs.[4] Much of this activity also focuses on land use planning regulation of the location and installation of infrastructure at the utility and residential levels.[5]

At the state level—the focus of this paper—energy policy affecting electricity sector planning includes energy efficiency programs, energy emergency planning efforts, utility regulation, energy planning, tax credits, and grant programs, and it is implemented by multiple bodies. In North Carolina, the Public Utilities Commission handles forecasting for and rate regulation of publicly owned utilities. But the Energy Policy Council, which is housed within the Department of Environmental Quality, establishes the overall vision for the state's energy sector.

When multiple agencies share responsibility for oversight and regulation of the electricity sector, varying institutional structures and policy directives can complicate coordination of their efforts, as can federal environmental policies delegated to the states for implementation. This mix of energy and environmental policies means that North Carolina decision makers must navigate multiple policy priorities both within and across state agencies. To integrate and balance these policy directives, decision makers have a number of policy mechanisms.

The most frequently used of these mechanisms are integrated resource plans (IRPs), state energy plans, and renewable portfolio standards. IRPs and state energy plans are long term and deal with future scenarios. IRPs are prepared by utilities, usually for state public utility commissions (PUCs), and involve forecasting of both energy needs and resources. State energy plans are usually the products of broad stakeholder processes, and they present the vision and strategies for meeting a state's energy needs and promoting economic development. Energy plans can be the purview of an energy-focused executive agency, such as a state energy office, or of another executive agency, like an environmental agency. Ideally, utility-specific IRPs from PUCs flow from and are integrated with state energy plans. Other policy tools come into play to dictate the sources and targets for energy sourcing. For example, procurement mandates dictate the percentage of energy resources that must come from certain types of sources (e.g., renewable resources such as solar and wind).

Each of these mechanisms has a place in a comprehensive energy policy approach. North Carolina uses many of them, but not all are well integrated with the others.

Establishing the Vision for Electricity's Future

Energy planning is, at its most basic level, a visioning process that intersects with utility regulation and management and that incorporates any targets set by state legislatures (e.g., renewable energy portfolio

[4] For example, Envision Charlotte is a public-private partnership that functions as an incubator for innovative programs that promote sustainability, resilience, economic competitiveness, and improved quality of life in and around Charlotte. *See* Envision: Charlotte Uniting for a Sustainable City, http://envisioncharlotte.com/.

[5] Examples of local regulatory policies are the Town of Chapel Hill's solar and wind access ordinance provisions that prohibit neighborhood associations, homeowners associations, or both from restricting the installation of solar panels on homes (*see* CHAPEL HILL, NC., CODE § 4.6.7 (2003)) and Wautauga County's wind ordinance to regulate the location of wind energy installations (*see* Watauga County, NC, *Ordinance to Regulate Winder Energy Systems*, http://www.wataugacounty.org/App_Pages/Dept/Planning/viewordinances.aspx?DbID=70).

standards, as discussed below). In North Carolina, energy policy for the electricity sector has primarily been the domain of the North Carolina Energy Policy Council (EPC) and the North Carolina Utilities Commission (NCUC). The EPC serves as the "central energy policy planning body" for North Carolina.[6] The NCUC and the associated Public Staff are concerned with direct regulation of the rates and operations of individual utilities, including forecasting of future energy needs and costs.

State Energy Plans and the North Carolina Energy Policy Council

State energy plans are the end product of effective comprehensive energy planning and can be a valuable tool for helping to shape other energy policies and to drive technological development. Comprehensive energy plans can serve as a guide for public decision makers (governors, legislators, agencies, commissions) to evaluate and assess existing policy priorities and think about future policies as well as educate the public, industry, businesses, and investors about a state's energy resources and priorities.[7]

State energy planning efforts may be led by state energy offices or other executive agencies, governors' offices, or even PUCs. Stakeholders are usually convened to participate in plan development. Inclusion of a broad range of stakeholders, including generators, industrial and commercial energy users, and public interest organizations, is important to generate support for the resulting plan and to allow decision makers to hear from diverse constituencies affected by it.

State energy plans generally include a comprehensive analysis of the state's current energy profile and present goals, visions, and recommendations for guiding the state's energy future. Some state plans also establish metrics and evaluation criteria for assessing the plan's progress.[8] State plans can also identify financing mechanisms for encouraging private sector and consumer investments. Mandates to develop such plans and engage in establishing new energy policy can come from the state legislative process or the governor's office.

In North Carolina, the directive to develop a state energy plan is a legislative one. The North Carolina Energy Policy Act[9] was originally passed in 1975 and amended in 2009 and 2013.[10] As originally passed, the act included findings that "[g]rowth in the consumption of energy resources is in some part due to the wasteful, uneconomic, and inefficient uses of energy" that if allowed to continue would "adversely affect the future social, economic, and environmental development of North Carolina."[11] In 2013, this finding was removed.[12] New findings were added to reflect a shift toward energy resource development. The new findings include the following:

> It is in the State's best interest to support the exploration, development, and production of domestic energy supplies, preferably from the resources within the State or region and most certainly from within the country.
>
> It is the duty of State government to protect and preserve the State's natural resources, cultural heritage, and quality of life and, above all, the public health and safety of its residents during the exploration, development, and production of domestic energy resources.

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[6] N.C. Gen. Stat. § 113B-2(c).
[7] National Conference of State Legislatures, *Planning for the Energy Future: A Policymaker's Guide to Comprehensive State Energy Planning*, http://www.ncsl.org/documents/energy/2014-Energy-Planning.pdf (last visited May 31, 2016).
[8] *Id*.
[9] N.C. Gen. Stat. § 113B-1 et seq.
[10] 2013 N.C. Sess. Laws 365.
[11] N.C. Gen. Stat. § 113B-1(2) (repealed by 2013 N.C. Sess. Laws 365).
[12] *Id.* In addition, a clause related to the protection of public health, safety, and the general welfare were removed from the findings as well.

> The State must provide the basis for development of a long-range unified energy policy to encompass comprehensive energy resource planning and efficient management of existing energy resources in relation to economic growth, to effectively meet an energy crisis, to encourage development of alternative sources of energy that are capable of achieving a positive benefit-to-cost ratio, and to ensure efficient utilization of energy resources in a manner consistent with assuring a reliable and adequate supply of energy for North Carolina, including active support and collaboration with the federal government to ensure access to the nation's energy resources located on the outer continental shelf directly adjacent to the State's coastal waters.[13]

The stated intent of the legislation is "to provide for development of such a unified domestic energy policy for the State of North Carolina as part of a nationwide effort for increased domestic energy production in the interest of national security and economic growth and stability."[14]

In the Energy Policy Act, the General Assembly provides for the North Carolina Energy Policy Council (EPC) to carry out these policy-making functions, and it delegates broad planning authority to the EPC. The EPC serves as the "central energy policy planning body" for North Carolina.[15] It is charged with advising and making recommendations to the governor and the General Assembly "on increasing domestic energy exploration, development, and production within the State and region to promote economic growth and job creation."[16] The EPC was originally situated in the Department of Administration prior to 2009 and in the Department of Commerce from 2009 to 2013.[17] It has been housed within the Department of Environment Quality since the 2013 amendments to the Energy Policy Act.[18] The EPC has 13 members: the secretary of Department of Environmental Quality, the secretary of Commerce, the lieutenant governor, and 10 gubernatorial, house, or senate appointees. Those 10 members are expected to represent a variety of areas of expertise, including utility management, resource development (gas, hydrocarbon, and alternative energy), and environmental management.[19] The duties and responsibilities of the EPC are as follows:

> To develop and recommend to the Governor and the General Assembly a comprehensive State energy policy that addresses requirements in the short term (10 years), in the midterm (25 years), and in the long term (50 years) to achieve maximum effective management and use of present and future sources of energy, such policy to include but not be limited to energy efficiency, renewable and alternative sources of energy, research and development into alternative energy technologies, and improvements to the State's energy infrastructure and energy economy, including smart grid and domestic energy resources that shall include at least natural gas, coal, hydroelectric power, solar, wind, nuclear energy, and biomass. []
>
> To conduct an ongoing assessment of the opportunities and constraints presented by various uses of all forms of energy to facilitate the expansion of the domestic energy supply and to encourage the efficient use of all such energy forms in a manner consistent with State energy policy.

[13] *Id.* § 113B-1(3a)-(4).
[14] *Id.* § 113B-1(5).
[15] *Id.* § 113B-2(c).
[16] *Id.* § 113B-2(a).
[17] 2009 N.C. Sess. Laws 446.
[18] N.C. Gen. Stat. § 113B-2(b).
[19] *Id.* § 113B-3.

> To continually review and coordinate all State government research, education and management programs relating to energy matters, to continually educate and inform the general public regarding such energy matters, and to actively engage in discussions with the federal government, its agencies, and its leaders to identify opportunities to increase domestic energy supply within North Carolina and its adjacent offshore waters.
>
> To recommend to the Governor and to the General Assembly needed energy legislation and rule making, and to recommend for implementation such modifications of energy policy, plans, and programs as the Council considers necessary and desirable.[20]

The EPC is specifically charged with developing state plans and generating annual reports that provide a vision for North Carolina's energy future.[21] The energy management plan is to address the following elements:

> An analysis of the current pattern of consumption of energy throughout the State by category of energy user and by sources of energy supply;
>
> An assessment of the effect of demand and supply of different forms of energy upon the current pattern of consumption;
>
> An independent analysis, in five-, 10- and 20-year forecasts, of future energy production, supplies and consumption for North Carolina in relation to forecasts of statewide population growth and economic expansion;
>
> An analysis of the anticipated effects of recommended conservation measures upon the consumption of energy in the State;
>
> An assessment of the possible effects of national energy and economic policy and international economic and political conditions upon an adequate and reliable supply of different forms of energy for North Carolina;
>
> An assessment of the social, economic and environmental effects of alternative future consumption patterns on energy usage in North Carolina, including the potentially disruptive effects of supply limitations;
>
> Recommendations on the use of different future energy sources that seem most appropriate and feasible for North Carolina in meeting expected energy needs during the next five-, 10- and 20-year periods, with consideration given to growth trends in North Carolina industry and possible adverse economic impact on such trends.[22]

This plan is required to be updated when the EPC finds that doing so is justified.[23]

The last update of the North Carolina Energy Plan was completed in 2003 (revised in 2004) and prepared for the EPC by the State Energy Office, which had also existed in the North Carolina Department of Administration prior to the 2009 amendments to the North Carolina Energy Policy Act and then in the Department of Commerce between 2009 and 2013.[24] The State Energy Office was assisted by the

[20] *Id.* § 113B-6(1)-(4).
[21] *Id.* § 113B-8.
[22] *Id.* § 113B-8.
[23] *Id.* § 113B-8(f).
[24] *Id.* § 113B-2(b).

Appalachian State University Energy Center in its preparation of the plan.[25] Though the North Carolina Energy Policy Act does not mandate the process by which the EPC is to address energy plan elements, the EPC and the State Energy Office used a quasi-legislative stakeholder process to develop this plan.[26] A working group of EPC members solicited input from the public, stakeholders representing industry, low-income communities, the building trade, community planning organizations, the business and finance sector, the agriculture sector, and the energy sector as well as input from national, regional, and state energy experts.[27] On the basis of this input, the working group drafted recommendations for consideration by the full EPC. The full EPC then developed and adopted an updated state energy plan in June 2003. Prior to 2003, a plan update had been completed in 1992.[28] The State Energy Office no longer exists. Staff at the DEQ assist the EPC with reporting and planning, but based on a review of publicly available documents, a full North Carolina Energy Plan update does not appear to have been completed since 2003. However, the EPC does address some aspects of energy and electricity planning in its biennial reporting discussed below.

In addition to the state energy management plan, the EPC submits a report every two years on state energy issues to the governor, the speaker of the House of Representatives, the president pro tempore of the Senate, the Environmental Review Commission, the Joint Legislative Commission on Energy Policy, and the chairman of the Utilities Commission.[29] This report covers many of the same topics as the overall energy management plan.[30] The most recent report was completed in March 2016.[31]

Though it has a duty to develop these two analyses—the plan and the report—the EPC is not empowered to enforce or implement its policy proposals. In its energy management plan, the EPC is to make proposals for implementing recommendations that can be carried out by executive orders from the governor.[32] Similarly, in its report, the EPC is to make recommendations for "administrative and legislative actions on energy matters."[33] The EPC has an overall obligation to develop policy consistent with the planning proceedings of the NCUC. The act states that "[f]or utilities regulated under [the Public Utilities Act], the policy developed under this subdivision shall be consistent with the analysis and plan developed under G.S. 62-110.1(c)."[34] As described below, the NCUC must develop, publicize, and keep current its own analysis of long-range needs related to expansion of electricity-generating facilities in North Carolina.[35] The NCUC's analysis is informed largely by the integrated resource planning processes for state-regulated utilities.

Integrated Resource Plans and the North Carolina Utilities Commission

Integrated resource planning is integral to the energy vision of North Carolina; the state energy plan must be consistent with the least-cost planning process of the NCUC. IRP policies require utilities to plan for

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[25] North Carolina Department of Administration State Energy Office and Appalachian State University Energy Center, *North Carolina State Energy Plan* (June 2003; revised November 2004), http://energy.appstate.edu/sites/energy.appstate.edu/files/sep_12-04.pdf (last visited September 8, 2016).
[26] *Id*. at 1.
[27] *Id*.
[28] *Id*.
[29] *Id*. § 113B-12(a).
[30] *Id*. § 113B-12(b)(1)-(7).
[31] North Carolina Department of Environmental Quality, *Energy Policy Council Report* (March 2016), https://ncdenr.s3.amazonaws.com/s3fs-public/documents/files/Energy%20Policy%20Council%20Report%20March%202016.pdf (last visited September 8, 2016).
[32] *Id.* §113B-8(d).
[33] *Id*. § 113B-12(6).
[34] *Id*. § 113B-6.
[35] N.C. Gen Stat § 62-110.1(c).

meeting future demand with the most reliable and efficient energy resources, and they are used by at least 28 states, including North Carolina.[36] The IRP process involves

> planning and selection … for new energy resources that evaluates the full range of alternatives, including new generating capacity, power purchases, energy conservation and efficiency, cogeneration and district heating and cooling applications, and renewable energy resources in order to provide adequate and reliable service to … electric customers at the lowest system cost.[37]

State-level IRP policy mechanisms have been adopted in several ways. Some state legislatures pass laws mandating IRPs. In other states, IRP policy has been adopted through administrative rules and regulations of state PUCs, state energy and environmental agencies, or both. In North Carolina, regulations implementing an IRP process were adopted by the NCUC pursuant to the North Carolina Public Utilities Act.

The act provides the NCUC with the authority "to regulate public utilities generally, their rates, services and operations, and their expansion in relation to long-term energy conservation and management policies and statewide development requirements."[38] The NCUC is made up of seven commissioners appointed by the governor with approval by the General Assembly.[39] The NCUC is also granted authority to employ a staff of hearing examiners, attorneys, clerks, and other professional, technical, and administrative staff as "the [NCUC] may determine to be necessary in the proper discharge of the Commission's duty and responsibility as provided by law."[40] The NCUC has broad authority over utilities, including authority to set "just and reasonable" rates for public utilities,[41] site transmission lines,[42] certify construction of new facilities,[43] oversee mergers and transfers of utility ownerships,[44] issue and manage utility franchises,[45] and make decisions about which costs (e.g., fuel costs, environmental compliance costs, construction costs) utilities can pass on to their customers in rates.[46] In addition to being "just and reasonable" in rate setting, the NCUC must also ensure that all of its energy planning and rate-setting activities are done "in a manner to result in the least cost mix of generation and demand-reduction measures which is achievable, including consideration of appropriate rewards to utilities for efficiency and conservation which decrease utility bills."[47]

To meet this least-cost standard, the NCUC is required to develop and keep up to date a long-range plan for the expansion of electricity-generating facilities in North Carolina.[48] Its analysis must include estimates of future load growth; needed generating reserves; size, mix, and location of generating plants; arrangements for pooled power not regulated by the Federal Energy Regulatory Commission; and any

[36] Rachel Wilson and Paul Peterson, *A Brief Survey of State Integrated Resource Planning Rules and Requirements*, (Synapse Energy Economics, Inc., April 28, 2011), http://www.cleanskies.org/wp-content/uploads/2011/05/ACSF_IRP-Survey_Final_2011-04-28.pdf (last visited November 5, 2015).
[37] 16 U.S.C. § 2602(19).
[38] N.C. Gen. Stat. § 62-2(b) (2015).
[39] *Id.* § 62-10(a).
[40] *Id.* § 62-14(a).
[41] *Id.* §§ 62-2(a)(4); 62-130 - 62-133.
[42] *Id.* § 62-101.
[43] *Id.* § 62-110.1.
[44] *Id.* § 62-111.
[45] *Id.* §§ 62-112 – 62-113.
[46] *Id.* §§ 62-133.2 – 133.6.
[47] *Id*. § 62-2(a)(3a).
[48] N.C. Gen. Stat. sec. 62-110.1(c).

other arrangements with other utilities or power suppliers.[49] To meet its obligations, the NCUC adopted regulations requiring regulated utilities to submit IRPs on a regular basis.

The three major investor-owned utilities in North Carolina—Duke Energy Progress, Duke Energy Carolinas, and Dominion North Carolina Power—are required to develop and keep current "least cost integrated resource plans."[50] IRPs are submitted every two years; in the off years, annual reports are filed to update the previous year's IRP.[51] The goal of the IRP is to establish an overall plan for each utility that addresses electricity supply management alongside conservation and demand-side measures. At a minimum, IRPs must include a 15-year forecast of load requirements and other system obligations that extend through at least one summer or winter peak, the supply-side and demand-side resources that the utilities expect to use to meet those loads, the associated reserve margins, and an analysis of all resource options on both the supply and demand side that includes alternative energy resources and that addresses the utilities' obligations under the renewable energy portfolio standard.[52] The utilities must also assess the potential for purchasing power from wholesale providers,[53] for promoting demand-side management through demand-response programs and energy efficiency and conservation programs,[54] and for alternative supply-side resources, including hydro, wind, geothermal, solar thermal, solar photovoltaic, municipal waste, fuel cells, and biomass.[55]

The standard for evaluating options in the IRPs is "the least cost combination (on a long-term basis) of reliable resource options for meeting the anticipated needs of the system."[56] The utilities are required to evaluate multiple scenarios in choosing a set of resources options and to take into account "the sensitivity of [the utilities'] analysis to variations in future estimates of peak load, energy requirements, and other significant assumptions, including but not limited to, the risks associated with wholesale markets, fuel costs, construction/implementation costs, transmission and distribution costs, and costs of complying with environmental regulation."[57] The utilities are also to take into account system operations, environmental impacts, and undefined "other qualitative factors" in assessing and choosing a planning scenario.[58]

The NCUC dictates the contents of the reports and the data to be included.[59] The utilities are required to describe to the NCUC the methods, models, variables, and assumptions used to prepare forecasts.[60] The forecasts for load, supply-side resources, and demand-side resources are to be based on the most recent 10-year history of customer numbers and energy sales, a tabulation of the forecasted needs for the next 15-year period (including the effects of any demand-side or energy efficiency programs) by customer class (residential, commercial, industrial), and descriptions of any future supply-side resources that the utilities propose to meet those forecasted needs.[61]

For generating facilities, the report must include data on existing and planned generating facilities and must identify the type of fuel(s) to be used. It must also indicate units' location; whether units are meant to meet base, intermediate, or peak loads; and any plans for retirements, upgrades, and extensions as well

[49] *Id.*
[50] *Id.* § 62.2(3a), 62.110.1.
[51] 4 N.C. Admin. Code. 11.R8-60(h).
[52] *Id.* 11.R8.60(c).
[53] *Id.* 11.R8.60(d).
[54] *Id.* 11.R8.60(f).
[55] *Id.* 11.R8.60(e).
[56] *Id.* 11.R8.60(g).
[57] *Id.* 11.R8.60(g).
[58] *Id.*
[59] *Id.* 11.R8.60(i).
[60] *Id.* 11.R8.60(i)(1).
[61] *Id.* 11.R8.60(h)(1).

as provide analyses to support the addition of new facilities.[62] The utilities are also required to list all non-utility generating facilities in their service areas and to include the facility's name, location, fuel type, capacity, and designation (base, intermediate, or peak generation) as well as to indicate whether the utility has included the facility in its total supply-side resources.[63] The utility also must provide the NCUC with calculations and supporting analysis for its winter and summer peak reserve margins for the 15-year period of the plan.[64] It must also provide detailed information about any wholesale contracts for the purchase or sale of power, including fuel type, capacity, designation, location, volume, and contract expiration date.[65] Transmission facility information must include lines and facilities of 161 or more kV that are under construction or planned during the 15-year time horizon and adequacy of transmission systems.[66]

For demand-side management, the utilities must include in their IRPs a detailed assessment of existing, potential, discontinued, and even rejected management programs.[67] For each resource, this assessment must provide information about type (e.g., whether it is demand response or energy efficiency), capacity, number of enrolled customers, frequency of use, and capacity of reduction realized when employed for existing programs.[68] For both proposed and rejected programs, the utility must provide rationales that include program descriptions, target customers, capacity, projected acceptance by customers, and explanations for acceptance or rejection.[69] Similarly, the utility must include assessments of existing, potential, and rejected alternative supply-side resources.[70] Finally, the utility must report on its evaluation of different scenarios,[71] levelized costs of each type of considered generation,[72] and smart grid impacts.[73]

IRPs are developed by the utilities and submitted to the NCUC for review with little direct involvement of ratepayers. North Carolina regulations provide for a quasi-judicial review process whereby the North Carolina Public Staff and other interested parties can file comments on IRPs or file their own IRP.[74] The North Carolina Public Staff is an independent agency that participates in many of the authorized regulatory activities of the NCUC, but it represents the consuming public and operates separate and apart from the NCUC and its staff.[75] The Public Staff operate as auditors and advocates that "[r]eview, investigate, and make appropriate recommendations to the Commission with respect to the reasonableness of rates charged or proposed to be charged by any public utility and with respect to the consistency of such rates with the public policy of assuring an energy supply adequate to protect the public health and safety and to promote the general welfare."[76] With regard to IRPs, the Public Staff and other intervenors may act within 150 days of a biennial report filing and within 60 days of an annual report filing.[77] This process for participation in the IRP process is retrospective in nature, and it resembles adjudicative

62 *Id.* 11.R8.60(h)(2).
63 *Id.* 11.R8.60(h)(2)(iii).
64 *Id.* 11.R8.60(h)(3).
65 *Id.* 11.R8.60(h)(4).
66 *Id.* 11.R8.60(h)(5).
67 *Id.* 11.R8.60(h)(6).
68 *Id.*
69 *Id.* 11.R8.60(h)(6)(ii)-(iii).
70 *Id.* 11.R8.60(h)(7).
71 *Id.* 11.R8.60(h)(8).
72 *Id.* 11.R8.60(h)(9).
73 *Id.* 11.R8.60(h)(10).
74 *Id*. 11.R8.60(j).
75 N.C. Gen. Stat. § 62-15(a).
76 *Id*. at § (d)(1). This section of the act goes on to list the administrative duties and capacities of the Public Staff such as intervention and petitioning.
77 N.C. Admin. Code 11.R8.60(j).

proceedings (including the presentment of evidence and experts, dockets, and hearings before the administrative body—the NCUC).

Cross-Walking between the North Carolina State Energy Plan and Integrated Resource Plans

Though the EPC's energy planning and reporting and the NCUC's integrated resource planning together establish the vision for North Carolina's energy future, these processes do not actively engage each other. The annual reports generated by the EPC are directed to the NCUC, among other decision makers, but the NCUC is not required to consider the recommendations made by the EPC in its rate-setting activities. And because the EPC's energy plan must be consistent with NCUC planning proceedings, the least-cost integrated resource planning process and resulting plans could affect the scope of the EPC's future visioning exercises.

General Assembly mandates place other constraints on and establish targets and goals for both entities with regard to the amount of renewable energy that must be generated and used in the state.

Setting Goals and Targets for Energy Sourcing

Many of the goals and targets that must be met through the energy planning process are within the purview of state legislative bodies. Legislative goals can be general, such as economic development, environmental protection, reliability, and affordability, but they can also be targeted, as in the case of specific standards for renewable energy sources or energy efficiency. These are requirements that utilities source a set percentage of their energy supply from renewable energy, through renewable portfolio standards (RPS), and that they achieve a set level of energy savings, through energy efficiency resource standards (EERS).[78] RPS are used in 29 states, and EERs, in 24.[79] The RPS is a policy tool that sets renewable energy quotas for utilities to meet in supplying energy to their customers. An RPS "establishes numeric targets for renewable energy supply, applies those targets to retail electricity suppliers [], and encourages competition among renewable developers to meet the targets in a least-cost fashion."[80] These quantitative targets generally increase over time, and compliance must be demonstrated on a regular (usually annual) basis. Utilities under a RPS may meet the requirements by constructing their own projects or by purchasing renewable energy from independent generators. The benefits of RPS as a policy tool are that they drive renewable energy development, lower the costs of such development, and can apply in a variety of market contexts (restructured or monopoly utility markets).[81] In addition, RPS can be structured to support diversity of the renewable energy supply by requiring a certain percentage of the supply to come from certain types of resources (e.g., biomass, solar, wind). An EERS policy also sets a quota for utilities to meet, but the target is a binding energy savings target for utilities.[82]

In North Carolina, the General Assembly adopted a "renewable energy and energy efficiency portfolio standard" that requires electricity utilities in the state to meet a certain percentage of their customers' needs with renewable sources or reduced electricity consumption by implementing energy efficiency programs.[83] In passing the new standard, the General Assembly amended the North Carolina Public Utilities Act to specifically charge the NCUC with "promot[ing] the development of renewable energy and energy efficiency through the implementation of a Renewable Energy and Energy Efficiency Portfolio Standard (REPS)."[84] The REPS is intended to "[d]iversify the resources used to reliably meet

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78 Shelley Welton, *Non-Transmission Alternatives*, 39 HARVARD ENVIRONMENTAL LAW REVIEW 457 (2015).
79 Database of State Incentives for Renewable Energy & Efficiency, http://www.dsireusa.org/ (last visited November 5, 2015).
80 Ryan Wiser, Kevin Porter, and Robert Grace, *Evaluating Experience with Renewables Portfolio Standards in the United States*, 10 MITIGATION AND ADAPTATION STRATEGIES FOR GLOBAL CHANGE 237, 239.
81 *Id*.
82 American Council for an Energy-Efficient Economy, State Energy Efficiency Resource Standards (EERS), (Policy Brief, 2015), http://aceee.org/sites/default/files/eers-04072015.pdf (last visited November 5, 2015).
83 N.C. Session Law 2007-397.
84 *Id.* § 62-2(a)(10).

the energy needs of consumers …, [p]rovide greater energy security through the use of indigenous energy resources available within [North Carolina], [e]ncourage private investment in renewable energy and energy efficiency, [and] [p]rovide improved air quality and other benefits to energy consumers and citizens of [North Carolina]."[85] North Carolina's REPS was first established in 2007.[86] It sets renewable energy targets for investor-owned utilities, municipal utilities, and electric cooperatives.

The REPS contains both overall and interim targets as well as targets for the sourcing of renewable energy. Investor-owned utilities must ultimately supply 12.5% of 2020 electricity from eligible renewable energy sources, with a ramp-up schedule of 3% by 2012, 6% by 2015, and 10% by 2018.[87] Municipal utilities and electric cooperatives must meet an overall target of 10% renewables by 2018, with a ramp-up schedule of 3% by 2012 and 6% by 2015.[88] Acceptable renewable energy resources include solar electric, solar thermal, wind, hydropower, geothermal, ocean current or wave energy; biomass resources that use best available control technology for air emissions (e.g., wood waste, landfill gas, animal waste); waste heat from a renewable energy resource; hydrogen from a renewable resource; and electric demand reduction.[89] The REPS also sets specific targets for sourcing from solar, swine waste, and poultry waste (Table 1).[90]

Table 1. Compliance schedule and overall annual targets for percentage of solar-, swine-waste-, and poultry-waste-derived electric power sold in North Carolina

Compliance schedule	Overall annual targets
2010	0.02% solar
2012–13	0.07% solar (3% overall target)
2014	0.07% solar, 0.07% swine waste, 170K MWh poultry waste (3% overall target)
2015	0.14% solar, 0.07% swine waste, 700K MWh poultry waste (6% overall target)
2016	0.14% solar, 0.07% swine waste, 900K MWh poultry waste (6% overall target)
2018–19	0.20% solar, 0.14% , swine waste, 900K MWh poultry waste (10% overall target)
2021	0.20% solar, 0.20% swine waste, 900K MWh poultry waste (12.5% overall target)

For investor-owned utilities, energy efficiency and conservation can be used for up to 25% of the overall target through 2021 and for up to 40% thereafter.[91] There is no cap for municipal utilities and electric co-ops.[92]

85 *Id.*
86 2007 N.C. Sess. Laws 397.
87 N.C. Gen. Stat. § 62-133.8(b)(1). Utilities may meet up to 25% of these requirements using out-of-state renewable energy credits (N.C. Gen. Stat. § 62-133.8(b)(2)).
88 *Id.* § 62-133.8(c)(1).
89 *Id.* § 62-133.8(a)(8); 133.8 (b)(1)-(b)(2); 133.8 (c)(1)-(b)(2).
90 *Id.* §§ 62-133.8(d)-(f); *see also* N.C. Clean Energy Technology Center, Renewable Energy and Energy Efficiency Portfolio Standard (Database of State Incentives for Renewables & Efficiency, February 3, 2015), http://programs.dsireusa.org/system/program/detail/2660 (last visited August 14, 2015).
91 *Id.* § 62-133.8(b)(2)(c).
92 *Id.* § 62.133.8(c)(2)(b).

Compliance with the targets is monitored by the NCUC through a system of renewable energy certificates or credits.[93] The NCUC has adopted rules governing the issuance of such credits.[94] It tracks them through the North Carolina Renewable Energy Tracking System.[95] Utilities are allowed to recover REPS compliance costs up to certain statutory caps per account.[96]

One of the other North Carolina energy policy mechanisms that assists the NCUC and utilities with meeting the REPS is net metering. The NCUC first adopted rules to allow for net metering in North Carolina in 2005 pursuant to a request by the North Carolina Sustainable Energy Association.[97] At that time, the NCUC ordered utilities to make net metering available to customer-generators with a capacity of up to 20 kilowatts for residential customers and 100 kilowatts for non-residential customers.[98] The NCUC placed a cap on net metering of 0.2% of the utility's North Carolina peak load for the previous year.[99]

In adopting the REPS, the North Carolina General Assembly directed the NCUC to "consider whether it is in the public interest to adopt rules for electric public utilities for net metering of renewable energy facilities with a generation capacity of one megawatt or less."[100] In response, the NCUC updated its rules in 2009 to allow generation capacities up to one megawatt, and it removed the aggregate limit.[101] The utilities typically carry forward any excess generation through each billing period at the full retail rate, but the excess is surrendered to the utility (without compensating the customer-generator) at the beginning of the summer billing season. There are exceptions to this general rule for customers on time-of-use demand tariffs (whereby the net-metering customers' peak generation is used to offset peak consumption, and off-peak generation is used to offset off-peak consumption).

Both the REPS and net metering rules provide clear guidance for the NCUC in regulating utilities and also for the EPC in developing energy plans for North Carolina. Well-designed legislative targets of sufficient duration will provide the needed legislative guidance for comprehensive electricity planning in North Carolina as well as allow time for utilities, businesses, and industry to bring electricity projects to fruition in ways that will benefit North Carolina.

TRENDS AND PLANNING OPPORTUNITIES IN THE ELECTRICITY SECTOR

North Carolina faces electricity planning challenges associated with seven trends: (1) innovative technologies for grid modernization, (2) the breakthrough of electricity storage, (3) increased consumer control of electricity and overall flat electricity demand, (4) environmental standards for power plants, (5) the rapid increase in the use of natural gas in electricity generation, (6) the decreasing costs of renewable resources, and (7) the uncertain future role of existing and new nuclear units. The first three trends are driven primarily by innovative technologies and changes in consumer behavior and demands. The remaining trends are driven by electricity fuel-mix changes. Without comprehensive and inclusive planning, North Carolina may not be able to realize the full economic and public benefit presented by this shifting electricity landscape.

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[93] *Id.* § 62.133.8(k).
[94] 4 N.C. Admin. Code 11.R8-67 (2015).
[95] North Carolina Renewable Energy Tracking System, http://www.ncrets.org/ (last visited August 14, 2015).
[96] N.C. Gen. Stat. § 62-133.8(h).
[97] NCUC Order, Docket No. E-100, Sub 83 (October 10, 2005), http://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=766d7127-977d-4312-a98c-e2fc6fa09742 (last visited August 14, 2015).
[98] *Id.*
[99] *Id.*
[100] N.C. Gen. Stat. § 62-133.8(i)(6).
[101] NCUC Order, Docket No. E-100, Sub 83 (March 31, 2009), http://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=f1b29a03-4445-4930-9dfd-14682ceb368e (last visited August 14, 2015).

Grid Modernization: Increased Development and Deployment of Innovative Technologies

The grid is the core of the electricity system—engineered to coordinate electricity generation and delivery of electricity to the end user. The grid is generally defined as the physical components for electricity generation, transmission, distribution, and storage and the information infrastructure that coordinates the generation of electricity and operation of the physical components. North Carolina's grid—like that of the nation's—is often described as centralized generation with unidirectional flow of electricity to consumers.

Largely in response to the shift toward distributed generation and storage, increasing use of intermittent resources, changing consumer demand, innovative grid technologies, and big data, the traditional grid is evolving to accommodate two-way flow of electricity and information both on long-distance transmission and local distribution systems. If the trends outlined here continue, the electricity grid will need to accommodate diverse generation resources, some of which are intermittent, from both central and distributed sources. It will need to be fully integrated to address real-time electricity needs. Two-way communication and management of information will change the operation of the grid so that it can support frequency and voltage requirements, accommodate new dispatch models, and improve security and resilience.

Grid modernization is in part a response to concerns about aging distribution and transmission infrastructure, accelerated technological advances, cost declines for energy resources, and evolving consumer demands.[102] It is defined by the Energy Independence and Security Act of 2007 as "the modernization of the Nation's electricity transmission and distribution system to maintain a reliable and secure electricity infrastructure that can meet future demand growth and achieve" a smart grid.[103]

Smart grids, as defined by the U.S. Department of Energy, are electricity grids that "allow for two-way communication between the utility and its customers" and that are comprised of transmission lines that can sense changes, such as power outages, and relay that information to the utility.[104] These new technologies will work as part of the traditional electricity grid to enhance reliability, increase efficiency, and reduce peak demand. Smart grids will also be better at integrating and utilizing distributed renewable and stored energy. Today's grid is already increasingly incorporating sensors and information technology, evolving from simply distributing electricity to collecting and organizing market and operational data. These data present an opportunity to optimize the operations of electricity generation, transmission, and distribution and to improve consumer use of the grid. If, as discussed below, renewable energy, either distributed or utility scale, becomes an increased part of the grid system, sensors and information technology could evolve to address the reliability concerns associated with renewables.[105] Smart grid technologies also encompass new technologies that increase consumers' ability to manage electricity use and distributed electricity generation. Coordination of the transmission and distribution portions of the grid will be necessary to achieve grid reliability and stability. Planning for grid modernization is the key to incorporating innovative technologies and electricity management approaches.

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[102] The Minnesota Public Utilities Commission has initiated an in-depth look at grid modernization and the best process by which to develop grid modernization policies. The proposed approach includes establishing principles, identifying action items, and setting the long-term vision for the state. To develop this approach, Minnesota PUC staff conducted a series of stakeholder meetings and produced a report to the commission that detailed recommendations. *See* Minnesota Public Utilities Commission, *Staff Report on Grid Modernization* (2016), *available at* http://morethansmart.org/wp-content/uploads/2015/06/MNPUC_Staff_Report_on_Grid_Modernization_March2016.pdf.

[103] Energy Independence and Security Act of 2007, Pub. L. 110-410, 42 U.S.C. §17381 (2016).

[104] U.S. Dep't of Energy, *What Is the Smart Grid?*, https://www.smartgrid.gov/the_smart_grid/smart_grid.html (last visited July 14, 2016).

[105] EPRI, *The Integrated Grid: Realizing the Full Value of Integrated and Distributed Resources* (2014), *available at* *http://tdworld.com/site-files/tdworld.com/files/uploads/2014/02/integratedgridepri.pdf*.

Recent Rise of Electricity Storage

Electricity storage—whether hydroelectric storage, thermal storage, hydrogen storage, or batteries—is an increasingly important component of the modernizing grid. Stored electricity can be distributed to residential or commercial installations or used by utilities to provide grid services.[106] For example, utilities can use stored electricity to adjust to time-of-use rates, making electricity purchases when the rates are lowest and selling it when rates are highest. Utility-scale storage can provide frequency regulation, transmission regulation, and voltage support.[107] Wide use of storage can reduce the need for increased capacity generation by reducing peak demand. Storage can also help grid operations by providing reserve power.

Storage of generation during production is often discussed as a game changer for renewable resources, particularly intermittent resources like solar and wind. It can reduce or eliminate intermittency and facilitate integration of renewables into the existing grid. Storage, however, can provide these grid services regardless of the generation fuel source and is likely to be a critical technology for increased grid resilience and reliability.

Electricity storage has been used for a number of years.[108] But recent technological developments have contributed to its rise. For example, Duke Energy recently announced its intent to deploy utility-scale storage in its regulated service territory.[109] Building on successful pilot projects and use of storage in competitive markets, Duke Energy is assessing grid needs to determine where storage can provide a more cost-effective solution than traditional grid infrastructure, like a substation. Currently, battery storage capacity is 1.1GW and is projected to grow to 21.6 GW globally by 2025.[110] Simultaneously, distributed storage is getting a boost from the development of affordable battery storage. Like distributed renewables and utility-scale renewables discussed below, distributed storage and utility-scale storage pull in opposite directions. Distributed storage coupled with solar generation allows consumers to store solar energy and, potentially, put that energy back onto the grid. Driven by policies such as net metering and variable rate structures, the storage market is forecasted to become more than half distributed storage by 2020.[111] Utility-scale storage installations may also increase as utilities respond to other drivers that favor the centralized grid system. Grid operators and regulators will need to plan how to use storage to increase grid resilience while optimizing storage location and size.[112]

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106 For a review of storage services and values across services, see Fitzgerald, Garrett, James Mandel, Jesse Morris, and Hervé Touati, *The Economics of Battery Energy Storage: How Multi-Use, Customer-Sited Batteries Deliver the Most Services and Value to Customers and the Grid* (Rocky Mountain Institute 2015).

107 Order No. 755, *Frequency Regulation Compensation in Organized Wholesale Power Markets*, 137 F.E.R.C. ¶ 61,064 (2011) (recognizing one benefit of storage is frequency regulation).

108 Pumped hydro-electricity storage is the primary storage technology in use today, but it is geographically limited. Other more nascent technologies include thermal storage, hydrogen storage, and batteries.

109 Matthew Bandyk, *Duke Energy Makes Business Case for Installing Battery Storage in Regulated Territories*, SNL, April 26, 2016, https://www.snl.com/InteractiveX/Article.aspx?cdid=A-36263700-14125&mkt_tok=eyJpIjoiWVRVek1UUTRNRGhqWmpBMyIsInQiOiJoeWhJOHFTOVpFZGt6UnFJam52WHBCeFgxdm5cLytub1p6bm1CZURYcDZ6M2VpZVIzWmwyOWZyR2ZOU2h6UjJTV2J1NnZBcFkyb1lZa0lMSzl0WjVhV3IyUzdIQXIwRnh3MmZ.

110 Danielle Ola, "Navigant Says 21.6GW by 2025 Grid-Scale Forecast Is 'Dramatic But Not Aggressive,'" *Energy Storage News,* June 10, 2016, http://www.energy-storage.news/news/dramatic-but-not-aggressive-growth-forecast-for-grid-scale-storage-industry.

111 *Id.*

112 For resources on integrating storage with the grid, see EPRI Energy Storage Integration Council, http://www.epri.com/Pages/EPRI-Energy-Storage-Integration-Council-% 28ESIC% 29.aspx (last visited July 14, 2016).

Changes in Consumer Behavior and Flat Electricity Demand

Changes in consumer behavior and increases in energy efficiency are driving one of the most striking trends—the slow rate of growth in electricity demand. Current U.S. electricity growth is at the lowest level in decades and is projected to remain relatively flat, reducing both the need for electricity load and the need for additional infrastructure, thereby potentially reducing utility revenue and pressuring the traditional utility revenue model. If an electric utility has significant infrastructure costs, a low growth rate will produce low revenue that may be insufficient to cover operation and maintenance of existing infrastructure. This dynamic—low sales revenues and high costs—will drive up the unit cost of electricity. Uncertain demand forecasts also raise utility concerns about stranded assets.

Some of the decline in growth has been driven by changes in the U.S. economy—notably the Great Recession—along with increasing improvements in energy efficiency for both buildings and technology. New energy efficiency standards and incentives are projected to continue to promote end-use efficiency and increase energy efficiency investments. According to the U.S. Energy Administration (EIA), the United States added an average of 18.3 GW of capacity annually between 1950 and 2015.[113] North Carolina added an average of 346 MW of capacity annually from 1990 to 2013 and is projected to add approximately 290 MW of capacity annually through 2018.[114] This rate of capacity growth is reflected in measured electricity demand. North Carolina's electricity demand has had a slow rate of growth, with an annual sales rate declining in 5 of the last 10 years between 2005 and 2014.[115] Forecasts for future annual growth extend this low growth rate for the next two decades.[116]

The primary contributors to the low growth are energy efficiency, distributed generation from renewables, and increased consumer control over electricity consumption.[117] Energy efficiency advances are affecting residential, commercial, and industrial electricity consumption and reducing the need for new grid infrastructure additions, saving consumers money and reducing environmental impacts from traditional electricity generation. Energy efficiency technologies, such as advanced lighting and heating and cooling, along with deployment of distributed renewable electricity generation and distributed storage, transportation, and other smart grid technologies combine to give consumers more control over energy consumption. States are also increasing residential and commercial energy efficiency by enacting building codes that are providing significant energy savings. All of these factors work together to keep electricity demand flat.

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[113] U.S. EIA, "Demand Trends, Prices, and Policies Drive Recent Electric Capacity Additions," March 18, 2016, https://www.eia.gov/todayinenergy/detail.cfm?id=25432.

[114] U.S. EIA, Detailed State Data, https://www.eia.gov/electricity/data/state/ (last visited July 14, 2016).

[115] According to the latest year for which EIA data are available, the 2014 electricity sales for North Carolina were 133,132,776 MWh, which is up from 129,779,905 MWh in 2013. Since 2000, the highest sales year was 2010, with 136,414,947 MWh, and the lowest was 2001, with 119,026,943 MWh. See U.S. EIA, https://www.eia.gov/electricity/sales_revenue_price/ (last visited July 14, 2016).

[116] Duke Energy Carolinas forecasts a 1.5% annual growth rate for residential, commercial, and industrial customers combined. Duke Energy Progress forecasts 1.3% growth for its service area. Once energy efficiency is included at a growth rate of 0.5%, the net growth rate for 2015–2029 is forecast to be 1.0%. Peak demand growth is forecast to grow slightly faster with an average projected growth rate of 1.4%. This information is provided in the Duke Energy Carolinas and Duke Energy Progress IRPs submitted in 2014. North Carolina's forecast growth rate is in the higher end of the U.S. national average. The EIA's annual energy outlook predicts that the average annual growth rate for residential consumption will vary between 0.4% and 1.2% for the forecast period of 2013–2040. *See* U.S. EIA, *Annual Energy Outlook 2015,* http://www.eia.gov/forecasts/archive/aeo15/ (last visited July 14, 2016). The range represents three scenarios: a reference case and a high and a low economic growth case. For the reference case, the national average electricity sales growth is 0.7% per year over the 2014–2040 forecast period, which is about half of the observed growth rate over 1990–2014 period. The projected range is similar for commercial and industrial consumption. *See* U.S. EIA, *Annual Energy Outlook 2015,* http://www.eia.gov/forecasts/archive/aeo15/ (last visited July 14, 2016).

[117] See U.S. EIA, *Annual Energy Outlook 2015,* http://www.eia.gov/forecasts/archive/aeo15/executive_summary.cfm#electricityprices (last visited July 14, 2016).

Energy efficiency can be encouraged by federal efficiency standards for consumer products (ENERGY STAR ®), tax credits, building codes, and an array of utility-funded incentive programs for electricity consumers.[118] It has been promoted as a "new" energy resource and may have multiple benefits such as reducing system costs, as compared to building new generation and consumer engagement.[119] But widely deployed, energy efficiency can result in low electricity sales growth, which may increase electricity generation costs, decrease utility capital investment, and shift rate design, depending on the utility's economic model. Utilities may have other economic concerns with widespread adoption of energy efficiency, such as recovery of costs associated with energy efficiency programs and interactions between efficiency programs and shareholder earnings from traditional utility investments.[120] Energy efficiency also poses unique modeling and planning challenges. It is not dispatchable and is disaggregated, and it requires new program delivery options if utilities are to effectively plan for changes on the consumer side of the meter.

In addition to increases in energy efficiency, innovative technologies are changing both the timing of consumer demand for electricity and demand growth. Smart meters are the consumer side of the smart grid. As electricity consumers become electricity suppliers and engage in active end-use management, they will be interacting in a dynamic way with grid operations. New metering technology will accurately measure consumer energy use and communicate that use in real time to the utility. This combination of enhanced measurement and communication creates opportunities to implement new rate structures, create effective demand-response policies, and empower consumers to actively manage their energy use. The data generated by smart meters on grid performance, combined with big data analytics, can facilitate deployment of distributed generation and storage in a manner that increases system resilience, reduces rate volatility, and maximizes grid flexibility.[121] Decision makers must address concerns about cyber security, privacy, and open data access if information technology continues to be a critical component of the energy system.[122] North Carolina consumers have already invested in smart meters, changing how the state's grid operates.[123]

Low electricity demand growth challenges the traditional utility model, which is based on increasing sales of electricity. Energy planning is critical to help utilities adjust to potential long-term trends of flat—or even declining—demand.

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118 For a review of state incentives and policies, see the Database of State Incentives for Renewables and Efficiency, which is hosted and maintained by the North Carolina Clean Energy Technology Center at North Carolina State University. See also, Dixon et al., "U.S. Energy Conservation and Efficiency Policies: Challenges and Opportunities," *Energy Policy* 38 (November 2010): 6389–7540.

119 *See* U.S. Dep't of Energy, Office of Energy Efficiency and Renewable Energy, *Energy Efficiency Savings Opportunities and Benefits*, http://energy.gov/eere/slsc/energy-efficiency-savings-opportunities-and-benefits (last visited July 14, 2016).

120 *See* Val R. Jensen, ICF International, and National Action Plan for Energy Efficiency, *Aligning Utility Incentives with Investment in Energy Efficiency* (2007); Maggie Molina and Marty Kushler, *Policies Matter: Creating a Foundation for an Energy Efficient Utility of the Future* (ACEE, 2015).

121 Denholm, P., R. Margolis, B. Palmintier, C. Barrows, E. Ibanez, L. Bird, and J. Zuboy, *Methods for Analyzing the Benefits and Costs of Distributed Photovoltaic Generation to the U.S. Electric Utility System,* Nat'l Renewable Energy Lab. Technical Paper No.6A20-62447 (National Renewable Energy Laboratory, 2014).

122 IBM, *Managing Big Data for Smart Grids and Smart Meters* (2014), http://www-935.ibm.com/services/multimedia/Managing_big_data_for_smart_grids_and_smart_meters.pdf. Sungard Financial Systems, *Big Data Challenges and Opportunities for the Energy Industry* (2013), http://financialsystems.sungard.com/~/media/fs/energy/resources/white-papers/Big-Data-Challenges-Opportunities-Energy-Industry.ashx. Oracle. *Utilities and Big Data: Using Analytics for Increased Customer Satisfaction* (2013), http://www.oracle.com/us/industries/utilities/big-data-analytics-customer-wp-2075868.pdf.

123 As of 2014, North Carolina had 502,697 smart meters installed across the state. Edison Foundation Institute for Electric Innovation, *Utility-scale Smart Meter Deployments: Building Block of the Evolving Power Grid* (2014), http://www.edisonfoundation.net/iei/Documents/IEI_SmartMeterUpdate_0914.pdf.

Environmental Standards and Requirements for Power Plants

Recent and proposed regulatory actions under the Clean Air Act (CAA) that will apply to electricity-generating units are driving major changes in the electricity business. The EPA issued the first of these actions in 2011: the Mercury and Air Toxics Standards (MATS) for power plants. MATS sets technology-based emissions limits for mercury, arsenic, lead, and other toxic air pollutants.[124] In June 2015, the U.S. Supreme Court ruled that the EPA failed to adequately consider compliance costs in promulgating the rule but that the EPA could regulate mercury if it adequately addresses costs.[125] The rule has been in effect since 2011, and most power plants have already installed control technologies or retired dirty plants. The Supreme Court remanded the case to the U.S. Court of Appeals for the D.C. Circuit, which allowed MATS to remain in effect while EPA revised its cost analysis. The EPA issued its revised compliance cost findings in April 2016, and the rule is fully in effect.[126]

The next major regulatory action to profoundly affect the electricity business is the Cross-State Air Pollution Rule (CSAPR), which requires states to improve control of ozone and particulate pollution from power plants, which can travel downwind and across state lines.[127] Twenty-seven states and the District of Columbia are required to implement the rule, which affects 3,632 electric-generating units at 1,074 coal-, gas-, and oil-fired facilities.[128] The rule was challenged, but in 2014, the Supreme Court upheld the EPA's authority to regulate cross-state air pollution.[129] The rule went into effect on January 1, 2015.

The final major regulatory action is the proposal, known as the Clean Power Plan (CPP), to regulate greenhouse gas emissions from existing power plants under CAA section 111(d).[130] Because carbon dioxide is not a criteria pollutant regulated as part of the NAAQS, the EPA is issuing the new emissions standards as a new source performance standard under 111(b) for new sources.[131] It is using its authority under 111(d) to also set standards for existing sources.[132] Under section 111(d), the EPA issues emissions performance goals for sources, and states must submit plans that lay out performance standards and implementation plans. Under the CPP, states have the option to choose between three forms of goals: a rate-based state goal measured in pounds per megawatt hour of electricity produced, a mass-based goal measured in total tons of carbon dioxide produced, or a mass-based goal with a new source complement measured in total tons of carbon dioxide produced. States are also given the option to choose between an emissions standards plan that places the burden solely on power plants to produce the reductions or a state measures plan that allows a mix of renewable energy and energy efficiency measures to achieve the reductions.[133] The CPP sets both final and interim reduction goals; all reductions are to be achieved by 2030.

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[124] National Emission Standards for Hazardous Air Pollutants from Coal and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units, 77 *Fed. Reg.* 9304 (Feb. 16, 2012) (codified at 40 C.F.R. pt. 60 and 63).

[125] *Michigan et al. v. Environmental Protection Agency et al.*, 135 S. Ct. 2699 (2015).

[126] For information on the rule, see https://www.epa.gov/mats/regulatory-actions-final-mercury-and-air-toxics-standards-mats-power-plants.

[127] 76 *Fed. Reg.* 48208 (August 8, 2011); subsequently amended by 77 *Fed. Reg.* 10324 (February 21, 2012).

[128] Center for Climate and Energy Solutions, *Cross-State Air Pollution Rule*, http://www.c2es.org/federal/executive/epa/cross-state-air-pollution-rule (last visited August 4, 2015).

[129] *Environmental Protection Agency v. EME Homer City Generation, L.P., et al*., 134 S. Ct. 1584 (2014).

[130] 42 U.S.C. § 7411(d)(1).

[131] Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generation Units, EPA-HQ-OAR-2013-0495 and EPA-HQ-OAR-2013-0603 (August 4, 2015) (to be codified at 40 C.F.R. pts. 60, 70, 71, and 90).

[132] Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, EPA–HQ–OAR–2013-0602 (August 4, 2015) (to be codified at 40 C.F.R. pt. 60).

[133] *Id*.

The CPP has been challenged by 28 states, including North Carolina. On September 28, 2016, the D.C. Circuit Court heard oral arguments on the CPP challenge, and the case is expected to go before the U.S. Supreme Court in 2017 or 2018. Assuming the CPP survives judicial review, its emphasis on low-carbon or zero-carbon energy sources will be another driver that may shift the generation mix in some states. But it is important to note some utilities expect minimal effect from the stay of the CPP because the economic conditions have already shifted utility investment away from carbon-intensive electricity generation and toward natural gas and renewable resources.[134]

The CAA is primarily implemented by North Carolina's environmental agencies—the North Carolina Department of Environmental Quality (DEQ) and the North Carolina Environmental Management Commission. As discussed above, DEQ also has a role in energy planning through the Energy Policy Council. The environmental planning process under the CAA affects utility decisions, which may also require input or approval from the North Carolina Utilities Commission. A benefit of comprehensive electricity planning is that it has a mechanism by which the overlap between state environmental planning and NCUC's electricity planning is considered.

Rapid Rise of Natural Gas

Natural gas is becoming the dominant fuel source for electricity generation, accounting for roughly one-third of electricity generation nationwide and edging out coal for the first time in 2015. New natural gas capacity surpassed all other electricity generation sources in 2015, with the addition of more than 5.6GW of new capacity.[135] The EIA expects this trend to continue for the near term. This dramatic shift is largely due to low-priced natural gas, which is the result of domestic shale gas production and environmental requirements that favor natural gas over coal both because natural gas has fewer associated air emissions and no waste streams, like coal ash or nuclear waste, that require disposal.

Over the last decade, the discovery and extraction of natural gas from reserves across the United States has increased domestic national gas supply, driving down fuel prices and stimulating natural gas infrastructure investment.[136] Natural gas prices at the national level have decreased from $10/million Btu in 2005 to $2.9/million Btu in 2015.[137] Although prices have historically trended downward over time,[138] natural gas prices have also been extremely volatile, ranging from $4.21 to $10.75/million Btu with significant year-to-year price variation.[139] The price decline is not expected to extend through 2040. EIA projects that Henry Hub natural gas prices will increase to $4.88/million Btu by 2020 and $7.85/million Btu in 2040.[140] Higher prices are expected because of a projected increase in domestic and international

[134] Joby Warrick and Steve Mufson, "Utilities Shrug Off Court Decisions Say Carbon Cutting Plans Are on Track," *Washington Post,* Feb. 12, 2016, https://www.washingtonpost.com/national/health-science/utilities-shrug-off-court-decision-say-carbon-cutting-plans-are-on-track/2016/02/11/d9e7dcb8-d10e-11e5-88cd-753e80cd29ad_story.html.
[135] U.S. Dep't of Energy, Quadrennial Energy Review 1.2 Stakeholder Briefing Memo, Feb. 4, 2016, http://energy.gov/sites/prod/files/2016/02/f29/Second% 20Installment% 20Briefing% 20Memorandum_0.pdf. For information on the Quadrennial Energy Review, see U.S. DOE, http://energy.gov/epsa/quadrennial-energy-review-qer (last visited July 14, 2016).
[136] U.S. EIA, *Natural Gas Explained*, http://www.eia.gov/energyexplained/index.cfm?page=natural_gas_home (last visited July 14, 2016).
[137] U.S. EIA, Annual Energy Outlook 2015, http://www.eia.gov/forecasts/archive/aeo15/ (last visited September 23, 2016).
[138] *Id.*
[139] U.S. EIA, Natural Gas Citygate Price in North Carolina, http://www.eia.gov/dnav/ng/hist/n3050nc3a.htm (last visited July 14, 2016).
[140] U.S. EIA, Annual Energy Outlook 2015, http://www.eia.gov/forecasts/archive/aeo15/. The EIA's Early Release Annotated Summary of Two Cases (May 2015) forecasts a natural gas price of approximately $4.40 MBtu by 2020, which levels off to approximately $5 MBtu through 2040. Although this projection is less than the forecast at the time this report was drafted, the overall trend is the same.

demand for natural gas, which will require additional gas well completions, and because easy-to extract resources have already been exploited, leaving only difficult-to-extract resources.[141]

Given decreases in natural gas prices, natural gas-fired electricity generation capacity has grown considerably.[142] Combined cycle plants are inexpensive to build in comparison to new coal, nuclear, and renewables units and are more efficient than existing natural gas, oil, or coal-fired steam plants.[143] Low-cost combined cycle plants are also the most economical means to meet the nation's growth for peak electricity demand absent other market or policy incentives.[144] The market for natural gas electricity is expected to increase because natural gas plants are expected to account for 58% of total capacity additions between 2013 and 2040.[145] Some electric utilities are responding to increased use of natural gas by purchasing natural gas companies. For example, in 2015 both Duke Energy and Southern Company announced mergers with natural gas supply companies.[146]

Natural gas market trends in the Southeast are expected to mirror national trends. Although natural gas prices in North Carolina have decreased over the last decade, prices are expected to increase at a 2.4% annual growth rate through 2040.[147] Even though gas prices are expected to climb, electricity generation from natural gas is expected to increase. The EIA has projected that electricity generated from natural gas will increase at a 1.1% annual growth rate through 2040 under current policy conditions.[148] Increases in natural gas supply projections are a result of the expanded use of existing natural gas facilities as well as the addition of new combined cycle capacity. Under current policy conditions, approximately 400MW of new natural gas capacity is expected to be implemented in North Carolina by 2020; capacity is expected to grow slightly between 2020 and 2030.[149]

The market for natural gas is expanding in North Carolina because infrastructure, fuel costs, and policy have all made natural gas a more economic option when compared to coal and nuclear generation. This market may also be buoyed by a consistent supply of cheap natural gas by way of the Atlantic Coast Pipeline (ACP). The ACP is expected to deliver 1.5 billion cubic feet of natural gas to Virginia and North Carolina—gas that could be as much as $1–1.5/MMBtu cheaper than Henry Hub natural gas from the Gulf.[150] A steady supply of gas could also stabilize regional prices and diminish the volatility of the natural gas market.[151] In general, the natural gas market in North Carolina is expected to continue to expand as new energy capacity and demand are met by natural gas combined cycle (NGCC) generation.

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[141] U.S. EIA, Annual Energy Outlook 2015 Executive Summary, http://www.eia.gov/forecasts/aeo/executive_summary.cfm (last visited July 14, 2016).
[142] U.S. EIA, Form EIA-923 Power Plant Operations Report, https://www.eia.gov/electricity/data/eia923/ (last visited July 14, 2016).
[143] U.S. EIA, Annual Energy Outlook 2015, 26, http://www.eia.gov/forecasts/archive/aeo15/ (last visited July 14, 2016).
[144] U.S. EIA, Annual Energy Outlook 2015 Electricity Generation, http://www.eia.gov/forecasts/aeo/section_elecgeneration.cfm (last visited July 14, 2016).
[145] U.S. EIA, Annual Energy Outlook 2014, http://www.eia.gov/forecasts/archive/aeo14/ (last visited July 14, 2016).
[146] Duke Energy, http://www.duke-energy.com/news/releases/2015102601.asp (last visited July 14, 2016) and Southern Company, http://investor.southerncompany.com/information-for-investors/latest-news/latest-news-releases/press-release-details/2015/Southern-Company-AGL-Resources-file-merger-request-in-Georgia/default.aspx (last visited September 8, 2016)
[147] U.S. EIA, Annual Energy Outlook 2015, http://www.eia.gov/forecasts/archive/aeo15/ (last visited July 14, 2016).
[148] U.S. EIA, Annual Energy Outlook 2015, http://www.eia.gov/forecasts/archive/aeo15/ (forecasting the current scenario without implementing the Clean Power Plan) (last visited July 14, 2016).
[149] Gumerman, E., D. Hoppock, and D. Bartlett, *Implications of Clean Air Act Section 111(d) Compliance for North Carolina,* NI R 14-06. Durham, NC, Duke University.
[150] ICF International, *The Economic Impacts of the Atlantic Coast Pipeline: Prepared for Dominion Transmission* (2015), https://www.dom.com/library/domcom/pdfs/gas-transmission/atlantic-coast-pipeline/acp-icf-study.pdf.
[151] *Id.*

Low natural gas prices may be the dominant driver for the changing generation portfolio in North Carolina, and increased use of natural gas has important implications for grid innovation planning and fuel diversity. As discussed above, North Carolina has identified a diverse generation mix as an important policy goal.[152] Continued low natural gas prices may lead to overreliance on natural gas, undercutting the benefits of diverse fuel mixes and slowing down other grid innovations. Increased natural gas deployment, however, also has clear benefits. NGCC units have lower air emissions than coal units and do not generate waste streams, such as coal ash, that require expensive disposal.[153] Natural gas also has operational benefits. Electricity-generating units must start and stop quickly and change output to accommodate variability in demand; flexibility is a key attribute of NGCC units. Effective energy planning balances short-term benefits with a long-term vision for modernizing electricity production and hedging against market uncertainties.

Increased Cost Competitiveness and Deployment of Renewable Energy

Renewable energy is creating opportunities and challenges for utilities and state energy planners. Increased cost-competitiveness of renewables, primarily solar and wind, is driving increased deployment in residential, commercial, and utility-scale installations. Integration of renewables into the utility grid is growing in many jurisdictions, including North Carolina. Increasing residential and commercial installation of solar is decreasing individual use of grid resources and resulting in two countervailing trends—diversification of grid resources and decentralization of energy resources. Some analysts have focused on the role that "defection" from the grid could have in disrupting the current utility model.[154] Other analysts have focused on the value proposition for a centralized generation, transmission, and distribution system, which is favored by increased utility-scale renewable deployment.[155] Some analysts combine the two trends and hypothesize a grid that utilizes distributed generation alongside a central grid that is connected to technologies that maximize the efficient deployment of a diverse suite of resources.[156] Energy planning must account for uncertainty about which trend will dominate.

The distinction between distributed and utility-scale renewable resources highlights a critical change in the traditional utility model—consumer choice and control of electricity generation. Consumer choice for distributed renewable generation affects not only demand forecasts for utilities but also grid operations. New grid technologies allow consumers to generate electricity for the grid and to increase control over electricity use. Consumer demand for renewable electricity generation can also drive increased utility-scale deployment. Electricity planners must make decisions about whether and when to accelerate or decelerate these two trends.

Renewable electricity generation has grown significantly in the past decade. According to Bloomberg New Energy Finance, renewable energy projects make up more than 50% of the new capacity additions. When natural gas is included, 94% of the new capacity has been either natural gas or renewable energy since 2000. Renewable sources of electricity generation comprised 64% of the 16.5 GW of new electricity

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[152] 2007 N.C. Sess. Laws 397.

[153] For an overview of U.S. carbon emissions associated with energy, see U.S. EIA, *U.S. Energy Related Carbon Dioxide Emissions, 2014,* available at http://www.eia.gov/environment/emissions/carbon/.

[154] *See, e.g.*, Rocky Mountain Institute, *The Economics of Grid Defection*, (2014), http://www.rmi.org/electricity_grid_defection; UBS, *Q-Series® on Global Utilities, Autos & Chemicals: Will Solar, Batteries and Electric Cars Re-shape the Electricity System?* (2014), *available at* http://knowledge.neri.org.nz/assets/uploads/files/270ac-d1V0tO4LmKMZuB3.pdf.

[155] *See e.g.*, Electric Power Research Institute (EPRI), *The Integrated Grid: Realizing the Full Value of Central and Distributed Energy Resources* (Palo Alto, CA: EPRI, 2014). Peter Kind, Edison Electric, *Disruptive Challenges: Financial Implications and Strategic Responses to a Changing Retail Electric Business* (2013), *available at* http://www.eei.org/ourissues/finance/documents/disruptivechallenges.pdf.

[156] *See, e.g.*, Mark Ruth and Benjamin Kroposki, "Energy Systems Integration: An Evolving Energy Paradigm," *Electricity Journal* 27(2014): 36–47, *available at* http://dx.doi.org/10.1016/j.tej.2014.06.001.

capacity that came online in 2015.[157] For the same period, wind eclipsed new natural gas capacity with the addition of more than 8.0 GW of capacity as compared with the addition of 5.9 GW of new natural gas capacity and 2.0 GW of utility-scale solar. Distributed solar installations also increased in 2015, and solar additions from all sources increased capacity approximately 7.3 GW, which is on par with solar additions in 2014.[158] The growth of other renewable resources, such as biomass, geothermal, and hydro, has remained relatively flat.[159]

The EIA forecasts that from 2013 to 2040 renewable electricity generation will grow from 13% to 18% of the total national generation mix, which represents more than one-third of the forecasted new generation capacity.[160] Wind and solar are the dominant renewable sources in the EIA analysis, accounting for two-thirds of the total increase. Much of this growth is predicted to be installed through federal tax credits and state renewable portfolio standards. Long-term forecasts predict moderate growth in response to slow electricity demand, which reduces the need for new generation capacity, and to continuation of relatively low natural gas prices.[161] Beyond 2030, the EIA forecasts an increased pace for renewable electricity generation in response to rising natural gas prices and increased cost-competitiveness in some regions.[162]

In North Carolina, renewable resources, including hydroelectric, wood and wood waste, other biomass (including landfill gas and agricultural biogas), and solar represent about 6% of electricity generation. Hydroelectric is the largest renewable resource, representing more than half of renewable electricity generation in the state.[163] In the past 10 years, solar generation has grown rapidly, though it still represents a small proportion of the state's electricity generation.

Corporate and consumer demand, federal tax incentives, qualifying facilities requirements of the Public Utility Regulatory Policies Act of 1978 (PURPA), and an increasing number of states with renewable portfolio standards all drive growth of renewable electricity generation. The extension of federal tax credits for both wind and solar are anticipated to promote increased renewable deployment by creating a financial incentive, the sunset of which has created regulatory certainty for the industry. The federal tax credit extension is projected to promote an additional 44 GW of new wind capacity from 2016 to 2021 as compared to 25 GW without the tax credit.[164] Declining technology costs and increasing consumer interest in residential-scale generation are driving consumer demand. Corporate sustainability goals also support expansion of renewable electricity generation. Corporations, such as Walmart, are installing solar

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[157] Federal Energy Regulatory Commission, *Energy Infrastructure Update December 2015*, *available at* http://ferc.gov/legal/staff-reports/2015/dec-infrastructure.pdf.

[158] *See* Solar Energy Industry Association, *Solar Market Insight 2015 Q4*, *available at* https://www.seia.org/research-resources/solar-market-insight-2015-q4.

[159] Bloomberg New Energy Finance and the Business Council for Sustainable Energy, *Sustainable Energy in America 2015 Factbook*, http://www.bcse.org/images/2015% 20Sustainable% 20Energy% 20in% 20America% 20Factbook.pdf (last visited July 14, 2016).

[160] U.S. EIA, Annual Energy Outlook 2015, A-1-A-40, *available at* http://www.eia.gov/forecasts/aeo/pdf/0383(2015).pdf.

[161] *Id*.

[162] U.S. EIA, Annual Energy Outlook 2015, http://www.eia.gov/forecasts/aeo/executive_summary.cfm#energyconsumption. EIA also develops high- and low-growth scenarios for forecasting energy market responses to economic growth and energy markets interactions. In EIA's high-growth scenarios, renewable electricity generation is expected to more than double from 2013 to 2040. This increase is driven primarily by increased demand or increased competing fuel prices. In the low-growth scenarios, renewable resources also grow by either 49% or 61% from 2013 to 2040, albeit not as significantly as in the high-growth scenarios.

[163] U.S. EIA Form 923 2012, "Monthly Generation and Fuel Consumption Time Series File"; U.S. EIA SEDS, *North Carolina Electricity Profile 2013,* Table 5. Electric power industry generation by primary energy source, 1990 through 2013.

[164] Bloomberg New Energy Finance, *Impact of Tax Credit Extensions for Wind and Solar*, http://about.bnef.com/content/uploads/sites/4/2015/12/2015-12-16-BNEF-US-solar-and-wind-tax-credit-impact-analysis.pdf (last visited July 14, 2016).

for company buildings, purchasing wind through power purchase agreements (PPAs), and participating in utility renewable programs, like Duke Energy's Green Source Rider. State renewable portfolio standards, like North Carolina's REPS, are also increasing deployment of renewables. Many states are increasing the mandate—notably Hawaii, which has recently revised its mandate to be 100% renewable by 2045.[165]

PURPA is also encouraging additional renewables, particularly in North Carolina, by creating a class of generation projects for which the regulated utility is a guaranteed purchaser.[166] In North Carolina, any project that is a "qualified facility" and has a capacity of up to 5 MW is guaranteed a 15-year fixed price contract at a rate that is equal to the utility's avoided cost.[167] This provision creates long-term certainty, a critical component for financing of renewables in the state.

Planning for increasing amounts of renewable electricity generation will require attention to drivers for distributed generation. Increased deployment of roof-top solar, for example, puts pressure on utilities to plan for sufficient generation capacity to address renewable generation intermittency and to compensate for reduced revenues from electricity sales. Much of the deployment of distributed commercial and residential renewable energy is outside the planning processes overseen by the NCUC. In addition, consumer decisions may increasingly intersect with traditional planning models, which will increase uncertainty for long-range planning. Even if consumer electricity generation does not become disruptive in North Carolina in the near term, increased use of utility-scale renewables presents planning challenges. Utility-scale renewables, including PURPA-qualified facilities, require other generation sources or storage to address intermittency and ensure reliability. Increased use of utility-scale renewables will also require transmission planning to safely and reliably connect renewable sources to the central grid.

Nuclear: Existing and New

Nuclear electricity generation has been the primary provider of carbon-free, baseload electricity nationally. Nuclear plants provide baseload power, which means they run continuously to provide the minimum amount of electricity demand. But economic pressures are forcing the early closure of some plants, and regulatory uncertainty about relicensing of existing plants may lead to the loss of others, while, conversely, several new plants are under construction. To be economical, baseload power must have low operating costs yet provide continuous power rather than power up and down. Nuclear plants are economically efficient if the revenue they receive is greater than the marginal cost for continuous operation.

In some markets, low wholesale electricity prices, driven by low natural gas prices, renewable subsidies, and low demand, among other market trends, are undermining the economic efficiency of nuclear plants, which in 2014 accounted for 20% of total electricity generation in the United States.[168] In these markets, economic pressures, along with expensive maintenance costs, have forced several existing plants to retire prior to the end of the planned operating lifetime. Since 2012, five nuclear units have closed in Florida,

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[165] Recent increases in state REPS goals include California's increase to 50% by 2030, New York's increase to 50% by 2030, and Vermont's increase to 75% by 2032. For a summary of all current state REPS, see the DSIRE database at http://programs.dsireusa.org/system/program?type=38&.

[166] 18 C.F.R. Part 292 (2016). The EIA recently noted that North Carolina leads the nation in PURPA-qualifying facilties, acknowledging the importance of PURPA for solar generation in North Carolina. U.S. EIA, *North Carolina has more PURPA-Qualifying Facilities than and other state*, Aug. 23, 2016, *available at* http://www.eia.gov/todayinenergy/detail.php?id=27632.

[167] Biennial Determination of Avoided Cost Rates for Elec. Util. Purchases from Qualifying Facilities, No. E-100, Sub 140, at 7 (N.C. Utils. Comm'n, Dec. 31, 2014) (order setting avoided cost input parameters). NCUC recently decided not to adjust the rules associated with qualifying facilities. For a brief discussion of the decision, see http://www.utilitydive.com/news/north-carolina-regulators-reject-proposals-to-change-utility-scale-solar-re/348314/.

[168] U.S. EIA, *Monthly Energy Review June 2016* Table 7.2a., http://www.eia.gov.totalenergy/data/montly/pdf/sec7_5.pdf.

Wisconsin, Vermont, and California.[169] The concern about the loss of existing nuclear due to unfavorable economics has prompted the Obama administration to develop efforts to retain nuclear energy as part of the U.S. energy portfolio.[170] Conversely, five new nuclear units are under construction in Tennessee, Georgia, and South Carolina.[171] At the same time, licenses for older nuclear facilities will expire in the near term, and the Nuclear Regulatory Commission has not finalized a process for a second license renewal.[172]

North Carolina is a significant generator and user of nuclear power, ranking sixth in the nation and providing approximately 5.1% of the total nuclear generation in the United States.[173] Its three nuclear power plants—Harris, McGuire, and Brunswick—provide about a third of the state's net electricity generation. All three facilities were constructed in the 1970s and 1980s. The two units at Brunswick are permitted to operate until 2035 and 2037, the two units at McGuire are permitted to operate until 2041 and 2044, and Harris is permitted to operate until 2047.[174] Duke Energy's 2014 IRPs indicate the utility's intention to implement nuclear uprates in the next 10 years, though it is uncertain whether uprates would occur at nuclear facilities in North Carolina or South Carolina. In addition, Duke Energy plans to go forward with permit applications to construct a new nuclear plant in Gaffney, South Carolina, a move that would help meet new demand while complying with potential carbon dioxide emissions regulations.[175] Nuclear facilities in the United States have yet to receive permitting extensions beyond 60 years, but the Nuclear Regulatory Commission is developing a process by which utilities could apply for a second license renewal.[176] Because of the age of the three nuclear plants in the state and the timeline for a second license renewal, decisions about the future of the state's existing nuclear fleet will need to be made within the next 20 years. The oldest units, at Brunswick, will reach retirement age in 2035 and 2037, necessitating permit decisions by 2023 and 2025, respectively.

As is often the case with nuclear power facilities, those in North Carolina operate as baseload capacity for electricity. These facilities have high construction costs and are challenging to maintain; however, they have relatively low variable operating costs, which ensure that their capacity is dispatched when the plant is operational.[177] Nuclear fuel prices are significantly lower than prices of other non-renewable energy sources such as coal or natural gas. For example, nuclear fuel prices in North Carolina were

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[169] *See* Doug Vine and Timothy Juliani, *Climate Solutions: The Role of Nuclear Power* (C2ES, 2014), http://www.c2es.org/publications/climate-solutions-role-nuclear-power. *See also* Nuclear Energy Institute, "Days Numbered for Ft. Calhoun?," http://www.nei.org/News-Media/News/News-Archives/Days-Numbered-for-Fort-Calhoun and Nuclear Energy Institute, "Three Illinois Reactors to Shut if Energy Bill Fails," http://www.nei.org/News-Media/News/News-Archives/Three-Illinois-Reactors-to-Shut-if-Clean-Energy-Bi.

[170] *See* The Whitehouse Office of the Press Secretary, *Factsheet: Obama Administration Announces Actions to Ensure the Nuclear Energy Remains a Vibrant Component of the United States Clean Energy Strategy*, November 6, 2015, https://www.whitehouse.gov/the-press-office/2015/11/06/fact-sheet-obama-administration-announces-actions-ensure-nuclear-energy.

[171] *See* Nuclear Energy Institute, "Five New US Reactors Reach Milestones," November 19, 2013, http://www.nei.org/News-Media/News/News-Archives/Five-New-US-Reactors-Reach-Milestones.

[172] *See* Nuclear Energy Institute, *Second License Renewal Roadmap*, May 2015, http://www.nrc.gov/docs/ML1521/ML15211A401.pdf

[173] *See* U.S. EIA, NC State Profile, http://www.eia.gov/state/?sid=NC (last visited July 14, 2016).

[174] *See* Duke Energy, *Nuclear Plants,* http://www.duke-energy.com/power-plants/nuclear.asp.

[175] For information on Duke Energy's generation plans, see the Duke Energy Carolinas Integrated Resource Plan at http://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=c3c5cbb5-51f2-423a-9dfc-a43ec559d307 and the Duke Energy Progress Integrated Resource Plan at http://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=badec175-5e4f-4bea-a267-80e113db8c16.

[176] *See* Nuclear Energy Institute, *Second License Renewal Roadmap* (2015), http://www.nei.org/CorporateSite/media/filefolder/Federal-State-Local-Policy/Regulatory-Information/Second-License-Renewal-Roadmap-small.pdf?ext=.pdf.

[177] *See* World Nuclear Association, *Nuclear Power in the USA: Electricity Market Challenges*, http://www.world-nuclear.org/info/Country-Profiles/Countries-T-Z/USA--Nuclear-Power.

approximately $0.59/million Btu in 2012 compared with $3.77/million Btu for coal and $4.21/million Btu for natural gas.[178] Although variable costs are significantly lower for nuclear energy than coal and natural gas, high construction costs make nuclear energy a less competitive option in the energy market. The EIA estimates that the levelized cost of electricity (LCOE) of new facilities coming on line in 2020 will range between $91.8/MWh and $101/MWh.[179] The nuclear energy market is uncertain due to factors such as the cost of natural gas and the efficiency of NGCC plants as well as federal policy regarding the renewal of nuclear licenses. Cheap natural gas has been lowering electricity prices across the country and appears to be the poised to take some baseload capacity from retiring coal plants.[180] Although nuclear facilities could replace the generational capacity of coal plants, capital costs may make long-term nuclear investment uneconomical while natural gas prices remain low.

Summary: Understanding the Impact of Recent Trends on Electricity Planning

Changes in technologies, consumer behavior or expectations, or market conditions could affect whether the trends summarized above remain the dominant forces in electricity planning in North Carolina. Building new infrastructure, changing policies, and responding to market changes all require long-term planning to optimize the system and maintain expected rates and reliability. Limited planning may result in an energy sector that misses key economic development opportunities. For example, regulatory disincentives to provide smart grid or demand-side efficiencies could leave North Carolina utilities and consumers with an inflexible energy production system. Such a system could be subject to stranded capital assets, fuel vulnerability to price fluctuations, and lock-in to one type of infrastructure system. Conversely, shifting the energy sector in advance of policy or market certainty could result in decreased reliability, rate structures that do not match the utility business model, and a changing consumer base. All of these potential risks reinforce the need to establish a clear energy vision and develop a comprehensive electricity plan to guide the pace and scale of energy transitions.

PATHWAYS TO COMPREHENSIVE ELECTRICITY PLANNING IN NORTH CAROLINA

Comprehensive planning in North Carolina's electricity sector faces structural challenges due to the institutional arrangements and bounds of energy planning processes in the state. The main challenge is that the primary process through which most planning occurs—the IRP process—includes a quasi-judicial process for public participation but no true stakeholder process early on. This challenge is compounded by the need for the other central planning process, energy management planning, to be consistent with the IRP process. Some states have managed to successfully negotiate the tangle of energy and environmental policy and improve their IRP and energy planning processes, which may be useful for North Carolina. Principles for evaluating them are presented below.

Evaluating State Planning Policies

Given the variety of stakeholders with an interest in electricity planning in North Carolina, no single plan for the electricity sector will satisfy all. The appropriate outcome of a planning process will depend on how decision makers and stakeholders in North Carolina decide to address the challenges and opportunities outlined here. Specifically, whether North Carolina decides to treat those opportunities and challenges as head winds or tail winds will determine, in large part, the outcome of the planning process. Several principles can be used to design the process, which will require a balancing of conflicting goals and viewpoints among stakeholders, utilities, and decision makers. The following principles have been

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[178] U.S. EIA, Annual Energy Outlook 2015, http://www.eia.gov/forecasts/aeo/pdf/0383(2015).pdf.

[179] *Id*.

[180] *See* Gumerman, E., D. Hoppock, and D. Bartlett, *Implications of Clean Air Act Section 111(d) Compliance for North Carolina*, NI R 14-06, Durham, NC: Duke University.

derived from a review of recommendations by a variety of entities engaged in analysis of energy sector planning for potential generation, transmission, and distribution changes.[181]

Principle 1: Transparency, Verifiability, or Both. Planning processes for the electricity sector that are conducted in an open manner can increase accountability and effectiveness. One critical aspect of transparency is ensuring that information used in analyses for planning are accessible to the maximum extent possible. In the case of confidential business information, neutral third-party reviewers can be utilized to provide an efficient yet secure means of holding utilities accountable for their analyses.

Principle 2: Clarity and Coordination of Roles. When multiple agency actors are involved, the roles of each must be clear and coordinated with one another to avoid potential conflicts. In an ideal world, energy planning functions for the electricity sector and utility regulation would be housed within the same administrative agency. Where this is not the case, as in North Carolina, it is even more important that agency roles be clearly delineated and coordinated.

Principle 3: Inclusiveness. Planning processes—whether development of the energy management plan or an integrated resource plan—that *prospectively* engage a diverse group of public stakeholders and utilities with agency actors and decision makers to set policy and targets have the advantage of a final plan that is acceptable to a diverse group of stakeholders.

Principle 4: Sufficient Capacity. Agency actors must have sufficient in-house capabilities for conducting analyses to support effective planning for the electricity sector—perhaps a team of researchers within one of the responsible agencies that can independently research energy management issues and electricity sector challenges and opportunities.

Principle 5: Iterative. Repeating the planning process at regular intervals can allow for adaptability and resilience in planning. Important elements of iterative planning include incorporating processes for clearly identifying lessons from the previous process and implementation of resulting plans; revisiting assumptions, recommendations, and policies in previous plans; and analyzing the gaps between what was expected during the previous planning process and what actually happened as implementation occurred.

Principle 6: Implementable Outcomes. Plans that are implementable and enforceable ensure that the overall vision from the planning process is achieved. If energy planning is to set an achievable—not merely aspirational—vision for the state's energy sector, state actors must have the tools and authority to enact that vision. In North Carolina, those actors currently include the EPC or the NCUC, the utilities, and other decision makers.

The principles outlined above and the best practices described below can guide effective planning policies and processes.

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[181] *See e.g.* National Conference of State Legislatures, *Planning for the Energy Future: A Policymaker's Guide to Comprehensive State Energy Planning*, http://www.ncsl.org/documents/energy/2014-Energy-Planning.pdf (last visited May 31, 2016); *see also* Rachel Wilson and Bruce Biewald, Best Practices in Electric Utility Integrated Resource Planning: Examples of State Regulations and Recent Utility Plans, Synapse Energy Economics, Inc., https://www.raponline.org/document/download/id/6608 (last visited May 31, 2016). For principles for evaluating renewable portfolio standards, *see* Ryan Wiser, Kevin Porter, and Robert Grace, *Evaluating Experience with Renewable Portfolio Standards in the United States*, MITIGATION AND ADAPTATION STRATEGIES FOR GLOBAL CHANGE (2005) 10:237–263.

Improving the Integrated Resource Planning Process

Multiple states and utilities have introduced innovate processes and planning methods that provide IRP best practices. These practices include incorporating criteria for assessing environmental and economic impacts and potential negative outcomes for electricity consumers as well as independent verification and analysis of the options for meeting future needs and modeling tools that capture uncertainty and the pros and cons of different investment options. Innovative processes and policies adopted by Colorado, Indiana, and the Tennessee Valley Authority are described below.

Colorado

The policy design of Colorado's IRP process has evolved dramatically over the last decade. Rather than simply base its IRP rules on "lowest system cost" or least cost,[182] the Colorado Public Utilities Commission (COPUC) has incorporated a cost-effectiveness standard, emphasized third-party oversight of utility modeling by creating its own Research and Emerging Issues staff and by requiring significant incorporation of stakeholder input on planning efforts.

In 2007, the COPUC struck the term "least cost" from its rules and adopted the standard of "cost-effective," which is "the reasonableness of costs and rate impacts in consideration of the benefits offered by new clean energy and energy-efficient technologies."[183] This change allows the COPUC to approve IRPs that may not be strictly least cost for the short term but that may provide benefits to the state in the longer term by allowing the development of new electricity supply resources.

Significant changes to the rules were necessary again in 2010 after the Colorado General Assembly passed the Clean Air-Clean Jobs Act, which requires utilities to create "coordinated plan[s] of emission reductions from … coal-fired power plants [that] will enable Colorado rate-regulated utilities to meet the requirements of the [federal Clean Air Act, 42 U.S.C. § 7401 *et seq*.] and protect public health and the environment at a lower cost than a piecemeal approach."[184] The COPUC and the Colorado Department of Public Health and the Environment are required to review these new filings for adequacy. Therefore, the COPUC once again revised its rules to include:

- A stated policy declaration that the COPUC will give the fullest possible consideration to clean energy and efficient technology
- Requirements that the IRPs submitted by utilities include
    - Annual water withdrawals and consumption rates for new sources
    - Information on the overall water intensity of the generation system as a whole
    - Projected emissions of sulfur dioxide, nitrogen oxides, particulates, mercury, and carbon dioxide for both new and existing sources
    - Descriptions of at least three alternative resource plans that meet the same needs as the base plan but that include proportionally more renewable energy or demand-side management and a range of possible future scenarios and input sensitivities for testing alternative plans

182 Some states have also been expanded their interpretation of the least-cost standard to allow for construction of innovative technologies, such as carbon capture and sequestration in advanced coal plants, and to share costs and benefits for cross-state demonstration projects through joint ownership processes. For more information, see Sarah K. Adair, David Hoppock, Jonas Monast, and Dalia Patino Echeverri, "The State Role in Technology Innovation," 2013, *available at* https://nicholasinstitute.duke.edu/climate/lowcarbontech/deploying-low-carbon-coal-technologies.

183 Colorado Public Utilities Commission, Decision No. C07-0829. Docket No. 07R-0368E (September 19, 2007).

184 HB07-1037. *See also* Colorado Public Utilities Commission, Decision No. C07-0829, *supra* note 182.

- A requirement that the COPUC consider potential new environmental regulations and the risk of higher future costs of carbon dioxide emissions when evaluating the utilities' IRPs.[185]

In addition to these innovations, the planning horizon for Colorado IRPs must be at least 20 and no more than 40 years.[186] The COPUC also divides its IRP process into two phases. In the first phase, the traditional IRP processes (i.e., extensive input and discussion of scenarios and modeling) occur. In the second phase, utilities are required to file needs assessments and requests for proposals for any new resource acquisitions, which the COPUC then has independently evaluated.[187]

Finally, the Colorado IRP process is innovative in that the COPUC has dedicated staffing for a Research and Emerging Issues (REI) section. The REI staff is charged with anticipating and analyzing issues for the COPUC and its staff before they come up through docketed proceedings, but the REI staff does not advise on open dockets. In 2012, the REI staff developed and analyzed, with significant public input, three scenarios exploring potential future issues facing the electricity business in Colorado: a "beyond carbon" scenario, a "producer consumer" scenario, and a "stagnating economy" scenario. The COPUC uses these scenarios in reviewing utility proposals.[188]

Indiana

The Indiana IRP process has been innovative in that it has integrated independent third-party analysis and evaluation of utility planning. The State Utility Forecasting Group (SUFG) is housed at Purdue University and was created in 1985 at the direction of the Indiana legislature to develop independent assessments of the state's energy needs.[189] This group was viewed as necessary after the state experienced significant generation capacity overbuilds that resulted in two abandoned nuclear plant construction efforts. The SUFG puts out biennial state energy forecasts and projects capacity needs by type (e.g., baseload or peak capacity). To do this work, SUFG is given access (through non-disclosure agreements) to confidential data from investor-owned utilities. The SUFG's forecasts are then entered into proceedings before the Indiana Utility Regulatory Commission and compared with utility-submitted forecasts and IRPs.[190]

Tennessee Valley Authority

The Tennessee Valley Authority's (TVA) IRP process is remarkable for the transparent and inclusive manner in which its plans are developed.[191] The TVA not only has a formal IRP working group but also solicits extensive input from the public, in part to comply with obligations under the National Environmental Policy Act. The TVA's public process goes beyond mere compliance. The IRP Working Group consists of 18 representatives of state agencies and other government entities, business, industry, power distributors, academia, and interested non-governmental organizations.[192] The TVA solicits public input during the scoping process for IRP development, which allows for prospective engagement from the

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[185] Rachel Wilson and Paul Peterson, *A Brief Survey of State Integrated Resource Planning Rules and Requirements*, (Synapse Energy Economics, Inc., 2011), http://www.cleanskies.org/wp-content/uploads/2011/05/ACSF_IRP-Survey_Final_2011-04-28.pdf.

[186] *Id*.

[187] *Id*.

[188] Sarah Adair and David Hoppock, *Alternative Approaches to Integrated Resource Planning* (Nicholas Institute for Environmental Policy Solutions, 2013) (on file with authors).

[189] *Id*.

[190] *Id*.

[191] Tennessee Valley Authority, *Development of the Integrated Resource Plan*, https://www.tva.com/Environment/Environmental-Stewardship/Integrated-Resource-Plan/Development-of-the-Integrated-Resource-Plan (last visited by May 31, 2016).

[192] Tennessee Valley Authority, *Integrated Resource Plan 2015 Final Report*, https://www.tva.com/file_source/TVA/Site%20Content/Environment/Environmental% 20Stewardship/IRP/Documents/2015_irp.pdf (last visited May 31, 2016).

public before development begins. The TVA also engages the public in reviewing its draft IRP. Even sensitive data are open to stakeholder input and review.

The TVA uses a slightly different standard than least cost, instead building its IRP process around least regret.[193] Rather than adopting a single future as the expected future for planning, the TVA evaluates multiple plausible futures and evaluates simultaneous changes to critical variables (such as loads and fuel prices) to develop a portfolio with a range of options that are expected to perform well under multiple future scenarios.[194] This approach forces the TVA and its stakeholders to consider the complexities associated with shifts in the generation, transmission, and distribution of electricity in an uncertain future.

Improving the State Energy Management Planning Process

New York

New York's electricity sector is in a competitive market and is therefore structured differently than North Carolina's. Nonetheless, the New York state energy planning process provides a useful framework for thinking about the institutional structures and policy directives for state electricity planning efforts. The New York State Energy Plan and its associated planning process is focused not just on "reliably meeting projected future energy demands" but also on doing so "while balancing economic development, climate change, environmental quality, health, safety and welfare, transportation, and consumer energy cost objectives."[195] This forward-thinking approach was initiated by Governor David Paterson in 2008 when he issued an executive order regarding the need for a state energy plan and stated that "the development, implementation, and periodic review of a sensible comprehensive energy plan will enable the State to determine its future energy needs and facilitate a deliberate, efficient, and cost-effective means of meeting those ends."[196] In response, the New York state legislature passed language in 2009 creating the State Energy Planning Board and directing the board to launch an energy planning process.[197]

New York conducted an energy potential study to identify the challenges and opportunities to be addressed in the plan.[198] The study and the process of translating it into a state energy plan included robust public involvement. Six hearings were held for the public to comment directly to the Energy Planning Board.[199] In addition, the state used a website to collect public comments.[200] The resulting planning process focused on "turning challenges into opportunities" in key areas such as affordability, environmental protection, reliability and resiliency, regulatory reform, environmental justice, and clean, reliable transportation.[201] The scope of the planning process considered how to grow New York's clean energy economy, including through innovation and development of new technologies and workforce development while simultaneously considering climate change and environmental impacts of energy and

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[193] Tennessee Valley Authority, *Exploring Least Regrets Resource Planning*, https://www.tva.com/file_source/TVA/Site% 20Content/Environment/Environmental% 20Stewardship/IRP/Development% 20of% 20the% 202015% 20IRP/Public% 20Meeting% 20Updates/apr_16_2014_least_regrets.pdf (last visited May 31, 2016).
[194] *Id*.
[195] New York State Energy Planning Process, http://energyplan.ny.gov/Process/Process (last visited November 5, 2015).
[196] New York Executive Order No. 2 (2008).
[197] New York Session Bill A5877-B (2009).
[198] *See* Energy Efficiency and Renewable Energy Potential Studies, http://www.nyserda.ny.gov/Cleantech-and-Innovation/EA-Reports-and-Studies/EERE-Potential-Studies (last visited November 13, 2015).
[199] *See* New York State, Draft State Energy Plan Hearing Schedule, http://energyplan.ny.gov/Process/2014-Draft-Hearing-Schedule (last visited May 31, 2016).
[200] New York State Energy Plan Process, *supra* note 194.
[201] 2015 New York State Energy Plan, The Energy to Lead, http://energyplan.ny.gov/Plans/2015 (last visited November 13, 2015).

electricity production.[202] The planning process also addressed the need to invest in resilient energy infrastructure and to assess energy production's health impacts and environmental justice considerations.

Minnesota

Minnesota has recently engaged in energy planning processes that can serve as useful guides for considering comprehensive electricity planning in North Carolina. Minnesota, like North Carolina, has a vertically integrated utility business model. In 2013, the Minnesota state legislature directed the Minnesota Legislative Energy Commission (LEC) to begin developing a framework for Minnesota's energy future that will guide the state toward a long-term and comprehensive plan that will address electricity, heating and cooling, transportation, industry, and agriculture. The legislation also called for an assessment of the costs and benefits of expanding solar thermal projects and an analysis of utility-managed, on-site energy storage potential.[203] The first step in this process was completion of an analysis that scoped the energy future study, a study that "would not blindly target clean energy adoption at any cost" but that would be "rooted in sound analytics and taking a holistic, multi-stakeholder perspective."[204] The study will include assessments of resource pathways, costs, reliability, environmental implications, economic development implications, and risk.[205]

Alongside these efforts, the Minnesota Public Utilities Commission has initiated proceedings to consider the need for grid modernization to meet new challenges arising in distribution systems in the state.[206] In addition to the energy future study and grid modernization efforts, stakeholders in Minnesota's energy sector have been engaged in a non-regulatory stakeholder process to make recommendations for the state's energy future. The e21 Initiative was formed by the Great Plains Institute. It brings together Xcel Energy, Minnesota Power, George Washington University Law School, the Center for Energy and Environment (CEE), and other actors to assess the "changing nature of the electric energy system" in Minnesota.[207] These efforts combined with complementary energy policies, such as a value-of-solar tariff, are generating a comprehensive vision for Minnesota's electricity sector.

CONCLUSION

The unprecedented rate of change in electricity generation, distribution, and transmission is likely to require more active and deliberate management and planning to ensure the provision of reliable and affordable electricity and to meet other public policy goals like economic development and protection of the environment and public health. This paper identified seven drivers of change that are likely to exert pressure on traditional electricity planning mechanisms. Planning for innovative grid technologies, evolving consumer demand, and uncertainty in electricity generation do not fit neatly within existing planning mechanisms and policies that were developed to support the one-way flow of electrons and information. Whether these trends are challenges or opportunities for North Carolina depends on the existing policy context, North Carolina's overall energy vision, and the process by which North Carolina can plan for and respond to the trends. This paper also described North Carolina's existing planning

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[202] New York State Planning Board, Scope for the 2013 New York State Energy Plan, file:///Users/bkb17/Box% 20Sync/Home% 20Folder% 20bkb17/Sync/NC% 20State% 20Energy% 20Framework/Scope% 20for% 20the% 202013% 20Energy% 20Plan.pdf (last visited May 31, 2016).

[203] MN Laws, 2013, Chapter 85 HF 729, Articles 7-13

[204] Rocky Mountain Institute, Scoping an Energy Future Study for Minnesota, https://mn.gov/commerce/energy/images/MNEnergyFutureStudyScopingReport_140102.pdf (last visited November 13, 2015).

[205] *Id.*

[206] Minnesota Public Utilities Commission, *Staff Report on Grid Modernization*, March 2016, https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={E04F7495-01E6-49EA-965E-21E8F0DD2D2A}&documentTitle=20163-119406-01 (last visited May 31, 2016).

[207] *See* Great Plains Institute, *e21 Initiative*, http://www.betterenergy.org/projects/e21-initiative.

mechanisms and presented guiding principles for planning along with examples of electricity planning processes in other states—processes that increase participation from diverse stakeholders, improve transparency and accountability, and improve regulatory coordination. The guiding principles provide a general framework for assessing and improving electricity planning to achieve a state's energy vision.

Robust electricity planning that is based on a comprehensive and coordinated policy framework across agencies and that creates strong stakeholder alignment has key benefits, including increased regulatory certainty for a changing electricity business model, diverse stakeholder investment in a common goal, and clear understanding among stakeholders and decision makers of electricity generation, transmission, and distribution options. Electricity planning that fails to incorporate the basic principles of good planning runs the risk of missing opportunities for economic and business development, regulatory efficiency, coordination among decision makers, and timely reaction to changes in markets, regulations, and technological innovations.

North Carolina has had significant success with many of its electricity policies, and it may be tempting to assess the existing planning processes in light of this success. But the accelerating evolution of the electricity sector puts new pressure on these processes. They now must reflect a two-way flow of information and electricity, anticipate deployment of new grid technologies, and respond to regulatory and consumer expectations for electricity generation, grid resilience, and affordability, among other priorities.

North Carolina has a range of options to institute comprehensive electricity planning that is aligned with the general principles of good planning; that anticipates new technologies, grid functions, and regulatory requirements; that ensures that investments made today complement the likely future grid; and that leads to the provision of reliable and affordable electricity. By identifying and implementing a coordinated and transparent planning process, North Carolina can build on its past successes to meet the challenges of a new energy future.

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Nicholas Institute for Environmental Policy Solutions

The Nicholas Institute for Environmental Policy Solutions at Duke University is a nonpartisan institute founded in 2005 to help decision makers in government, the private sector, and the nonprofit community address critical environmental challenges. The Nicholas Institute responds to the demand for high-quality and timely data and acts as an "honest broker" in policy debates by convening and fostering open, ongoing dialogue between stakeholders on all sides of the issues and providing policy-relevant analysis based on academic research. The Nicholas Institute's leadership and staff leverage the broad expertise of Duke University as well as public and private partners worldwide. Since its inception, the Nicholas Institute has earned a distinguished reputation for its innovative approach to developing multilateral, nonpartisan, and economically viable solutions to pressing environmental challenges.

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