North Carolina’s energy industry is powerful. Almost 40,000 people work in its energy and energy-efficiency sectors, according to Cary-based Economic Development Partnership of North Carolina Inc. They are supported by world-class universities that develop and monetize technology and a community-college system that provides a workforce trained to a company’s specific needs. The industry’s work spans from integrating renewable and alternative sources of energy to keeping nuclear energy competitive for years to come. You’ll find their stories inside these pages.
Charlotte-based Duke Energy Corp. customers have the power to reduce their carbon footprint, the amount of carbon dioxide that's emitted from the fossil fuels they use. A greenhouse gas, carbon dioxide's rising atmospheric level has been linked to climate change. The utility’s My Home Energy Report compares a customer’s usage with comparable homes in the community, encouraging those who use more to reduce consumption by any one of several means. "Cutting-edge LEDs have become especially popular with customers visiting participating retailers or the online savings store," says Lee Mazzocchi, Duke’s senior vice president of grid solutions. "Customers have purchased 4 million LEDs in the last two years." According to the U.S. Department of Energy, residential LED lighting uses 75% less electricity and lasts 25 times longer than incandescent lighting. And less energy means less carbon dioxide.

Duke — the country’s largest utility — generates electricity for 7.4 million retail customers in six states. With more emphasis on energy conservation and a clean environment, utilities are eyeing greener methods of generation and encouraging business and residential customers to reduce energy use. "Across Duke Energy, since 2005, we’ve reduced coal generation by approximately 23%, increasing natural gas by about the same amount," Mazzocchi says. "We have retired over 4,700 megawatts of coal-generating plants and have plans to retire an additional 1,800 megawatts by 2020. When we replace coal generation with [natural] gas, carbon-dioxide emissions per megawatt hour decrease by about 60%, sulfur-dioxide emissions drop by about 99% and nitrogen-oxide emissions fall by about 45%.

The Obama administration’s Clean Power Plan calls for carbon-dioxide emissions from coal-fired electric generation plants to be 32% below 2005 levels by 2030. Some states see it as an attack on the coal

Utilities are embracing technology and cleaner-burning fossil fuels such as natural gas to help protect the environment.

Clean sweep

Charlotte-based Duke Energy Corp. has invested $4 billion to expand solar and wind generation in the six states it serves and cut coal-power generation by 23%.
At Dominion, we consult with the best technical minds to maximize the benefits of the Atlantic Coast Pipeline. We also meet with residents and small business owners like Antonio to get their input and share information about the project.

The Atlantic Coast Pipeline will deliver clean natural gas from West Virginia, where it is taken from one of the largest reserves in the world, to Virginia and North Carolina to help meet growing energy needs.

Here is what it means for North Carolina.

$680 MILLION IN ECONOMIC ACTIVITY FOR NORTH CAROLINA

The economic impact of the Atlantic Coast Pipeline in North Carolina is estimated to be $680 million during the construction phase alone, with more than 4,400 jobs supported. Once in operation, the state could see $11.7 million in annual economic activity, with more than 900 jobs supported. In all, $1.2 billion in capital will be invested in North Carolina.

The pipeline will also generate tax revenue for state and local governments, with estimates totaling more than $60 million in tax revenue during the first 10 years of operation alone.

The Atlantic Coast Pipeline will help meet North Carolina’s urgent energy needs. Demand for natural gas in our region is expected to rise 16.5 percent in the next 25 years, and new businesses will be reluctant to locate in areas that don’t have reliable energy. This pipeline will help public utilities meet energy needs that exceed our current capacity.

Most importantly, the Atlantic Coast Pipeline will reduce energy costs for businesses and homeowners alike. In North Carolina, consumers could realize $134 million in average cost savings each year. And the pipeline will help diversify our domestic energy sources, providing greater energy security.

Dominion is proud to have the support of Antonio and thousands like him, and we pledge to continue to keep the lines of communication open as this process moves forward. We also make it a priority to listen. That’s why we’ve held dozens of community meetings and open houses – and made hundreds of route adjustments – to listen to people who live and work in the communities along the pipeline route.

$11.7 MILLION IN ANNUAL ECONOMIC ACTIVITY

To learn more, visit us at dom.com/acpipeline. You can also email us at acpipeline@dom.com or call us toll-free at 844-215-1819.
industry. North Carolina and 23 others challenged the EPA’s compliance strategy. “North Carolina will continue our policy of cleaning up our power sector,” says N.C. Department of Environmental Quality Secretary Donald R. van der Vaart. “North Carolina has one of the most efficient coal fleets in the country. Looking forward, we expect new-generation needs to be met with a combination of natural gas, nuclear and renewable energy facilities. [The Clean Power Plan] ignores North Carolina’s success in reducing emissions and its advancements in renewable energy. In the next five years, large amounts of solar energy will be connected to the power grid to meet the state’s renewable energy mandates. Within 10 years, new nuclear power units will be essential in continuing to move toward clean, reliable, affordable energy. Construction for new nuclear will begin in the early 2020s if the federal power plan is upheld.”

Duke Energy is preparing to build natural-gas plants, which will help with solar integration and meet generation requirements during winter, for example, when sunlight is at a premium. The $5 billion Atlantic Coast Pipeline will feed those plants. It will start in West Virginia and traverse 600 miles, ending in Robeson County. It will carry natural gas from Ohio, Pennsylvania and West Virginia. Its builders — Atlanta-based AGL Resources Inc., Richmond, Va.-based Dominion Resources Inc. and Piedmont Natural Gas Co. Inc. and Duke, both headquartered in Charlotte — say 80% of the natural gas carried by the pipeline will fuel power plants. The ACP is scheduled to be complete by 2019.

Clean energy needs technological advances. Durham-based industrial commercialization company 8 Rivers Capital LLC is developing NET Power, a technology that makes electricity from natural gas while capturing carbon dioxide and other emissions without additional cost. "In a nutshell, we will allow the world to meet all of its climate targets without having to pay more for electricity," says 8 Rivers co-founder Bill Brown. Ground was broken for NET Power’s demonstration plant near Houston in March 2016. The first full-scale plant is scheduled to open in 2020.

Ryan Kennedy earned an engineering degree from UNC Charlotte in 2004. He
owns Charlotte-based Atom Power LLC, a hardware and software company that makes power-distribution products such as the Atom Switch, which it calls “the world’s fastest circuit breaker.” It is the first commercially viable solid-state circuit breaker that incorporates modern intelligence, metering and communications. “With the Atom Switch, we can provide energy management to turn off and on the flow of power,” Kennedy says. “With power metering built into every Atom Switch, we can monitor our power consumption and characteristics, and we can even change the fundamental tripping characteristics through software. Now we have a device that not only provides all the energy capabilities we’ve always dreamed of but also is making electricity safe.”

Mazzocchi says technological advances such as the Atom Switch are needed. “Electric grid investments make clean energy a practical part of the energy mix. Grid investments keep the electric transmission and distribution system reliable and stable when large generators are removed from service, or when intermittent sources like solar fluctuate their output. As we are deploying advanced metering technologies across all of our states, we are offering more information to help customers manage their energy usage. Customers can access detailed interval data through a web portal to better understand their usage patterns. Very soon, they may receive energy usage alerts to give them notice when they are approaching a preset limit.”

North Carolina will continue to connect with solar, van der Vaart says. “North Carolina is breathing cleaner air today than at any time in decades. … The solar industry has experienced tremendous growth in recent years, thanks to incentives and tax credits, and I hope that we can see some of those incentives applied to other forms of energy to expand our portfolio even further.”

— Kathy Blake is a freelance writer from the Wilmington region.


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Sunny side up

Investment, advances and demand give renewables a bright future in North Carolina.

Electricity generated from nuclear and fossil fuels ruled before 2010, especially in North Carolina. But since, solar prices in the U.S. have dropped 66%, easing its implementation, according to Washington, D.C.-based Solar Energy Industries Association. In 2015, solar-energy providers installed 1,140 megawatts of electric capacity statewide, second only to California, and more than 200 solar companies employ nearly 6,000 Tar Heels.

Clean energy — including solar, wind, biomass, landfill gas and hydroelectric — is a $7 billion industry in North Carolina that employs more than 26,000, according to Raleigh-based North Carolina Sustainable Energy Association. Over the next five years, more than 3,600 megawatts of solar, twice the current capacity, is expected to be added. Renewables are creating a network of systems operators; municipal power authorities and agencies; regional transmission organizations; equipment and power engineering suppliers; and independent power producers that is challenging traditional generation.

Charlotte-based Duke Energy Corp. has spent $4 billion to expand solar and wind capacity in the six states it serves. It owns and operates 500 megawatts of solar projects in North Carolina for its consumer business. Duke purchases up to 1,400 megawatts of solar electricity from independent power producers to meet renewable-energy requirements. On the commercial side, Duke Energy Renewables invested $400 million in eight solar projects in 2015, bringing the total to 30 farms in North Carolina. Cornelius-based solar farm developer and operator O2 emc LLC has garnered $250 million from private tax equity investors to help it lease or purchase farmland for solar sites, says President Olee Joel Olsen. O2 installations generate millions in county tax revenue, more jobs and farmer paychecks, plus above-market returns, the company says, thanks to a generous 30% federal tax credit on renewable energy investments.

Renewables have seen some cloudy days. North Carolina’s 35% renewables tax credit expired in 2015, raising concerns of a slowdown. That has yet to happen, but the state’s Renewable Energy and Energy Efficiency Portfolio Standard, which mandates public utilities generate as much as 12.5% of electricity through renewables by 2021, continues to see challenges. Those include house bills in 2013 and 2015, which died in committee. Brian O’Hara, senior vice president of strategy and government affairs for Chapel Hill-based solar provider Strata Solar LLC, isn’t worried about expiration dates or squabbles. “I don’t come at this with any ideology. Just looking at the economics and engineering, the transition [to renewables] is happening because the technology is there and the price is right.”

Renewable energy goals and mandates are helping make wind generation a reality in northeastern North Carolina.
Ken Flechler is chief administrative officer at Mount Airy-based Pike Corp., the country’s third-largest power construction company. Its work includes hardening and updating the grid, and it will be engineering the microgrid for heavy renewable demand in the future. Flechler says renewables need one technological advance in order to start steadily expanding. “I think the biggest factor is going to be battery technology. Once battery technology gets economic on a utility scale, that will be a game changer for the renewable sector.” Batteries would store energy for days when environmental conditions aren’t conducive to solar or wind generation. “The biggest challenge with renewables is lack of consistency. Once you can make [solar and wind] an on-demand energy source, I think that will drastically change the demand.”

Wind has encountered stiffer opposition than solar. “Initially there was a great deal of interest with regard to offshore wind development. But it’s been slow here due to environmental and tourism concerns,” says David Doctor, president and CEO of Charlotte-based E4 Carolinas, a trade group for the Carolinas energy cluster. The $400 million Amazon Wind Farm USA East in Pasquotank and Perquimans counties encountered only token resistance during its permitting process about five years ago. But now that its nearly 500-foot turbines are standing, some locals call it disruptive. It was scheduled to start delivering 208 megawatts of power to the Seattle-based online retailer’s data centers in Virginia in December 2016. Two other projects — Timbermill in Chowan and Perquimans counties and Little Alligator in Tyrrell County — may not see output. “They’re on the table, [but] you never know if they’re going to go,” says Katharine Kollins, president of Raleigh-based Southeastern Wind Coalition. “In general, wind-farm permits have been issued at the county and federal levels. But when North Carolina started to insert state-level permitting, it gave discretion over the issuance of a permit to the Department of Environmental Quality. The [state permit] legislation is ambiguous. There are no clear points that would result in a clear ‘yes’ or ‘no’ decision for permitting.”

But wind power may be inevitable. Kollins cites three factors driving its development. “First, you have commercial and industrial customers that have renewable energy goals or mandates, and these companies need sources of renewables that are sited as close to their operations as possible. Second, in northeast North Carolina, the wind farms are in close proximity to a regional transmission organization, which manages and distributes wholesale power across large interstate areas.” Finally, technology will advance. Since stronger, steadier winds in the Southeast are found at higher altitudes, towers will stand taller and blades will grow longer. Timbermill’s towers and blades, for example, are expected to stretch about 600 feet. “We continue to look at our electricity as one resource versus another instead of looking at the whole system,” says Ivan Irlaub, executive director of Raleigh-based North Carolina Sustainable Energy Association. “It’s how they get integrated into the system and the business [that counts]. The biggest challenge is the yawning adaptability gap between a utility’s regulated vs. [commercial] parts of the business. In regulated, a utility can’t make money from renewables. … On the commercial side, in deregulated markets, which cover a little less than half the country, Duke’s wind and solar farms are profitable right now. While the commercial business is only 10% of Duke’s holding business, it makes up 18% of its revenues.”

Irlaub believes there is a solution. “It’s much more cost effective for renewable energy developers to build projects than for utilities to do it themselves. Developers have figured out business models to reduce hard and soft costs. They can put together tax equity investors to use federal tax credits. Because of tax normalization and in-place amortization schedules, utilities may be able to take a tax credit for a new plant over a 25-year period, whereas developers can do it in five.”

— Arielle Emmett is a freelance writer who specializes in science and technology.

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Staying power

Nuclear has proven a safe, reliable and environmentally friendly contributor to the state’s energy needs.

Large nuclear reactors can cost $7 billion and require 500 people to build and activate. Portland, Ore.-based NuScale Power LLC, which has an office in Charlotte, is developing a less expensive alternative. Its small modular reactor will cost $2.7 billion and need a construction crew of only 368.

“If I look at the size of the containment dome of a large reactor, I can fit probably 120 of my reactors in that containment building ... which gives us an advantage in manufacturing,” says Nils Breckenridge of NuScale’s business development department. “I can manufacture in a factory and deliver the modules to the site, so construction becomes much easier. And time-wise, you’re looking at three years construction instead of five.”

NuScale contracted with the U.S. Department of Energy in May 2014 for funding for SMR development, licensing and commercialization. After more than 65 presentations to the Nuclear Regulatory Commission and 14 reports, it submitted its design certification application in December 2016. It has plans for a dozen SMRs. The first is scheduled to go online in Idaho by 2024.

“There are people who are interested, but they’re making sure that before [SMRs] become public that they have a sound basis for doing so based on economic research and outreach,” he says.

Nuclear has produced electricity safely and reliably for decades. SMRs will help ensure it remains part of a changing energy map that now includes renewables and friendlier fossil fuels such as natural gas. “A decade ago, nuclear was thought to be a real growth industry in the U.S., and it has turned out not to be that,” says David Doctor, president and CEO of E4 Carolinas, the Charlotte-based trade association that represents Carolina energy companies. “Natural gas has taken the lead, and nuclear projects have become more costly and taken longer to build. It’s easier to build a natural-gas power plant, but here’s the rub: We’re finding that natural-gas power plants still produce carbon and contribute to methane entering the environment. Nuclear plants don’t.”

John Gilligan is a nuclear engineering professor and College of Engineering executive associate dean at N.C. State University. He also directs the DOE’s Nuclear Energy University Program Integration Office. He says there will always be a need to generate base-load electricity, the minimum
level of demand on a grid over 24 hours. “Natural gas is cheap right now, but it’s not always considered base load. Nuclear still has a bright future in this country, without greenhouse gases. It can be as cheap as any other source if it’s done right, then licensed in an efficient way. I think the plants that are coming online now in [the Carolinas] will serve very well to keep the costs down, and I think we have some of the lowest costs in the country right now because of nuclear. Natural gas and oil prices have gone up and down, so I don’t anticipate they’ll stay down forever.”

Pittsburgh-based Westinghouse Electric Corp. owns Irving, Texas-based Fluor Corp., which has assumed construction of VC Summer Nuclear Generating Station in Fairfield County, S.C. It’s expected to be complete by 2020. Delays prior to Fluor’s involvement increased costs 21% to $13.8 billion, according to Cayce, S.C.-based SCANA Corp., parent company of South Carolina Electric & Gas Co. “Fluor was selected by Westinghouse to manage the construction of two Westinghouse AP1000 nuclear power reactor projects in Georgia and South Carolina, owned and operated by Georgia Power/Southern Co. and SCANA/Santee Cooper, respectively,” says Chris Tye, Fluor’s Power Business Division president. “The construction of Units 3 and 4 of Vogtle Electric Generating Plant and Units 2 and 3 of VC Summer will bring approximately 4,500 megawatts of carbon-free electricity generation to the power market.”

Safety, both during operation and in handling waste afterward, concerns generators and customers. Wilmington-based GE Hitachi Nuclear Energy LLC develops outage and inspection solutions for nuclear reactors, trains outage service workers, and designs and manufactures reactor components. Its Economic Simplified Boiling Water Reactor, a design approved by the Nuclear Regulatory Commission in 2014, has a system that allows the reactor to cool itself for seven days without operator intervention. Its sodium-cooled PRISM reactor addresses the challenge of used nuclear fuel. After 30 years of development, it is being exported to the United Kingdom.

AREVA Inc., which provides planning and construction services to nuclear power generators, moved its headquarters to Charlotte from Bethesda, Md., in 2013. Its 300 licensed professionals make it one of the city’s largest engineering companies. “We have a workforce that is committed to improving the efficiency of all the nuclear plants, so we still support that as a major source of energy for us,” says AREVA Senior Vice President and CEO Kathy Williams. “You can always count on nuclear. As a resident of Charlotte and a customer of Duke Energy, I appreciate the lower natural-gas prices but also understand that we need the supply of nuclear in North Carolina and South Carolina to keep the prices at a very stable level. So, we work with all the main suppliers of energy to maintain being competitive.”

Williams says nuclear’s future starts in the school systems. AREVA supports science, technology, engineering and mathematics — STEM — education, and company representatives visit elementary, middle and high schools. “They talk about nuclear not being something to be afraid of but a supplier of energy in the U.S. and a major force in the world,” she says. “We devote most of our corporate contributions to STEM. In 15 years, I predict we’ll have job opportunities with all engineering functions, math opportunities and with communications, which will involve people understanding the disciplines and meeting the needs of our company.”

Long-range planning is vital, NuScale’s Breckenridge says. “We think it’s an interesting time for nuclear power, and I think in the long term, technology will win out. We’ll find ways to burn coal cleaner, find ways to burn natural gas cleaner. And nuclear already is clean. The strategy and the goal is a much cleaner generation portfolio.”

— Kathy Blake is a freelance writer from the Wilmington region.
Powering a workforce

North Carolina colleges and universities use high-tech classrooms and industry partnerships to prepare the next generation of energy workers.

Inside UNC Charlotte’s 20,000-square-foot Energy Production and Infrastructure Center, professors immerse engineering students in classwork, research and laboratory studies. “We have support for students through EPIC funding, internships with industries and graduate fellowships, so it’s a wide variety of programs for students to get them involved in the energy sector,” says David Young, EPIC’s interim director. “All of this is aimed at workforce development and getting students excited about careers and projects in energy that make them better prepared to take these jobs and career opportunities with companies in Charlotte, the region and anywhere.”

The Charlotte region is a global hub for energy companies. EPIC helps train their workforce. It’s one of several university and college programs across the Carolinas that are embracing the need for skilled workers in this rapidly changing industry.

“When you talk about energy jobs, these are jobs that aren’t going away,” says Jay Potter, former Charlotte-based Central Piedmont Community College dean and current career and technical education workforce consultant. “We have to not only create infrastructure in new areas like solar but enhance the infrastructure we have. And that can only be done with a quality workforce. This is our chance to address that economic mobility and make sure people are aware of the opportunities and get the proper education to have people commit to hiring them. Someone has to make the machines; someone has to keep the machines running.”

Mike Horrigan is a consultant for E4 Carolinas, a Charlotte-based trade group that represents energy businesses in the Carolinas, and principal of Charlotte-based human-resources company M/H/R Services LLC. “Industry, education and government must work together,” he says. “Industry will get the workers. Education will have people for career-readiness programs. And in Charlotte, there are upward mobility implications in terms of helping folks left behind by the economic recovery. Instead of training for jobs that will be automated out, we’re trying to update and redigest the jobs observations. [Those who] set their sights on going to work for an energy company like Duke or Siemens or Piedmont Natural Gas or AREVA, [they’re] going to have to have some technical credentials that say [they] can do the job once [they’re] hired. The days of industry training that is four years long and paves the way for you to see if you can do the job, that’s not how companies go about it these days.”
EPIC offers the nation’s only master’s degree with a concentration in energy. But studies can start much earlier. UNC Charlotte and Charlotte-Mecklenburg Schools opened an engineering magnet high school in 2014. Students spend two years in high-school courses and three more in college studies and work-based learning, job shadowing and internships.

Siemens Energy Inc., part of Germany-based Siemens AG, manufactures power-generation equipment in Charlotte. It started an apprenticeship program with CPCC in 2010. The college’s two-year degree programs in welding, electrical systems technology, mechanical engineering and civil engineering technology put students in the workforce quickly. “And if they want to go beyond that, they can go on to a four-year college,” says Jill Lutz, executive director of the college’s skills initiative program. “With our [Siemens] apprentice program … students are going to school on a part-time basis, and they’re working for the company.”

Raleigh-based N.C. State University brings the workplace onto campus. Inside a three-story building, students use a $1.5 million PULSTAR nuclear reactor. “Students go right up to the reactor and look down on it,” says John Gilligan, nuclear engineering professor and executive associate dean of the College of Engineering. “Once you walk up to it and start understanding it, it takes all the scariness away. We have the first nuclear program in the country, and we’re the first to graduate Ph.D.s. So there’s a strong history of success in attracting students and in funding from the federal government.”

Gilligan teaches about 100 graduate students and 105 undergrads. “There’s a variety of jobs in the nuclear area. They can work for utilities like Duke Energy or [Tennessee Valley Authority] or nuclear plants and design units for those companies. They can work for vendors, such as Westinghouse, General Electric or AREVA, or for medical equipment companies that make devices for nuclear diagnostics in the medical area, which is growing quite a bit.”

— Kathy Blake is a freelance writer from the Wilmington region.