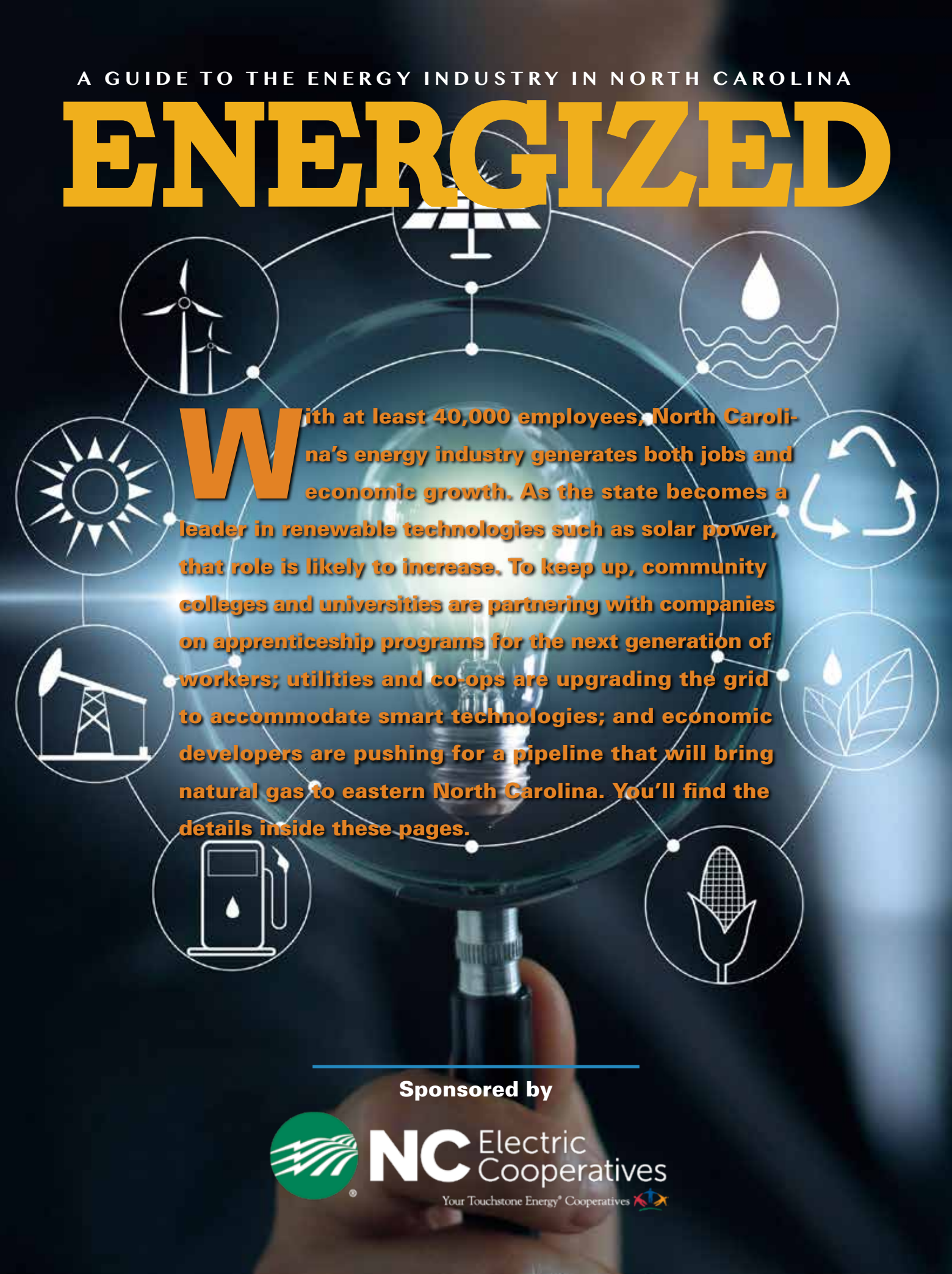
A GUIDE TO THE ENERGY INDUSTRY IN NORTH CAROLINA

ENERGIZED



With at least 40,000 employees, North Carolina's energy industry generates both jobs and economic growth. As the state becomes a leader in renewable technologies such as solar power, that role is likely to increase. To keep up, community colleges and universities are partnering with companies on apprenticeship programs for the next generation of workers; utilities and co-ops are upgrading the grid to accommodate smart technologies; and economic developers are pushing for a pipeline that will bring natural gas to eastern North Carolina. You'll find the details inside these pages.

Power lines like these have been a feature of the landscape for many years. But the future holds major innovation in the way electricity is managed and distributed.

A SMART ENERGY FUTURE

Microgrids and smart thermostats are among the innovations in ways power is distributed.

Lee Ragsdale is excited about the future of energy in North Carolina. As senior vice president of grid infrastructure and compliance for North Carolina's Electric Membership Cooperatives, he is looking to technology to deliver more reliable electricity to 2.5 million largely rural consumers served by the organization's 26 member co-ops.

"Technology enables us to do great things, from energy storage to electric vehicles to creating a modern electric grid," Ragsdale says. "Costs are coming down, and we are developing more and more resources."

The old grid model of days gone by is outdated, with infrastructure no longer capable of delivering energy to households, businesses and industry efficiently. Today, consumers are using energy in different ways and expect new methods to monitor how and when they use power.

Duke Energy is at work upgrading, expanding and improving the energy infrastructure, according to spokesperson Jeff Brooks.

"It's data-driven, designed to improve reliability, strengthen the grid, and give customers options and control over how they use energy," he says.

In 2017, Duke Energy launched a 10-year initiative to modernize North Carolina's electrical-grid system with a $13 billion price tag. The Power/Forward Carolinas plan would help protect the system against storms and outages; install underground power lines; make the grid more resilient against cyberattacks and physical threats; and help expand renewable energy.

But last year, the North Carolina Utilities Commission rejected the proposal, which would have increased the basic monthly charge for residential customers by 51% to $17.79 per month from $11.80 per month.

"We heard a variety of concerns from stakeholders," says Chris Ayers, executive director of the commission. "Concepts and pieces of the plan truly would modernize the grid, but others would not."

The commission requested a more focused plan at a lower cost to consumers. The revised plan, which is now known as the North Carolina Grid Improvement Plan, will focus on grid modernization, battery storage, customer access to data and electric-vehicle charging stations. The basic monthly charge would settle at around $14 per month.

According to its settlement with regulators, Duke's new North Carolina Grid Improvement Plan will stretch over four years and cost $2.5 billion, including $25 million on electric-vehicle charging. The new plan also commits to developing storage projects.

The plan also will increase innovation and growth in the renewable energy sector, Brooks adds.

Mark Feasel is vice president of the electric utility segment and smart grid for Schneider Electric, a worldwide energy-management company. He sees a rise in customers who want to understand their energy bills and have the power to change their consumption day-by-day or even hour-by-hour.

He views decentralized electricity using microgrids as a way to develop

and deliver more reliable energy to local homes and businesses.

In 2017, Schneider Electric partnered with Duke Energy Renewables to deploy two advanced microgrids to serve the Montgomery County, Md., Public Safety Headquarters and Correctional Facility. The energy generated through solar power will provide 3.3 million kilowatt-hours each year.

The North Carolina Electric Membership Cooperative is eyeing microgrids to serve its customers, who are located mostly in rural areas.

In the last two years, NCEMC has deployed microgrids at Ocracoke and Butler Farms in Lillington, with plans for others in coming years. Each integrates new technologies and on-site energy resources, such as batteries and solar, to help improve resilience for local members as well providing co-ops with an opportunity to discover future applications for microgrids and their components.

On Ocracoke Island, with a population of about 500, residents are using energy from a diesel generator and solar panels. Served by Tideland Electric Membership Corp., Ocracoke Island is vulnerable to severe weather and isolated from central power plants.

"Ocracoke is at the end of the line," Ragsdale says. "The microgrid offers a more reliable source of power because it is closer to where the residents live."

While it is a component of the main electric grid, it also can work independently and has control mechanisms that respond to demand and control the power storage and generation to balance load with available resources.

Residents also benefit from the Tideland EMC smart-thermostat pilot program. The smart thermostat allows islanders to track energy consumption in real time and control their thermostats from mobile devices. Residents enrolled in the program receive a $2 per month participation credit on their bills.

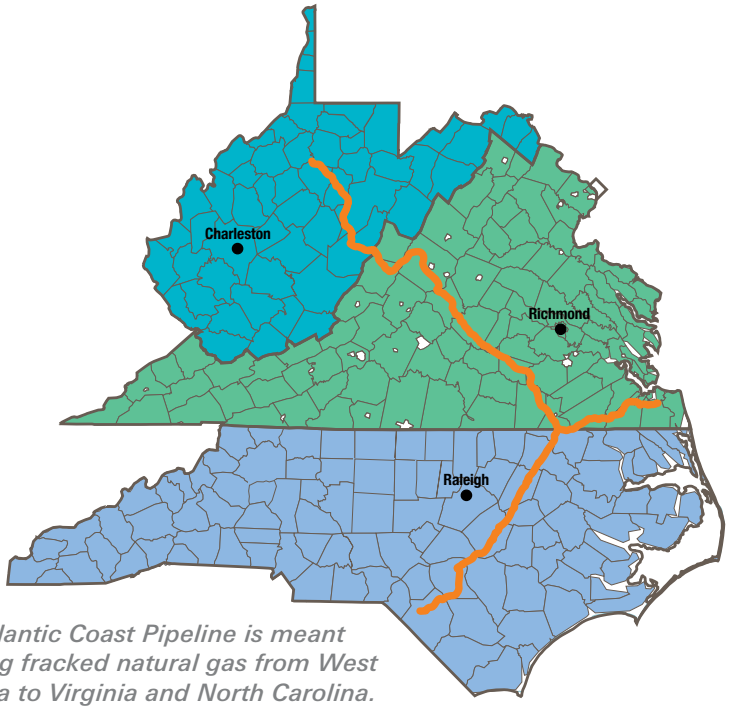
Biogas fuels the power at Butler Farms in rural Harnett County. With 800 head of hogs, a biogas digester and a biogas generator working together, the Butler Farms microgrid generates electricity to power the farm as well as eight nearby homes. Solar makes up another of the farm's microgrid components. The NCEMC provided a battery storage microgrid.

During normal conditions, the microgrid will connect to South River EMC's distribution system to supplement and diversify traditional power resources. During outages, it can operate independently.

Cost has been the main challenge to developing these grids in the past, Ragsdale says. "Now costs are coming down, and this technology is growing more affordable."

— Teri Saylor is a freelance writer from Raleigh.

A PIPELINE TO GROWTH



The Atlantic Coast Pipeline is meant to bring fracked natural gas from West Virginia to Virginia and North Carolina.

Snaking from West Virginia across Virginia and ending at North Carolina's southern border, the 600-mile Atlantic Coast Pipeline was scheduled to start delivering natural gas by the end of 2018.

Instead, the pipeline has been halted after two rulings last December stayed key environmental permits.

Still, eastern North Carolina economic developers are counting on good things from the pipeline, which will carry natural gas from the fracking fields of West Virginia. And Dominion Energy Inc. is fighting in court to ensure the pipeline can move forward.

Driven by service. Inspired by innovation.

North Carolina's electric cooperatives are building a brighter energy future for 2.5 million North Carolinians. Beyond providing electricity, each of the 26 not-for-profit cooperatives is investing in its communities and delivering new energy solutions to improve quality of life for co-op members in 93 of North Carolina's 100 counties.

Learn more at **NCElectricCooperatives.com/Innovation**

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Economic-development teams in the areas the pipeline would serve believe abundant natural gas is crucial. In eastern North Carolina, they are counting on the ACP to deliver industrial development and jobs, along with natural gas.

"For a large manufacturer such as a food-processing plant, natural gas is a necessity," says Chris Chung, chief executive officer of the North Carolina Economic Development Partnership. "A site could have electricity, water, sewer and broadband, but if it doesn't have natural gas, that site will not be selected."

A 4th Circuit Court of Appeals ruling Dec. 7 overturned a permit from the U.S. Fish and Wildlife Service that applied to 100 miles of the pipeline in West Virginia and Virginia because construction would threaten endangered species. In a subsequent decision a week later, the court stayed U.S. Forest Service approval to allow the pipeline to cross two national forests and the Appalachian Trail.

Richmond, Va.-based Dominion Energy has suspended construction and filed motions with the court to narrow the order so it can resume construction in areas not affected by disputes over natural resources.

"We feel the court's decision to halt construction on all 600 miles is unwarranted and overly broad as it affects four wildlife species over 100 miles," Dominion spokesman Aaron Ruby says.

If the stay is lifted and barring new lawsuits over environmental concerns, Dominion will proceed with the eagerly anticipated project on a new schedule.

"We are now looking at completing the project in two phases, with up to 70% operating by year-end 2019 and the other 30% in operation by summer 2020," says Bruce McKay, senior energy policy director for state and local affairs at Dominion.

Dominion is building the $7 billion pipeline in partnership with Duke Energy, Piedmont Natural Gas Co. and Southern Co., based in Georgia. The recent rulings are part of a series of delays the project has faced due to lawsuits from environmental groups trying to stop it. Greg Buppert, an attorney with the Southern Environmental Law Center, argues that the existing Transcontinental Pipeline system has an adequate capacity to meet the demand.

But if the project is permanently stayed, it would cost North Carolina 4,400 jobs, says Robert Van Geons, president and CEO of the Fayetteville Cumberland County Economic Development Corp.

In Fayetteville, workers had already been hired for construction jobs, and many had already started, frustrating Van Geons.

"Many of our local people were going through skills training and preparing for work," Van Geons says. "The project receives approval, but it is derailed time and time again, and that is concerning. This is holding up employment, economic development and access to reliable energy. Those jobs would be temporary, but the skills workers learn and money spent locally would remain."

Dominion officials have filed a motion asking the court to reconsider construction on all 600 miles, according to Ruby. "We are appealing the court's decision vigorously and are confident that on its merits, we will prevail," he says.

In Fayetteville, Van Geons is eager for a resolution.

"This project is very valuable to the residents in eastern North Carolina, and everything is on hold until the pipeline issues are resolved," he says.

— Teri Saylor is a freelance writer from Raleigh.

Dominion Energy has been named America's best managed electric and gas company.

It helps when 1 in 5 new hires is a veteran.

The latest "Management Top 250," published by *The Wall Street Journal*, ranks the best run U.S. companies based on customer satisfaction, employee engagement and development, innovation, social responsibility and financial strength. Dominion Energy was **ranked as the top electric and gas utility.** And military publication *G.I. Jobs* ranks Dominion Energy top in our industry and 5th among all U.S. companies. It marks the 10th consecutive year Dominion Energy has been recognized as a military-friendly company. So to each and every one of our 16,000+ dedicated employees, THANK YOU for your commitment to excellence, your dedication to community and most of all for the energy you bring to this company each and every day.

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AN ENERGETIC FUTURE

Schools and industry officials are partnering to entice students to join the energy workforce.

When Siemens underwent a major expansion at its Charlotte manufacturing facility in 2011, it faced a shortage of skilled workers and started an apprenticeship program to find and train employees.

The company, which employs about 1,600 people in Charlotte, manufactures steam turbines and electrical generators for energy firms.

"We started a four-year program in partnership with Central Piedmont Community College," says Dawn Braswell, director of training and development at Siemens.

The program started with a cohort of six students, and currently 21 students participate.

"Our focus is on advanced manufacturing," Braswell says. "The worker of the future must be agile. As technology evolves, so will the workers. They will need to be able to think critically, to know how to troubleshoot and to work as a team."

According to a 2017 report by the Center for Energy Workforce Development, the overall size of the workforce has decreased by 2.7%.

"About 59,000 employees may need to be replaced over the next 10 years for retirements, with an additional 30,000 potential replacements over the next five years for non-retirement attrition," the report stated.

Rural areas outside major cities and education hubs have their own unique problems, according to Nelle Hotchkiss, senior vice president of association services and chief operating officer of the N.C. Electric Membership Cooperatives.

"The electric utility industry is going through a transformation," Hotchkiss says. "Solar distribution generators, battery storage and smart devices require a different knowledge base. In the cities, finding bright young folks is not difficult, but serving our cooperative members in rural communities can be challenging."

Like Siemens, NCEMC relies on community colleges and adds a multifaceted strategy, including a Bright Ideas program for kids in grades K-12 at the local level. NCEMC also offers opportunities for local teachers to join the Kenan Fellows program, where they learn how to teach their students about energy.

Located on the Charlotte Research Institute campus of UNC Charlotte, the Energy Production & Infrastructure Center serves as a state-of-the-art research center that provides educational and applied-research opportunities to students with energy-related interests, according to Mike Mazzola, director and Duke Energy distinguished chair in power engineering systems.

"Power is our nation's single most important infrastructure," Mazzola says.

In addition to engineers, the workforce of the future will require talent from other business sectors.

The EPIC program also has partnered with UNCC's Belk College of Management to develop a concentration in the energy sector.

New at UNCC is the EPIC Affiliates program. Conceptualized in 2008, it became an official part of the EPIC program in 2016, according to Christina Kopitopoulou, program manager.

"Energy corporations are seeking young people to transform their business, and our mission is to connect our industry affiliates with students," she says.

EPIC administrators have noticed that the recent surge in renewable energy sources has sparked interest among youths attracted to solar, electric cars and smart-grid technology.

"Twenty-five years ago, students didn't find energy very interesting, but attitudes are changing," Kopitopoulou says. "Thanks to the renewables industry, it's making energy sexy again."

— Teri Saylor is a freelance writer from Raleigh.

PROVIDED BY SIEMENS

Siemens is among the companies using apprenticeships to train next-gen energy workers.

LEADER IN ENERGY STORAGE

North Carolina has positioned itself to be a national leader in renewable energy, thanks to its status as one of the top states for producing solar energy, its work on grid modernization and its efforts to move the needle forward in implementing energy-storage options, according to energy experts from N.C. State University.

"North Carolina is the No. 2 state for storage, just behind California," says Steve Kalland, executive director of the North Carolina Clean Energy Technology Center. "Solar deployment makes storage more important. Combine that with smart grid, and North Carolina is emerging as a national leader."

Last December, a special N.C. State Energy Storage Study team released "Energy Storage Options for North Carolina," a report detailing ways lawmakers can inform energy policy.

Factors influencing the value include capital investment, the electric grid, utility savings, job creation, consumer rates and service quality, according to the report.

"Our stakeholders have been interested in lithium ion batteries like those in laptop computers, phones and cars, but there is also a lot of interest in using batteries on the grid, and costs are dropping," says Joseph DeCarolis, associate professor in the department of civil, construction, and environmental engineering at N.C. State, who participated in writing the report.

Prices are dropping dramatically, as much as 70% to 80% annually, Kalland says.

"The costs are dropping so rapidly that using batteries for large-scale energy storage will be cost-effective in 10 years," DeCarolis says.

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