Centering smart and efficient energy technology in the Southeast

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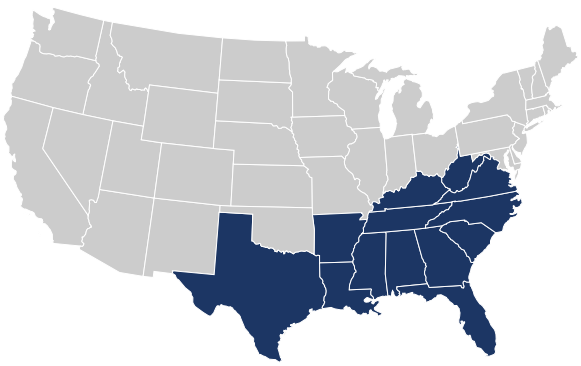


The southeastern United States is a diverse region that stands to gain significantly from a transition to a clean energy economy, both in the utility and transportation sectors and by drawing on its natural and industrial resources.

The region is historically dependent on fossil fuels, and the American Petroleum Institute's vision—which includes current and prospective shale plays, expanded drilling in the Gulf of Mexico, and the Keystone XL pipeline extension in the neighboring states of Texas and Oklahoma—promises little more than business as usual, built on yesterday's limited view of the region's capabilities and potential. In fact, the region is home to significant energy innovation, and the transition to a more diverse and modern energy infrastructure holds great promise for the region.

The Southeast has significant potential across a range of advanced energy technologies. Promising offshore wind opportunities exist for North Carolina and South Carolina,[91] and neighboring Texas has emerged as a leader in onshore wind. While currently underutilized, solar energy is also a strong potential job creator in the region, as is biomass, a resource extremely well-suited for the southern energy mix.[92]

The Southeast is second only to the Midwest in its concentration of advanced and efficient vehicle manufacturing and the diverse technology supply chain that supports it.[93] With significant auto manufacturing hubs in Kentucky, Tennessee, Alabama, North Carolina, South Carolina, and neighboring Texas and Missouri, the broader region stands to build thousands of jobs as the industry retools to build the cleaner vehicles that are our most effective response to high gas prices and less oil security.[94]

More proactive policy action at a local, state, and federal level could help push the region forward to better capture economic and environmental gains in all these areas, but an additional and unique opportunity exists for the region in the coming wholesale modernization of our electric infrastructure nationally and globally. This transformation encompasses both the technological transformation of our electric grid—so-called smart-grid innovation that will change everything from household appliances to utility-scale electric transmission and distribution equipment—as well as widespread basic improvements in household, business, and industrial efficiency.

The Southeast is an early leader in this emerging field, with numerous companies developing and producing advanced smart-grid technology. This new equipment and information technology improves the ability of utilities and customers to communicate, manage energy generation and distribution, and manage their energy equipment—whether that's a clothes dryer or a power plant. It also delivers a more reliable, efficient, diverse, and flexible electric system overall. With enhanced commitment to regional smart-grid deployment, the Southeast has the potential to become a leader in a growing global industry and reap the benefits of that leadership in the local economy.

At the same time, the region lags in deploying "traditional" efficiency policies such as statewide energy efficiency standards and programs to drive upgrades to residential and commercial buildings and industrial equipment.[95] Addressing the region's efficiency shortfall can provide an immediate boost to business competitiveness and household budgets in a region where many communities are also economically challenged.[96]

Taken together, efficiency and smart-grid innovation will deliver not only energy savings and environmental benefits but also jobs and economic development across a wide range of industries and professions—from local installation and repair jobs to manufacturing and high-tech engineering to software design. This vision provides an opportunity for the Southeast to be a global leader in energy innovation, while ensuring that local energy transition brings good jobs, lasting economic growth, and improved quality of life.

Smart grid: Building a 21st century energy system

The energy world is changing. New clean and renewable power generation gets a lot of press: Wind, solar, geothermal, biomass, and even wave power are rapidly expanding as communities and nations look for ways to make the power that families and businesses need in cleaner, cheaper, more secure, and often more local ways. But the need to meet modern energy demands is driving an equally profound change in how we move, manage, and use whatever energy we generate, making our electric system much more flexible, responsive, and efficient.

The Southeast still has a way to go to live up to its potential in clean energy generation but, as mentioned above, is an early leader in the new smart-grid energy infrastructure, which is a key element in making it possible to meet the energy demands of a rapidly growing and resource-constrained world.

The smart grid refers to a whole range of new technologies that network the electric power system and enable two-way information sharing, communication, and management of electric systems and equipment. These technologies enable utilities to use existing power plants and equipment far more efficiently, cut waste, and improve reliability while limiting the need for costly emergency power. The new flexible systems are also essential for the widespread integration of intermittent renewable power (such as large wind farms and solar power plants), distributed generation (such as home or business solar roofs, or commercial or industrial facilities that generate their own power) and electric vehicles. The value of increased reliability from smart-grid technology alone is huge, as power outages currently cost the U.S. economy about $150 billion a year.[97]

Smart-grid technologies also create an array of new business opportunities and consumer benefits, allowing residential and commercial customers to participate in and share the value of utility services. These include selling energy from rooftop solar panels back to the grid; enabling "microgrids" for homes, businesses, or communities that can stand alone and keep energy flowing during power failures; enabling electric vehicle owners to charge their cars when power is cheapest and cleanest—and potentially, when they're not driving, to use that car battery for power at home or to sell energy storage services to the grid. Consumers will also be able to control the technology and energy in their lives from their smart phones or laptops.

Finally, more efficient use of our energy infrastructure means significant energy savings, estimated at 12 percent to 18 percent of total electric-sector energy

use and emissions.[98] These savings are arrived at in significant part by engaging consumers in energy management in ways that not only provide savings but connect energy choices with better products, new services, and improved home or business energy security and control. These innovations can go a long way toward combating a perennial obstacle to efficiency adoption—spurring retail customers to action. Put differently, traditional efficiency is often not very sexy, but if combined with new products and services it can be.

The smart-grid transformation of the electric system is coming rapidly and globally. The global market value of smart-grid products was estimated at $69 billion in 2009 and is growing at more than 20 percent a year.[99] Leading smart-grid countries made $17 billion in public investment in the smart grid in 2010 alone—the bulk in China and the United States. A 2011 study by Duke University's Center on Globalization, Governance and Competitiveness argues that countries are coming to the smart grid with slightly different objectives. China and Brazil are looking to meet massive new electric infrastructure needs with state-of-the-art technology, while the United States is looking to upgrade aging infrastructure to improve reliability and enhance customer satisfaction. Japan and South Korea are largely focused on innovation for export, while Australia and Europe are looking to facilitate adoption of high levels of renewable and low carbon energy.[100]

All of these benefits beckon for industry leaders. The Southeast is well-positioned to benefit.

The Southeast is a leader in smart-grid technology

The Southeast is currently a leader in smart-grid development and deployment. In a study of leading companies in this field, the region boasted more firms (83) across the whole smart-grid value chain than any other region, with Raleigh, North Carolina, rivaling San Francisco as the leading city.[101] A subsequent study that examined local supply chains found 59 smart-grid-related firms with 101 locations in the Research Triangle area alone.[102]

Smart-grid innovation and manufacturing companies are found across the region. Georgia is also a leading state in smart-grid device manufacturing, research, and engineering, A 2011 survey of Georgia "smart energy" businesses by the Technology Association of Georgia Smart Energy Society indicated Georgia revenues from these businesses of $2.3 billion—and the group believes that this

is a conservative figure.[103] The utility equipment manufacturing giant General Electric, Co. has its Digital Energy business headquarters outside of Atlanta and opened its Smart Grid Technology Center of Excellence there in 2010, adding 400 jobs. The Grid IQ Experience Center, a "tourist attraction," is also aimed at explaining the smart grid to the public.[104]

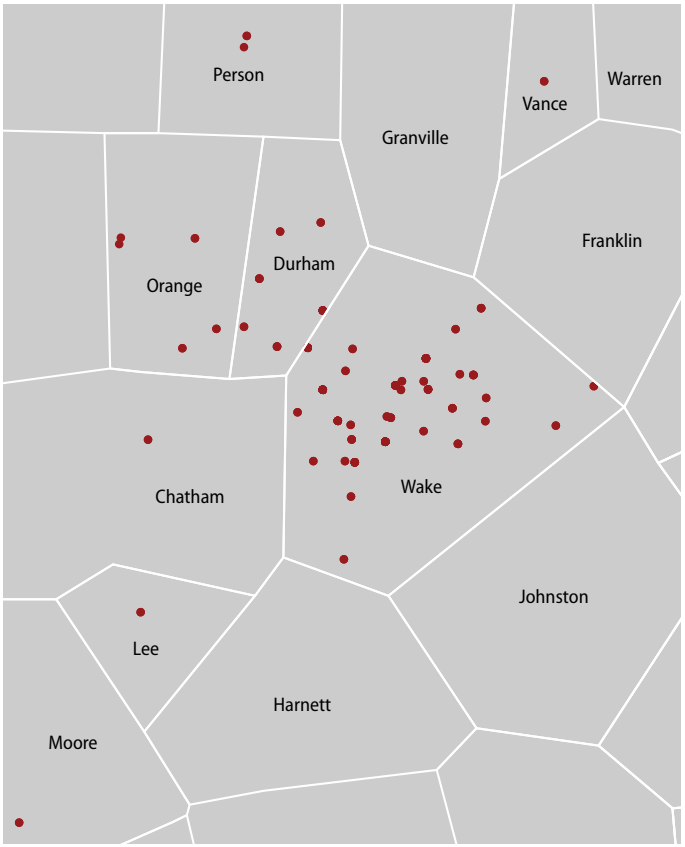
Utilities across the country, including in the Southeast, are rolling out smart meters as an important first step, but the Southeast has the potential to dive far deeper into smart-grid adoption.

The nation's best known and most comprehensive medium-scale deployment of advanced energy and transportation technology is happening just outside the Southeast region and can provide a good model for innovation within the region. In Austin, Texas, a committed municipal utility, Austin Energy, has been working with a supportive city government and leading research and corporate partners to simultaneously test high levels of renewable energy, electric vehicles, and smart-home technology—all integrated by smart-grid controls.[105] Other local utilities are also stepping up such as Lakeland Electric, a community-owned utility from Lakeland, Florida, which will deploy not just smart meters but also time-based rate programs and in-home displays and web equipment for customers to manage their energy use.[106]

At the opposite end of the spectrum, the huge Charlotte, North Carolina-based Duke Energy Corp. has a nearly $700 million project underway as part of the Department of Energy's smart-grid program. It goes modestly beyond advanced metering infrastructure and spans five states: North Carolina, South Carolina, Kentucky, Indiana, and Ohio.[107] In addition, the company is working with Department of Energy's Advanced Research Projects Agency, the Electric Power Research Institute, Toyota Motor Co., and others to pilot microgrids—or elec-

North Carolina's exceptional smart grid assets

In research triangle area alone: employee locations engaged in the smart grid industry



Source: Duke University Center on Globalization, Governance and Competitiveness at the Social Science Research Institute

tric vehicle connections to smart-grid technology and other facets of smart-grid deployment. Duke Energy is now the nation's largest electric utility, following its recent merger with Progress Energy, and it could be in a position to lead national smart-grid adoption from its base in the Southeast.[108]

Indeed, taken together, the concentrated local deployment made possible by comparatively small forward-looking municipal utilities working closely with city governments and elected leaders, along with the experience of large investor-owned utilities, could provide a foundation for the learning, policy leadership, and enhanced partnerships needed to drive forward much larger-scale smart-grid deployment in the region.

An engine of jobs and economic growth

A recent study of the smart-grid supply chain by Duke University's Center on Globalization, Governance and Competitiveness finds 334 company locations in 39 states today, and estimates that the industry has created 17,000 jobs in the smart grid supply sector to date.[109] These are jobs outside the utilities themselves and include developing, designing, building, and installing the technology that enables smart-grid services. Taking a closer look at a local level, the study cites estimates that about 3,000 people are employed in smart-grid businesses in the North Carolina Research Triangle alone.[110] Likewise, in its initial survey the Technology Association of Georgia Smart Energy Society estimated that there were almost 5,000 people employed in Georgia's "smart energy" companies.[111] Looking forward, different researchers estimate that nationwide implementation of the smart grid would add nearly 280,000 jobs, both in utilities and the supply chain.[112]

Nationwide, these jobs are in device manufacturing, hardware development, software development, and services, as well as strategic and management functions. Companies in the Southeast are currently quite evenly spread across these areas.[113] In addition, the region can draw on high-quality universities, and engineering and manufacturing talent, including in related renewable energy and electric vehicle fields and adoption.[114]

According to the same Duke University report, smart-grid expansion promises the opportunity for expansion and diversification of existing U.S. companies, as well as for export growth. The study predicts future job growth in smart-grid-related information technology innovation in product and systems development and

engineering, as well as innovative hardware manufacturing.[115] While the region will have to compete with other regions of our nation and with countries worldwide to retain some of these jobs, smart-grid deployment also creates installation, operations, and services jobs that must be performed locally within local utilities' service territories. In addition, the greater the local market for smart-grid products and services, the greater likelihood that cutting-edge innovation and manufacturing will remain in the region.

Winning the transition

Even in the Southeast, outdated fossil-fuel-based power, particularly coal-based generation, is in decline. So too is hands-on maintenance of aging infrastructure as it necessarily gets upgraded. At the same time, the utility-sector workforce is aging dramatically, with 45 percent of electric-utility engineers eligible for retirement by 2014 and nearly 30 percent of the faculty in the programs that train them scheduled to retire.[116]

In the absence of aggressive adoption of the next generation of technology and energy services, this decline could result in significant job loss across the region, as retiring workers in older technologies are simply not replaced. With an ambitious and comprehensive efficiency and smart grid strategy, however, jobs can be replaced across a range of skill levels and fields, enabling the Southeast to position itself to lead both in local job creation and in a rapidly growing but competitive global industry.

The efficiency opportunity

The smart grid is critical to building a modern energy infrastructure that uses limited resources effectively to deliver clean, high quality, affordable, and reliable power to a growing country and economy. But it is not sufficient. Traditional energy efficiency measures that ensure that households, commercial buildings, and industry have the design, equipment, and practices to cut energy waste and cut cost are also essential. Efficiency improvements can provide results rapidly and spur jobs in mainstream manufacturing, construction, installation, and repair, which complement the mostly high-tech jobs in the emerging smart-grid sector. Together they provide a critical opportunity to capture jobs for the future in a transitioning industry and labor market.

But where the Southeast is an emerging leader in smart grid, it lags in traditional efficiency. The region relies more heavily on fossil fuels than the national average, uses more energy per capita, and lags in adoption of most energy efficiency policies. In addition, the region's population and energy use per capita is growing more rapidly than the nation as a whole.[117] In 2009 the Southeast used 20 percent more electricity per capita than the national average, and the larger 16-state southern Census region was on a trajectory to increase residential, commercial, and industrial energy consumption by 16 percent over 20 years.[118] But this position as a regional energy efficiency laggard also means the Southeast boasts disproportionate opportunity to become a leader. A 2009 McKinsey study found that 41 percent of the nation's cost-effective efficiency improvements could be found in the Southeast, Texas, and Oklahoma.[119]

The American Council on an Energy Efficiency Economy, a leading energy efficiency advocacy and research organization, found in its 2011 annual survey of state energy efficiency policies and actions that no southern state made it into the top 10, and that three of these states fell into the bottom 10.[120] Few southeastern states have Energy Efficiency Resource Standards requiring utilities to increase efficiency adoption, and many also lag in implementing other common efficiency policies.[121] But some progress has been made in recent years: Tennessee, Florida, and North Carolina were ranked by the American Council on an Energy Efficiency Economy near the middle of the pack nationally, making them potential leaders in the region. Alabama and Tennessee were cited by the council among the "most improved" states for their adoption of building codes. Tennessee was also cited for incentives for high efficiency vehicles.[122]

Tackling the efficiency challenge can bring major economic returns

In an in-depth study of efficiency opportunities across the 16-state southern Census region, Georgia Tech and Duke University modeled the impact of policies used in other states that showed the potential to cut overall energy use in homes, commercial buildings, and industries by 16 percent in 2030 relative to projections. Applied to these southern states, this would essentially keep energy use at current levels, even as the population and economy of the region grow.[123]

This increased efficiency would result in major economic benefits for the region. Consumers would save $41 billion annually in 2020 and $71 billion annually in 2030 on their energy bills, relative to business as usual.[124] These savings occur because

consumers use less energy and because lower demand necessitates fewer ratepayer-financed power plants be built. This in turn means 13 percent to 17 percent lower electricity rates relative to projections in 2030. The added efficiency also reduces carbon dioxide emissions and reduces water use for power plant cooling by 20 billion gallons in 2030, cutting projected growth in water use approximately in half.[125]

The Georgia Tech/Duke University report also estimates that the efficiency gains will further boost the region's economy by increasing employment by 380,000 jobs in 2020 and 520,000 jobs in 2030.[126] These jobs result both from direct investment in the retrofits, audits, plant upgrades, and equipment needed to achieve the efficiency reductions and from shifts in spending, as households and businesses save on energy and use those savings for other needs.

Estimated economic impact of energy efficiency in the South

Efficiency offers a significant opportunity to create jobs and major economic benefits across the 16-state south Census region

	Employment gains	Annual consumer savings
2020	380,000	$41 Billion
2030	520,000	$71 Billion

Source: Georgia Tech/Duke University

The economic benefits of energy efficiency are not only a general stimulus to the economy of the region, which lags behind the rest of the nation economically.[127] They also can help better position the region's energy and manufacturing infrastructure, supply chain, and skills base for the future. Moving beyond sole reliance on traditional baseload power plants that risk becoming redundant as the industry changes, these states can incubate a more diverse set of labor-intensive industries and jobs in efficient-product manufacturing and services.

The auditing, repair, installation, and maintenance that goes into upgrading the efficiency of homes, businesses, and industrial facilities must be performed locally to those facilities. Put simply, you can't export a building to China to have it retrofitted. The building and electrical materials and equipment associated with efficiency improvements are very likely to be "made in America," as well.[128] In general, both goods and services for end-use efficiency tend to be significantly more labor intensive and also more local than those associated with traditional baseload power plants.[129]

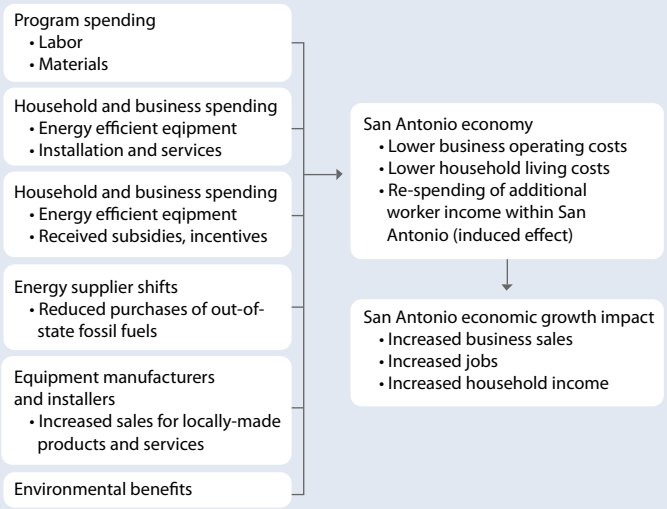
In addition to local job creation across a region with a disproportionate number of families living in poverty, efficiency programs can also help low-income residents in specific communities directly. Case in point: A 2009 report co-authored by the World Resources Institute and Southface Energy Institute highlights Virginia's creative use

San Antonio: Capturing the benefits of energy efficiency

For individual states or cities, the optimal mix of efficiency policies will vary depending on that area's current energy portfolio, housing stock, and industrial base. The opportunities to align that energy policy with local economic development strategies will vary, as well. An analysis done in 2005 for San Antonio (see below) provides a glimpse of how one municipal utility in neighboring Texas thought through the benefits of enhanced efficiency for its current and future economy.[130] San Antonio went on to implement robust energy efficiency measures and reap significant environmental and economic benefits as a result.[131]

Economic impacts of cost-effective energy efficiency

Energy efficiency programs' effect on San Antonio economy



Source: Economic Development Research Group

of the federal low-income housing tax credit to improve the energy efficiency of new low-income housing, cutting tenants' total monthly utility costs by 15 percent.[132]

Inspired by the potential to create jobs and boost consumer savings, states and communities across the Southeast are beginning to step up their energy efficiency efforts, some for the first time. Gov. Phil Bryant of Mississippi has made efficiency a priority of his new administration, and the state has just received a grant from the Department of Energy, matched with funds from the Tennessee Valley Authority, to enable its largest universities to cut energy consumption 20 percent by 2020—moves that the state hopes can spur energy reductions throughout the university system and state government.[133]

A number of the region's major utilities have also begun taking action on efficiency. The Tennessee Valley Authority—whose electric power serves not just Tennessee but significant parts of Mississippi, Alabama, Georgia, and Kentucky, as well—committed in 2008 to cutting peak demand by 4 percent by 2012 and Tennessee utilities reported at least twice the energy savings of most neighboring

states in 2009. In 2010 Arkansas was the first southeastern state to set an energy efficiency resource standard, and North Carolina also sets energy savings targets as part of the state's renewable energy and energy efficiency portfolio standard. Similarly, in the lead up to the merger of their parent companies, Duke Energy Carolinas and Progress Energy Carolinas committed to energy efficiency savings of 7 percent of retail sales between 2014 and 2018.[134]

Capturing the gains

Though critical first steps are being taken, challenges remain for the region to meet its efficiency potential. Approaches that help maximize economic and jobs benefits can help overcome political obstacles to policy change. New regulatory approaches can help reward rather than penalize utilities for enhanced efficiency that may reduce sales. Codes, incentives, and innovative financing mechanisms—such as on-bill financing, which allows consumers to pay back the cost of the initial energy retrofit through savings on their electric bills—can help persuade consumers to make efficiency investments. In addition, new benefits from the smart grid for utilities and consumers can help make efficiency improvements attractive in ways beyond the cost savings that have driven them so far.

Indeed, a few key actions can move the region forward in both traditional and next-generation efficiency and grid modernization. First, transforming infrastructure is hugely job creating but takes time and money. Clear state and federal policy frameworks—particularly those that set long-term efficiency and renewable energy goals—are critical to provide local demand and investment certainty for utilities, municipalities, and supply-chain manufacturers in emerging fields.

Second, major utilities in the Southeast are central and critical players in rapid efficiency and smart-grid deployment and have an opportunity to lead nationally. Whether looking at traditional efficiency or smart-grid implementation, there are opportunities to scale up from existing successes—whether that's learning from municipal utilities such as Austin Energy or from the Department of Energy Smart Grid pilots, extending the Tennessee Valley Authority's efforts to neighboring utilities or Duke Energy's smart grid and efficiency engagement across its new and even larger footprint. Mechanisms that better align utilities' business models, profitability, and the regulatory framework that supports it with objectives other than increasing the quantity of power sold—e.g., with efficiency—are particularly important.

Finally, innovation, implementation, and economic development are mutually reinforcing. Whether through state and federal policy or other, more local mixes of energy and economic development actions, the region must commit not just to policy pilots or technology innovation but also to large-scale implementation of efficiency and smart grid in the region. In a competitive global industry, we cannot rely on domestic innovation translating into domestic job creation throughout the supply chain unless we have a robust market at home. It is becoming increasingly clear that high-tech, high-value-added manufacturing drives robust innovation, research, and development as much as the reverse. Latecomers will still be able to capture the efficiency benefits of a new generation of energy technology and the jobs operating that technology—but will have access to far less of the very significant design, engineering, and manufacturing for a growing global market.

States, communities, companies, and utilities are innovating in the Southeast. A more concerted, coordinated effort to modernize and transform the electric sector through smart grid and efficiency has the potential to bring far cleaner energy to the region, as well as new jobs and much-needed economic revitalization. In addition, connecting energy innovation with other emerging sectors such as next generation vehicles, energy storage, consumer electronics, and information technology presents the opportunity for long-term economic growth and diversification. Basic efficiency gets waste out of our economy and puts money back in people's pockets today, while smart grid innovation adds high quality jobs, global competitiveness, and improved quality of life for the future.

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