JUNE 2020

STATE + LOCAL DECARBONIZATION POLICIES FOR THE SOUTH

Report by Mark Paul, PhD + Leah Stokes, PhD

SOUTHERN ECONOMIC ADVANCEMENT PROJECT

ABOUT THE SOUTHERN ECONOMIC ADVANCEMENT PROJECT (SEAP)

SEAP is your partner and resource. We amplify the efforts of existing organizations and networks that work towards broadening economic power and building a more equitable future.

Broadening economic power brings attention to how race, class, and gender intersect social and economic policy in the South. We explore policy ideas designed to directly address these connections. SEAP focuses on 12 Southern states and marginalized/vulnerable populations within the region and is a fiscally sponsored project of the Roosevelt Institute.

SEAP

Executive Summary

Communities in the South are coming to terms with their new reality: life in the era of climate change. The region is highly exposed to climate change impacts given its extreme vulnerabilty to increased temperatures and rising sea levels, low levels of climate mitigation and adaptation to date, and high level of inequality (GCRP, 2018; Muro et al., 2019). A recent study showed that as global warming intensifies, economic losses will disproportionately affect the South (Hsiang et al., 2017).

While some warming and sea level rise are already locked in, bold action on climate mitigation and adaptation policy now can wean the region off fossil fuels, leading to a healthier, safer, and more resilient South.

The poverty crisis in the South will continue to be amplified by climate change, making it that much more important for the region to act. High levels of poverty and inequality are associated with energy insecurity, increased vulnerability during extreme weather events, and higher levels of pollution. Considerable attention in this report is focused on how to tackle the climate crisis while easing the energy burden for the most vulnerable households.

The South has the opportunity for climate leadership and the economic prosperity it brings. This report equips state and local policymakers, as well as other stakeholders, with actionable policies that reduce emissions, promote employment and economic growth, and provide broad-based health benefits by eliminating deadly co-pollutants. Reducing greenhouse gas emissions will be no small feat. Yet, it is achievable. The South is poised to make up for lost time by passing bold climate policy to protect the environment and propel the economy forward.

To address the climate crisis and make tangible emissions reductions, we recommend the following policies to sectors of the economy be implemented:

Electricity Sector Policy:

• Enact ***Renewable Portfolio Standards and Clean Electricity Standards*** that set annual benchmarks for the production of clean or renewable electricity state-wide. Reduce the financial burden associated with deep decarbonization by implementing ***Policies for Stranded Costs***, such as power plant debt refinancing mechanisms and funds for workers affected by power plant shutdowns.

• Adopt ***Distributed Generation Policies, such as net metering***, that reduce regulatory barriers and provide incentives to increase deployment of distributed energy resources and technologies such as photovoltaic solar arrays and battery storage.

Building Sector Policy:

• Get a head start on deep decarbonization by reducing total energy consumption of residential and commercial buildings via ***Energy Efficiency Investments***, including passing an ***Energy Efficiency Resource Standard.***

• Reduce in-home reliance on polluting fuels by funding ***Building Electrification*** programs that target home appliances and heating/cooling systems.

• Strengthen ***Building Codes and Zoning*** requirements for new construction that expand energy efficiency requirements and target urban sprawl.

Transportation Sector Policy:

• Enact ***Electric Vehicle (EV) Policies*** to provide market-based incentives that reduce consumer barriers to EVs and support producers, in tandem with policies that build out city-level EV infrastructure.

• Electrify and expand bus and light rail transit systems through ***Public Transit Investments*** to reduce automobile traffic and provide reliable transportation services to residents.

• Prioritize the needs of pedestrians and bicyclists by centering ***Walk and Bike Mobility*** goals in urban planning policy.

Carbon Pricing:

• Hold polluters accountable for carbon emissions by setting a ***Carbon Price*** and directing subsequent revenue to carbon dividends, renewable energy, and community equity investments.

Agricultural and Oceans Policy:

• Decarbonize the ***Agriculture*** sector by providing financial and technical support to farmers engaged in regenerative agriculture practices that sequester carbon in soil and protect rural lands.

• Expand publicly owned ***Forests and Wildlands*** to conserve native biodiversity and maintain carbon sinks.

• Enact and enforce regulation of ***Coastal Ecosystems*** to protect the ocean's natural ability to store carbon long-term.

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Introduction

Climate change is the greatest problem of the 21st century. It is a problem not for future generations, but for today. We have already warmed the planet by 1 °C. According to the Intergovernmental Panel on Climate Change, the global community has just ten years to cut emissions by about half and thirty years to reach carbon neutral to have a reasonable chance at limiting warming to 1.5 °C (IPCC, 2018). Even with the dire need for immediate action to reduce greenhouse gas emissions to protect the economy, public health, and the planet, the federal government has failed to take decisive action. Even more troubling, the Trump administration has weakened or repealed climate regulations at least 130 times since taking office (Sabin Center, 2020). This regulatory rollback is occurring even though the vast majority of Americans support government action to address climate change, including the majority of young Republicans (YPCCC, 2019; Pew, 2019).

Across the country, climate impacts are already present. From the deadly wildfires in California to the rapidly disappearing lands of Louisiana, communities are just starting to come to terms with their new reality: life in the era of climate change. More recently, Southern states experienced more than 120 tornadoes on Easter Sunday April 12 and April 13, 2020 (NWS, 2020). According to the Fourth National Climate Assessment, as the planet continues to warm, sea level rise will put tens of millions of Americans at risk (GCRP, 2018). These damages will be concentrated in the South, which is particularly vulnerable due to geographical disadvantages and high levels of economic insecurity, which put the population at undue risk.

As the federal government rolls back life-saving climate policies, many state and local governments have taken action to mitigate climate change and adapt to its impacts. While numerous states have begun to implement meaningful policy, Southern states have lagged behind the rest of the nation. For example, nearly thirty states across the country have adopted Renewable Portfolio Standards (RPS) or Clean Electricity Standards (CES), both policies that set deadlines for clean energy production. Yet, only one state in the South, North Carolina, has

adopted a RPS (NCSL, 2019). Yet, other states, including Texas, Iowa, and South Dakota, have chosen to embrace these climate measures, and have seen a boom in renewables and jobs as a result. While some states in the Southeast do gain tax revenue and jobs from the current fossil fuel economy, a managed transition to renewables can ensure a just transition for the workers, and a sufficiently strong economy to maintain, and likely strengthen, the economic position of state governments (Morris, 2016).[1] There will be challenges in this transition. Currently fossil fuels generate significant tax revenues in many Southern states. For example, severance taxes from fossil fuels can be as much as 10% of a state's total tax revenue in Louisiana, West Virginia and Texas (Morris, 2016). However, in states where government policy has helped propel renewable energy investments, local tax revenue has grown from these sources. In 2019, Kansas received $29 million in local tax payments from wind projects alone (AWEA, 2019). As states invest in clean energy, it can provide new tax revenue.

The South has untapped potential for economic growth and climate leadership. What policies could states adopt to meet these goals? This report aims to inform state and local policymakers, as well as other stakeholders, about policies the Southern states could adopt to decarbonize and create well paying jobs.

The policies we cover aim to reduce emissions, promote employment and economic growth, and provide broad-based health benefits by eliminating deadly co-pollutants. While decarbonizing is front and center, equity is also incorporated throughout; as a more resilient South means not only addressing the climate crisis, but confronting the economic insecurity crisis simultaneously.

The first section of the report provides a brief overview of the current state of climate policy in the Southern states. Section 2 outlines policies that could be adopted at the state and local level to drive climate action. Section 3, which makes up the bulk of the report, provides significant detail on these policies, including examples from the South and other states across the country. We conclude with Section 4, which contains a list of resources for further reading and research on these topics.

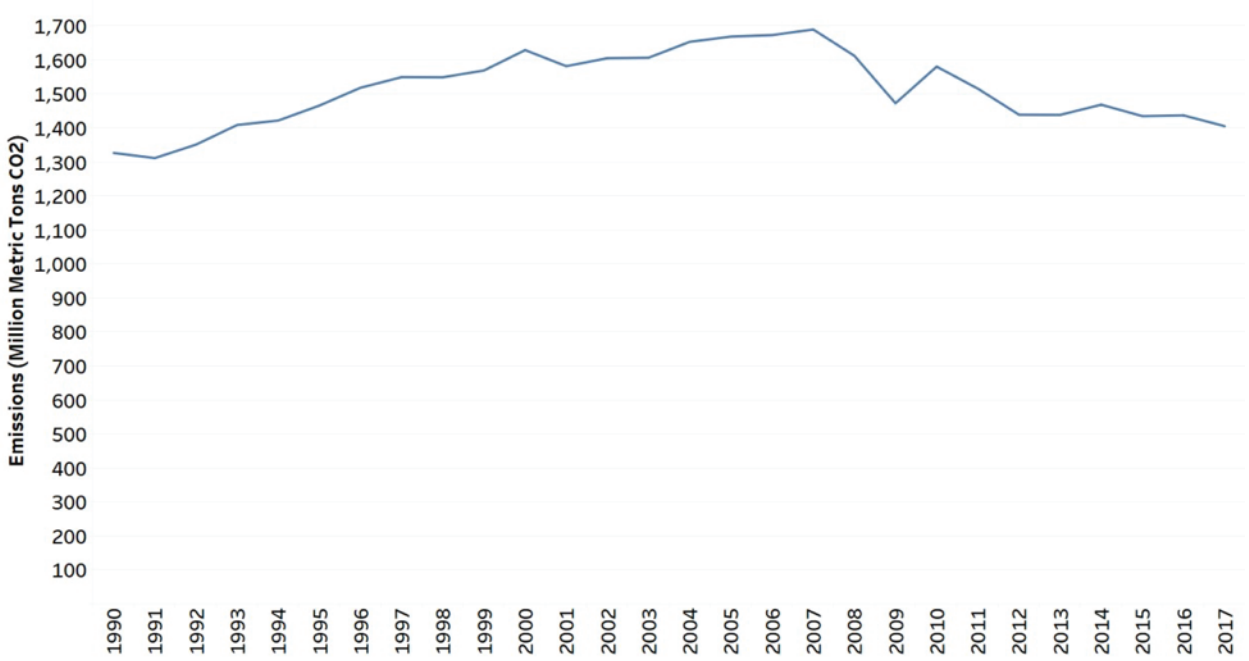
[1] For example, Texas already has more wind jobs than the entire fossil fuel sector in either LA or WV (USEER 2020).

Section 1:
The State of Climate Policy in the Southern States

The South is at a crossroads. The region is highly exposed to climate change impacts given its high level of inequality, extreme vulnerability to increased temperatures and rising sea levels, and low levels of climate mitigation and adaptation to date (GCRP, 2018; Muro et al., 2019). Compared to the rest of the country, the South is going to face significantly worse than average climate impacts. A recent study showed that high levels of global warming will concentrate the highest economic losses in the country in the South (Hsiang et al., 2017). While some warming and sea level rise are already locked in, climate policy can wean the region off fossil fuels, leading to a healthier, safer, and more resilient South.

Currently, the South is heavily reliant on fossil fuels. While carbon emissions have fallen slightly from their peak in 2007, they remain stubbornly high (Figure 1). Energy usage in the South is also quite high. In fact, Louisiana tops the charts nationally for energy consumption per capita (EIA, 2017).

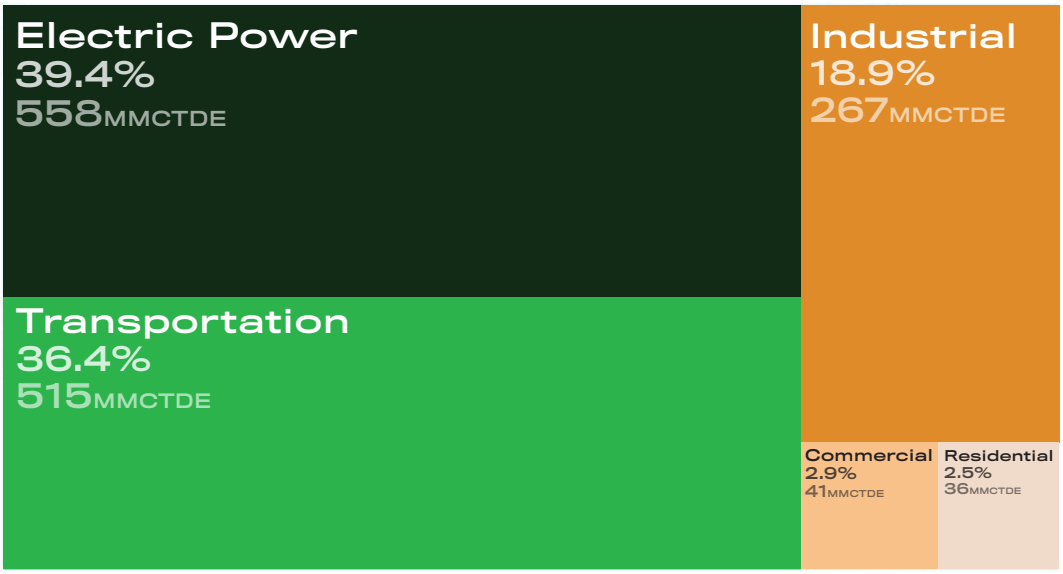
Figure 1: Annual U.S. CO_2 Emissions from Fossil Fuel Combustion, 1990–2017



Source: EPA https://www.epa.gov/sites/production/files/2019-11/documents/co2ffc_2017.pdf

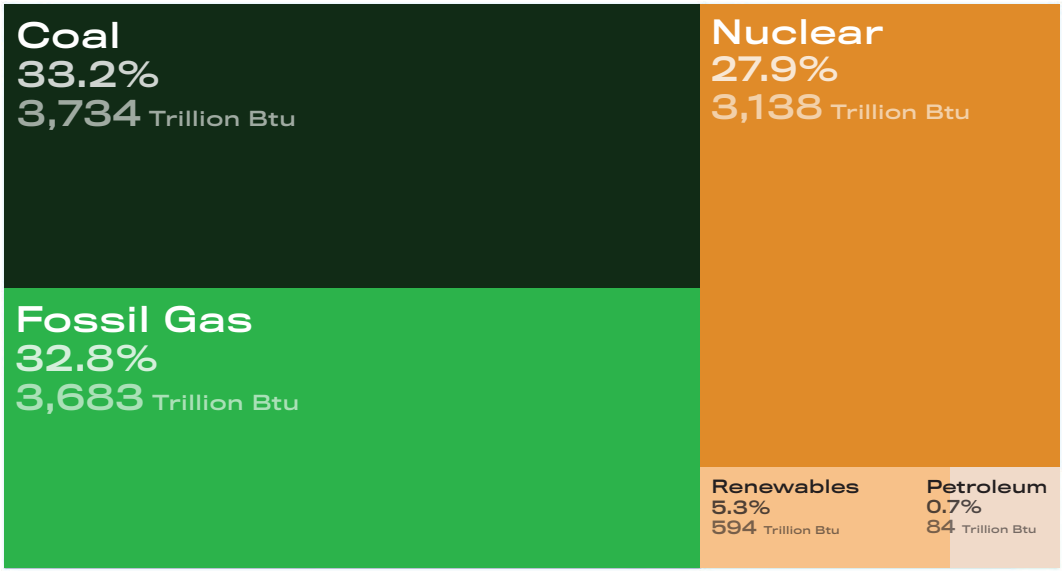
To understand the South's carbon emissions, we can look at emissions by sector (Figure 2). Electricity generation is responsible for almost 40% of the region's emissions, followed closely by the transportation sector at 36%. While the residential and commercial sectors appear to be small sources, that's not the whole story. The figure below only identifies direct emissions through on-site combustion of fossil fuels in buildings, for example gas stoves and water heaters. Emissions associated with electricity consumed by buildings are counted in the electricity sector in the graphic below. Thus, the building sector has a much larger carbon footprint than this figure suggests. This figure also excludes agricultural emissions, which nationally account for around 9% of total emissions; thus, this is a sector that also warrants significant policy attention (EPA, 2019).

Figure 2: South Green House Gas Emissions by Sector, 2017



Source: EIA https://www.eia.gov/environment/emissions/state/

Figure 3: Electric Power Generation Mix, South States, 2017

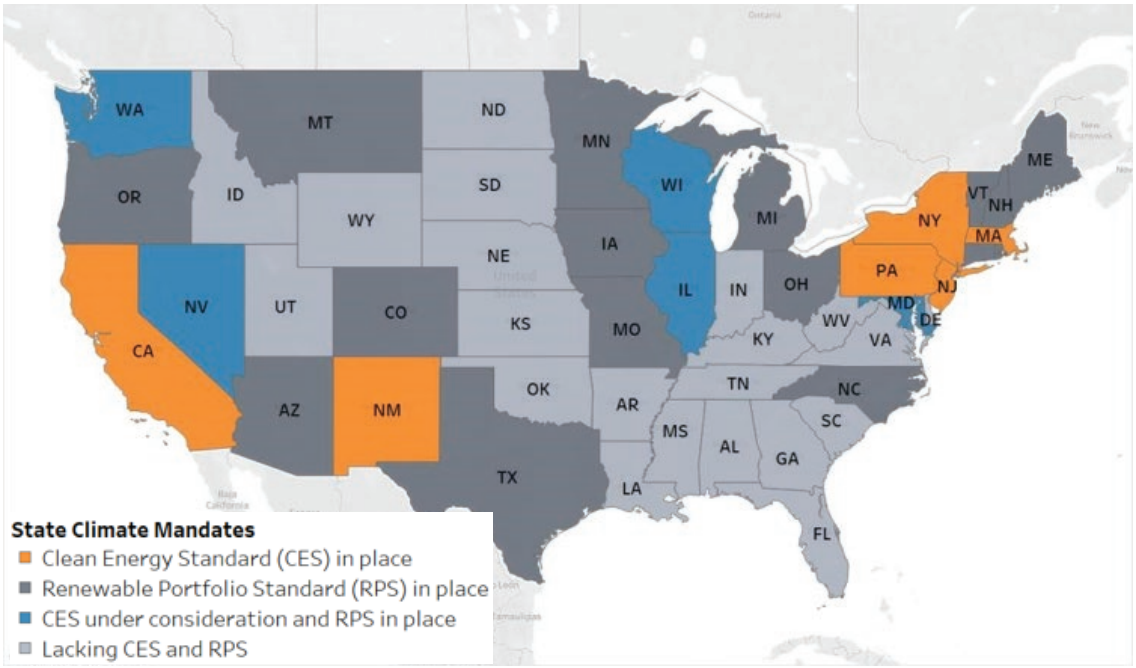


Source: EIA https://www.eia.gov/state/seds/data.php?incfile=/state/seds/sep_sum/html/sum_btu_eu.html&sid=US

The poverty crisis in the South will make addressing climate change more challenging – and even more vital. High levels of poverty and inequality are associated with energy insecurity, increased vulnerability during extreme weather events, and higher levels of pollution. Four of the five states with the highest rates of poverty are located in the South (Semega et al., 2019). Low incomes in the region result in high levels of 'energy burden': households spending more than 6% of their income on energy. All five states with the highest percentage of households that are energy burdened – Alabama, Arkansas, Georgia, Mississippi, and South Carolina – are located in the South (DOE, 2018). Across the South, nearly two-thirds of all electric power generated comes from expensive coal and fossil gas power plants (Figure 3). We focus considerable attention in this report on how to tackle the climate crisis while easing the energy burden for the most vulnerable households.

While the South has passed some limited policy measures to reduce fossil fuel use, other regions have been more active in adopting policy to transition away from fossil fuels. Take clean energy standards and renewable portfolio standards as an example. The majority of states in the U.S. have now adopted one of these measures to ensure that clean and renewable electricity provide a growing share of the electricity system (Figure 4). Additionally, nine states, along with over 200 cities and counties, have committed to 100% clean and renewable electricity. Today, more than one-third of Americans live in a region that has committed to, or achieved, 100% clean electricity (LCI, 2019). Unfortunately, very few parts of the South have made these goals.

Figure 4: Clean Energy Policies Across the Country



Source: The Breakthrough Institute

Reducing carbon emissions will be no small feat. Yet, it is achievable. To address the climate crisis and make tangible emissions reductions requires policymakers to develop and implement measures in each sector of the economy. This can also create thousands of new in-state jobs and dramatically reduce air pollution. The South is poised to make up for lost time by passing bold climate policy.

A row of solar panels is installed at Silicon Ranch's latest project outside Blakely, Ga. This 102.5-megawatt power plant will generate electricity for Facebook's new data center in Newton County, Ga., 200 miles away. *Source: Johnathon Kelso for NPR*

Section 2: Overview of Policies to Drive Climate Action in the Southern States

Electricity Sector Policy:

- Enact ***Renewable Portfolio Standards and Clean Electricity Standards*** that set annual benchmarks for the production of clean or renewable electricity state-wide.
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Siesta Key Beach – Sarasota, Florida.

Section 3: Policies to Drive Climate Action in the Southern States

3.1 Electricity Sector Policy

Absent sufficient federal action to promote clean energy, states have been central to cleaning up the electricity sector. State level renewable energy targets have driven large amounts of clean energy adoption across the country. Unfortunately, states in the South have not yet adopted these laws. To increase the rate that coal and natural gas plants retire, states can also adopt policies for "stranded costs." This approach allows debt to be refinanced, to reduce the costs associated with retiring these plants. Additionally, Southern states may seek to reform utility regulation, to prioritize renewables and bring down costs. We encourage Southern policymakers to take the following bold steps to decarbonize the electricity sector quickly and equitably.

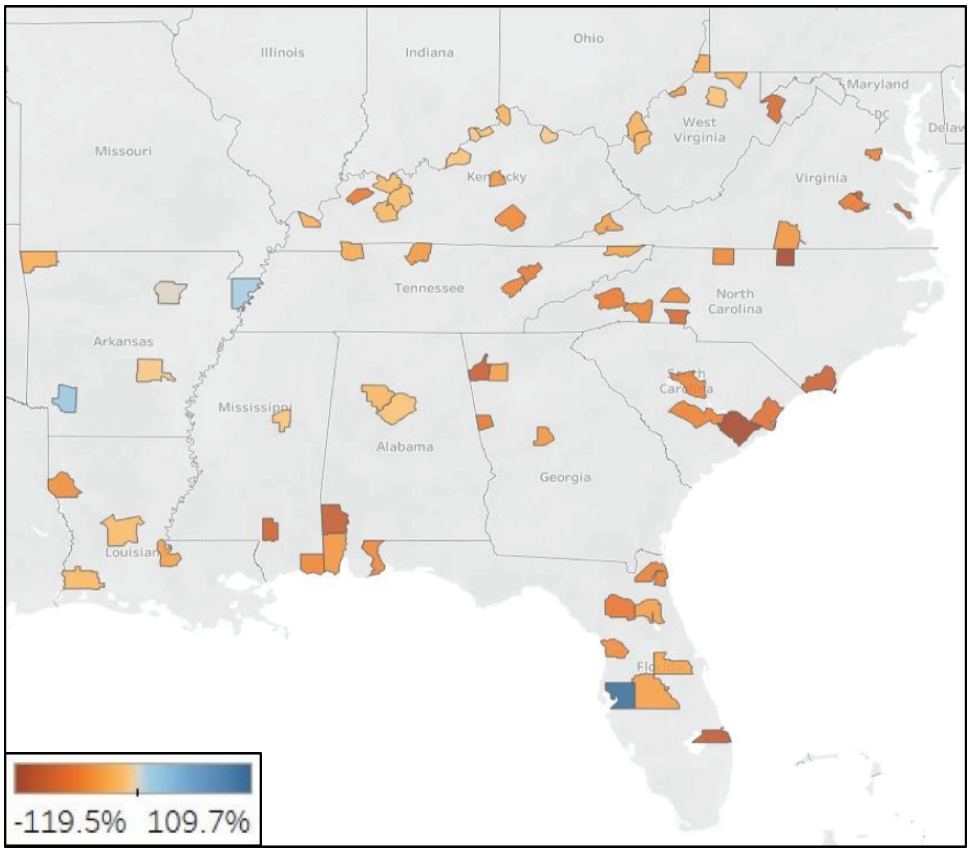
3.1.1 Renewable Portfolio Standards and Clean Electricity Standards

Renewable Portfolio Standards (RPS) and Clean Electricity Standards (CES) are among the most successful policies that states have used to decarbonize the electricity sector. These laws set annual benchmarks for the percentage of the state's electricity to be derived from eligible sources. While RPS policies usually allow wind and solar to count, CES policies also count nuclear, since it does not emit carbon. These laws have been crucial to driving progress. Since 2000, nearly half of all renewable energy generation growth in the U.S. can be attributed to state renewable energy requirements (Barbose, 2019). Unfortunately, states across the South have not adopted these policies, and as a result, they are falling behind on clean energy.

State RPS policies vary in terms of eligible resources and requirements. As of 2019, 29 states, Washington, D.C., and three territories have adopted an RPS (NCSL, 2019). Nine strong leaders have passed legislation that sets 100% clean energy targets (CAP, 2019). Other states have not passed an RPS policy or clean energy requirement of any kind. Of these 13 states without RPS or clean energy targets, nine of them are in the South. However, South Carolina, North Carolina, and Virginia have been successful in passing renewable energy legislation. Similarly, Texas established its law in 1999, and has achieved its goals (NCSL, 2019).

• Pass clean energy targets: Since most states in the South lack any clean energy target, passing this policy would be a great first step. States could target 50% clean electricity by 2030, and 100% by 2045.

Figure 5: Local Renewables Cost Compared to Running Existing Coal-Fired Power Plants, 2025



Source: Energy Innovation 2019.

Securitization is one policy that is being used by more and more states. Similar to refinancing a mortgage on a home, securitization enables utilities to refinance the debt on their coal and natural gas plants at a lower interest rate. Lowering costs is beneficial to all parties. With securitization, the debt can be repaid through government-backed bonds (Richardson, 2019). This policy is currently available in 24 states, including Mississippi and Louisiana in the South.

Closing fossil fuel infrastructure does not just affect the workers at a given plant. It also affects the regional economy. As a result, many stakeholders will need to be involved in shutting down these plants. Policy can be designed to ensure that both workers and communities are supported during the transition away from fossil plants. For example, in 2019, New Mexico passed a law to not only increase their RPS to achieve 100% clean energy by 2045, but also allocate $40 million in transition assistance for the community

where a coal plant would close (Long, 2019). Though it has yet to be used, Colorado passed similar legislation in 2019, which sets aside 15% of the savings from the securitization program to benefit workers and communities affected by coal plant closures (Marcacci, 2019).

In the South, Entergy Louisiana was able to sell $1.65 million in bonds to support the shutdown of their coal-fired plants in the state. In Florida, Duke Energy used $1.3 billion in securitized bonds to begin the decommissioning process for their Crystal River Nuclear Plant (Duke Energy, 2019). This bond-issued cost recovery helps to significantly reduce the consumer burden associated with shutting down plants.

- Begin planning to shut down coal plants: Given the large number of coal plants across the South, which are more expensive to continue operating than new clean alternatives, the region must start planning for their retirement. Shutting these plants down will have dramatic benefits for public health by reducing air pollution. It will also reduce carbon emissions from the electricity sector. One option to reduce the costs of early coal plant retirements when these plants have outstanding debt is securitization.

3.1.3 Distributed Generation Policy

Decarbonizing and modernizing the electricity grid requires the introduction of distributed energy resources as well as regulatory reform. Distributed generation refers to electricity that is produced near where it is consumed. Technologies like solar photovoltaic (PV), micro wind turbines and battery storage enable this approach (EPA, 2018). State governments can utilize distributed generation policy to increase renewable energy deployment on the grid, create local jobs in technology manufacturing and reduce the grid's energy losses. By incentivizing private actors to change their behavior and invest in their own on-site renewable technologies and storage, customers will experience increased energy independence.

One of the longest standing distributed generation policies is net energy metering (NEM), which makes on-site solar a financially-viable option for electricity customers. Net metering allows residential and commercial customers to sell their excess electricity to a utility and receive credit on their utility bill (NCSL, 2017). Customers receive dual benefits: reduced electricity bills and the ability to generate their own clean energy "behind the meter." The approach also helps support clean energy deployment without requiring a direct financial outlay by the state. As of 2020, 38 states have net metering options, but many states in the Southern region still lack this policy (SEIA, 2020).

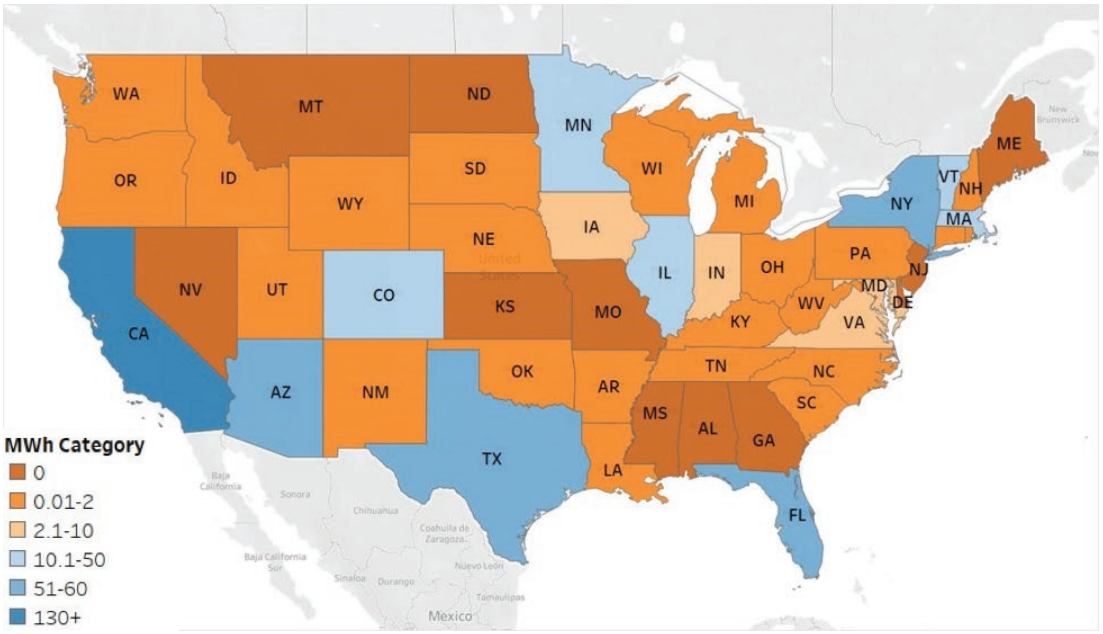
Currently, this policy is undergoing changes in many states. For example, California has recently transitioned to net metering 2.0. This policy introduced time-of-use (TOU) rates for all new solar customers, charging customers based on the length of time they used electricity as opposed to on a volumetric basis (Trabish, 2018). California, which has the largest solar market in the country with over 25,000 MW installed, recently recorded its 1 millionth installation, with solar power generating 20% of total state electricity (SEIA, 2019a).

As costs of solar decline and demand grows, California's distributed generation policy success should inspire similar legislation in Southern states. Kentucky and Louisiana, for instance, generate less than 1% of their electricity mix from solar (SEIA, 2019b). However, recent distributed generation and solar policies in the region should encourage optimism. South Carolina passed a comprehensive clean energy law, the Energy Freedom Act, last year. The law lifts the state's 2% cap on net metering, streamlines the contract process for small power producers, bolsters utility customer rights, and requires utilities to submit Integrated Resource Plans at least once every three years (Roselund, 2019). In 2018, Virginia passed the Grid Transformation and Security Act which requires the state's largest IOU, Dominion Energy, to have 3,000 MW of solar and wind in operation or under development by 2022 (Dominion Energy Virginia, 2018).

To design climate-resilient clean energy grids, improved battery storage will be needed to combat the intermittency and reliability constraints of renewable energy technologies. With the cost of lithium-ion batteries down by nearly 73% since 2013, it is no surprise that energy storage deployment grew by 500% in the residential sector in 2018 alone (Figure 6). In the same year, over 750 MWh of storage was brought online across all sectors (SEPA, 2019).

As of 2018, five state legislatures have established energy storage targets, which incentivize the development and deployment of battery storage (NCSL, 2018). One of the oldest battery incentive programs in the U.S. is California's Self-Generation Incentive Program (SGIP). Updated in 2018, the program will spend roughly $166 million per year, for the next five years, in incentives for qualifying behind-the-meter technologies (CPUC, 2020). Beyond traditional lithium-ion battery energy storage systems, the program supports fuel cells, small wind turbines, and combined heat and power generators.

Figure 6: Annual Energy Storage Deployment (MWh), 2018



Utility Energy Storage Market Snapshot 2019

Source: Smart Electric Power Alliance (SEPA).

Though few Southern states have set explicit distributed generation and energy storage targets to date, the following policy actions are key to decarbonizing this sector:

- ***Adopt distributed generation policies:*** To decarbonize the grid, reduce transmission and distribution challenges and reach state energy goals with "behind the meter" and "one-site" technologies such as small-scale wind turbines and solar panels. By introducing economic incentives and rebates, reducing market barriers and introducing favorable legislation, electricity utilities and ratepayers can deploy more distributed generation technologies to increase consumer energy independence and reduce grid strain.
- ***Enact net energy metering (NEM) legislation:*** Encourage solar deployment through grid compensation programs that allow commercial and residential customers to receive credit for their excess energy production.
- ***Implement battery storage incentives and targets:*** Set utility and consumer wide battery storage deployment goals, and create incentive programs that help offset the initial high capital cost of installation and meet statewide targets.

3.2 Building Sector Policy

The building sector is currently one of the largest sources of carbon pollution in the United States. Together, the estimated 118 million residential and 5.6 million commercial buildings across the country account for 40 percent of total energy use and 29 percent of total GHG emissions in the U.S. (Leung, 2018; EIA, 2016; EIA, 2019). Decarbonizing

the building sector will be a sizable undertaking. However, it is also an important opportunity for job creation, cost savings, health improvements, improved grid resiliency, and increased comfort for residents.

Decarbonizing the building sector requires two key outcomes: buildings must be fully electrified so they can run off clean electricity; and buildings must undergo energy efficiency retrofits to run on less electricity. Together, these steps can help reduce both direct emissions — emissions due to on-site combustion of fossil fuels (e.g. gas stove or water heater) — and indirect emissions from electricity consumption.

3.2.1 Energy Efficiency Investments

Energy efficiency (EE) allows the same service to be delivered with less energy. Take the light bulb as an example: most people grew up with incandescent bulbs, but modern compact fluorescent lamps (CFLs) and light emitting diodes (LEDs) tend to use 25-80% less energy and last up to 25 times longer. Energy efficiency retrofits for buildings, including upgrading insulation, windows, lighting, and appliances, is critical to reducing electricity demand. These investments also have the added benefit of saving consumers money.

When policies to promote energy efficiency are well designed, they can create a win-win-win: promoting cost savings for households and businesses, reducing GHG emissions and harmful co-pollutants, and creating local jobs (Bouton et al., 2010). Savings from modest sized investments in energy efficiency can be substantial. For instance, a 2014 study found that an investment of $2,500 in energy-efficiency retrofits for dwellings can reduce energy consumption by an average of 30 percent, providing enduring benefits for the climate and those paying the utility bills. They also found that building retrofits are labor intensive, which means local job creation. For each million dollars spent on energy efficiency an estimated seven direct jobs and five indirect jobs are created (Pollin et al., 2014). However, high up-front costs and imperfect information regarding long-term savings are significant challenges to improving energy efficiency in residential and commercial buildings. To overcome these roadblocks, public policies are necessary.

According to a report by the American Council for an Energy-Efficient Economy (ACEEE), the South ranks last in the country for energy efficiency (ACEEE, 2019c). Of the U.S. states that do not have EERS standards, approximately 50% are located in the

South (C2ES, 2020). The South should adopt an EERS which mandates electric and natural gas utilities to implement energy efficiency programs that achieve an annual savings of 2% in electricity and natural gas. This annual goal will be cumulative and should be applied at least through 2035.

Kentucky stands out as a state with numerous programs to promote energy efficiency. They have a sales tax exemption for energy efficient products as well as numerous residential rebate programs that local utilities run. These often entail cash incentives for energy efficiency upgrades such as building insulation, AC improvements, electric water heaters and lighting upgrades (DSIRE, 2019). Similarly, Alabama offers an energy efficiency loan program called AlabamaSAVES. The program is designed to finance non-profit, industrial and commercial business' projects including upgrades to refrigeration equipment, lighting, doors and windows (DSIRE, 2017).

At the local level, a number of cities across the South have participated in the Department of Energy's Better Buildings Challenge, which requires a commitment to improving the energy efficiency of local buildings by at least 20% over a decade. Atlanta has been a regional leader in this program, meeting its 20% energy reduction goal two years early for 450 buildings, spanning 114 million square feet. This work has created over 650 jobs, added an estimated $52 million to the regional economy, and saved the carbon emissions equivalent of removing half a million cars from the road for a year (ABCC, 2019; DOE, n.d.). Other Southern participants in the program include Chattanooga, TN; West Palm Beach, FL; Roanoke, VA; and Bullitt County Public Schools, KY.

Southern leaders should not only serve as examples for model policies to be implemented in neighboring states, but should also serve as validation for the region's growing potential. According to National Renewable Energy Laboratory's (NREL) State Residential Energy Efficiency Potential map, the Southern states can save 23-31% of single-family homes' energy use through cost effective residential energy efficiency programs. Single-family homes in states such as Alabama, South Carolina and West Virginia have the potential to save 28% of their current energy use through energy efficiency improvements. These improvements would reduce air pollution and create thousands of jobs in the South. For example, North Carolina had over 80,000 jobs in energy efficiency in 2016. And if the state lived up to its full potential in energy efficiency, residents could save an estimated $2.1 billion a year through lower bills — that's $754 in savings per household per year (NREL, 2017).

Across the South, energy efficiency programs will help people save money, clean up the air and create jobs. They would also dramatically reduce carbon emissions. These policies are excellent first actions for states to take.

- ***Adopt an EERS policy:*** To require energy efficiency to grow by 2% of annual electricity and natural gas sales. This goal can be cumulative and applied at least through 2035.
- ***Incentivize residential energy efficiency:*** Offer rebate programs or sales tax exemption for Energy-Star certified lighting and appliances to encourage residential and commercial upgrades.
- ***Make available financial assistance:*** for more expensive energy efficiency upgrades. This may include residential heating and cooling system upgrades, solar installation, and building insulation retrofits.
- ***Make available an energy assessment program:*** for residents and businesses to identify areas of energy efficiency improvement. A free to low-cost assessment may be carried out with an in person energy efficiency specialist to maximize energy savings recommendations.

3.2.2 Building Electrification

To further reduce emissions from buildings, policymakers also have to help drive building electrification. Thanks to recent advances in technology, the electrification of buildings is a cost-effective strategy to reduce emissions and indoor air pollution. A number of states and localities across the country have begun committing to the electrification of buildings through a number of policies. As of 2019, 25% of homes nationwide were all electric. This is especially the case in the Southeastern states of the U.S. where 45% of homes are using only electricity. As of 2015 the Southeastern region had nearly 20 million homes electrified compared to just over one million in the Northeast (EIA, 2019). Importantly, electrifying buildings offers a way to bring benefits for both electric utilities and consumers — including cost savings, improved grid management, and reduced emissions. The political viability of electrification is improved since it increases demand for electricity, which electric utilities favor. In this section, we focus on measures to electrify existing buildings. In the next section, we cover building codes which are also essential to electrifying new buildings.

A number of new technologies now exist to help drive building electrification. Induction stoves, which are far superior for cooking to traditional electric stoves, are just recently becoming widely available as prices drop rapidly. Other examples include heat pumps, which can heat and cool buildings more efficiently and without fossil gas. A variety of

policies from city and state governments can be deployed to overcome information and finance barriers to electrification:

- ***Direct customer incentives:*** Governments can offer financial incentives such as rebates and sales tax breaks for the electrification of appliances, including heat pumps, cook stoves, and water heaters to lower the upfront costs of electrification. The Mass Save program in Massachusetts offers an excellent example. Currently, they offer rebates and incentives for homeowners, renters, landlords, and businesses for a variety of electrification measures, including up to $1,250 per ton on electric heating and cooling, up to $700 on electric heat pump water heaters, and $50 on ENERGY STAR® electric clothes dryer.
- ***Electrification finance:*** While electrification is often cost-competitive over the long-run, it can have higher up-front costs than fossil gas. To overcome these barriers, state and local governments should implement financing options for residential and commercial properties.
  - ***Property assessed clean energy (PACE) financing:*** PACE financing is a way to assist homeowners and businesses with the upfront costs associated with electrification, energy efficiency upgrades, and renewable energy installation. PACE financing allows projects to be paid back over a 5-25 year time horizon by incorporating the payment into the property taxes associated with the building. Kentucky and Florida already offer PACE financing, but it could be expanded to all other Southern states. PACE financing is not subsidized. This may be attractive to states, but subsidized financing options would speed building electrification and improve affordability for low-income consumers.[2]
  - ***Subsidized loans:*** A number of states currently offer subsidized loans to assist residential and commercial property owners with electrification. The HEAT loan, offered by MASS Save in MA provides 7-year 0% interest loans up to $25,000 for residential and $100,000 for commercial buildings for approved energy efficiency upgrades. The initial loan is provided by local banks and credit unions at roughly 5% interest. This interest is then bought down to 0% by utilities, thereby subsidizing the investment for home and business owners (MDOER, 2014).
  - ***State and local green banks:*** Green banks can help leverage low-cost capital, including private capital, to fund clean and renewable energy projects. Challenges in deployment usually arise due to the fact that clean and renewable options often have higher upfront, or fixed costs, but lower operating costs. Thus, it takes time to recoup the initial investment. Green banks have already been developed in several places across the United States, including Connecticut, New York, Rhode Island, California,

[2] For more on PACE financing, see: https://www.energy.gov/eere/slsc/property-assessed-clean-energy-programs

Hawaii, and Montgomery County, Maryland. Green banks can offer a variety of products, including assistance for residential and commercial building owners to decarbonize infrastructure.[3]

- ***Education, and outreach programs:*** In existing buildings, worn out appliances tend to be replaced by units using the same fuel, often fossil fuels (Hopkins et al., 2017). Outreach programs can help turn the tide towards electrification. For example, states could set up user-friendly websites for cost-comparisons and savings calculators to heat pump installer guides (Rhode Island Public Utilities Commission, 2017). Programs like Mass Save in Massachusetts provide an excellent example of what awareness and outreach programs could look like. They provide online no-cost assessment tools to help home and business owners develop an energy profit and assess electrification options (Mass Save, 2020).

3.2.3 Building Codes and Zoning

New buildings are going up across the South at an impressive pace. But how, and where, these new buildings are constructed will have enduring benefits or costs, for owners and occupants, the region, and the environment. While this growth means a stronger regional economy, scientists are warning that it could also mean devastation of natural ecosystems, including ecosystems vital to protect the region from a changing climate (Terando et al., 2014).

Building codes are key to reducing emissions and energy use. Asymmetric information and incomplete contracts are the norm in the sector, as developers and builders seek to minimize up-front construction costs rather than taking long-term operating costs into effect. Further, consumers and taxpayers tend to receive poor information about the long-term energy costs associated with a home or office space they are considering. This all leads to underinvestment in high-quality energy efficient buildings during construction (Gerarden et al., 2017). Addressing these market failures alone could improve efficiency in the residential building stock by up to 35% (Murtishaw and Sathaye, 2006; Gerarden et. al, 2015). The most straightforward policy measures to adopt are home energy assessments at time of sale, which can be used to develop a home energy rating or score, and energy-use disclosures. Such policies are increasingly being adopted to improve markets and support more efficient buildings, including in Austin, TX; Montgomery County, MD; Chicago, IL; Santa Fe, NM, and elsewhere (ACEEE, 2018).

[3] For more on green banks, see: https://www.energy.gov/eere/slsc/property-assessed-clean-energy-programs.

While electrifying and retrofitting existing buildings with energy efficiency upgrades is a good option for the current building stock, strengthening building codes for new construction is the only sure-fire way to decarbonize the sector in the long-run. Building codes can be used to set minimum energy efficiency standards for residential and commercial buildings at the state and local level. These can be phased in and tightened over time, and cover a wide range of areas, including: the building envelope, heating, ventilation, and air conditioning systems; lighting; and water heating systems (Cox, 2016). Importantly, stronger building codes bring about more than economic and environmental benefits, they bring about social benefits including "significant equity benefits by reducing energy poverty, strengthening energy resilience, and improving energy access for all" (Becque et. al 2019, 2).

Florida is currently leading the region in energy efficient building codes by having adopted the 2015 International Energy Conservation Code (IECC), while Louisiana is using the 2009 IECC standard. At the other end of the spectrum, Mississippi has yet to adopt and implement any statewide building energy code program (Office of Energy Efficiency & Renewable Energy, 2020). According to the DOE, the adoption of model energy codes for residential and commercial buildings could save the country $126 billion and avoid 841 million metric tons (MMT) of CO_2 emissions through 2040 (Office of Energy Efficiency & Renewable Energy, 2017). For states like Louisiana, updating their residential codes would save consumers roughly $6,000-$7,000 on average and consumers' cash flow would be positive in 1-2 years (Taylor, 2019; Mendon et al., 2015).

Improving zoning is another important climate policy, particularly as the region continues to undergo strong growth. Recent research indicates that the South has the most sprawl of any region, and this pattern is expected to continue (Lopez, 2014; Fremstad et al., 2017). Transforming zoning ordinances can play a large role in decarbonizing the economy and fighting climate change. Adapting current zoning policies to more environmentally-conscious zoning and land use patterns has the capacity to significantly cut greenhouse gas emissions while improving affordability for residents (Gerrard & Dernbach, 2018). Increased density can also minimize people's footprint on the land, allowing more land to be utilized for ecosystem services, including carbon sequestration as was accomplished in Gulfport, Mississippi through the adoption of a SmartCode for future development in the mid-2000s (Gulfport SmartCode, 2007).

The South can embark on a number of reforms to improve building codes and zoning:

- ***Update building codes:*** State and local building codes should be updated to reflect the most recent standards for commercial and residential buildings. Automatic tightening of these codes should also be implemented, to ensure that new codes are quickly adopted.
- ***Adopt stretch code:*** Cities and states can adopt stretch codes that go above and beyond the national energy code model for minimum standards. To date, California, Massachusetts, Vermont, and New York have been leading in this area. For example, cities like San Jose, CA require all new residential buildings be zero net energy starting this year (City of San Jose, 2020).
- ***Target sprawl with zoning reform:*** Zoning rules can exacerbate sprawl, and through it, increase energy use and carbon emissions. The code can be updated to eliminate minimum lot and house size requirements, eliminate the separation of various land uses, and decrease setback requirements. Additionally, cities and states should implement upzoning to limit single-family housing development and promote infill development. Upzoning is defined as a change in zoning classification from less intensive to more intensive development allowing for taller and denser units than previously allowed.
- ***Develop regional plans:*** Cities and states across the South should work with the EPA's Smart Growth Implementation Assistance Plan program to develop regional plans.[4] A number of successful cases across the South have already been implemented.

3.3 Transportation Sector Policy

The transportation sector is responsible for the largest portion of greenhouse gas emissions in the United States. It's also responsible for more than one-third of the South's emissions. Transportation in the South is heavily reliant on the automobile because the region has less urban density than other regions (APTA, 2019). Fortunately, decarbonization strategies are not out of reach for many Southern cities and states looking to transition away from fossil fuels.

The region can aim to increase electric vehicle adoption, expand public transit, invest in rail and increase walking and biking. Programs that incentivize Southerners to make the switch from a traditional gas vehicle to an electric one ought to be designed and implemented in ways that benefit all drivers, not just the wealthy. Additionally, transit-oriented urban development can prioritize walking and biking, decrease reliance on emissions-intensive modes of transportation, promote public health and contribute to

[4] For examples of Smart Growth Plans, including fixes for urban and suburban codes in the Southeast, see: https://www.epa.gov/smartgrowth/codes-support-smart-growth-development#formareaplans.

the larger goal of livable, culturally vibrant cities. There is tremendous potential to make these technologies affordable for all Southerners, ensuring a just transition off of fossil fuels.

3.3.1 Electric Vehicle Policy

Replacing vehicles powered by internal combustion engines with electric vehicles (EVs) would help to rapidly decarbonize the South's transportation sector. EVs are not yet carbon neutral because of the continuing use of fossil fuels in electricity. Yet, as the electric grid is cleaned up, they will get cleaner as well. Although a large part of consumer aversion to EVs is due to higher upfront costs, EV manufacturing and battery costs are rapidly falling. Analysts predict that EVs are likely to reach cost parity within the next several years, with some models already equal to combustion engine vehicles in total ownership costs (JP Morgan, 2018; McKerracher, 2018).

The EV market needs to scale up rapidly, to help the U.S. make meaningful emissions reductions. While the EV market is growing, with 1.3 million EVs on U.S. roads in September 2019, market share remains around 2% (EEI, 2019). Within the U.S., EV adoption varies considerably. California has been a long-time leader – EVs have a 5% market share there. By contrast, the South has lagged behind. For example, Louisiana and Arkansas have less than 0.2% (EIA, 2020).

States can implement a number of policies to reduce consumer barriers to EV adoption, including reducing financial barriers through tax credits and rebates and building out charging infrastructure (ICCT, 2018). As a leader in EV policy, California offers a number of initiatives that can be considered by Southern states.

- ***Zero Emission Vehicle (ZEV) program:*** Since 1990, California has had a program to incentivize electric vehicles and other options with less emissions (Stokes & Breetz, 2018). The ZEV program requires low-emissions vehicles to make up a fraction of automakers' sales volume. Several other states have since adopted the policy, which essentially serves as a regulatory requirement for EVs (Wesseling et al., 2014). Eleven states now have ZEV policies, including Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, Vermont and Colorado.
- ***Clean Vehicle Rebate program:*** This program gives EV customers between $1,500 and $2,500 toward the cost of zero-emission vehicles, thereby improving affordability. This policy is even more important today, as the federal EV tax credits have lapsed for the main manufacturers of EVs.

• ***EV infrastructure program:*** The availability of charging stations is vital to supporting greater adoption of EVs. Recognizing this, former California Governor Jerry Brown used an executive order to create a $2.5 billion initiative focused on building 250,000 charging stations. The program aims to help meet the target of having five million EVs on the roads by 2030. Nearly one-fourth of electric vehicle charging stations in the U.S. were located in California as of 2019 (EIA, 2020).

Similarly, local governments can encourage EV, as exemplified by Austin, TX. In 2012, the municipally-owned utility Austin Energy formed the Texas River Cities Plug-in Electric Vehicle Initiative (TRC) with funding from the U.S. Department of Energy. The program offers discounts and rebates on charging station installation. The TRC paid special attention to consumers' "range anxiety" (fear that an EV may run out of power without a charging station nearby) and got to work installing charging stations nearby multi-family housing, workplaces and along the San Antonio-Austin corridor (TRC, 2012). Austin Energy now reports a total of 800 charging stations and a 100% growth over historical trends in monthly EV purchases (Larned, 2019).

The good news is that the South need not be left behind during this transition. Public and private utilities can play a large role in implementing plans and rebates. Local regulatory commissions can set advantageous rate schedules for EV owners. State and local leaders can pressure the federal government to provide more funding for EV tax credits and other customer rebates. Beyond demand-side incentives for consumers, the labor force of the automobile manufacturing industry ought to be a priority for Southern policymakers looking to swap gas-vehicles for EVs in their cities and states. A large portion of automobile assembly plants are located in Southern states, including those of Hyundai, Toyota and Nissan. To ensure a just transition away from fossil fuels, state policies that seek to expand EV production should keep Southern autoworkers in mind. Fortunately, transitioning to a clean-energy automobile industry presents opportunities to re-train existing employees and thus maintain the good-paying car manufacturing jobs that have come to define many Southern cities.

A few Southern examples of EV leadership over the past decade include:

• In 2000, ***Georgia*** became an overnight leader in EV-friendly policy by offering a generous $5,000 tax credit for the purchase of a zero-emission vehicle. The resulting EV sales figures exceeded expectations, and the state was on track to be a leader in transportation decarbonization. However, in 2015 the Georgia state legislature elimi-

nated the $5,000 EV tax credit and sales plummeted to roughly one-tenth previous levels (Voelcker, 2018). Within the same piece of legislation, and to offset declining gasoline tax revenue, the state began charging EV owners a $200 annual fee (Galloway, 2019; NCSL, 2019). Fortunately, current legislation has been introduced to reinstate an EV tax credit with bipartisan support, which would reinvigorate the once-booming electric vehicle market on the roads by 2030. Nearly one-fourth of electric vehicle charging stations in the U.S. were located in California as of 2019 (EIA, 2020).

- The ***Atlanta*** City Council passed an "EV Ready" ordinance in 2017, which required that all new homes and public parking facilities accommodate EVs and be equipped with the electrical infrastructure needed to install EV charging stations (AMOC, 2017).
- ***Orlando*** Utilities Commission offers rebates to customers who purchase or lease an EV (OUC n.d.). The Electrification Coalition also helped start a first-of-its-kind program in Orlando called "Drive Electric Orlando"— an electric car rental initiative that leverages Orlando's status as one of the largest car rental markets in the U.S. (Vehicle Technologies Office, 2018).
- The ***Florida*** legislature has signed into law policies that support EVs, including a policy prohibiting insurance companies from charging customers more for EVs and another that requires condominiums allow the installation of EV equipment in a homeowner's designated parking space.

3.3.2 Public Transit Investments

Public transit should be a top priority for Southern policymakers. The federal Department of Transportation estimates that for every zero-emission bus added to a city's transit fleet, there is a corresponding elimination of 1,690 tons of CO_2 — the equivalent emissions of 359 passenger cars over their lifespan (SACE, 2019). On average, subways produce 76% lower GHG emissions per passenger mile than the average single-occupancy vehicle, while light rail systems produce 62% less, and bus transit produces 33% less (Hodges, 2010). If ridership on these services can be increased and they were to be electrified using existing technologies, emissions per passenger would be substantially lower. Beyond immediate reductions in greenhouse gas emissions, the electrification and expansion of public transit can improve economic growth, reduce personal expenditure on vehicles, alleviate traffic congestion, and reduce local air pollution.

Some Southern cities are already working on expanding and decarbonizing public transit options. Louisville, Kentucky and Seneca, South Carolina have both launched electric bus fleets. In fact, Seneca was the first city in the United States to transition to an all-electric bus fleet and has become the model for other municipalities looking to make the switch. Louisville created a first-of-its-kind, all-electric bus. Known as the "LouLift," the bus is powered by batteries located under the bus floor. The batteries automatically recharge as they are connected to a high-capacity charger located overhead. The bus batteries last for around two hours and can be recharged within 10 minutes (Louisville Downtown Partnership, 2019).

Similarly, the Clemson Area Transit in South Carolina, invested in 10 electric buses and installed charging infrastructure. Their buses were manufactured in neighboring Greenville, South Carolina. These vehicles now serve almost 2 million passengers a year in the cities of Seneca, Clemson, Central and Pendleton, as well as on four university campuses. It has eliminated over 2.8 million pounds of greenhouse gas emissions since 2015. This fleet was funded by a $3.9 million grant from the Federal Highway and Transit Administration (FTA). By utilizing federal programs to invest in their transit systems, Southern cities are able to provide important services to their residents and contribute to decarbonization.

Regional transportation is also key. Here, Atlanta, Georgia is a clear leader. It has one of the largest metropolitan areas in the United States, and its transit system, the Metropolitan Atlanta Rapid Transit Authority (MARTA) currently ranks as the rail system with the greatest ridership in the South and 11th largest in the U.S. (APTA, 2019). In November 2016, Atlanta City residents voted for a half-cent sales tax increase that would directly fund major upgrades to the city's bus service and build out nearly 30 miles of light rail lines, among other public transit improvements (City of Atlanta, 2016). Dubbed 'More MARTA Atlanta,' these transit enhancements are specifically designed to improve services in historically underserved communities, and deliver equitable transportation outcomes to the city's diverse and growing population (Sharpe, 2019). In April 2018, the Georgia state legislature passed a law to create the Atlanta-Regional Transit Link Authority (ATL), granting it authority over transit planning for all 13 of the metro area counties. This policy will allow these counties to pass a ballot measure to increase sales tax to fund rail projects in their communities (Wickert, 2018). More Marta Atlanta and the ATL serve as powerful examples of a Southern regional partnership that utilizes innovative funding mechanisms to put the future of rail service and climate mitigation in the hands of local residents.

The South can enact a number of public transit policies that expand ridership and decarbonize existing services:

- ***Electrify municipal bus fleets:*** Replace gas and diesel powered busses with all-electric fleets by capitalizing on existing federal funding mechanisms, such as the Federal Highway and Transit Administration's Low-or No-Emissions program. Install necessary charging infrastructure for a smooth transition.
- ***Expand light rail systems in larger metropolitan areas:*** Develop and fund upgrades to existing light rail transit systems, including new routes to underserved areas and areas with chronic traffic congestion. Connect rail systems to nearby metropolitan areas to reduce longer distance travel.

3.3.3 Walk and Bike Mobility

Public transit expansion and EVs are not the only tools available to decarbonize the transportation sector. In fact, daily trips over short distances — to work or school for instance—are a leading source of carbon emissions. Improving pedestrian and bike mobility in Southern cities will serve a myriad of decarbonization goals: reducing CO_2 emissions and automobile traffic congestion, increasing density and reducing urban sprawl, and reducing costs associated with road maintenance. In addition, there are tremendous public health and urban livability benefits that come with more residents walking and biking to work, to school, and to urban centers.

Charlottesville, VA stands out as one of only two cities in the South with a Walk Friendly Communities Gold level ranking. Walkers and cyclists in Charlottesville account for 18% of work commutes (City of Charlottesville, 2020). A closer look at Charlottesville's city planning and land use development policy reveals careful attention to the needs of pedestrians and cyclists. In 2010, the City Council passed a 'Complete Streets' policy that required streets to be "designed and executed in a balanced, responsible and equitable way to accommodate and encourage travel by bicyclists, public transportation vehicles and their passengers and pedestrians of all ages and abilities" (Tubbs, 2014). The city's 2015 Bicycle and Pedestrian Master Plan measures 9.6 miles of urban trails, 30 miles of bike lanes, and 175 miles of sidewalk throughout Charlottesville (City of Charlottesville, 2015).

Well-designed urban trails and paths are an important first step for any city looking to increase the number of residents who bike or walk instead of drive. Favorable zoning ordinances, mixed-use development and accessory dwelling units drive pedestrian and

cyclist traffic. Mixed-use zoning reduces dependence on daily driving commutes because residents live near where they work and shop. According to the Brookings Institute, this kind of planning will also lead to economic growth (Leinberger & Loh, 2019).

Key policy options to increase walkability include:

- ***Zoning changes:*** Rezoning urban areas for infill by allowing mixed-used development and accessory dwelling units.
- ***Planning for pedestrians and bikes:*** Building sidewalks and walkways with pedestrian comfort in mind by planting trees, widening sidewalks, building crosswalks, erecting lighting, and planning paths through historical districts, landmarks, parks, art installations, and along waterways. Building public squares or plazas can also increase walkability, as can closing streets to automobiles for pedestrian-only traffic on special events or in specific areas.
- ***Increasing bike infrastructure:*** Building protected bike lanes, both on and off the street, is important to increasing bike safety and through it, usage. Cities and regions may also want to enter partnerships with sponsored bike sharing programs.

3.4 Carbon Pricing

Putting a price on carbon — whether through a carbon tax, cap, or a hybrid model — is one of the most straightforward ways to help reduce carbon emissions and other air pollution. This is especially true for fiscally constrained governments at the state and local level, as carbon pricing can be designed to raise revenues. The idea is rather simple: the government levies a price on fossil fuels to ensure polluters pay for the pollution they release into the atmosphere. The carbon price therefore helps level the playing field between fossil fuels and carbon-free energy sources. While many policies are aimed at specific sectors of the economy, such as the building sector or electricity sector, carbon pricing is an example of a policy that could be cross-sector if applied economy-wide.

Currently, there are 46 countries and 31 subnational jurisdictions with some form of carbon pricing (World Bank, 2019). While the United States does not have a national carbon price, a number of local carbon pricing programs exist across the country. The Regional Greenhouse Gas Initiative (RGGI) is the most successful carbon price in the U.S. It is a cap-and-trade system covering emissions from the electricity sector across ten northeast states (RGGI, 2020). Importantly, RGGI has proven to be a stable, transparent, and bipartisan framework for the Northeast in their effort to reduce emissions. While emissions have indeed fallen, the program has had a number of added benefits,

energy efficiency programs, and improvements in public health due to reductions in co-pollutants in the air (Morris, 2017; Hibbard et al., 2018; ABT Associates, 2017).[5]

Policymakers must consider carbon pricing programs' design and scope. For instance, RGGI only covers emissions from the power sector. To increase the effectiveness of the program, policymakers should consider a carbon price covering all sectors of the economy, especially transportation, which is the largest polluting sector in the economy.[6] California's cap-and-trade program, for example, has expanded over time and now covers most sectors. Policymakers must also decide how to use revenues from a carbon price. The Northeast uses funding from RGGI to increase energy efficiency and community-based renewable energy projects, provide low-income bill assistance, and train workers for the green economy (Hibbard et al., 2018). These spending decisions helped further reduce emissions in the region, addressed equity concerns through investing in low-income communities, and provided assistance to fuel regional jobs and economic growth.

- ***Implement carbon pricing:*** Southern states can adopt a carbon price as an important measure to reduce emissions throughout the region. While many design options exist, we suggest a price collar which is a hybrid model utilizing features from both a carbon tax and a carbon cap. All pollution permits would be allocated through quarterly auctions. The initial price floor could be set at $\$25/tCO_2e$ in year one, then rising by $\$5/tCO_2e$ per year, plus inflation. The price ceiling may be initially set at $\$35/tCO_2e$ rising by $\$10/tCO_2e$ per year, plus inflation. Revenue should be used to invest in energy efficiency and electrification measures, especially for low-income consumers, in order to reduce energy demand and protect consumers from increasing the price of carbon-intensive electricity. States may also want to return some revenue back to the public via carbon dividends.

3.5 Agricultural and Oceans Policy

The climate crisis will greatly impact farmers in the South and across the nation. The agriculture sector is already facing higher temperatures, drought, and extreme weather events, and these will only be amplified as global warming intensifies. Sustained high temperatures decrease crop yields and expose livestock to heat stress. Fisheries already burdened by overfishing and pollution will face higher water temperatures, which have been shown to disrupt ecosystems, facilitate the spread of marine diseases

[5] For more on RGGI, see this report by the Congressional Budget Office and this report by M.J. Bradley & Associates: https://fas.org/sgp/crs/misc/R41836.pdf; https://www.mjbradley.com/sites/default/files/rggimarketsO2-15-2017.pdf

[6] While RGGI is a carbon cap-and-trade system, a carbon cap without trade or a price collar that combines the two would likely be more effective at reducing emissions and limit any chance to financialize carbon permits.

and alter marine species' reproduction and migration lifecycles (EPA, 2017). In the South, where crop cultivation, livestock, and fisheries are important to regional economies, climate action is necessary to protect the sector. The region produces more than $55 billion in agriculture products each year, roughly equal to 17% of total U.S. production (Asseng, 2013). The Southern states along the Gulf of Mexico are the second largest domestic source of seafood by landings, with four of the top ten U.S. commercial fishing ports located along the South Atlantic and Gulf Coasts (NOEP, 2016).

Small-scale agricultural and coastal land use policies that support climate change mitigation already exist in the U.S. There is considerable room for further innovation. Southern policymakers can act to decarbonize these sectors by focusing policy efforts on climate-mitigating agricultural practices, preserving wild lands and forests, and protecting critical coastal habitats.

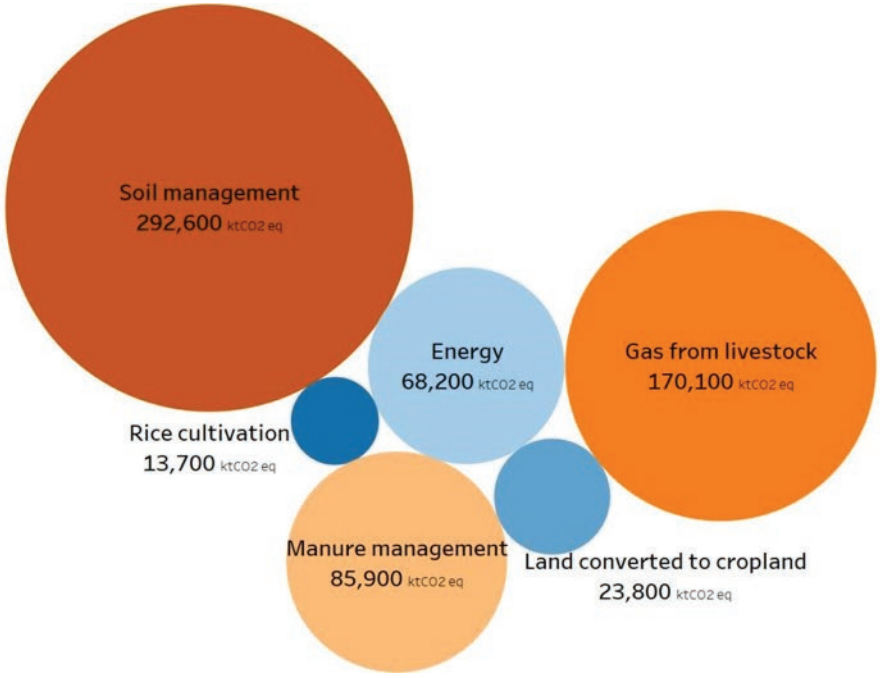
3.5.1 Agricultural Climate Policy

Industrialized agriculture generates nearly 10% of all greenhouse gas emissions in the United States, including methane (CH_4), carbon dioxide (CO_2), and nitrous oxide (N_2O) (ERS, 2017). These emissions are linked to fertilizer use, soil erosion and degradation, loss of grass wildlands, and methane emissions from livestock. Nitrous oxides are released from synthetic fertilizer application, with higher than average emissions in the Lower Mississippi River Basin. Direct and indirect nitrous oxides emissions are particularly high in the Southeast compared to the rest of the country (EPA, 2017). Agricultural sector emissions are largely tied to large-scale farming operations. Often, large-scale operations discourage practices like crop rotation and no-till farming that sequester carbon and maintain soil health. Neglecting crop diversity in favor of mono-cropping diminishes natural soil recovery processes that would allow microorganisms to replenish soil nutrients and help sequester carbon in the soil.

Agriculture can be a critical part of climate change mitigation policy, including in the South. In particular, regenerative agriculture has the potential to restore rural environments and agricultural lands, increase biodiversity, produce high-quality food, and store carbon from the atmosphere in the soil– all while supporting local economies (Rodale Institute, 2014). Farming practices can prioritize soil health and carbon sequestration. Modern agriculture methods deplete the soil of its organic carbon through tillage, monocropping and yield-based management systems. Alternative approaches can be used, including reduced tillage, composting, cover crops, and rotational crops. With this

approach, modern farms have the potential to become carbon sinks, reducing more atmospheric pollution than they release (Rodale Institute, 2014) .

Figure 7: Agriculture Sources of Greenhouse Gas Emissions, 2016



Sources: EPA; FAO

Southern policymakers can incentivize these practices through policy. For example, the Maryland Healthy Soils Program was passed in 2017 with wide support from diverse stakeholders like fishers, farmers, and environmentalists (Regeneration International, 2017). This program requires the Department of Agriculture to provide a variety of financial resources, training assistance and research services to farmers, incentivizing them to adopt the regenerative agriculture practices. The policy makes grants to farmers to plant cover crops and expand no-till farming.

Connecting consumers to locally-sourced agricultural products also reduces the need for long-distance transportation and supports local farmers. Beginning in 1990, the "Fresh From Florida" program, conducted by the Florida Department of Agriculture and Consumer Services, allows Florida farmers to market their products under the "Fresh From Florida" logo, which increases consumer awareness and increases sales for local farmers. The program also provides advertising support and develops supermarket partnerships on behalf of local farmers. The program has proven popular – the Southeast Florida Regional Climate Change Compact lists "Fresh From Florida" as one of its most implemented policy recommendations.

Key policy options to decarbonize the Southern Agriculture industry include:

- ***Reform agriculture practices*** by bringing together a diverse coalition of stakeholders to develop and fund regenerative agriculture grants through existing state and local agriculture institutions.
- ***Support local produce markets*** by implementing programs that connect local farmers, supermarkets, and consumers to shorten delivery routes and fortify local agriculture economies.

3.5.2 Forests and Wildlands

Like the rest of the United States, the South has lost many thousands of acres of native forests and wildlands, including grasslands and wetlands, largely due to urban development and agriculture. The state of Georgia leads the nation in urban tree loss, which stresses wildlife and decreases tree canopy and the availability of clean air (Nowak and Greenfield, 2018). Similarly, Houston, Raleigh, and Charlotte have lost much of their urban trees. By removing carbon dioxide from the atmosphere and storing carbon, trees and other plants play a support role in countering the climate threat. The ability of these forests and native habitats to improve air quality, sequester carbon, maintain biodiversity, and provide recreational opportunities offers a call to action for Southern policymakers. It's important to note, however, that these policies are not a substitute for reducing fossil fuels. Ultimately, reducing fossil fuels is the only way to address climate change.

The conservation and sustainable management of forests and wildlands is key to maintaining their existing carbon sequestration power. Policy options include state and local land use regulation and conservation easements that protect existing forests and encourage reforestation. In particular, state and local governments should expand publicly-owned forests and wildlands. The Forestry Legacy Program, administered by the U.S. Forest Service, allows private landowners to participate by "either selling their property outright or by retaining ownership and selling only a portion of the property's development rights; both are held by state agencies or another unit of government" (USFS, 2020a).

Recently funded projects include Arkansas' Hot Springs Forest, Florida's Welannee Watershed Forest, and Texas' Fox Hunters Hill – totaling $8.3 million in project funds (USFS, 2020b). For fiscal year 2021, states can submit three projects totaling $10 million in federal funds. Projects of this kind, when paired with deep decarbonization in

other sectors, protect nature's ability to pull carbon from the air and mitigate additional warming.

Key policy options for rural land use deep decarbonization include:

- ***Increase land conservation and connectivity*** in line with the goals of the Southeast Conservation Blueprint, a living spatial plan determined by federal and state agencies, tribes, nonprofits, businesses and universities.[7] Strategic conservation is critical in light of urban growth and climate change and can be achieved through public acquisition as well as conservation easements that keep family farms and forests on the landscape.
- ***Support land management that improves ecosystem health and function*** in line with the Southeastern Conservation Adaptation Strategy (SECAS).[8] This includes the implementation of ecological restoration activities, such as the use of prescribed fire where appropriate, and may be achieved through greater funding for public land management agencies as well as through cost-shares and technical assistance programs for private landowners.
- ***Encourage the development of Payment for Ecosystem Services markets*** that reflect the climate regulation (carbon) and water (quality and quantity) benefits of forests, wetlands, and other native ecosystems.[9] The development and maturation of such markets will help provide alternative revenue sources necessary for conservation to function as a cost-effective alternative to clear-cut harvesting on private forestland while also ensuring the delivery of critical benefits to the general public.[10]

3.5.3 Coastal and Wetland Ecosystems

In the South, inland and coastal land use policies are closely tied to one another. Deforestation and poor watershed stewardship are paired with inland agricultural pollution and subsequent runoff harm marine ecosystems. Destructive coastal development projects can harm native habitats that are crucial to climate mitigation and adaptation and should be carefully regulated to prevent further damage. Over the last century, negligent coastal development – including dredging, filling, and diking – has stressed or destroyed native mangrove forests (Office of Resilience, 2019).

[7] http://secassoutheast.org/blueprint

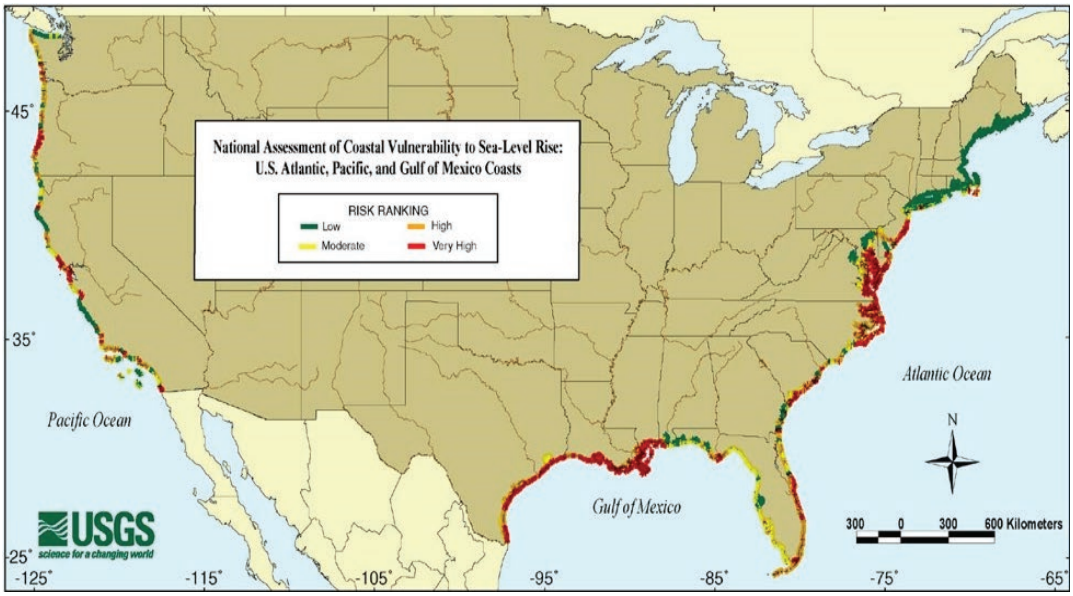
[8] http://secassoutheast.org/pdf/SECAS-goal-report-2019.pdf

[9] For a discussion of payments for ecosystem services, see this report by the UN FAO: http://www.fao.org/3/ca6842en/CA6842EN.pdf

[10] For a discussion on cost-effective strategies for sustainable timberland, see https://www.conservationfinancenetwork.org/2020/01/28/can-non-timber-strategies-generate-cash-fortimberland-investment-management

The importance of coastal ecosystems to carbon sequestration and climate mitigation efforts cannot be overstated. In total, 83% of global carbon is circulated through the ocean (Blue Carbon Initiative, 2019). Mangroves and coastal wetlands store carbon at a greater rate than most ecosystems, including three to five times more than tropical forests. Coastal ecosystems also provide one of the first lines of defense against climate-change-induced sea level rise and stronger, more damaging hurricanes. Mangroves span the much of the Florida coastline, and stretch the Gulf from Louisiana to Texas, playing a vital role in the stability and health of the Southeastern coastline (Figure 8). Mangrove forests protect the coastline from storm wind, waves, and flood damage; prevent coastal erosion; and maintain the clarity and purity of the Gulf of Mexico.

Figure 8: National Assessment of Coastal Vulnerability to Sea-Level Rise, 2017



Source: U.S. Geological Survey National Assessment of Coastal Change Hazards 2017.

It is essential that states and municipalities with coastal ecosystems take proactive steps to protect and restore mangrove systems using existing environmental policy frameworks. For example, there are multiple Florida Statutes and Florida Administrative Code rules that give authority to the Office of Resilience and Coastal Protection to enact and enforce mangrove forest protection programs. In 2006, Texas made it illegal to uproot seagrass beds in Redfish Bay when the state discovered significant damage due to propeller scarring. Relatedly, Charleston, South Carolina recently sued Exxon-Mobil for toxic contamination of salt marshes and impacts on the native wildlife. $6.3 million was allocated from the lawsuit for restoration of the state's critical Lowcountry habitats (Fretwell, 2019). Cities and states could take a similar polluter-pays approach to their own wetlands restoration.

Wetland restoration is key to Southern efforts to mitigate and adapt to climate change. Cities and states can protect coastal wetlands through increased regulation and enforcement, as well as public outreach and education campaigns about the necessity and sensitivity of wetlands. Federal programs within U.S. Fish and Wildlife, the EPA, FEMA, the U.S. Army Corp of Engineers, NOAA, and other federal agencies and departments, offer grants for ecosystem and wildlife restoration. Most state level agencies also offer similar programs for coastal communities to adapt and mitigate the effects of climate change. Non-profit groups like The Wildlife Conservation Society's Climate Adaptation Fund, the Rockefeller Foundation, and several other charitable groups offer assistance to local restoration and mitigation efforts.

Key ocean and coastal climate policy options include:

- ***Restore Damaged Coastal Ecosystems:*** Pass state-wide coastal protection laws or work within existing environmental protection policy frameworks to fund programs that restore coastal habitats to their natural state, and build partnerships with groups already working in the field to capitalize on nonprofit and ecologist expertise.
- ***Reduce Human Impacts on Coastal and Wetland Ecosystems:*** Enact stronger water quality standards to reduce nutrient pollution runoff from stormwater, wastewater, and industrial sources; create state revolving loan funds to support local water and wastewater infrastructure projects, including septic-to-sewer conversion and advanced wastewater treatment; enact new and stronger measures, including those governing boating, fishing, and recreation, to protect wetlands and enable local authorities to enforce ecosystem-sensitive behavior and protect coastal carbon sinks throughout the region.
- ***Make Polluters Pay:*** Enforce sanctions and other accountability measures to ensure polluters are held responsible for their actions and bear the cost of restoring critically damaged ecosystems.

Conclusion

Climate change is here, and it represents a serious threat to the economy, ecosystems and people in the South. The region is particularly vulnerable to climate change, yet remains behind many other regions of the United States in terms of action. Thankfully, technologies and public policies to put the region on the path to decarbonization exist. But this change will not arise on its own. Altering the current trajectory of the region will take leadership across scales of government to re-orient sectors across the economy. The energy, transportation, agriculture, land use, and industrial policies currently in place are in immediate need of updating.

These advancements will generate new well-paying employment opportunities, improve development patterns, improve air quality and public health, reduce energy burdens for households, and bolster economic growth. Together, these changes can build a strong, more resilient, and more equitable Southern United States.

The aim of this report has been to provide a menu of policy options for policymakers to consider in their efforts to address one of the most pressing issues of our time: climate change. While decarbonizing the region will require sizable changes to our economy, they are necessary. Importantly, the economy is going to be changed drastically if global warming is allowed to continue unabated; the question becomes, do we shape the future into one centered on sustainability and a vibrant local economy, or do we allow global warming to take its toll on the region, devastating the local economy and destroying our communities? The choice is ours. Local and state policymakers should not let this opportunity go to waste.

Resources for Further Reading:

- ***For an environmental legislative toolkit with ideas for legislation, browse:*** *USC Schwarzenegger Institute Digital Environmental Legislative Handbook.*

- ***For a framework to achieve a nationwide net-zero 2050 goal, see:***
  - Podesta, J., Goldfuss, C., Higgins, T., Bhattacharyya, B., Yu, A., Costa, K. (2019, October). *A 100 Percent Clean Energy Future. Center for American Progress.*

- ***For a customizable database of policy recommendations based on local priorities in the Southeast Florida region, see:***
  - *Southeast Florida Regional Climate Action Plan.* Policy recommendation areas include: agriculture; energy and fuel; natural systems; social equity; and sustainable communities and transportation.

- ***For a comprehensive guide for policy driven energy solutions, see:***
  - Harvey, H., Orvis, R., Rissman, J. (2018). *Designing Climate Solutions: A Policy Guide for Low-Carbon Energy. Island Press.*

- ***For a legal strategy for technical and policy decarbonization pathways, see:***
  - Gerrard, M. B., Dernbach, J. C. (2018). *Legal Pathways to Deep Decarbonization in the United States: Summary and Key Recommendations. Environmental Law Institute.*

- ***For an in-depth review of the economics of electrifying buildings, see:***
  - Billimore, S., Henchen, M., Guccione, L. Louis-Prescott, L. (2018). *The Economics of Electrifying Buildings: How Electric Space and Water Heating Supports Decarbonization of Residential Buildings. Rocky Mountain Institute.*
  - Deason, J., Wei, M., Leventis, G., Smith, S., Schwartz, L. (2018). *Electrification of buildings and industry in the United States: Drivers, barriers, prospects, and policy approaches*. Lawrence Berkeley National Laboratory.

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Acknowledgments

The authors thank Matto Mildenberger and Bracken Hendricks for their comments and insight. Special thanks for research assistance from Anais Goubert and Sean Sellers. SEAP staff Alí R. Bustamante contributed to the project.

References

ABT Associates. 2017. The Regional Greenhouse Gas Initiative (RGGI) Analysis. https://www.abtassociates.com/rggi

Aktas, Can B., and Melissa M. Bilec. 2011. "Impact of Lifetime on US Residential Building LCA Results." The International Journal of Life Cycle Assessment, vol. 17, no. 3, pp. 337-349.

American Council for an Energy-Efficient Economy (ACEEE). 2019a. Policy Brief: State Energy Efficiency Resource Standards (EERS).

American Council for an Energy-Efficient Economy (ACEEE). 2019b. State and Local Policy Database: North Carolina. https://database.aceee.org/state/north-carolina

American Council for an Energy-Efficient Economy (ACEEE). 2019c. 2019 State Energy Efficiency Scorecard. https://www.aceee.org/research-report/u1908

American Public Transportation Association. 2019. 2019 Public Transportation Fact Book. https://www.apta.com/wp-content/uploads/APTA_Fact-Book-2019_FINAL.pdf

American Wind Energy Association. 2019. "Wind Energy in Kansas."

Ashley N. Bulseco, Anne E. Giblin, Jane Tucker, Anna E. Murphy, Jonathan Sanderman, Kenly Hiller-Bittrolff, Jennifer L. Bowen. 2019. "Nitrate addition stimulates microbial decomposition of organic matter in salt marsh sediments." Global Change Biology.

Asseng, S. 2013. Impact of climate change on agriculture in the southeast USA, including key climate vulnerabilities, uncertainties, adaptation, assessment and research needs. In Climate of the southeast United States:

Variability, change, impacts, and vulnerability, eds.K.T. Ingram, K. Dow, and L. Carter. Island Press: Washington D.C.

Atlanta Better Building Challenge (ABCC). 2019. Building Atlanta's Sustainable Future: Final Report. https://www.atlantabbc.com/wp-content/uploads/2019/10/ABBC-Annual-Report-and-Case-Study.pdf

Atlanta Mayor's Office of Communication (AMOC). 2017, November 21. News Release: "City of Atlanta Passes "EV Ready" Ordinance into Law." https://www.atlantaga.gov/Home/Components/News/News/10258/1338?backlist=/

Barbose, Galen. 2019. US Renewables Portfolio Standards: 2019 Annual Status Update. Lawrence Berkeley National Laboratory. https://emp.lbl.gov/publications/us-renewables-portfolio-standards-2

Bouton, Shannon, Jon Creyts, John Livingston, Tomas Nauclér. 2010. "Energy efficiency: A compelling global resource." McKinsey Sustainability & Resource Productivity. https://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/Sustainability/PDFs/A_Compelling_Glo bal_Resource.ashx

California Public Utilities Commission (CPUC). 2020. Self-Generation Incentive Program. https://www.cpuc.ca.gov/sgip/

Center for American Progress (CAP). 2019. A 100 Percent Clean Future. https://www.americanprogress.org/issues/green/reports/2019/10/10/475605/100-percent-clean-future/

Chu, Hong-Hanh, Benjamin Miller, Kurt Gaertner, Deirdre Buckley, Eve Schluter, Sharon Weber, Will Space, et al. 2019. "Global Warming Solutions Act 10-Year Progress Report." Boston: Commonwealth of Massachusetts. https://www.mass.gov/files/documents/2019/04/02/GWSA-10-Year-Progress-Report.pdf

City of Atlanta, GA. 2016. TSPLOST and MARTA Referenda. https://www.atlantaga.gov/government/mayor-soffice/projects-and-initiatives/tsplost-and-marta-referenda

City of Charlottesville. 2015. Bicycle and Pedestrian Master Plan Update, 2015. https://www.charlottesville.org/home/showdocument?id=34147

City of Charlottesville. 2020. Bicycle and Pedestrian Transportation. https://www.charlottesville.org/departments-and-services/departments-h-z/neighborhood-developmentservices/transportation/bicycle-and-pedestrian

City of San Jose. 2020. Zero Net Carbon Buildings. https://www.sanjoseca.gov/your-government/departments/environmental-services/climat e-smart-san-jos/zero-net-carbon-buildings

Cox, S. 2016. Building Energy Codes: Policy Overview and Good Practices. National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy16osti/65542.pdf

C2ES. 2019. "Energy Efficiency Standards and Targets." Center for Climate and Energy Solutions, Center for Climate and Energy Solutions, https://www.c2es.org/document/energy-efficiency-standards-and-targets/

Dedoussi, Irene C., Sebastian D. Eastham, Erwan Monier, Steven R. H. Barrett. 2020. "Premature Mortality Related to United States Cross-State Air Pollution." Nature 578, 261–265. https://doi.org/10.1038/s41586-020-19838

Department of Energy (DOE). 2018. "Low-Income Household Energy Burden Varies Among States – Efficiency Can Help In All of Them." https://www.energy.gov/sites/prod/files/2019/01/f58/WIP-Energy-Burden_final.pdf

Department of Energy (DOE). n.d. Better Buildings Challenge. https://betterbuildingssolutioncenter.energy.gov/challenge

Department of Energy (DOE). n.d. "Electricity Laws and Incentives in Florida." Alternative Fuels Data Center. https://afdc.energy.gov/fuels/laws/ELEC?state=FL

Dominion Energy Virginia. 2018. "Dominion Energy Launches Grid Transformation Program, Paving Way for Virginia's Energy Future With 3,000 Megawatts of New Solar and Wind Planned by 2022." PR Newswire. https://www.prnewswire.com/news-releases/dominion-energy-launches-grid-transformation-program-paving-way-for-virginias-energy-future-with-3-000-megawatts-of-new-solar-and-wind-planned-by-2022--300685854.html

DSIRE. "Kentucky Utilities Company and Louisville Gas & Electric - Residential Energy Efficiency Rebate Program." DSIRE, NC Clean Energy Technology Center, 13 May 2019, https://programs.dsireusa.org/system/program/detail/5206

DSIRE. "AlabamaSAVES Revolving Loan Program." DSIRE, NC Clean Energy Technology Center , 3 May 2019, https://programs.dsireusa.org/system/program/detail/4487

Duarte, C. M., Middelburg, J. J., and Caraco, N. 2005. "Major role of marine vegetation on the oceanic carbon cycle." Biogeosciences, 2, 1-8, https://doi.org/10.5194/bg-2-1-2005

Duke Energy. 2019 "Duke Energy Plans to Decommission Retired Florida Nuclear Plant by 2027 – Nearly 50 Years Sooner than Originally Scheduled." Duke Energy | News Center, https://news.duke-energy.com/releases/dukeenergy-plans-to-decommission-retired-florida-nuclear-plant-by-2027-nearly-50-years-sooner-than-originallyscheduled

Economic Research Service (ERS). 2017. September 24. Climate Change. US Department of Agriculture. https://www.ers.usda.gov/topics/natural-resources-environment/climate-change/

Energy Information Administration (EIA). Table B1. Summary Table: Total and Means of Floorspace, Number of Workers, and Hours of Operation, 2012. 2016. Table B1. Summary Table: Total and Means of Floorspace, Number of Workers, and Hours of Operation, 2012, https://www.eia.gov/consumption/commercial/data/2012/bc/pdf/b1-b46.pdf

Energy Information Administration (EIA). 2015. "Commercial Buildings Energy Consumption Survey (CBECS) – Analysis & Projections." https://www.eia.gov/consumption/commercial/reports/

Energy Information Administration (EIA). 2012. "CBECS Survey Data." https://www.eia.gov/consumption/commercial/data/2012/bc/pdf/b1-b46.pdf

Energy Information Administration (EIA). 2017. "Rankings: Total Energy Consumed per Capita, 2017." https://www.eia.gov/state/rankings/

Energy Information Administration (EIA). 2019. "How Much Energy Is Consumed in U.S. Residential and Commercial Buildings?" https://www.eia.gov/tools/faqs/faq.php?id=86&t=1

Environmental Protection Agency (EPA). 2017. "Inventory of U.S. Greenhouse Gas Emissions and Sinks." https://www.epa.gov/sites/production/files/2019-04/documents/us-ghg-inventory-2019-main-text.pdf

Environmental Protection Agency (EPA). 2017. "Climate Impacts on Agriculture and Food Supply." https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-agriculture-and-food-supply_.html

Environmental Protection Agency (EPA). 2018. "Distributed Generation of Electricity and its Environmental Impacts." https://www.epa.gov/energy/distributed-generation-electricity-and-its-environmental-impacts

Environmental Protection Agency (EPA). 2019. "Sources of Greenhouse Gas Emissions." Last Updated On September 13, 2019. https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

Fact Sheet: Gwinnett MARTA Referendum. ItsMarta. Retrieved 16, February 2020. https://itsmarta.com/gw-factsheet.aspx

Florida Department of Agriculture and Consumer Services (FDACS). "Fresh From Florida" Industry Membership. https://www.fdacs.gov/Agriculture-Industry/Fresh-From-Florida-Industry-Membership

Florida Museum of Natural History. 2018, Impacts on Mangroves. https://www.floridamuseum.ufl.edu/southflorida/habitats/mangroves/impacts/

Fremstad, A., Underwood, A., Zahran, S. 2017. The Environmental Impacts of Sharing: Household and Urban Economies in CO2 Emissions. Ecological Economics, 145, 137-147.

Fretwell, S. 2019. For decades, fertilizer plants polluted SC salt marsh. Now, ExxonMobil pays the price. The State. https://www.thestate.com/news/local/environment/article233038347.html

Galloway, Jim. 2019. "Analysis: A Republican pushes to revive Georgia's electric vehicle market." AJC. https://www.ajc.com/blog/politics/republican-pushes-revive-georgia-electric-vehiclemarket/LGMSk6i7HsLayZjuGHkEBO/

Gimon, Eric, Mike O'Boyle, Christopher T. M. Clack, and Sarah McKee. 2019. "The Coal Cost Crossover: Economic Viability of Existing Coal Compared to New Local Wind and Solar Resources." San Fransico, CA: Energy Innovation and Vibrant Clean Energy. https://energyinnovation.org/wp-content/uploads/2019/03/Coal-Cost-Crossover_Energy- Innovation_VCE_FINAL.pdf

Global Change Research Program (GCRP). 2018. "Fourth National Climate Assessment." Washington, DC: US Global Change Research Program. https://www.globalchange.gov/nca4.

Gulfport, Mississippi. 2007. Code of Ordinances, Appendix D - SmartCode. Derived from Ord. No. 2522. Retrieved from https://library.municode.com/ms/gulfport/codes/code_of_ordinances?nodeId=PTIICOOR_APXDSM.

Hibbard, P. J., Tierney, S. F., Darling, P. G., Cullinan, S. 2018. "The Economic Impacts of The Regional Greenhouse Gas Initiative on Nine Northeast and Mid-Atlantic States." https://www.analysisgroup.com/globalassets/uploadedfiles/content/insights/publishing/an alysis_group_rggi_report_april_2018.pdf

Hodges, T. 2010. Public Transportation's Role in Responding to Climate Change. US Department of Transportation. https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/PublicTransportationsRoleInRespondingToClimateChange2010.pdf

Hopkins, Asa, Ariel Horowitz, Pat Knight, Kenji Takahashi, Tyler Comings, Philip Kreycik, Neil Veilleux, Jeremy Koo. 2017. "Northeastern Regional Assessment of Strategic Electrification." Report prepared for Northeast Energy Efficiency Partnerships. Synapse Energy Economics, Inc. & Meister Consultants Group. https://neep.org/sites/default/files/DRAFT%20Strategic%20Electrification%20Summary.pdf

Hsiang, Solomon, Robert Kopp, Amir Jina, James Rising, Michael Delgado, Shashank Mohan, D. J. Rasmussen, et al. 2017. "Estimating Economic Damage from Climate Change in the United States." Science 356, no. 6345: 1362-69. https://science.sciencemag.org/content/356/6345/1362.

Intergovernmental Panel on Climate Change (IPCC). 2018. "Summary for Policymakers," in Global Warming of 1.5°C, ed.V. Masson- Delmotte, V., P. Zhai, H. -O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, et al.. Geneva: IPCC.

Larned, Tori. 2019. "An electric city: Almost 10,000 electric cars are now on Austin streets." KVUE.com. https://www.kvue.com/article/money/economy/boomtown-2040/almost-10000-electric-cars-are-now-onaustin-streets/269-abdec076-2e89-49ec-ba15-3a9c003deeff

Leinberger, C.B., Loh, T. H. 2019. "The economic power of walkability in metro areas." The Brookings Institute. https://www.brookings.edu/blog/the-avenue/2019/07/12/the-economic-power-of-walkability-in-metroareas/

Leung, Jessica. 2018. "Decarbonizing U.S. Buildings." Center for Climate and Energy Solutions (C2ES). https://www.c2es.org/document/decarbonizing-u-s-buildings/

Long, Noah. 2019. "New Mexico Embraces Transition to 100% Clean Energy." NRDC, https://www.nrdc.org/experts/noahlong/new-mexico-embraces-transition-100-clean-energy.

Lopez, R. 2014. Urban Sprawl in the United States: 1970-2010. Cities and the Environment 7(1), 7. http://digitalcommons.lmu.edu/cate/vol7/iss1/7

Maclay Architects. 2015. Net Zero Energy Feasibility Study Full Report. Efficiency Vermont. https://www.efficiencyvermont.com/Media/Default/docs/white-papers/efficiency-vermont-net-zero-energy feasibility-study-final-report-white-paper.pdf

Marcacci, Silvio. 2019. "Closing Colorado Coal Would Save $2.5 Billion. A New Proposal Could Unlock The Coal-To Clean Shift." Forbes, https://www.forbes.com/sites/energyinnovation/2019/01/09closing-colorado-coal-could-save 2-5-billion-a-new-proposal-would-unlock-the-coal-to-clean-shift/#1146da9f4ca5.

Mass Save. 2016. "Massachusetts Energy Efficiency Efforts Providing Unprecedented Savings to Customers." Boston: Mass Save. https://www.masssave.com/en/about/news-and-events/News/ massachusetts-energy-efficiencyefforts-providing- unprecedented-savings/.

Mass Save. 2020. Take an Online Home Energy Assessment. RCS Network. https://www.masssave.com/en/saving/energy-assessments/online-home-energy-assessment

Massachusetts Department of Energy Resources (MDOER). 2014. MA HEAT Loan Overview. https://www.energy.gov/sites/prod/files/2014/01/f6/f1-avers-ma_heat_loan_overview.pdf

Mendon, V. V., Selvacanabady, A., Zhao, M., Taylor, Z. T. 2015. National Cost-Effectiveness of the Residential Provisions of the 2015 IECC. https://www.energycodes.gov/sites/default/files/documents/2015IECC_CE_Residential.pdf

Midwest Energy Efficiency Alliance (MEEA). 2019, May 8. "Testimony on Behalf of the

Midwest Energy Efficiency Alliance (MEEA). 2019, May 8. "Testimony on Behalf of the Midwest Energy Efficiency Alliance Ohio House Energy and Natural Resources Committee." https://www.mwalliance.org/sites/default/files/meea-research/meea-testionmony-hb6-oh-house-5.8.19.pdf

Morris, J. 2017. RGGI Report: Less Pollution Drives Billions in Health Gains. Natural Resource Defense Council. https://www.nrdc.org/experts/jackson-morris/rggi-report-less-pollution-drives-billions-health-gains

Muro, Mark, David G. Victor, and Jacob Whiton. 2019. "How the geography of climate damage could make the politics less polarizing." Metropolitan Policy Program Report, Brookings Institute. https://www.brookings.edu/research/how-the-geography-of-climate-damage-could-make-the-politics-lesspolarizing/

Morris, Adele C. 2016. "The Challenge of State Reliance on Revenue from Fossil Fuel Production." Climate and Energy Economics Discussion Paper, Brookings Institute. https://www.brookings.edu/wpcontent/uploads/2016/08/state-fiscal-implications-of-fossil-fuel-production-08092l6-morris.pdf

National Conference of State Legislatures (NCSL). 2017. "State Net Metering Policies." https://www.ncsl.org/research/energy/net-metering-policy-overview-and-state-legislative-updates.aspx

National Conference of State Legislatures (NCSL). 2018. 2018 Energy Trends Across State Legislatures. https://www.ncsl.org/research/energy/2018-energy-trends-across-state-legislatures.aspx

National Conference of State Legislatures (NCSL). 2019. "State Renewable Portfolio Standards and Goals." https://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx

National Conference of State Legislatures (NCSL). 2019. "New Fees on Hybrid and Electric Vehicles." https://www.ncsl.org/research/energy/new-fees-on-hybrid-and-electric-vehicles.aspx

National Renewable Energy Laboratory (NREL). 2017. North Carolina Residential Energy Efficiency Potential. https://resstock.nrel.gov/factsheets/NC

National Oceanic and Atmospheric Administration (NOAA). (2019, October 19). What is a salt marsh? https://oceanservice.noaa.gov/facts/saltmarsh.html

National Oceanic and Atmospheric Administration (NOAA). 2020. Coastal Blue Carbon. NOAA Fisheries. https://www.fisheries.noaa.gov/insight/coastal-blue-carbon

National Ocean Economics Project (NOEP). 2016. "State of the U.S. Ocean and Coastal Economies, 2016 Update." Center for the Blue Economy. https://www.midatlanticocean.org/wpcontent/uploads/2016/03/NOEP_National_Report_2016.pdf

National Weather Service (NWS). 2020. Preliminary Information from NWS Storm Surveys. https://twitter.com/NWSEastern/status/1251267853090766849

Nowak, D. J., Greenfield, E. J. 2018. Declining urban and community tree cover in the United States. Urban Forestry & Urban Greening, 32, 32-55. https://www.fs.fed.us/nrs/pubs/jrnl/2018/nrs_2018_nowak_005.pdf

Office of Energy Efficiency & Renewable Energy. 2017. Building Energy Codes Program. U.S. Department of Energy. https://www.energycodes.gov/about/results

Office of Energy Efficiency & Renewable Energy. 2020. Building Energy Codes Program. U.S. Department of Energy. https://www.energy.gov/eere/buildings/building-energy-codes-program

Office of Resilience and Coastal Protection. 2019. Florida's Mangroves. Florida Department of Environmental Protection. https://floridadep.gov/rcp/rcp/content/floridas-mangroves

Orlando Utilities Commission (OUC). n.d. Electric Vehicles. https://www.ouc.com/residential/save-energy-watermoney/electric-vehicles-at-home

Petersen, A., Gartman, M., Corvidae, J. 2019. The Economics of Zero-Energy Homes. Rocky Mountain Institute. https://rmi.org/insight/economics-of-zero-energy-homes/

Pew Research Center. 2019. Pew Research Center. "U.S. Public Views on Climate and Energy." https://www.pewresearch.org/science/2019/11/25/u-s-public-views-on-climate-and-energy/

Pollin, Robert, Heidi Garrett-Peltier, James Heintz, and Bracken Hendricks. 2014. Green Growth: A U.S. Program for Controlling Climate Change and Expanding Job Opportunities. Center for American Progress & Political Economy Research Institute UMass. http://www.peri.umass.edu/fileadmin/pdf/Green_Growth_2014/GreenGrowthReport-PERISept2014.pdf

Regeneration International. 2017, July 12. Summary of State Efforts To Promote Healthy Soils and Soil Carbon Sequestration. https://regenerationinternational.org/2017/08/09/summary-state-effortspromote-healthy-soils-soil-carbon-sequestratio/

Richardson, Jeremy. 2019. "How Securitization Can Help Achieve a Just Transition for Coal Communities." Union of Concerned Scientists [Blog]. https://blog.ucsusa.org/jeremy-richardson/securitization-can-help-achieve-justtransition-for-coal-communities

Rigamer, B., Pinsonat, B. 2019, July. Statewide Louisiana Coastal Issues Survey. BDPC, LLC. http://mississippiriverdelta.org/files/2019/08/2019-Coastal-Survey-Topline-Deck.pdf

RIPUC. 2017 State of Rhode Island Public Utilities Commission, www.ripuc.ri.gov/.

Rodale Institute. 2014. Regenerative Ocean Agriculture and Climate Change. https://rodaleinstitute.org/wp-content/uploads/rodale-white-paper.pdf

Roselund, Christian. 2019. "The Energy Freedom Act Has Passed the South Carolina Senate."Pv Magazine USA, https://pvmagazine-usa.com/2019/05/08/energy-freedom-act-passes-south-carolina-senate/

RTD Denver. (2018, June). EagleP3 Fact Sheet. https://www.rtd-denver.com/sites/default/files/files/2018-06/2017EagleP3-factsheet.pdf

Sabin Center for Climate Change Law. 2020. Climate Deregulation Tracker. Columbia Law School. https://climate.law.columbia.edu/climate-deregulation-tracker

Sanderman, J., et al. 2018. A global map of mangrove forest soil carbon at 30 m spatial resolution. Environmental Research Letters, 13(5). https://doi.org/10.1088/1748-9326/aabe1c

Semega, Jessica, Melissa Kollar, John Creamer, & Abinash Mohanty. 2019. "Income and Poverty in the United States: 2018." US Census Bureau. Report Number P60-266. https://www.census.gov/data/tables/2019/demo/income-poverty/p60-266.html

Sharpe, M. 2019. "MARTA TURNS 40: Atlanta's trusted public transportation provider celebrates 40 years of service. The Atlanta Voice. https://www.theatlantavoice.com/articles/marta-turns-40-atlantas-trusted-public-transportation-provider-celebrates-40-years-of-service/

Smart Electric Power Alliance (SEPA). 2019. "2019 Utility Energy Storage Market Snapshot." https://sepapower.org/resource/2019-utility-energy-storage-market-snapshot/

Sneider, J. (2018, November). U.S. transit agencies likely to step up use of public-private partner ships, industry execs say. https://www.progressiverailroading.com/passenger_rail/article/US-transit-agencies-likely-to-step-upuse-of-public-private-partnerships-industry-execs-say--56056

Solar Energy Industries Association (SEIA). 2019a. California Solar. https://www.seia.org/state-solar-policy/california-solar

Solar Energy Industries Association (SEIA). 2019b. Solar State by State. https://www.seia.org/states-map

Solar Energy Industries Association (SEIA). 2020. "Net Metering." https://www.seia.org/initiatives/net-metering

Southeast Florida Regional Compact Climate Change (SFRCCC). n.d.. AG-3: Promote local Goods https://southeastfloridaclimatecompact.org/recommendations/promote-local-goods/

Taylor, Z. T., 2019. Preliminary Energy Costs and Savings Estimates: 2018 IECC Residential Requirements. Pacific Northwest National Laboratory.

Terando, Adam J., et al. 2014. "The Southern Megalopolis: Using the Past to Predict the Future of Urban Sprawl in the Southeast U.S." PLoS ONE, vol. 9, no. 7.

Texas Parks and Wildlife. n.d. A Summary of Seagrass Management in Texas. https://tpwd.texas.gov/landwater/water/habitats/seagrass/redfish-bay

Texas River Cities Plug-In Electric Vehicle Initiative (TRC). 2012. Regional Plan and Final Report. https://cleancities.energy.gov/files/u/projects_and_partnerships/project_material/supporting_material/252/texas_river_cities_readiness_plan.pdf

The Blue Carbon Initiative. 2019. Mitigating Climate Change Through Coastal Ecosystem Management. https://www.thebluecarboninitiative.org/

The Regional Greenhouse Gas Initiative (RGGI). (2020). Elements of RGGI. https://www.rggi.org/program-overviewand-design/elements

Thind, Maninder P. S., Christopher W. Tessum, Inês L. Azevedo, and Julian D. Marshall "Fine Particulate Air Pollution from Electricity Generation in the US: Health Impacts by Race, Income, and Geography." Environ. Sci. Technol. 2019, 53, 23, 14010-14019. DOI: 10.1021/acs.est.9b02527

Trabish, Herman K. 2018. "California Utilities Prep Nation's Biggest Time-of-Use Rate Rollout." Utility Dive, https://www.utilitydive.com/news/california-utilities-prep-nations-biggest-time-of-use-rate-roll-out/543402/

Tubbs, S. 2014. "Council adopts new 'complete streets' policy, allocates $50K for consultants." Charlottesville Tomorrow.

UCLA Luskin Center for Innovation (LCI). 2019. "Progress Toward 100% Clean Energy in Cities and States Across the U.S." https://innovation.luskin.ucla.edu/wp-content/uploads/2019/11/100-Clean-Energy-Progress-ReportUCLA-2.pdf

United States Energy & Employment Report (USEE). 2020. "Energy Employment By State – 2020." National Association of State Energy Officials. https://static1.squarespace.com/static/5a98cf80ec4eb7c5cd928c61/t/5e78198f28dc473dd3225f04/158 4929183186/USEER-Energy-Employment-by-State-2020.pdf

United States Forest Service (USFS). 2020a. How the Forest Legacy Program Works. U.S. Department of Agriculture. https://www.fs.usda.gov/managing-land/private-land/forest-legacy/program

United States Forest Service (USFS). 2020b. Fiscal Year 2020 Forest Legacy Program Funded Projects. U.S. Department of Agriculture. https://www.fs.usda.gov/sites/default/files/FY20Funded Projects-508.pdf

U.S. Green Building Sustainability Council Massachusetts (USGBC MA). 2019. "Zero Energy Buildings in Massachusetts: Saving Money from the Start." https://usgbcma.org/wpcontent/uploads/2019/09/ZeroEnergyBldgMA2019.pdf

U.S. Green Building Sustainability Council (USGBC). 2020. Projects. https://www.usgbc.org/projects?Country=%5B%22United+States%22%5D&State=%5B%22Kansas%22%5D

Vehicle Technologies Office. Technology Integration 2018 Annual Progress Report. Office of Energy Efficiency and Renewable Energy , 2018, Technology Integration 2018 Annual Progress Report, https://www.energy.gov/sites/prod/files/2019/04/f62/VTO_2018_APR_TechnologyIntegration%20Final.pdf

Voelcker, John. 2018, January 29. "Georgia to take second try at electric-car tax credit after killing first one." Green Car Reports. https://www.greencarreports.com/news/1115041_georgia-to-take-second-try-at-electric-cartax-credit-after-killing-first-one

Wickert, D. 2019. "New board to oversee transit expansion across metro Atlanta." Atlanta Journal Constitution. https://www.ajc.com/news/local-govt--politics/new-board-oversee-transit-expansion-acrossmetro-atlanta/vRokGfsvlHC6tpzIlpPhLK/

World Bank. 2019. Carbon Pricing Dashboard. https://carbonpricingdashboard.worldbank.org/map_data

World Resources Institute. 2011. "Forest Cover Loss to Development by County in the Southern United States." https://www.wri.org/resources/maps/forest-cover-loss-development-county-southern-unitedstates-2001-2006

Worley, K., Booher, V. 2019. Fruit Creek Farm Restoration Project Monitoring Report 2019. Environmental Science Division, Conservancy of Southwest Florida. https://www.conservancy.org/file/15---science-docs/mangrovereports/goodland-fruit-farm-creek-bowen-final--rpt-2018-2019-compressed.pdf

Yale Program on Climate Change Communication (YPCCC). 2019. "Poll: American Voters Support Climate Action." http://www.climatecommunication.yale.edu/news-events/poll-american-voters-support-climate-action/