RETAINED TRANSPORTATION FUEL SPENDING IN THE SOUTHEAST

ELECTRIC VS INTERNAL COMBUSTION VEHICLES

cleanenergy.org Southern Alliance for Clean Energy

AUGUST 2021

RETAINED TRANSPORTATION FUEL SPENDING IN THE SOUTHEAST

ELECTRIC VS INTERNAL COMBUSTION VEHICLES

AUTHORS

Heather Pohnan
Energy Policy Manager
heather@cleanenergy.org

Stan Cross
Electric Transportation Policy Director
stan@cleanenergy.org

Maggie Shober
Director of Utility Reform
maggie@cleanenergy.org

ACKNOWLEDGEMENTS

The authors would like to thank Kathy Harris and Luis Martinez at the Natural Resources Defense Council (NRDC), Zach Amittay and Bob Keefe at Environmental Entrepreneurs (E2), David Doctor at E4 Carolinas, and internal SACE staff for their feedback on this analysis and report. Any remaining errors are the responsibility of the authors.

ABOUT SACE

The Southern Alliance for Clean Energy is a nonprofit organization that promotes responsible and equitable energy choices to ensure clean, safe and healthy communities throughout the Southeast. As a leading voice for energy policy in our region, SACE is focused on transforming the way we produce and consume energy in the Southeast.

Proper citation for this report:
Southern Alliance for Clean Energy (2021).
Retained Transportation Fuel Spending in the Southeast, 2021 Report.

CONTENTS

INTRODUCTION

Current dependence on gasoline and diesel to power internal combustion engine vehicles (ICE) has led to a transfer of wealth from drivers in Southeastern states to other parts of the United States and other countries. When sold to drivers, a portion of gasoline and diesel fuel sales leave the state to pay for portions of the fuel supply chain outside of the state where the fuel is produced or sold. The portion that remains in a given state is referred to here as "retained transportation fuel spending," and the purpose of this paper is to determine how much is retained in the Southeast annually and how much will be retained when electricity displaces gas and diesel as electric vehicles (EVs) replace ICE.

FUEL TRANSPORTATION IS EXPENSIVE

Southeast consumers spend approximately $94 billion on gas and diesel fuels annually. And because the region has nearly no oil production or refining operations, only about one-third of that amount — approximately $30 billion — is retained in our region's economy, and the rest leaves to pay for the imported fuels. **That adds up to $64 billion leaking out of our region's economy every year.**

ELECTRIFYING TRANSPORTATION COULD PATCH THE LEAK

As light, medium, and heavy-duty vehicle electrification accelerates, more efficient vehicles and cheaper in-state-generated electricity allow consumers to spend less to drive the same number of miles. If all of the region's vehicle miles traveled were electric today, Southeast consumers would spend approximately $52 billion on electricity, **reducing consumer transportation fuel spending by $42 billion annually**.

EXTRA SPENDING KEPT IN THE SOUTHEAST BY ELECTRIFYING TRANSPORTATION

Additionally, if all of the region's vehicle miles traveled were electric today, more than two-thirds of those $52 billion dollars we would spend on electricity for transportation — approximately $35 billion — would stay in the region, vs. the $30 billion we retain under the current system that relies heavily on gas and diesel. This means that we could **keep an additional $5 billion annually** recirculating through and supporting local economies if we switched to a fully electric transportation system.

Thus, by saving consumers $42 billion in fuel spending and keeping an extra $5 billion in-region, **electrifying transportation in the Southeast would result in $47 billion in transportation fuel spending retained annually.**

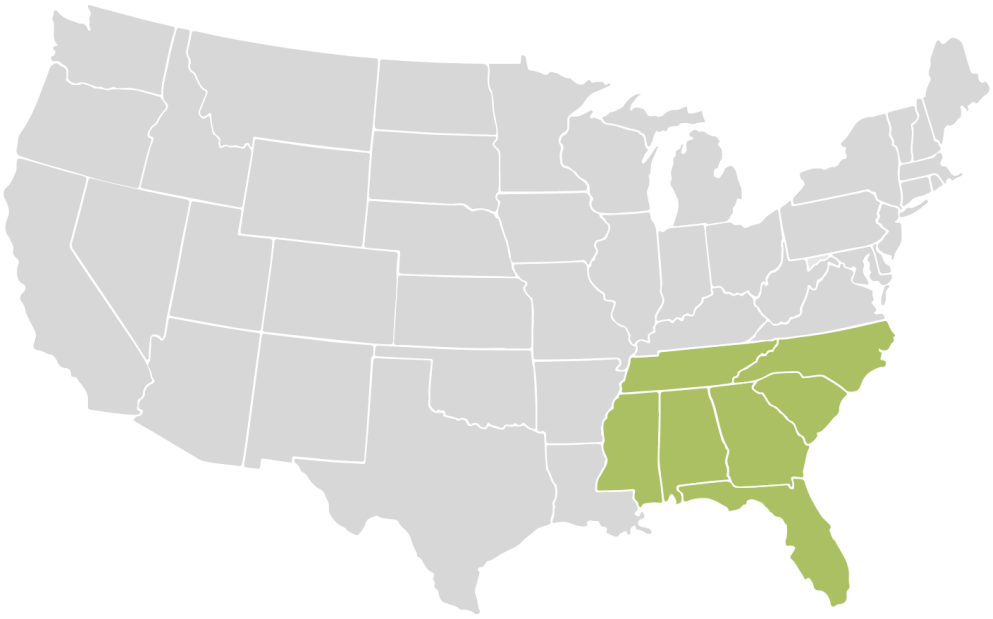
Expenditures Retained In Southeast Region vs. Lost, by Fuel Type (Billions $, 2019)

Electrifying transportation will save consumers money at the plug and keep more of their transportation fuel dollars recirculating through local economies.

METHODS OF ANALYSIS

This paper examines how much current transportation fuel spending remains in a given Southeast state and how much goes elsewhere to benefit other states or regions.[1] We also look at the parallel calculation for electricity that would power EV miles driven if all on-road gas and diesel-powered cars, trucks and buses are replaced with vehicles that drive entirely on electricity. The geographic scope is limited to the Southeast, defined in this paper as Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Tennessee is illustrated below.

Figure 2 – Geographic Coverage of Analysis



For **motor fuel expenditures,** we start with how much is spent on gasoline and diesel in each state. The prices of gasoline and diesel, as well as gasoline consumed by the transportation sector, are available through the U.S. Energy Information Administration's (EIA) State Energy Data System (SEDS). We obtained data from EIA's Sales of Distillate Fuel Oil by End-Use dataset for the diesel used only by the on-highway transportation sector.[2] To determine how much money was retained in a given state, the components of the retail price were broken down using approximations from EIA. Per gallon fuel taxes collected at the state and federal levels were calculated for motor fuels, and also used as a "stand-in" for electricity calculations described below.

We also analyzed **electricity sales for vehicle charging** as the counterfactual to the continued use of gasoline and diesel. We used stock-weighted miles per gallon (MPG) averages of vehicles derived from Oak Ridge's National Household Travel Survey (NHTS) to convert gallons of fuel to electrified miles. From there, a miles per kWh conversion factor is used to estimate the amount of electricity, or load, to meet each state's transportation fuel needs: 4 miles per kWh for light-duty gasoline vehicles and 2 miles per kWh for medium and heavy-duty diesel vehicles.[3]

---

[1] Note this analysis does not examine where these dollars went, just that they did not remain within the state in which the fuel was purchased.
[2] EIA Sales of Distillate Fuel Oil by End Use, available at: eia.gov/dnav/pet/pet_cons_821dst_a_EPD2D_VHN_Mgal_a.htm
[3] Vehicle performance evaluations of current fleets may reveal lower averages, but these values were chosen to reflect newer technologies that would be likely to replace the remaining unconverted fleet.

Transportation spending for electricity was calculated in several steps. First, state level retail prices of electricity from EIA were used to calculate transportation expenditures. Next, EIA's breakdown of factors affecting electricity prices was applied to each state's expenditures. Retail sales plus the fuel tax "stand-in" was applied after this step. For context, the main components of retail prices per unit for both motor fuels ($/gallon) and electricity (¢/kwh) are reproduced below.

Table 1 – Main Components of Retail Price of Transportation Fuels

Fuel Type	Component of Retail Price	Level Retained	Per Unit
Gas / Diesel	Crude oil	Low	54% / 46%
	Distribution & marketing[4]	**High**	15% / 21%
	Federal & state taxes[5]	Medium	18% / 18%
	Refining costs & profits	Low	13% / 15%
Electricity	Generation	Medium	56%
	O&M	**High**	Varies
	Purchased power	**High**	Varies
	Fuel costs	Low	Varies
	Distribution	**High**	31%
	Transmission	**High**	13%

Source: U.S. Energy Information Administration. Energy Explained entries on "Factors Affecting Gasoline Prices" and "Factors Affecting Electricity Prices"

The national average shows that electricity generation is the largest component of retail price and is therefore an important driver of how much transportation spending is retained in a given state. For this reason, we further subdivided generation costs into components such as fuel costs, operations & maintenance, and power purchase costs. This builds on Southern Alliance for Clean Energy (SACE) research on utility cost models and the calculated cost of the power supply for generation units in the Southeast, so the division of generation costs among these different categories varies are specific to each state. For a complete description of how these factors are treated in this paper, please see Appendix.

Many components of electricity are assumed to be retained 100% in-state: transmission, distribution, and the operations & maintenance (O&M) subcomponent for generation. Purchased power costs vary, but can reflect recovery of capital costs from power plants that have been built in-state so the level retained can range from 50% to nearly 100% depending on the state. Fuel for power plants is often purchased from out of state (and in the case of nuclear is always out of state), with only Alabama and Mississippi having significant in-state production of electricity fuels. Therefore, less than 10% of fuel costs are retained in most states. The final step is to apply retail sales taxes to electricity sales, which are all retained locally, and also the state gas and diesel fuel tax "stand-in" which is retained locally while the federal portion is not.

[4] Some or all electric utility marketing expenses may be spread across the categories depending on the type of electric utility, rather than in a single category such as those for motor fuels.
[5] Table shows national average for context, taxes are calculated by state individually.

STATE & REGIONAL RESULTS

MOTOR FUEL EXPENDITURES

Out of the approximately $94 billion spent at the pump on gas and diesel fuel by consumers in the Southeast annually, we estimate that just under $30 billion, or one-third, of those expenditures, are retained in the state where fuel was purchased. The remaining 68% leaves the region for the states and countries where oil reserves and petroleum processing plants are located. The estimated portion kept in-state varies by state, ranging from low-end South Carolina at 25% to Mississippi at the upper end at 36%.

Table 2 – Motor Fuel Transportation Expenditures by Type and State

State	Total Expenditures (Billion $, 2019)			Expenditures Kept In-State	
	Motor Gas	Diesel	Total	Billion $	(%)
Alabama	$6.45	$2.46	$8.91	$2.49	28%
Florida	$22.20	$5.39	$27.60	$9.65	35%
Georgia	$11.80	$3.63	$15.43	$4.84	31%
Mississippi	$4.01	$2.05	$6.07	$2.16	36%
North Carolina	$11.92	$3.51	$15.42	$5.25	34%
South Carolina	$6.77	$2.41	$9.18	$2.31	25%
Tennessee	$8.30	$3.09	$11.38	$3.16	28%
Southeast	**$71.44**	**$22.54**	**$93.99**	**$29.85**	**32%**

It is important to note that the factors impacting these results vary by state. Mississippi sees a higher portion of expenditures remain in-state because it has *some* crude oil production and refining. However, two other states with a relatively high portion that remains in the state are Florida and North Carolina. These two states have higher state and local gasoline and diesel tax rates than other Southeast states.[6] Sales and/or use taxes are sometimes added to gasoline excise taxes, while other states might include inspection fees, environmental fees, leaking underground storage tank taxes, etc.

It is also notable that several factors that influence these results, including crude oil production and refining, prices at the pump and the gas tax, are unlikely to hold steady in the future. For example, rising fuel efficiency standards for cars and trucks have led to more vehicle miles traveled (VMTs) on fewer gallons of gasoline and diesel, thereby decreasing revenue from state and federal gas taxes. Additionally, what little crude oil production and refining occur in the region is often located in low-lying coastal areas threatened by more frequent extreme weather events that disrupt oil production and refining.

[6] Oak Ridge National Laboratory, Transportation Energy Data Book: Edition 39, Table 11.10

ELECTRICITY EXPENDITURES

To contrast, we provide a hypothetical comparison of how much money would be kept in each state if all the regions' cars, trucks, and buses were electric. This would result in the transportation sector consuming electricity instead of motor fuel to provide the same level of transportation services. Driving electric cars, trucks and buses would cost consumers $51.7 billion on electricity—a savings of over $42 billion annually. This is because electricity is cheaper than gas and diesel and EVs are more efficient than ICE. Additionally, of the $51.7 billion spent, we estimate that $35.2 billion, is retained in the region, which is $5.33 billion more compared to gas and diesel. These two numbers combine to equal $47 billion in potential transportation fuel spending retained annually by electrifying the region's transportation.

Table 3 – Electricity Transportation Expenditures by Type and State

State	Expenditures for Electricity (Billion $, 2019)			Expenditures Kept In-State		
	Replacement of Gasoline	Replacement of Diesel	Total	Billion $	(%)	ICE to EV Savings Billion $*
Alabama	$2.42	$1.83	$4.25	$2.76	65%	$.27
Florida	$10.06	$7.16	$17.22	$11.74	68%	$2.09
Georgia	$4.89	$3.78	$8.68	$5.96	67%	$1.12
Mississippi	$1.41	$1.23	$2.64	$1.60	61%	-$.56
North Carolina	$4.87	$3.75	$8.62	$6.14	71%	$.89
South Carolina	$2.58	$1.96	$4.54	$3.04	67%	$.73
Tennessee	$3.25	$2.51	$5.76	$3.95	69%	$.79
Southeast	**$29.48**	**$22.22**	**$51.70**	**$35.18**	**68%**	**$5.33**

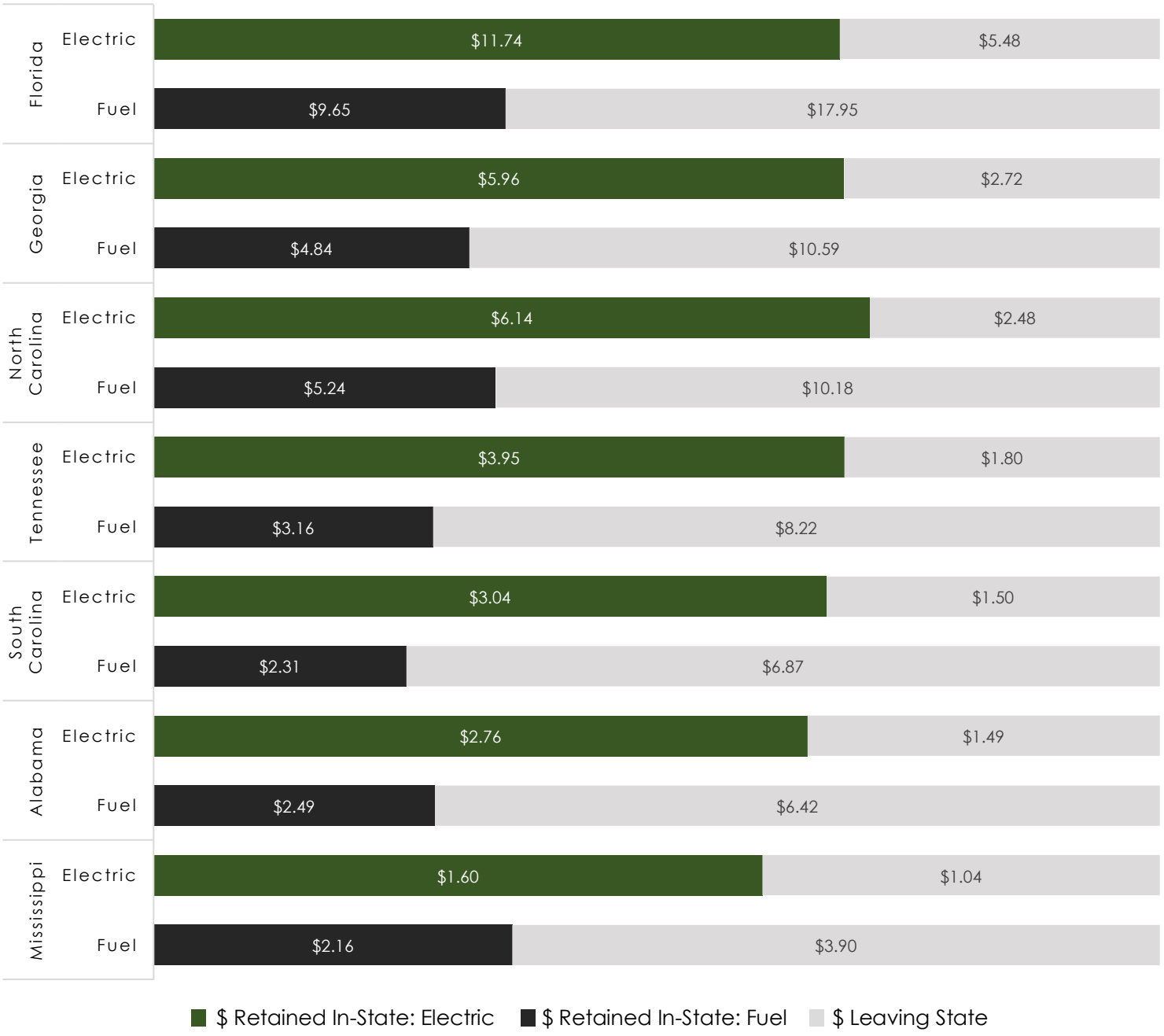
**Additional retained spending calculated by switching from motor fuel transportation to electric.*

Overall, the comparatively high percentage of transportation spending retained powering transportation with electricity results from the nature of the infrastructure needed to generate and deliver electricity to customers. For example, delivering electricity to consumers through transmission & distribution makeup approximately 44% of electricity prices which is all retained in the state where it is sold. Distribution lines are maintained locally, and while electricity can travel across state lines via transmission lines, it does so infrequently and to neighboring states rather than traveling through multiple states.

States like North Carolina that meet a large portion of their needs through self-generation see a higher percentage of dollars retained because a more significant portion of utility costs come from operations & maintenance (O&M), which generally remain in-state since local utility workers and sub-contractors perform them. Additionally, power purchase costs often occur between in-state utilities rather than from power plants in other regions since there are a large number of cooperative and municipal utilities.

However, a large component of retail prices goes toward fuel costs for nuclear, coal, and gas, and typically leave the state. Therefore, states like Mississippi that rely heavily on imported fossil gas for generation to meet power demand see a lower percentage of dollars retained because a larger percentage of utilities' fuel costs leave the state, just like imported motor fuels.

Figure 3 - Expenditures Retained In-State vs. Leaving State, by Fuel (Billion $, 2019)



Implicit in these findings is also that when electrifying the Southeast, consumers will spend less on transportation to drive the same number of miles. Consumers currently spend $94 billion on gasoline and diesel annually but the same level of service can be achieved with electric vehicles for $42 billion fewer dollars annually. Therefore, not only does electrification retain more money annually, but it also reduces the amount of transportation spending that unnecessarily leaves the local economy.

Lastly, it is important to recognize that the Southeast is bathed in sunshine and is home to two of the nation's leading solar states, Florida and North Carolina. As regional solar generation continues to ramp up, more of the electricity that will power EVs will be generated locally, leading to even more transportation fuel spending retained.

DISCUSSION & IMPACTS

Our key finding is that because electricity is cheaper than gas and diesel, EVs more efficient than ICE, and the region's electricity generation, transmission and distribution more local than oil production and refining, electrifying the transportation sector will retain more transportation fuel spending in the region's economy. In our analysis of a 100% shift from ICE to EVs, we considered both the reduced consumer spending on transportation fuel and the higher percentage of that spending that remains in states' economies. It is critical to look at both these numbers—$42 billion and $5 billion respectively—to understand the potential positive economic impact. Our findings have also prompted several observations on topics outside the core focus of this paper, including consumer-level impacts, highway fuel tax, electric utility regulation, public policy, and the local economic impact of recirculating billions of dollars in retained transportation fuel spending.

CONSUMER IMPACTS

Many other studies have documented the cost benefits of electrified transportation to the consumer. Rather than recreate similar findings, we attempt to contextualize how reduced consumer costs can contribute to a state's economic well-being. As is the case with energy efficiency, a reduction in household expenditures for energy keeps more dollars in consumers' pockets. With electric transportation, the cost to travel the exact mileage is significantly lowered, which frees up room in the household budget for other necessary expenditures and disposable income expenses.

Argonne National Laboratory recently calculated that households spend on average 3.3% of their income on transportation fuel costs, also known as transportation burden. In most Southeastern states, consumers spend higher than the national average. In an Oak Ridge survey, more consumers also said that gasoline prices impact their travel and that travel is a financial burden, indicating the potential pressure for households to make sacrifices in order to pay for transportation costs.

Table 4 – Affordability of Household Transportation Fuel Costs

State	Affordability of Household Transportation Fuel Costs		
	Transportation Burden	Price of Gasoline Affects Travel	Travel is a Financial Burden
Alabama	3.52%	59.4%	47.9%
Georgia	3.38%	56.8%	44.0%
Florida	3.04%	48.2%	37.6%
Mississippi	3.91%	69.6%	58.1%
North Carolina	3.36%	58.3%	44.7%
South Carolina	3.34%	56.8%	41.7%
Tennessee	3.53%	50.8%	39.9%
National Average	**3.27%**	**48.8%**	**41.8%**

Source: Affordability of Household Transportation Fuel Costs by Region and Socioeconomic Factors, Argonne National Laboratory; National Household Travel Survey by Oak Ridge National Laboratory

FUEL TAX STAND-IN

Between federal and state collections, Southeast consumers spend approximately $28.6 billion on fuel taxes, with about $16.4 billion of that being state taxes that are retained locally. For the purpose of this paper's analysis, it is assumed that federal and state governments will need to continue generating revenue to fund the region's roadways and thus, the same levels of taxes are assumed for motor fuel and electricity expenditure calculations. Policymakers are currently exploring how best to ensure long-term roadway funding meets demand as ICE vehicles become increasingly more fuel efficient and electric vehicle market share grows.

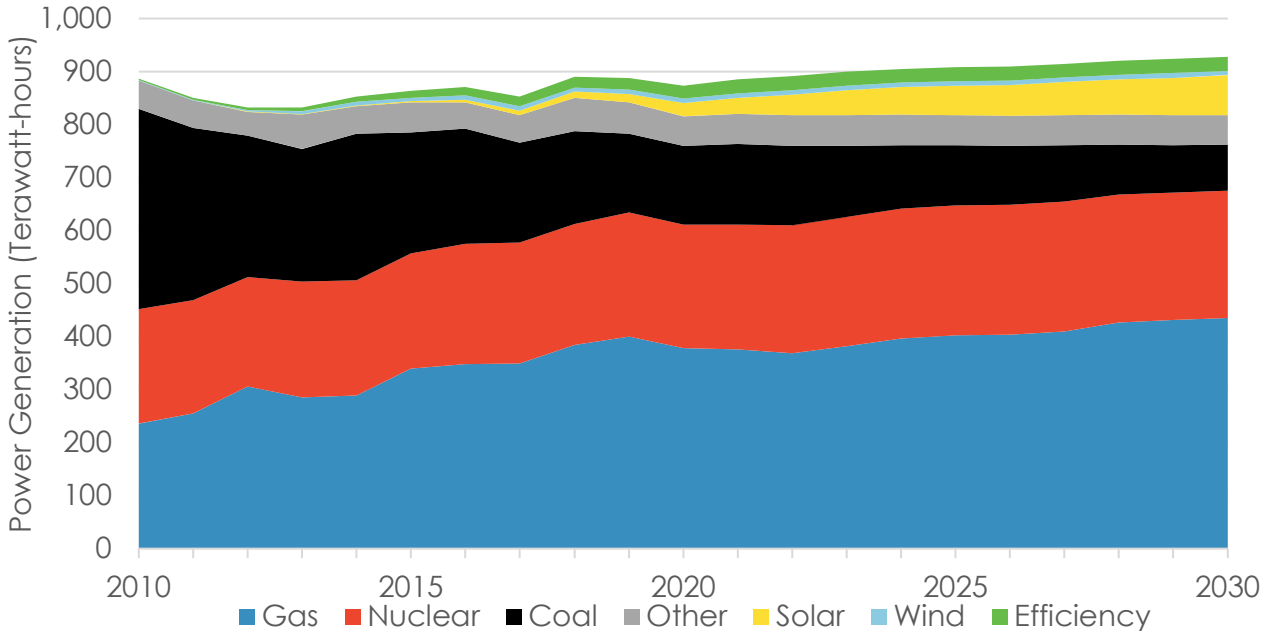
IMPACT OF INDUSTRY REGULATION

The electricity sector operates under a different regulatory model from the petroleum sector. Motor fuel prices tend to be driven by international oil pricing and trades, which creates a volatile market. Electric utilities are regulated monopolies, and in the Southeast, utilities are set up to be the sole provider of electricity in exchange for regulation of spending and pricing by state, local, or even federal entities. A historical look at the volatility of gasoline prices compared to the slow climb of residential electricity rates is driven, in part, by the differences in the regulatory model. Another driver of the differences in price volatility includes the diversity of fuels relied on to generate electricity. The commodity markets for those fuels are generally less volatile than the international oil market, with the exceptions of fossil gas markets that have seen some historical volatility.

IMPACT OF FUEL MIX

Finally, but perhaps most importantly, one key aspect of how much customer spending is kept in-state under transportation electrification is the state's reliance on out-of-state fuels like coal, fossil gas, and nuclear fuel to generate electricity. Currently, the majority of the region's electricity comes from these sources, as shown below.

Figure 4 – Southeast Generation Forecast by Fuel Type, 2010-2030[7]



[7] Southern Alliance for Clean Energy (2021). Tracking Decarbonization in the Southeast: Generation & Emissions., 2021 Report.

Investments in clean energy resources like energy efficiency and local renewable generation from solar, wind, and energy storage are proven ways to keep more customer wealth within the state and drive economic development. When transitioning to these resources, electricity prices will be composed primarily of operations & maintenance, and transmission & distribution, which are all local and in-state expenditures.

SACE has mapped out the transition to clean energy for the four largest utility systems in the Southeast with a high investment in distributed sources,[8] and it is clear that transitioning electric generation to cleaner sources while simultaneously electrifying transportation can further increase the level of consumer spending retained within states and also the region.

[8] Southern Alliance for Clean Energy (2021). Achieving 100% Clean Electricity in the Southeast, 2021 Report.