CITIZENS UTILITY BOARD
CUB
Empowering Michigan Consumers

UTILITY PERFORMANCE REPORT

RANKING MICHIGAN AMONG THE STATES

2024 EDITION

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GLOSSARY

Terms and Abbreviations

CAIDI	Customer Average Interruption Duration Index
CO_2	carbon dioxide
EIA	Energy Information Administration
EPA	Environmental Protection Agency
IEEE	Electrical and Electronics Engineers
MED	Major Event Days
NG	Natural Gas
NO_x	nitrogen oxides of multiple types
OHF	Other Heating Fuel
RPS	Renewable Portfolio Standard
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SEDS	State Energy Data System
SO_2	sulfur dioxide
Trend CAGR	average yearly change of the fitted trendline

Units of Measurement

GWh	gigawatt hour—one million kilowatt hours
kWh	kilowatt hour—a unit of electricity measurement typical on U.S. electric bills, the average American household uses about 11,000 kWh per year
Mcf	thousand cubic feet of natural gas
Metric Ton	one million grams or 2204.6 pounds
MMBTU	one million British thermal units, equivalent to 293.07 kWh
MWh	megawatt hour—one thousand kilowatt hours
Therm	one hundred cubic feet of natural gas
TWh	terawatt hour—one billion kilowatt hours

INTRODUCTION

Report Overview

The data in this year's report show Michigan utilities continuing the long-term trend of highly unreliable electric service relative to utilities across the country and those in neighboring states. Michigan utilities also continue to charge relatively high electric rates, especially for residential customers. On metrics related to pollution and the environment, Michigan utilities tend to rank in the bottom half of states on key measures such as emissions intensity.

It appears 2021 was a particularly bad year for reliability in Michigan, a result driven by major weather events affecting large numbers of customers. Michigan's reliability performance in 2022 was better than in 2021, close to its five-year average performance on these metrics. Still, among its neighbors, Michigan has the highest number of outage minutes per customer, driven largely by the duration of outages rather than their frequency. In other words, while Michigan does show a high vulnerability to outages, its poor performance is driven by Michigan utilities being slow to act to restore service. A recurring theme across different versions of this report, reinforced by the latest data, is that Michigan utilities have continually failed to improve their basic reliability performance, a weakness that is likely to be magnified during severe weather, which experts expect will be more common as the climate continues to warm.

Overall energy affordability continues to be another weakness for Michigan, driven by high electricity prices. In 2022, Michiganders spent an average of 4.04% of their income on energy, well above the national average, even though Michigan ranked in the top 10 least expensive states for residential natural gas. The last time Michigan's energy burden exceeded 4% was 2018, and 2022 was a significant jump from 2021. Michigan's high electricity prices accentuate the importance of energy efficiency programs, which seek to spare utilities from marginal costs and lower overall electricity prices. On the metrics of efficiency program cost effectiveness and program deployment, Michigan ranks better than most states: in 2022, Michigan utilities' efficiency programs allowed them to avoid producing 1.5% of their collective electricity sales, and these savings cost a fraction of what the electricity would have cost.

On environmental metrics, Michigan's performance is mixed. In 2022, Michigan had the 6th highest total CO2 emissions from the power sector, the 5th highest SO2 emissions, and the 7th highest CO_2 emissions resulting from lost natural gas, despite having the 10th largest population among the states. However, a significant shift in Michigan's electricity mix from coal to natural gas reduced the SO_2 emissions intensity from 2021 to 2022. Clean energy laws passed in 2023 will require Michigan's utilities to generate a rapidly increasing fraction of their electricity from clean sources. The Palisades Nuclear Plant is on track for a first-of-a-kind restart of its operations, which would add a significant amount of clean electricity to the grid. So while Michigan so far has continued to rely heavily on dirty energy, this will likely change soon.

What's New for 2024

Tableau

In this year's report, similar to last year, all the figures were developed in Tableau, an industry standard data visualization software. The CUB website's Tableau platform contains a *comprehensive set of figures* for all the metrics contained in this report, and more, for many data years. Readers can visit the platform to perform their own analysis of the underlying utility performance data—they can interact with the figures to compare states, view historical trends for the metrics we discuss in the report, and compare utilities nationwide, not just in Michigan.

Figure 1: Michigan Summary Table for 2022

State Summary Table

Metric Name	Unit	Metric Value	Rank
SAIDI with MED	outage minutes per customer	513.126	43
SAIDI without MED	outage minutes per customer	165.616	42
SAIFI with MED	interruptions per customer	1.339	28
SAIFI without MED	interruptions per customer	1.013	29
CAIDI with MED	outage minutes per interruption	383.166	49
CAIDI without MED	outage minutes per interruption	163.557	49
Clean Generation as % of Total Generation	%	31.747	34
CO2 Emissions Intensity	kg per MWh	497.969	36
CO2 Equivalent Emissions From Lost NG	thousand metric tons	2,480.366	44
CO2 Total Emissions	thousand metric tons	58,509.880	46
NOX Emissions Intensity	g per MWh	415.336	37
NOX Total Emissions	thousand metric tons	48.801	46
Renewable Generation as % of Total Generation	%	11.719	36
SO2 Emissions Intensity	g per MWh	415.321	42
SO2 Total Emissions	thousand metric tons	48.799	47
Average Price of Electricity - Commercial Sector	$/kWh	0.125	36
Average Price of Electricity - Industrial Sector	$/kWh	0.083	31
Average Price of Electricity - Residential Sector	$/kWh	0.179	41
Efficiency Programs - Electricity Savings as % of Sales - Commercial Sector	%	2.600	2
Efficiency Programs - Electricity Savings as % of Sales - Industrial Sector	%	0.457	12
Efficiency Programs - Electricity Savings as % of Sales - Residential Sector	%	1.339	13
Electrical Generation - all utility-scale solar as % of All Utility Scale Generation	%	0.726	33
Electrical Generation - biomass as % of All Utility Scale Generation	%	1.908	17
Electrical Generation - coal as % of All Utility Scale Generation	%	29.132	33
Electrical Generation - conventional hydroelectric as % of All Utility Scale Generation	%	1.171	13
Electrical Generation - natural gas as % of All Utility Scale Generation	%	34.794	25
Electrical Generation - nuclear as % of All Utility Scale Generation	%	21.977	14
Electrical Generation - wind as % of All Utility Scale Generation	%	7.731	20
Efficiency Programs - Cost per kWh of Electricity Savings - Commercial Sector	$/kWh	0.015	18
Efficiency Programs - Cost per kWh of Electricity Savings - Industrial Sector	$/kWh	0.016	21
Efficiency Programs - Cost per kWh of Electricity Savings - Residential Sector	$/kWh	0.051	37
Electrical Generation - geothermal as % of All Utility Scale Generation	%	Null	Null
Electrical Generation - other as % of All Utility Scale Generation	%	1.248	44
Electrical Generation - petroleum coke as % of All Utility Scale Generation	%	1.224	3
Electrical Generation - petroleum liquids as % of All Utility Scale Generation	%	0.090	29
Electricity Consumption per Household	kWh per household	8,566.439	11
Electricity Expenditures per Household	$ per household	1,529.661	18
Electricity Expenditures per Household as % of Median Income	%	2.284	26
Energy Expenditures per Household	$ per household	2,705.271	37
Energy Expenditures per Household as % of Median Income	%	4.039	38
Fossil Generation as % of Total Generation	%	66.350	34
NG - Consumption per Customer - Residential Sector	Mcf per customer	104.720	50
NG - Price - Residential Sector	$/Mcf	11.309	7
OHF - Expenditures per Household - Residential Sector	$ per household	2,343.205	26
OHF - Total Consumption Per Household - Residential Sector	million BTU per household	121.013	36
Utility ROE	%	9.957	39

About This Report

The rankings listed in Figure 1 are in order from best performance to worst. For example, a "1" ranking implies that a state's performance on the given metric is the most desirable out of the 50 states plus D.C., and a "51" ranking implies its performance is the least desirable.

In some cases, a smaller value for a given metric will mean "better" performance and thus a higher ranking. For example, when it comes to the reliability metrics, a lower numerical value is desirable because a smaller number means shorter or less frequent outages, so the lower the value reported for a state, the closer to the top of the rankings it will fall. But in other cases, a higher value will mean "better" performance on a metric. For example, our report assumes that it is desirable for renewables to make up a higher percentage of generation, so a higher number on that metric leads to a better (i.e. lower) ranking for a state. Similarly, energy efficiency representing a higher percentage of a state's electricity sales also leads to a higher ranking.

Because some data are released earlier than others by the Energy Information Administration (EIA) of the U.S. Department of Energy, this report displays some data from 2023, but mostly shows data from calendar year 2022.

This report discusses Michigan in relation to a "peer group" consisting of Ohio, Indiana, Illinois, Wisconsin and Minnesota. These states generally have similar weather, population dynamics, industrial activity and market conditions, and this comparison introduces some context for the statistics in this report.

RANKING MICHIGAN ELECTRIC UTILITIES ON RELIABILITY, AFFORDABILITY AND EFFICIENCY

2022 Alpena Power Co Performance Summary

Metric	Value	Michigan	US Average	IOU Rank
Number of Electric Customers - All Sectors	16683	5035495	3140427	6
Average Price of Electricity - Residential Sector ($/kWh)	0.143	0.179	0.150	1
Average Price of Electricity - Commercial Sector ($/kWh)	0.123	0.125	0.124	2
Average Price of Electricity - Industrial Sector ($/kWh)	0.091	0.083	0.083	6
SAIDI with MED (outage minutes per customer)	159.900	513.126	335.082	1
SAIDI without MED (outage minutes per customer)	92.300	165.616	123.925	1
SAIFI with MED (interruptions per customer)	1.800	1.339	1.384	4
SAIFI without MED (interruptions per customer)	0.800	1.013	1.038	1
CAIDI with MED (outage minutes per interruption)	88.833	383.166	242.191	1
CAIDI without MED (outage minutes per interruption)	115.375	163.557	119.408	1
Efficiency Programs - Electricity Savings as % of Sales - Residential Sector		1.339	0.776	

2022 Consumers Energy Co Performance Summary

Metric	Value	Michigan	US Average	IOU Rank
Number of Electric Customers - All Sectors	1875019	5035495	3140427	2
Average Price of Electricity - Residential Sector	0.181	0.179	0.150	5
Average Price of Electricity - Commercial Sector	0.137	0.125	0.124	5
Average Price of Electricity - Industrial Sector	0.087	0.083	0.083	4
SAIDI with MED (outage minutes per customer)	466.550	513.126	335.082	3
SAIDI without MED (outage minutes per customer)	181.990	165.616	123.925	3
SAIFI with MED (interruptions per customer)	1.287	1.339	1.384	2
SAIFI without MED (interruptions per customer)	0.961	1.013	1.038	2
CAIDI with MED (outage minutes per interruption)	362.510	383.166	242.191	6
CAIDI without MED (outage minutes per interruption)	189.376	163.557	119.408	5
Efficiency Programs - Electricity Savings as % of Sales - Residential Sector	1.280	1.339	0.776	4

2022 DTE Electric Company Performance Summary

Metric	Value	Michigan	US Average	IOU Rank
Number of Electric Customers - All Sectors	2257415	5035495	3140427	1
Average Price of Electricity - Residential Sector	0.184	0.179	0.150	6
Average Price of Electricity - Commercial Sector	0.122	0.125	0.124	1
Average Price of Electricity - Industrial Sector	0.077	0.083	0.083	2
SAIDI with MED (outage minutes per customer)	583.893	513.126	335.082	6
SAIDI without MED (outage minutes per customer)	146.154	165.616	123.925	2
SAIFI with MED (interruptions per customer)	1.249	1.339	1.384	1
SAIFI without MED (interruptions per customer)	0.980	1.013	1.038	3
CAIDI with MED (outage minutes per interruption)	467.488	383.166	242.191	7
CAIDI without MED (outage minutes per interruption)	149.137	163.557	119.408	4
Efficiency Programs - Electricity Savings as % of Sales - Residential Sector	1.694	1.339	0.776	3

2022 Indiana Michigan Power Co Performance Summary

Metric	Value	Michigan	US Average	IOU Rank
Number of Electric Customers - All Sectors	131149	5035495	3140427	3
Average Price of Electricity - Residential Sector	0.161	0.179	0.150	3
Average Price of Electricity - Commercial Sector	0.131	0.125	0.124	3
Average Price of Electricity - Industrial Sector	0.105	0.083	0.083	7
SAIDI with MED (outage minutes per customer)	542.700	513.126	335.082	4
SAIDI without MED (outage minutes per customer)	235.900	165.616	123.925	6
SAIFI with MED (interruptions per customer)	1.501	1.339	1.384	3
SAIFI without MED (interruptions per customer)	1.121	1.013	1.038	4
CAIDI with MED (outage minutes per interruption)	361.559	383.166	242.191	5
CAIDI without MED (outage minutes per interruption)	210.437	163.557	119.408	7
Efficiency Programs - Electricity Savings as % of Sales - Residential Sector	1.034	1.339	0.776	5

2022 Northern States Power Co Performance Summary

Metric	Value	Michigan	US Average	IOU Rank
Number of Electric Customers - All Sectors	8939	5035495	3140427	7
Average Price of Electricity - Residential Sector	0.147	0.179	0.150	2
Average Price of Electricity - Commercial Sector	0.133	0.125	0.124	4
Average Price of Electricity - Industrial Sector	0.079	0.083	0.083	3
SAIDI with MED (outage minutes per customer)	391.059	513.126	335.082	2
SAIDI without MED (outage minutes per customer)	211.827	165.616	123.925	5
SAIFI with MED (interruptions per customer)	1.972	1.339	1.384	5
SAIFI without MED (interruptions per customer)	1.483	1.013	1.038	7
CAIDI with MED (outage minutes per interruption)	198.306	383.166	242.191	2
CAIDI without MED (outage minutes per interruption)	142.837	163.557	119.408	3
Efficiency Programs - Electricity Savings as % of Sales - Residential Sector	1.737	1.339	0.776	2

2022 Upper Michigan Energy Resources Corp. Performance Summary				
Metric	**Value**	**Michigan**	**US Average**	**IOU Rank**
Number of Electric Customers - All Sectors	37063	5035495	3140427	5
Average Price of Electricity - Residential Sector	0.177	0.179	0.150	4
Average Price of Electricity - Commercial Sector	0.166	0.125	0.124	6
Average Price of Electricity - Industrial Sector	0.089	0.083	0.083	5
SAIDI with MED (outage minutes per customer)	799.000	513.126	335.082	7
SAIDI without MED (outage minutes per customer)	286.000	165.616	123.925	7
SAIFI with MED (interruptions per customer)	2.340	1.339	1.384	7
SAIFI without MED (interruptions per customer)	1.390	1.013	1.038	5
CAIDI with MED (outage minutes per interruption)	341.453	383.166	242.191	4
CAIDI without MED (outage minutes per interruption)	205.755	163.557	119.408	6
Efficiency Programs - Electricity Savings as % of Sales - Residential Sector		1.339	0.776	

2022 Upper Peninsula Power Company Performance Summary				
Metric	**Value**	**Michigan**	**US Average**	**IOU Rank**
Number of Electric Customers - All Sectors	53418	5035495	3140427	4
Average Price of Electricity - Residential Sector	0.230	0.179	0.150	7
Average Price of Electricity - Commercial Sector	0.186	0.125	0.124	7
Average Price of Electricity - Industrial Sector	0.075	0.083	0.083	1
SAIDI with MED (outage minutes per customer)	566.800	513.126	335.082	5
SAIDI without MED (outage minutes per customer)	204.600	165.616	123.925	4
SAIFI with MED (interruptions per customer)	2.310	1.339	1.384	6
SAIFI without MED (interruptions per customer)	1.480	1.013	1.038	6
CAIDI with MED (outage minutes per interruption)	245.368	383.166	242.191	3
CAIDI without MED (outage minutes per interruption)	138.243	163.557	119.408	2
Efficiency Programs - Electricity Savings as % of Sales - Residential Sector	2.361	1.339	0.776	1

ELECTRIC AND NATURAL GAS UTILITY RELIABILITY AND PERFORMANCE

Electric Utilities Overview

Electricity is essential to modern life. As the U.S. moves towards decarbonizing its economy through electrification, electric reliability will become increasingly important, and, in turn, a more reliable electric system will promote electrification. Much of the public discussion about electric utility reliability focuses on what utility regulators and utilities call “resource adequacy.” Resource adequacy ensures that there is sufficient power generation capacity to satisfy utility customer peak demand. However, loss of electricity supply due to generation or transmission problems accounts for only about 1% of outage minutes nationally. Power outages that utility customers experience on a regular basis are not caused by insufficient generation capacity or long-distance transmission, but by breakdowns in the electricity delivery system—the distribution grid. Distribution breakdowns may occur due to storms breaking power lines, wildfires, animals touching pairs of power lines and causing a “short,” equipment failures and many other reasons.

The electric power industry, led by the Institute of Electrical and Electronics Engineers (IEEE), has determined that the best overall measure of an electric utility’s reliability is the average number of minutes of outage per year per customer, calculated by a method referred to as the System Average Interruption Duration Index (SAIDI). SAIDI is our primary metric for electric reliability, but it is the product of two other reliability metrics: the System Average Interruption Frequency Index (SAIFI), which measures outages per customer, and the Customer Average Interruption Duration Index (CAIDI), which measures the average time for the utility to restore power to a customer after an outage starts.

Beginning in 2013, the EIA began collecting annual reports of SAIDI, SAIFI, and CAIDI from utilities and publishing those data in annual compilations. These data are collected on form EIA-861 and may be downloaded *here*. The latest available reliability data from EIA are for calendar year 2022. The EIA collects SAIDI and SAIFI metrics with and without Major Event Days (MED). MED are often the result of ice storms, windstorms, wildfires and hurricanes, and can materially affect annual reliability statistics. While reliability metrics that include MED can fluctuate greatly year-to-year, they provide a more accurate representation of customer experience than metrics excluding MED. For this reason, reliability data are presented with and without MED.

When looking at the figures in this report, it is worth understanding that MED are a statistical classification, defined by the IEEE as any day on which more than 10% of utility customers are without power. The result of this hard threshold is that sometimes reliability scores without MED may, in fact, be driven by major events. If recovery from a storm lasts multiple days, the day/s toward the beginning of that recovery may be considered MED because over 10% of utility customers are without power, but the day/s towards the end of the recovery may not be considered MED because fewer than 10% of utility of utility customers are without power, even though all the days of outage were caused by the same event.

We computed SAIDI, SAIFI, and CAIDI with and without MED by state using an average of the reporting utilities within each state, weighted by the number of customers served by each utility.

Michigan’s performance on most reliability measures places it among the worst performing states. More detailed analysis of the reliability of Michigan’s electric utilities compared to that of other states follows.

Reliability: Michigan Compared to the Nation

System Average Interruption Duration Index (SAIDI) – Average Minutes of Outage per Customer per Year

As can be seen in Figure 2, in 2022 Michigan ranked 43rd, or 9th worst, among the states in overall average number of minutes of outage per customer (SAIDI with MED) over the year and 42nd, or 10th worst, in number of minutes of outage per customer (SAIDI without MED) over the year. In 2021, Michigan ranked 46th and 45th for these two metrics, respectively, suggesting that Michigan performed relatively better in 2022 than in 2021.

While Michigan's SAIDI values were better in 2022 than in 2021, the 5 year averages in Figure 5 show that Michigan regularly performs poorly compared to other states: Michigan ranks 45th in the nation in SAIDI without MED and 44th in SAIDI with MED over the past five years.

Figure 2: 2022 System Average Interruption Duration Index (SAIDI) (outage minutes per customer)

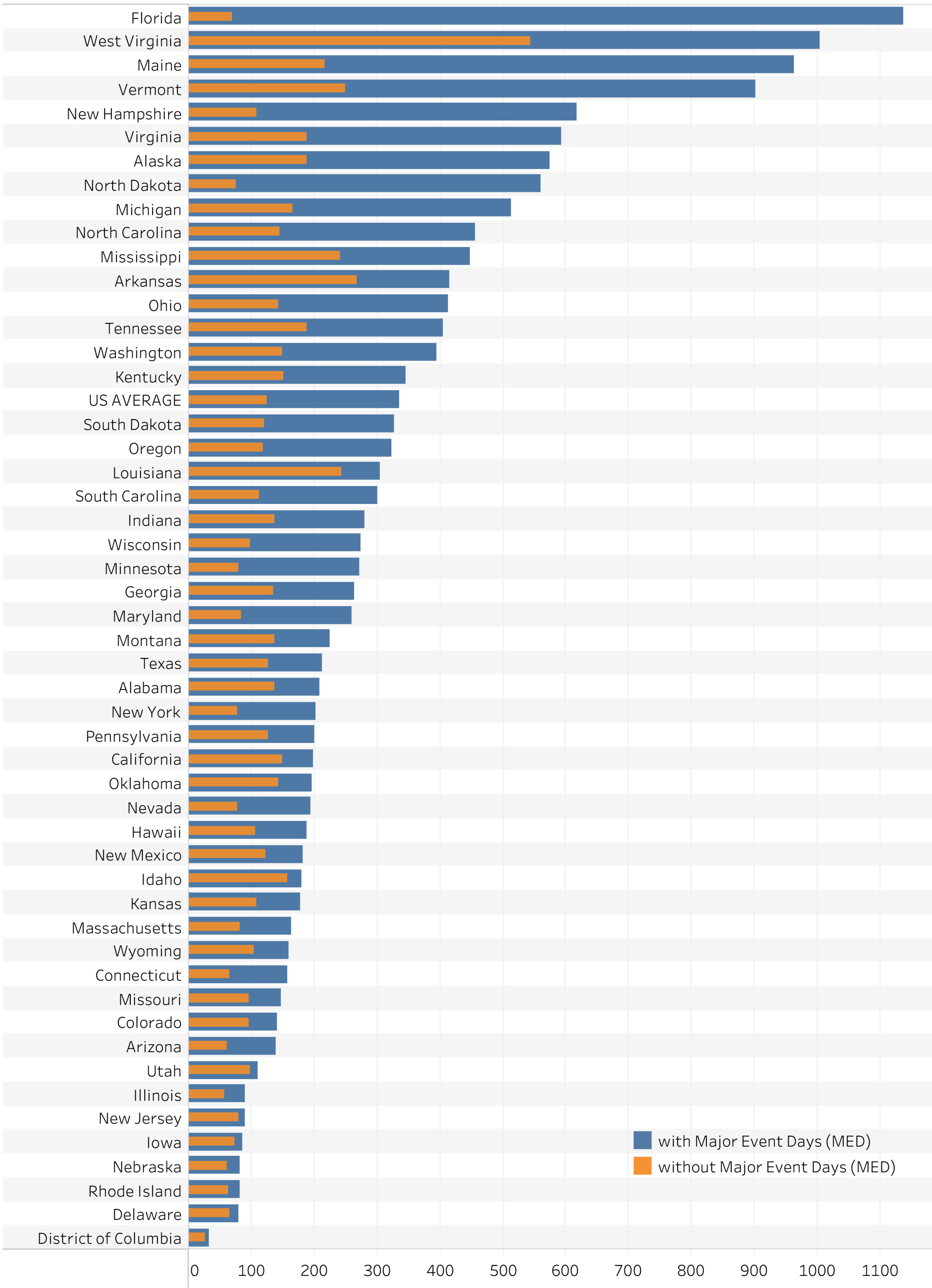


Figure 3: 2022 System Average Interruption Duration Index (SAIDI) with Major Event Days (outage minutes per customer)

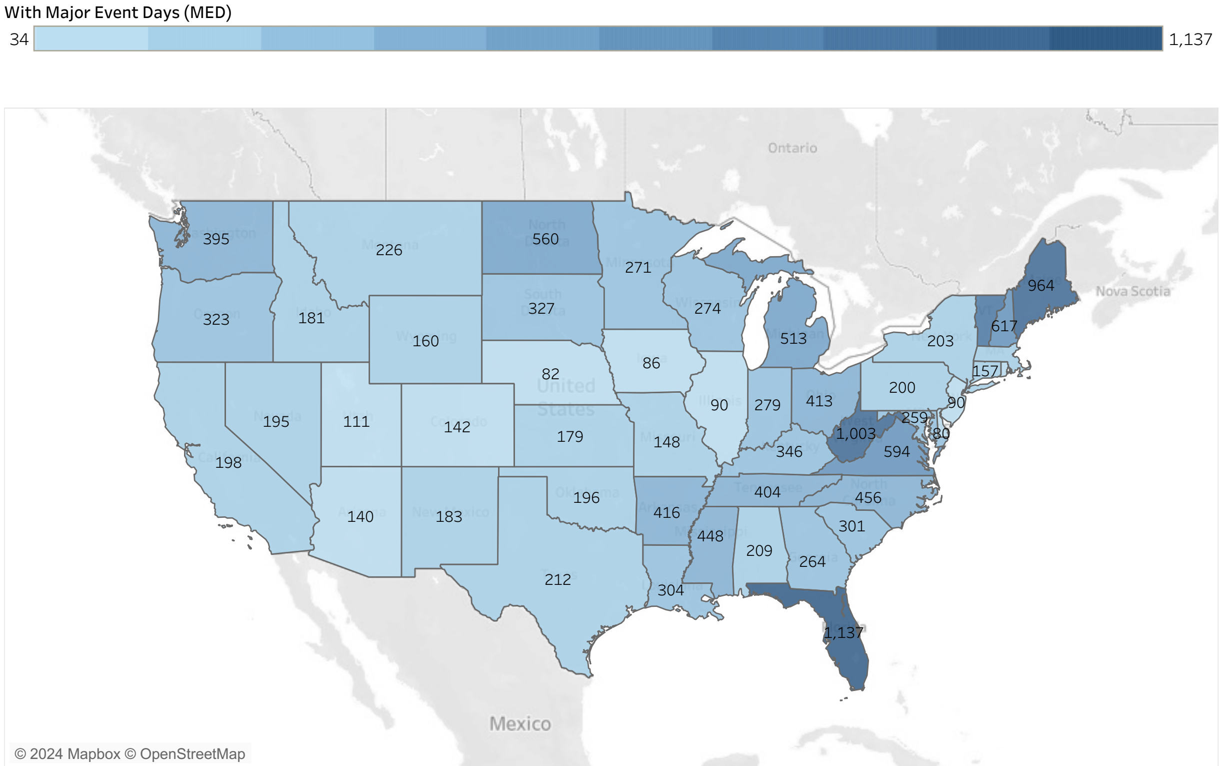
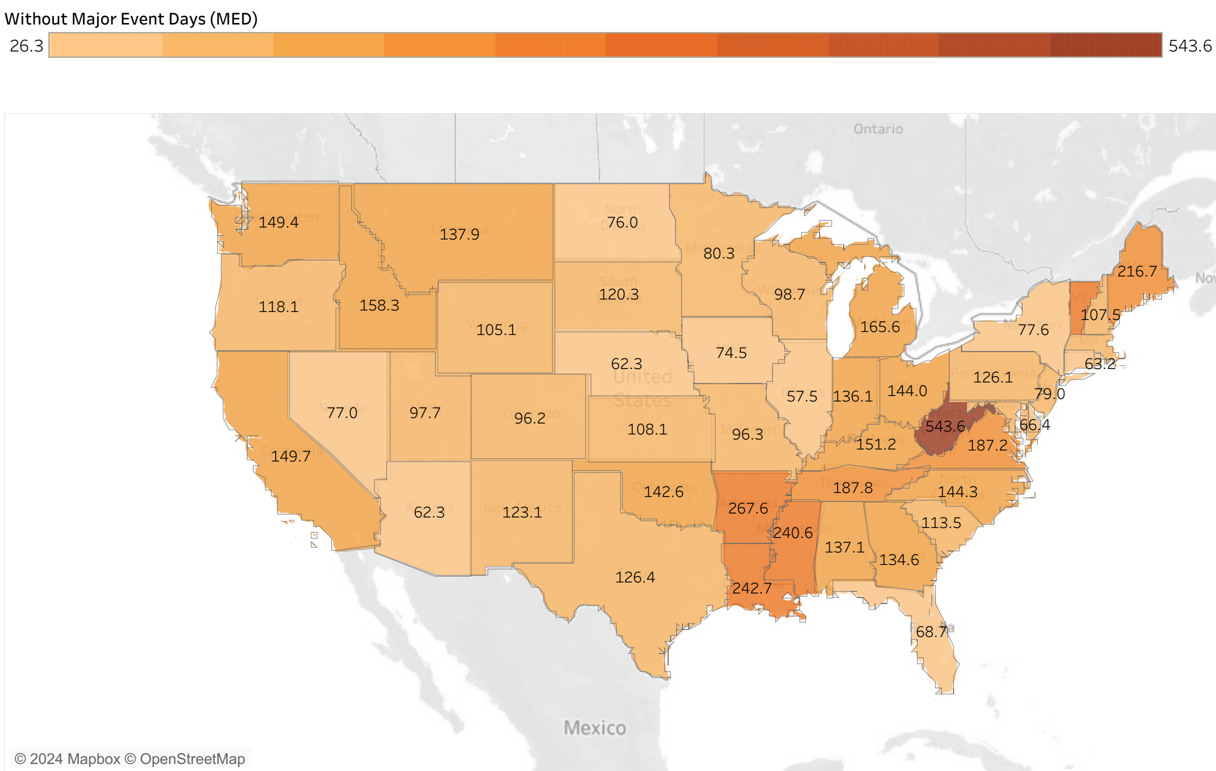


Figure 4: 2022 System Average Interruption Duration Index (SAIDI) without Major Event Days (outage minutes per customer)



SAIDI (Five-Year Average)

Figure 5: Average (2018-2022) System Average Interruption Duration Index (SAIDI) (outage minutes per customer)

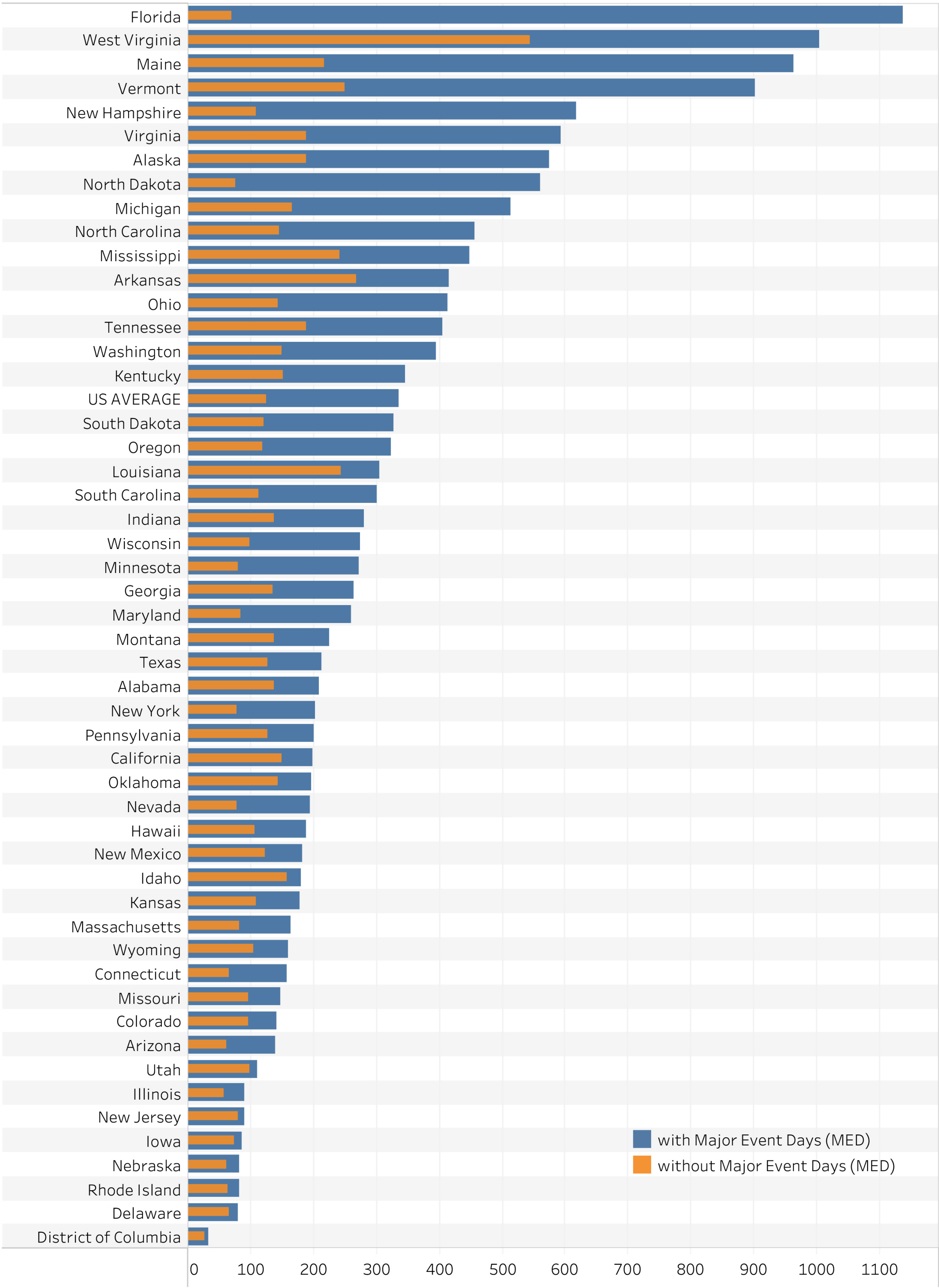


Figure 6: Average (2018-2022) System Average Interruption Duration Index (SAIDI) with Major Event Days (outage minutes per customer)

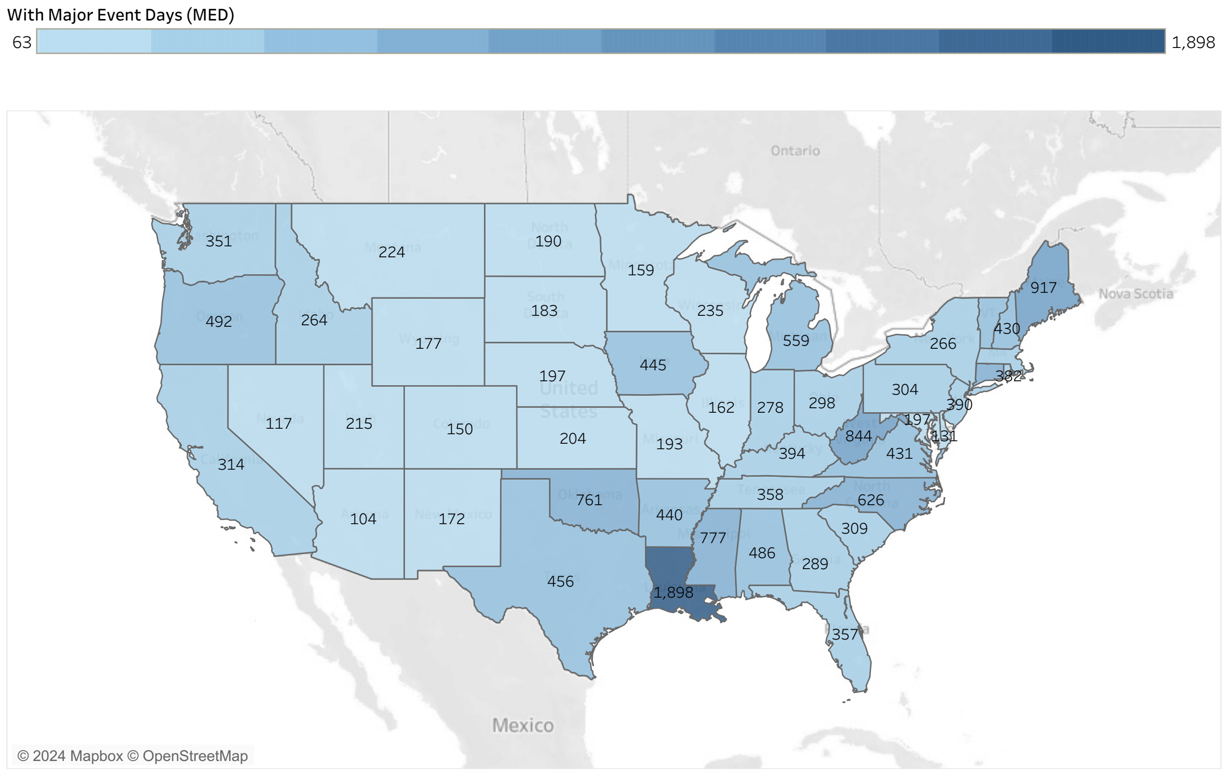
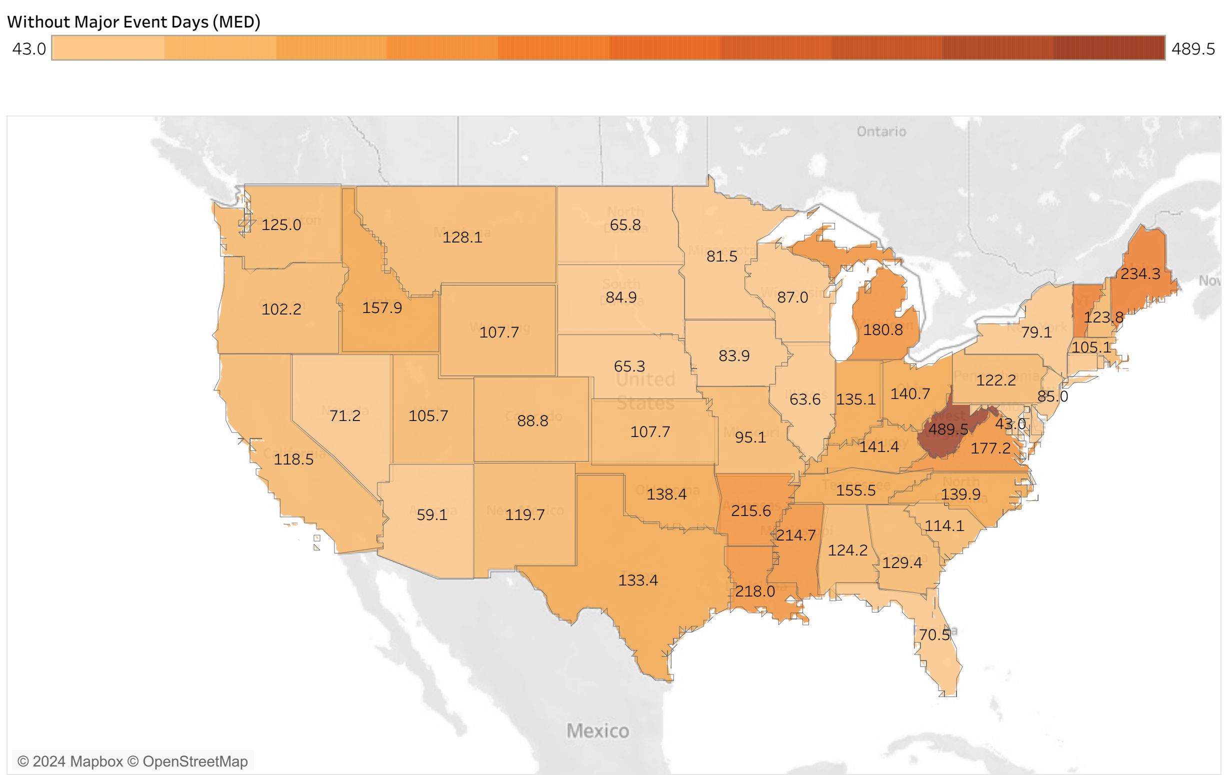


Figure 7: Average (2018-2022) System Average Interruption Duration Index (SAIDI) without Major Event Days (outage minutes per customer)



System Average Interruption Frequency Index (SAIFI) – Outages per Customer per Year

Figure 8 shows Michigan's number of outages per customer per year compared to other states, with and without MED.

In 2022, Michigan performed slightly better than the US average, both including and excluding MED. Michigan ranked 28th among the states when including MED and 29th when excluding them. This is an improvement over the 2021 figures, when Michigan ranked 39th and 31st for SAIFI with and without MED, respectively.

Figure 11 shows that Michigan's number of outages per customer with or without MED is above the national average for the last five years.

Figure 8: 2022 System Average Interruption Frequency Index (SAIFI) (interruptions per customer)

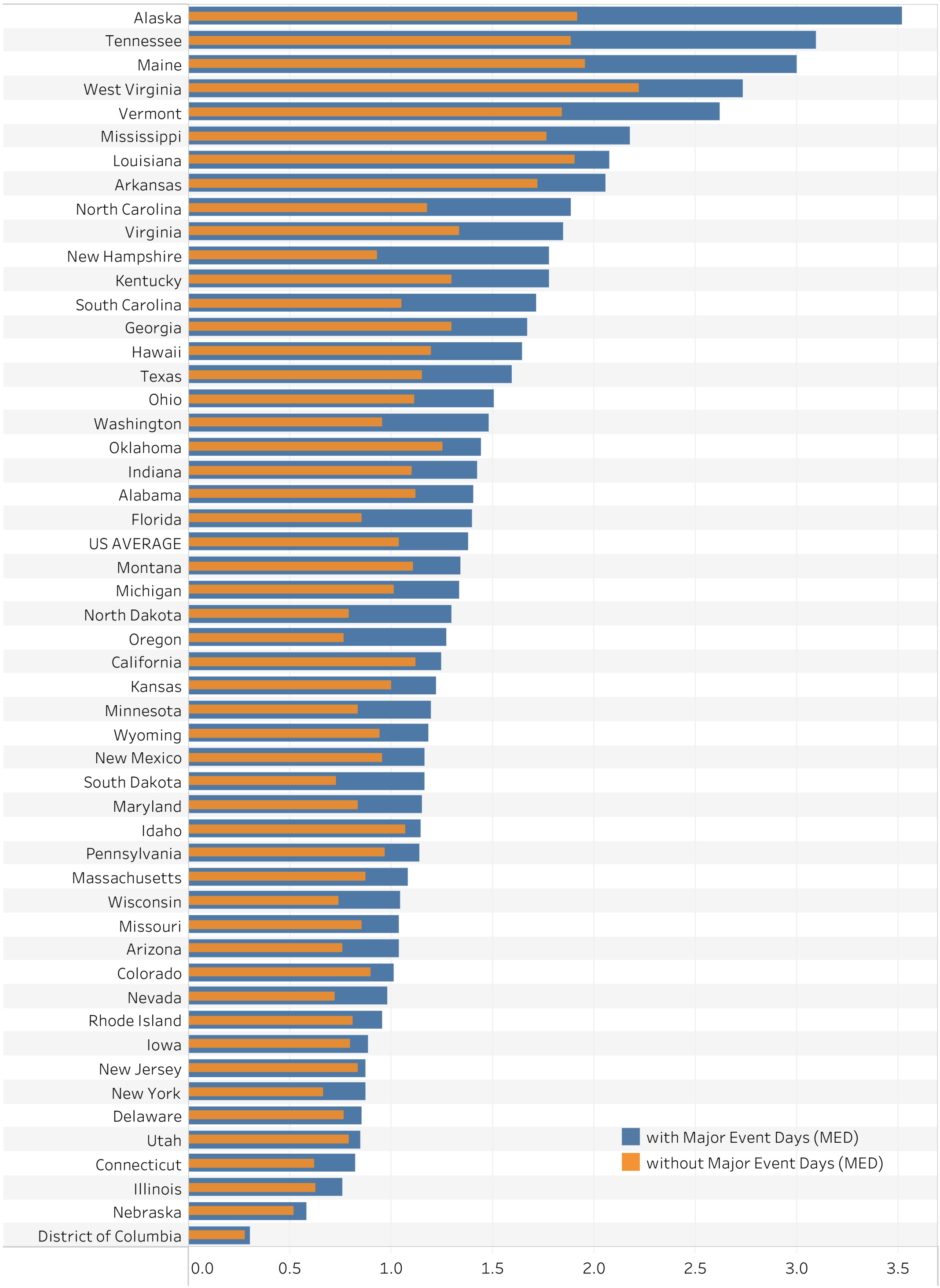


Figure 9: 2022 System Average Interruption Frequency Index (SAIFI) with Major Event Days (interruptions per customer)

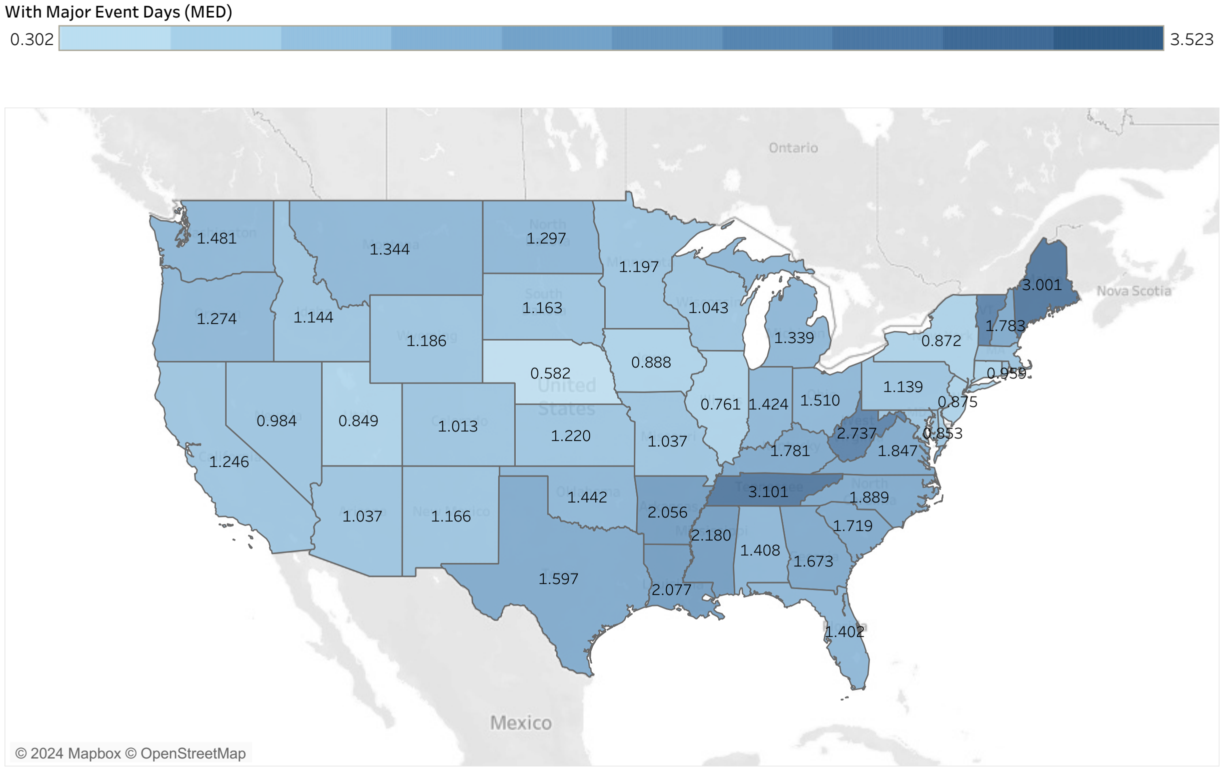
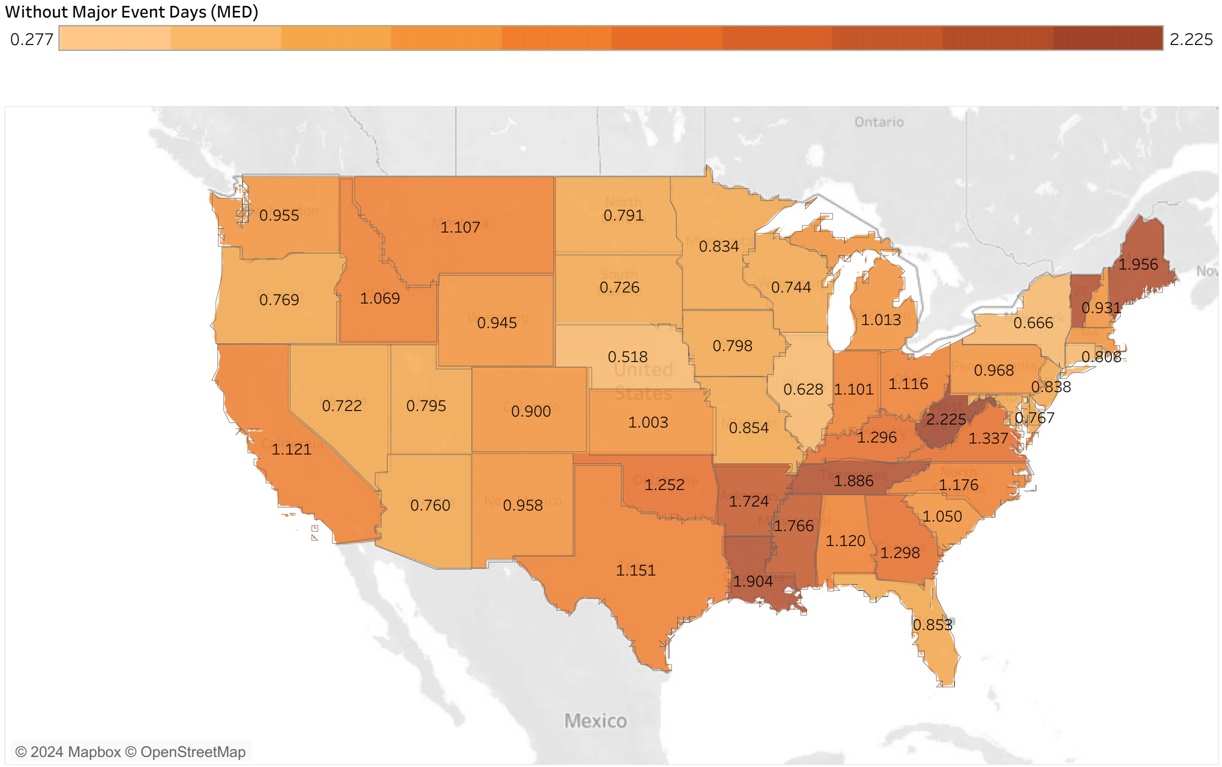


Figure 10: 2022 System Average Interruption Frequency Index (SAIFI) without Major Event Days (interruptions per customer)



SAIFI (Five-Year Average)

Figure 11: Average (2018-2022) System Average Interruption Frequency Index (SAIFI) (interruptions per customer)

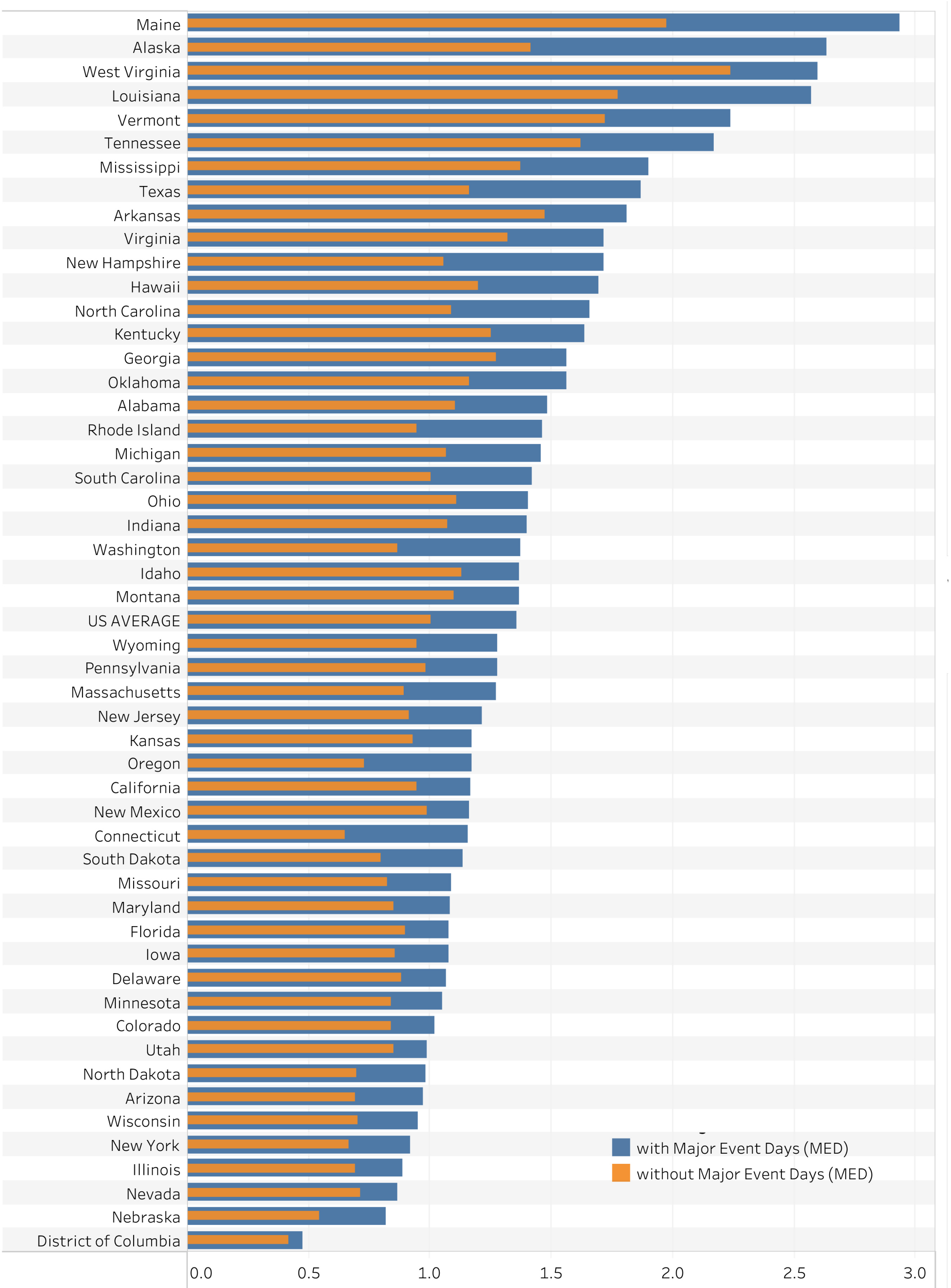


Figure 12: Average (2018-2022) System Average Interruption Frequency Index (SAIFI) with Major Event Days (interruptions per customer)

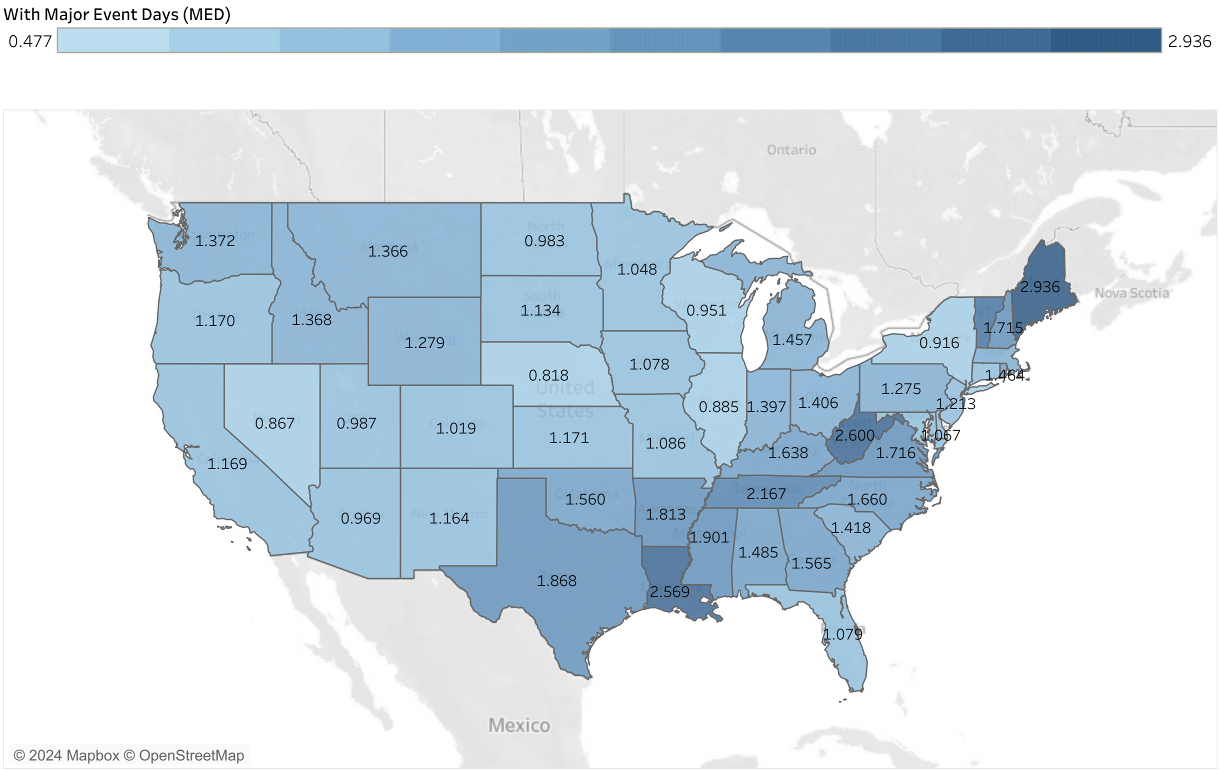
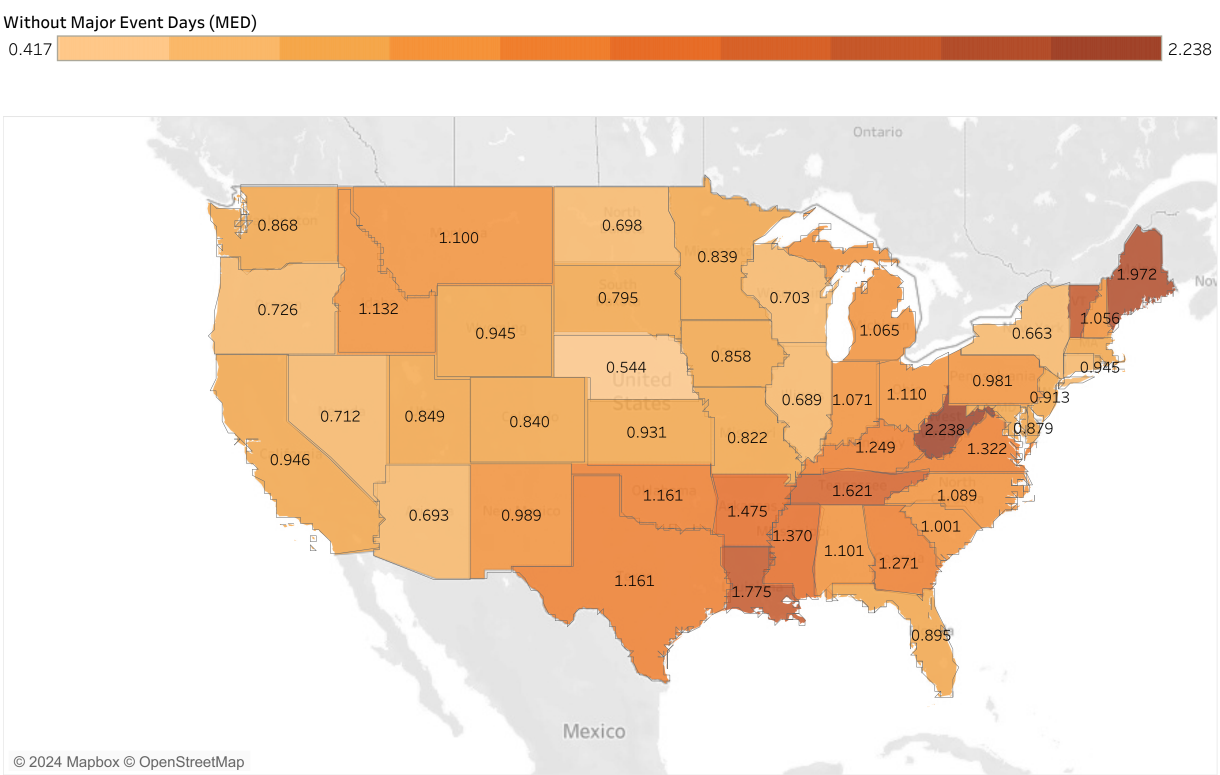


Figure 13: Average (2018-2022) System Average Interruption Frequency Index (SAIFI) without Major Event Days (interruptions per customer)



Customer Average Interruption Duration Index (CAIDI) – Average Minutes to Restore Power to a Customer

Michigan's power restoration time following an outage (CAIDI) is among the worst in the country, with and without MED. In 2022, Michigan ranked 49th (3rd worst nationwide) for CAIDI, both including and excluding MED. In 2021, Michigan ranked 48th and 50th for CAIDI with and without MED, respectively.

As shown in Figure 17, this is consistent with Michigan's poor performance over the past five years, where Michigan ranks 47th and 50th for CAIDI with and without MED, respectively. While still ranked poorly among the states, Michigan did perform substantially better in 2022 than in 2021.

Figure 14: 2022 Customer Average Interruption Duration Index (CAIDI) (outage minutes per interruption)

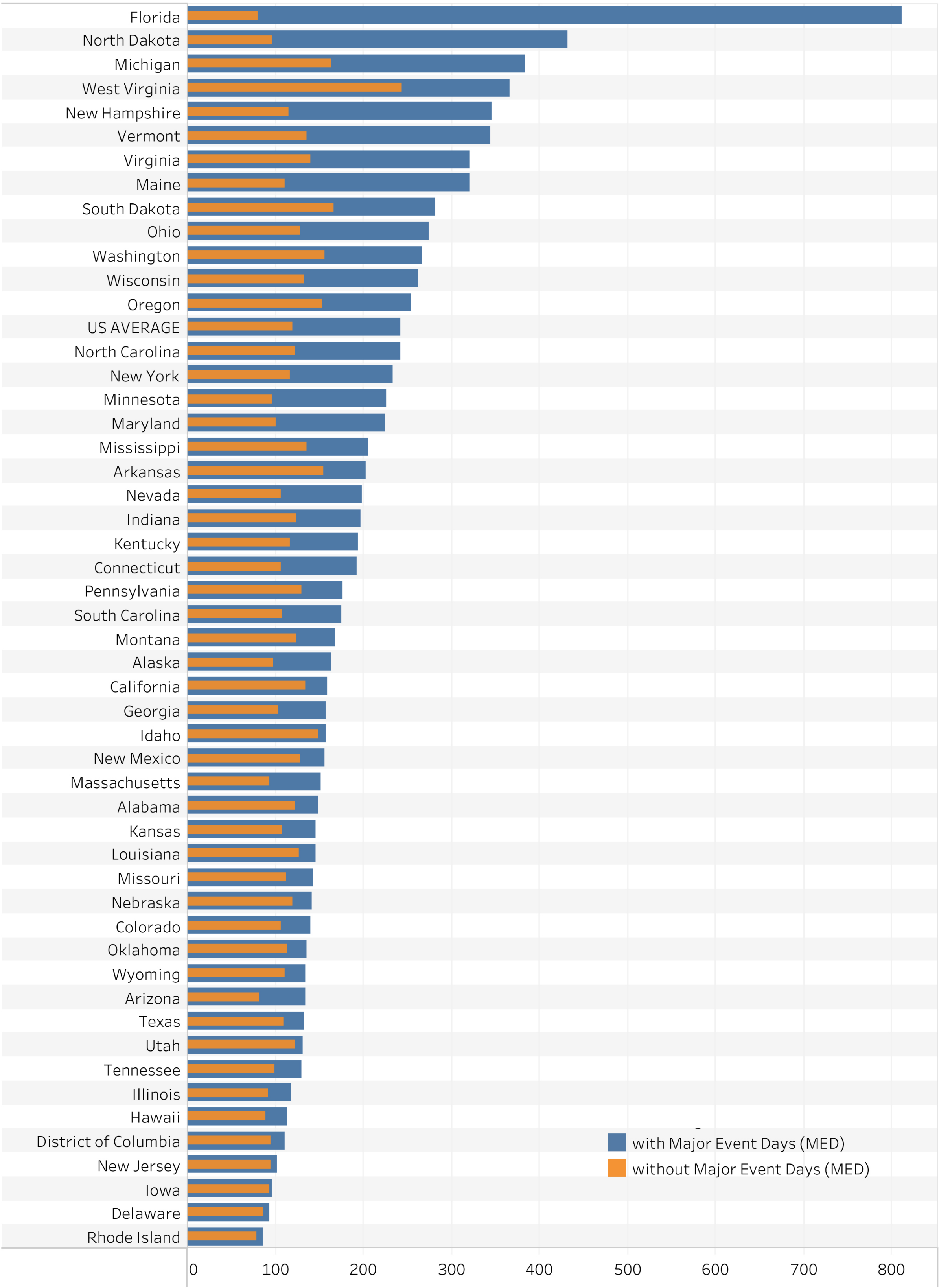


Figure 15: 2022 Customer Average Interruption Duration Index (CAIDI) with Major Event Days (outage minutes per interruption)

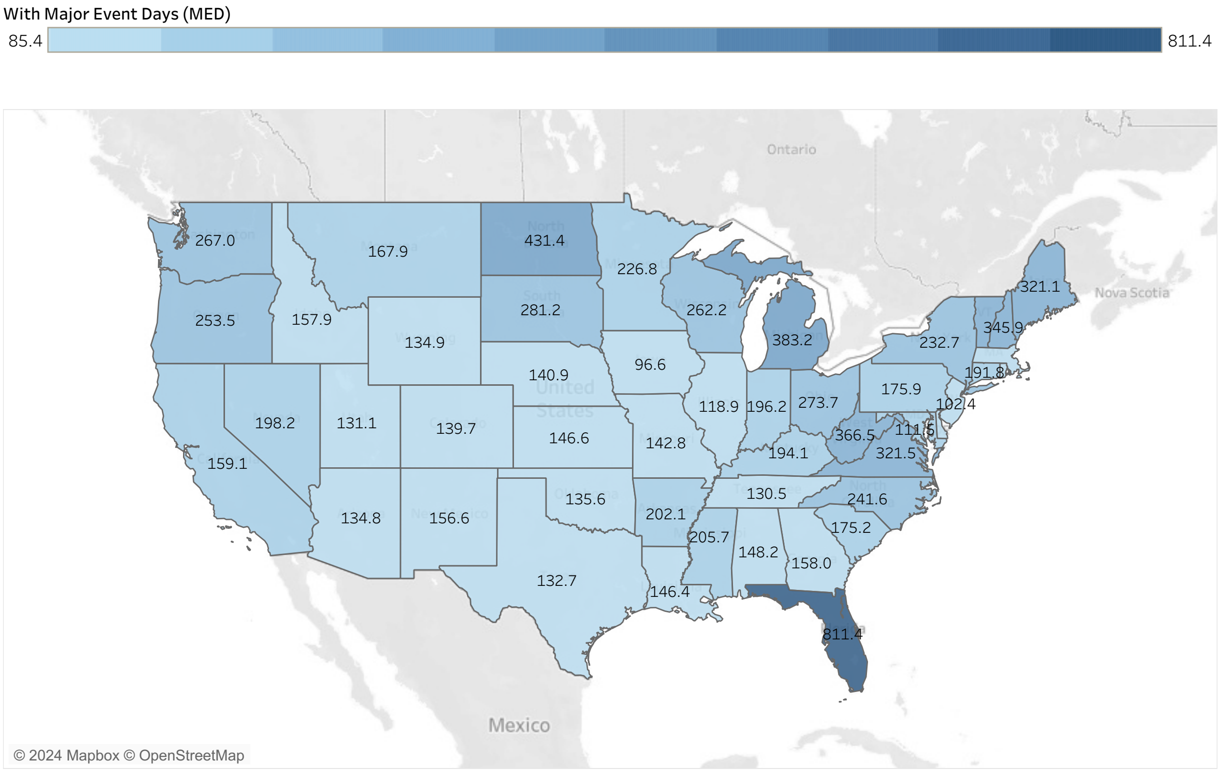
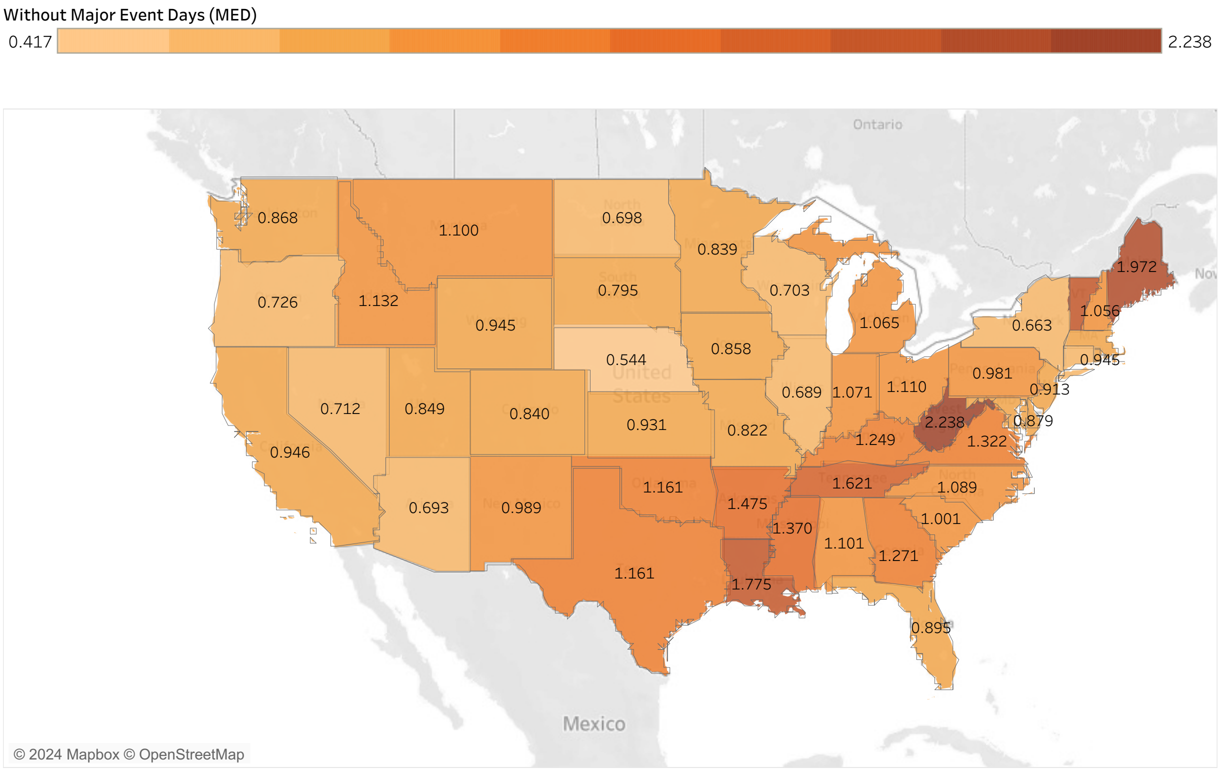


Figure 16: 2022 Customer Average Interruption Duration Index (CAIDI) without Major Event Days (outage minutes per interruption)



CAIDI (Five-Year Average)

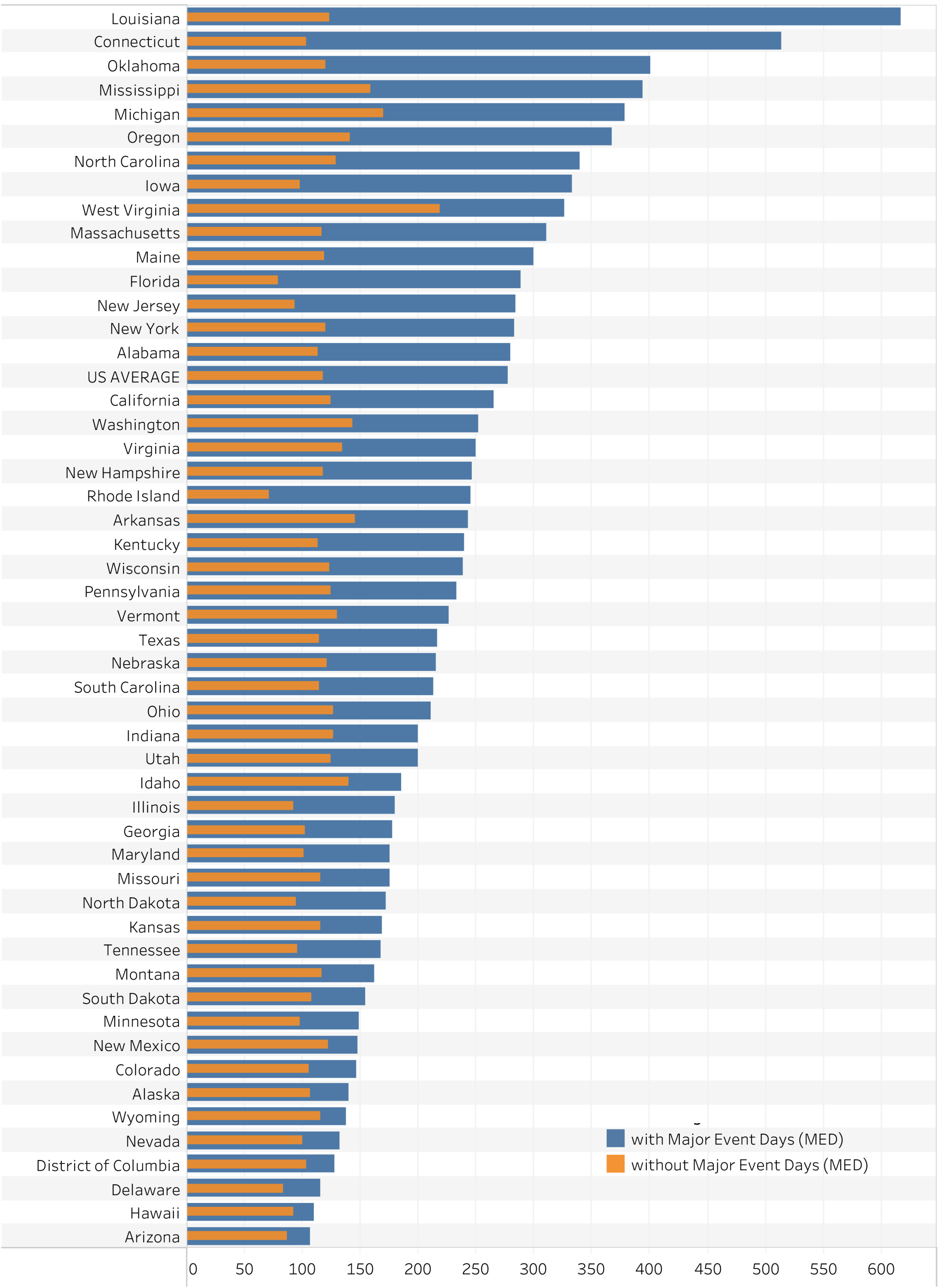


Figure 17: Average (2018-2022) Customer Average Interruption Duration Index (CAIDI) (outage minutes per interruption)

Figure 18: Average (2018-2022) Customer Average Interruption Duration Index (CAIDI) with Major Event Days (outage minutes per interruption)

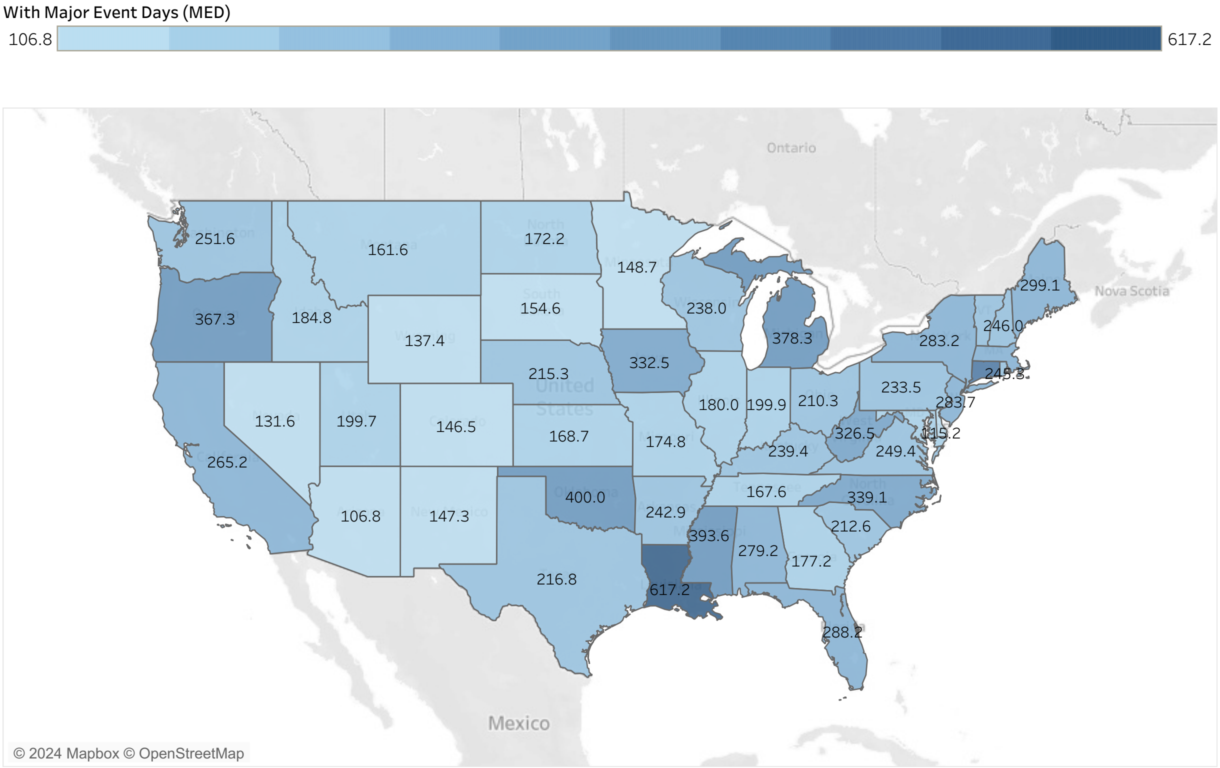
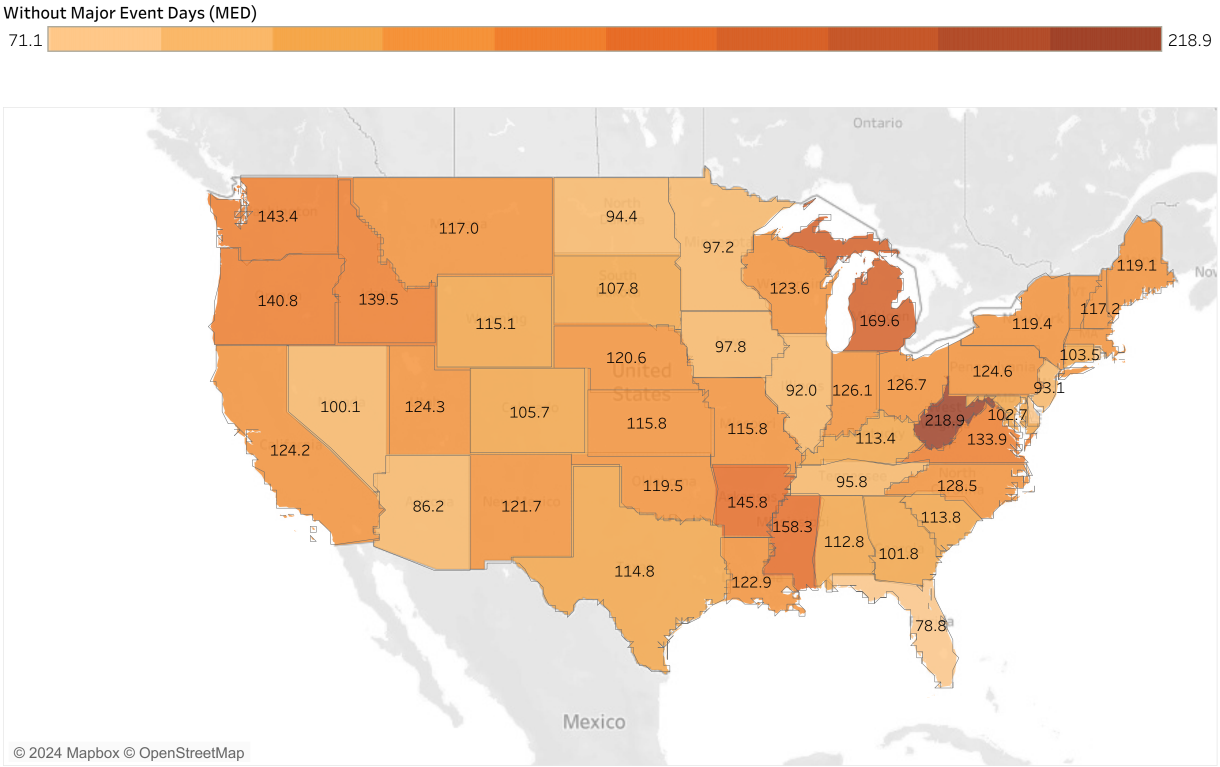


Figure 19: Average (2018-2022) Customer Average Interruption Duration Index (CAIDI) without Major Event Days (outage minutes per interruption)



Reliability: Comparing Michigan Utilities

Electric co-ops are the least reliable utilities in Michigan and municipal utilities are the most reliable, with investor-owned utilities (IOUs) landing somewhere in between.

The causes of these trends are reasonably clear. Michigan's cooperative utilities serve predominantly rural areas and include many miles of distribution lines to serve comparatively few customers. These lines are almost always above ground and are exposed to weather and tree damage. Conversely, Michigan's municipal utilities serve the discrete boundaries of cities or towns, have lower total mileage of distribution lines and may have some of these lines buried, making them less susceptible to the weather and tree damage that plague the co-ops' lines. Michigan's IOUs serve a mix of areas and are thus subject to both sets of conditions in differing measures.

However, while the reliability of cooperative utilities should not be ignored, the largest improvements to Michigan's statewide trends would involve improvements to the practices of the state's two largest utilities, DTE and Consumers Energy, which together serve more than 80% of the state's electric customers. These two companies dominate Michigan's poor statewide performance on reliability and rank badly among the nation's investor-owned utilities. The CUB website's Tableau platform illustrates this point clearly—see the IOU National Comparison dashboard to explore these trends.

Figure 20: 2022 System Average Interruption Duration Index (SAIDI) for Michigan Utilities (outage minutes per customer)

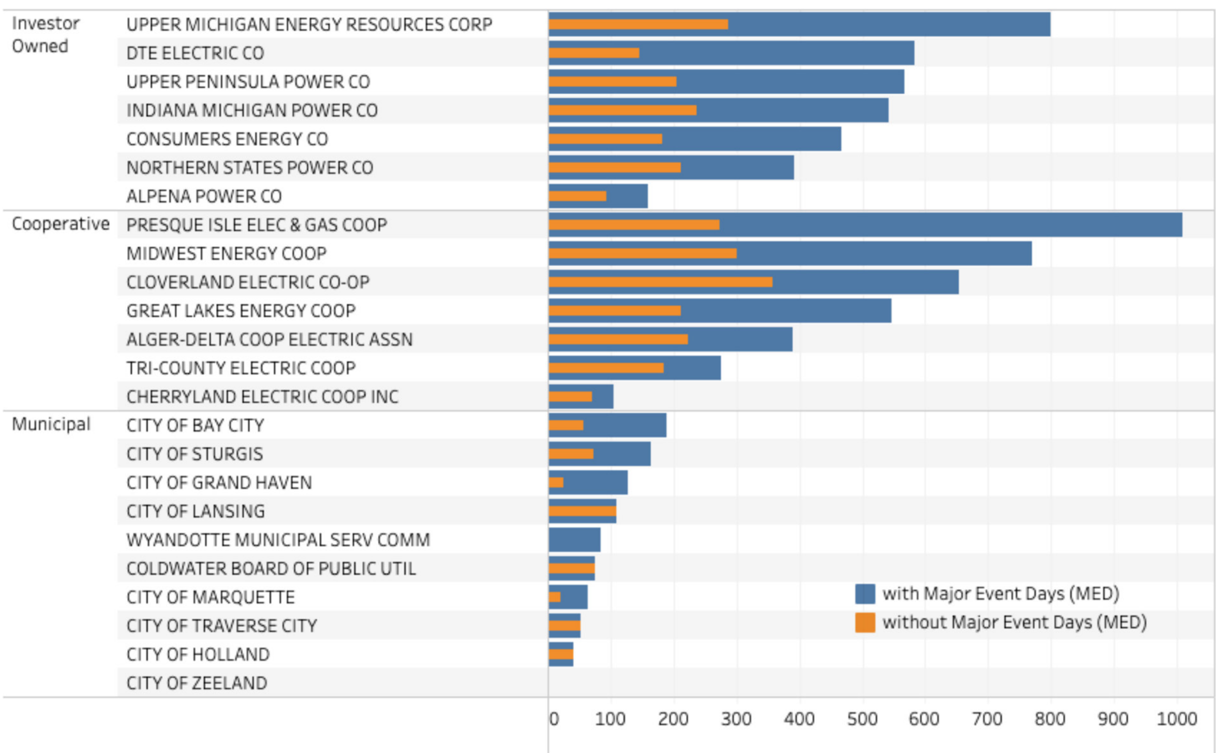


Figure 21: 2022 System Average Interruption Frequency Index (SAIFI) for Michigan Utilities (interruptions per customer)

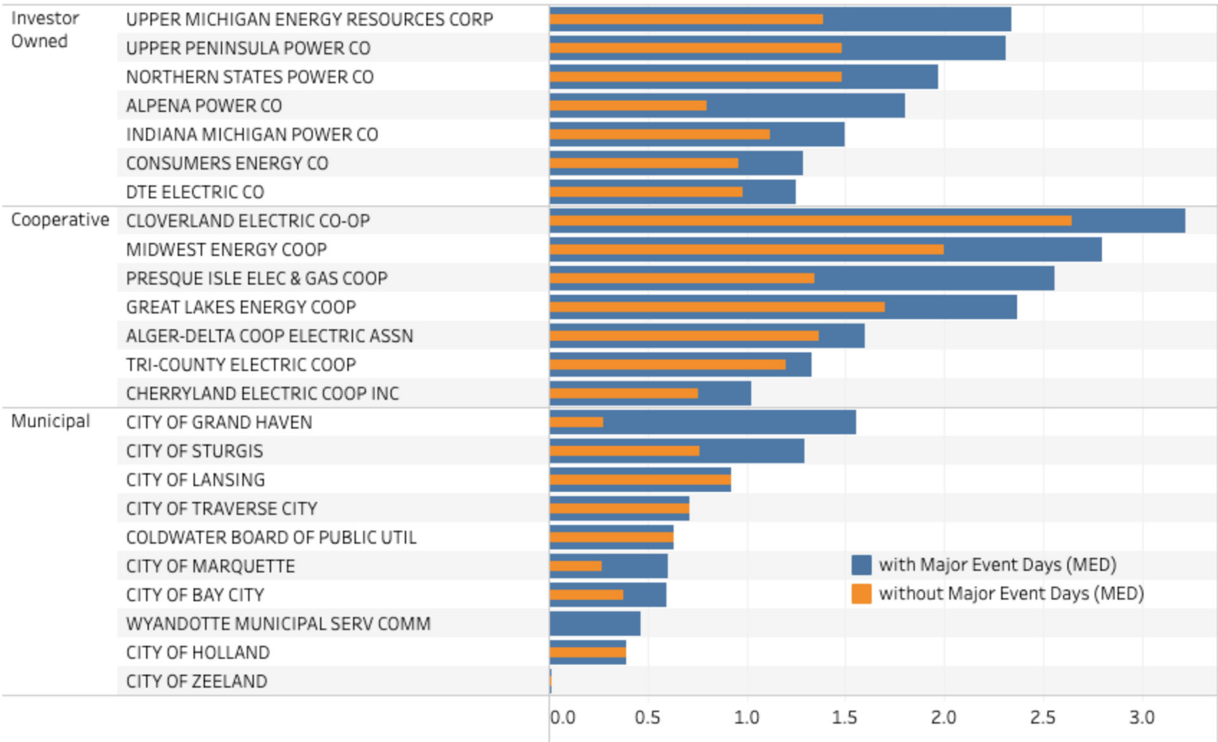
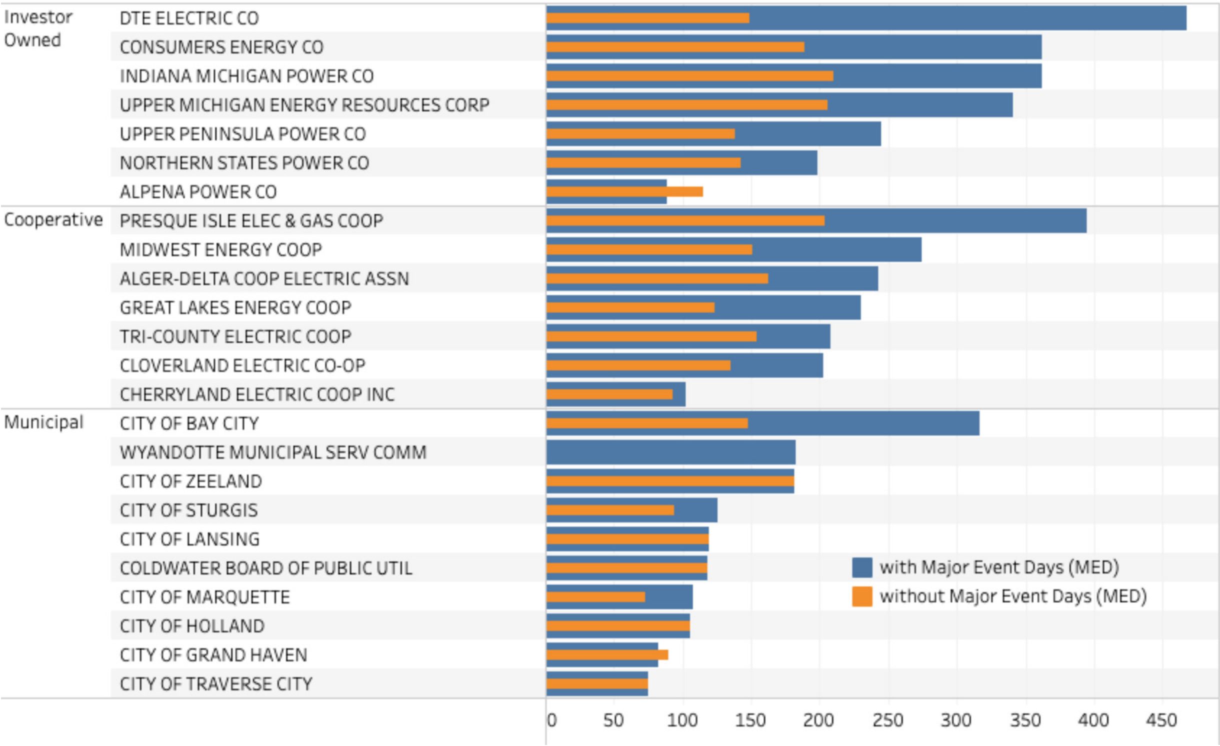


Figure 22: 2022 Customer Average Interruption Duration Index (CAIDI) for Michigan Utilities (outage minutes per interruption)



Gas Utilities

Gas utilities do not record reliability metrics like electric utilities. This dearth of reliability data may be due to our natural gas infrastructure being generally more reliable than our electricity infrastructure since natural gas lines are mostly buried and less likely to be damaged by storms, wildfires or wildlife.

Furthermore, when natural gas lines are disrupted only slightly, they continue to function. Unless a natural gas line is severed or leaking massively, the system may still be pressurized well enough to fulfill customers' needs, leading to the problem of long-term undetected leaks. These leaks are dangerous because natural gas is highly flammable if ignited and can cause asphyxiation in high concentrations. In addition, natural gas consists mainly of methane, a highly potent greenhouse gas, with a lifetime atmospheric heating capacity 25 times that of carbon dioxide. The Natural Gas Emissions section of this report quantifies the potential greenhouse effects of leaked natural gas.

Natural gas data are collected as part of form EIA-176. This form records total supply, disposition, losses and unaccounted-for gas. Losses are due to pipeline leaks, accidents, damage, thefts or blow down. Pipeline leaks tend to occur in a utility's distribution infrastructure—the numerous smaller pipes that run to homes and businesses. Unaccounted-for gas is the difference between the total supply and the total disposition (accounting for consumption, deliveries, or losses). Sources of unaccounted-for gas could be recording errors or physical losses not included in the previous list.

Unaccounted-for gas can take on positive or negative values, depending on the difference between total supply and total disposition, with a negative value implying more gas was delivered than a utility accounted for purchasing or producing.

Figure 23 shows natural gas losses as a percentage of sales as an indication of gas utility reliability. This is a useful statistic, but it is imperfect, because states that produce natural gas for export may show leaks from their production and export infrastructure as losses, thus skewing the ratio of losses to in-state sales and absorbing some of the losses that could be attributable to the states that import their natural gas.

As shown in Figure 23, in 2022 Michigan ranked 13th best among the states for natural gas losses from leaks plus unaccounted for gas when expressed as a percentage of total state sales. This is a marked improvement over Michigan's 2021 performance on these metrics, when the state ranked 29th, or 23rd worst.

Figure 23: 2022 Unaccounted-for Natural Gas plus Losses of Gas as a Percentage of Sales

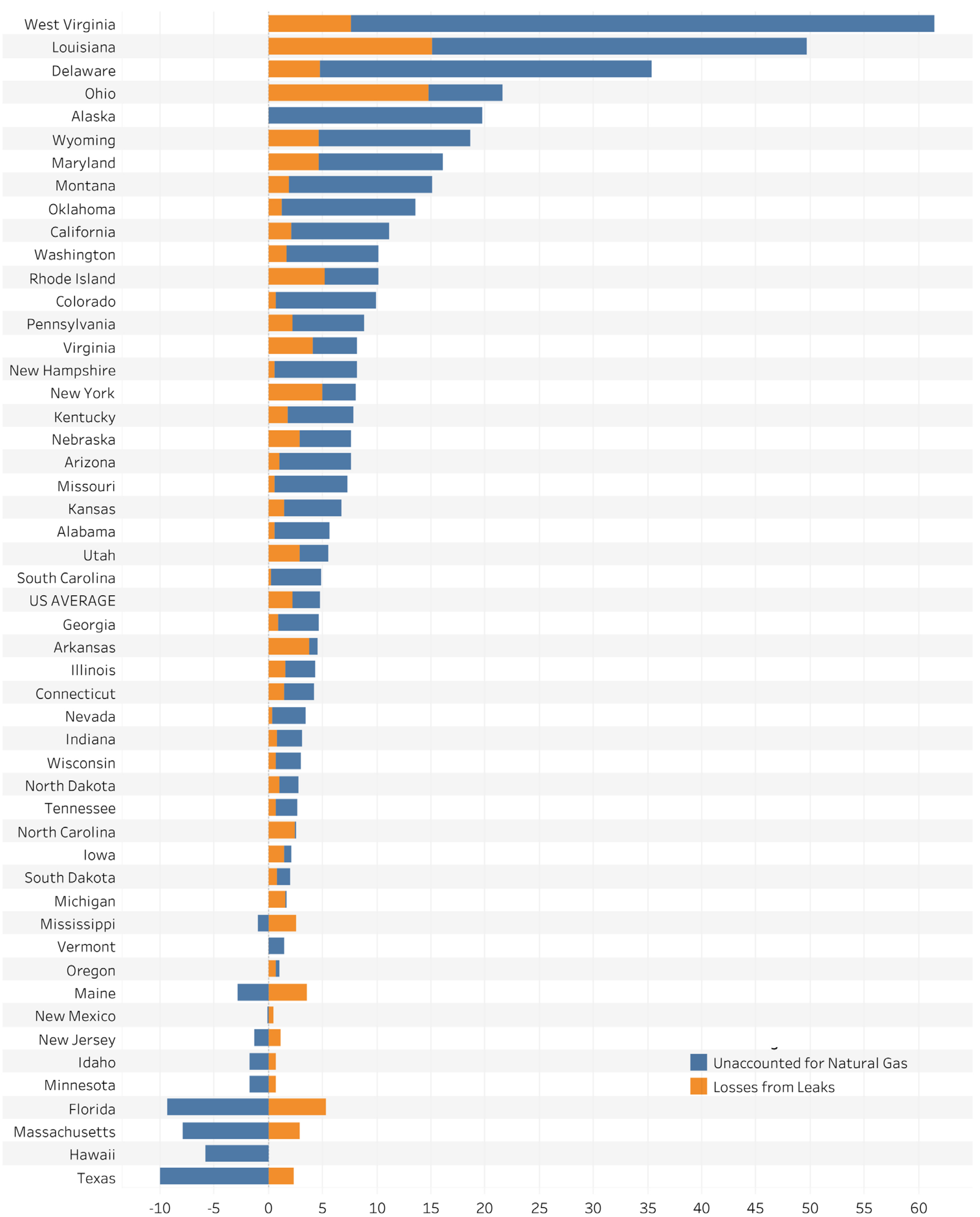
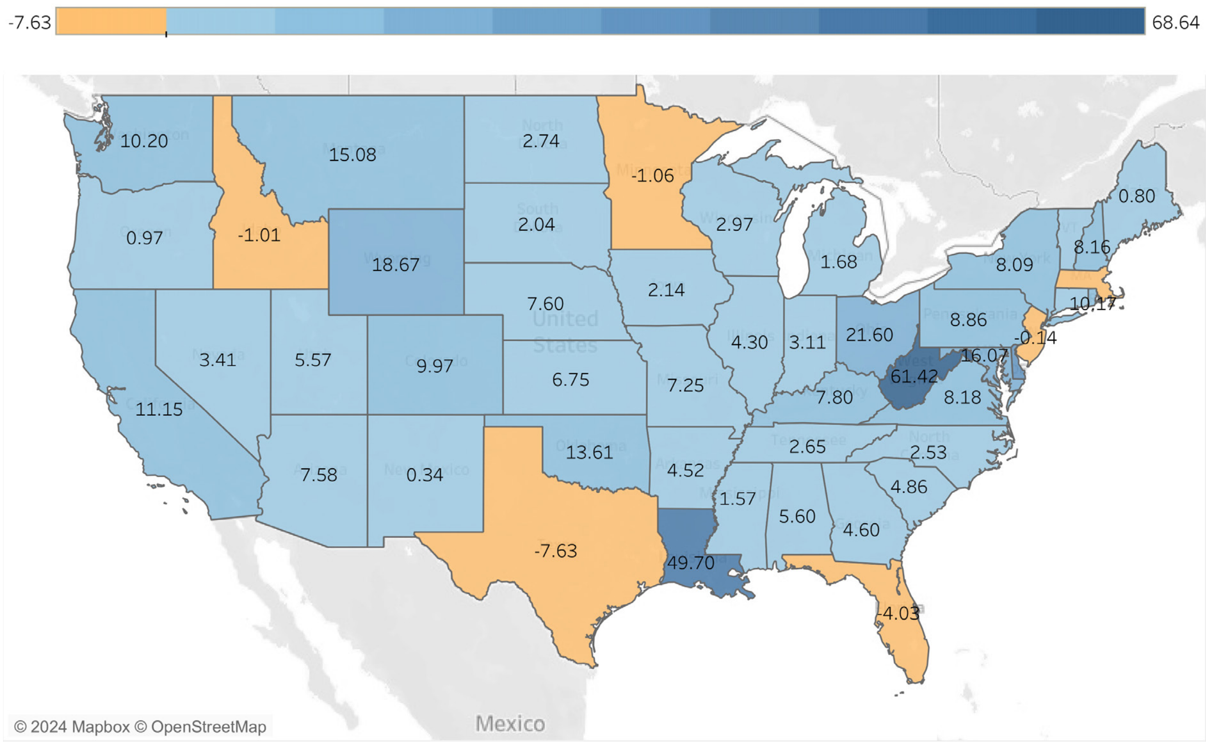


Figure 24: 2022 Unaccounted-for Natural Gas plus Losses of Gas as a Percentage of Sales



AFFORDABILITY OF ENERGY

Residential Costs

This section quantifies energy affordability through the metric of energy expenditures per household as a percentage of state median income, also known as the energy burden. For these figures, energy expenditures refer to expenditures on all forms of energy combined, which includes electricity, natural gas and other heating fuels.

The broad trends in affordability show that some of the states with the highest energy burdens are relatively low-income southern states with high electricity bills for cooling, such as Mississippi and Alabama, as well as cold northern states with high fuel costs and use and state median incomes closer to the mean, such as Vermont and Maine (Figure 28).

In 2022, Michigan ranked 38th, or 14th worst, on energy burden, similar to the ranking for 2021 (39th). While the ranking slightly improved, the average Michigan household spent 4.04% of its income on energy in 2022 (Figure 28), an increase from 3.85% in 2021. In absolute terms, the average Michigan household spent $2705 on energy in 2022, making Michiganders' energy bills the 15th highest in the nation (Figure 25). While this is a better ranking than in 2021, when Michigan had the 9th highest energy bills among the states, Michiganders' energy burdens have continued to increase from their most recent minimum of 3.78%, which occurred in 2019.

Figure 25: 2022 Energy Expenditures per Household ($)

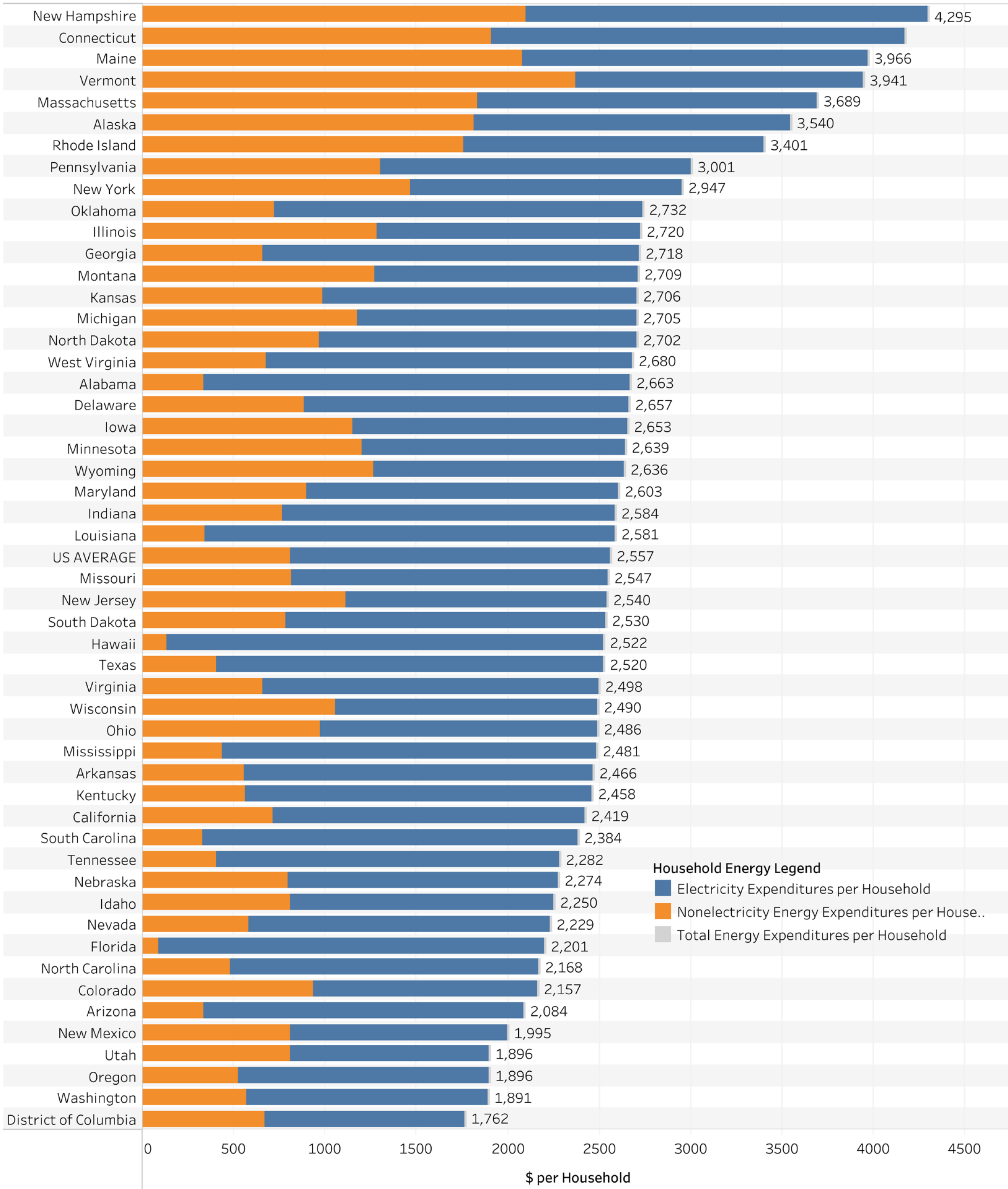


Figure 26: 2022 Energy Expenditures per Household ($)

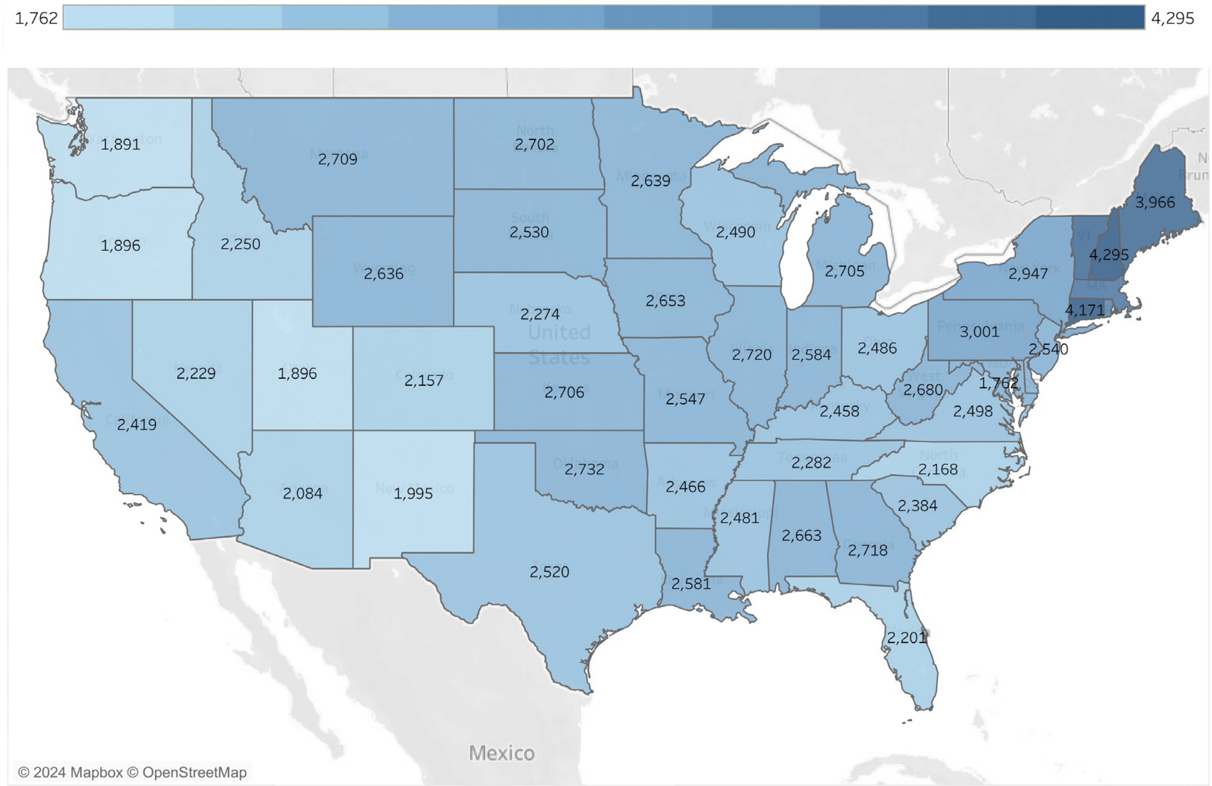


Figure 27: 2022 Energy Expenditures per Household as a percentage of Median Household Income

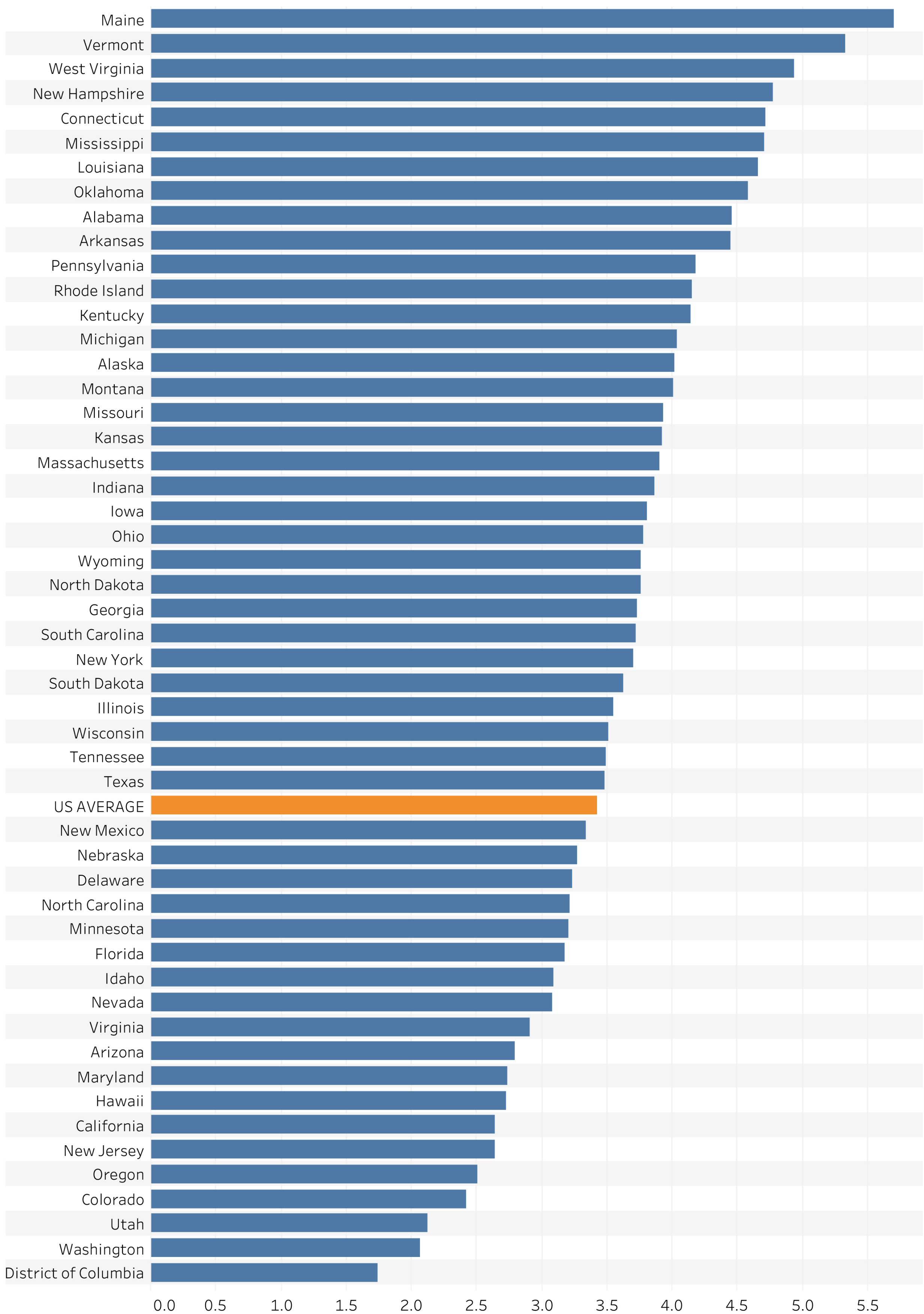
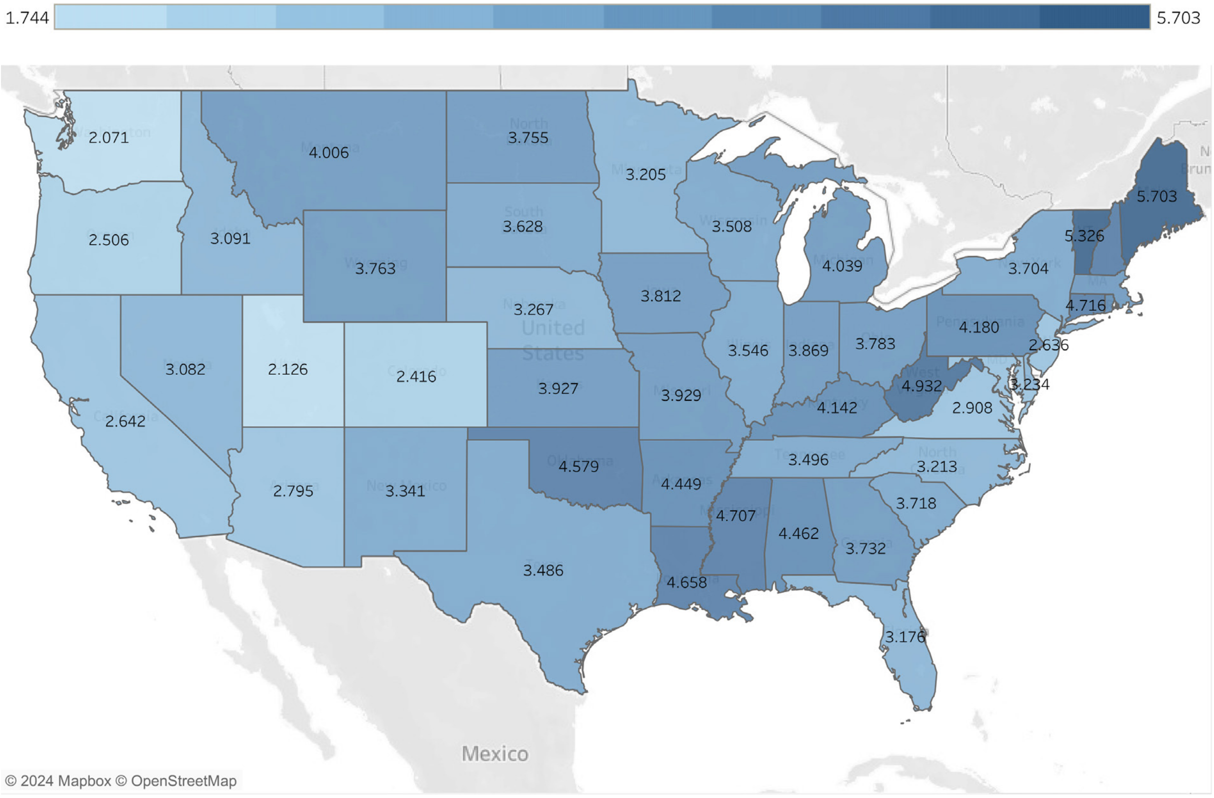


Figure 28: 2022 Household Residential Energy Expenditures as a Percentage of Median Income



Household Electricity Costs and Expenditures

Electricity bills often have many components: fixed monthly charges, charges based on the customer's peak rate of power usage in the billing month or previous year, a charge per kWh of electricity and others. The way utilities assign costs to these components of the bill varies across states and between utilities and classes of customers. Because, for customer purposes, each kWh is identical, dividing the total bill by the kWh used is generally the best way to compare utility costs.

The EIA collects monthly data from each utility in each state on the amount of electricity sold and the revenue from electricity by customer class. Customer classes include residential, commercial, industrial, transportation and "other," with almost all electricity delivered in most states going to the first three classes. The EIA collects these data as part of its *Form 861*.

The figures in this section show that Michigan had the 11th highest residential electricity cost per kWh in the country in 2022, higher than any of its peers in the Midwest, as is easily visible in Figure 32. Despite these high electricity costs, in 2022 Michigan had the 18th lowest yearly electricity expenditures per household in the country (Figure 29). This is due to relatively low electricity consumption statistics in Michigan.

Figure 29: 2022 Electricity Expenditures per Household ($)

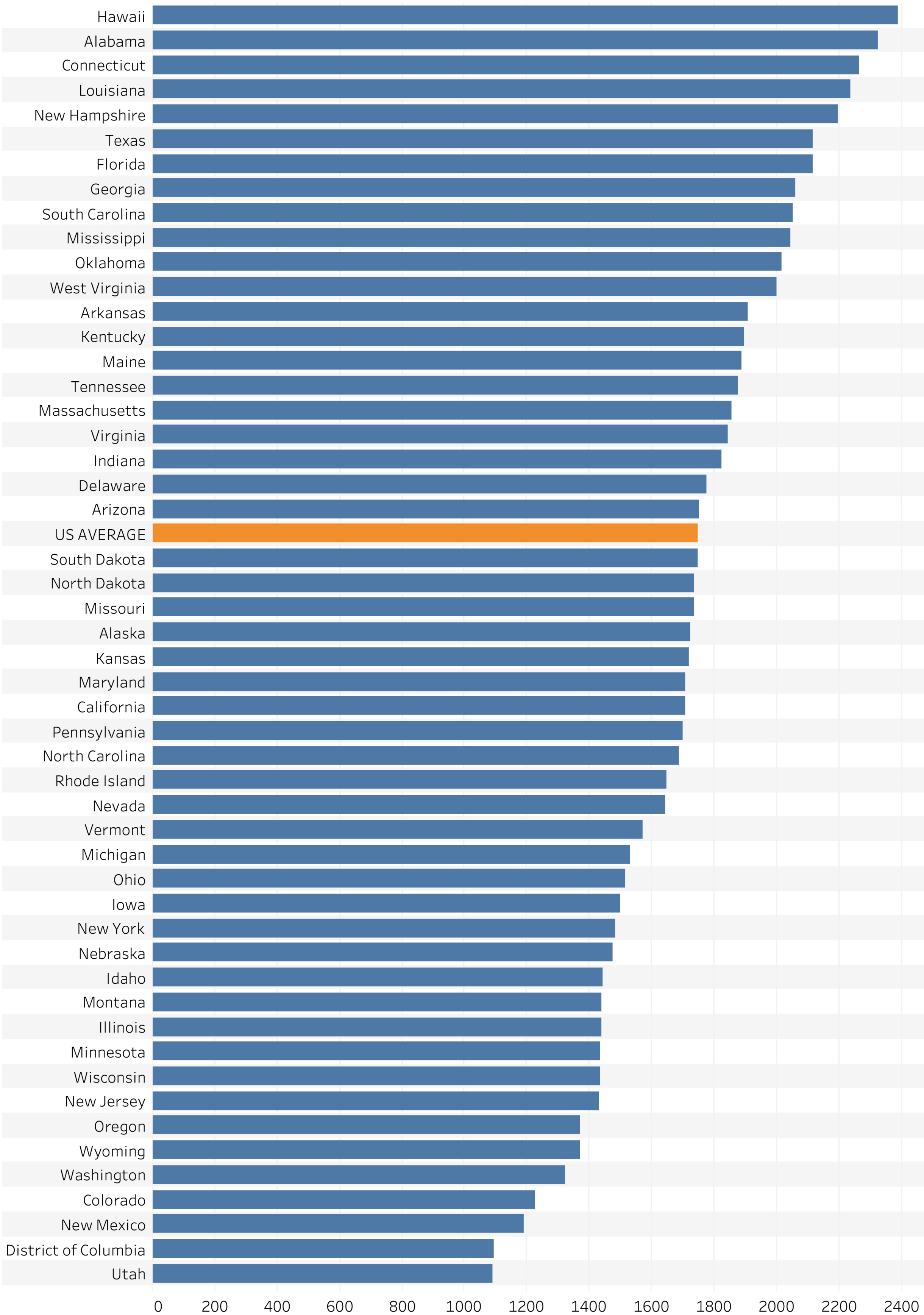


Figure 30: 2022 Electricity Expenditures per Household ($)

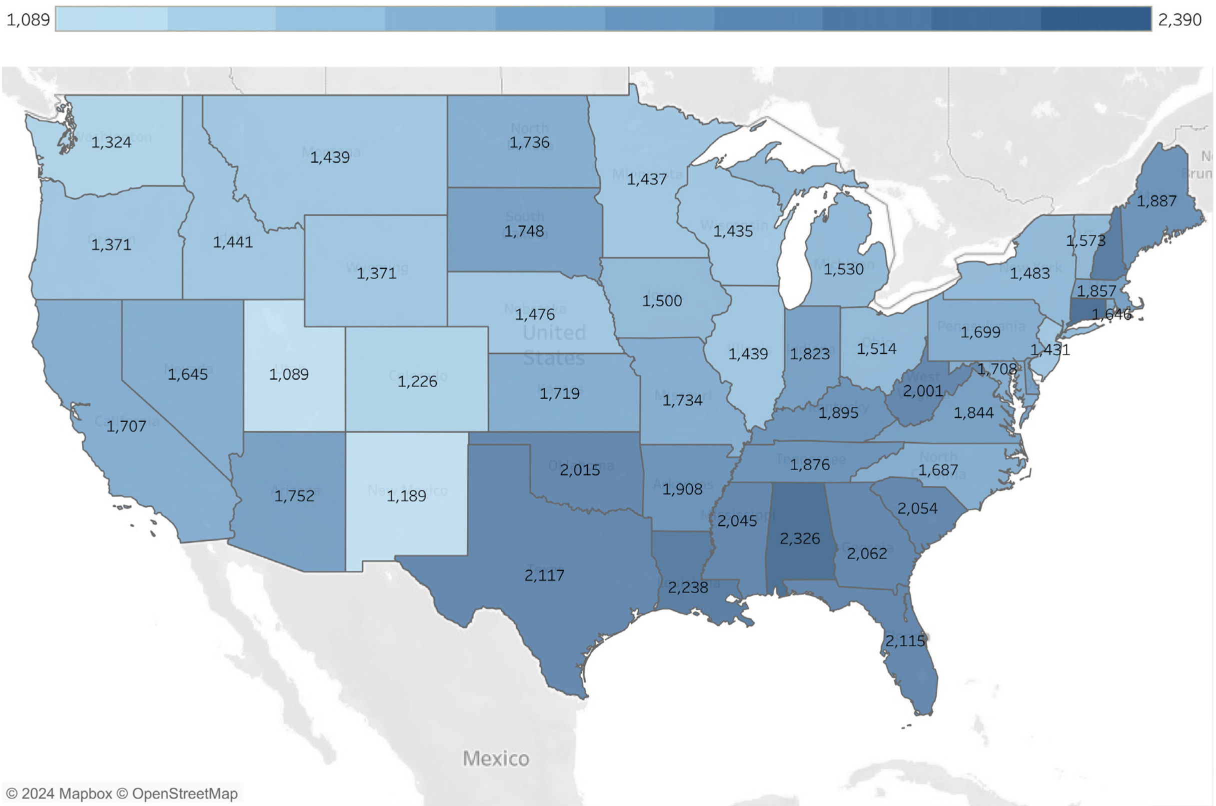


Figure 31: 2022 Cost of Electricity in the Residential Sector ($/kWh)

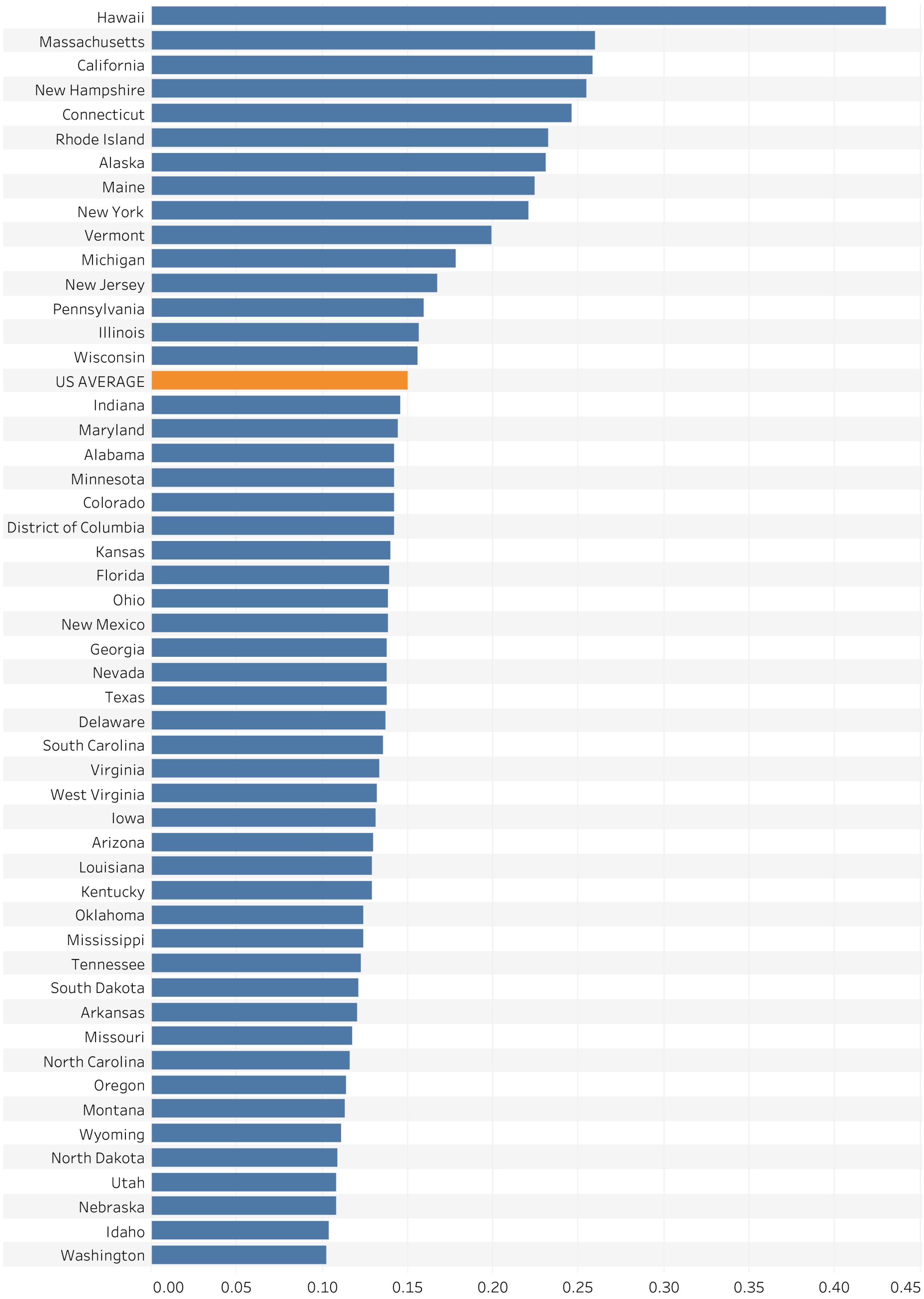
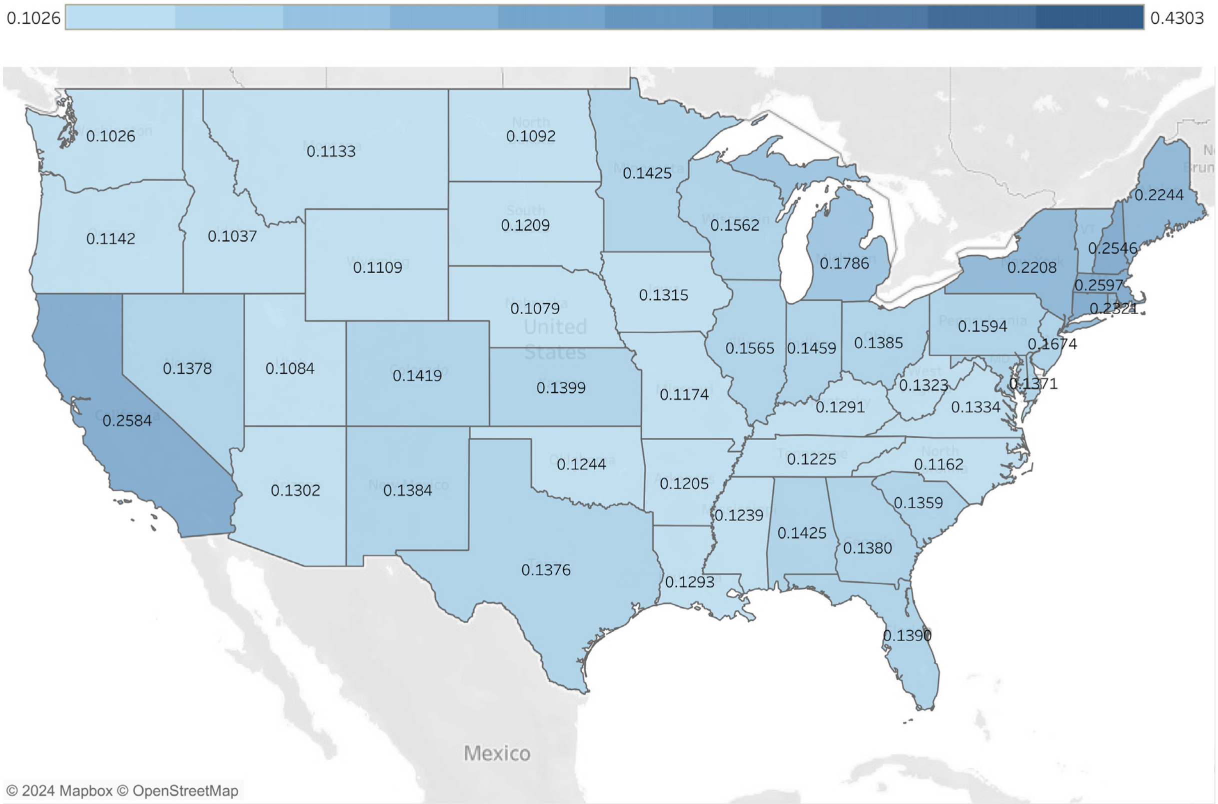


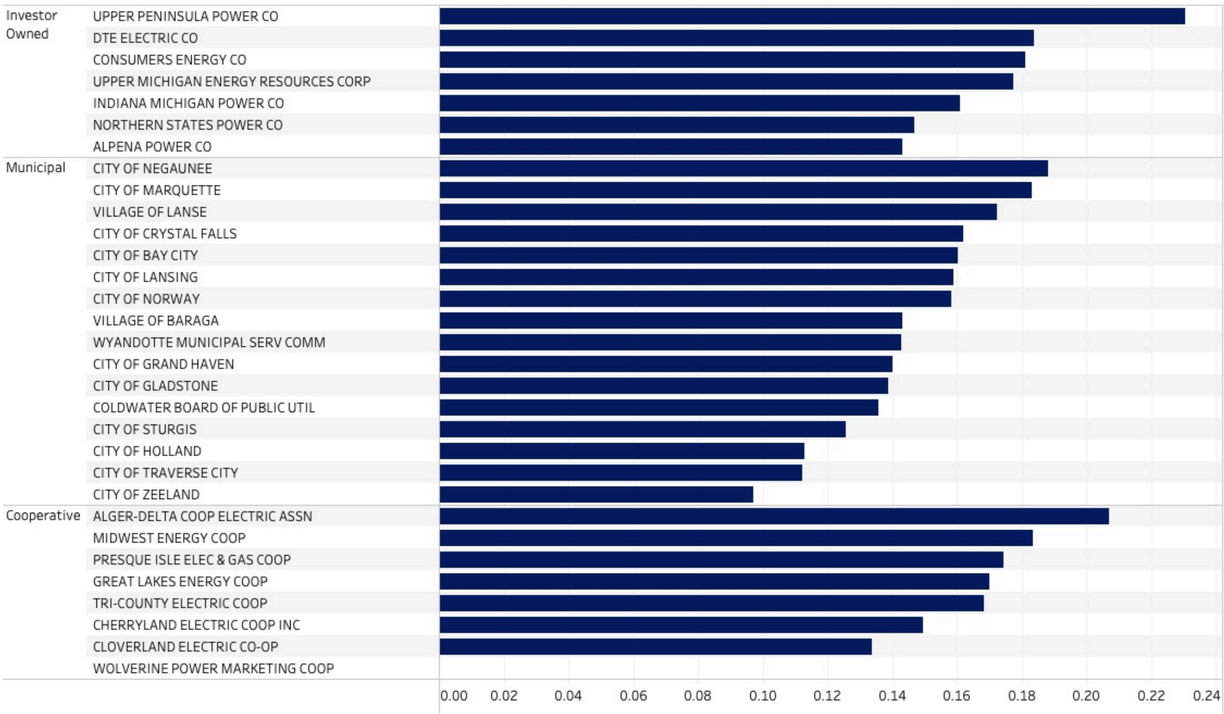
Figure 32: 2022 Cost of Electricity in the Residential Sector ($/kWh)



Average Price of Electricity: Residential Sector for Michigan Utilities

Figure 33 shows that that per kWh residential electricity costs vary from 9.7 cents per kWh for the City of Zeeland municipal utility to just over 23 cents per kWh for the Upper Peninsula Power Company. The most obvious trend in Michigan's residential electricity costs is that the highest cost utilities are in the Upper Peninsula. The Upper Peninsula's high electricity costs result from the high expense of distribution infrastructure in rural areas plus the relatively low amount of local generation resources. That said, most utilities in Michigan have residential electricity costs falling in a range between 13 and 19 cents per kWh.

Figure 33: 2022 Cost of Electricity in the Residential Sector for Michigan Utilities ($/kWh)



Household Natural Gas Costs and Expenditures

Although responsible for significant greenhouse gas emissions and other pollutants, natural gas remains an affordable and accessible fuel for water and space heating in cold climates. However, consumers are not insulated from price spikes or distribution disruptions, especially during harsh winters.

Different natural gas utilities measure their sales in different units, but the EIA reports natural gas sales data through Form 176 using units of thousands of cubic feet, abbreviated as Mcf. According to the EIA, burning 1 Mcf of natural gas produces roughly 10.38 therms of energy.

In previous years, this section has contained figures that expressed natural gas costs in dollars per therm and in dollars per kWh, a unit generally used to measure electricity (one therm is precisely equal to 29.3 kWh). This was to allow readers to compare the absolute energy costs of these disparate energy forms.

This year, the reader is encouraged to explore the CUB website's Tableau platform to make this comparison. The figures in this section express natural gas costs in dollars per Mcf. On Tableau, hovering over any state when viewing the price of natural gas in the Energy Costs dashboard will reveal the equivalent cost per kWh of electricity, assuming that each kWh of natural gas is equivalent to one kWh of electricity. Under this assumption, readers can also look at the price figures in this section and divide by 304 to convert $/Mcf roughly into $/kWh of electricity.

This comparison shows that natural gas is usually cheaper than electricity on a "kWh for kWh" basis, which helps explain why it is a more common heating fuel in climates with high heating requirements. However, comparing one kWh of natural gas to one kWh of electricity ignores the fact that electric appliances are often more efficient than gas appliances. For example, electric heat pump appliances for space and water heating are often two to four times more efficient than their gas-powered counterparts.

In these cases, gas appliances are only cheaper to use from the customer's perspective if the premium on one kWh of electricity outweighs the efficiency savings compared to natural gas. A comparison of Figures 36 and 32 shows that this is true in Michigan in 2022: electricity costs $0.17 per kWh in the residential sector, roughly 4.8 times more expensive than each kWh of natural gas.

Although the geographies of high and low costs and expenditures are different for natural gas than for electricity, the trends that relate costs to expenditures and use follow a similar logic to electricity's. There are higher expenditures but lower costs in areas with higher use, such as colder, more northern climates where natural gas is a common heating fuel.

Unsurprisingly, given the trends described above, average household expenditures on natural gas in Michigan are relatively high, ranking 35th among the 50 states and D.C. But the residential cost of natural gas is relatively low in Michigan, ranking 7th in the country on that metric. Figure 35 shows that Michigan's expenditures are about average when compared to its neighboring states, with higher expenditures than Wisconsin, Indiana and Iowa, but lower costs than its neighbors (Figure 37).

Figure 34: 2022 Natural Gas Expenditures per Household (in Dollars)

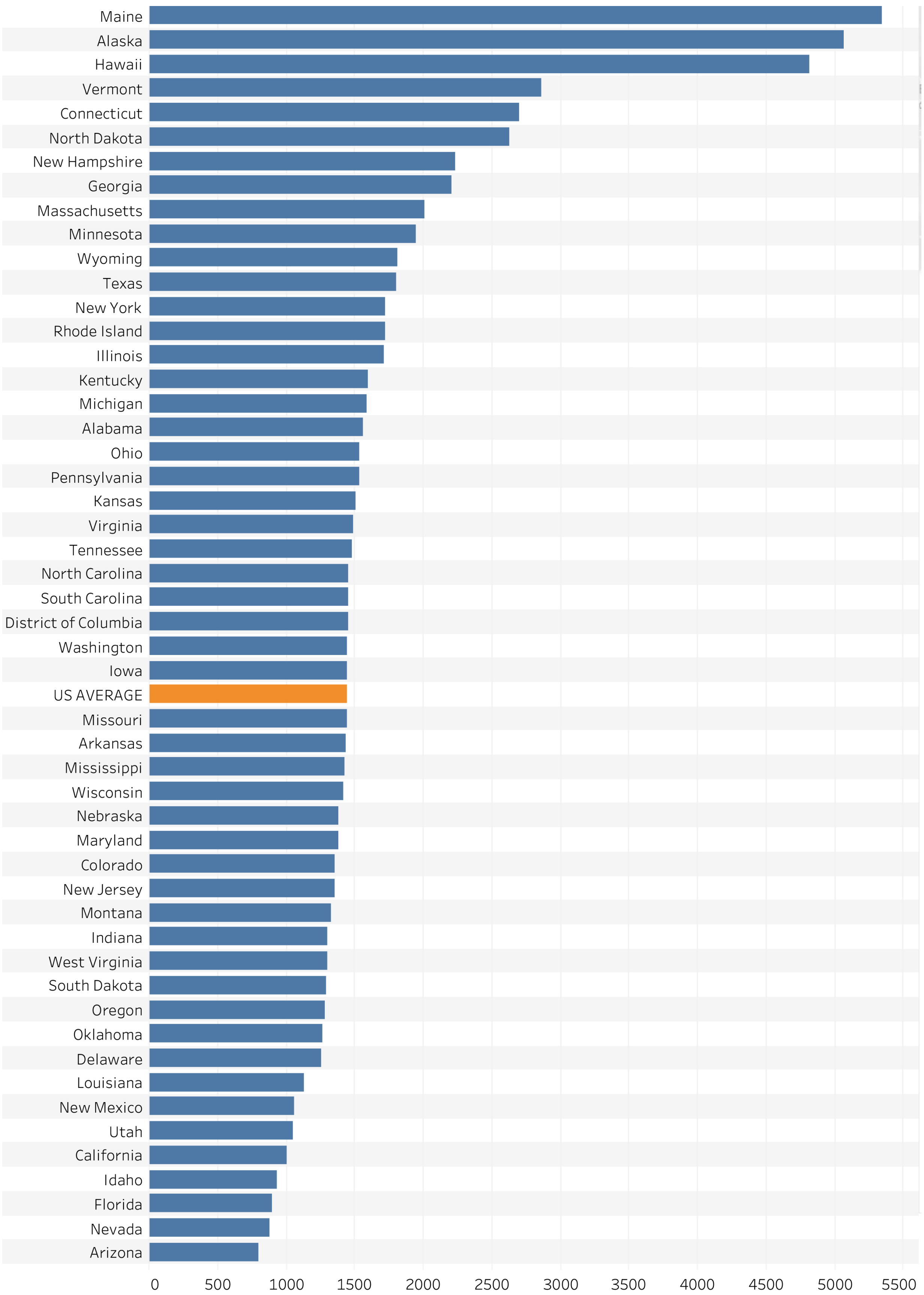


Figure 35: 2022 Natural Gas Expenditures per Household ($)

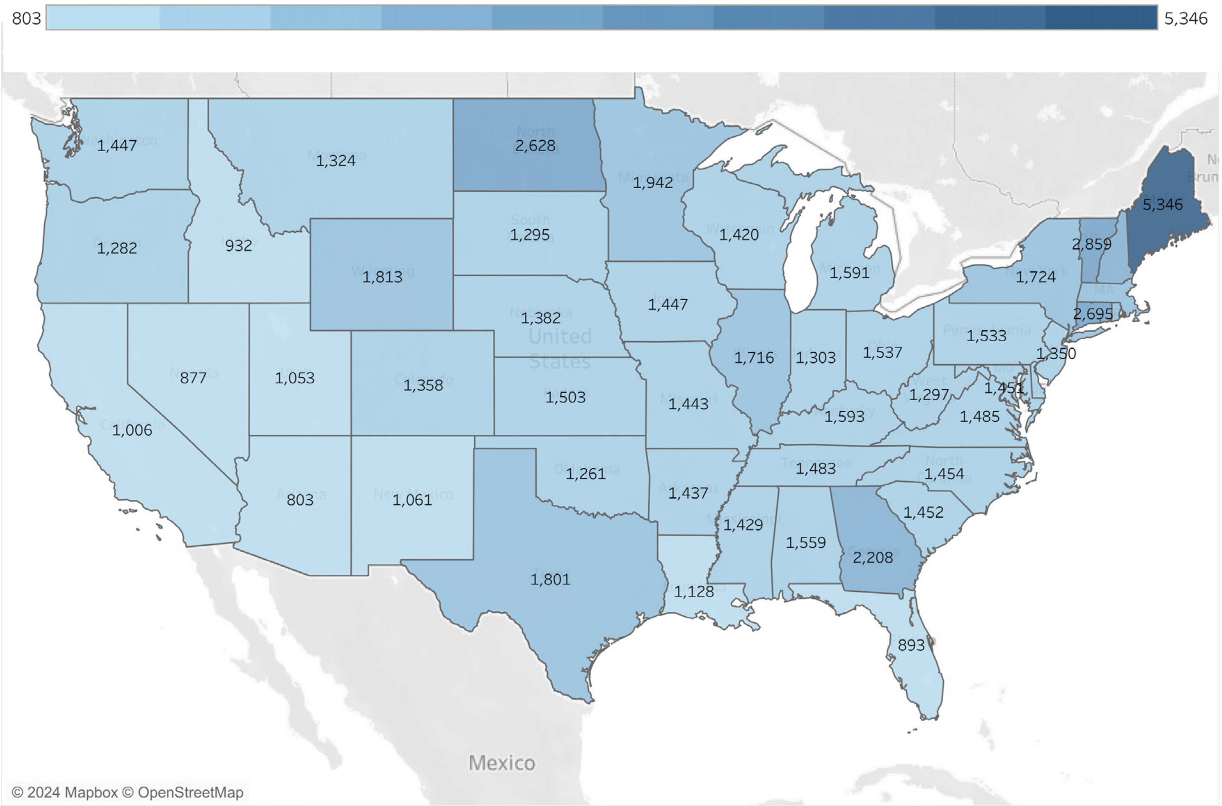


Figure 36: 2022 Natural Gas Cost in the Residential Sector ($/Mcf)

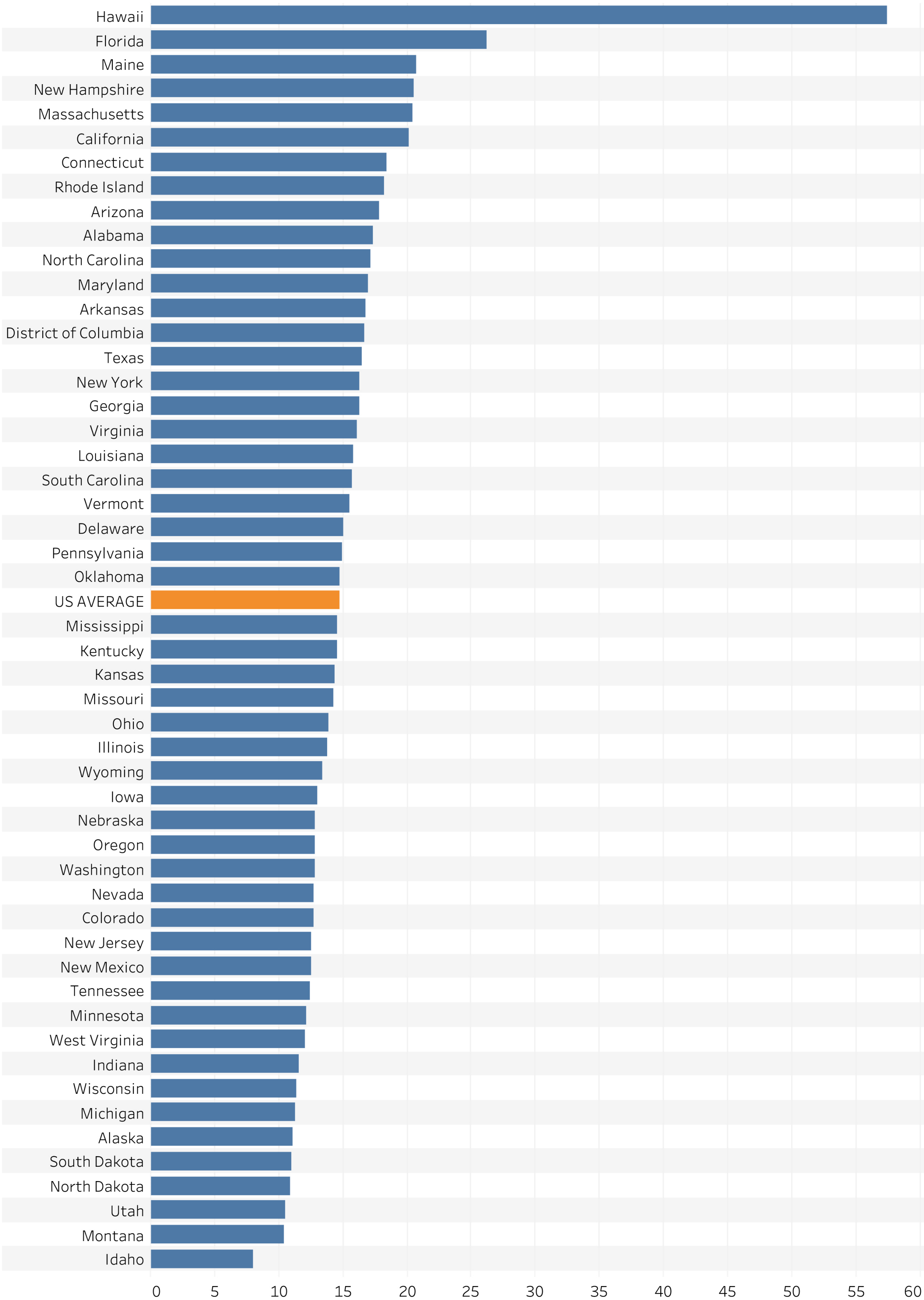
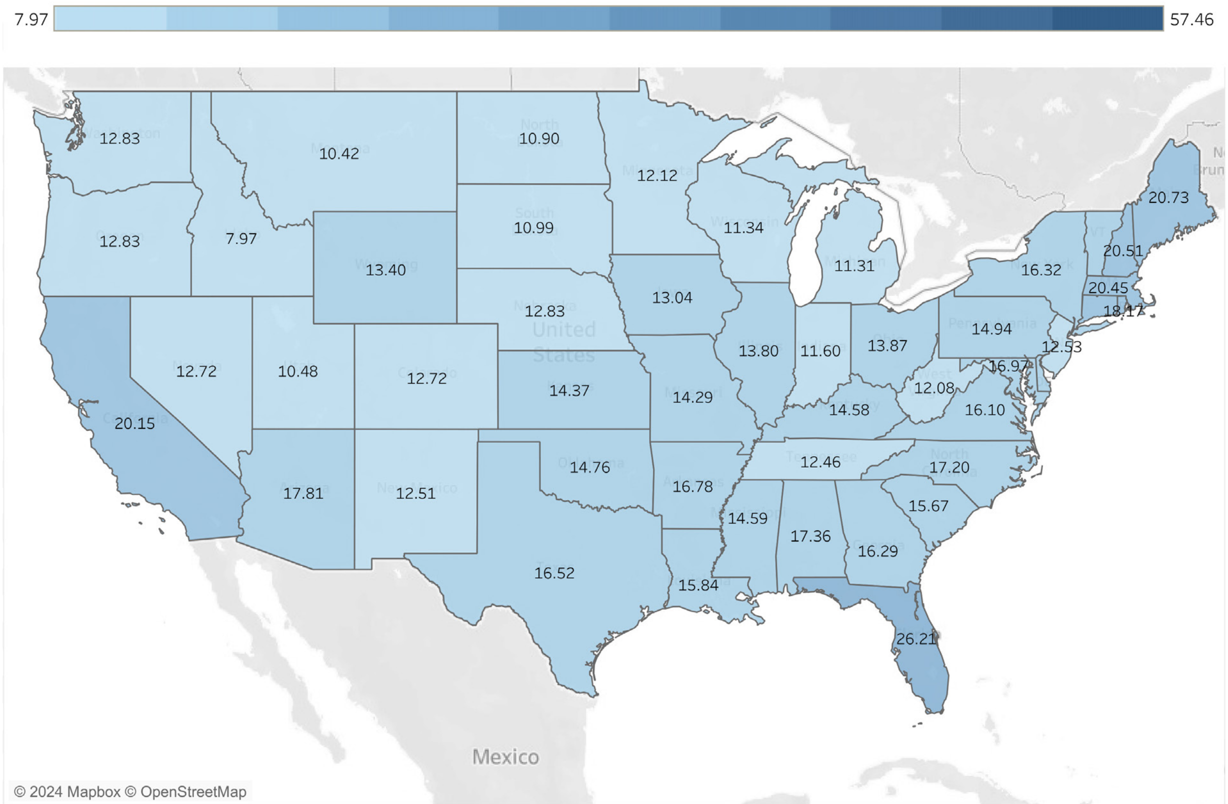


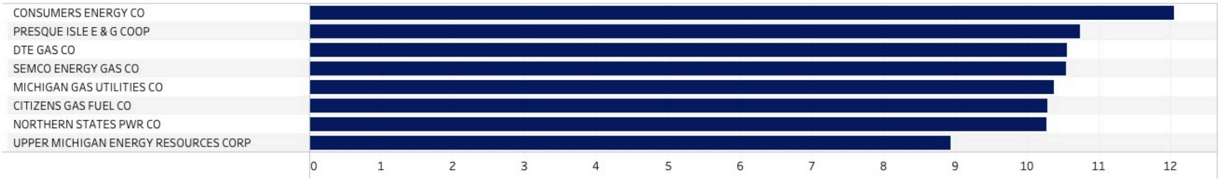
Figure 37: 2022 Natural Gas Cost in the Residential Sector ($/Mcf)



Residential Natural Gas Cost for Michigan Utilities

The cost of natural gas for Michigan utilities increased significantly from 2021 to 2022, continuing an existing trend. The cost varied between $8.9 and $12 per thousand cubic feet (Mcf) for natural gas utilities in 2022 compared to range of $6.4 and $10.5 in 2021. Among all of Michigan's utilities, Consumers Energy had the highest price at $12.04 per Mcf.

Figure 38: 2022 Natural Gas Cost in the Residential Sector for Michigan Utilities ($/Mcf)



Heating Fuel Sources

The type of fuel American households use for heat, both for home heating and for other heat uses such as cooking, hot water heating and clothes drying, is dependent on factors such as geography, average daily temperature, access to infrastructure and relative fuel costs.

As discussed previously, natural gas is historically often a more affordable energy source than electricity on a "kWh for kWh" basis for producing heat. This is also true of other heating fuels in some places. However, this trend is being challenged by the increasing affordability of high-quality air-source heat pumps that can perform efficiently at progressively lower temperatures. According to Canary Media, *heat pumps outsold gas* furnaces in 2022 and 2023 in the US, with the trend showing a widening gap.

Given that energy price dynamics favor natural gas in cold climates, however, the shift towards electric heating in northern states will likely lag behind warmer states, where resistance electric heat or air-source heat pumps can easily provide enough heat for the coldest days there. Electrifying household appliances offers another advantage over gas appliances, namely that disconnecting the gas line avoids the maintenance costs associated with the gas utility. Thus, as the technology improves and electricity prices approach parity with gas and other heating fuels, the shift towards electric heating will likely be seen everywhere, including in cold climates.

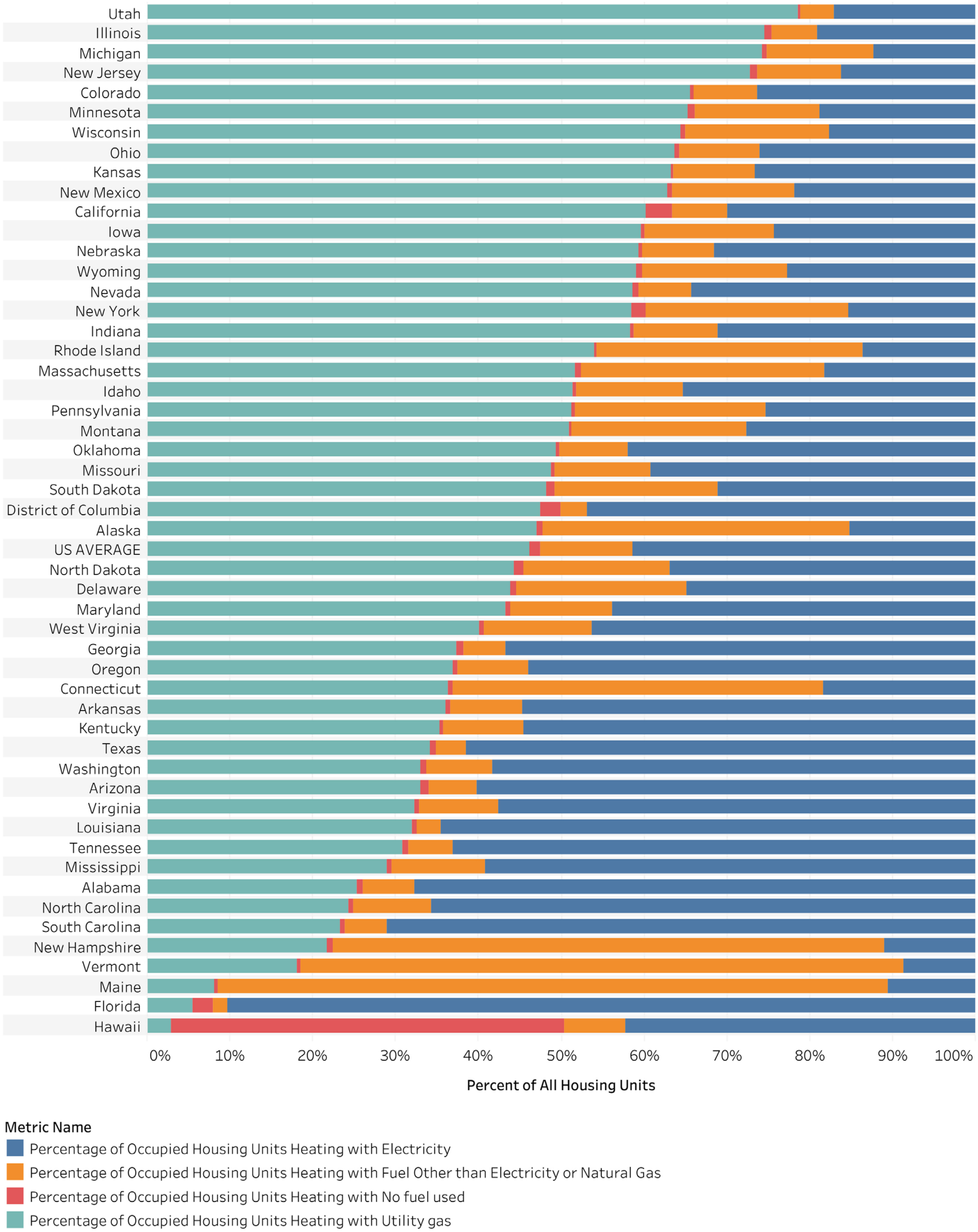
The Northeastern U.S. shows very few homes heating with electricity but a high penetration of other heating fuels (Figure 41). This trend is less the product of low-population density, as these Northeastern states are some of the *densest*, and more the product of older housing stock and infrastructure.

Most of the data in this subsection come from the EIA, but data on which fuel sources are used for home heating come from the United States Census Bureau, specifically from American Community Survey (ACS) form *B25040*, which gathers information on physical housing characteristics of occupied housing.

In 2022 12.28% of Michigan's occupied housing units were heated with electricity, an increase from 11.83% in 2021. Only three states in the country heated a smaller proportion of their homes with electricity: New Hampshire, Maine, and Vermont.

In 2022 74.31% of Michigan's population heated their homes with natural gas, making Michigan households the 3rd most likely to be heating with natural gas. In 2021, Michigan was also 3rd most likely, and 74.85% heated their homes with gas.

Figure 39: 2022 Percentage of Households Using Heating Source by Fuel



Household Other Heating Fuels Costs and Expenditures

Beyond electricity and natural gas, Americans use a variety of other fuels as sources of heat, including propane, kerosene, fuel oil, wood and more. Given their relatively limited use compared with electricity and natural gas, this report aggregates all fuel sources other than electricity and natural gas into a category called “other heating fuels” (OHFs).

Residential consumers purchase OHFs in different forms and units, but when reporting consumption of these fuels, the EIA converts the energy embodied in those materials to a basic unit of energy measurement—MMBTU, or million BTU. The conversion factor from MMBTU to kWh is 293 kWh to 1 MMBTU. To get a “kWh for kWh” price comparison between OHFs and electricity, divide the cost per MMBTU in any state by 293 (see Figure 43).

However, as discussed in the section on residential natural gas prices, one kWh of energy produced via OHF is not equivalent to one kWh of electricity. Appliances that use OHFs are often less efficient than natural gas appliances, while electric appliances are often significantly more efficient. Combined with the higher cost of OHFs (at least in Michigan), this suggests that electrification programs could more economically target households currently using OHFs than households using natural gas.

In 2022, Michigan ranked 26th for yearly expenditures on OHFs and 16th for costs per MMBTU, an improvement from 32nd place and 22nd place in these two metrics, respectively, in 2021.

Michigan had higher OHF expenditures than all neighboring states except Minnesota, lower costs than Ohio, and higher costs than Illinois and Wisconsin (Figures 41 and 43).

Figure 40: 2022 Residential Other Heating Fuel Expenditures per Household ($)

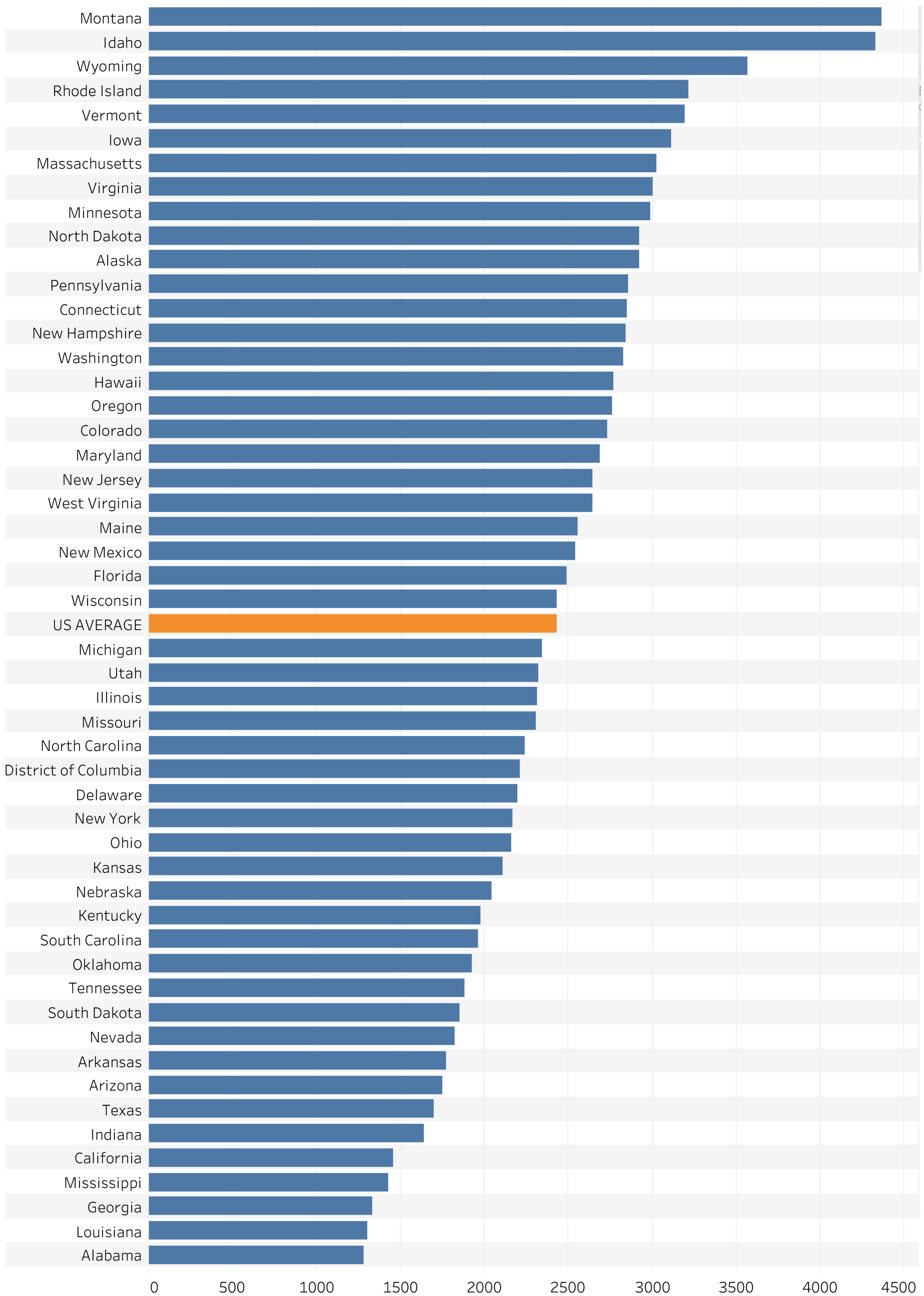


Figure 41: 2022 Residential Other Heating Fuel Expenditures per Household ($)

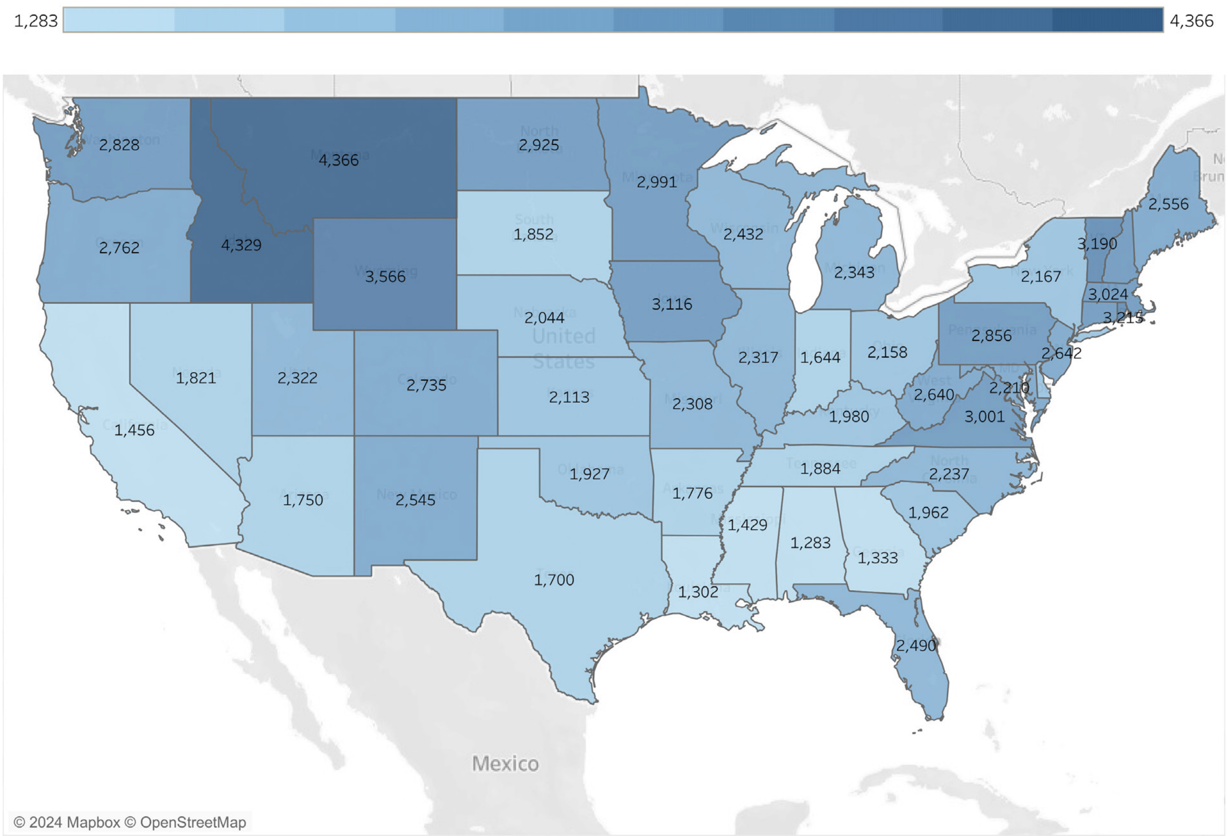


Figure 42: 2022 Cost of Other Heating Fuels in the Residential Sector ($/MMBTU)

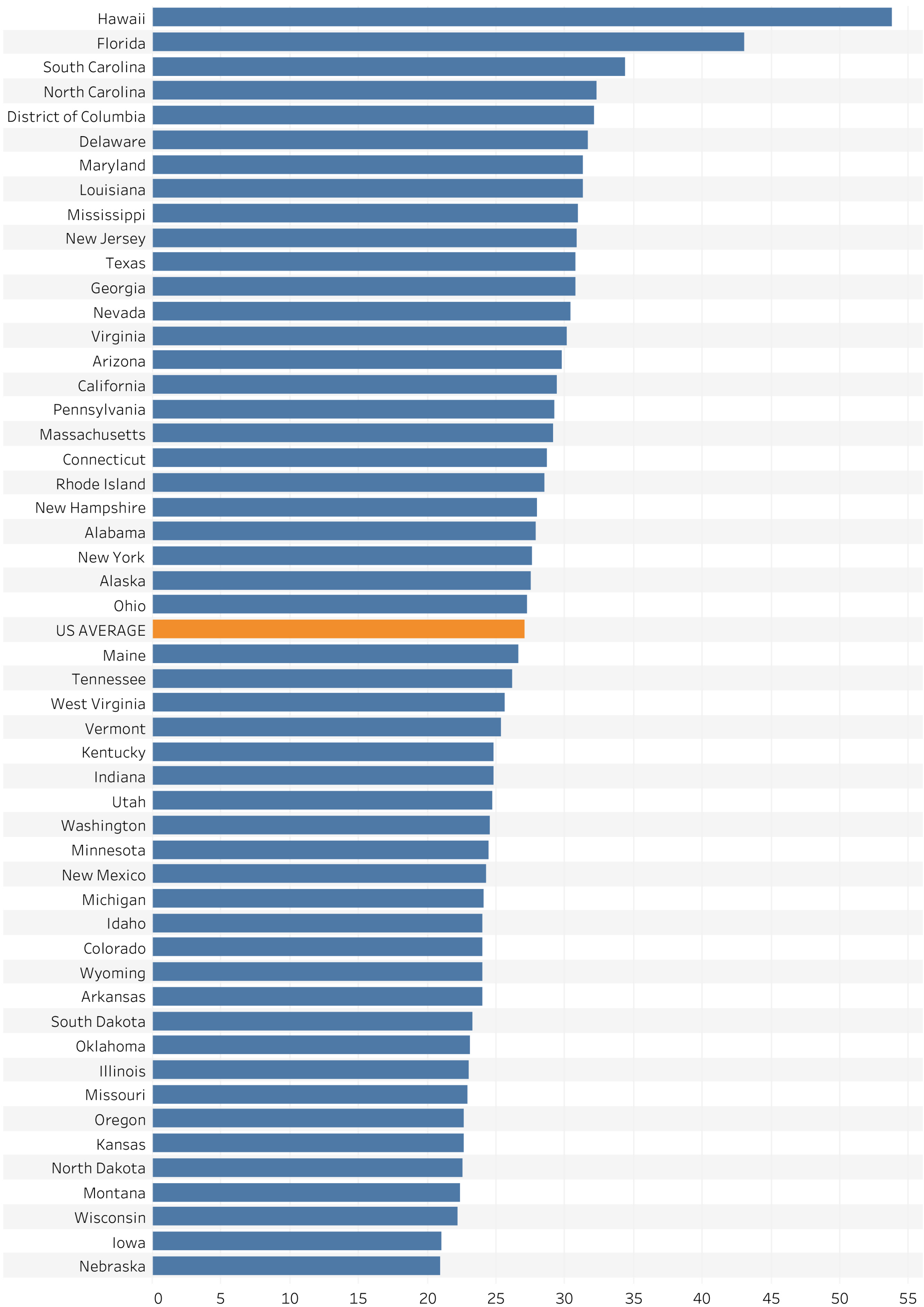
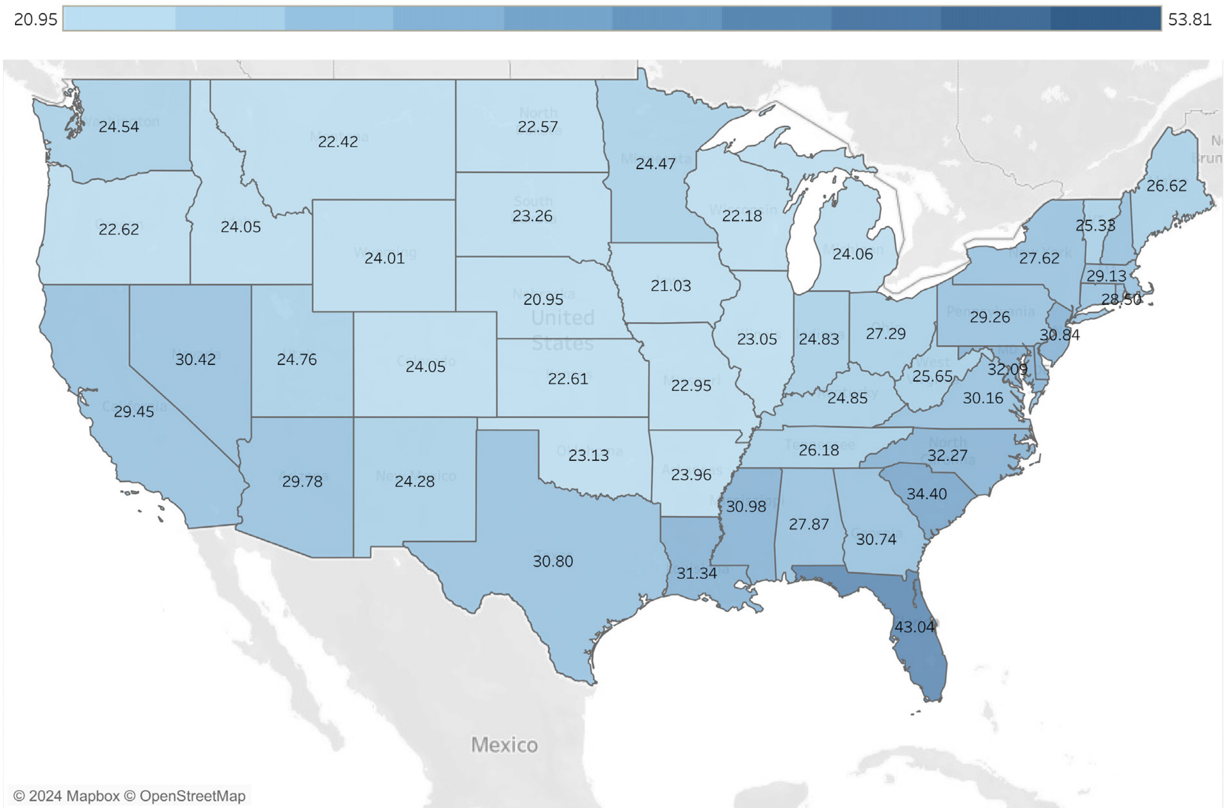


Figure 43: 2022 Cost of Other Heating Fuels in the Residential Sector ($/MMBTU)



Non-Residential Energy Costs

Residential, commercial and industrial customers all pay different costs for electricity and natural gas. Industrial customers generally receive the lowest rates of the customer classes because they are large users that require singular hookups. The energy costs for industrial customers can be understood in the electricity sector as primarily transmission and generations costs, and in the natural gas sector as transmission and production costs. Residential and commercial customers, on the other hand, pay for transmission, generation/production, and the construction and maintenance of distribution infrastructure. How much of these costs falls on commercial customers and how much falls on residential customers is largely a matter of policy. The significantly higher residential cost for both electricity and natural gas relative to the commercial cost shows there is a clear lack of uniformity in how distribution costs are shared between residential and commercial customers.

In Rhode Island, the commercial cost of electricity is actually lower than the industrial cost, and the residential sector is forced to pay for distribution infrastructure. Conversely, in many southern states, including Kentucky, Tennessee, Alabama and Mississippi, there is a large spread between commercial and industrial prices, but a very small spread between commercial and residential, suggesting that distribution system costs are shared between the two classes. Similar trends exist in natural gas costs, although which states they exist in appear uncorrelated to where they exist for electricity.

Non-Residential Electricity Costs

In 2022, Michigan's 12.55 cents per kWh price of electricity in the commercial sector is close to the US average and ranks 36th in the nation. Michigan's electricity price for industrial customers was 8.33 cents per kWh, also close to the US average, and Michigan ranked 31st in overall industrial sector electricity price. Figure 45 shows that Michigan's commercial electricity price was the highest among its peer states, whereas Figure 47 shows that Michigan's industrial electricity price is higher than in Ohio and Iowa, lower than in Minnesota, and comparable to Wisconsin, Illinois, and Indiana.

Figure 44: 2022 Cost of Electricity in the Commercial Sector ($/kWh)

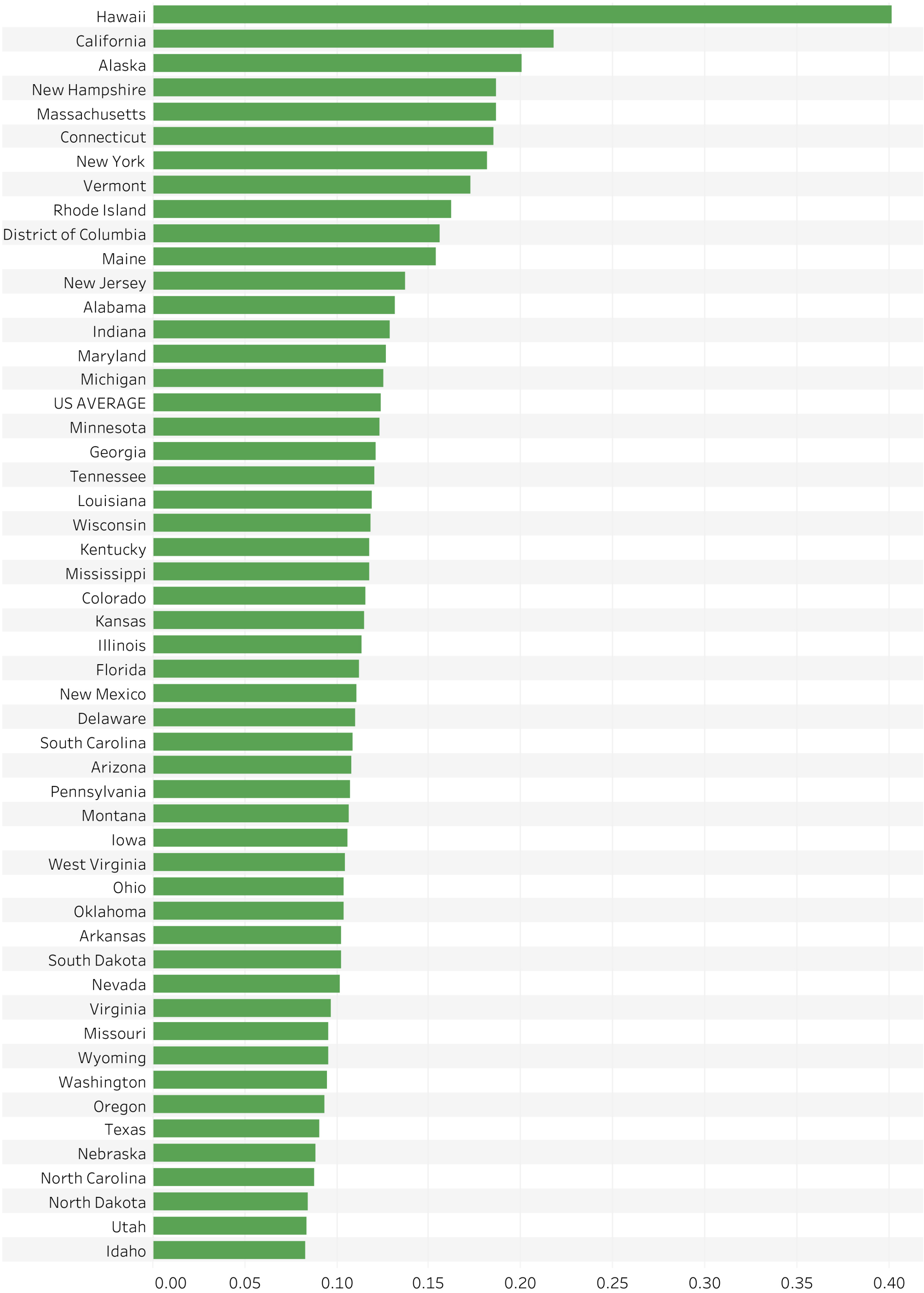


Figure 45: 2022 Cost of Electricity in the Commercial Sector ($/kWh)

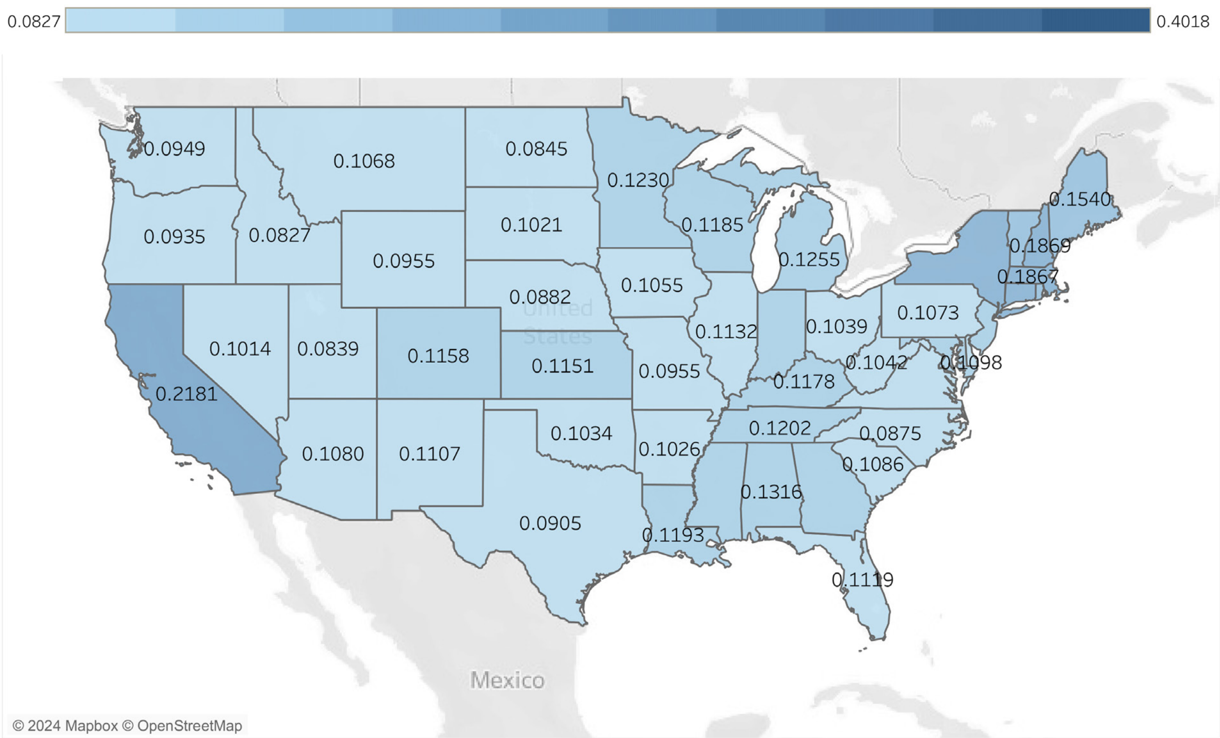


Figure 46: 2022 Cost of Electricity in the Industrial Sector ($/kWh)

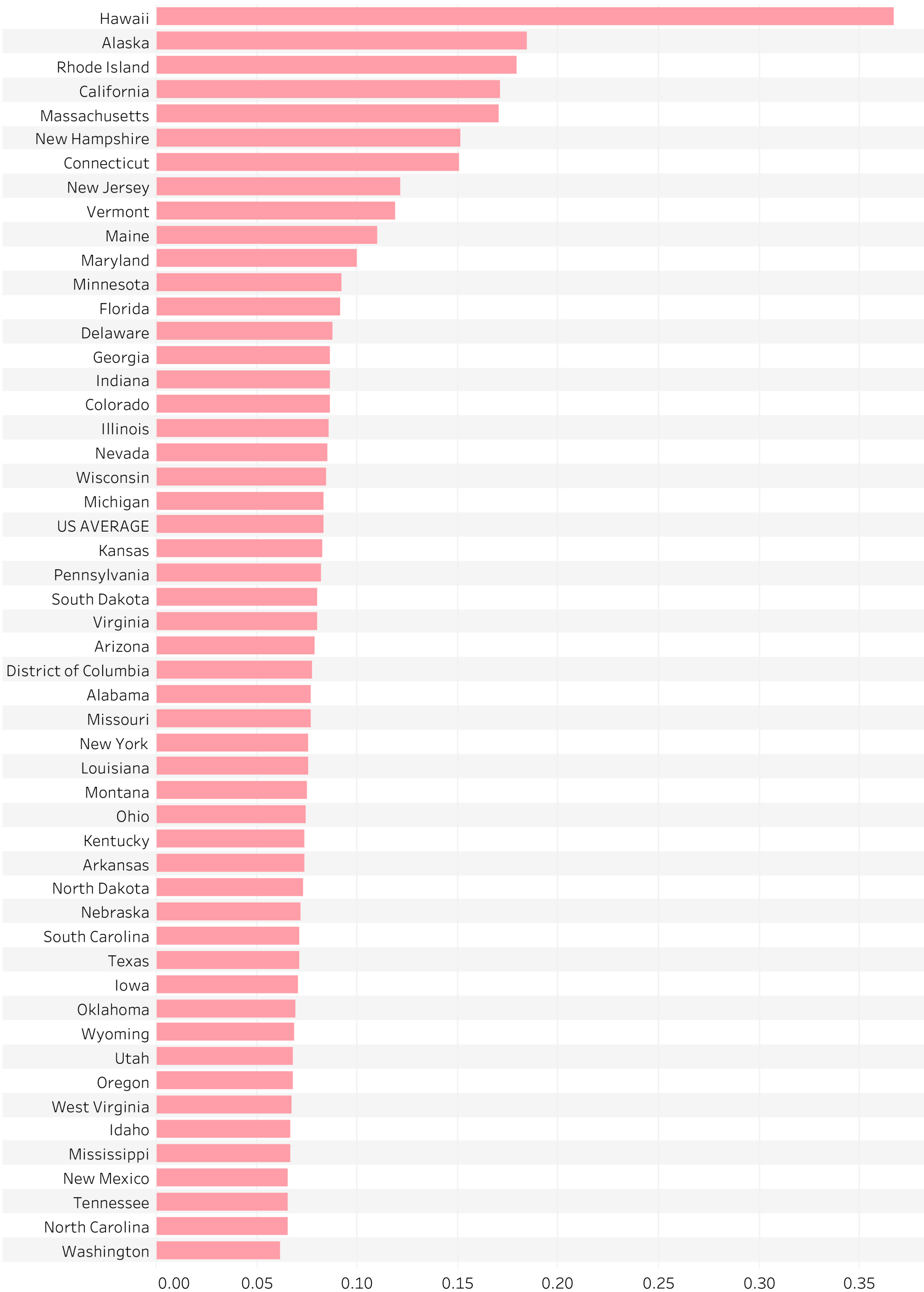
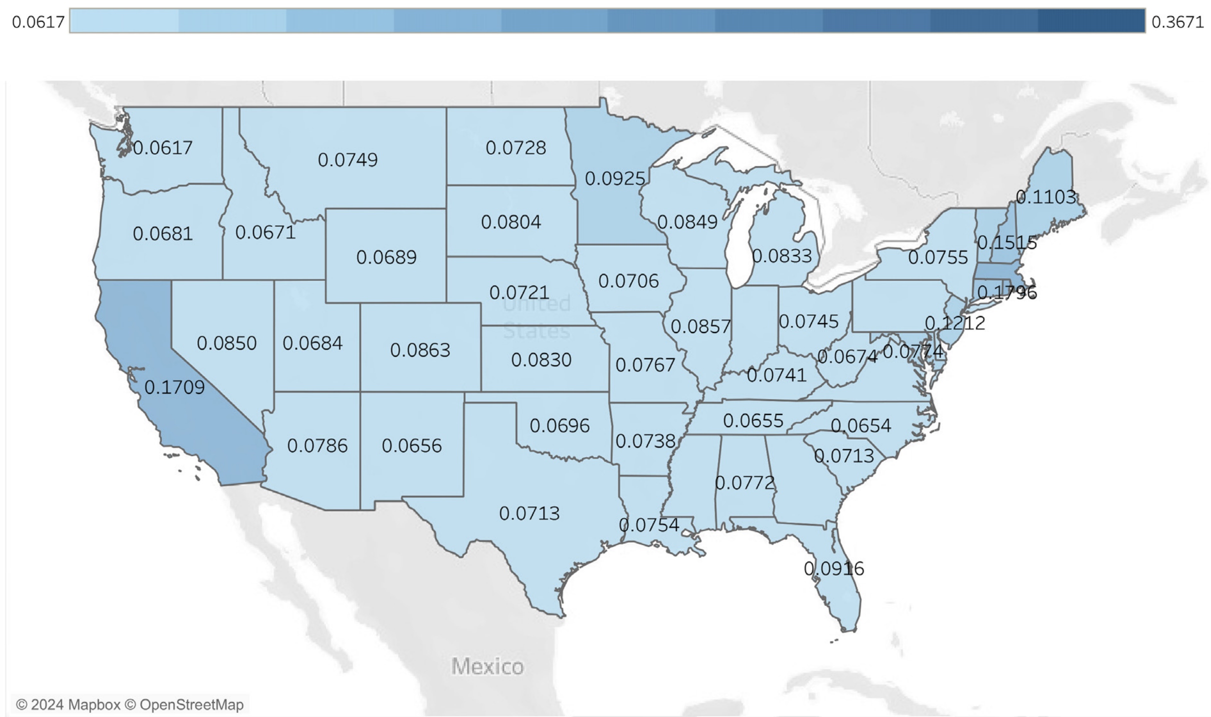


Figure 47: 2022 Cost of Electricity in the Industrial Sector ($/kWh)



Non-Residential Electricity Costs for Michigan Utilities

Figures 48 and 49 show the comparative pricing by sector of different utilities across Michigan. It is interesting to note that, for some smaller municipal and cooperative utilities, the normal pattern of price increasing from industrial to commercial to residential is not always the case. Although they may represent real differences in cost of service between different sectors, these discrepancies are more likely to represent the political priorities of these smaller utilities that have more pricing flexibility because of their smaller scales and institutional structures.

Figure 48: 2022 Cost of Electricity in the Commercial Sector for Michigan Utilities ($/kWh)

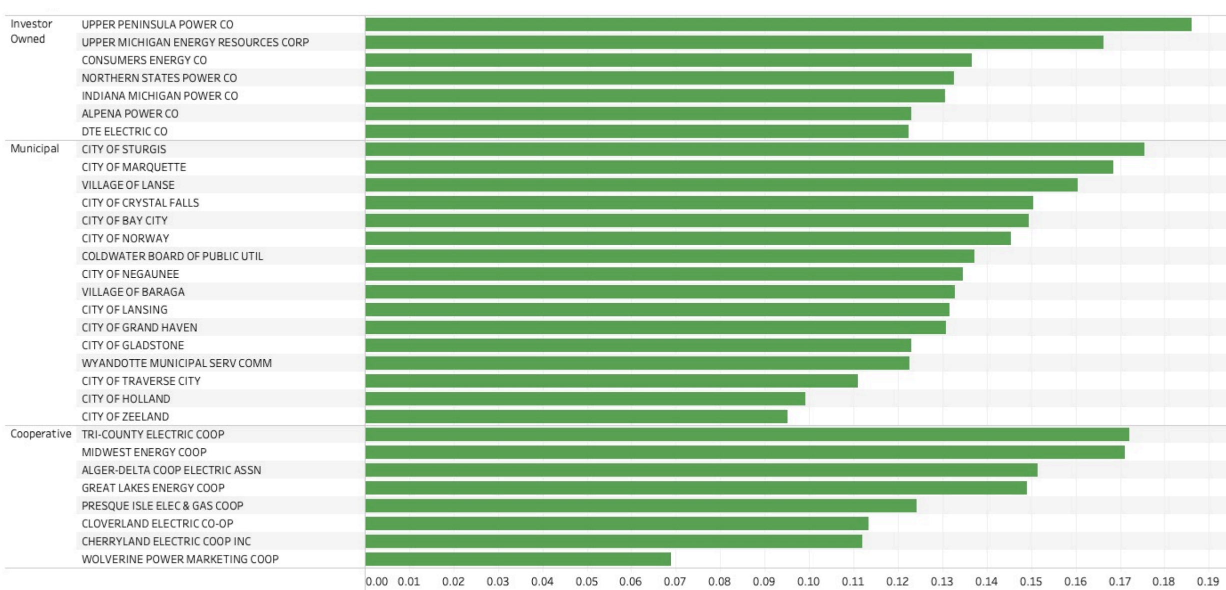
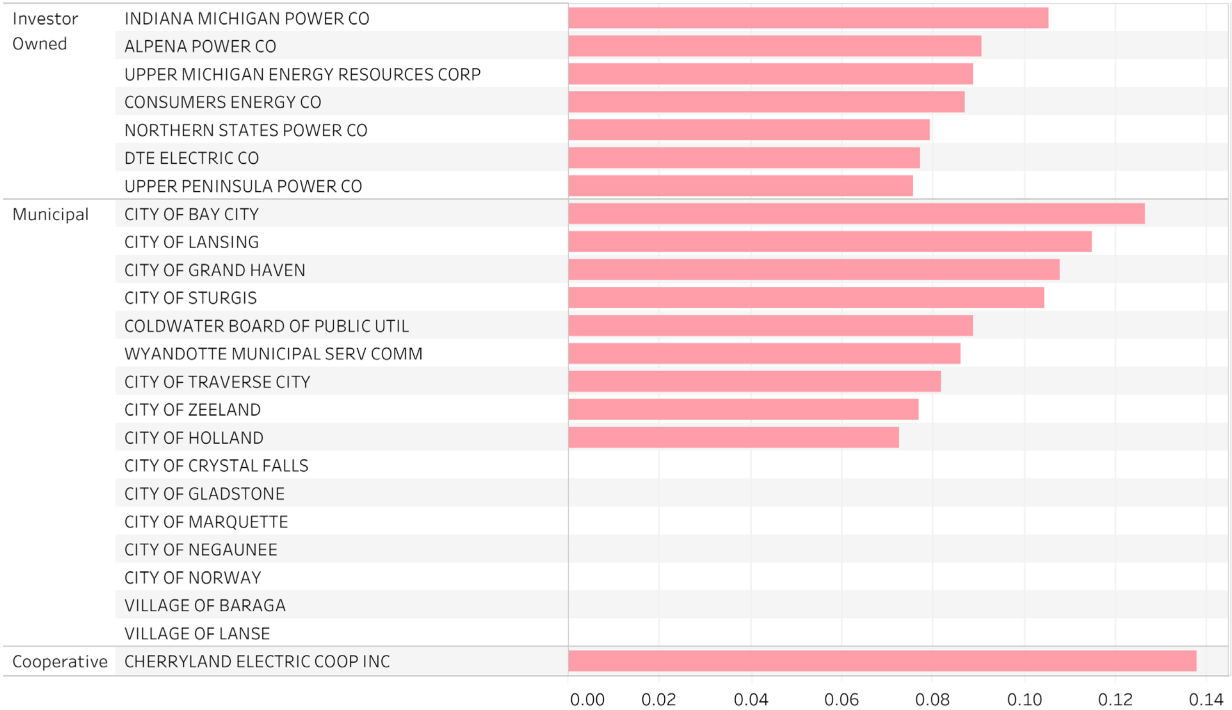


Figure 49: 2022 Cost of Electricity in the Industrial Sector for Michigan Utilities ($/kWh)



Michigan Non-Residential Natural Gas Costs

In 2022, Michigan's natural gas price of $10.00 per thousand cubic feet (Mcf) in the commercial sector is relatively low compared to other states, ranking 10th. Michigan's natural gas price for industrial customers was $9.11 per Mcf, ranking 28th in the nation. This result is notably much worse than the state's rankings for commercial and residential natural gas prices. Whereas commercial and residential sector natural gas rates are driven by space heating and go down as infrastructure costs are divided up over a higher volume sold, in the industrial sector, natural gas price is driven by other factors, unlinked to the demand produced by space heating.

Figure 50: 2022 Price of Natural Gas in the Commercial Sector ($/Mcf)

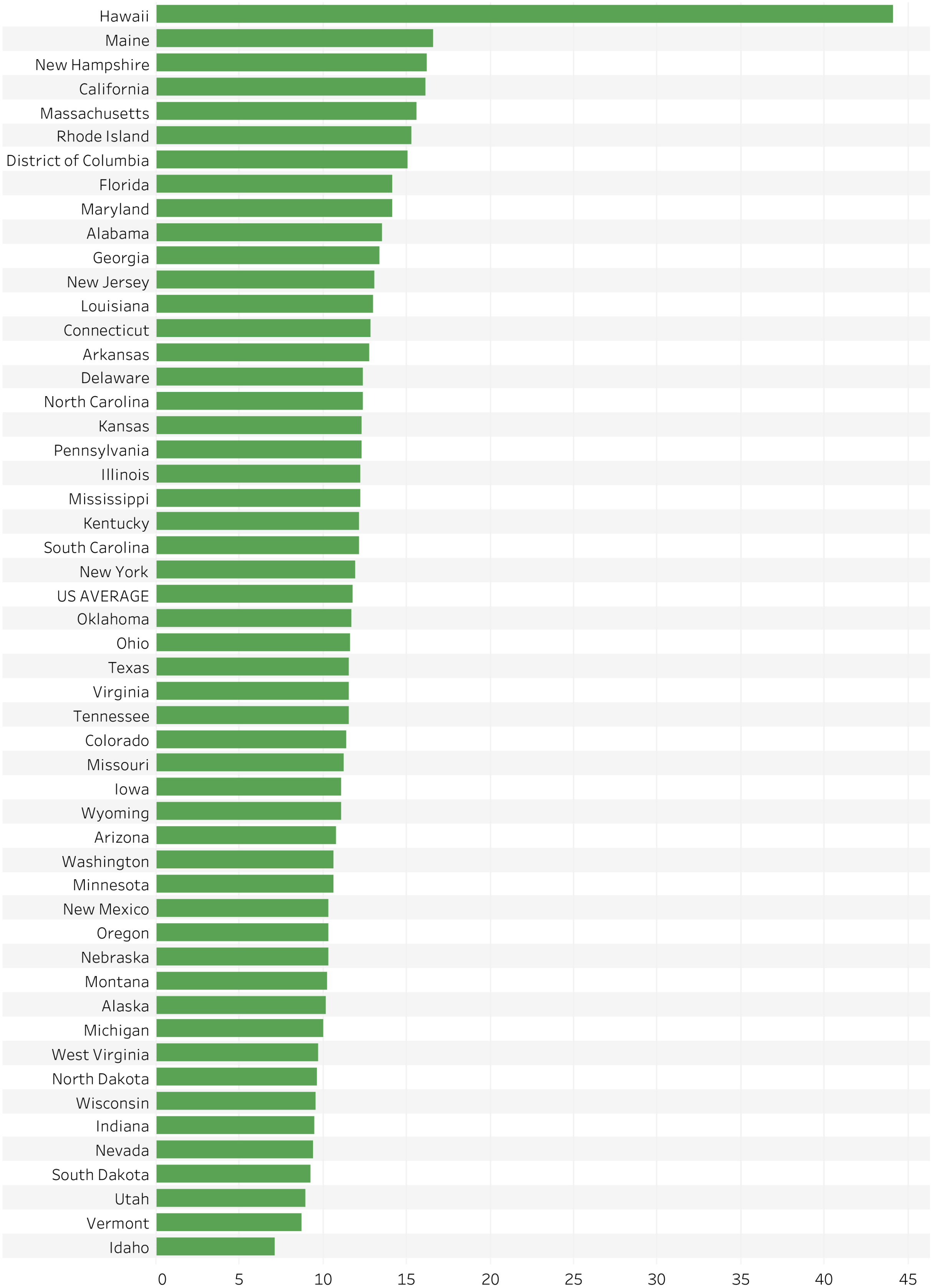


Figure 51: 2022 Price of Natural Gas in the Commercial Sector ($/Mcf)

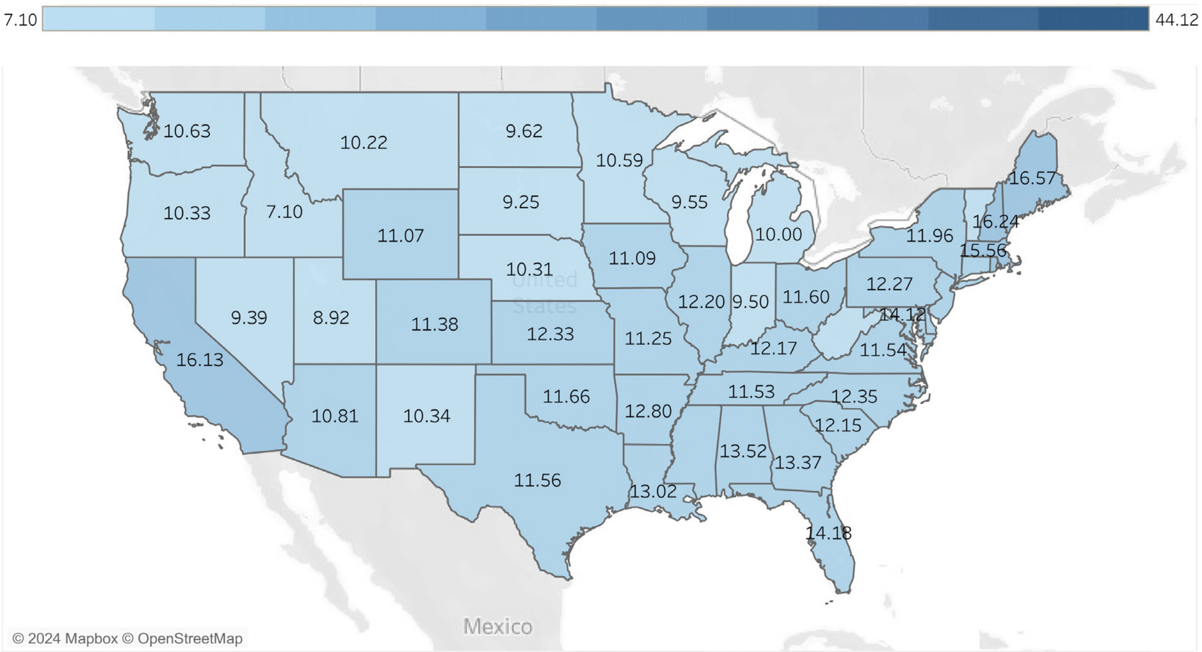


Figure 52: 2022 Price of Natural Gas in the Industrial Sector ($/Mcf)

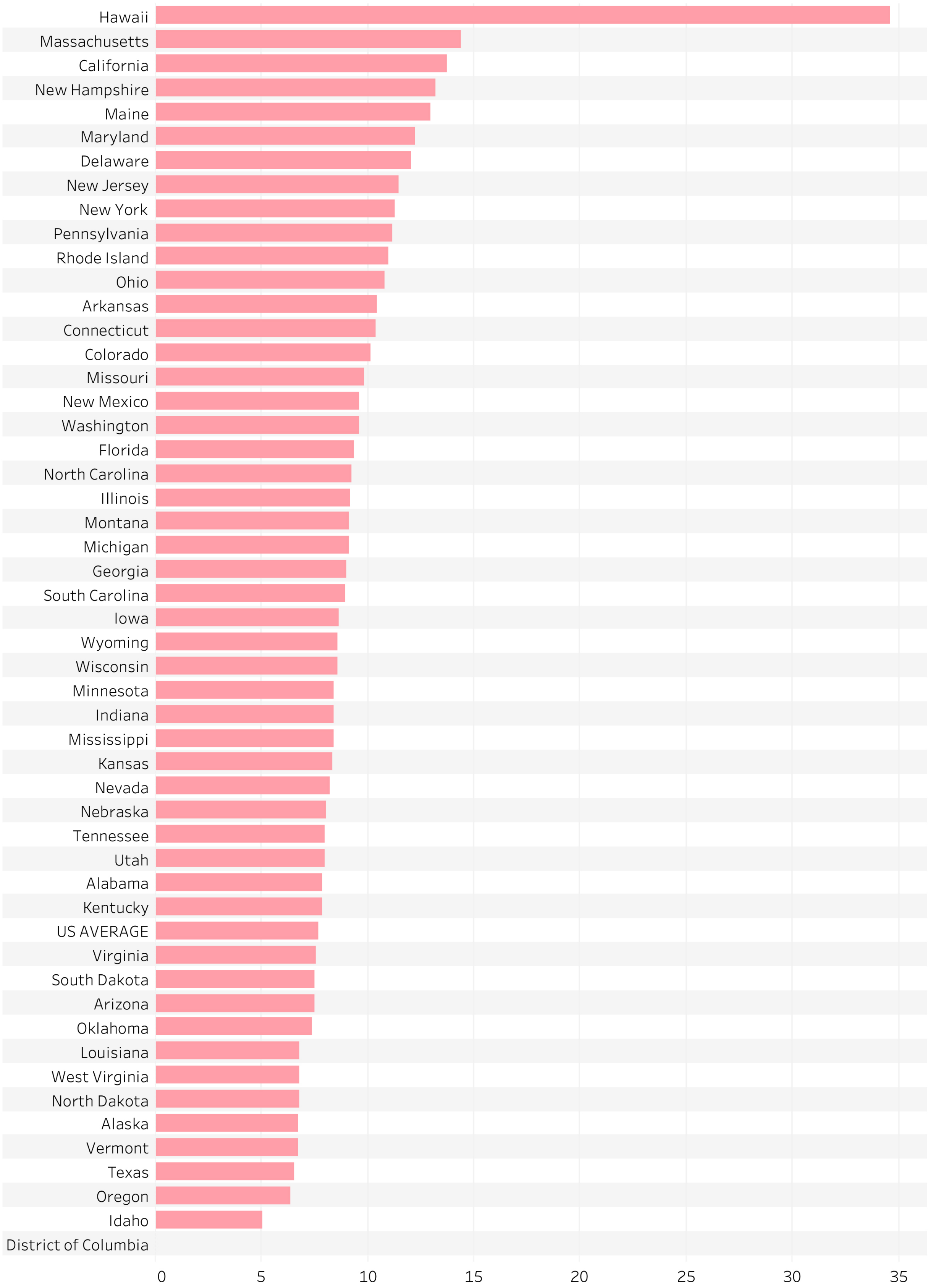
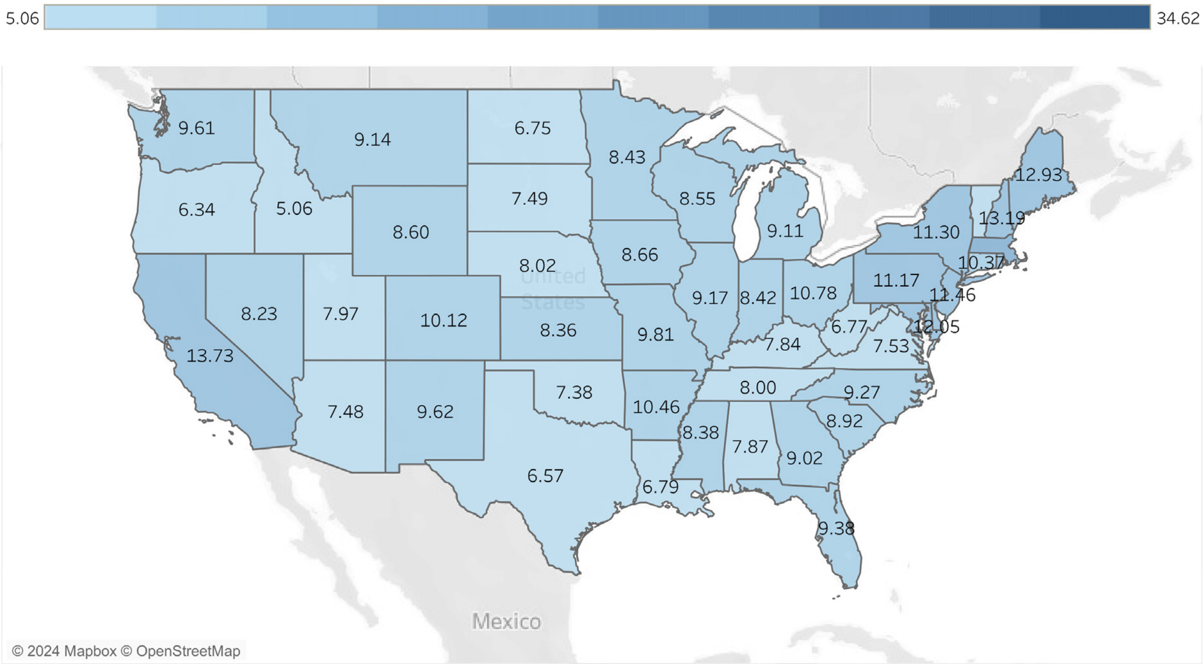


Figure 53: 2022 Price of Natural Gas in the Industrial Sector ($/Mcf)



Energy Efficiency

Electric utilities across the country are working to reduce carbon emissions and are closing their oldest and dirtiest power plants. This trend is the result of both economic pressures and state and federal legislation. To make up for the lost electricity supply, as well as increases in load resulting from electrification, utilities are looking both to build new clean supply, and to control the demand side of the equation. From the point of view of utilities and utility regulators, a kWh of unused electricity is the same as, and often cheaper than, the production of an additional kWh of clean generation. The practice of intentionally reducing electricity use is called demand-side management. Energy efficiency programs are a big part of demand-side management. These energy efficiency programs come in different forms, but typical programs include weatherization programs to help improve insulation and air sealing, and programs that either provide or subsidize the replacement of older, less efficient lightbulbs and appliances, with newer, more efficient versions.

However, not all energy efficiency programs are equal, and not all utilities use them to their full potential. To get at the differences in program efficiency and deployment, we present two metrics that we have produced from data reported in utilities' Form 861 filings to the EIA. These metrics are "Cost per Kilowatt Hour of Energy Efficiency Savings," which is a measurement of how well utilities are spending their money on energy efficiency, and "Energy Efficiency Savings as a Percentage of Sales," which measures how aggressively utilities are deploying energy efficiency programs. We report these metrics for each major economic sector—residential, commercial and industrial—at the state and Michigan utility levels.

Energy Efficiency Program Costs

In 2022, Michigan had the 37th lowest cost residential energy efficiency program in the country, the 18th lowest cost program in the commercial sector and the 21st lowest cost program in the industrial sector. These programs provided energy efficiency savings at $0.051/kWh for residential, $0.015/kWh for commercial and $0.016/kWh for industrial. Compared to its peer states, Michigan utilities' energy efficiency programs tend to be more expensive. Michigan is less than expensive than Ohio for residential programs, and less than expensive than Illinois for commercial and industrial programs. Notably, Michigan's demand-side management appears to be much more cost-effective than generating and delivering electricity in the state.

Figure 54: 2022 Cost of Energy Efficiency Savings in the Residential Sector ($/kWh)

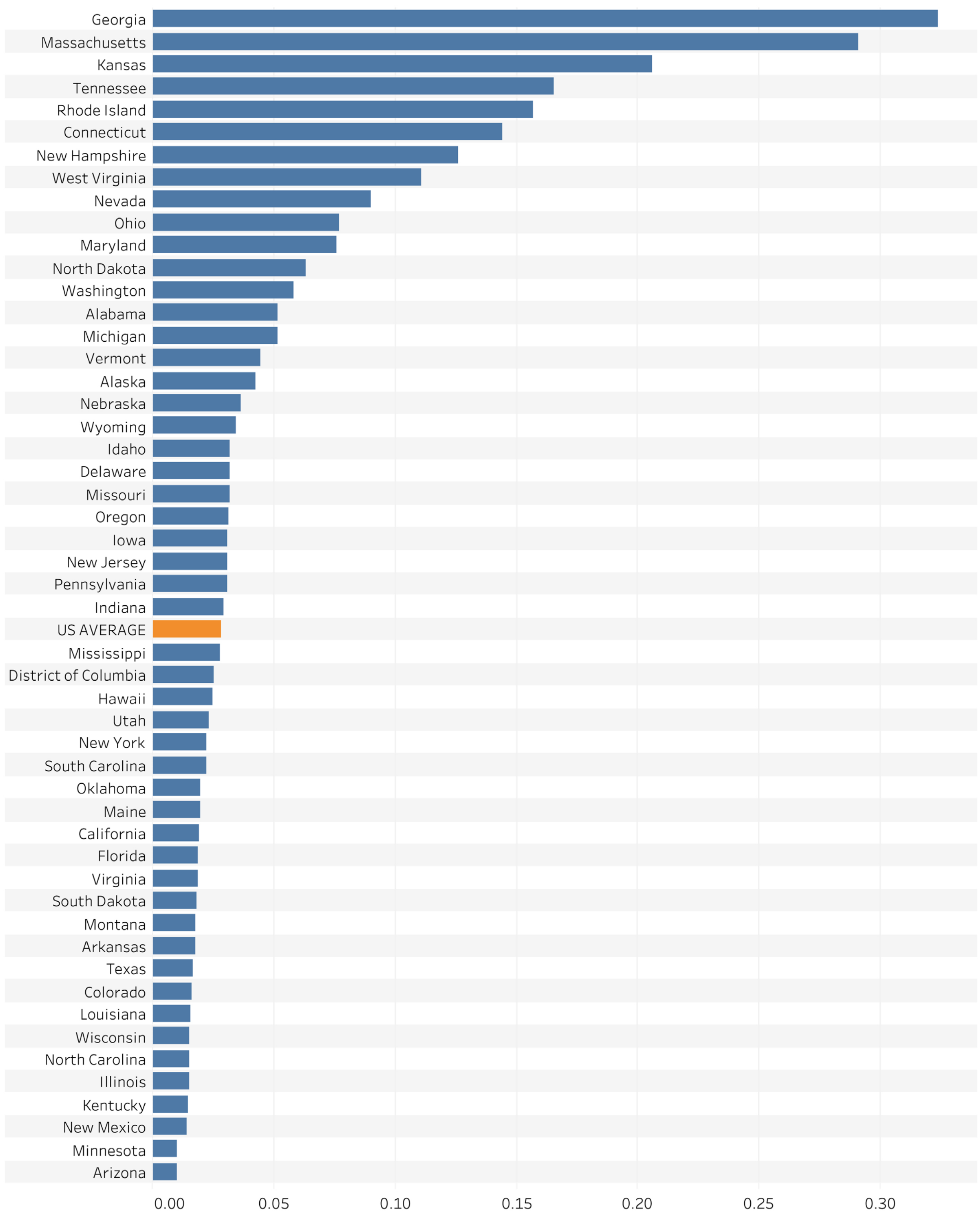


Figure 55: 2022 Cost of Energy Efficiency Savings in the Residential Sector ($/kWh)

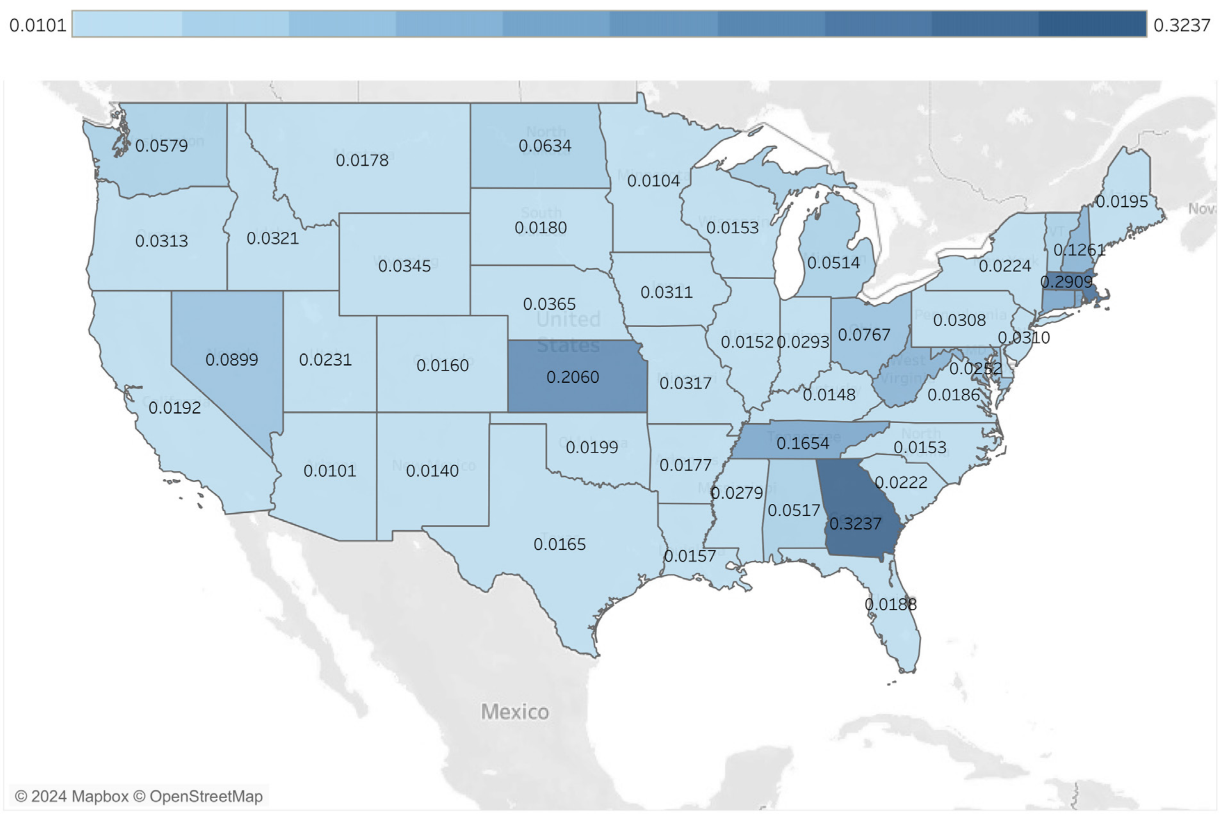


Figure 56: 2022 Cost of Energy Efficiency Savings in the Commercial Sector ($/kWh)

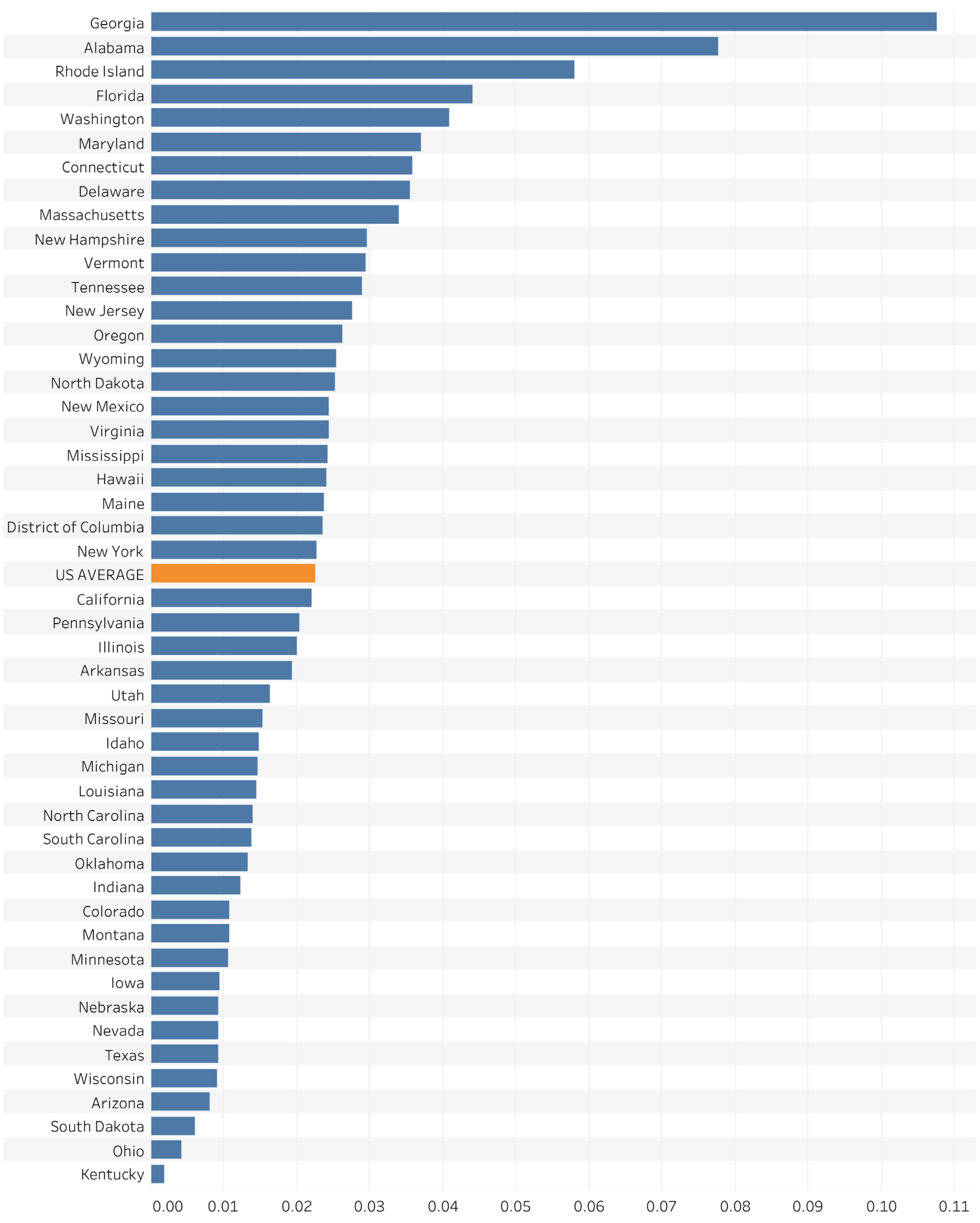


Figure 57: 2022 Cost of Energy Efficiency Savings in the Commercial Sector ($/kWh)

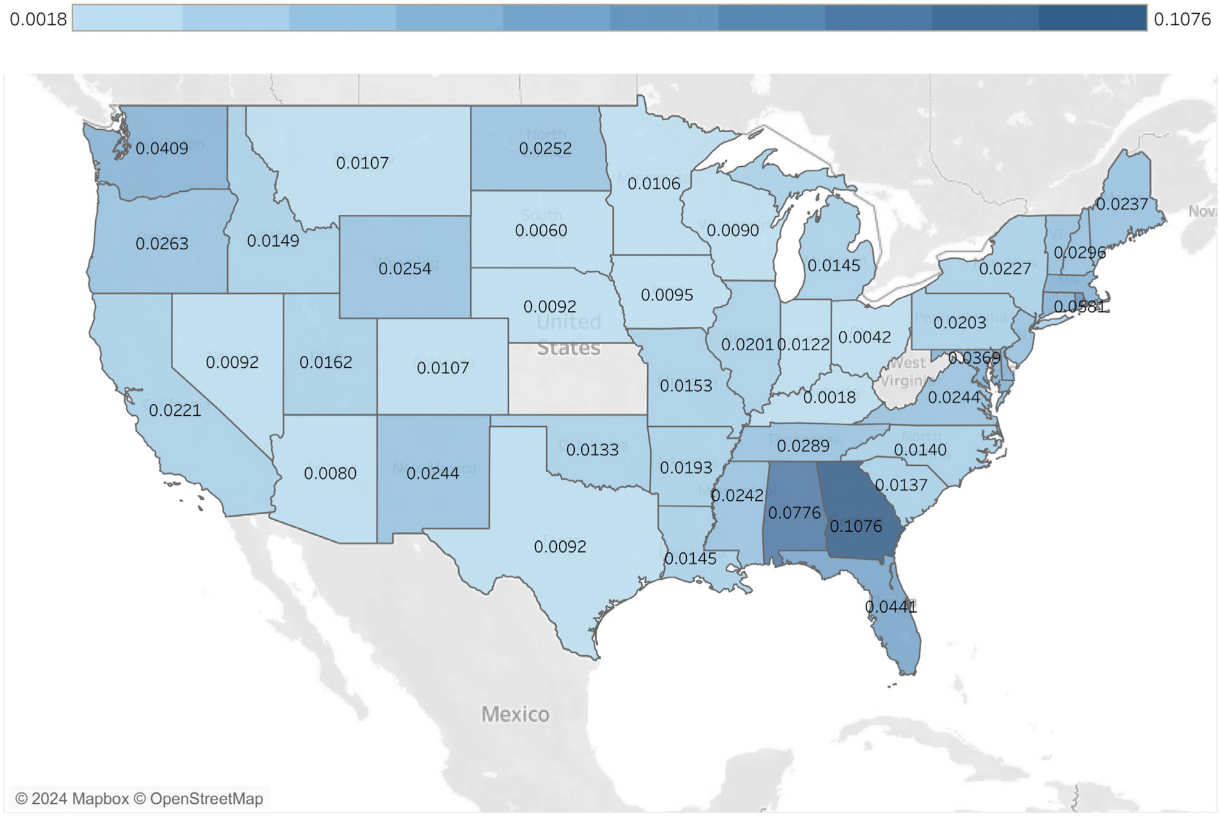


Figure 58: 2022 Cost of Energy Efficiency Savings in the Industrial Sector ($/kWh)

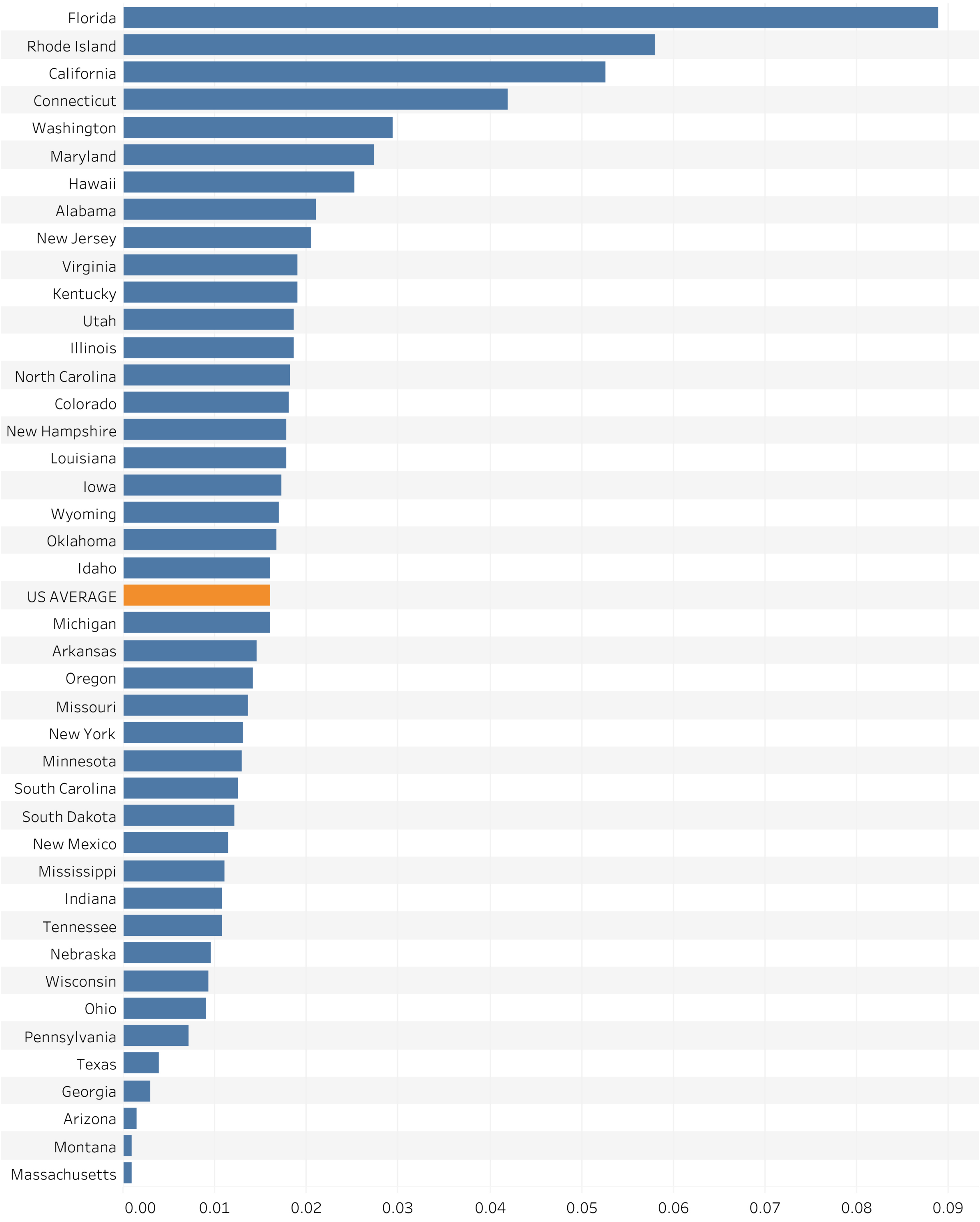
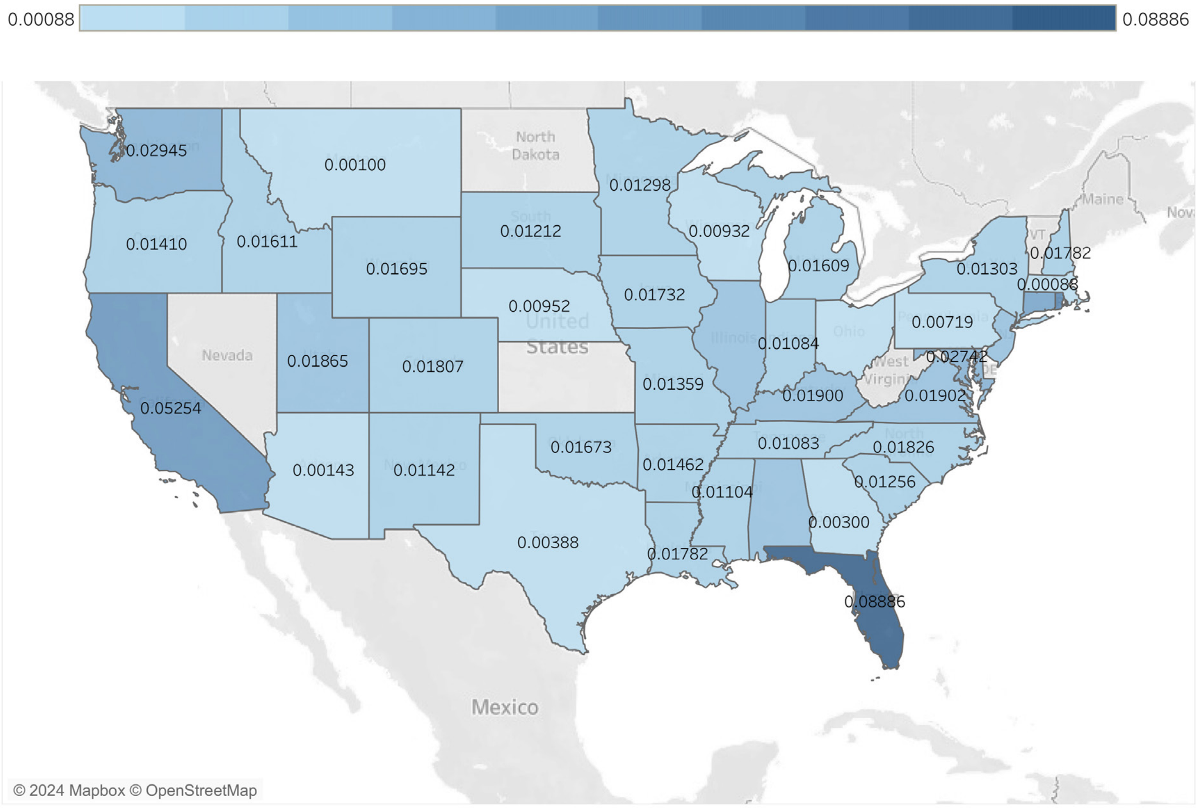


Figure 59: 2022 Cost of Energy Efficiency Savings in the Industrial Sector ($/kWh)



Energy Efficiency Program Deployment

As discussed above, Michigan's residential energy efficiency programs are fairly costly compared to those in other states, especially in the residential sector. In 2022, on the metric "Energy Efficiency Savings as a Percentage of Sales," however, Michigan utilities' residential sector programs ranked the 13th best among all states at 1.34%, and near the middle of states in its peer group, with Illinois and Minnesota performing better, and Ohio, Indiana and Wisconsin performing worse.

Michigan performed even better with its commercial sector programs, performing 2nd best among all states at 2.6%, being out-performed only by Vermont.

At 0.46%, Michigan's industrial sector programs ranked 12th best among all states and better than all states in Michigan's peer group except Wisconsin.

Figure 60: 2022 Energy Efficiency Savings as a Percentage of Electricity Sales in the Residential Sector

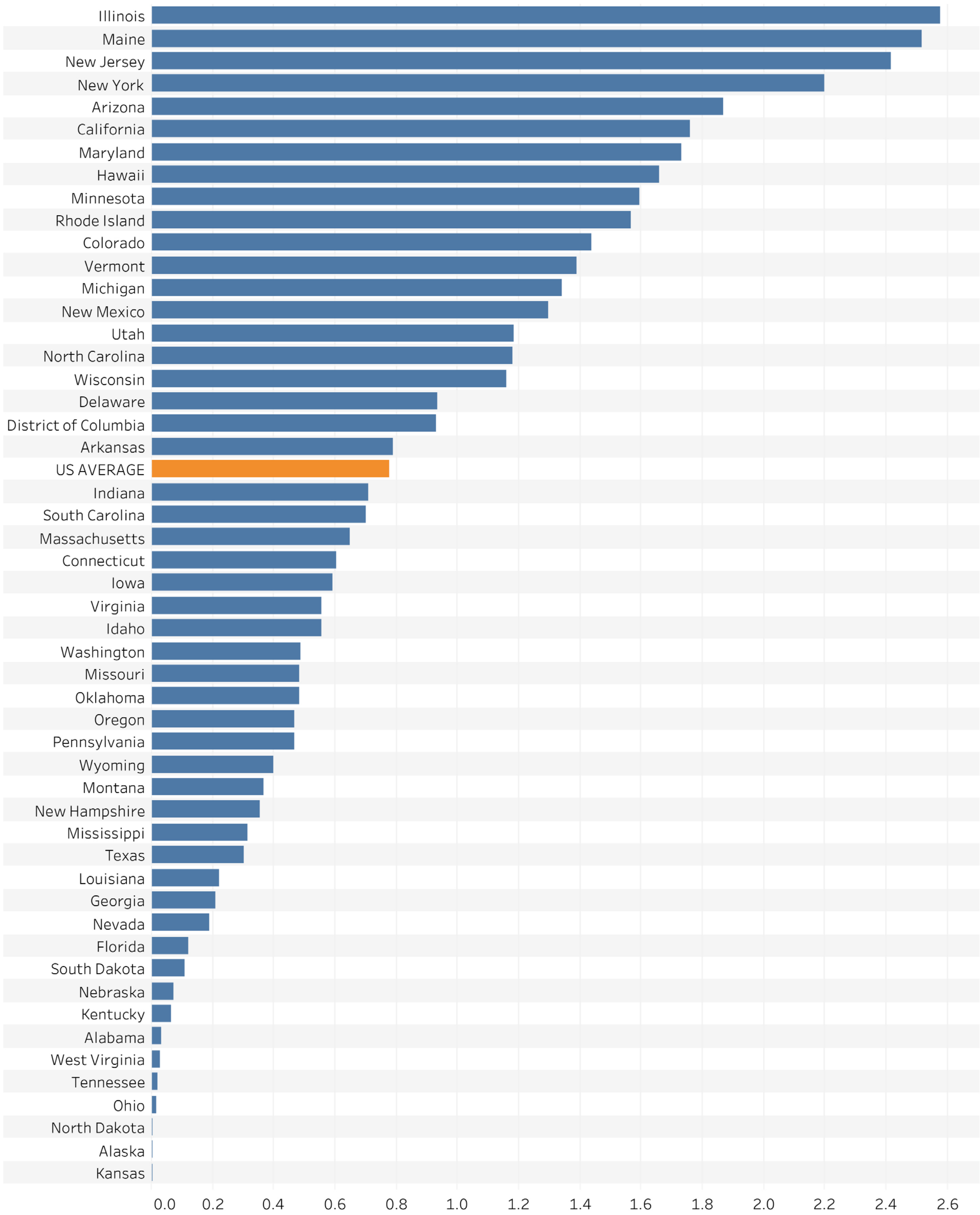


Figure 61: 2022 Energy Efficiency Savings as a Percentage of Electricity Sales in the Residential Sector

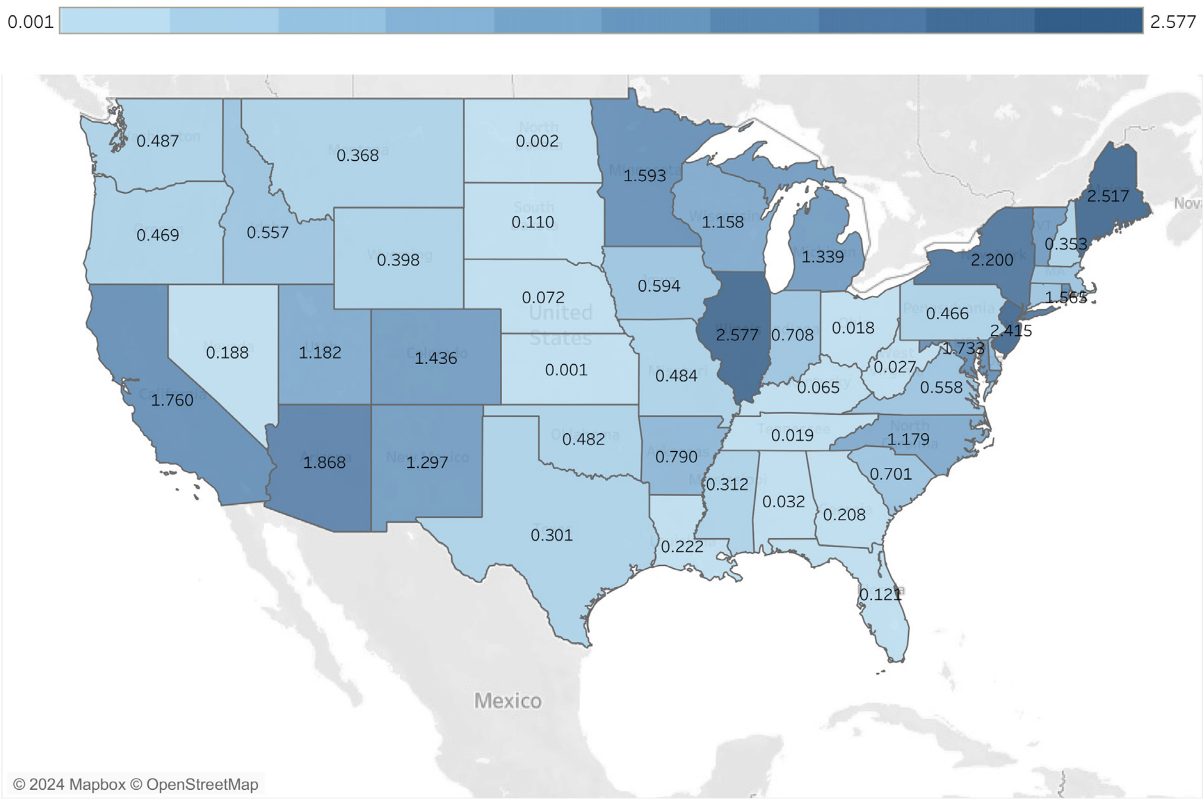


Figure 62: 2022 Energy Efficiency Savings as a Percentage of Electricity Sales in the Commercial Sector

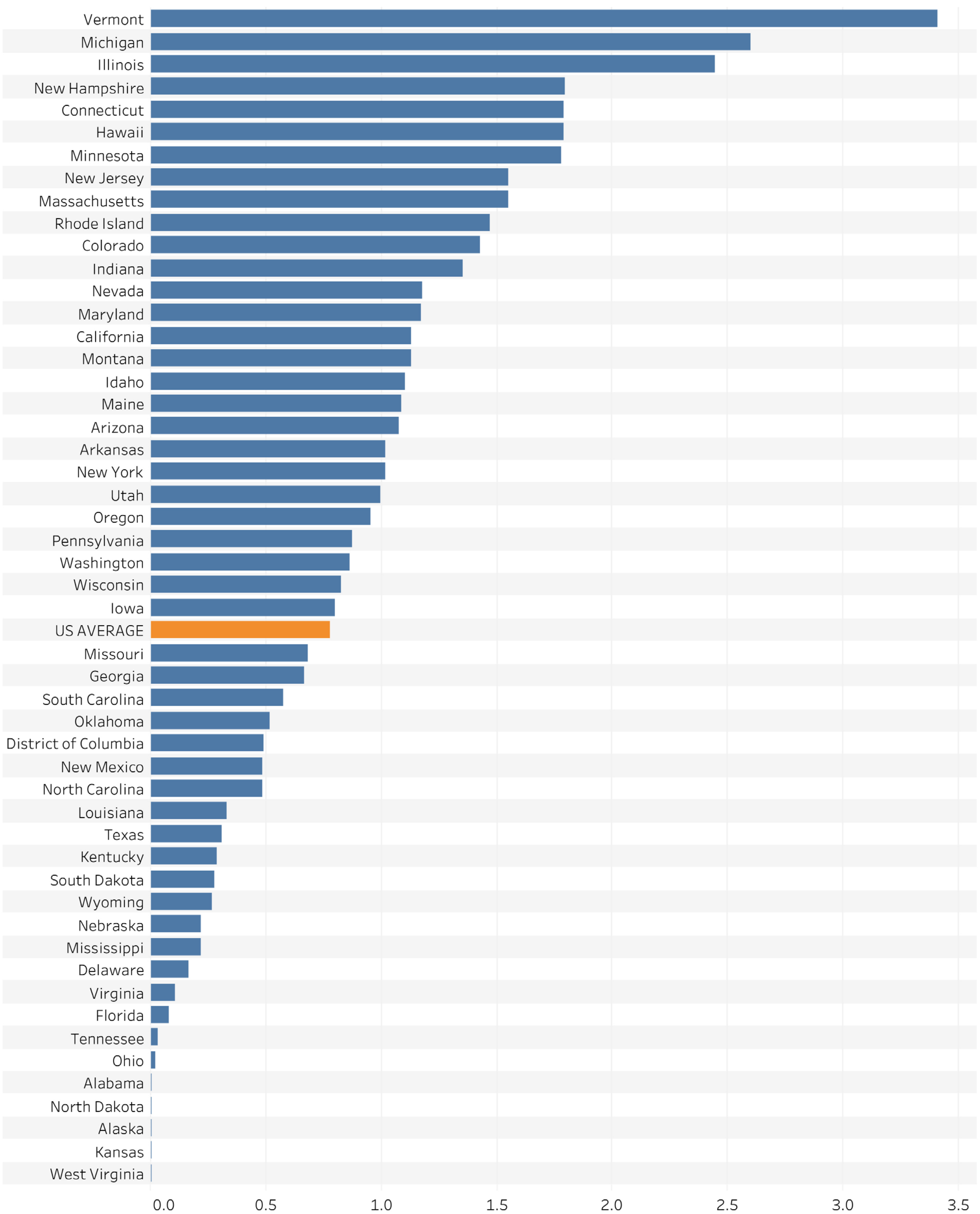


Figure 63: 2022 Energy Efficiency Savings as a Percentage of Electricity Sales in the Commercial Sector

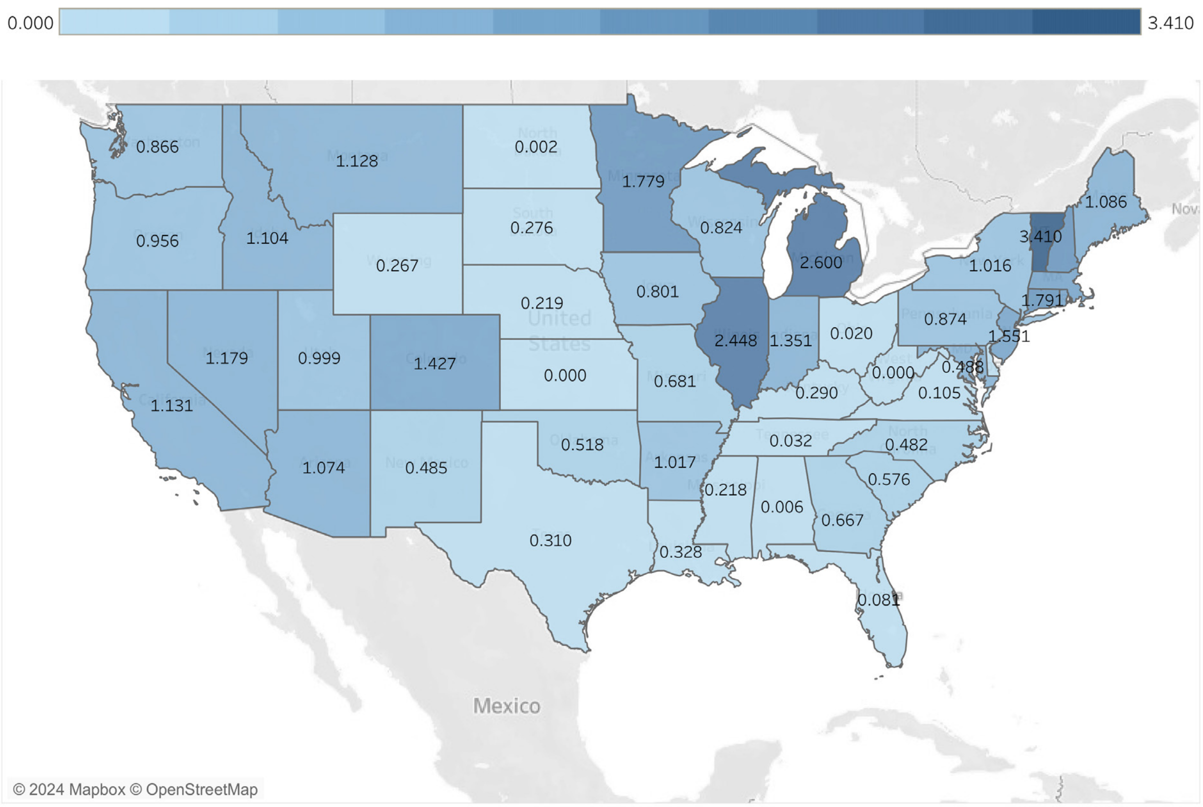


Figure 64: 2022 Energy Efficiency Savings as a Percentage of Electricity Sales in the Industrial Sector

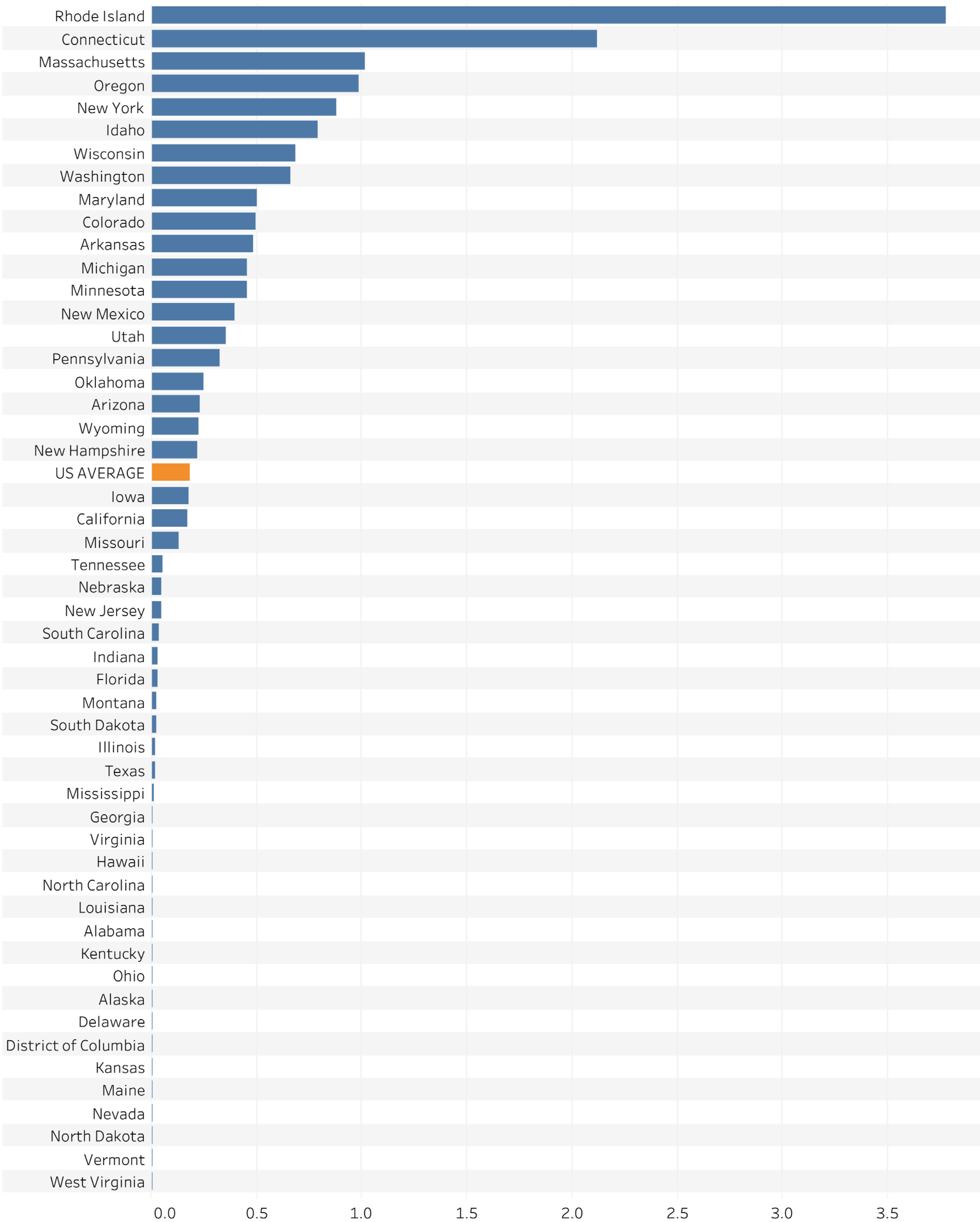
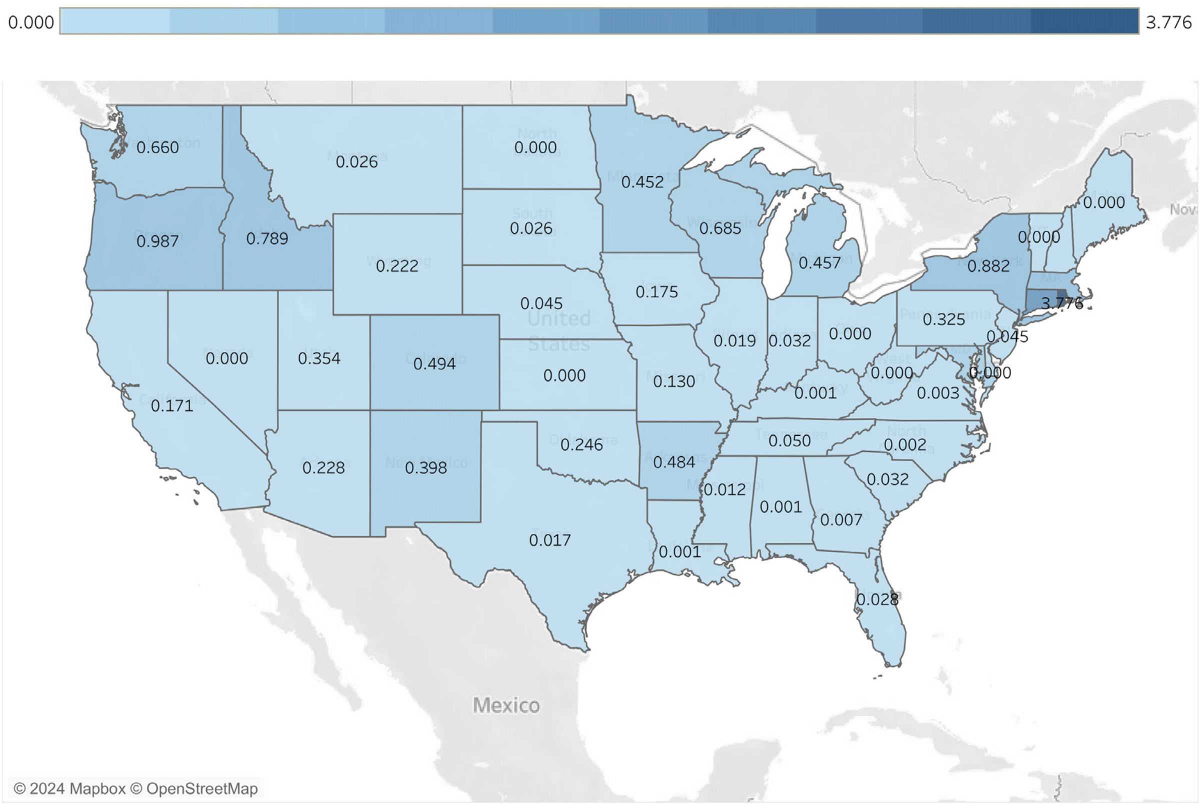


Figure 65: 202 Energy Efficiency Savings as a Percentage of Electricity Sales in the Industrial Sector



ELECTRICITY GENERATION

Electricity is the most important form of energy in the contemporary era because of its diverse uses—it powers our electronics and lighting, cools our homes and, increasingly, fuels many of our vehicles. As economies transition away from fossil fuel use in buildings, transportation, and industry, and as artificial intelligence-driven demand for computing power grows, electric utilities will be expected to provide an ever larger and more reliable supply of electricity. Unfortunately, there are externalities from electricity generation that affect both our immediate health and our environment. Mitigating these externalities is crucial in preventing the worst effects of climate change.

Generation Overview

The data in this section come from the EIA's *Electricity Data Browser*. The figures in this section illustrate what proportions of electricity generation come from different sources (see Figure 66). Renewable sources include hydro, solar, wind, geothermal, and biomass, while clean generation includes hydro, solar, wind, geothermal, and nuclear.

In 2023, 10.6% of Michigan's electricity generation came from renewable sources, ranking 37th, or 15th worst. This is a decrease from 11.7% in 2022. While Michigan's substantial nuclear power industry allows the state to generate 31.6% of its electricity from clean sources in 2023, in line with the 2022 figure, Michigan still ranks 35th in the country on this metric. In 2021, this number was 37.8%, and Michigan ranked 27th, very close to the national average. The drop in Michigan's clean electricity generation occurred due to the May 20, 2022 closure of the Palisades nuclear plant, one of four nuclear reactors in the state. However, the Nuclear Regulatory Commission is preparing to oversee a first-of-a-kind effort to restart Palisades under a potential power purchase agreement with Wolverine Power Cooperative. (See *https://www.nrc.gov/info-finder/reactors/pali.html* and *https://www.ans.org/news/article-6278/doe-oks-15b-loan-for-restoration-and-maintenance-at-palisades/* for more information.)

In 2023, Michigan's largest source of electricity generation was natural gas (45%), followed by nuclear (23%) and coal (19%). This is a remarkable shift from 2022: roughly 10% of generation shifted from coal to natural gas, while nuclear remained steady. This shift away from coal is attributable to several coal plant retirements that occurred in late 2022 and in 2023: Consumers Energy retired two coal-fired generating units at the Karn Generating Plant, while DTE retired the Trenton Channel plant and several of the coal-fired units at its St. Clair plant. These retirements came after DTE's 2021 retirement of the River Rouge plant. DTE replaced these coal-fired units with the 1,150-megawatt natural gas-powered Blue Water Energy Center, which began operation in 2022.

Power Mix by State (2022)

Figure 66: 2023 Percentage of Electricity Generation by Generation Type

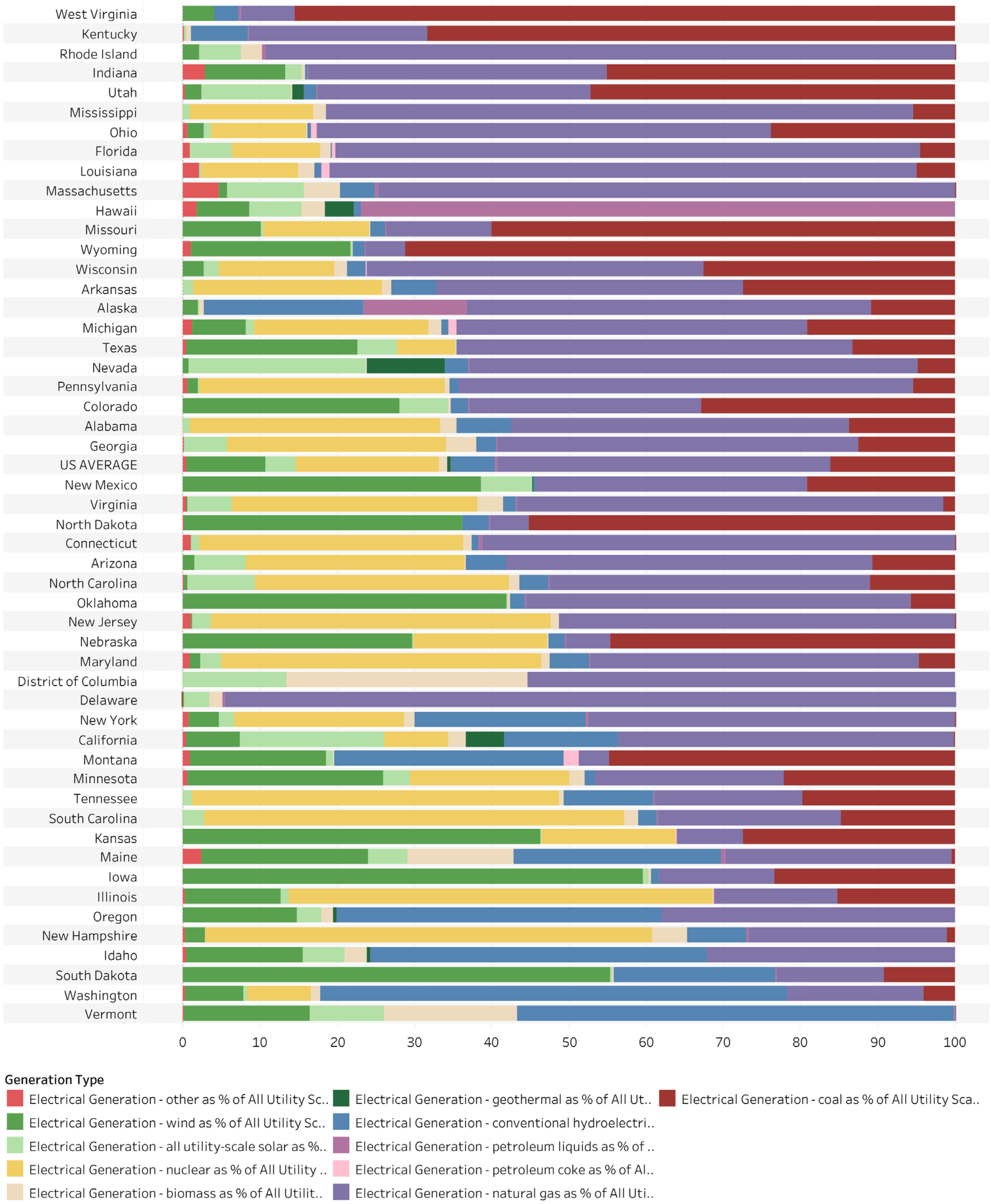


Figure 67: 2023 Dominant Generation Type by State

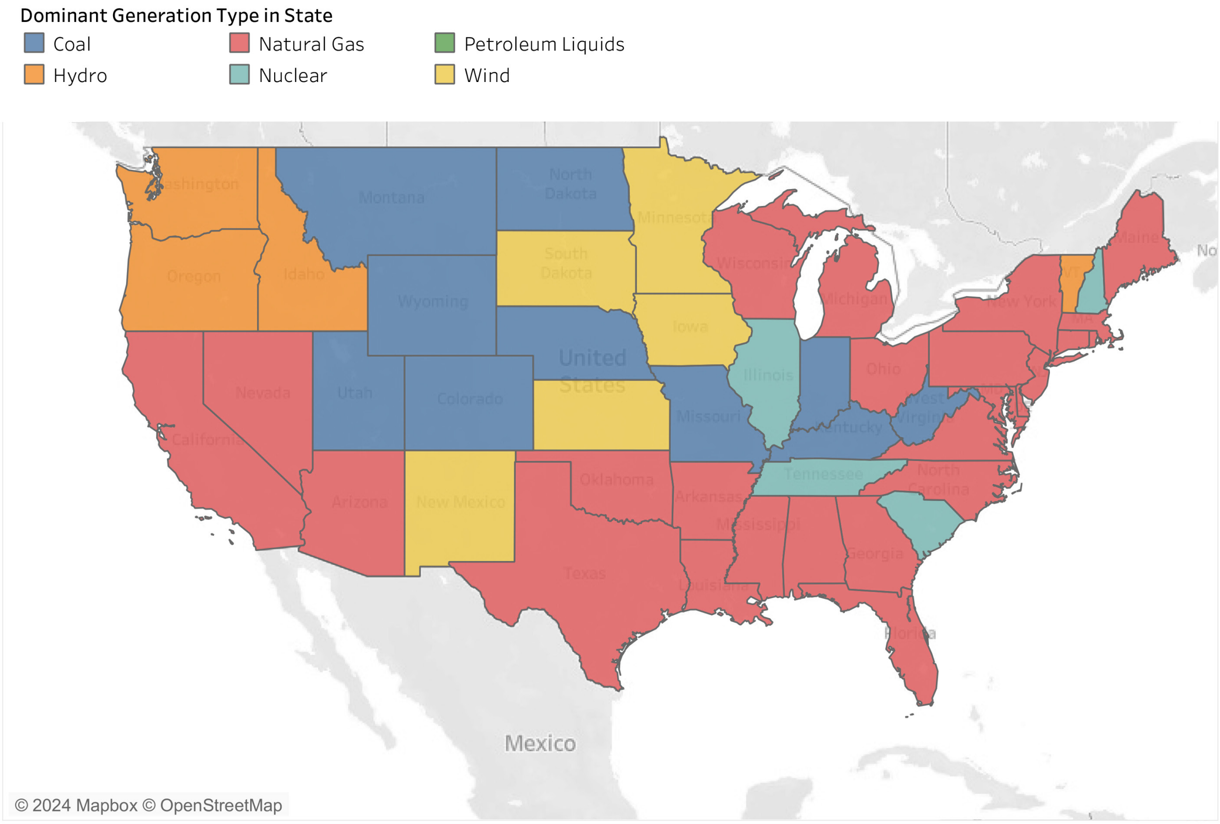


Figure 68: 2023 Renewable Generation as a Percentage of Total Generation

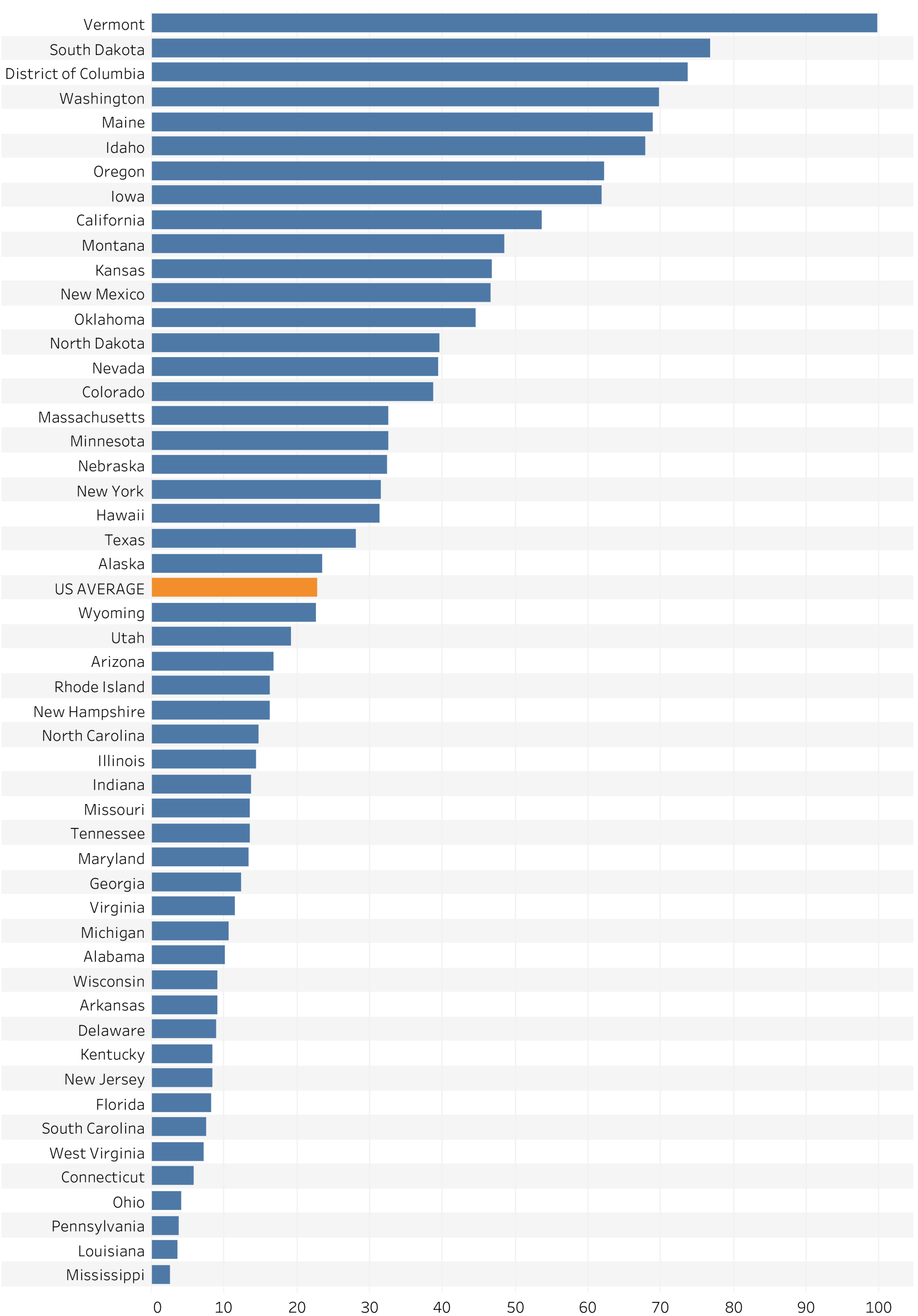


Figure 69: 2023 Renewable Generation as a Percentage of Total Generation

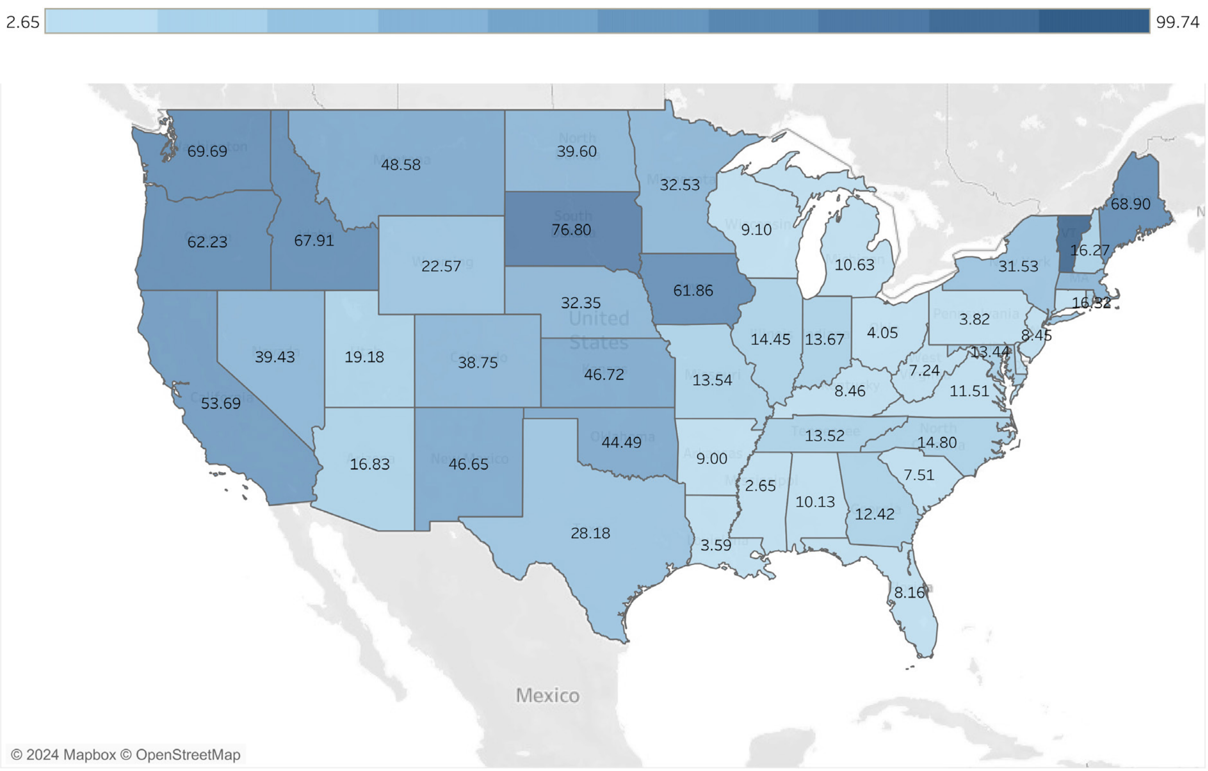


Figure 70: 2023 Clean Generation as a Percentage of Total Generation

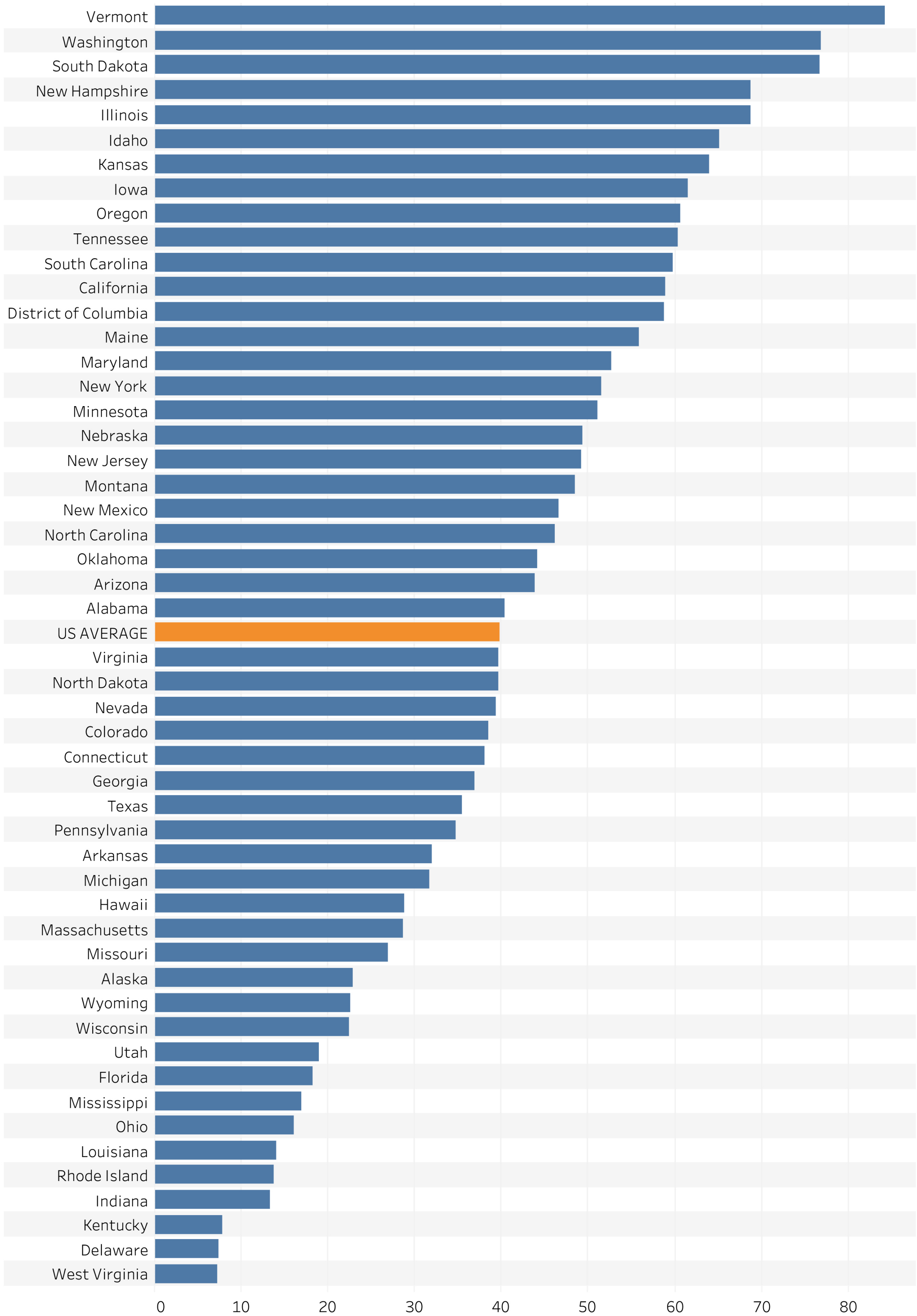


Figure 71: 2023 Clean Generation as a Percentage of Total Generation

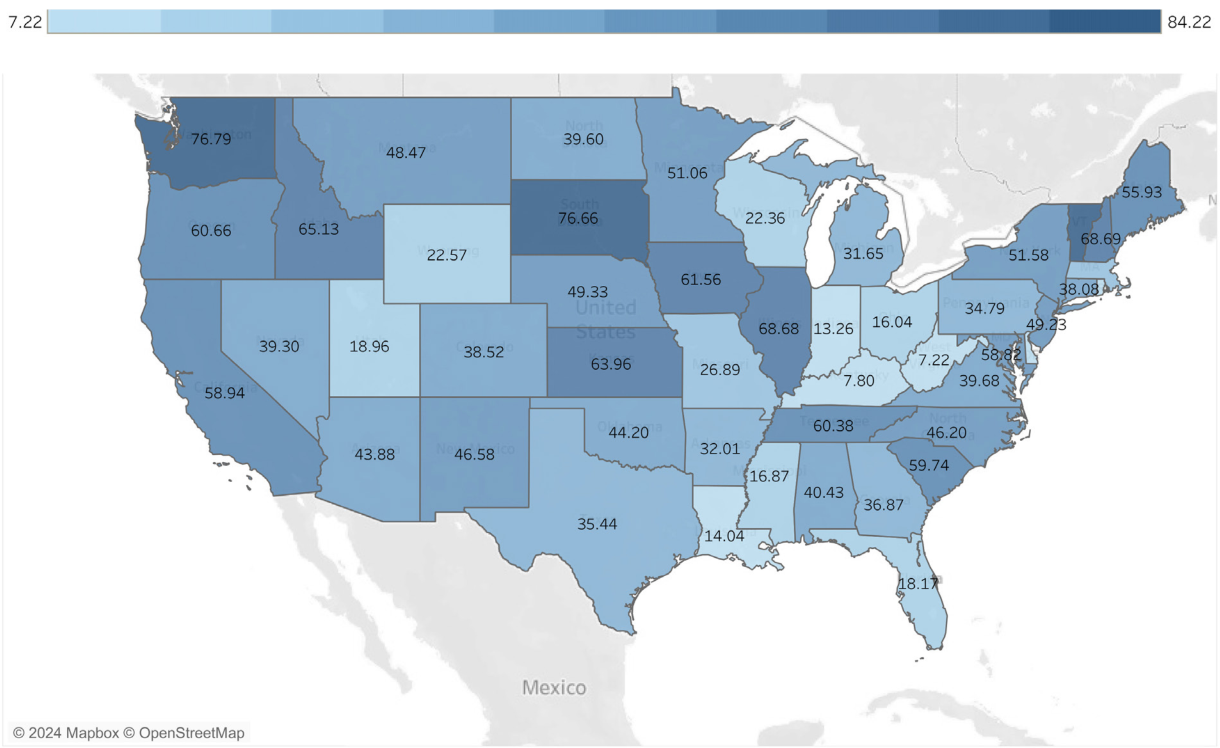


Figure 72: 2022 Renewable Generation as a Percentage of Sales

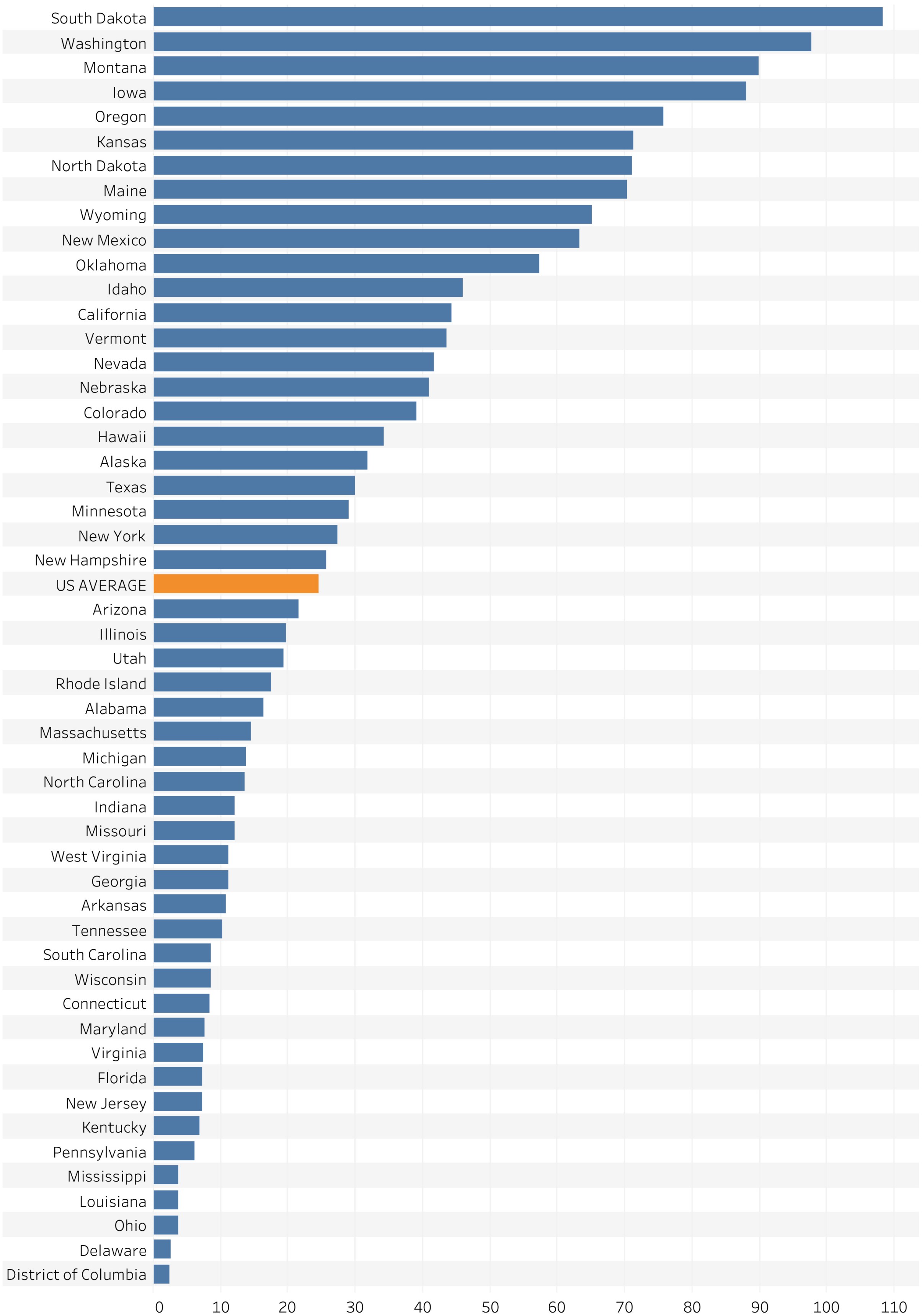


Figure 73: 2022 Renewable Generation as a Percentage of Sales

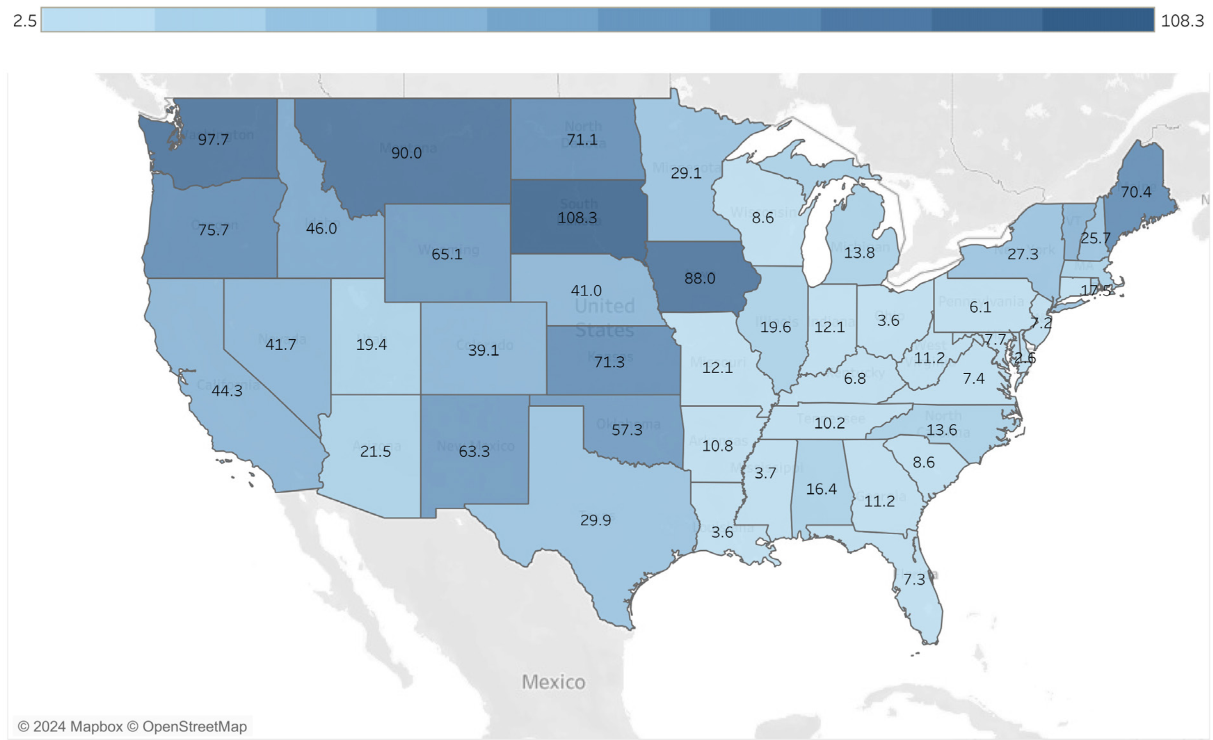


Figure 74: 2022 Clean Generation as a Percentage of Sales

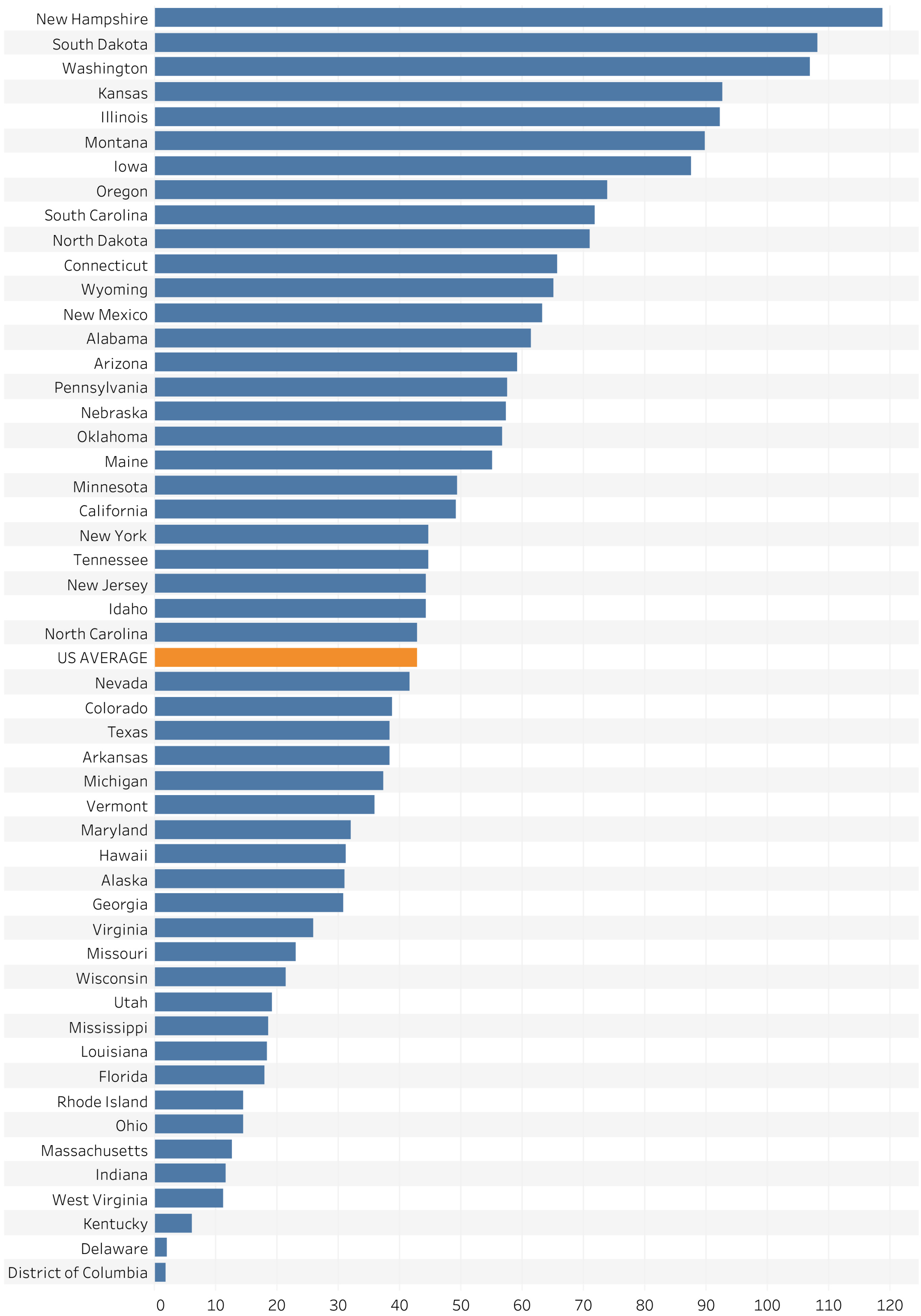
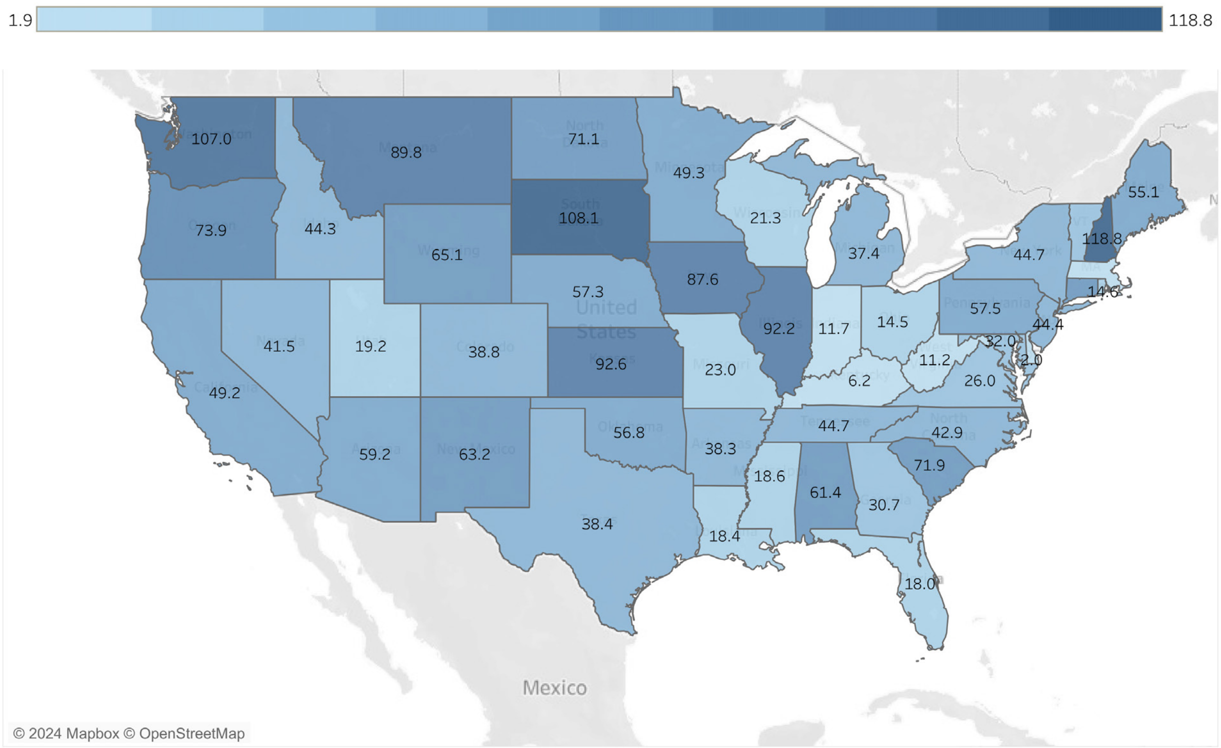


Figure 75: 2022 Clean Generation as a Percentage of Sales



Emissions

Power plants emit many different pollutants, but the largest quantities and arguably the most severe effects are from:

- carbon dioxide (CO_2), which is the principal gas causing climate change and has deleterious effects on cognitive function
- sulfur dioxide (SO_2), which causes asthma attacks, cardiopulmonary diseases, acid rain and is a chemical precursor to formation of small particles that when breathed cause several respiratory and other problems, miscarriages and birth defects
- nitrogen oxides (NO_x), which cause respiratory problems including wheezing, asthma and other breathing difficulties and is a chemical precursor to formation of small particles and ozone in the air that also cause numerous health problems

Electric utilities report emissions of key pollutants from each power plant to the EPA, which compiles this information and makes it available to the EIA. 2022 is the most recent complete compilation currently available and can be obtained *here*. Effects on the environment and human health can be determined by the quantity of pollution released, and, in the cases of sulfur dioxide and nitrogen oxides, by location relative to human population and natural resources. However, as a measure of overall utility performance, it is most appropriate to consider emissions per unit of power generated. So, for example, while Texas's electricity sector produces the most emissions of all pollutants by a wide margin, its emissions intensity for all pollutants is close the median.

Carbon Dioxide

As shown in Figure 77, Michigan ranked 36th, or 16th worst, among the states in 2022 for CO_2 emissions intensity (measured in kg of CO_2 emitted per MWh of electricity generated). This places it near the median of its six state peer group, with only Illinois and Minnesota performing better. The 2022 result of 498.0 kg per MWh is an increase from 476.5 kg per MWh in 2021, and the state's ranking fell by three spots. Michigan's carbon dioxide emissions intensity has fallen from its peak of 637.4 kg per MWh in 2013.

Figure 76 shows that Michigan's annual carbon dioxide emissions of 58.51 million metric tons ranked 46nd, or 6th worst, among the states in 2022, a fall from 2021, when Michigan ranked 10th worst.

Figure 76: 2022 Total CO2 Emissions (thousands of metric tons)

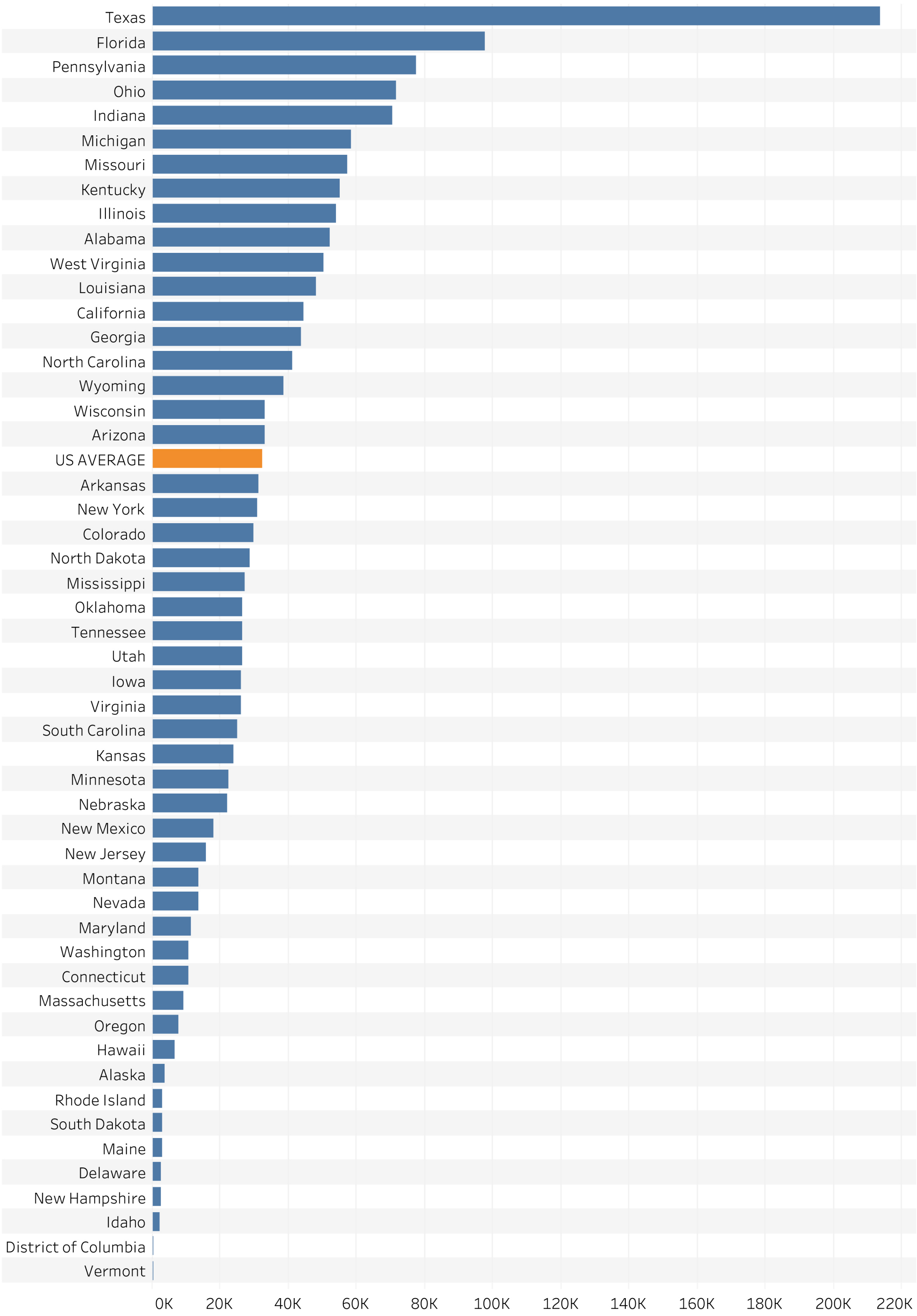


Figure 77: 2022 CO_2 Emissions Intensity (kg per MWh)

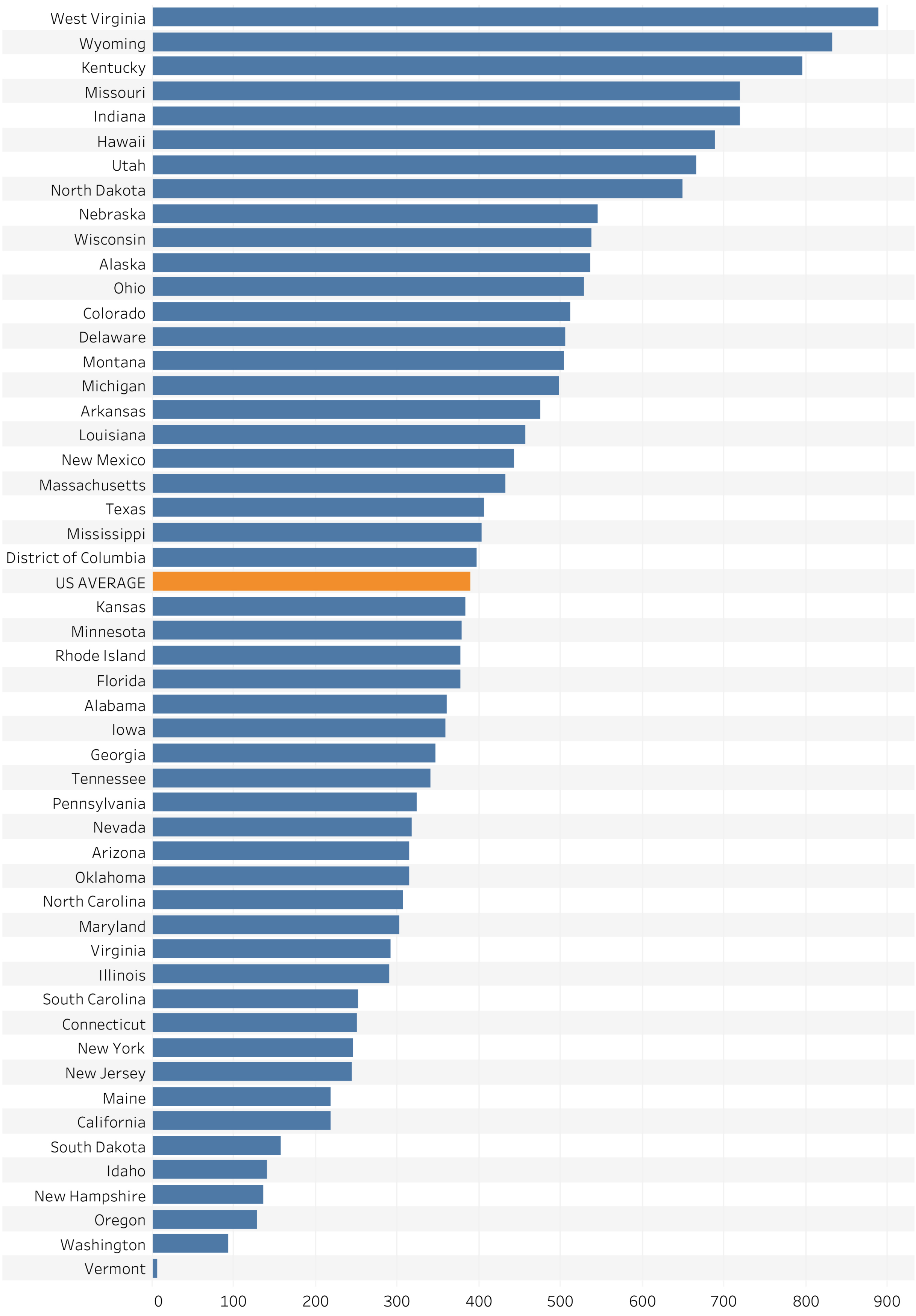
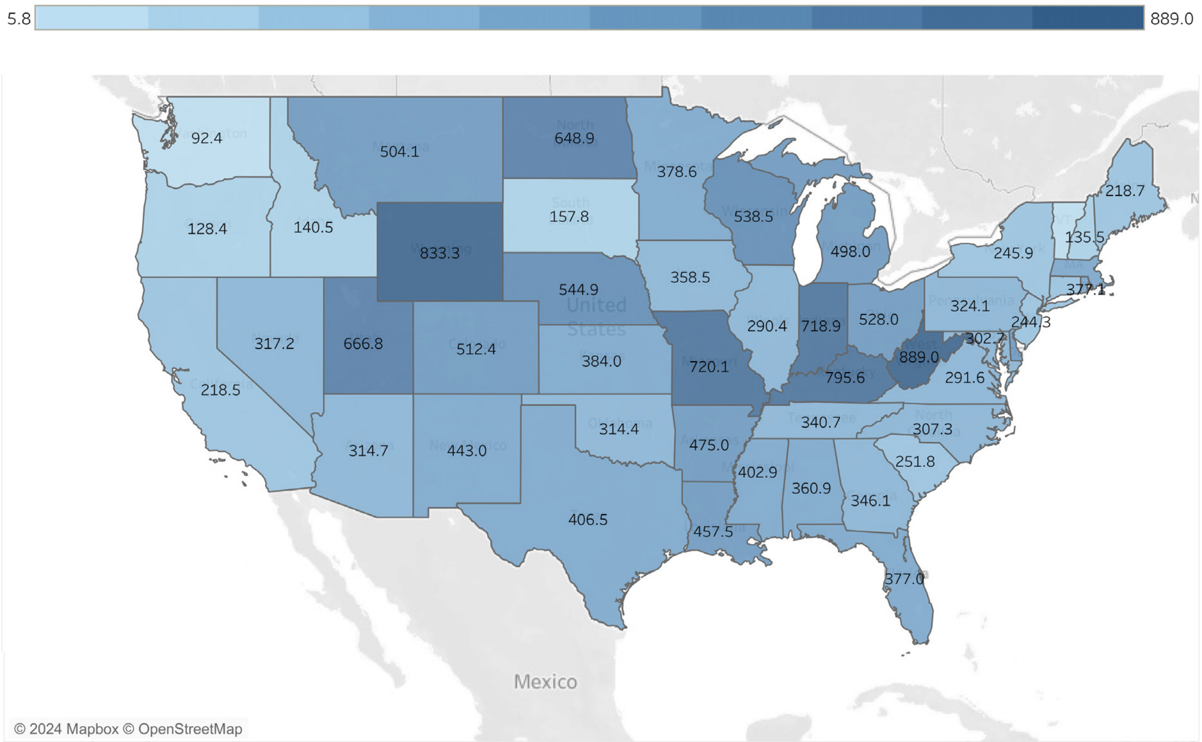


Figure 78: 2022 CO_2 Emissions Intensity (kg per MWh)



Sulfur Dioxide

As shown in Figure 80, Michigan ranked 42nd, or 10th worst, among the states in sulfur dioxide pollution per GWh in 2022, with 415 g emitted for every MWh generated. Compared to its peer group, Michigan was 2nd worst for this metric, with only Ohio performing worse. Michigan's sulfur dioxide emissions intensity has significantly and steadily declined since 2011, when the rate was 2150 g per MWh. However, many states have experienced larger rates of decreases over that period.

Figure 79 shows that Michigan's 2022 sulfur dioxide emissions of 48,799 metric tons ranked 47th, or 5th worst, among the states, with only Illinois and Ohio emitting more sulfur dioxide among peer states. In 2021, Michigan was 4th worst among the states for total sulfur dioxide emissions, and 10th worst for sulfur dioxide emissions intensity.

Figure 79: 2022 Total SO2 Emissions (thousands of metric tons)

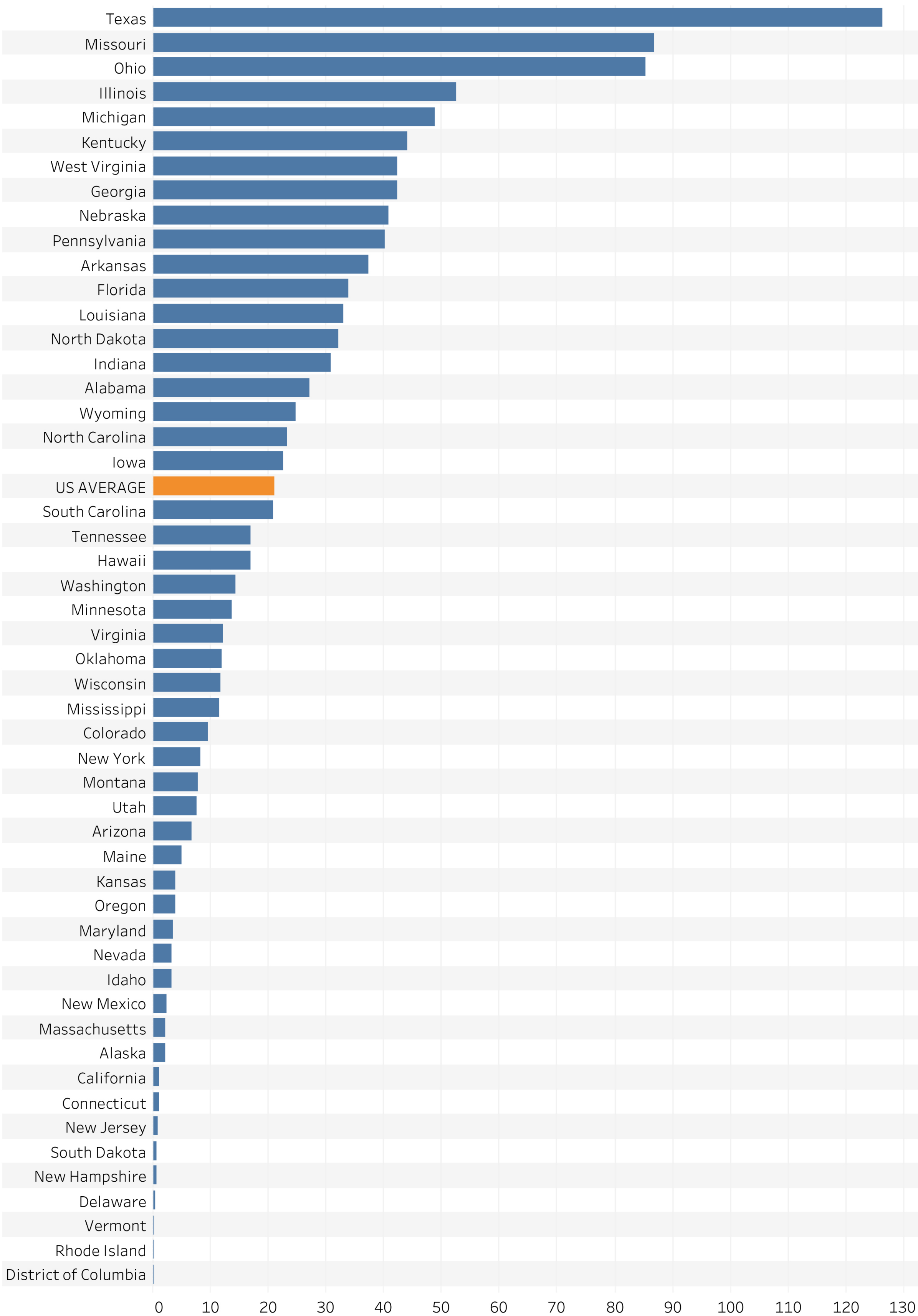


Figure 80: 2022 SO2 Emissions Intensity (g per MWh)

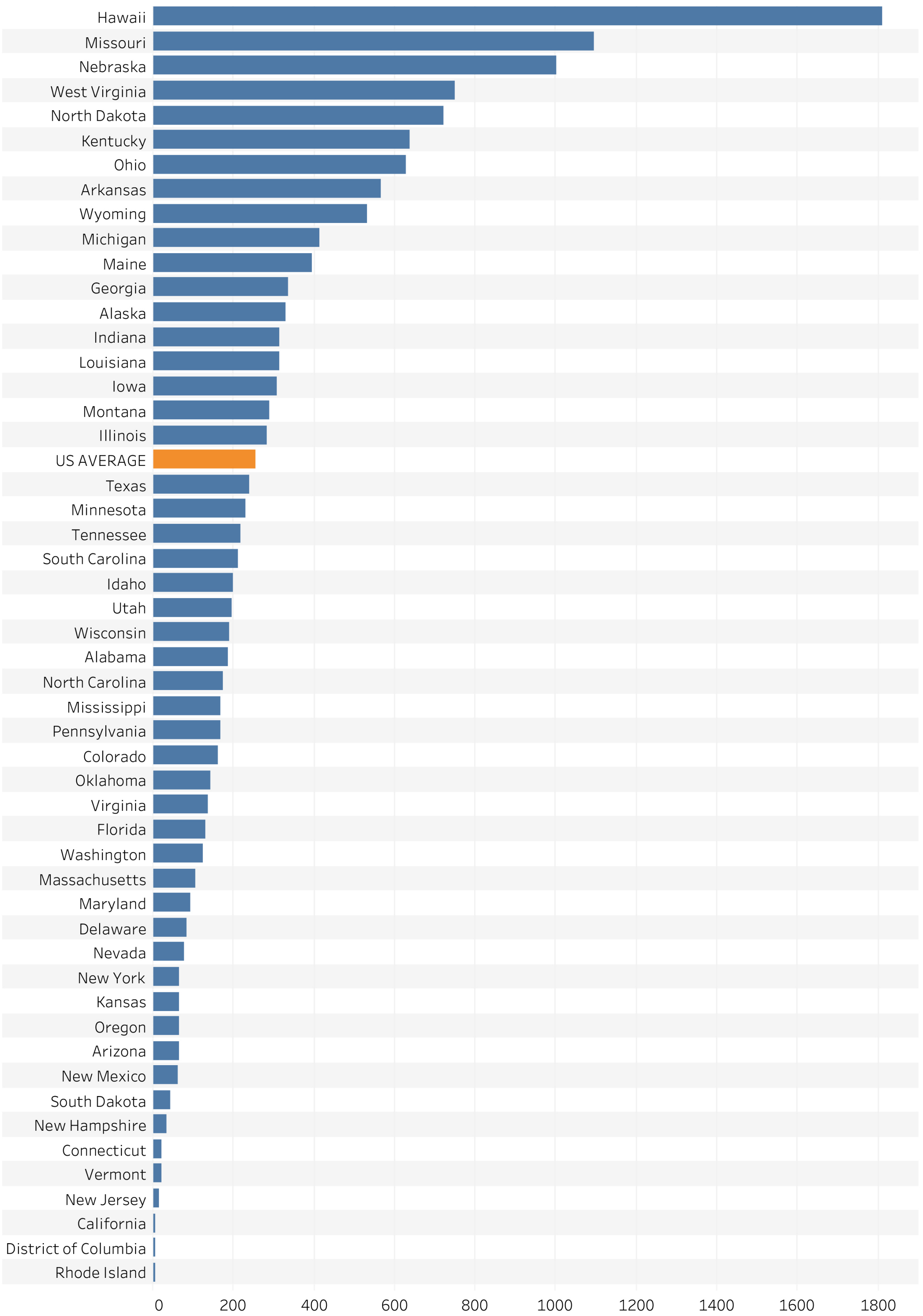
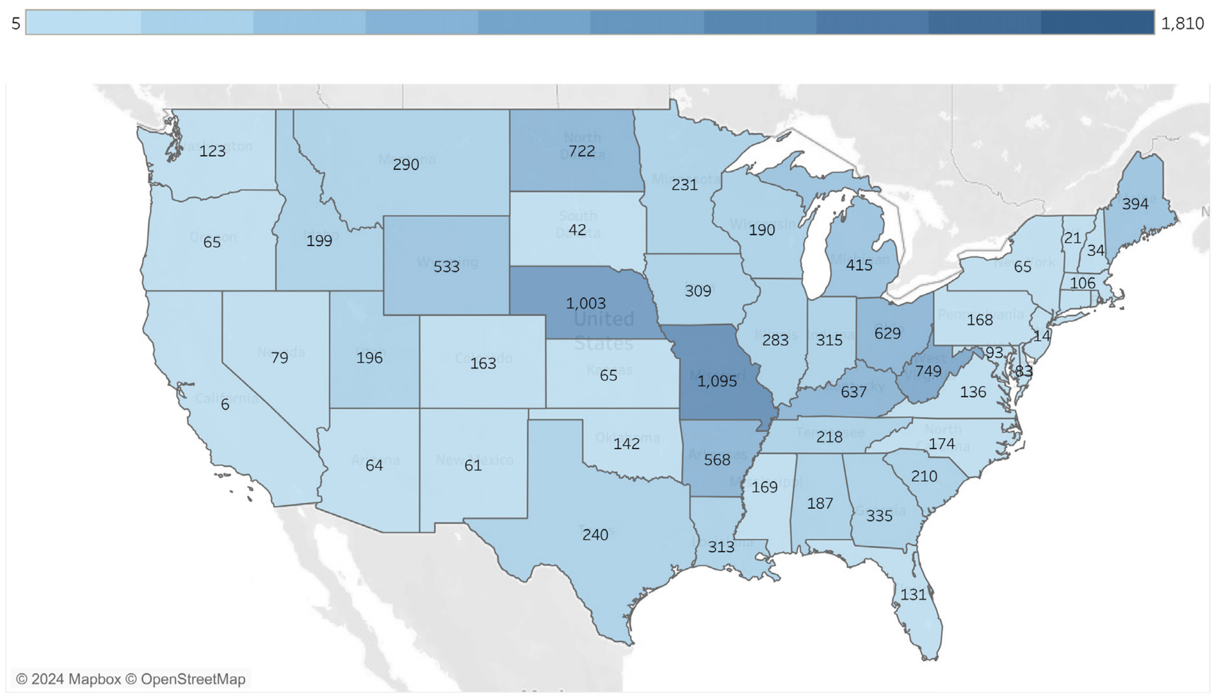


Figure 81: 2022 SO2 Emissions Intensity (g per MWh)



Nitrogen Oxides

As shown in Figure 83, Michigan ranked 37th, or 15th worst, among the states in nitrous oxide emissions intensity in 2022, one rank better than in 2021, with an emissions intensity of 415 g per MWh generated. Michigan performs worse than all its peers except for Indiana. In 2013, Michigan's nitrogen oxide emissions intensity was 733 g per MWh.

As shown in Figure 82, Michigan utilities emitted 48,801 metric tons of nitrogen oxides in 2022, and ranked 46th, or 6th worst, in total nitrogen oxide emissions, down from 3rd worst in 2021.

Figure 82: 2022 Total NOx Emissions (thousand metric tons)

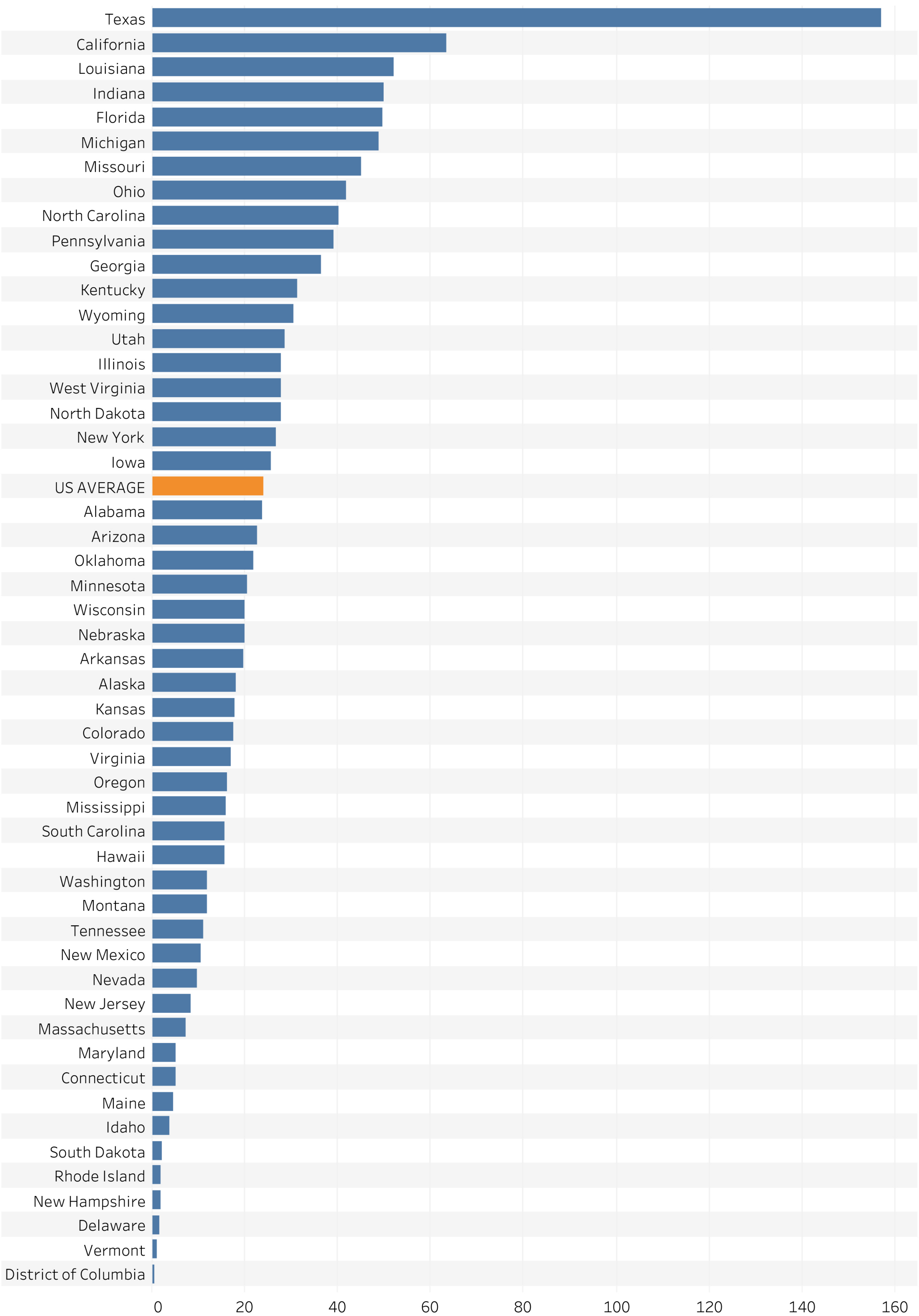


Figure 83: 2022 NO_x Emissions Intensity (g per MWh)

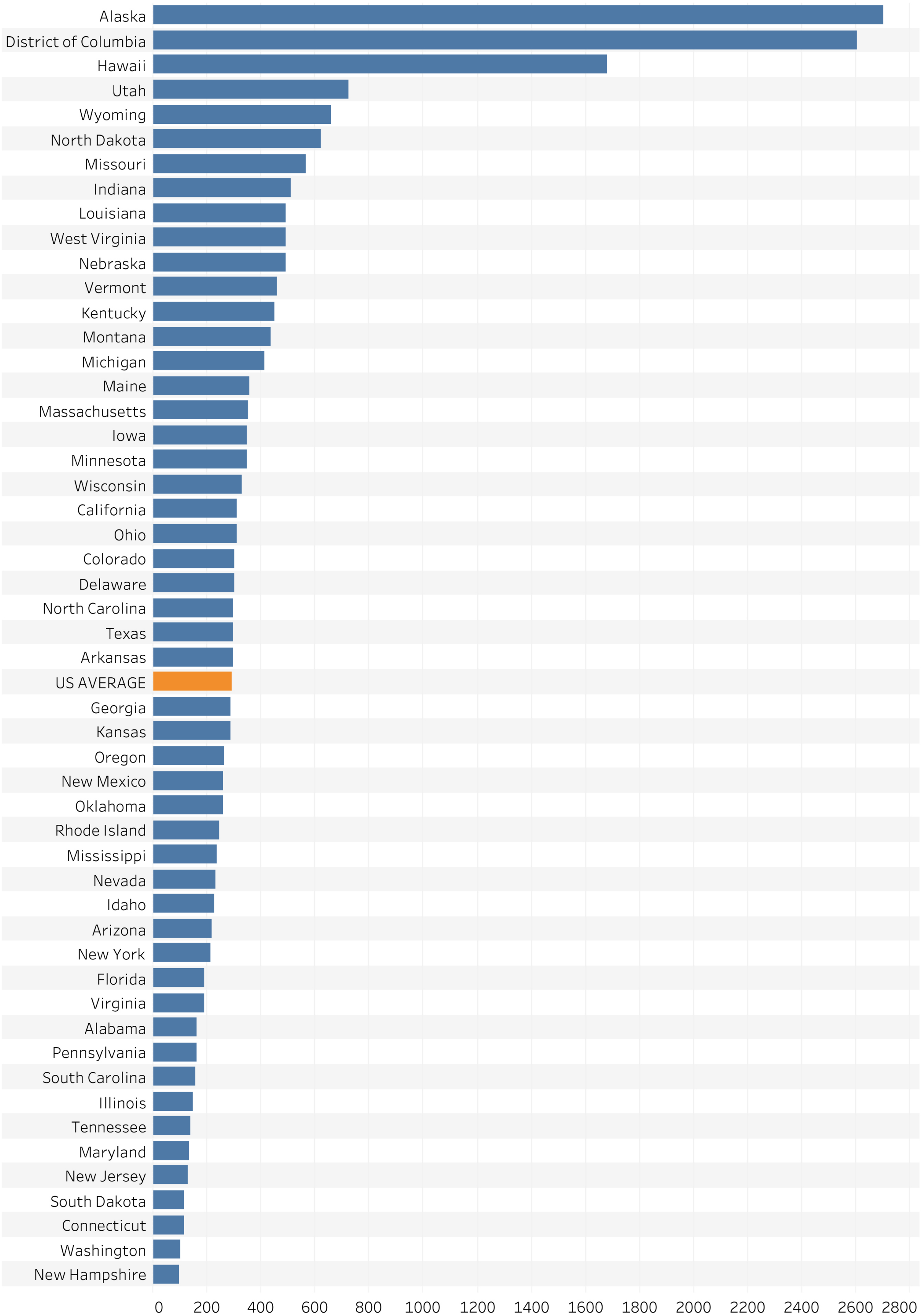
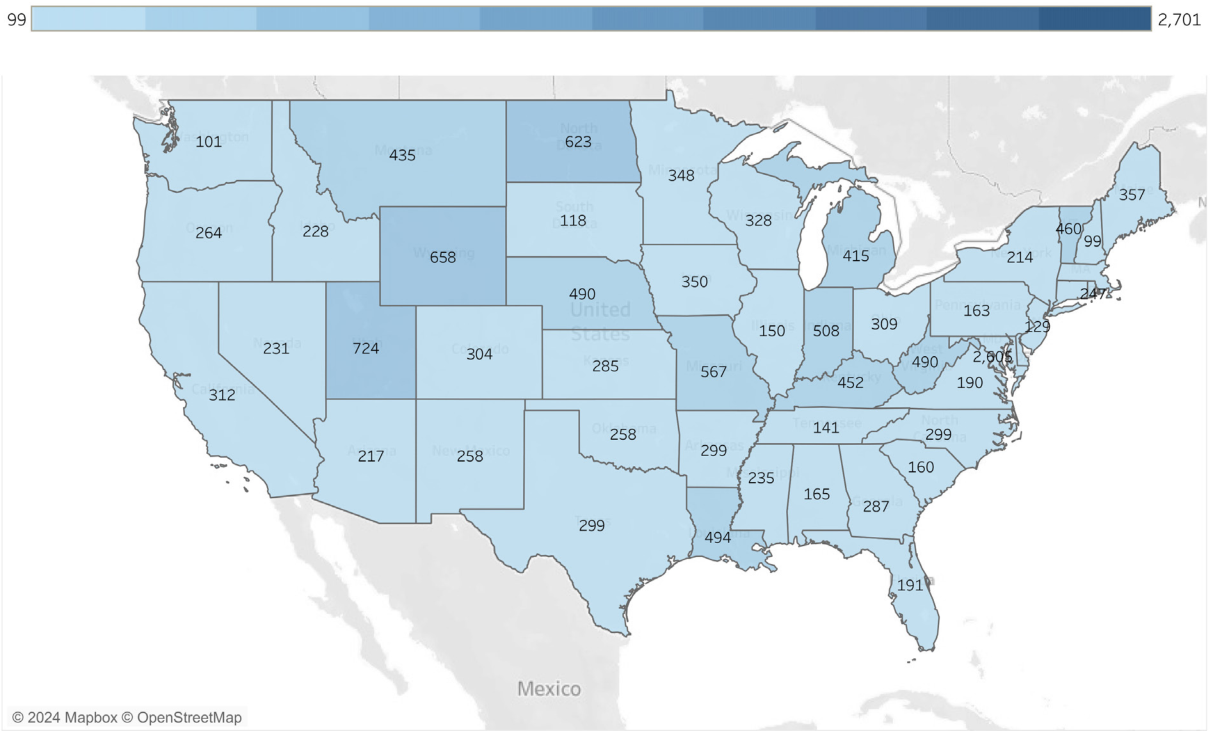


Figure 84: 2022 NO_x Emissions Intensity (g per MWh)



Water Consumption and Withdrawals from Power Generation

Water is used in large quantities by the electricity sector, both for cooling and the production of steam to turn turbines in thermoelectric plants. The EIA's Thermoelectric cooling water data contains generation and water withdrawal and consumption metrics for most of the generators and boilers at most of the plants around the country.

Many thermoelectric plants require more water to run than they consume. When power plants use water for cooling, the water passes through the plant and is rereleased in the form of uncontaminated, but warmed, water, which can be harmful to aquatic ecosystems. Some power plants are designed to recycle and recondense steam, thus minimizing their total withdrawals, but increasing the proportion of water that is lost to steam. Because, as with emissions, not all power plants use water with equal efficiency, water withdrawal and consumption intensity—gallons per megawatt-hour (MWh)—is a useful way of understanding the relative water efficiency of different states' electric sectors.

In 2022, Michigan ranked had the 4th highest water withdrawal intensity and the highest overall water consumption intensity in the nation for electricity production, withdrawing 161,940 gallons and consuming 29,336 gallons for each MWh generated. This is likely because, due to Michigan's location among the Great Lakes, there are larger numbers of large nuclear and coal plants using once-through cooling instead of cooling ponds or towers that recirculate water.

Figure 85: 2022 Weighted Average Water Withdrawal Intensity for Electricity Generation (gallons per MWh)

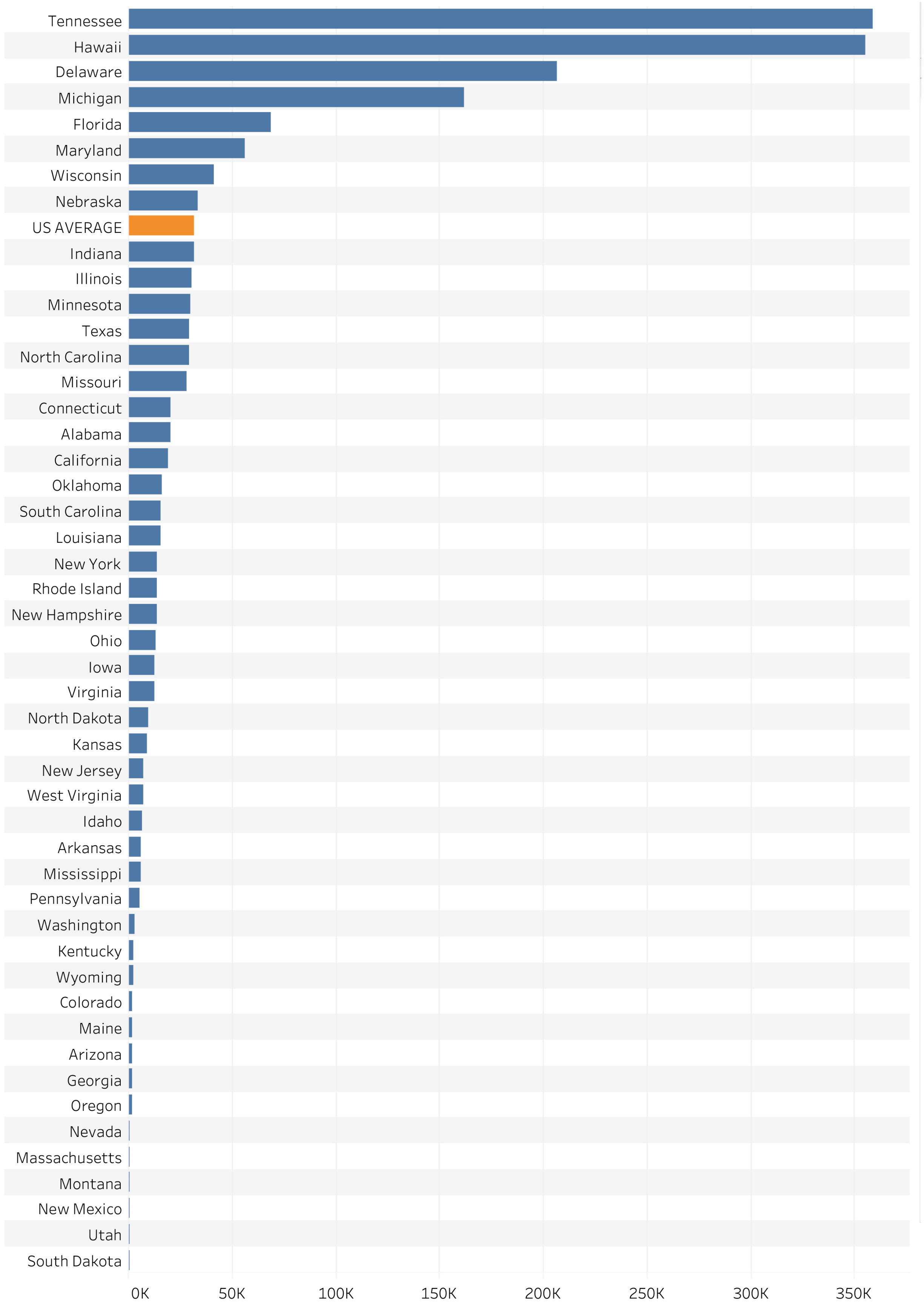


Figure 86: 2022 Weighted Average Water Withdrawal Intensity for Electricity Generation (gallons per MWh)

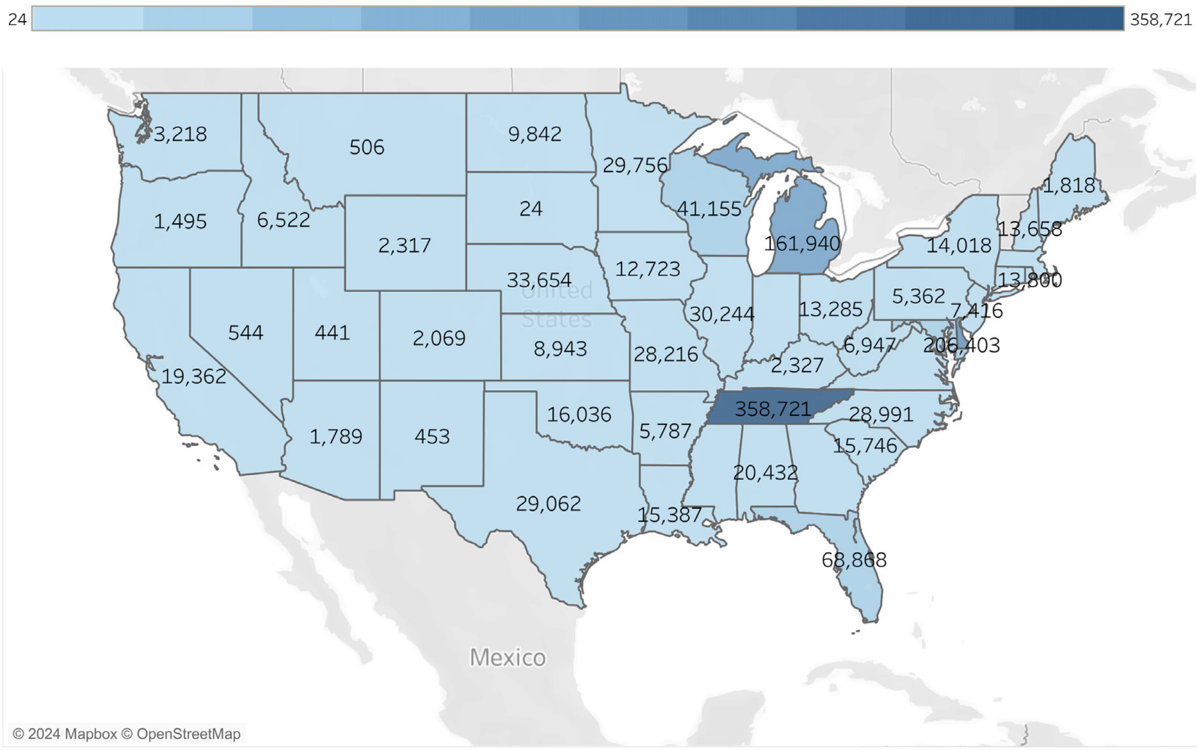


Figure 87: 2022 Weighted Average Water Consumption Intensity for Electricity Generation (gallons per MWh)

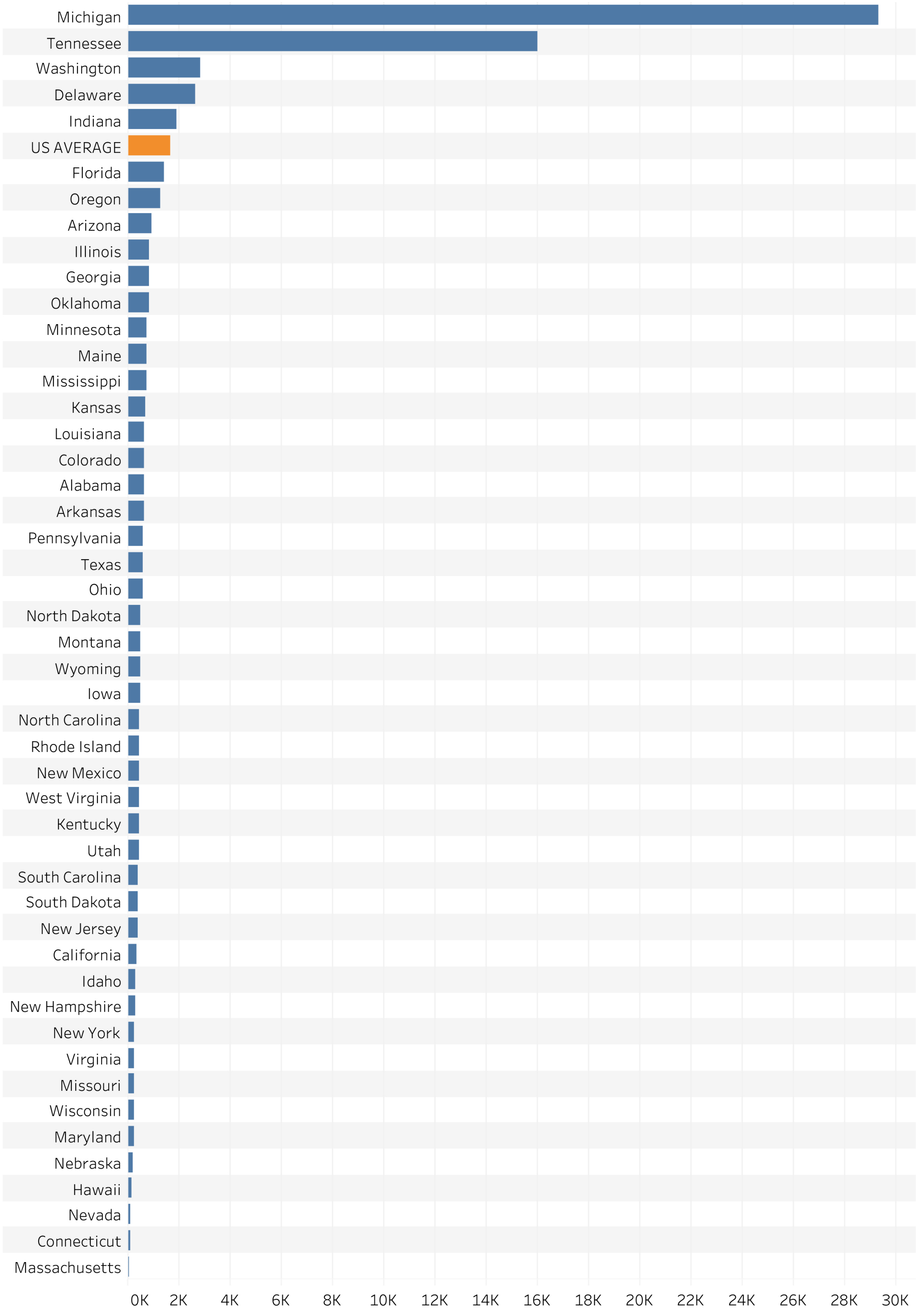
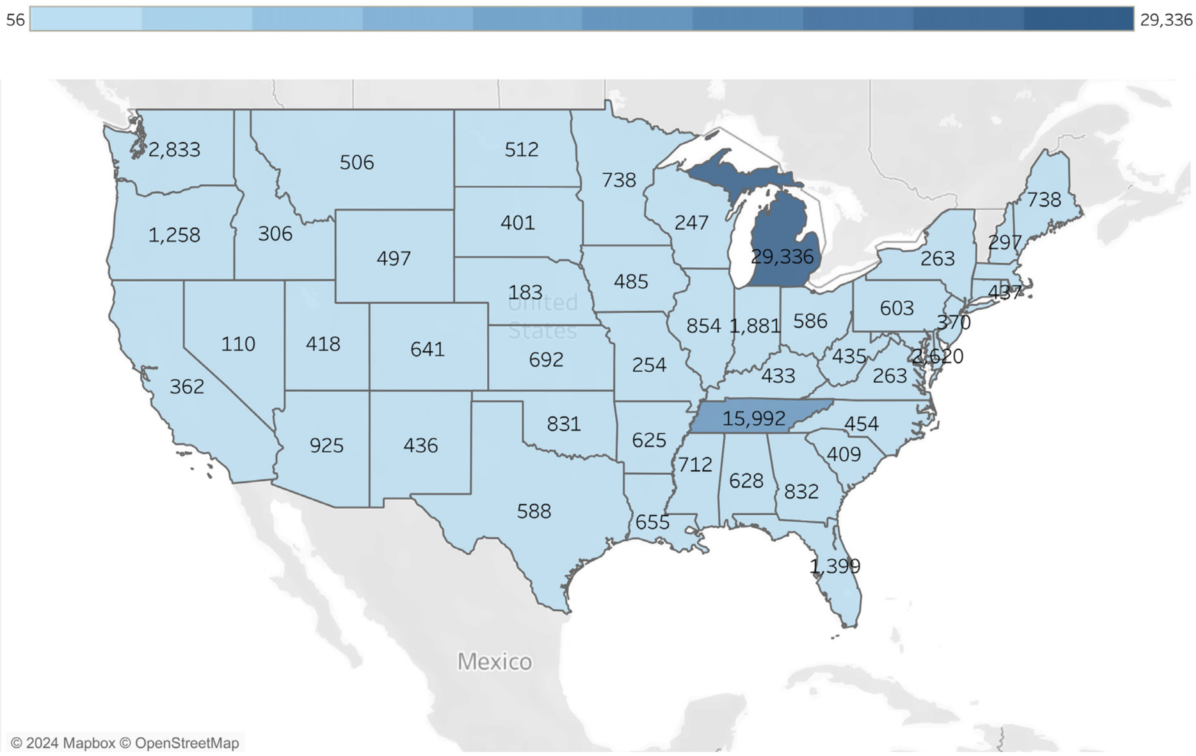


Figure 88: 2022 Weighted Average Water Consumption Intensity for Electricity Generation (gallons per MWh)



Natural Gas Emissions

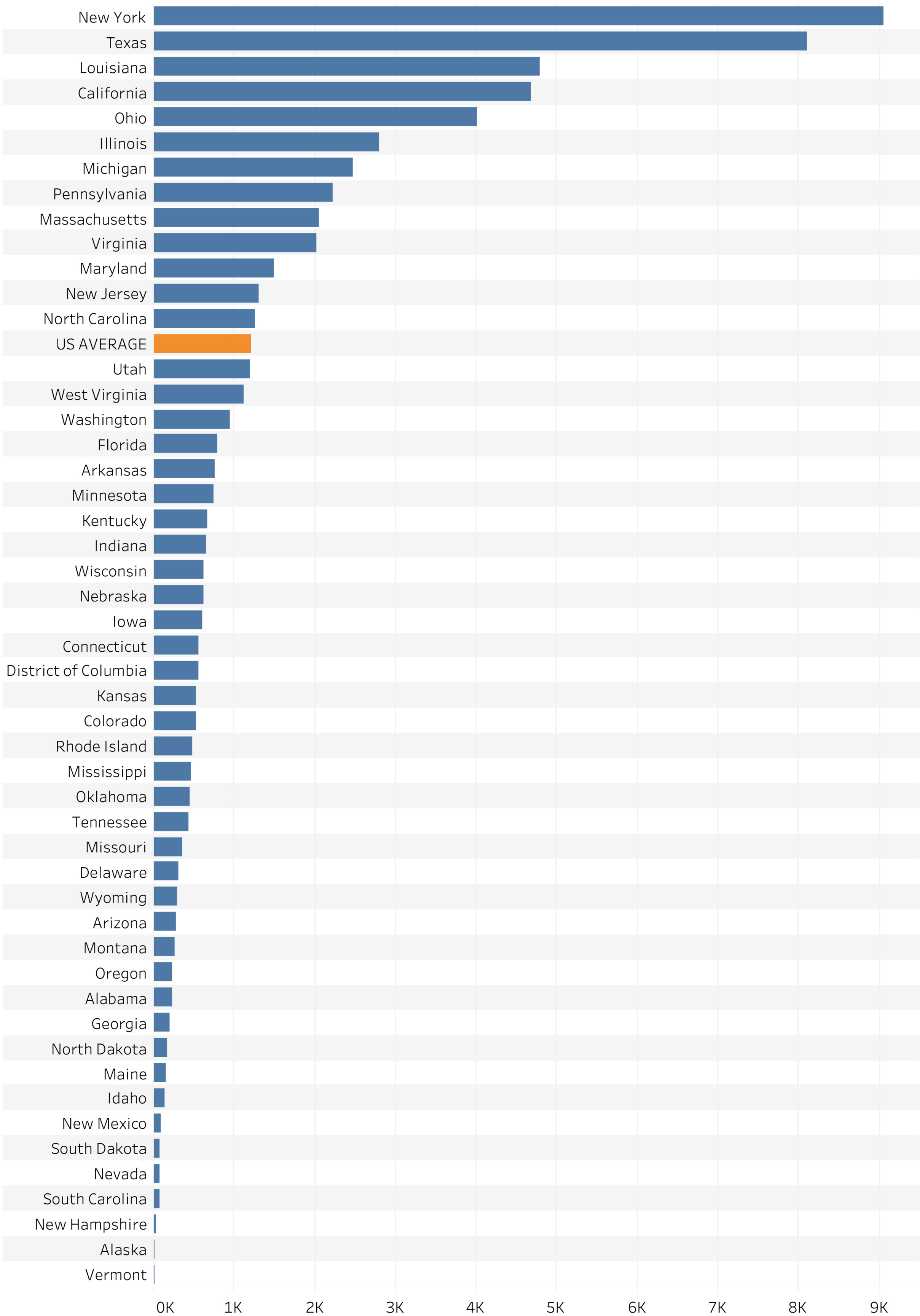
Methane, the main component of natural gas, creates emissions when burned, but is itself also a potent greenhouse gas. This section looks to fill in a gap on the potential damages done to the environment from the natural gas sector. Emissions from the burning of natural gas for electricity production are included in Emissions from Electricity Generation above. This section addresses the warming potential of natural gas losses by gas utilities, as reported by volume in Gas Utility Performance, as well as the warming potential of natural gas burned by sectors outside of the electric sector. The residential and commercial sectors burn natural gas for space and water heating, and the industrial sector burns natural gas for many other heat uses necessary for manufacturing.

Natural Gas Losses as CO_2 Equivalents

Emissions from natural gas losses are reported as CO_2 equivalents by taking natural gas loss volume, the same volume as reported above in Figures 23 and 24, converting it to metric tons and multiplying it by the lifetime CO_2 equivalency factor for methane. The final formula for converting methane to CO_2 equivalents is thus: Metric Tons of CO_2 Equivalents = Losses in CF*Weight per CF methane (.035lb) * CO_2 Equivalency Factor (25)/lbs. per Metric Ton (2204.6 lbs).

In 2022, Michigan's CO_2 equivalents from lost natural gas were ranked 45th, or 7th worst, in the nation at 2.48 million metric tons, which is higher than all its peer states except Illinois and Ohio.

Figure 89: 2022 CO_2 Equivalent Emissions from Lost Natural Gas (in Metric Tons)



Emissions from Gas Combustion Outside the Electric Sector

Burning natural gas produces multiple emission types including CO_2, SO_2 and NO_x. There are consistent emissions factors for CO_2 and SO_2 from the burning of natural gas, but the NO_x emission factor from burning natural gas depends on the conditions under which it is burned. There is generally a higher NO_x emission factor when burning larger volumes of natural gas at higher temperatures. To compensate for this differential, the reported NO_x emissions use one factor—100lb/million CF natural gas—for residential and commercial uses, and a higher factor—190lb/million CF natural gas— for industrial uses. Unfortunately, this provides only a rough approximation of the real NO_x emissions produced by these sectors.

The natural gas consumption data used for this subsection come from the *SEDS* database, while the emissions factors come from the *EPA*.

In Michigan, just under half of non-electric sector natural gas consumption—and therefore emissions—comes from the residential sector, with the commercial and industrial sectors contributing nearly equal amounts of the other half.

In 2022, Michigan ranked as the 44th, or 8th worst, producer of emissions from natural gas use in terms of CO_2 and SO_2 with emissions of 38.6 million and 193 metric tons, respectively (Figures 90 and 91). Michigan was the 40th ranked, or 12th worst, emitter of NO_x from site use of natural gas in the country (Figure 92). In relation to its peer states, Michigan is near the middle, producing fewer CO_2, and SO_2 emissions than Ohio and Illinois and fewer NO_x emissions than Ohio, Illinois and Indiana.

Figure 90: 2022 CO_2 from Combusted Natural Gas in All Sectors Except Electrical (thousand metric tons)

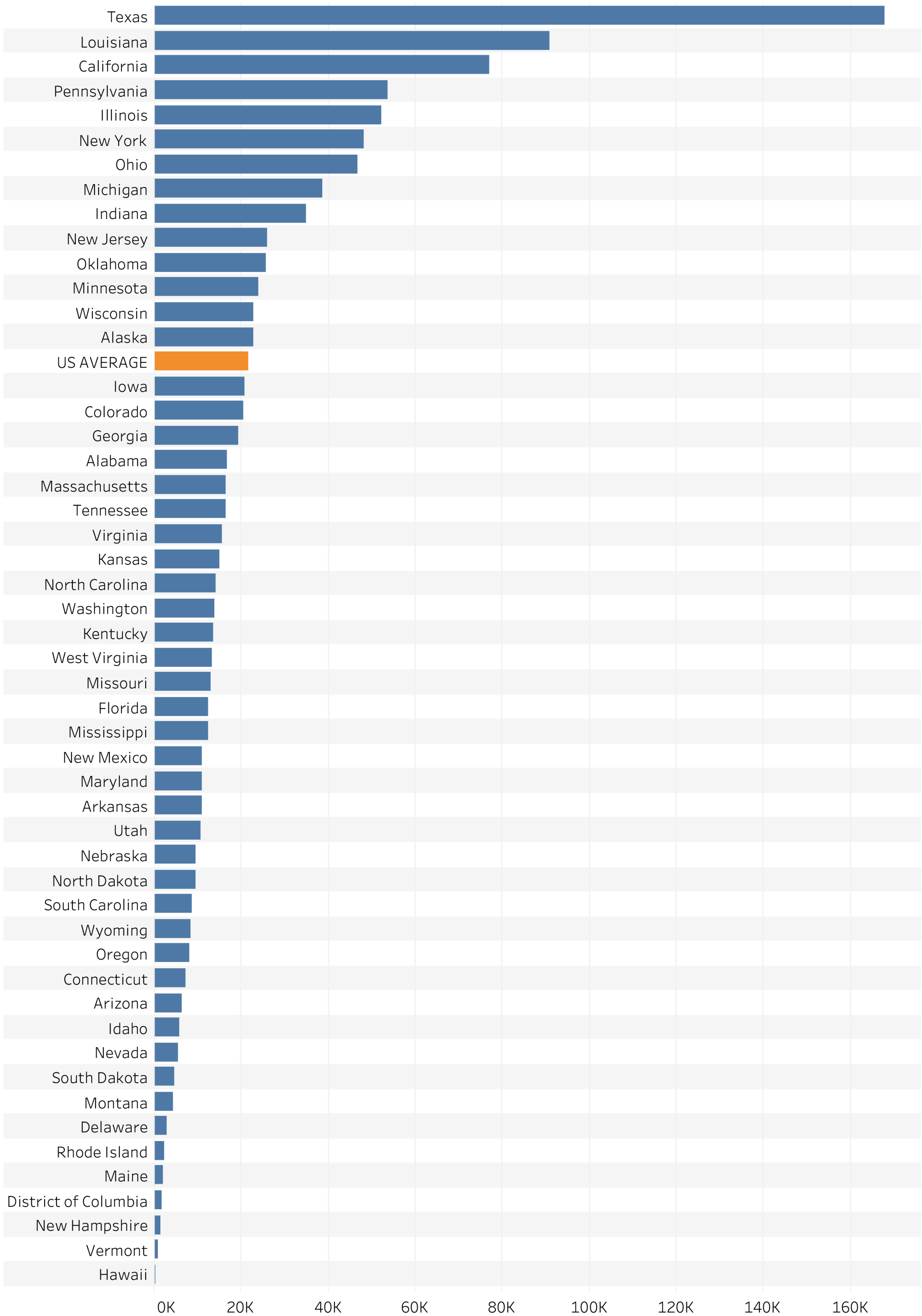


Figure 91: 2022 SO_2 from Combusted Natural Gas in All Sectors Except Electrical (thousand metric tons)

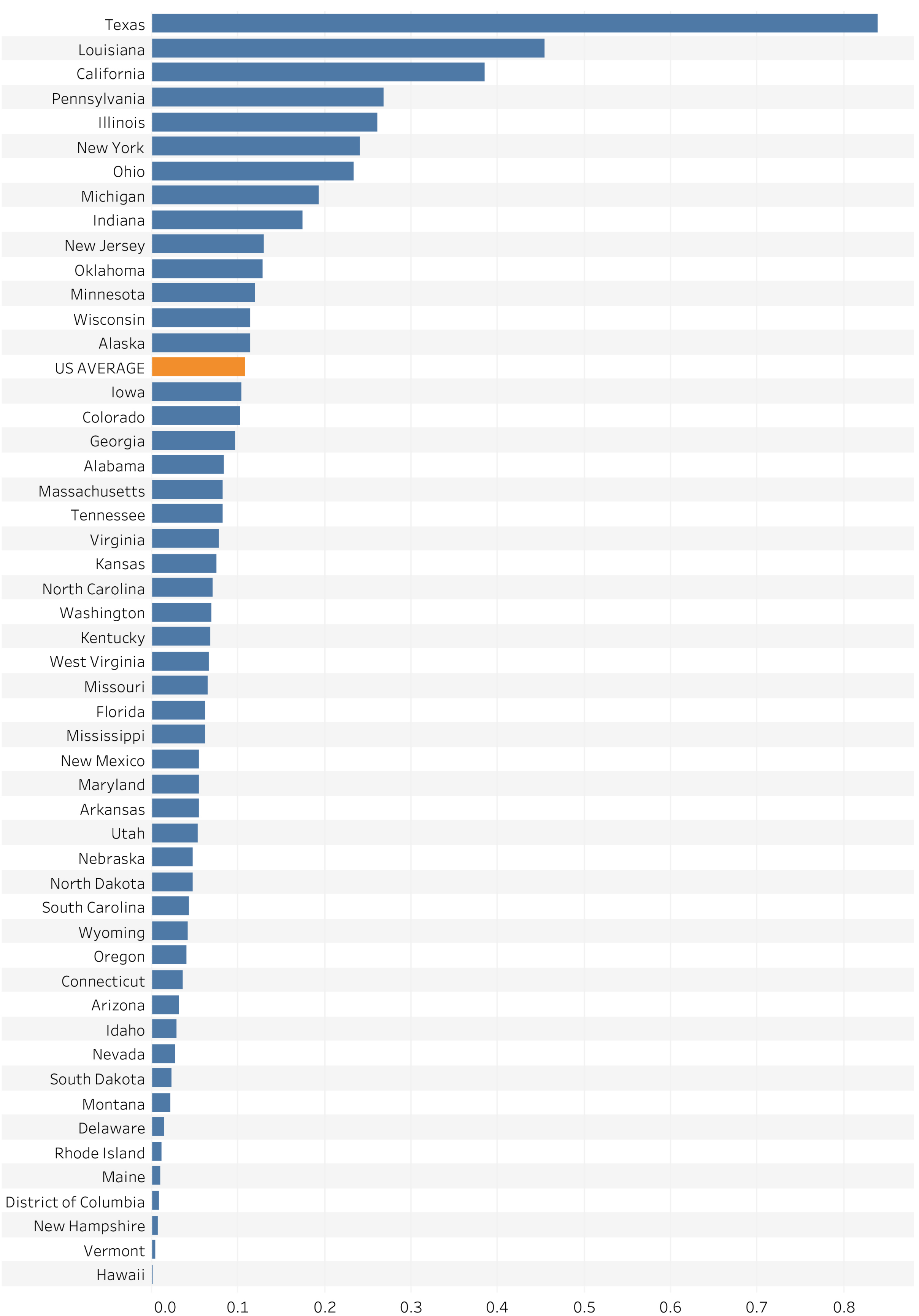
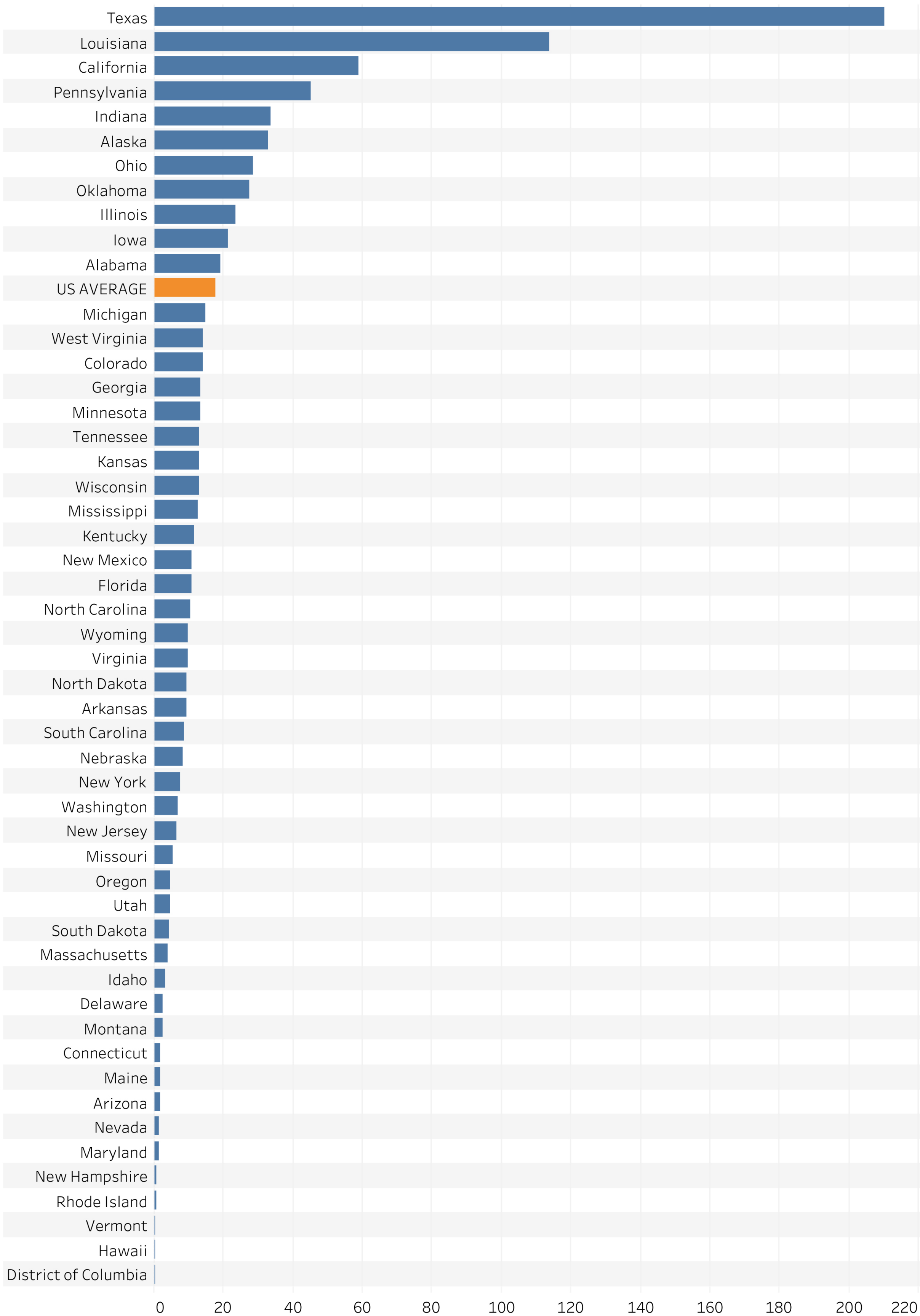


Figure 92: 2022 NO_x from Combusted Natural Gas in All Sectors Except Electrical (thousand metric tons)



RETURN ON EQUITY (ROE) FOR INVESTOR-OWNED UTILITIES

Return on equity (ROE) measures each dollar of profit generated by a utility for each dollar of equity invested by its shareholders. We include ROE in this year's report to allow readers to compare the profitability of utilities in a state to their performance on other metrics like affordability or reliability. That comparison can reveal, for example, which utilities are enjoying high profits despite their relatively unaffordable and/or unreliable service.

ROE is defined as the ratio of the annual net income of a utility to its average shareholders' equity, and the statewide ROE is a weighted average of this ratio among all such utilities in each state. This financial data is collected from FERC Form 1 for each investor-owned utility serving distribution customers for calendar year 2021. Form 1 is an annual report to FERC required of all operating electric utilities.

According to sales data found in EIA form 861, investor-owned utilities provided 49% of electricity in the U.S. in 2022.

State regulatory agencies often have delicate relationships with the utilities they regulate. It is common for utilities to wield significant political power at the state level to influence these rules. The statewide ROE, when considered alongside other utility performance metrics, may provide insight into the nature of those relationships.

Figure 93 shows the weighted average utility ROE for each state among utilities that report these data through FERC form 1. Figure 94 shows a map of the same results. ROE data are not available for Hawaii, Nebraska, South Dakota and Washington, D.C. Furthermore, data are not available for every IOU in each state. For example, only data for Consumers Energy, DTE, and Upper Peninsula Power Company are available for the state of Michigan. Figure 95 shows these results.

Figure 93: 2023 Weighted Average Utility Return on Equity by State (percent)

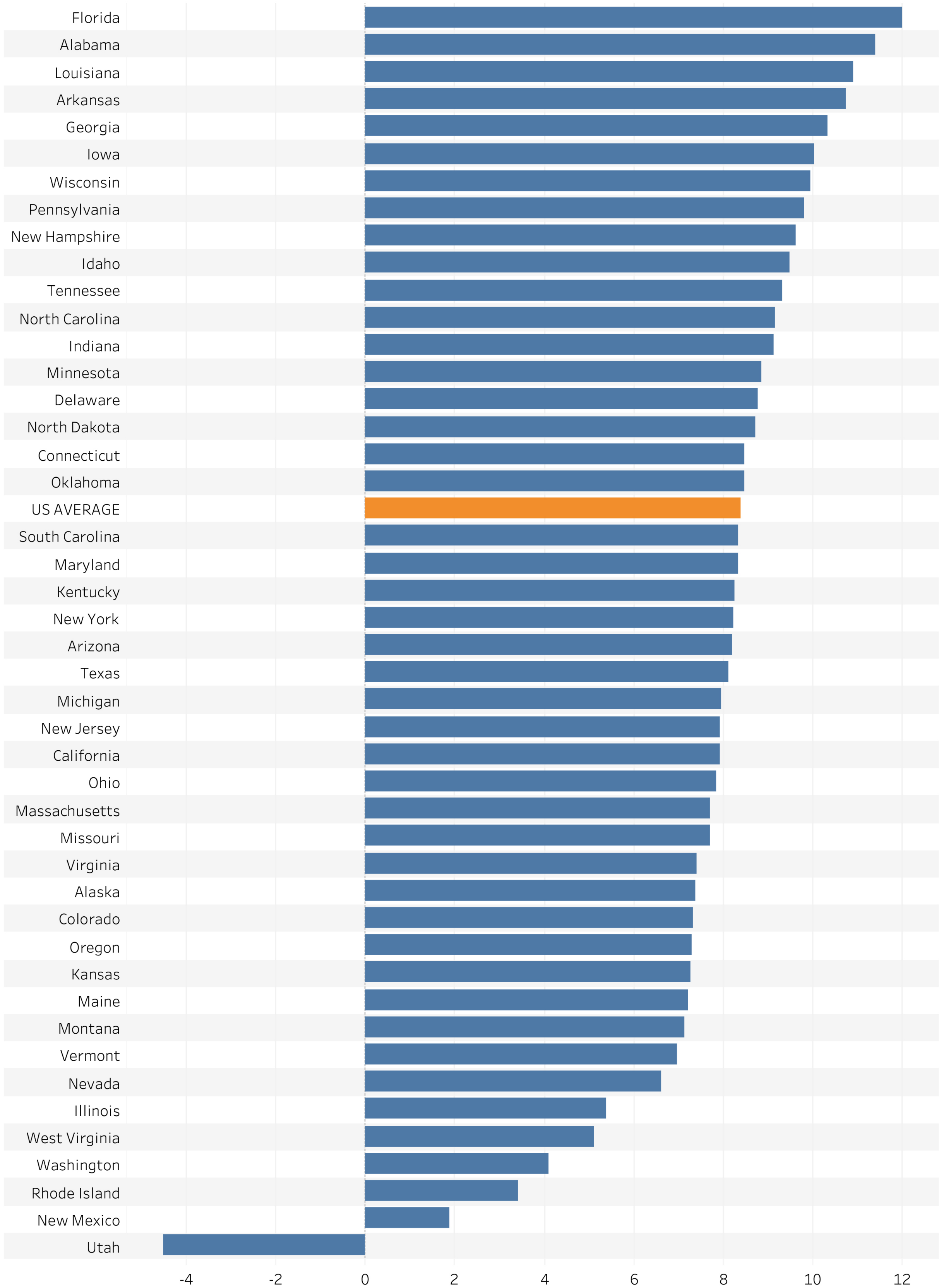


Figure 94: 2023 Weighted Average Utility Return on Equity by State (percent)

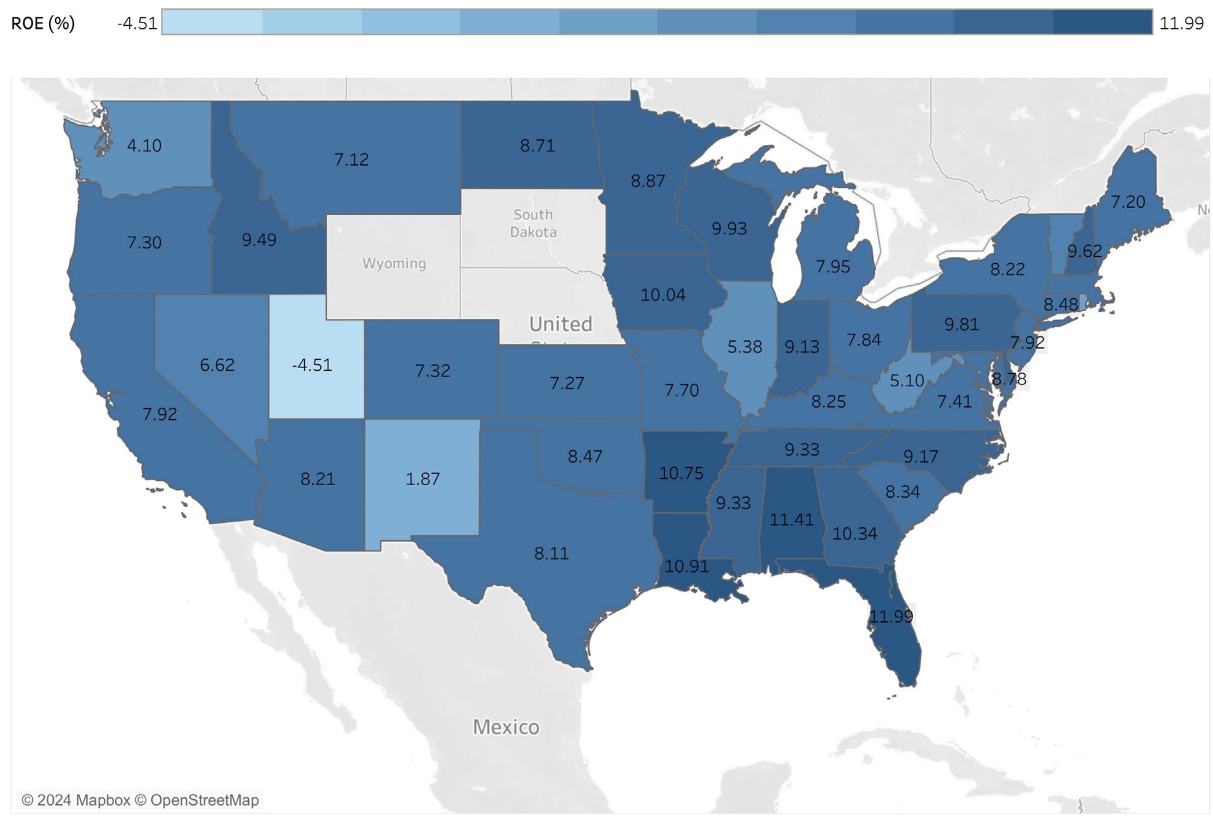
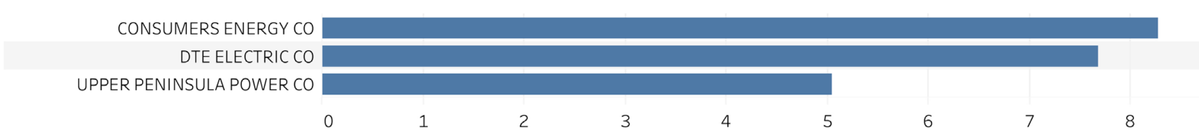


Figure 95: 2023 Weighted Average Utility Return on Equity for Michigan Utilities (percent)



APPENDIX

Figure 96: 2022 Number of Electricity Customers for Michigan Utilities (continued on next page)

		Year					
		2013	2014	2015	2016	2017	2018
Behind the M..	GREENSKIES RENEWABLE ENERGY LLC						1
Cooperative	ALGER-DELTA COOP ELECTRIC ASSN	10,012	9,948	9,949	9,972	9,951	10,047
	BAYFIELD ELECTRIC COOP INC	66	66	64	65	65	67
	CHERRYLAND ELECTRIC COOP INC	33,641	33,925	34,274	34,700	35,145	35,628
	CLOVERLAND ELECTRIC CO-OP	42,254	42,281	42,297	42,611	42,503	42,444
	GREAT LAKES ENERGY COOP	123,000	122,833	123,199	123,874	124,622	125,447
	MIDWEST ENERGY COOP	34,127	34,201	34,285	34,452	34,578	34,707
	ONTONAGON COUNTY R E A						
	PRESQUE ISLE ELEC & GAS COOP	33,216	33,045	33,084	33,224	33,468	33,525
	THUMB ELECTRIC COOP OF MICH	12,248	12,216	12,204	12,225	12,232	12,255
	TRI-COUNTY ELECTRIC COOP	25,591	25,603	25,654	25,742	25,873	25,983
	WOLVERINE POWER MARKETING COOP	19	21	22	23	21	21
Investor Owned	ALPENA POWER CO	17,634	17,672	17,667	17,695	17,691	17,690
	CONSUMERS ENERGY CO	1,790,148	1,791,366	1,796,196	1,805,489	1,816,948	1,826,166
	DTE ELECTRIC CO	2,134,569	2,142,829	2,153,990	2,168,567	2,184,813	2,196,620
	INDIANA MICHIGAN POWER CO	127,908	127,734	127,807	127,887	128,632	129,418
	MIDAMERICAN ENERGY CO	76	87	27			
	NORTHERN STATES POWER CO	9,043	9,027	8,981	8,958		8,945
	NORTHERN STATES POWER CO WISCONSIN					8,958	
	UPPER MICHIGAN ENERGY RESOURCES CORP					36,727	36,764
	UPPER PENINSULA POWER CO	52,035	51,925	47,991	56,127	62,872	58,377
	WISCONSIN ELECTRIC POWER CO	27,561	27,550	27,582	27,658	1	1
	WISCONSIN PUBLIC SERVICE CORP	9,006	9,015	9,017	9,041		
Municipal	CITY OF BAY CITY	20,097	20,056	20,056	20,049	20,206	20,237
	CITY OF CHARLEVOIX						
	CITY OF CROSWELL						
	CITY OF CRYSTAL FALLS	1,571	1,605	1,603	1,609	1,630	1,607
	CITY OF DETROIT	229	229				
	CITY OF DOWAGIAC						
	CITY OF EATON RAPIDS						
	CITY OF ESCANABA	7,227	7,243	7,242	7,244	7,243	7,235
	CITY OF GLADSTONE	2,834	2,854	2,849	2,857	2,864	2,868
	CITY OF GRAND HAVEN	13,616	13,682	13,505	13,616	13,850	14,187
	CITY OF HARBOR SPRINGS						
	CITY OF HART HYDRO						
	CITY OF HOLLAND	27,827	28,042	28,232	28,345	28,578	28,917
	CITY OF LANSING	96,108	96,489	96,704	96,842	97,185	97,651
	CITY OF LOWELL						
	CITY OF MARQUETTE	16,793	16,813	16,842	16,941	17,163	17,092
	CITY OF MARSHALL	4,469	4,514	4,806	4,744	4,557	4,577
	CITY OF NEGAUNEE	2,255	2,269	2,216	2,214	2,215	2,220
	CITY OF NILES	7,482	7,486	7,043	7,038	7,026	7,014
	CITY OF NORWAY	2,092	2,101	2,113	2,087	2,090	2,093
	CITY OF PETOSKEY	5,326	5,334	5,331	5,345	5,373	5,401
	CITY OF PORTLAND						
	CITY OF SEBEWAING						
	CITY OF SOUTH HAVEN	8,208	8,186	8,226	8,277	8,334	8,375
	CITY OF ST LOUIS						
	CITY OF STEPHENSON						
	CITY OF STURGIS	7,057	7,067	7,028	7,057	7,080	7,107
	CITY OF TRAVERSE CITY	12,252	12,452	12,489	12,802	12,098	12,995
	CITY OF WAKEFIELD						
	CITY OF ZEELAND	6,292	6,358	6,330	6,525	6,606	6,665
	COLDWATER BOARD OF PUBLIC UTIL	6,823	6,982	7,053	6,964	7,127	7,225
	HILLSDALE BOARD OF PUBLIC WKS	6,311	6,381	6,304	6,025	6,041	6,031
	NEWBERRY WATER & LIGHT BOARD						
	VILLAGE OF BARAGA	781	868	867	879	894	781
	VILLAGE OF CHELSEA						
	VILLAGE OF CLINTON						
	VILLAGE OF DAGGETT						
	VILLAGE OF LANSE	1,200	1,202	1,205	1,204	1,184	1,183
	VILLAGE OF PAW PAW						
	VILLAGE OF UNION CITY						
	WYANDOTTE MUNICIPAL SERV COMM	12,400	12,412	12,504	12,603	12,728	12,759
Retail Power Marketer	CALPINE ENERGY SOLUTIONS LLC				36	34	35
	CMS ENERGY RESOURCE MANAGEMENT	1	1	1	1		1
	CMS ENERGY RESOURCE MANAGEMENT CORP					1	
	COMMERCE ENERGY INC	233	201	173	154	125	96
	CONSTELLATION ENERGY SERVICES INC	1,054	1,197	1,235	966	844	
	CONSTELLATION NEWENERGY INC	383	367	377	380	638	3,167
	DIRECT ENERGY BUSINESS	187	211	270	409		1,373
	DYNEGY ENERGY SERVICES LLC			1	0		
	ELIGO ENERGY LLC				7	15	17
	ENERGY HARBOR CORP						
	FIRST ENERGY SOLUTIONS CORP	682	682	366	94	71	35
	GLACIAL ENERGY HOLDINGS	408	515	509	0		
	MIDAMERICAN ENERGY SERVICES LLC				26	27	40
	NOBLE AMERICAS ENERGY SOLUTIONS LLC	51	46	38			
	SPARTAN RENEWABLE ENERGY INC	1	1	1	1	3	4
	STRATEGIC ENERGY LLC					1,513	
	UP POWER MARKETING LLC	9	9	9	9	9	9

		Year			
		2019	2020	2021	2022
Behind the M..	GREENSKIES RENEWABLE ENERGY LLC	1	1		
Cooperative	ALGER-DELTA COOP ELECTRIC ASSN	10,089	10,208	10,288	10,291
	BAYFIELD ELECTRIC COOP INC	69			
	CHERRYLAND ELECTRIC COOP INC	36,075	36,487	36,915	37,421
	CLOVERLAND ELECTRIC CO-OP	42,471	42,852	43,175	43,190
	GREAT LAKES ENERGY COOP	126,250	126,956	128,202	130,291
	MIDWEST ENERGY COOP	34,748	34,919	35,168	35,342
	ONTONAGON COUNTY R E A	4,868			
	PRESQUE ISLE ELEC & GAS COOP	33,713	33,769	34,547	34,651
	THUMB ELECTRIC COOP OF MICH	12,274			
	TRI-COUNTY ELECTRIC COOP	26,105	26,349	26,610	26,829
	WOLVERINE POWER MARKETING COOP	21	20	21	21
Investor Owned	ALPENA POWER CO	16,511	16,554	16,624	16,683
	CONSUMERS ENERGY CO	1,836,668	1,855,672	1,870,123	1,875,019
	DTE ELECTRIC CO	2,209,021	2,226,500	2,244,945	2,257,415
	INDIANA MICHIGAN POWER CO	129,283	129,886	130,586	131,149
	MIDAMERICAN ENERGY CO				
	NORTHERN STATES POWER CO	8,942	8,913	8,930	8,939
	NORTHERN STATES POWER CO WISCONSIN				
	UPPER MICHIGAN ENERGY RESOURCES CORP	36,818	36,896	36,921	37,063
	UPPER PENINSULA POWER CO	52,889	53,159	53,233	53,418
	WISCONSIN ELECTRIC POWER CO	1			
	WISCONSIN PUBLIC SERVICE CORP				
Municipal	CITY OF BAY CITY	20,243	20,159	20,218	20,295
	CITY OF CHARLEVOIX	4,455			
	CITY OF CROSWELL	1,438			
	CITY OF CRYSTAL FALLS	1,603	1,603	1,557	1,542
	CITY OF DETROIT				
	CITY OF DOWAGIAC	2,608			
	CITY OF EATON RAPIDS	3,300			
	CITY OF ESCANABA	7,245			
	CITY OF GLADSTONE	3,168	2,934	3,122	2,877
	CITY OF GRAND HAVEN	14,403	14,642	14,720	14,846
	CITY OF HARBOR SPRINGS	3,712			
	CITY OF HART HYDRO	1,410			
	CITY OF HOLLAND	29,131	29,423	29,967	30,281
	CITY OF LANSING	98,268	99,274	99,425	99,070
	CITY OF LOWELL	2,948			
	CITY OF MARQUETTE	17,230	17,264	17,001	17,013
	CITY OF MARSHALL	4,574			
	CITY OF NEGAUNEE	2,234	2,250	2,239	2,237
	CITY OF NILES	7,085			
	CITY OF NORWAY	2,094	2,088	2,065	2,101
	CITY OF PETOSKEY	5,392			
	CITY OF PORTLAND	2,586			
	CITY OF SEBEWAING	1,282			
	CITY OF SOUTH HAVEN	8,444			
	CITY OF ST LOUIS	1,980			
	CITY OF STEPHENSON	498			
	CITY OF STURGIS	7,108	7,048	7,114	7,118
	CITY OF TRAVERSE CITY	12,599	12,812	12,468	11,979
	CITY OF WAKEFIELD	1,079			
	CITY OF ZEELAND	6,749	6,857	6,871	7,057
	COLDWATER BOARD OF PUBLIC UTIL	7,233	7,324	7,390	7,431
	HILLSDALE BOARD OF PUBLIC WKS	6,024			
	NEWBERRY WATER & LIGHT BOARD	1,415			
	VILLAGE OF BARAGA	750	738	736	771
	VILLAGE OF CHELSEA	3,112			
	VILLAGE OF CLINTON	1,485			
	VILLAGE OF DAGGETT	135			
	VILLAGE OF LANSE	1,176	1,132	1,216	1,158
	VILLAGE OF PAW PAW	1,759			
	VILLAGE OF UNION CITY	1,516			
	WYANDOTTE MUNICIPAL SERV COMM	12,790	12,635	12,673	12,712
Retail Power Marketer	CALPINE ENERGY SOLUTIONS LLC	35	36	37	40
	CMS ENERGY RESOURCE MANAGEMENT	1	1	1	1
	CMS ENERGY RESOURCE MANAGEMENT CORP				
	COMMERCE ENERGY INC	113	87	77	69
	CONSTELLATION ENERGY SERVICES INC				
	CONSTELLATION NEWENERGY INC	3,117	3,116	3,262	3,347
	DIRECT ENERGY BUSINESS	1,253	1,179	1,146	1,069
	DYNEGY ENERGY SERVICES LLC				
	ELIGO ENERGY LLC	11			
	ENERGY HARBOR CORP	39	28	49	64
	FIRST ENERGY SOLUTIONS CORP				
	GLACIAL ENERGY HOLDINGS				
	MIDAMERICAN ENERGY SERVICES LLC				
	NOBLE AMERICAS ENERGY SOLUTIONS LLC				
	SPARTAN RENEWABLE ENERGY INC	4	4	3	3
	STRATEGIC ENERGY LLC				
	UP POWER MARKETING LLC	1	1	1	1