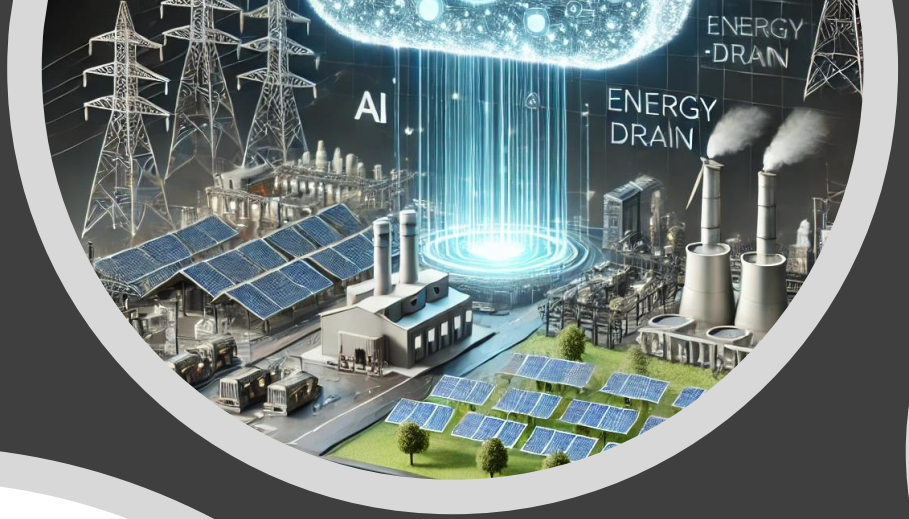


Group 2: Powering the Future Regional and Industrial Energy Consumption Insights

vath

Project Objectives – Looking To Understand

What regions of the US are consuming the most energy?

What is driving that consumption?

Will the energy industry be able to meet the increasing demand?

How will how will new demand impact energy costs?

Data Sourcing

US Energy Information Administration (EIA)

- Government Source
- High Quality Data
- Collected through government survey and industry reporting

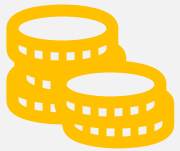
Our World In Data

- Public Data Platform
- Moderate to High Quality
- Aggregates reputable international sources

Data Collection

Energy consumption by region: Total Energy in kWh (State, Region)

Industry-Specific Consumption: Residential, Commercial, Industrial and Transportation



Energy cost data: Historical data to understand possible future costs

	Total energy consumption, billion Btu	Unnamed: 1	Unnamed: 2	Unnamed: 3	Unnamed: 4	Unnamed: 5	Unnamed: 6	Unnamed: 7	Unnamed: 8	Unnamed: 9	...	Unnamed: 91	Unnamed: 92	Unnamed: 93	Unnamed: 94	U
0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	
1	State	1960	1961	1962	1963	1964	1965	1966	1967	1968	...	NaN	NaN	NaN	NaN	
2	AK	59,303	70,020	76,642	78,488	82,793	85,319	100,481	112,625	119,992	...	NaN	NaN	NaN	NaN	
3	AL	842,283	806,682	853,424	885,811	949,411	1,011,125	1,055,347	1,100,904	1,208,038	...	NaN	NaN	NaN	NaN	
4	AR	417,153	423,192	446,994	474,761	515,874	515,759	553,146	581,814	620,382	...	NaN	NaN	NaN	NaN	
5	AZ	273,431	294,660	313,581	337,213	357,961	362,858	390,820	400,280	442,172	...	NaN	NaN	NaN	NaN	
6	CA	3,360,697	3,513,822	3,623,382	3,825,677	4,112,125	4,267,121	4,525,141	4,703,411	4,979,463	...	NaN	NaN	NaN	NaN	
7	CO	417,013	453,816	459,822	457,373	488,833	498,729	521,816	543,833	611,043	...	NaN	NaN	NaN	NaN	
8	CT	496,298	505,953	523,254	532,247	549,692	554,317	593,831	606,150	630,827	...	NaN	NaN	NaN	NaN	
9	DC	115,737	113,840	115,913	116,637	127,494	153,758	164,156	176,165	175,877	...	NaN	NaN	NaN	NaN	

10 rows × 101 columns

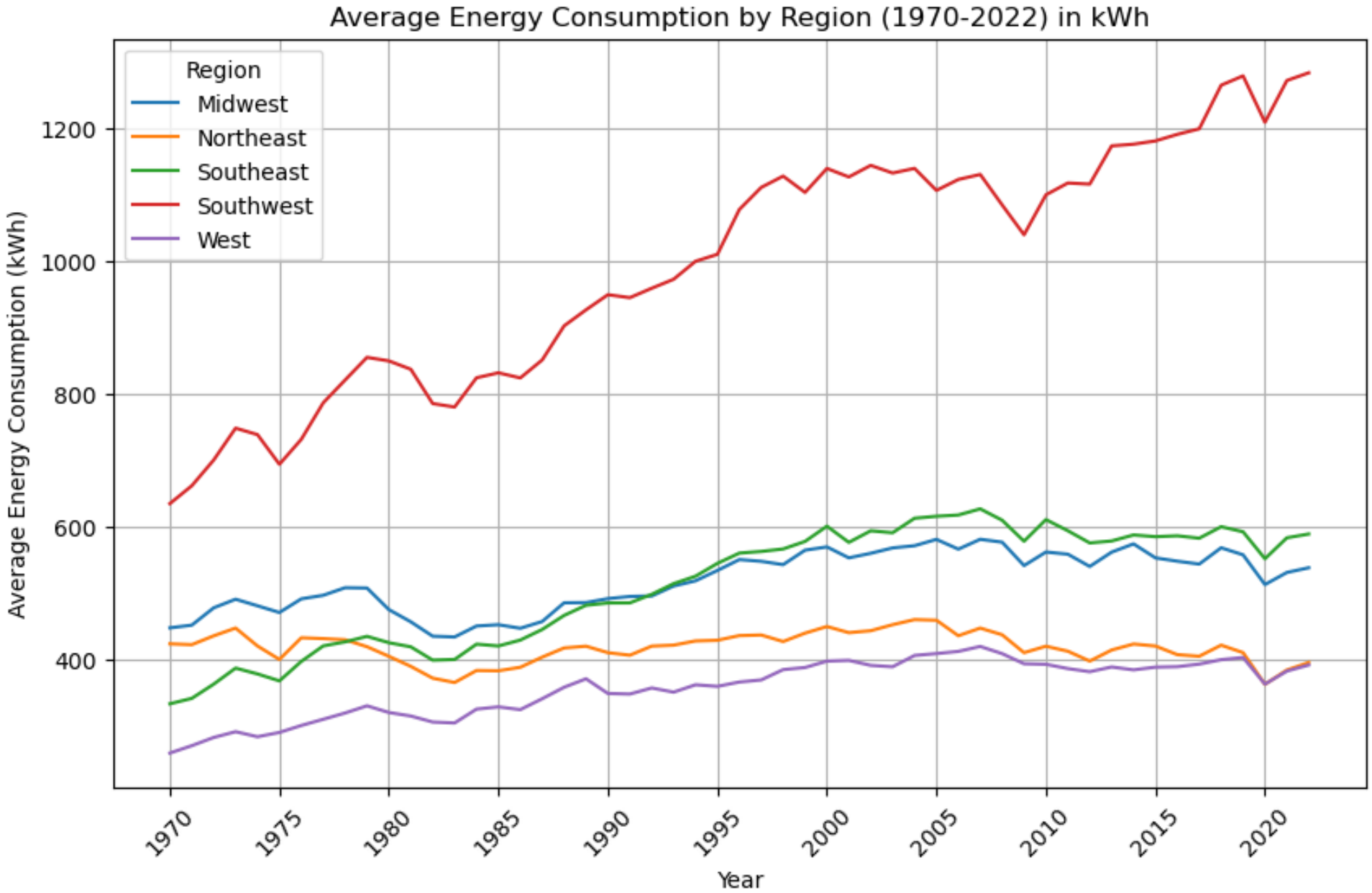
	State 1	Region 1	State 2	Region 2	State 3	Region 3	State 4	Region 4	State 5	Region 5
0	CT	Northeast	ME	Northeast	MA	Northeast	NH	Northeast	RI	Northeast
1	VT	Northeast	NJ	Northeast	NY	Northeast	PA	Northeast	IL	Midwest
2	IN	Midwest	MI	Midwest	OH	Midwest	WI	Midwest	IA	Midwest
3	KS	Midwest	MN	Midwest	MO	Midwest	NE	Midwest	ND	Midwest
4	SD	Midwest	DE	Southeast	FL	Southeast	GA	Southeast	MD	Southeast
5	NC	Southeast	SC	Southeast	VA	Southeast	WV	Southeast	AL	Southeast
6	KY	Southeast	MS	Southeast	TN	Southeast	AR	Southeast	LA	Southeast
7	AZ	Southwest	NM	Southwest	OK	Southwest	TX	Southwest	AK	West
8	CA	West	CO	West	HI	West	ID	West	MT	West
9	NV	West	OR	West	UT	West	WA	West	WY	West

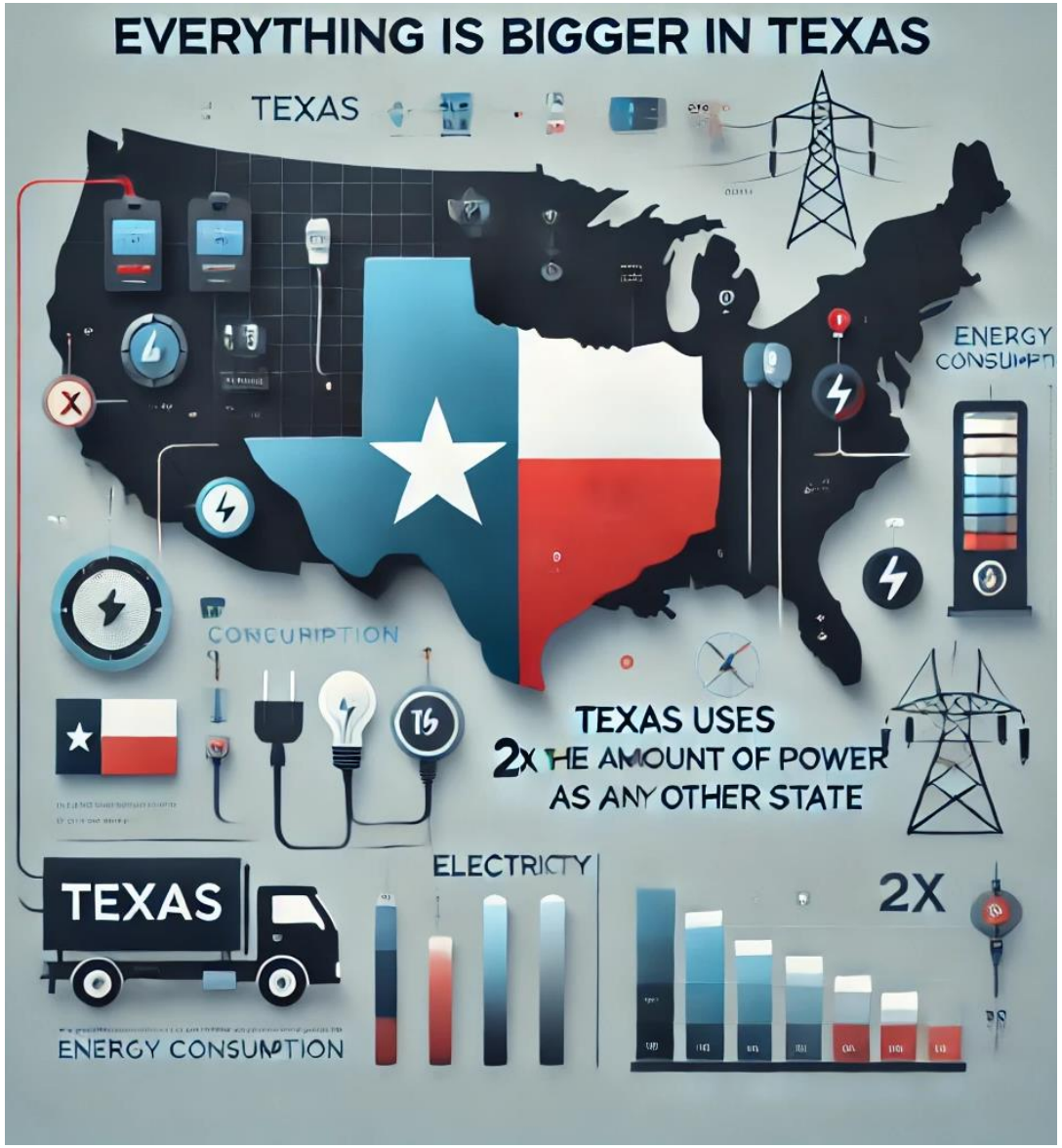
Data Cleaning and Presentation

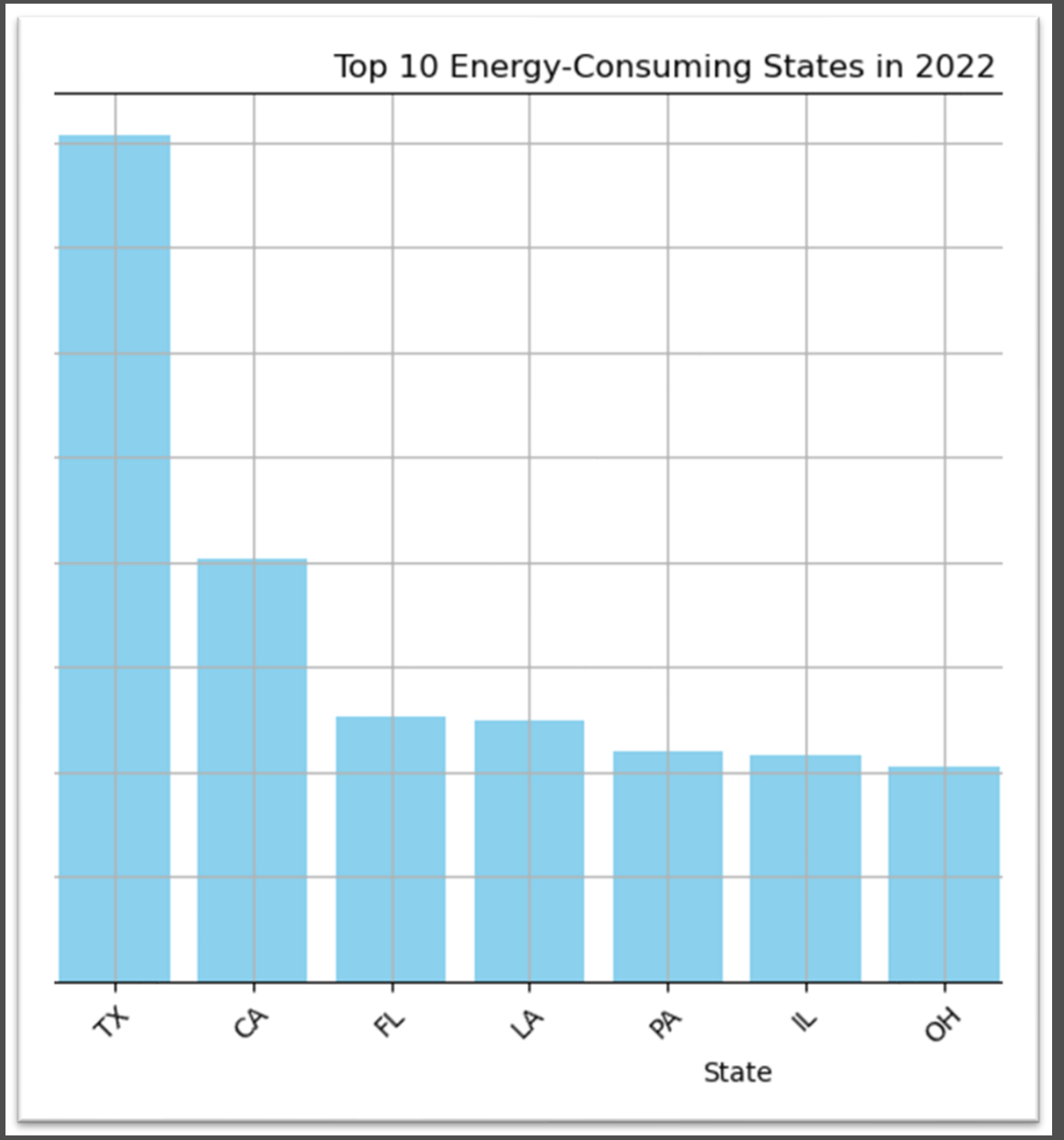
Issues, Leaning, Fixes

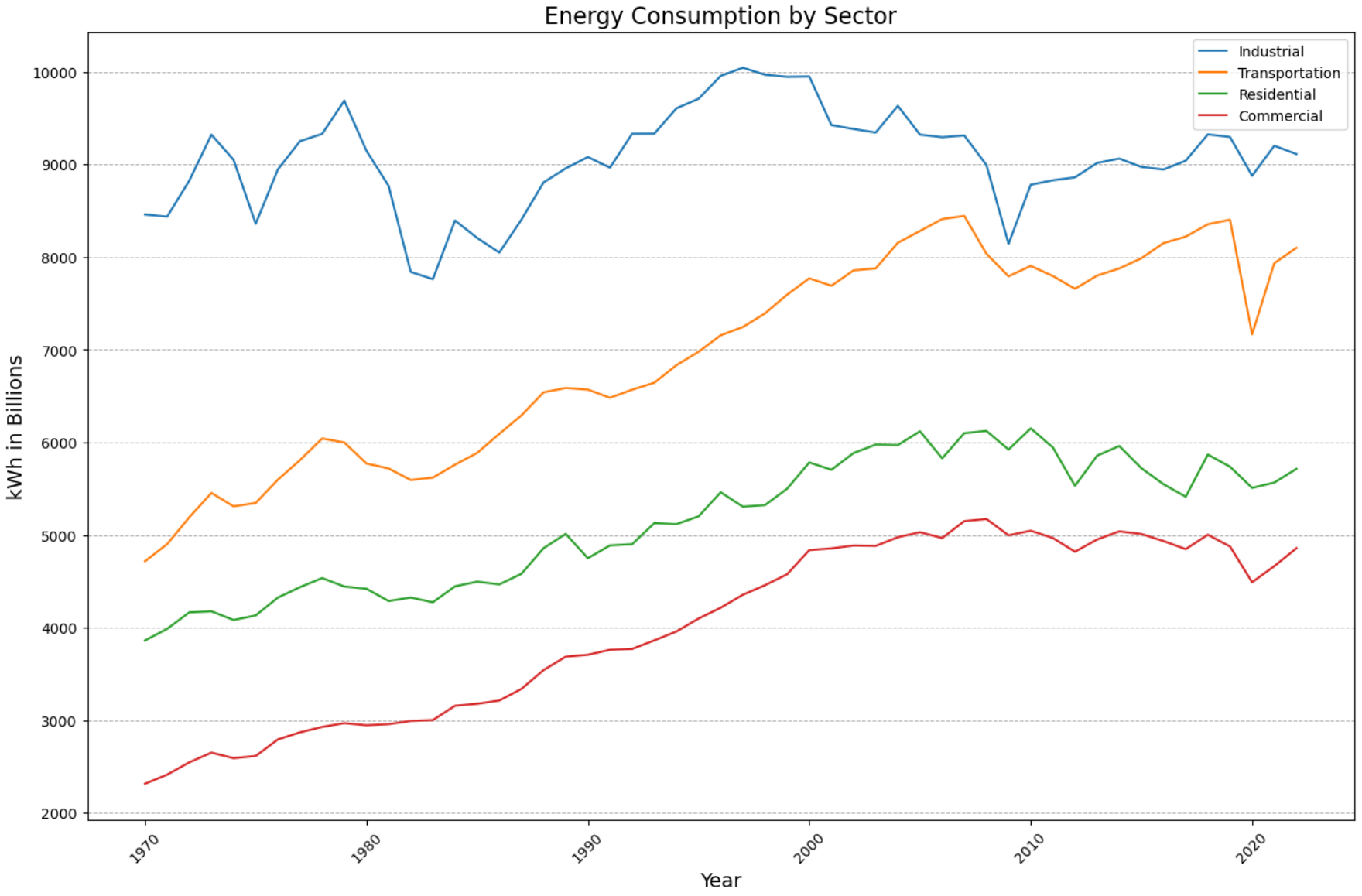
- Dictionary Generation
- Excel data had rows and columns for human readability
- String Conversion For Mixed Data Sets
- Prophet limitations for complex data sets
  - Leading/Lagging Indicators

Question 1: Regional Consumption




EVERYTHING IS BIGGER IN TEXAS
TEXAS
TEXAS USES
2X THE AMOUNT OF POWER
AS ANY OTHER STATE
TEXAS
ELECTRICITY
2X
ENERGY CONSUMPTION

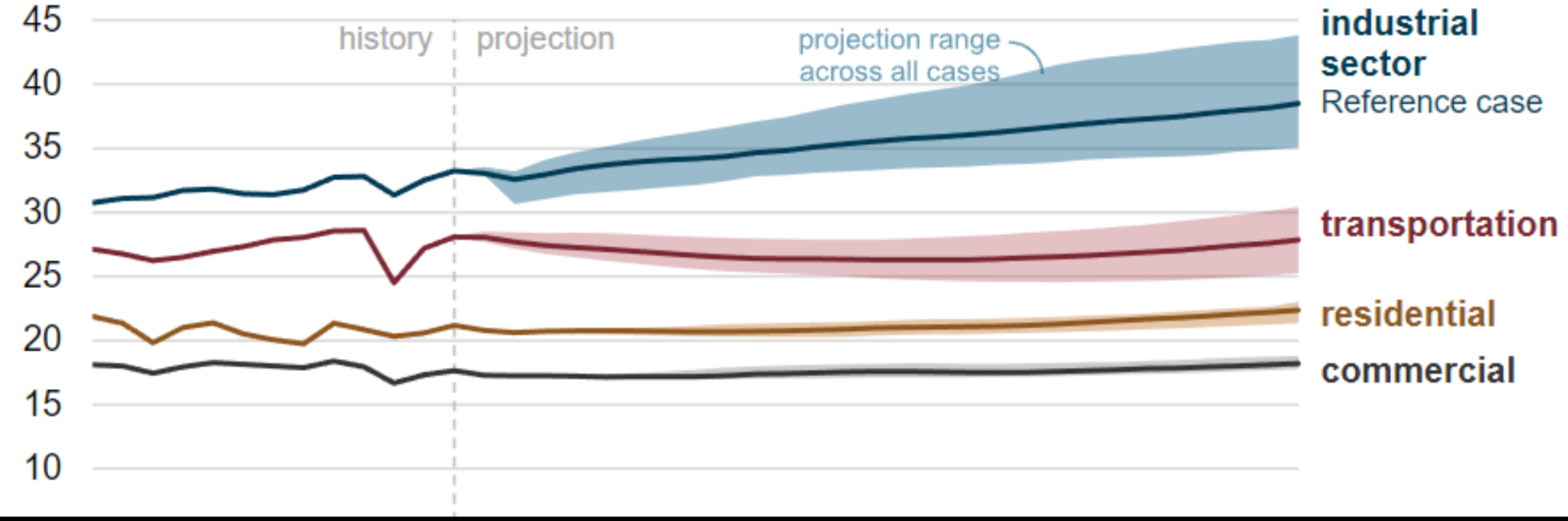

Top 10 Energy-Consuming States in 2022
TX
CA
FL
LA
PA
IL
OH
State


Energy Consumption by Sector
Industrial
Transportation
Residential
Commercial
kWh in Billions
10000
9000
8000
7000
6000
5000
4000
3000
2000
1970
1980
1990
2000
2010
2020
Year

APRIL 3, 2023

U.S. energy consumption increases between 0% and 15% by 2050

Total energy consumption by end-use sector, United States (2010–2050)
quadrillion British thermal units

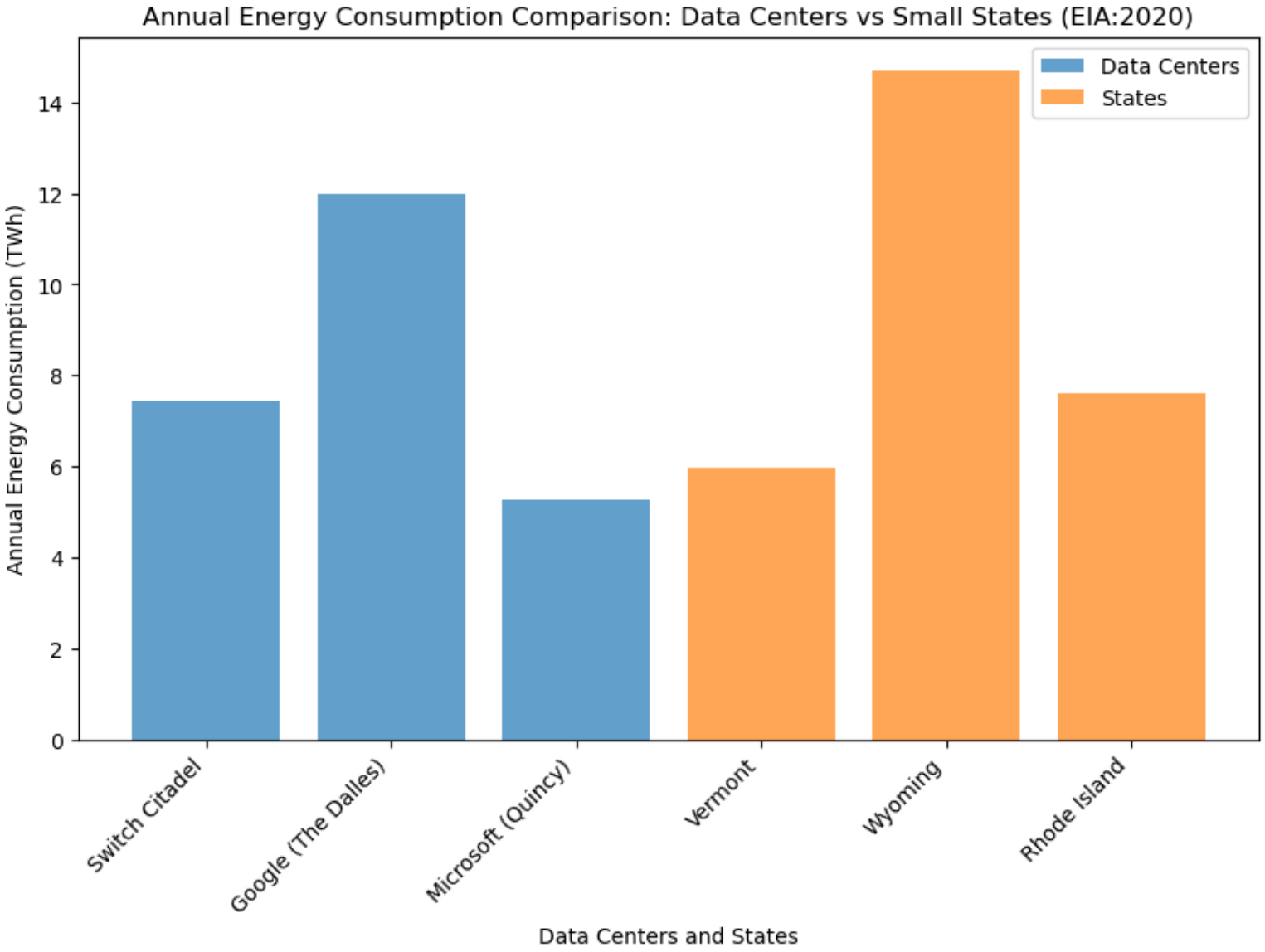


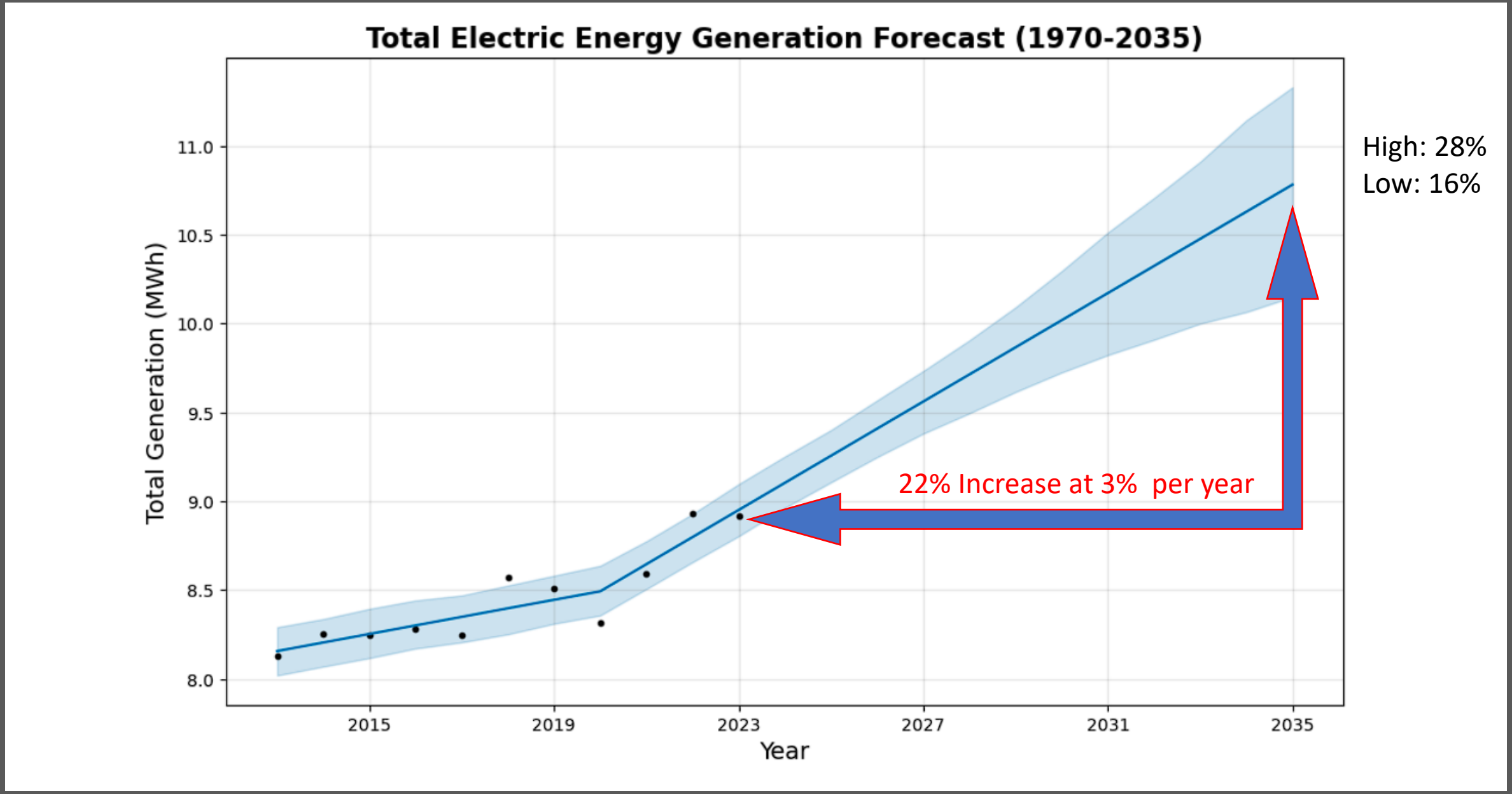
Source: 2023 EIA.gov Report on Energy Consumption Projections

Energy Consumption: Driving Factors

- High cooling costs
- Water Treatment and Transport
- Energy demanding industry
  - Petrochemical processing
  - Data Centers and AI
- Urban population density

- As of 2022
  - Data Center Energy Usage was 2% of US Total
  - Expectation: Growth to 180-220 Billion kWH annually by 2035
  - Difficulty predicting


Annual Energy Consumption Comparison: Data Centers vs Small States (EIA:2020)
Data Centers
States
Annual Energy Consumption (TWh)
0
2
4
6
8
10
12
14
Switch Citadel
Google (The Dalles)
Microsoft (Quincy)
Vermont
Wyoming
Rhode Island
Data Centers and States


Total Electric Energy Generation Forecast (1970-2035)
Total Generation (MWh)
11.0
10.5
10.0
9.5
9.0
8.5
8.0
2015
2019
2023
2027
2031
2035
Year
22% Increase at 3% per year
High: 28%
Low: 16%

Energy Pricing Outlook 2024-2035

2024

$0.14 per kWh (estimated starting point)

2025–2028

Gradual increase of ~2-3% per year due to inflation and increased renewable energy integration

2029–2031

Significant fluctuations expected from global supply chain disruptions, regulatory changes, and technology advancements

2032–2035

Stabilization expected as renewable energy becomes a larger share of the grid; estimated average price ~$0.19 per kWh by 2035

Conclusion

Moderate Rise in Prices by 2035:

- Driven by regional demand, infrastructure upgrades, economic and political factors.
- Technological advancements in renewable energy may mitigate increases.

Energy-Intensive AI Systems:

- Growing consumption of electricity by AI systems.
- Increasing importance of addressing energy costs.

Efficiency and Sustainability:

- Optimize model training and select energy-efficient architectures.
- Leverage sustainable computing resources to reduce costs.

Benefits of Prioritizing Efficiency:

- Lower operational costs.
- Support global sustainability efforts.
- Align with corporate responsibility and minimize environmental impact.

Thank You For Your Time

Questions?