U.S. Electric Power & Thermal Capacity

Overview & National Security Implications

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SOUTH CAROLINA GOVERNOR'S NUCLEAR ADVISORY COUNCIL MEETING

DECEMBER 15, 2025

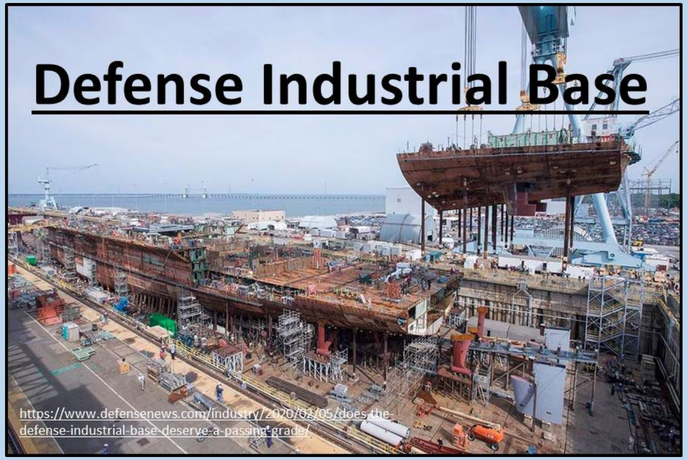

OTR Freight
https://www.fleetequipmentmag.com/us-bank-freight-payment-index-shipments/


Mining
Oil, Natural Gas, Coal, Uranium, Minerals, Metals
https://resource-erectors.com/career-blog/integrated-operations-management-in-minerals-metals-and-mining/


Natural Gas-Fired Power Plants


Nuclear Power Plants


Rail & Shipping
https://www.cato.org/publications/policy-analysis/jones-act-burden-america-can-no-longer-bear


Defense Industrial Base
https://www.defensenews.com/industry/2020/02/05/does-the-defense-industrial-base-deserve-a-passing-grade/


Electric Power Grid
https://phys.org/news/2016-09-geomagnetic-storms-nation-electric-power-grid.html


Agriculture &
Food Production
https://www.wsj.com/articles/u-s-farmers-who-once-fed-the-world-overtaken-by-new-world-powers-1492700574


Cement Production
https://www.britannica.com/technology/cement-building-material/Extraction-and-processing

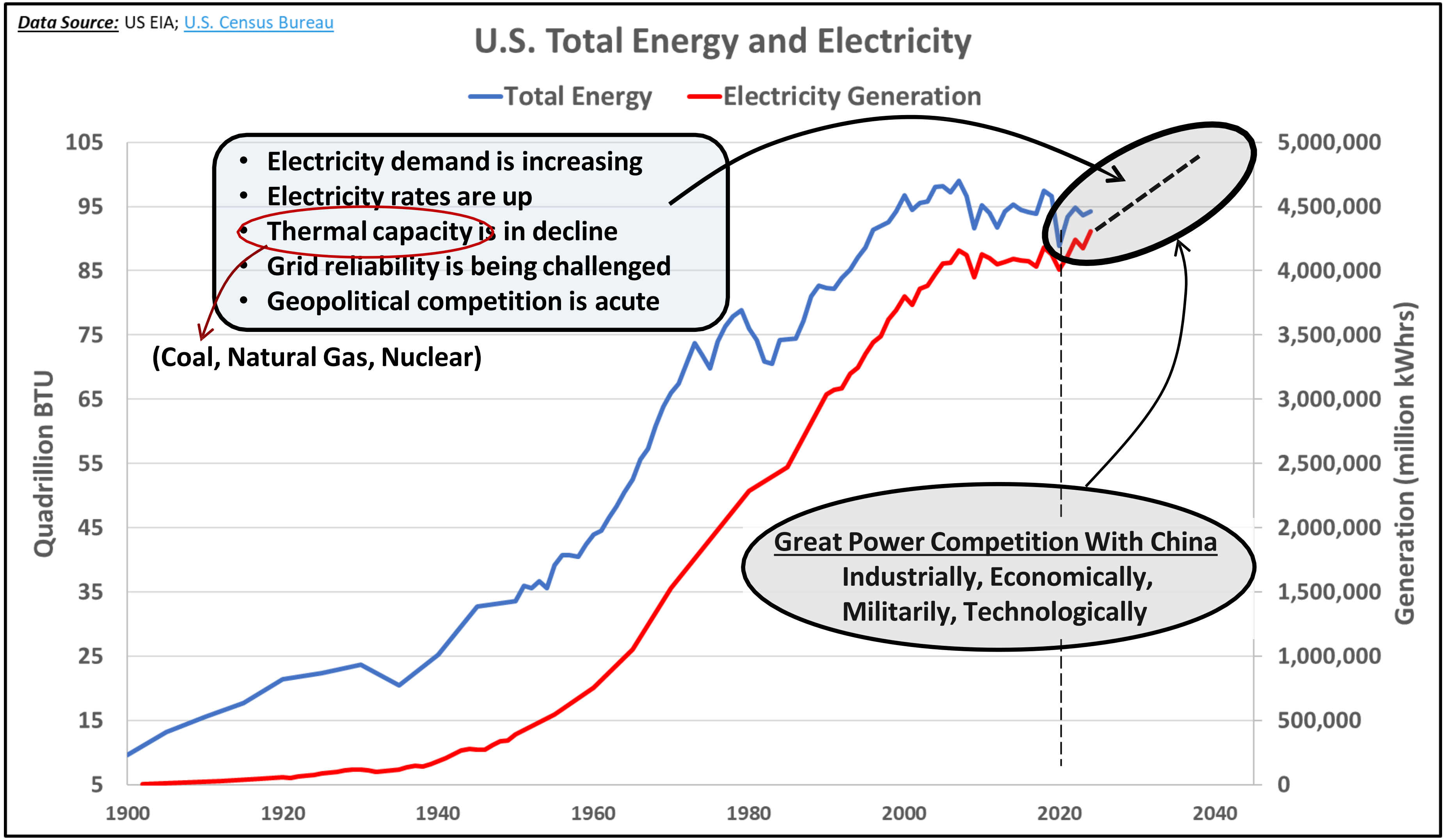

Coal-Fired Power Plants
https://www.georgiapower.com/company/environmental-compliance/plant-list/plant-bowen.html


Chemical Production
https://www.aiche.org/chenected/2018/07/introduction-advanced-manufacturing-chemical-engineers


Iron and Steel Forging
https://www.steel.org/steel-technology/steel-production/


Oil and Natural Gas Refining

Bottom Line Up Front



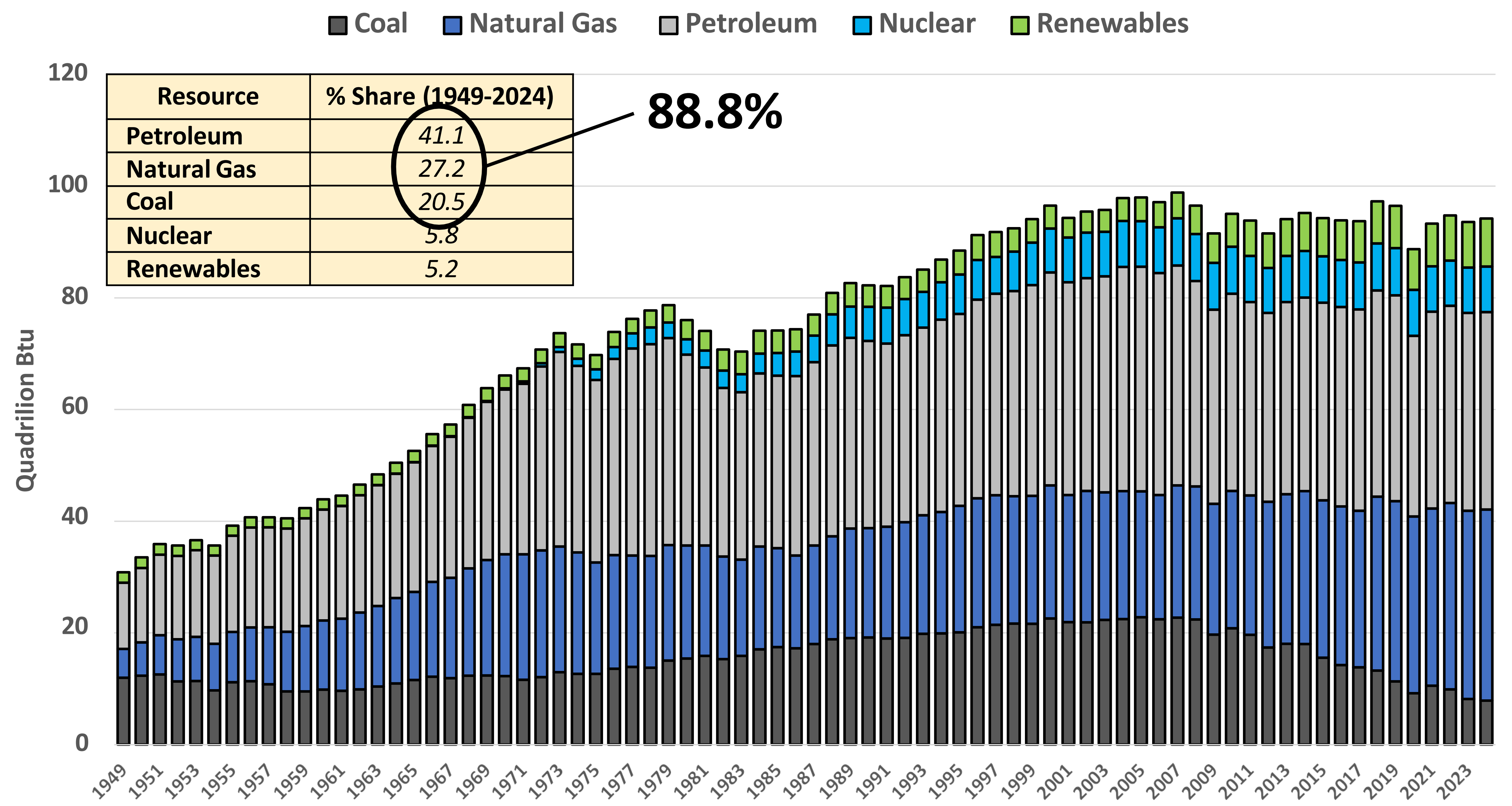
National Power

*"In general, a state's **natural resources, geography, economy, infrastructure, and industrial base** are traditionally recognized as foundational elements of power—those that are critical for supporting strategic actions."*

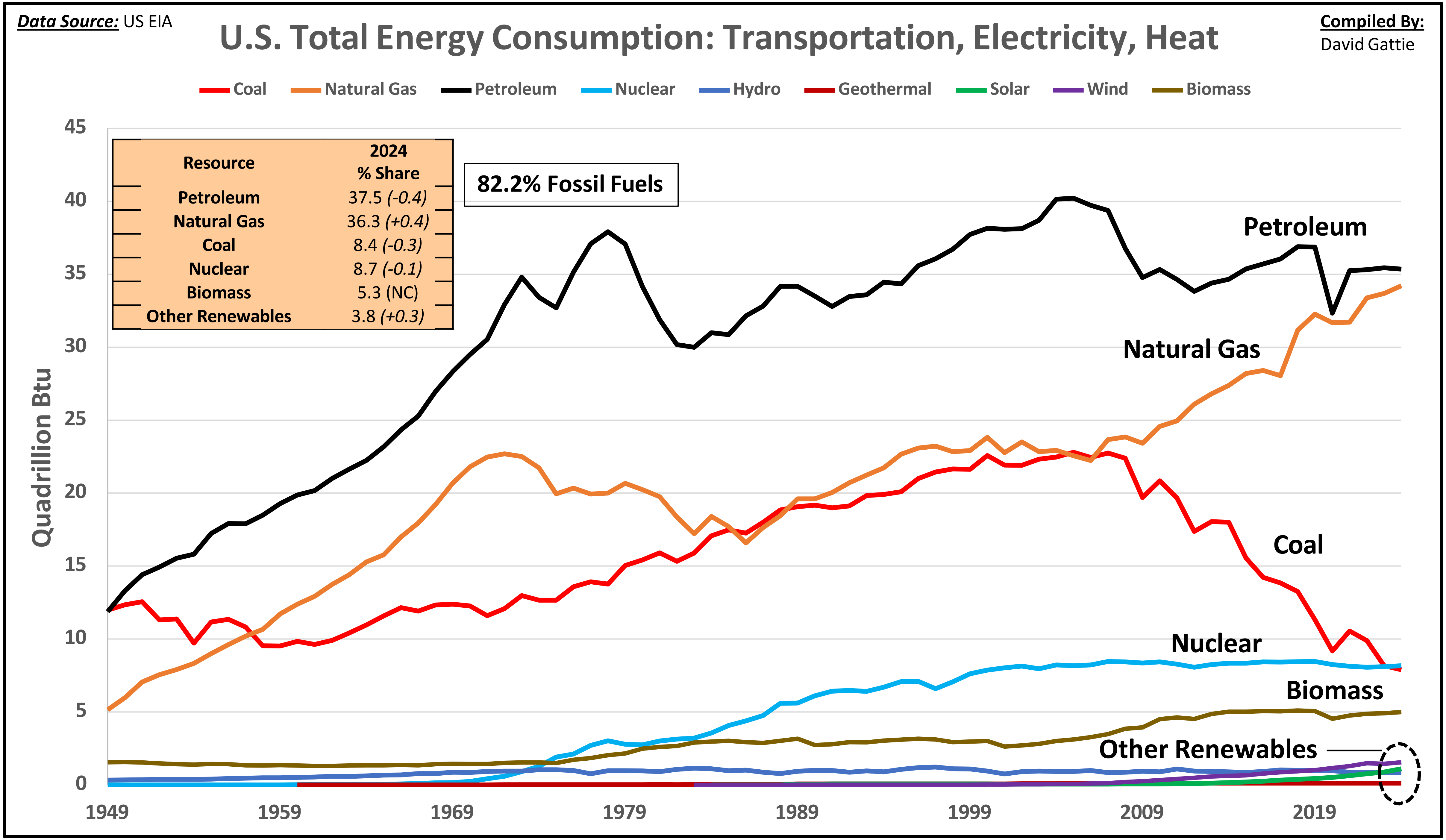
(National War College. 2019. A National Security Strategy Primer. Steven Heffington, Adam Oler, and David Tretler, Editors. National Defense University Press, Washington, DC.)

U.S. National Security

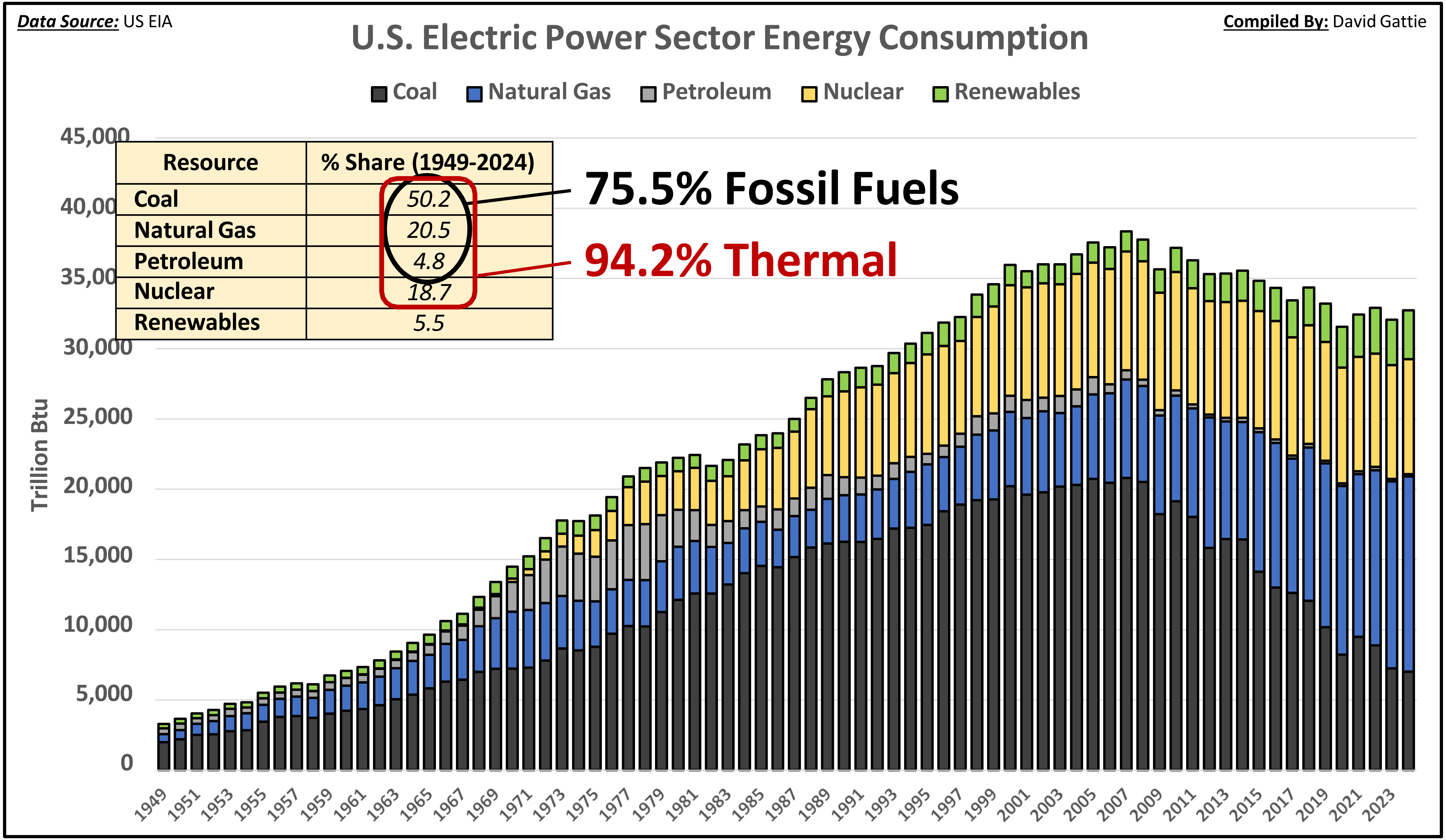
- America's capacity to ***defend*** against and ***deter*** any and all threats to its citizens, its freedoms and liberties, its economy, its institutions and its government
- A core measure of America's capacity to provide and sustain national security is ***having competitive advantage relative to nations*** that pose a threat—multiple advantages:
  - Economic, natural resources, ***energy***, military, technological, diplomatic, geopolitical
  - A deep, diverse ***industrial base***
  - A flexible, reliable, resilient ***power grid***

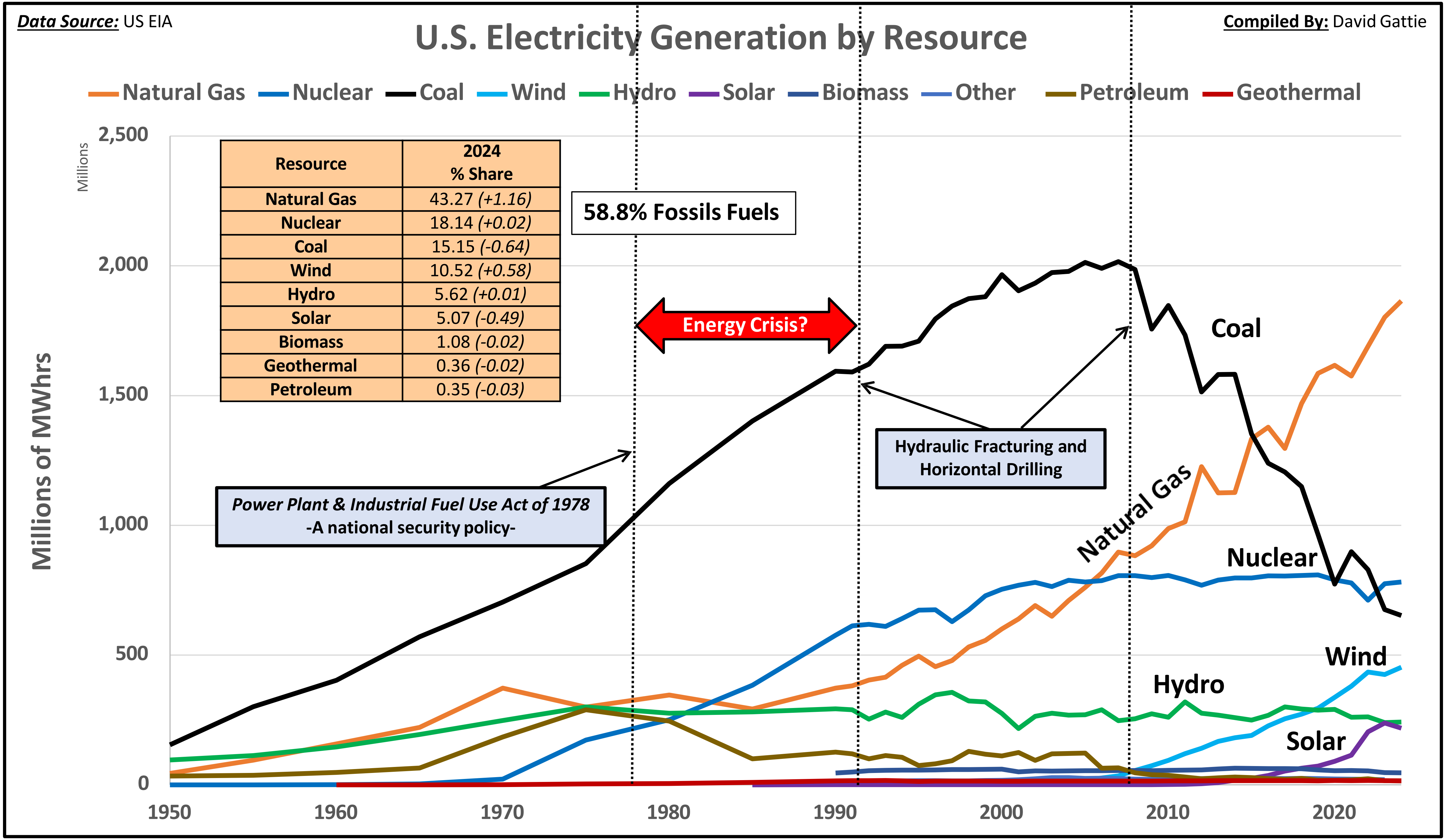


Resource	% Share (1949-2024)
Petroleum	41.1
Natural Gas	27.2
Coal	20.5
Nuclear	5.8
Renewables	5.2

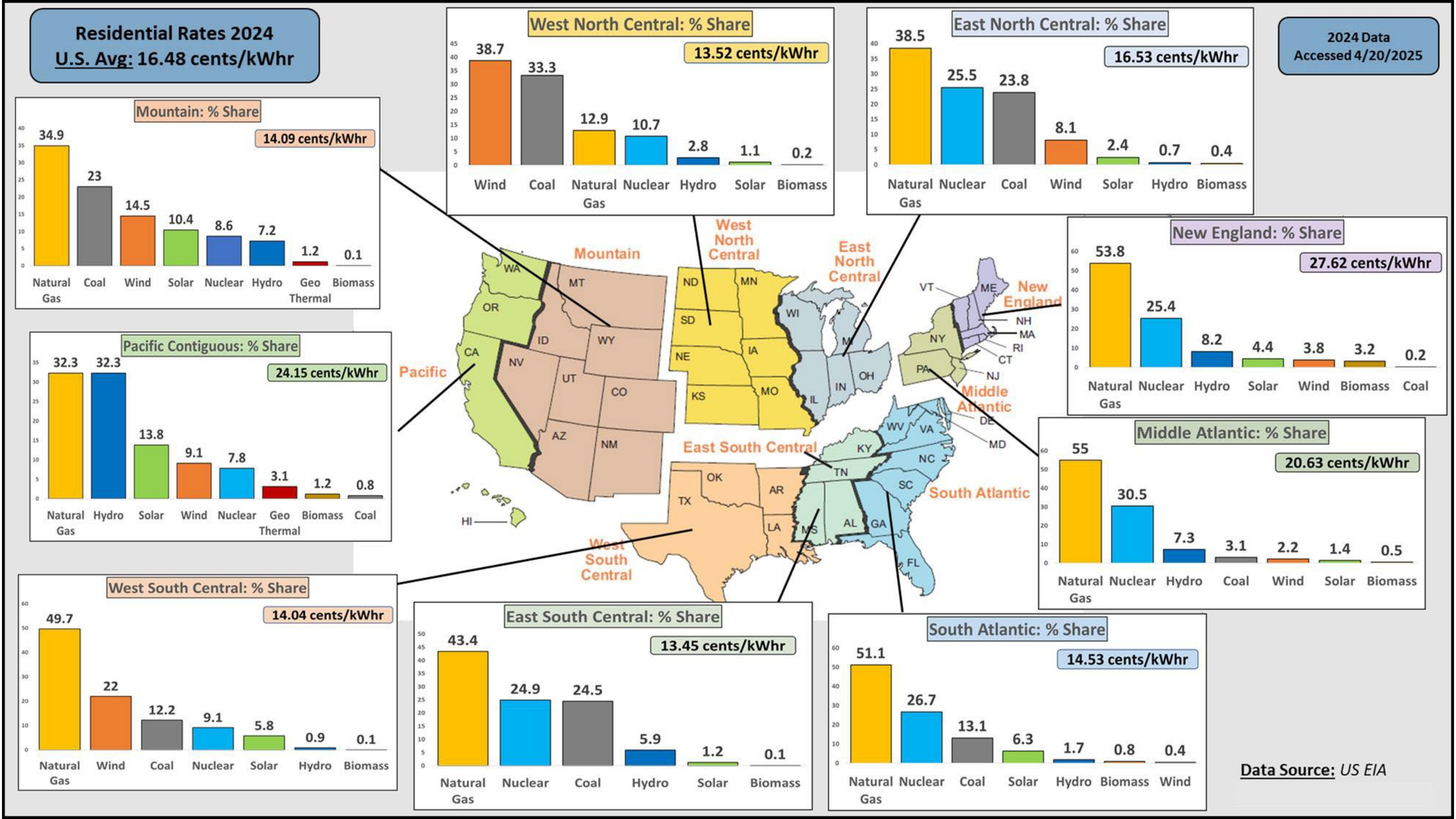


Data Source: US EIA
U.S. Total Energy Consumption: Transportation, Electricity, Heat
Compiled By: David Gattie
Coal
Natural Gas
Petroleum
Nuclear
Hydro
Geothermal
Solar
Wind
Biomass
Resource
2024 % Share
Petroleum 37.5 (-0.4)
Natural Gas 36.3 (+0.4)
Coal 8.4 (-0.3)
Nuclear 8.7 (-0.1)
Biomass 5.3 (NC)
Other Renewables 3.8 (+0.3)
82.2% Fossil Fuels
Quadrillion Btu
45
40
35
30
25
20
15
10
5
0
1949
1959
1969
1979
1989
1999
2009
2019
Petroleum
Natural Gas
Coal
Nuclear
Biomass
Other Renewables

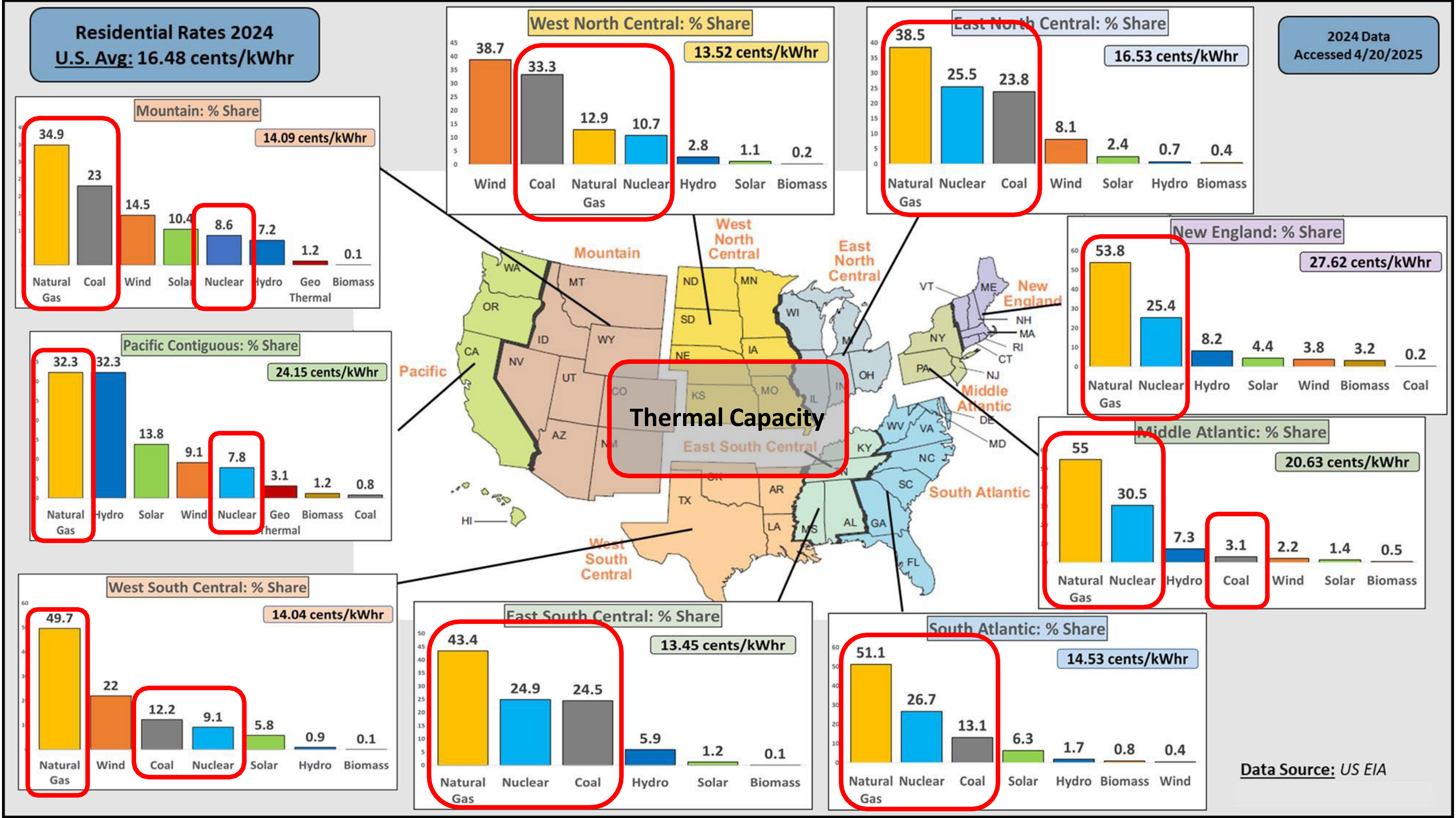

Data Source: US EIA
U.S. Electric Power Sector Energy Consumption
Compiled By: David Gattie
Coal
Natural Gas
Petroleum
Nuclear
Renewables
Resource | % Share (1949-2024)
Coal | 50.2
Natural Gas | 20.5
Petroleum | 4.8
Nuclear | 18.7
Renewables | 5.5
75.5% Fossil Fuels
94.2% Thermal
Trillion Btu
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1949
1951
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023



Resource	2024 % Share
Natural Gas	43.27 *(+1.16)*
Nuclear	18.14 *(+0.02)*
Coal	15.15 *(-0.64)*
Wind	10.52 *(+0.58)*
Hydro	5.62 *(+0.01)*
Solar	5.07 *(-0.49)*
Biomass	1.08 *(-0.02)*
Geothermal	0.36 *(-0.02)*
Petroleum	0.35 *(-0.03)*



Residential Rates 2024
U.S. Avg: 16.48 cents/kWhr
2024 Data
Accessed 4/20/2025
West North Central: % Share
13.52 cents/kWhr
Wind 38.7
Coal 33.3
Natural Gas 12.9
Nuclear 10.7
Hydro 2.8
Solar 1.1
Biomass 0.2
East North Central: % Share
16.53 cents/kWhr
Natural Gas 38.5
Nuclear 25.5
Coal 23.8
Wind 8.1
Solar 2.4
Hydro 0.7
Biomass 0.4
Mountain: % Share
14.09 cents/kWhr
Natural Gas 34.9
Coal 23
Wind 14.5
Solar 10.4
Nuclear 8.6
Hydro 7.2
Geo Thermal 1.2
Biomass 0.1
New England: % Share
27.62 cents/kWhr
Natural Gas 53.8
Nuclear 25.4
Hydro 8.2
Solar 4.4
Wind 3.8
Biomass 3.2
Coal 0.2
Pacific Contiguous: % Share
24.15 cents/kWhr
Natural Gas 32.3
Hydro 32.3
Solar 13.8
Wind 9.1
Nuclear 7.8
Geo Thermal 3.1
Biomass 1.2
Coal 0.8
Middle Atlantic: % Share
20.63 cents/kWhr
Natural Gas 55
Nuclear 30.5
Hydro 7.3
Coal 3.1
Wind 2.2
Solar 1.4
Biomass 0.5
West South Central: % Share
14.04 cents/kWhr
Natural Gas 49.7
Wind 22
Coal 12.2
Nuclear 9.1
Solar 5.8
Hydro 0.9
Biomass 0.1
East South Central: % Share
13.45 cents/kWhr
Natural Gas 43.4
Nuclear 24.9
Coal 24.5
Hydro 5.9
Solar 1.2
Biomass 0.1
South Atlantic: % Share
14.53 cents/kWhr
Natural Gas 51.1
Nuclear 26.7
Coal 13.1
Solar 6.3
Hydro 1.7
Biomass 0.8
Wind 0.4
Pacific
Mountain
West North Central
East North Central
New England
Middle Atlantic
East South Central
South Atlantic
West South Central
WA OR CA ID NV MT WY UT AZ CO NM ND SD NE KS MN IA MO WI MI IL IN OH KY TN MS AL OK TX AR LA WV VA NC SC GA FL PA NY NJ DE MD VT NH ME MA RI CT HI
Data Source: US EIA



Residential Rates 2024
U.S. Avg: 16.48 cents/kWhr
2024 Data Accessed 4/20/2025
West North Central: % Share
13.52 cents/kWhr
38.7 Wind
33.3 Coal
12.9 Natural Gas
10.7 Nuclear
2.8 Hydro
1.1 Solar
0.2 Biomass
East North Central: % Share
16.53 cents/kWhr
38.5 Natural Gas
25.5 Nuclear
23.8 Coal
8.1 Wind
2.4 Solar
0.7 Hydro
0.4 Biomass
Mountain: % Share
14.09 cents/kWhr
34.9 Natural Gas
23 Coal
14.5 Wind
10.4 Solar
8.6 Nuclear
7.2 Hydro
1.2 Geo Thermal
0.1 Biomass
Pacific Contiguous: % Share
24.15 cents/kWhr
32.3 Natural Gas
32.3 Hydro
13.8 Solar
9.1 Wind
7.8 Nuclear
3.1 Geo Thermal
1.2 Biomass
0.8 Coal
New England: % Share
27.62 cents/kWhr
53.8 Natural Gas
25.4 Nuclear
8.2 Hydro
4.4 Solar
3.8 Wind
3.2 Biomass
0.2 Coal
Middle Atlantic: % Share
20.63 cents/kWhr
55 Natural Gas
30.5 Nuclear
7.3 Hydro
3.1 Coal
2.2 Wind
1.4 Solar
0.5 Biomass
Thermal Capacity
Mountain
West North Central
East North Central
New England
Pacific
Middle Atlantic
East South Central
South Atlantic
West South Central
WA OR CA ID NV MT WY UT AZ CO NM ND SD NE KS OK TX MN IA MO AR LA WI IL MI IN OH KY TN MS AL GA FL SC NC VA WV PA NY VT NH ME MA RI CT NJ DE MD HI
West South Central: % Share
14.04 cents/kWhr
49.7 Natural Gas
22 Wind
12.2 Coal
9.1 Nuclear
5.8 Solar
0.9 Hydro
0.1 Biomass
East South Central: % Share
13.45 cents/kWhr
43.4 Natural Gas
24.9 Nuclear
24.5 Coal
5.9 Hydro
1.2 Solar
0.1 Biomass
South Atlantic: % Share
14.53 cents/kWhr
51.1 Natural Gas
26.7 Nuclear
13.1 Coal
6.3 Solar
1.7 Hydro
0.8 Biomass
0.4 Wind
Data Source: US EIA

Thermal Capacity Trends

NERC 2024 Long-Term Reliability Assessment

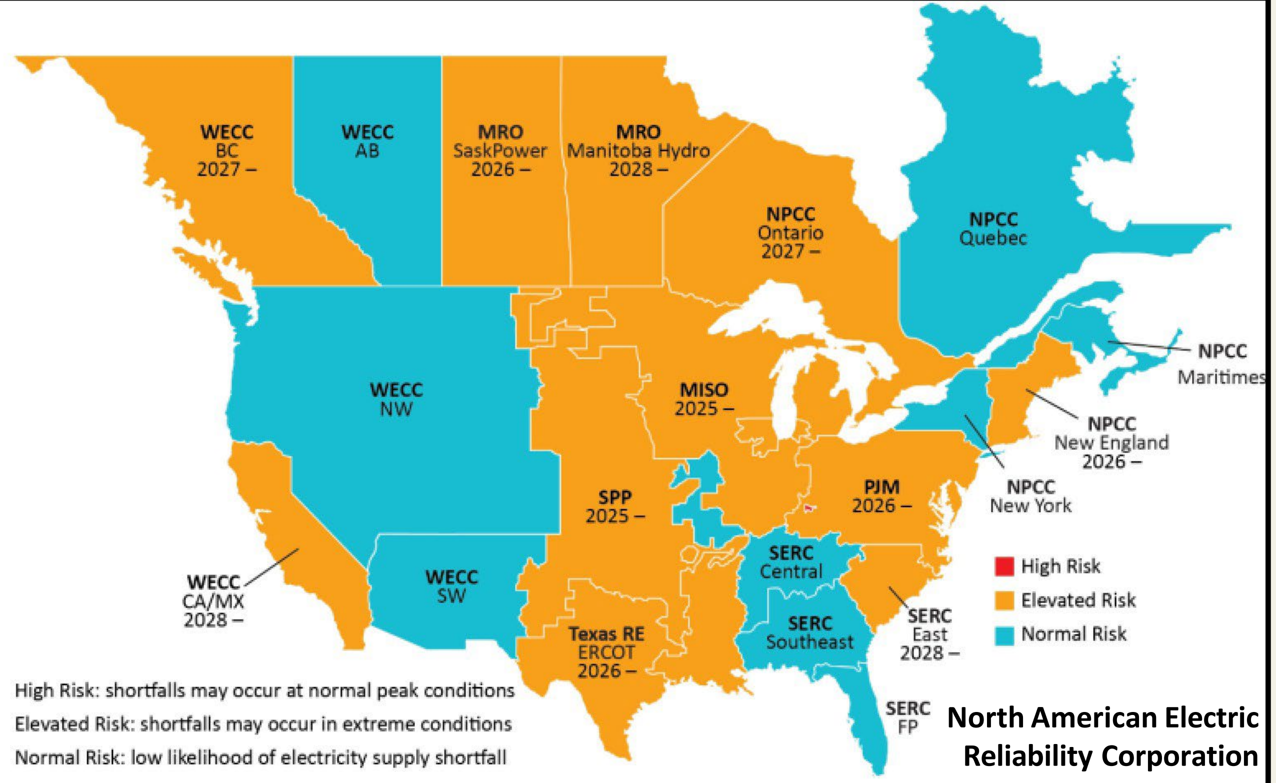


Figure 1: Risk Area Summary 2025–2029 (Corrected July 2025)

As older fossil-fired generators retire and are replaced by more solar PV and wind resources, the resource mix is becoming increasingly variable and weather-dependent. Solar PV, wind, and other variable energy resources (VER) contribute some fraction of their nameplate capacity output to serving demand based on the energy-producing inputs (e.g., solar irradiance, wind speed). The new resources also have different physical and operating characteristics from the generators that they are replacing, affecting the essential reliability services (ERS) that the resource mix provides. As generators are deactivated and replaced by new types of resources, ERS must still be maintained for the grid to operate reliably.

NERC 2025 Summer Reliability Assessment

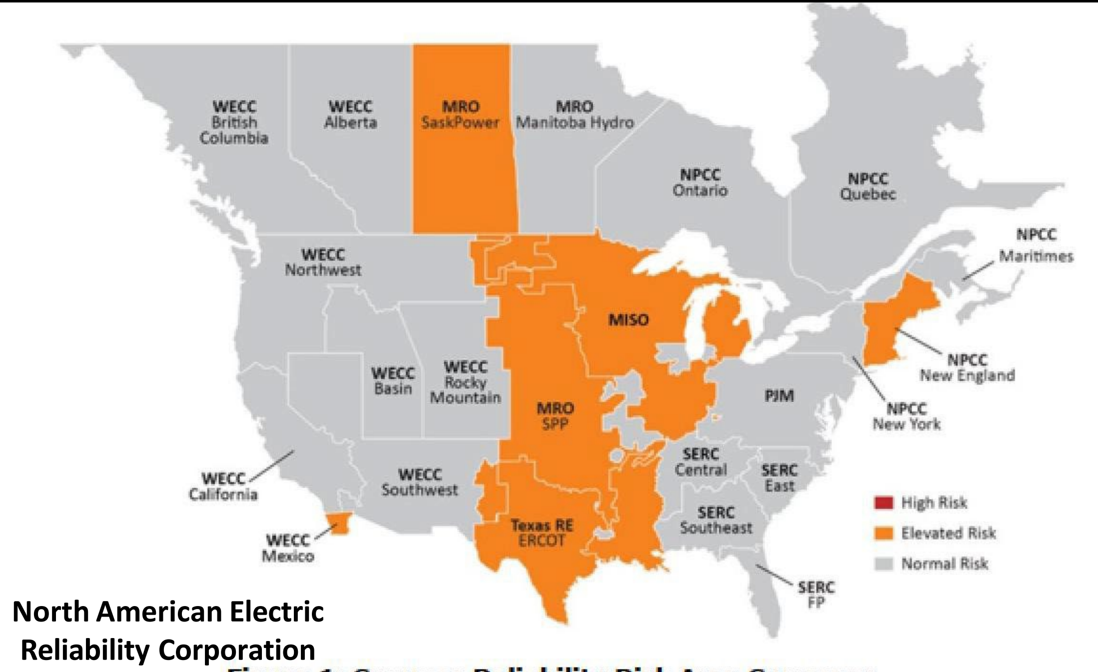
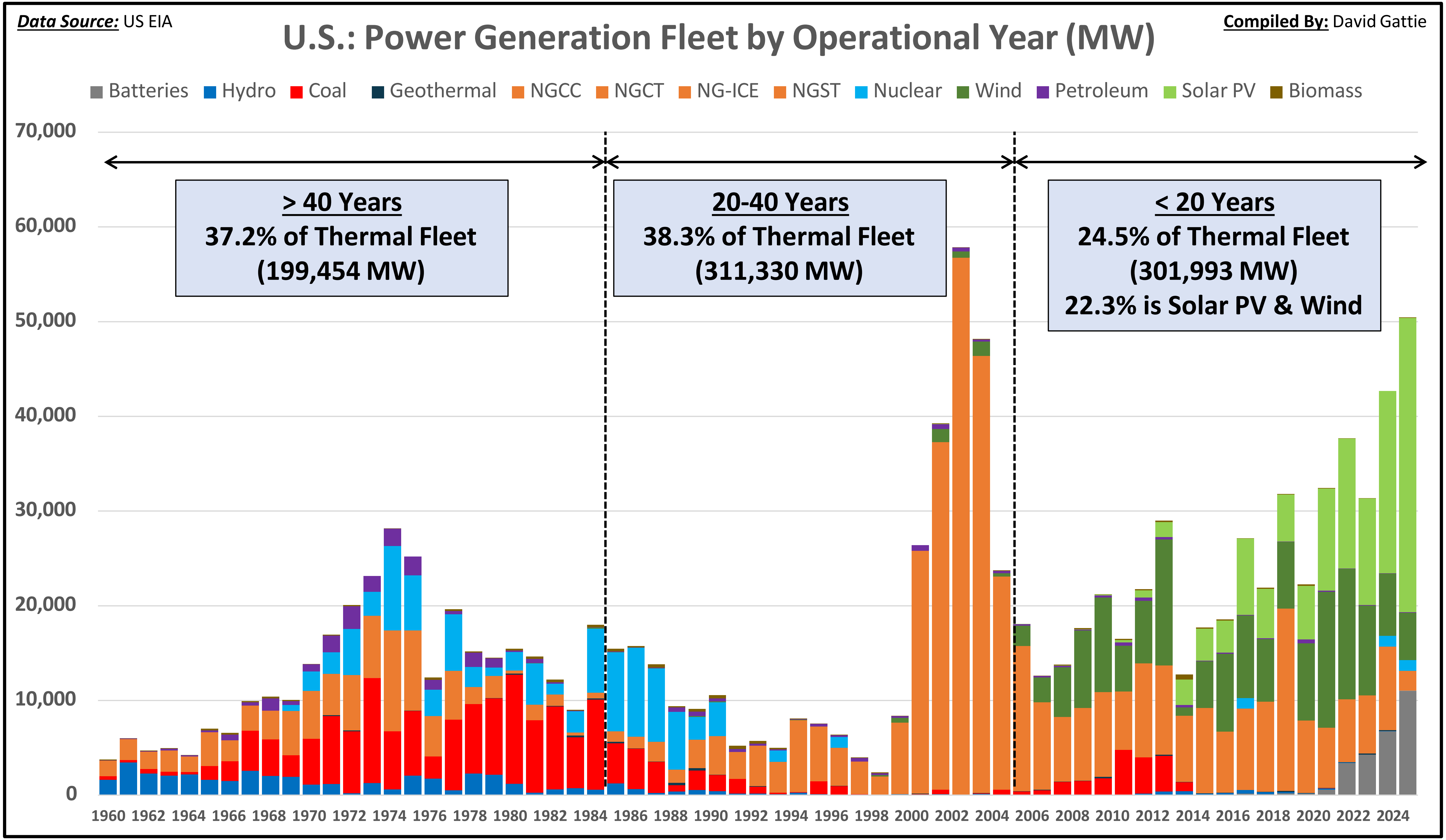


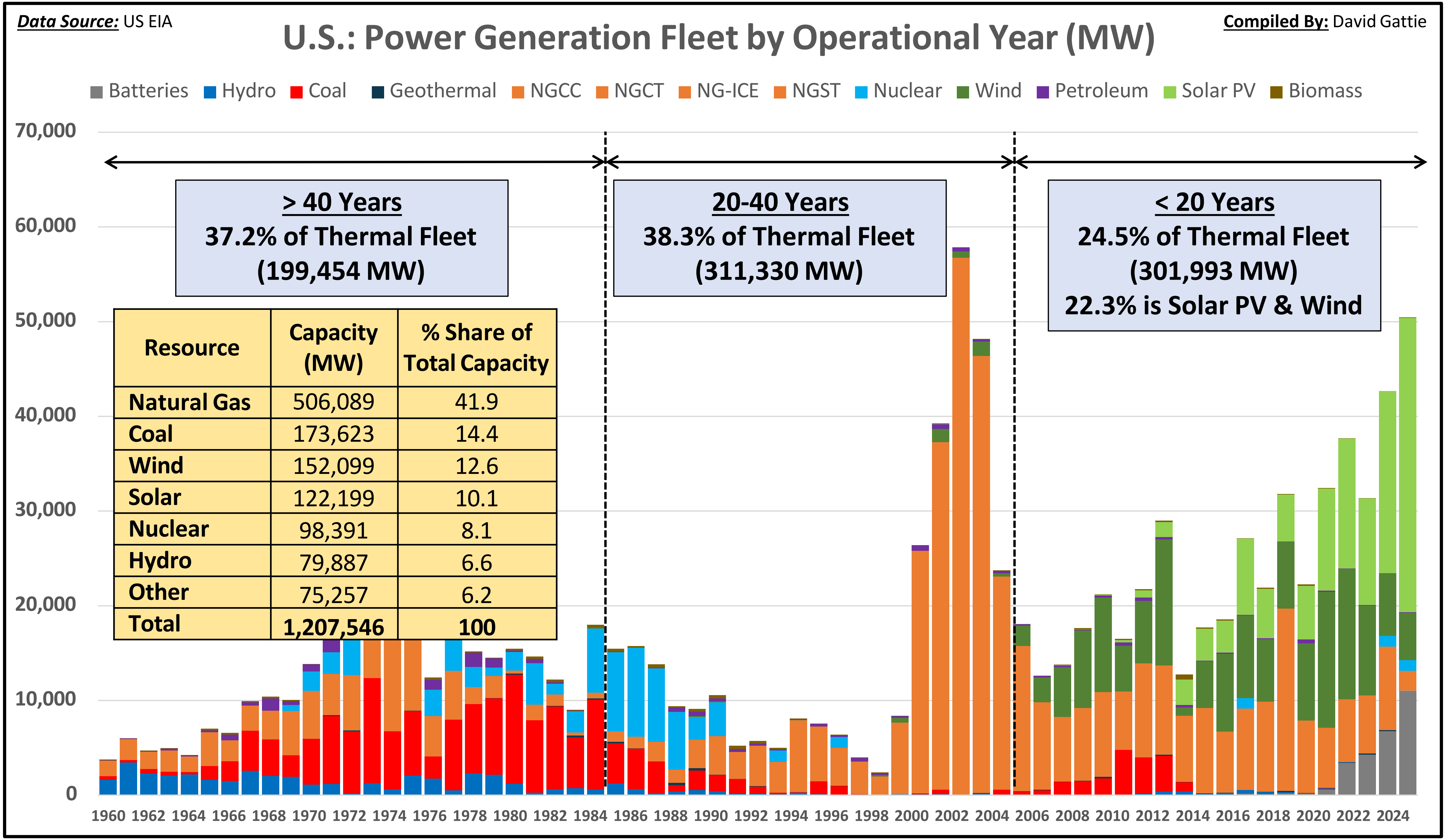
Figure 1: Summer Reliability Risk Area Summary

Seasonal Risk Assessment Summary	
High	Potential for insufficient operating reserves in normal peak conditions
Elevated	Potential for insufficient operating reserves in above-normal conditions
Normal	Sufficient operating reserves expected

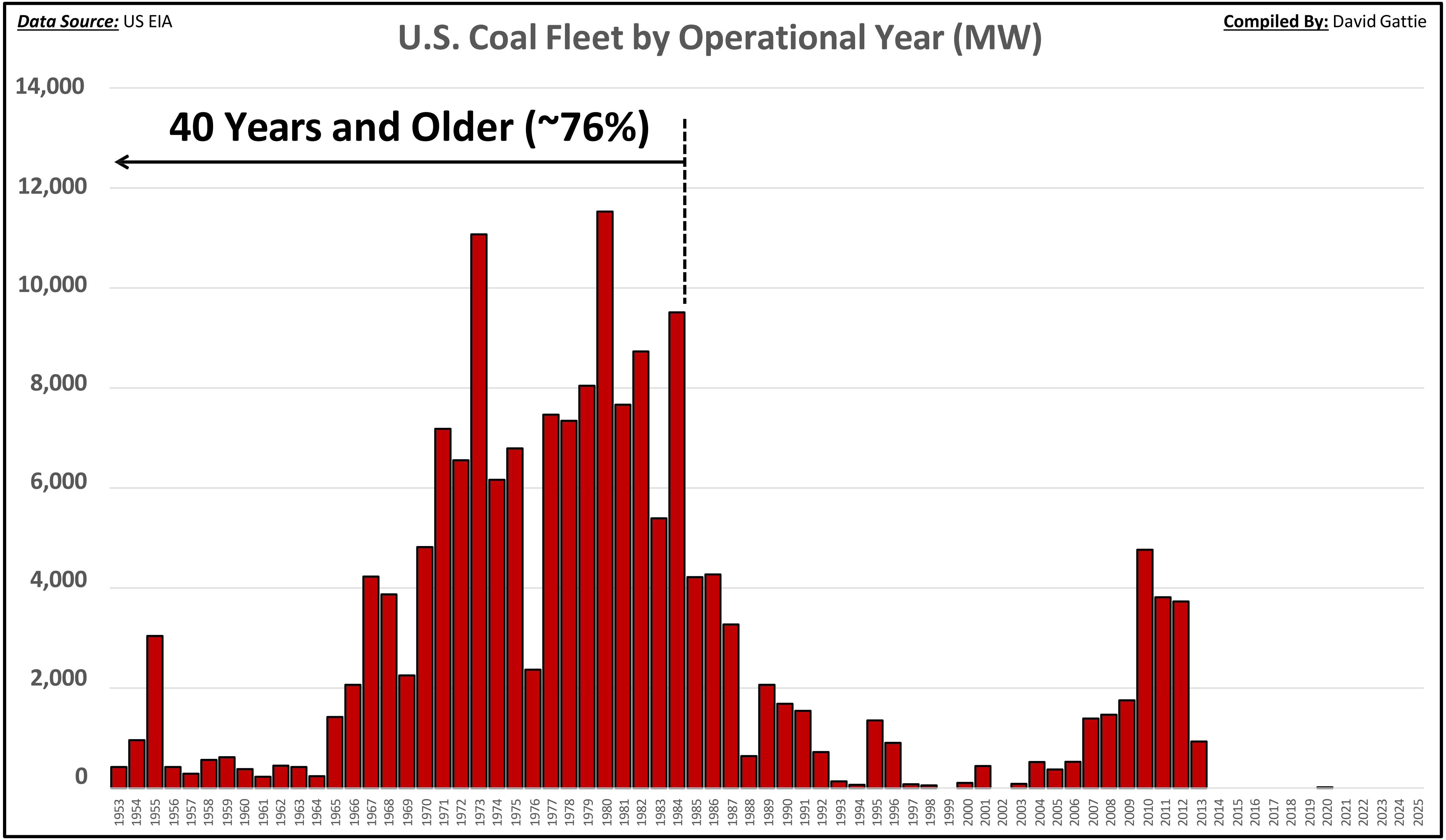
In the *2024 LTRA*, NERC finds that most of the North American BPS faces mounting resource adequacy challenges over the next 10 years as surging demand growth continues and thermal generators announce plans for retirement. New solar PV, battery, and hybrid resources continue to flood interconnection queues, but completion rates are lagging behind the need for new generation. Furthermore, the performance of these replacement resources is more variable and weather-dependent than the generators they are replacing. As a result, less overall capacity (dispatchable capacity in particular) is being added to the system than what was projected and needed to meet future demand. **The trends point to critical reliability challenges facing the industry: satisfying escalating energy growth, managing generator retirements, and accelerating resource and transmission development.**

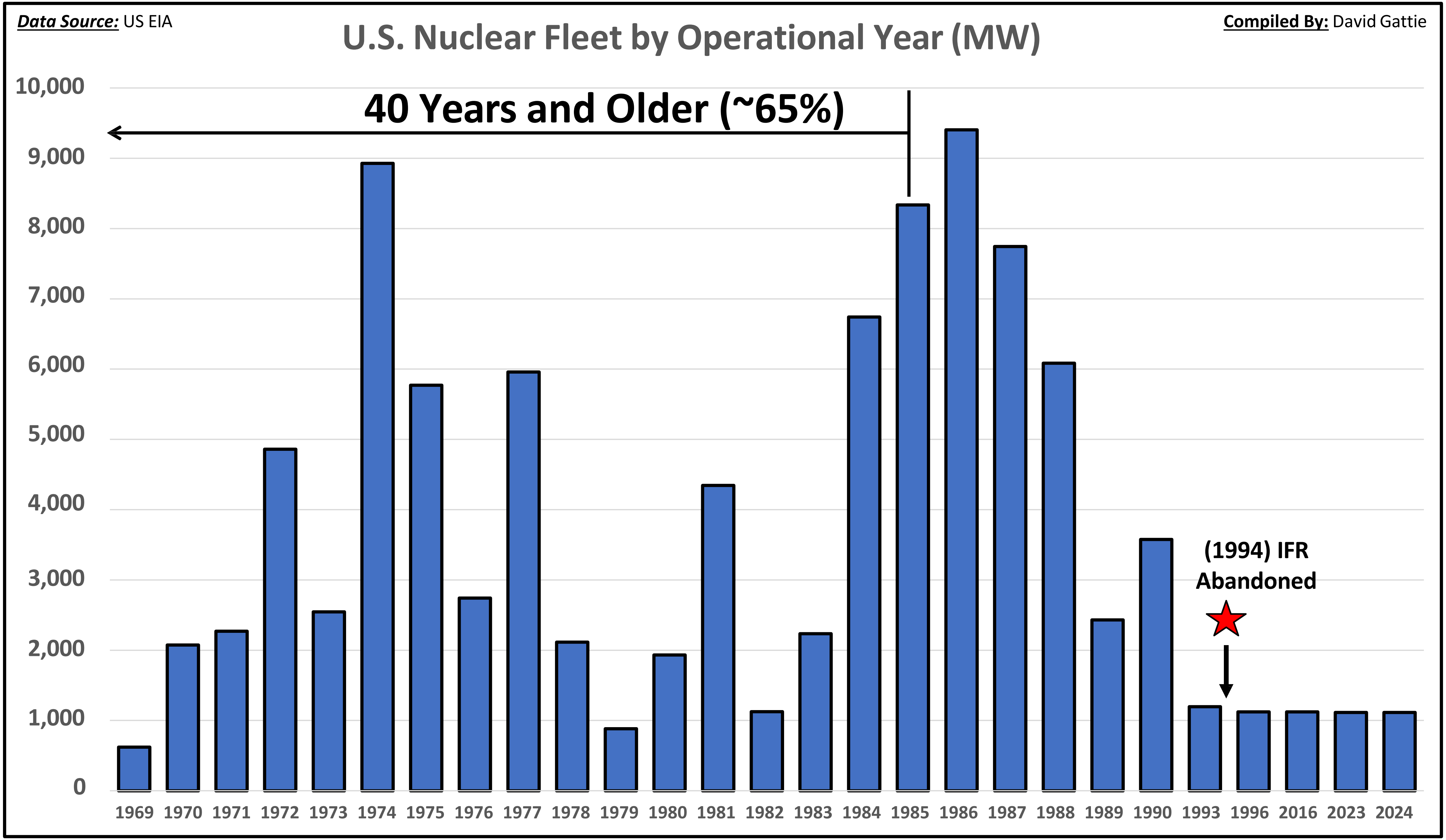


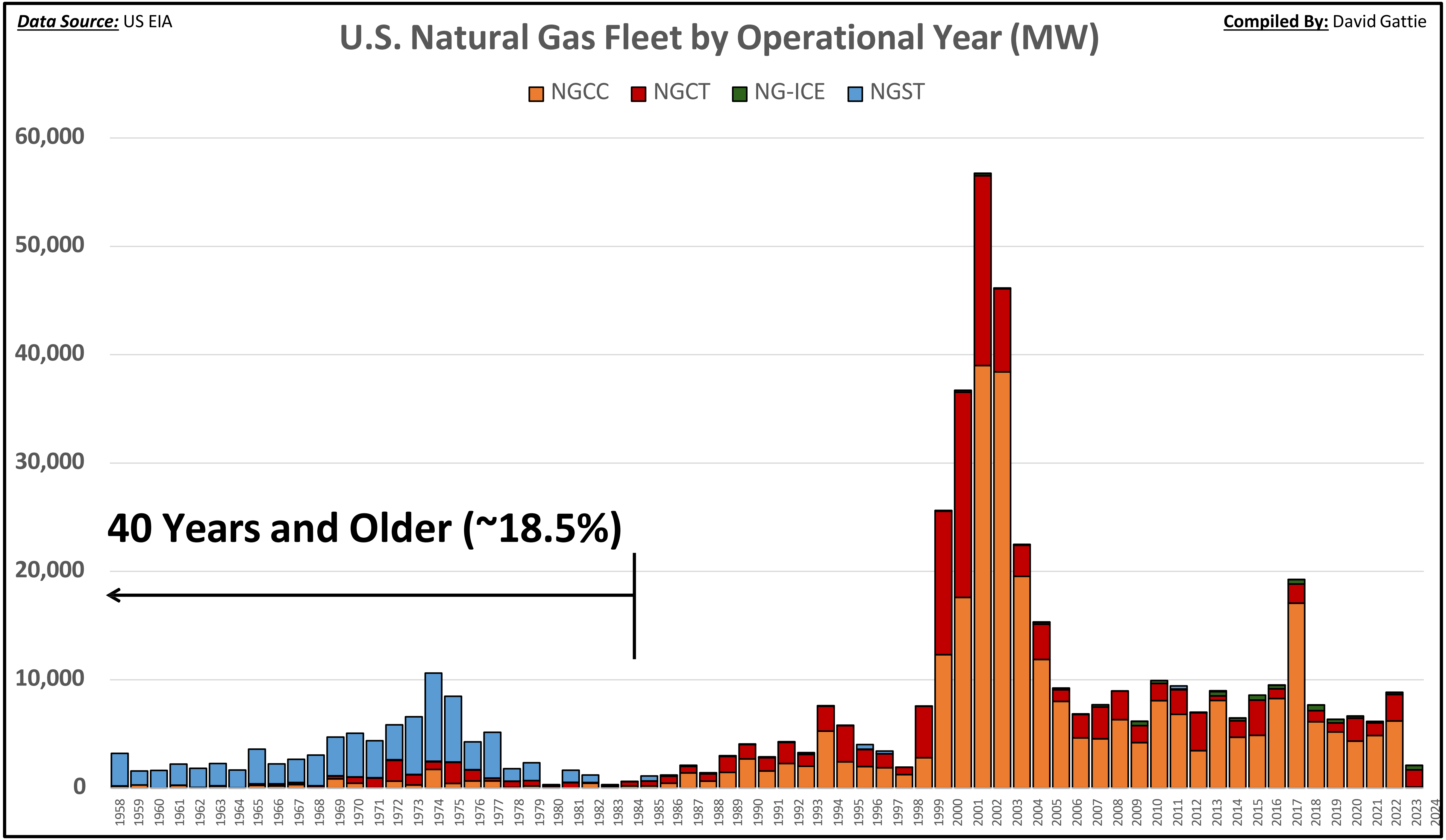
Data Source: US EIA
U.S.: Power Generation Fleet by Operational Year (MW)
Compiled By: David Gattie
Batteries
Hydro
Coal
Geothermal
NGCC
NGCT
NG-ICE
NGST
Nuclear
Wind
Petroleum
Solar PV
Biomass
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
> 40 Years
37.2% of Thermal Fleet
(199,454 MW)
20-40 Years
38.3% of Thermal Fleet
(311,330 MW)
< 20 Years
24.5% of Thermal Fleet
(301,993 MW)
22.3% is Solar PV & Wind
1960 1962 1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020 2022 2024



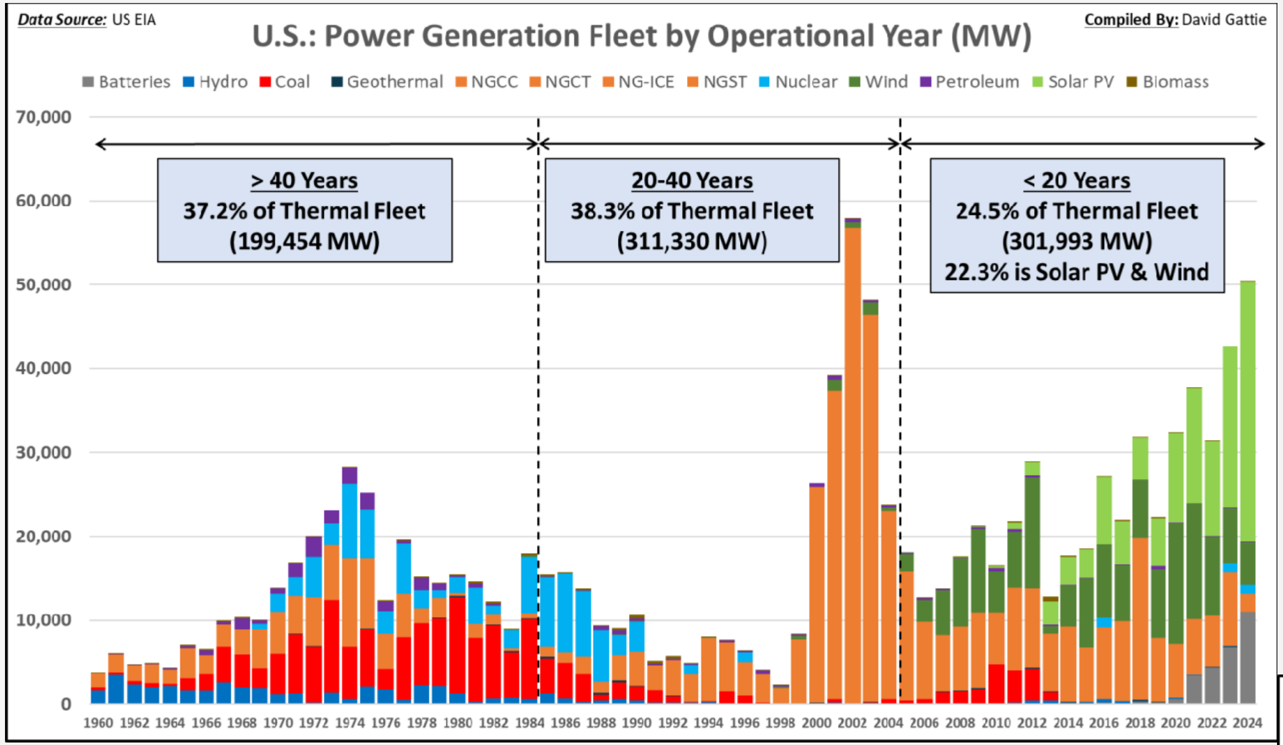
Resource	Capacity (MW)	% Share of Total Capacity
Natural Gas	506,089	41.9
Coal	173,623	14.4
Wind	152,099	12.6
Solar	122,199	10.1
Nuclear	98,391	8.1
Hydro	79,887	6.6
Other	75,257	6.2
Total	**1,207,546**	**100**


Data Source: US EIA
U.S. Coal Fleet by Operational Year (MW)
Compiled By: David Gattie
40 Years and Older (~76%)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025


Data Source: US EIA
U.S. Nuclear Fleet by Operational Year (MW)
Compiled By: David Gattie
40 Years and Older (~65%)
(1994) IFR Abandoned
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1993 1996 2016 2023 2024

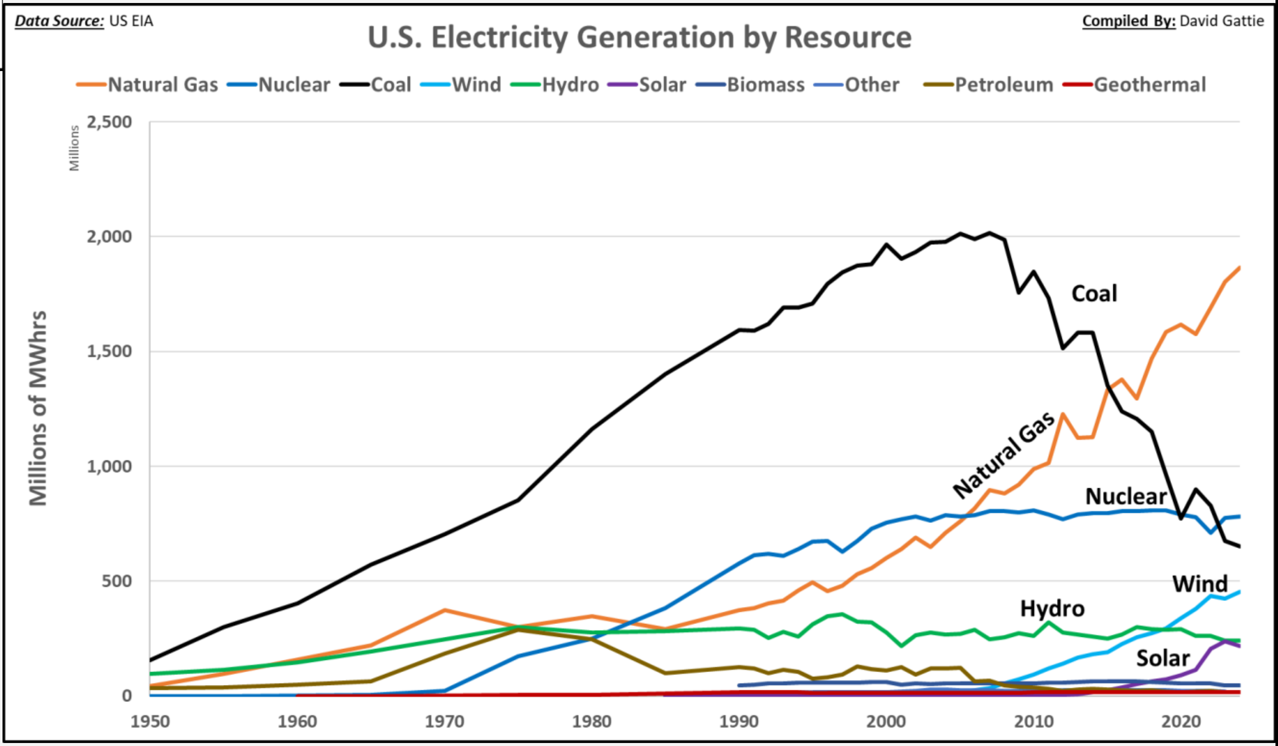


Data Source: US EIA
U.S. Natural Gas Fleet by Operational Year (MW)
Compiled By: David Gattie
NGCC
NGCT
NG-ICE
NGST
60,000
50,000
40,000
30,000
20,000
10,000
0
40 Years and Older (~18.5%)
1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024



Current
Thermal
66.2%

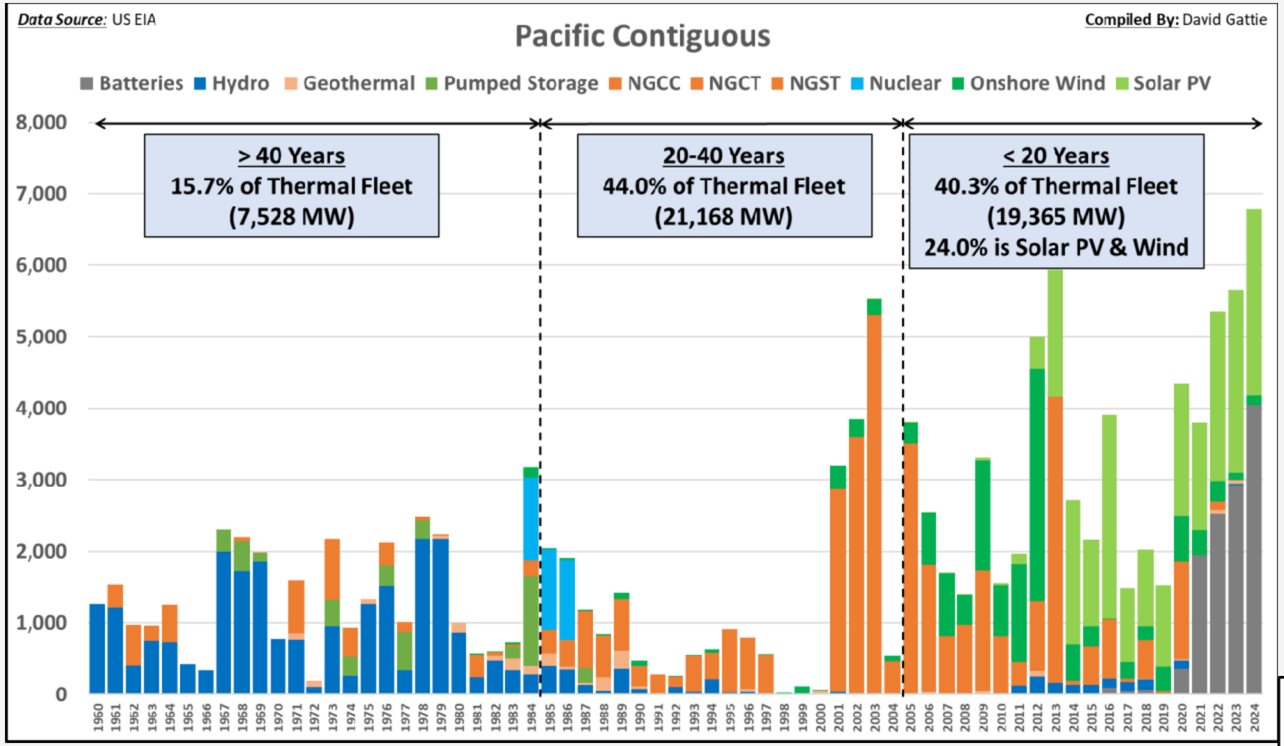
Technology	Capacity (MW)	% Share of Total Capacity
NGCC	291,805	24.2
Coal	173,623	14.4
Onshore Wind	151,928	12.6
NGCT	133,064	11.0
Solar PV	122,199	10.1
Nuclear	98,391	8.1
Hydro	79,887	6.6
NGST	74,904	6.2
Petroleum	27,282	2.3
Other	54,464	4.5
Total	**1,207,546**	



2024 Residential Rate

16.48 cents/kWhr

U.S. Regions

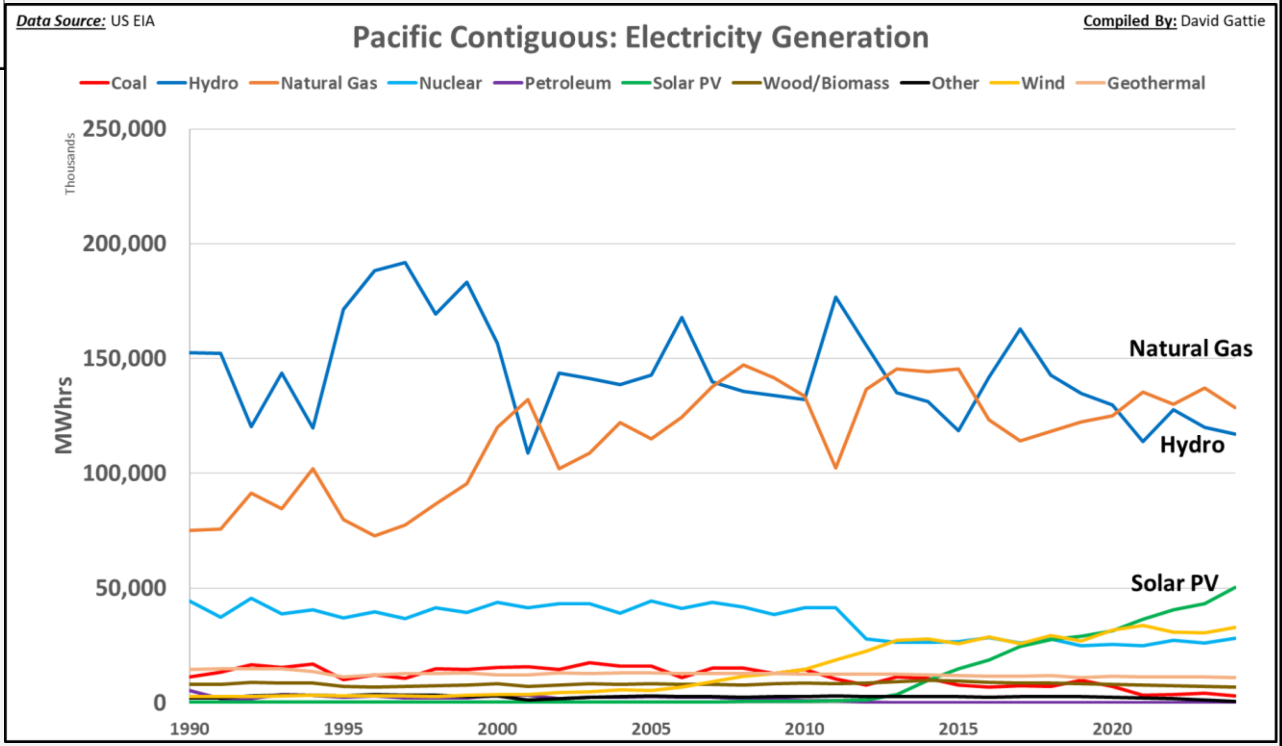


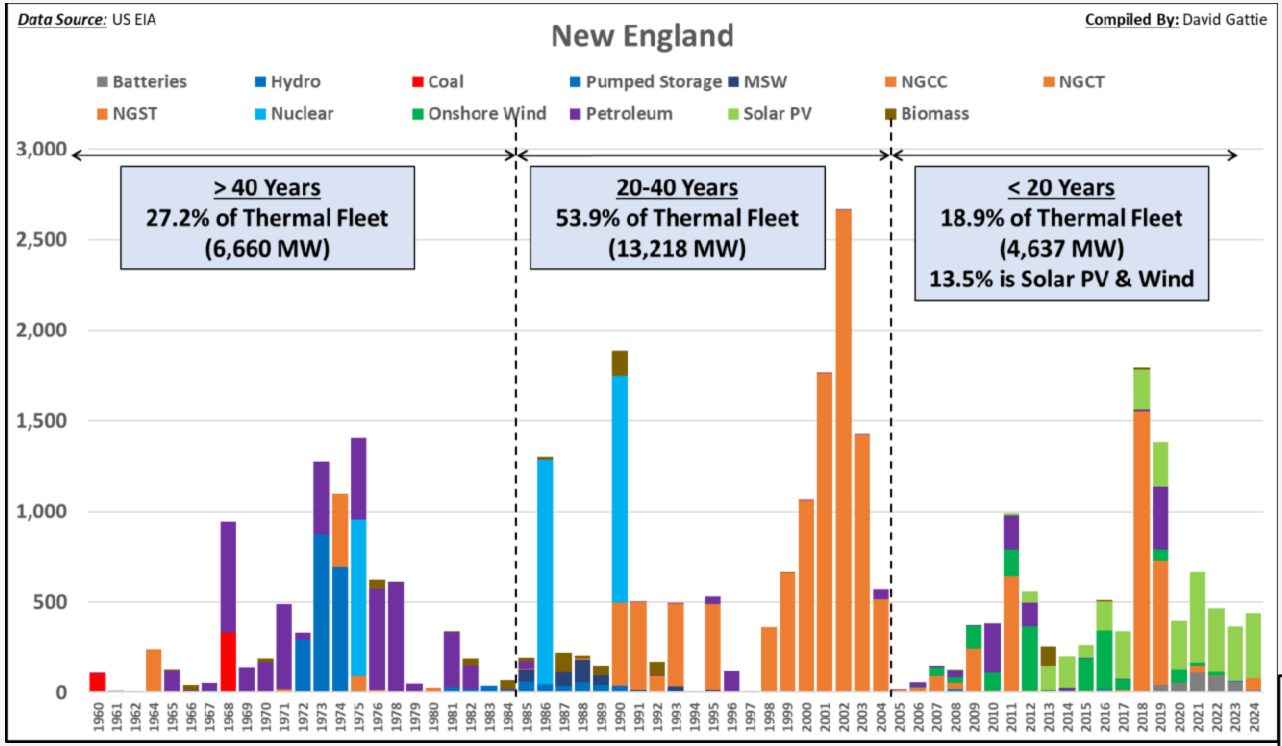
Technology	Capacity (MW)	% Share of Total Capacity
Hydro	39,991	27.5
NGCC	26,458	18.2
Solar PV	22,666	15.6
Onshore Wind	13,802	9.5
NGCT	12,350	8.5
Batteries	12,043	8.3
Pumped Storage	4,184	2.9
NGST	3,747	2.6
Nuclear	3,391	2.3
Geothermal	1,901	1.3
Total	**145,465**	

Current Thermal 32.9%

States
California
Oregon
Washington

2024 Residential Rate
24.15 cents/kWhr
U.S. Avg: 16.48





Technology	Capacity (MW)	% Share of Total Capacity
NGCC	12,524	36.1
Petroleum	5,557	16.0
Nuclear	3,354	9.7
Solar PV	3,121	9.0
Hydro	1,952	5.6
Pumped Storage	1,863	5.4
Wind	1,546	4.5
NGCT	1,456	4.2
Other Thermal	1,448	4.2
Total	34,702	

Current Thermal 70.1%

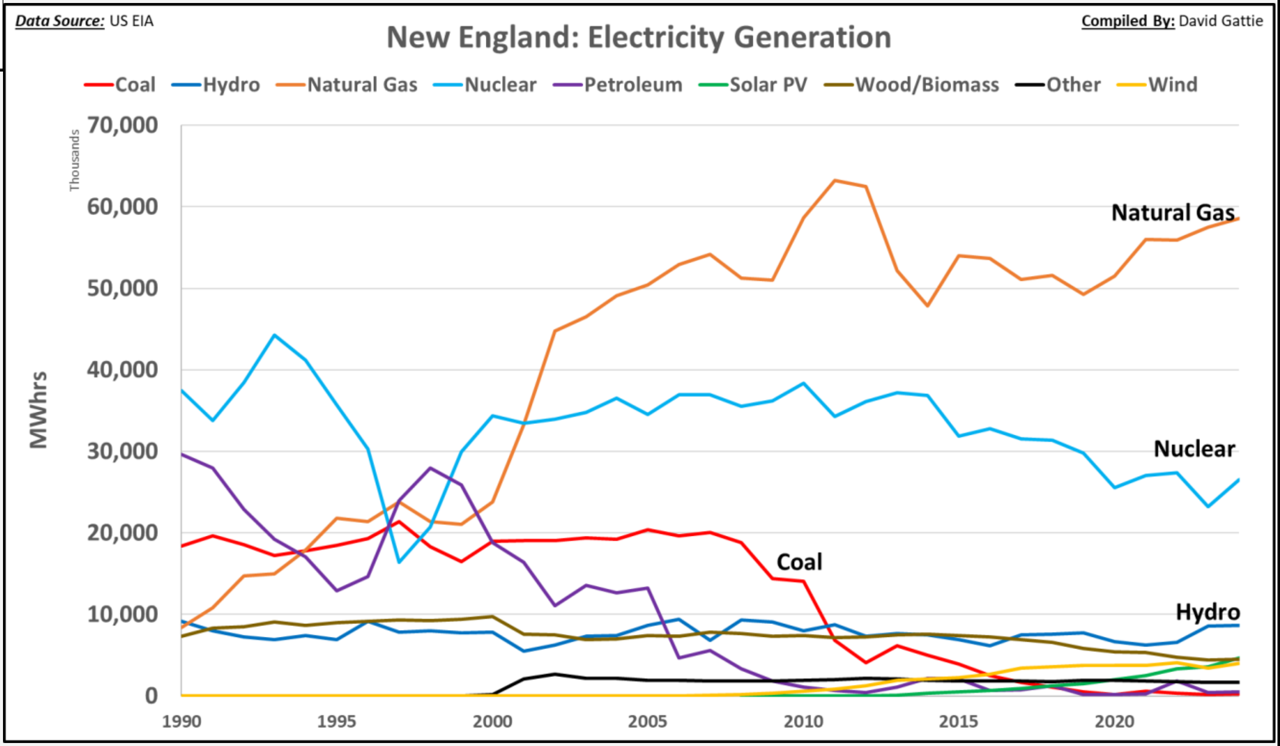
States

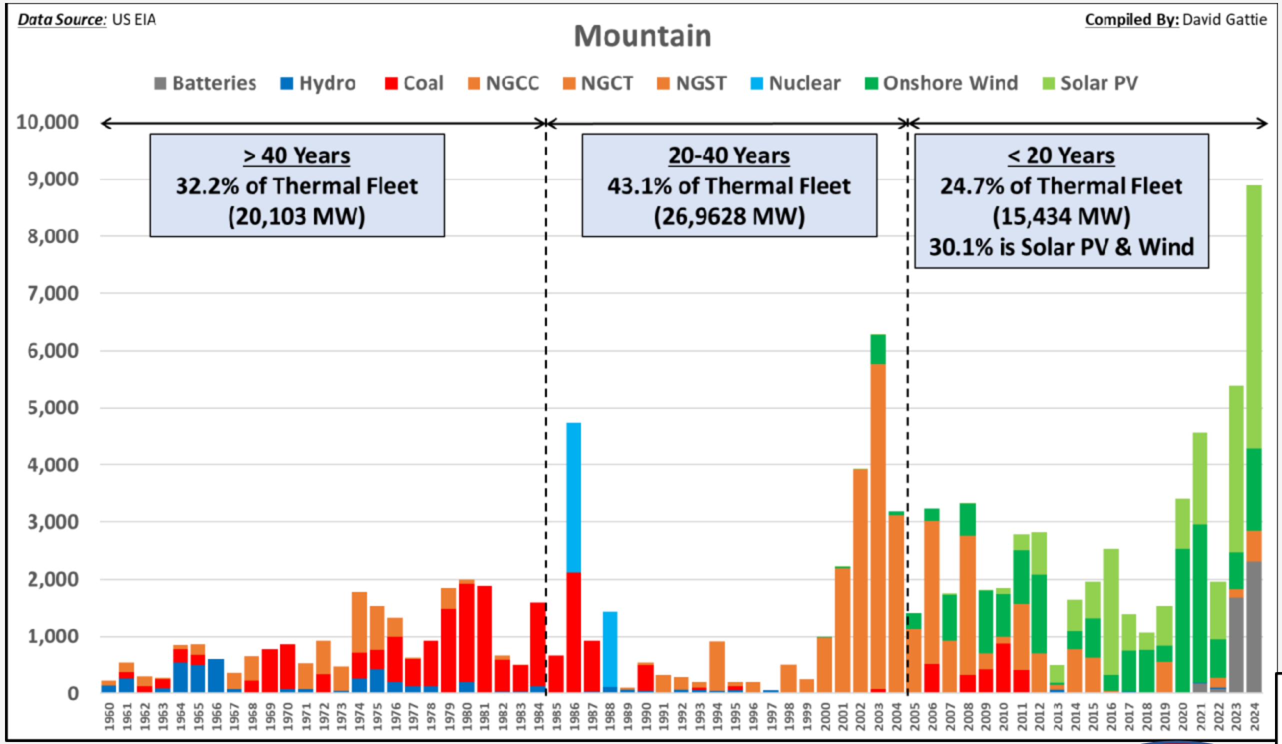
Connecticut
Maine
Massachusetts
New Hampshire
Rhode Island
Vermont

2024 Residential Rate

27.62 cents/kWhr

U.S. Avg: 16.48



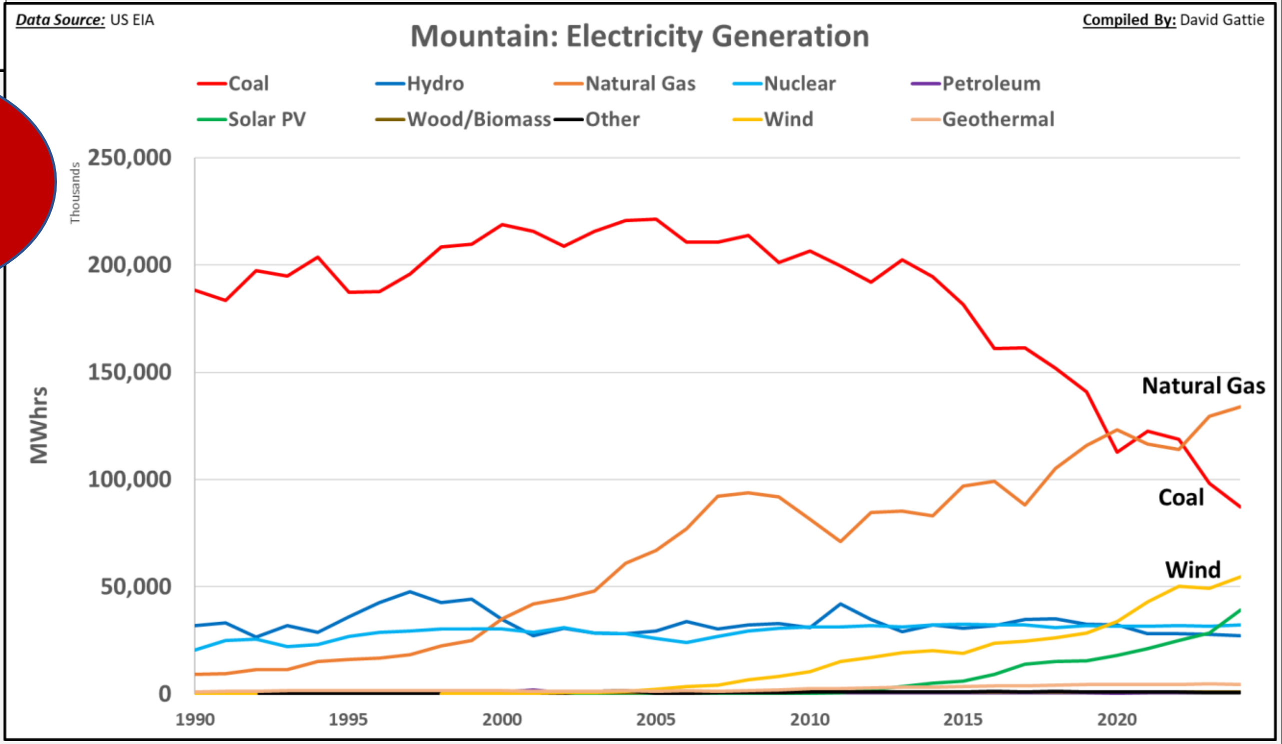


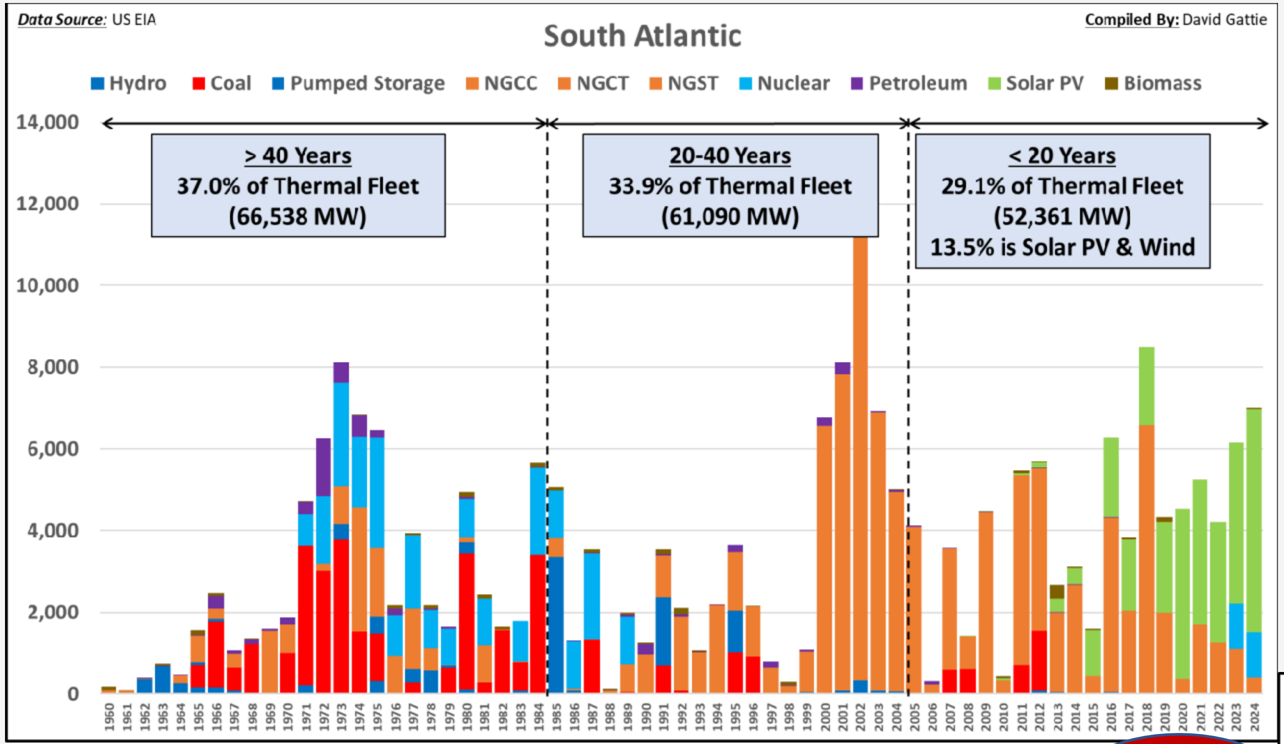
Technology	Capacity (MW)	% Share of Total Capacity
NGCC	23,011	20.0
Coal	20,209	17.6
Onshore Wind	17,736	15.4
Solar PV	17,572	15.3
Hydro	10,594	9.2
NGCT	9,916	8.6
Batteries	4,312	3.7
NGST	4,128	3.6
Nuclear	3,937	3.4
Total	115,142	

States
Arizona
Colorado
Idaho
Montana
Nevada
New Mexico
Utah
Wyoming

Current Thermal
54.2%

2024 Residential Rate
14.09 cents/kWhr
U.S. Avg: 16.48





Technology	Capacity (MW)	% Share of Total Capacity
NGCC	65,889	28.4
Coal	35,415	15.3
NGCT	32,492	14.0
Solar PV	29,971	12.9
Nuclear	27,018	11.6
NGST	12,948	5.6
Pumped Storage	8,273	3.6
Hydro	7,054	3.0
Petroleum	5,849	2.5
Biomass	2,649	1.1
Total	**232,141**	

States

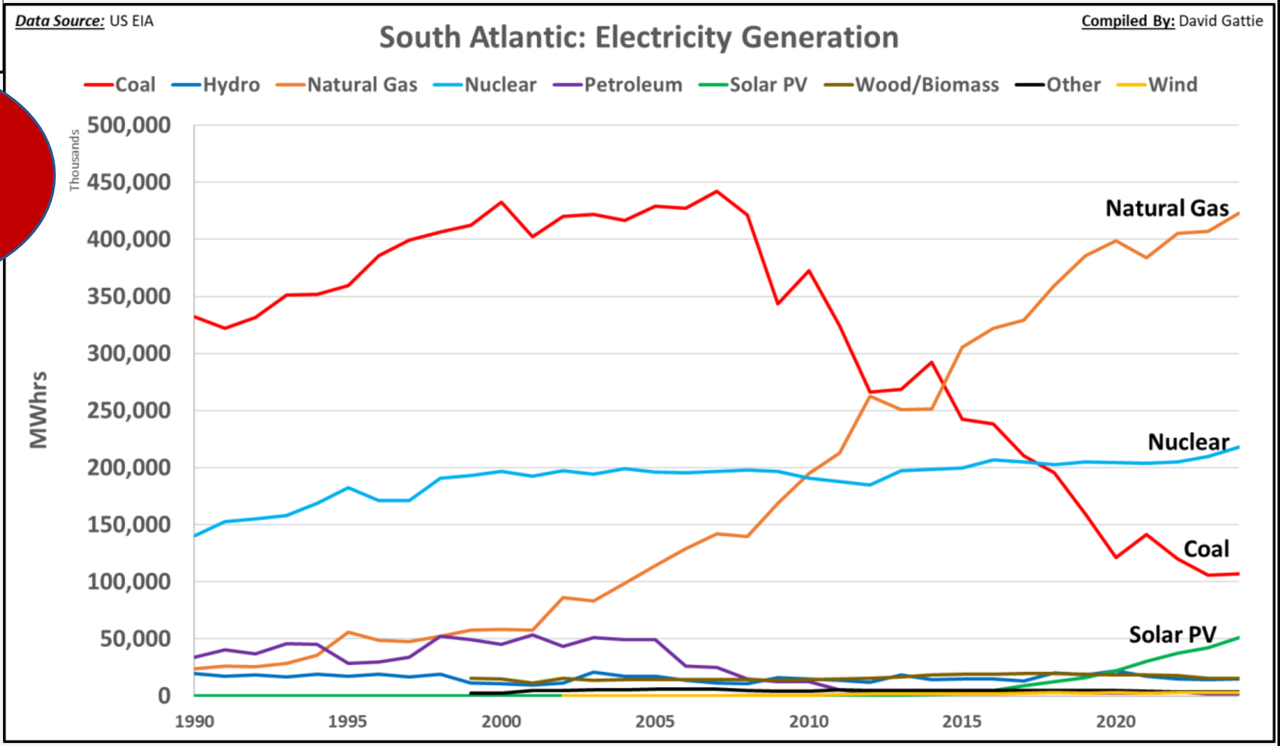
Delaware
DC
Florida
Georgia
Maryland
North Carolina
South Carolina
Virginia
West Virginia

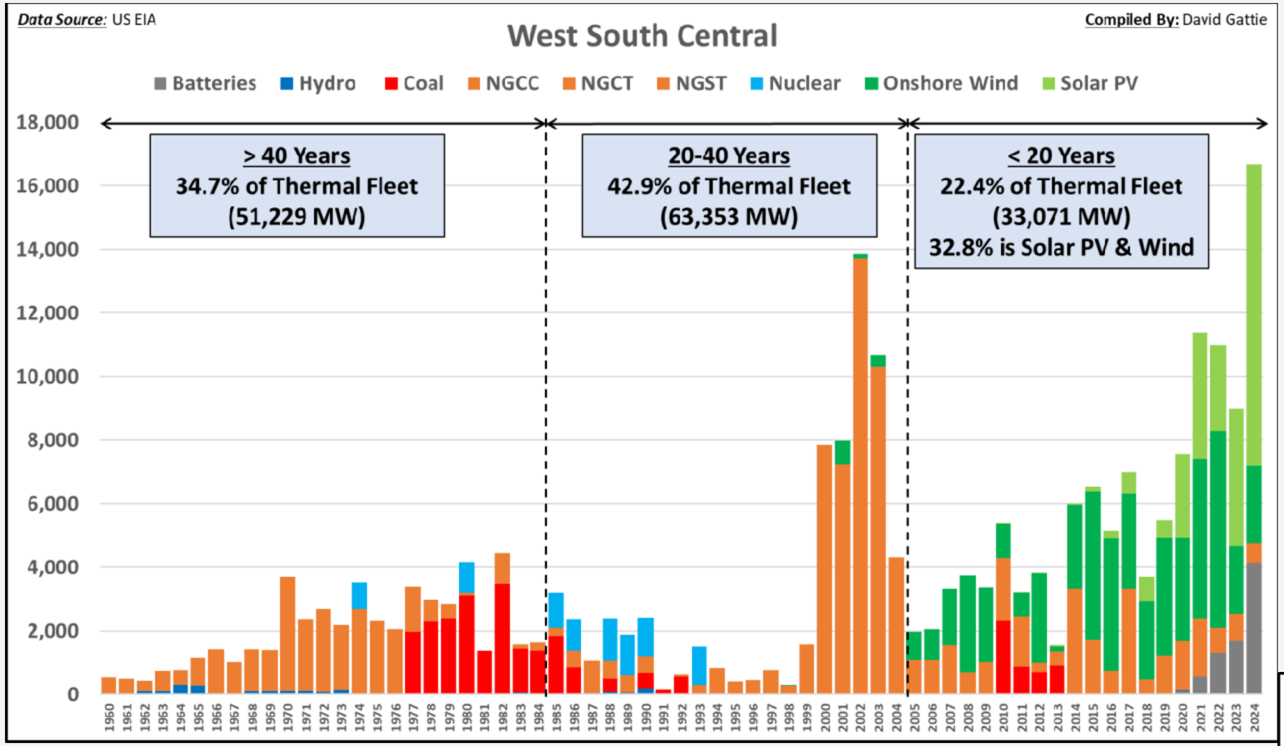
Current Thermal 77.5%

2024 Residential Rate

14.53 cents/kWhr

U.S. Avg: 16.48



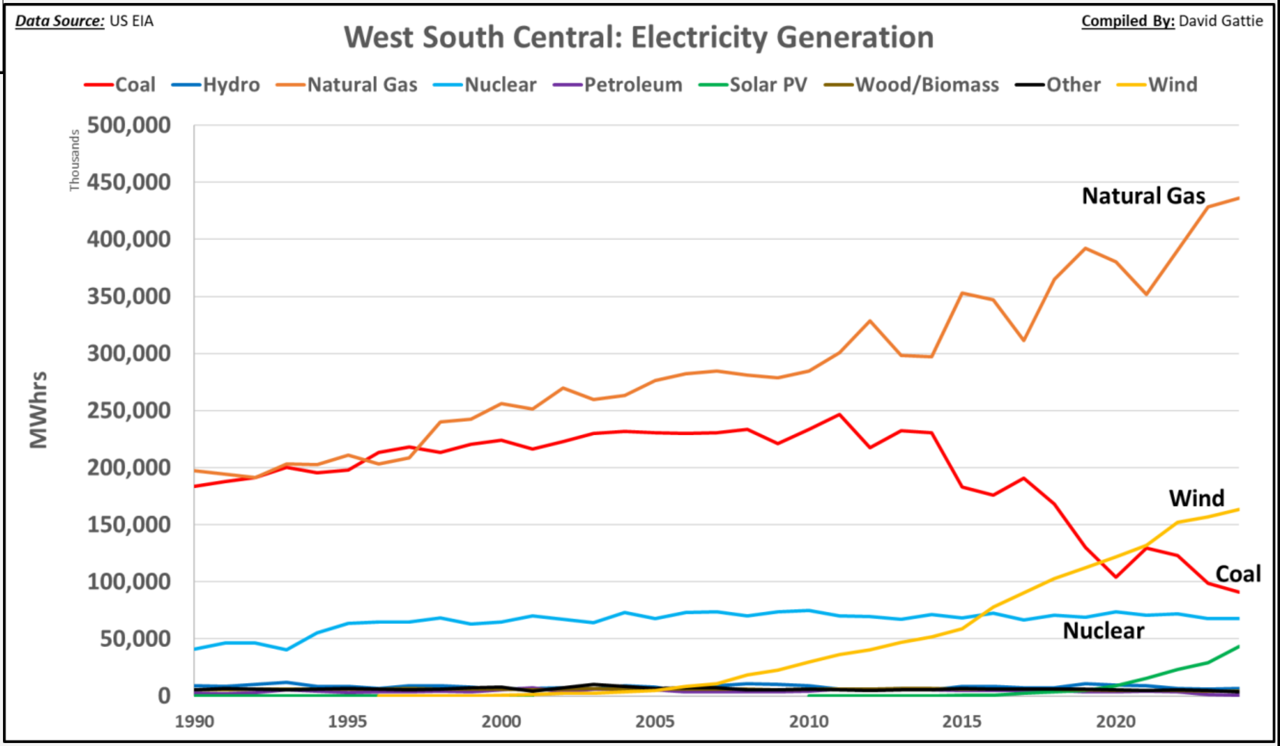


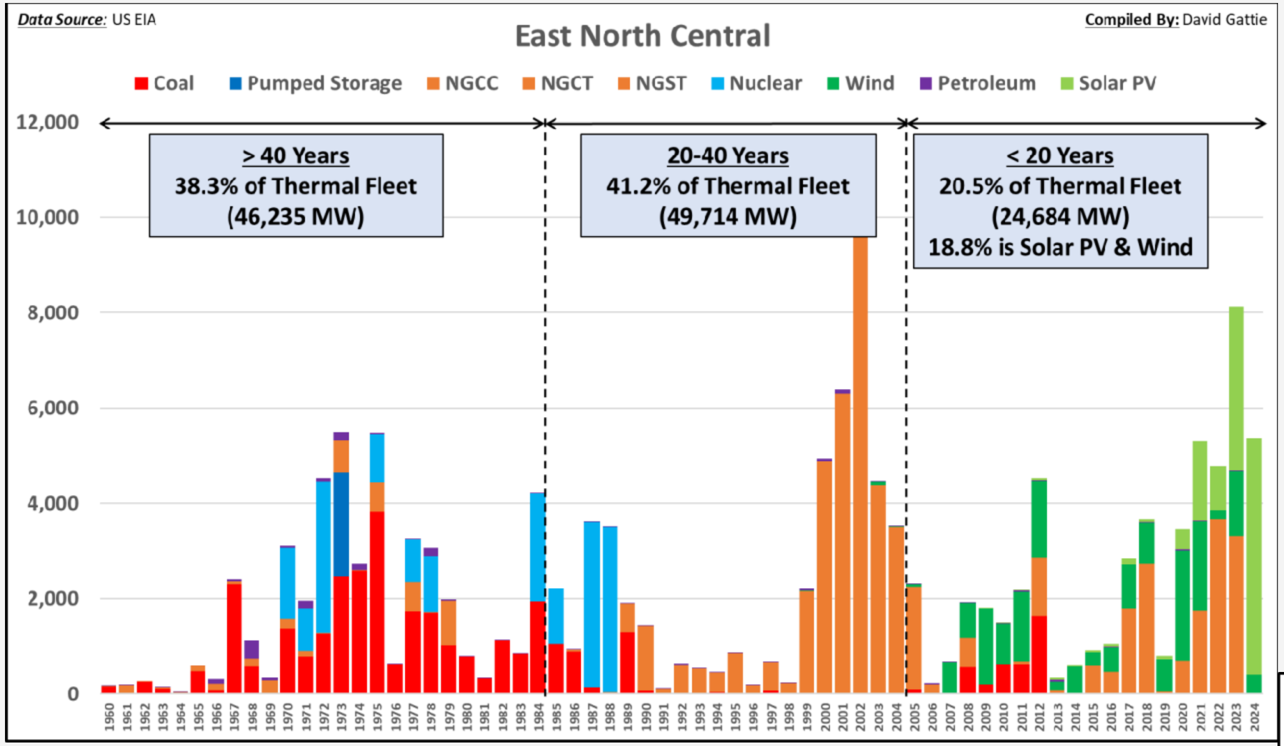
Technology	Capacity (MW)	% Share of Total Capacity
NGCC	64,444	26.7
Onshore Wind	54,726	22.7
NGST	27,390	11.4
Coal	26,394	10.9
Solar PV	25,724	10.7
NGCT	17,447	7.2
Nuclear	8,853	3.7
Batteries	7,943	3.3
Hydro	3,002	1.2
Total	**241,304**	

Current Thermal 60.8%

States
Arkansas
Louisiana
Oklahoma
Texas

2024 Residential Rate
14.04 cents/kWhr
U.S. Avg: 16.48



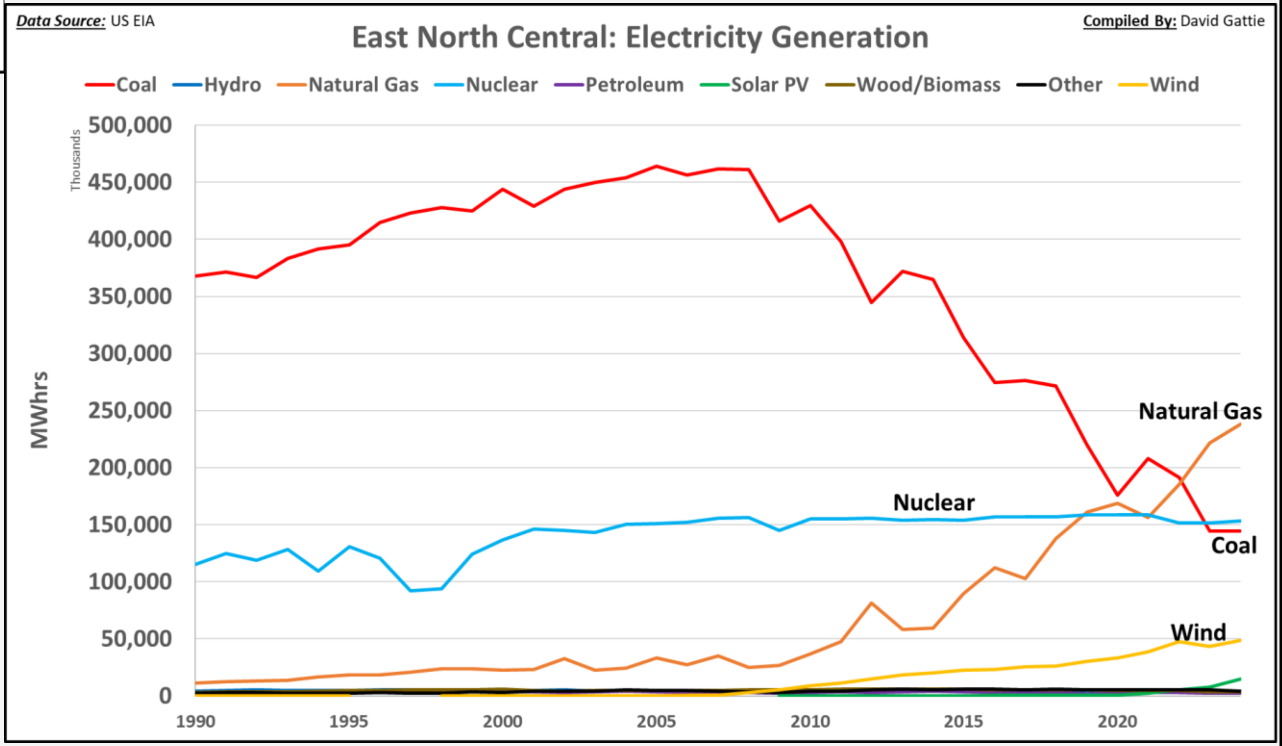


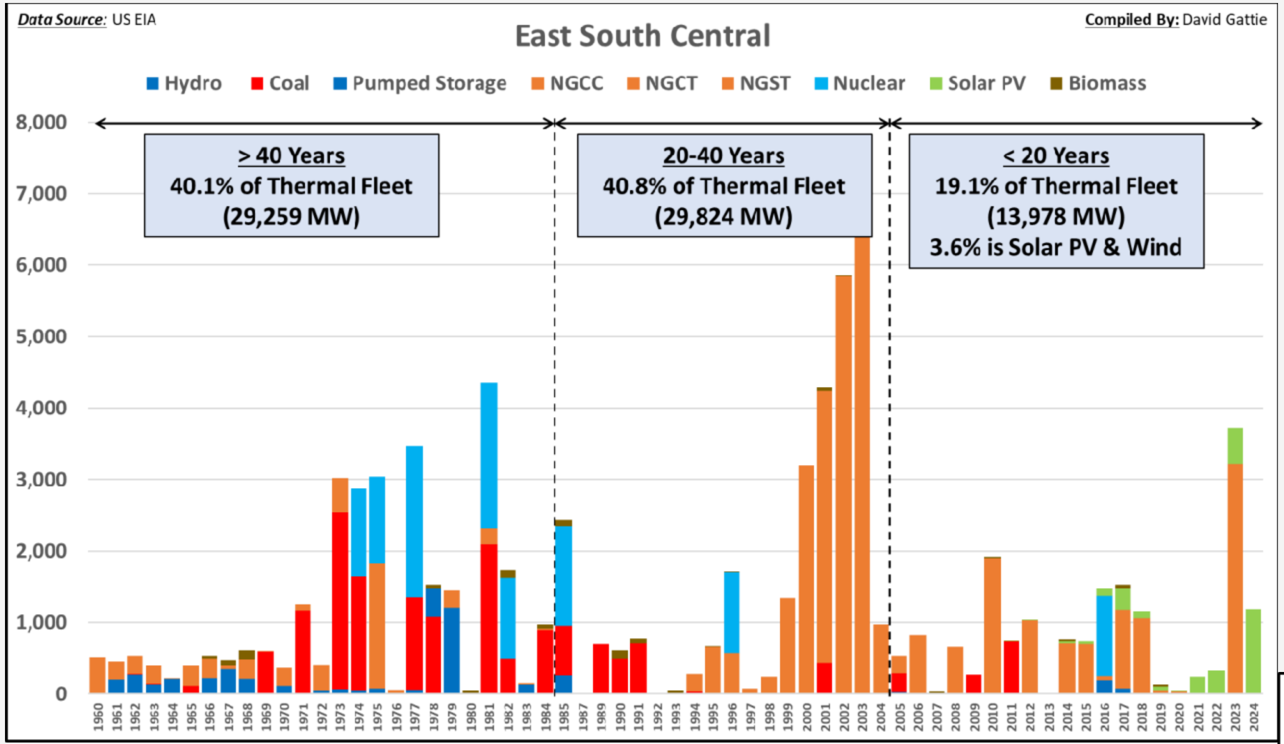
Technology	Capacity (MW)	% Share of Total Capacity
Coal	35,957	23.3
NGCC	31,065	20.2
NGCT	26,166	17.0
Nuclear	18,997	12.3
Wind	17,215	11.2
Solar PV	11,935	7.7
NGST	3,839	2.5
Pumped Storage	2,180	1.4
Petroleum	2,147	1.4
Total	**154,162**	

Current Thermal 77.2%

States
Illinois
Indiana
Michigan
Ohio
Wisconsin

2024 Residential Rate
16.53 cents/kWhr
U.S. Avg: 16.48



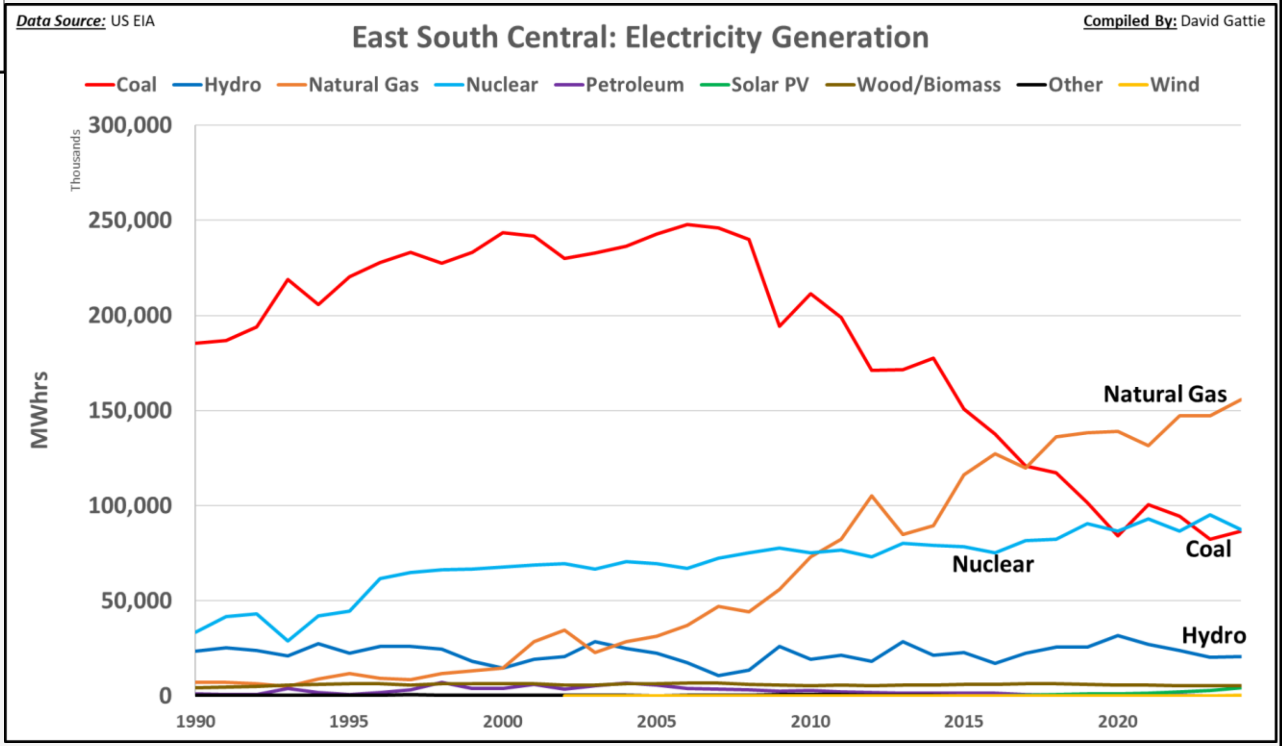


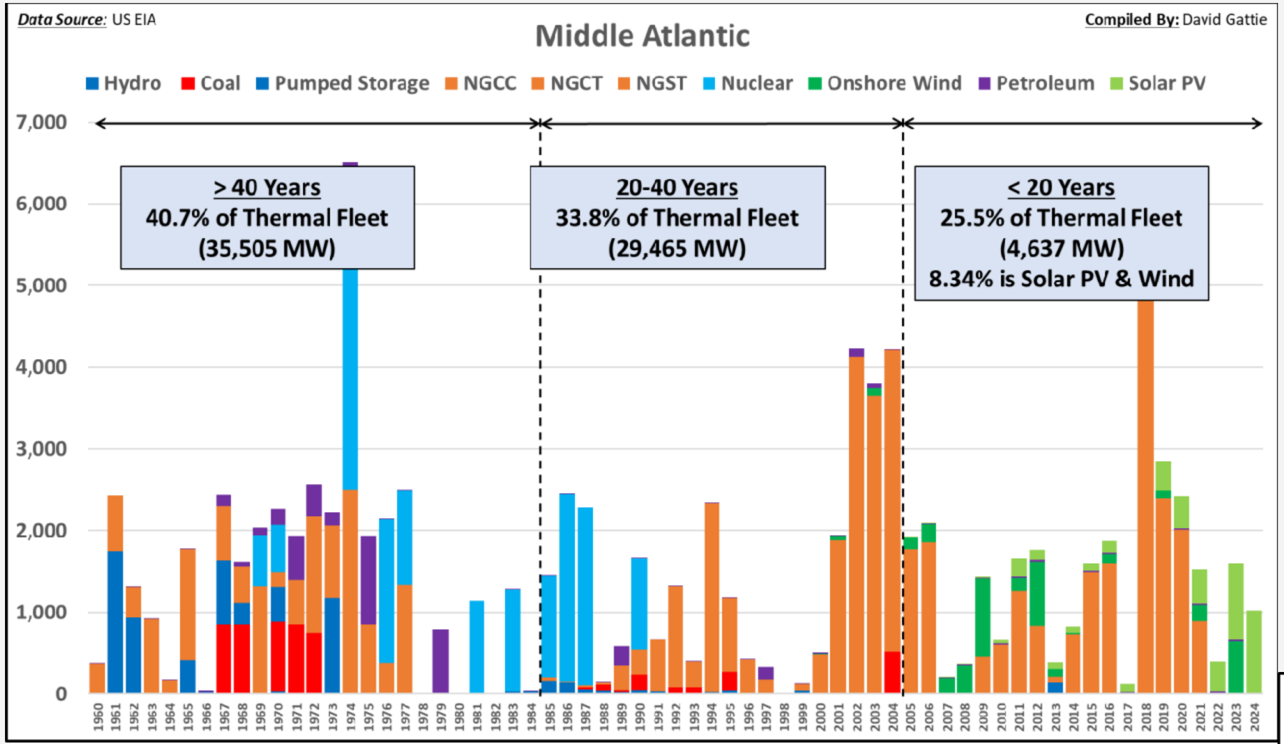
Technology	Capacity (MW)	% Share of Total Capacity
NGCC	23,835	27.7
Coal	19,507	22.7
NGCT	13,685	15.9
Nuclear	11,366	13.2
Hydro	7,037	8.2
NGST	4,082	4.8
Solar PV	2,910	3.4
Pumped Storage	1,616	1.9
Biomass	1,033	1.2
Total	**85,942**	

Current Thermal
85.0%

States
Alabama
Kentucky
Mississippi
Tennessee

2024 Residential Rate
13.45 cents/kWhr
U.S. Avg: 16.48



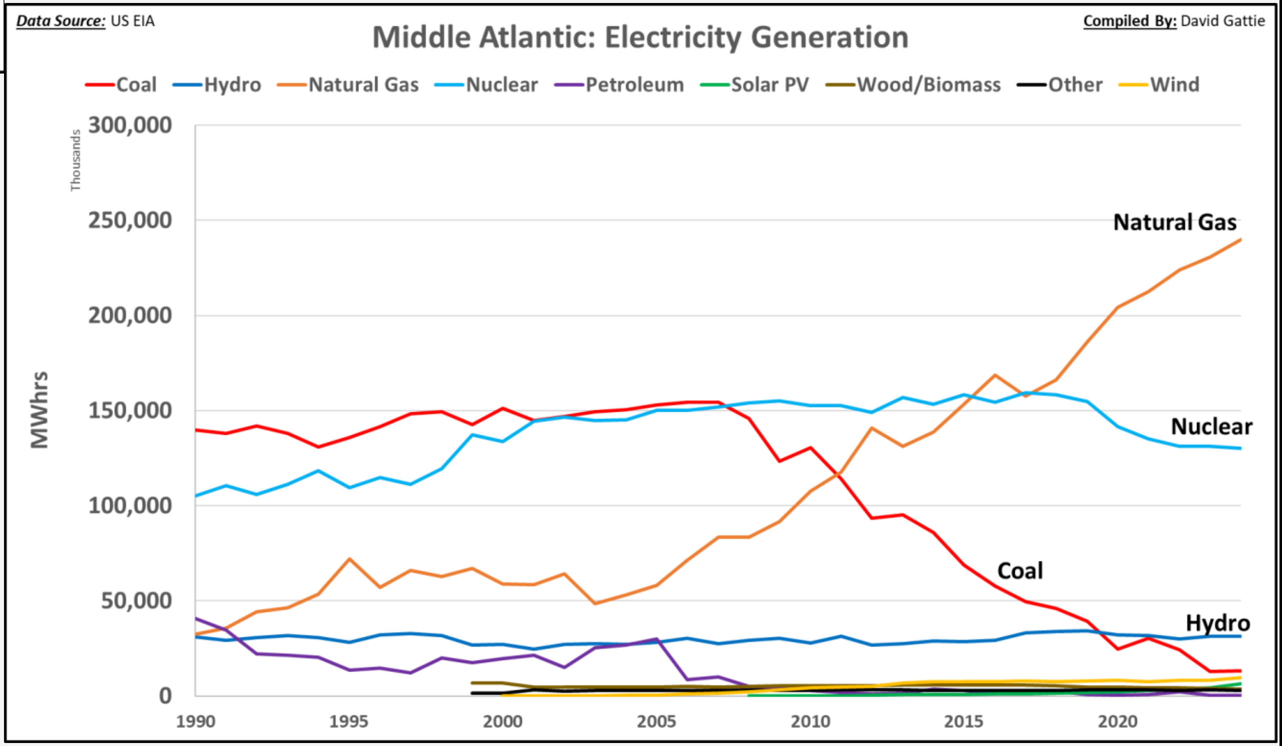


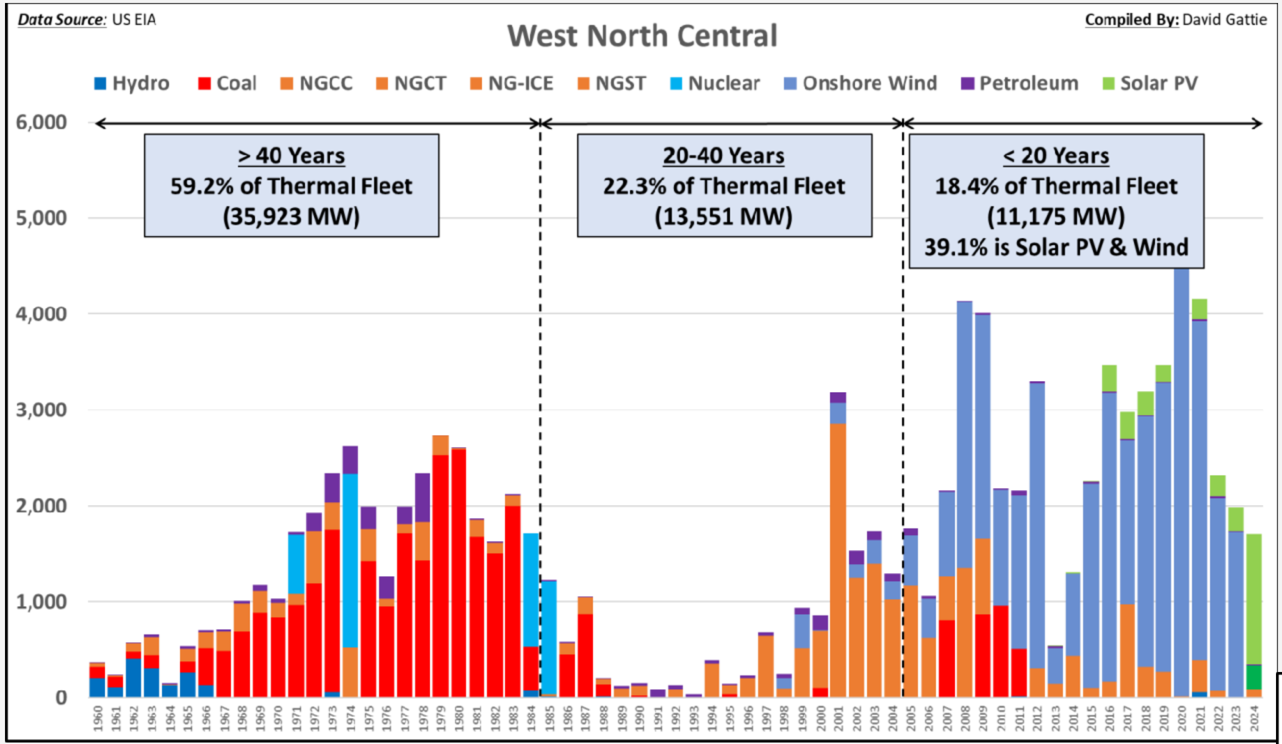
Technology	Capacity (MW)	% Share of Total Capacity
NGCC	37,152	34.8
Nuclear	16,683	15.6
NGST	15,487	14.5
NGCT	6,971	6.5
Hydro	5,505	5.2
Coal	5,383	5.0
Petroleum	5,092	4.8
Solar PV	4,628	4.3
Onshore Wind	4,300	4.0
Pumped Storage	3,317	3.1
Total	**106,636**	

Current Thermal
81.7%

States
New Jersey
New York
Pennsylvania

2024 Residential Rate
20.63 cents/kWhr
U.S. Avg: 16.48





Technology	Capacity (MW)	% Share of Total Capacity
Onshore Wind	40,679	37.3
Coal	29,330	26.9
NGCT	11,874	10.9
NGCC	7,052	6.5
Nuclear	4,792	4.4
Petroleum	3,815	3.5
Hydro	3,364	3.1
Solar PV	3,199	2.9
NGST	2,368	2.2
NG-ICE	1,379	1.3
Total	108,986	

Current Thermal 55.6%

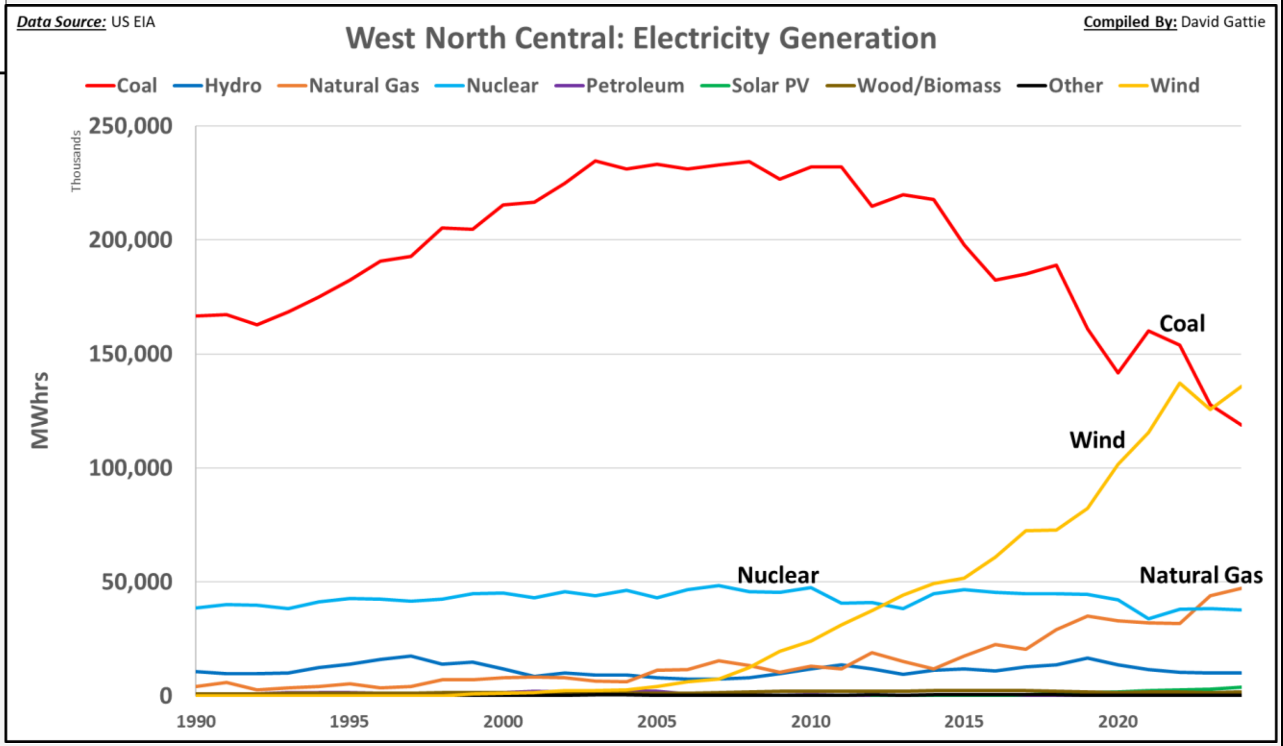
States

Iowa
Kansas
Minnesota
Missouri
Nebraska
North Dakota
South Dakota

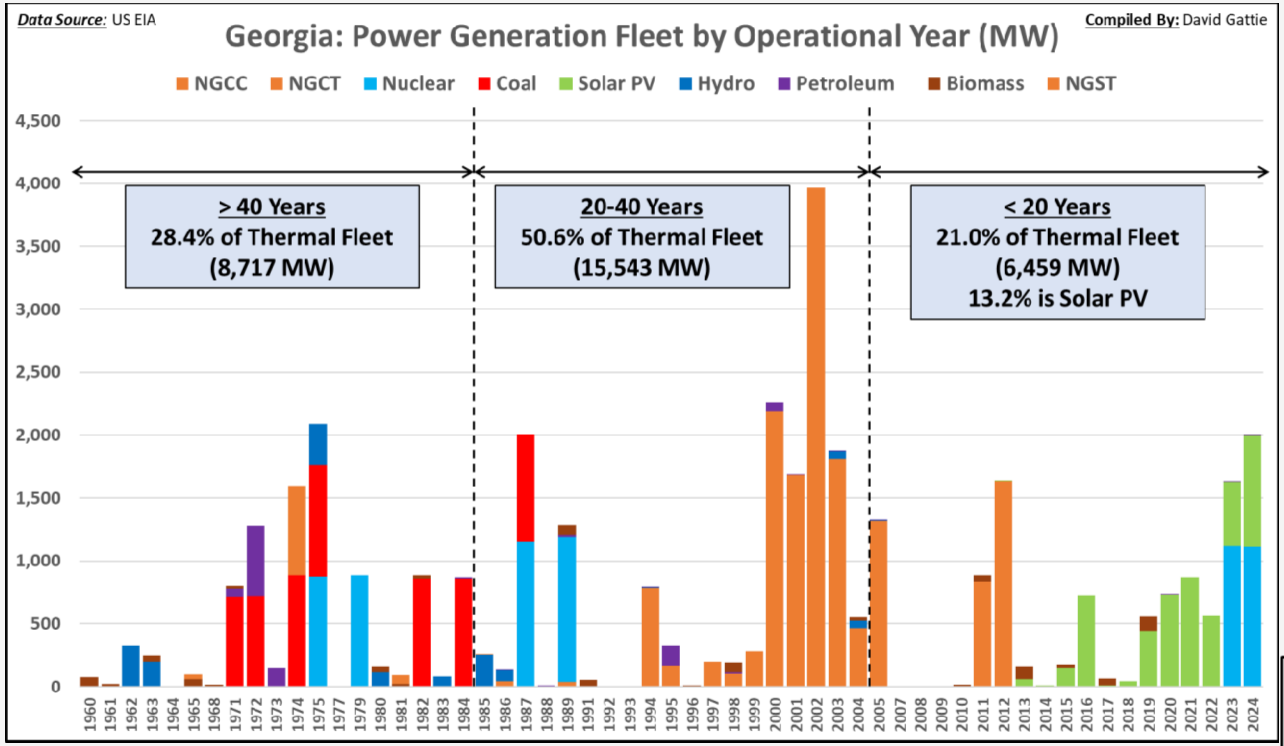
2024 Residential Rate

13.52 cents/kWhr

U.S. Avg: 16.48

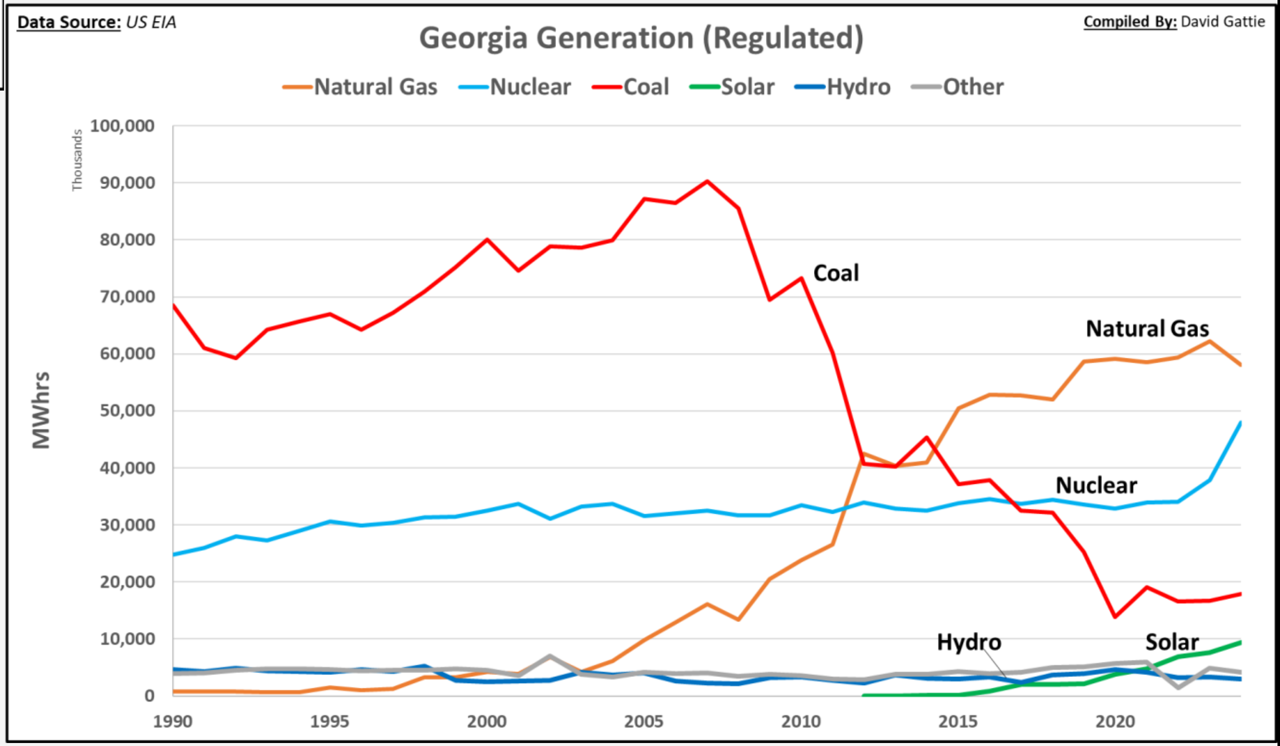


Select Southeastern States



Current Thermal 78.1%

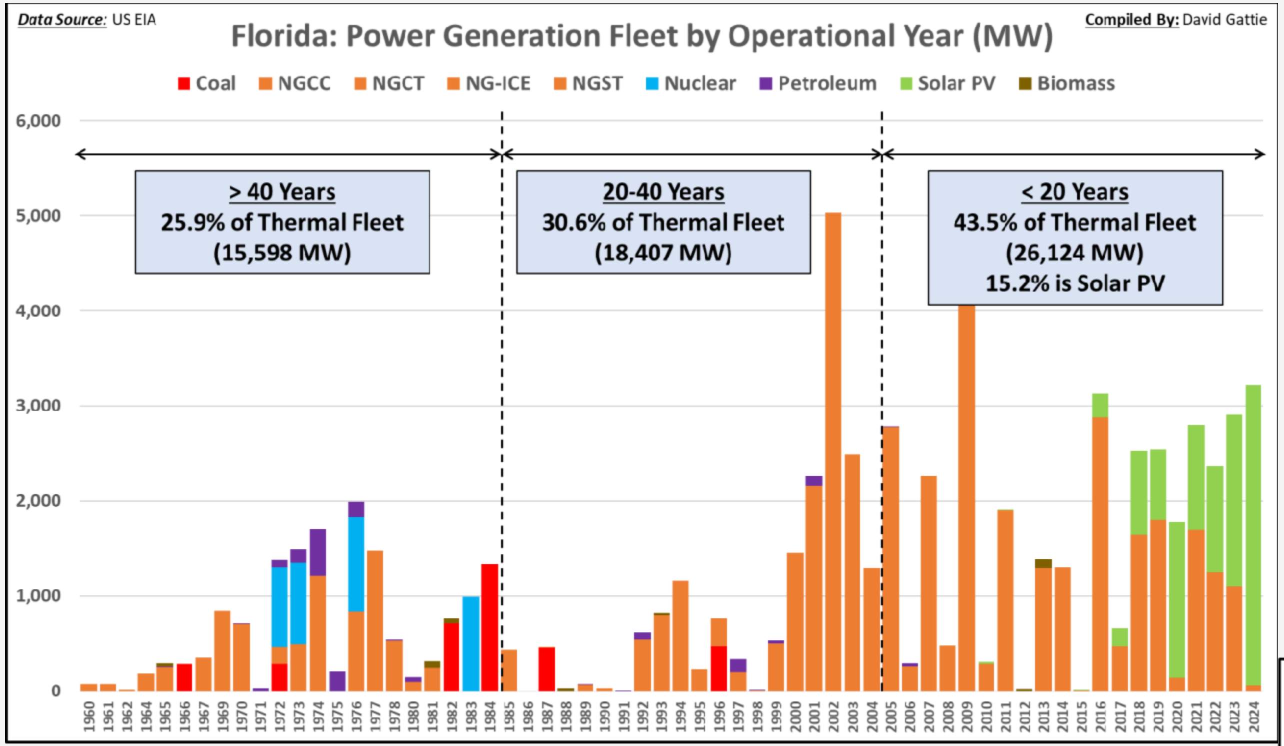
Resource	Capacity (MW)	% Share of Total Capacity
Natural Gas	16,387	43.3
Nuclear	6,289	16.6
Coal	5,780	15.3
Solar PV	5,004	13.2
Hydro	1,985	5.2
Petroleum	1,108	2.9
Biomass	1,011	2.7
Other	285	0.8
Total	**37,849**	**100**



2024 Residential Rate

14.14 cents/kWhr

U.S. Avg: 16.48



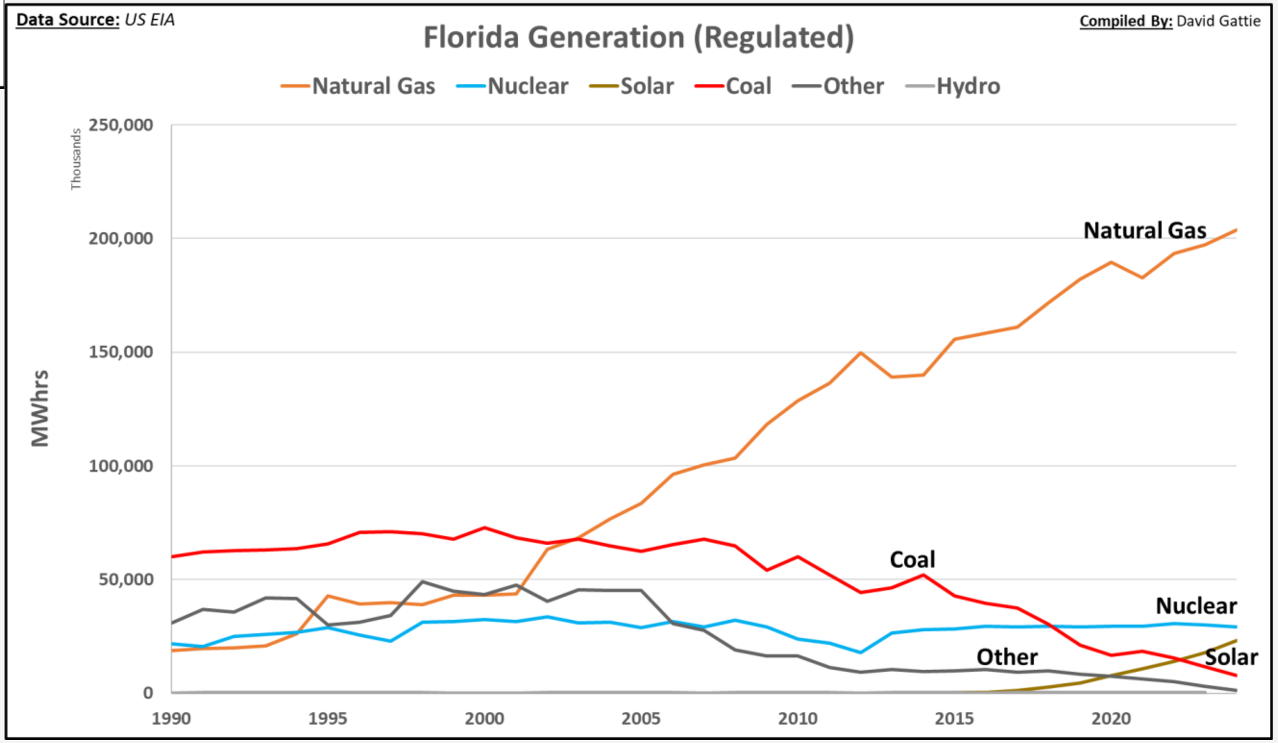
Current Thermal 82.1%

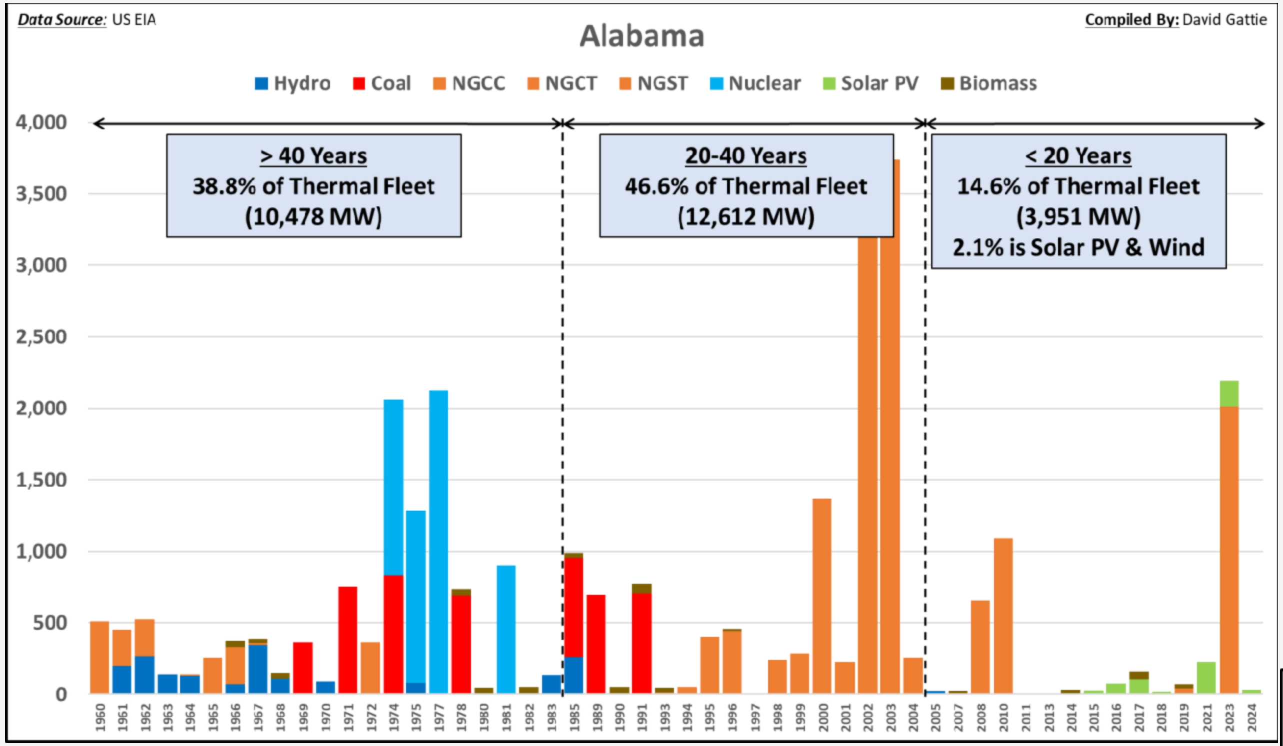
Resource	Capacity (MW)	% Share of Total Capacity
Natural Gas	50,309	69.9
Solar PV	10,949	15.2
Nuclear	3,666	5.1
Coal	3,565	5.0
Other	1,924	2.7
Petroleum	1,597	2.2
Total	**72,010**	**100**

2024 Residential Rate

14.15 cents/kWhr

U.S. Avg: 16.48





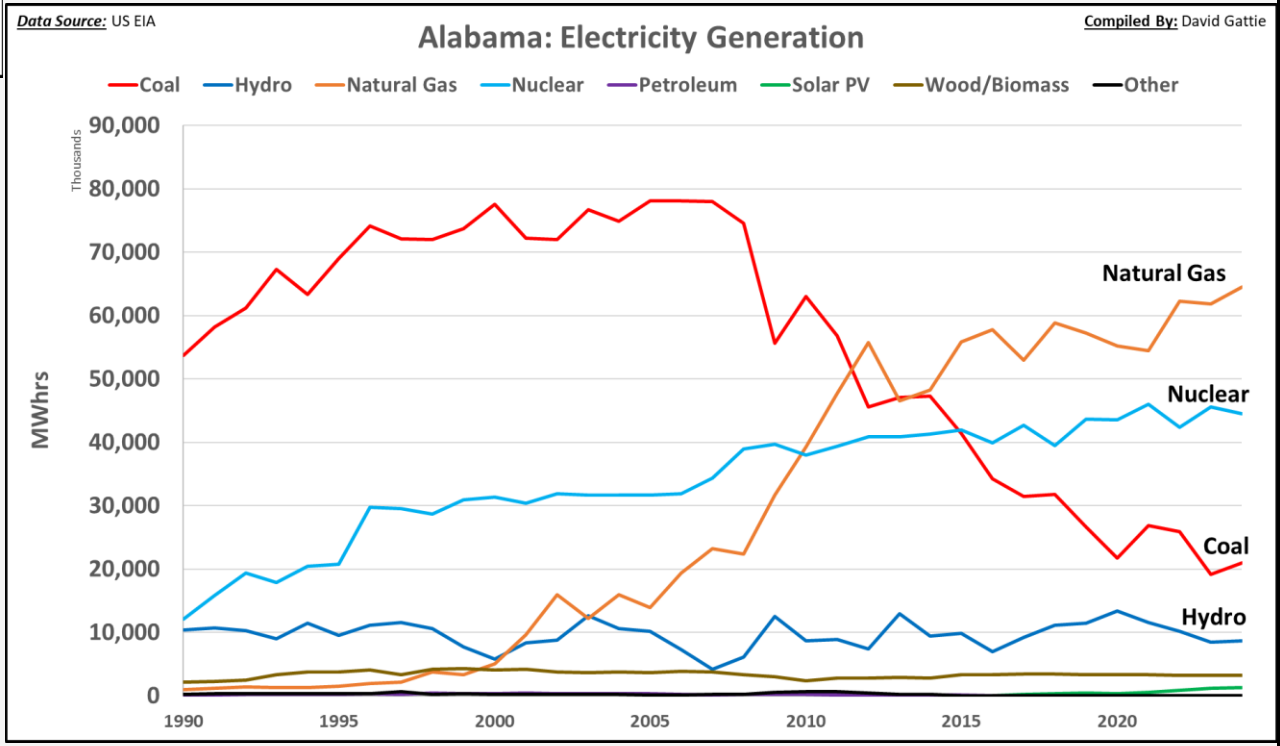
Current Thermal 85.2%

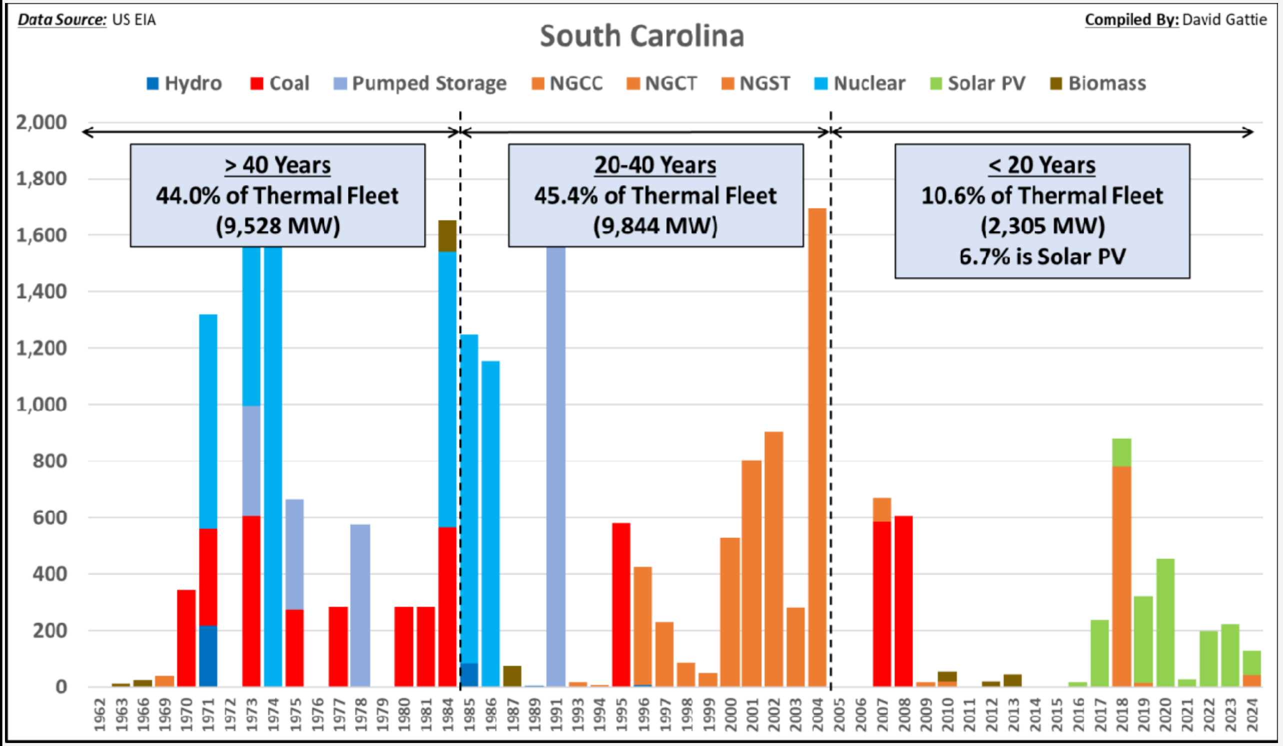
Resource	Capacity (MW)	% Share of Total Capacity
NGCC	11,138	35.9
Nuclear	5,453	17.6
Coal	4,728	15.3
Hydro	3,291	10.6
NGCT	3,285	10.6
NGST	1,752	5.7
Solar PV	664	2.1
Biomass	608	2.0
Total	30,996	

2024 Residential Rate

15.12 cents/kWhr

U.S. Avg: 16.48





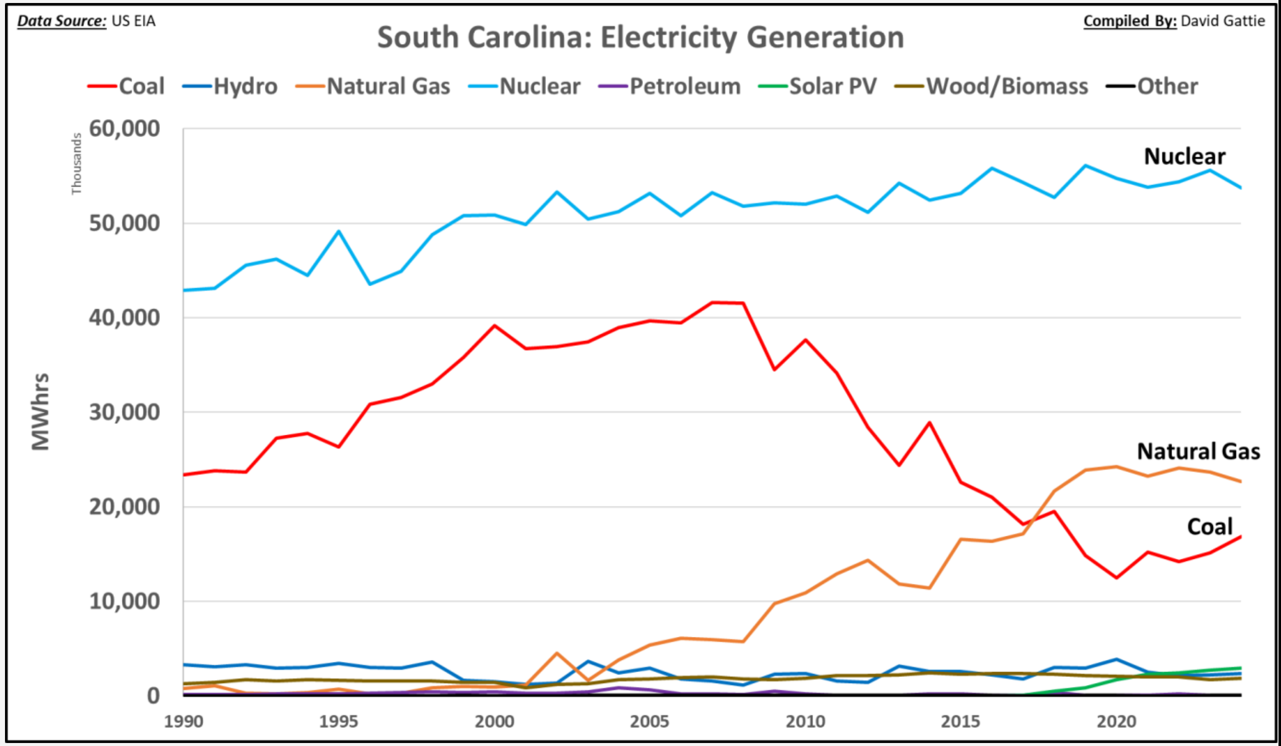
Current Thermal 73.6%

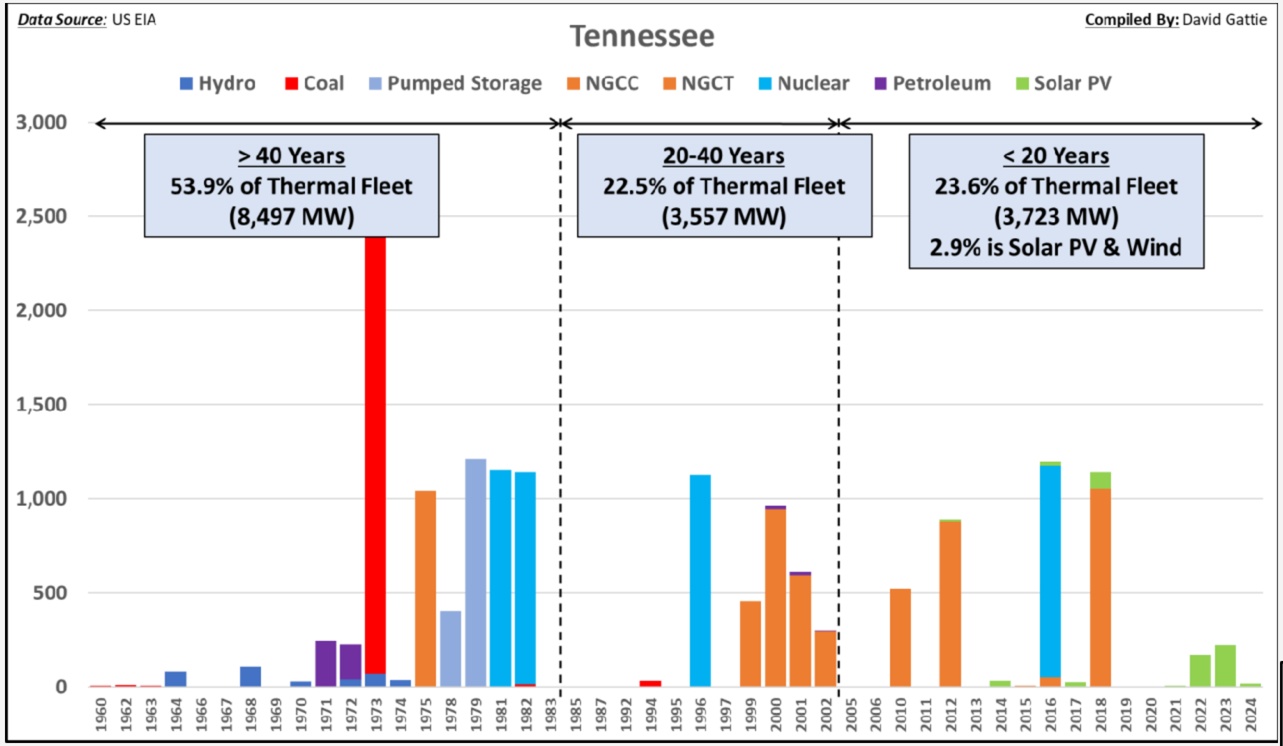
Technology	Capacity (MW)	% Share of Total Capacity
Nuclear	6,600	26.7
Coal	4,754	19.2
NGCC	3,252	13.2
Pumped Storage	3,036	12.3
NGCT	2,548	10.3
Solar PV	1,645	6.7
Hydro	1,294	5.2
NGST	780	3.2
Biomass	422	1.7
Total	**24,703**	

2024 Residential Rate

14.13 cents/kWhr

U.S. Avg: 16.48

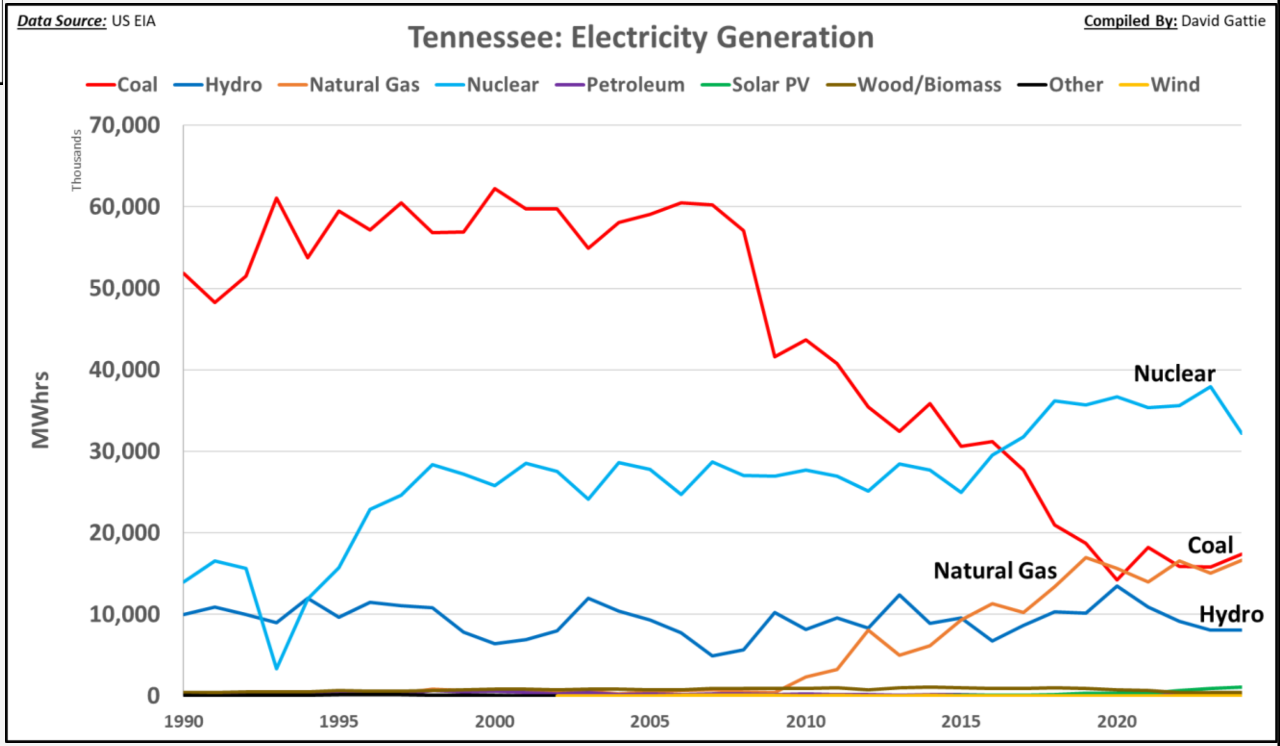


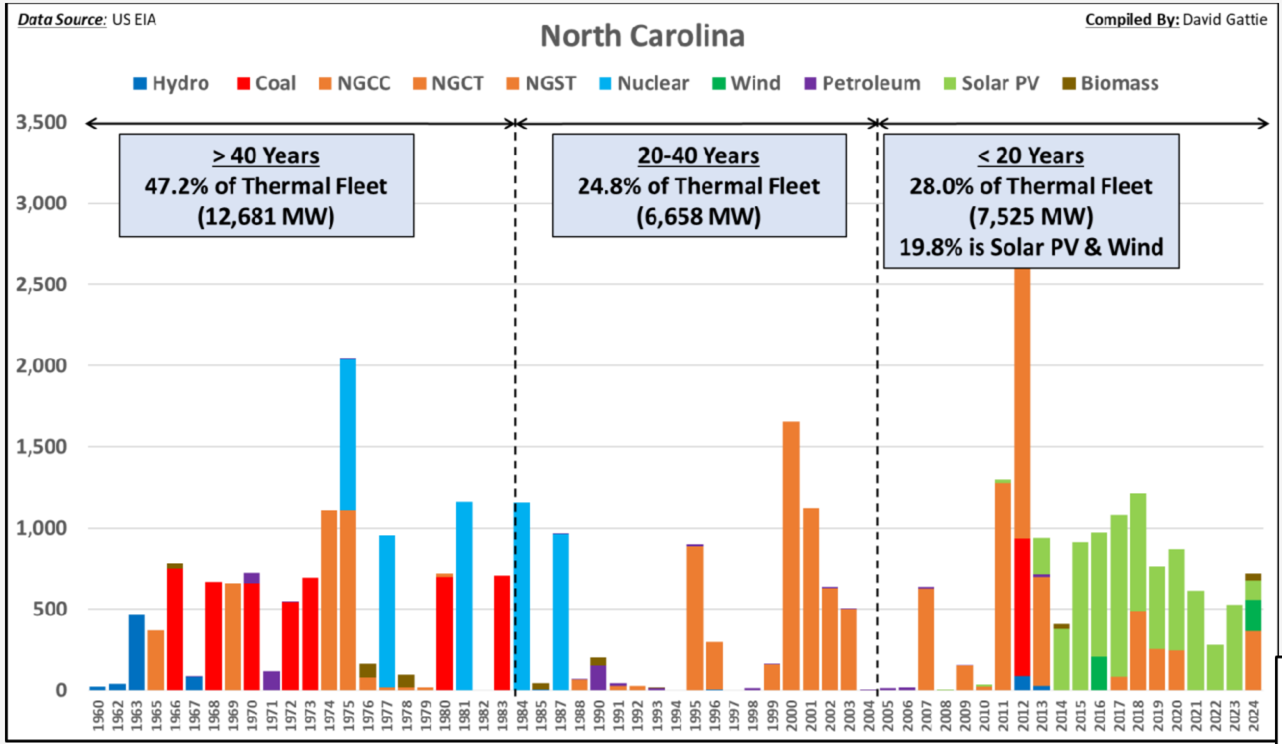


Current Thermal 76.1%

Technology	Capacity (MW)	% Share of Total Capacity
Coal	4,704	22.8
Nuclear	4,523	21.9
NGCT	3,405	16.5
Hydro	2,609	12.7
NGCC	2,455	11.9
Pumped Storage	1,616	7.8
Solar PV	601	2.9
Petroleum	470	2.3
Total	20,605	

2024 Residential Rate
12.54 cents/kWhr
U.S. Avg: 16.48





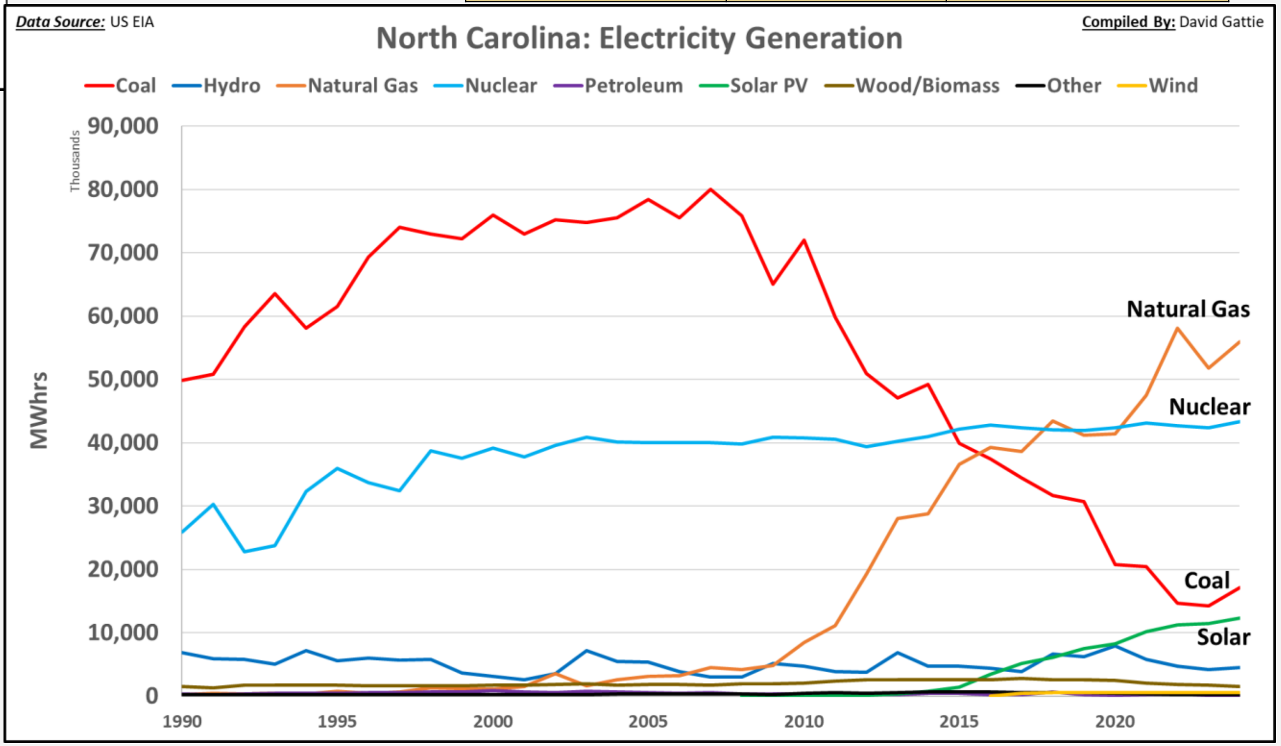
Current Thermal 72.8%

Technology	Capacity (MW)	% Share of Total Capacity
Solar PV	6,787	18.7
NGCT	6,396	17.6
NGCC	5,579	15.4
Coal	5,561	15.3
Nuclear	5,150	14.2
NGST	3,278	9.0
Hydro	2,009	5.5
Petroleum	491	1.4
Wind	397	1.1
Biomass	347	1.0
Total	**36,337**	

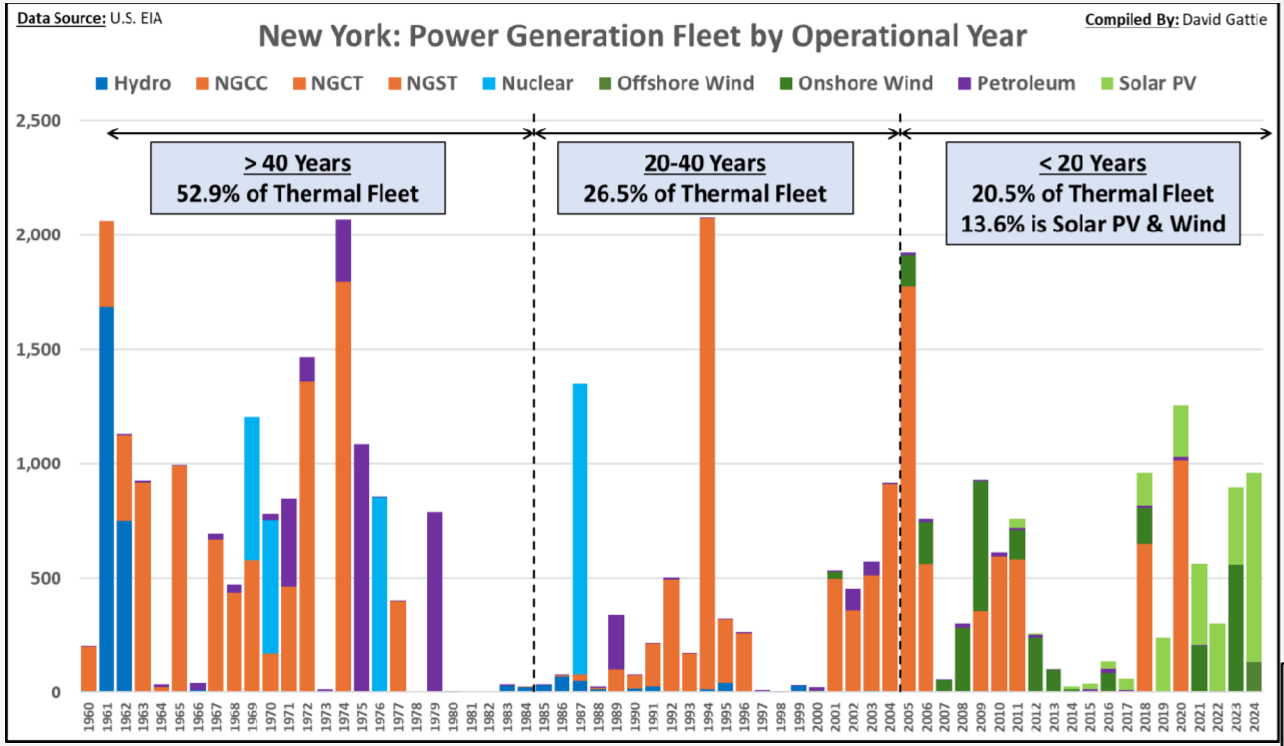
2024 Residential Rate

14.12 cents/kWhr

U.S. Avg: 16.48



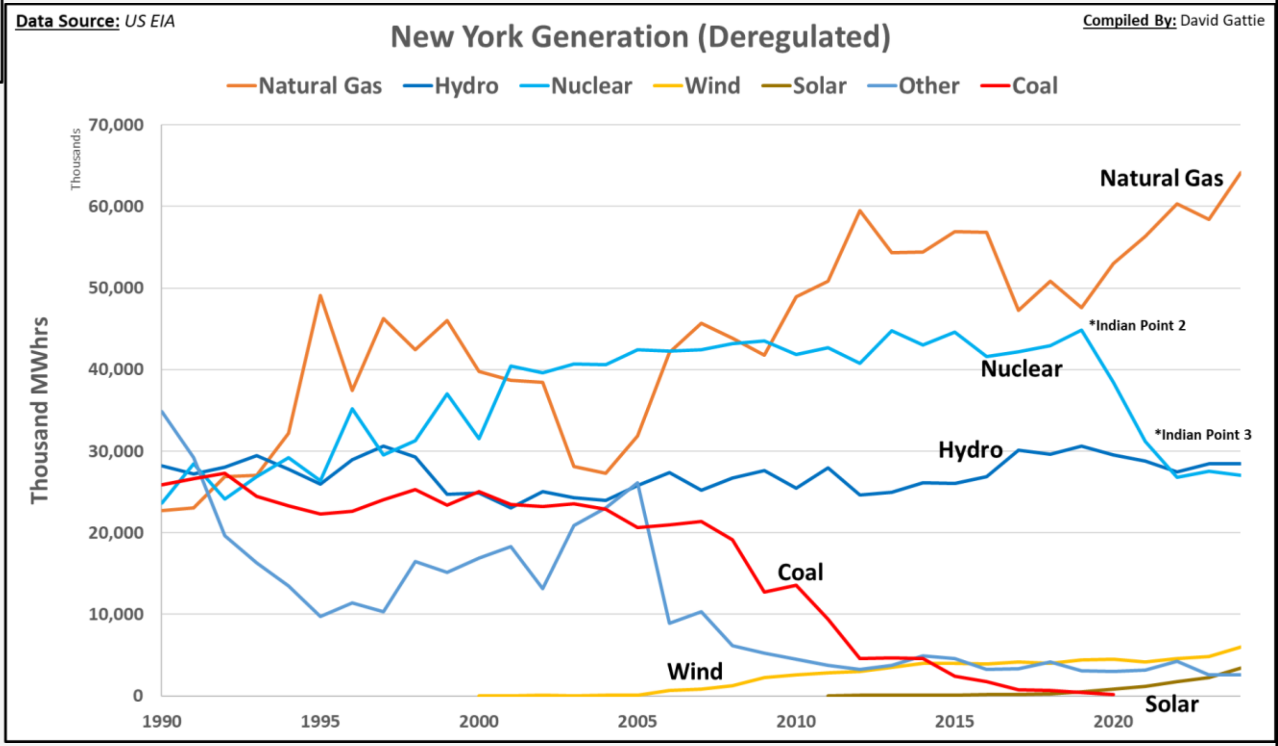
Unique Examples

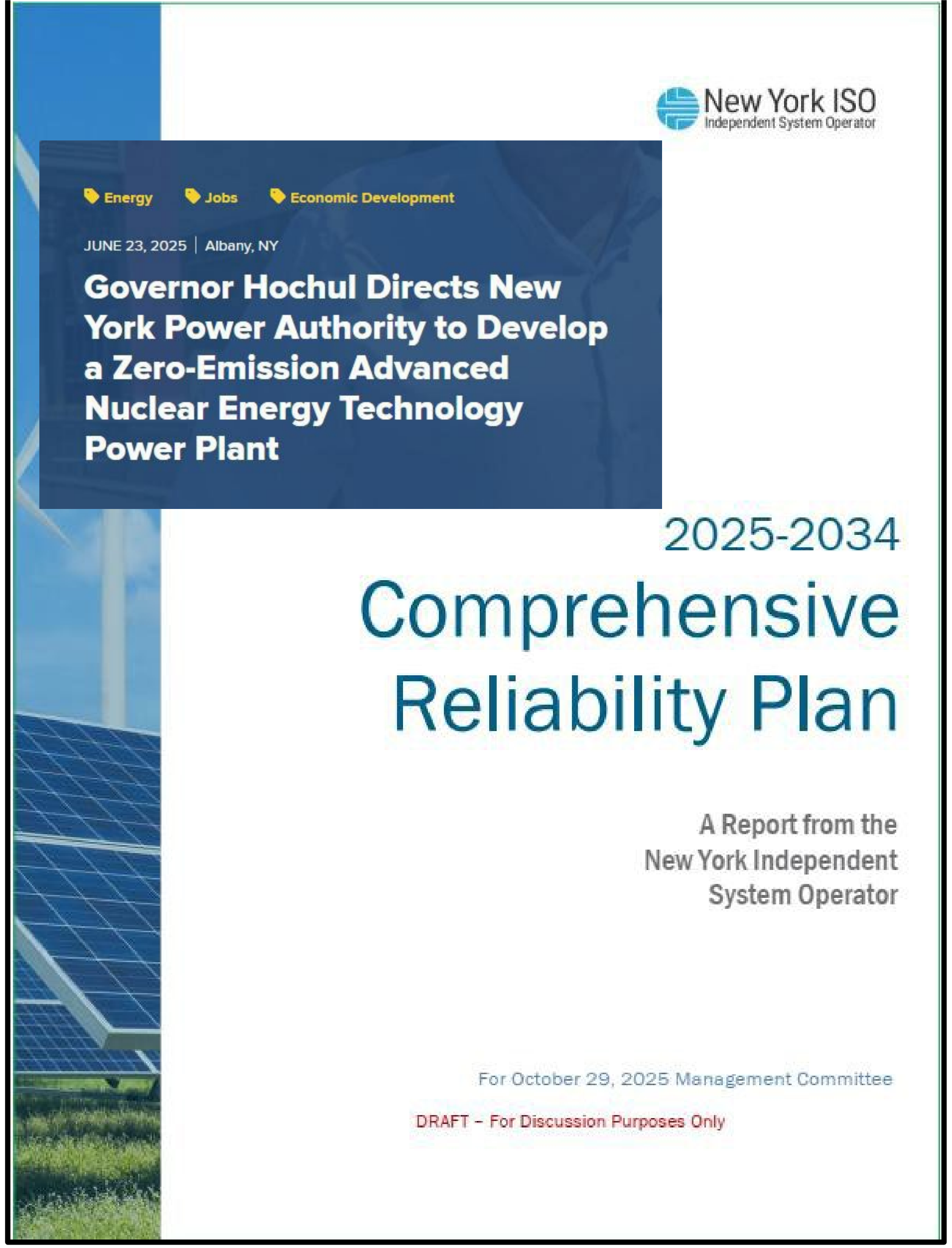


Current
Thermal
73.1%

Technology	Capacity (MW)	% Share of Capacity
Natural Gas	22,280	56.0
Hydro	4,563	11.5
Petroleum	3,468	8.7
Nuclear	3,330	8.4
Wind	2,870	7.2
Solar PV	2,589	6.5
Total	39,799	100

2024 Residential Rate
24.37 cents/kWhr
U.S. Avg: 16.48




New York ISO
Independent System Operator

Energy Jobs Economic Development

JUNE 23, 2025 | Albany, NY

Governor Hochul Directs New York Power Authority to Develop a Zero-Emission Advanced Nuclear Energy Technology Power Plant

2025-2034
Comprehensive Reliability Plan

A Report from the New York Independent System Operator

For October 29, 2025 Management Committee

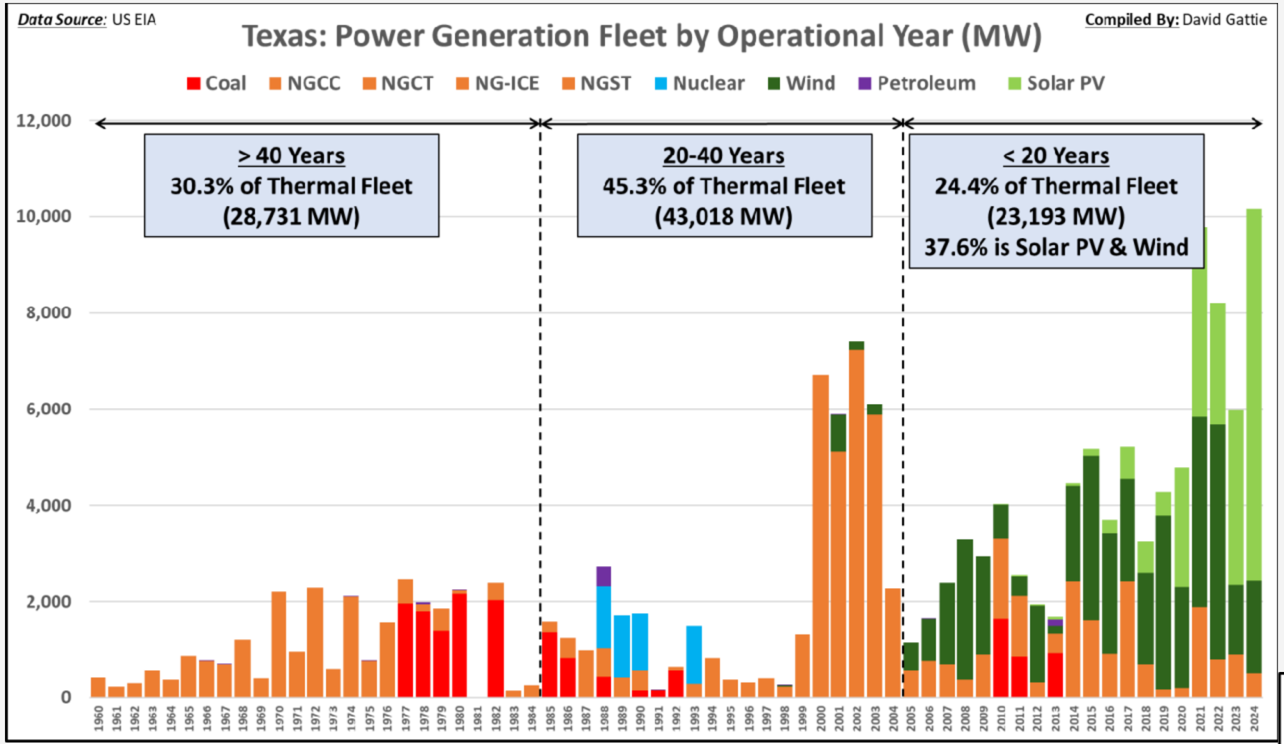
DRAFT – For Discussion Purposes Only

Executive Summary

New York's electric system faces an era of profound reliability challenges as resource retirements accelerate, economic development drives demand growth, and project delays undermine confidence in future supply. Additionally, 25% of the state's total generating capacity is fossil-fuel-based generation that has been in operation for more than 50 years. As these generators age, they are experiencing more frequent and longer outages.

While this 2025–2034 Comprehensive Reliability Plan (CRP), under current applicable reliability criteria and procedures, identifies no actionable Reliability Needs, this outcome should not be mistaken for long-term system adequacy. The margin for error is extremely narrow, and most plausible futures point to significant reliability shortfalls within the next ten years. Depending on demand growth and retirement patterns, the system may need several thousand megawatts of new dispatchable generation over that timeframe.

The grid is at an inflection point, driven by the convergence of three structural trends: the aging of the existing generation fleet, the rapid growth of large loads, and the increasing difficulty of developing new dispatchable resources. These trends are not isolated, they are compounding. As older conventional plants deactivate, the system loses firm capacity and operational flexibility. At the same time, new demand from data centers, industrial facilities, and electrification is accelerating, placing additional stress on the grid.



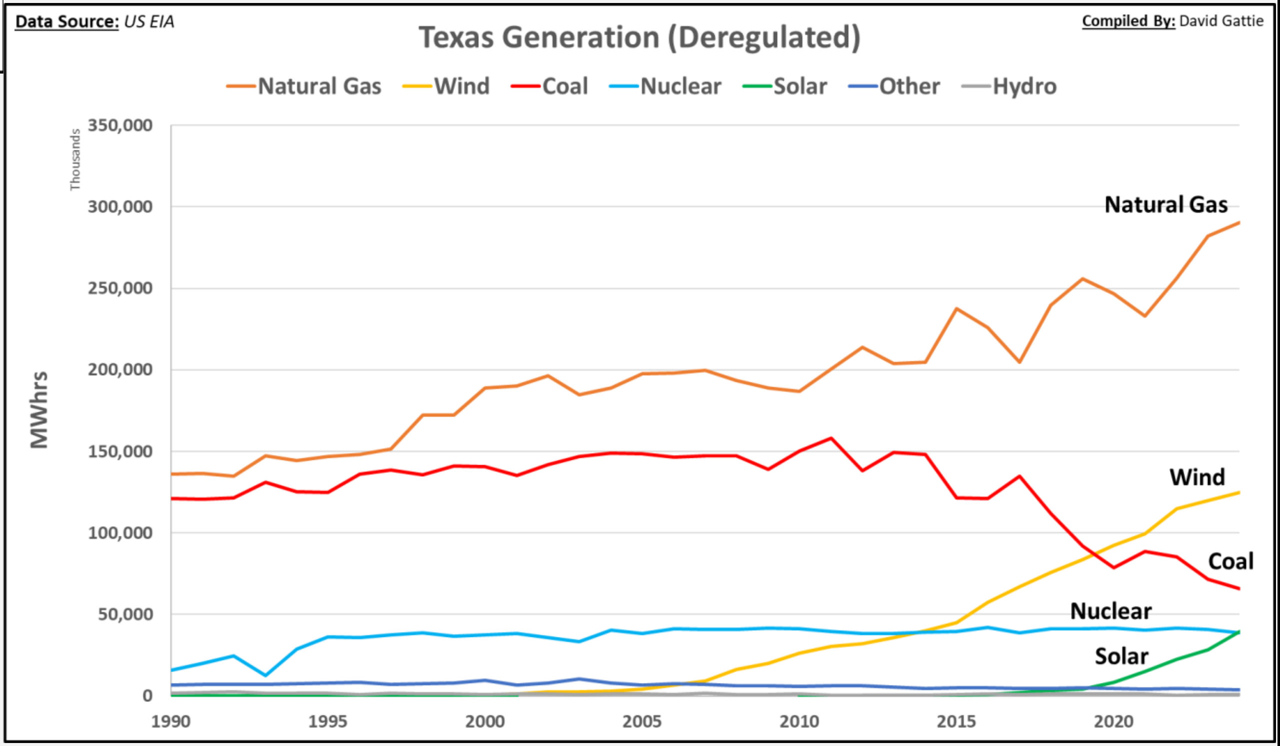
Current Thermal 55.7%

Technology	Capacity (MW)	% Share of Capacity
Natural Gas	72,771	43.1
Wind	41,978	24.9
Solar PV	22,713	13.5
Coal	16,284	9.6
Batteries	7,905	4.7
Nuclear	4,980	3.0
Other	2,154	1.3
Total	**168,784**	**100**

2024 Residential Rate

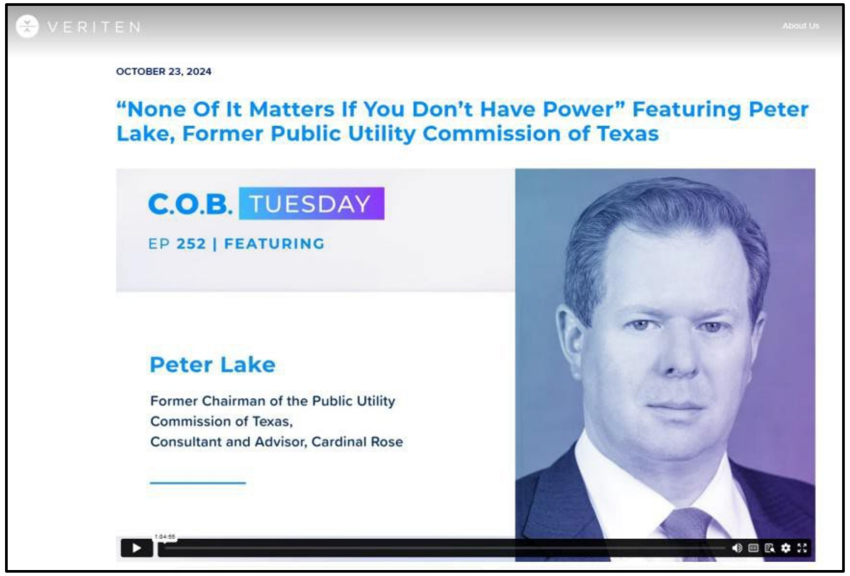
14.94 cents/kWhr

U.S. Avg: 16.48

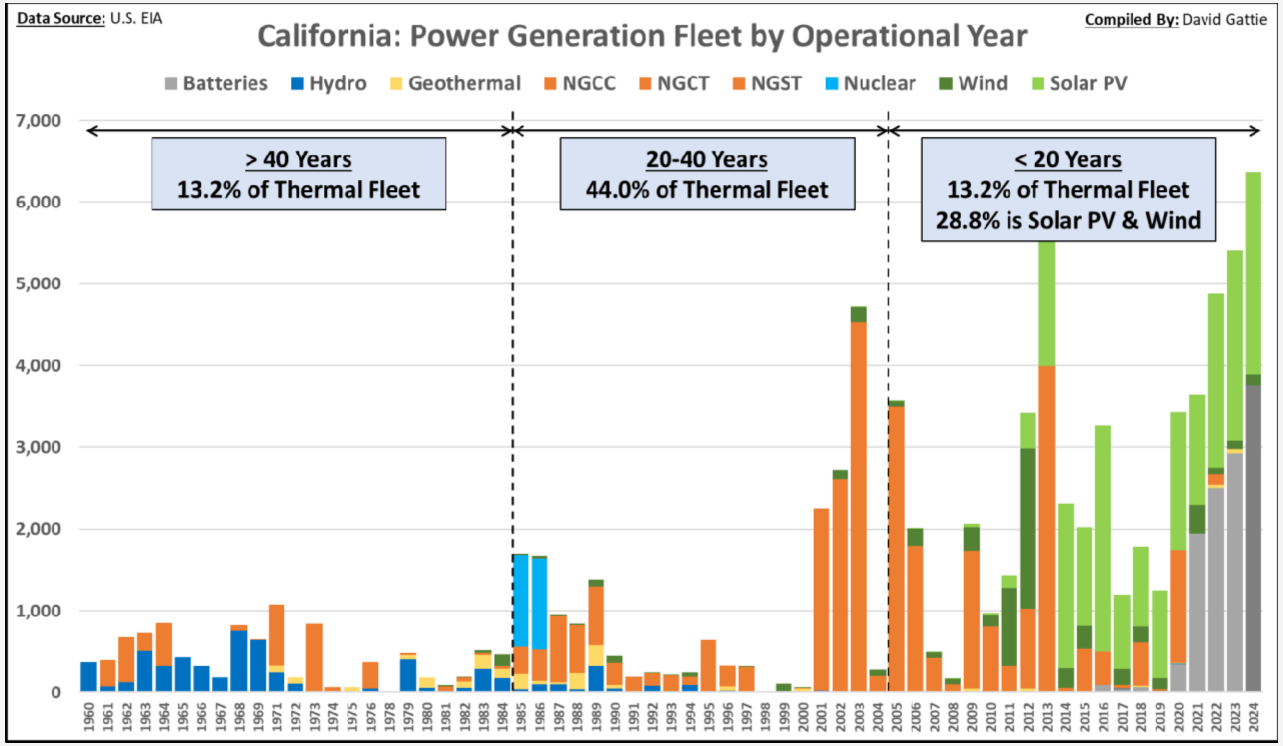


"The country has been leaning on and borrowing on the reliability and the operating reserves that were developed over the last 30 years. So the investments that were made to build that dispatchable, reliable power fleet we have been leaning on that as we have over the last 10 years stopped building those plants and built only solar, wind and now batteries. So we're going to get caught up on that kind of credit card debt that we've been taking out on not building those types of reliable resources. So I don't know that we need to necessarily have new incentives. I just think we need to let the value of reliability, which has always been a core part of the energy policy of this country, get back to the front of the line where it belongs".

Link to podcast:
https://veriten.com/stream/cobt-256/



"We were 4 minutes and 37 seconds away from a black start, and that is a universal failure—25 million people without power for weeks, at best."
Before Uri: CARE
After Uri: RACE (Big R, in Bold)
Link to podcast: https://veriten.com/stream/cobt-252/



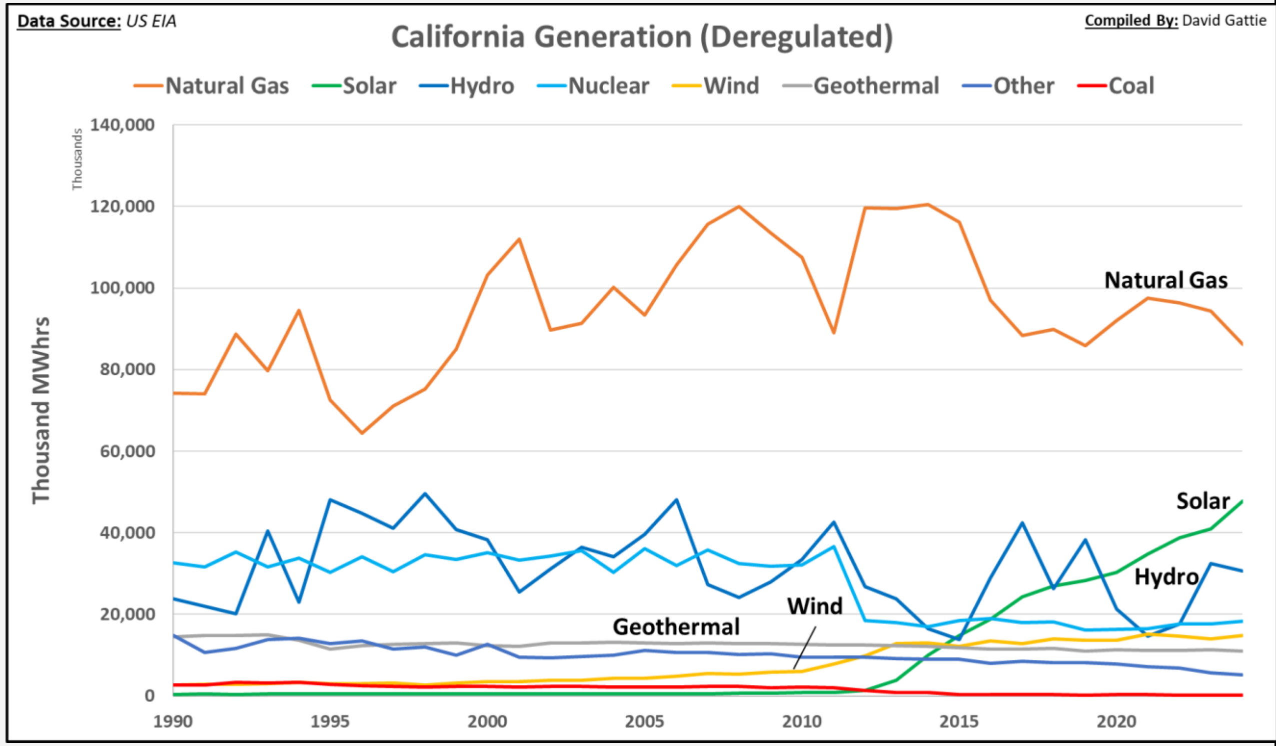
Current Thermal 41.8%

Technology	Capacity (MW)	% Share of Total Capacity
Solar PV	21,346	23.0
NGCC	20,413	22.0
Batteries	11,715	12.6
NGCT	11,506	12.4
Hydro	10,214	11.0
Wind	6,457	6.9
NGST	3,744	4.0
Nuclear	2,240	2.4
Geothermal	1,881	2.0
Total	**92,928**	

2024 Residential Rate

31.86 cents/kWhr

U.S. Avg: 16.48



Broader Implications

FROM GRID RELIABILITY TO US NATIONAL SECURITY

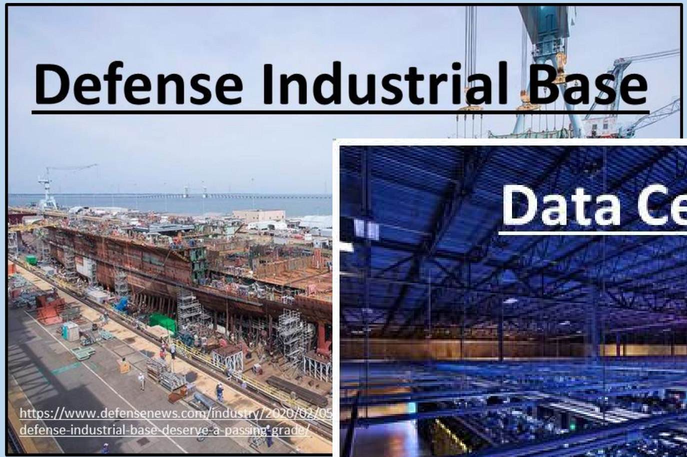

OTR Freight
https://www.fleetequipmentmag.com/us-bank-freight-payment-index-shipments/

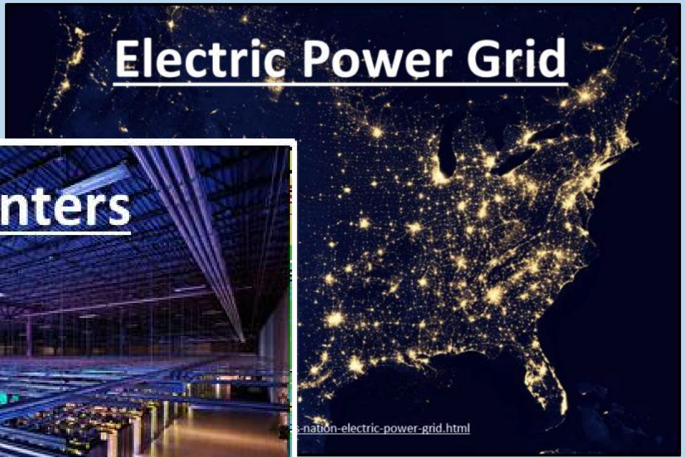

Mining
Oil, Natural Gas, Coal, Uranium, Minerals, Metals
https://resource-erectors.com/career-blog/integrated-operations-management-in-minerals-metals-and-mining/


Natural Gas-Fired Power Plants


Nuclear Power Plants
https://www.georgiapower.com/company/energy-industry/generating-plants/plant-vogtle.html


Rail & Shipping
https://www.cato.org/publications/policy-analysis/jones-act-burden-america-can-no-longer-bear


Defense Industrial Base
https://www.defensenews.com/industry/2020/02/05
defense-industrial-base-deserve-a-passing-grade/


Electric Power Grid
-nation-electric-power-grid.html


Data Centers
Photo: MIT Technology Review


Agriculture &
Food Production
https://www.wsj.com/articles/u-s-farmers-who-once-fed-the-world-overtaken-by-new-world-powers-1492700574


Cement Production
https://www.britannica.com/technology/cement-building-material/Extraction-and-processing


Coal-Fired Power Plants
https://www.georgiapower.com/company/environmental-compliance/plant-list/plant-bowen.html


Chemical Production
https://www.aiche.org/chenected/2018/07/introduction-advanced-manufacturing-chemical-engineers


Iron and Steel Forging
https://www.steel.org/steel-technology/steel-production/

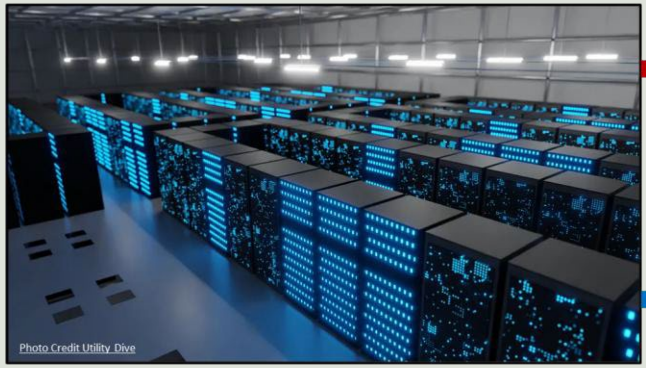

Oil and Natural Gas Refining

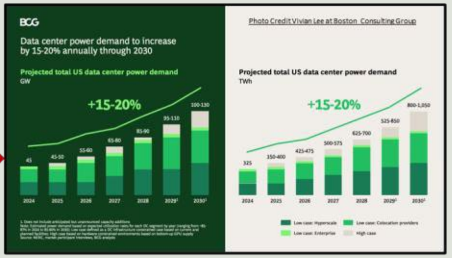
The Next Wave of Energy Demand
...and Strategic Competition

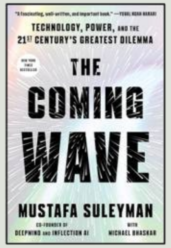
- Artificial Intelligence (AI) and data centers are foundational technologies for the 21st century—nations, economies, industries, militaries
- For the U.S. to maintain its status as the dominant global power and its competitive advantage over its pacing challenger, China, the U.S. must be the global leader in AI

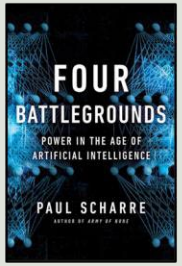
Data Centers & AI

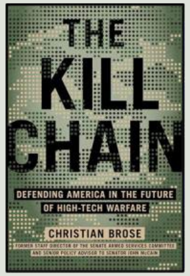
Power Demand & National Security









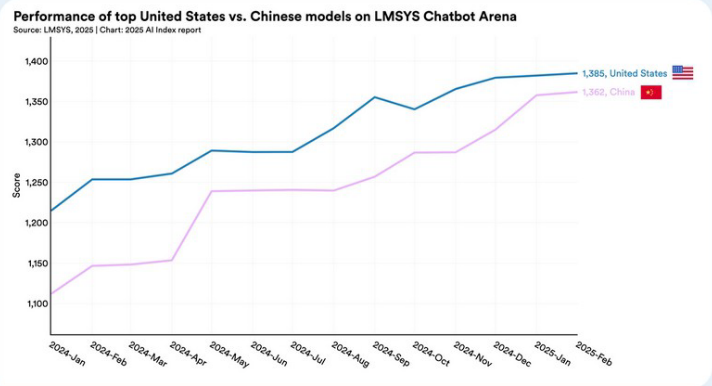


"…AI could transform the power and prosperity of nations in the decades to come… Militaries and intelligence agencies must harness AI's transformative potential… countries stand to gain a competitive edge if they can adopt AI at scale across the economy and society. Winning the race to AGI development…will boost the leading country's national security, economic vitality, and global technological influence. (Kahl and Mitre, Foreign Affairs; 2025)

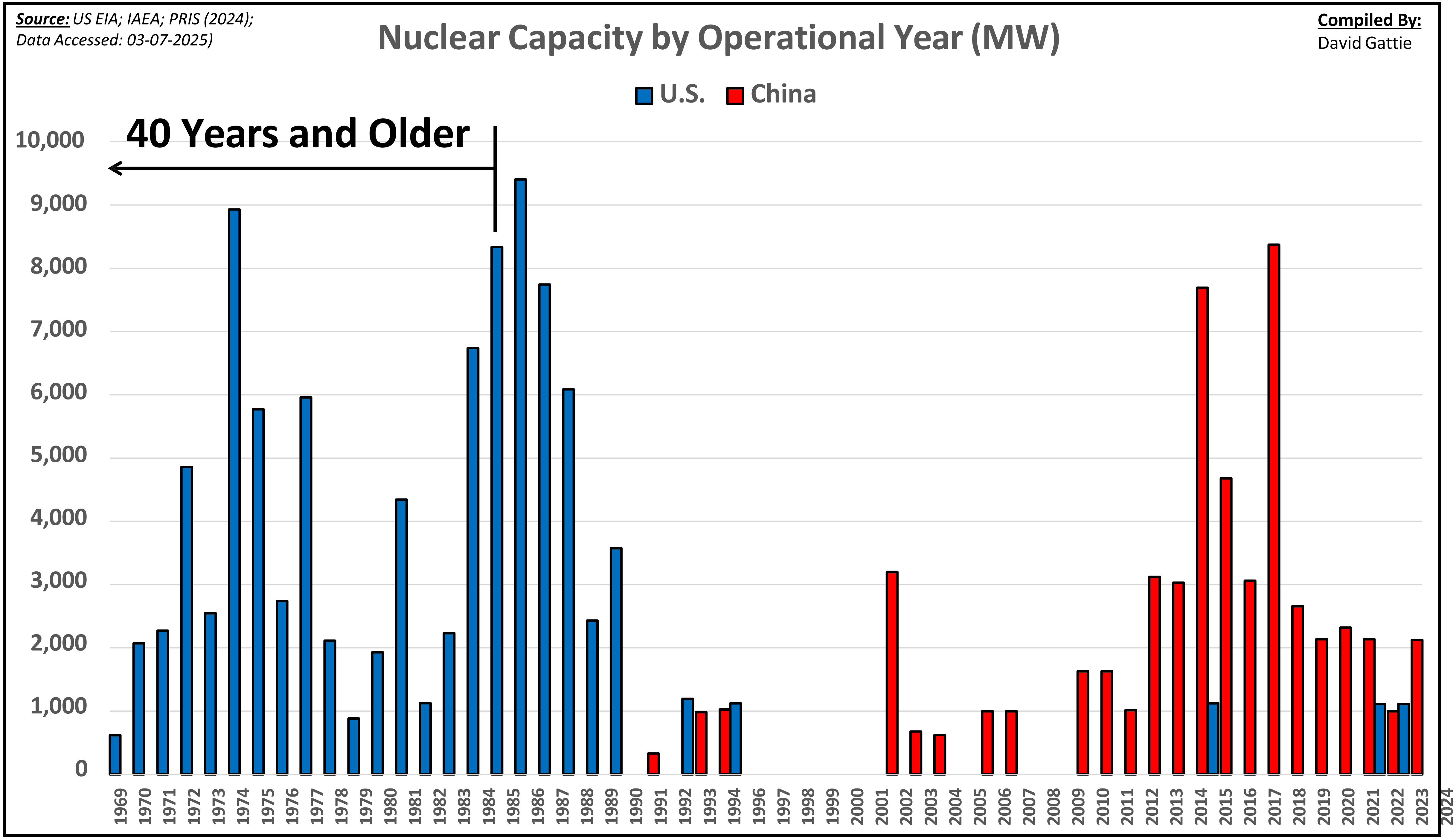
"…may well be the next such transformative technology that has profound implications for the United States, its position in the world order, and U.S. national security and economic strength." (RAND, How AGI Could Affect the Rise and Fall of Nations, 2025)

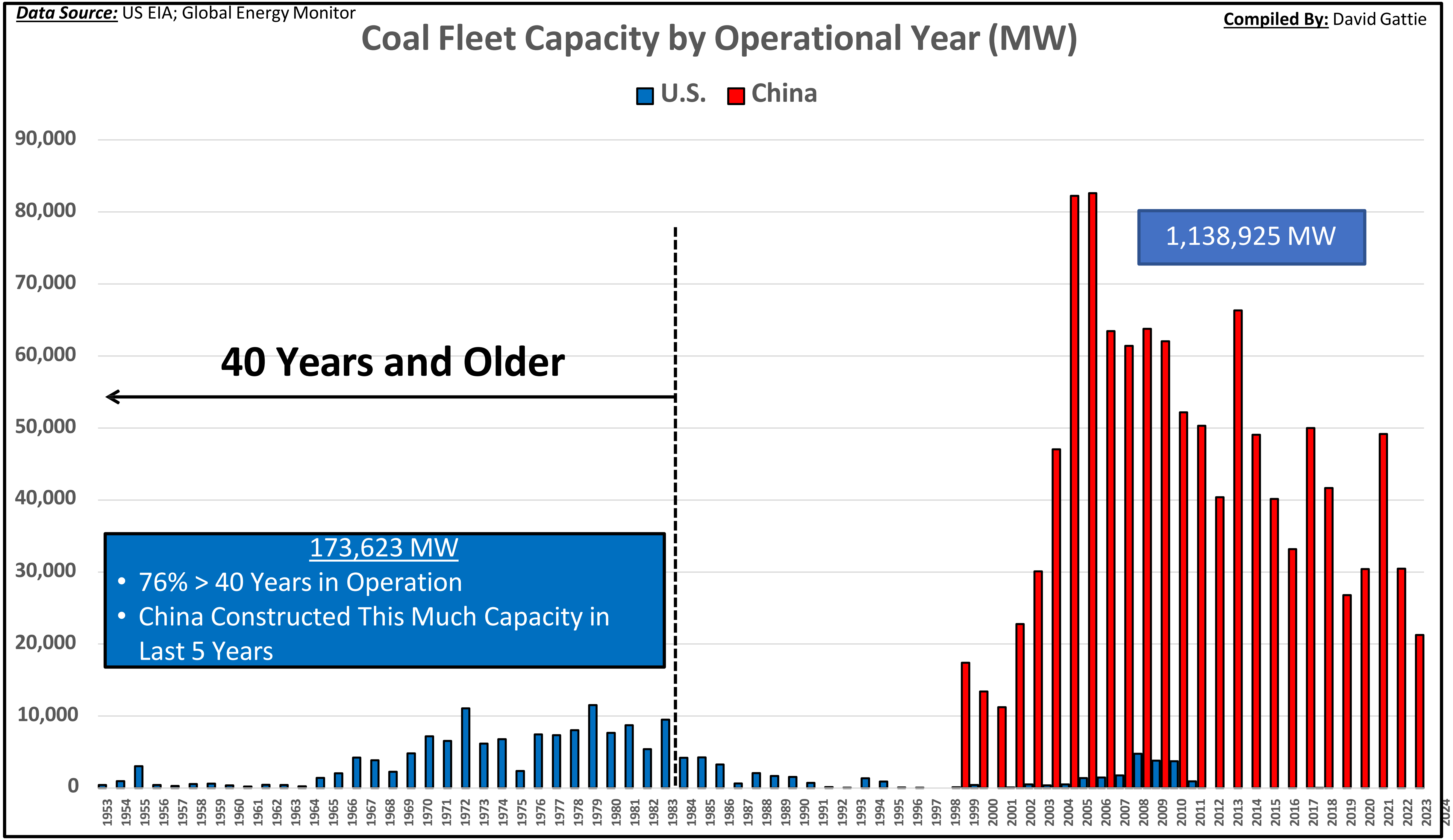
4. The U.S. still leads in producing top AI models—but China is closing the performance gap.

In 2024, U.S.-based institutions produced 40 notable AI models, significantly outpacing China's 15 and Europe's three. While the U.S. maintains its lead in quantity, Chinese models have rapidly closed the quality gap: performance differences on major benchmarks such as MMLU and HumanEval shrank from double digits in 2023 to near parity in 2024. Meanwhile, China continues to lead in AI publications and patents. At the same time, model development is increasingly global, with notable launches from regions such as the Middle East, Latin America, and Southeast Asia.



Source: https://hai.stanford.edu/ai-index/2025-ai-index-report


Source: US EIA; IAEA; PRIS (2024); Data Accessed: 03-07-2025)
Nuclear Capacity by Operational Year (MW)
Compiled By: David Gattie
U.S.
China
40 Years and Older
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024

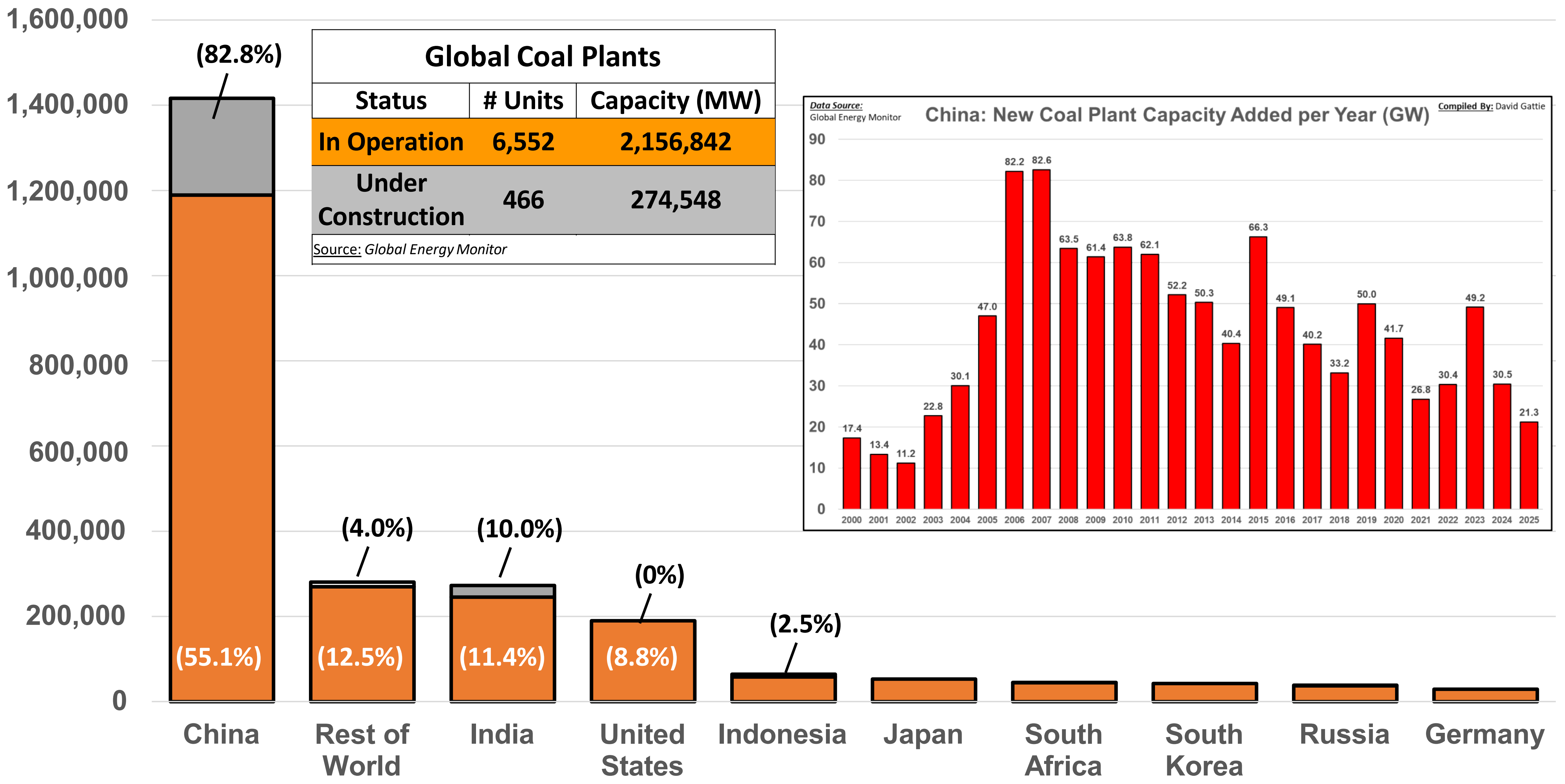


Data Source: US EIA; Global Energy Monitor
Compiled By: David Gattie
Coal Fleet Capacity by Operational Year (MW)
U.S.
China
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
40 Years and Older
1,138,925 MW
173,623 MW
• 76% > 40 Years in Operation
• China Constructed This Much Capacity in Last 5 Years
1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

Data Source:
Global Energy Monitor

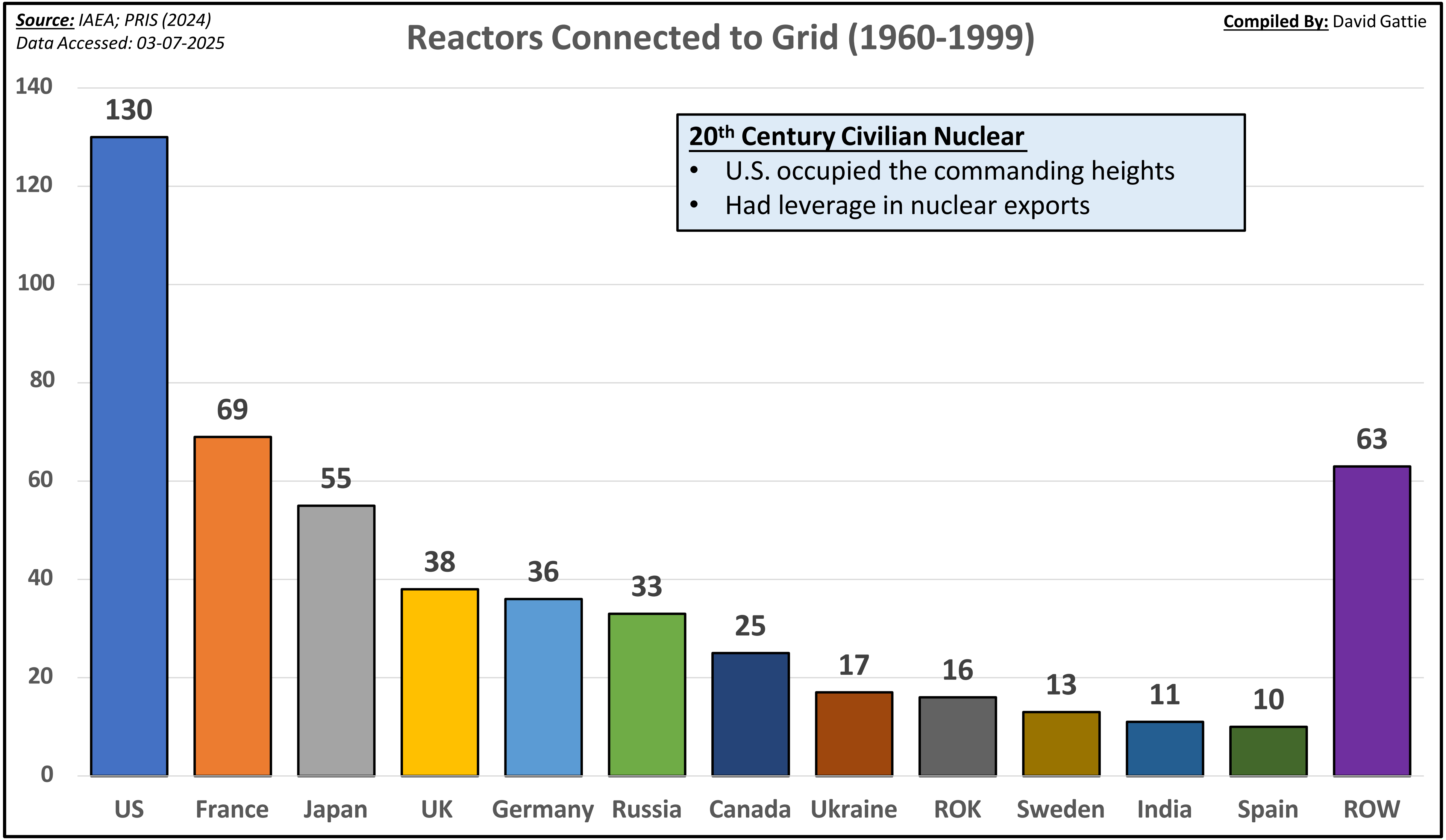
Coal Plants in Operation and Under Construction (MW)

Compiled By: David Gattie



Global Coal Plants		
Status	**# Units**	**Capacity (MW)**
In Operation	**6,552**	**2,156,842**
Under Construction	**466**	**274,548**

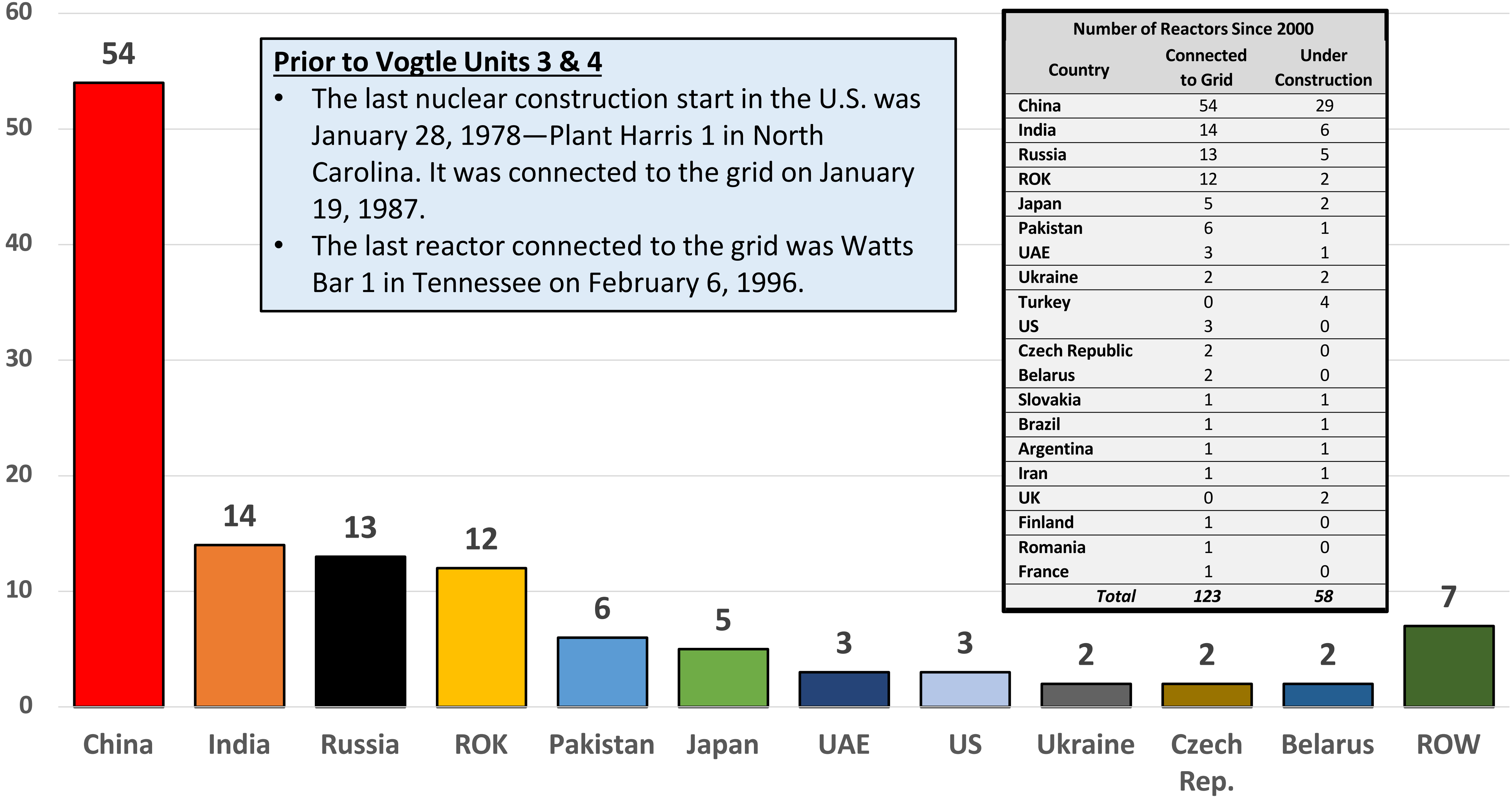
Source: *Global Energy Monitor*


Source: IAEA; PRIS (2024)
Data Accessed: 03-07-2025
Reactors Connected to Grid (1960-1999)
Compiled By: David Gattie
20th Century Civilian Nuclear
• U.S. occupied the commanding heights
• Had leverage in nuclear exports
140
120
100
80
60
40
20
0
130
69
55
38
36
33
25
17
16
13
11
10
63
US
France
Japan
UK
Germany
Russia
Canada
Ukraine
ROK
Sweden
India
Spain
ROW

Source: *IAEA; PRIS (2024); Data Accessed: 11-16-2025)*

Reactors Connected to Grid & Under Construction (2000-Present)

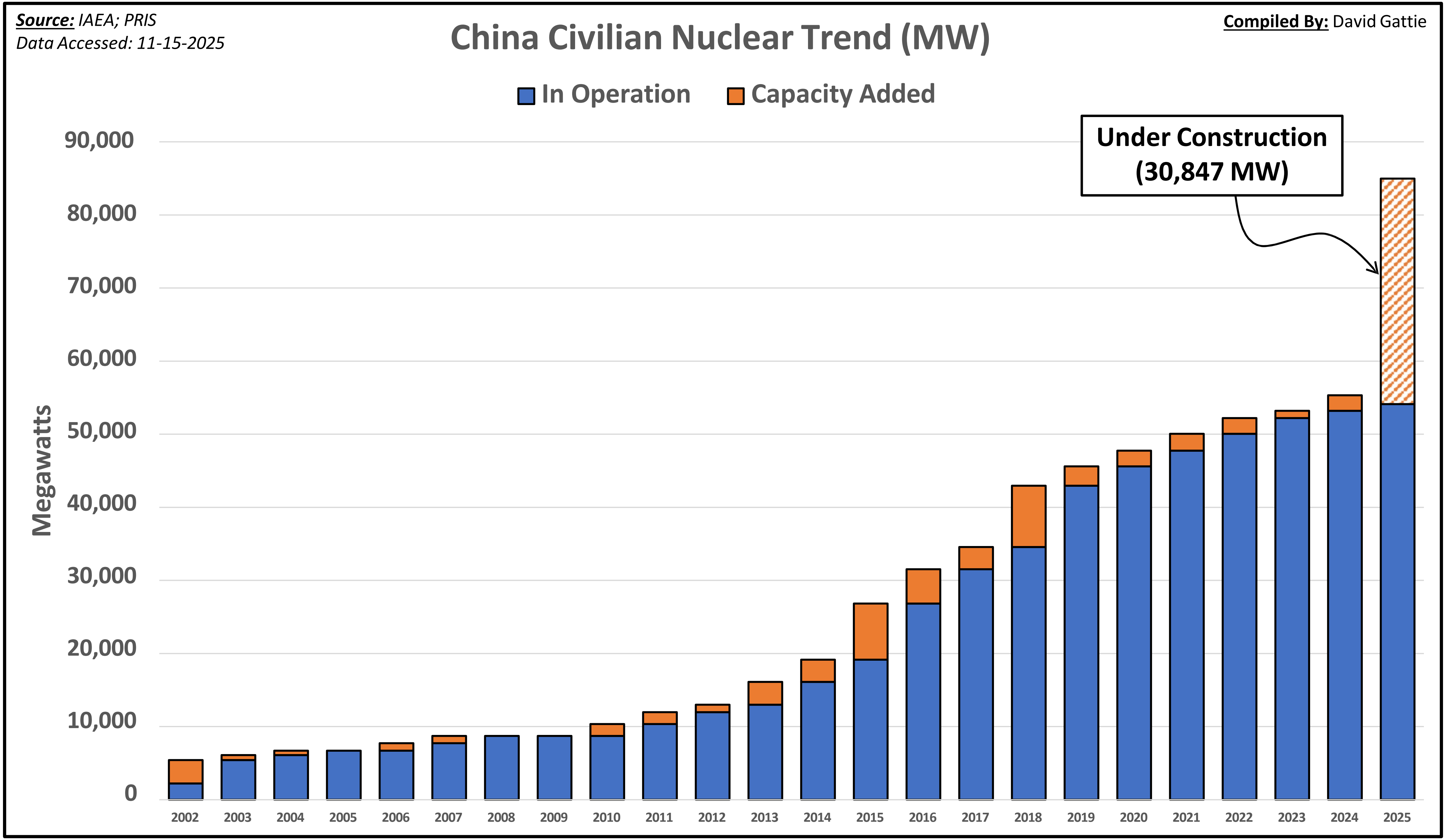
Compiled By:
David Gattie



Prior to Vogtle Units 3 & 4

- The last nuclear construction start in the U.S. was January 28, 1978—Plant Harris 1 in North Carolina. It was connected to the grid on January 19, 1987.
- The last reactor connected to the grid was Watts Bar 1 in Tennessee on February 6, 1996.

Number of Reactors Since 2000		
Country	Connected to Grid	Under Construction
China	54	29
India	14	6
Russia	13	5
ROK	12	2
Japan	5	2
Pakistan	6	1
UAE	3	1
Ukraine	2	2
Turkey	0	4
US	3	0
Czech Republic	2	0
Belarus	2	0
Slovakia	1	1
Brazil	1	1
Argentina	1	1
Iran	1	1
UK	0	2
Finland	1	0
Romania	1	0
France	1	0
Total	***123***	***58***



Source: IAEA; PRIS
Data Accessed: 11-15-2025
China Civilian Nuclear Trend (MW)
Compiled By: David Gattie
In Operation
Capacity Added
Under Construction (30,847 MW)
Megawatts
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025

Nuclear Power: Beyond the Numbers

THE NATIONAL SECURITY IMPERATIVE

America's Special Relationship With Nuclear Power

"The riven atom, uncontrolled, can be only a growing menace to us all, and there can be no final safety short of full control throughout the world. Nor can we hope to realize the vast potential wealth of atomic energy until it is disarmed and rendered harmless. ***Upon us, as the people who first harnessed and made use of this force, there rests a grave and continuing responsibility for leadership in turning it toward life, not death.****"*

(Henry Stimson, Secretary of War, 1940-1945)

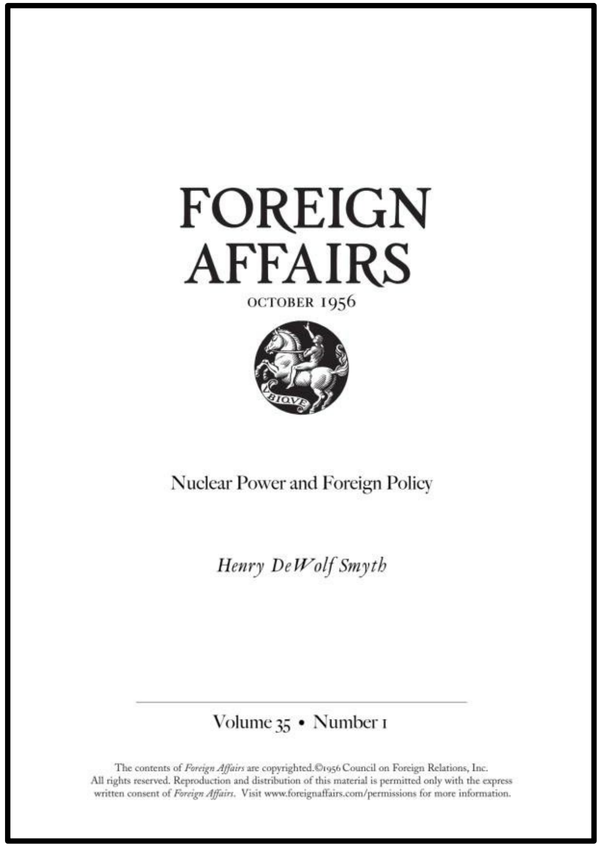
The Enduring First Principles of U.S. Nuclear Power Policy

(*NSC Report 5507/2: Peaceful Uses of Atomic Energy*, 1955)

- Maintaining U.S. leadership in the field, particularly in the development and application of atomic power. *[Soft Power]*
- Using such U.S. leadership to promote cohesion within the free world and to forestall successful Soviet exploitation of the peaceful uses of atomic energy to attract the allegiance of the uncommitted peoples of the world. *[Soft Power]*
- Increasing progress in developing and applying the peaceful uses of atomic energy in free nations abroad. *[Soft Power]*
- Assuring continued U.S. access to foreign uranium and thorium supplies.
- Preventing the diversion to non-peaceful uses of any fissionable materials provided to other countries.

“Are the aims of our foreign policy consistent with the aims of our domestic policy as far as nuclear power is concerned. Consequently, we have a specific obligation to back up our foreign policy gestures in this field with growing technological strength. To do so we must maintain a vigorous program of reactor development.

How can we offer to build reactors abroad without building enough reactors here to know what we are doing? How can we expect to send materials and helpful information abroad if we let our technology fall behind?”



Henry DeWolf Smyth

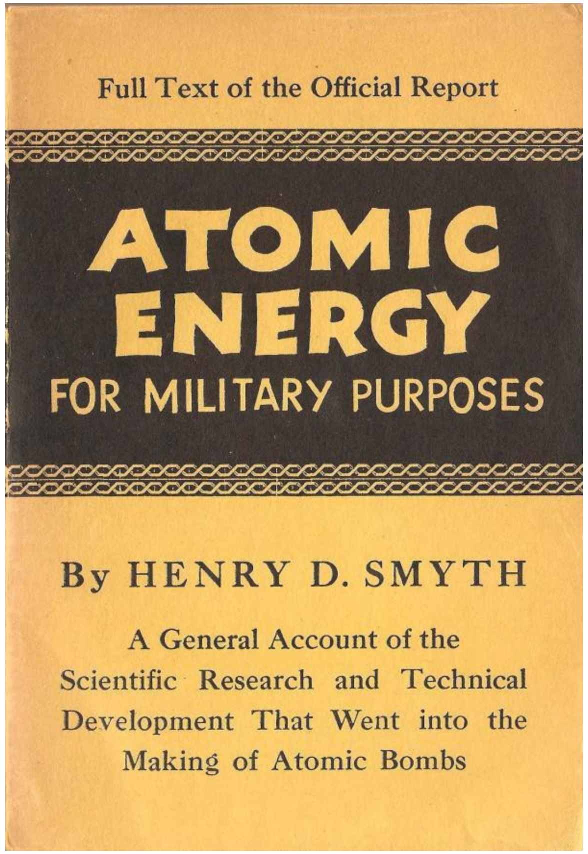
Manhattan Project, Atomic Energy Commission, IAEA U.S. Ambassador

Author of The Smyth Report on “Atomic Energy for Military Purposes”: https://www.orau.org/ptp/pdf/smythreport.pdf

(*NUCLEAR POWER AND FOREIGN POLICY;* FOREIGN AFFAIRS, 1956)

"I have recalled this history to emphasize the fact that decisions about the peacetime development of nuclear energy have not, cannot and probably should not be made on the basis of strict economic realism"

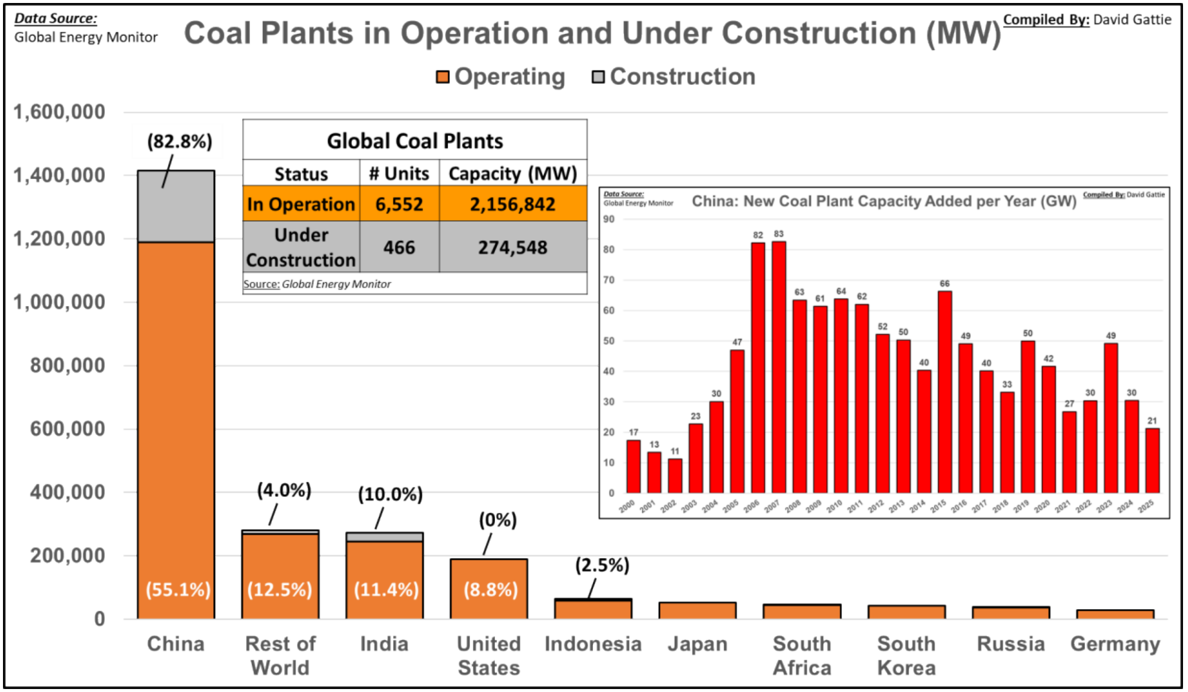
(*Nuclear Power and Foreign Policy;* Foreign Affairs, 1956)

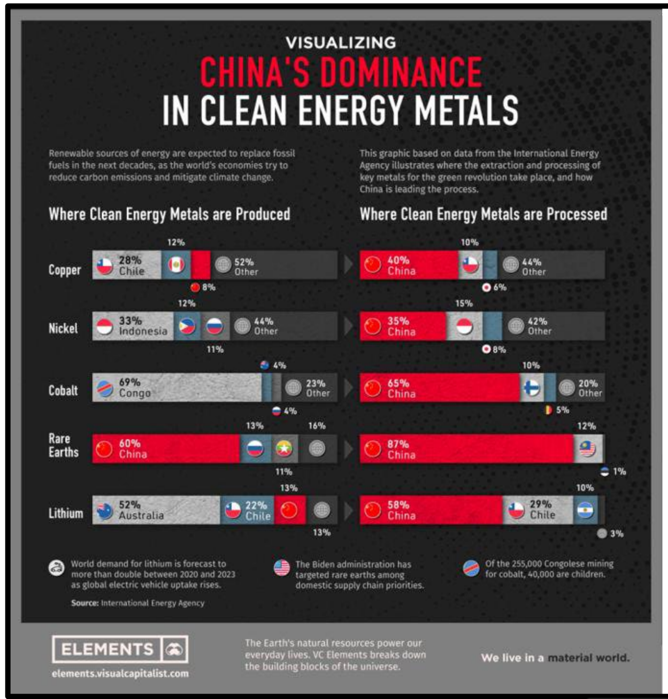


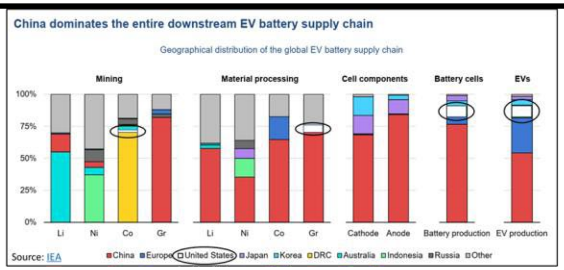
Henry DeWolf Smyth (1956)

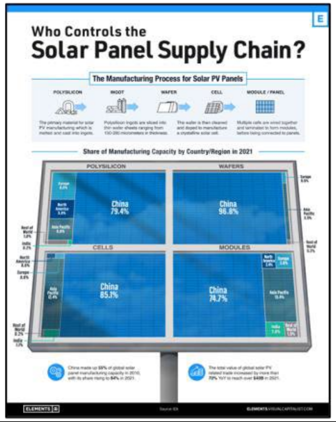
Manhattan Project, Atomic Energy Commission, IAEA U.S. Ambassador

Author of The Smyth Report on "Atomic Energy for Military Purposes": https://www.orau.org/ptp/pdf/smythreport.pdf



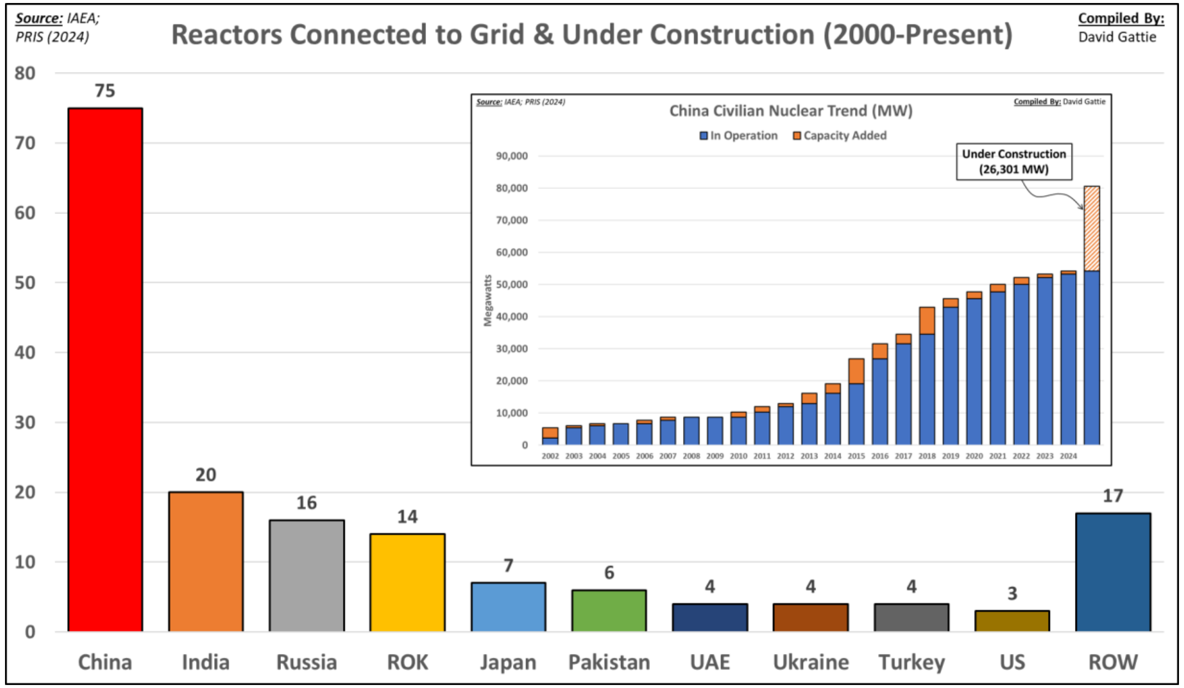






Strategem #28:

Lure them onto the roof, then take away the ladder



Xi Doubles Down on Alliance With Putin

Sino-Russian oil trade grew in 2023. ***Russia's exports to China are concentrated in commodities, especially oil, gas, and coal. Consequently, Moscow unsurprisingly continues to regard energy as a critical feature of the relationship***.

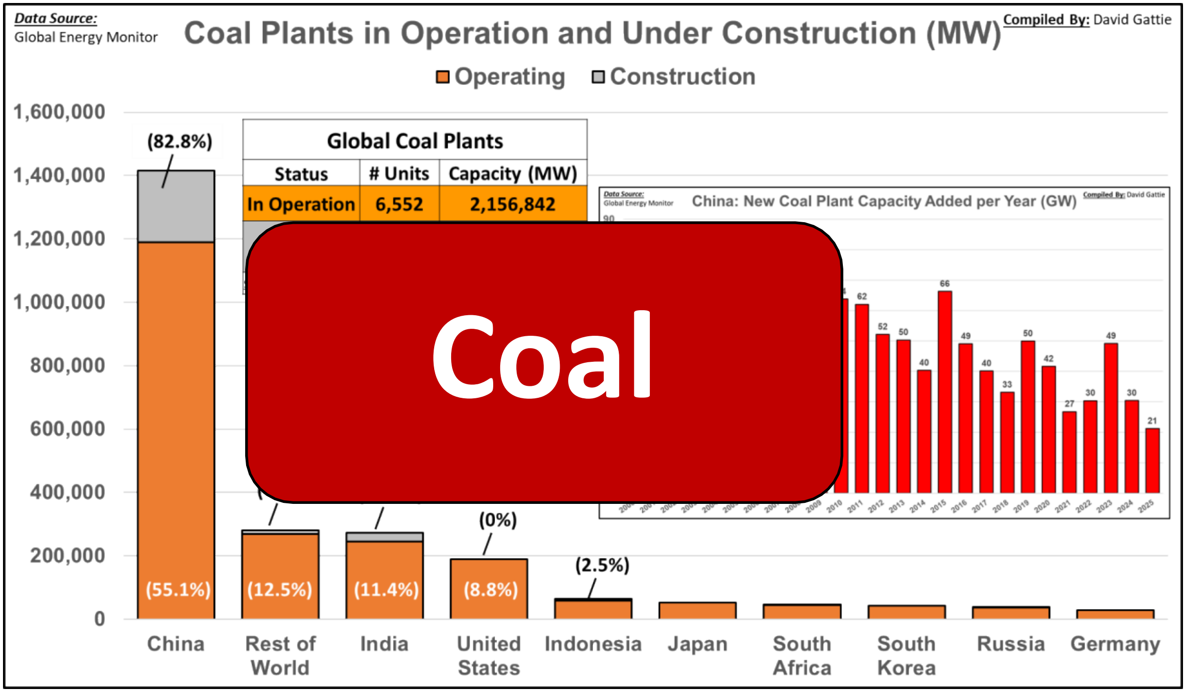
Sources: Xi-Putin CN RF Relations; CN Nods to Tighter Ties With RF; The Diplomat

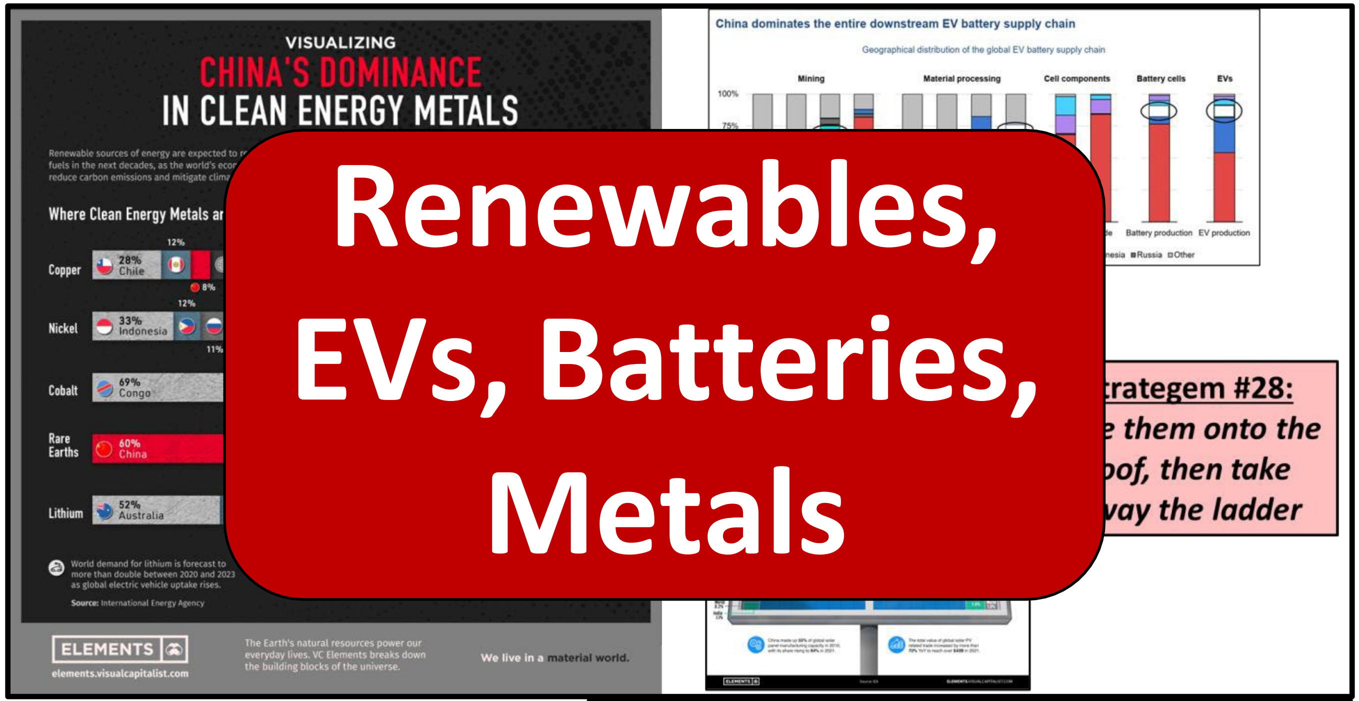
Xi Pledges More Energy Deals With Gulf Producers

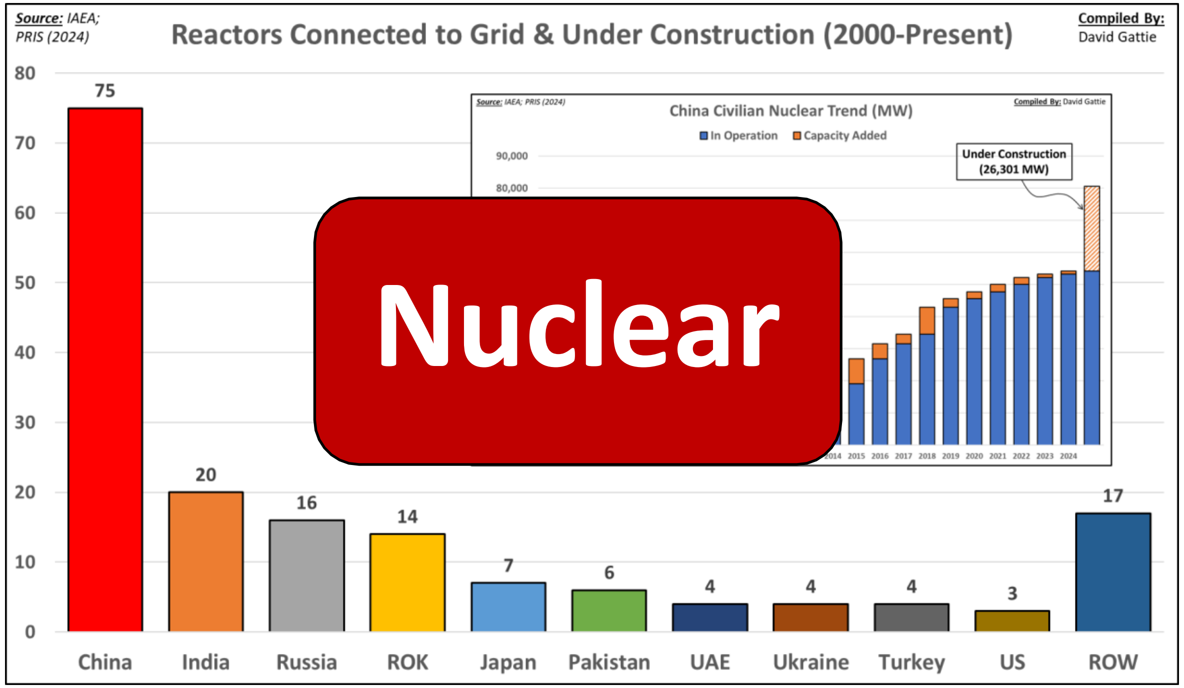
"***Saudi Arabia has always considered China as a strategic partner***, and that the Committee strives for further alignment between the Saudi and China visions of the future, ***especially in the energy sphere***, where there are multiple synergies," Prince Abdulaziz said. In the meeting, the co-chairs discussed ***areas where Saudi Arabia and China look to strengthen their relationship, such as oil and petrochemicals, decarbonization technologies, electricity and renewables, hydrogen, energy efficiency, civil nuclear energy, and supply chain security, in addition to industrial cooperation, the fourth industrial revolution, mining and logistics***... (October 27, 2022)

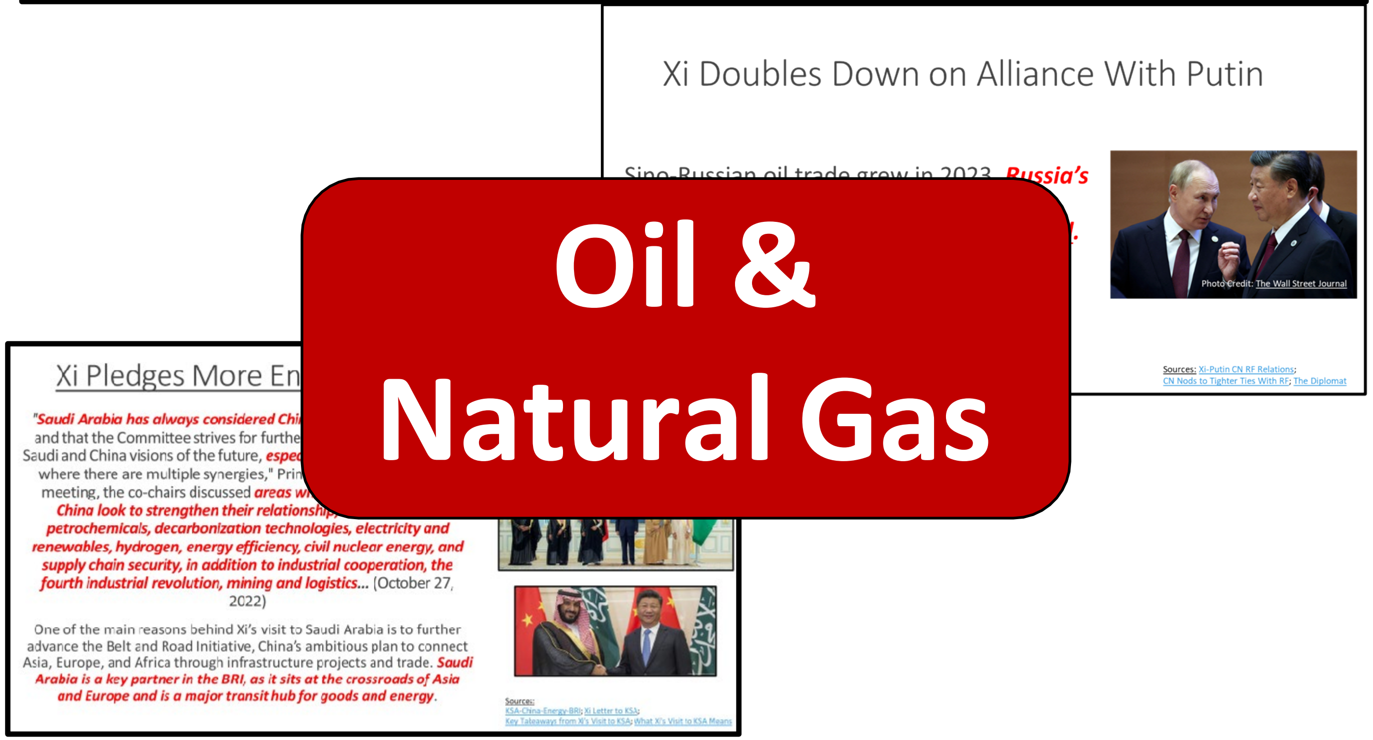
One of the main reasons behind Xi's visit to Saudi Arabia is to further advance the Belt and Road Initiative, China's ambitious plan to connect Asia, Europe, and Africa through infrastructure projects and trade. ***Saudi Arabia is a key partner in the BRI, as it sits at the crossroads of Asia and Europe and is a major transit hub for goods and energy***.

Source: KSA-China-Energy-BRI; Xi Letter to KSA; Key Takeaways from Xi's Visit to KSA; What Xi's Visit to KSA Means


Data Source: Global Energy Monitor
Coal Plants in Operation and Under Construction (MW)
Compiled By: David Gattie
Operating
Construction
Global Coal Plants
Status
Units
Capacity (MW)
In Operation
6,552
2,156,842
China: New Coal Plant Capacity Added per Year (GW)
(82.8%)
(55.1%)
(12.5%)
(11.4%)
(0%)
(8.8%)
(2.5%)
China
Rest of World
India
United States
Indonesia
Japan
South Africa
South Korea
Russia
Germany
Coal


VISUALIZING
CHINA'S DOMINANCE
IN CLEAN ENERGY METALS
Copper
Nickel
Cobalt
Rare Earths
Lithium
28% Chile
33% Indonesia
69% Congo
60% China
52% Australia
ELEMENTS
elements.visualcapitalist.com
We live in a material world.
China dominates the entire downstream EV battery supply chain
Geographical distribution of the global EV battery supply chain
Mining
Material processing
Cell components
Battery cells
EVs
Battery production
EV production
Stratagem #28:
them onto the
oof, then take
way the ladder
Renewables,
EVs, Batteries,
Metals


Source: IAEA; PRIS (2024)
Reactors Connected to Grid & Under Construction (2000-Present)
Compiled By: David Gattie
China Civilian Nuclear Trend (MW)
In Operation
Capacity Added
Under Construction (26,301 MW)
75
20
16
14
7
6
4
4
4
3
17
China
India
Russia
ROK
Japan
Pakistan
UAE
Ukraine
Turkey
US
ROW
Nuclear


Xi Doubles Down on Alliance With Putin
Sino-Russian oil trade grew in 2023. Russia's
Photo Credit: The Wall Street Journal
Xi Pledges More En
"Saudi Arabia has always considered Chi
and that the Committee strives for furthe
Saudi and China visions of the future, espe
where there are multiple synergies," Prin
meeting, the co-chairs discussed areas w
China look to strengthen their relationship
petrochemicals, decarbonization technologies, electricity and
renewables, hydrogen, energy efficiency, civil nuclear energy, and
supply chain security, in addition to industrial cooperation, the
fourth industrial revolution, mining and logistics... (October 27, 2022)
One of the main reasons behind Xi's visit to Saudi Arabia is to further
advance the Belt and Road Initiative, China's ambitious plan to connect
Asia, Europe, and Africa through infrastructure projects and trade. Saudi
Arabia is a key partner in the BRI, as it sits at the crossroads of Asia
and Europe and is a major transit hub for goods and energy.
Oil &
Natural Gas

To Which Great Power Belongs the Competitive Advantage?

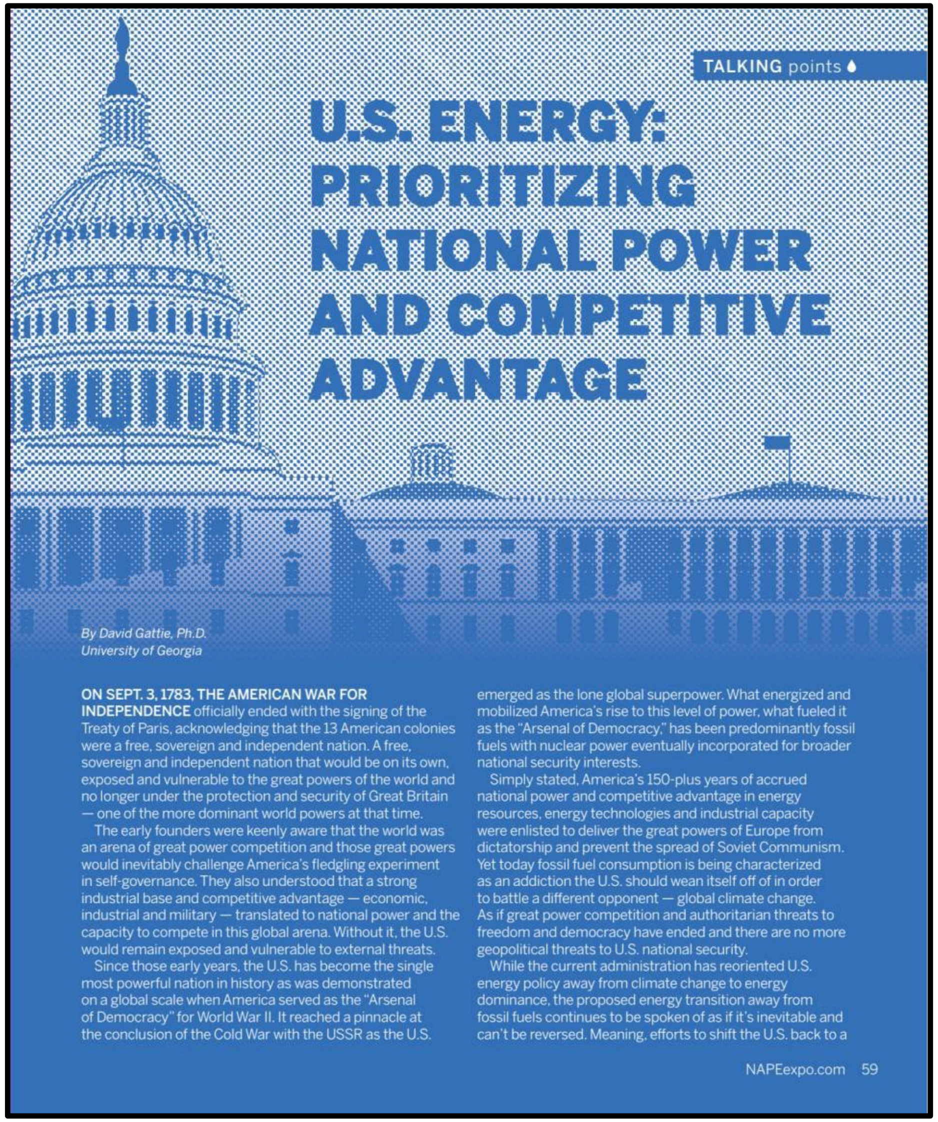
Thank You

National Security Imperative for All Energy Resources & Technologies

THE NATIONAL INTEREST

U.S. Energy Strategy: Prioritizing Peace Through Strength

January 29, 2025 | By: David Gattie



TALKING points

U.S. ENERGY: PRIORITIZING NATIONAL POWER AND COMPETITIVE ADVANTAGE

By David Gattie, Ph.D.
University of Georgia

ON SEPT. 3, 1783, THE AMERICAN WAR FOR INDEPENDENCE officially ended with the signing of the Treaty of Paris, acknowledging that the 13 American colonies were a free, sovereign and independent nation. A free, sovereign and independent nation that would be on its own, exposed and vulnerable to the great powers of the world and no longer under the protection and security of Great Britain — one of the more dominant world powers at that time.

The early founders were keenly aware that the world was an arena of great power competition and those great powers would inevitably challenge America's fledgling experiment in self-governance. They also understood that a strong industrial base and competitive advantage — economic, industrial and military — translated to national power and the capacity to compete in this global arena. Without it, the U.S. would remain exposed and vulnerable to external threats.

Since those early years, the U.S. has become the single most powerful nation in history as was demonstrated on a global scale when America served as the "Arsenal of Democracy" for World War II. It reached a pinnacle at the conclusion of the Cold War with the USSR as the U.S. emerged as the lone global superpower. What energized and mobilized America's rise to this level of power, what fueled it as the "Arsenal of Democracy," has been predominantly fossil fuels with nuclear power eventually incorporated for broader national security interests.

Simply stated, America's 150-plus years of accrued national power and competitive advantage in energy resources, energy technologies and industrial capacity were enlisted to deliver the great powers of Europe from dictatorship and prevent the spread of Soviet Communism. Yet today fossil fuel consumption is being characterized as an addiction the U.S. should wean itself off of in order to battle a different opponent — global climate change. As if great power competition and authoritarian threats to freedom and democracy have ended and there are no more geopolitical threats to U.S. national security.

While the current administration has reoriented U.S. energy policy away from climate change to energy dominance, the proposed energy transition away from fossil fuels continues to be spoken of as if it's inevitable and can't be reversed. Meaning, efforts to shift the U.S. back to a

NAPEexpo.com 59

"Upon us, as the people who first harnessed and made use of this force, there rests a grave and continuing responsibility for leadership in turning it toward life, not death."

THE NATIONAL INTEREST

Restoring America's Relationship with Nuclear Power as a National Security Priority

June 4, 2025 | By: David Gattie

Contention

The U.S. must prioritize the national security imperative of civilian nuclear power to regain competitive advantage over geopolitical rivals and restore America's special relationship with nuclear power.

Nuclear is not just another energy commodity

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Residential Rates

Residential rates are from the U.S. Energy Information Administration. These rates represent a weighted average of consumer revenue and sales for a state, and do not equal the per KWhr rate charged by the electric power industry participant to an individual consumer. They are offered here in order to provide a common metric for comparison across states.

(Reference: https://www.eia.gov/electricity/monthly/pdf/AppendixC.pdf)