US Energy and Climate Policy

Implications for National Security and America's Industrial Base

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WYOMING MINING ASSOCIATION, JULY 22, 2021

A Battle of Ideas

The US is in the middle of a national and international discussion as to which energy resources (Fossil Fuels, Nuclear Power, Renewables) will drive the US economy in the 21st century—a debate that, increasingly, is revolving around ***global*** climate change and ***domestic*** carbon reduction.

—We're Having a Battle of Ideas Over the US Energy Sector—

In an October 24, 2020 interview, then-Presidential candidate Joe Biden was asked about climate change. His response: "It's the number one issue facing humanity. And it's the number one issue for me. *Look, climate change is the existential threat to humanity.*"

Upon taking office, President Biden acted on this position by Executive Order (EO), "*putting the climate crisis at the center of United States foreign policy and national security.*"

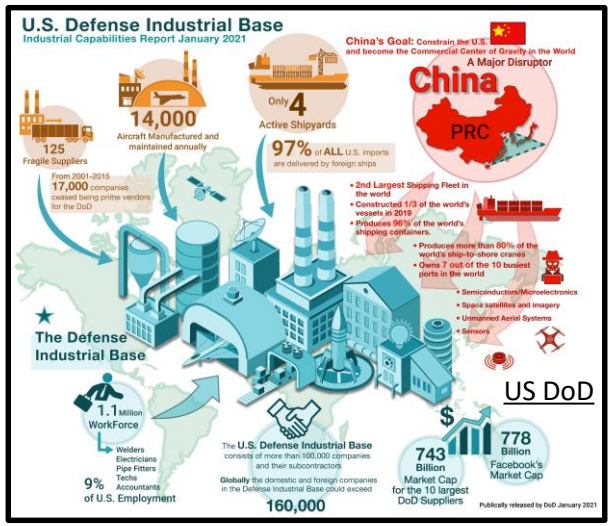
A Relevant Question

Post-WWII, America established its national power dominance, thus its national security, and upheld its security guarantees to allies through decades of a Cold War-centric foreign policy where America pursued technology dominance over the USSR

Can America maintain that national power dominance and national security and uphold security guarantees to its allies within a climate-centric foreign policy focused on domestic carbon reduction?

"The United States has entered an era of long-term competition with revisionist powers. A key aspect of this competition will revolve around a contest for technological superiority waged between the national innovation bases of the respective competitors. The outcome of this competition will determine not just American national security but also how the nations of the world interact—and whether a free and open political and economic system will remain the foundation of those interactions."

(The Contest for Innovation:
Strengthening America's National Security Innovation Base
in An Era of Strategic Competition, *Ronald Reagan Institute*, 2019)



The US Industrial Base & Critical Infrastructure Sectors

GREAT POWER COMPETITION WITH CHINA AND RUSSIA HAS EXTENDED THE FIELD OF COMPETITION TO INCLUDE, NOT ONLY MILITARY, BUT ALSO

ENERGY RESOURCES AND ENERGY TECHNOLOGIES

Underlying Contentions for this Talk

- Energy is preeminently a resource with *intrinsic national security value for the U.S.*
  - Value that is currently non-monetized and unaccounted for in US policy
- Energy resources and technologies are not merely market commodities or diplomatic chattel for global deliberations around climate change
  - They're central to the strength and diversity of the ***US industrial base***, thus America's capacity to remain a great power competitor and protect its interests at home and abroad

Overview

- Global realities of energy consumption and CO_2
- National security implications of US energy & climate policy
- Critical questions and a proposed security-centric framework for energy and climate policy
- Closing Points

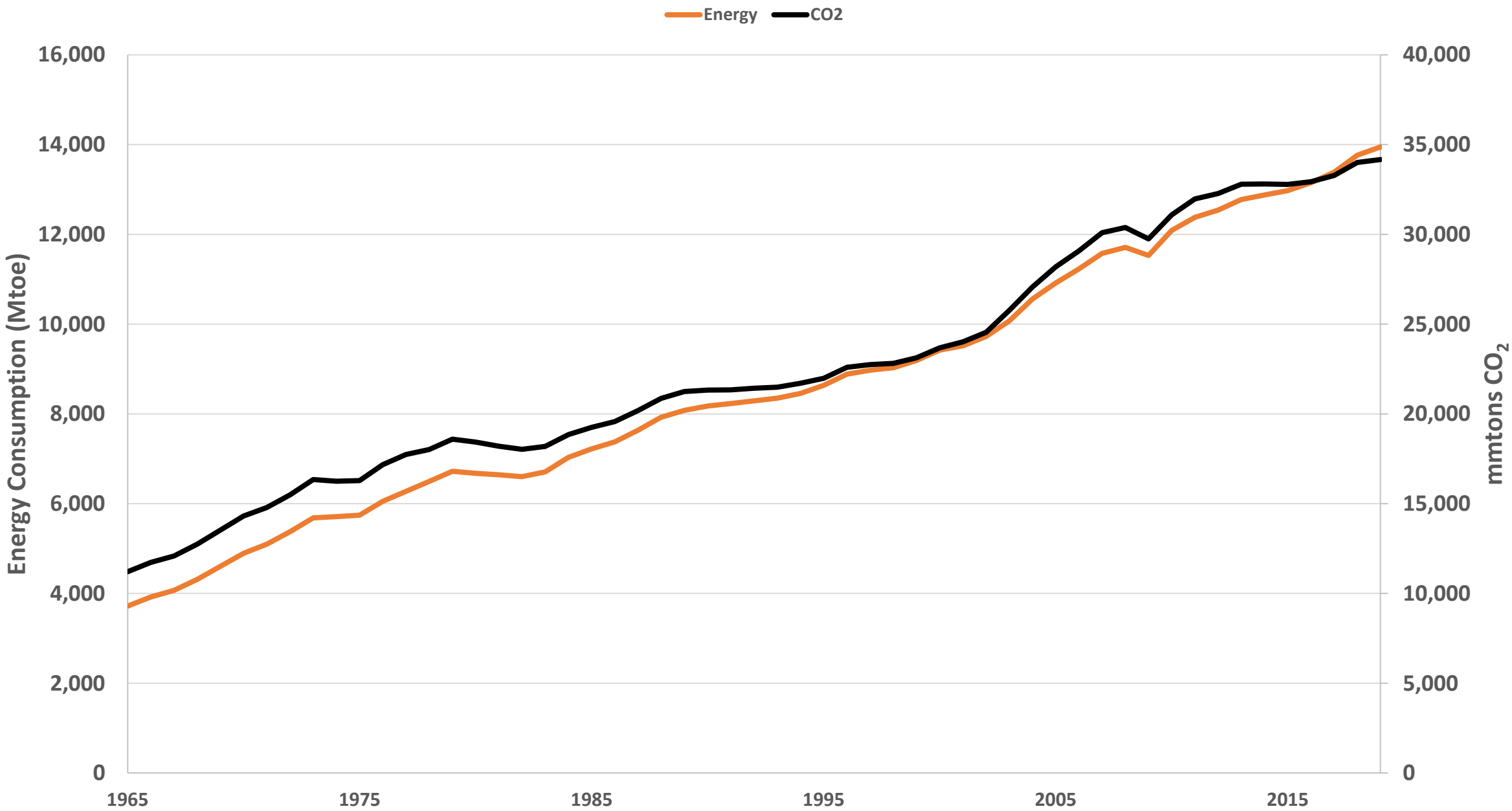
Energy & CO_2

CONTEXT & GLOBAL REALITIES

Data Source: BP Statistical Review 2020

Compiled By: David Gattie

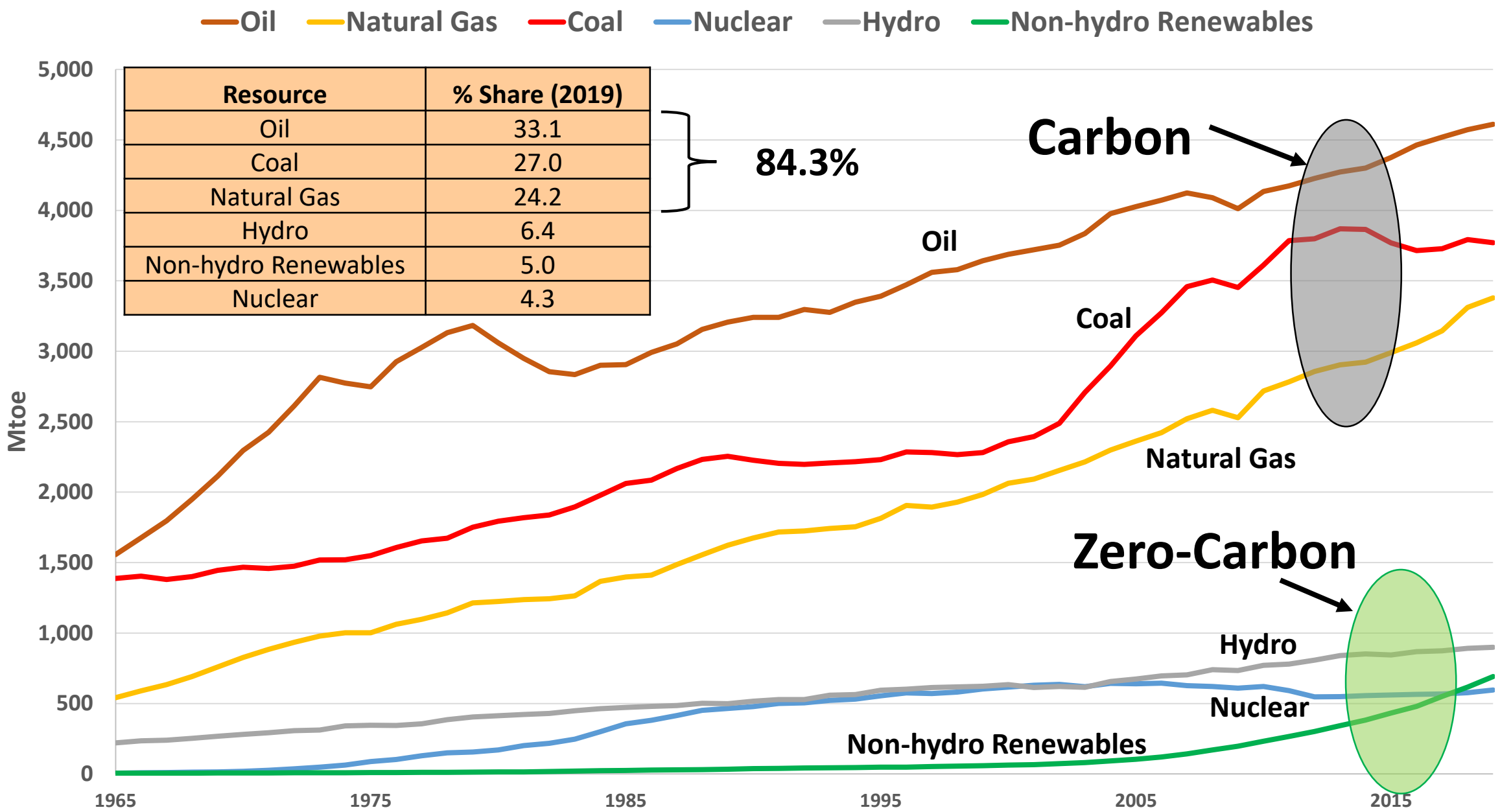
World Total Energy Consumption & CO_2 Emissions



Data Source: BP Statistical Review 2020

Compiled By: David Gattie

World Total Energy Consumption

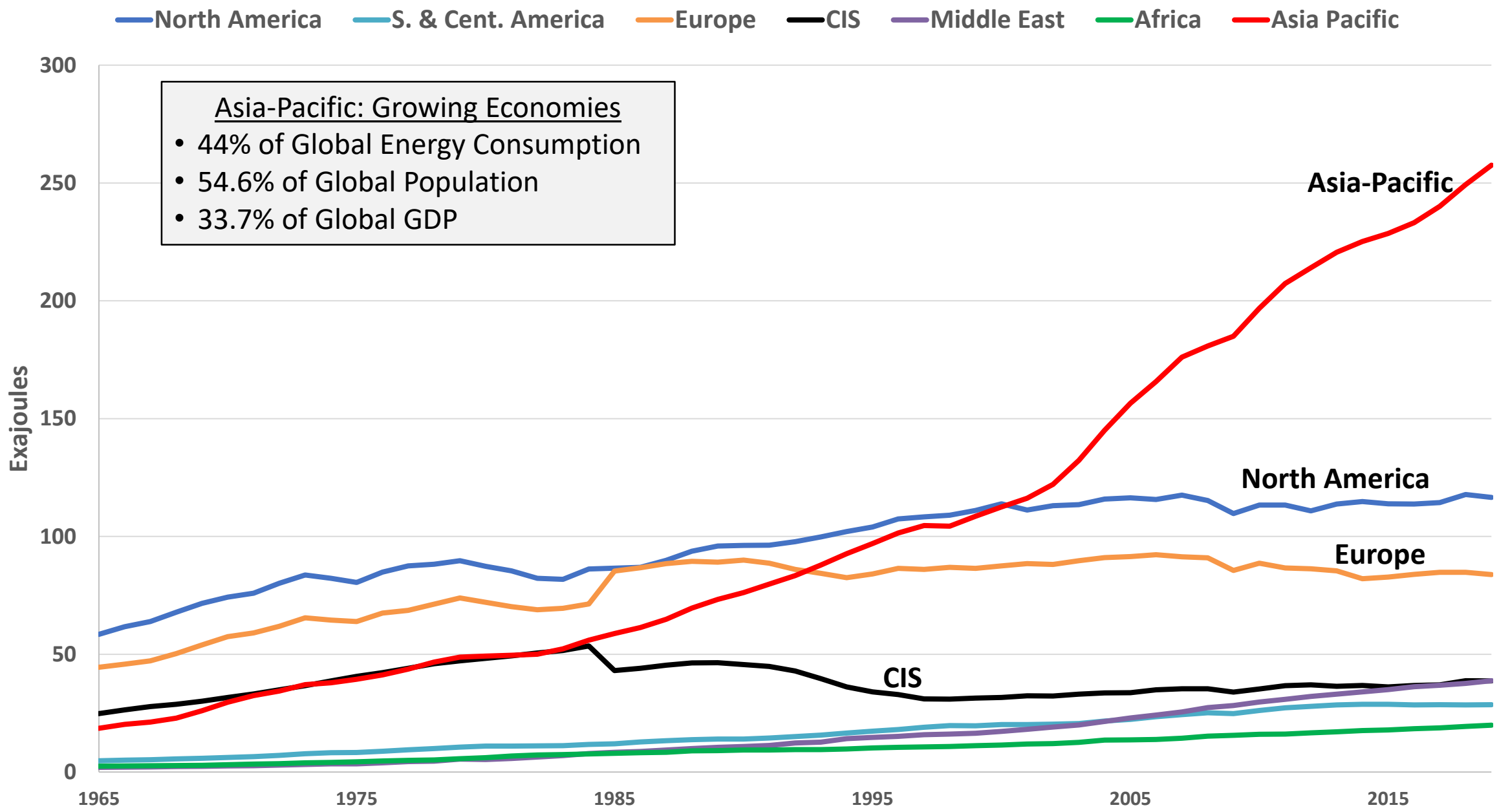


Resource	% Share (2019)
Oil	33.1
Coal	27.0
Natural Gas	24.2
Hydro	6.4
Non-hydro Renewables	5.0
Nuclear	4.3

Data Source: BP Statistical Review 2020

Compiled By: David Gattie

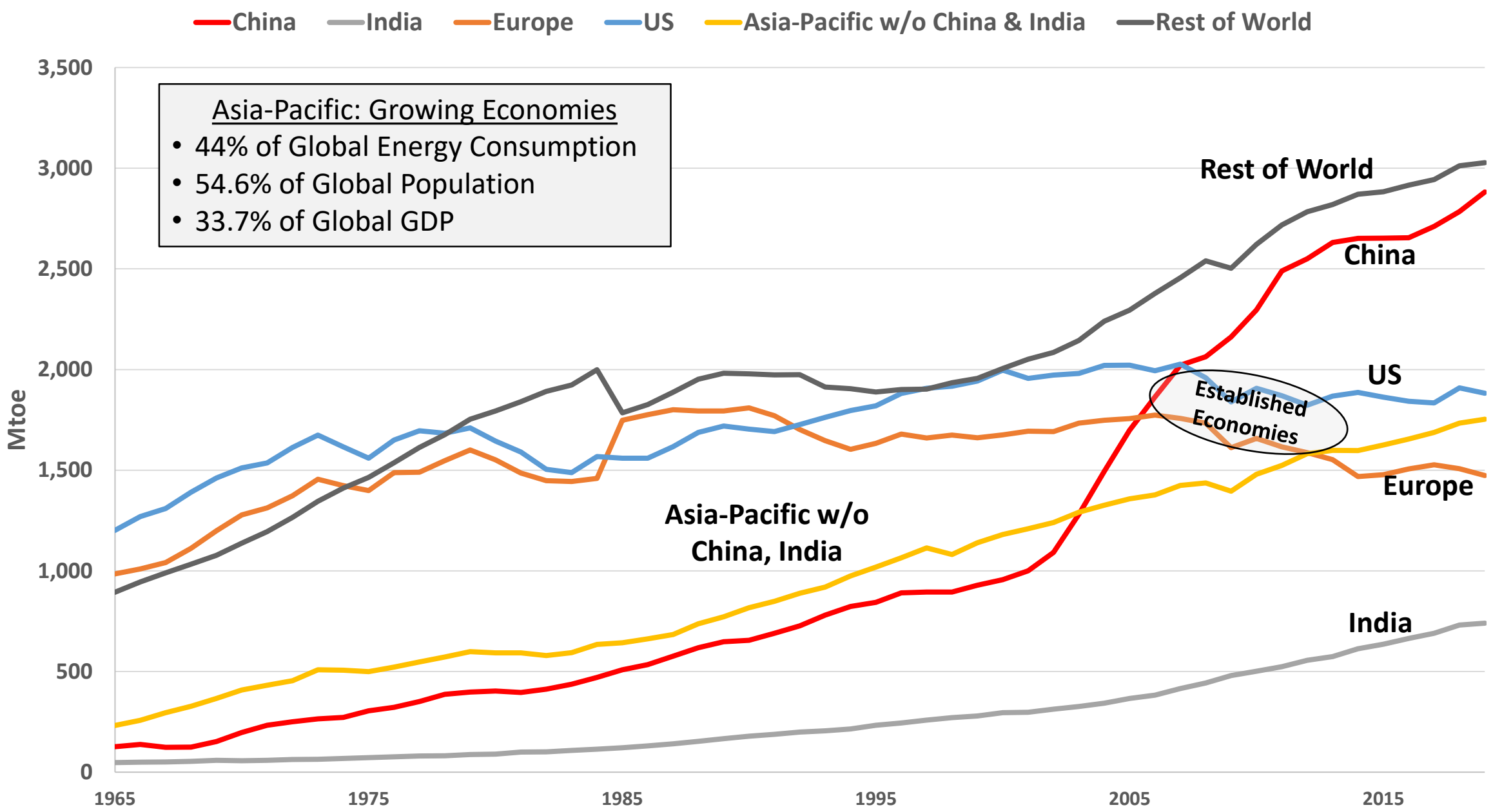
Total Energy Consumption by Region



Data Source: BP Statistical Review 2020

Compiled By: David Gattie

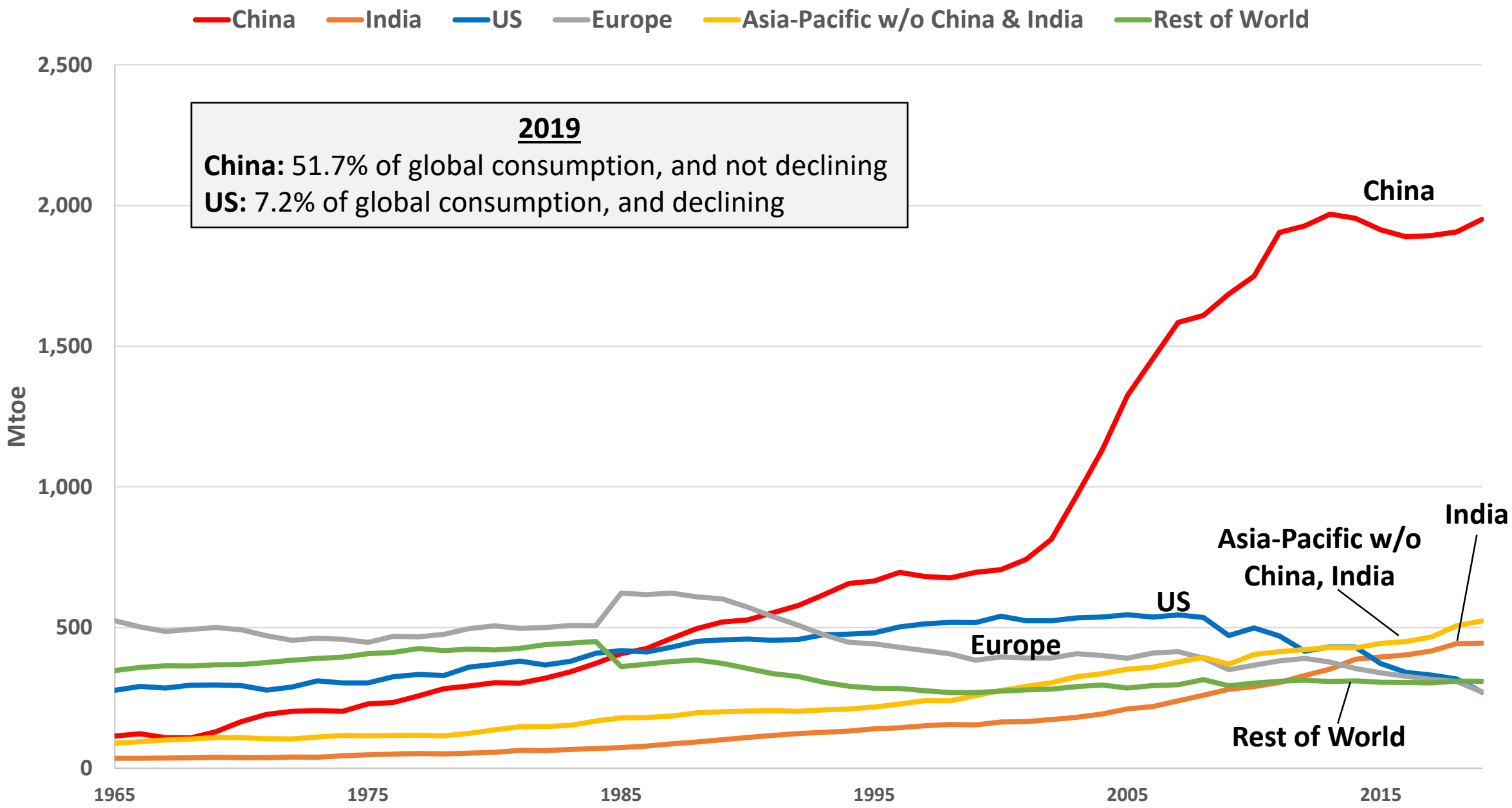
Fossil Fuel Consumption: Some Detail



Data Source: BP Statistical Review 2020

Compiled By: David Gattie

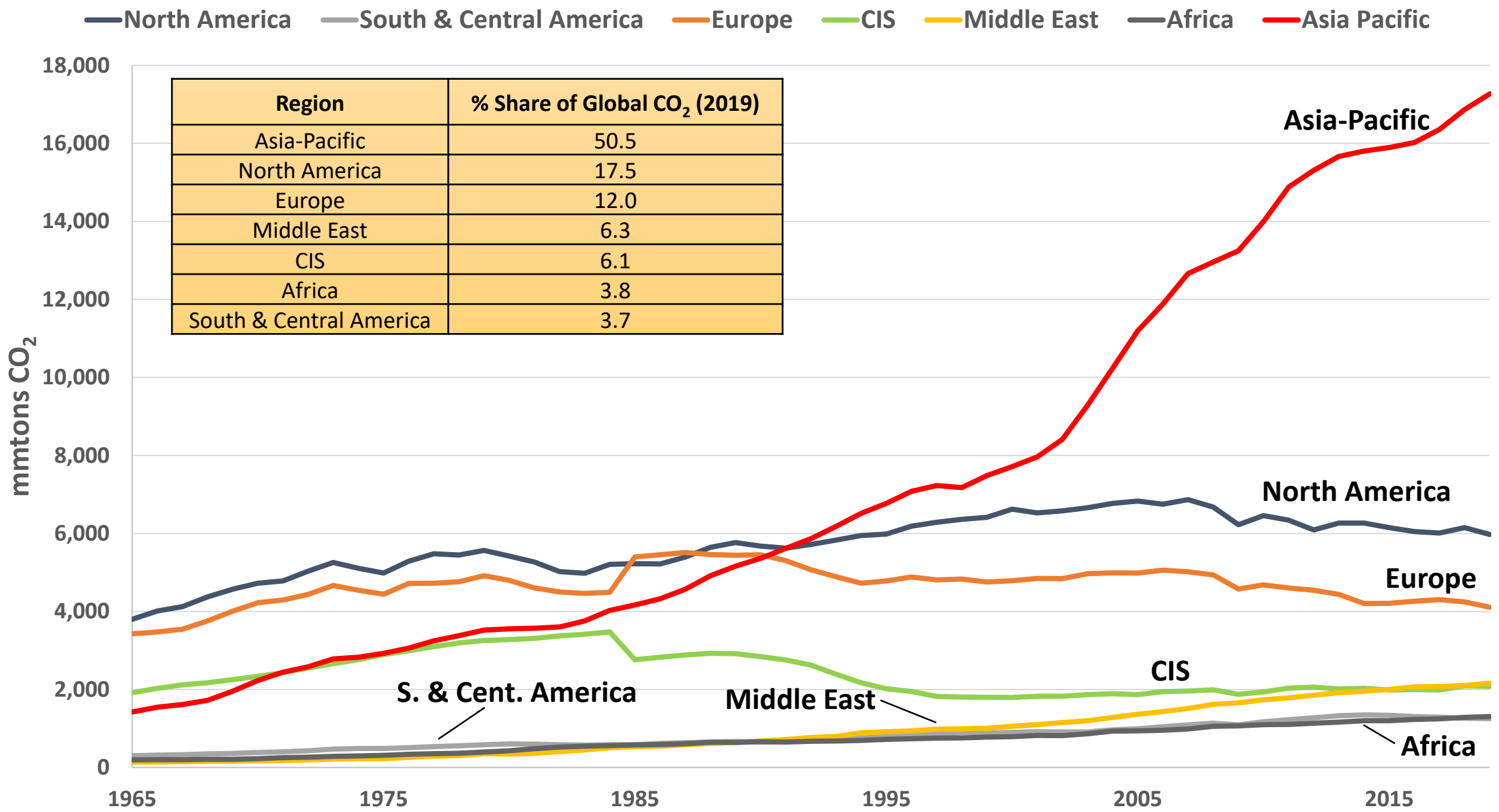
Global Coal Consumption



Data Source: BP Statistical Review 2020

Compiled By: David Gattie

CO_2 Emissions by Region

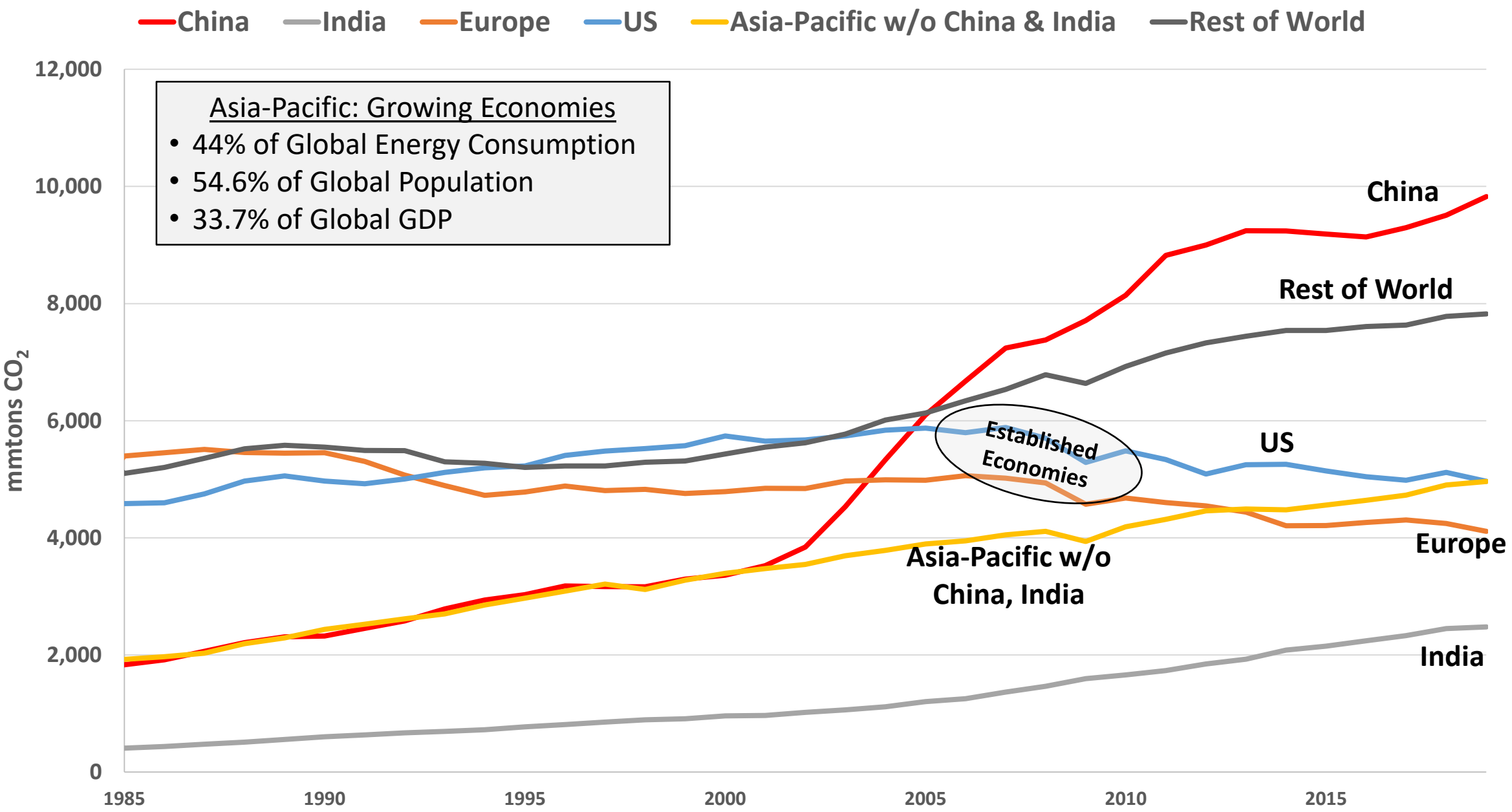


Region	% Share of Global CO_2 (2019)
Asia-Pacific	50.5
North America	17.5
Europe	12.0
Middle East	6.3
CIS	6.1
Africa	3.8
South & Central America	3.7

Data Source: BP Statistical Review 2020

Compiled By: David Gattie

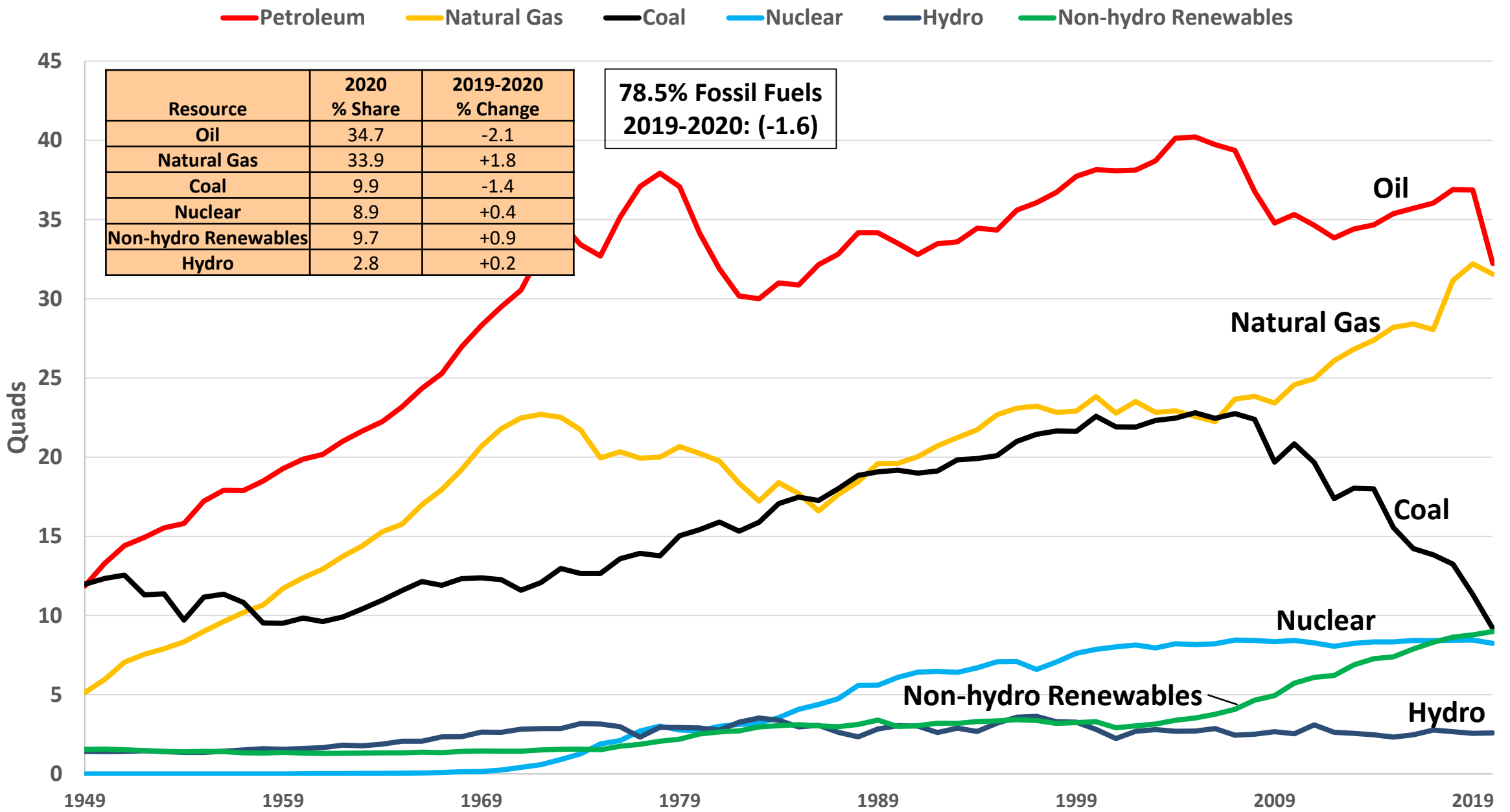
CO_2 Emissions: Some Detail



Data Source: US EIA

Compiled By: David Gattie

US Total Energy Consumption



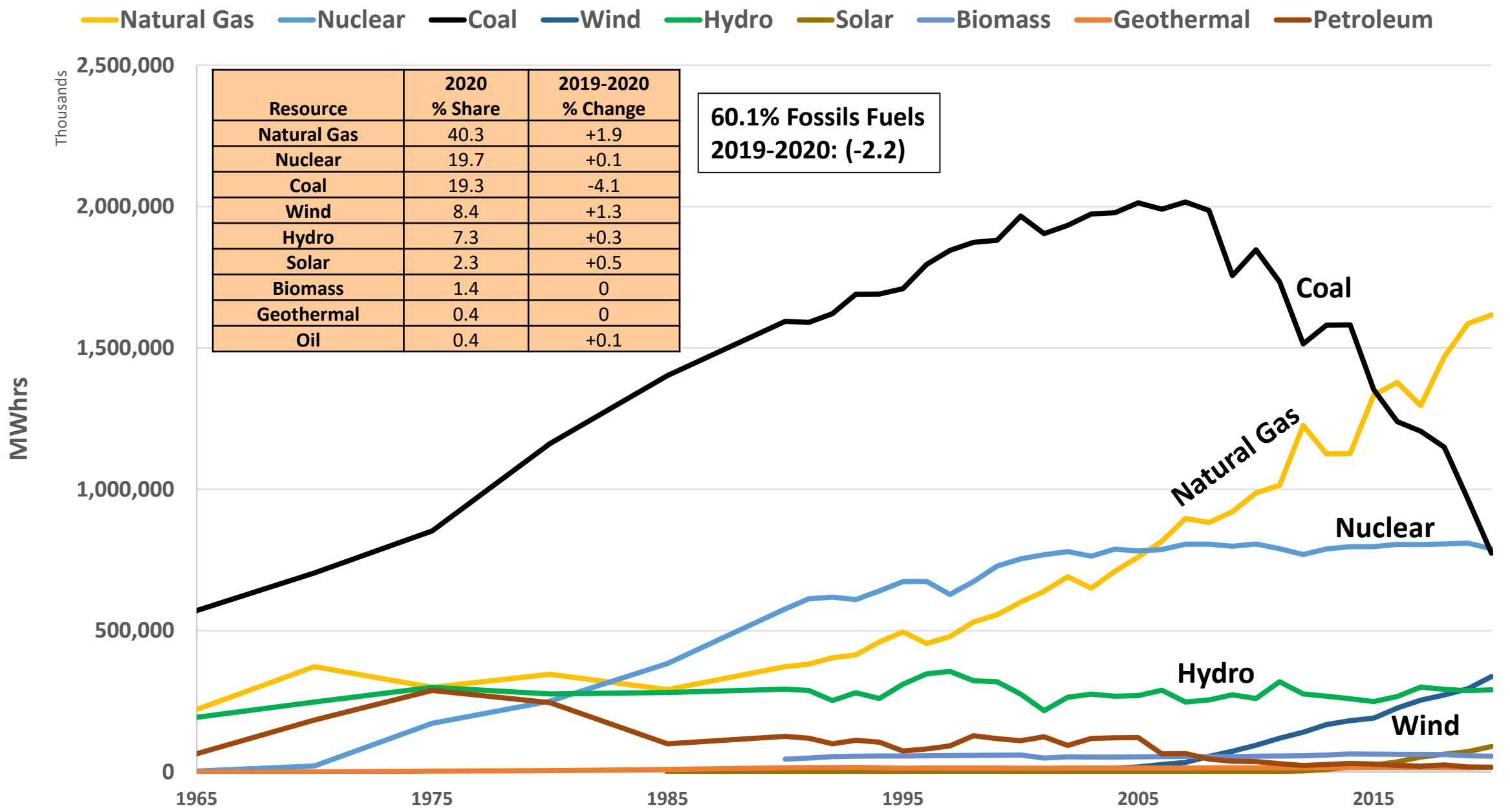
Resource	2020 % Share	2019-2020 % Change
Oil	34.7	-2.1
Natural Gas	33.9	+1.8
Coal	9.9	-1.4
Nuclear	8.9	+0.4
Non-hydro Renewables	9.7	+0.9
Hydro	2.8	+0.2

78.5% Fossil Fuels
2019-2020: (-1.6)

Data Source: US EIA

Compiled By: David Gattie

US Electricity Profile: Utility-Scale



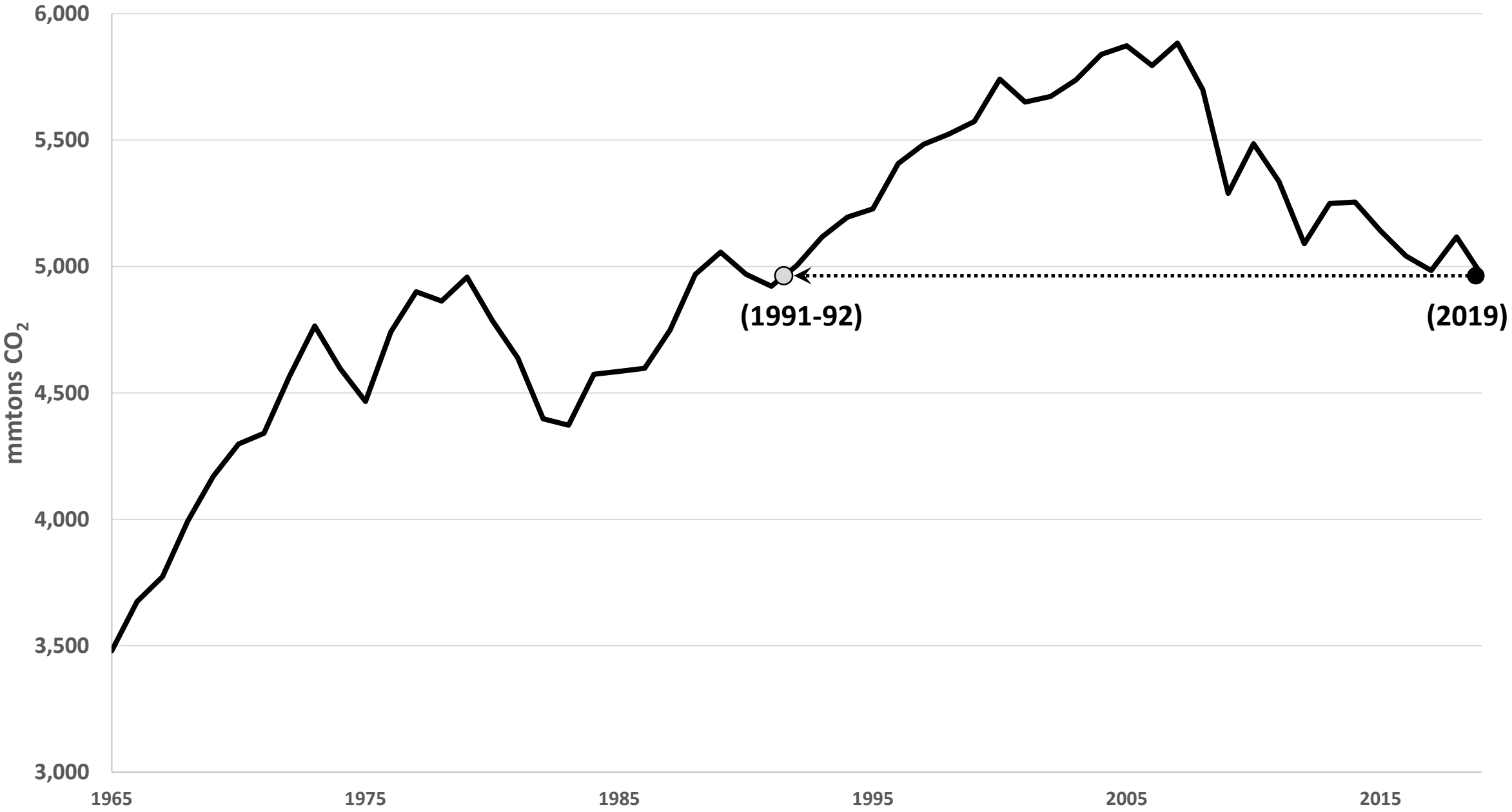
Resource	2020 % Share	2019-2020 % Change
Natural Gas	40.3	+1.9
Nuclear	19.7	+0.1
Coal	19.3	-4.1
Wind	8.4	+1.3
Hydro	7.3	+0.3
Solar	2.3	+0.5
Biomass	1.4	0
Geothermal	0.4	0
Oil	0.4	+0.1

60.1% Fossils Fuels
2019-2020: (-2.2)

Data Source: BP Statistical Review 2020

Compiled By: David Gattie

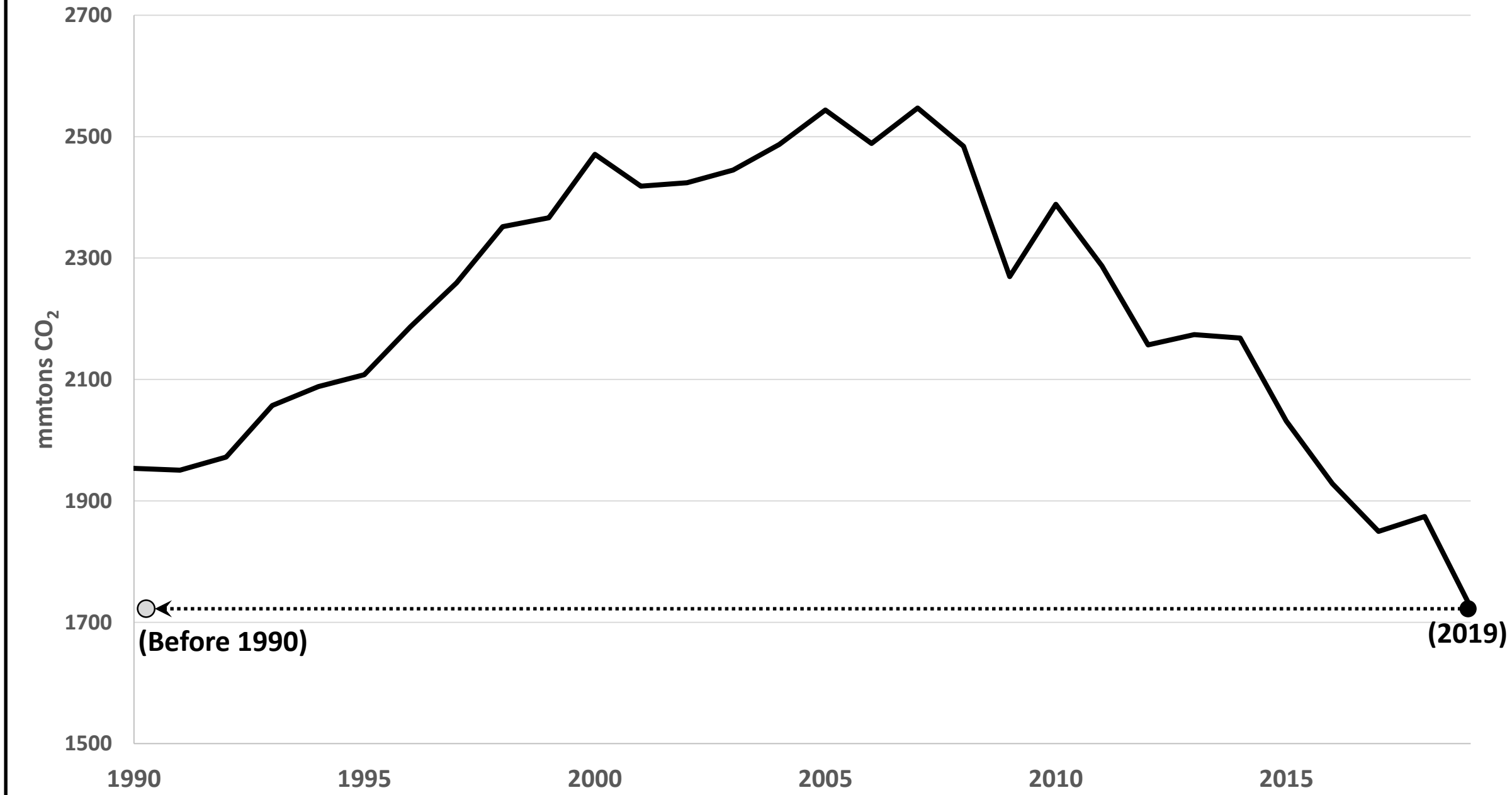
US CO_2 Emissions



Data Source: U.S. EIA

Compiled By: David Gattie

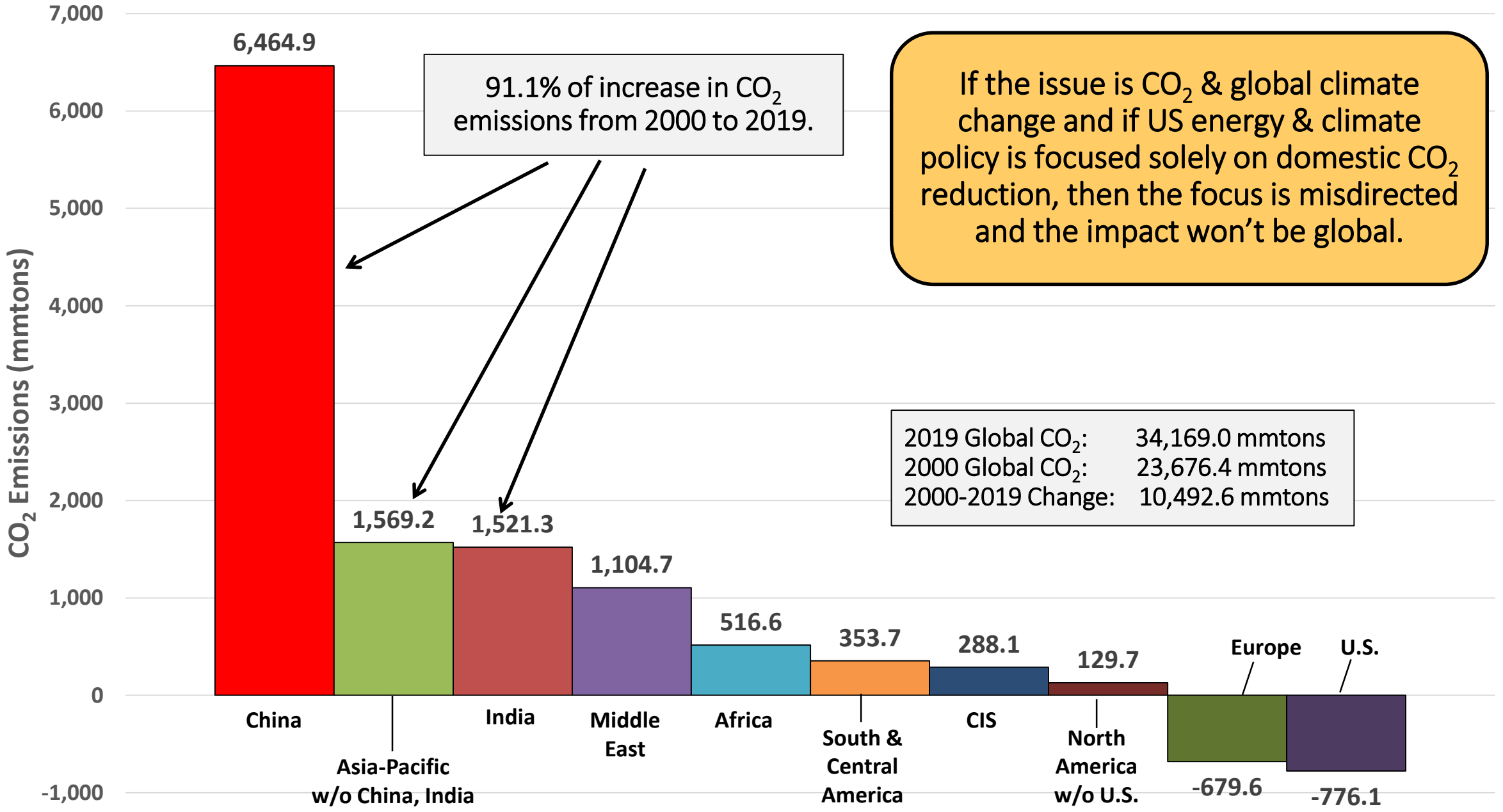
US Electric Power Sector CO_2 Emissions



Data Source: BP Statistical Review 2020

Compiled By: David Gattie

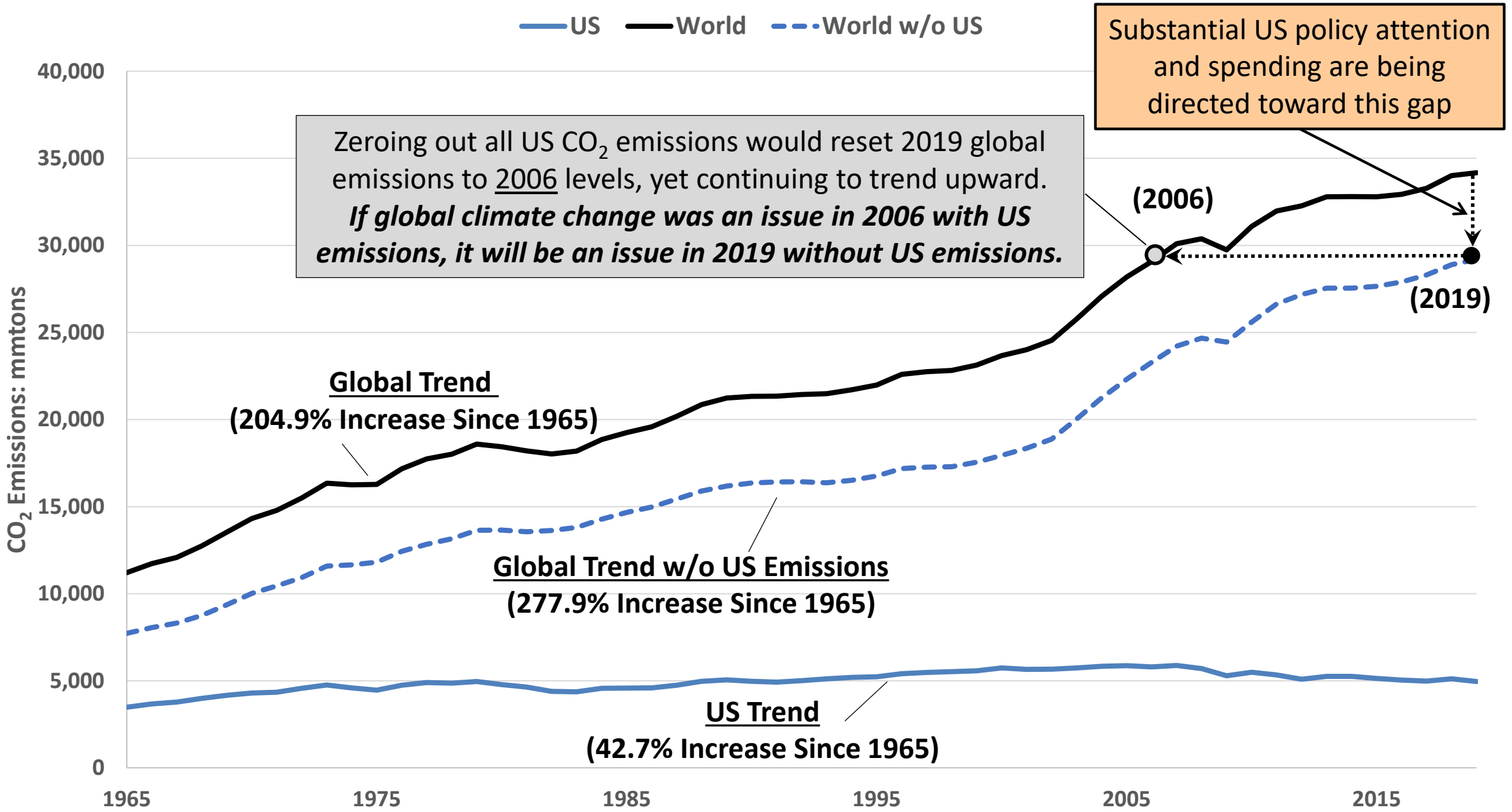
Change in CO_2 Emissions (2000-2019)



Data Source: BP Statistical Review 2020

Compiled By: David Gattie

CO_2 Emissions: World and US Comparison



US Global Competitiveness and Engagement

ENERGY RESOURCES AND ENERGY TECHNOLOGIES

Data Source: BP Statistical Review 2020

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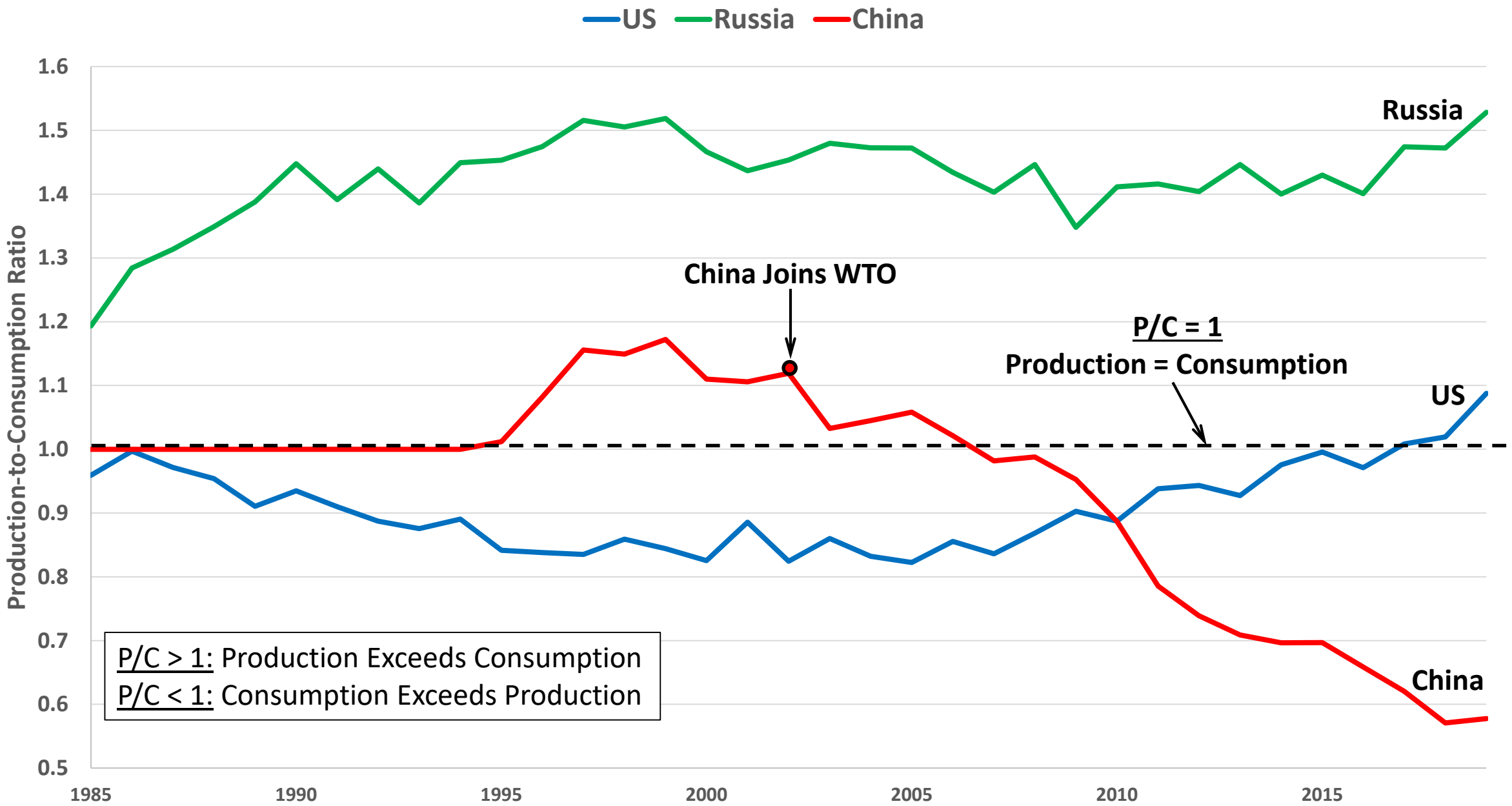
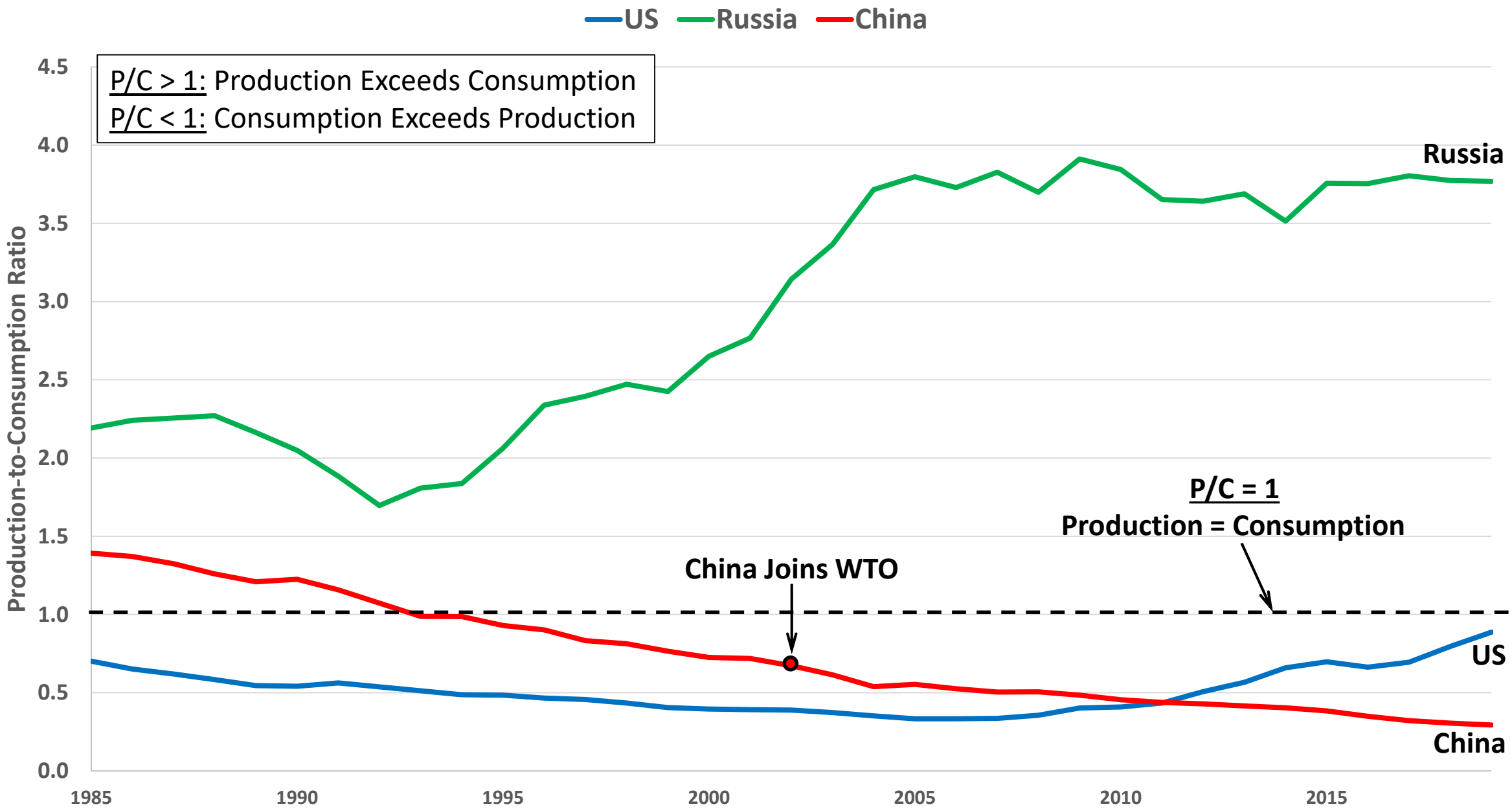
Natural Gas Production-to-Consumption Ratio



Data Source: BP Statistical Review 2020

Compiled By: David Gattie

Oil Production-to-Consumption Ratio



Russia: The Energy Producer and Disruptor

- Oil and gas production constitutes about 35% of Russia's economy
  - 12.8% of global oil exports & 8.1% of global LNG are Russian
  - 39.9% of gas piped into Europe is Russian; 17.1% of LNG shipped to Europe is Russian
- Power of Siberia natural gas pipeline to China—30 year agreement
  - Currently conducting feasibility study for Power of Siberia 2
- Working in the Arctic to secure more oil, gas and mineral resources

References:
https://warsawinstitute.org/russias-economy-becoming-heavily-dependent-hydrocarbons/
https://www.oceaneconomics.org/arctic/extractive/

China: The Energy Consumer and Strategic Challenger

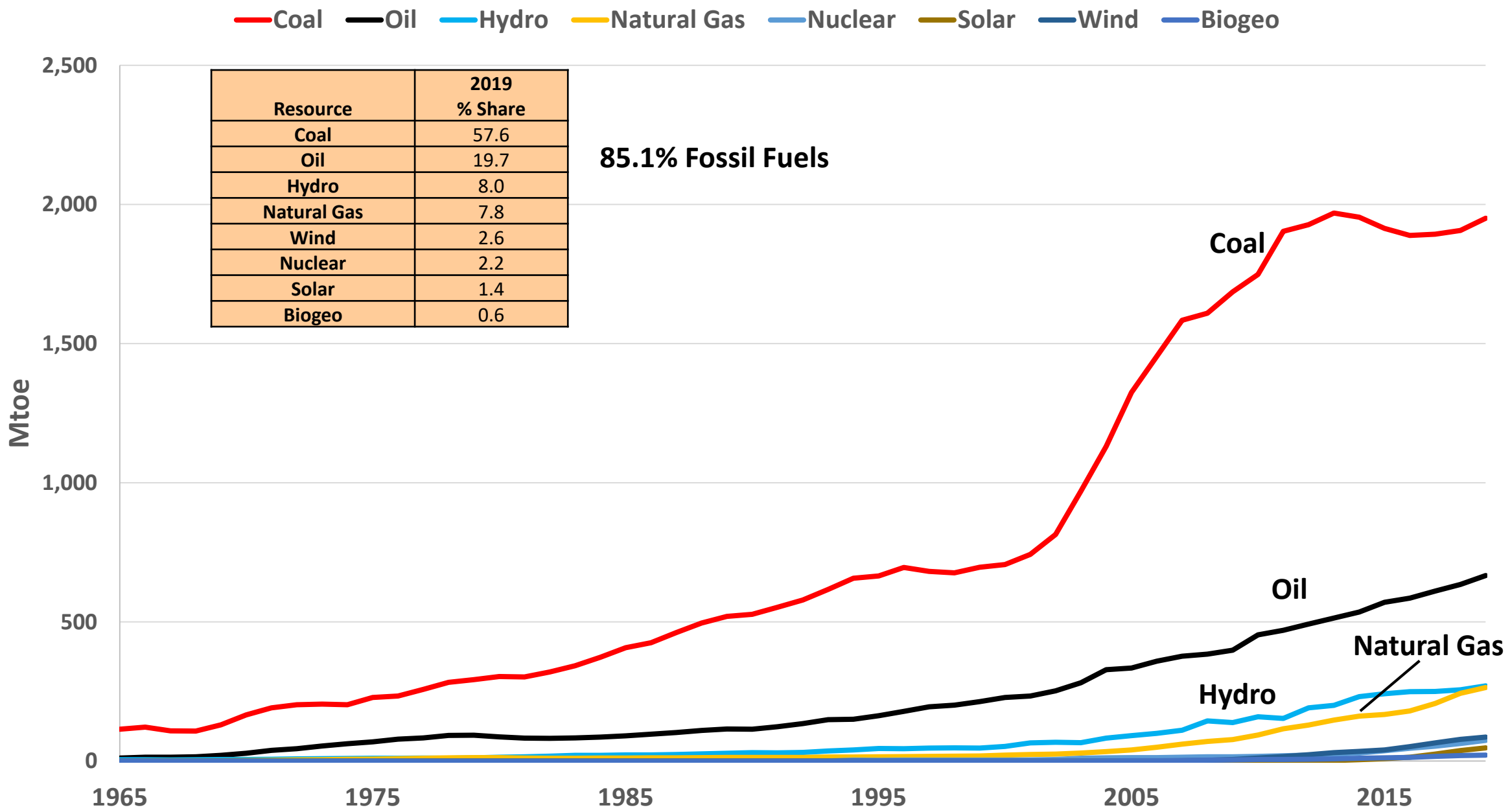
- Consumes 24.3% of world's total energy and 43.3% of world's fossil fuels
  - Currently claims sovereignty over South China Sea with an estimated 11 billion barrels of oil and 190 trillion ft^3 of natural gas—proved reserves
- *Made in China 2025* and *14th Five-Year Plan* includes all energy resources and associated technologies—including fossil fuels.
  - China is currently financing 56,129 MW of coal-fired power plants globally
- China's Arctic Policy *"promotes technology innovation in Arctic oil and gas drilling and exploitation"*

References:
https://www.cfr.org/global-conflict-tracker/conflict/territorial-disputes-south-china-sea
https://china.usembassy-china.org.cn/china-escalates-coercion-against-vietnams-longstanding-oil-and-gas-activity-in-the-south-china-sea/
https://endcoal.org/finance-tracker/
http://english.www.gov.cn/archive/white_paper/2018/01/26/content_281476026660336.htm

Data Source: BP Statistical Review 2020

Compiled By: David Gattie

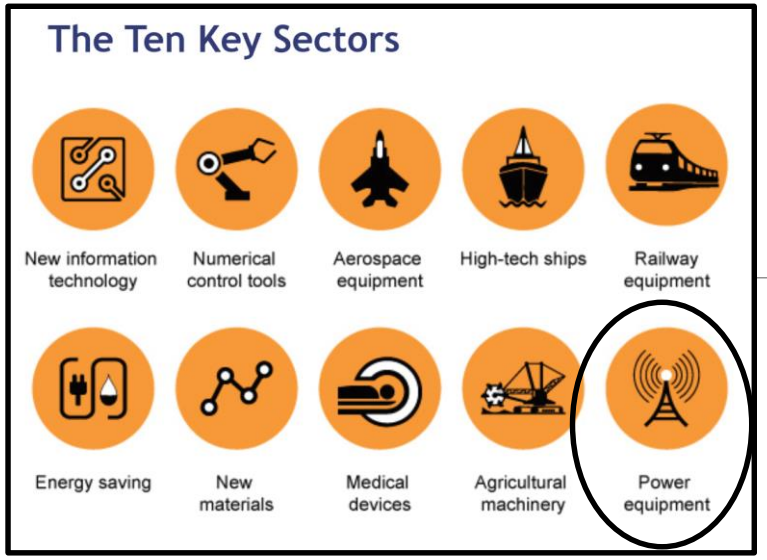
China Total Energy



Resource	2019 % Share
Coal	57.6
Oil	19.7
Hydro	8.0
Natural Gas	7.8
Wind	2.6
Nuclear	2.2
Solar	1.4
Biogeo	0.6

85.1% Fossil Fuels

Made in China 2025



Main Steps	Milestone
2025	Major manufacturing power
2035	Global manufacturing power
2049	Leading manufacturing power

Objective:
National Rejuvenation
…not climate change

Source: China Tech Blog. Made in China 2025—Halftime Analysis.
Link: https://www.chinatechblog.org/blog/madeinchina2025

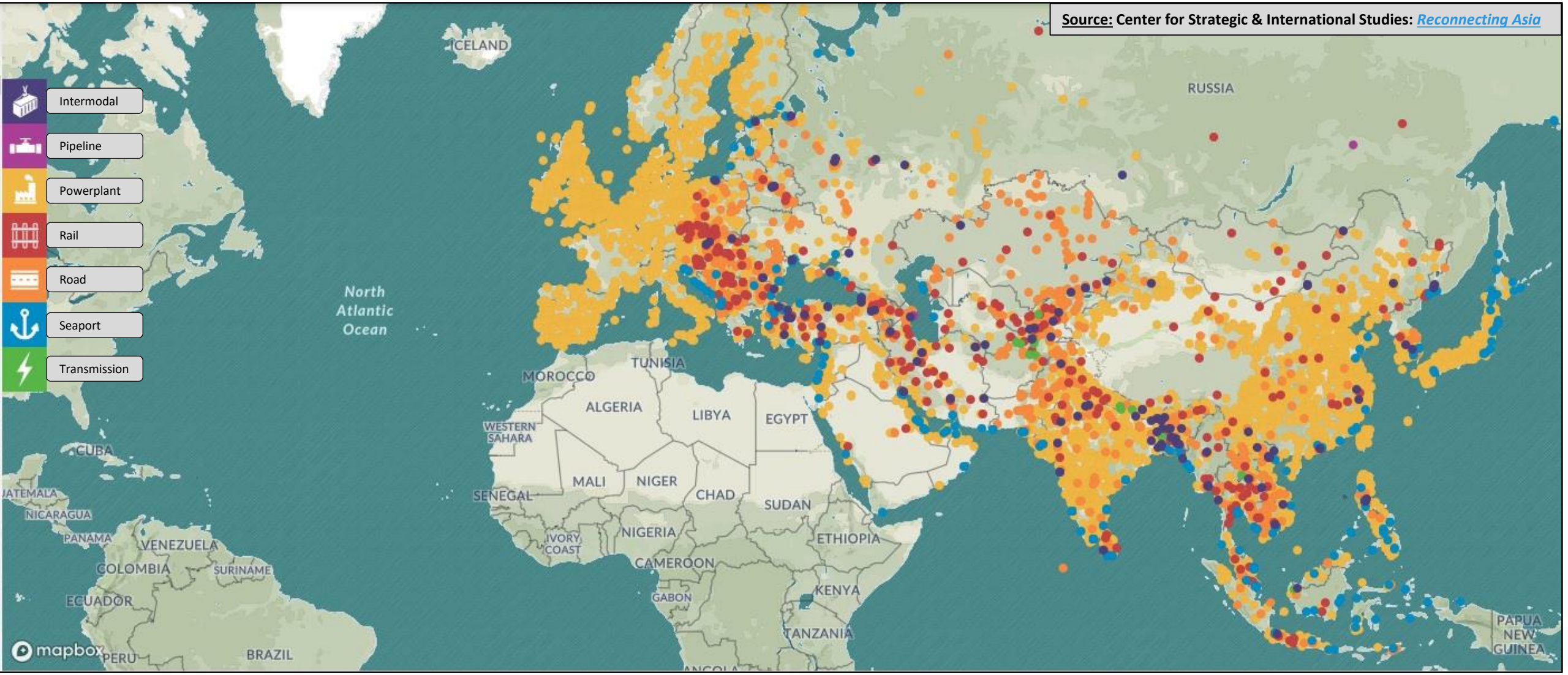
A state-led industrial policy to modernize China's economy, boost productivity and make innovation a driver of economic growth.

Central to it is a *"whole-of-society" strategy of military-civil fusion* where state-owned enterprises will receive extensive financial assistance through state-directed investment and priority credit from state banks.*

Belt-and-Road Initiative.

*Congressional Research Service. April 12, 2019. *The Made in China 2025 Initiative: Economic Implications for the United States*. Link: https://fas.org/sgp/crs/row/IF10964.pdf

China’s Belt & Road Initiative

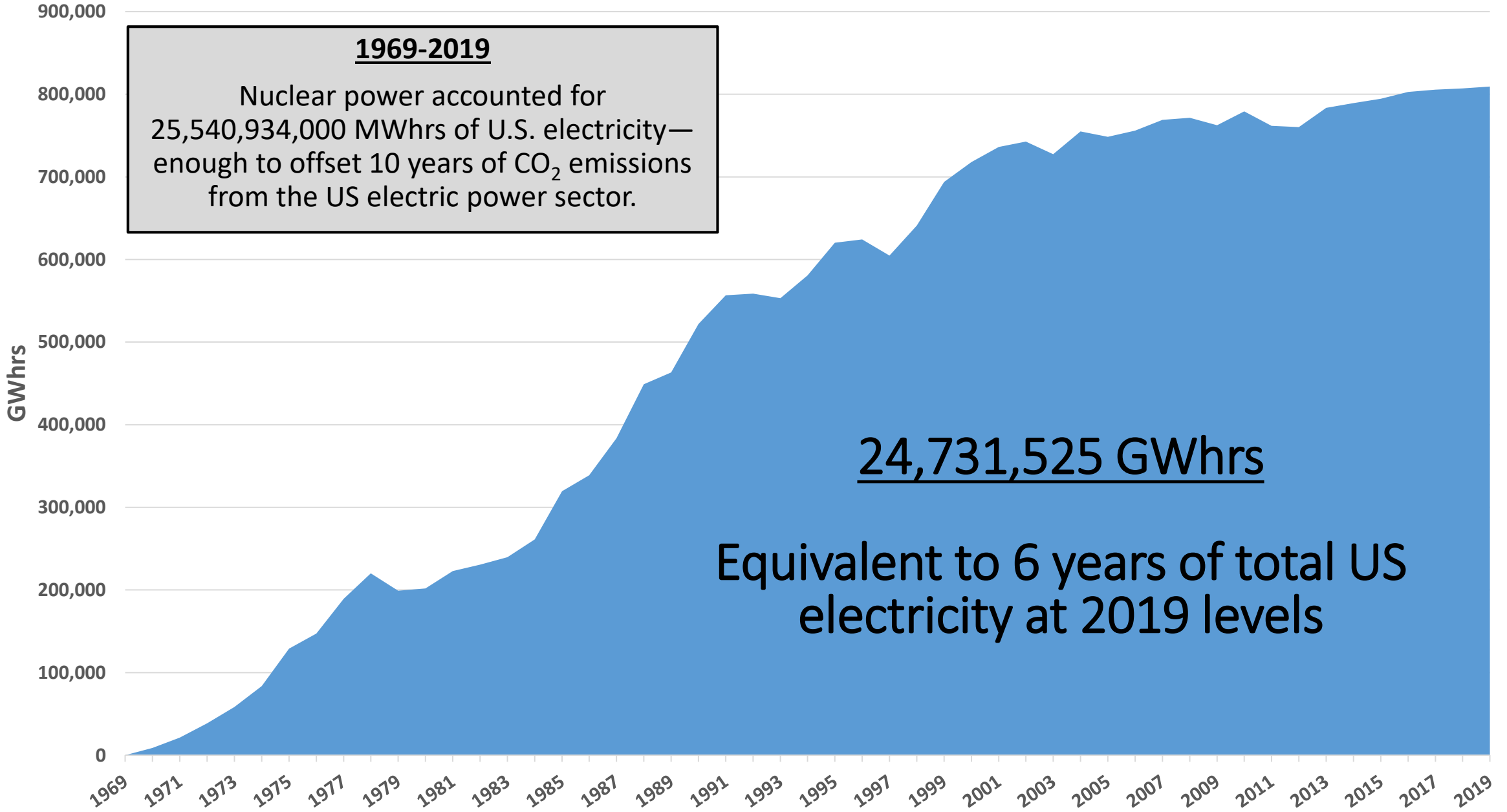


Civilian Nuclear Power

Data Sources: U.S. EIA and IAEA

U.S. Nuclear Generation

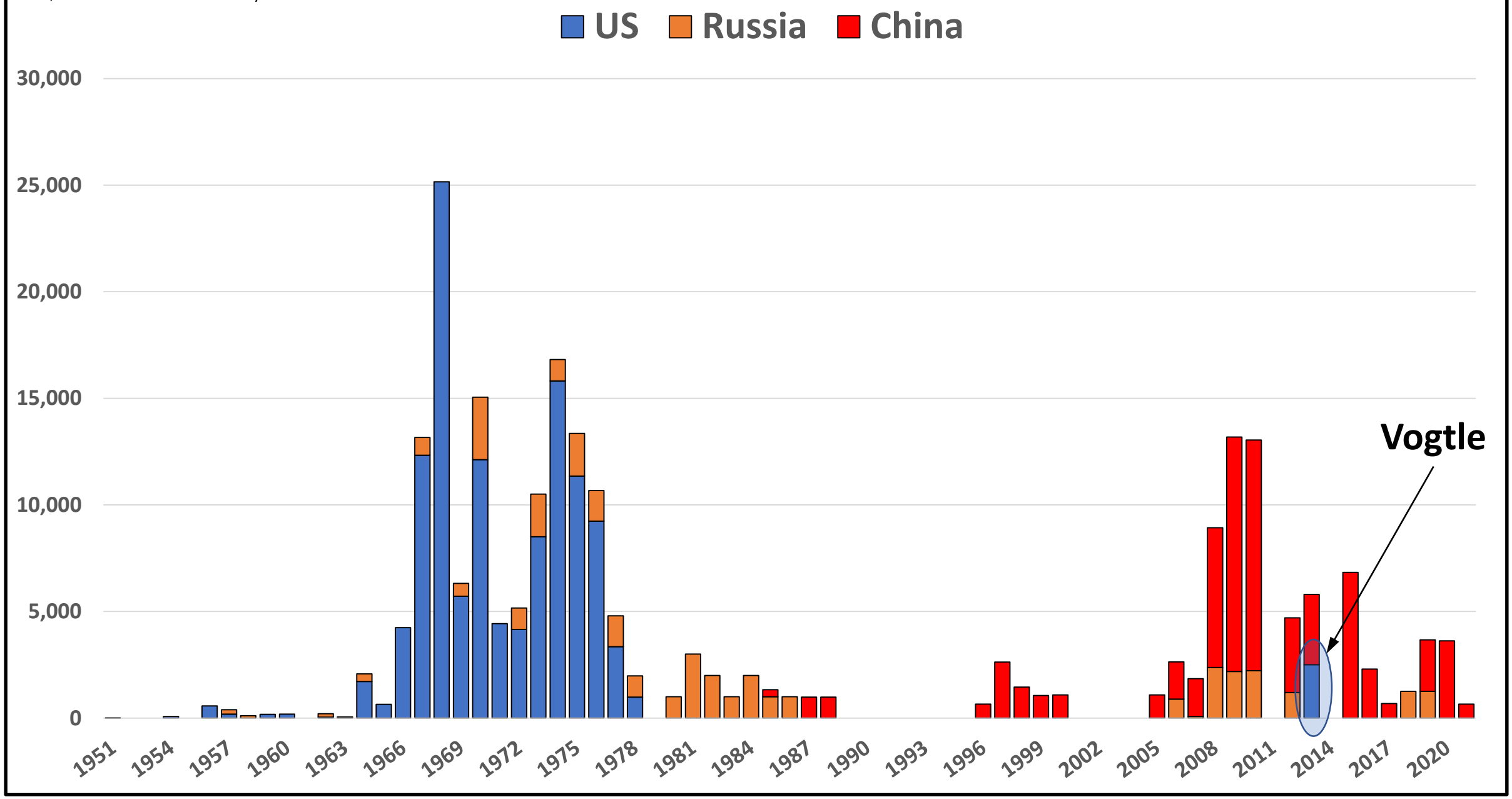
Compiled By: David Gattie



Nuclear Reactor Construction Starts: Historical Total (MW)

Data Source:
IAEA; Power Reactor Information System

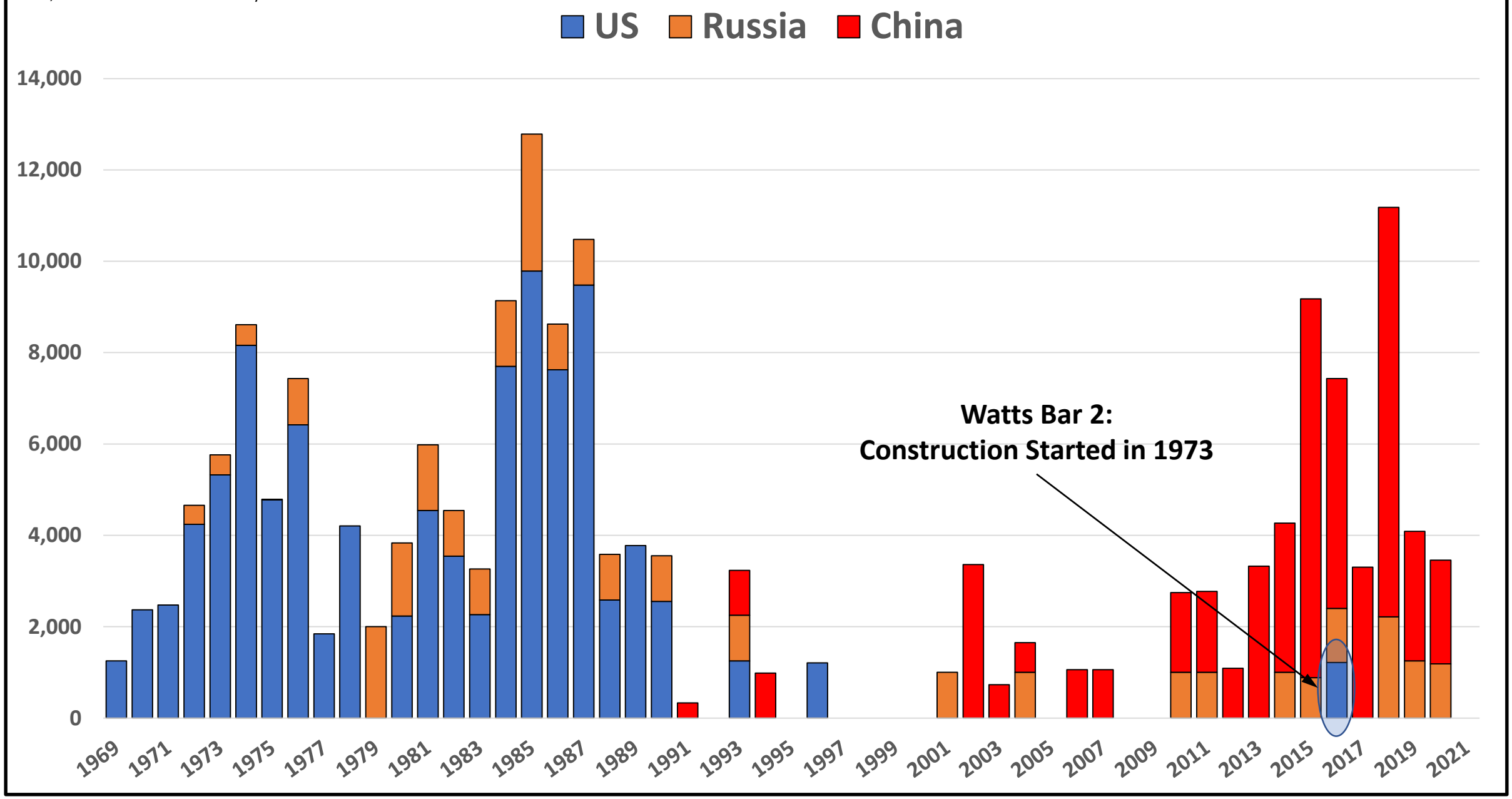
Compiled By: David Gattie



Nuclear Reactor Grid Connects: Currently Operational (MW)

Data Source:
IAEA; Power Reactor Information System

Compiled By: David Gattie



Nuclear Power in the 21st Century

Of these 155 reactors, 105 are associated with China or Russia—either by location or by reactor technology.

Number of Reactors Since 2000		
Country	**Connected to Grid**	**Under Construction**
China	47	14
Russia	13	3
India	12	6
South Korea	10	4
Japan	5	2
Pakistan	5	1
Czech Republic	2	
Ukraine	2	2
Argentina	1	1
Belarus	1	1
Brazil	1	1
Iran	1	1
UAE	1	3
US	1	2
Romania	1	
Bangladesh		2
Finland		1
France		1
Slovakia		2
Taiwan		0
Turkey		3
UK		2
Total	***103***	***52***

Source: *World Nuclear Association; IAEA (2021)*

US Nuclear Reactors: Shutdown & Under Threat

Status	Plant	Nameplate Capacity (MW)	Location	Generation (MWhrs)	Retirement Year
Retired (11)	Crystal River	860	Florida	7,000,079	2013
	Kewaunee	566	Wisconsin	4,990,254	2013
	San Onofre 2 & 3	2,150	California	18,097,173	2013
	Vermont Yankee	604	Vermont	5,060,582	2014
	Fort Calhoun	483	Nebraska	3,425,235	2016
	Oyster Creek	608	New Jersey	4,585,091	2018
	Pilgrim	674	Massachusetts	5,414,318	2019
	Three Mile Island 1	803	Pennsylvania	5,214,196	2019
	Duane Arnold	601	Iowa	5,235,716	2020
	Indian Point 2	1,016	New York	8,351,945	2020
	Total	***8,365***		***67,374,589***	
Planned (8)	Diablo Canyon 1 & 2	2,240	California	16,165,384	2024, 2025
	Palisades	772	Michigan	6,865,167	2022
	Dresden 2 & 3	1,797	Illinois	15,081,715	2021
	Byron 1&2	2,300	Illinois	20,117,981	2021
	~~Indian Point 3~~	~~1,038~~	~~New York~~	~~8,342,898~~	~~2021~~
	Total	***8,147***		***66,573,145***	
State Action (16)	Davis-Besse	894	Ohio	7,837,459	2020 (Hold)
	Perry	1,240	Ohio	9,173,102	2020 (Hold)
	Beaver Valley 1 & 2	1,808	Pennsylvania	15,456,470	2021 (Hold)
	FitzPatrick	848	New York	7,355,106	2017 (Hold)
	R. E. Ginna	581	New York	4,993,693	2017 (hold)
	Clinton	1,065	Illinois	8,363,289	2017 (Hold)
	Nine Mile Point 1&2	2,054	New York	15,821,376	2017, 2018 (Hold)
	Quad Cities 1 & 2	1,819	Illinois	15,386,504	2018 (Hold)
	Salem 1 & 2	2,295	New Jersey	17,910,378	2020, 2021 (Hold)
	Hope Creek	1,172	New Jersey	8,726,946	2020, 2021 (Hold)
	Millstone 2 & 3	2,073	Connecticut	16,733,398	2020 (Hold)
	Total	***15,849***		***127,757,721***	
	Total All	***32,361***		***261,705,455***	

8.3% of total US nuclear generation

Shut Down April 30, 2021

8.2% of total US nuclear generation

15.8% of total US nuclear generation

Compiled By: David Gattie

Data Source: US EIA; NEI
Retirement Years: Third Way

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Shut Down April 30, 2021

8.2% of total US nuclear generation

All Deregulated Markets

15.8% of total US nuclear generation

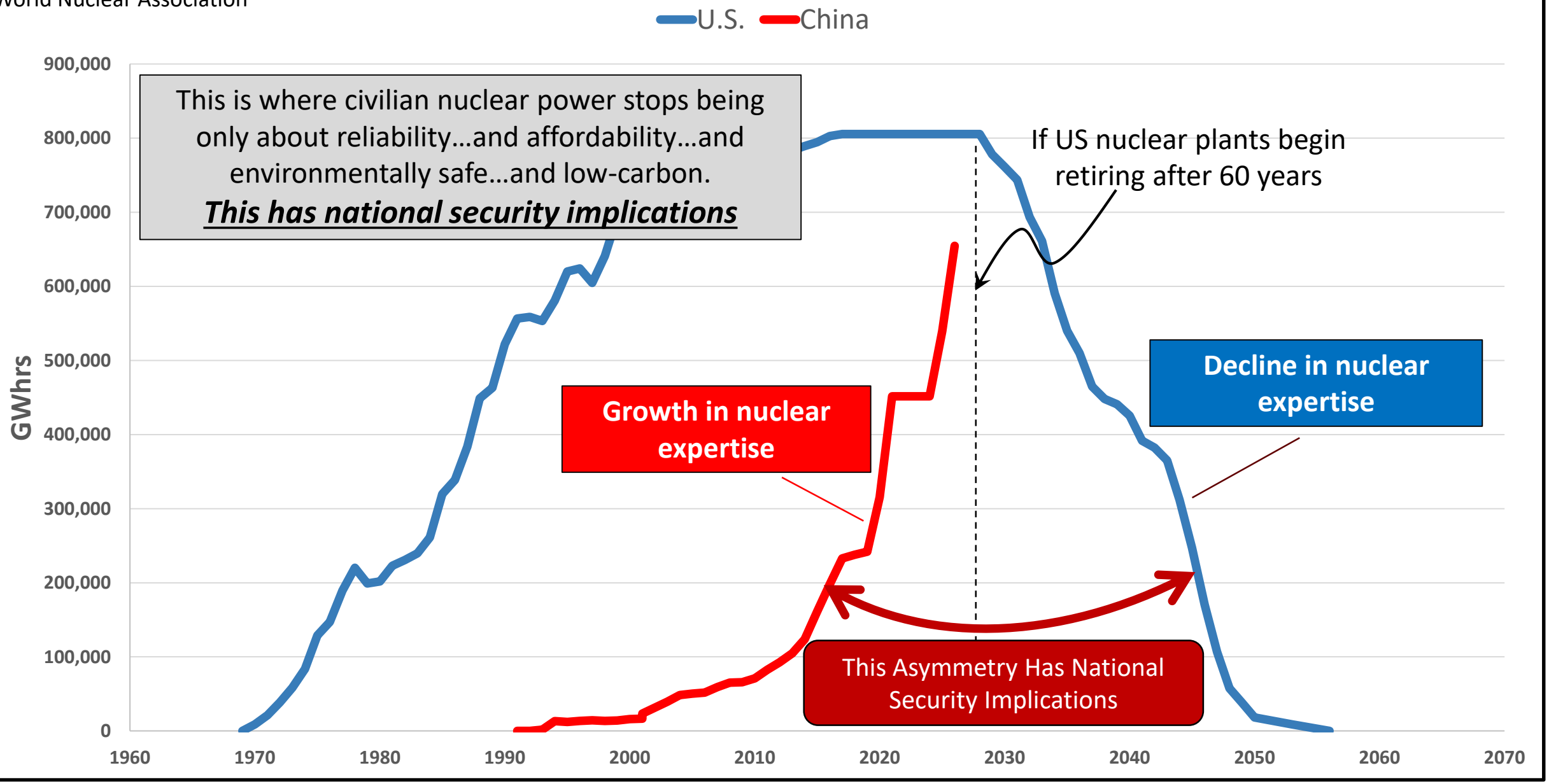
Compiled By: David Gattie

Data Source: US EIA; NEI
Retirement Years: Third Way

Data Source:
US EIA; IAEA; &
World Nuclear Association

US and China Nuclear Power Generation: Projected

Compiled By: David Gattie

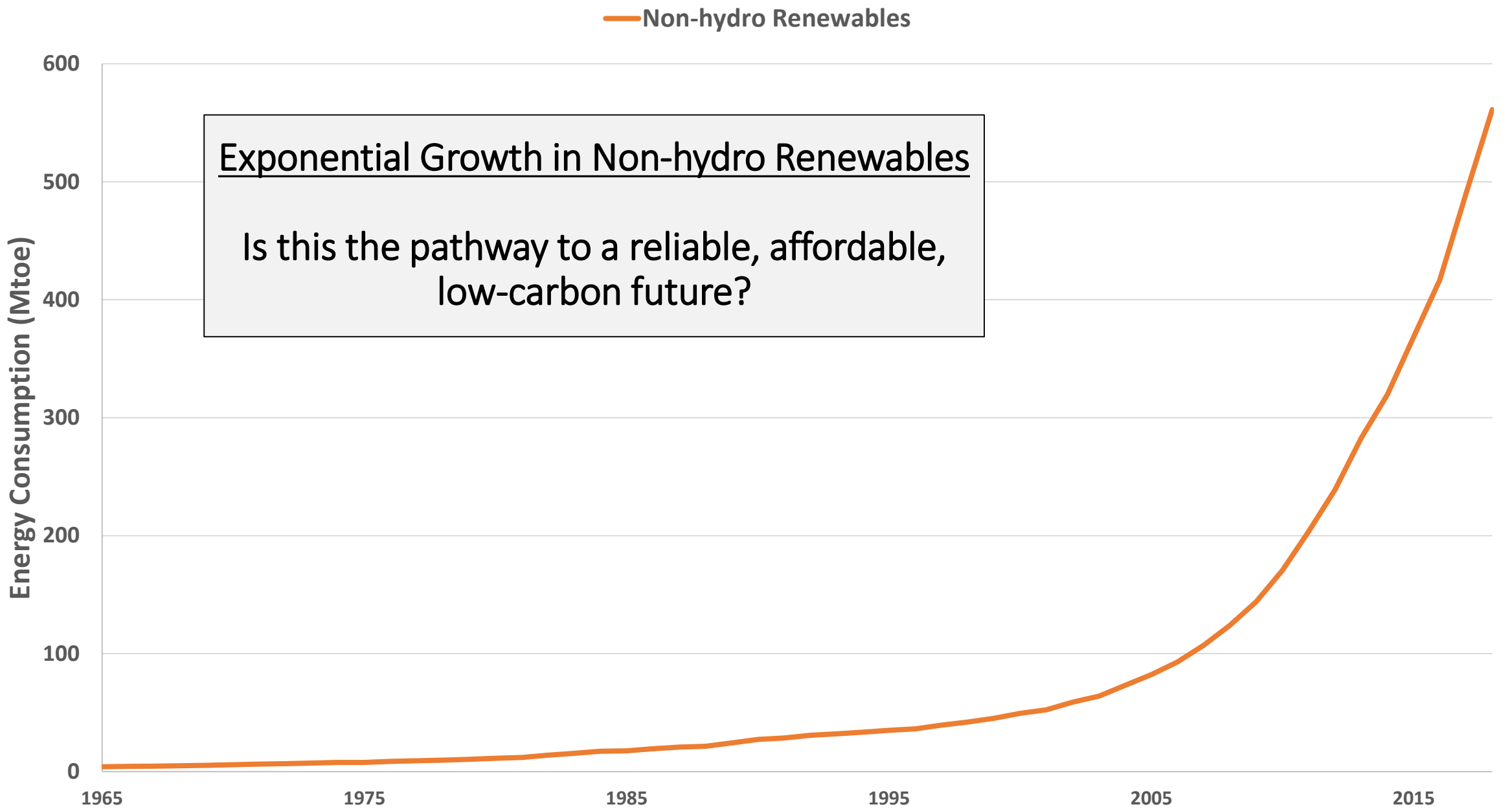


Decarbonization by Renewables

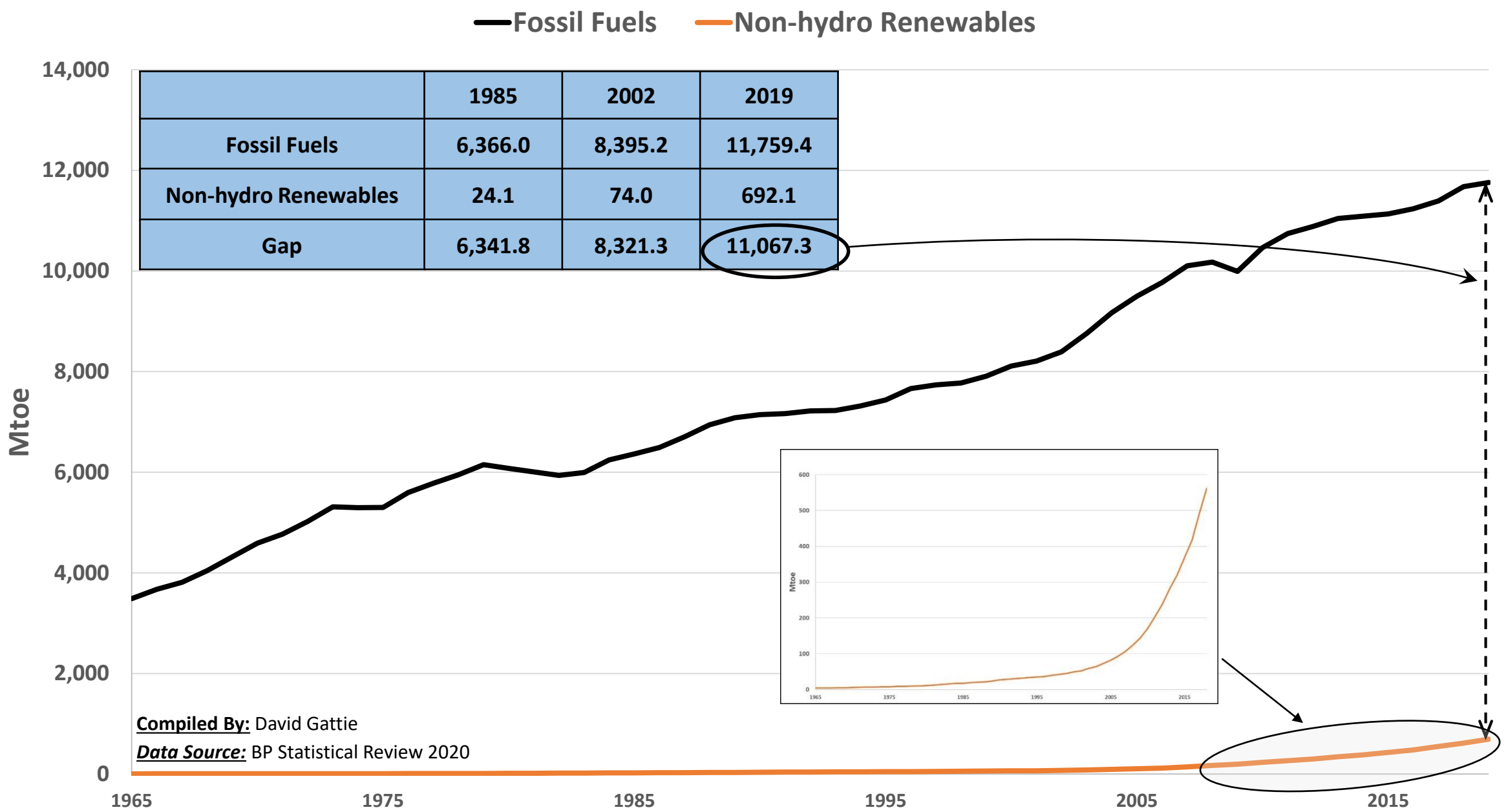
Data Source:
BP Statistical Review 2019

World Energy Consumption: Non-hydro Renewables

Compiled By: David Gattie



World Primary Energy Consumption: Fossil Fuels & Non-hydro Renewables



	1985	2002	2019
Fossil Fuels	6,366.0	8,395.2	11,759.4
Non-hydro Renewables	24.1	74.0	692.1
Gap	6,341.8	8,321.3	11,067.3

Compiled By: David Gattie

Data Source: BP Statistical Review 2020

Global Solar Generation

Compiled By: David Gattie

Country	Solar Generation		Total Generation (2019)		GDP (2019)	
	2019 Share of World Total (%)	2018-19 Change (TWhrs)	Fossil Fuels & Nuclear (%)	Fossil Fuels, Nuclear & Hydro (%)	Current $US (millions)	Share of World Total (%)
China	30.9	46.9	72.6	89.5	14,342,903	16.4
U.S.	15.0	14.1	82.4	88.6	21,374,419	24.4
Japan	10.4	9.2	77.1	84.2	5,081,770	5.8
Germany	6.6	1.7	55.9	59.2	3,845,630	4.4
India	6.4	9.9	80.9	91.3	2,875,142	3.3
Italy	3.4	1.7	58.6	74.5	2,001,244	2.3
Australia	2.5	5.7	79.1	84.5	1,392,681	1.6
Spain	2.1	2.3	62.0	71.1	1,394,116	1.6
UK	1.8	-0.2	60.1	62.6	2,827,113	3.2
Subtotal	**79.1**	**106.2**			**55,135,018**	**62.9**
World		*141.3*			*87,697,519*	*100*

GDP Data Source: *World Bank*
Energy Data Source: *BP Statistical Review of World Energy 2020*

Global Wind Generation

Compiled By: David Gattie

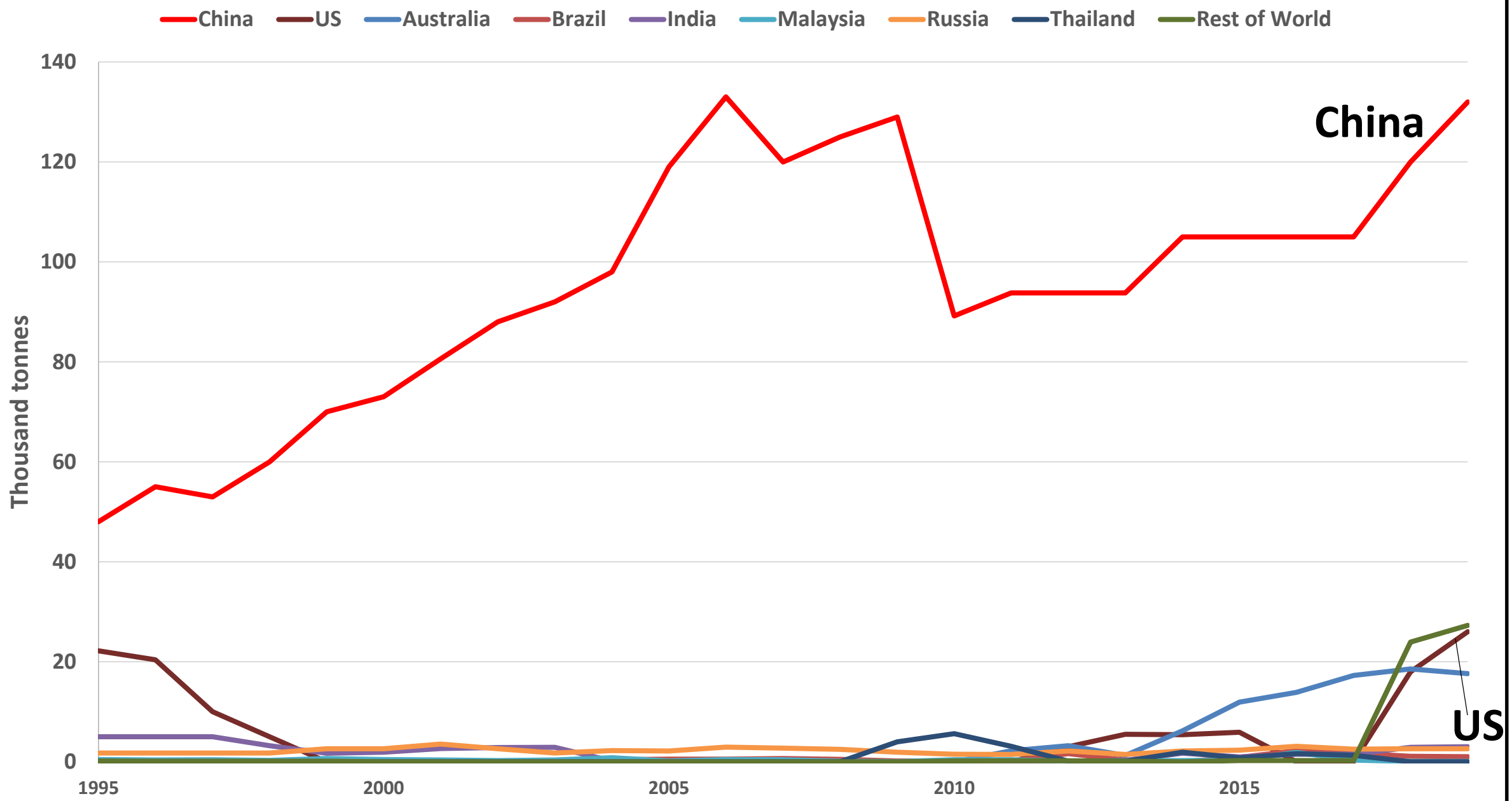
Country	Wind Generation		Total Generation (2019)		GDP (2019)	
	2019 Share of World Total (%)	2018-19 Change (TWhrs)	Fossil Fuels & Nuclear (%)	Fossil Fuels, Nuclear & Hydro (%)	Current $US (millions)	Share of World Total (%)
China	28.4	39.9	73.7	90.4	14,342,903	16.4
U.S.	21.2	27.7	83.1	89.6	21,374,419	24.4
Germany	8.8	16.0	60.9	63.7	3,845,630	4.4
UK	4.5	7.7	64.6	66.2	2,827,113	3.2
India	4.4	7.1	83.1	92.1	2,875,142	3.3
Spain	3.9	6.1	60.8	73.5	1,394,116	1.6
Brazil	3.9	3.1	17.6	82.3	1,839,758	2.1
France	2.4	3.9	72.1	83.2	2,715,518	3.1
Canada	2.4	3.1	33.5	92.7	1,736,426	2.0
Subtotal	**79.9**	**114.5**			**52,951,025**	**60.4**
World		*159.5*			*87,697,519*	*100*

GDP Data Source: *World Bank*
Energy Data Source: *BP Statistical Review of World Energy 2020*

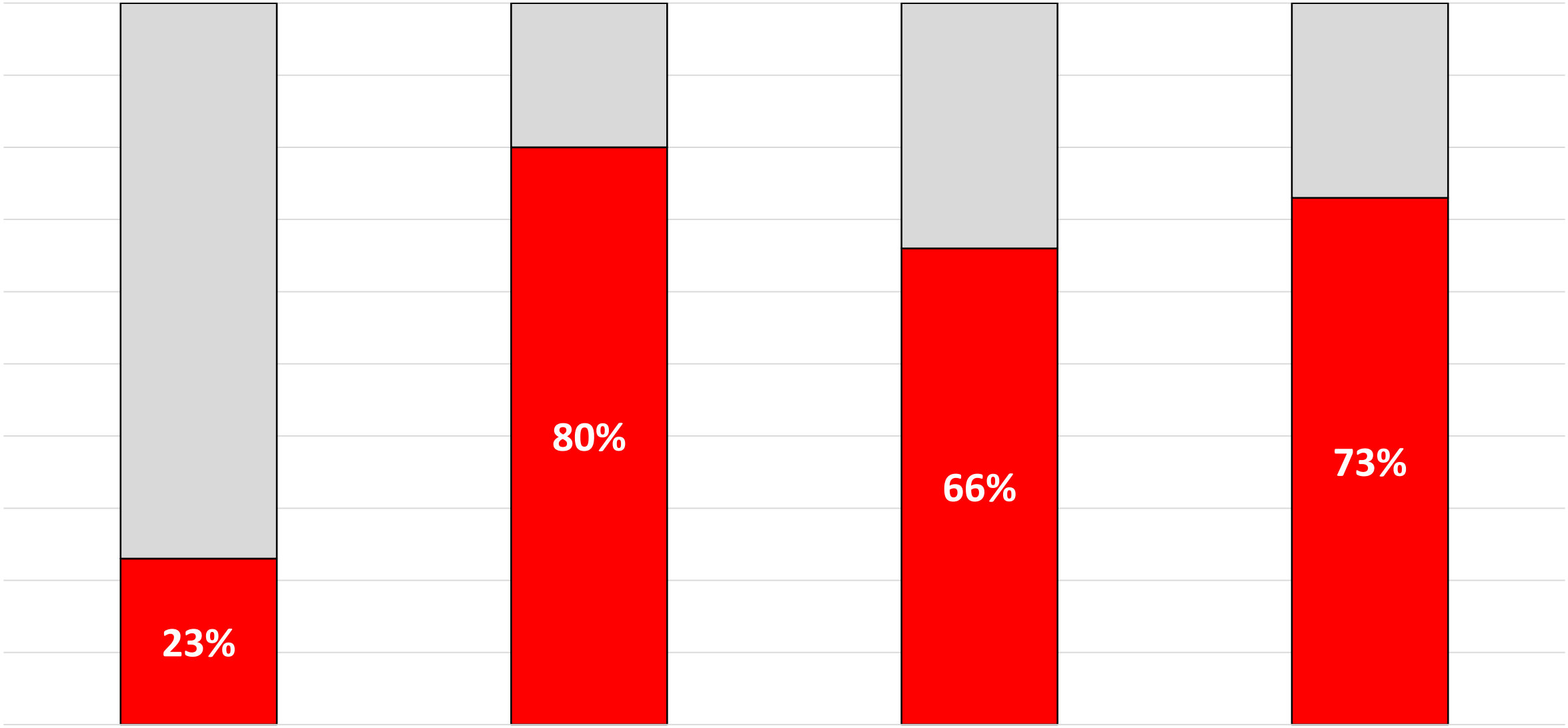
Data Source: BP Statistical Review 2020

Compiled By: David Gattie

Rare Earth Production & Reserves

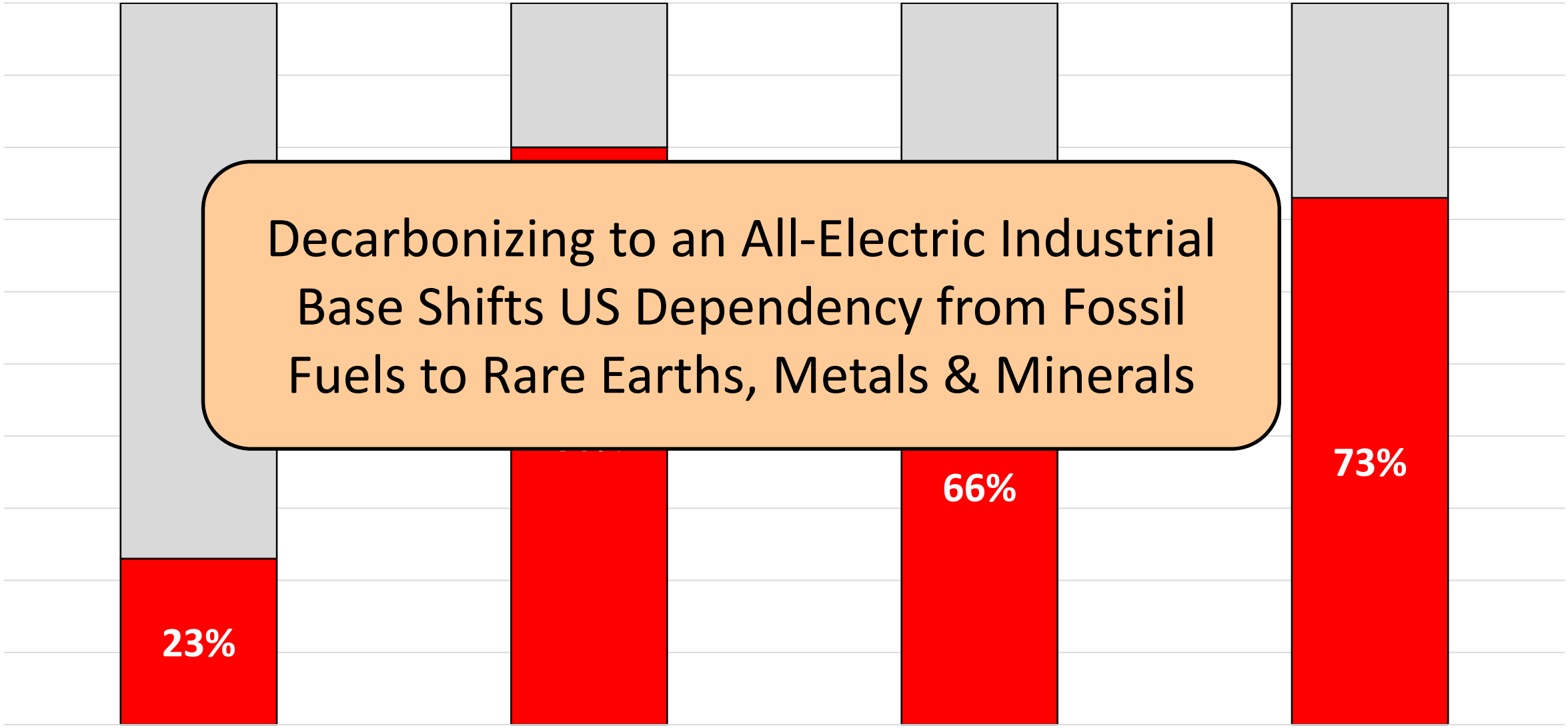


China's % Share of Li-ion Battery Production (2019)



Source: Benchmark Minerals Intelligence

China's % Share of Li-ion Battery Production (2019)



Decarbonizing to an All-Electric Industrial Base Shifts US Dependency from Fossil Fuels to Rare Earths, Metals & Minerals

Source: Benchmark Minerals Intelligence

A Contrast in Perspectives

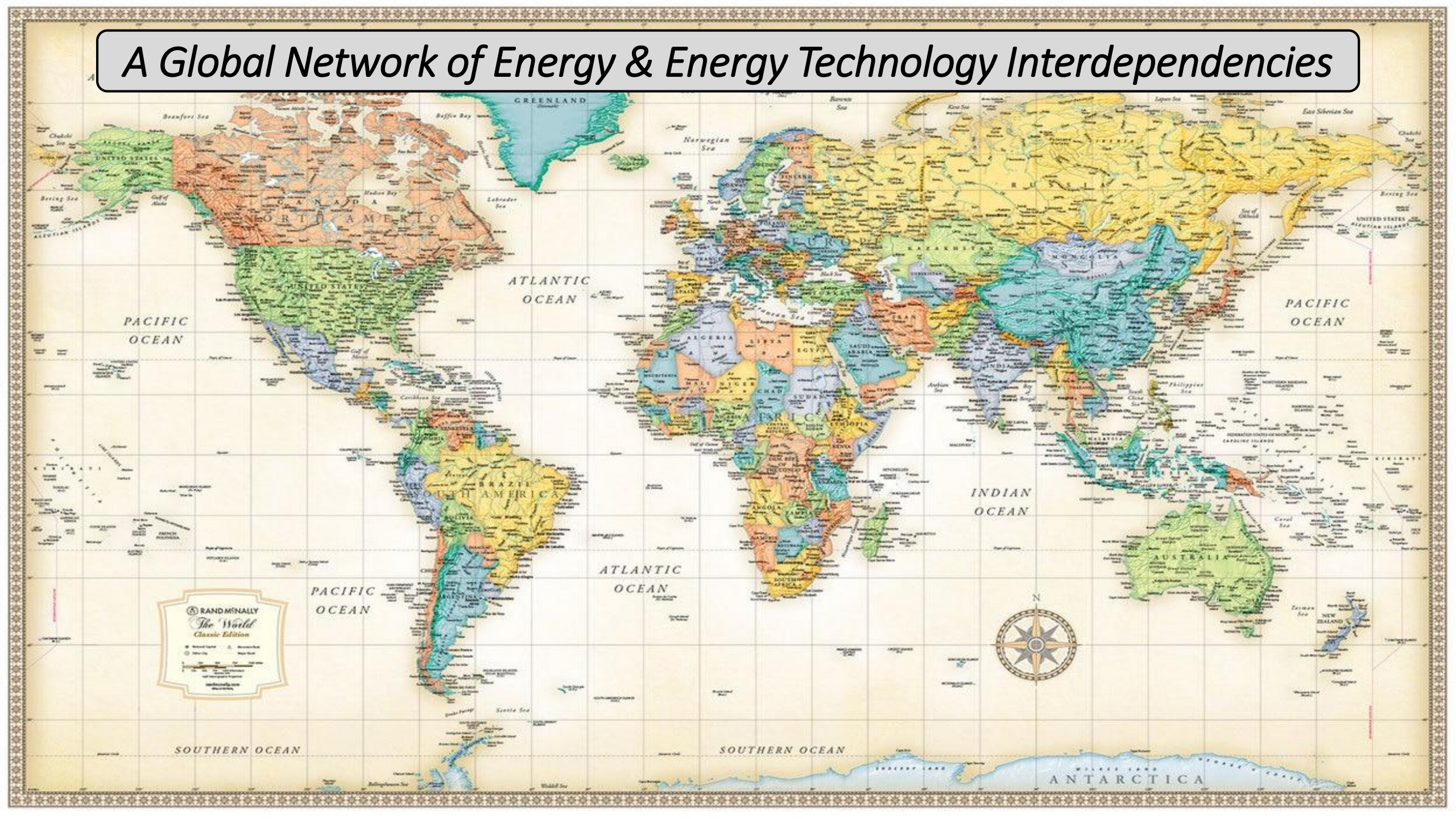
US:

Energy is largely a market commodity or a climate issue

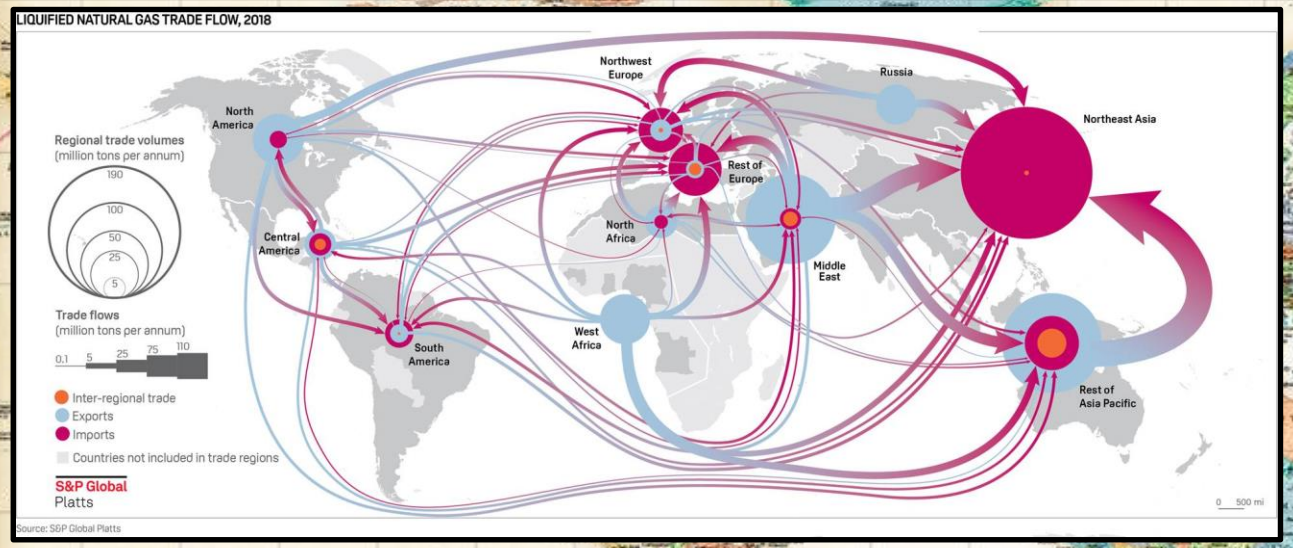
China and Russia:

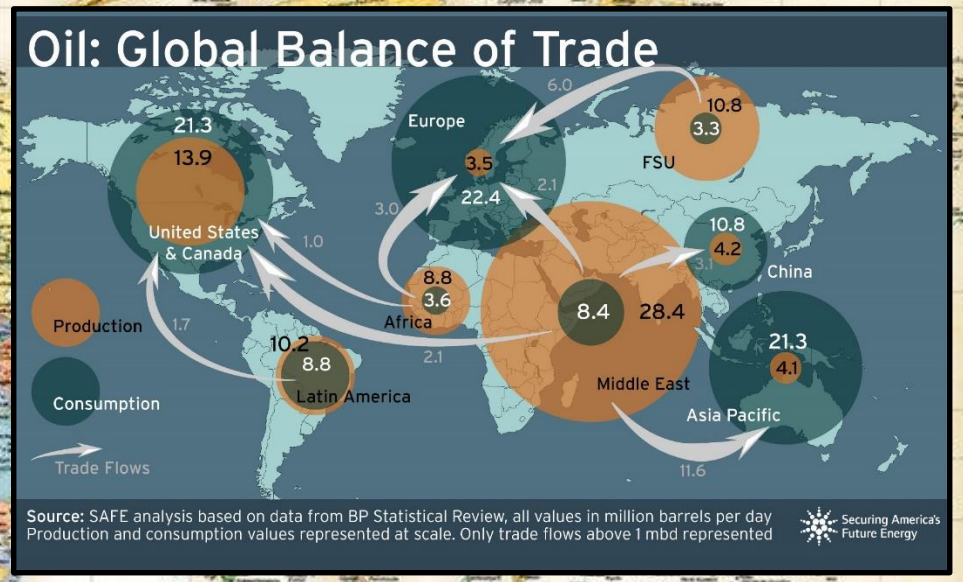
Energy and energy technologies are instruments of national power to achieve geopolitical objectives—national security and national power are at the center of their energy policy

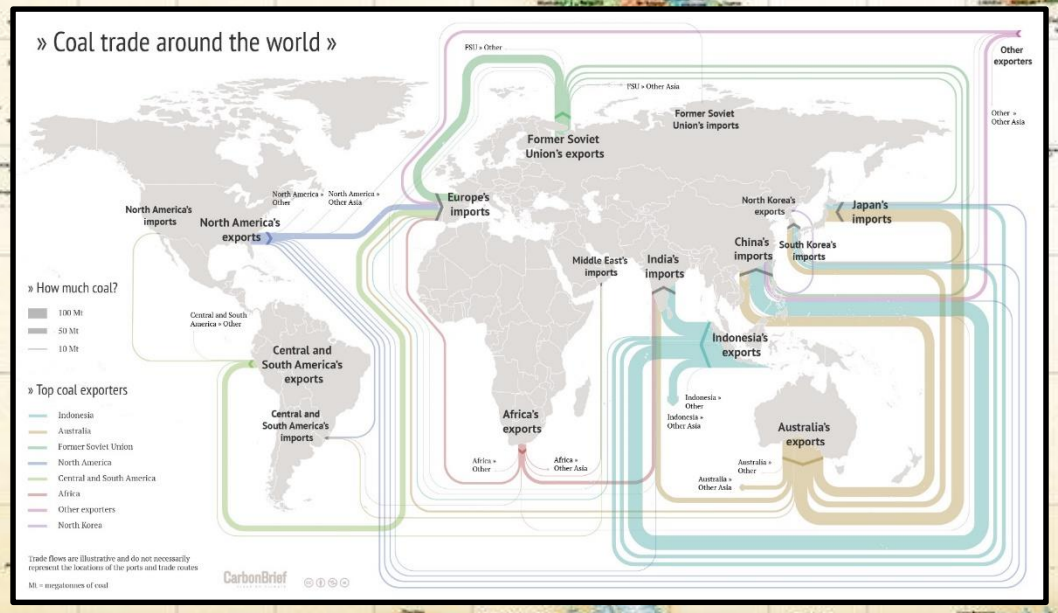
A Global Network of Energy & Energy Technology Interdependencies

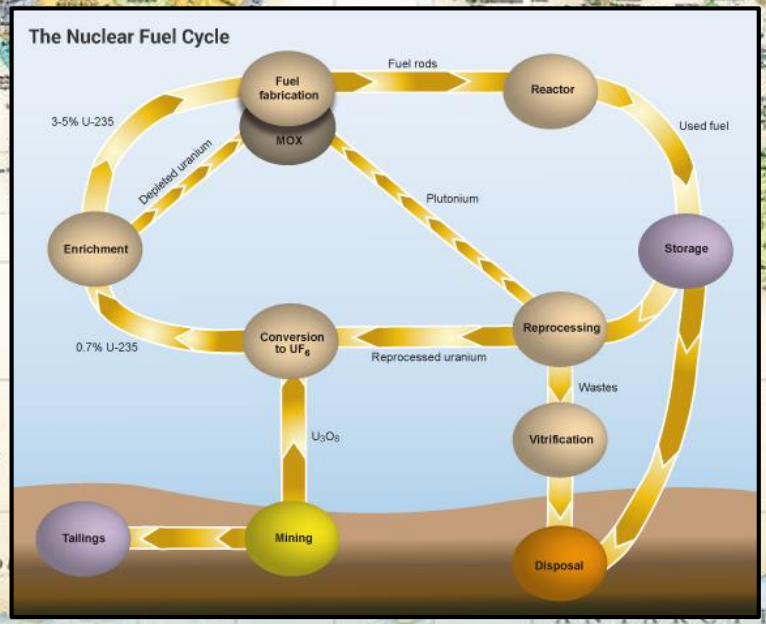


A Global Network of Energy & Energy Technology Interdependencies

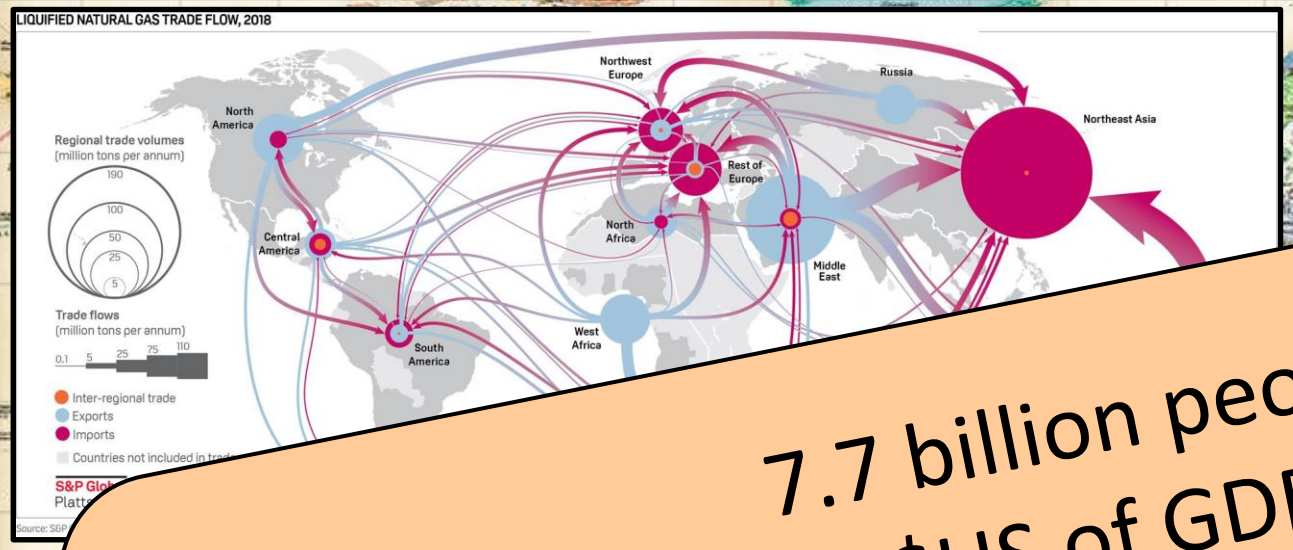


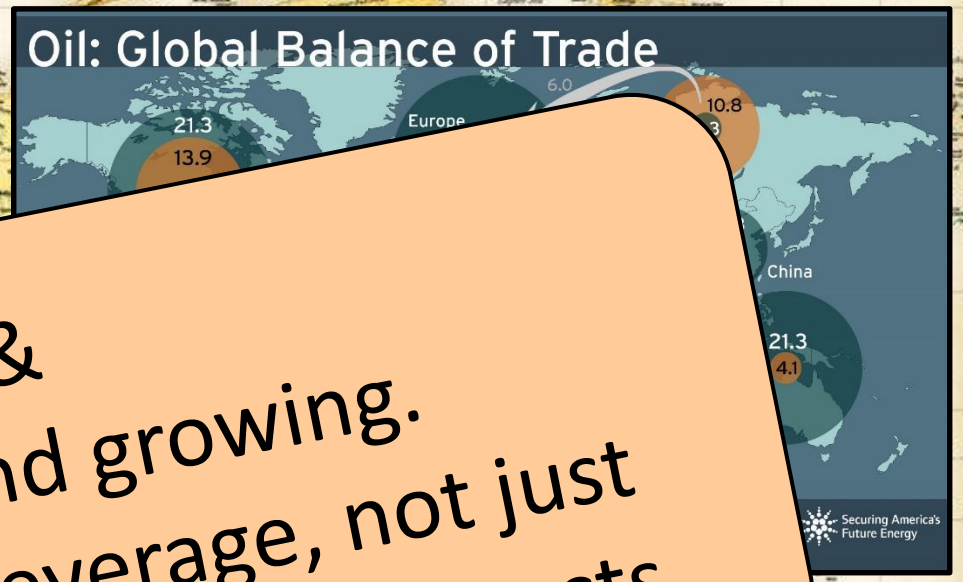


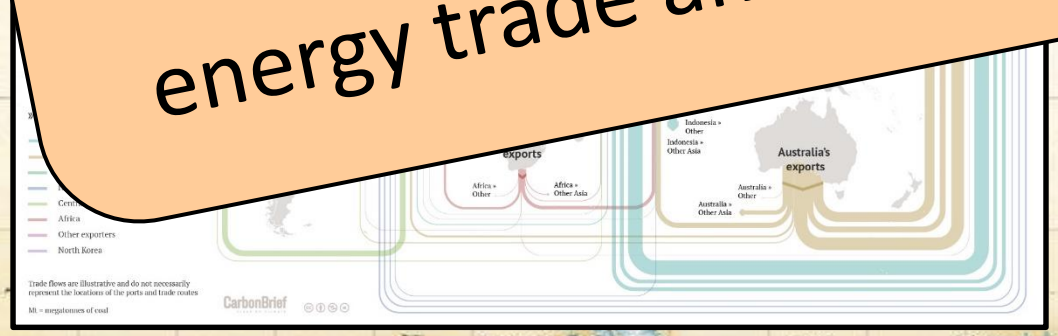


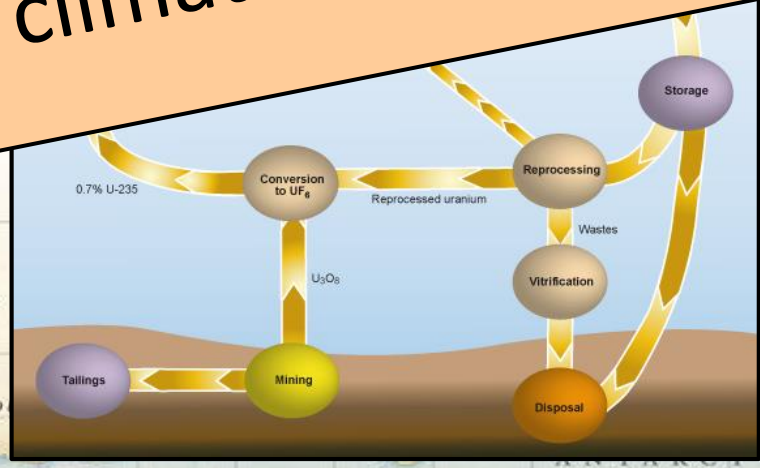


A Global Network of Energy & Energy Technology Interdependencies

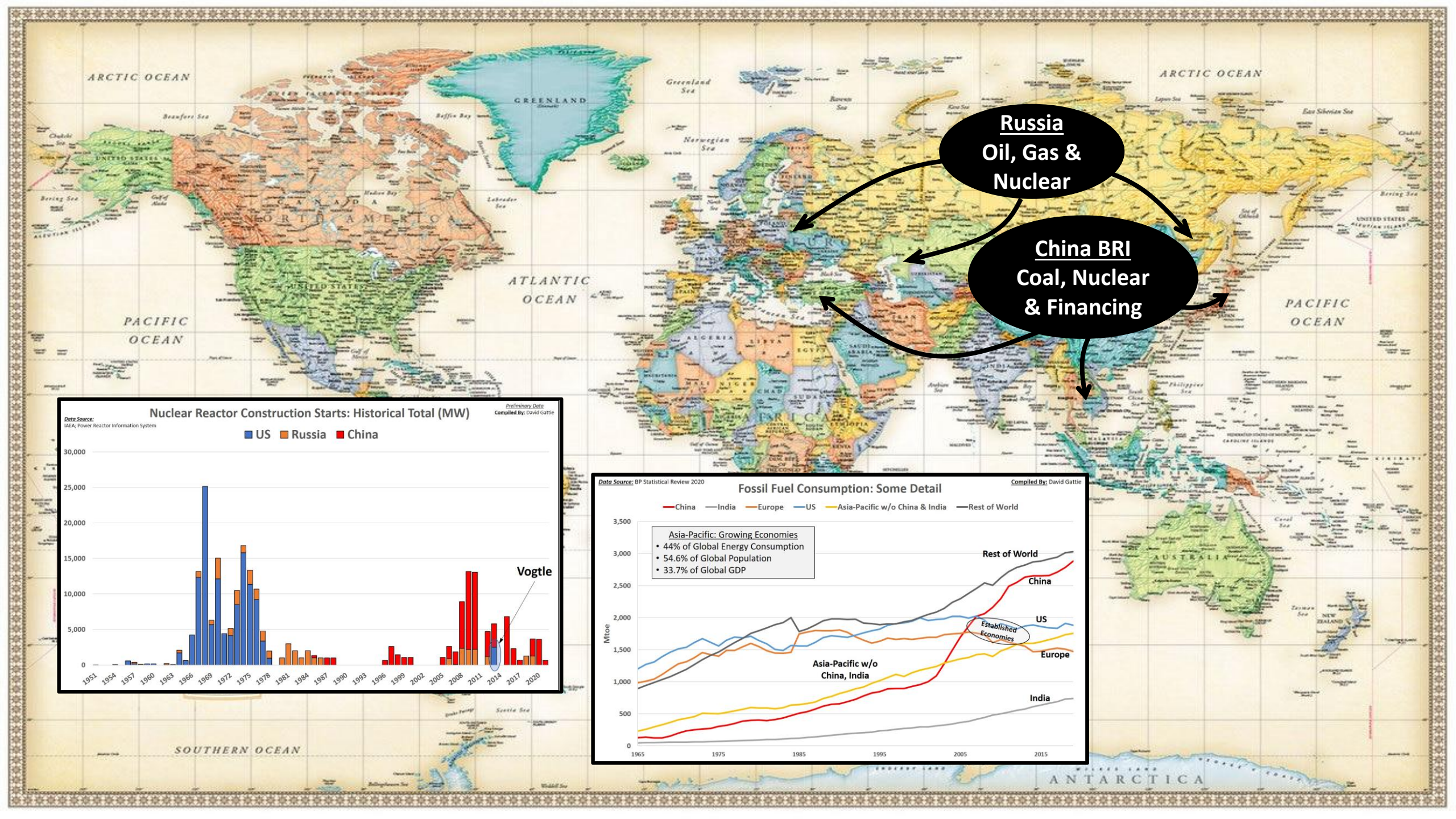








7.7 billion people &
87.8 trillion $US of GDP…and growing.
These are maps of geopolitical leverage, not just energy trade and not just climate change impacts.


Russia
Oil, Gas & Nuclear
China BRI
Coal, Nuclear & Financing
ARCTIC OCEAN
ATLANTIC OCEAN
PACIFIC OCEAN
SOUTHERN OCEAN
GREENLAND
EUROPE
ANTARCTICA
Nuclear Reactor Construction Starts: Historical Total (MW)
Data Source: IAEA; Power Reactor Information System
Preliminary Data
Compiled By: David Gattie
US
Russia
China
Vogtle
Fossil Fuel Consumption: Some Detail
Data Source: BP Statistical Review 2020
Compiled By: David Gattie
China
India
Europe
US
Asia-Pacific w/o China & India
Rest of World
Asia-Pacific: Growing Economies
• 44% of Global Energy Consumption
• 54.6% of Global Population
• 33.7% of Global GDP
Mtoe
Established Economies
Asia-Pacific w/o China, India

If America Unilaterally Disengages From the Global Energy Network

- America's geopolitical leverage and influence will be diminished
- It will create global vulnerabilities for emerging economies, particularly with respect to great power rivals and authoritarian states
- It will create openings for energy-rich and technology-advantaged countries to occupy the space America once occupied, but with different geopolitical objectives
- US national security will be threatened if the energy and energy technologies that operationalize America's industrial base shifts asymmetrically and weakens it relative to great power competitors

Questions US Policymakers Must Face Up To…and Answer

- Will policymakers in China and Russia subject their respective energy technology industrial bases to an all-in effort to reduce carbon emissions and solve the climate crisis?
  - Or will they weaponize climate change?
- Will Russia jeopardize the global status of its state-owned energy and nuclear power enterprises in favor of renewable energy?
- Will the Chinese Communist Party tell its Belt and Road partners across Eurasia that China won't engage in nuclear power development until it has solved its nuclear waste issue or in coal and natural gas power plants due to carbon emissions?
- If the U.S. disengages from fossil fuels and doesn't aggressively promote nuclear power, who will be the trusted energy partner for emerging economies?

US Energy Policy

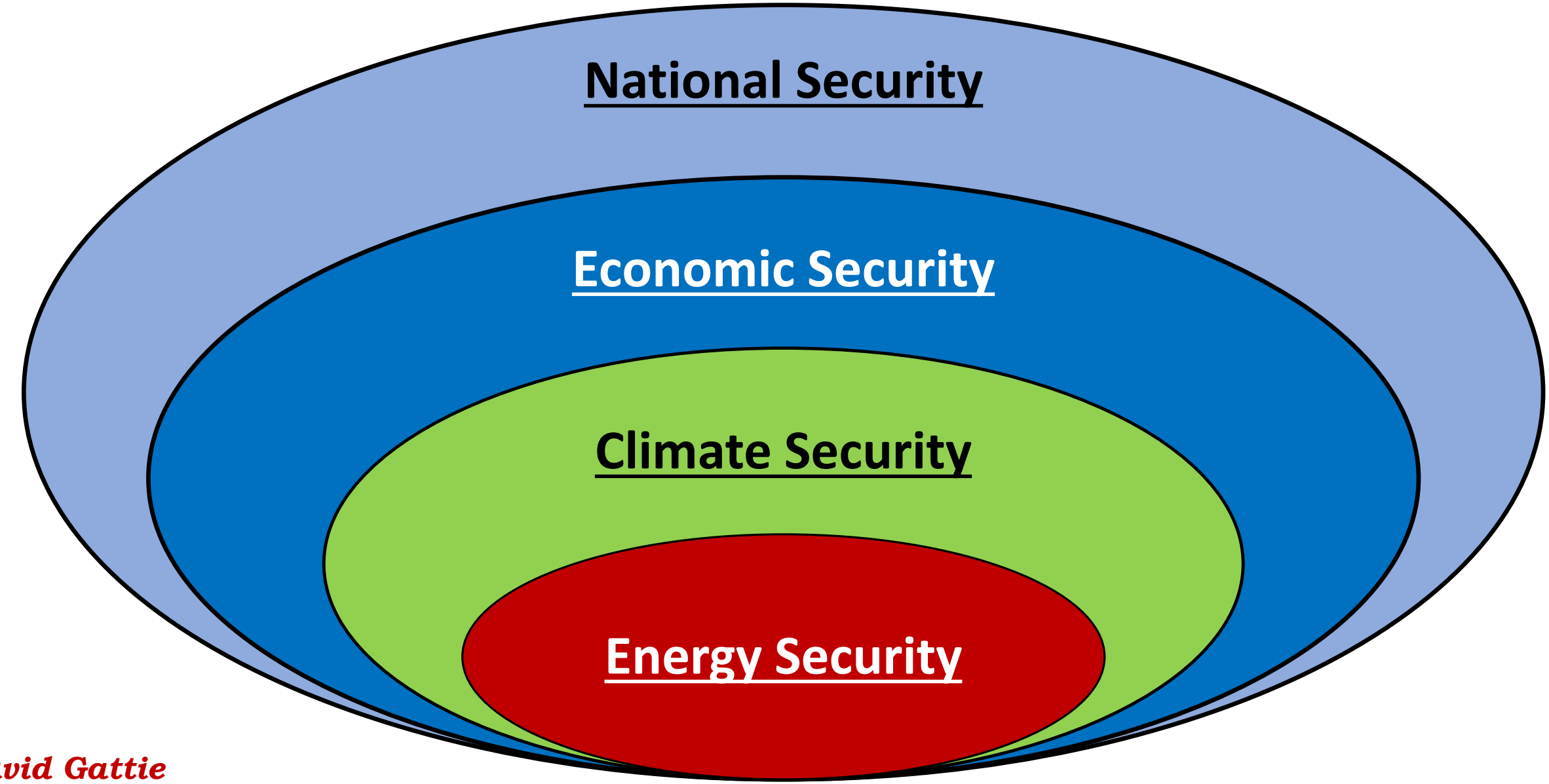
A Security-Centric Framework

ENERGY SECURITY—CLIMATE SECURITY—ECONOMIC SECURITY

WITH *DOMESTIC* & *GLOBAL* OBJECTIVES

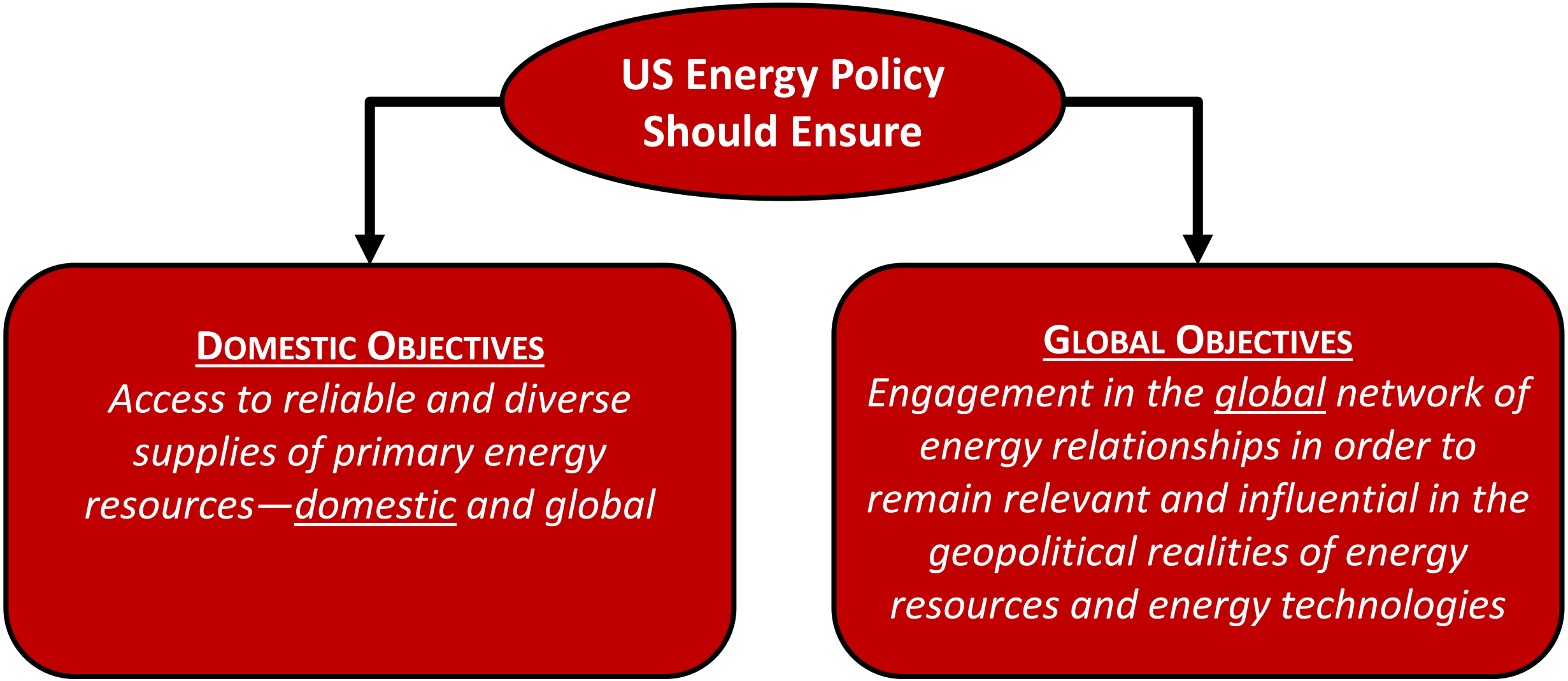
David Gattie

The Primacy of National Security for US Energy Policy

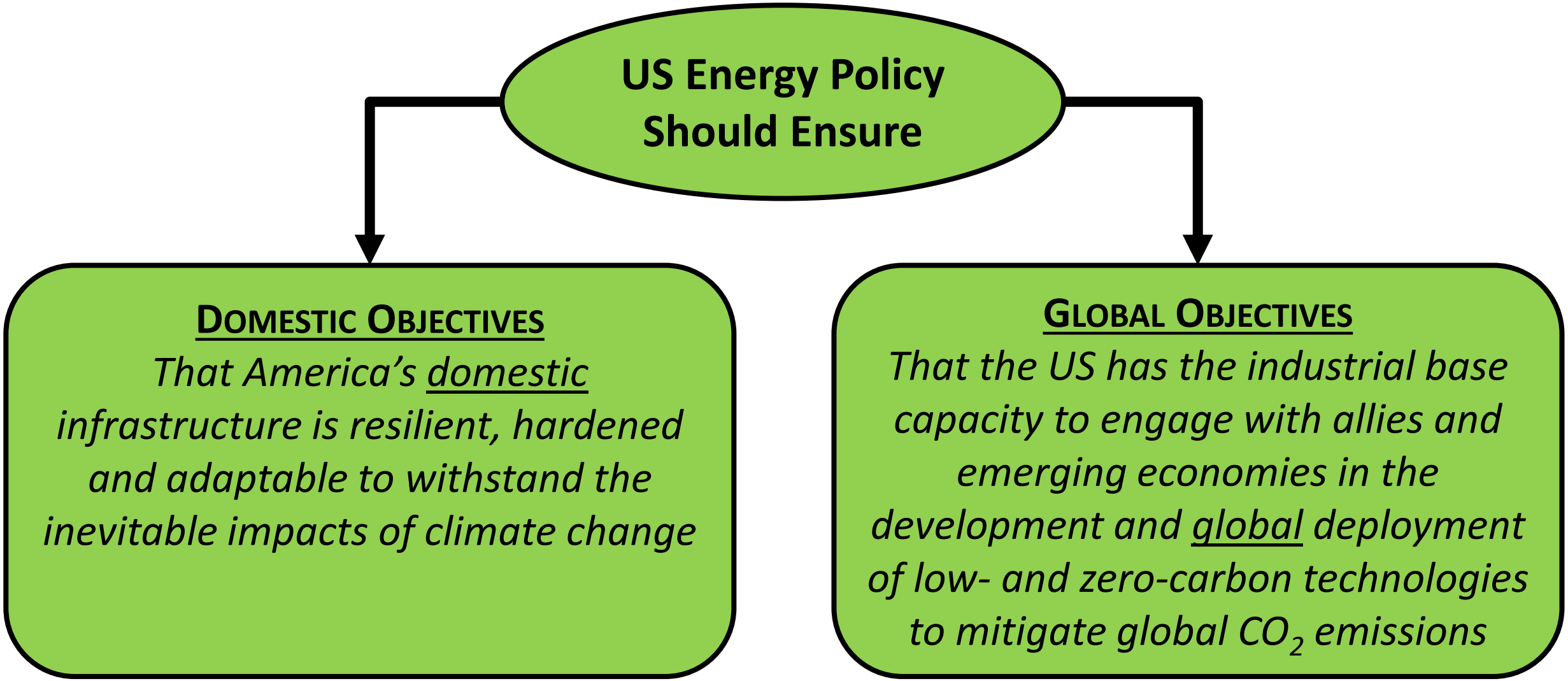


David Gattie

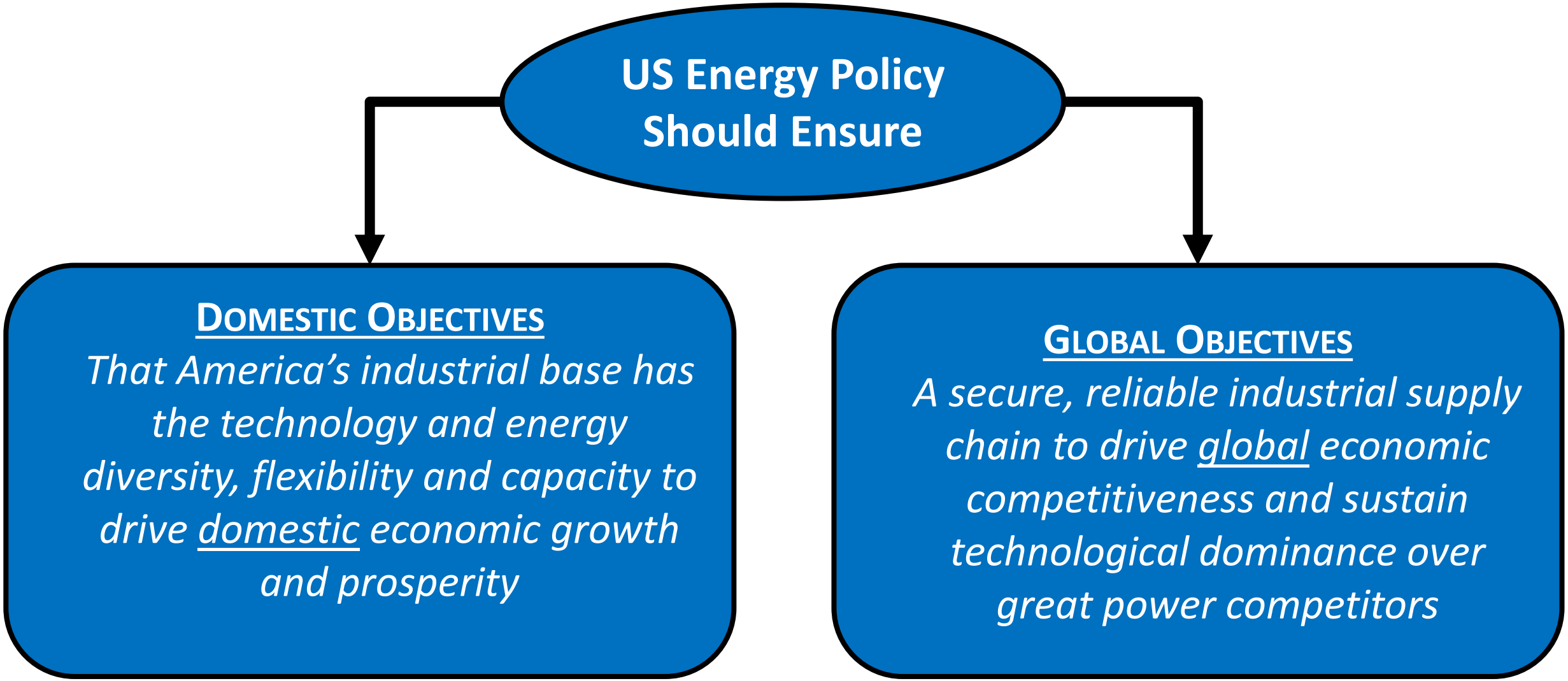
US Energy Policy and *Energy Security*



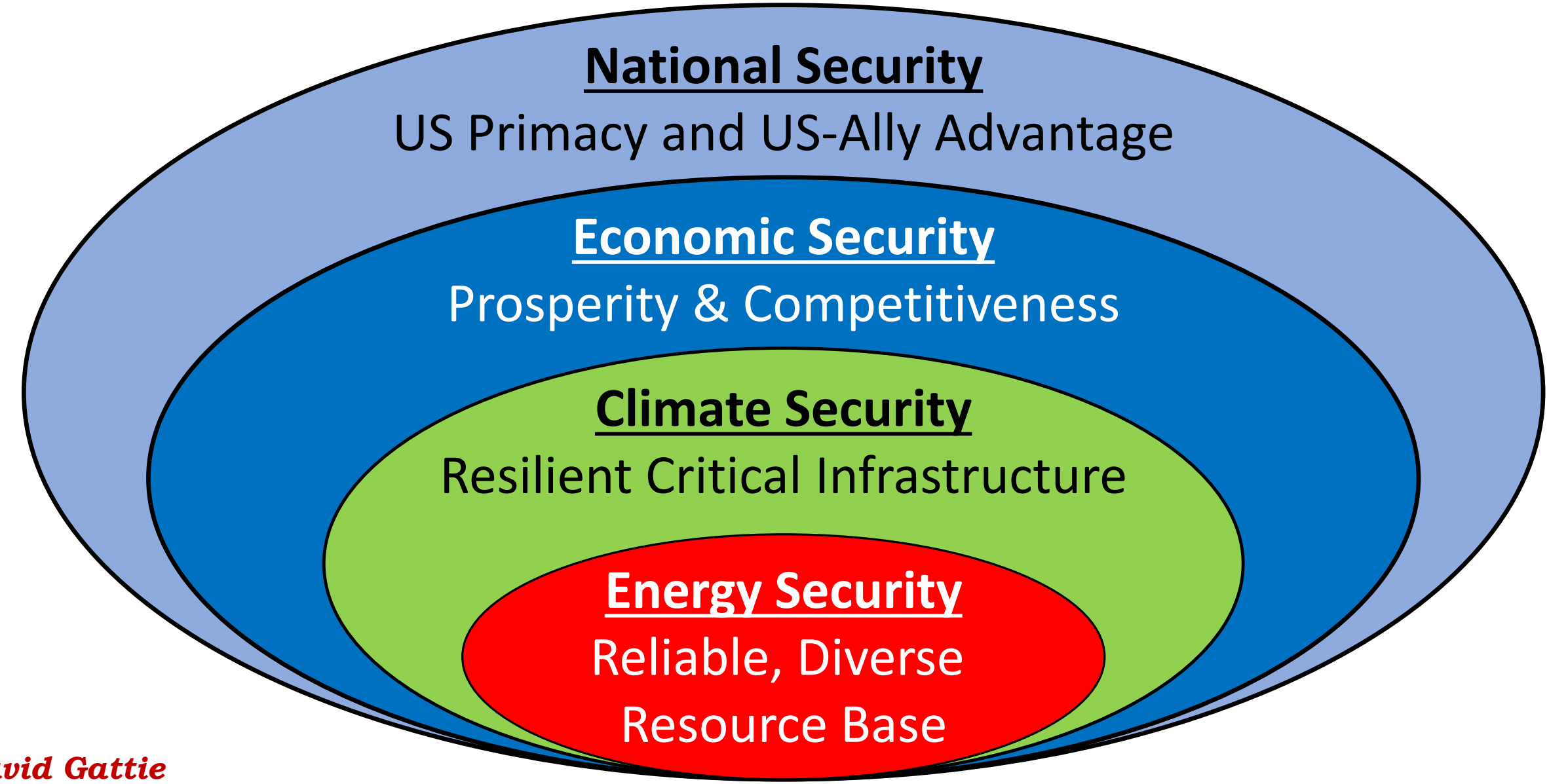
US Energy Policy and *Climate Security*



US Energy Policy and *Economic Security*



The Primacy of National Security for US Energy Policy



David Gattie

Summary Points

- The space between where the U.S. is today and where it wants to be in a low-carbon future will be *dominated by great power competition*, much of which will be around energy resources and technologies and *much of which will be indifferent to climate change concerns**
- That space should be navigated strategically, with constraints that extend beyond domestic carbon reduction and account for the geopolitical implications of attempting to disengage from the international fossil fuel network and not aggressively pursuing nuclear power*

Summary Points

- A transition away from fossil fuels will dilute the diversity of energy resources and energy technologies in America's industrial base while great power competitors China and Russia expand their options*
- This raises security concerns as emerging economies are moving in the same direction as these authoritarian U.S. rivals—toward fossil fuels and nuclear—which would shift the geopolitical advantage in energy and energy technology partnerships to China and Russia*

Summary Points

The U.S. must include in its energy and climate policy calculus that authoritarian great power competitors will exploit for their own geopolitical advantage, what many in the world are calling a crisis and an existential threat to humanity…

*—that being, climate change—**

*https://nationalinterest.org/feature/south-korea%E2%80%99s-summit-solution-dreams-and-zero-carbon-realities-181517

Pyrrhic Victory (aka, Winning the Battle, but Losing the War)

The armies separated; and, it is said, Pyrrhus replied to one that gave him joy of his victory that *one other such victory would utterly undo him*. For he had lost a great part of the forces he brought with him, and almost all his particular friends and principal commanders; there were no others there to make recruits, and he found the confederates in Italy backward. On the other hand, as from a fountain continually flowing out of the city, the Roman camp was quickly and plentifully filled up with fresh men, not at all abating in courage for the loss they sustained, but even from their very anger gaining new force and resolution to go on with the war.

—PLUTARCH, LIFE OF PYRRHUS; FOLLOWING KING PYRRHUS' VICTORY AT THE BATTLE OF ASCULUM IN 279 BC

America Cannot Allow Its Battle Against Climate Change to Result in a Pyrrhic Victory

THERE'S A MUCH LARGER BATTLE AT HAND WITH MORE IMMEDIATE CONSEQUENCES

AMERICA MUST BATTLE ON MULTIPLE FRONTS

Thank You

ANY OPINIONS EXPRESSED IN THIS PRESENTATION REPRESENT THE OPINIONS OF THE AUTHOR, DAVID GATTIE, AND NOT NECESSARILY THE OPINIONS OF THE UNIVERSITY OF GEORGIA

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