Energy, Climate, Poverty and Prosperity

SPE Queensland Section - May 30, 2025

Ron Gusek, Liberty Energy

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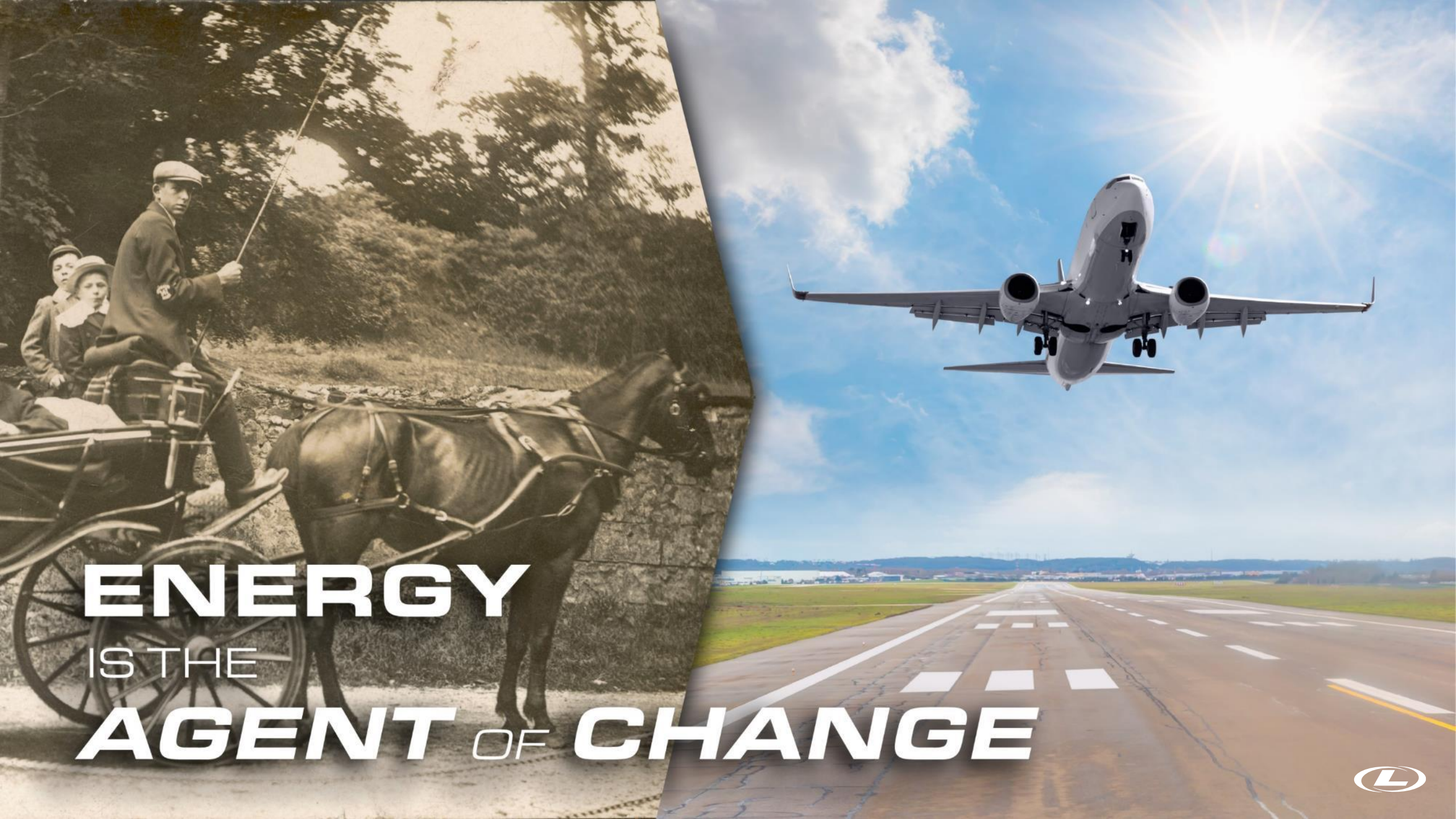
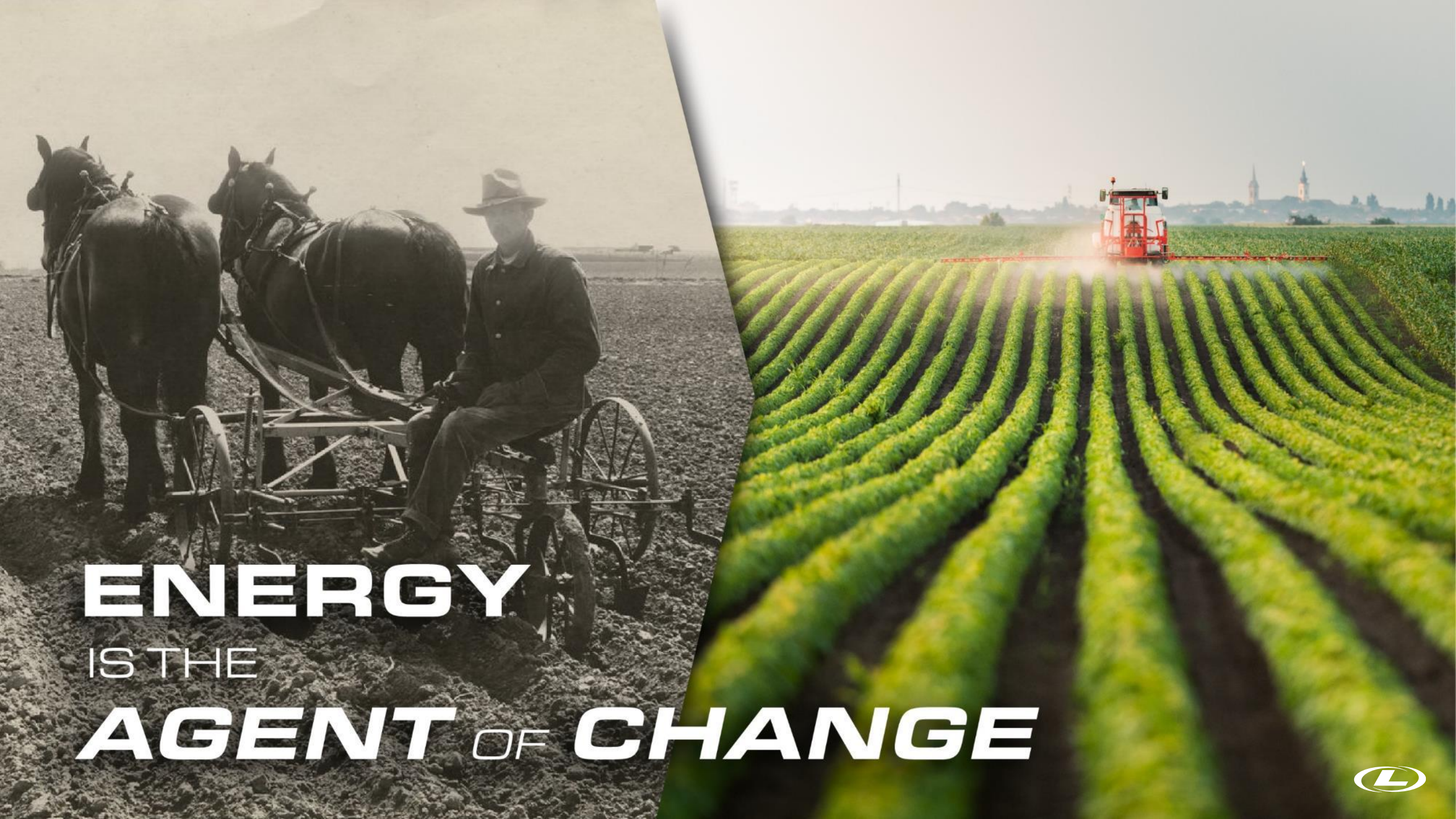
BHL 2024 Summary

- Last one to two centuries have seen tremendous progress in the human condition due to the rise of hydrocarbons and human liberty.
- Shale Revolution has turbocharged hydrocarbon progress and transformed energy markets, energy security, and geopolitics.
- However…we are also seeing rising opposition to hydrocarbons.
- BHL 2024 provides the data and context to evaluate the inevitable tradeoffs between energy, climate change, poverty, and prosperity.


ENERGY
IS THE
AGENT OF CHANGE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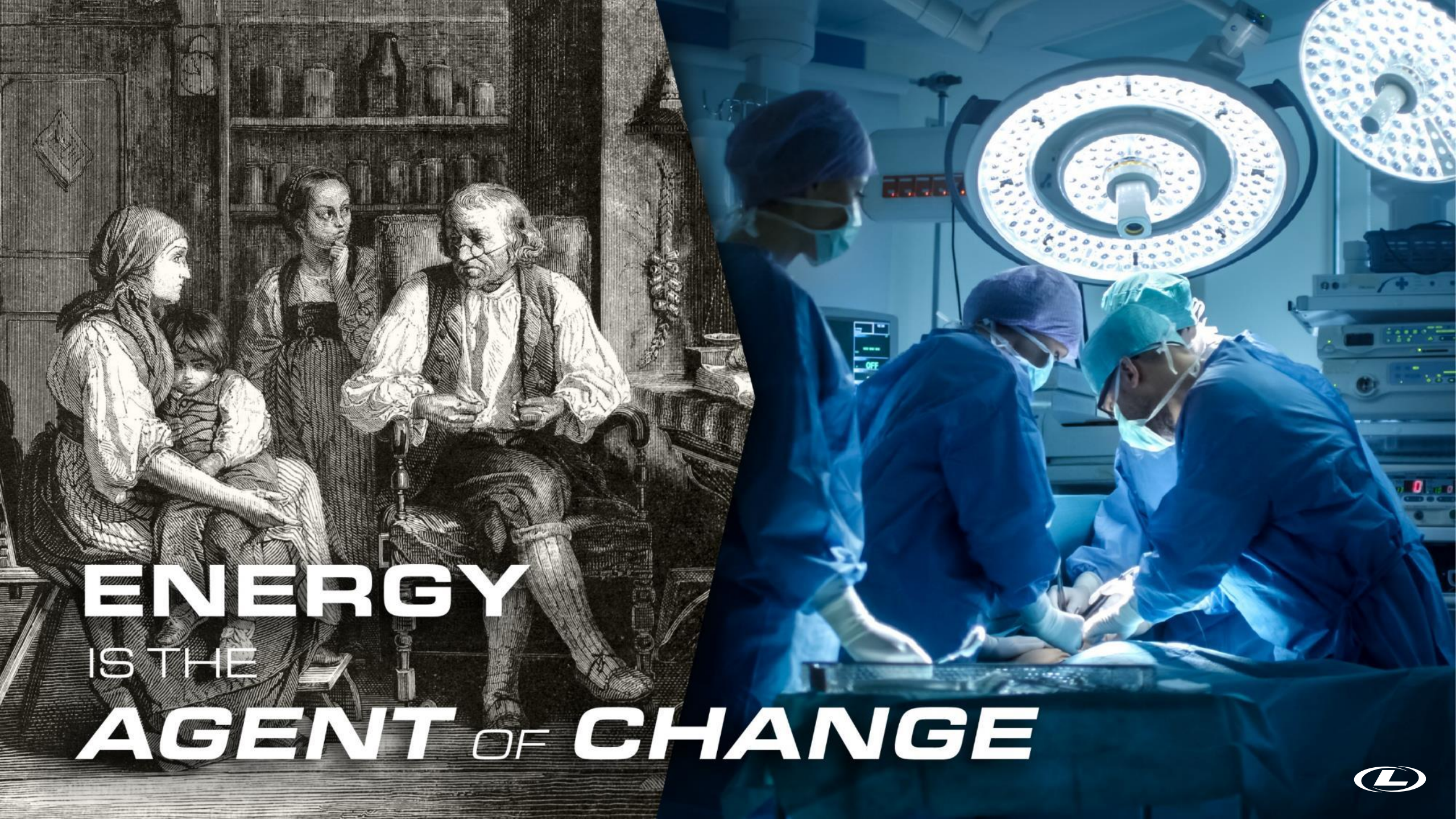
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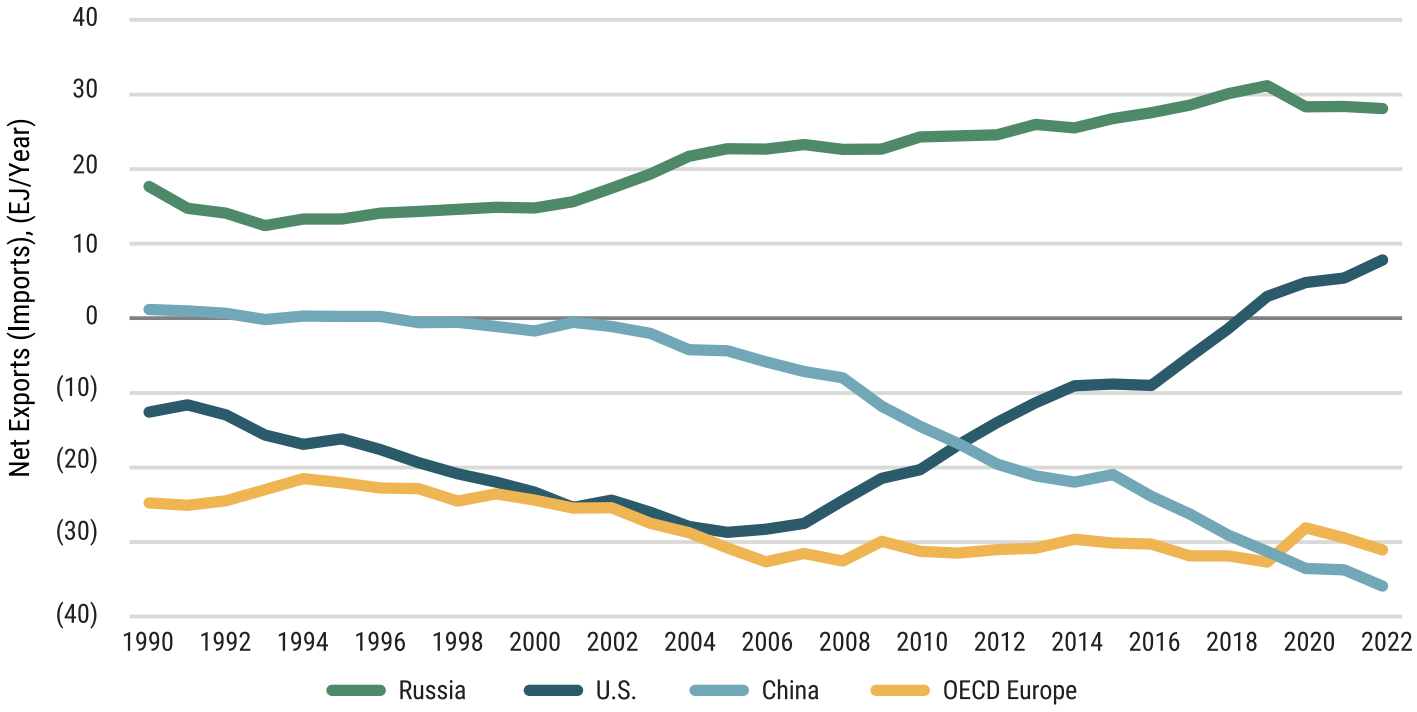
Energy & Geopolitics

Impact of U.S. Shale Revolution

Figure A

Energy Independence vs. Energy Dependence: Net Exports (Imports) of Oil, Natural Gas & Coal



Source: Energy Institute - Statistical Review of World Energy (2023), IEA, JP Morgan Annual Energy Paper.

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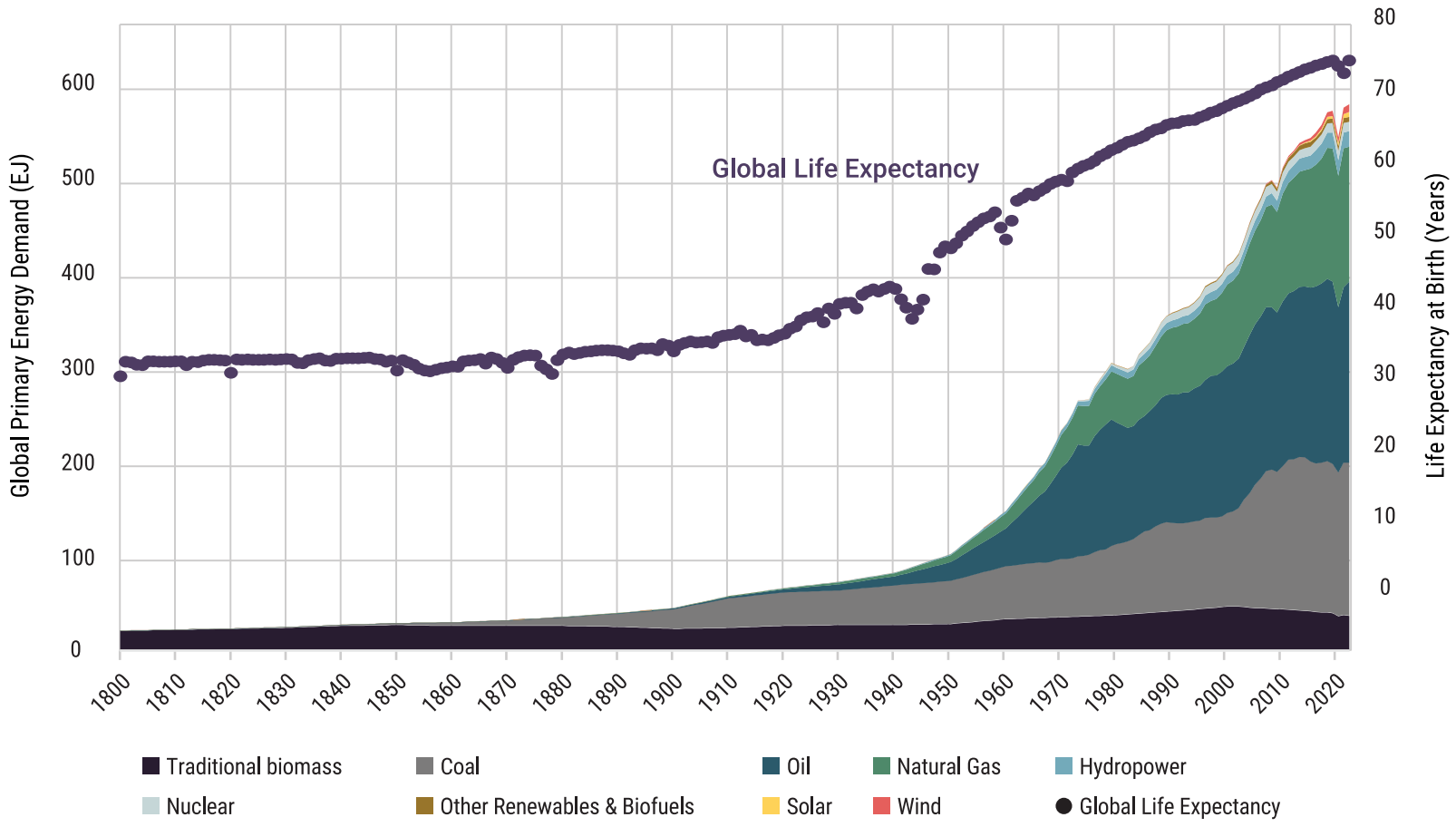
Energy vs. Life Expectancy

Life expectancy experiences a remarkable surge, coinciding with the rapid and overwhelming increase in energy supply upon the arrival of hydrocarbons.

Figure 1.1

Global Primary Energy Demand by Source vs. Life Expectancy 1800–2022



Source: Smil, Vaclav, 2017. Energy Institute - Statistical Review of World Energy (2023), IEA, OWID, Gapminder, and Bijou Insights

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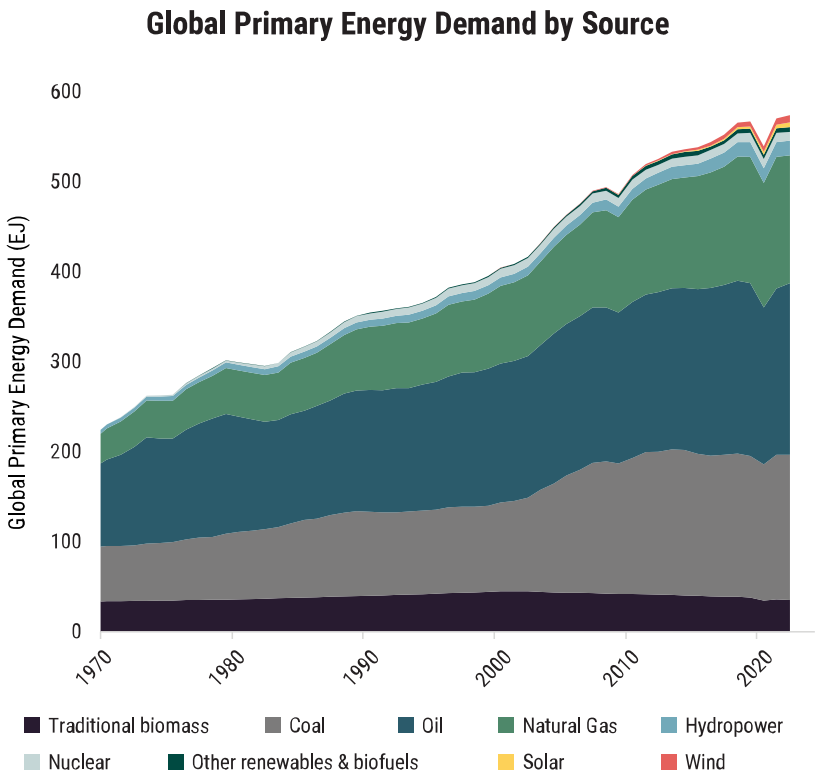
There is No Energy Transition



Source: Smil, Vaclav, 2017. Energy Institute, IEA, Maddison Project, 2020, and Bijou Insights

Hydrocarbons accounted for 85% of global energy during the Yom Kippur War (1973).

Over the last 50 years, global primary energy consumption has more than doubled (1.6% CAGR).

Hydrocarbons still make up ~85% of global energy today.

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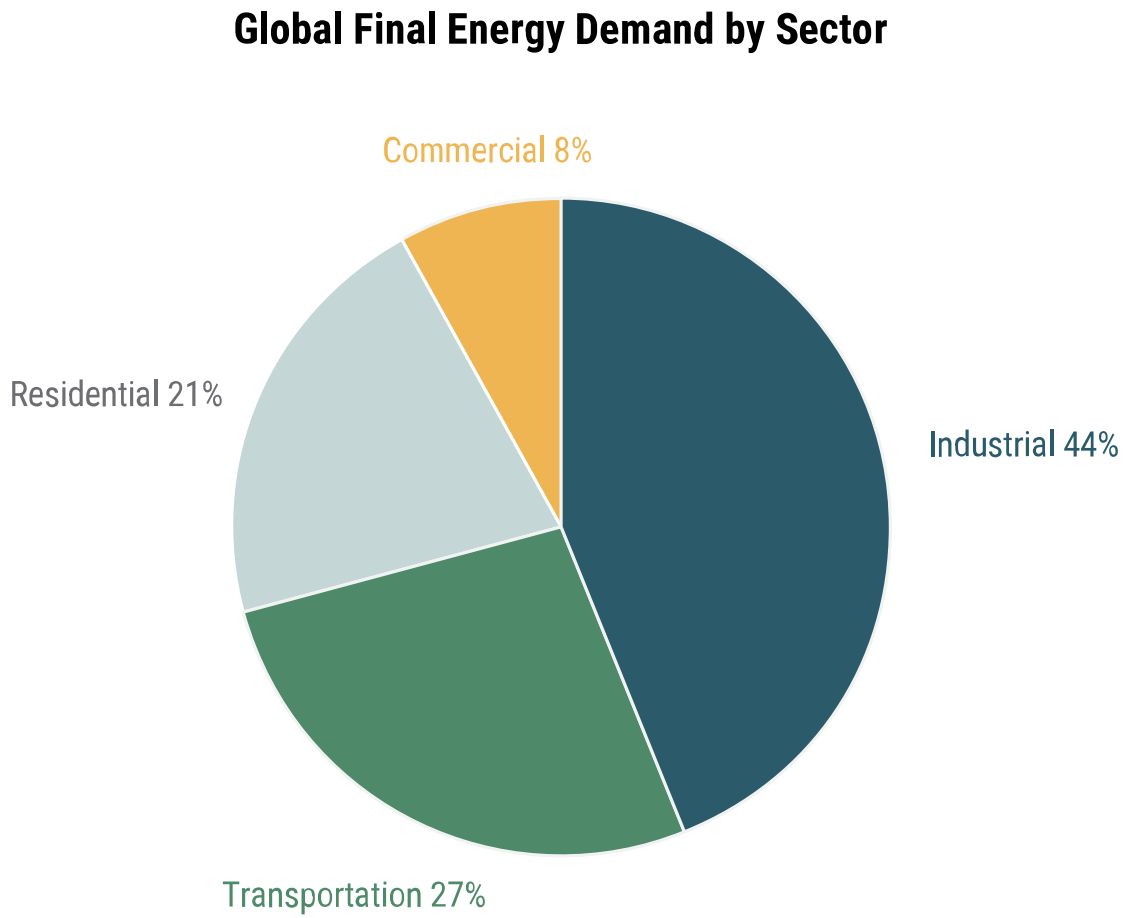
Global Uses of Energy

Only 20% of global energy consumption is in the form of electricity



Source: IEA and Bijou Insights

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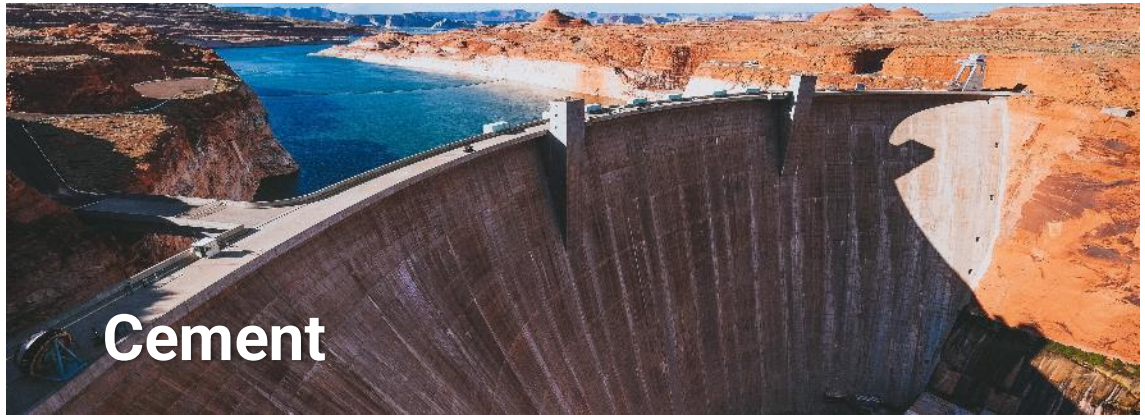
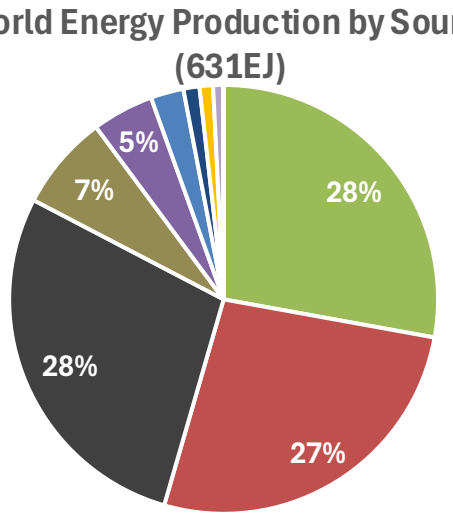
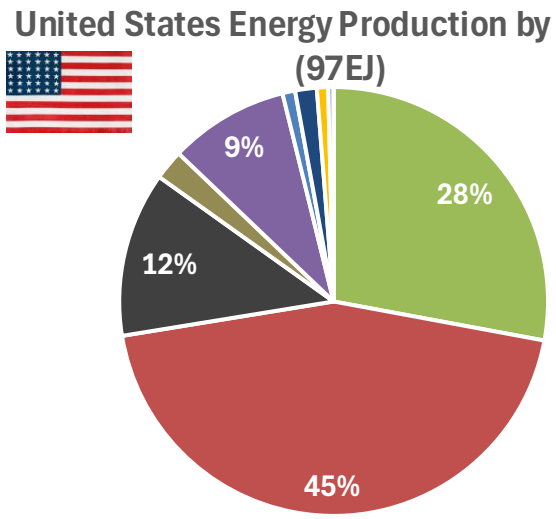
Four Pillars of Civilization

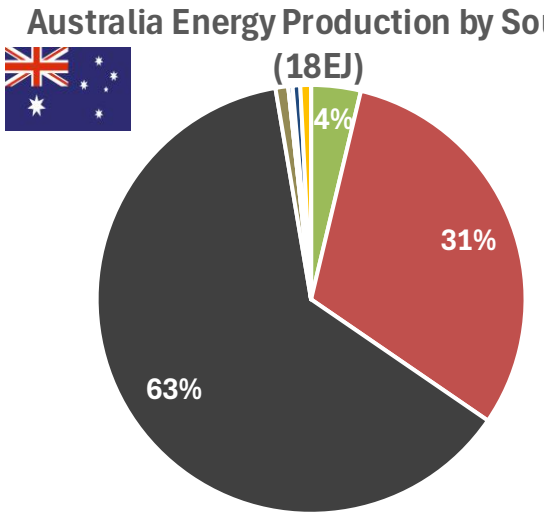


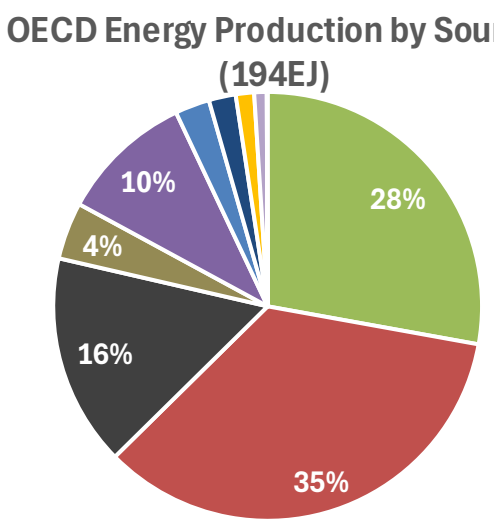
Energy Production by Source

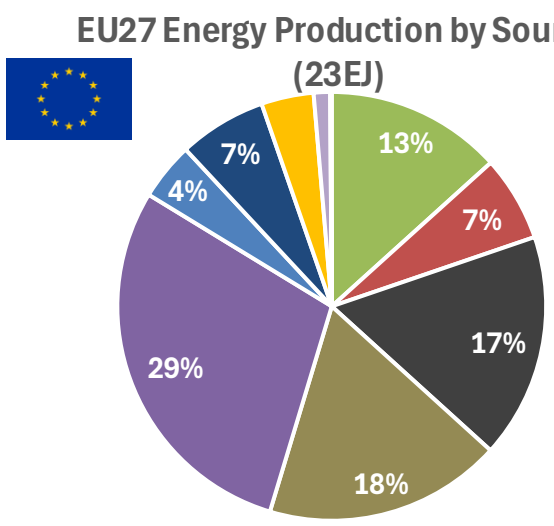
Domestic sources of production in Australia are relatively concentrated & poorly match the diversity of its consumption

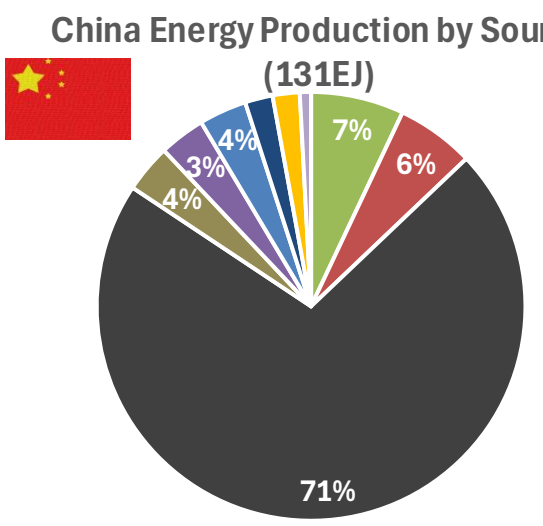










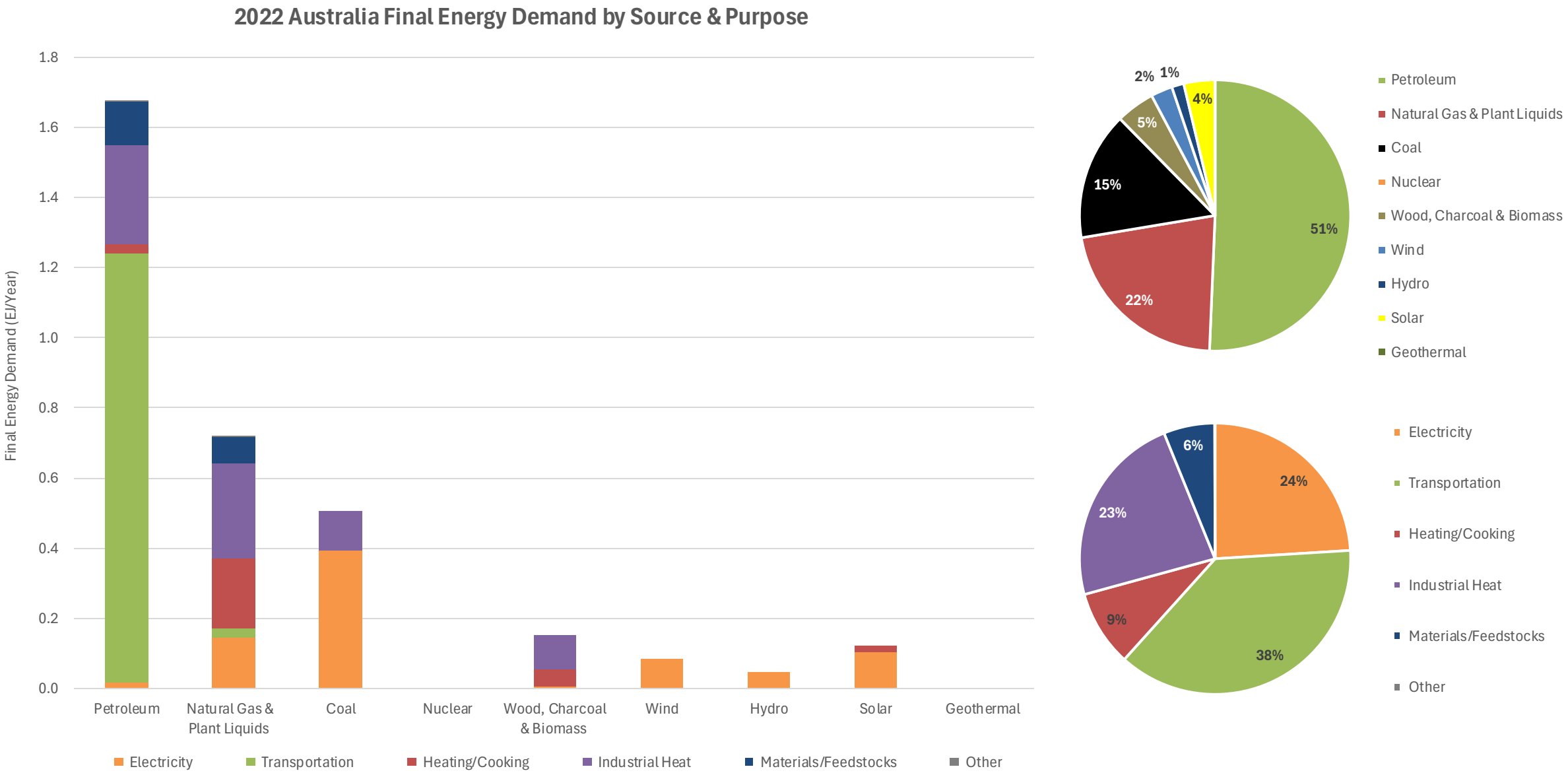


Coal | Wood, Charcoal & Biomass | Natural Gas & Plant Liquids | Petroleum | Nuclear | Hydro | Wind | Solar | Geothermal

Source: IEA World Energy Balances database

Australia Final Energy Consumption

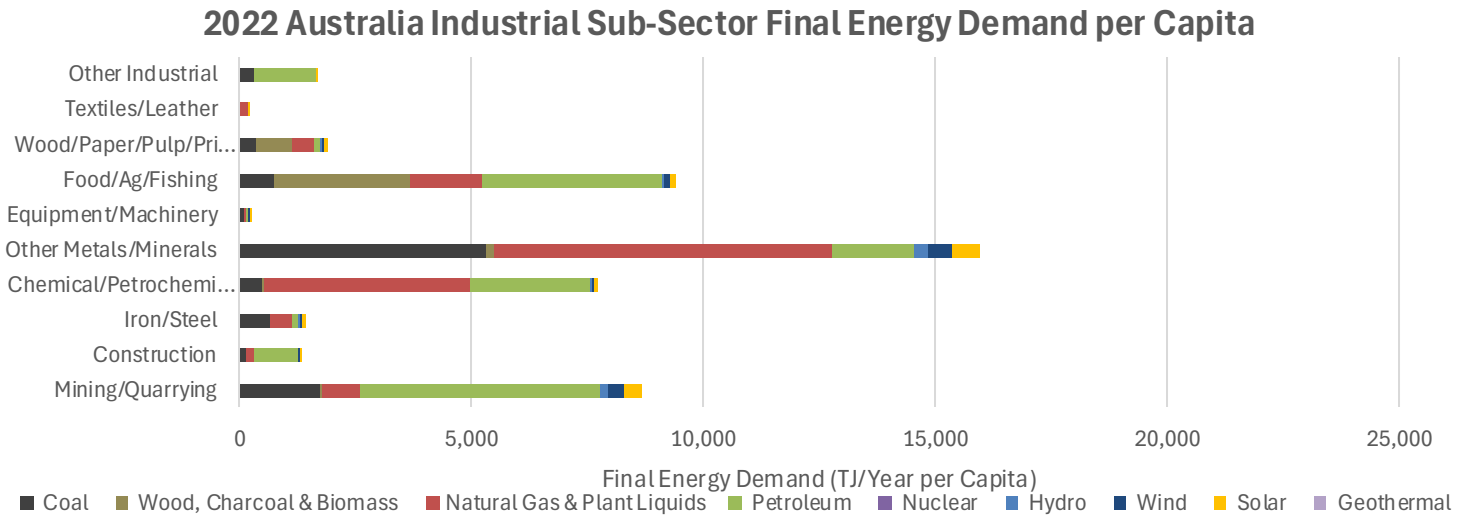
Internal demand remains Petroleum dominated | Relatively high level of electrification on the back of domestic Coal resource

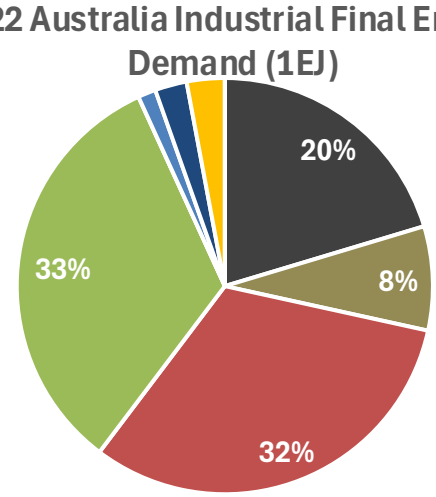


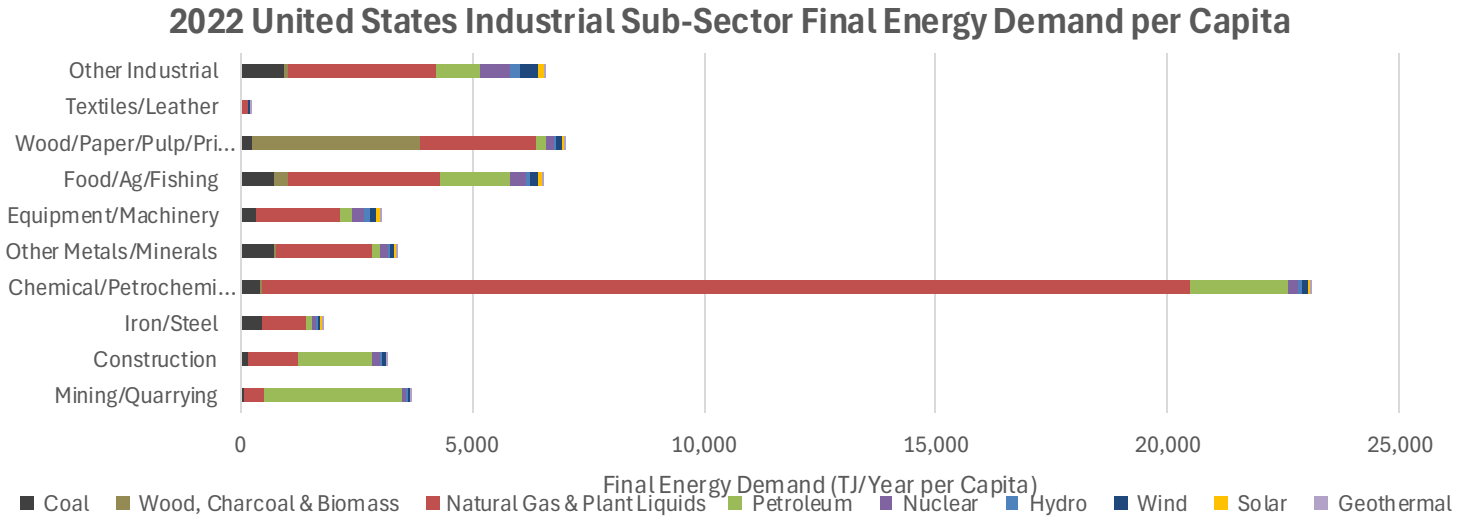
Source: IEA World Energy Balances database

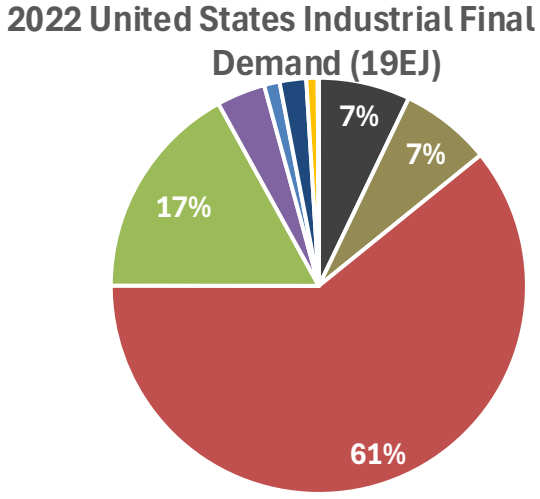
Australia vs U.S. Industrial Final Energy Demand

Domestic shale gas resources could fuel the growth & balance of the Australian industrial foundation









Source: IEA World Energy Balances database

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Lucky 1 Billion. Less Fortunate 7 Billion.

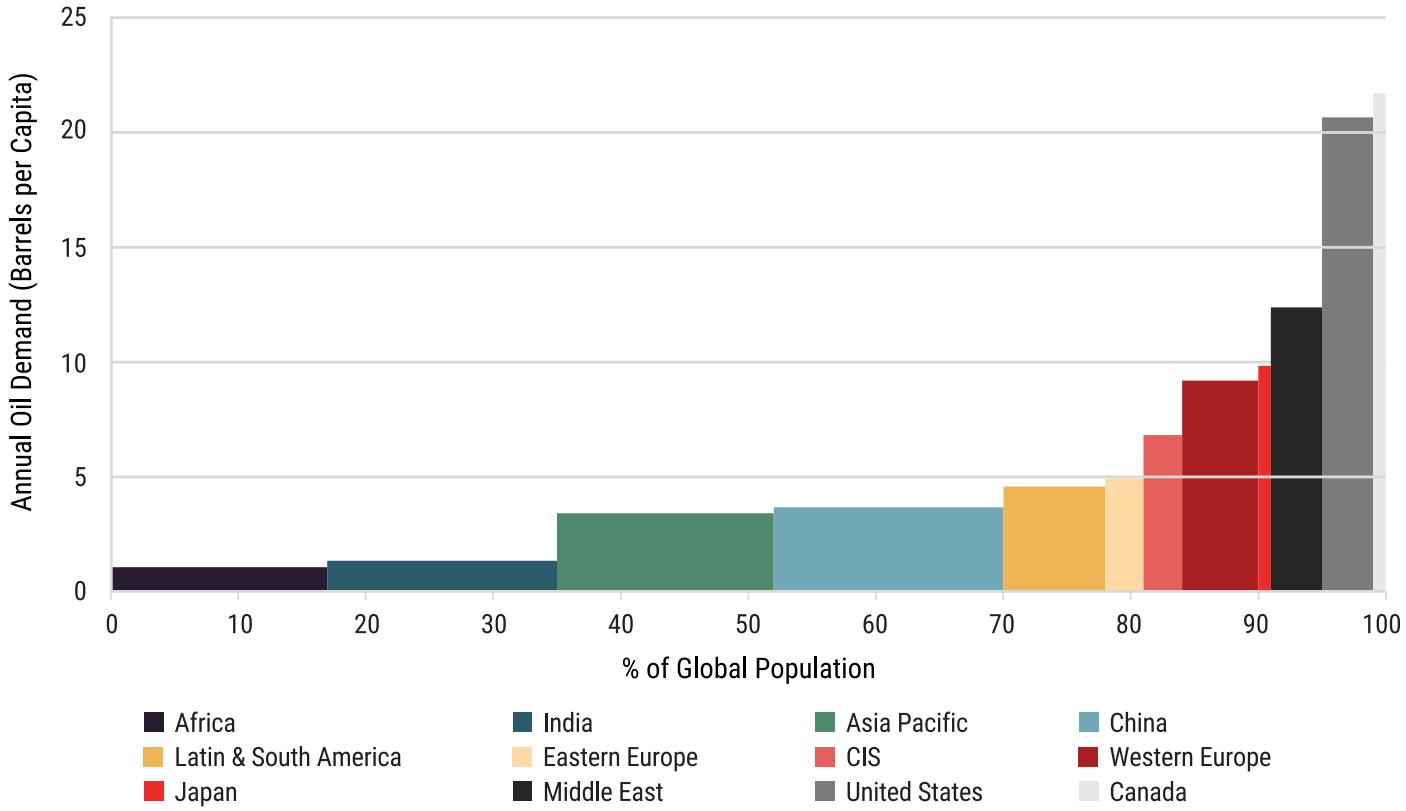
Lucky **one billion** consume **13 barrels of oil per year**.

Other **seven billion** consume **only 3**.

Peak oil?

Figure 3.13

2022 Oil Demand Per Capita



Source: Energy Institute Statistical Review of World Energy, and Bijou insights

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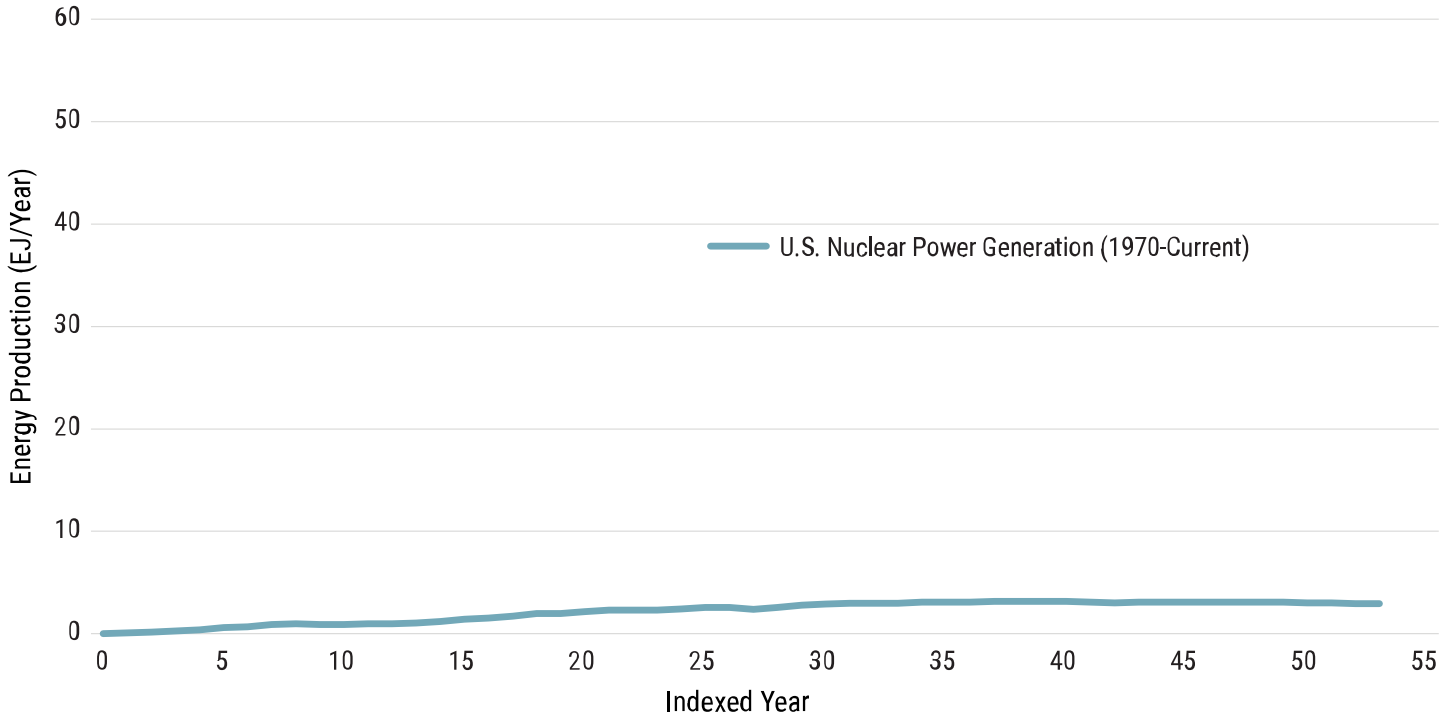
Impact of New Energies

Figure 2.1

Global and U.S. Energy Production



Source: Bijou Insights analysis of data from Energy Institute - Statistical Review of World Energy (2023), EIA

ENERGY & THE MODERN WORLD

Impact of New Energies

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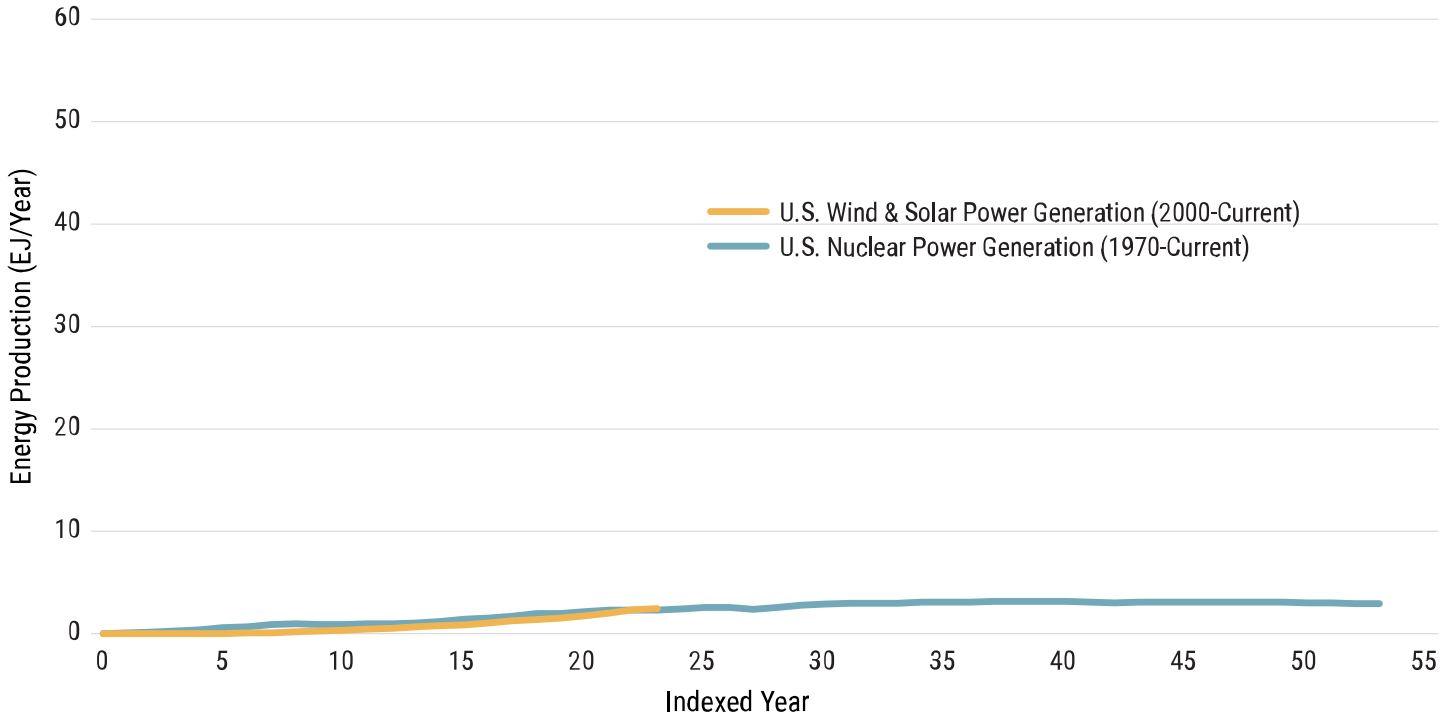

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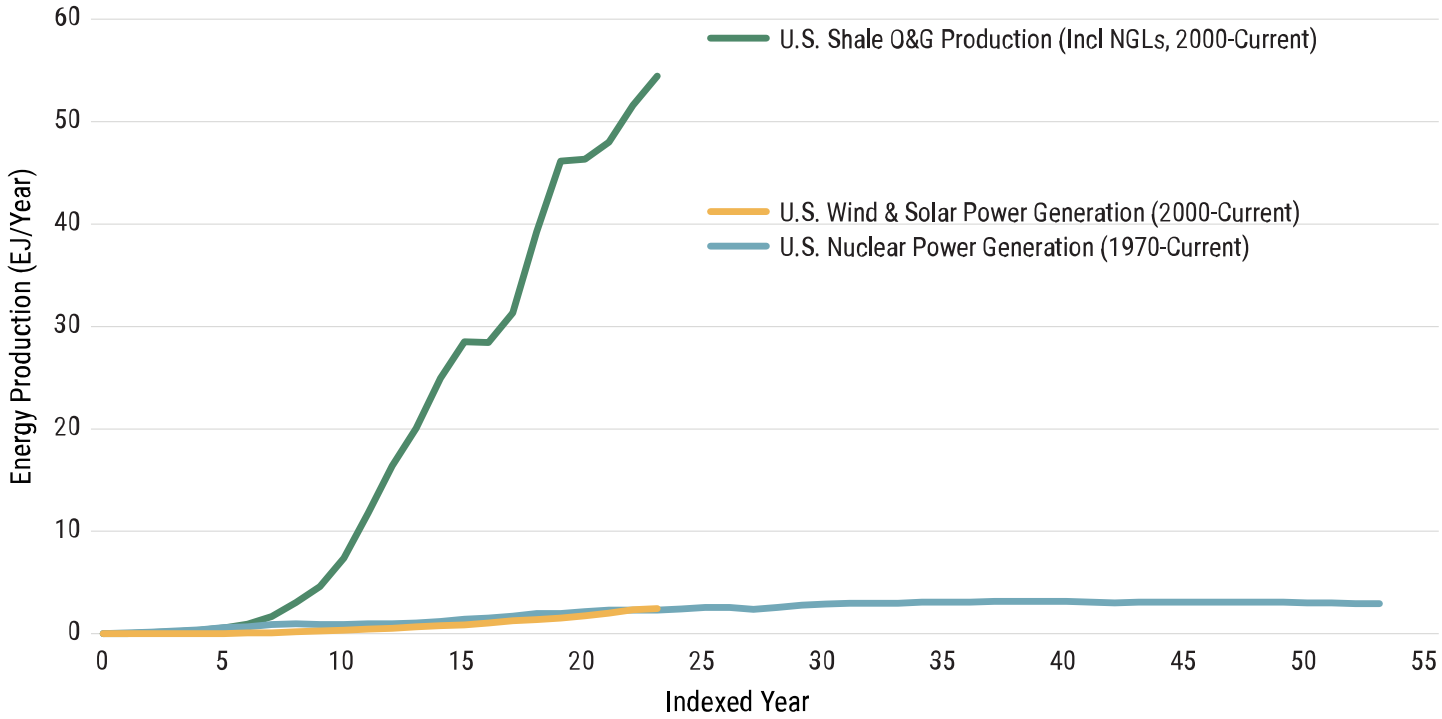
Impact of New Energies

Energy produced from U.S. shale is equivalent to 58% of U.S. primary energy demand and nearly 10% of global primary energy demand.

Figure 2.1

Global and U.S. Energy Production



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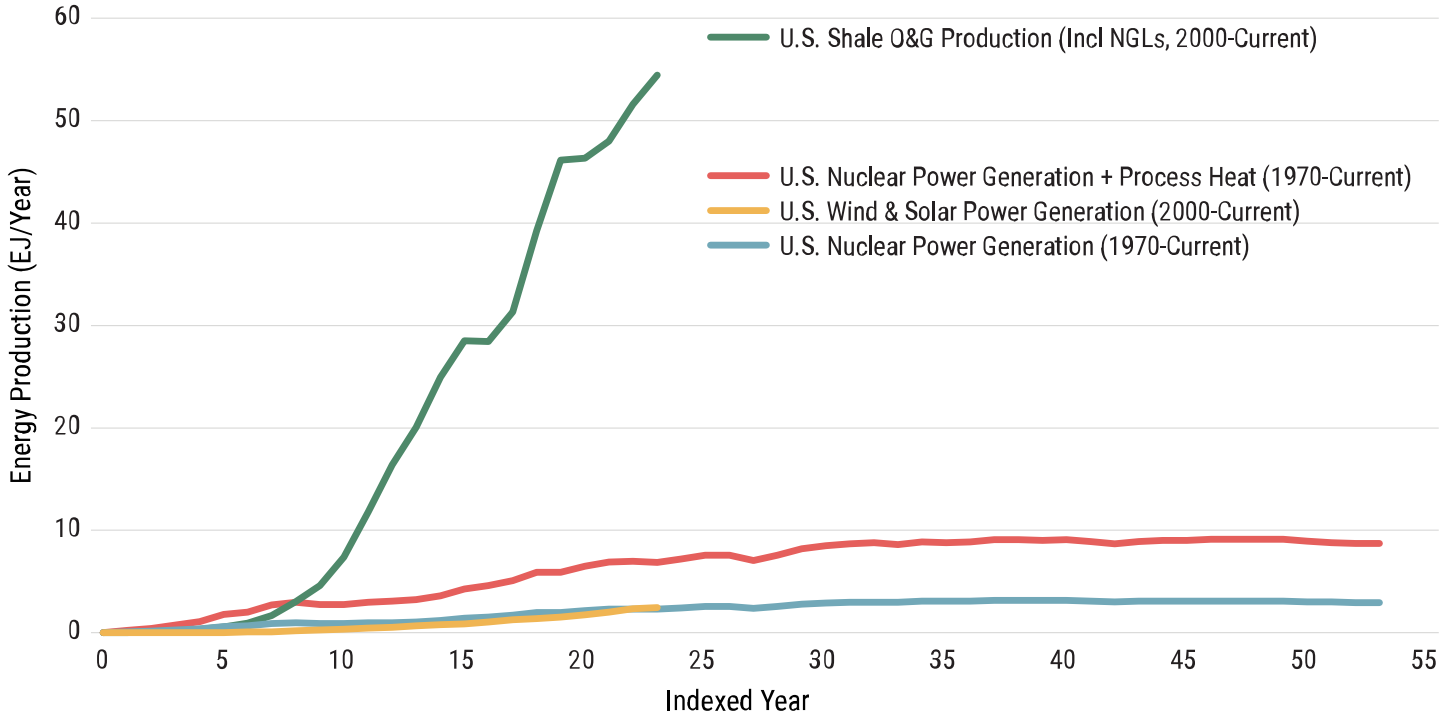

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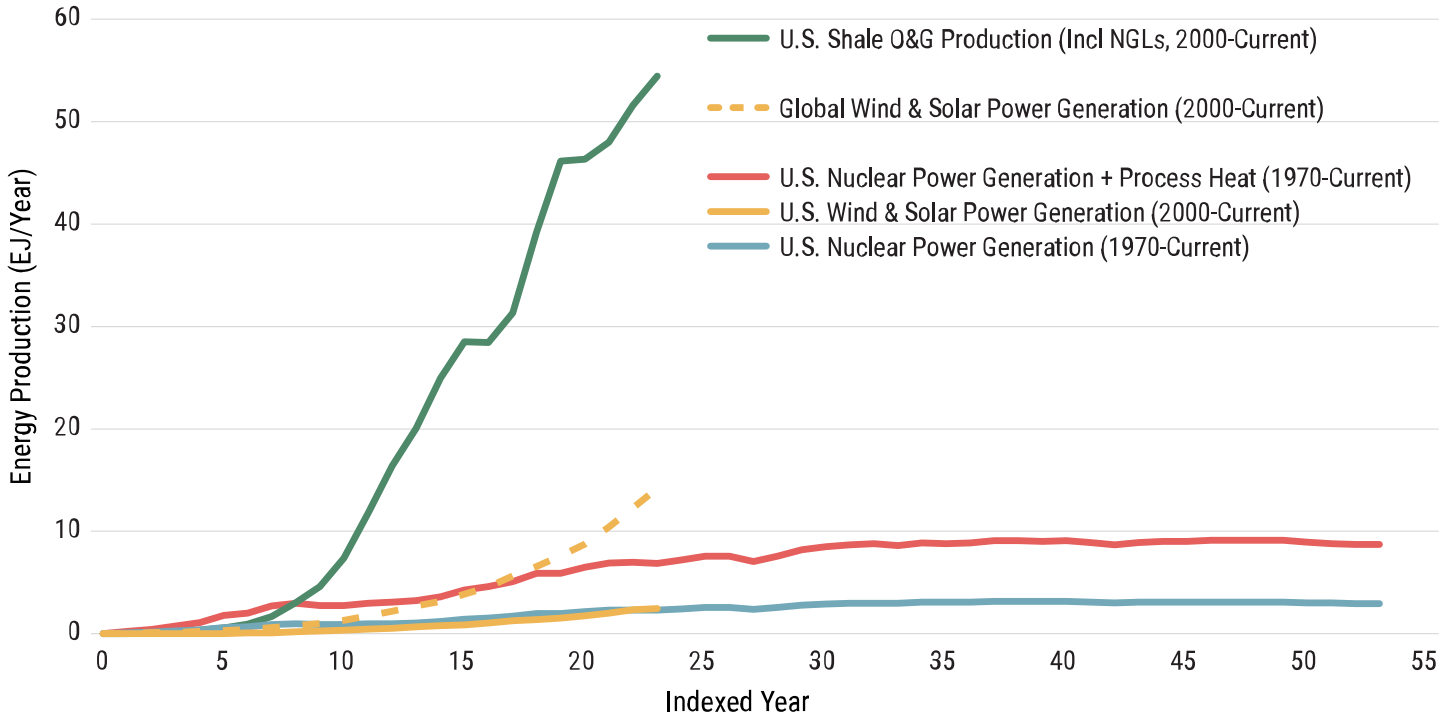

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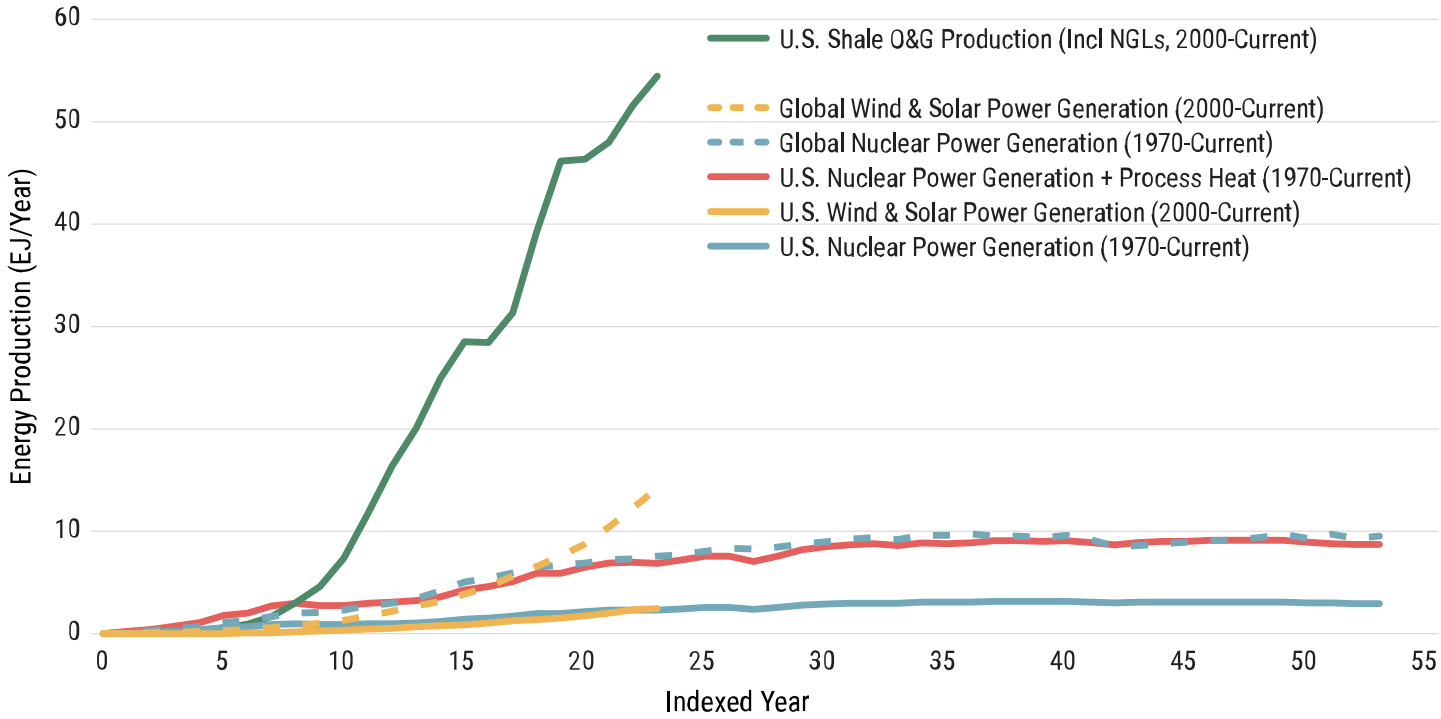

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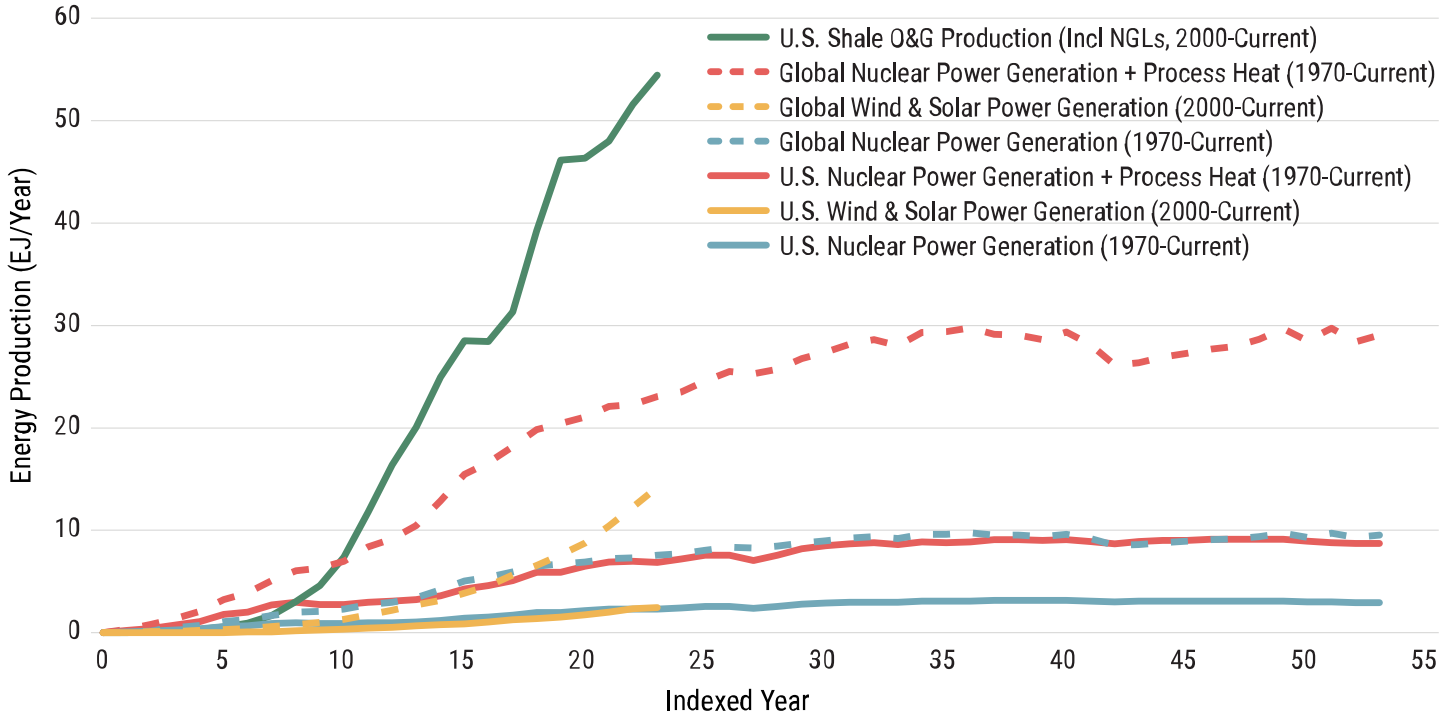


Source: Bijou Insights analysis of data from Energy Institute - Statistical Review of World Energy (2023), EIA


CLIMATE CHANGE

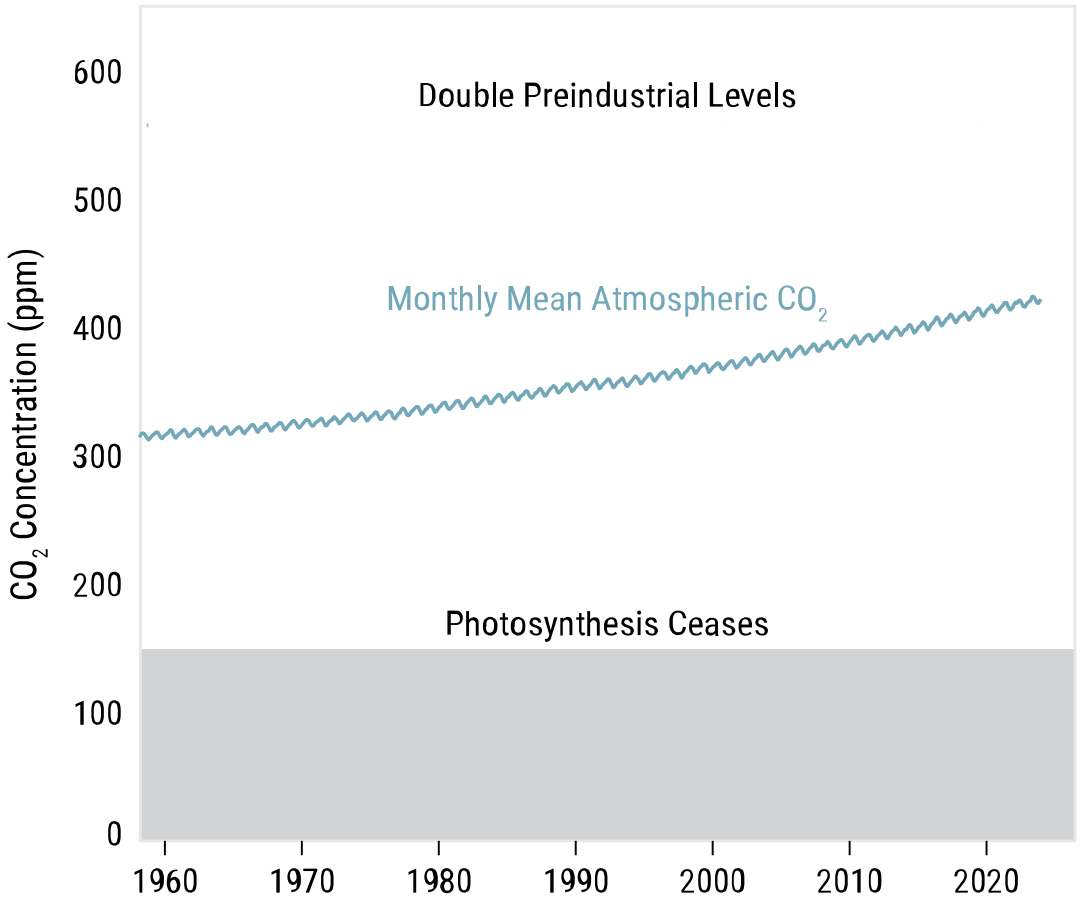
CLIMATE CHANGE

Atmospheric Carbon Dioxide

The hydrocarbon-powered global economic growth since World War II has driven a steady climb in atmospheric CO_2 concentration to slightly above 0.04%.

Figure 4.1

Atmospheric CO_2 at Mauna Loa Observatory



Source: Scripps Institution of Oceanography NOAA Earth System Research Laboratory https://www.e-education.psu.edu/earth103/node/1018

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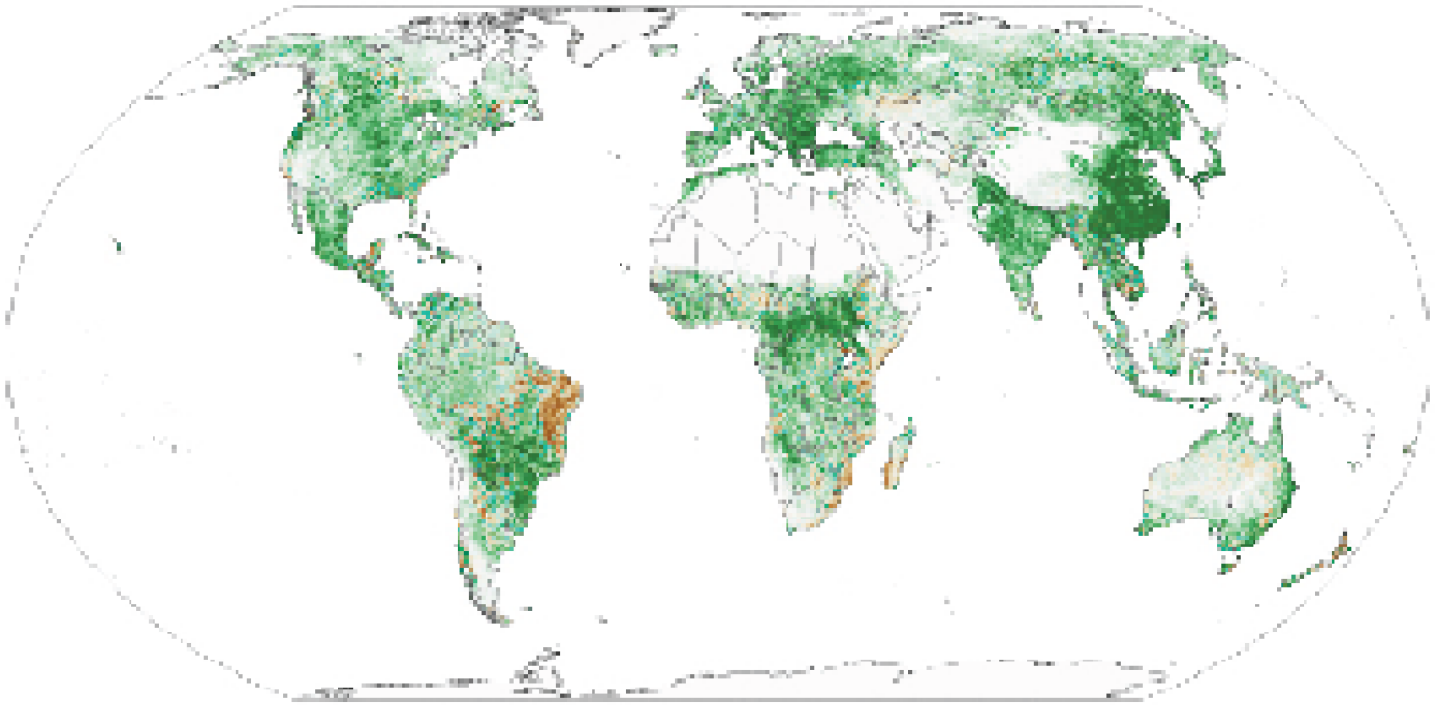
Earth is Getting Greener

Roughly half the CO_2 released from burning hydrocarbons goes into the oceans or into “greening” the planet. This leads to increased agricultural productivity and plant matter.

Figure 4.2

Global Greening from CO_2 Fertilization



Trend in Growing Season Mean Leaf Area Index (2000–2018, 10-3 m2/m2/year)

≤-18 -9 0 9 ≥18

Source: Hille, Karl. “Carbon Dioxide Fertilization Greening Earth, Study Finds.” NASA, NASA, 25 Apr. 2016

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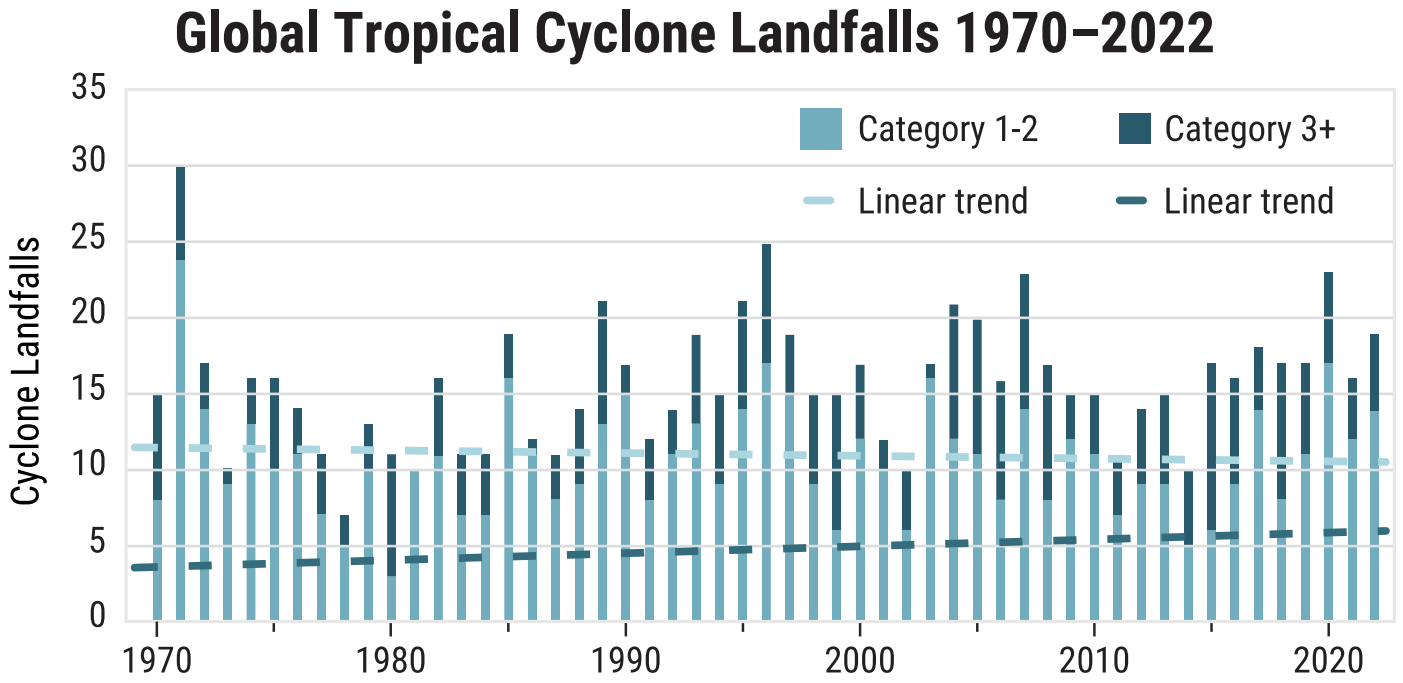
Tropical Cyclones

Trend in the number of global land-falling hurricanes since 1970.

Figure 4.7



Source: Jr., Roger Pielke. Global Hurricane Landfalls 1970 to 2022, The Honest Broker by Roger Pielke Jr., 18 Jan. 2022. NOAA Hurricane Research Division, Colorado State University Tropical Meteorology Project

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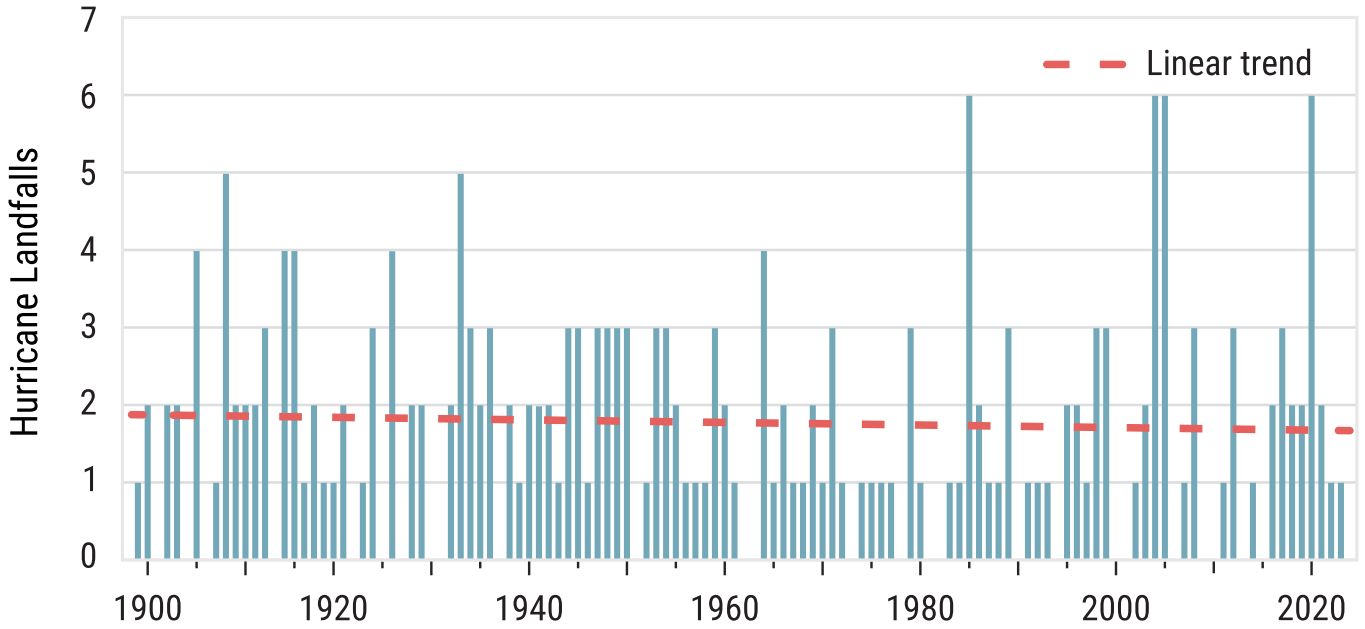
U.S. Hurricanes

Data shows large annual variability in hurricane activity but no obvious rising trend.

Figure 4.8

Continential U.S. Landfalling Hurricanes 1900–2023



Source: “US Hurricane Landfalls.” Atlantic Oceanographic and Meteorological Laboratories. ; Jr., Roger Pielke. “U.S. Hurricane Overview 2023.”

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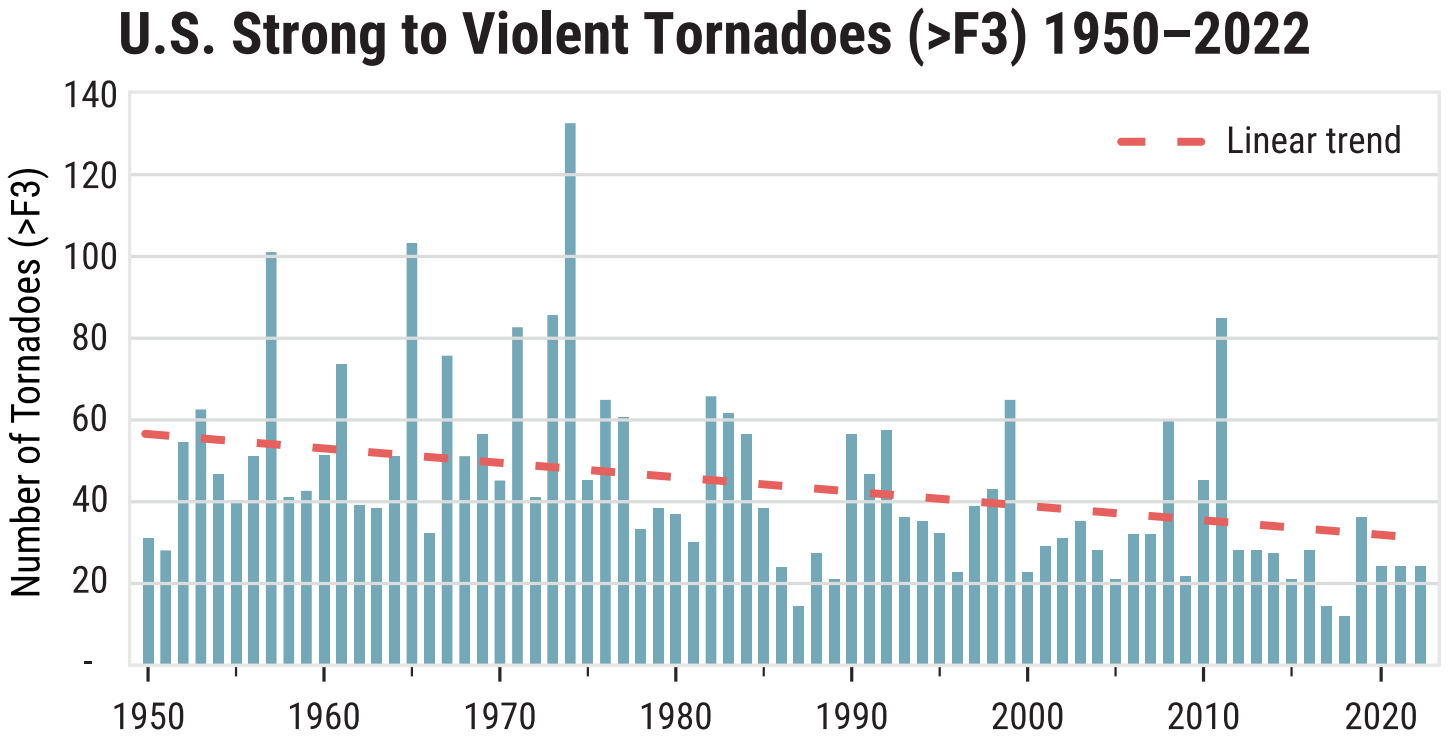
U.S. Tornadoes

The frequency of severe tornadoes in the United States since 1954 appears to trend downward.

Figure 4.9



Source: "Storm Prediction Center WCM Page." Storm Prediction Center.

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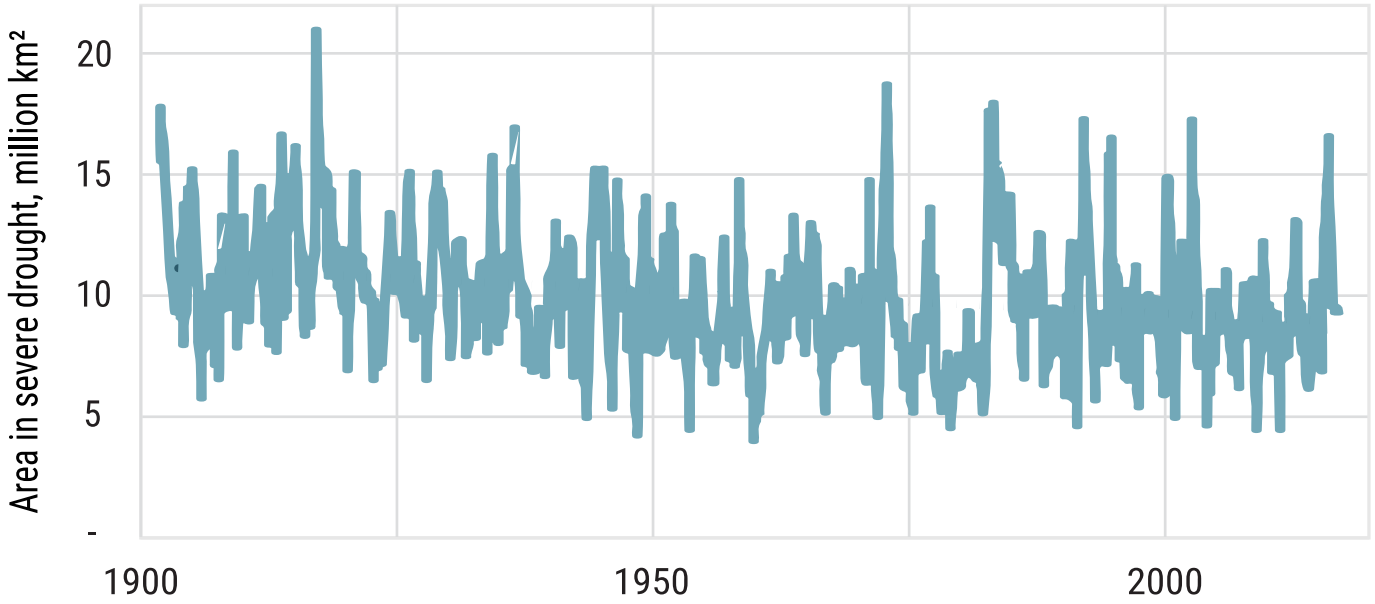
Global Drought

There appears to be a slight decline in global drought prevalence over the last century, which is to be expected as a slightly warmer world implies a slightly wetter world.

Figure 4.10

Global Area in Severe Meteorological Drought 1901–2017



Source: Lomborg, Bjorn. "Welfare in the 21st Century: Increasing Development, Reducing Inequality, the Impact of Climate Change, and the Cost of Climate Policies." Technological Forecasting and Social Change, North-Holland, 24 Apr. 2020.

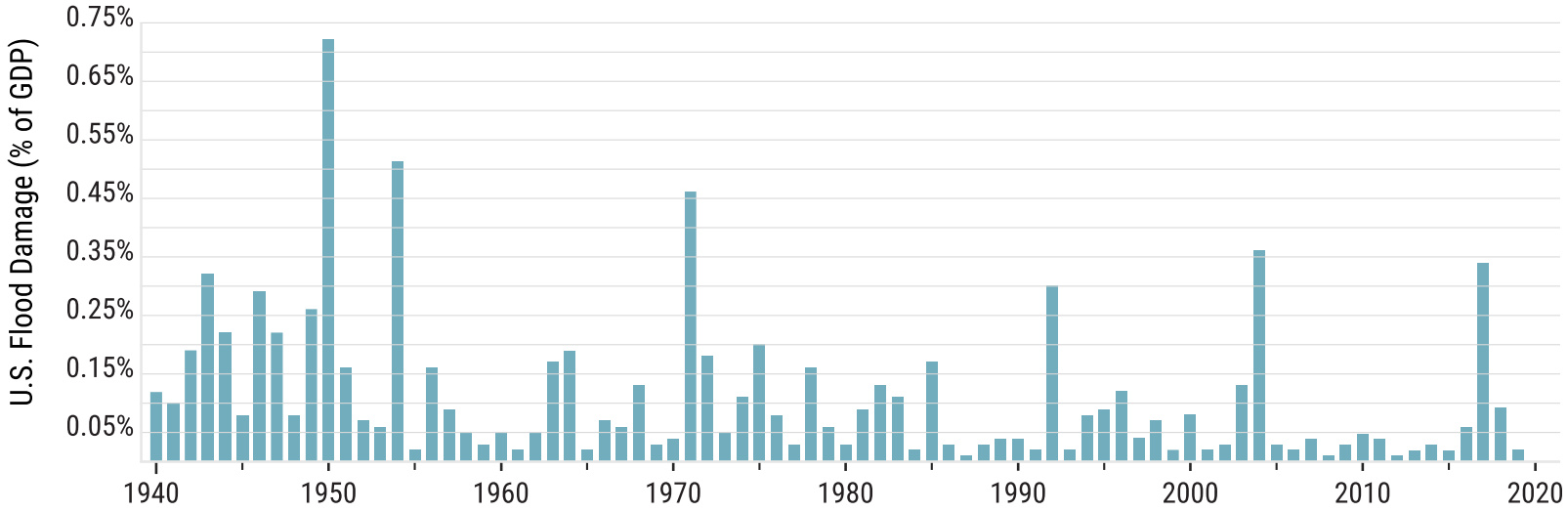
CLIMATE CHANGE

U.S. Flood Damage

U.S. flood damage as a percentage of GDP trends downward, more likely due to better flood preparedness than an actual reduction in floods or extreme rain events.

Figure 4.13

U.S. Flood Damage as Percentage of GDP 1940–2019



Source: Downton, Mary W., et al. "Reanalysis of U.S. National Weather Service Flood Loss Database: Natural Hazards Review: Vol 6, No 1." Natural Hazards Review, American Society of Civil Engineers, 1 Feb. 2005. ; Contribution of Historical Precipitation Change to US Flood ... - Pnas. ; Jr., Roger Pielke. "Global Disasters: A Remarkable Story of Science and Policy Success." The Honest Broker Newsletter, The Honest Broker Newsletter, 14 Jan. 2021.

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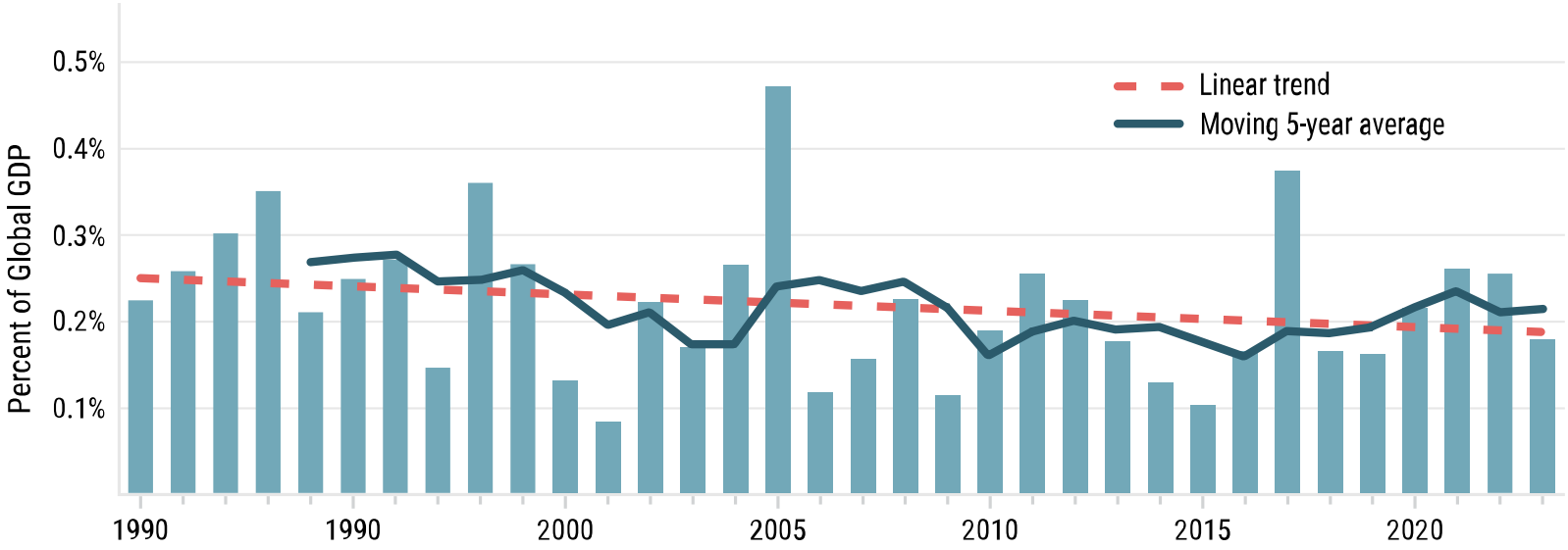
Extreme Weather & Global GDP

Damages from extreme weather events as a percentage of global GDP have declined by roughly 20% over the last three decades.

Figure 4.14

Global Weather Disaster Losses as Percent of Global GDP 1990–2023



Source: Roger Pielke, Jr., Munch RE, 2023, NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2024).

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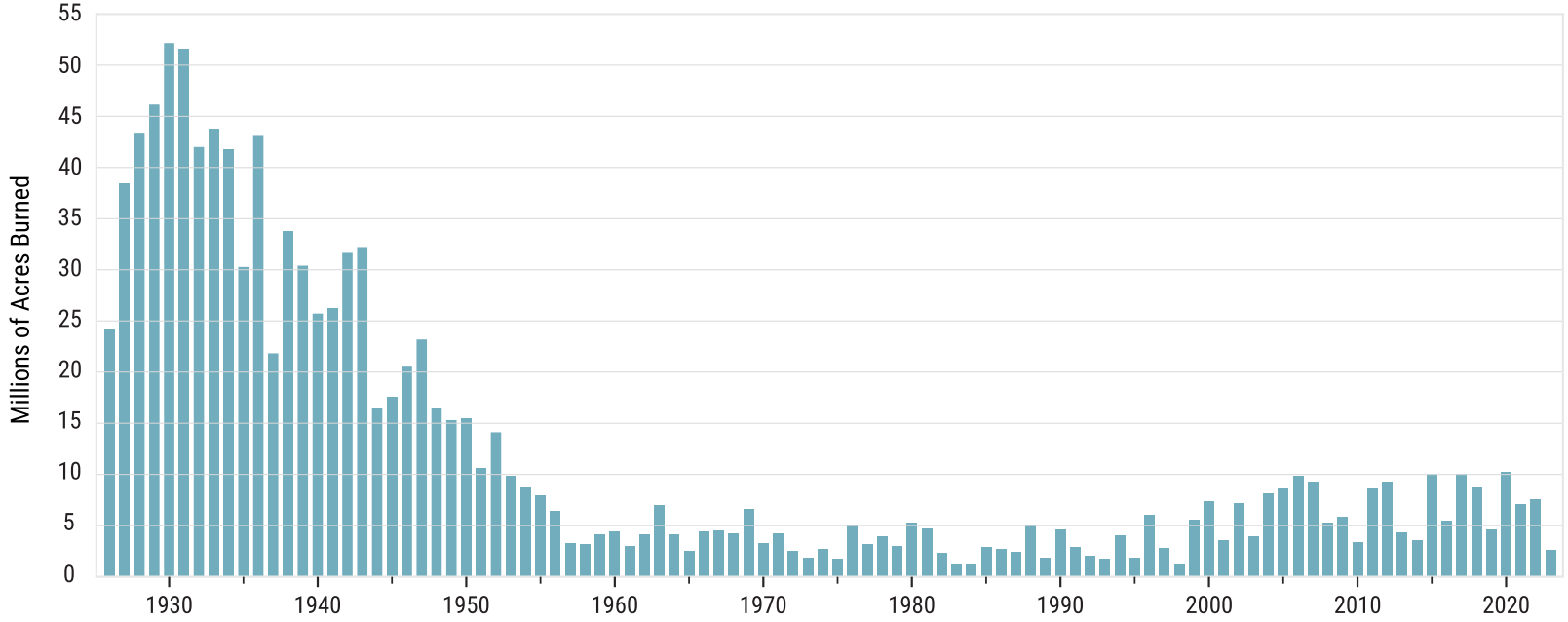
Wildfires & Forest Management

Forest Service scientists conclude that increased “live fuel” due to changing forest management practices was responsible for more than 50% of the recent increase in wildfires.

Figure 4.15

U.S. Wildfire Acres Burned 1926–2023



Source: National interagency Fire Center, Roger Pielke, Jr.

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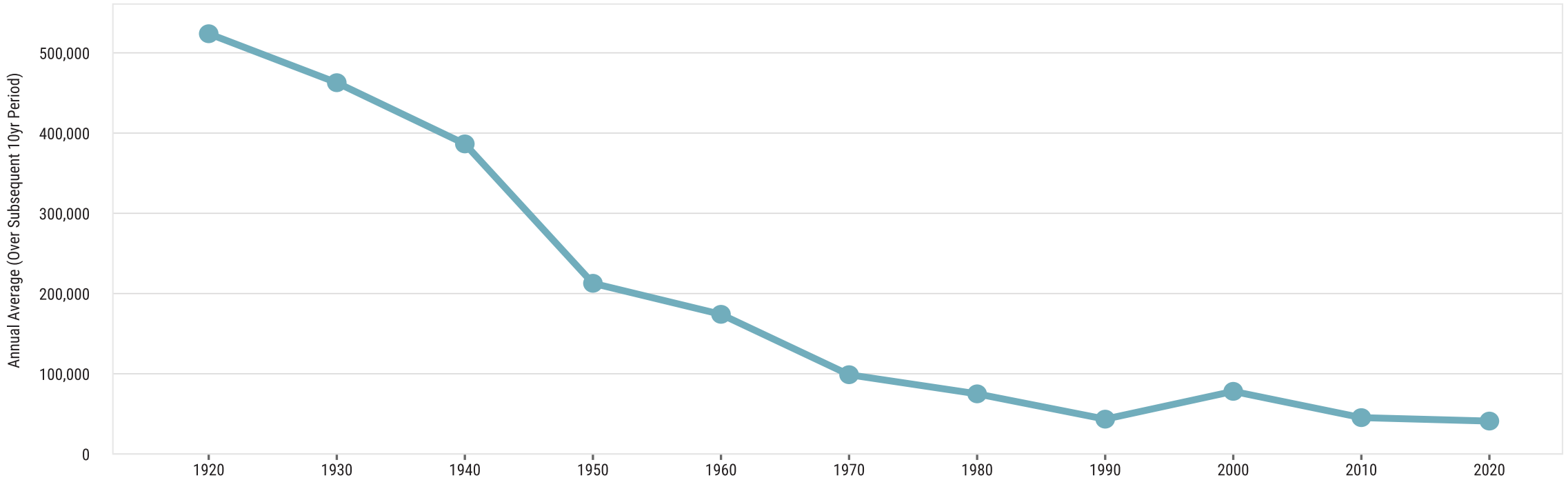
Large Downward Trend of Severe Weather Deaths

Figure 4.16

Global Deaths from Severe Weather 1920–2020



Source: "EM-DAT: The International Disasters Database." EM-DAT, Centre for Research on the Epidemiology of Disasters (CRED). ; Lomborg, Bjorn. "Welfare in the 21st Century: Increasing Development, Reducing Inequality, the Impact of Climate Change, and the Cost of Climate Policies." Technological Forecasting and Social Change, North-Holland, 24 Apr. 2020.

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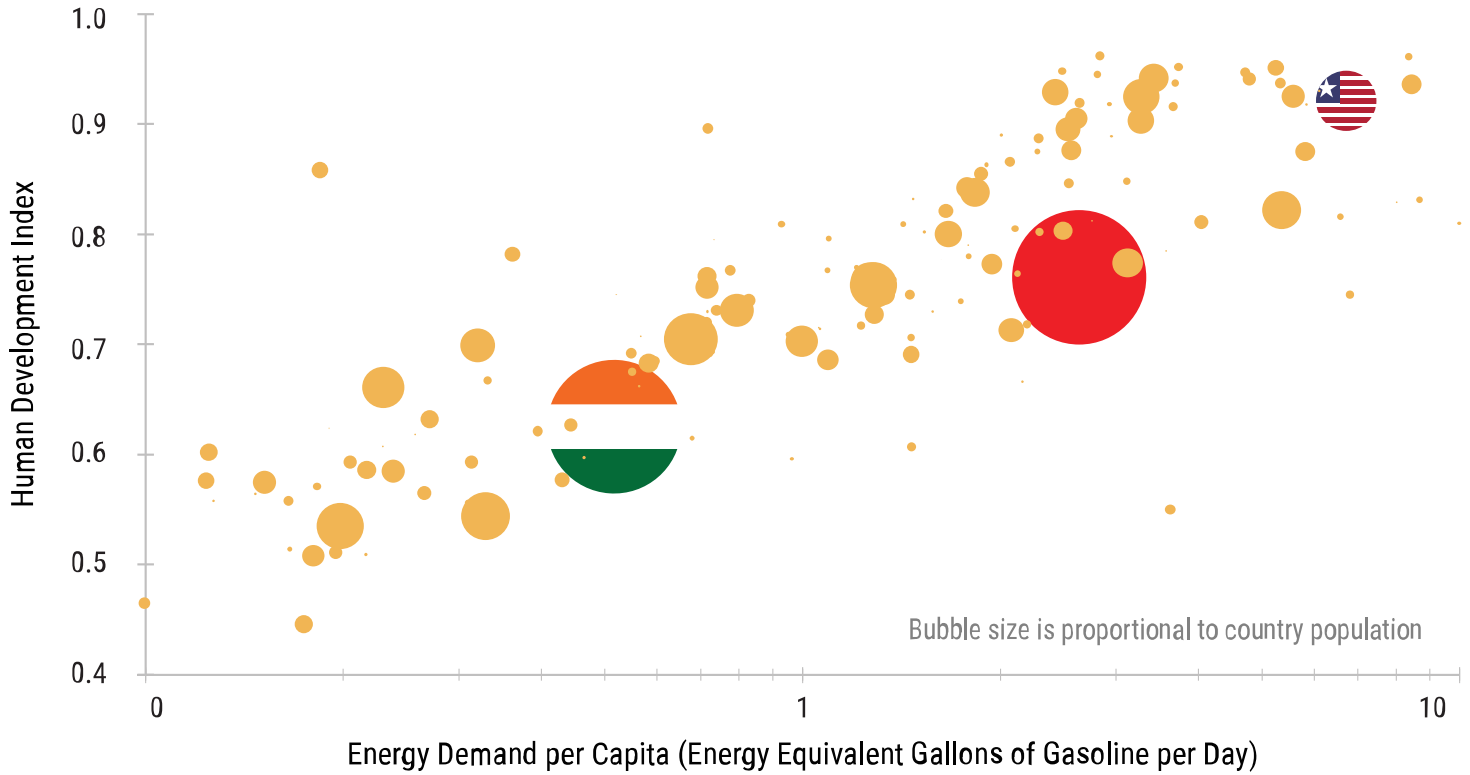
Energy & HDI

Higher HDI scores go hand in hand with higher energy consumption

Figure 3.9

2021 HDI vs. Primary Energy Demand per Capita



Source: United Nations, EIA, and Bijou Insights

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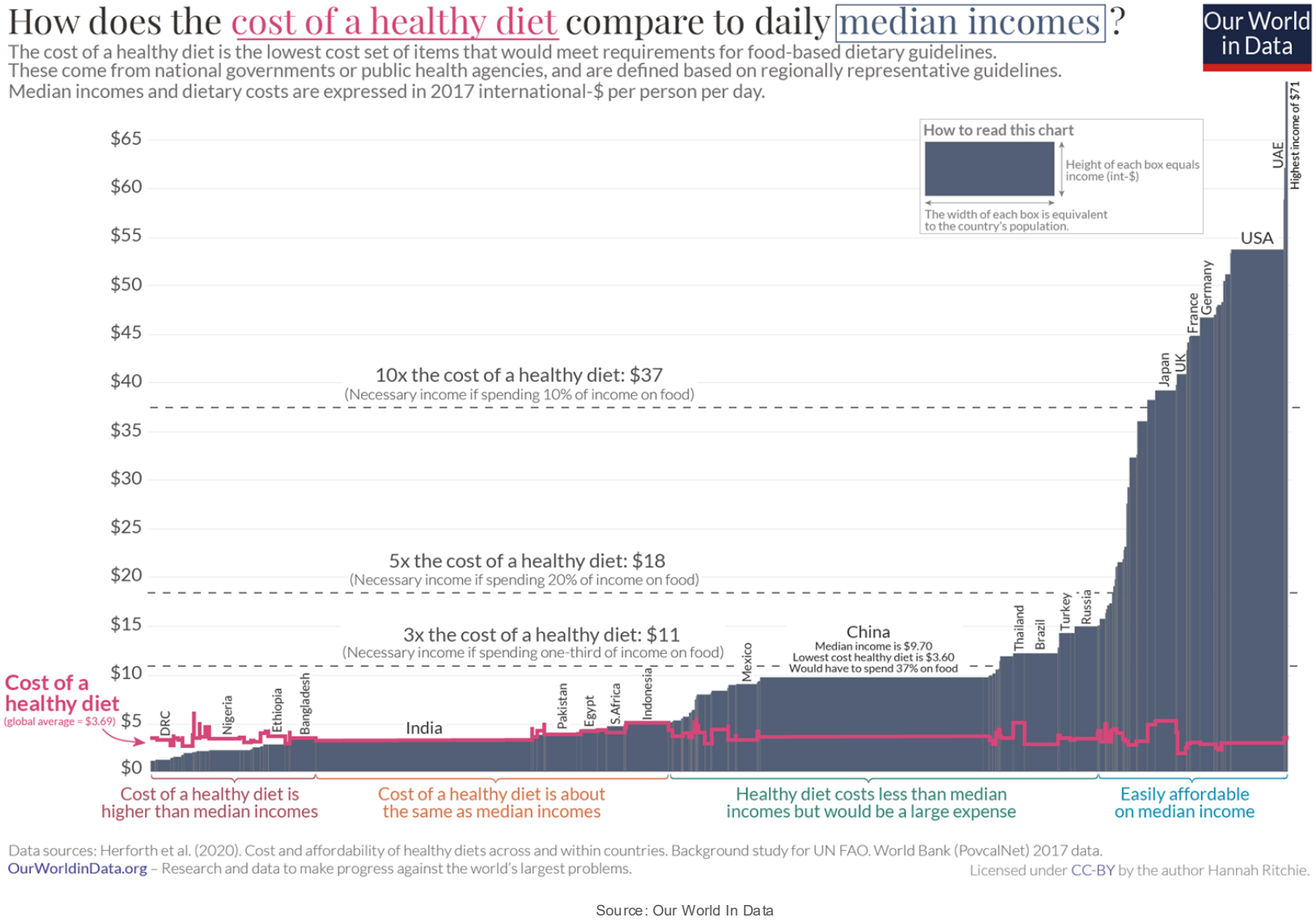
Food & Hydrocarbons

Elimination of natural gas-synthesized nitrogen fertilizer would cut global food production in half



Source: Our World In Data

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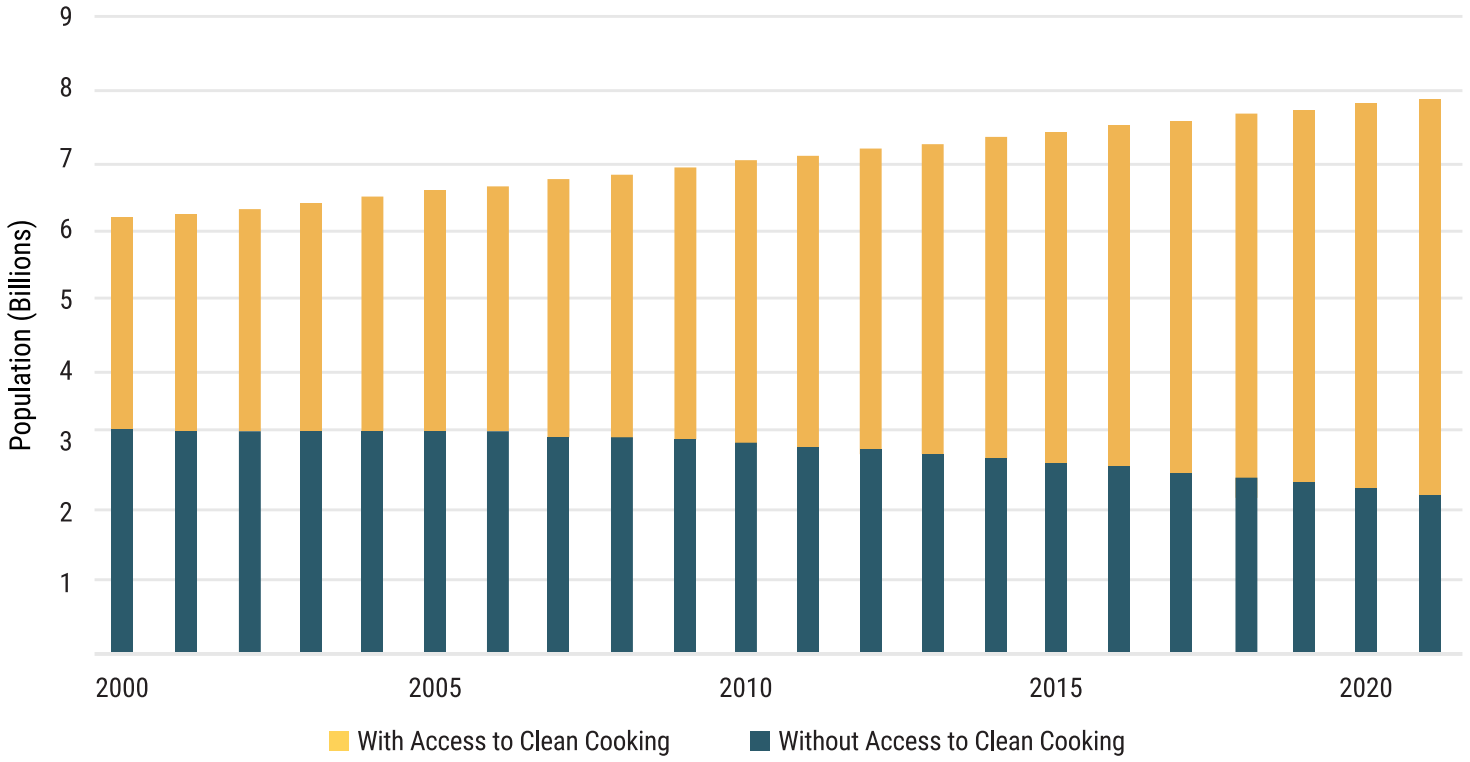
ENERGY POVERTY

Clean Cooking Access

Almost one-third of humanity still lack access to clean cooking fuel, including 82% in Sub-Saharan Africa and nearly 30% of Indians.

Figure 3.2

People in the World With & Without Access to Clean Cooking 2000–2021



Source: World Bank, United Nations Sustainable Development Goals Report, 2022

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World's Biggest (Fixable) Problems

- Malnutrition
- Basic healthcare
- Indoor air pollution
- Outdoor air pollution
- Universal education
- Rule of law and property rights (human liberty)

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CLIMATE ECONOMICS

Case Study: Germany

Over the past two decades, Germany has reduced coal and eliminated nuclear power, relying more heavily on unreliable wind and solar

Electric power **capacity increased** 93% while total electricity **production declined** by about 15%.

German industrial production is decreasing as **manufactures move to other countries**.

Primary energy from hydrocarbons dropped from 80% to 74%. **Energy Transition?**

Electricity prices have risen to about **3X higher** than average prices in the U.S. Electricity use has dropped 17%.

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QUESTIONS?

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