

## On Energy Transitions and the Oil Market



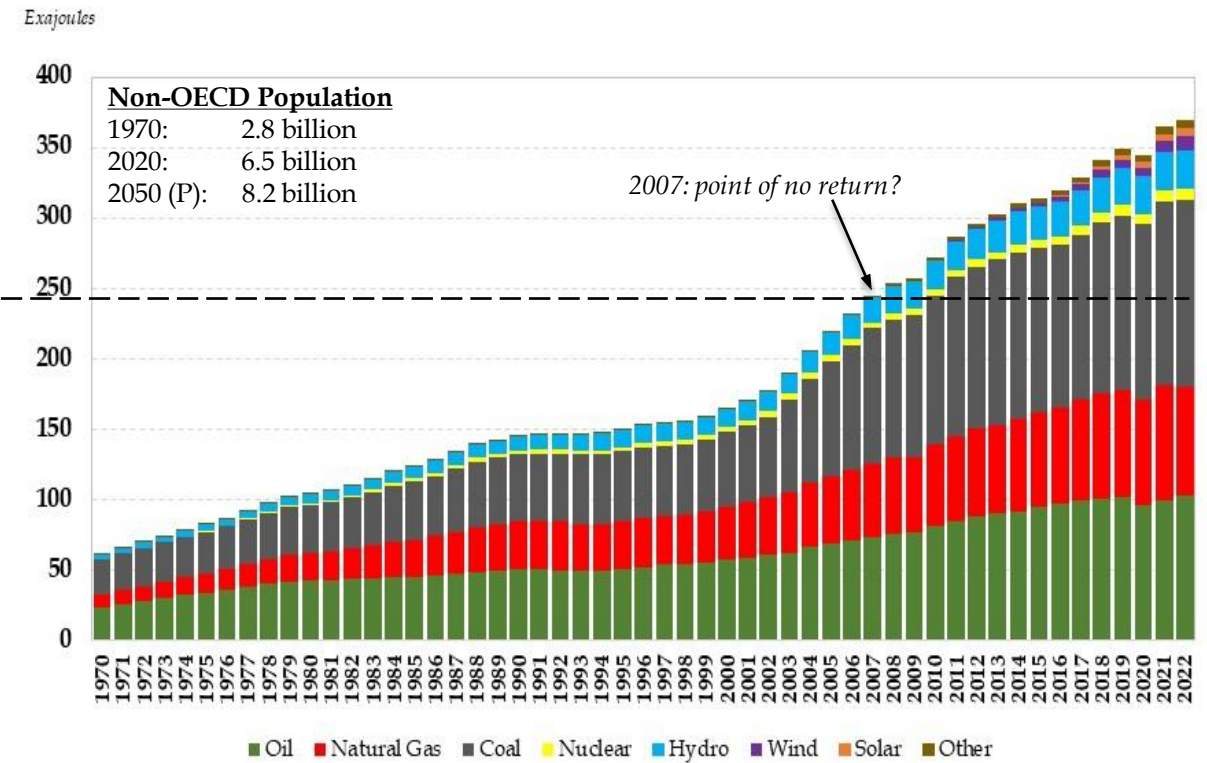
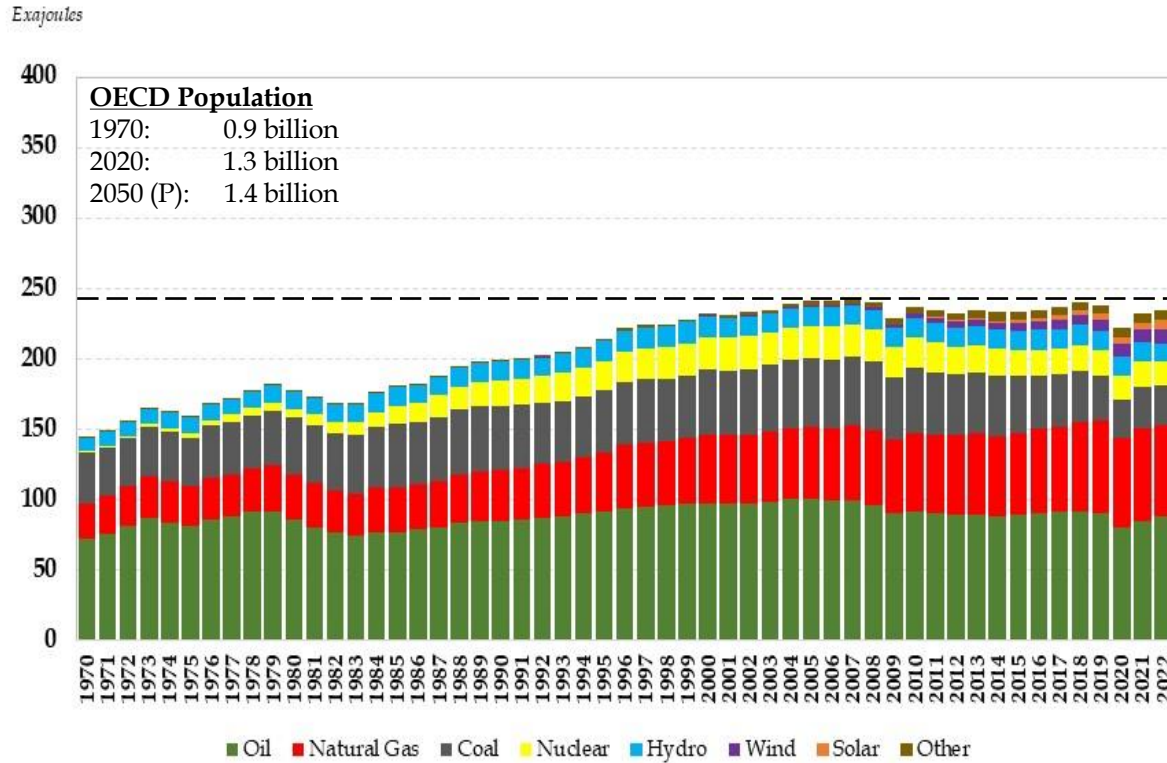
**Kenneth B Medlock III, PhD**

**James A Baker III and Susan G Baker Fellow in Energy and Resource Economics, and Senior Director  
Center for Energy Studies, Baker Institute for Public Policy, Rice University**

**November 7, 2023**

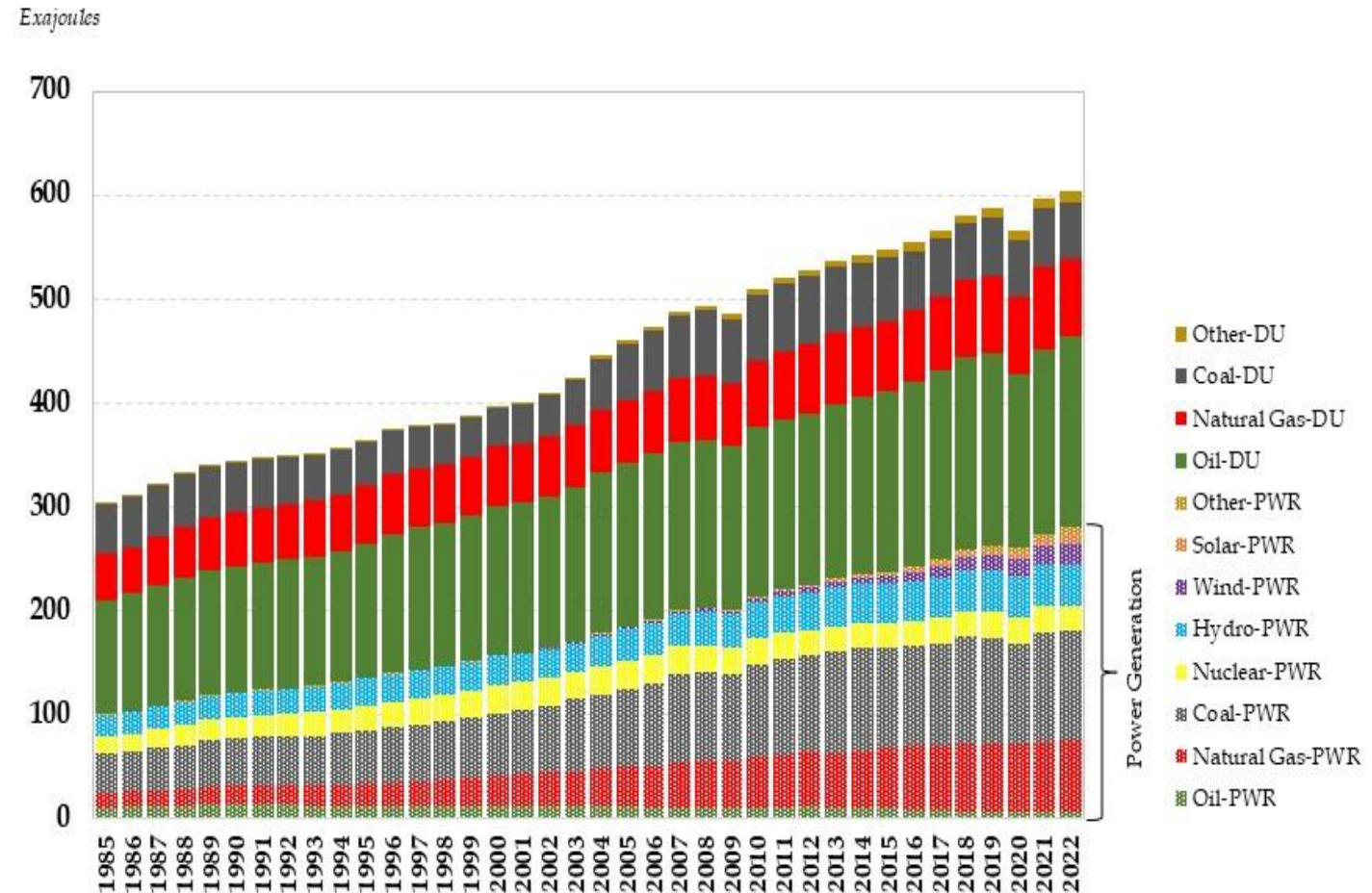
# The evolving energy landscape is a developing nation story

- Energy demand is rising fastest in the developing world, largely driven by hydrocarbon fuels.
  - EU is 9.6% of global demand; N. America is 19.6% of global demand; developing Asia is 39.0% of global demand.
- Projections for population and economic growth indicate this trend will likely continue.



# The global energy landscape and the reality of “scale”

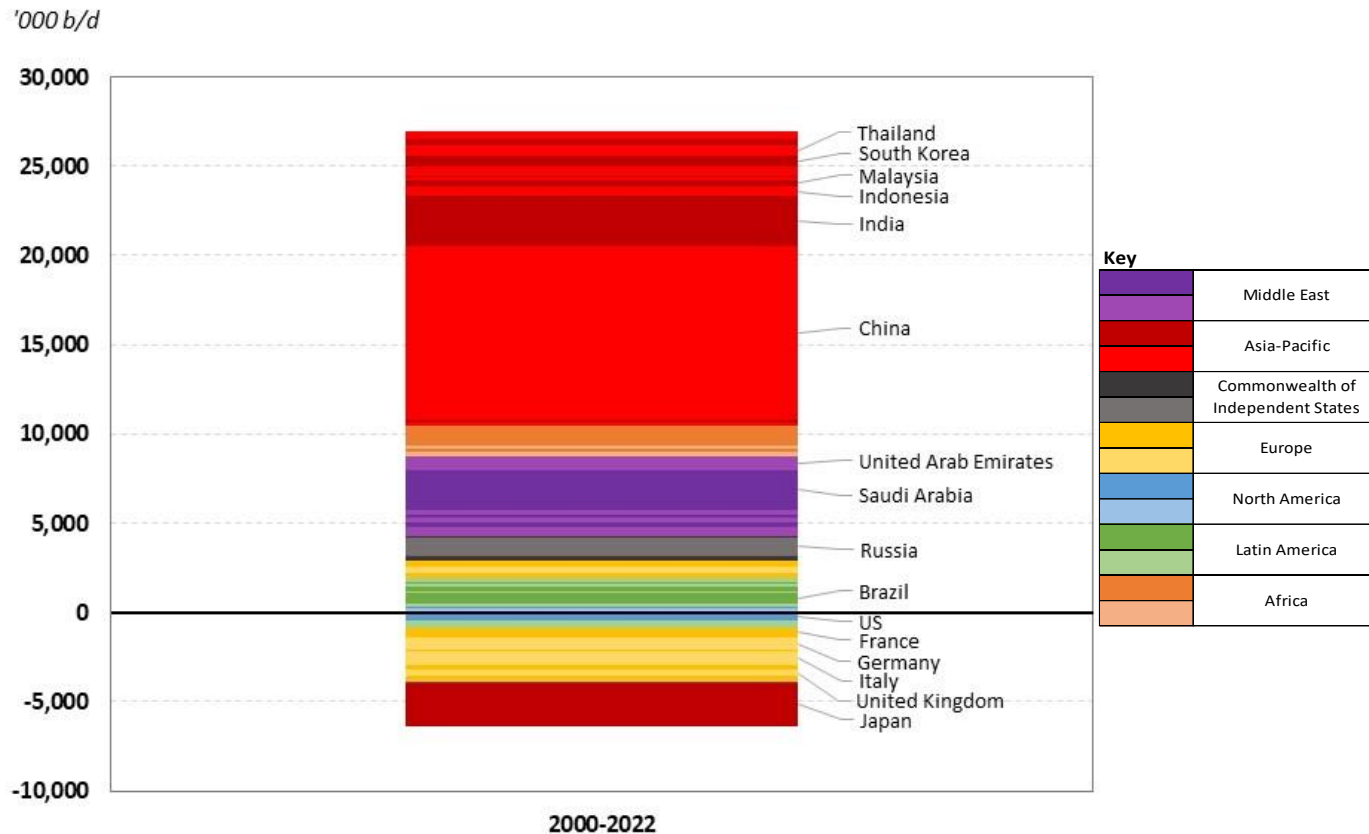
- Even with double-digit year-on-year percentage increases for wind and solar over the last 20 years, they are still a small proportion of the total energy mix, 3.3% and 2.1%, respectively, in 2022... the “101 of Scale”
- Electricity is about 46% of total energy. Zero-carbon generation sources account for 35% of electricity (nuclear 8.5%, hydro 15%, wind 7%, and solar 4.5%).
- Hydrocarbons account for 65% of power generation, 97% of all non-electric energy, and 82% of all energy.
- Decarbonization requires multiple solutions, including *net* decarbonization of incumbent supply chains.
- Paths will look different everywhere, and will hinge on “resource” endowments – nature, minerals, energy, human capital, etc.
- **The future of oil is complicated by needs for infrastructure, economic growth, and incumbent energy uses.**



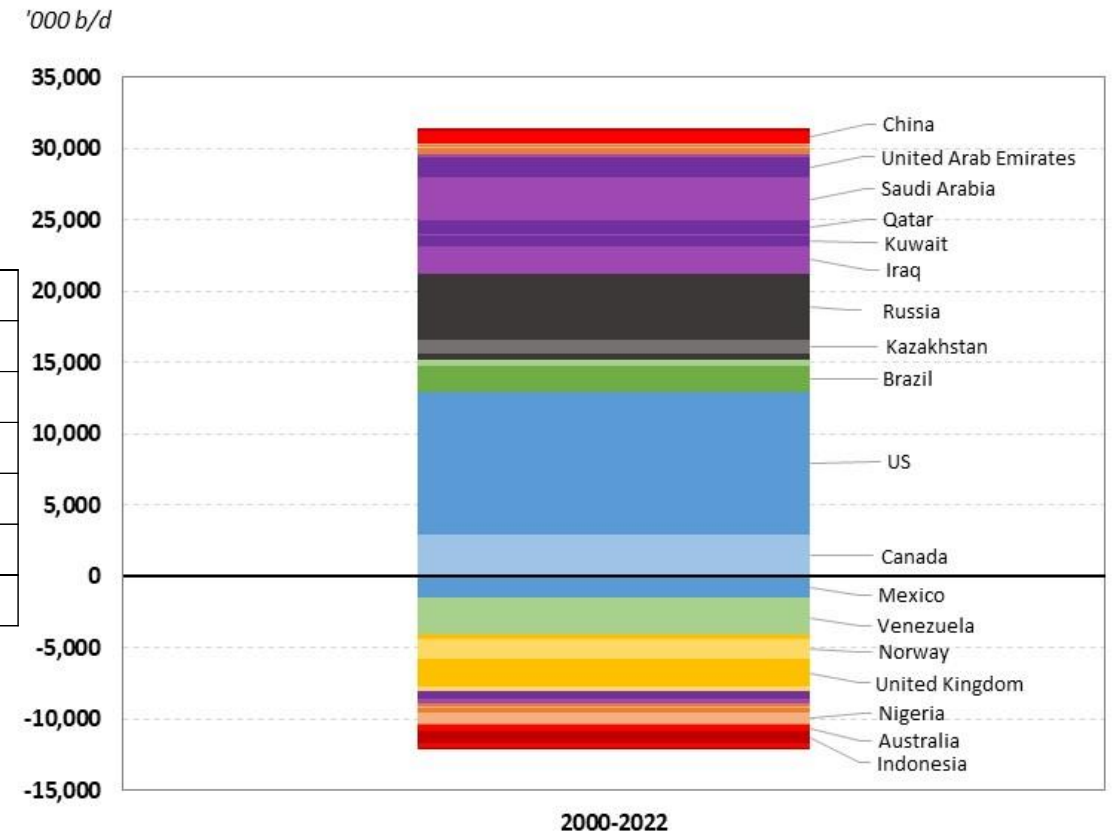
# The global oil market has expanded...

- Demand has grown in the developing world, but not in the developed world.
- Supply growth has been from “incumbent” producers, and the emergence of the US, Canada and Brazil.
- Net growth since 2000 has been 20 million b/d, and that includes 2020!

**Change in Demand, 2000-2022**



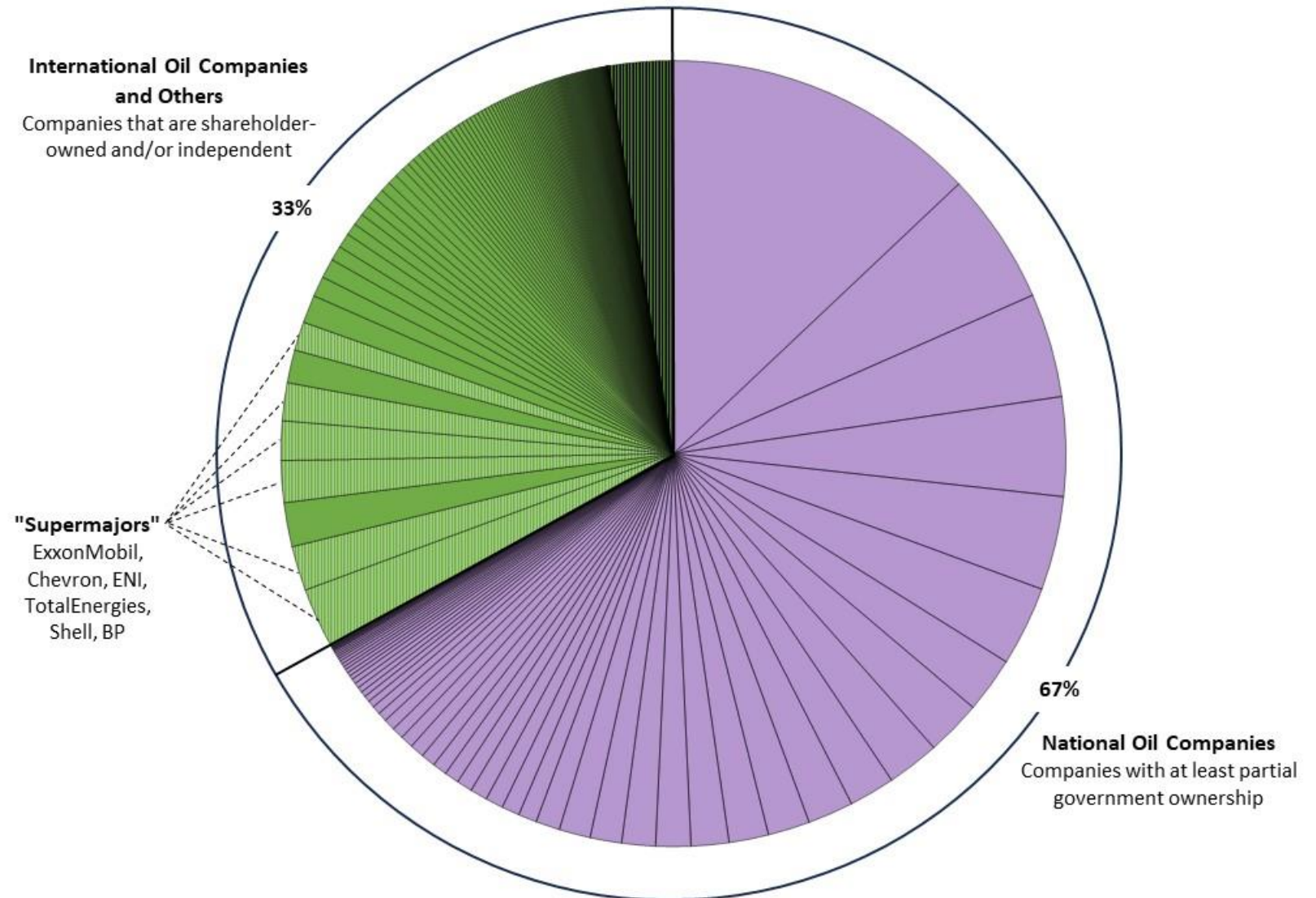
**Change in Supply, 2000-2022**



## ... and production is highly diverse...

- The oil market is highly diverse, but NOCs deliver the majority of production.
- Shareholder-owned and independent companies account for roughly 33% of global output in 2022.
- “Supermajors” accounted for roughly 10% of global output in 2022, less than the output of the world’s largest NOC: Aramco.
- Why raise this? Because market structure matters. It has implications for price, capital allocation, geopolitics, energy security, and energy transitions.

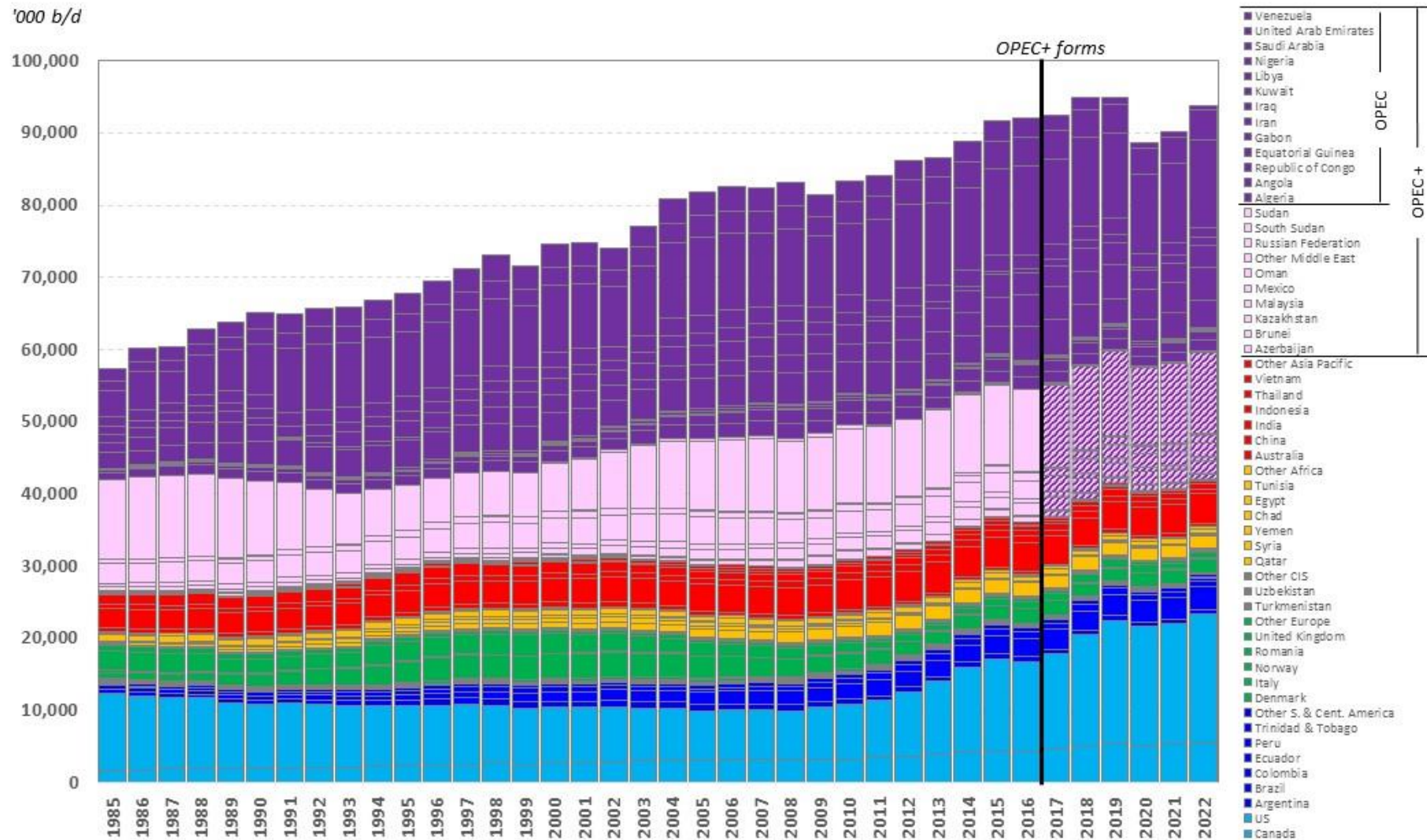
Global Oil Production by Company, 2022



Data Source: Company annual reports, compiled by author

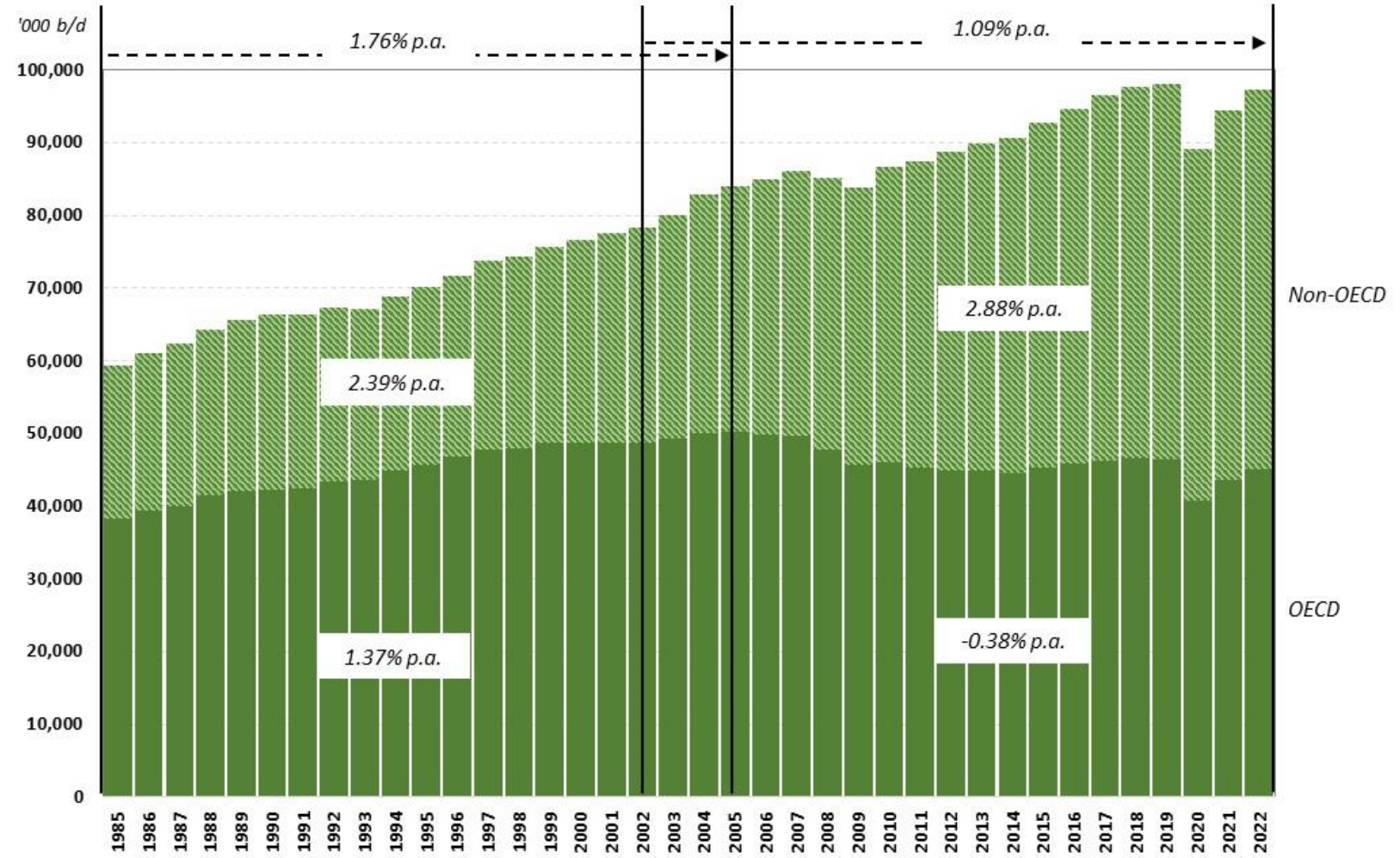
# ... but is highly coordinated.

- OPEC+ was a paradigm shift, pushing explicit coordination from 37% to 56% of global production .

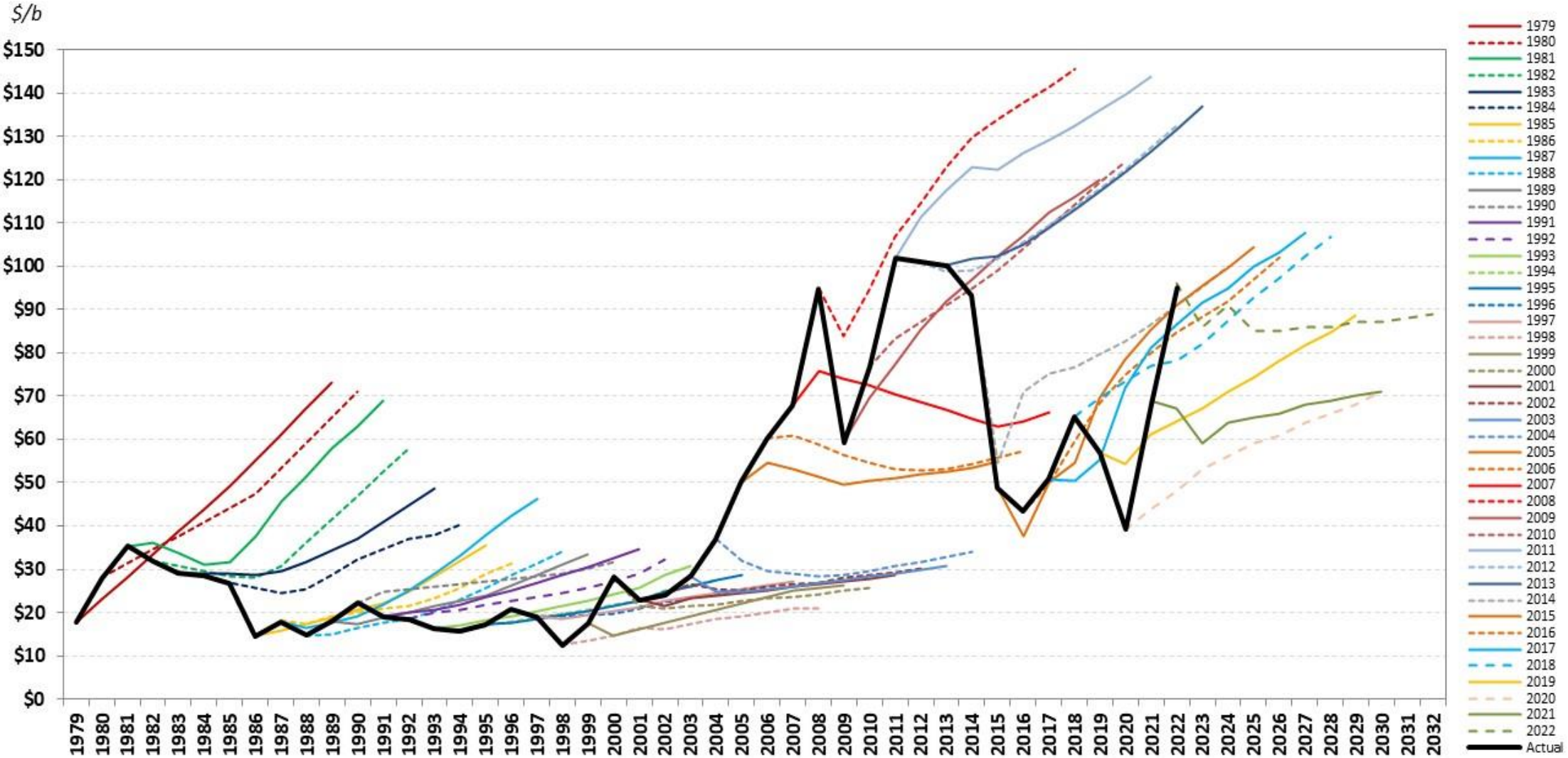


# Oil demand is growing, and growth is different regionally

- OECD demand has declined over the past 20 years, which is a shift from the last 2 decades of the 20<sup>th</sup> century.
- Non-OECD demand growth has accelerated.
- The future of global oil demand is a developing nation story, but not all developing nations are equal.
- Is a “peak” in demand imminent?
  - EVs, efficiency improvement, slower economic growth, aging populations



# Forecasting is an inexact science, and consensus is a dangerous place to be.



Data Source: EIA Annual Energy Outlook, [www.eia.gov](http://www.eia.gov)



# Energy transitions are complex...



Transitions will look different everywhere



Sustainability is multifaceted



Economics matter



Supply chains matter



Infrastructure is central to any energy future



Energy transitions require material transitions

**Innovation and growth will shape the future of energy**

*center for*  
**ENERGY**  
**STUDIES**

Rice University's Baker Institute