

Understanding the Cost, Risk, and Scale Challenge of the Net Zero Transition

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About Energy Policy Research Foundation



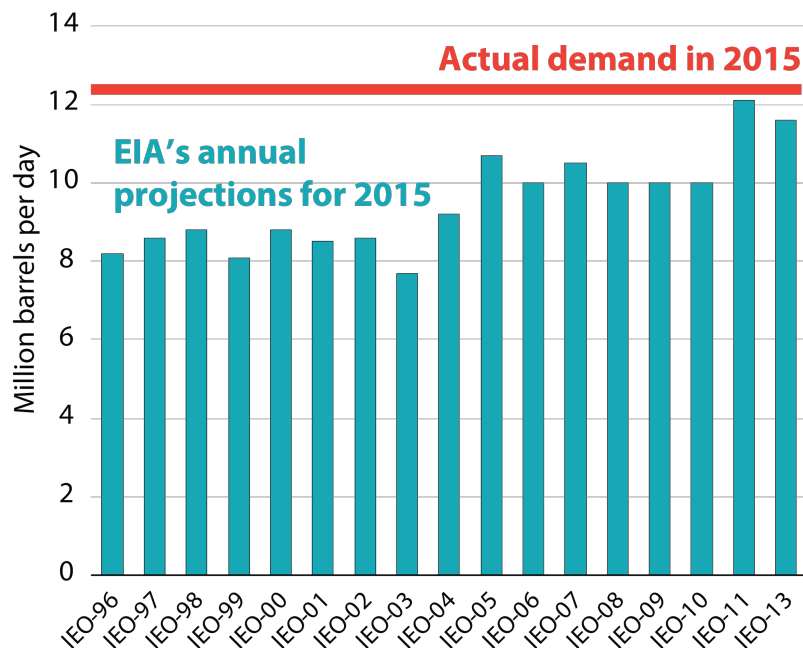
- Est. 1944 (PIRINC)
- Washington, D.C.
- Partnerships with domestic and international think tanks
- Analysis of transition pathways, electrification, transportation issues
- Gaskins Center for Energy Security Studies (2023)
- www.eprinc.org

Content

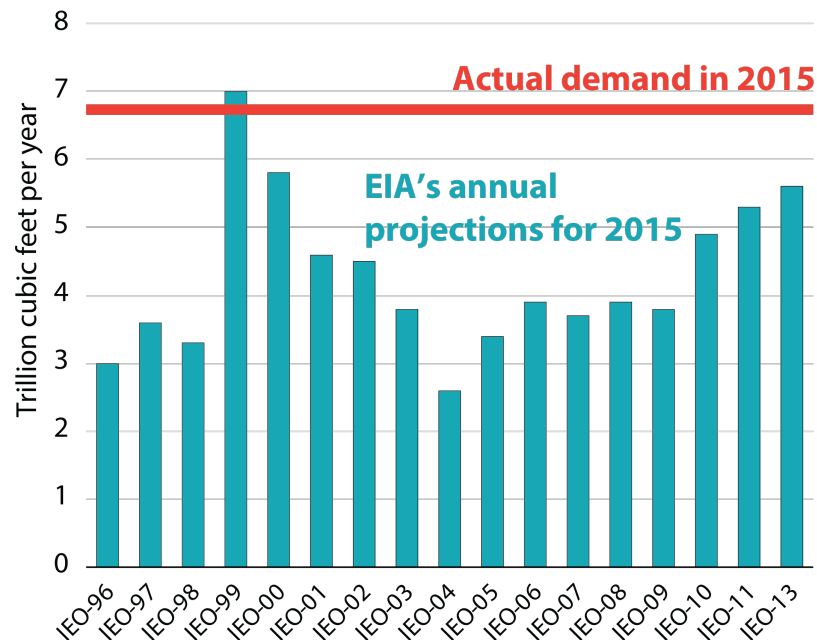
- Scenario analysis
- IEA's Net Zero Scenario
- Cessation of investment in new oil and gas fields
- Cost, risk, and scale challenges to the net zero transition
- Most likely outcome: varied-speed transition

Predicting the Future

China's Liquids Demand in 2015: Projected vs. Actual

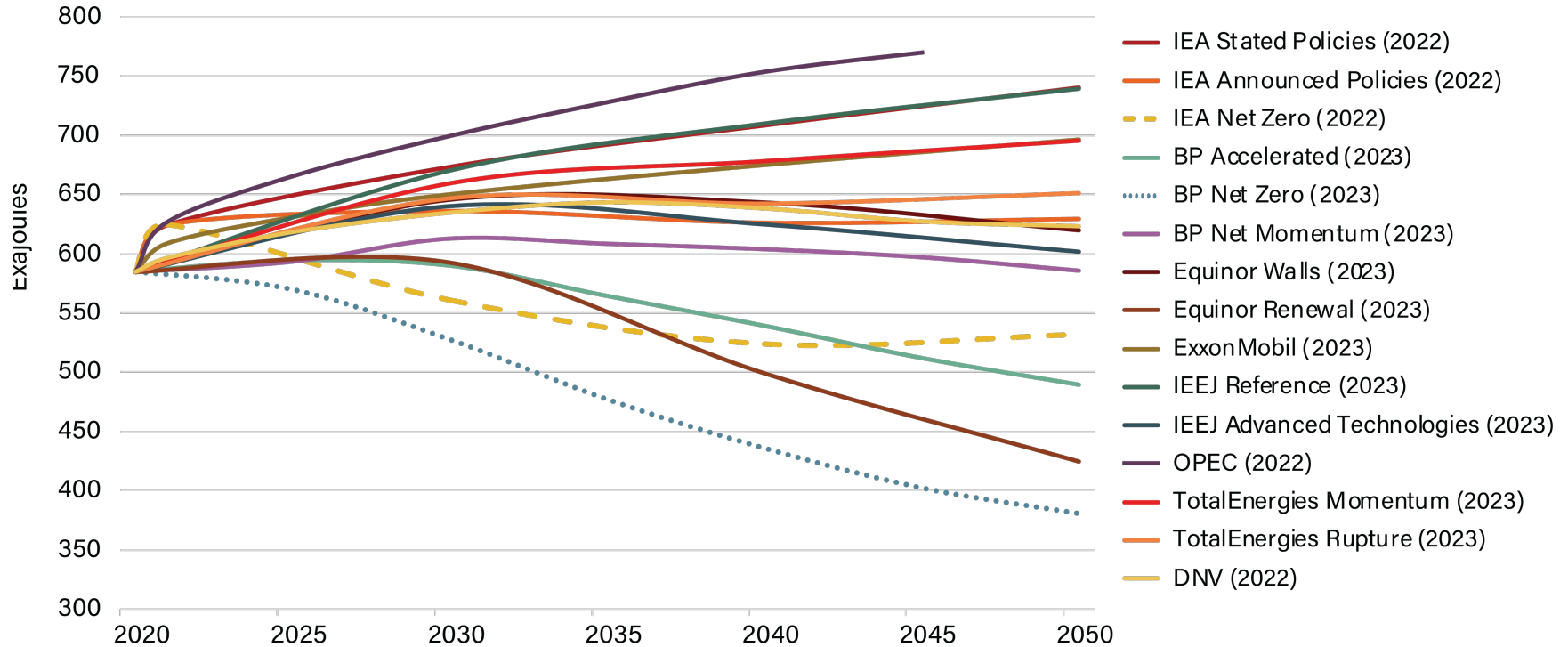


China's Gas Demand in 2015: Projected vs. Actual



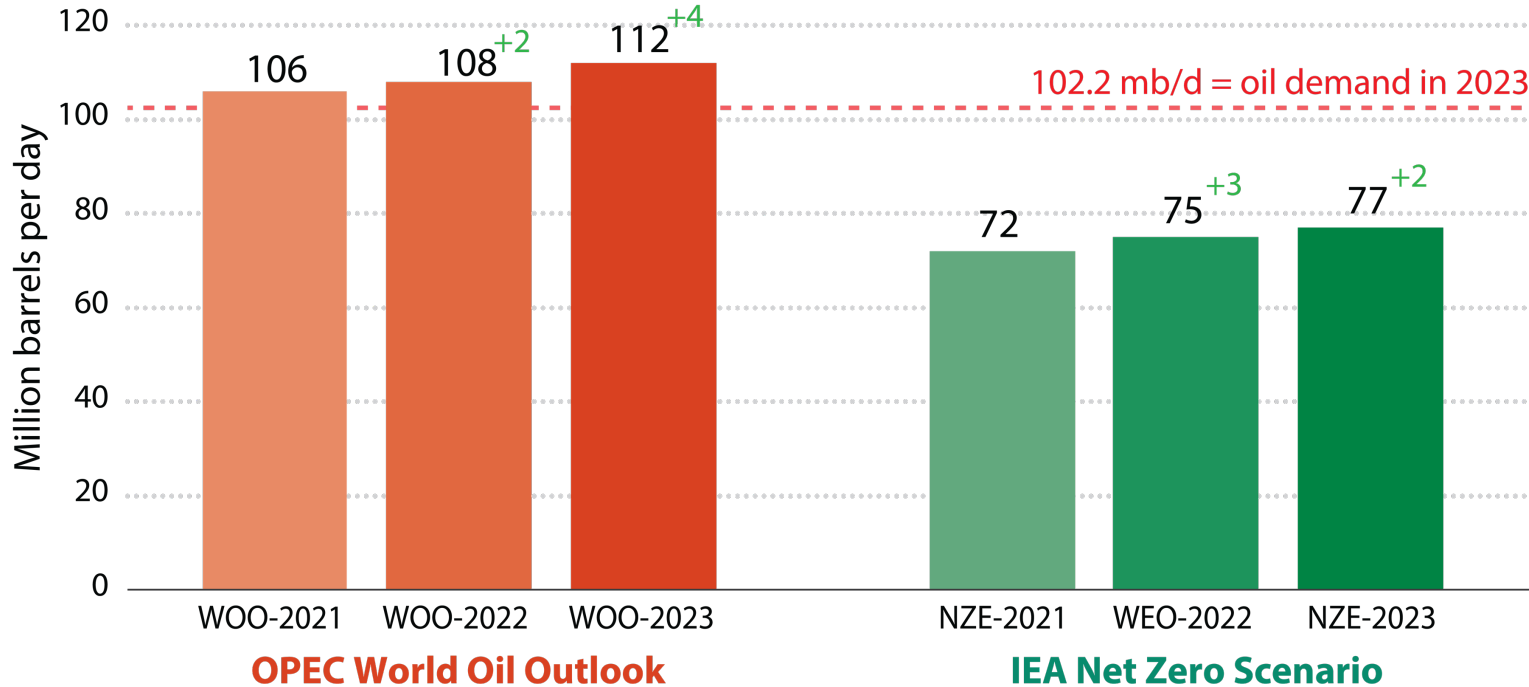
Source: U.S. EIA's International Energy Outlooks (IEO) 1996-2013, 2016, EPRINC.

Long-term Global Energy Outlooks (Adjusted to Physical Content)



World Oil Demand in 2030

Two Opposite Scenarios  , Similar Upward Adjustments 



WOO = World Oil Outlook, NZE = Net Zero Roadmap, WEO = World Energy Outlook

Source: Energy Policy Research based on WOO 2021-2023, IEA NZ Roadmap 2021, NZ Update 2023, WEO-2022.

IEA Net Zero Scenario (NZE)

- “Reaching net-zero emissions globally by 2050 is a **critical and formidable goal.**”

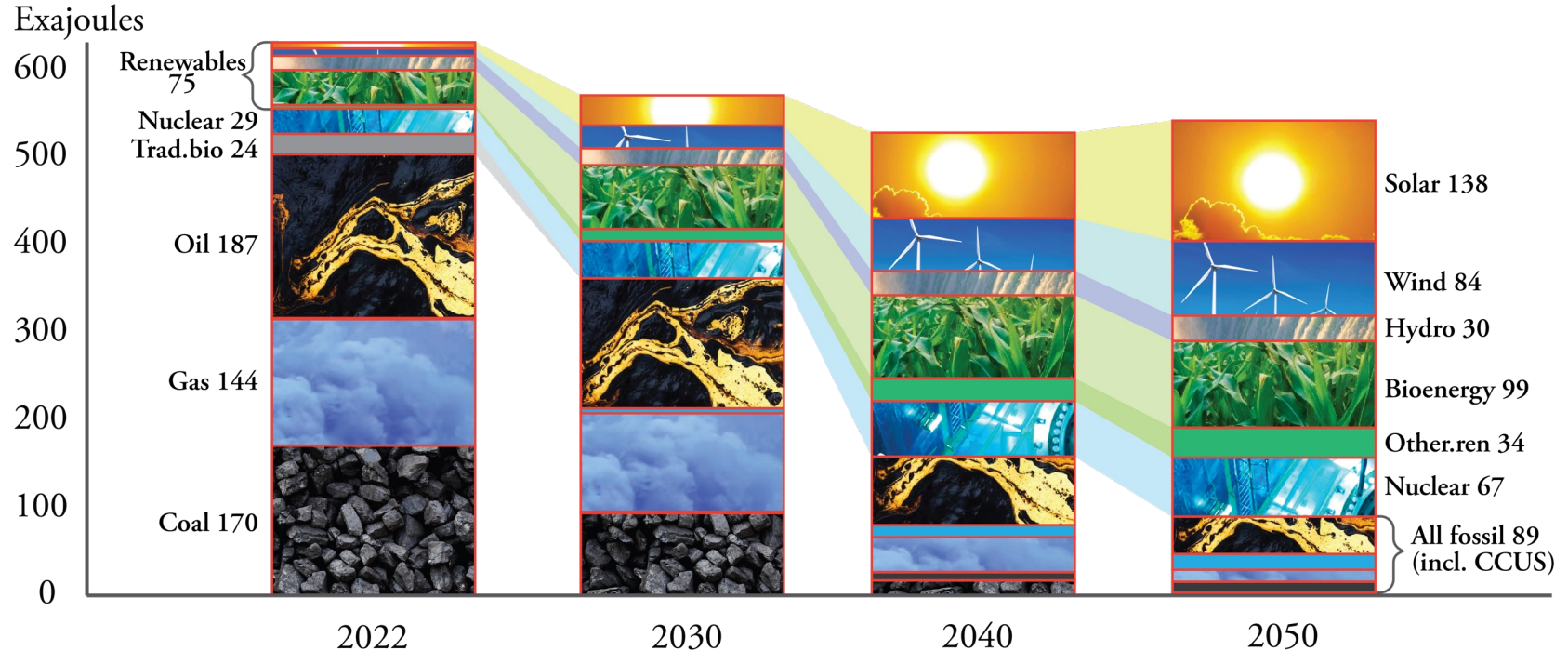
- IEA, Net Zero by 2050 Report: Summary for Policy Makers

- “No fossil fuel exploration is required in the [Net Zero Scenario] as **no new oil and natural gas fields are required beyond those that have already been approved for development.**”

- IEA, Net Zero by 2050, p. 160

Fossil's Share from 80% today to 16% in 2050

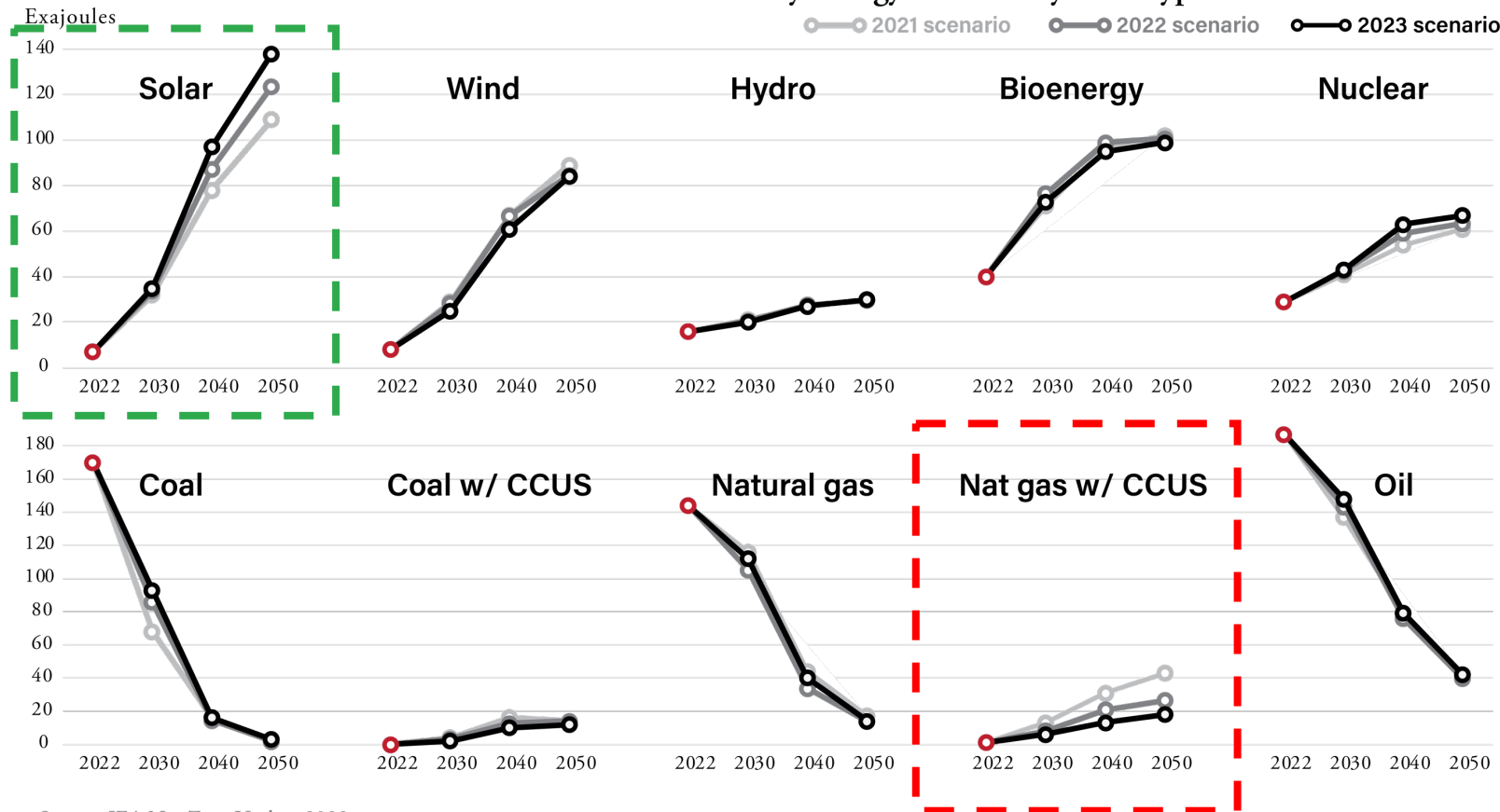
Global Primary Energy Supply under IEA Net Zero Scenario (2023)



Source: IEA Net Zero Update 2023

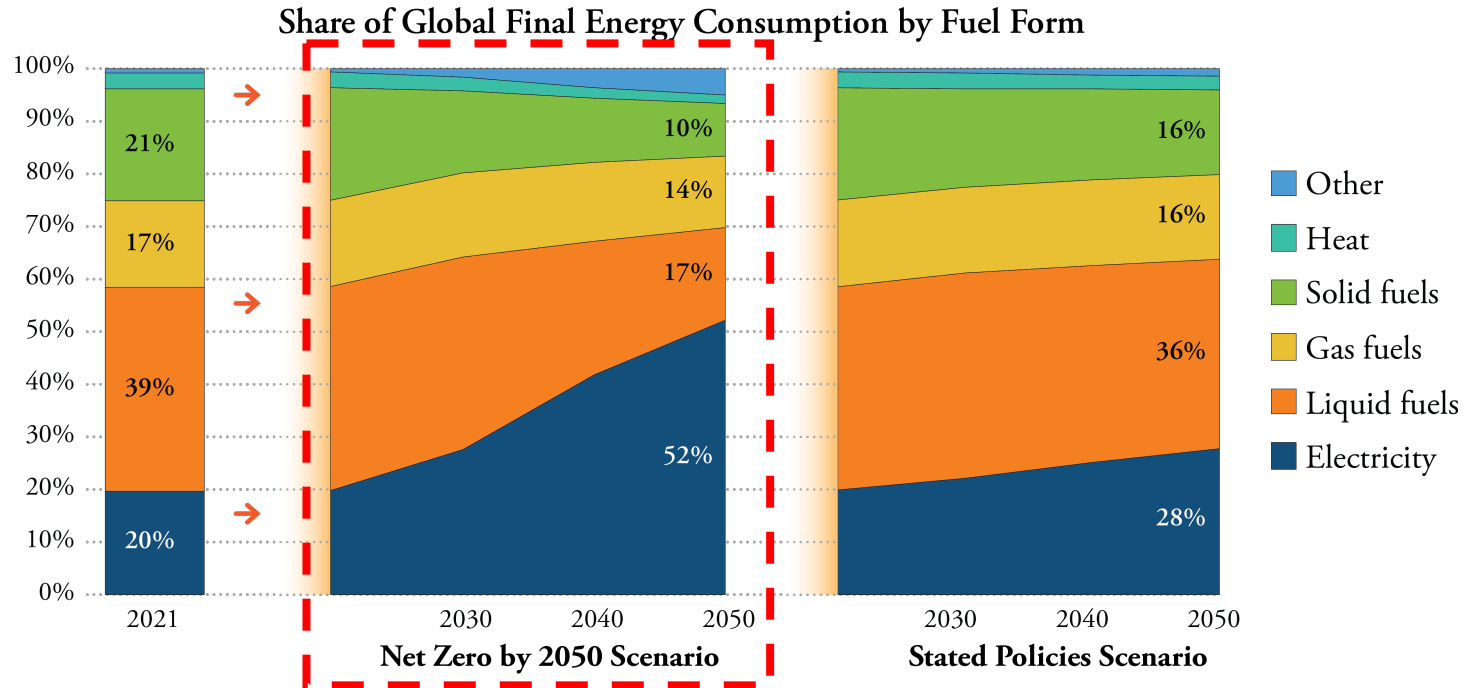
Updated Scenario: Solar Up, CCUS Down

IEA Net Zero 2023: Global Primary Energy Demand by Fuel Type



Source: IEA Net Zero Update 2023

Electricity Share in Global Final Energy Consumption Rises From 20% in 2021 to 50+% in 2050



Source: Energy Policy Research, IEA World Energy Outlook 2022

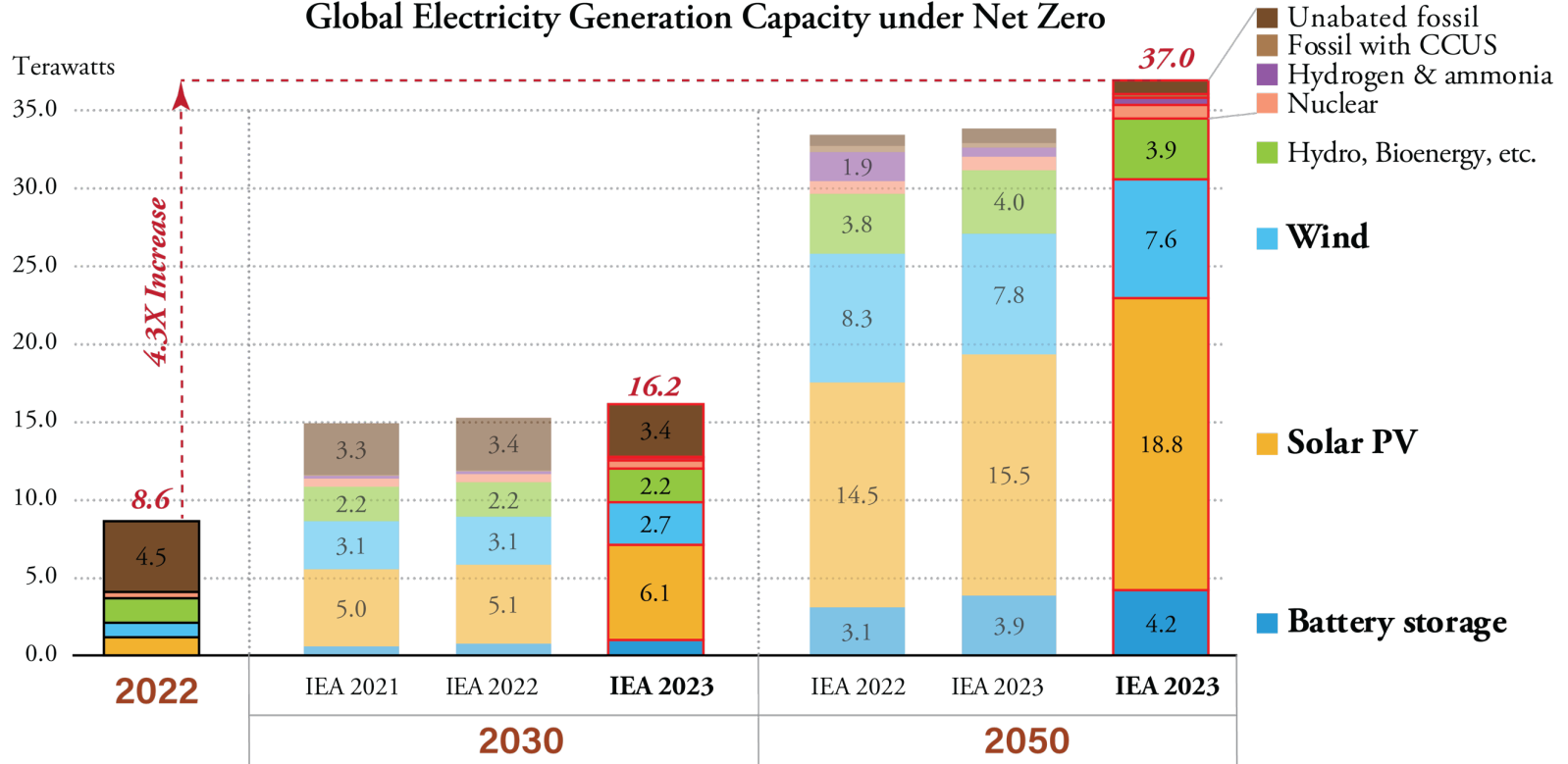
Power Gen Capacity (GW), 2021

Reaching Net Zero in Electricity Generation:

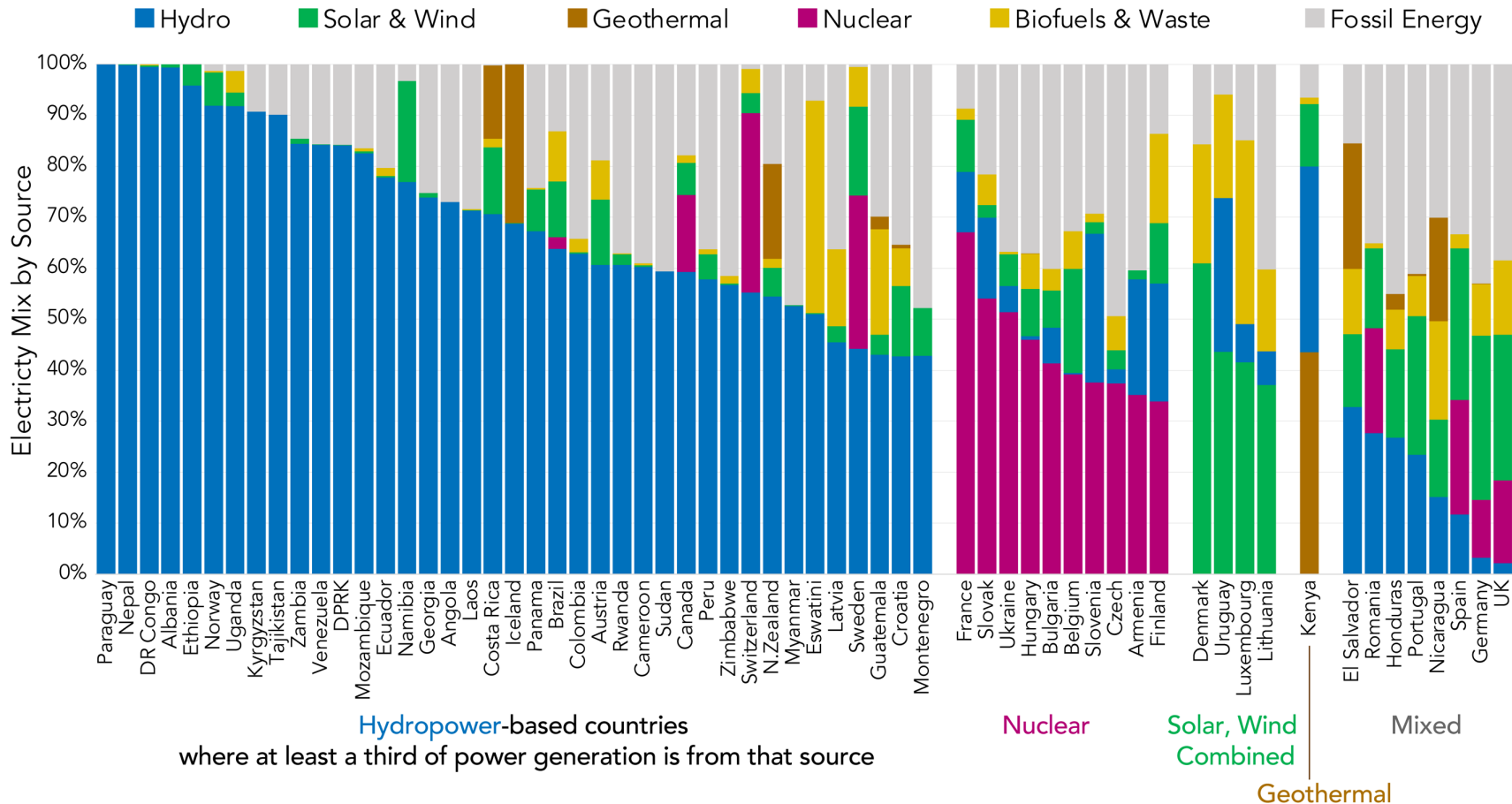
- Advanced economies by 2035
- China by 2040
- Developing countries by 2045

By 2050, Solar Capacity Alone Reaches 2.2x Current World Total Generation Capacity

Global Electricity Generation Capacity under Net Zero



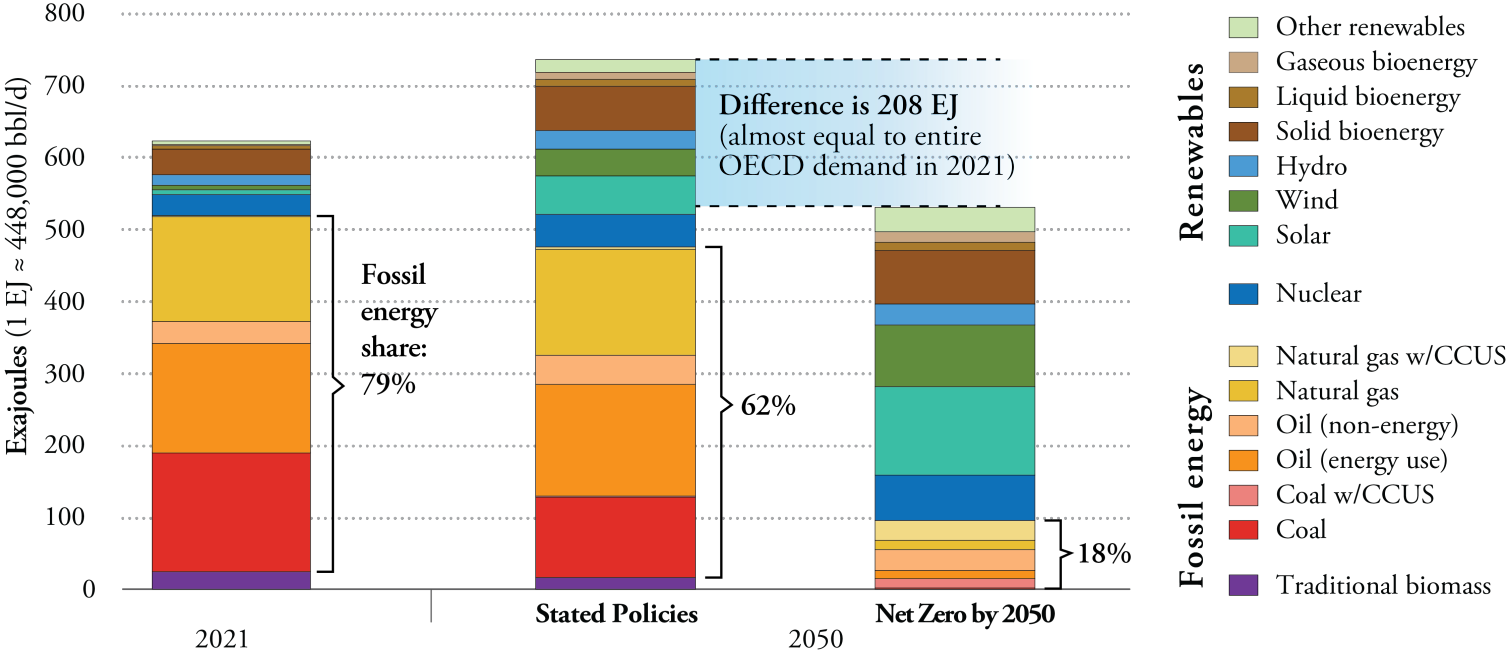
62 Countries Where Over Half of Electricity Comes from Non-Fossil Energy Sources (2020)



Source: EPRINC analysis based on IEA data

Primary Energy Supply Equal to OECD Demand Must be Removed by 2050

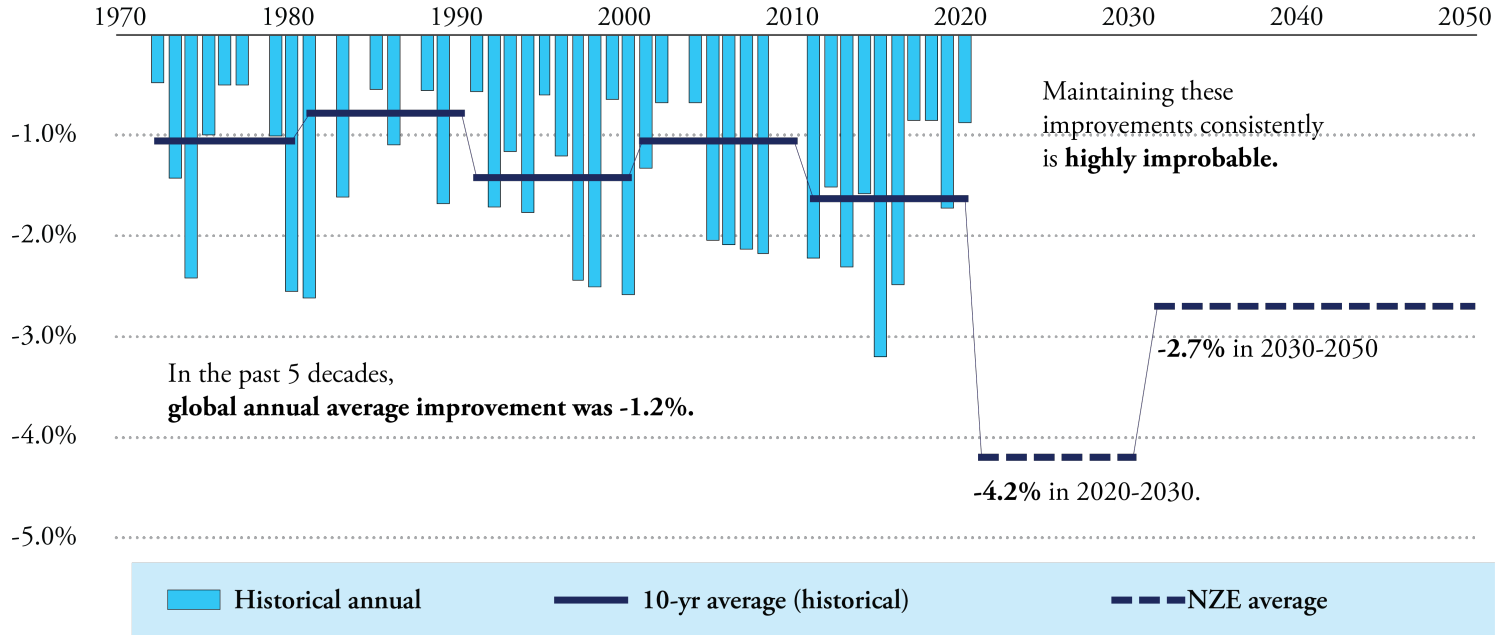
Primary Energy Supply: Stated Policies vs. Net Zero by 2050



Source: Energy Policy Research, IEA World Energy Outlook 2022

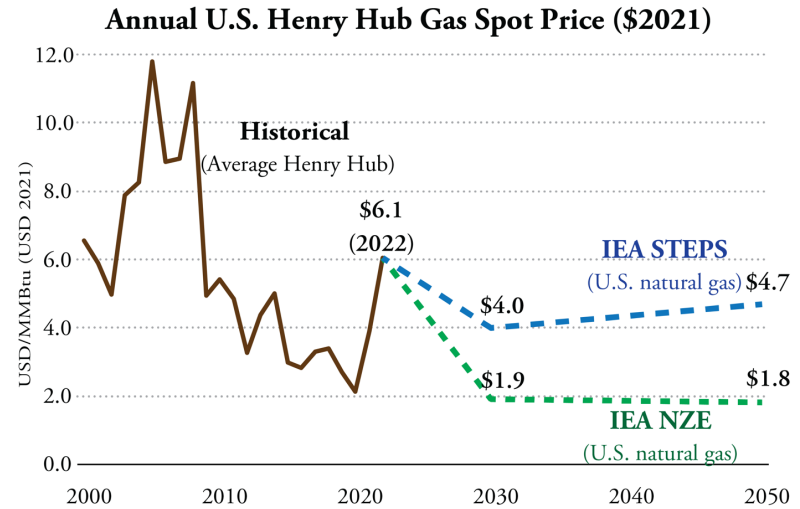
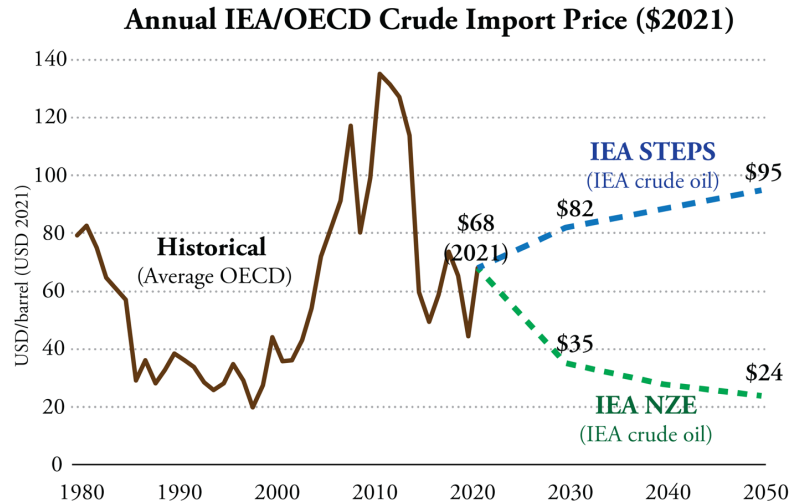
Historical Rate of Annual Energy-Intensity Improvements Must Triple During Next Decade

Global Energy Intensity Improvements: Historical vs. IEA's Net Zero Scenario



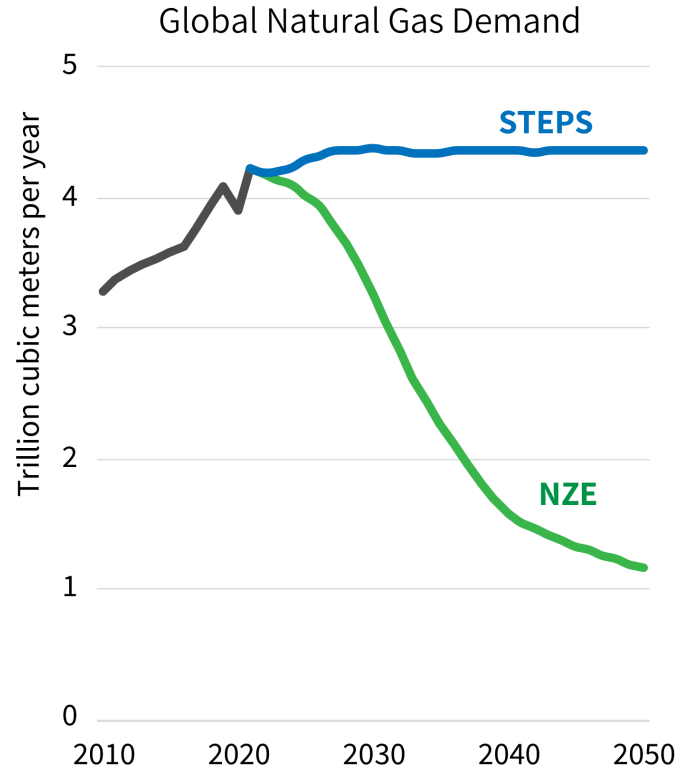
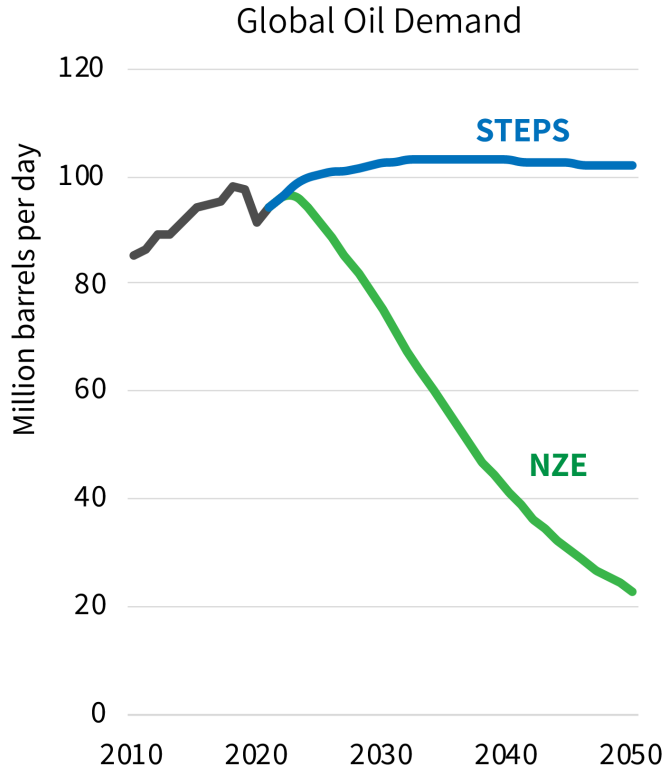
Source: Energy Policy Research, IEA World Energy Balances database
 Note: Primary energy / GDP (2019 USD PPP) is used for the calculation.

Oil and Gas Prices According to IEA



“If supply were to transition faster than demand, with a drop in fossil fuel investment preceding a surge in clean energy technologies, this would lead to much higher prices—possibly for a prolonged period—even if the world moves towards net zero emissions.” (IEA, WEO–2022, p. 134)

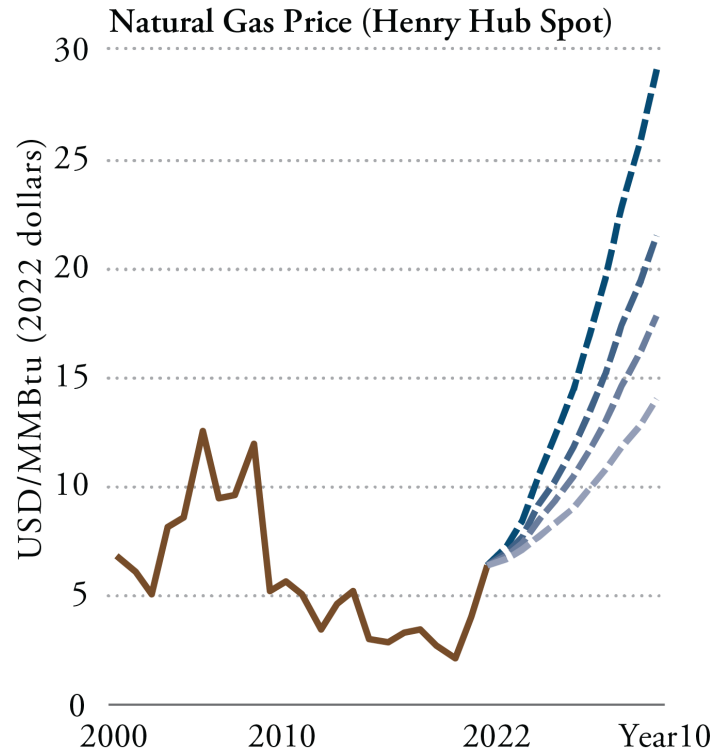
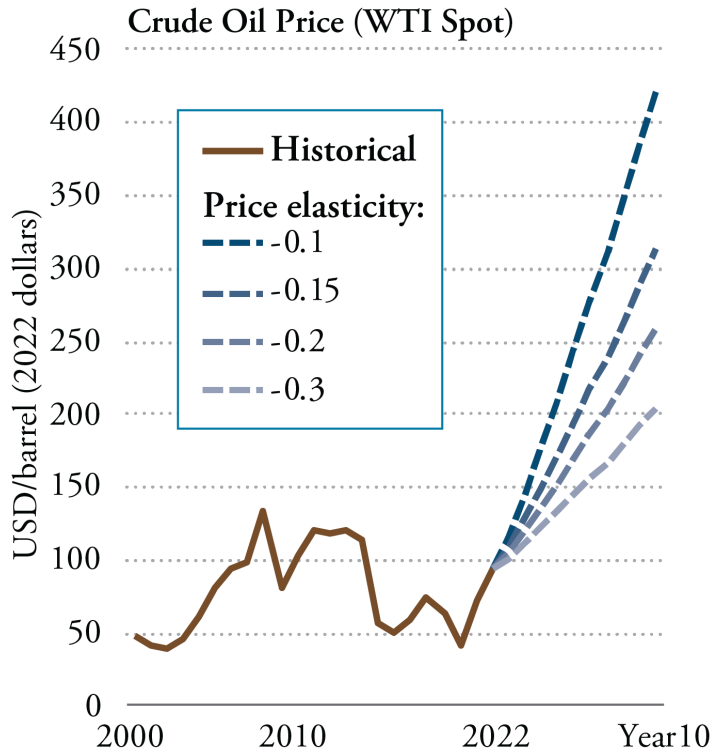
Oil and Gas Demand in IEA World Energy Outlook 2022



Data: IEA WEO-2022 & Outlooks for gas markets and investment (2023)

Likely Oil and Gas Prices under Net Zero

(Based on Historical Price Elasticities of Demand)

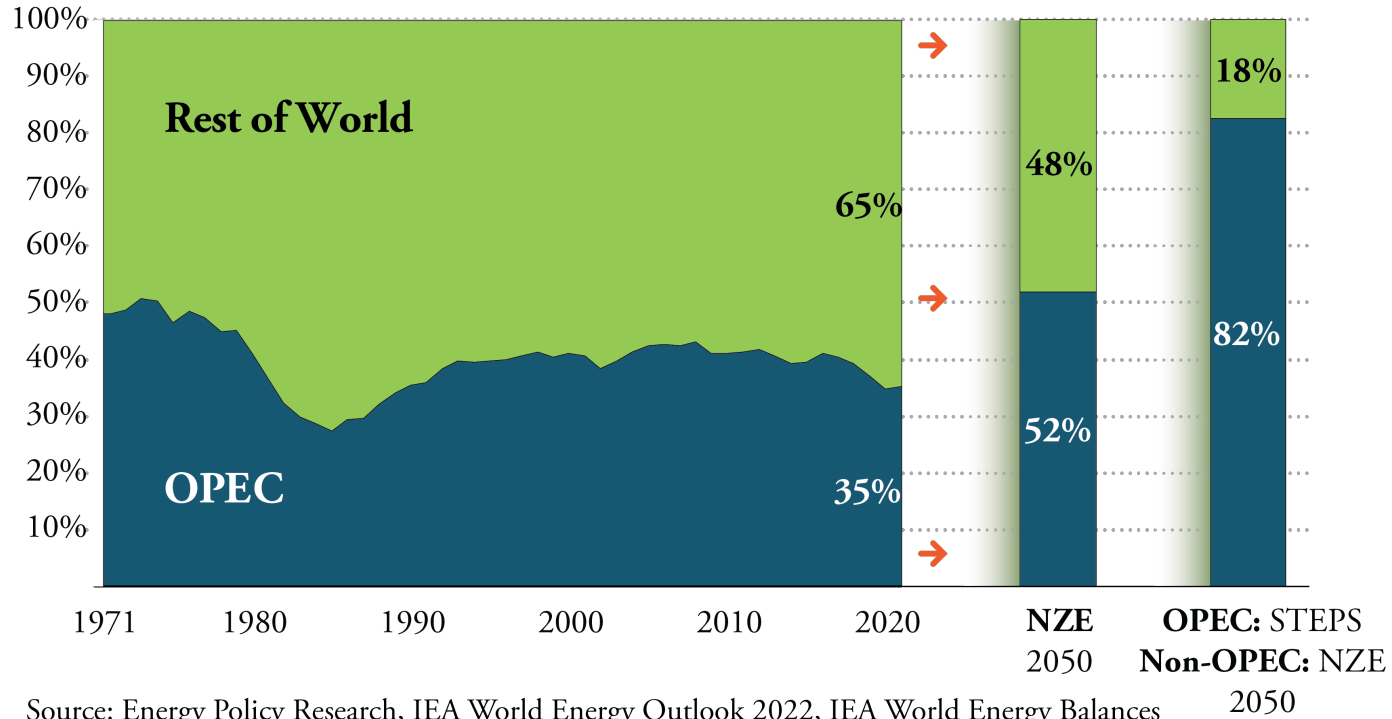


The price elasticity of demand is the ratio of the percentage change in quantity to the percentage change in price. (umn.edu)

Source: Energy Policy Research

Oil Supply Concentration Under Net Zero

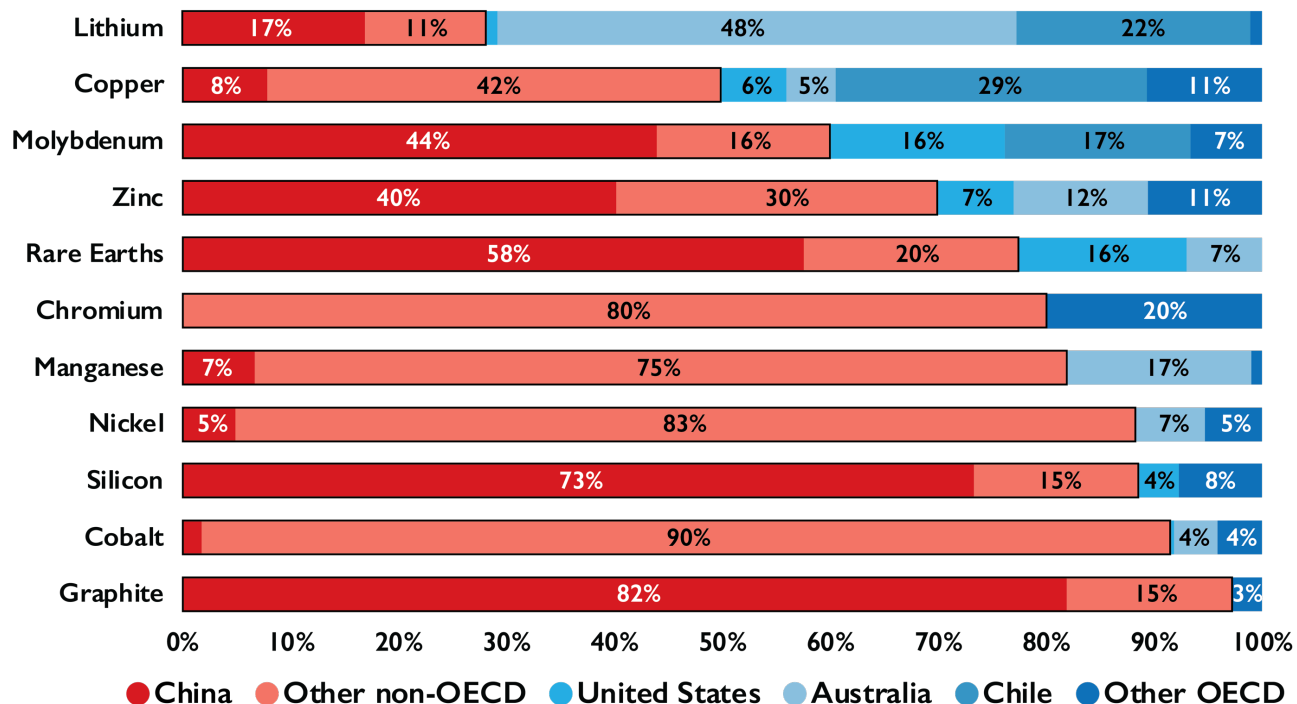
OPEC Share of Global Oil Production



Source: Energy Policy Research, IEA World Energy Outlook 2022, IEA World Energy Balances

Critical Minerals: A National and Economic Security Issue

Current Metals and Critical Minerals Production Non-OECD vs. OECD (latest available data)

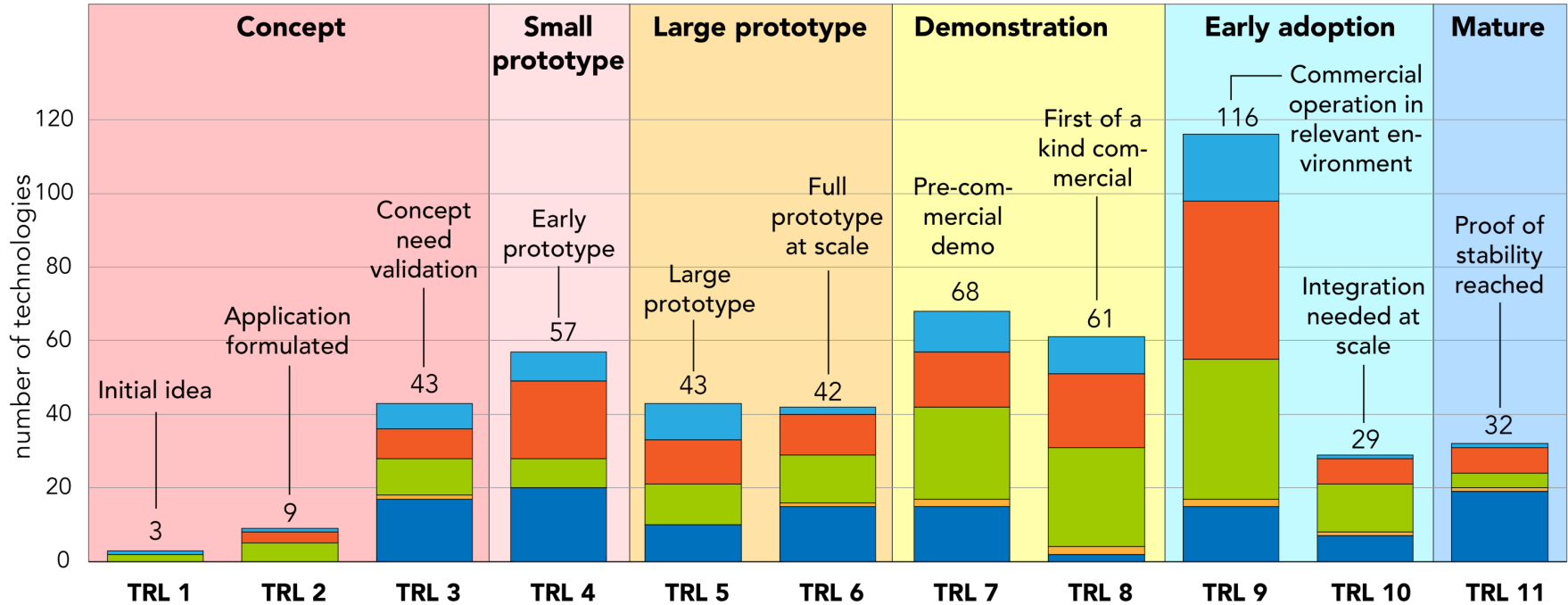


Note: Copper data is from 2018, Cobalt from 2019, Lithium from 2020, all other data from 2021
EPRINC figure based on data from the Global Economy, US Geological Survey, Statistica, and other sources

Technology Requirements are High

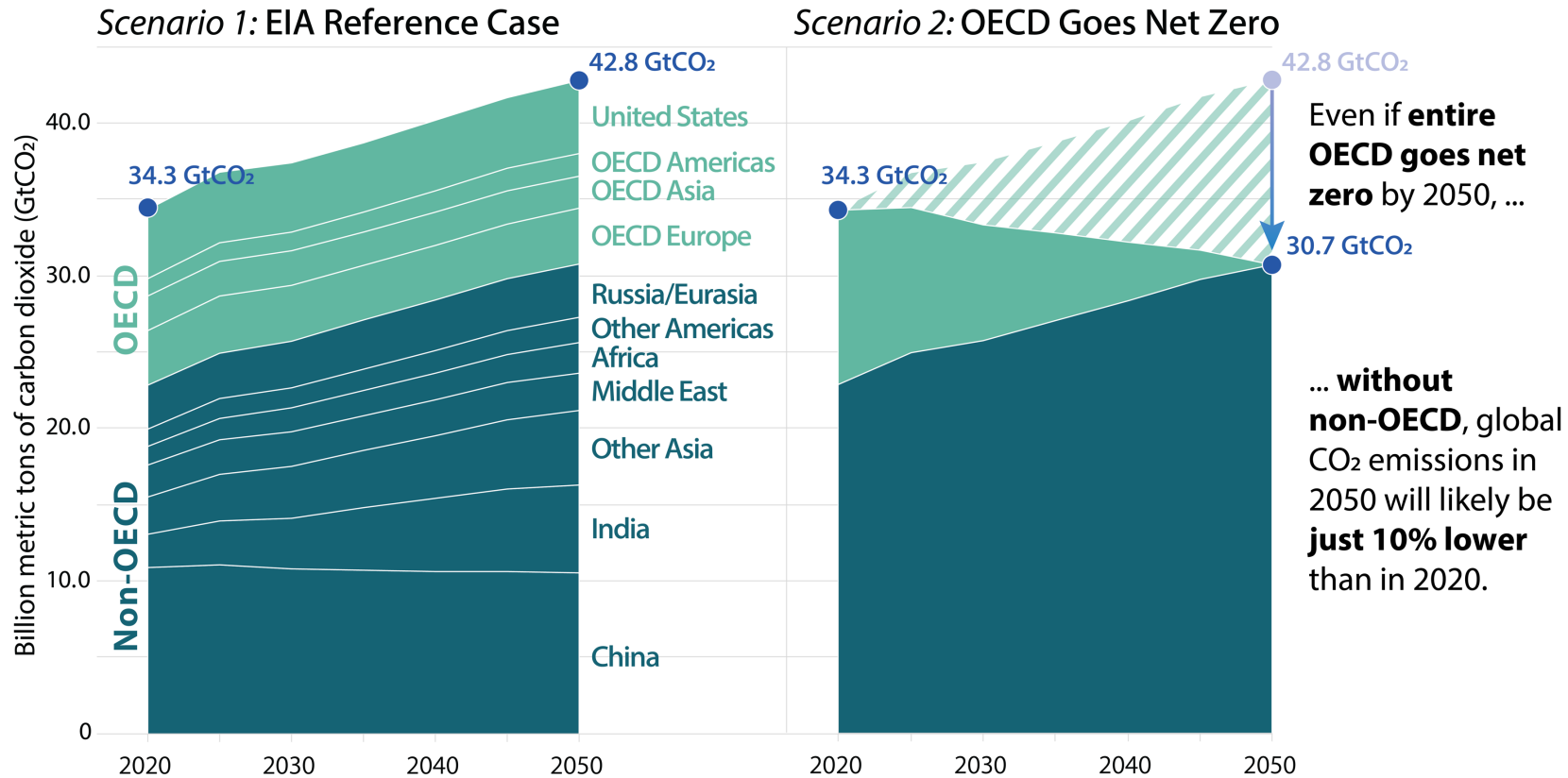
IEA: Technology Readiness Levels of 500 Technologies Important for Net Zero Emissions

■ Buildings
 ■ CO2 management
 ■ Energy transformation
 ■ Industry
 ■ Transport



Source: EPRINC analysis based on IEA ETP

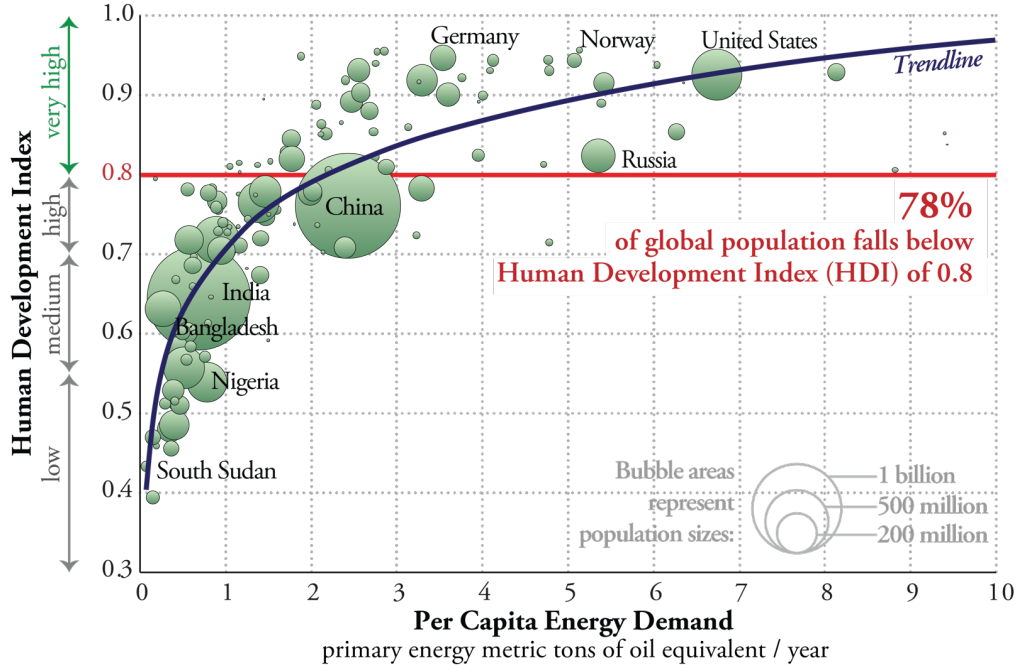
Global CO₂ Emissions: What If Only OECD Goes Net Zero by 2050?



Energy Policy Research analysis based on EIA's International Energy Outlook (Oct 2021)

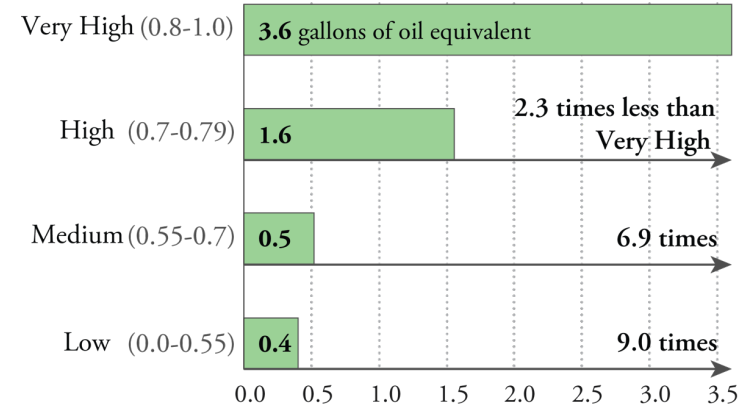
Net Zero: “All countries co-operate towards achieving net zero emissions worldwide.”

Per Capita Energy Demand and Human Development Index (2019)



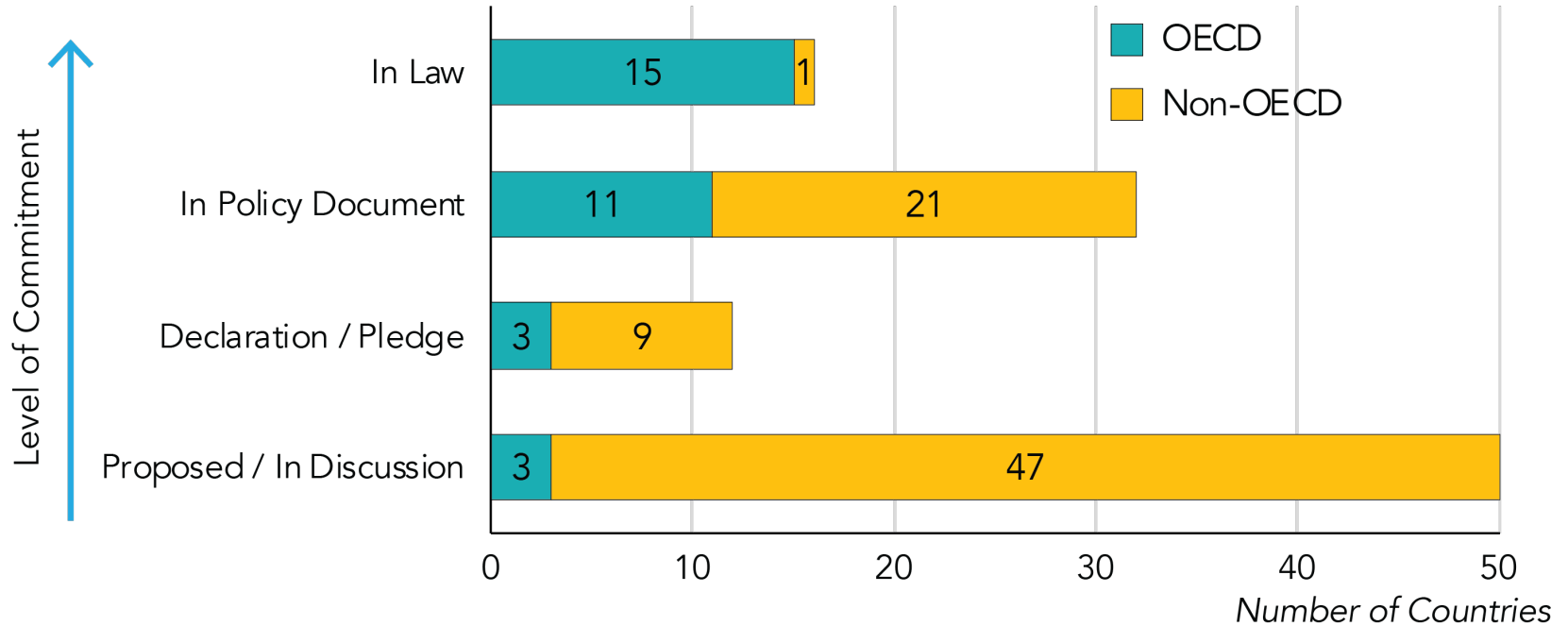
Source: Energy Policy Research, IEA, UN

Daily per Capita Energy Demand by HDI (2019)



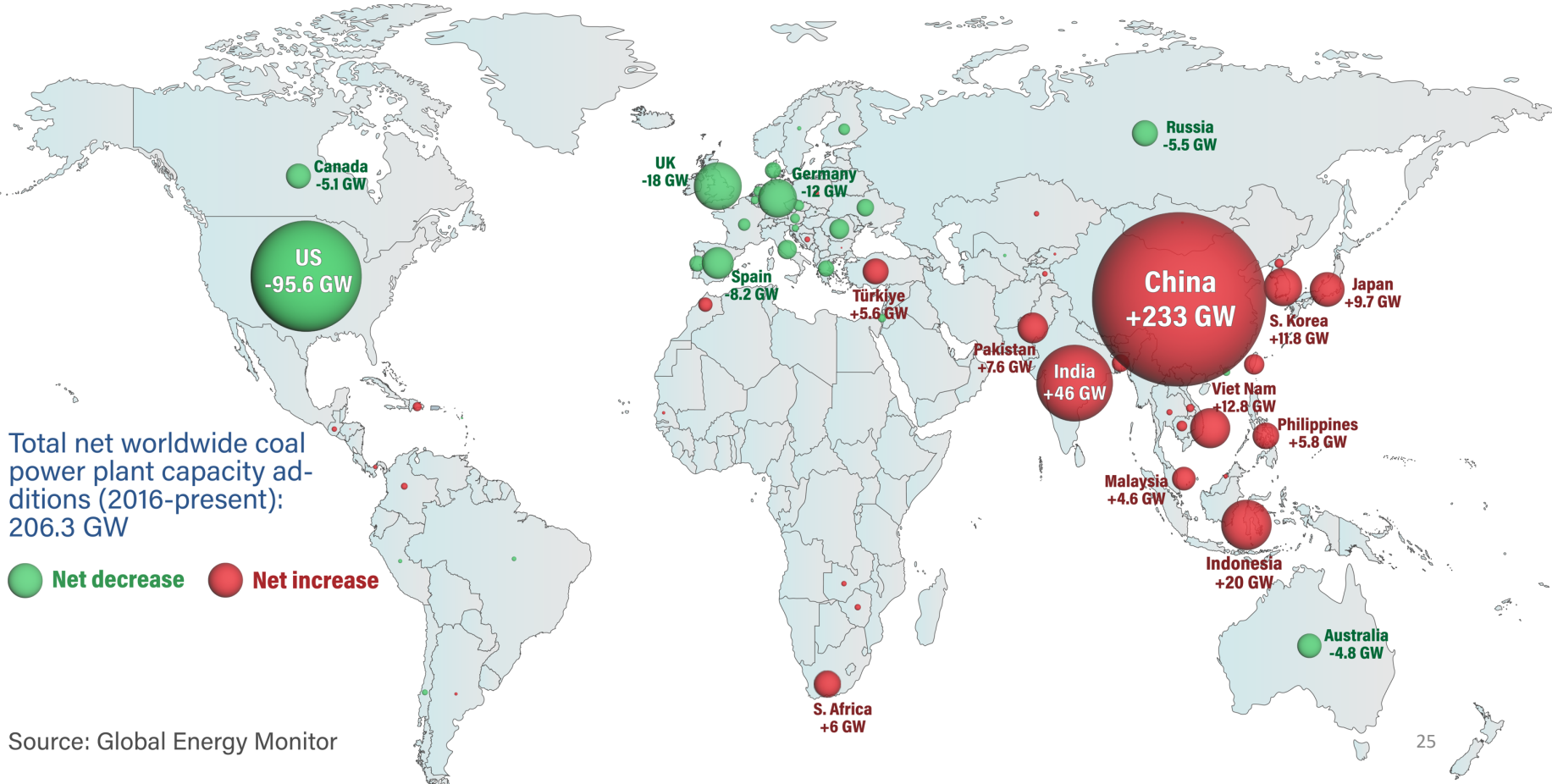
How Serious are the Commitments?

Two-Speed Transition: Net Zero by 2050 Level of Commitment



Sources: EPRINC figure based on data from Net Zero Tracker.

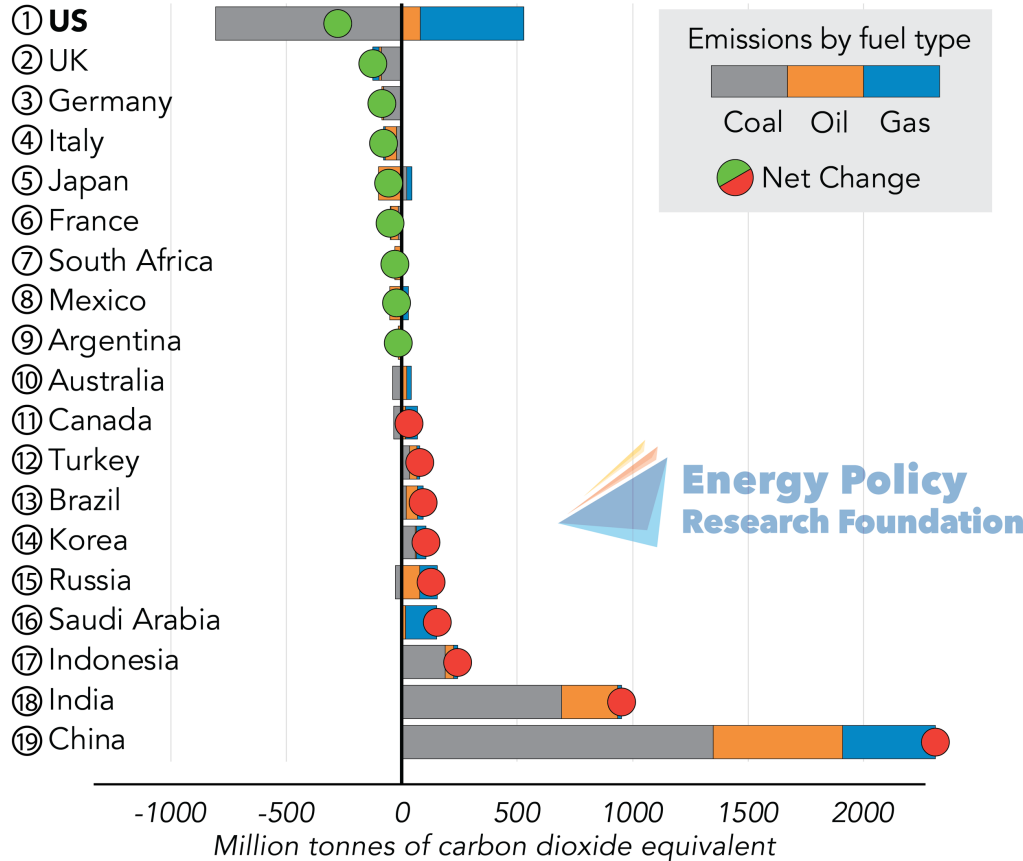
NET ADDITIONAL COAL PLANT CAPACITY SINCE 2015 PARIS AGREEMENT



Source: Global Energy Monitor

Role of Natural Gas in Emission Reduction

2019 vs. 1999: Change in Annual CO₂ Emissions from Energy in G20

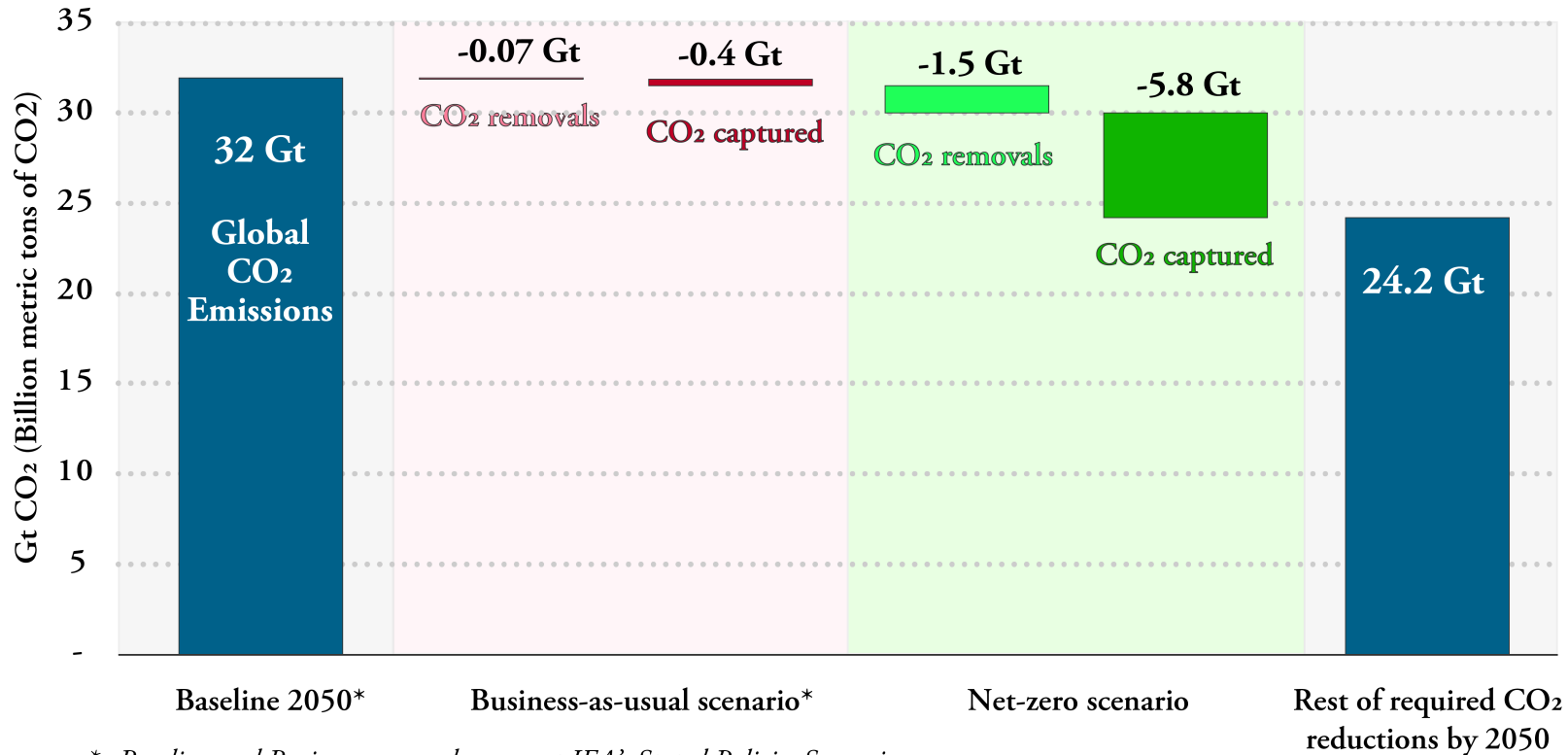


Summary

- There has been major progress in EVs, batteries, and low-carbon technologies in recent years, suggesting massive new opportunities in the transition.
- However, the transition will likely happen at varied speeds in developed and developing parts of the world, so we must adopt a realistic approach that does not inflict irreparable harm on the economy, national security, and the well-being of society.
- Unquestioningly following the net-zero scenario's requirements, especially ceasing investment in new oil and gas fields, will have serious implications for people's livelihoods, energy access, and environmental issues across the globe.
- It is recommended that policymakers and industry take holistic measures, leverage proven and least-cost mitigation efforts like coal-to-gas switching, and invest more resources in adaptation while supporting research, development, and deployment (RD&D) in low-carbon technologies.

Thank you!

Global CO₂ Removals and Captured Under Net Zero Scenario (Gigatons CO₂)



* Baseline and Business-as-usual represent IEA's Stated Policies Scenario
 Source: Energy Policy Research, IEA WEO-2022