

Technologies for Energy Transition

2024 IEEJ/APERC International Energy Symposium

Joseph Majkut, 19 April, 2024

Energy is central to modern life

- Energy use is an important part of daily life and economic growth
- Most energy use emits greenhouse gas emissions
- Greenhouse gases accumulating in the atmosphere cause climate change

$$\text{CO}_2 = P \times \left(\frac{\text{GDP}}{P} \right) \times \left(\frac{E}{\text{GDP}} \right) \times \left(\frac{\text{CO}_2}{E} \right)$$

CO₂: Total CO₂ emissions

P : Global population

GDP : World Gross Domestic Product

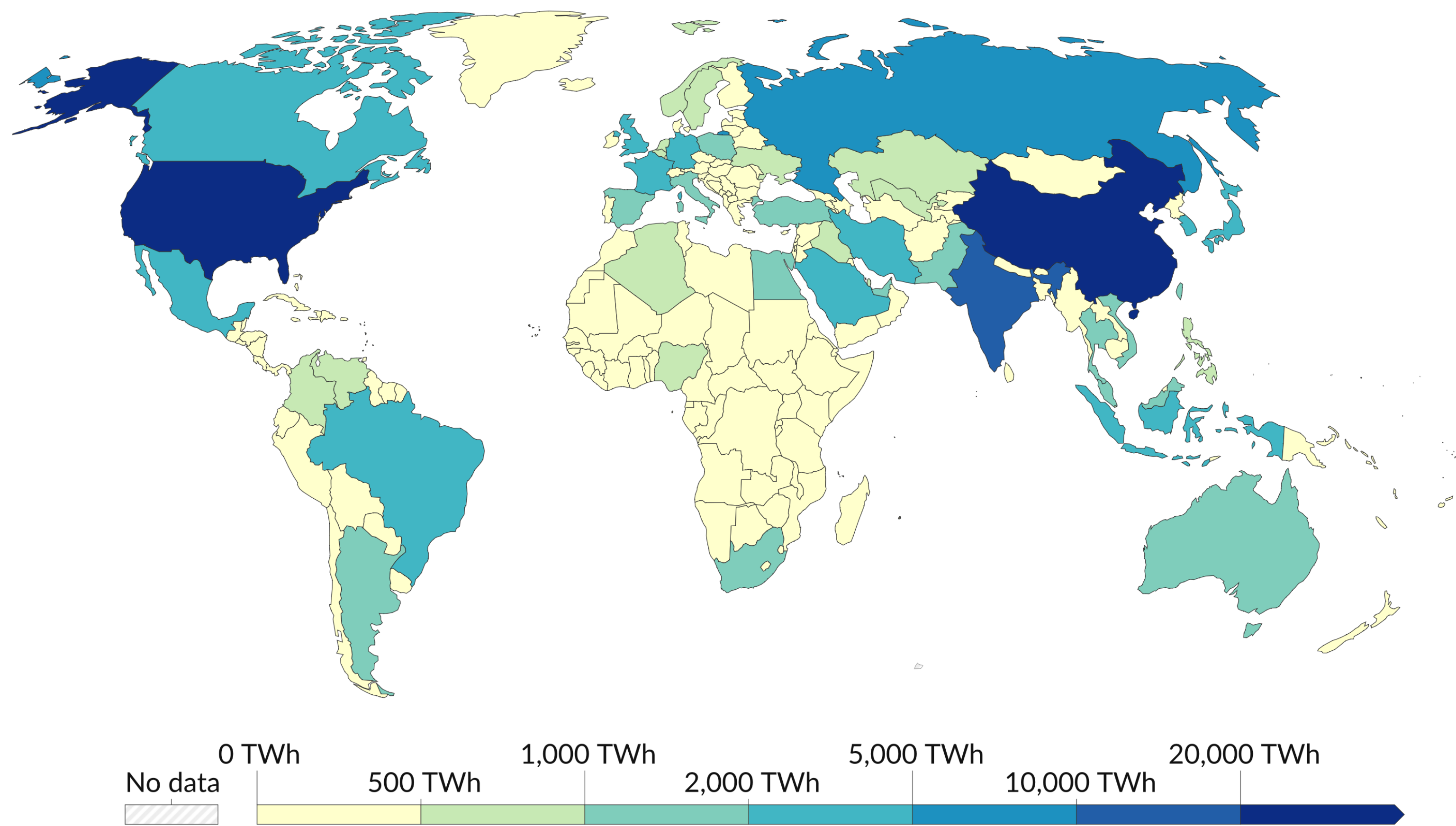
E: Global energy consumption

Geographic Distribution of Energy Use

Primary energy consumption, 2022



Primary energy¹ consumption is measured in terawatt-hours², using the substitution method³.

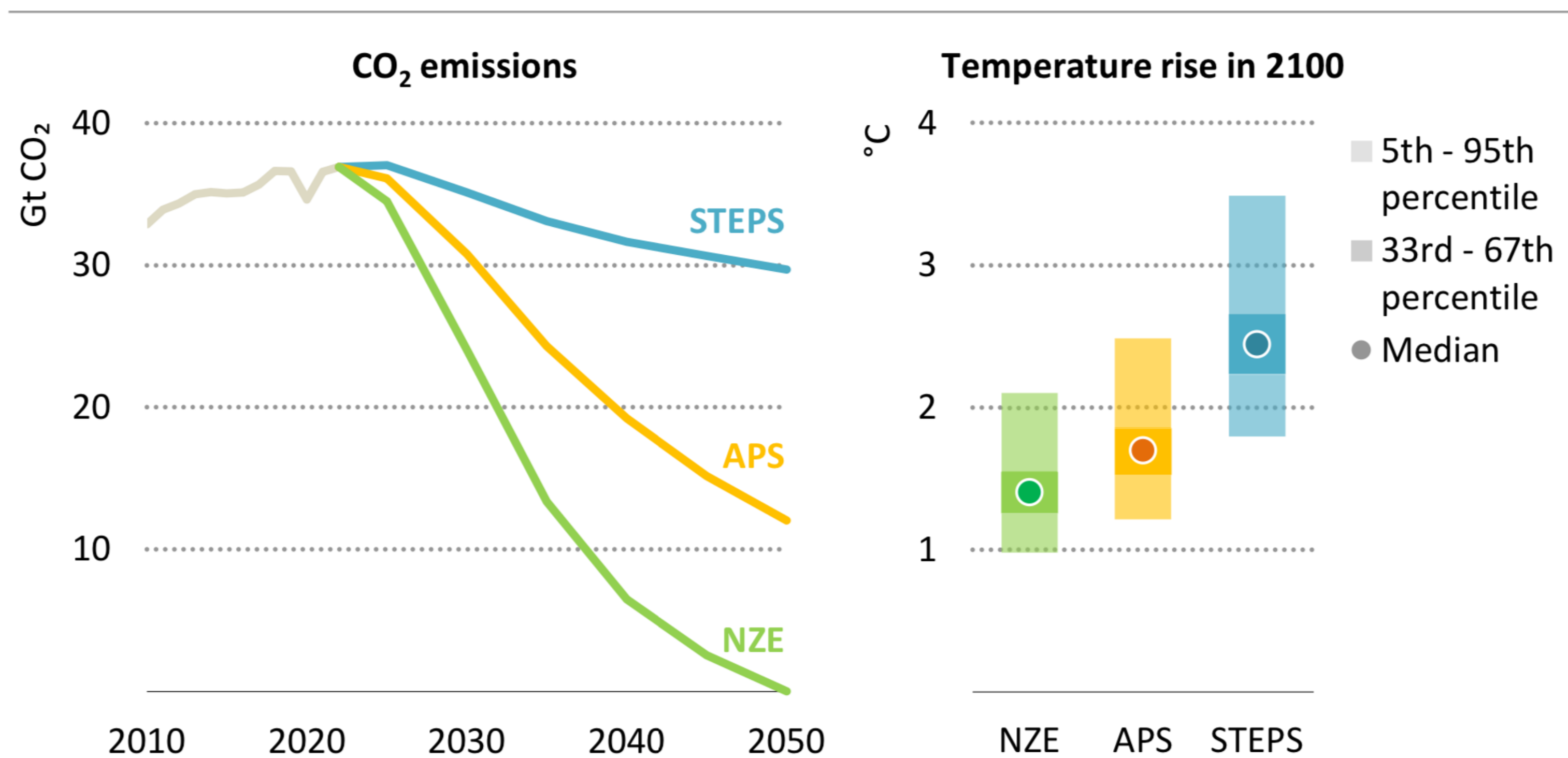


Hannah Ritchie, Pablo Rosado and Max Roser (2020) - "Energy Production and Consumption" Published online at OurWorldInData.org. Retrieved from: '<https://ourworldindata.org/energy-production-consumption>' [Online Resource]

Path to net-zero emissions

Achieving Climate Targets

Figure 4.1 ▶ Global energy-related and industrial process CO₂ emissions by scenario and temperature rise above pre-industrial levels in 2100

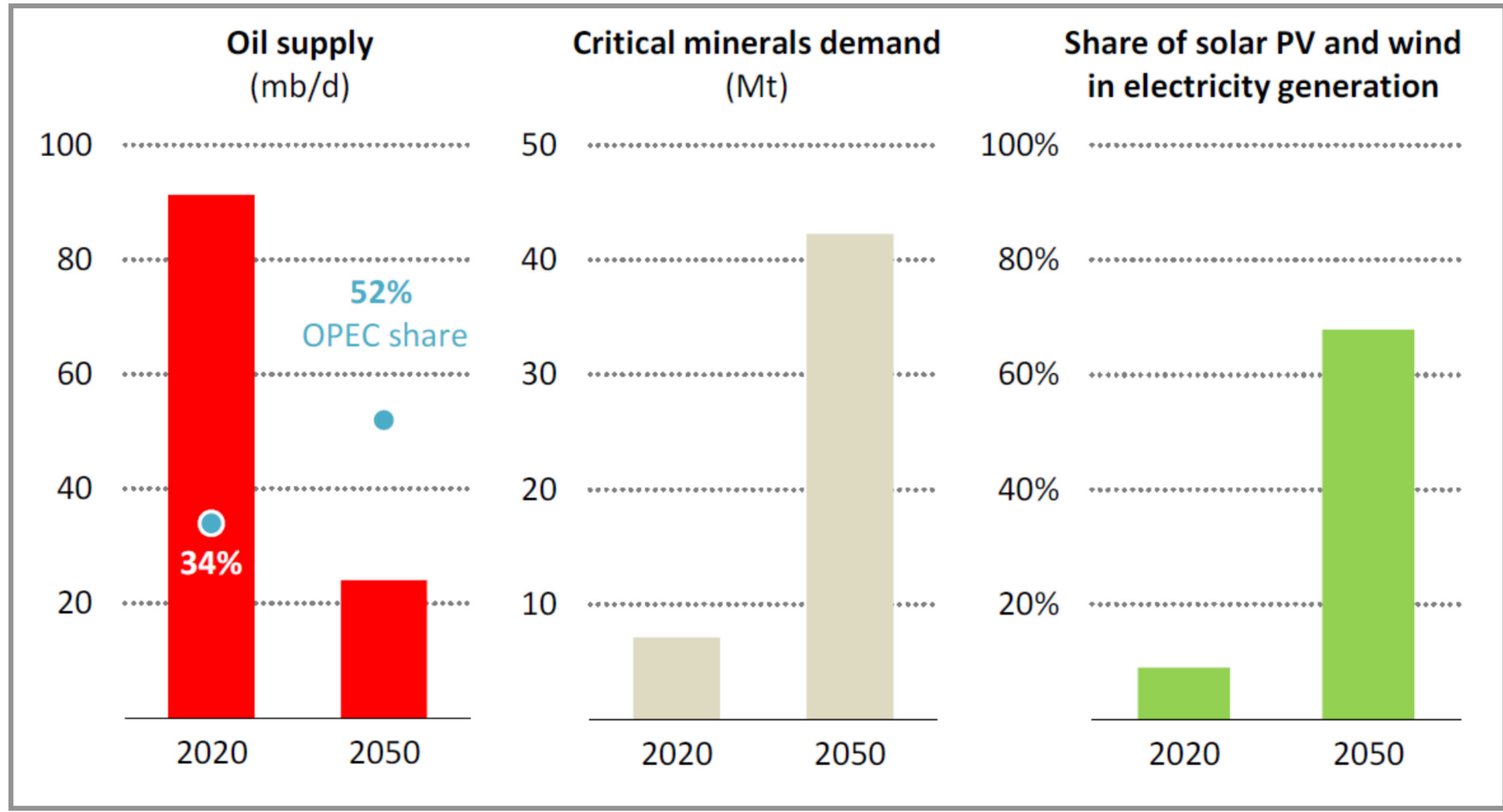


IEA. CC BY 4.0.

Temperature rise in 2100 is 2.4 °C in the STEPS and 1.7 °C in the APS: it peaks at just under 1.6 °C around 2040 in the NZE Scenario and then declines to about 1.4 °C by 2100

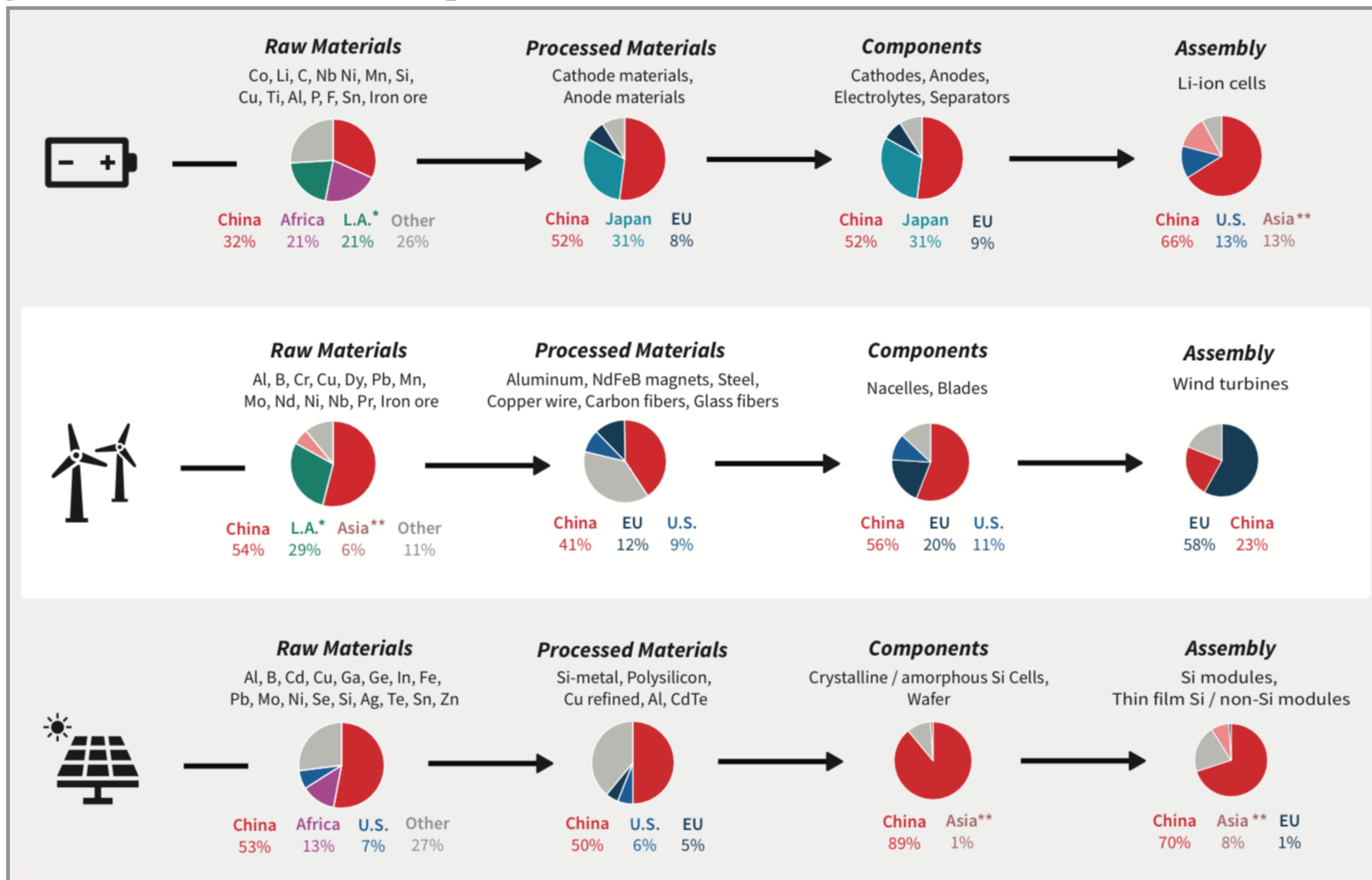
Normative Scenarios are a guide

Net zero Emissions Scenario from IEA



Minerals in Clean Energy Supply

Each supply chain is unique



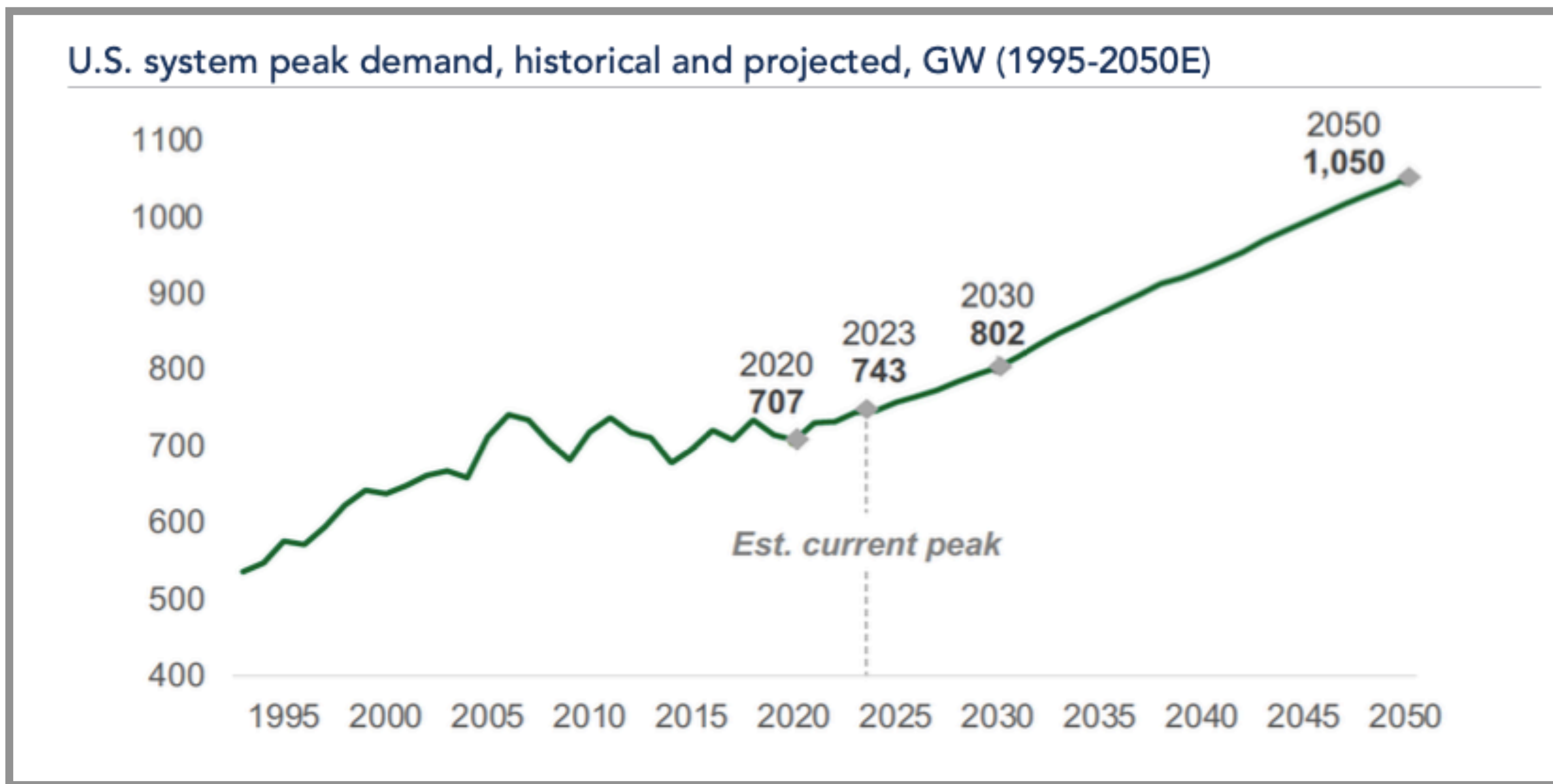
* Latin America

** Excluding China and Japan

Source: Created by Ian Barlow based on data from European Commission, *Critical materials for strategic technologies and sectors in the EU - a foresight study, 2020* (Brussels: European Commission, 2020).

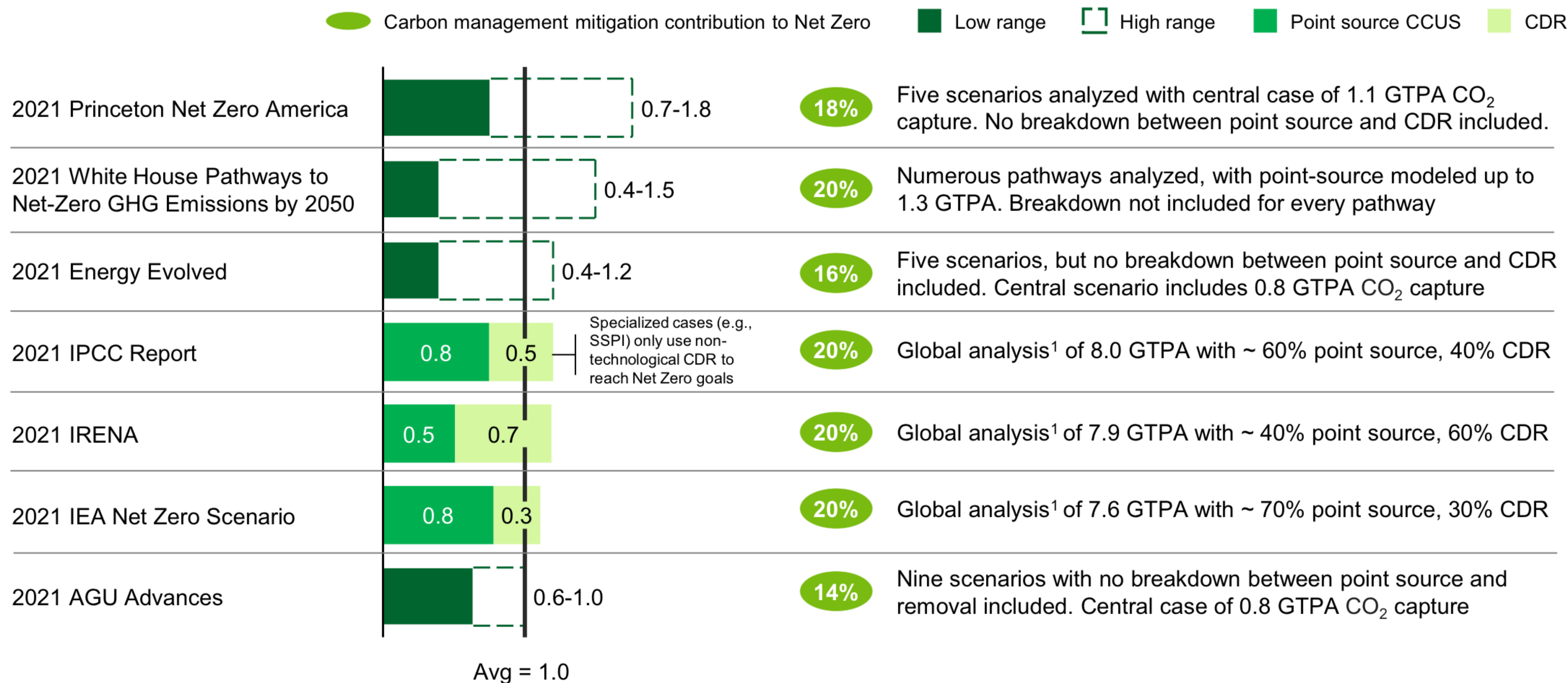
Resource Adequacy

Growing Peak Demand



Net-Zero and Carbon Management

Estimates of U.S. CCUS, CDR² required to reach Net Zero by 2050, GTPA CO₂



New Energy Strategies

Security and Competition

REINVESTING IN DOMESTIC ENERGY COMPETITIVENESS

- 1 Spending for share in hydrogen, batteries, carbon capture, and minerals.
- 2 Deployment in power, transportation, and heavy industry – *more than R&D*
- 3 Emphasis on manufacturing to meet US demand and possible export

ESTABLISHING AN INTERNATIONAL LEADERSHIP ROLE

- 1 Reform trade regimes to allow for investment without resorting to protectionism.
- 2 Increase efforts related to international emissions reductions, sharing technology and finance tools.
- 3 Maintain a leading role in global energy markets through responsible production and export of fossil fuels.