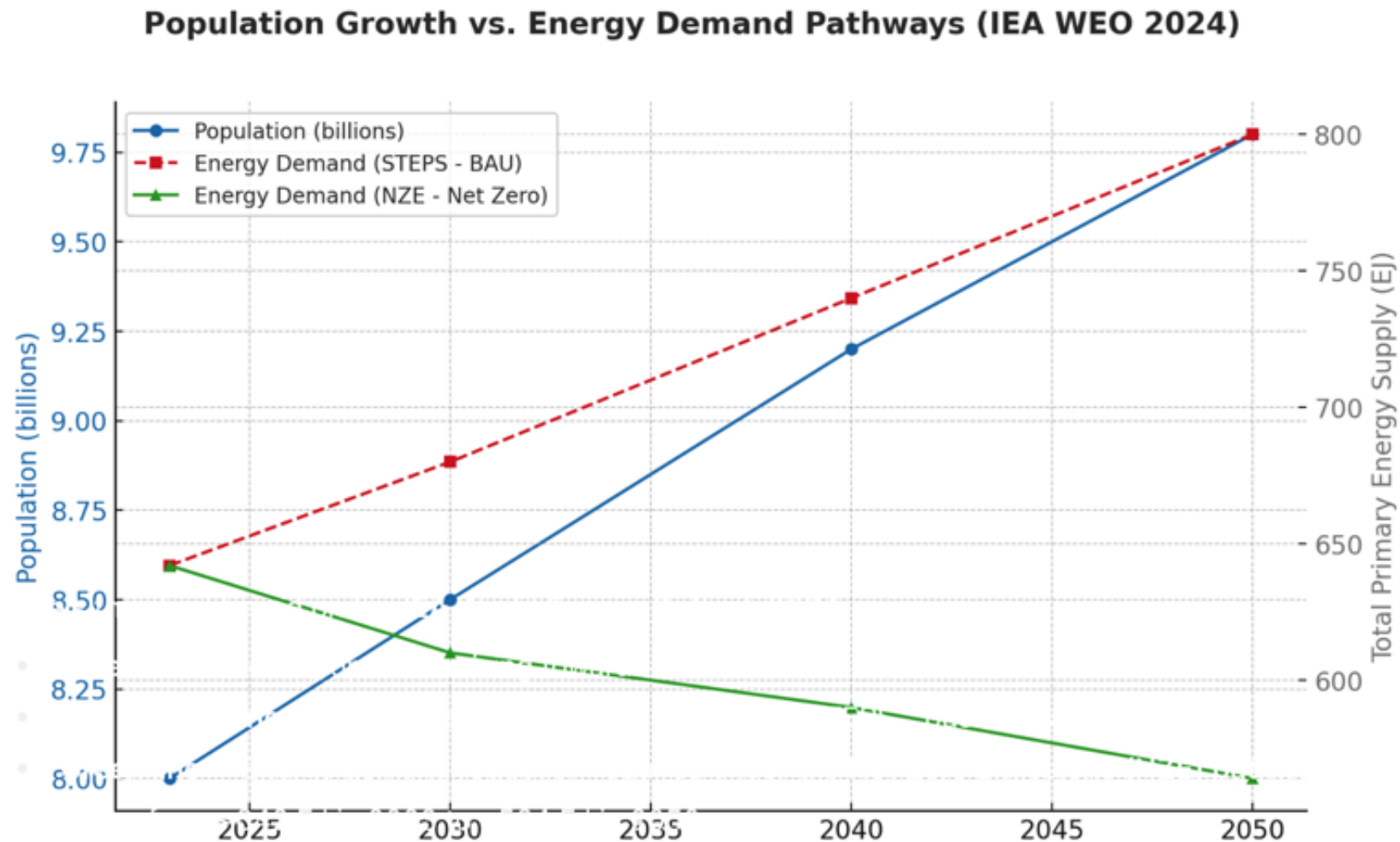


# Ensuring Stable Global Resource Supply: A Preliminary Exploration

Paul Baruya | Director of Strategy and Sustainability

# The World's Demand for Resources is Rising at an Extraordinary Pace



# Stability Requires Coordinated Action Across National and International Levels



**Diversification**



**Technology**

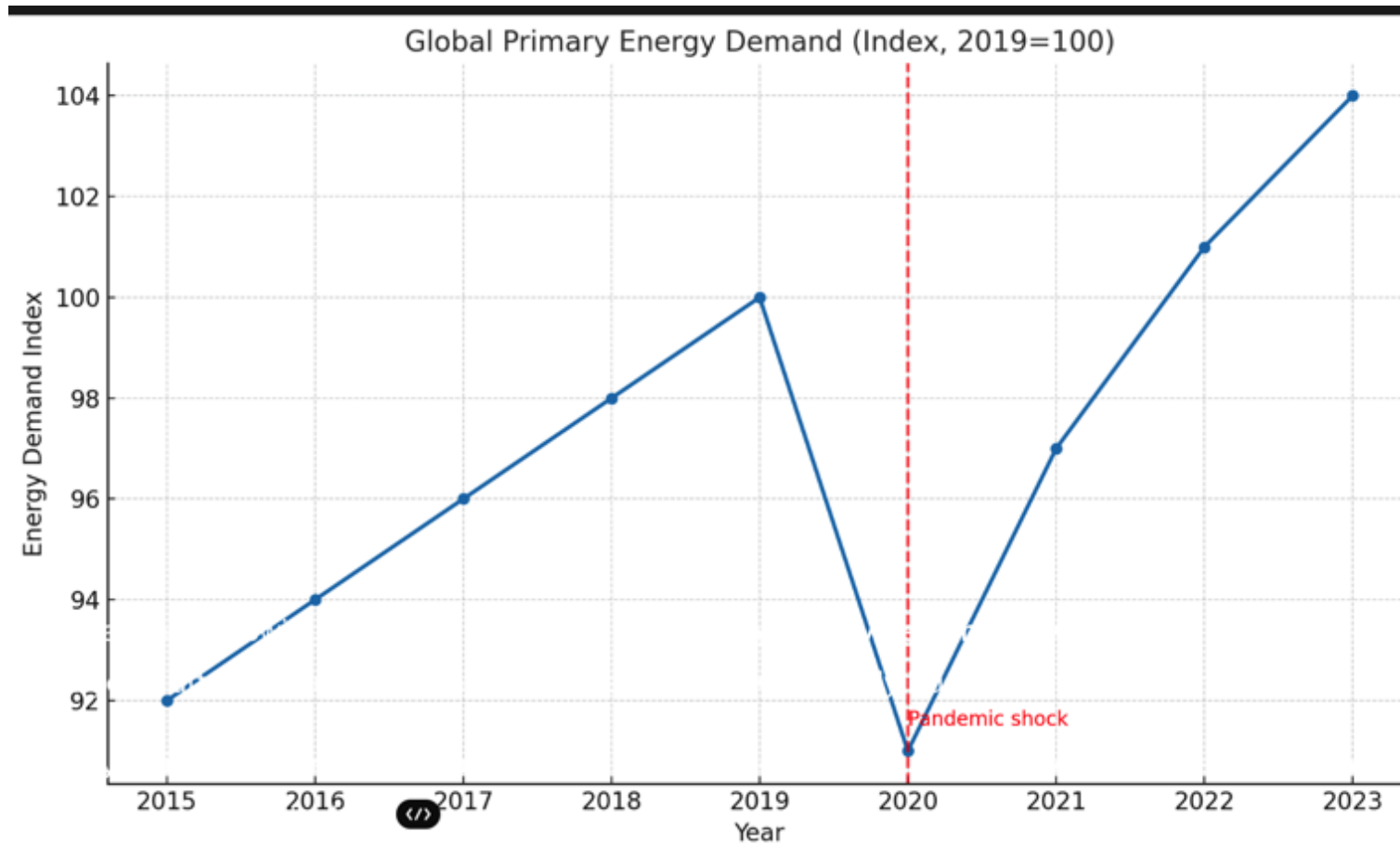


**Partnerships**

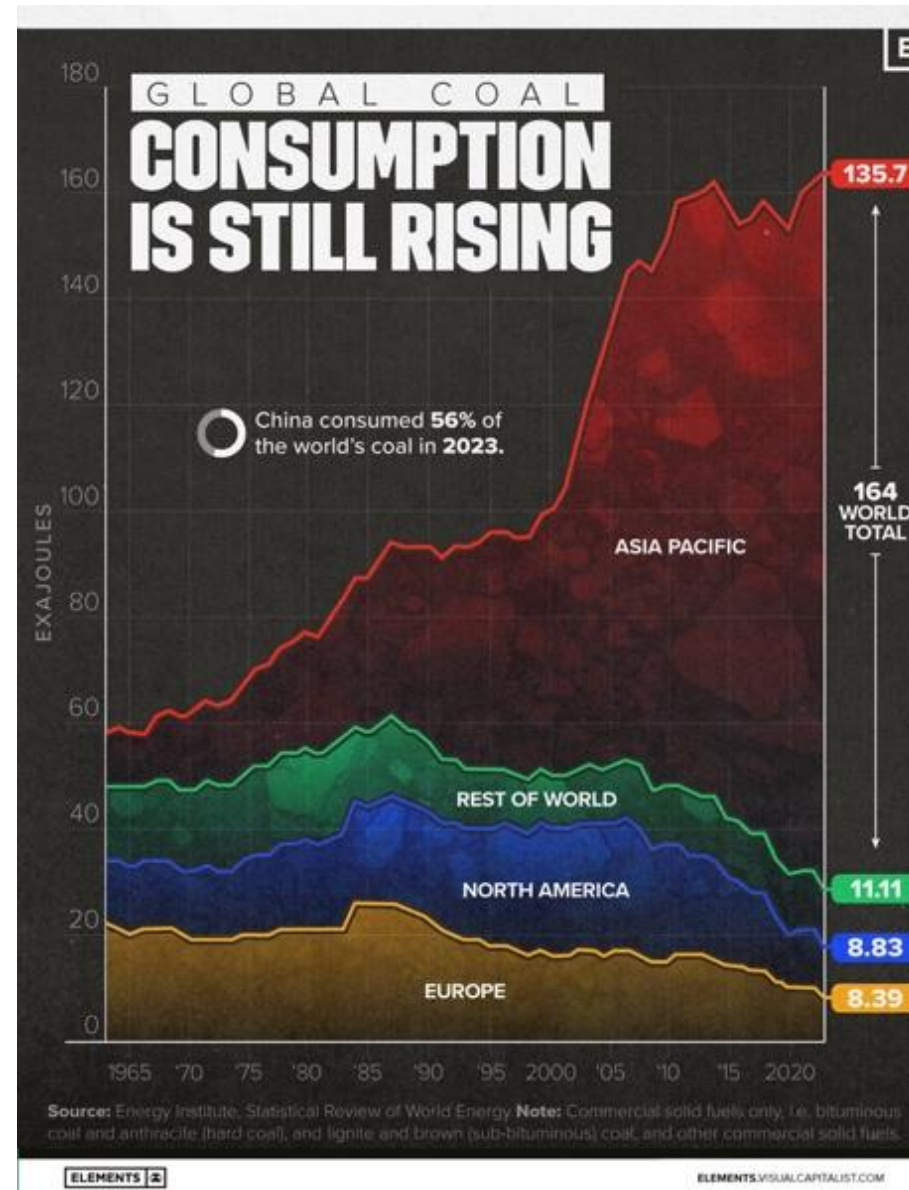


**Policy  
Alignment**

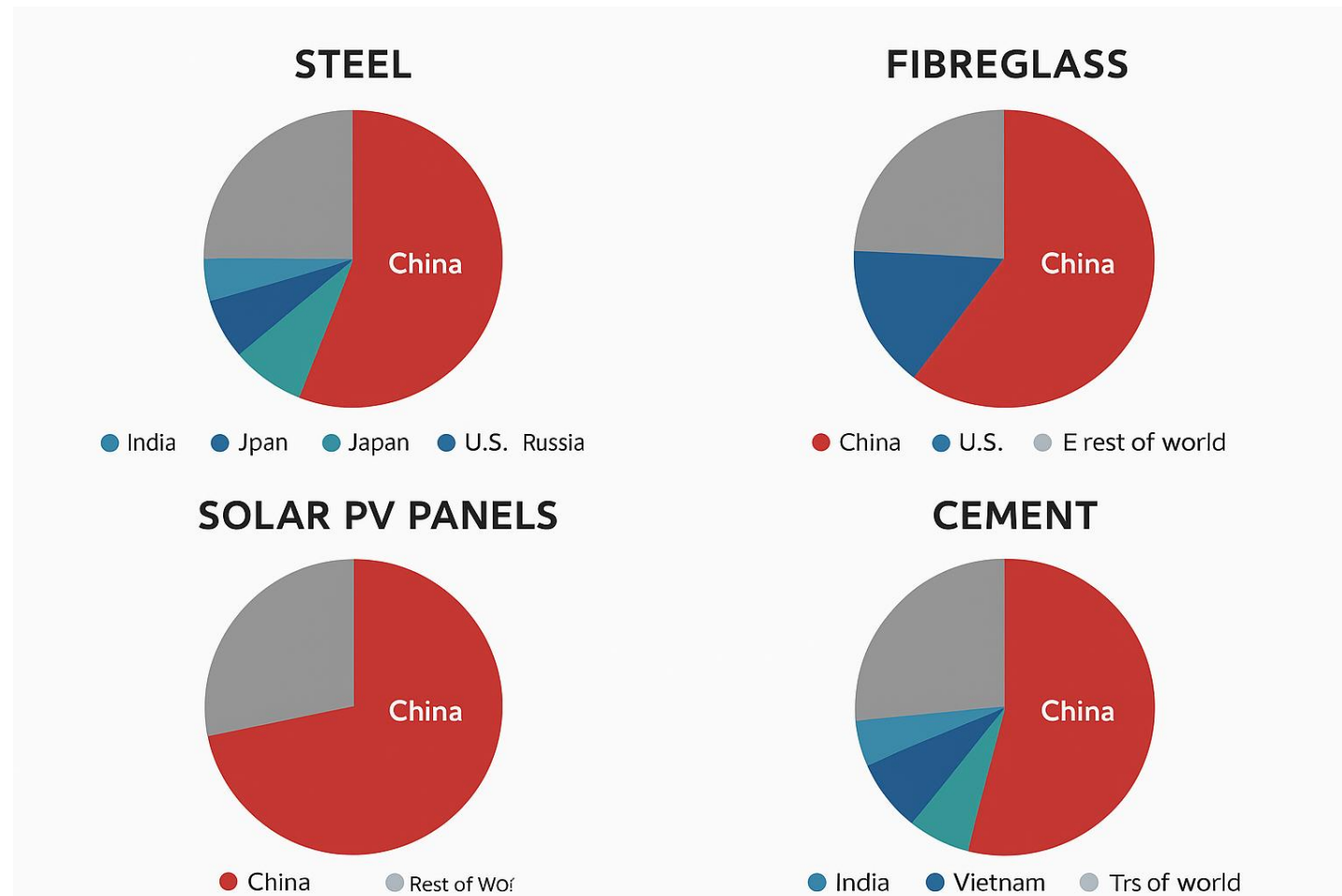
# Lessons from Recent Shocks



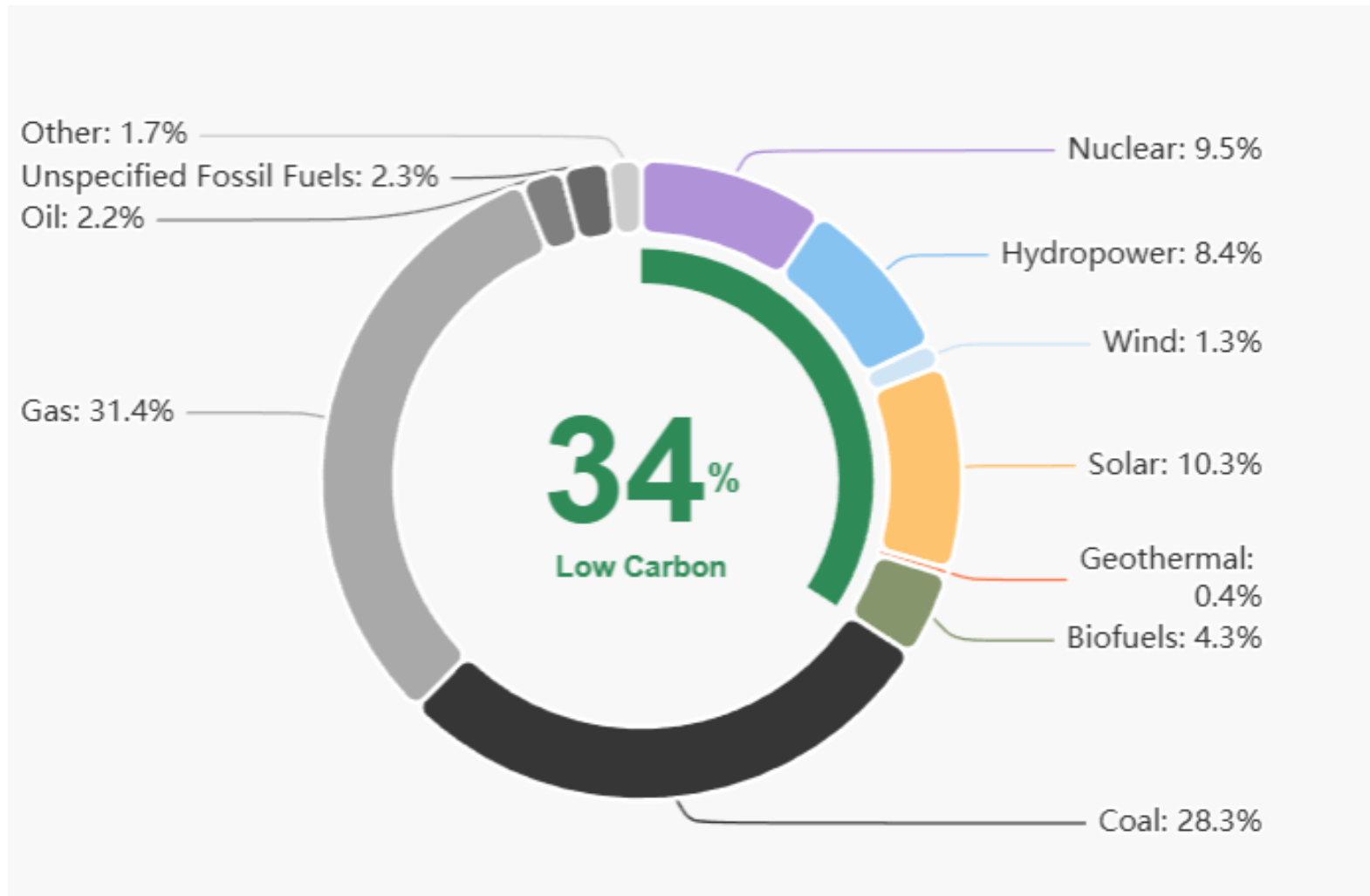
# Coal's Global Supply Advantage



# Renewable Energy Supply Chains are Highly Concentrated



# Japan's Energy Diversity is A Model for Others to Follow



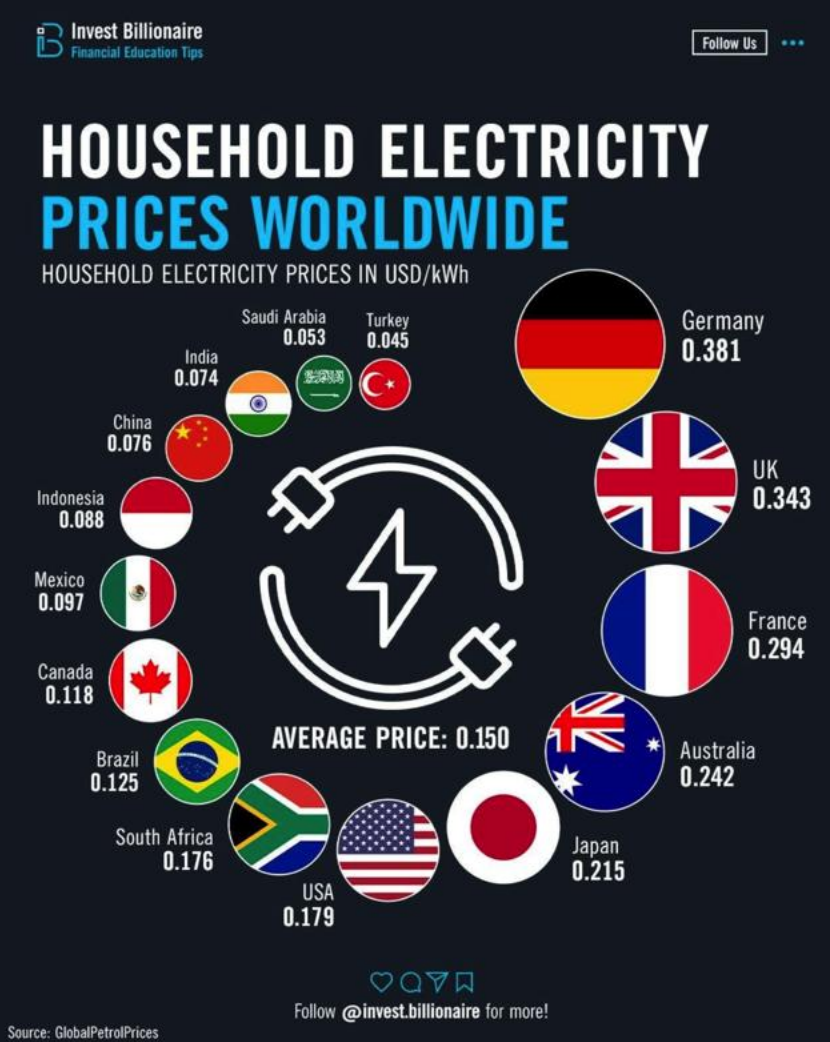
Source: Low Carbon Power



# Green Electricity Costs a Bundle

The data make clear: The notion that solar and wind power save money is an environmentalist lie.

By Bjorn Lomborg  
Jan. 1, 2025 5:31 pm ET



Independent Age  
Sponsored

Independent Age

At **10°C**  
a home  
can kill

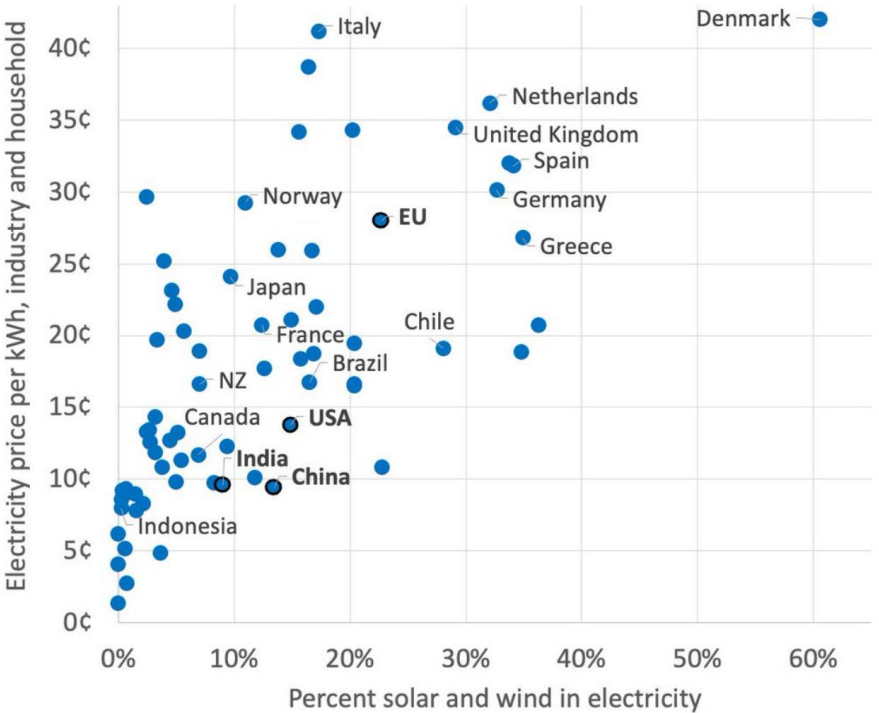
HELP AN OLDER PERSON  
TURN THE HEATING ON

THIS WINTER  
**159,380**  
CHILDREN  
IN ENGLAND ARE HOMELESS

URGENT APPEAL    DONATE £25 NOW

# Expensive Solar and Wind

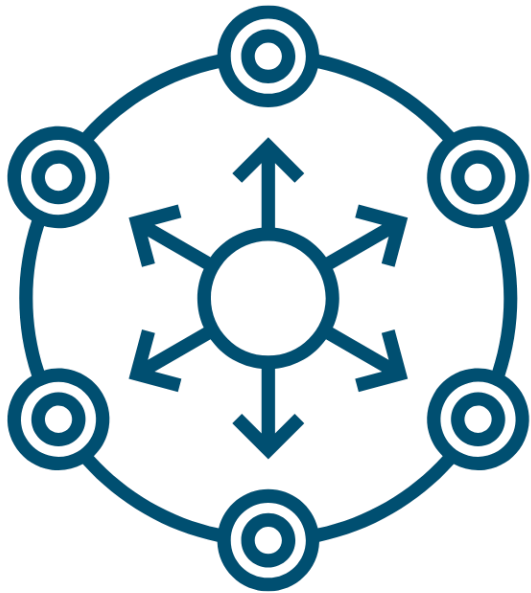
The elites tell you that solar and wind are cheap  
Reality: The more solar and wind, the costlier it gets  
That is because solar and wind are worthless when not sunny and windy  
Data for 2022, but same result for 2019, just before Covid and Ukraine war



All data for 2022. Price in USD for residential and industry from International Energy Agency, <https://www.iea.org/data-and-statistics/data-product/energy-prices>, weighted by consumption and adjusted to 2024 USD, <https://www.bls.gov/cpi>. Percent solar and wind generation of all national generation from <https://ember-energy.org/data>, excluding countries with less than 50% of their consumption covered by domestic generation (i.e., Luxembourg producing just 18% and Lithuania 32%). This leaves 68 country observations (vs 78 in 2019). China is missing in IEA data (only residential prices from 2019). Here, China estimated from very similar Statista estimates ([www.statista.com/statistics/1373596/business-electricity-price-china](https://www.statista.com/statistics/1373596/business-electricity-price-china) and [www.statista.com/statistics/1373587/household-electricity-price-china](https://www.statista.com/statistics/1373587/household-electricity-price-china)). The similar scatter plot for 2019 shows less solar+wind and lower prices, but it has a substantially similar least-square line. x.com/bjornlomborg



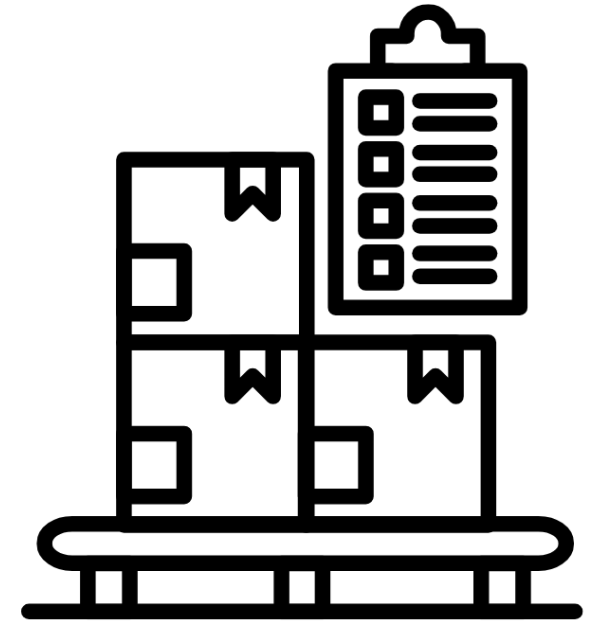
# Japan's Multi-Pronged Strategy for Critical Minerals



**Diversification**



**Recycling**



**Stockpiling**

Sustainable Coal Stewardship (SCS) provides a pathway which supports extracting more value per tonne of coal.

Value is determined and measured in both economic and environmental benefits.

## Pre-Combustion

- Digitalisation & Intelligent Platforms
- Dust and Water Management
- Efficient Coal Processing, Washing & Beneficiation
- Electric Vehicles
- Land Disturbance & Rehabilitation
- Management of Surface Subsidence
- Methane Management
  - Recycling
  - Renewable Power
  - Waste Management

## Combustion

- Emission Control Technologies
- Combined Heat and Power (CHP)
- High Efficiency and Low Emissions (HELE)
- Coal Gasification (Integrated Gasification in Combined Cycle)
- Co-firing with Biomass or Ammonia
- Carbon Capture Utilisation Storage (CCS/CCUS)
- Pollution control: Flue gas desulphurisation, particulate control, nitrogen oxides, and mercury
  - Circulating fluidised bed combustion
  - Allam cycle

## Beyond Combustion

- Coal to Blue Hydrogen
- Coal to Liquids (CTL)
  - Synthetic Liquid Hydrocarbons, Methanol
- Coal to Chemicals
  - Ammonia, Agri-Chemicals, Olefins, etc.
- Blast Furnance Steel Production
- Coal to Construction
  - Cement Clinker Production
  - Gypsum, Cement replacement (Fly Ash & Slag), Carbon Bricks, Materials for Clean Energy
- Coal and Coal Waste to Advanced Materials
  - Critical Minerals
  - Rare Earth Metals
  - Graphene
  - Carbon fibre
  - Alumina
  - Activated Carbon for Water/Gas Filtration

# Sustainable Coal Stewardship

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