

2007 Bernstein Private Wealth Symposium





The Investing Implications of Climate Change

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Kilimanjaro's Ice Cap Is Shrinking

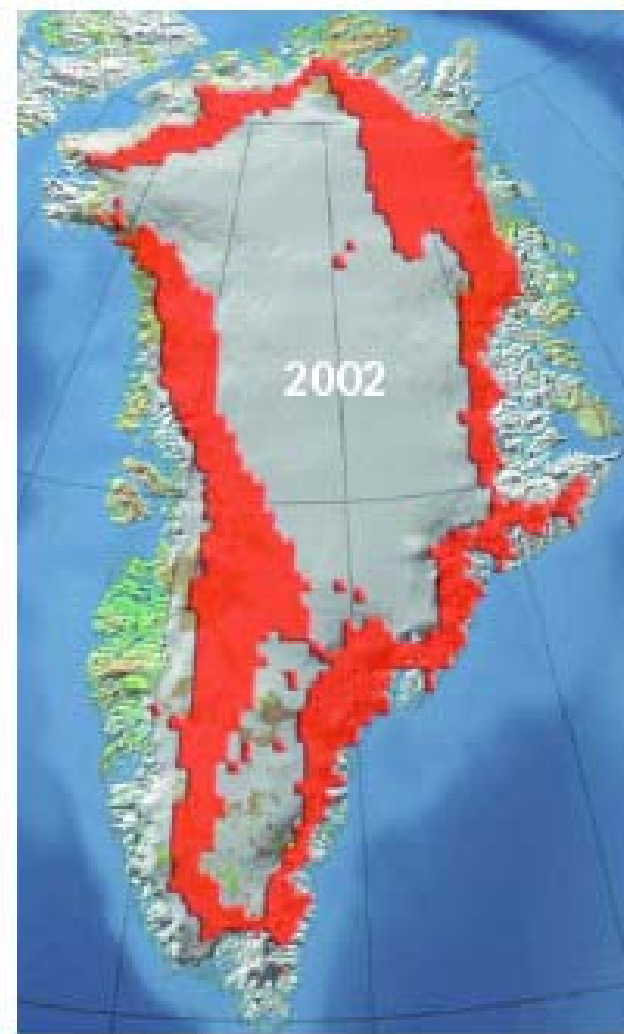
15 Years Ago



Recent



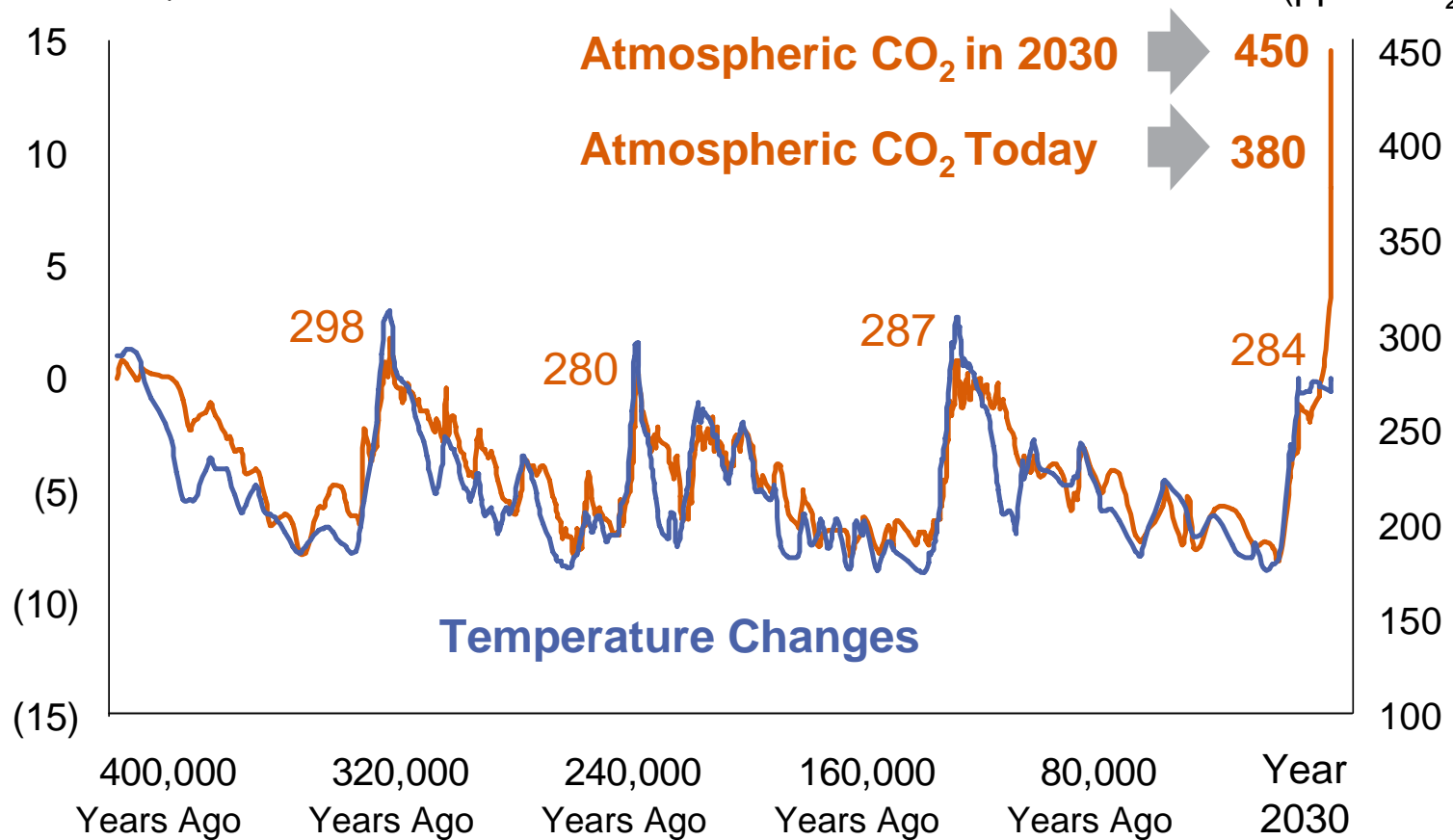
Greenland's Summer Ice Sheet Is Melting



Atmospheric CO₂ May Soon Reach Critical Level

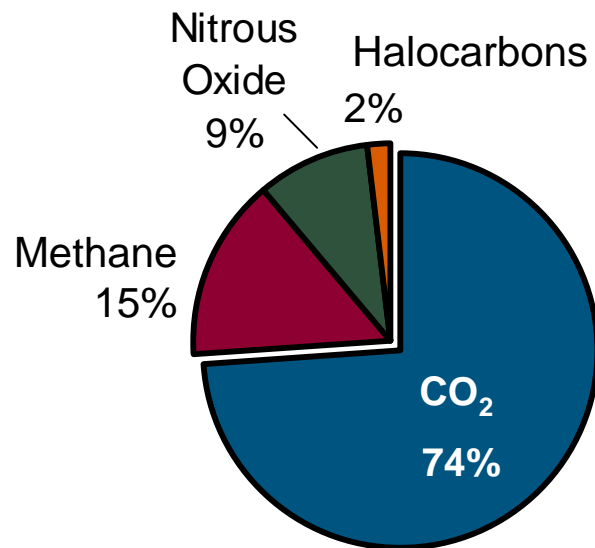
Temperature Change
(Degrees Celsius,
0 = Present)

Atmospheric
Concentration
(ppm CO₂)

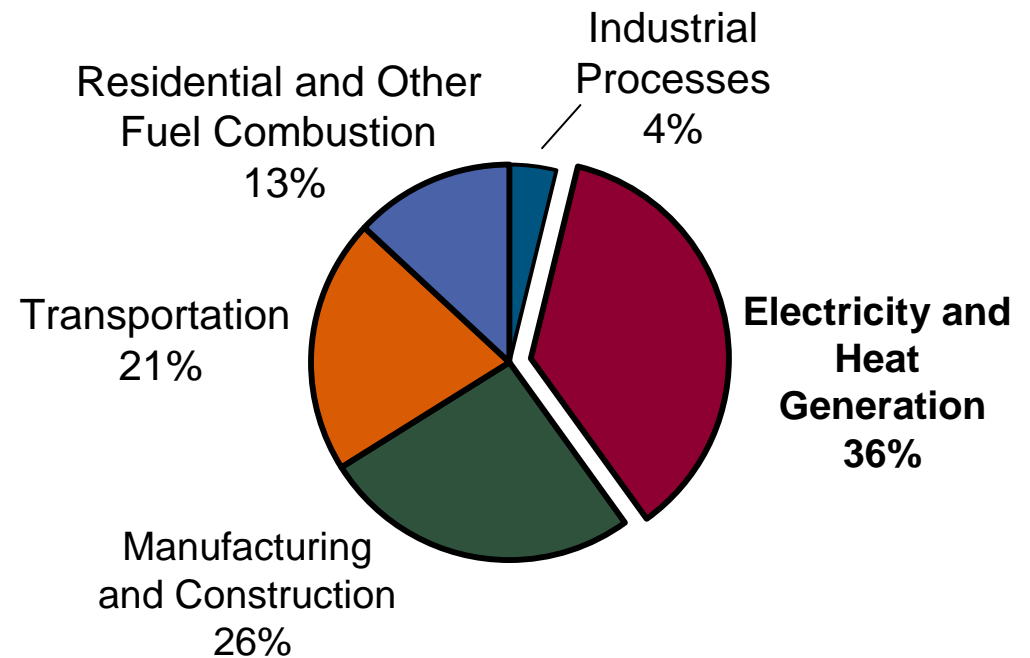


We Focused on the Central Problems: CO₂ and Electricity

Man-Made Greenhouse Gas Emissions (2006E)*



Sources of CO₂ Emissions (2006E)**

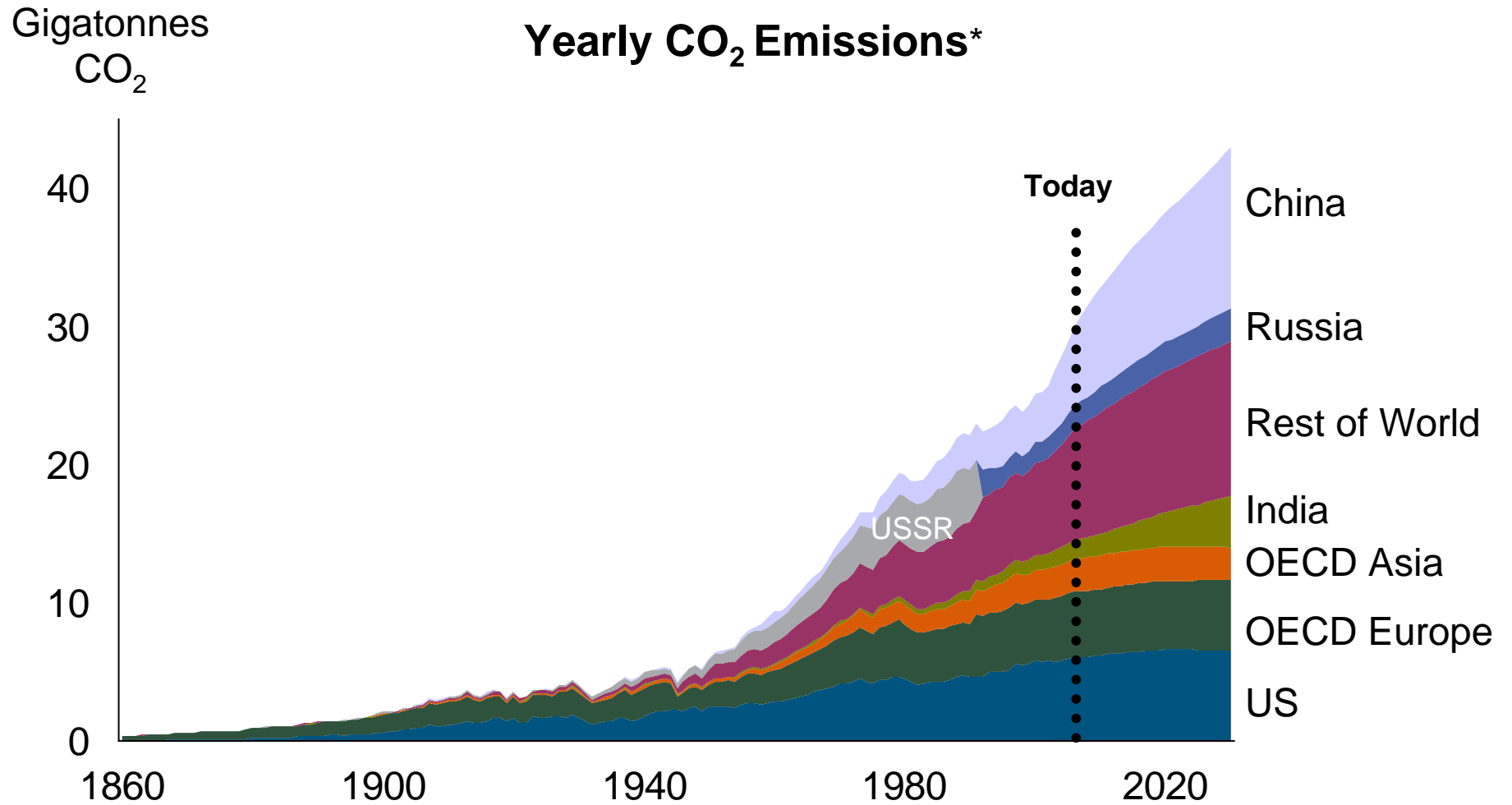


*Estimated from 2000 anchor data

**Estimated from 2003 anchor data

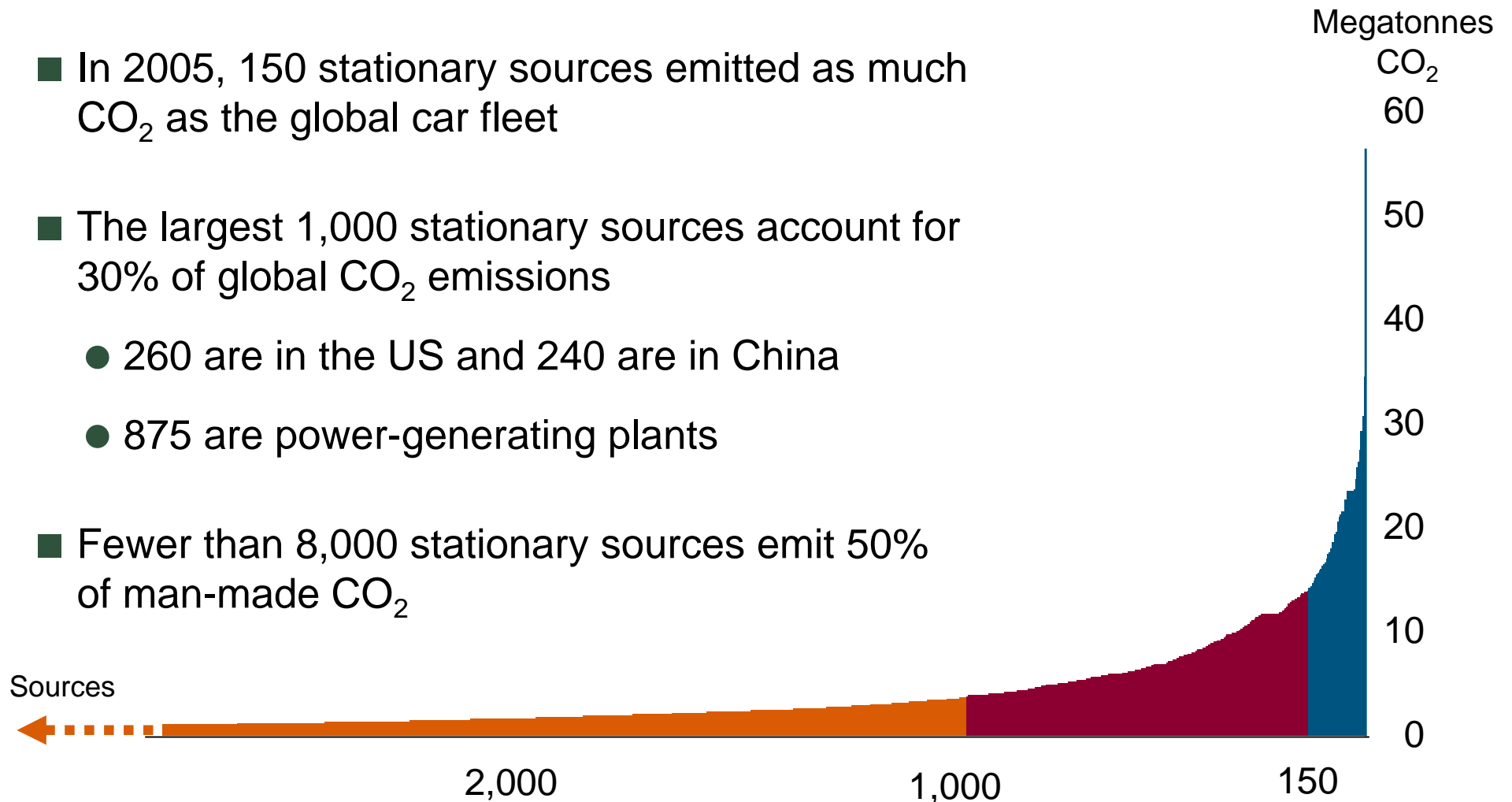
Source: EIA, IEA, IPCC, WRI and AllianceBernstein

Without Intervention, CO₂ Emissions Will Grow with Economic Development



Good News: Most CO₂ Emissions Come from Few Sources

- In 2005, 150 stationary sources emitted as much CO₂ as the global car fleet
- The largest 1,000 stationary sources account for 30% of global CO₂ emissions
 - 260 are in the US and 240 are in China
 - 875 are power-generating plants
- Fewer than 8,000 stationary sources emit 50% of man-made CO₂



How Can We Reduce CO₂ Emissions?

Not Feasible

Feasible

Reduce global energy consumption



Increase earth's natural CO₂ absorption

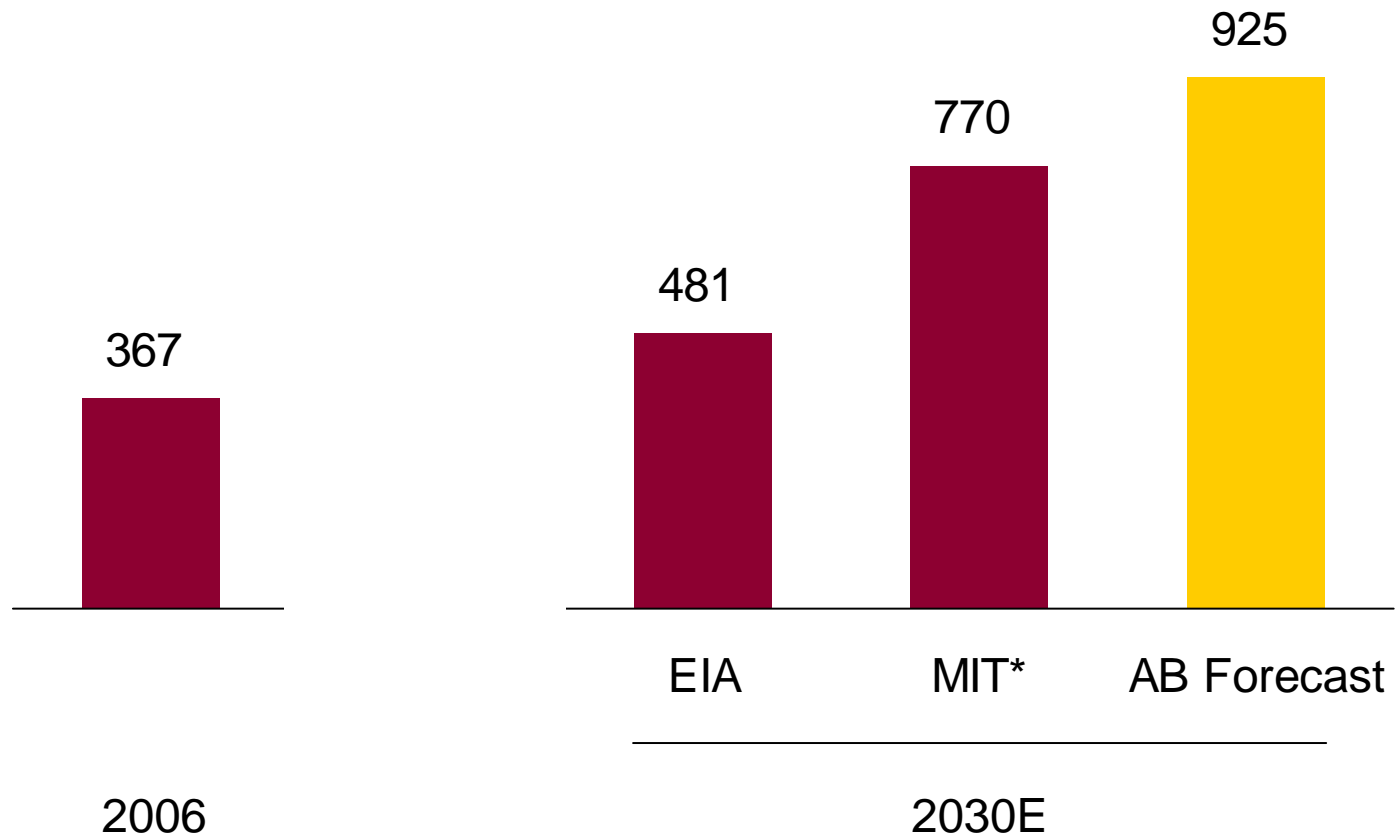


Switch to nuclear energy and renewables



Nuclear Energy Capacity Will Rise Substantially...

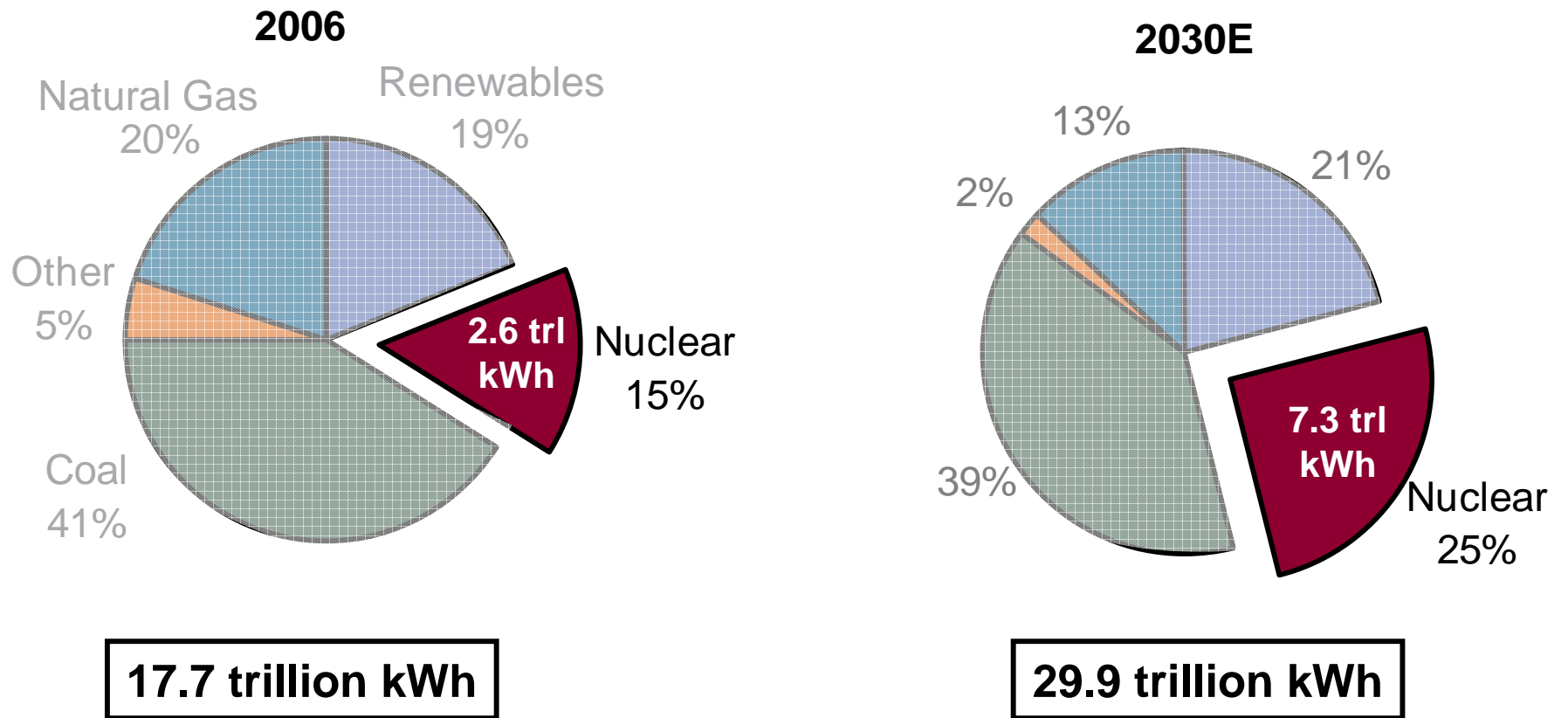
Gigawatts of Global Capacity



*Based on MIT's *The Future of Nuclear Power*, 2003, high-growth case, interpolating via CAGR between 2000 and 2050 anchor years
Source: EIA, International Atomic Energy Agency (IAEA), Massachusetts Institute of Technology (MIT) and AllianceBernstein

...And Nuclear Power Generation Will Gain Share of Global Market

Share of Global Power Generation



Renewables Face Serious Obstacles...



Solar

Cost

High

Distance to Power Grid

Moderate

Unpredictable Output

High



Wind

Moderate

Moderate/High

Very High



Hydro

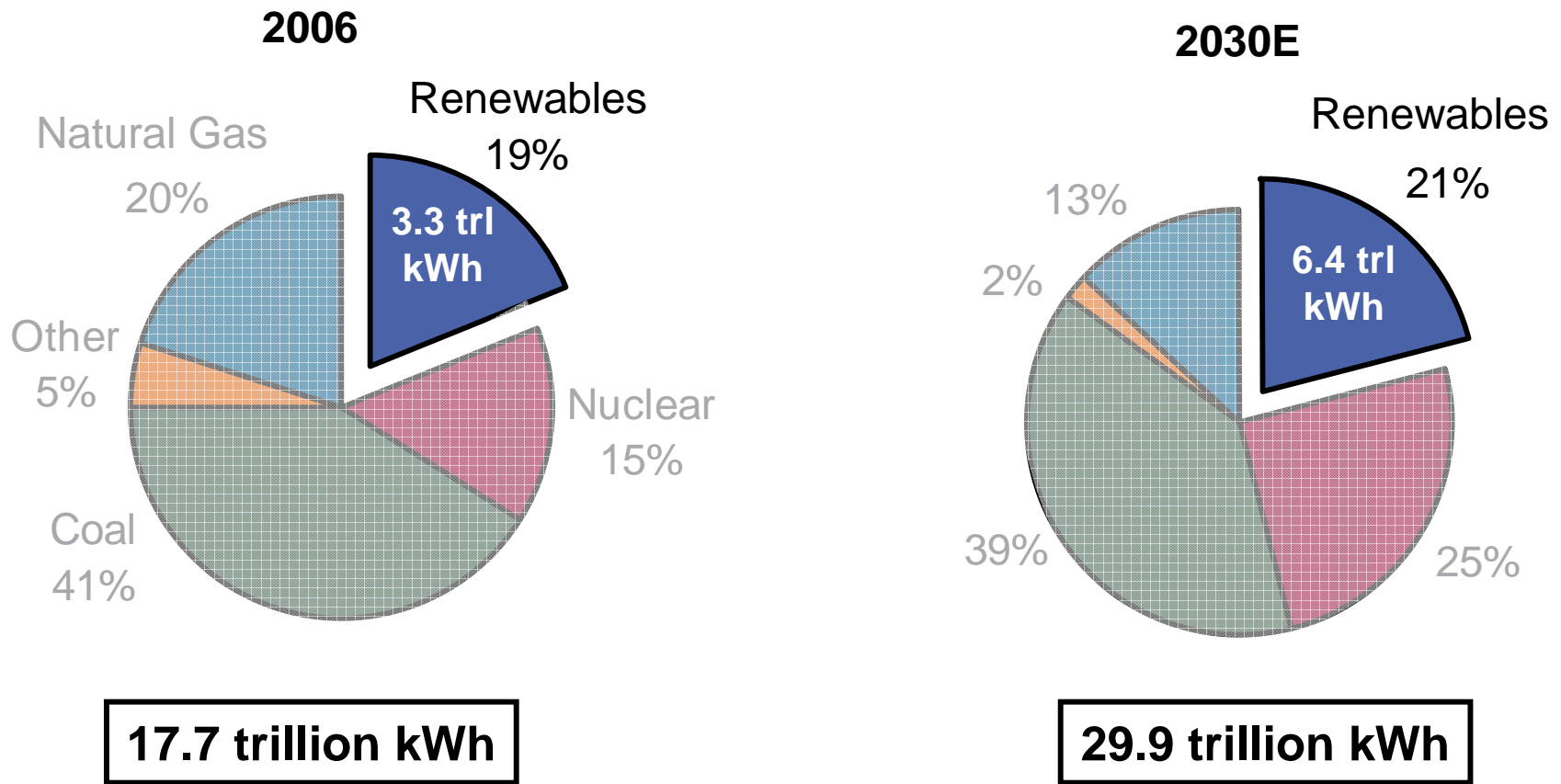
Low/Moderate

Very High

Low

...And Will Gain Only a Bit More Market Share

Share of Global Power Generation



How Can We Reduce CO₂ Emissions?

Not Feasible

Feasible

Reduce global energy consumption



Increase earth's natural CO₂ absorption



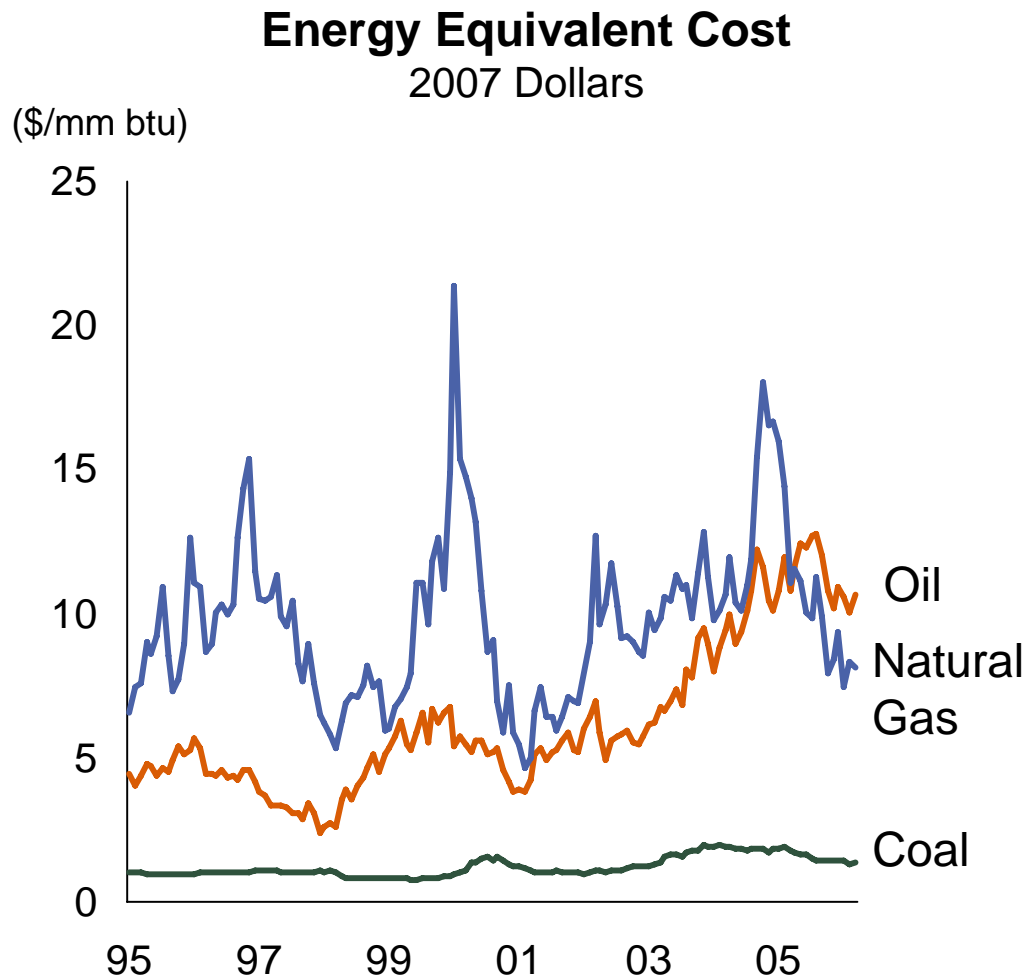
Switch to nuclear energy and renewables



Capture fossil fuel emissions

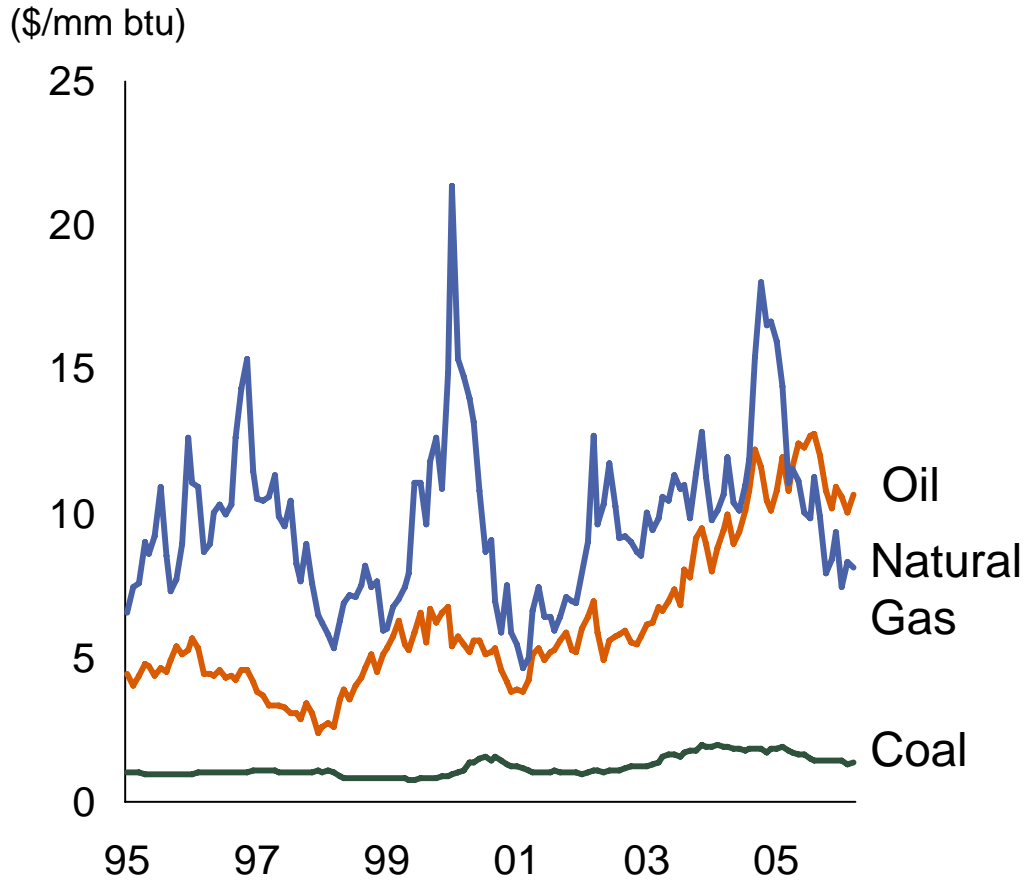


Coal Is Consistently Cheaper than Other Fossil Fuels...

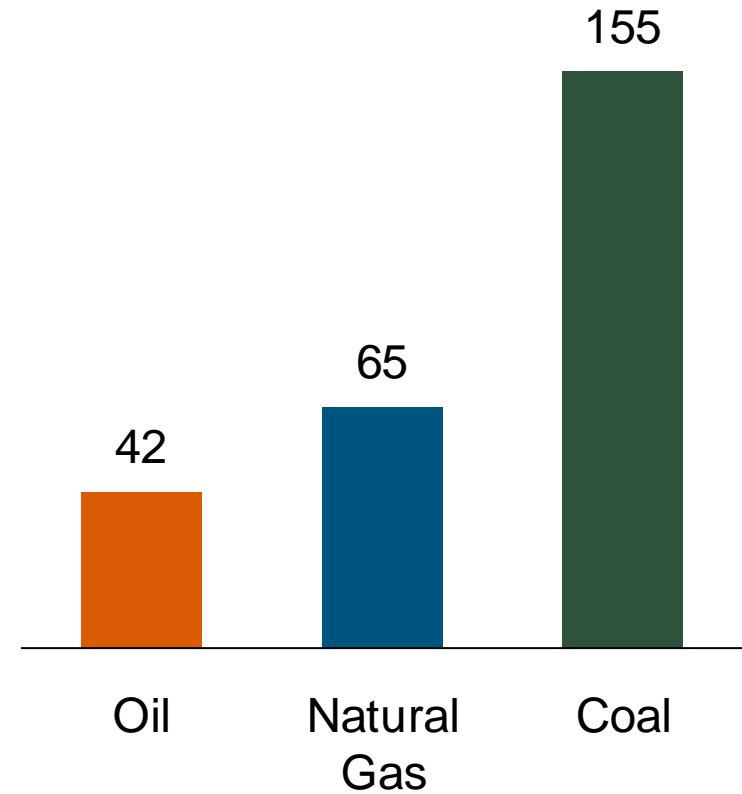


...And More Widely Available...

Energy Equivalent Cost 2007 Dollars

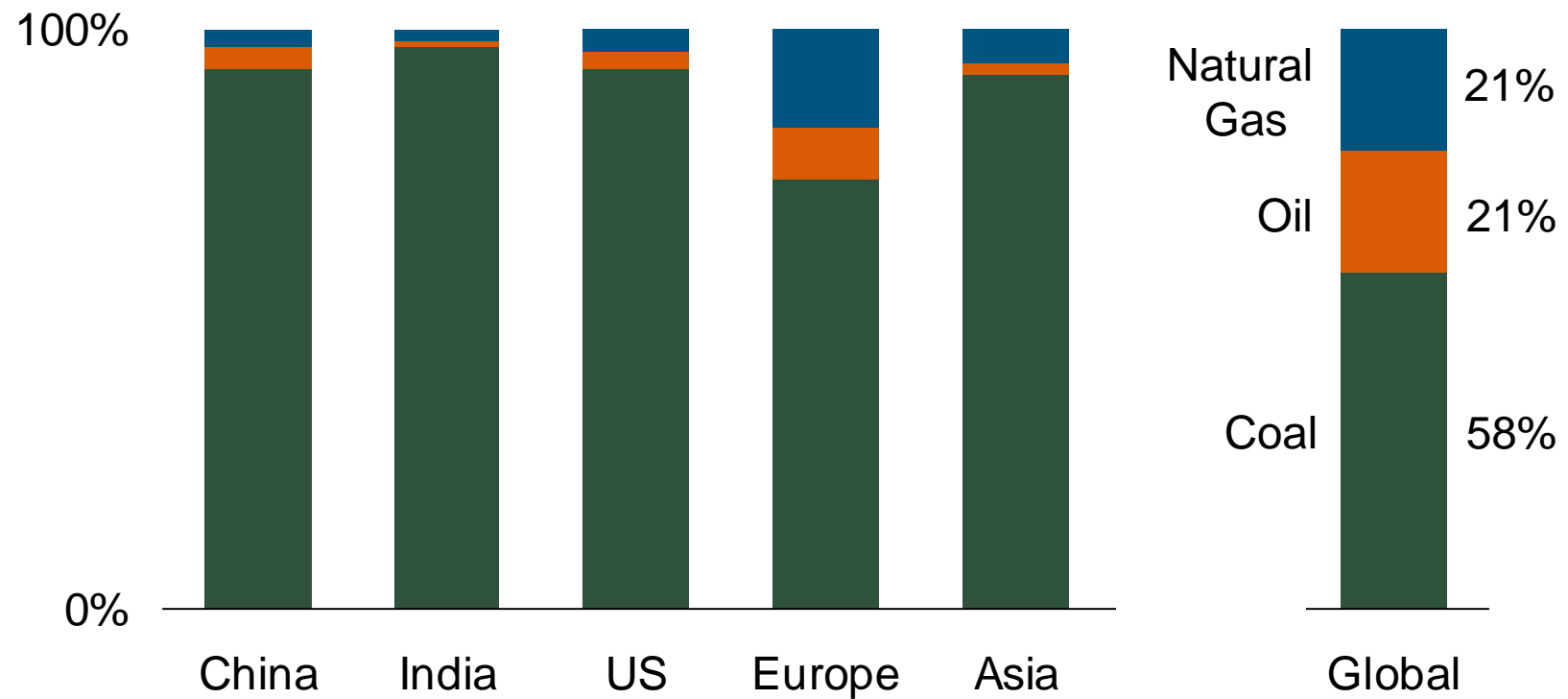


Ratio of Global Reserves to Production Number of Years

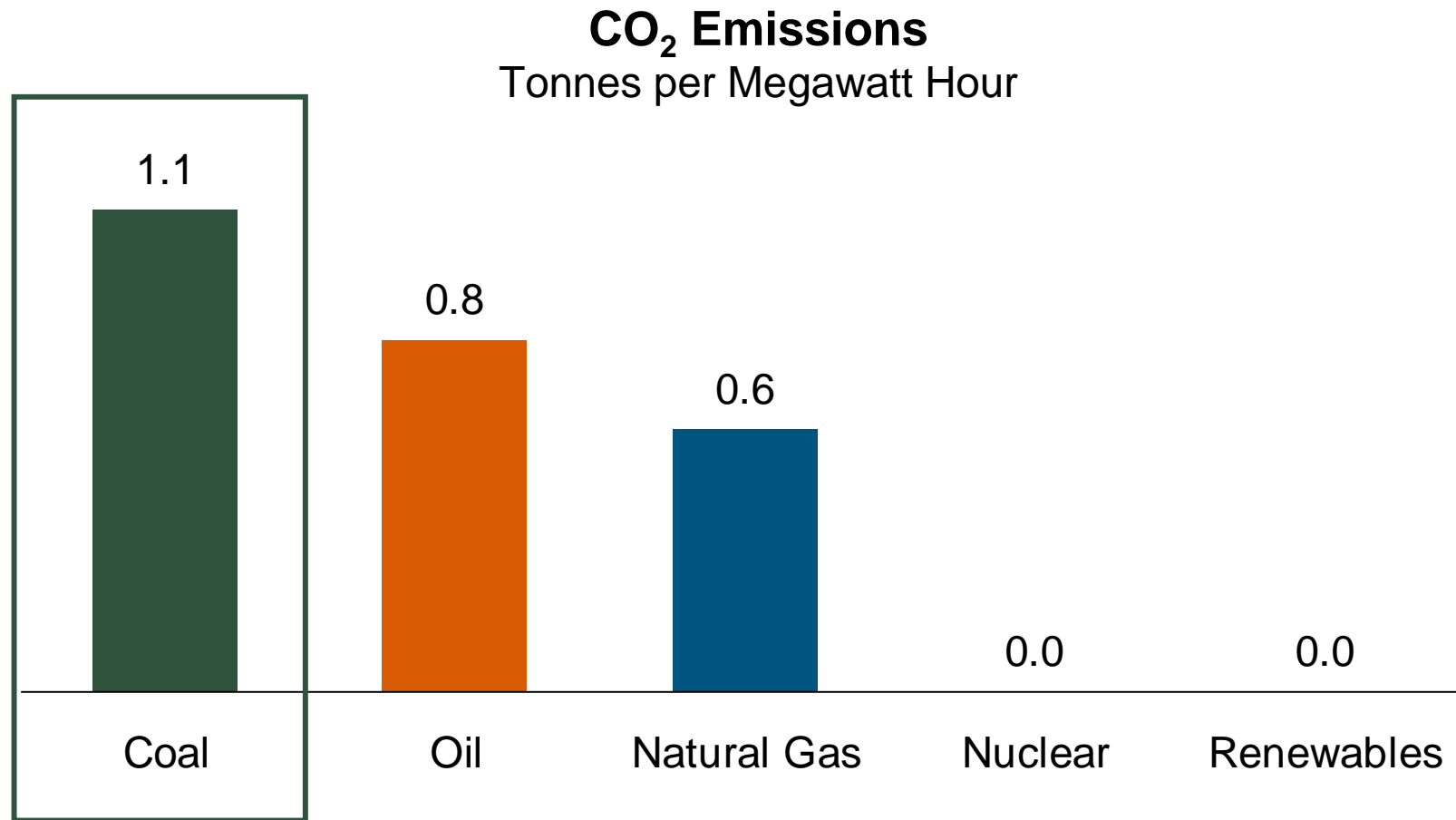


...Particularly in Key Regions

Proven Reserves of Fossil Fuels*



The Problem with Coal: High Carbon Dioxide Emissions



Q: How Can We Reduce Coal Plants' CO₂ Emissions?

A: Retrofit existing facilities to capture CO₂ after combustion

Technology choices

- Adding chilled ammonia to flue gas
- Blowing oxygen, rather than air, into flue gas

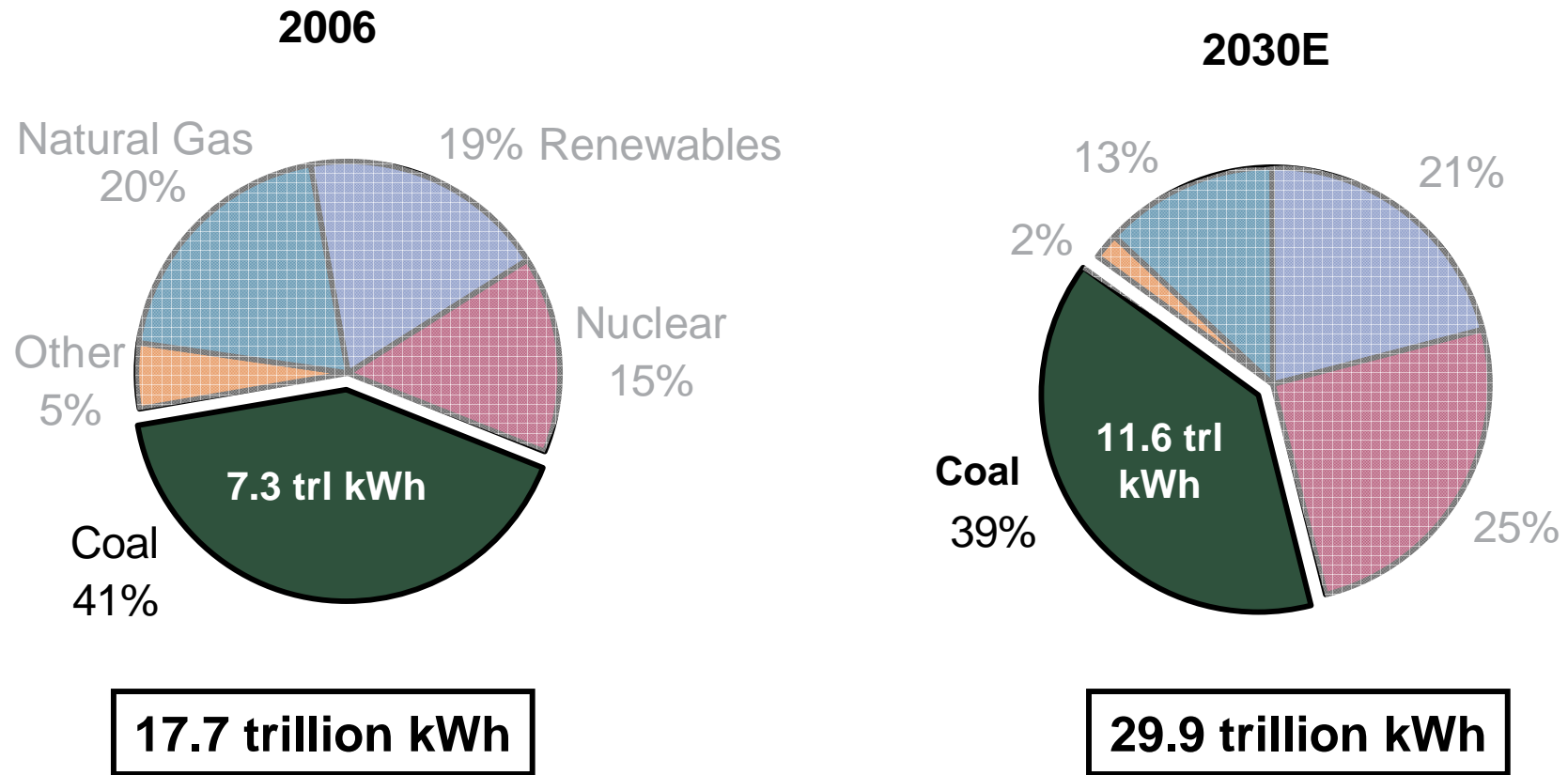
A: Build new plants using clean technology

Technology choices

- Gasifying coal to capture CO₂ before combustion (IGCC)

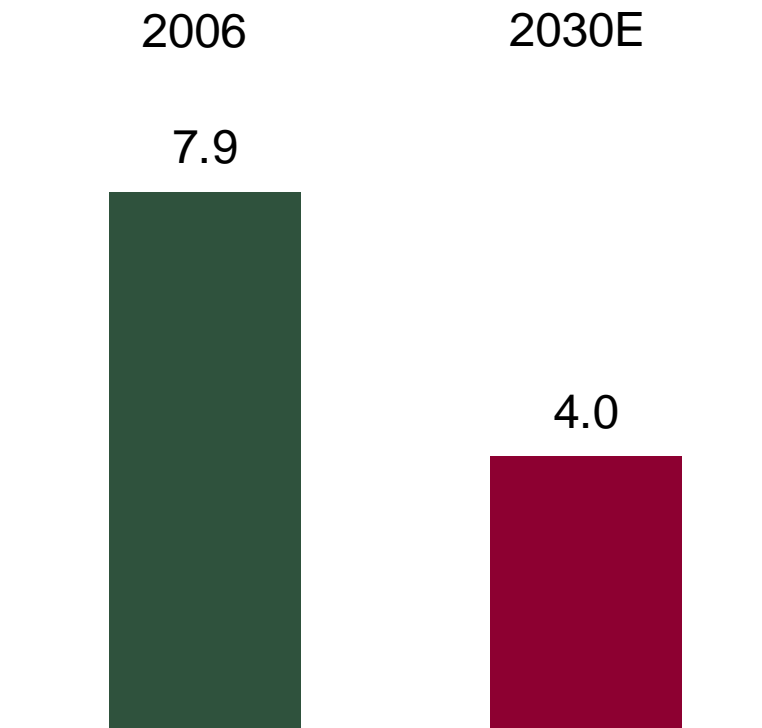
Coal Will Continue to Be the Dominant Fuel Source...

Share of Global Power Generation



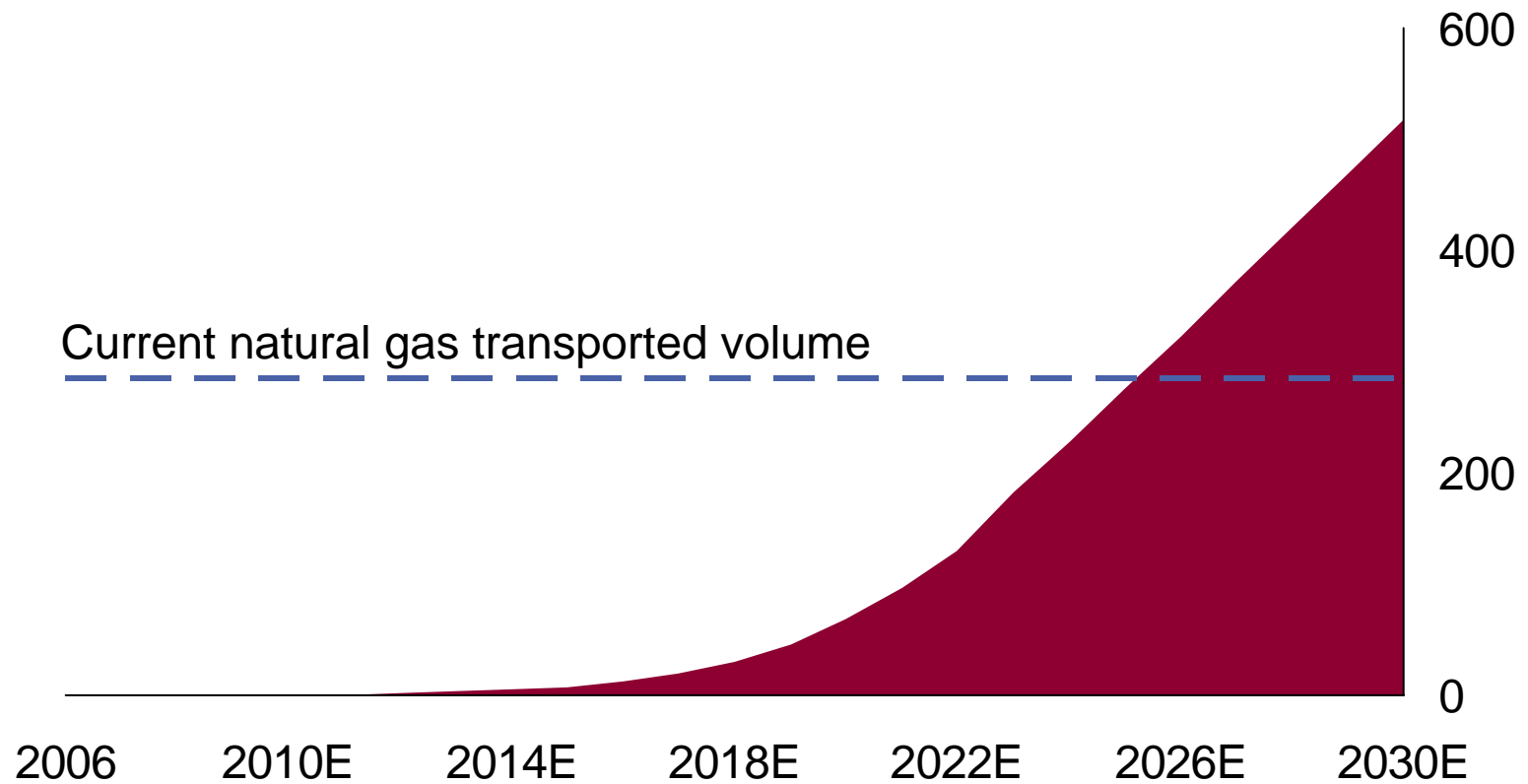
...Yet CO₂ Emissions from Coal Plants Will Drop 50%

CO₂ Emissions from Coal Power (Gigatonnes)



CO₂ Transport and Storage Will Be a Large New Market

CO₂ Transported and Injected
Billion Cubic Feet Per Day



How Can We Reduce CO₂ Emissions?

Not Feasible

Feasible

Reduce global energy consumption



Increase earth's natural CO₂ absorption



Switch to nuclear energy and renewables



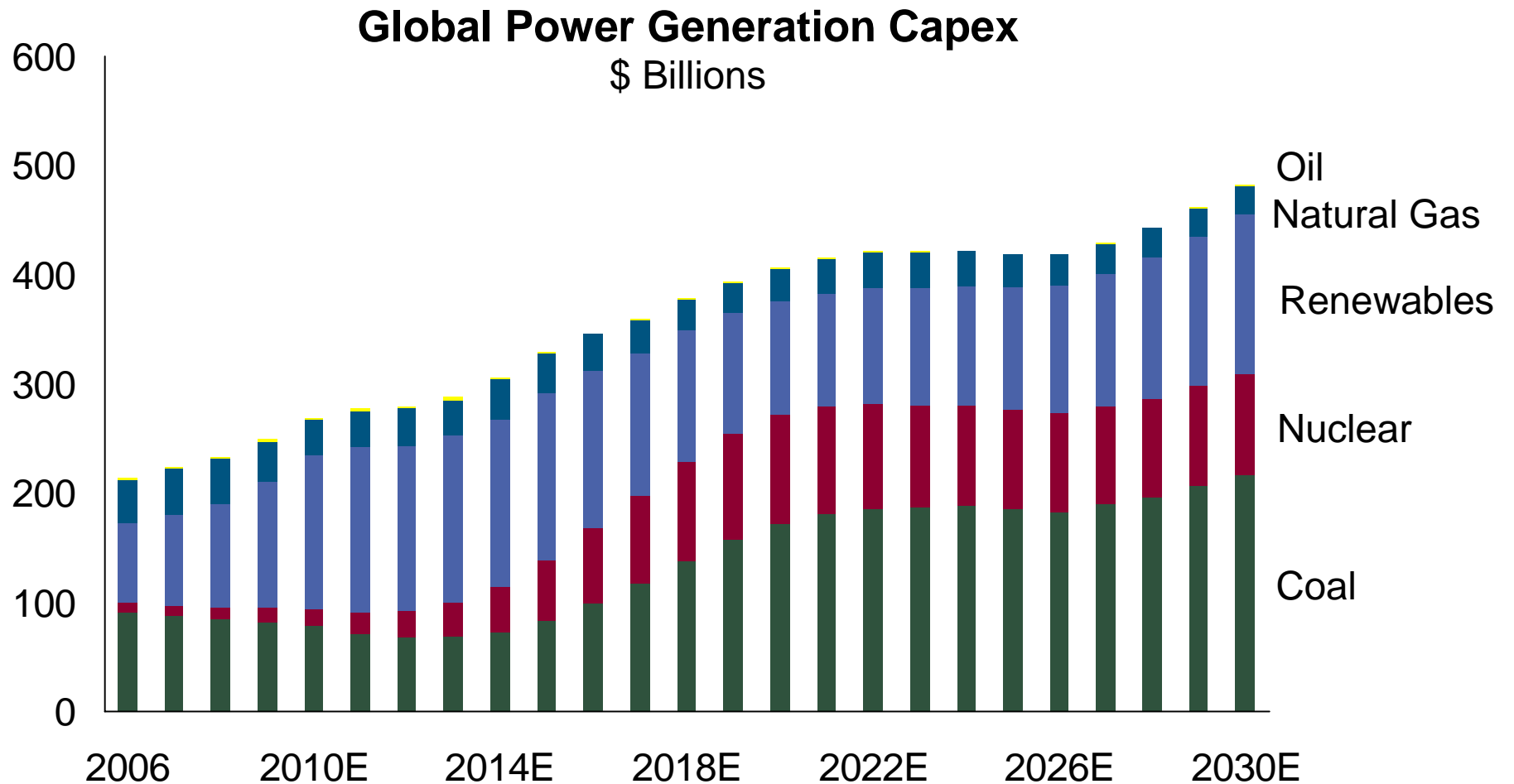
Capture fossil fuel emissions



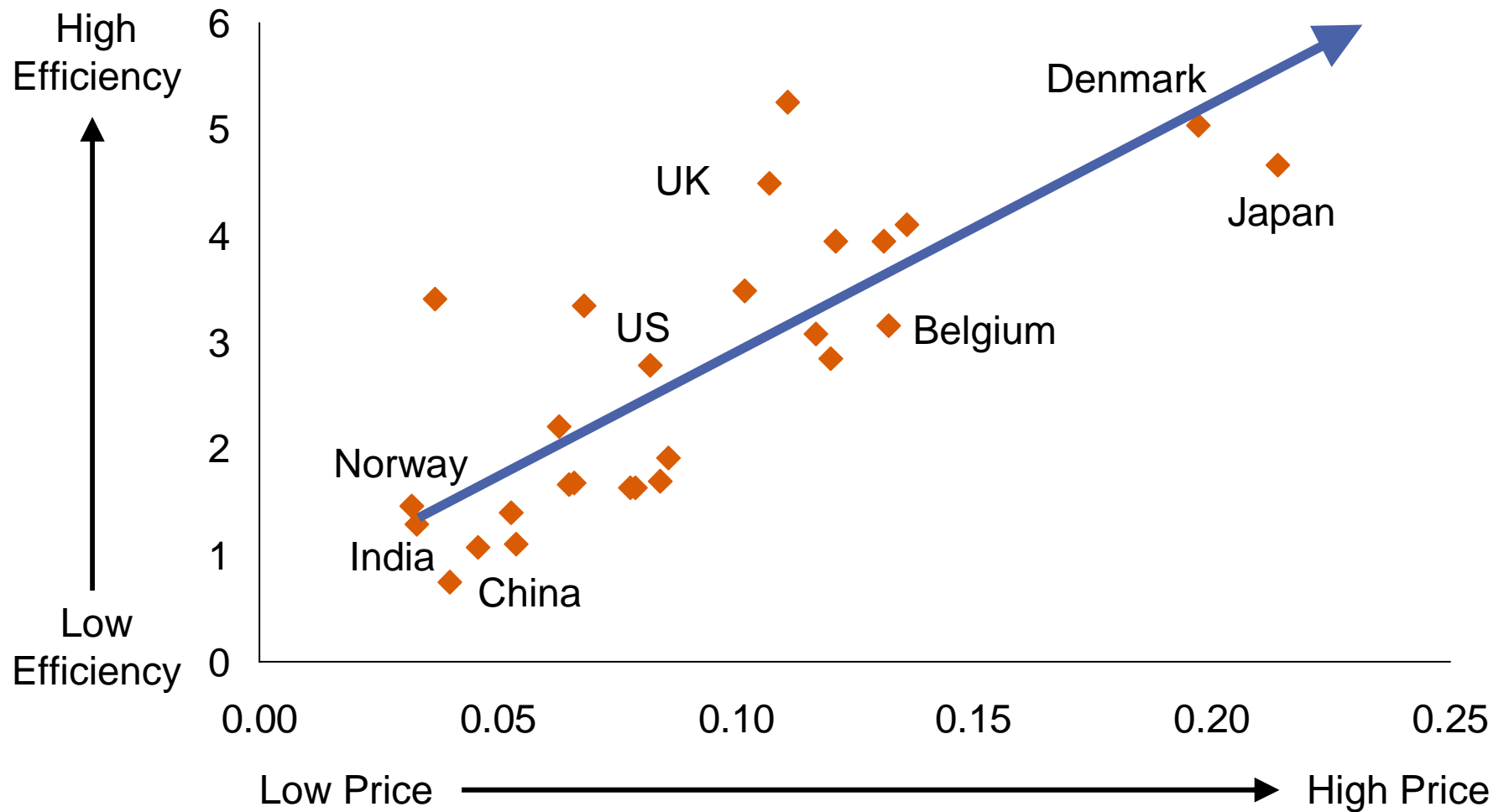
Improve energy efficiency



Total Spending to Control Emissions Will Be Large



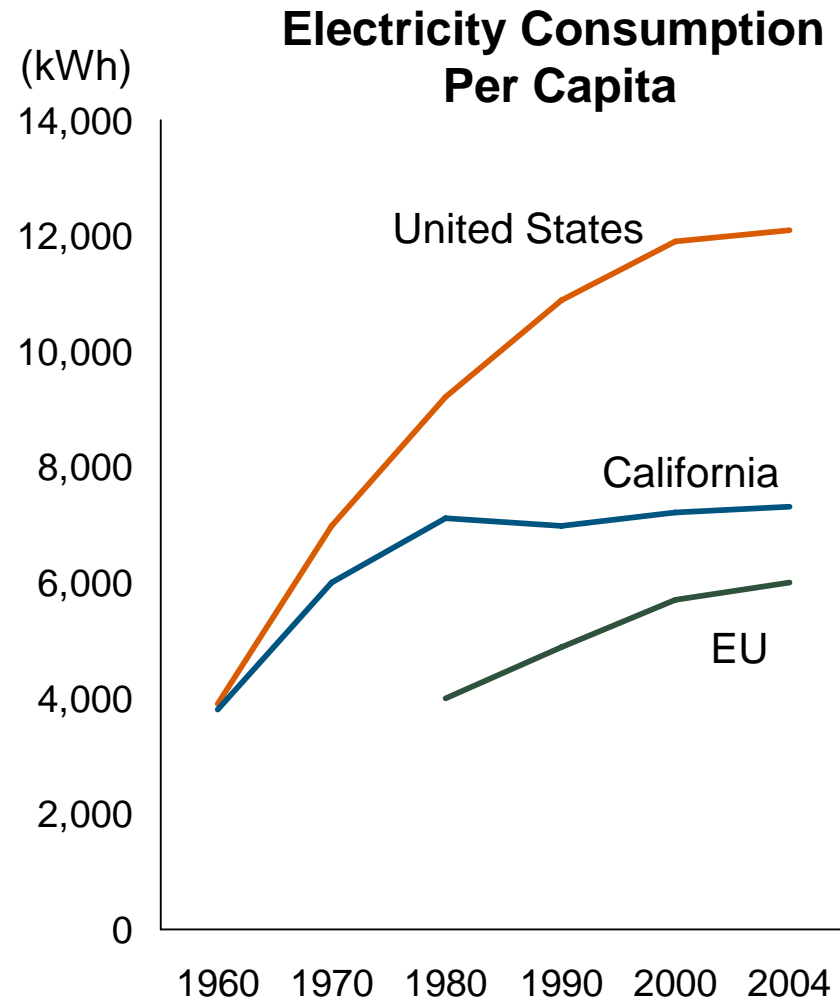
Price of Electricity Tends to Drive Efficiency



Data from 2000
Source: EIA, World Bank and AllianceBernstein

Regulation Can Also Drive Efficiency...

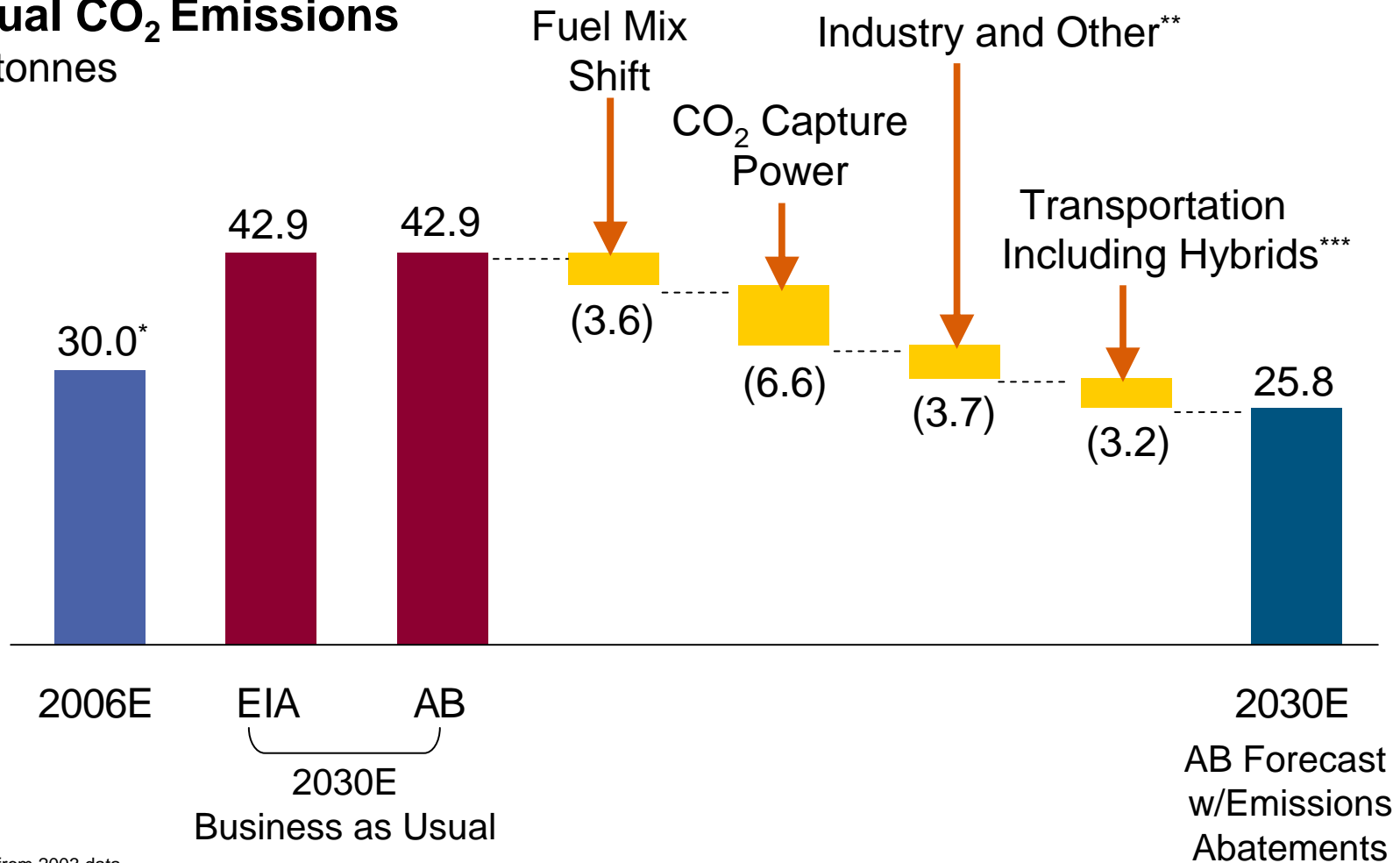
- California first adopted stringent appliance and building standards in the 1970s
- The EU has proposed a 20% improvement in home appliance efficiency
- The US is considering new standards for motors, drives and home appliances



Source: California Energy Commission, California Public Utilities Commission, European Union and US Department of Energy

...But Emissions Control Efforts Will Make a Big Difference

Annual CO₂ Emissions Gigatonnes



*Estimated from 2003 data

**Includes some CO₂ capture

***Only reflects decline in emissions from increased fuel economy

Source: EIA, IEA, Oak Ridge National Laboratory (ORNL), WRI and AllianceBernstein

Macroeconomic Implications of Reducing Emissions

- Global coordination to limit emissions will lead to spread of clean technologies and least-cost carbon practices
- Jobs and wealth will be created
- Energy productivity will improve
- Geopolitical risk may fall as influence of oil wanes

Investment Implications: The Major Winners

Generating Equipment



Pipeline Operators



Transmission Equipment



Engineering and Construction Firms



Electric Utilities



Power Electronics



Oil Field Services

