A Century's Quest for Energy Policy Consensus

Section 4: Energy and Climate Change
Reconciling Incompatible Goals

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The Climate Change Debate

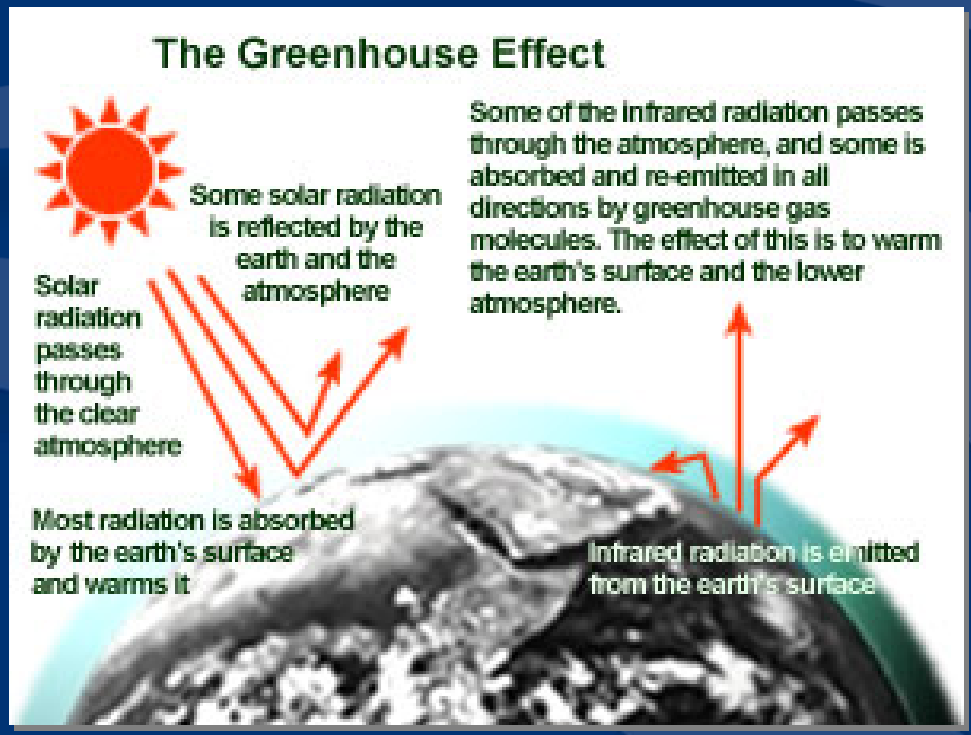
"Climate change is a new and very different national security challenge…it will cause shifts in fundamental building blocks of economic, social and political systems around the world. Throughout human history, disruption on this scale almost always meant war."

Senator Joseph Biden

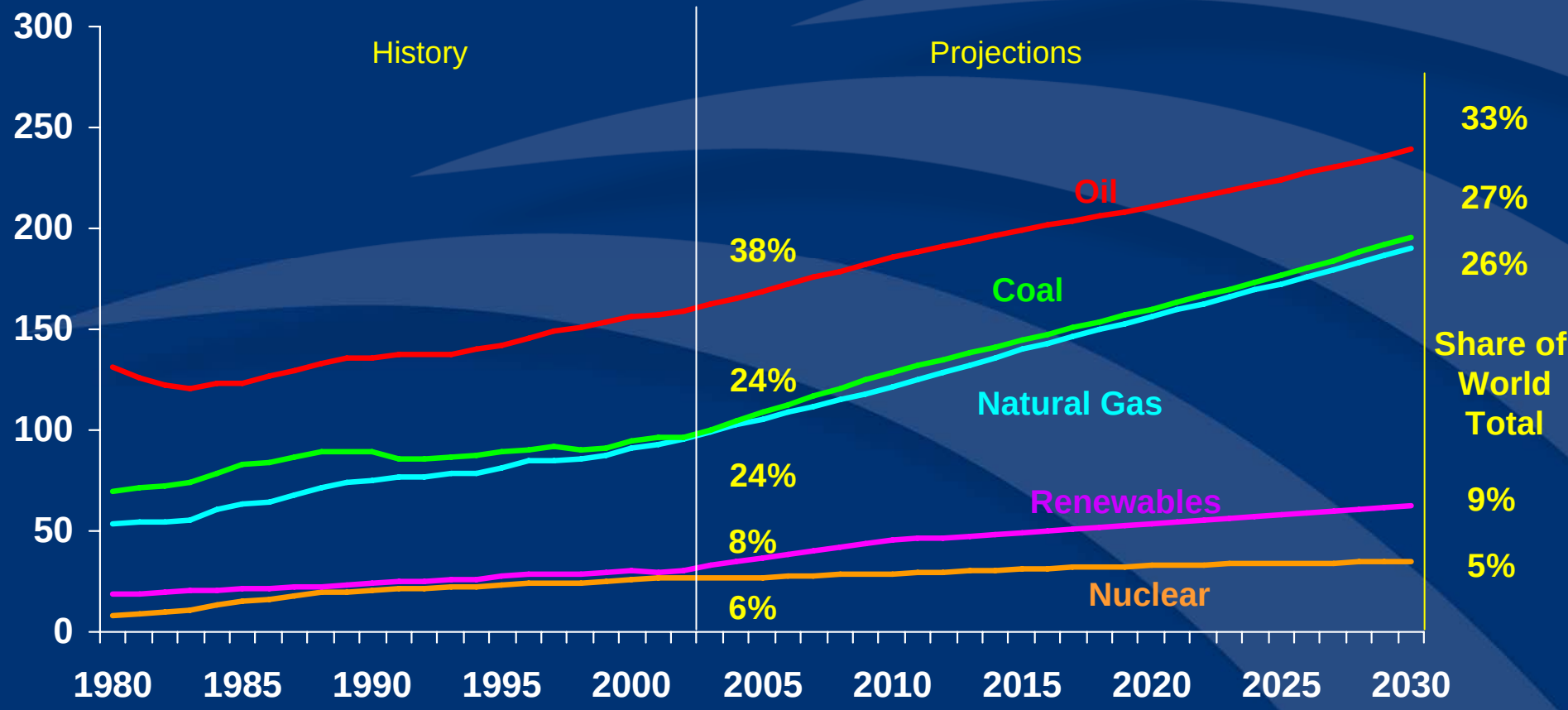
9 May 2007

The Greenhouse Effect

- Greenhouse gases trap heat
- Without them, Earth would be 60º F. colder
- Heat trapping properties of GHGs are well-understood

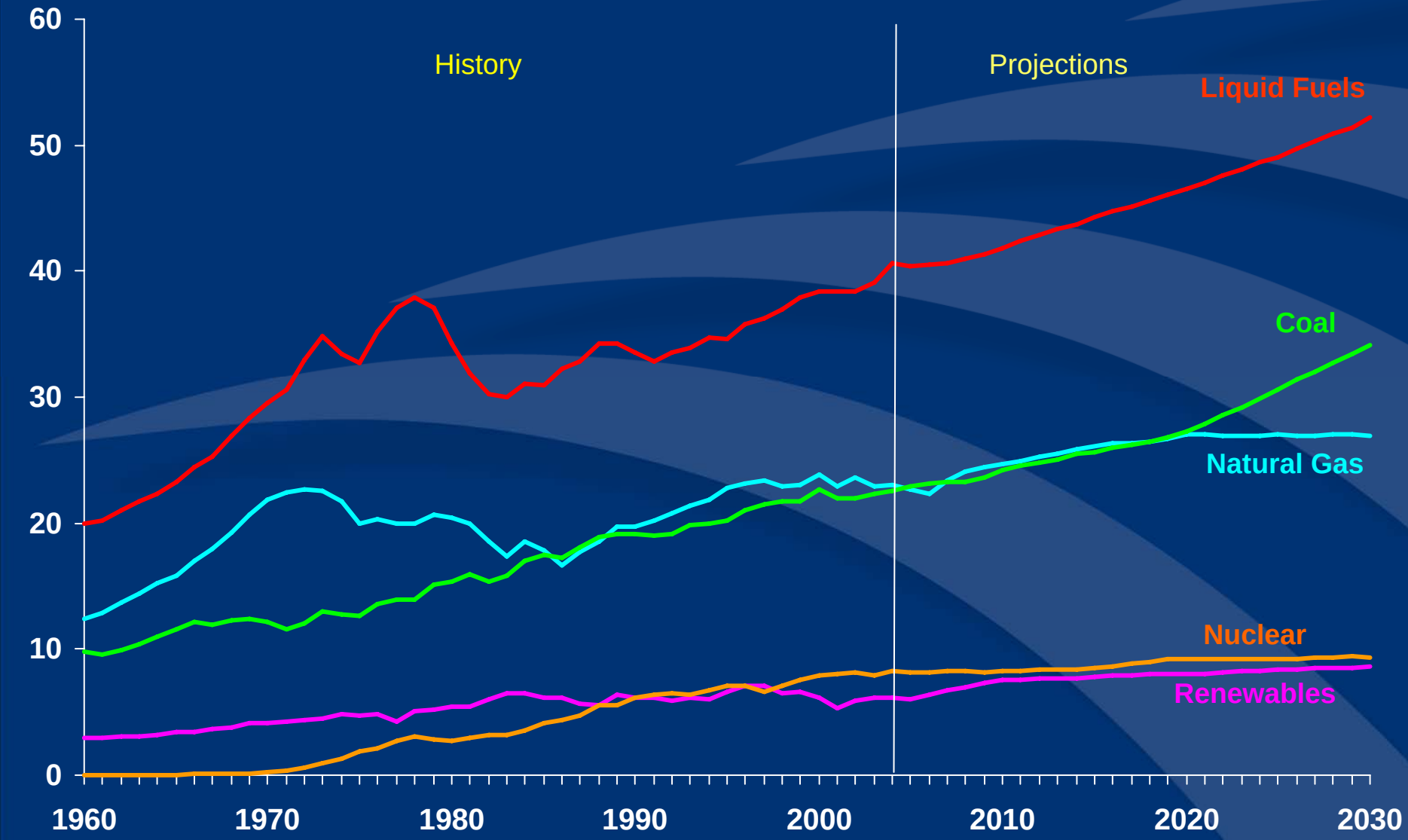


World Marketed Energy Use by Fuel, 1980-2030 (Quadrillion Btu)



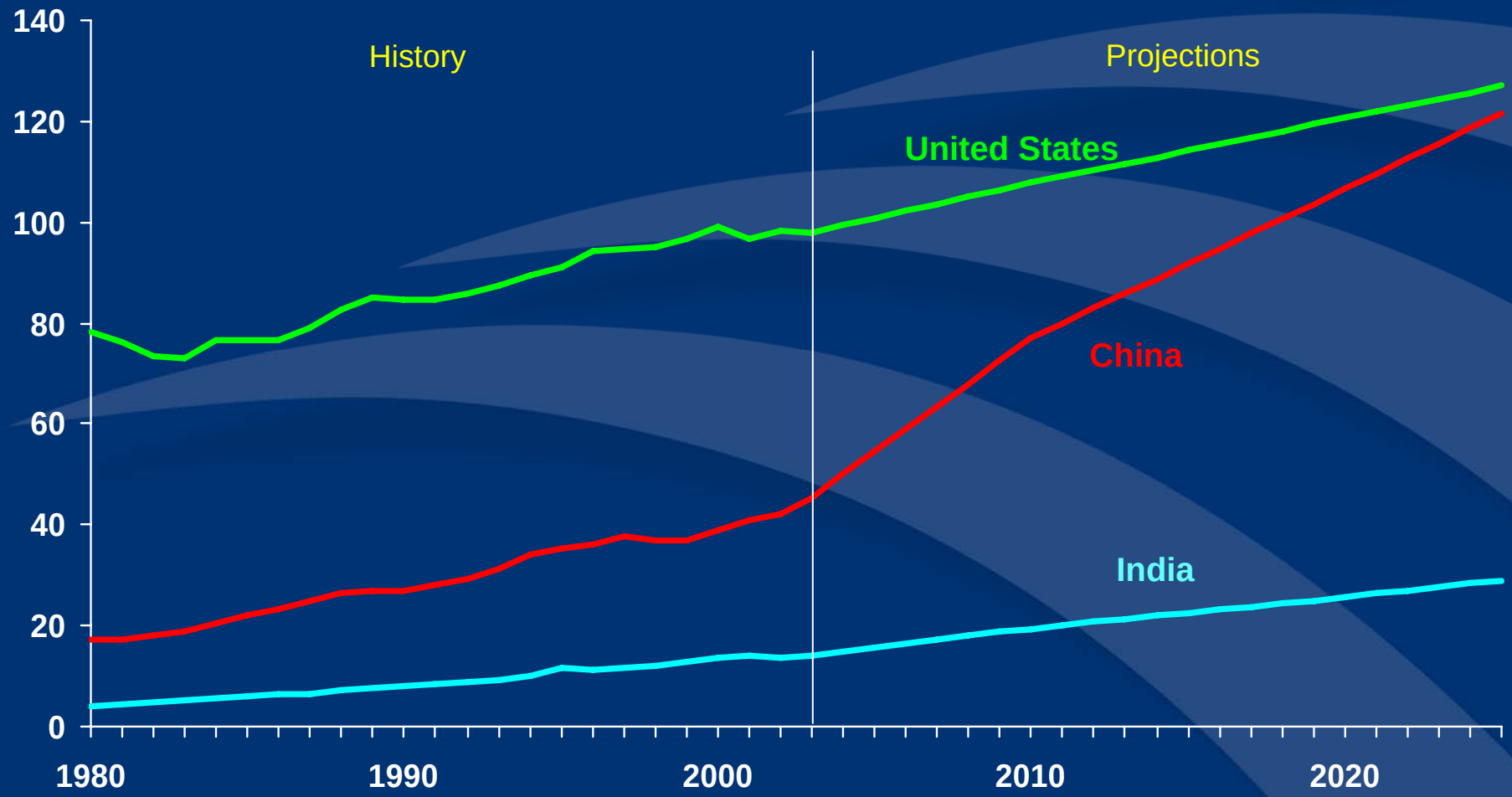
International Energy Outlook 2006

U.S. Primary Energy Consumption by Fuel, 1960-2030 (Quadrillion Btu)



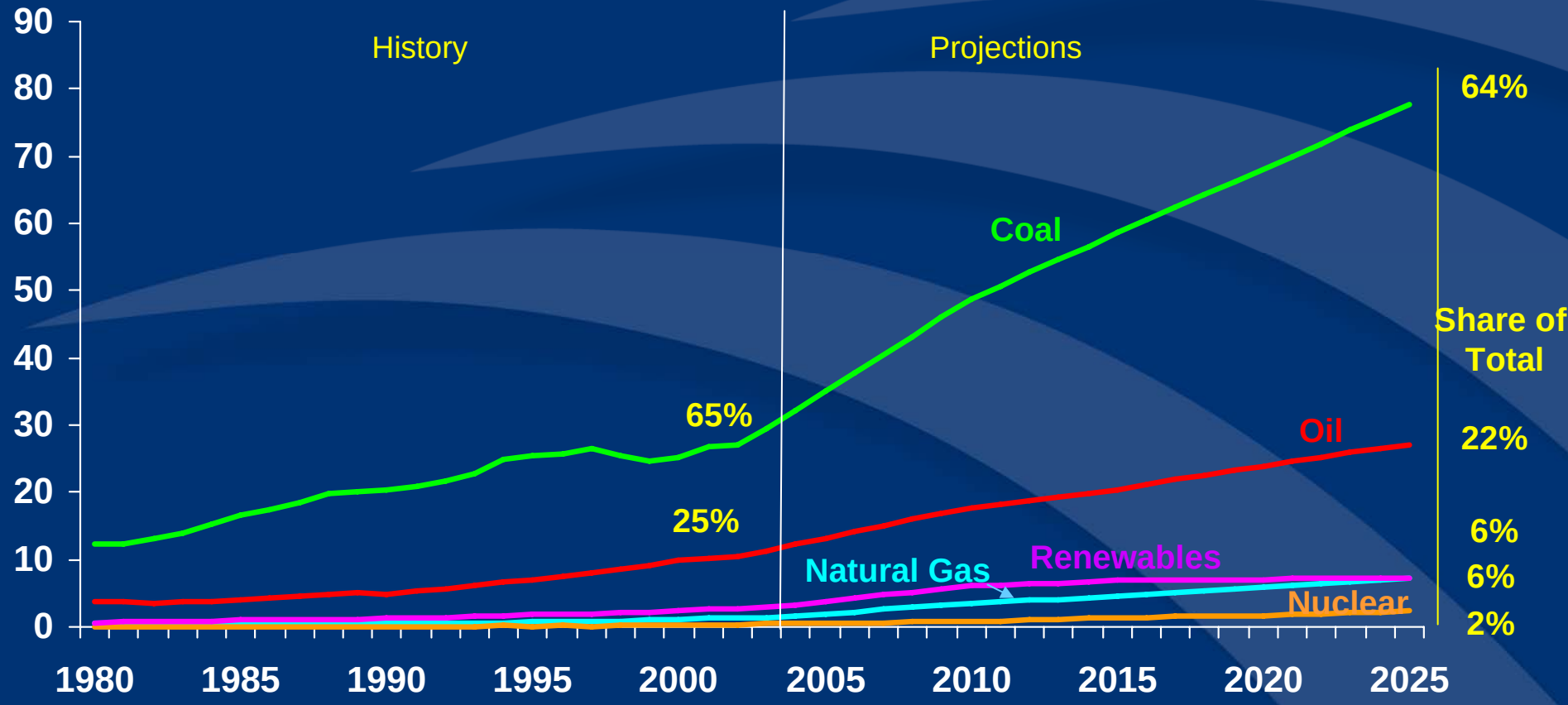
Annual Energy Outlook 2007

Energy Consumption in the United States, China, and India, 1980-2025 (Quadrillion Btu)



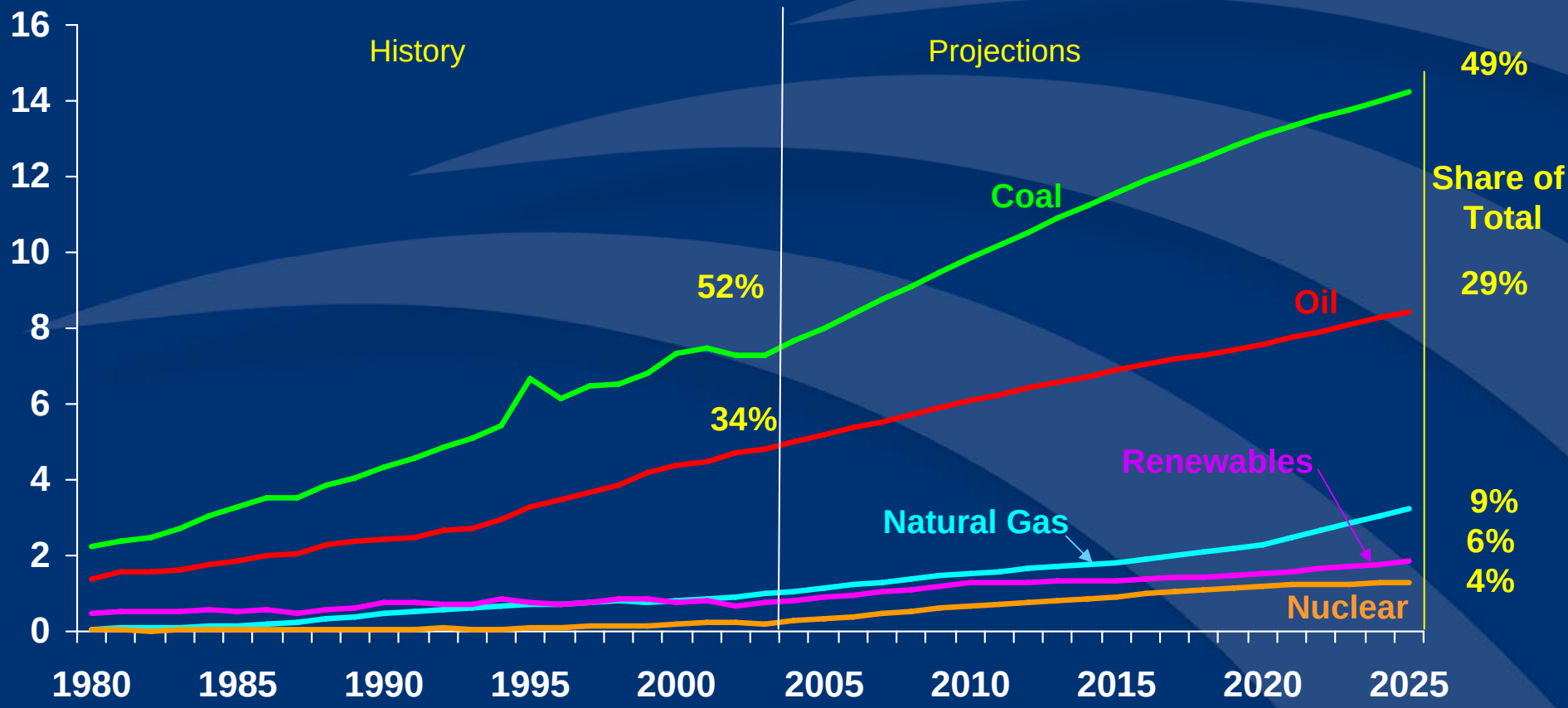
International Energy Outlook 2006

Chinese Marketed Energy Use by Fuel, 1980-2025 (Quadrillion Btu)



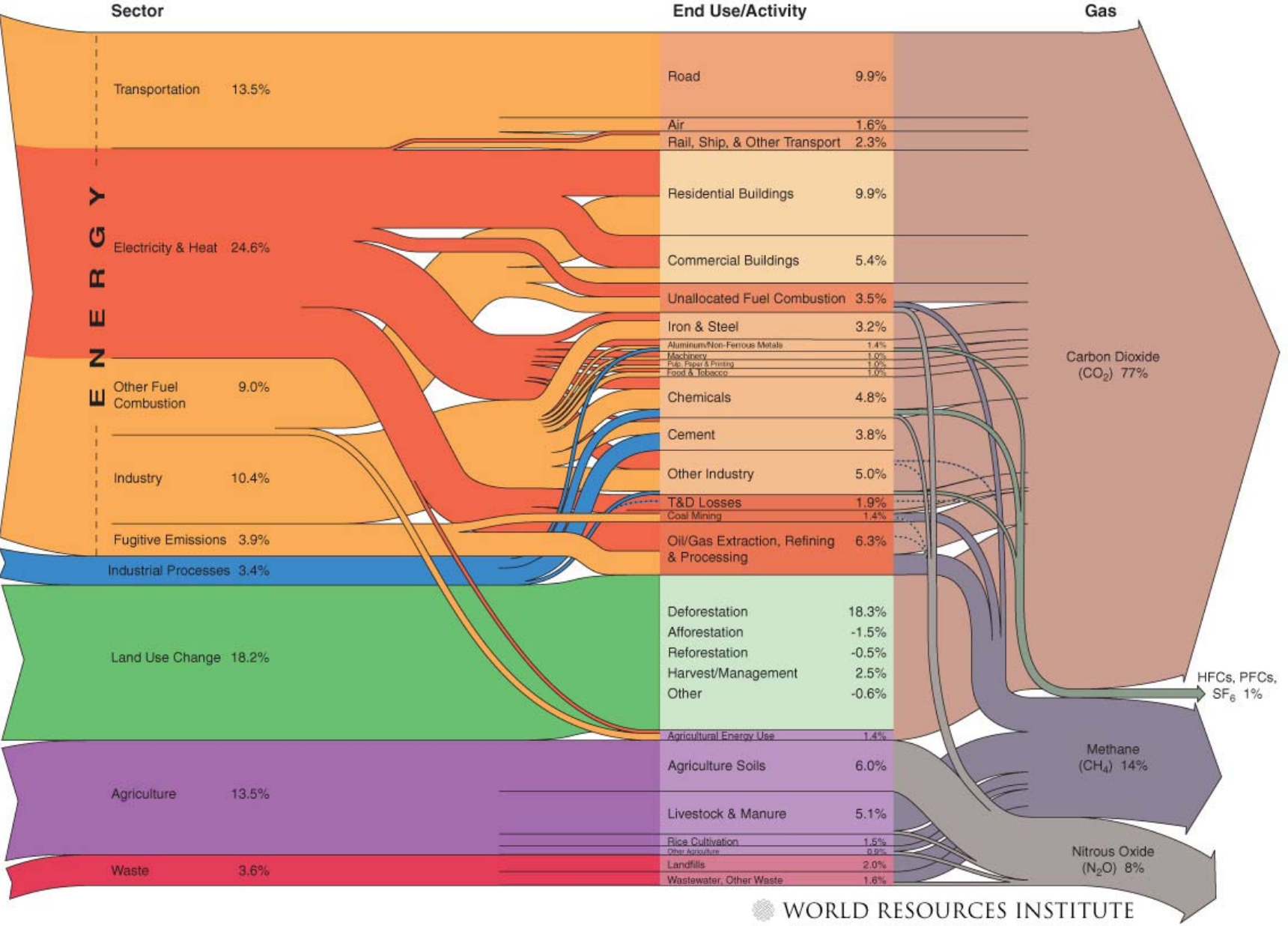
International Energy Outlook 2006

Indian Marketed Energy Use by Fuel, 1980-2025 (Quadrillion Btu)

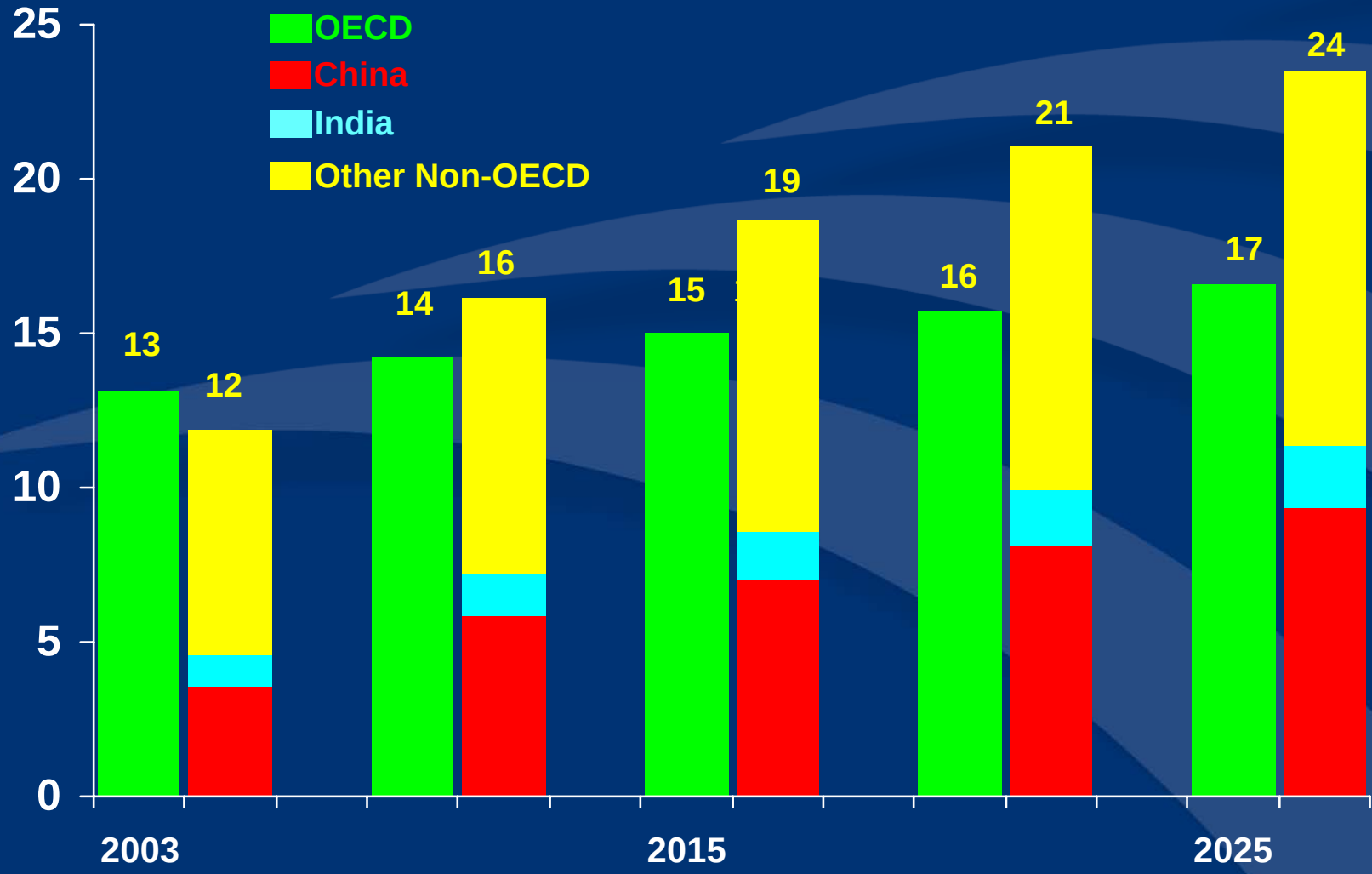


International Energy Outlook 2006

World GHG Emissions Flow Chart

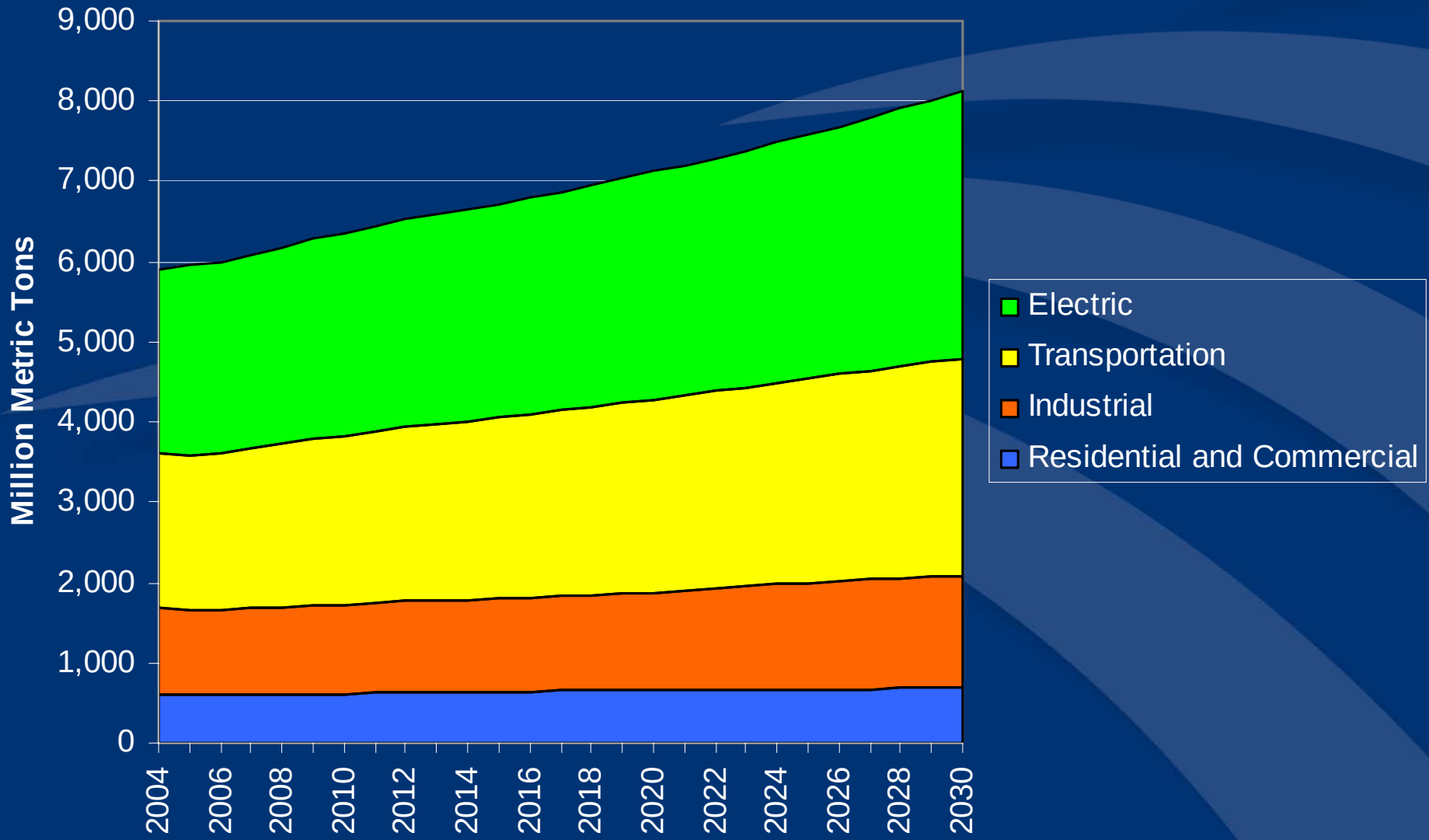


World Carbon Dioxide Emissions, 2003-2035 (Billion Metric Tons)

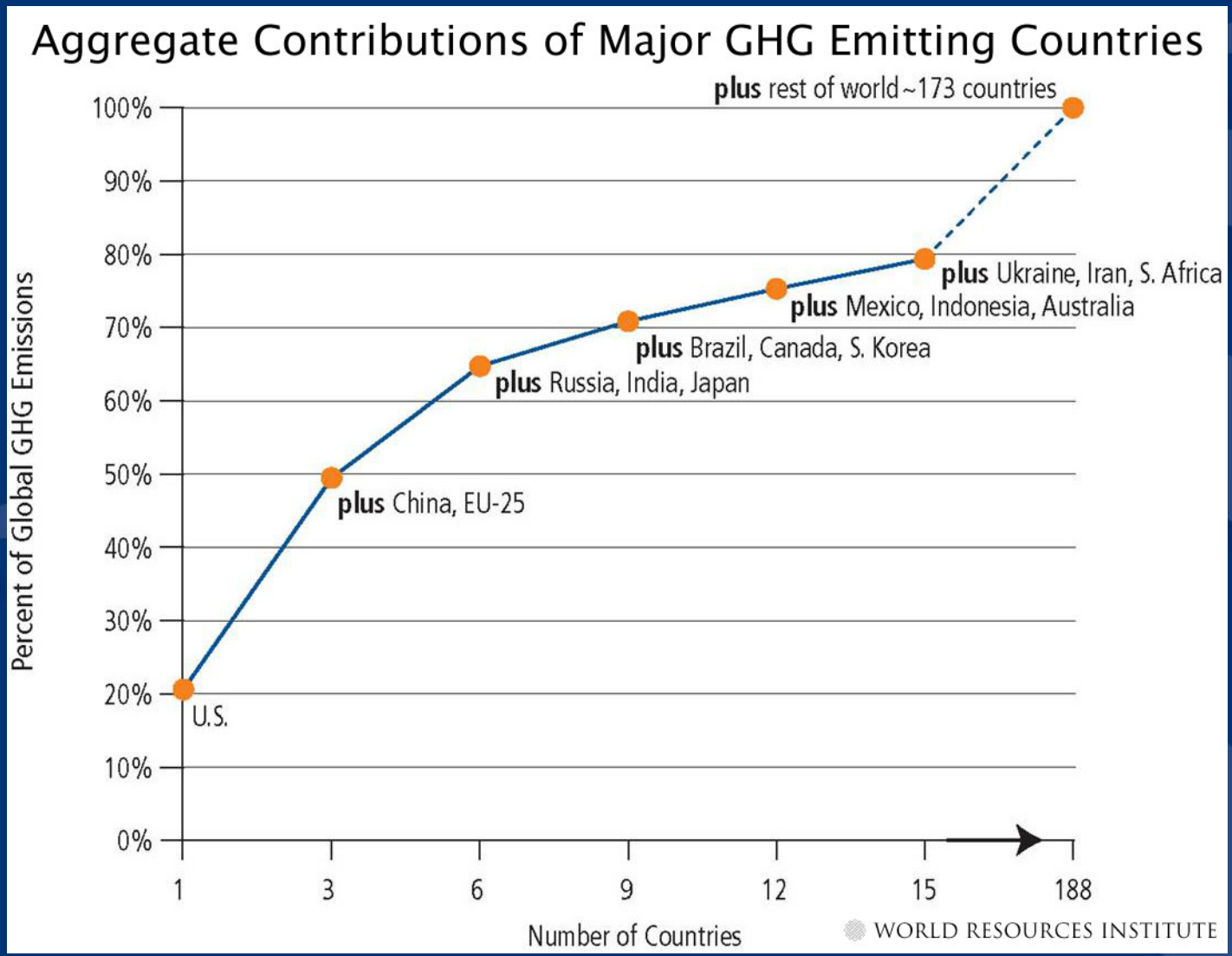


International Energy Outlook 2006

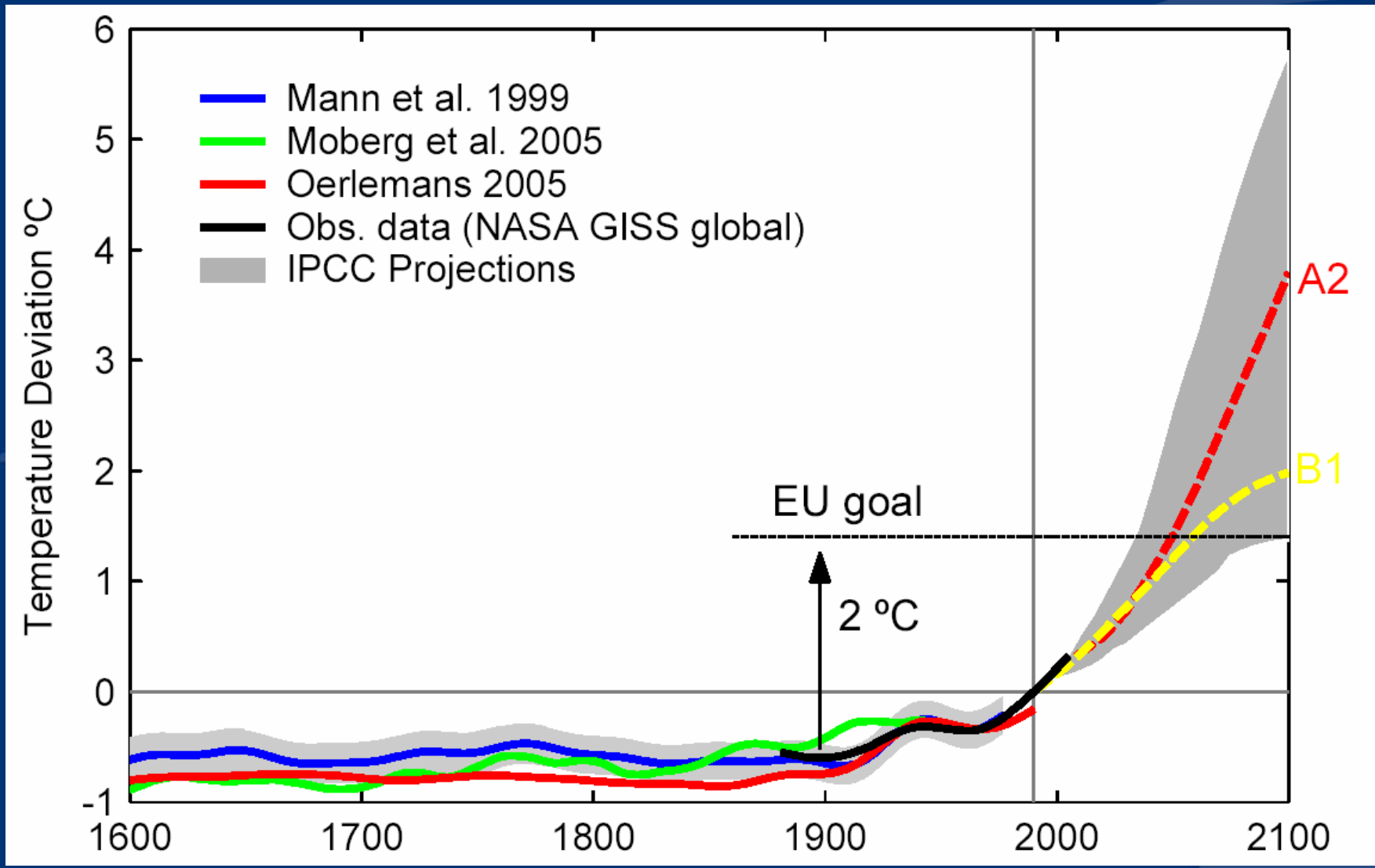
U.S. Carbon Dioxide Emissions by Sector



Source: EIA AEO 2006.


Aggregate Contributions of Major GHG Emitting Countries
plus rest of world ~173 countries
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
plus Ukraine, Iran, S. Africa
plus Mexico, Indonesia, Australia
plus Brazil, Canada, S. Korea
plus Russia, India, Japan
plus China, EU-25
U.S.
Percent of Global GHG Emissions
1
3
6
9
12
15
188
Number of Countries
WORLD RESOURCES INSTITUTE

The Last 400 and Next 100 Years of Global Temperature

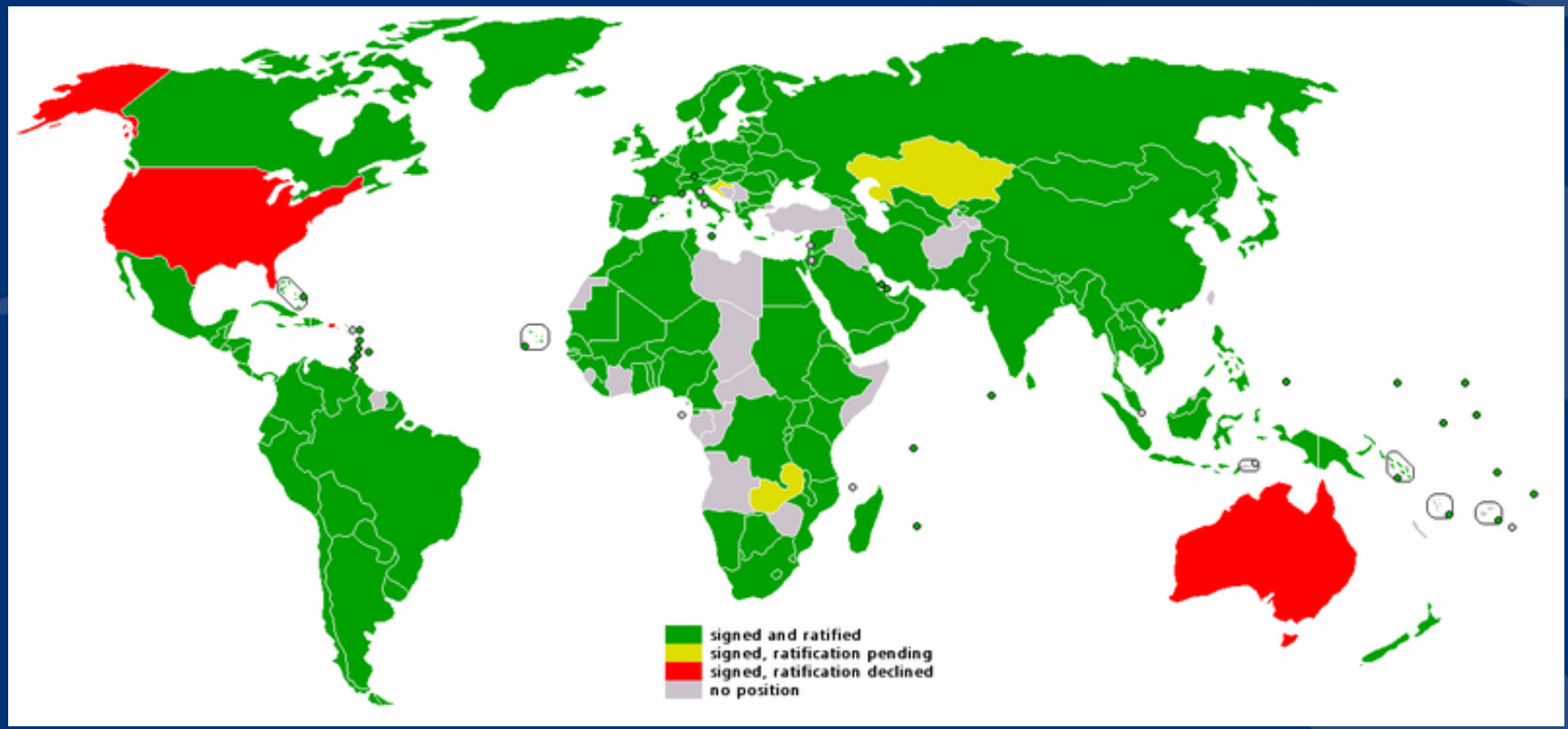


Mid-range scenarios are heading for T's last seen 30 million years ago.

Climate Change Science Conclusions

- Science is clear:
  - GHGs warm atmosphere
  - Atmospheric composition has been altered due to emissions of GHGs and aerosols
  - Observed warming and other climate change indicators
- Consensus that most of recent warming is human induced
- Range in projections for rate and magnitude of future warming due to uncertainties but:
  - We are already committed to some warming
  - All projections suggest future increases in concentrations and temperature

Climate Change Policy Development



Milestones in Climate Policy Development

- 1988: U.N. Approves establishment of Intergovernmental Panel on Climate Change
- 1992: Rio Conference reaches agreement on Framework Convention on Climate Change
- 1993: President Clinton calls for tax on energy consumption
- 1997: U.S. and other countries sign Kyoto Protocol
- 2001: President Bush withdraws from Kyoto Treaty
- 2002: President Bush announces package of voluntary measures to reduce “energy intensity” and funds R&D on low carbon technologies

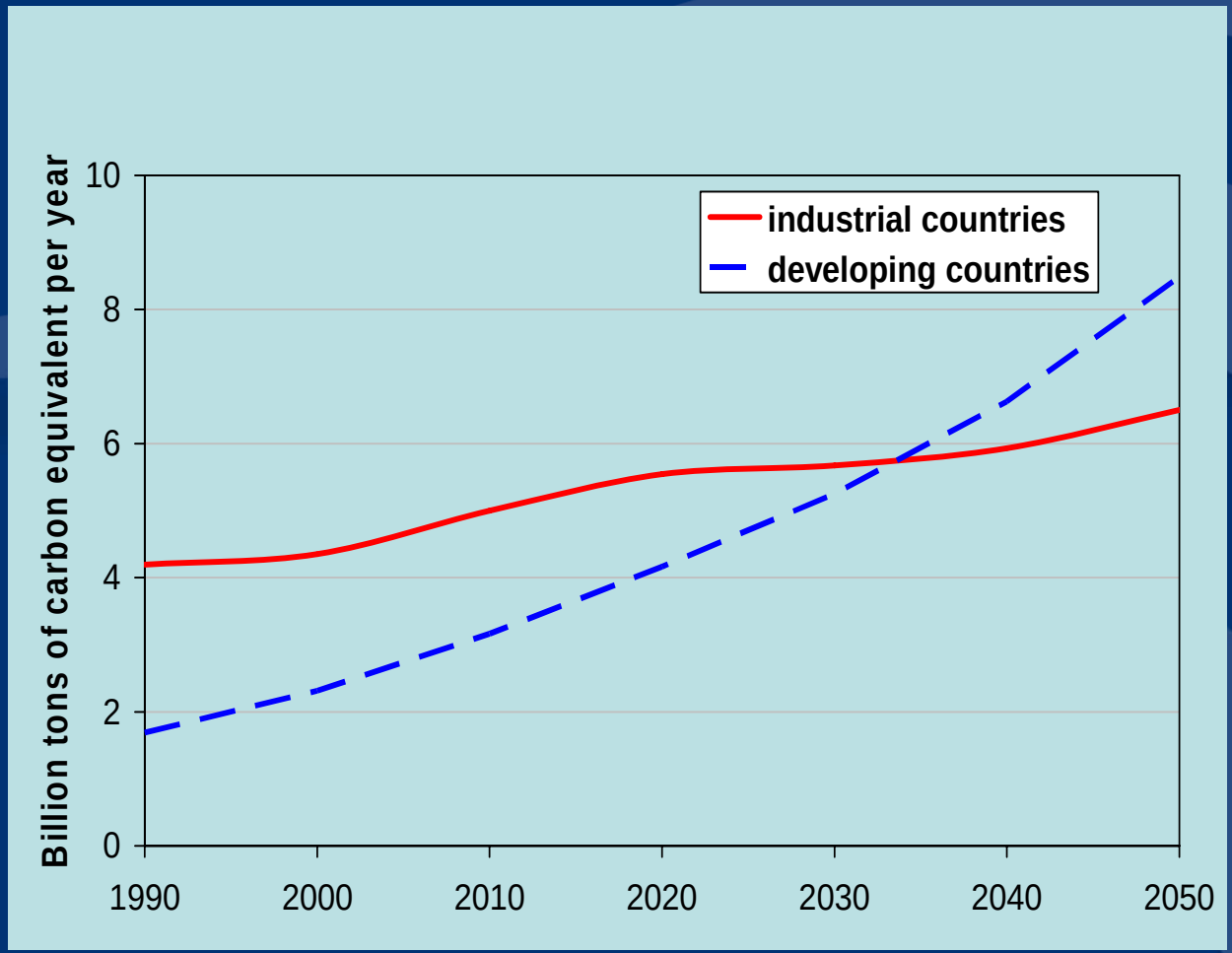
Kyoto Protocol

- Specifies legally binding emission limits for industrialized countries, relative to 1990 levels, over 2008-2012.
- Countries are free to trade their requirements, as well as bank them for future use.
- Can generate credits through projects in developing countries (Clean Development Mechanism or CDM) that can be applied to industrialized country commitments.
- Came into force on February 16, 2005, without the U.S. or Australia.
- Compliance with current commitments, as well as possibility of future targets, unclear

Assessment of Kyoto

- Generally adopted the flexible approach advocated by the U.S.
- But large emission reductions in short timeframe would be expensive
  - U.S. target was 7% below 1990 levels (30% reduction from business as usual) by 2012
- No requirement for developing country emission reductions

Developed vs. Developing Country Emissions



Policy Options to Address Climate Change

- Emissions trading
- Taxes
- Regulatory standards
- Voluntary Agreements
- R&D

Emissions Trading

- Set a target or cap
- Distribute tradable permits (allowances) to industry
- Companies choose emission reduction strategies and may trade allowances
- Government measures emissions and assesses penalties if emissions exceed allowances
- Cap provides certainty that a quantity of emissions will not be exceeded but leaves uncertainty about price

Taxes

- Set a price for carbon or carbon dioxide
- Measure emissions (or fuel use) and collect fee
- Creates certainty about price of policy (but not quantity of emissions)
- A hybrid of emissions trading and a tax is also possible.

Regulatory Standards

- Conventional, direct regulation
- Less flexible, but still appropriate in some situations
- Examples:
  - Auto efficiency standards (CAFE)
  - Building standards
  - Technology mandates for power plants

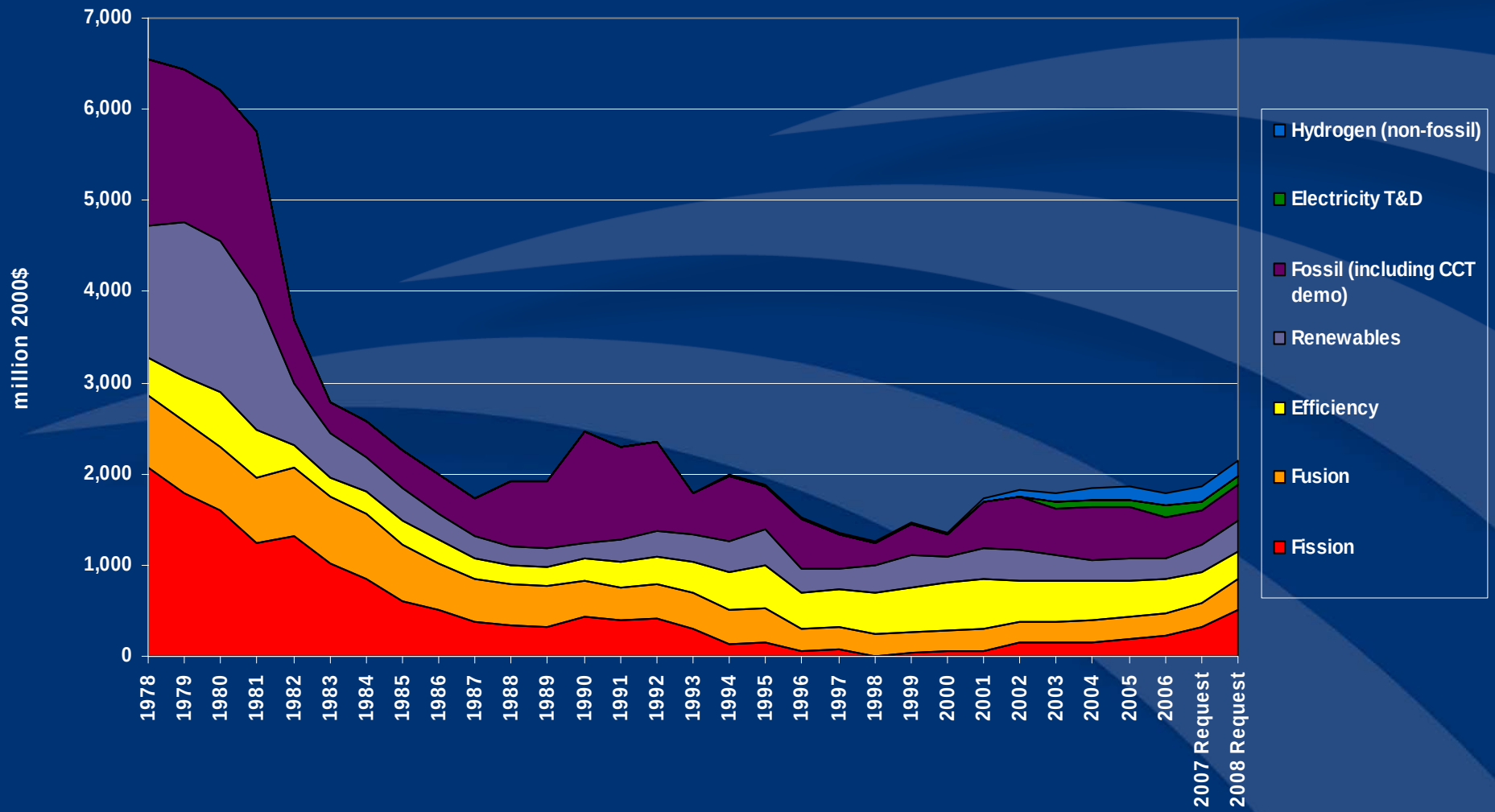
Voluntary Agreements

- Companies commit to certain activities
  - Emissions targets
  - Energy efficiency goals
- Agreements can take a variety of forms
  - In some programs (in Europe), there is a more formal structure with consequences if companies do not fulfill agreements
  - U.S. programs: voluntary without consequences

Research & Development

- Government expenditures on technology development
- Fills a gap for longer-term development of “higher risk” technologies
- May need to be paired with other policies for deployment and diffusion of low carbon technologies

U.S. DOE Energy RD&D Funding History



Source: Gallagher, K.S., Sagar, A, Segal, D, de Sa, P, and John P. Holdren, "DOE Budget Authority for Energy Research, Development, and Demonstration Database," Energy Technology Innovation Project, John F. Kennedy School of Government, Harvard University, 2007.

Current Climate: Politics and Policy of Climate Change

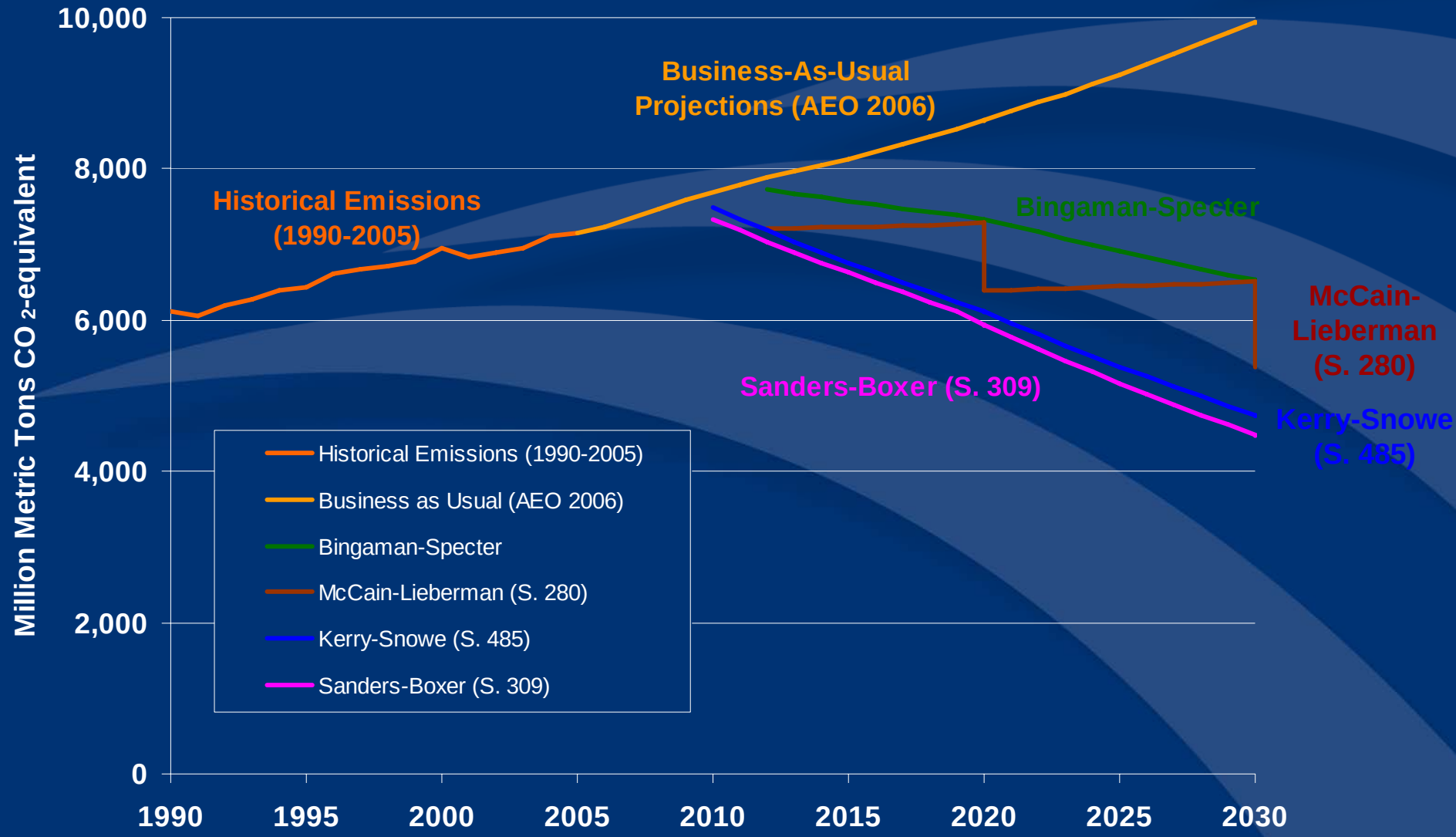
CCX

What Would Jesus Drive?
www.WhatWouldJesusDrive.org

Bush Administration Policy

- National goal to reduce GHG intensity (tons of CO_2 equivalent per unit of GDP) by 18% from 2002 levels by 2012
  - More than 60 federal energy-related programs (voluntary, mandatory, and with incentives) contribute to achieving goal
- Funding for climate change science and technology programs
  - Climate Change Technology Program ($3 billion)
    - Significant funding for research and development of new technologies (Zero emission coal-fired power plant (FutureGen), hydrogen economy, carbon sequestration, Fusion Energy, GNEP)
  - Climate Change Science Program ($2 billion)

Comparison of Legislative Proposals in the 110th Congress



Overview of Key U.S. Climate Change Legislative Proposals

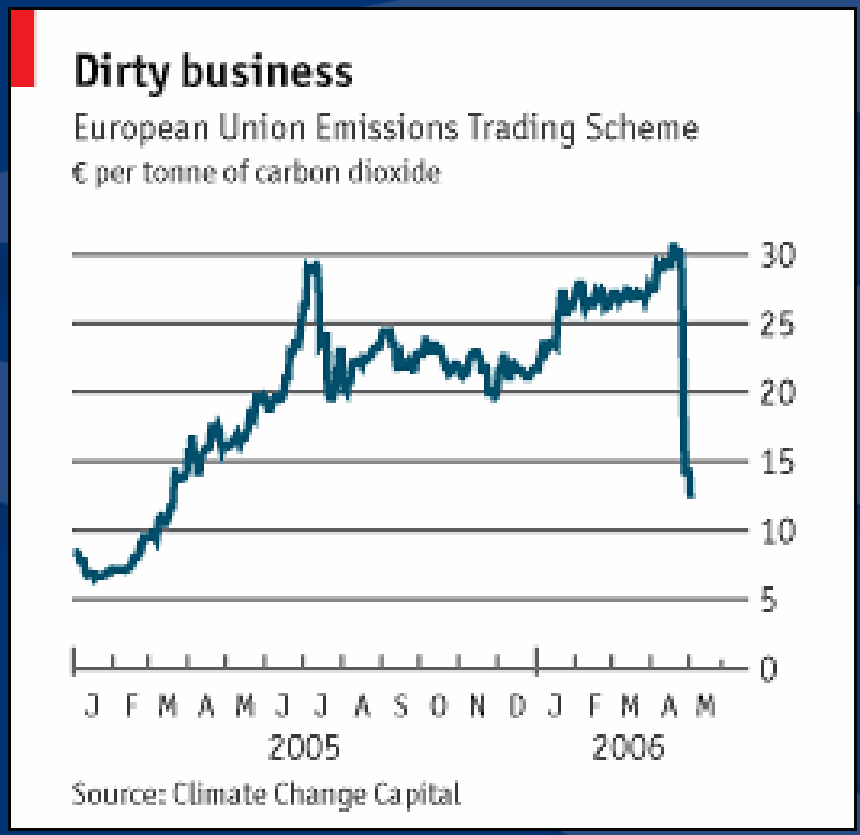
- Bingaman/Specter
  - GHG 2006 levels by 2020
  - GHG 1990 levels by 2030
- Lieberman/Warner
  - GHG 15% below 2005 by 2020
    - 30% below 2005 by 2030
    - 50% below 2005 by 2040

Summary of the EU Trading System

- **Participants:** 25 Member States (MS)
- **Timing:** Periods are 2005-2007 and 2008-2012
- **Coverage:**
  - **Sectors:** Energy activities (including electric power), iron & steel, minerals, pulp and paper
  - ~11,500 installations covering 46% of CO_2 emissions

EU Market

- Active trading
  - $9 billion in transactions in 2005
  - $19 billion in the first 9 months of 2006
- Volatility
  - Poor market information?
  - Fuel prices?
  - Too many allowances?
- New caps and allocations are under discussion for 2008-2012 period



Graphic: The Economist

Discussion

- Should the U.S. adopt a mandatory emissions system?
- Should the US reengage in Kyoto and the UN-led International system?
- Should the US begin to reduce its own emissions domestically first?
- What obligation do the rich countries like the US have to address this issue first.
- When it is reasonable to expect developing countries to make commitments?
- What should the US role be in creating and diffusing technology domestically and around the world?
- What is the intersection between concerns about climate change and concerns about oil dependence? Are there other reasons the US should be moving away from fossil fuel based economy?

Discussion (continued)

- Will it be in U.S. economic self interest to reduce emissions?
- What role do you think climate will play in the 2008 Presidential election?
- Do you think the US has the political will to address climate change sufficiently in time to reduce its impact?
- Do you think your children and grandchildren are going to live in a different world—no matter what we do?
- How important are energy and climate change to the way judge a candidate?