

Energy: A View from EIA
for
National Academy of Sciences
National Research Council
Committee on
Climate, Energy, and National Security

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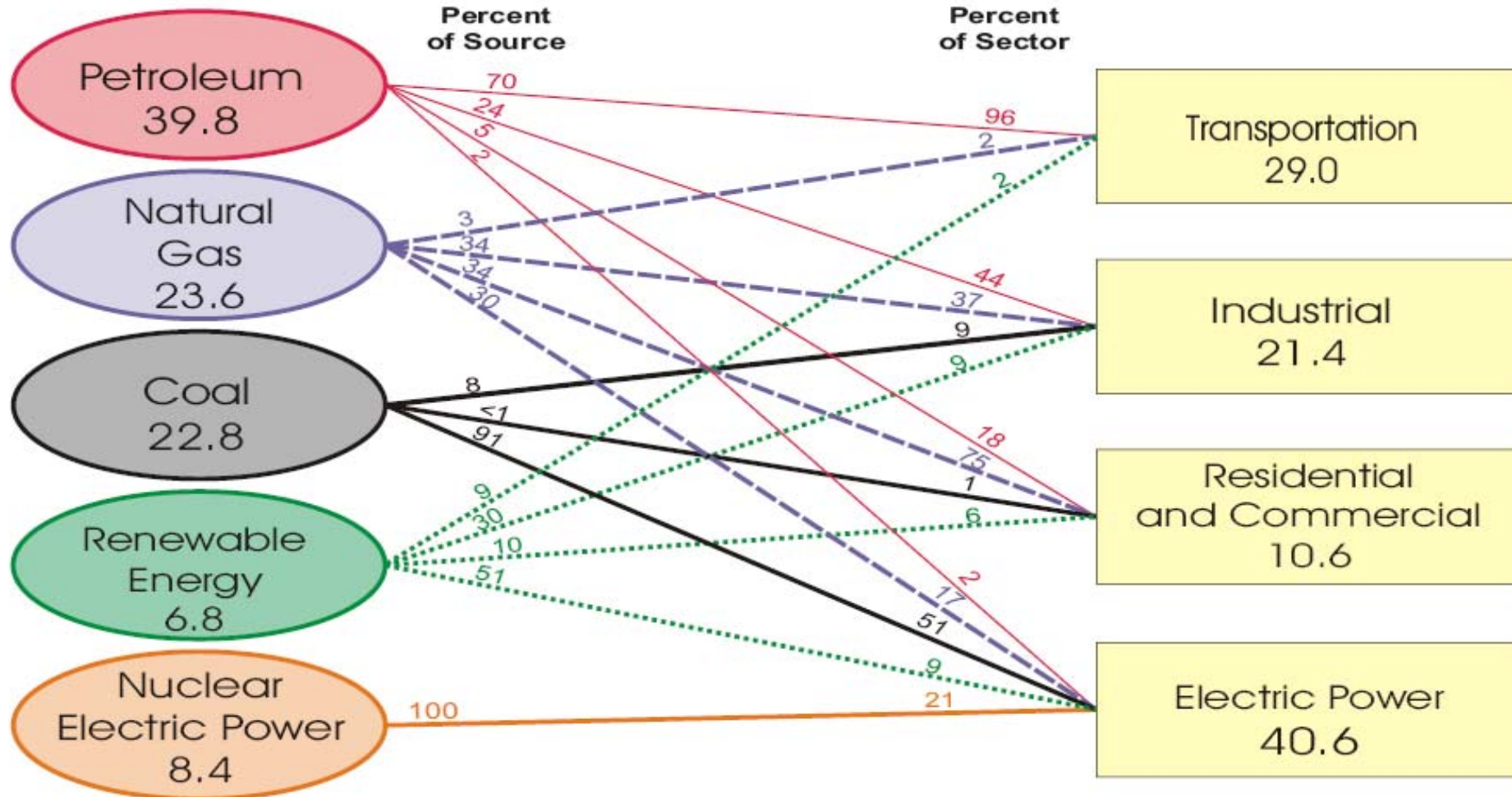


Energy Information Administration
Official Energy Statistics from the U.S. Government

Key Topics

- **Where we stand today**
- **U.S. energy projections under current laws and policies**
 - **Insights from EIA's recent analyses of a cap & trade policy to limit greenhouse gas emissions: an example of using the NEMS.**
- **Global energy projections**
- **Natural gas reserves and resources – an illustration of EIA's approach**

U.S Primary Energy Consumption by Source and Sector, 2007 (quadrillion Btu)

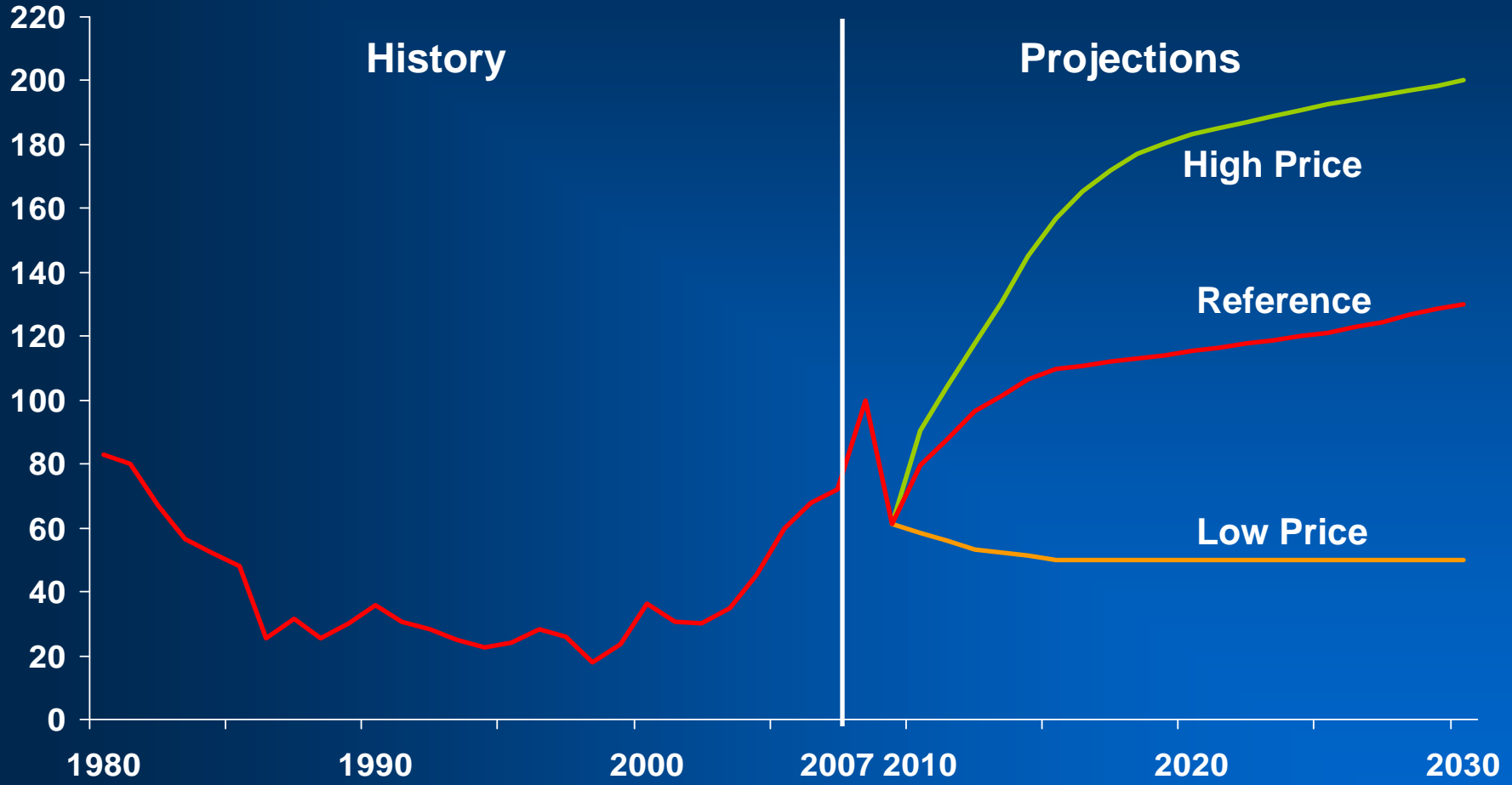


U.S. Energy Projections Under Current Laws and Policies:

**Annual Energy Outlook 2009
Early Release Reference Case**

The reference assumes rising oil prices; the full AEO includes price cases that span a wide range

2007 dollars per barrel



Unconventional liquids become more important over time

(Million barrels per day)

		Low Price Case (prelim)	Reference Case	High Price Case (prelim)
	<u>2007</u>	<u>2030</u>	<u>2030</u>	<u>2030</u>
Conventional Crude*	71.0	93.6	77.3	57.7
Natural Gas Plant Liquids	8.0	11.2	12.4	12.1
Refinery Gain	2.1	3.2	2.7	2.1
Conventional Subtotal	81.1	108.1	92.4	71.9
Unconventional Crude**	2.0	6.7	5.6	6.1
CTL and GTL	0.2	0.8	1.6	2.8
Biofuels (Volume)	1.2	3.3	5.4	7.7
Unconventional Subtotal	3.4	10.8	12.6	16.6
Total Liquids***	85.8	119.3	105.4	88.9

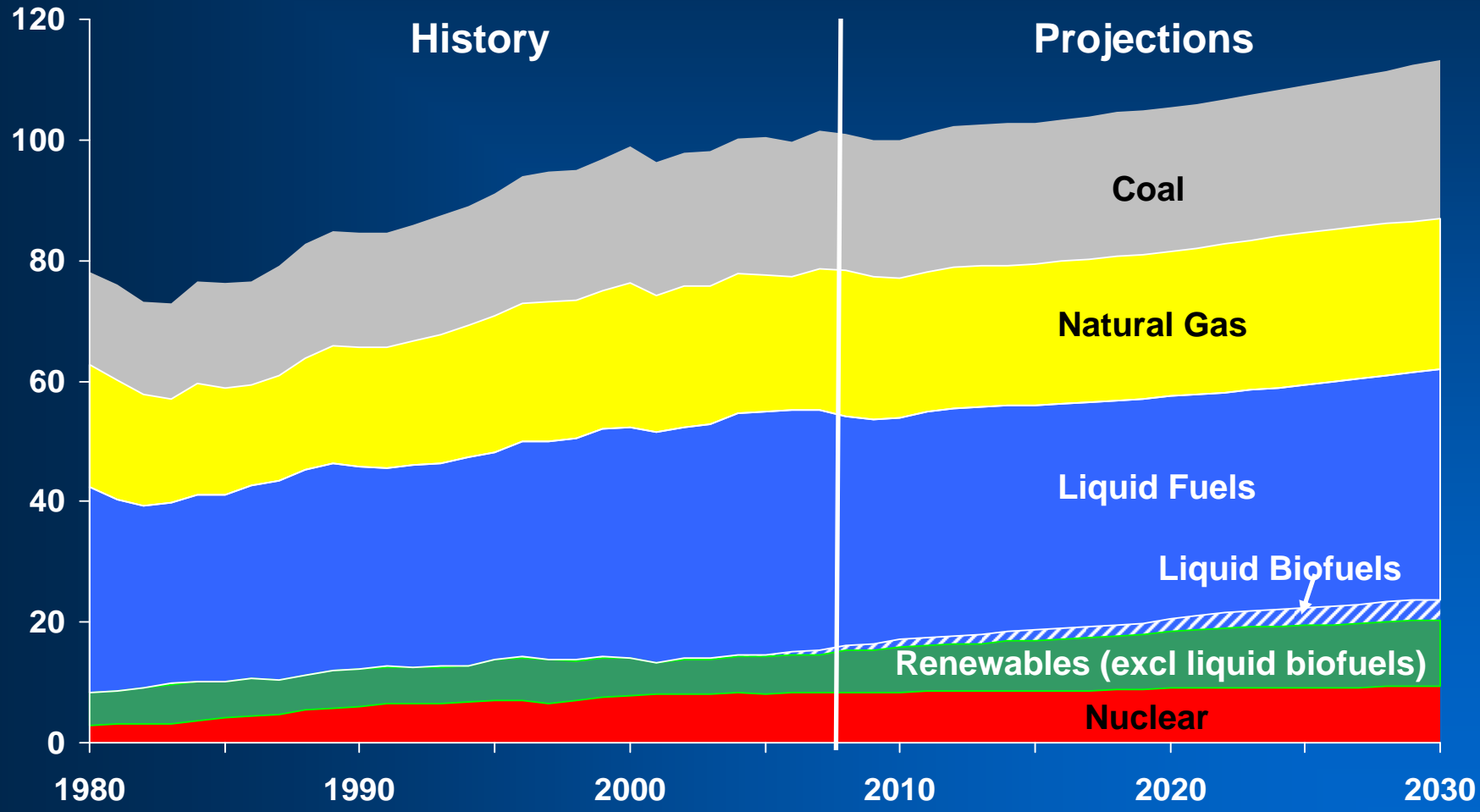
*Crude oil and lease condensates. ** Oil sands, extra-heavy crude, and shale oil

*** includes net stock withdrawals, ethers and other hydrocarbons

Source: Annual Energy Outlook 2009.

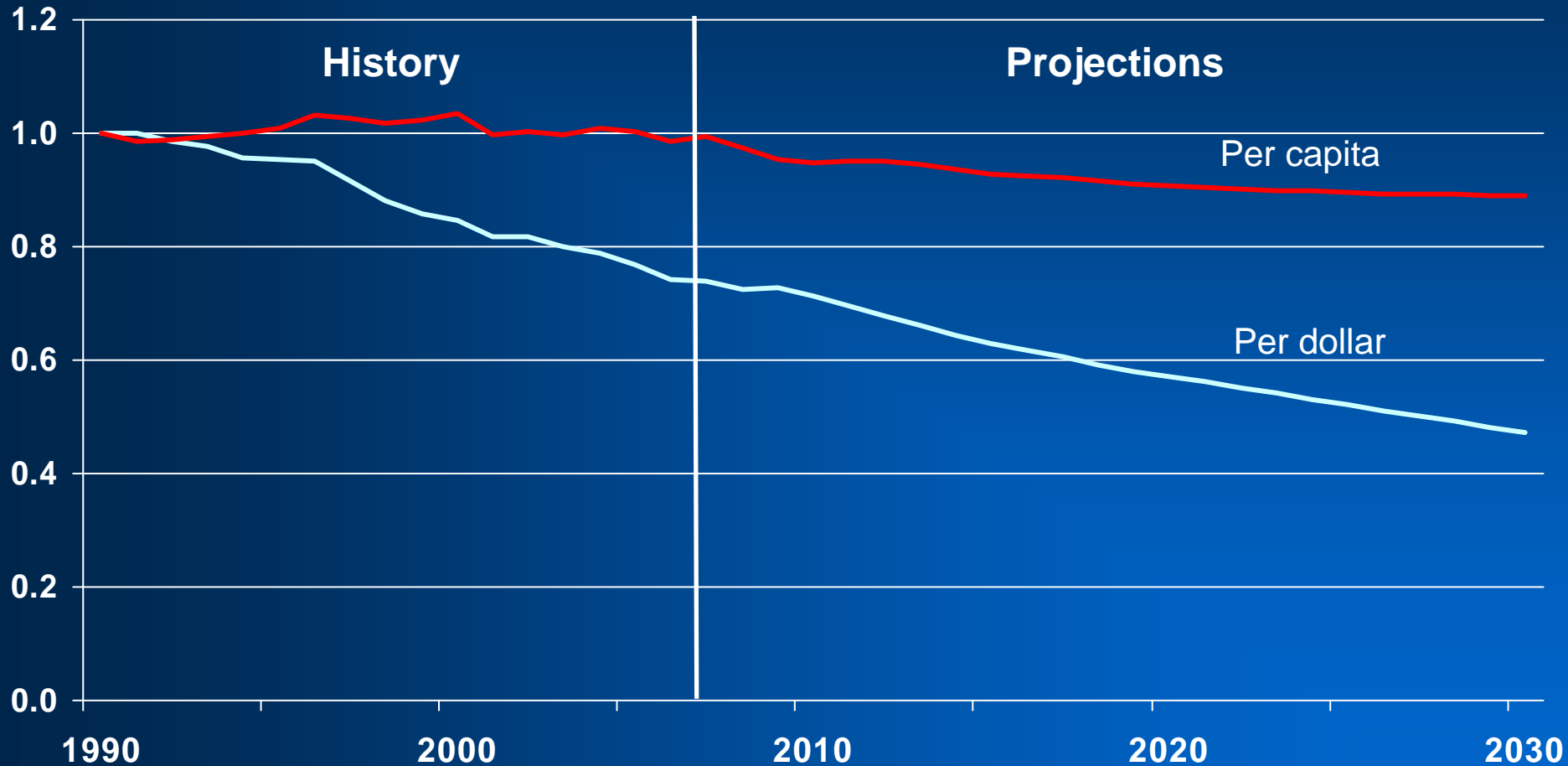
Non-fossil energy use grows rapidly, but fossil fuels still provide 79 percent of total energy use in 2030

quadrillion Btu



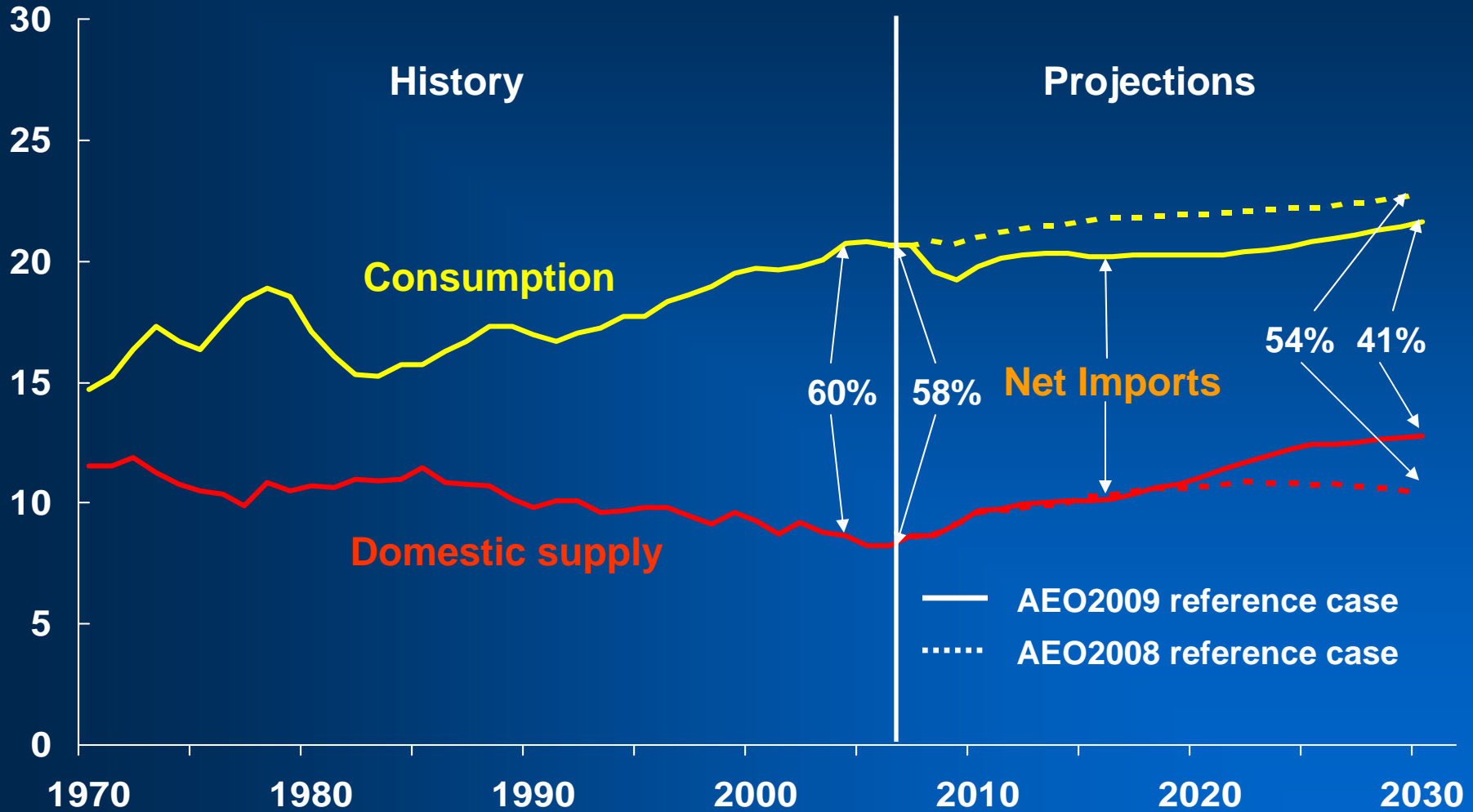
Energy use per dollar of GDP continues to decline; per capita energy use also declines

index, 1990=1.0



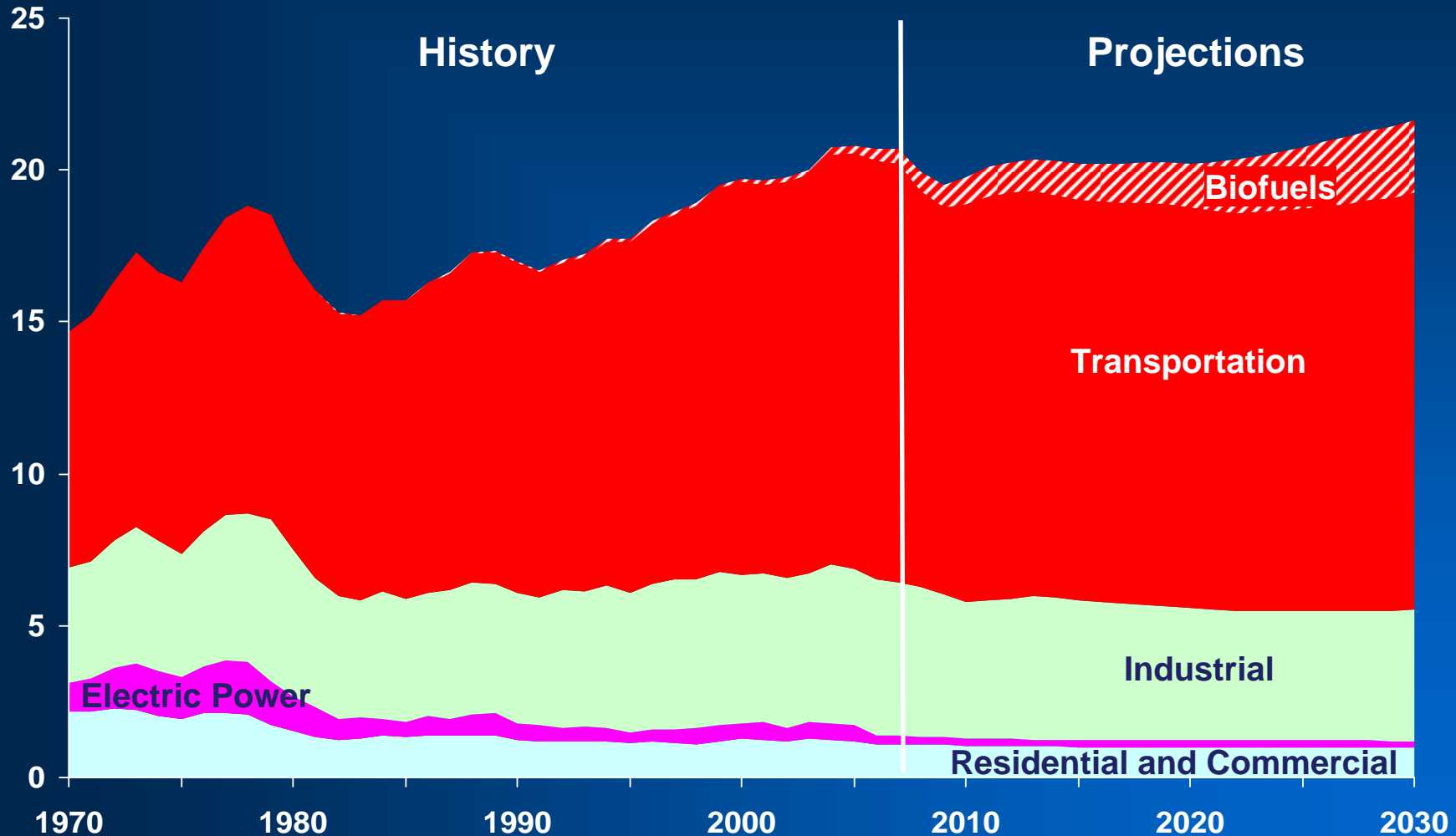
Net dependence on imported liquids declines dramatically over the next 20 years

million barrels per day



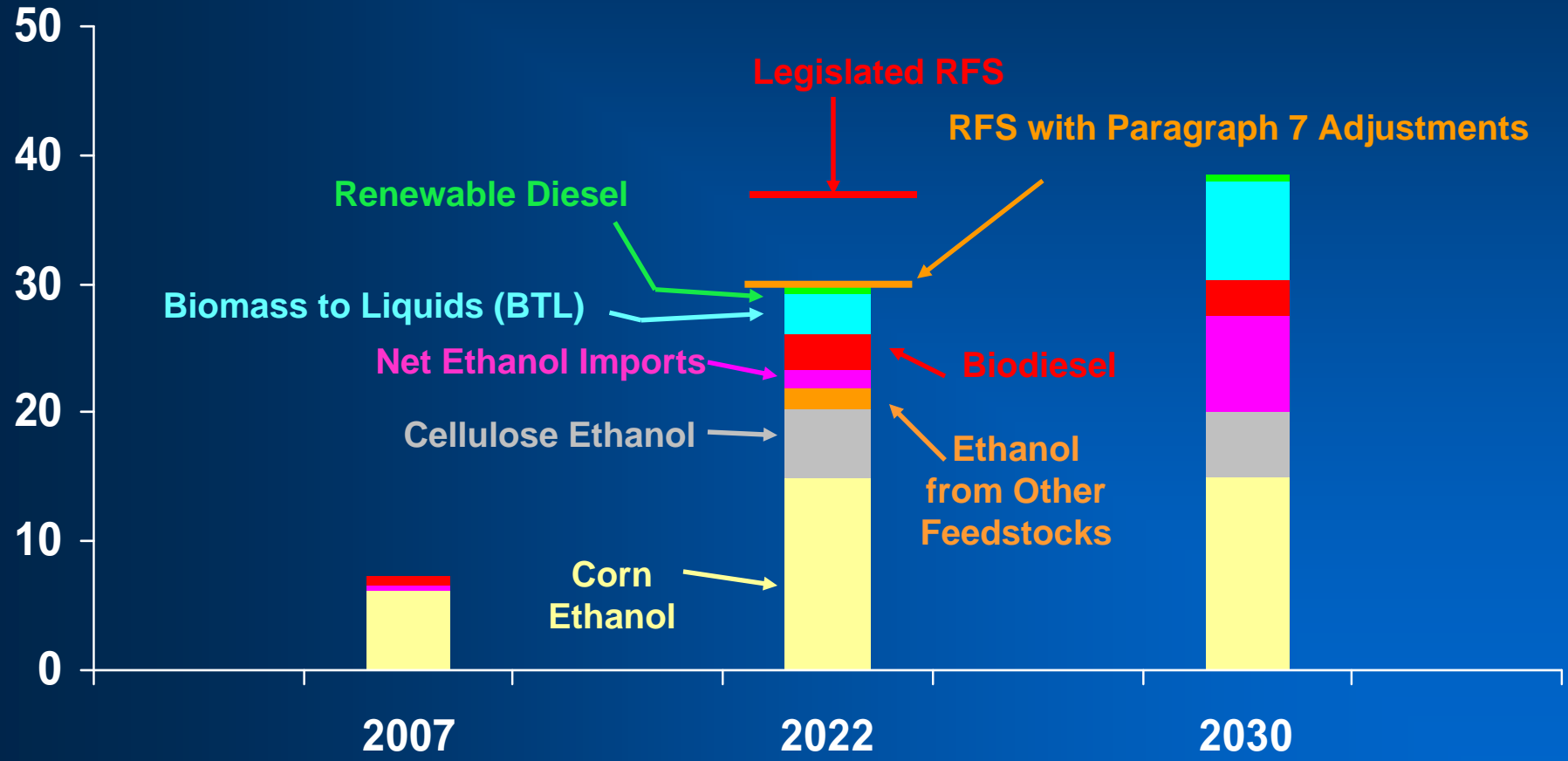
Petroleum-based liquids consumption is projected to be flat as biofuels use grows

million barrels per day



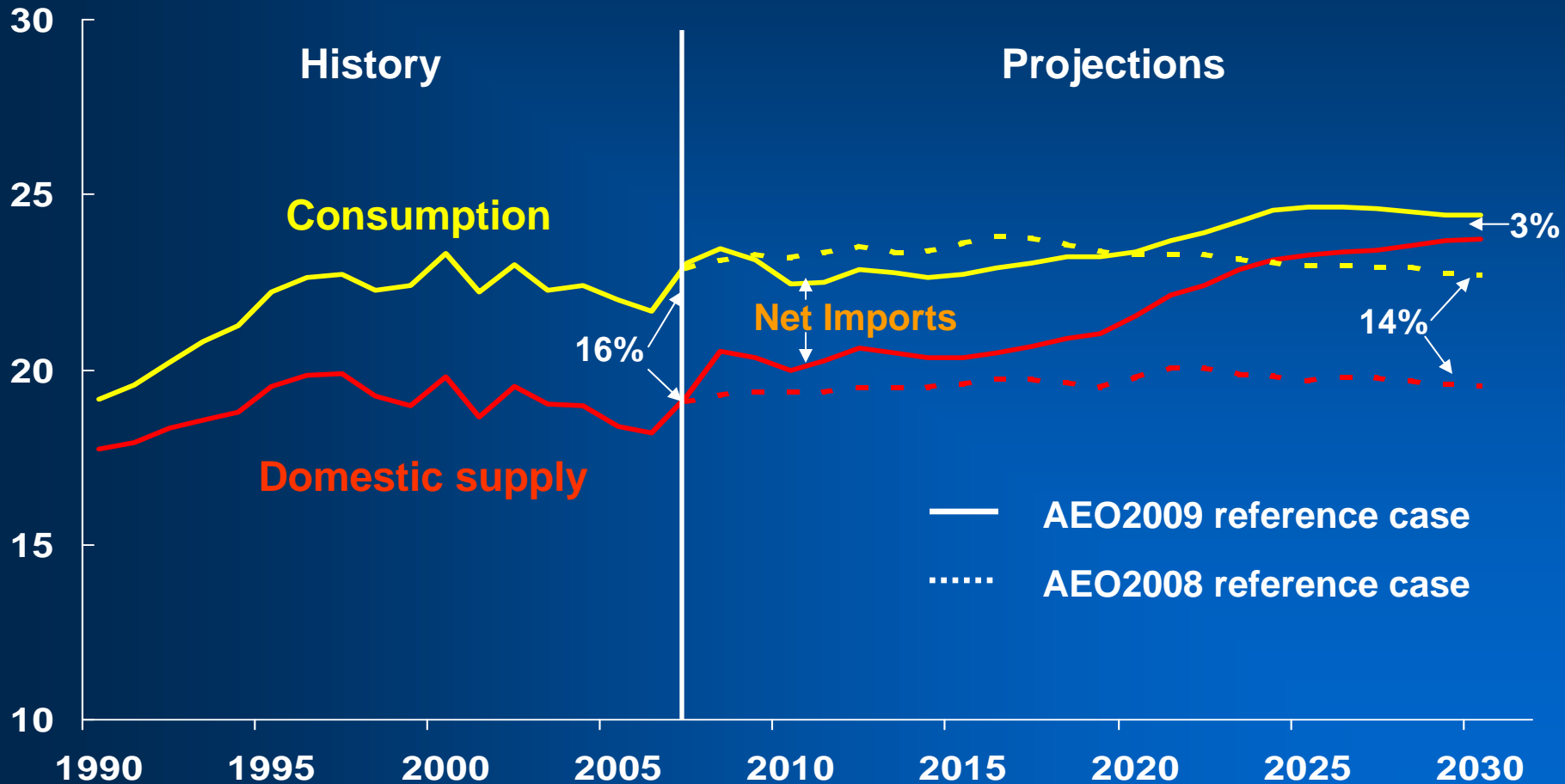
Biofuels use falls short of the 36 billion gallon RFS target in 2022, but exceeds it by 2030

billion credits



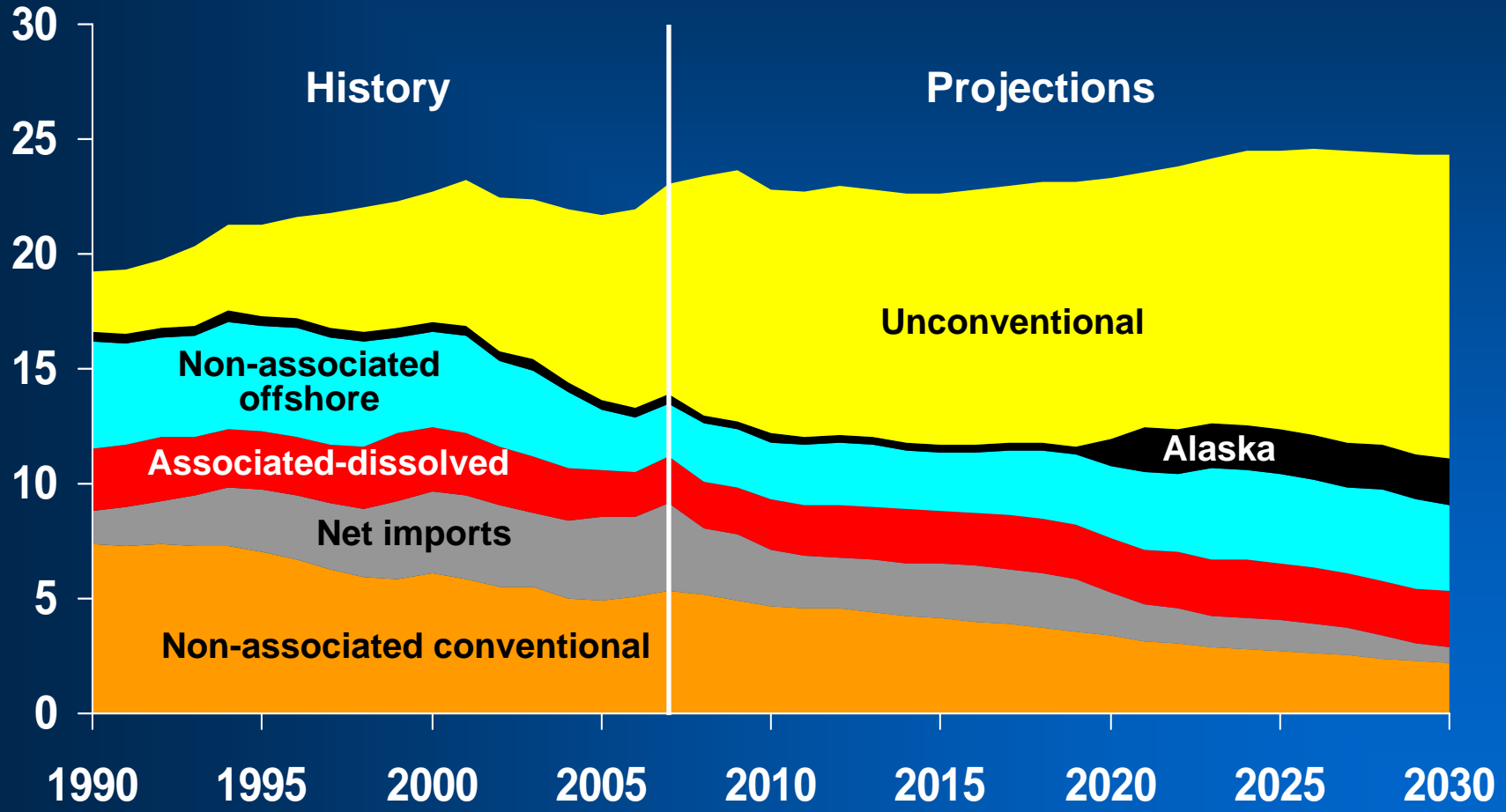
The import share of natural gas supply declines sharply as domestic supply grows

trillion cubic feet



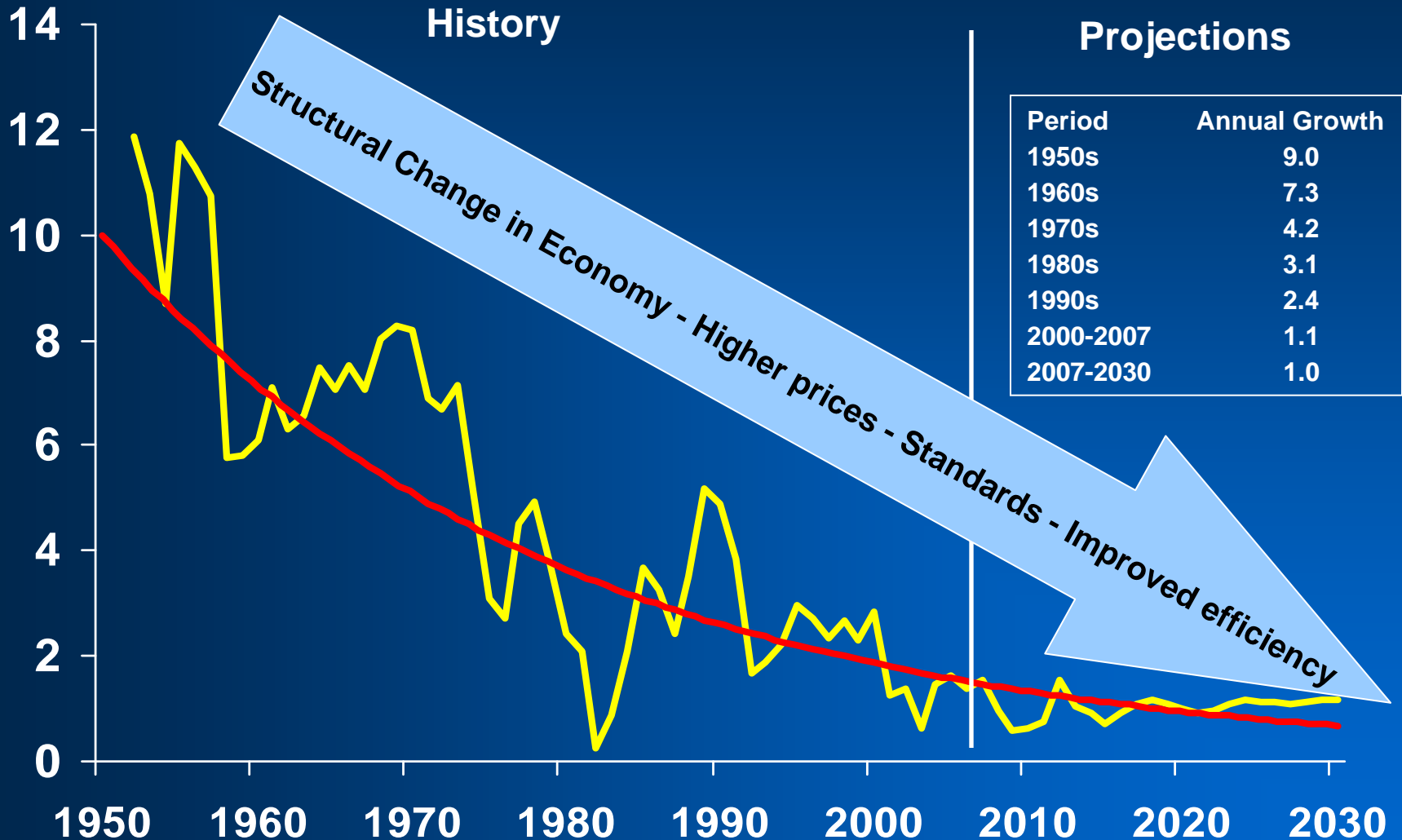
Unconventional production meets most growth in natural gas demand and offsets the decline in conventional production and imports

trillion cubic feet



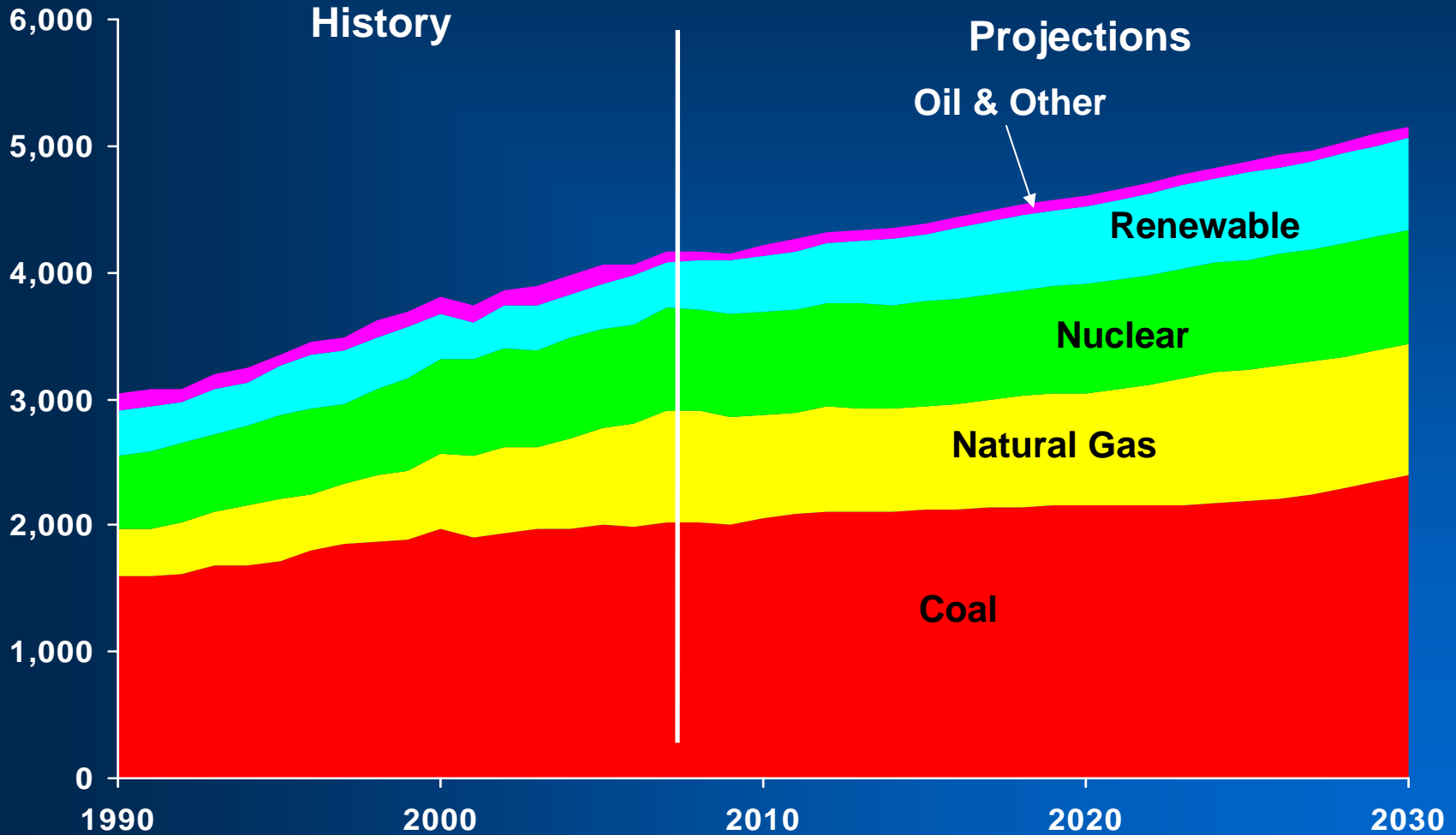
Growth in electricity use continues to slow

3-year rolling average percent growth

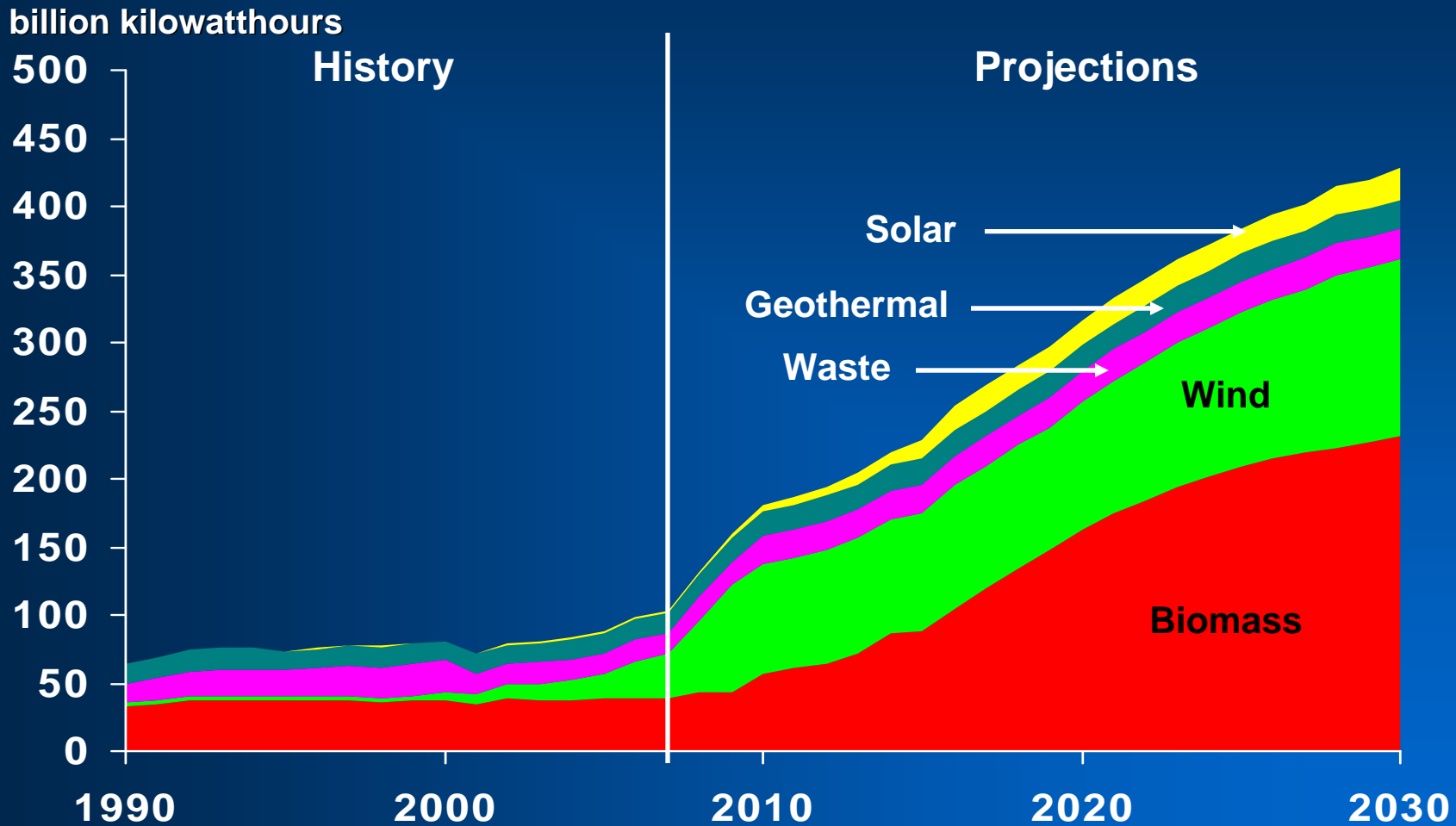


Generation mix gradually shifts to lower carbon options

billion kilowatthours

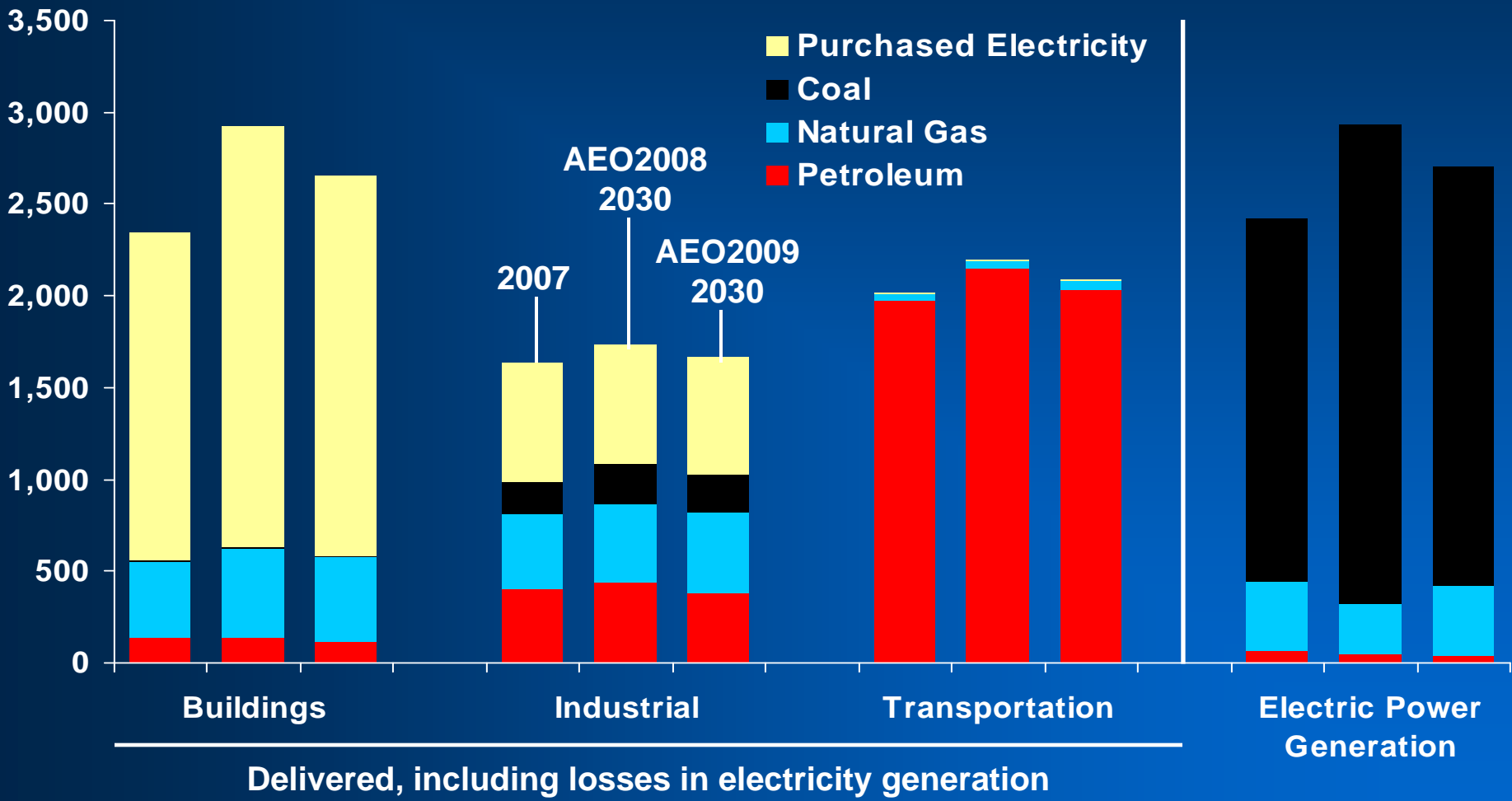


Nonhydropower renewable sources meet 33% of total generation growth between 2007 and 2030



Electricity generation is the dominant source of CO₂ emissions growth

million metric tons



Delivered, including losses in electricity generation

Key results from AEO2009 reference case

- World oil prices rise to higher levels due to growth in world demand and more limited access to resources
- U.S. oil use remains near its present level through 2030 as modest growth in overall liquids demand is met by biofuels
- U.S. dependence on imported oil, measured as a share of U.S. liquids use, is expected to decline sharply over the next 25 years
- Natural gas import share of total supply also declines sharply due to increased domestic production with higher prices
- Unconventional natural gas production, lead by gas shales, is expected to provide the majority of growth in gas supply
- Energy-related CO₂ emissions grow at 0.3 percent per year, absent any new policies to limit emissions

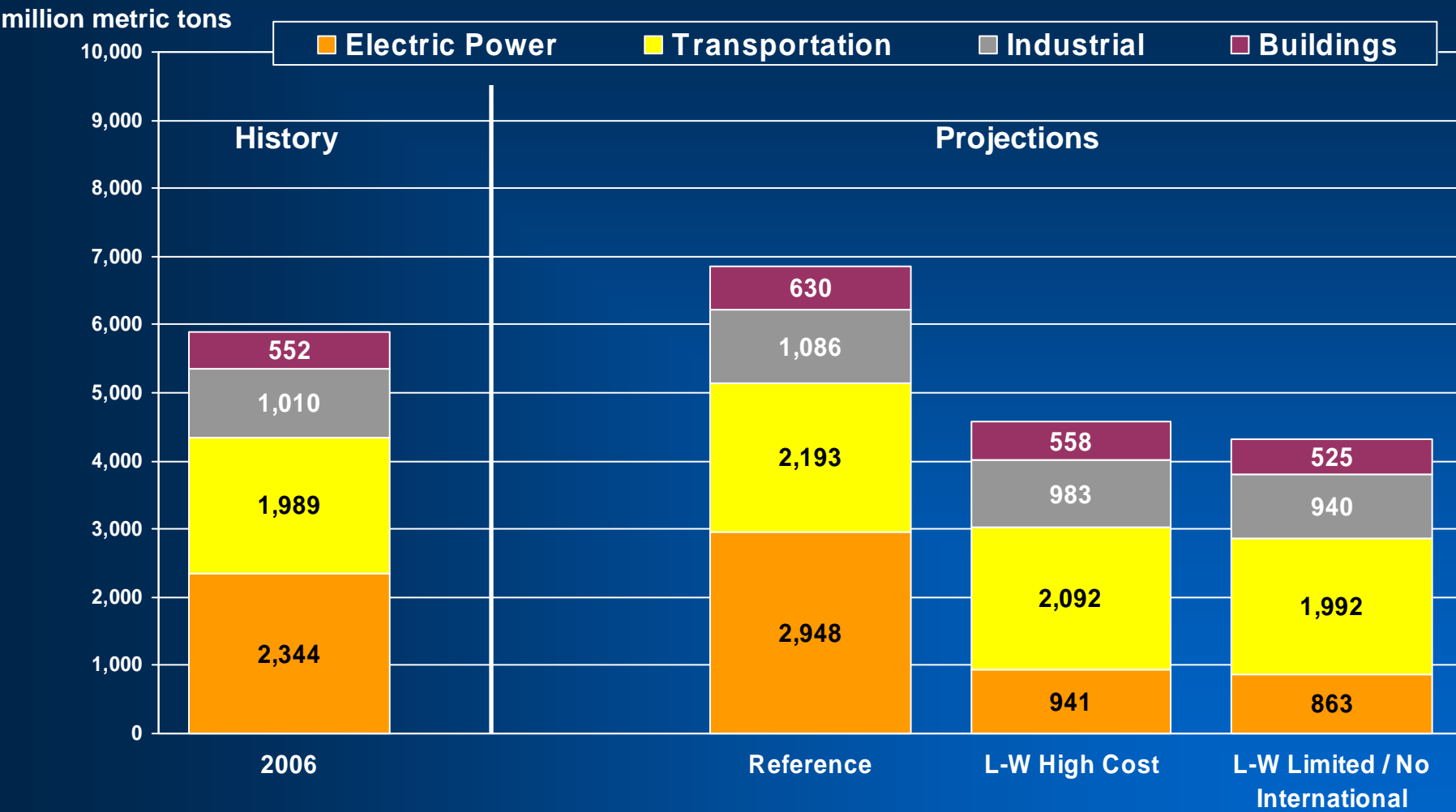
Insights from Recent EIA Analyses of A Cap & Trade Policy for U.S.GHG

Placing a value on carbon dioxide raises the delivered price of coal relative to other fossil and non-fossil fuels

Fuel	CO ₂ content (tons per million Btu)	Delivered Price (2007 dollars, all sectors, per million Btu)	Impact of \$10 per ton CO ₂ value		Impact of \$50 per ton CO ₂ value	
			\$	percent	\$	percent
Coal	0.094	1.81	0.94	51.9	4.70	260
Oil	0.074	20.31	0.74	3.6	3.70	18.2
Nat. Gas	0.053	9.01	0.53	5.9	2.65	29.4

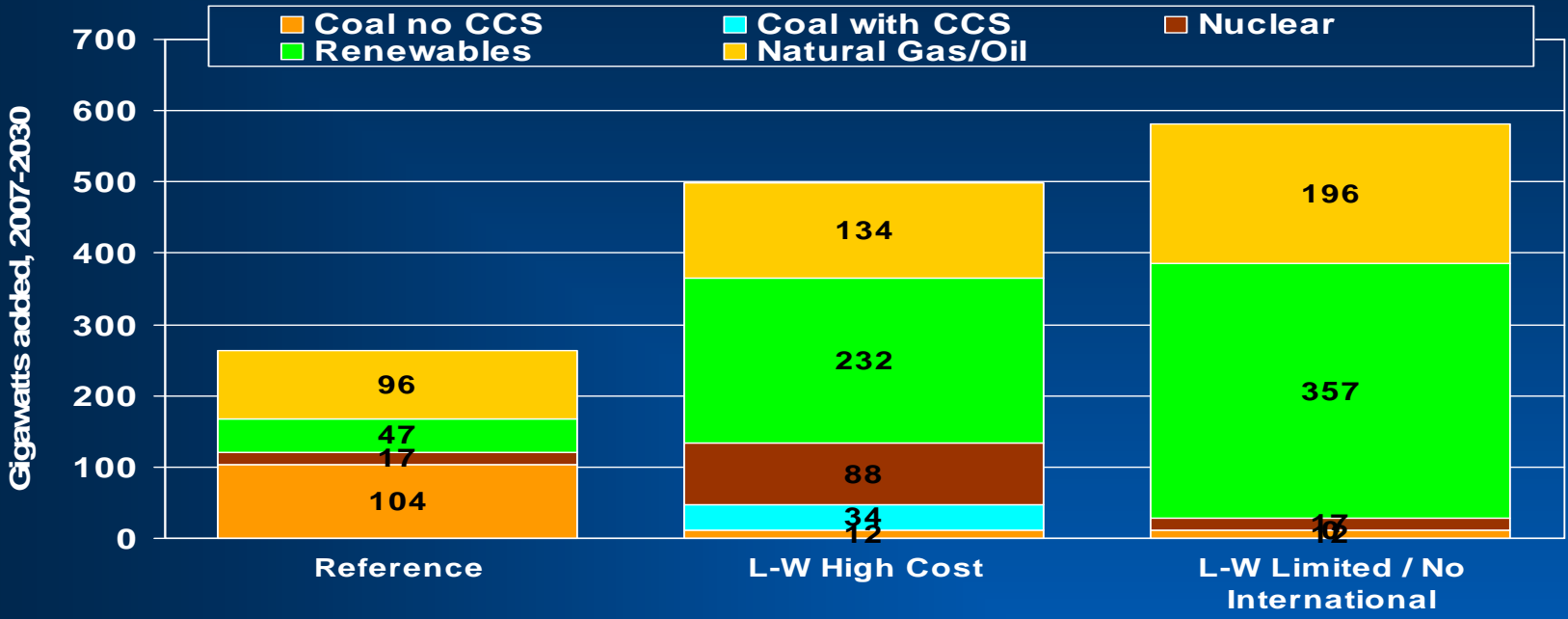
- This reflects both the substantially lower price of coal relative to other fossil fuels under baseline conditions and its higher emission of CO₂ per unit of energy
- A \$50/ton value on CO₂ raises gasoline prices by about 46 cents per gallon.

The electricity sector dominates emissions reductions in EIA's analysis of the Lieberman-Warner (L-W) cap & trade proposal



- The electric power sector dominates energy-related CO₂ emission reductions in all L-W cases.
- Other sectors play a relatively small role, unless allowance prices get very high.

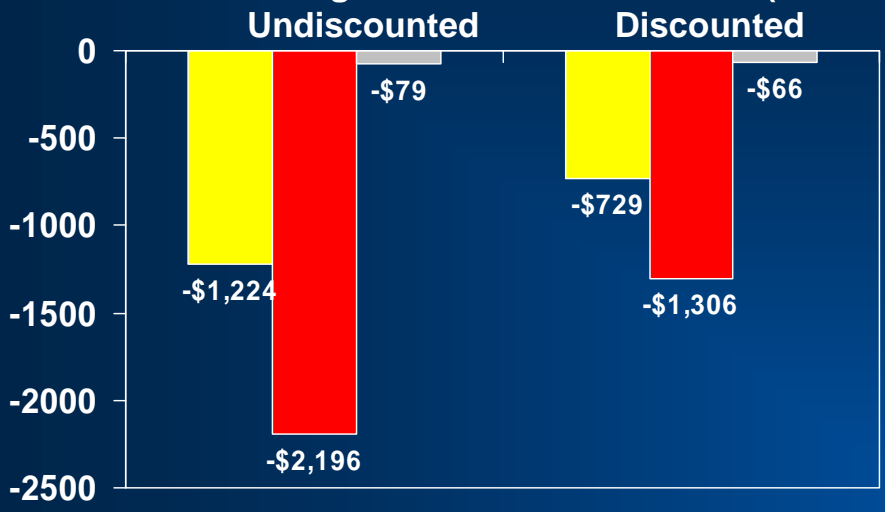
Regardless of technology assumptions, emissions cuts increase the total requirement for siting NEW capacity



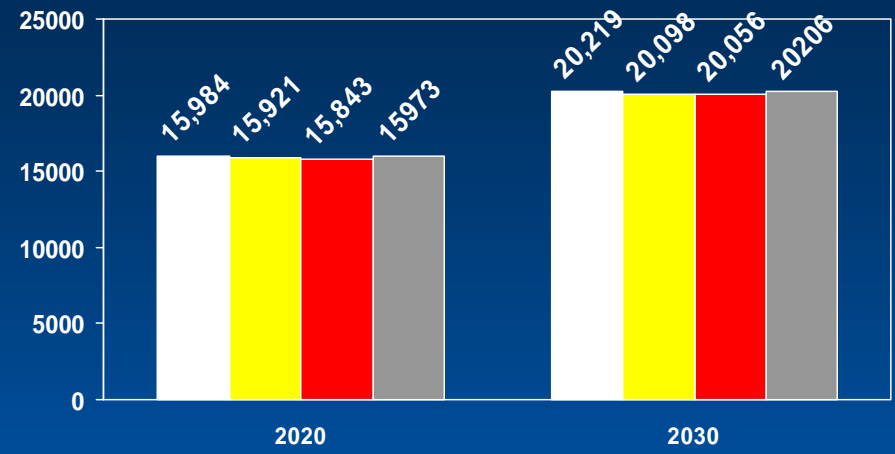
- More power plant additions are needed to make up for the retirement of existing coal capacity under L-W or other programs to reduce emissions
- Transmission siting needs (not shown) also increase greatly
- Additions of coal plants without CCS are virtually eliminated in the L-W cases
- When nuclear and coal with CCS are available, they are used for new capacity and to replace existing conventional coal plants. When they are not available, higher allowance prices spur more additions of renewable and natural gas capacity.

Economic Impacts of GHG Limitation: EIA strives to present its estimates in a neutral manner, letting others do the "framing."

Cumulative Change in Real GDP 2009-2030 (billion 2000 \$)



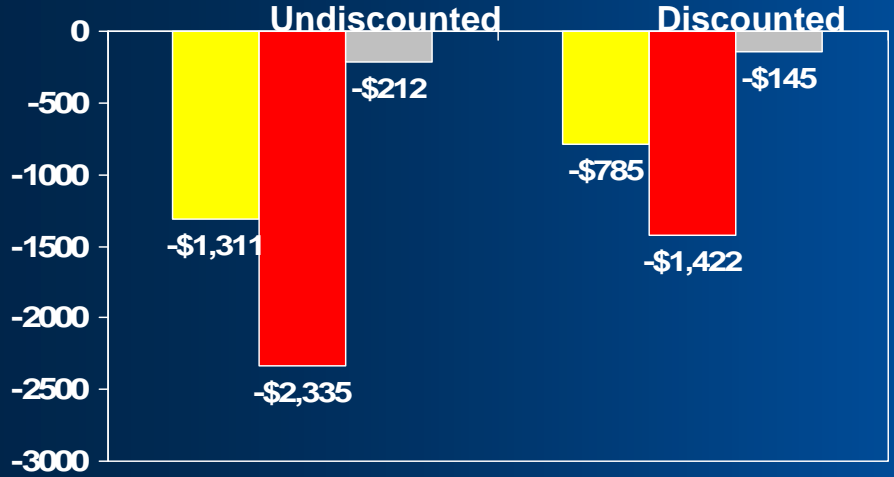
Real GDP (billion 2000 \$)



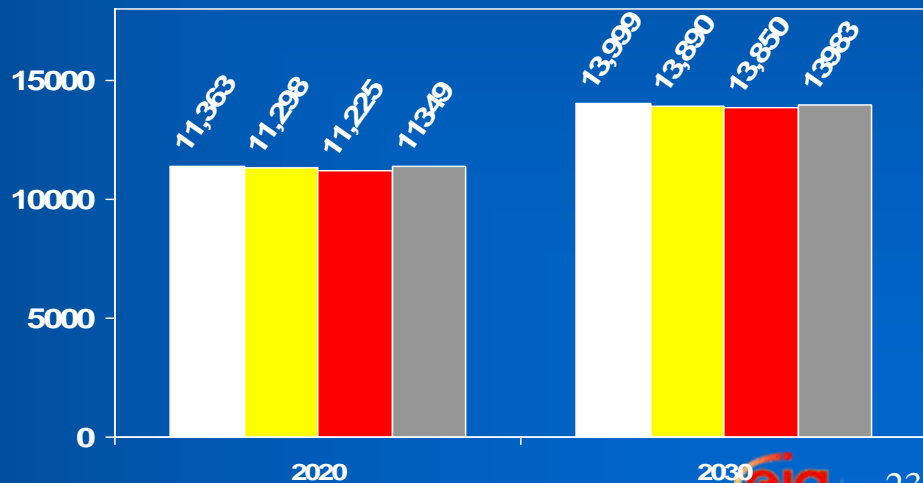
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Cum. Change in Real Consumption 2009-2030 (billion 2000 \$)

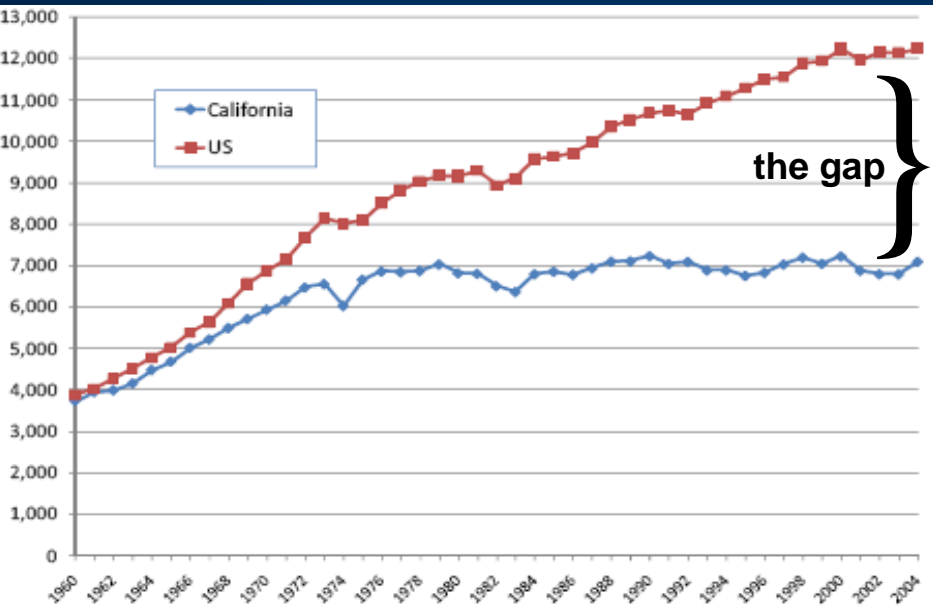


Real Consumption (billion 2000 \$)



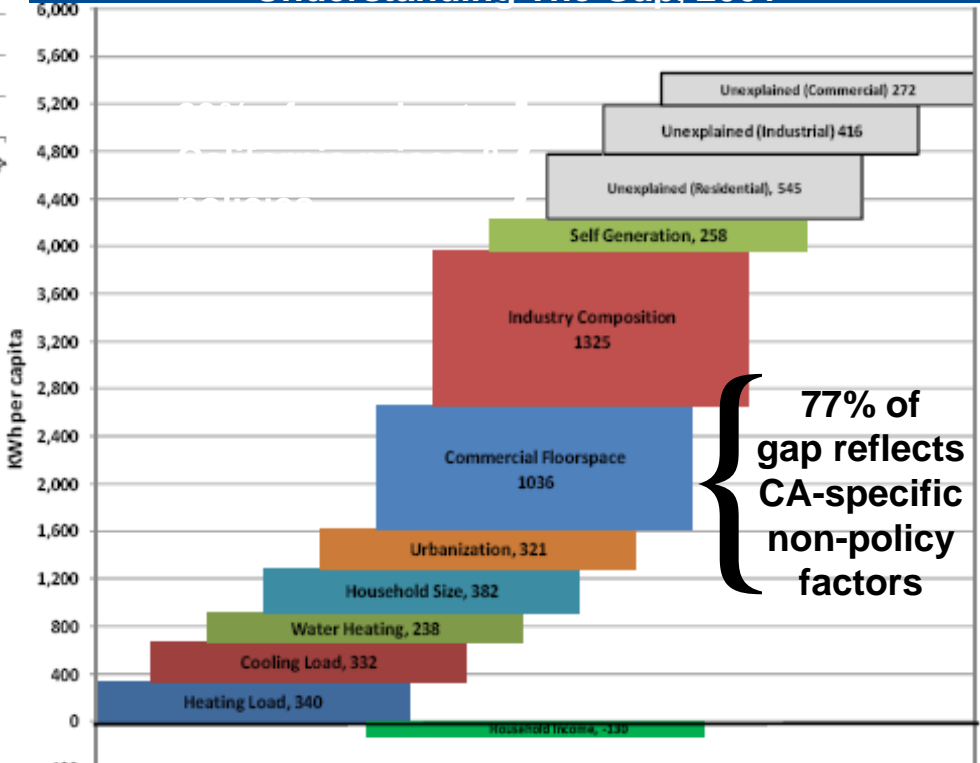
Structural and policy differences both matter to outcomes

Kwh /year Electricity Use Per Capita, US and California



- California’s per capita electricity use is well below the U.S. average.
- Recent analysis from Stanford University shows that factors other than efficiency policies and prices account for 77 percent of the gap.

Understanding The Gap, 2001



LESSON: California’s efficiency policies reduce consumption, but nationwide implementation would not bring the U.S. anywhere close to California’s per-capita consumption level.

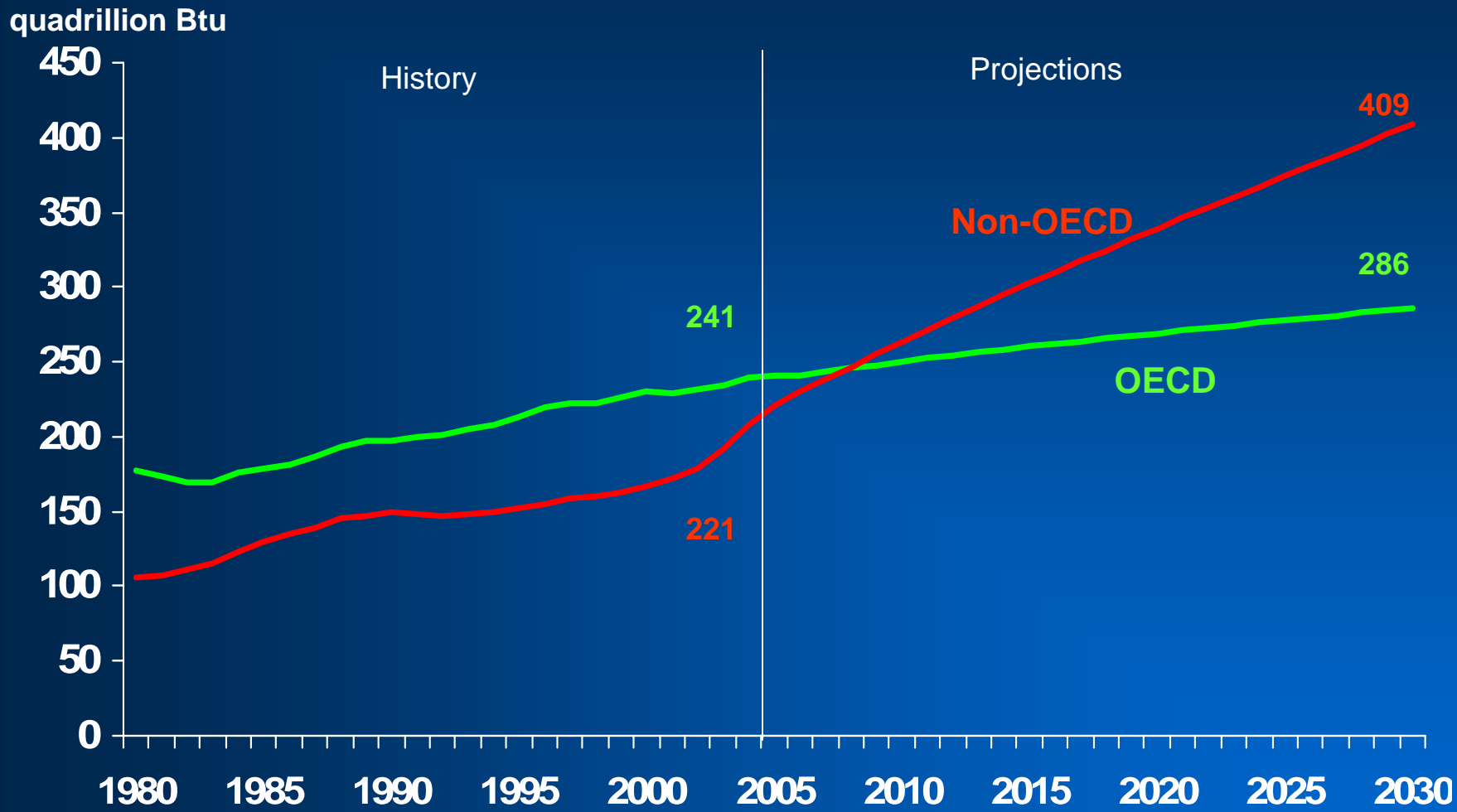
Source: Sudarshan and Sweeney, 2008

EIA's International Energy Outlook 2008

International Energy Outlook 2008 – The Big Picture

- **Worldwide marketed energy consumption is projected to grow by 50 percent between 2005 and 2030. The demand in developing non-OECD countries grows by 85 percent.**
- **Renewables are the world's fastest-growing energy source at an average of 2.1 percent per year, followed closely by coal, at 2.0 percent per year.**
- **Although petroleum and other liquids retain the largest share of total world energy use through 2030, their share falls from 37 percent in 2005 to 33 percent in 2030 in the reference case.**
- **Energy-related carbon dioxide emissions are also projected to rise by 50 percent between 2005 and 2030.**

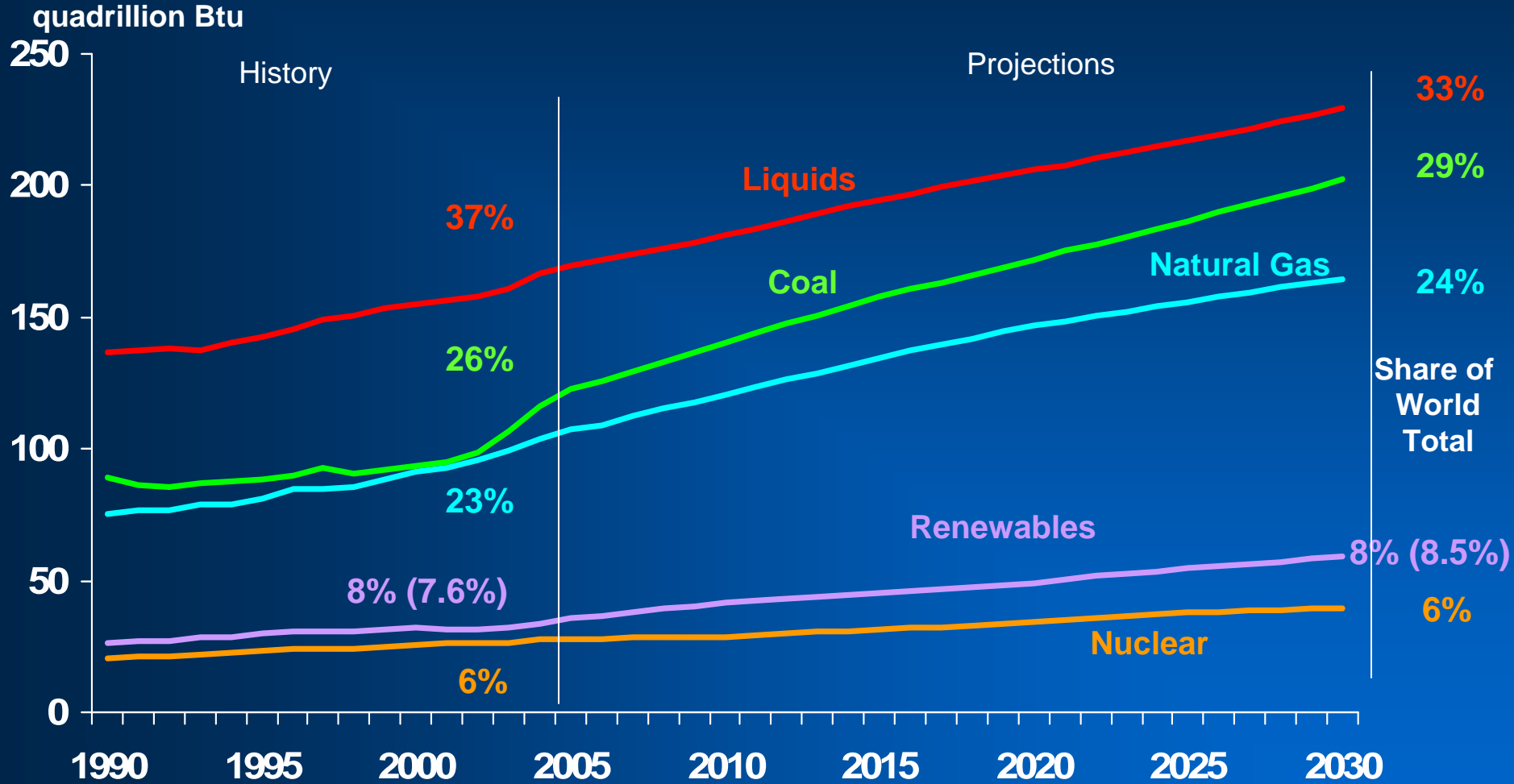
Marketed energy use in the non-OECD nations surpasses that of the OECD nations



International Energy Outlook 2008



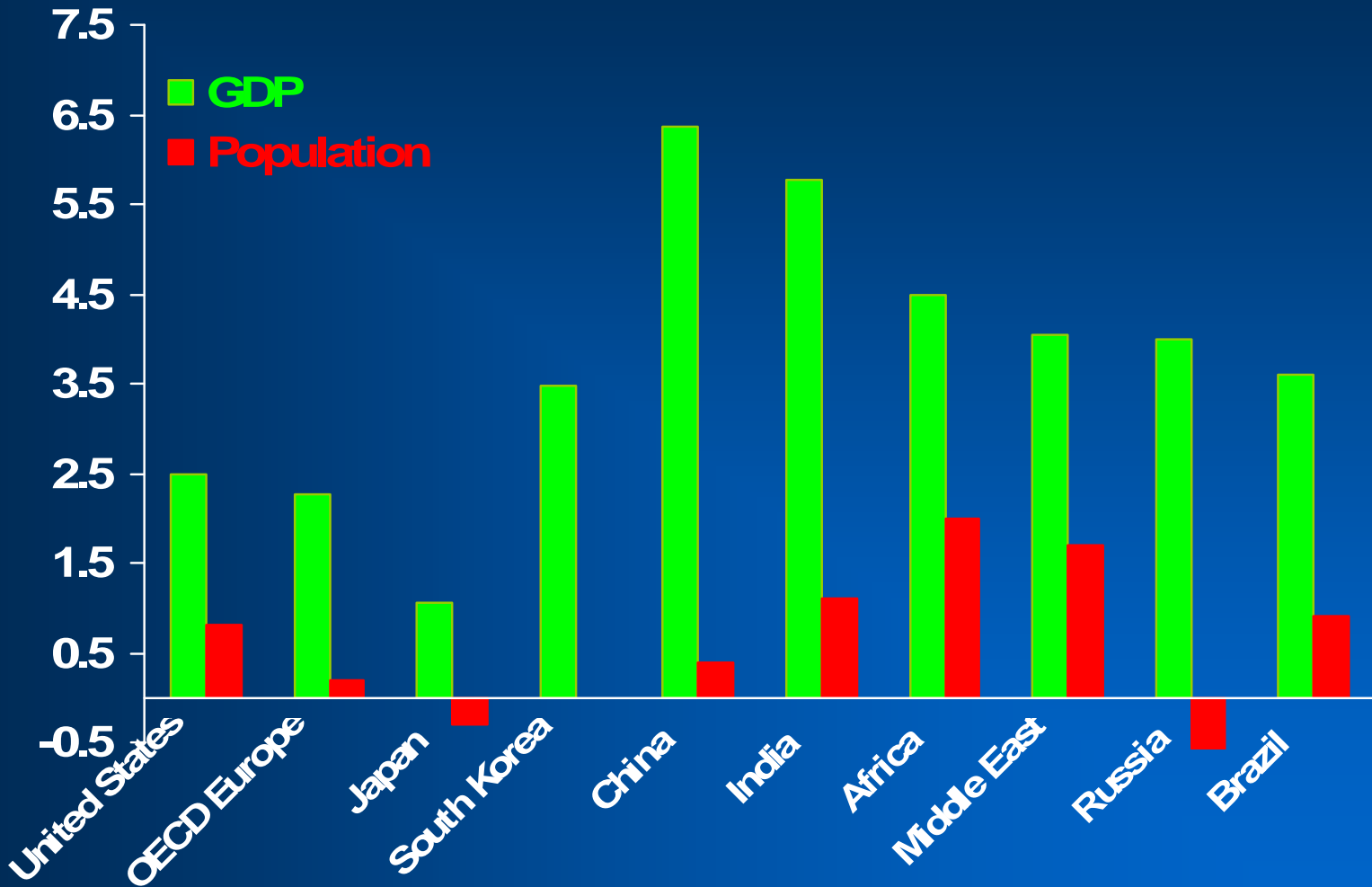
Fossil fuels continue to dominate marketed energy consumption



International Energy Outlook 2008

Countries with rapid economic growth drive energy demand

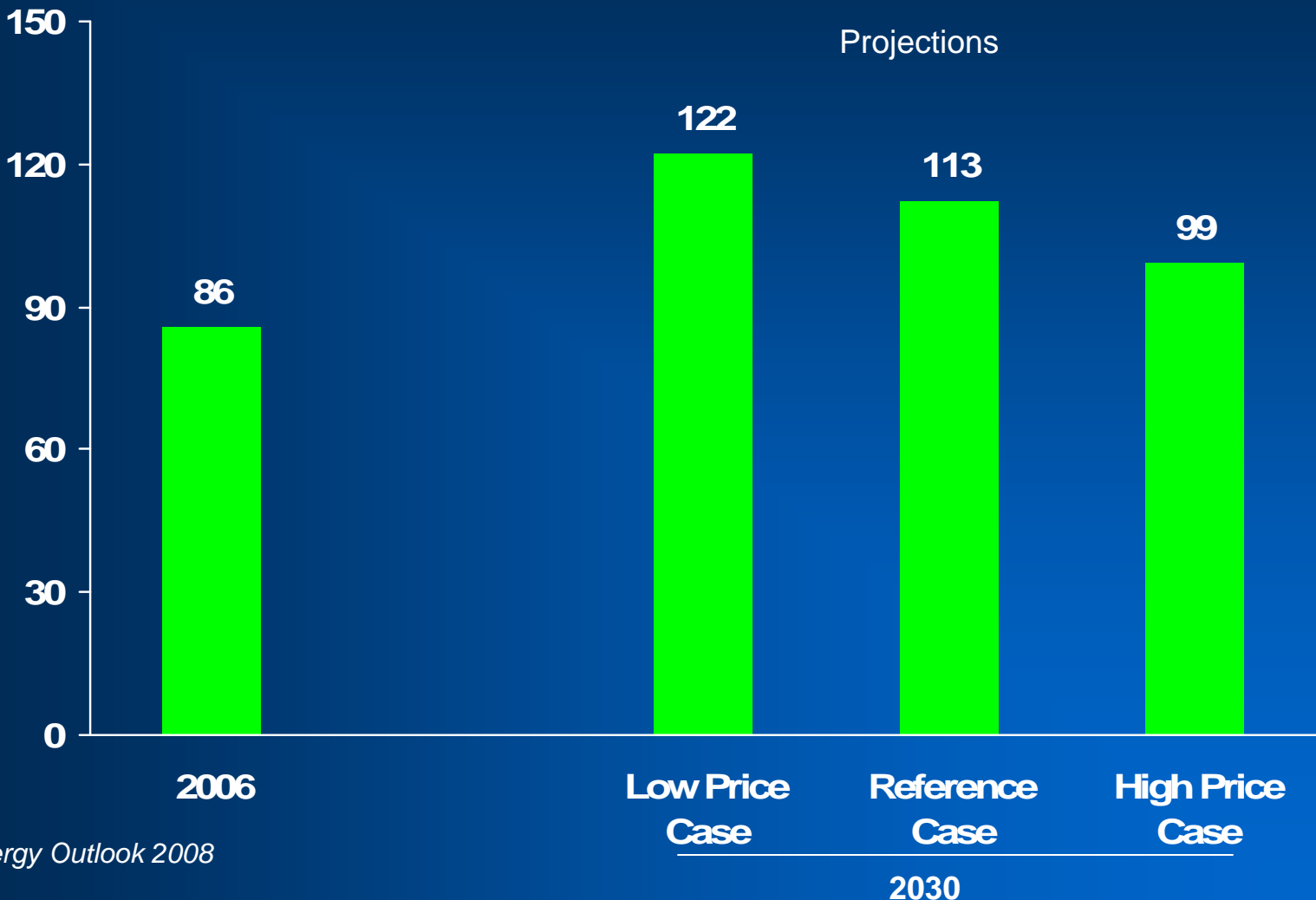
average growth, percent per year



International Energy Outlook 2008

Projected consumption of liquids in 2030 varies across the price scenarios

million barrels oil equivalent per day

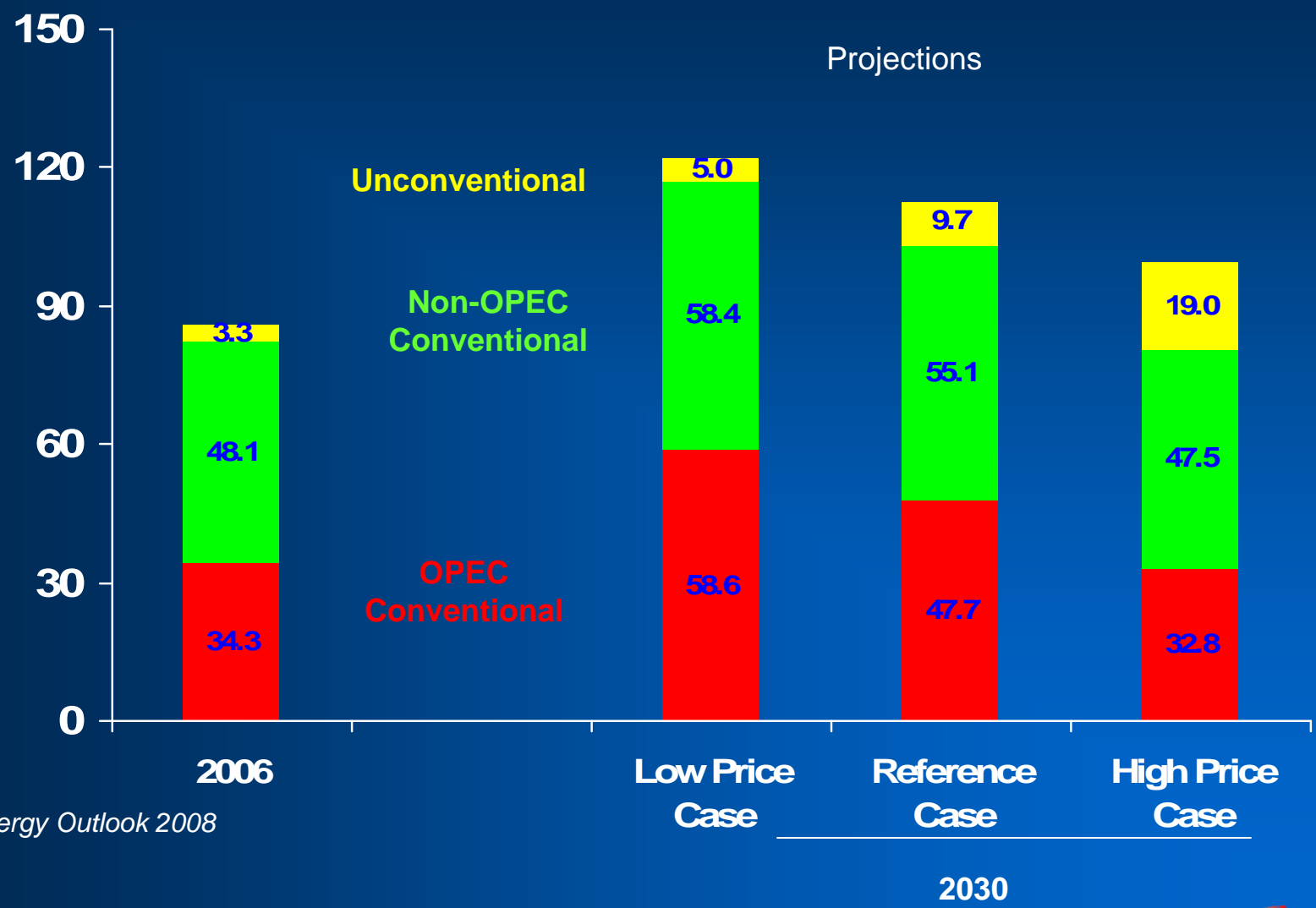


International Energy Outlook 2008



With higher prices, unconventional liquids become a more significant source of supply

million barrels oil equivalent per day

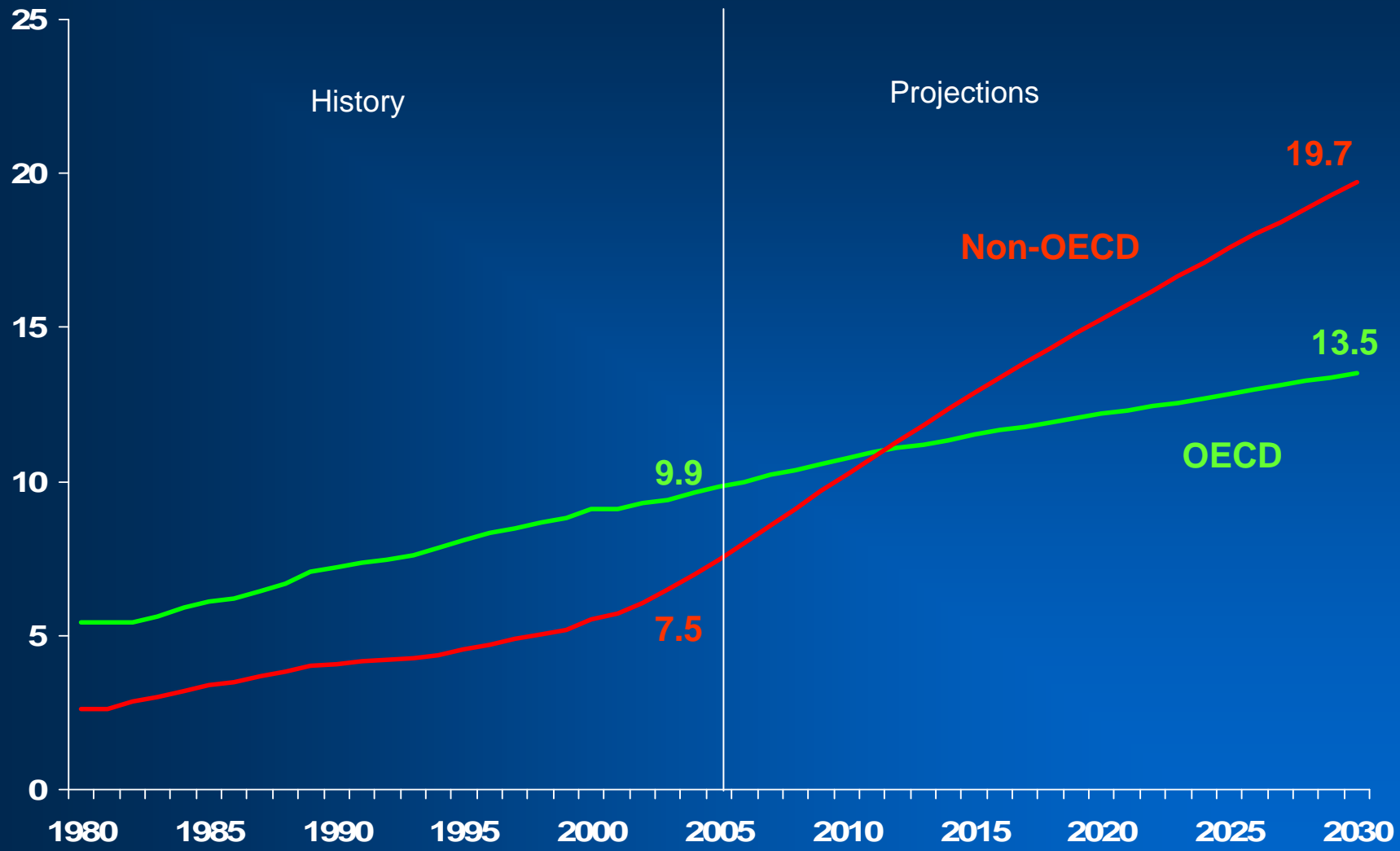


International Energy Outlook 2008



World electric power generation nearly doubles in the reference case from 2005 to 2030

trillion kilowatthours

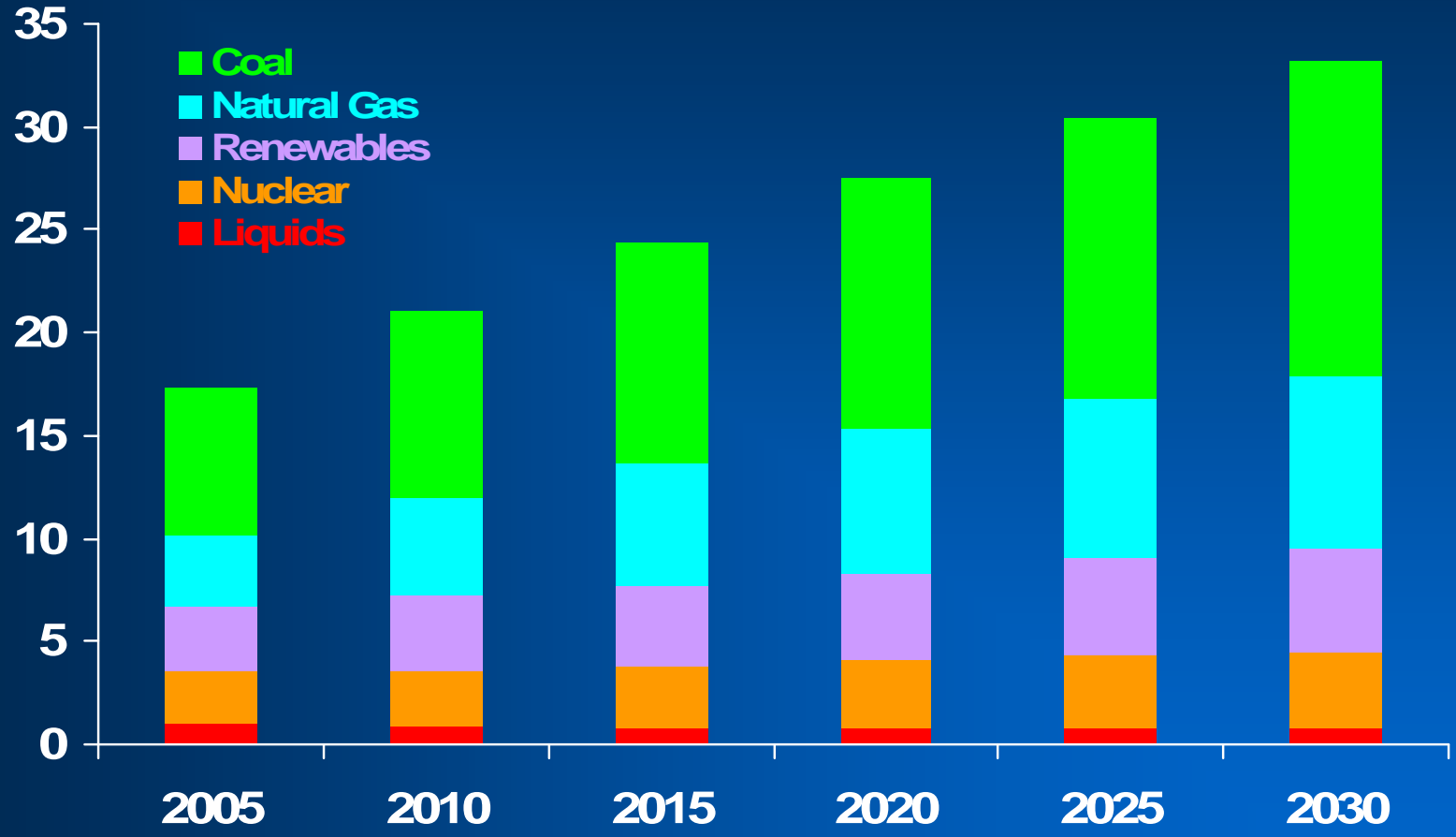


International Energy Outlook 2008



Coal and natural gas account for most of the increase in electricity generation

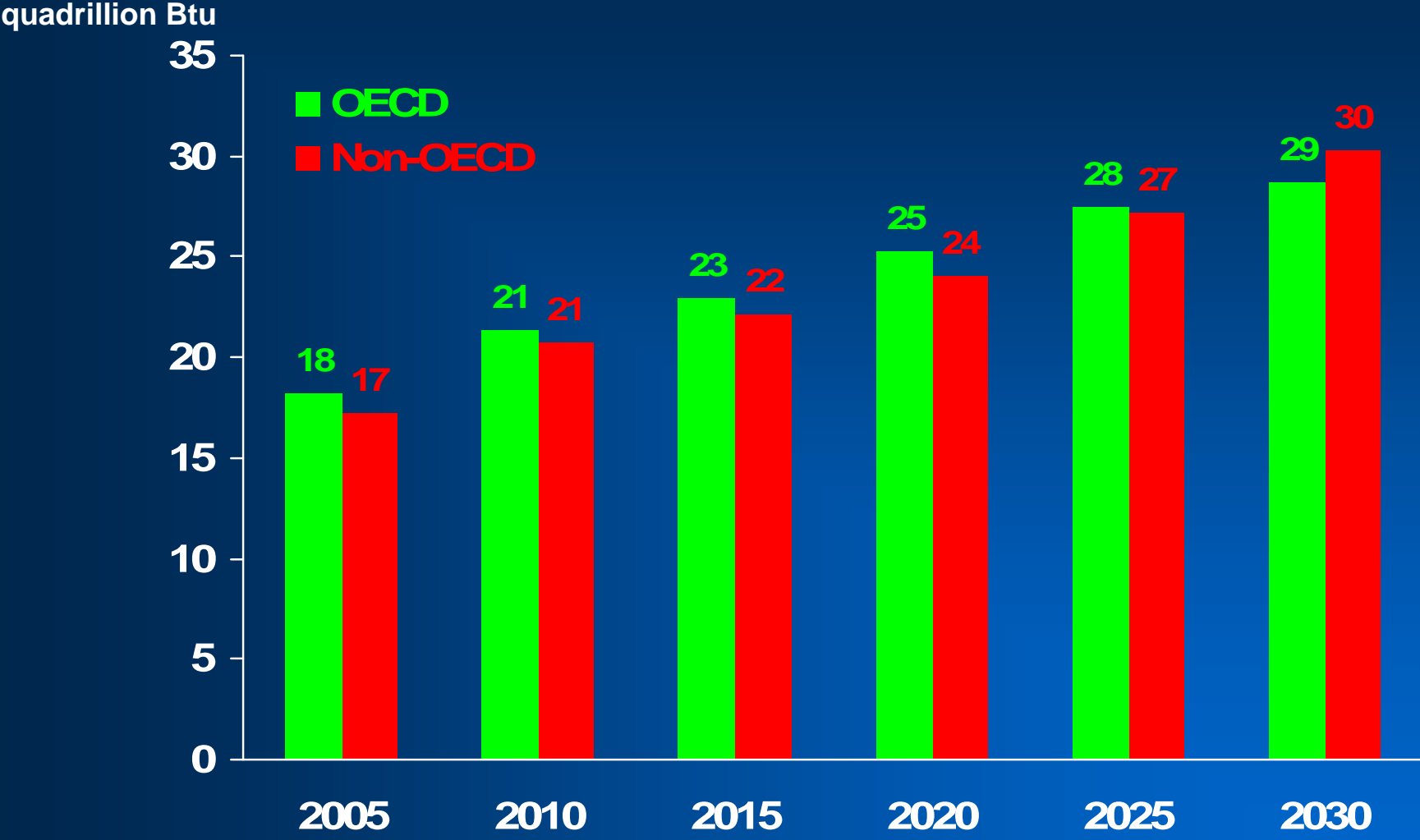
trillion kilowatthours



International Energy Outlook 2008



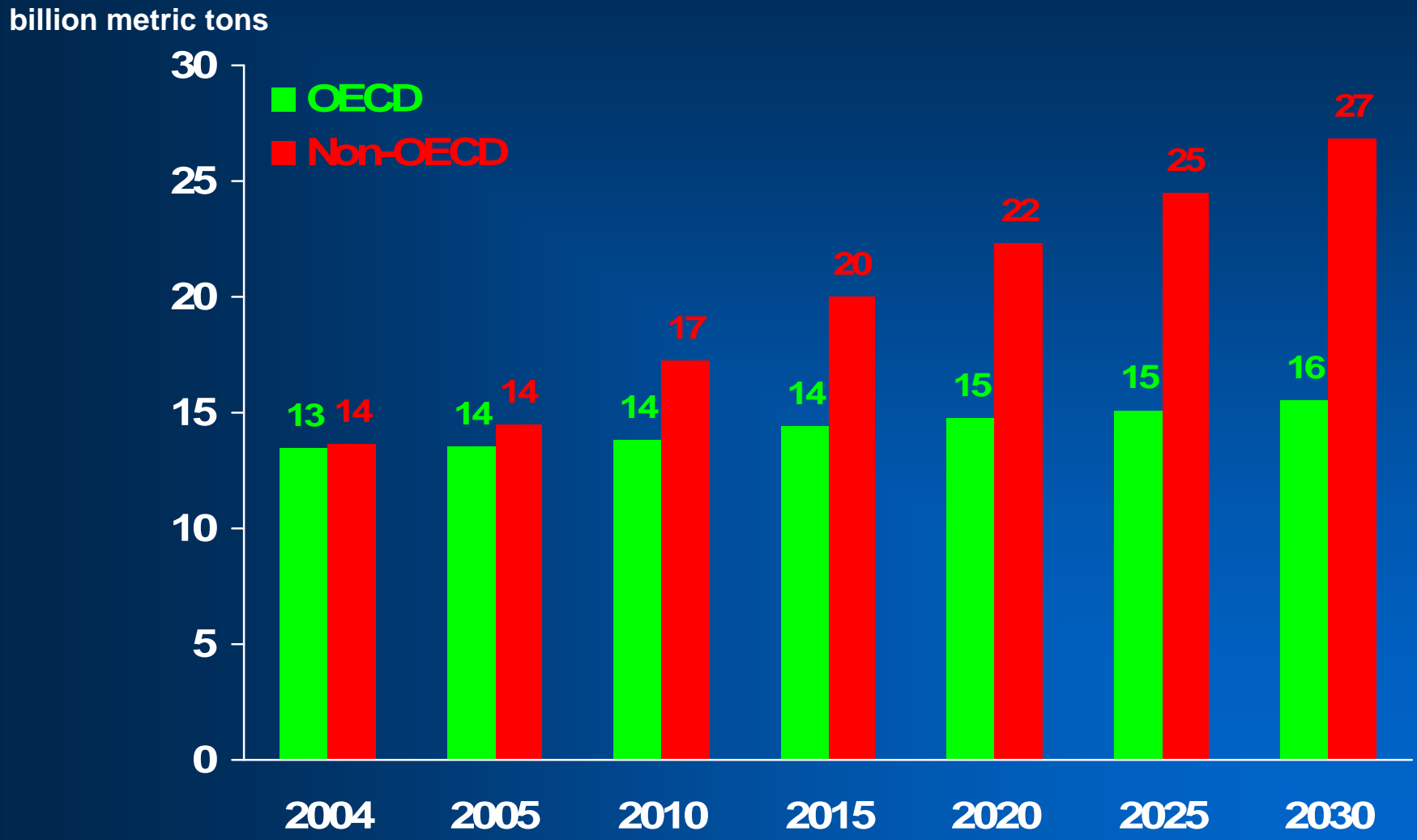
Fossil fuel prices, environmental concerns, and government policies also encourage growth in renewable energy



International Energy Outlook 2008



World carbon dioxide emissions grow by about 50 percent by 2030



International Energy Outlook 2008

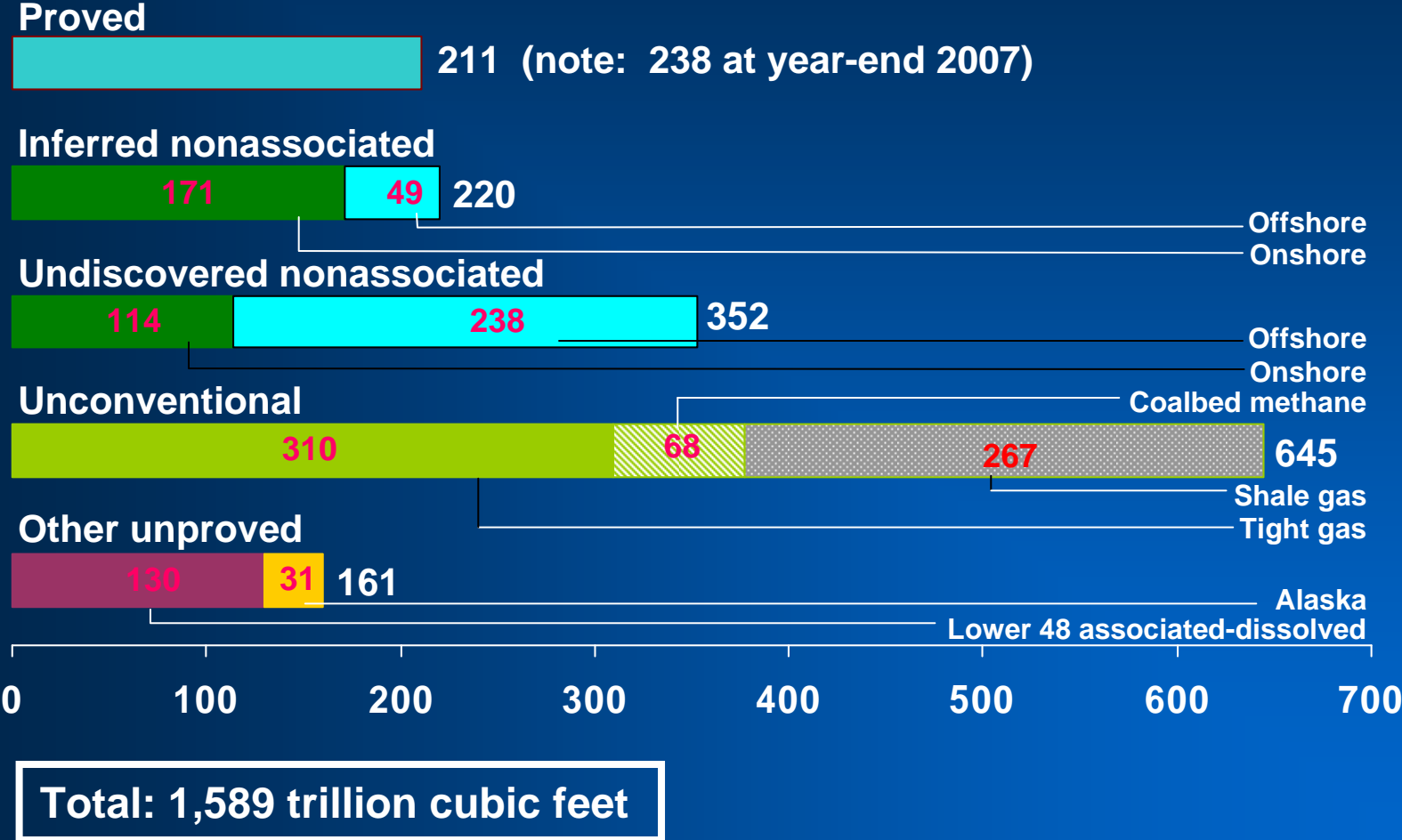


U.S. Natural Gas Proved Reserves and Technically Recoverable Resources

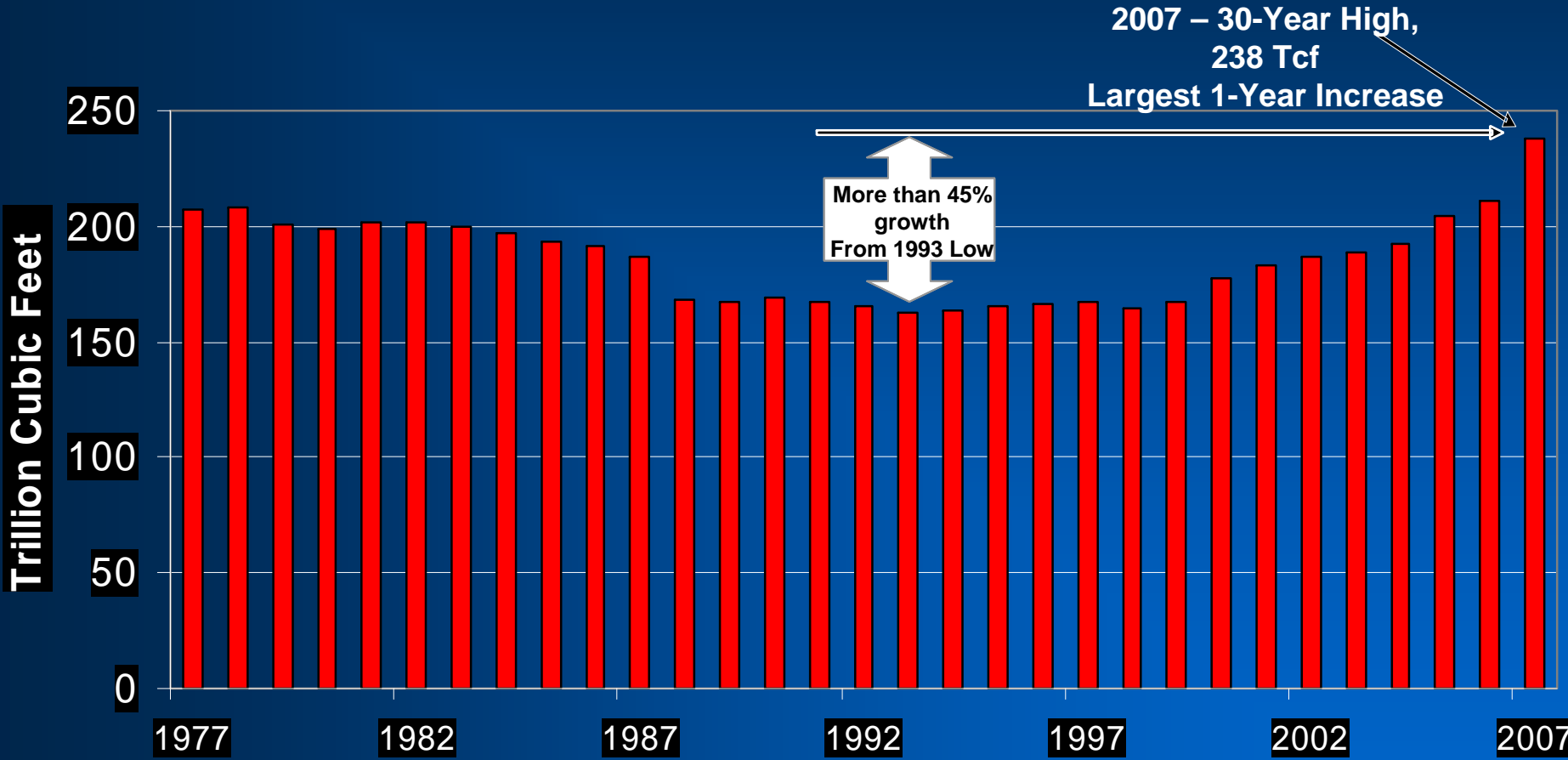
U.S. natural gas production has increased dramatically since the start of 2007



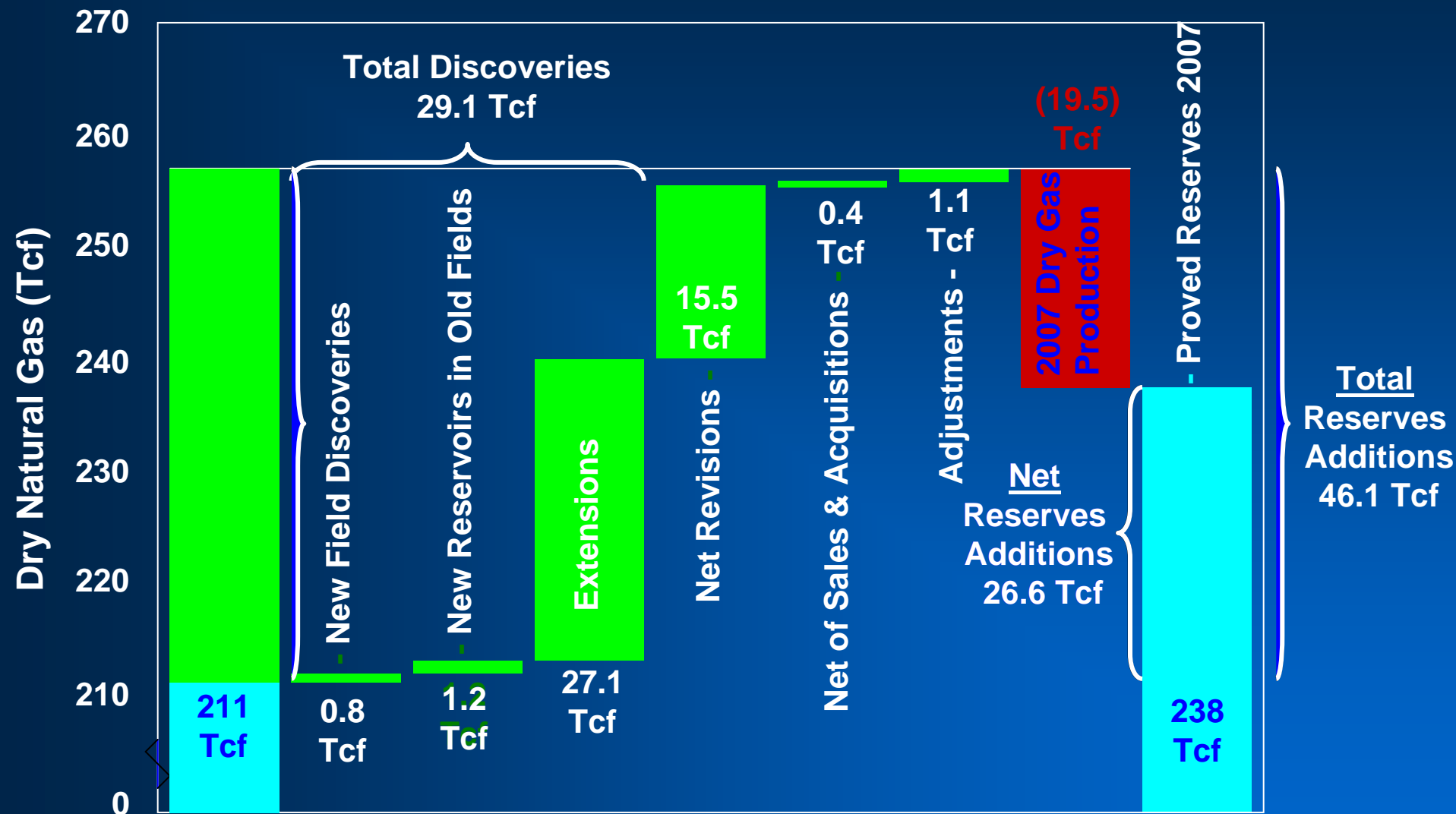
Unconventional resources were the largest component of the natural gas resource base for AEO2009



Proved natural gas reserves increased at a record rate in 2007 despite growing production



Extensions and net revisions together accounted for over 90 percent of total reserve additions in 2007



Examples of EIA Periodic Reports

Petroleum Status and Natural Gas Storage Reports, weekly

Short-Term Energy Outlook, monthly

Annual Energy Outlook 2009, December 2008/ February 2009

International Energy Outlook 2008, August 2008

U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 2007, October 2008 (Advance Summary), January 2009 (Full Report)

Examples of EIA Special Analyses

Analysis of Crude Oil Production in the Arctic National Wildlife Refuge, May 2008

Energy Market and Economic Impacts of S.2191, the Lieberman-Warner Climate Security Act of 2007, April 2008

Federal Financial Interventions and Subsidies in Energy Markets 2007, April 2008

“Impacts of Increased Access to Oil and Natural Gas Resources in the Lower 48 Federal Outer Continental Shelf,” Annual Energy Outlook 2007