

Poseidon's SONGS:

Is there a case for expanded nuclear baseload?

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NSF-PIRE Extreme Materials for Nuclear Systems

iSEE Congress

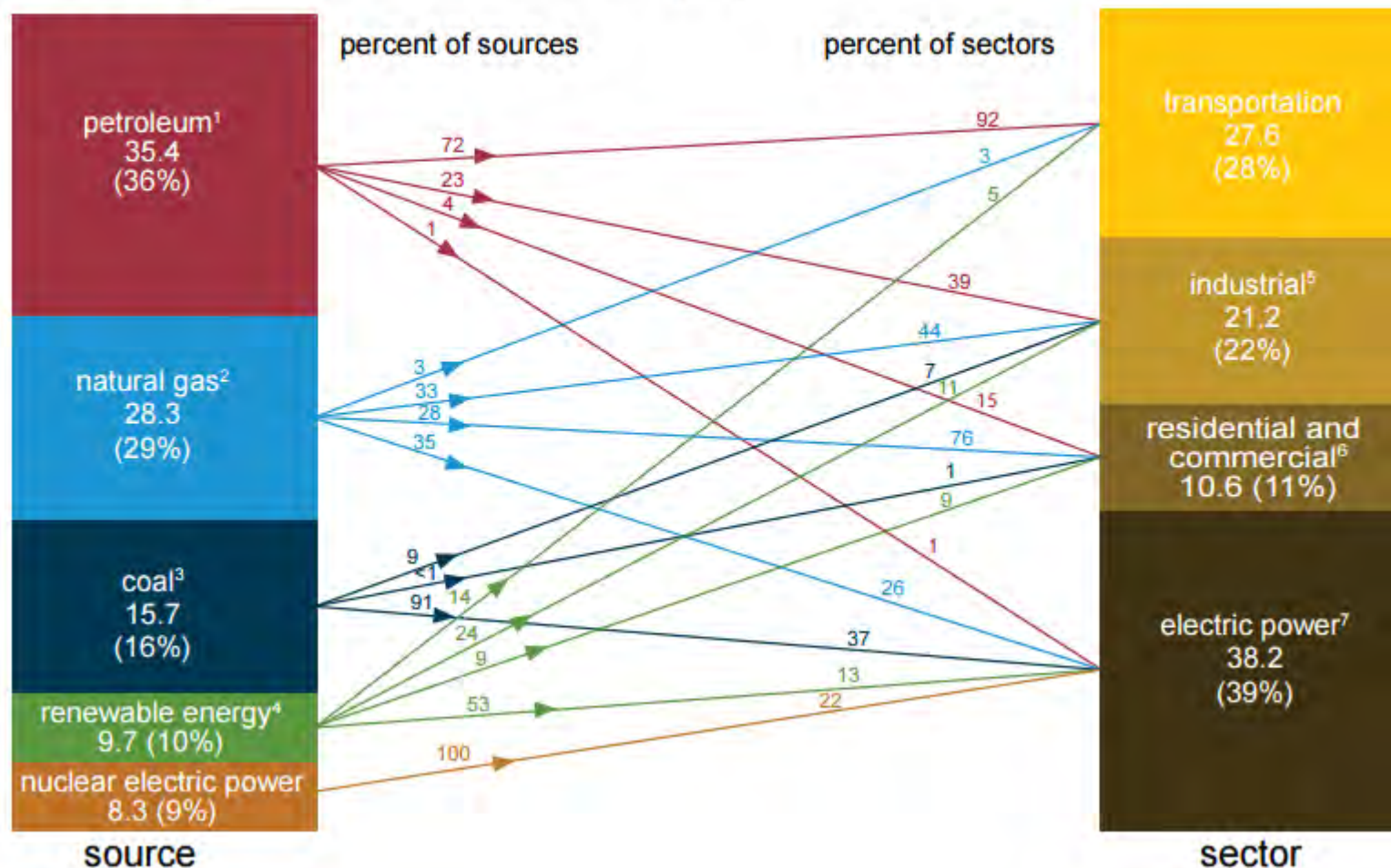
September 14th 2016



Energy Distribution in the US

U.S. primary energy consumption by source and sector, 2015

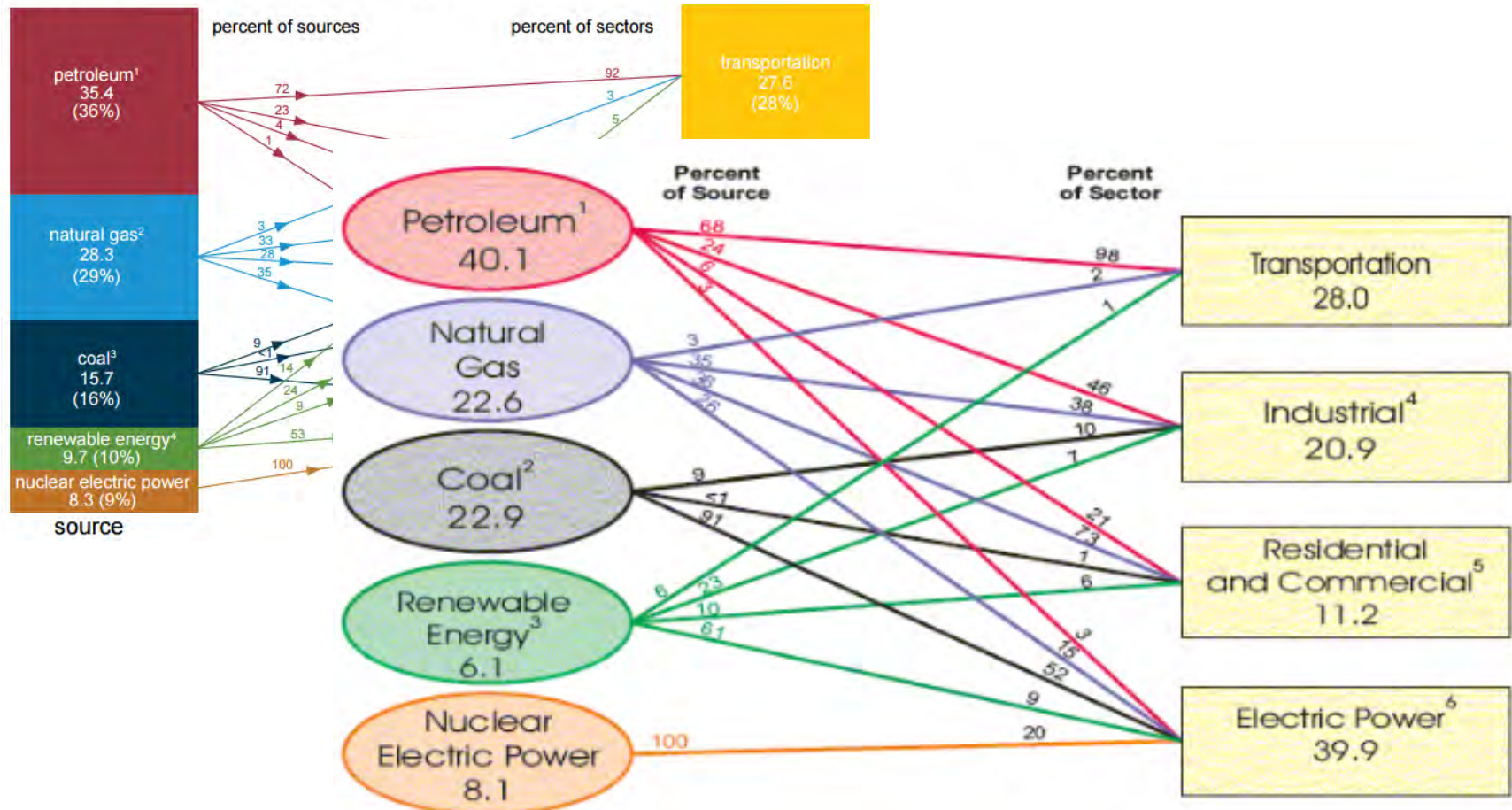
Total = 97.7 quadrillion British thermal units (Btu)



Energy Distribution in the US

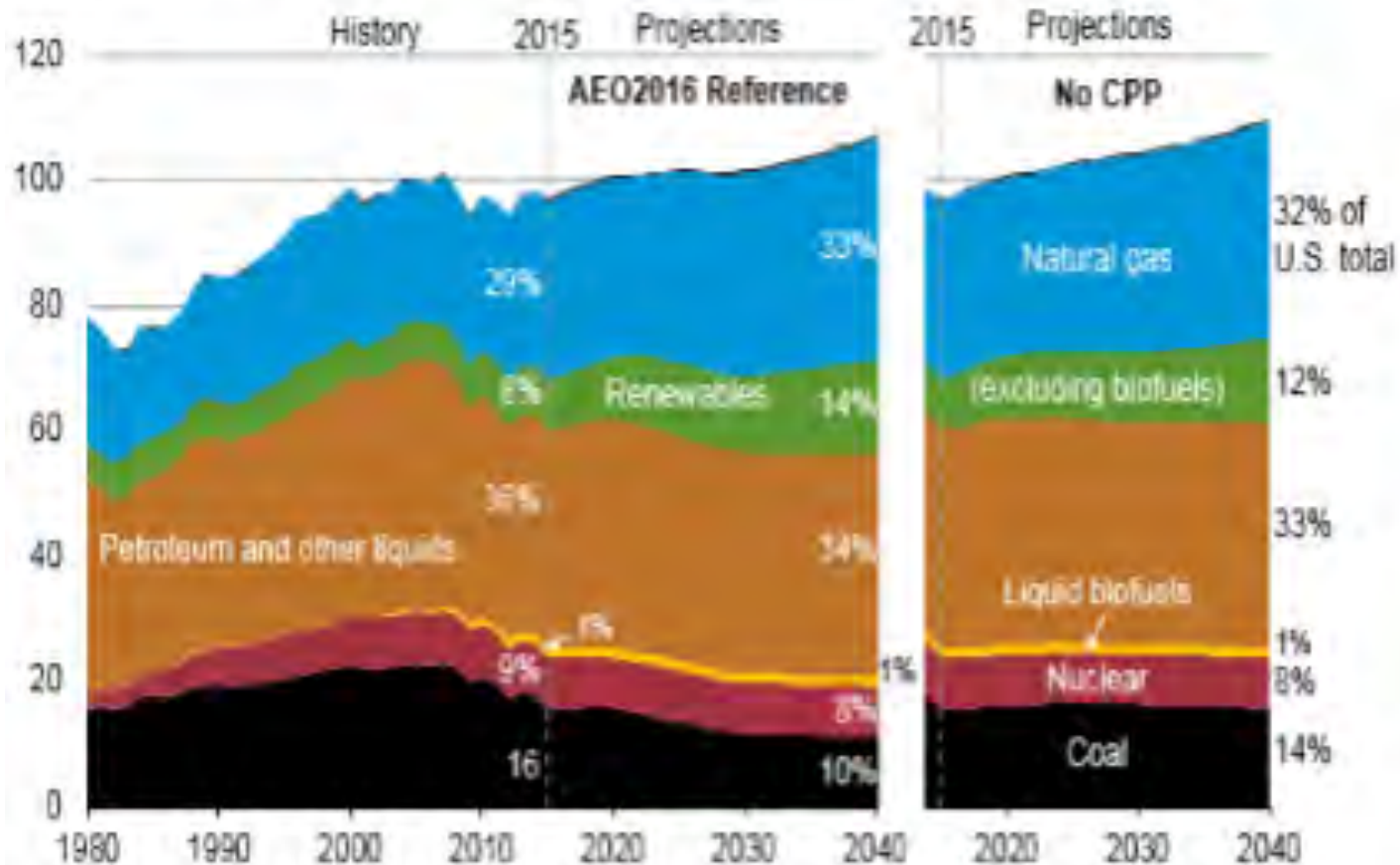
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Energy Consumption US

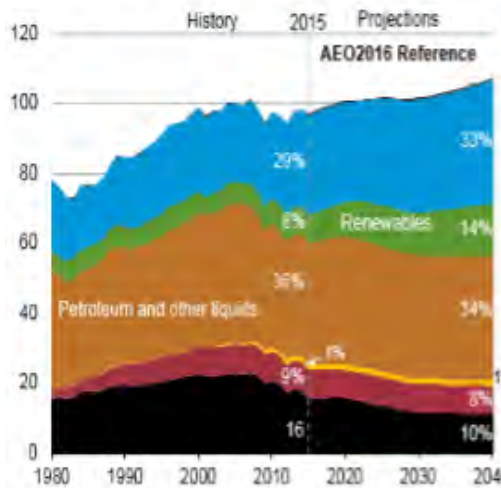
U.S. primary energy consumption
quadrillion Btu



Source: EIA, Annual Energy Outlook 2016

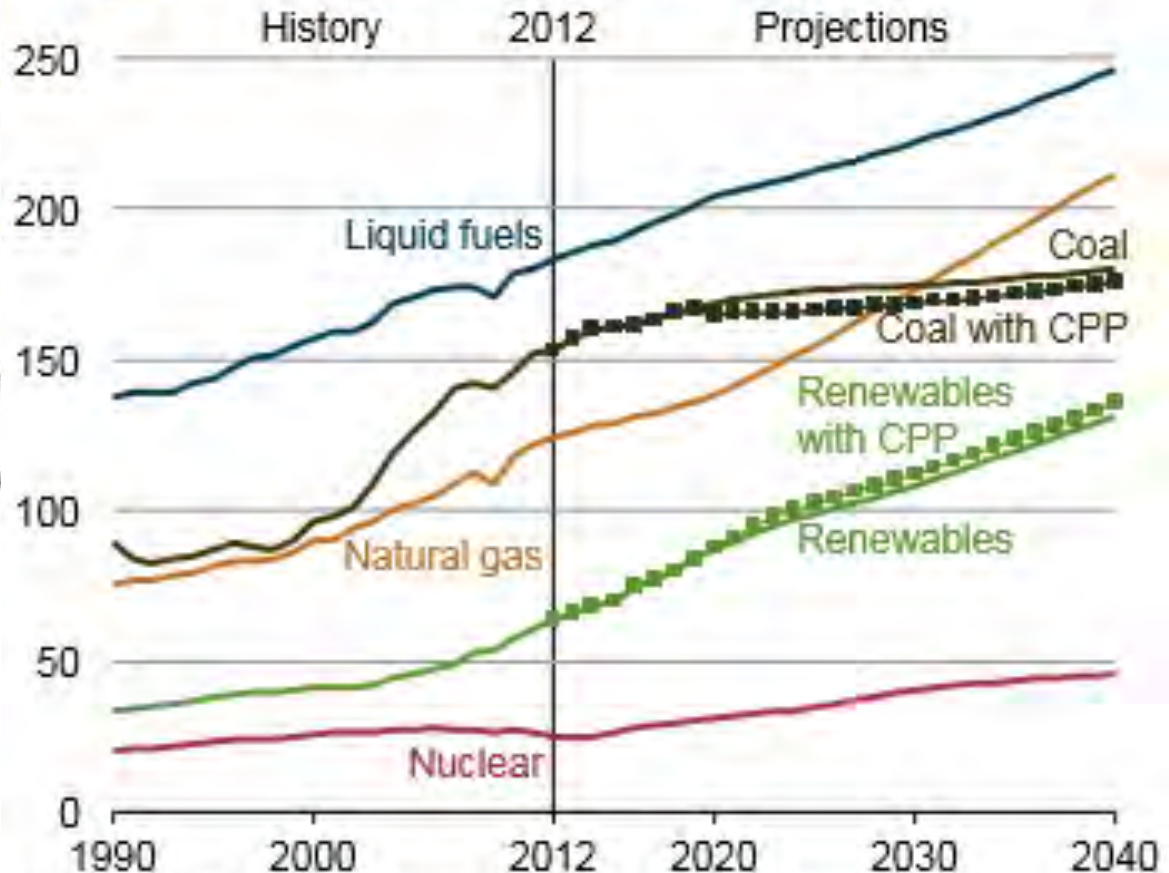
Energy Consumption US vs World

U.S. primary energy consumption
quadrillion Btu



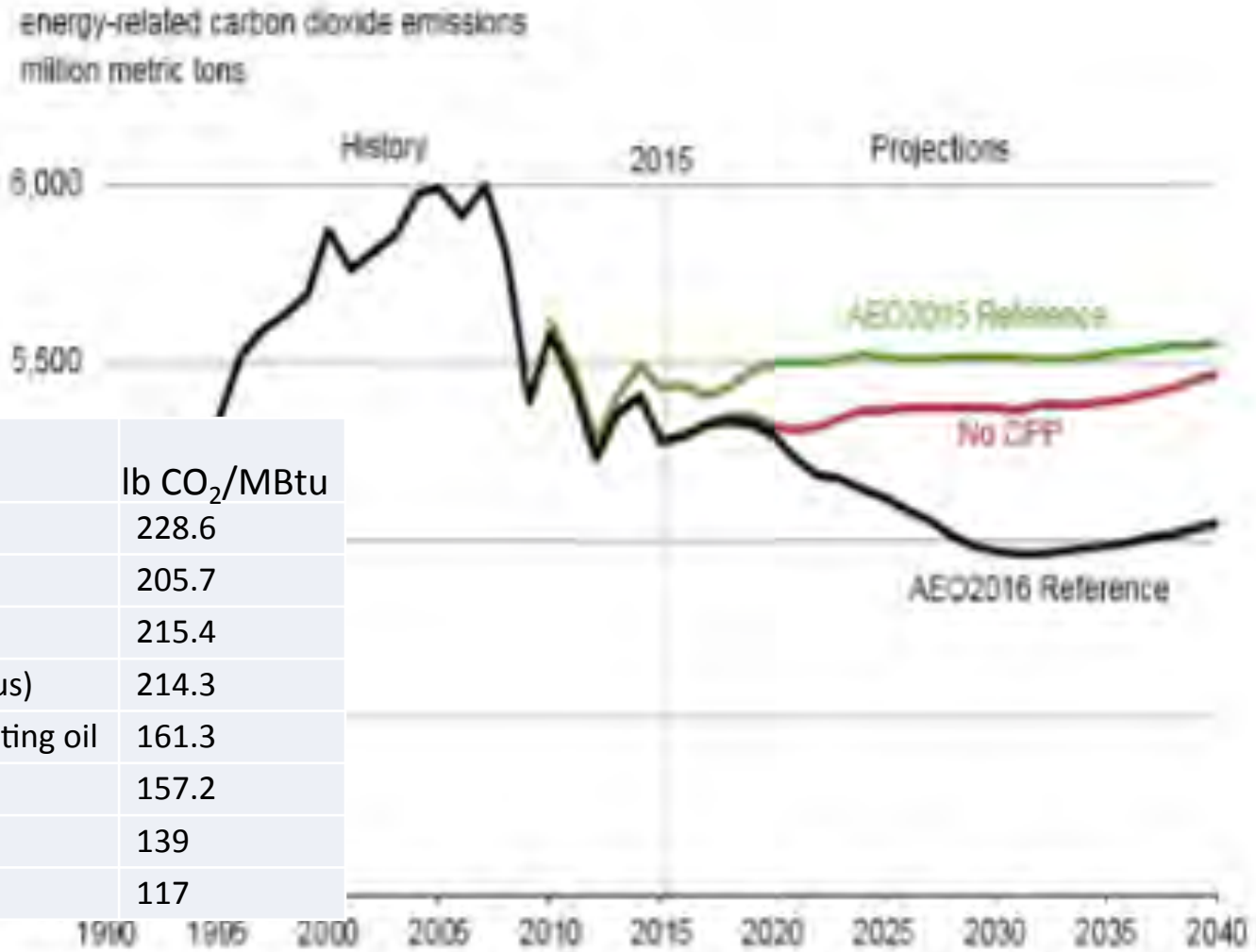
Source: EIA, Annual Energy Outlook 2015

Figure ES-2. Total world energy consumption by energy source, 1990–2040 (quadrillion Btu)



Note: Dotted lines for coal and renewables show projected effects of the U.S. Clean Power Plan.

US Carbon Emissions – EIA AEO2016

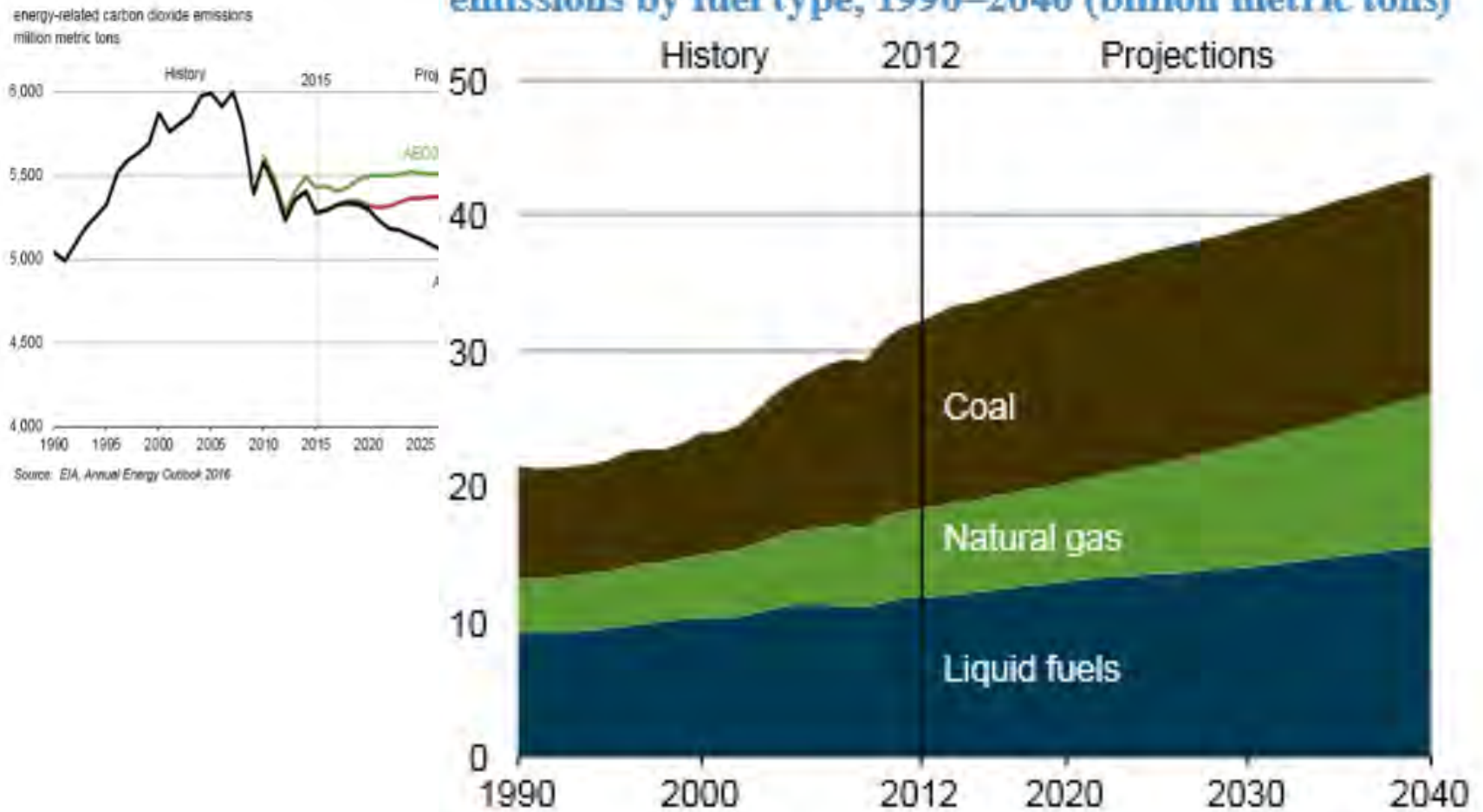


Source	lb CO ₂ /MBtu
Coal (anthracite)	228.6
Coal (bituminous)	205.7
Coal (lignite)	215.4
Coal (subbituminous)	214.3
Diesel fuel and heating oil	161.3
Gasoline	157.2
Propane	139
Natural gas	117

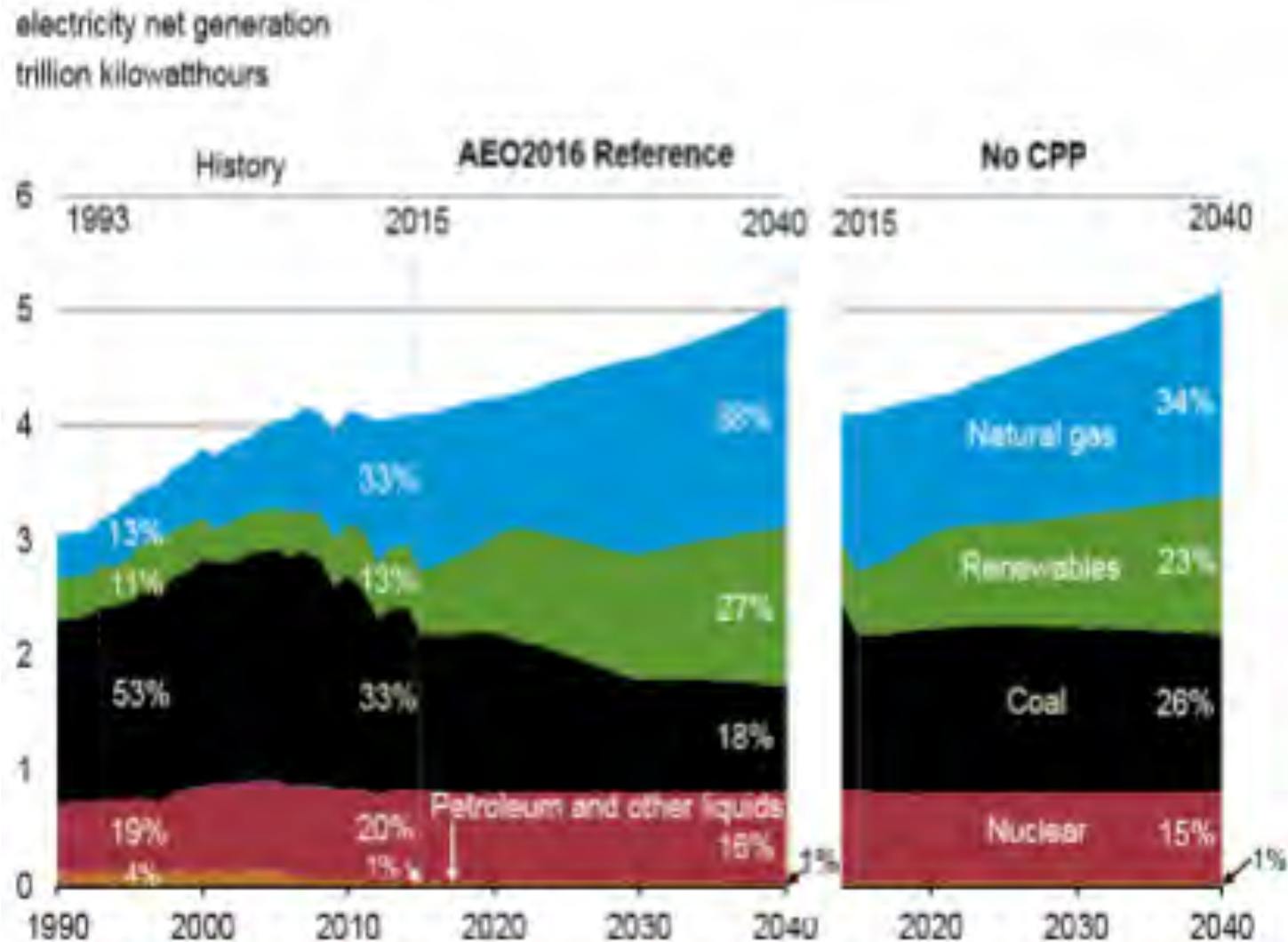
Source: EIA, Annual Energy Outlook 2016

Carbon Emissions: US vs World

Figure ES-8. World energy-related carbon dioxide emissions by fuel type, 1990–2040 (billion metric tons)

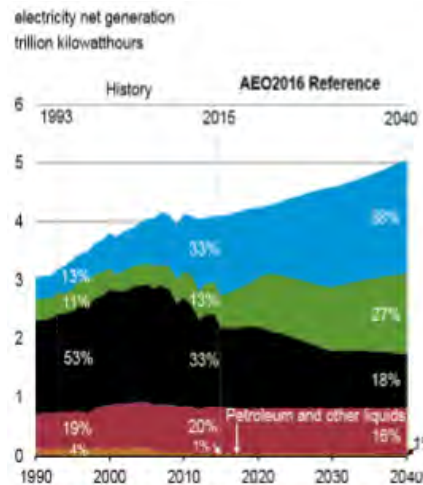


US Electricity Sources – EIA AEO2016

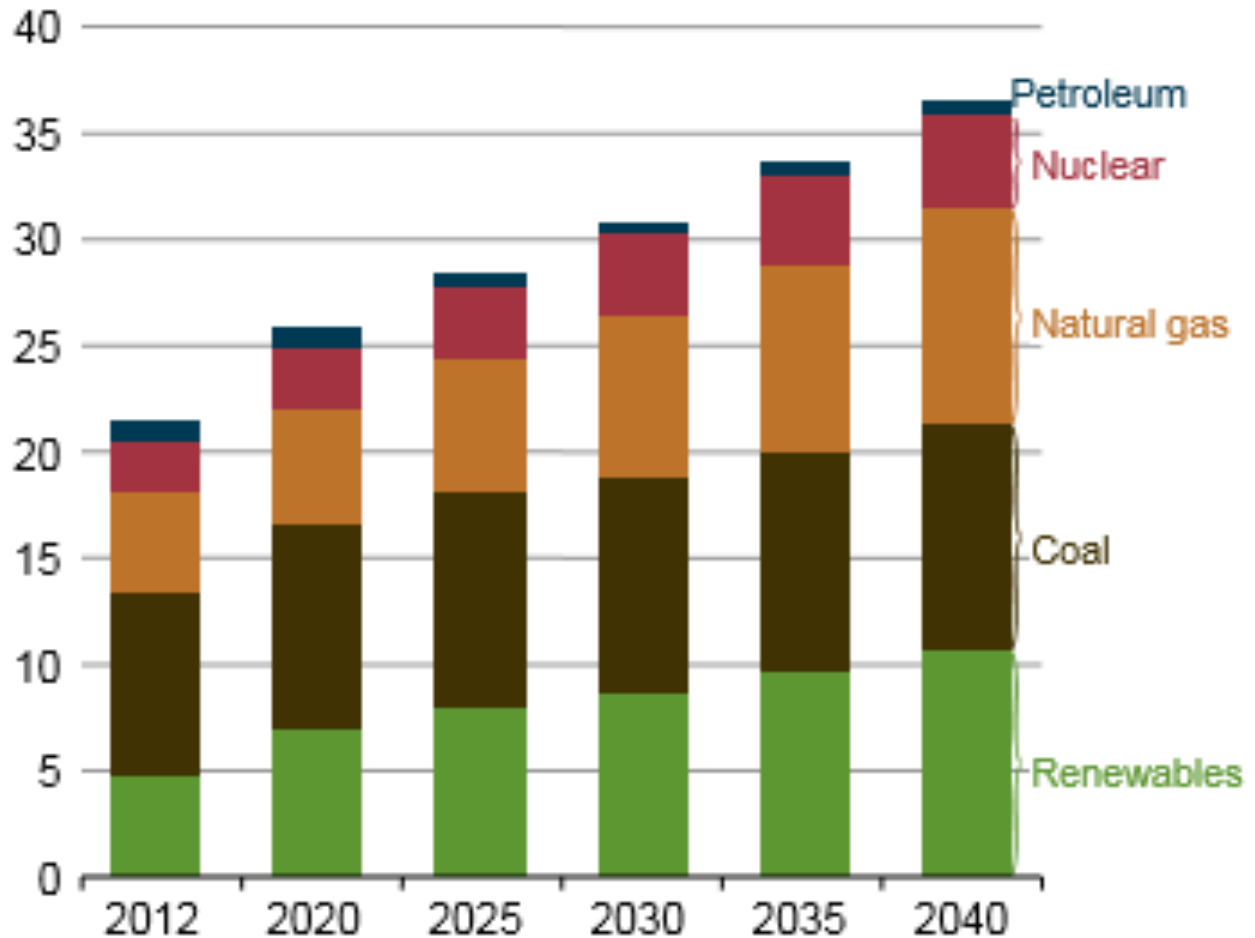


Electricity Sources: US vs World

Figure ES-6. World net electricity generation by energy source, 2012–40 (trillion kilowatthours)



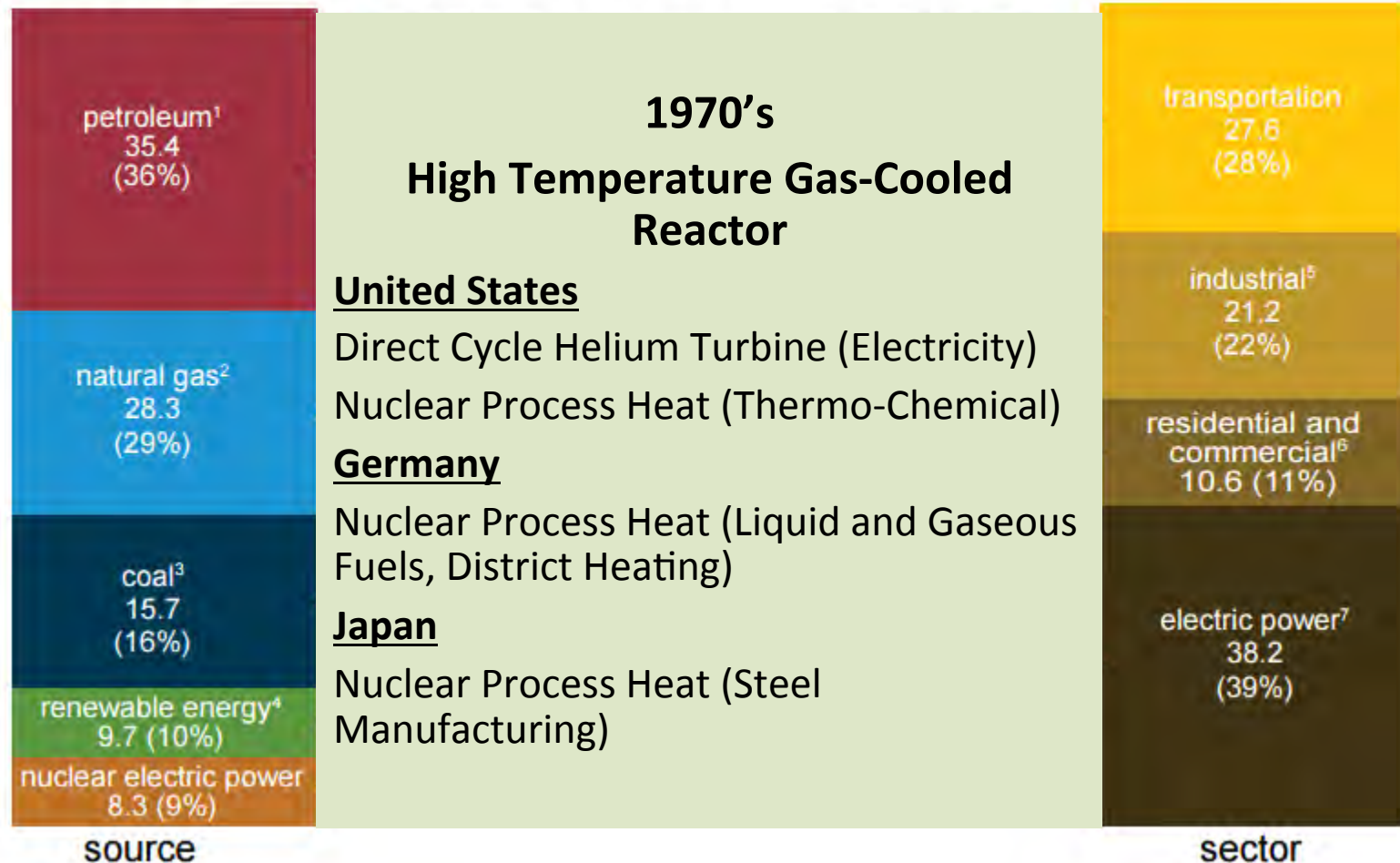
Source: EIA, Annual Energy Outlook 2016



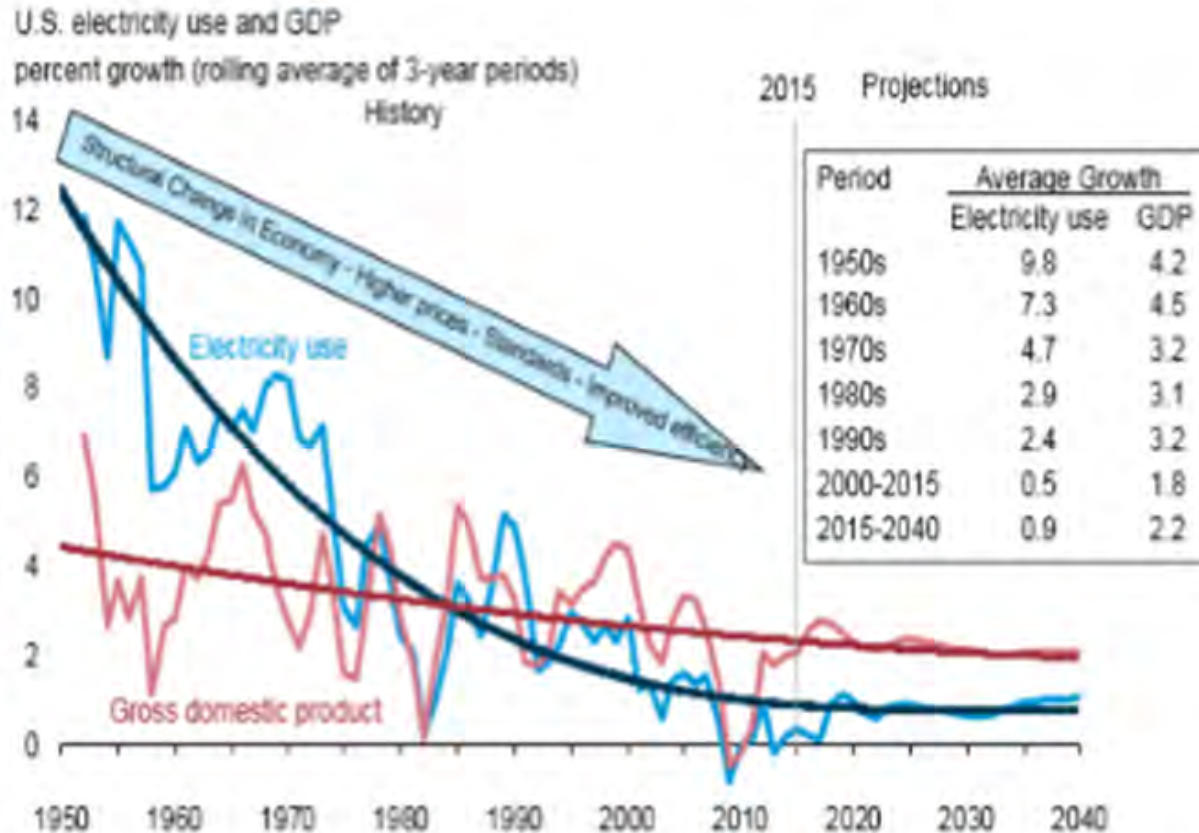
Nuclear Reactor Technology ~1980

U.S. primary energy consumption by source and sector, 2015

Total = 97.7 quadrillion British thermal units (Btu)



US Electricity & GDP Growth Rates



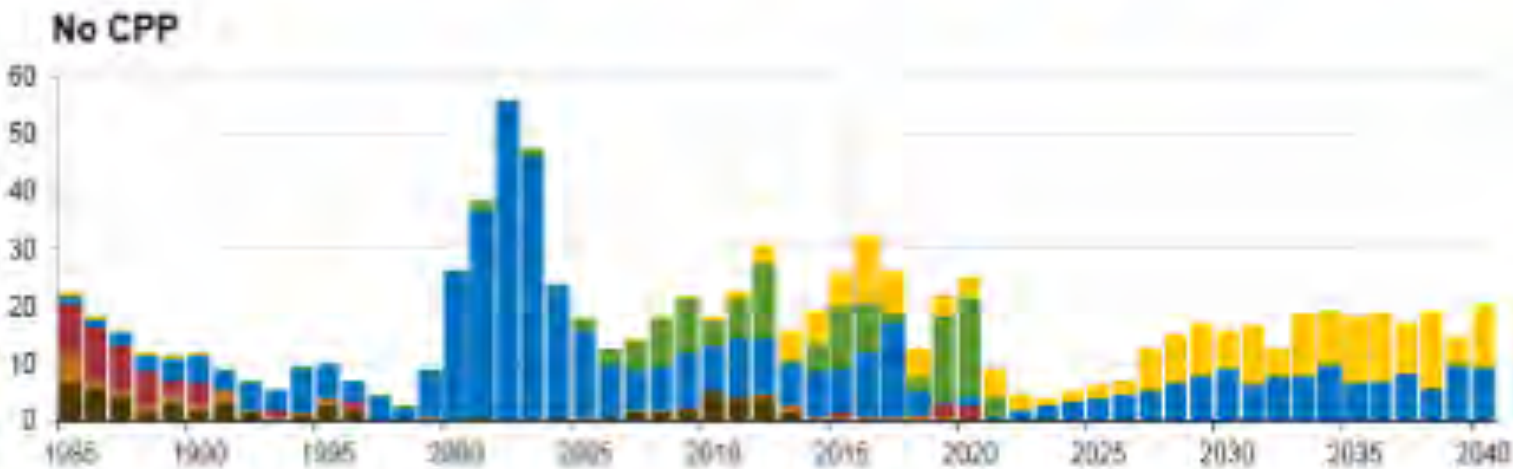
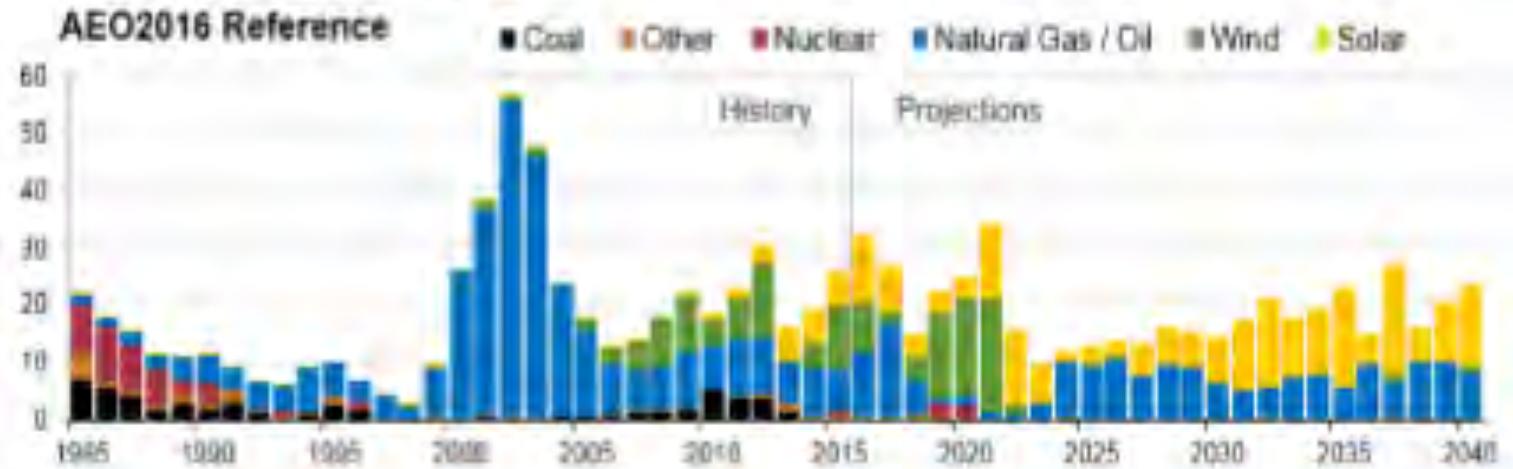
Source: EIA, Annual Energy Outlook 2016

Drivers

- ❖ Cost/Supply
- ❖ Incentives
- ❖ Construction Time
- ❖ Financial Risk

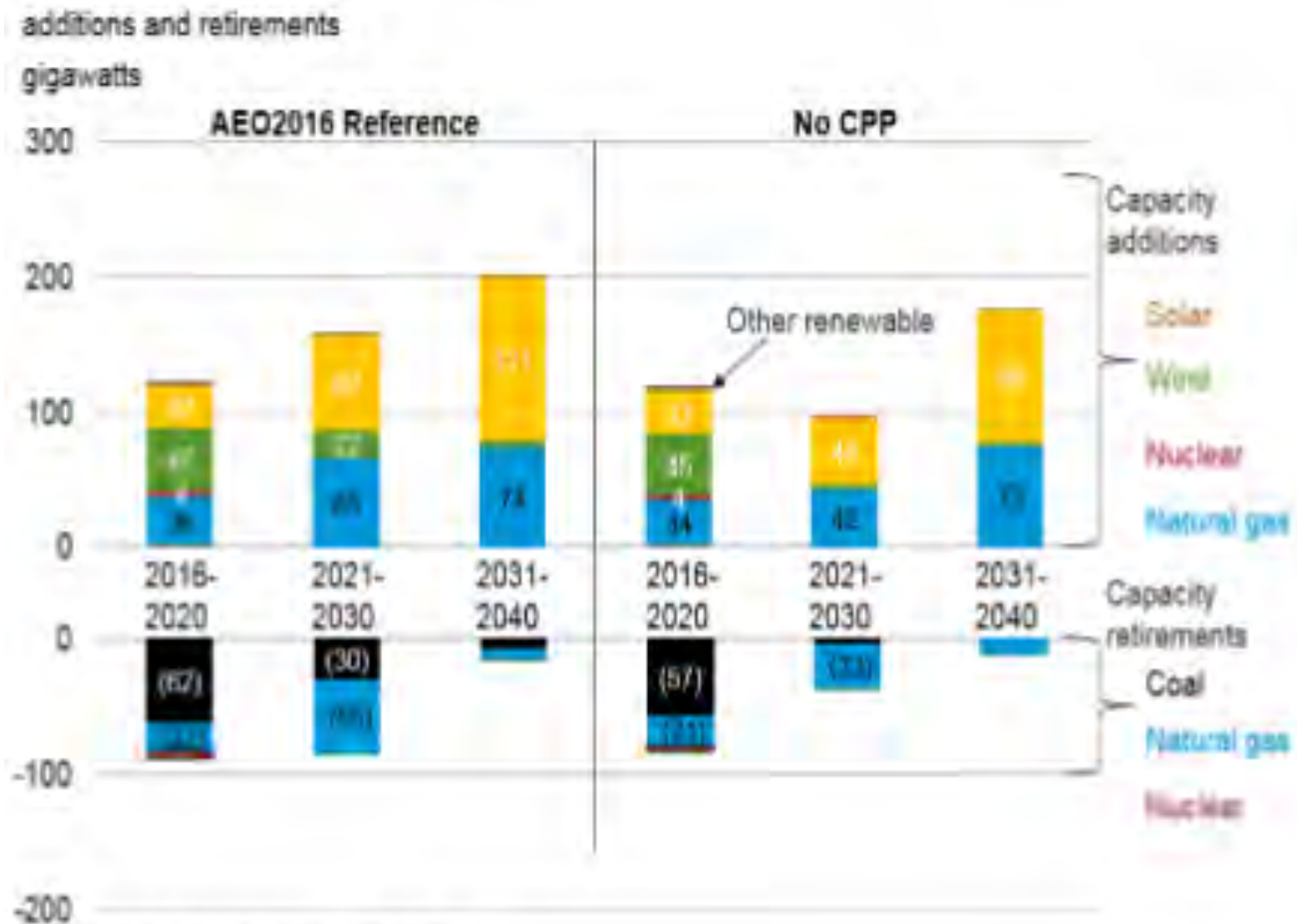
Generating Capacity Additions

annual capacity additions, gigawatts



Source: EIA, Annual Energy Outlook 2016

US Generation Additions & Retirements

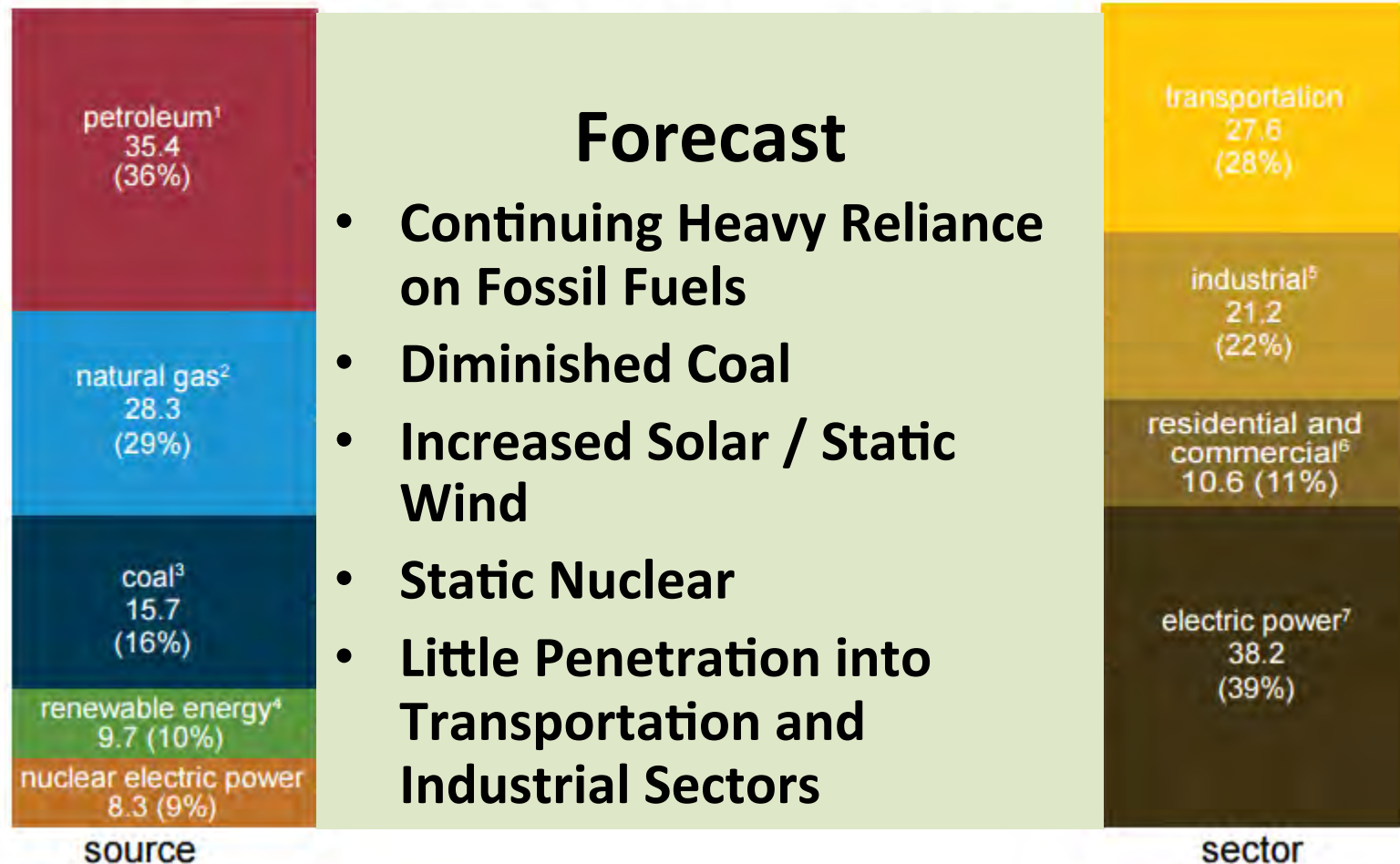


Source: EIA, Annual Energy Outlook 2016

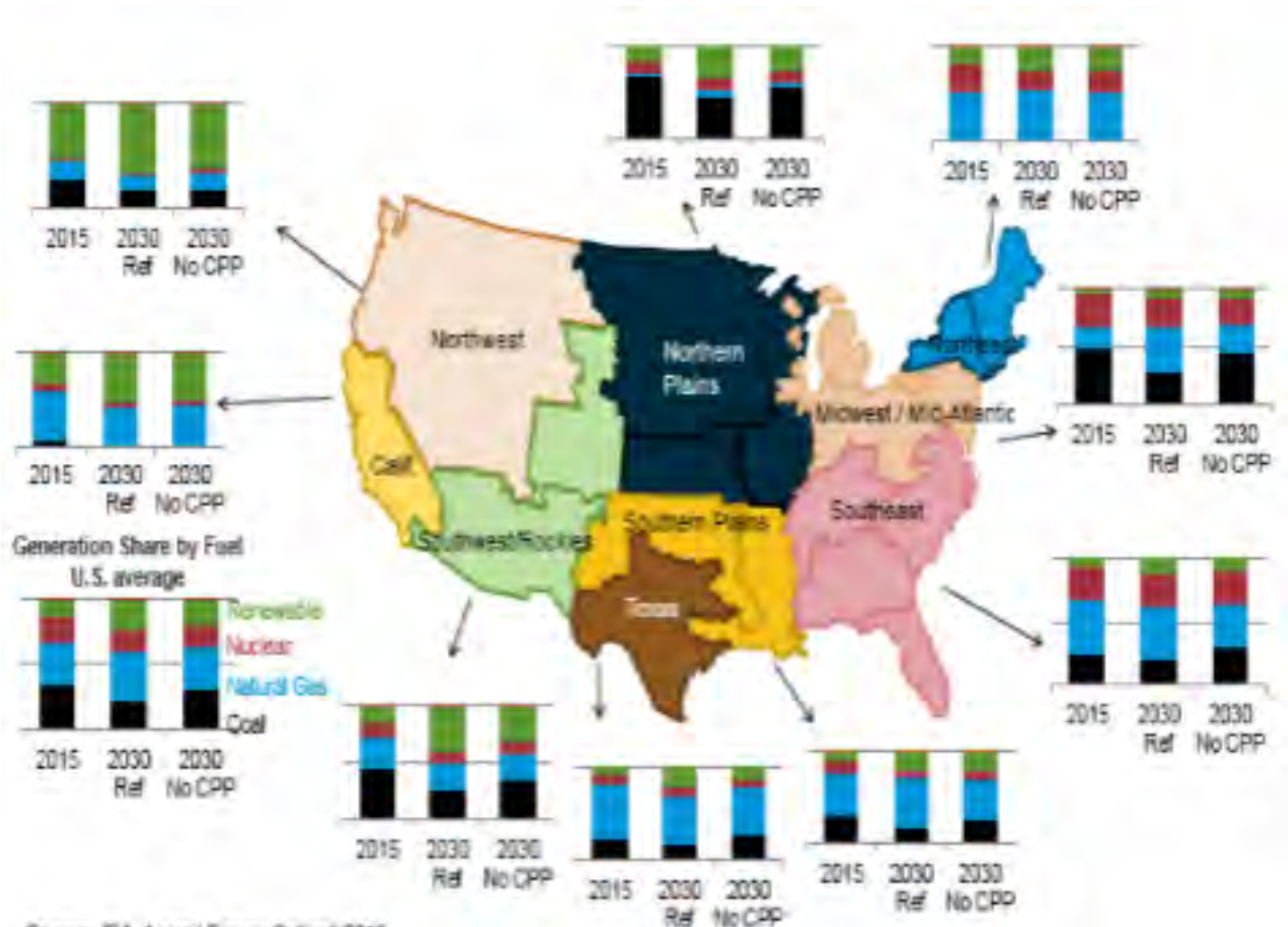
Future Electricity Trends

U.S. primary energy consumption by source and sector, 2015

Total = 97.7 quadrillion British thermal units (Btu)



US Regional Production Mixes



Objectives



THE **RUNDOWN**

A BLOG OF NEWS AND IN

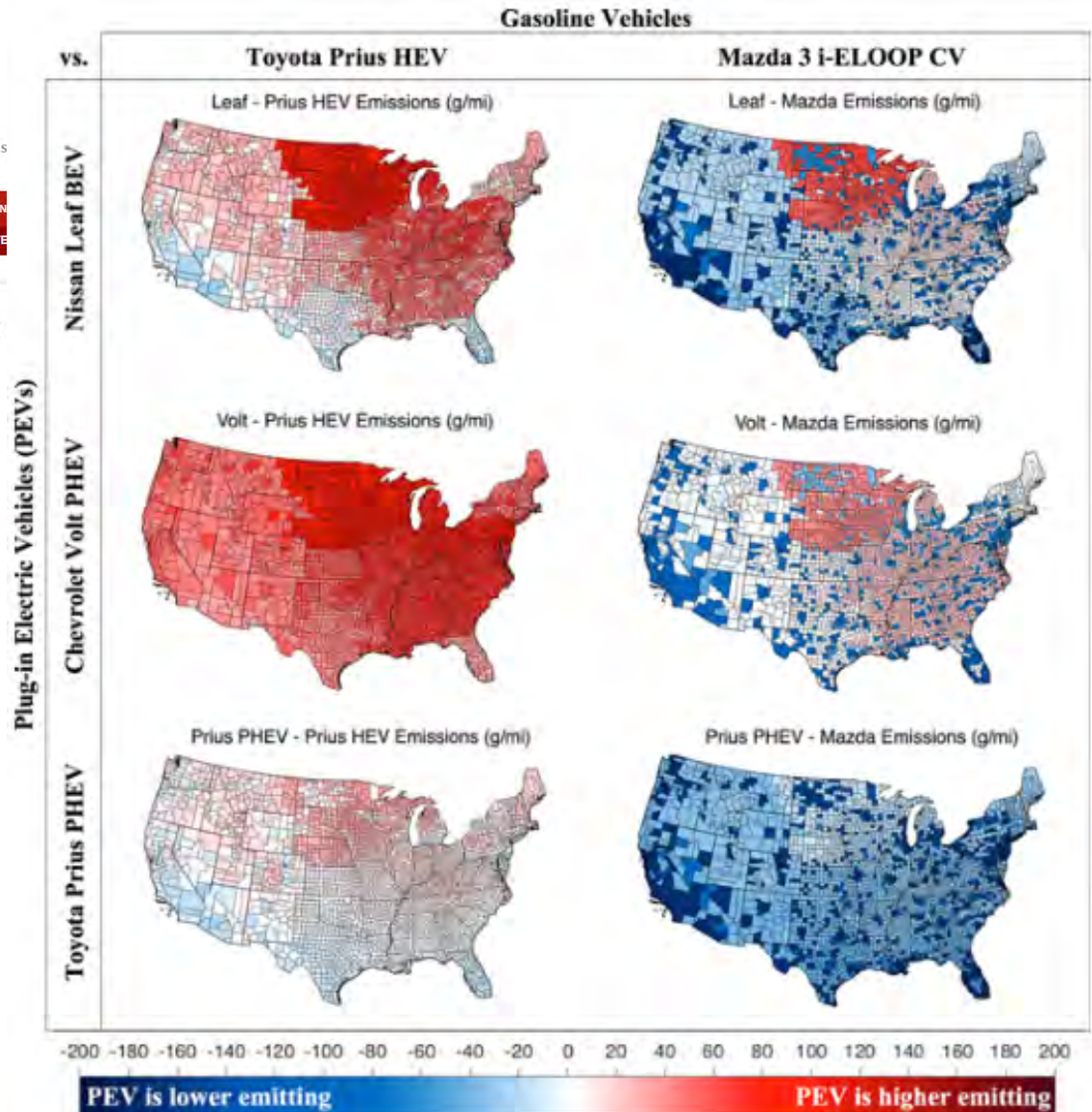
HEALTH SUPREME COURT VOTE

SCIENCE

Why charging an electric car at night is worse for the environment



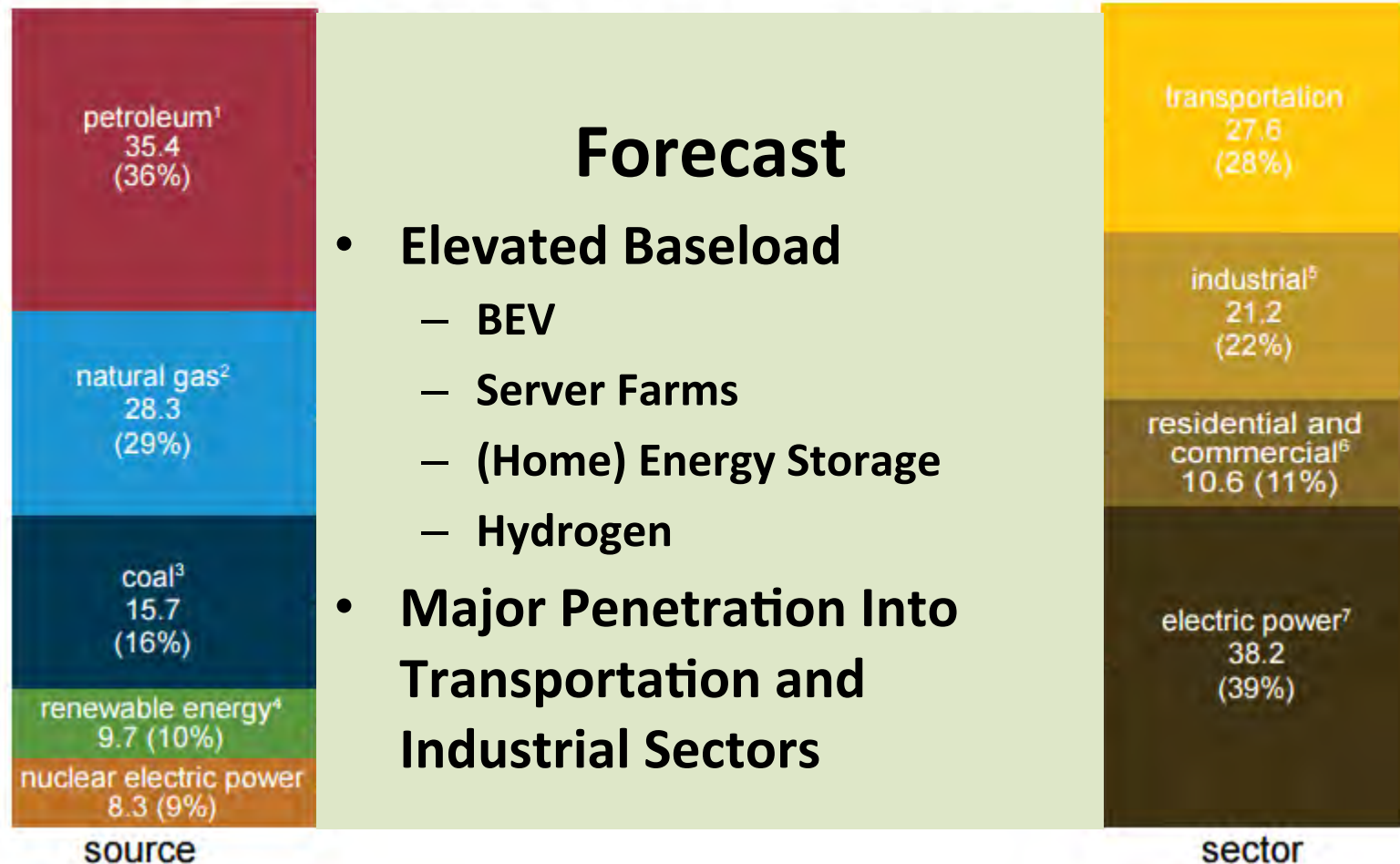
BY DAVID BIELLO May 12, 2016 at 3:22 PM EDT



Disruptors

U.S. primary energy consumption by source and sector, 2015

Total = 97.7 quadrillion British thermal units (Btu)



Poseidon's SONGS

Carlsbad Project



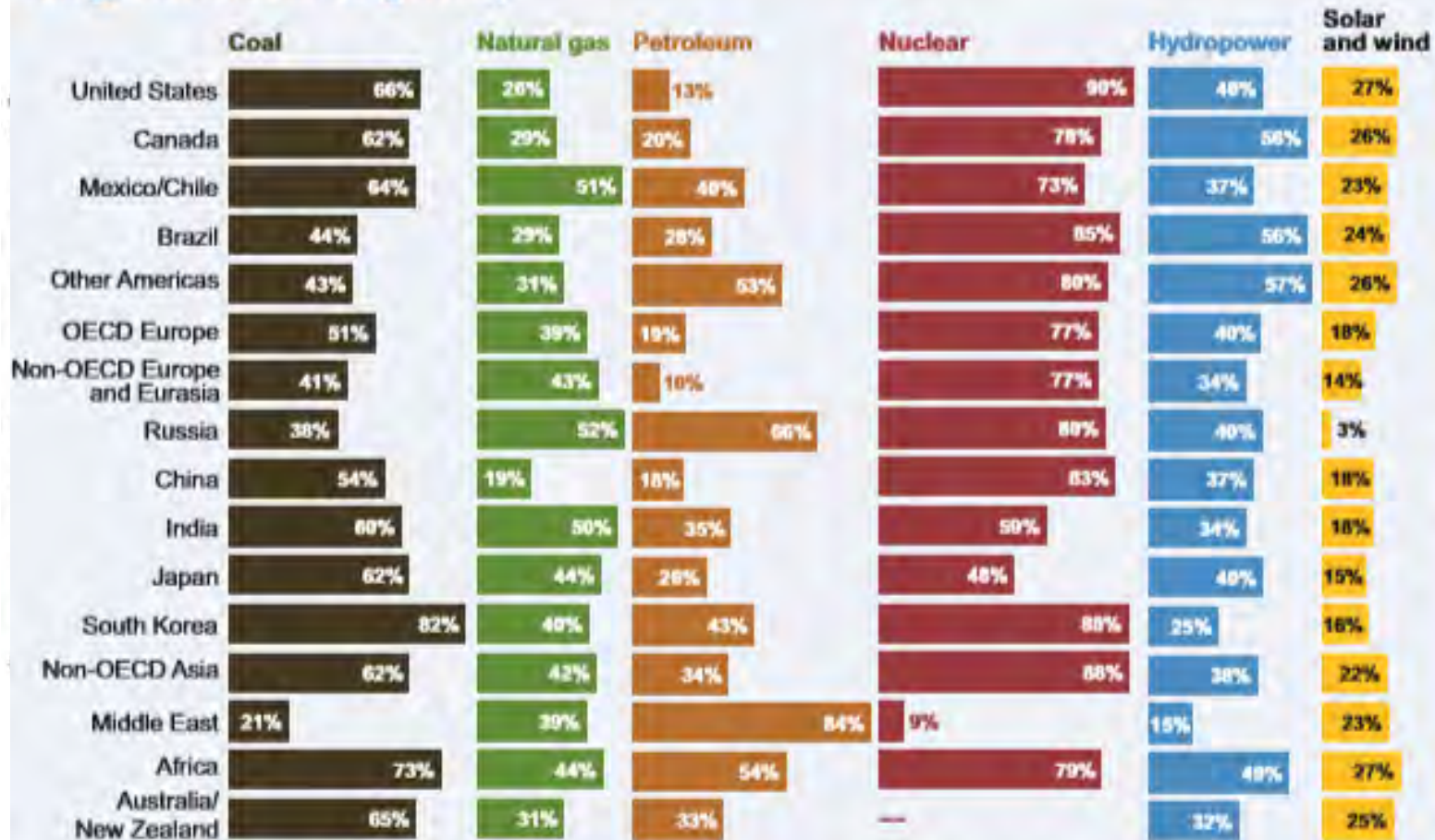
Poseidon's Carlsbad Water Purification Plant: 50 Million Gallons per day; 40 MW continuous power; 10% of the San Diego Water Supply

Units 2 & 3 of the San Onofre Nuclear Generating Station (SONGS); 2 Pressurized Water Reactors; ~1000 MWe each; Operated 1984-2013



Capacity Factors

Figure 5-9. Average annual capacity factors for electricity generators by IEO region and energy source, 2008–12 (percent)



Note: Solar and wind capacity factors for Russia and the Other Americas region include only wind capacity. Australia/New Zealand has no installed nuclear capacity.

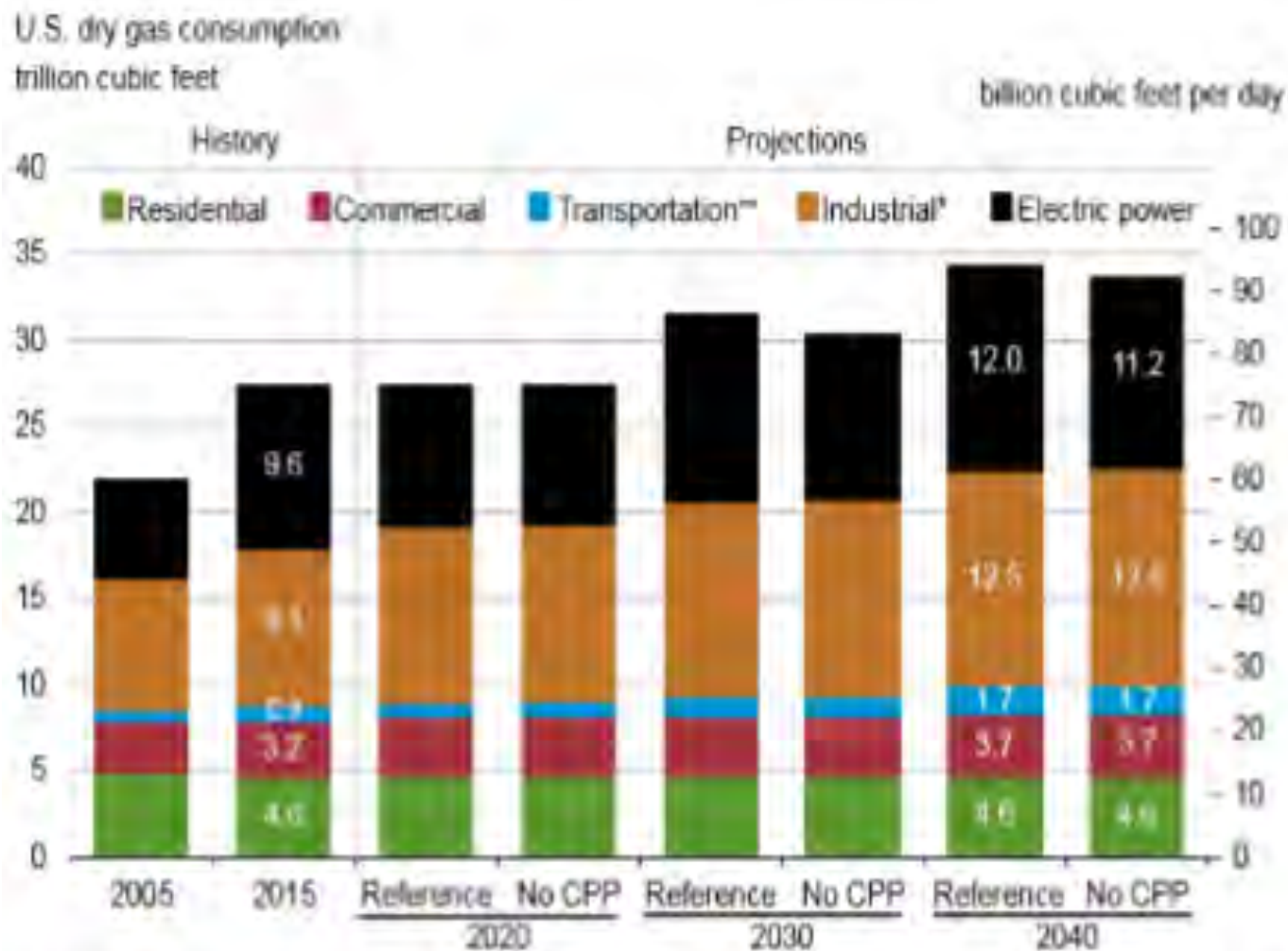
Data Centers

- [10. The SuperNAP, Las Vegas \(Switch Communications\)](#)
- [9A and 9B. Microsoft Data Centers in Quincy Washington and San Antonio](#)
- [8. CH1, Elk Grove Village, Ill. \(DuPont Fabros\)](#)
- [7. Phoenix ONE, Phoenix \(i/o Data Centers\)](#)
- [6. Microsoft Dublin \(Microsoft\)](#)
- [5. Container Data Center, Chicago \(Microsoft\)](#)
- [4. NGD Europe, Newport Wales \(Next Generation Data\)](#)
- [3. The NAP of the Americas, Miami \(Terremark\)](#)
- [2. Metro Technology Center, Atlanta \(Quality Technology\)](#)
- [1. 350 East Cermak / Lakeside Technology Center \(Digital Realty\)](#)

Energy Requirements

- ❖ Current: ~91 Billion KWh per year
- ❖ Equals ~17 1000MWe Nuclear Power Plants
- ❖ Estimated to grow to 140 Billion KWh per year in 2020
- ❖ Equivalent to 25 1000MWe Nuclear Power Plants

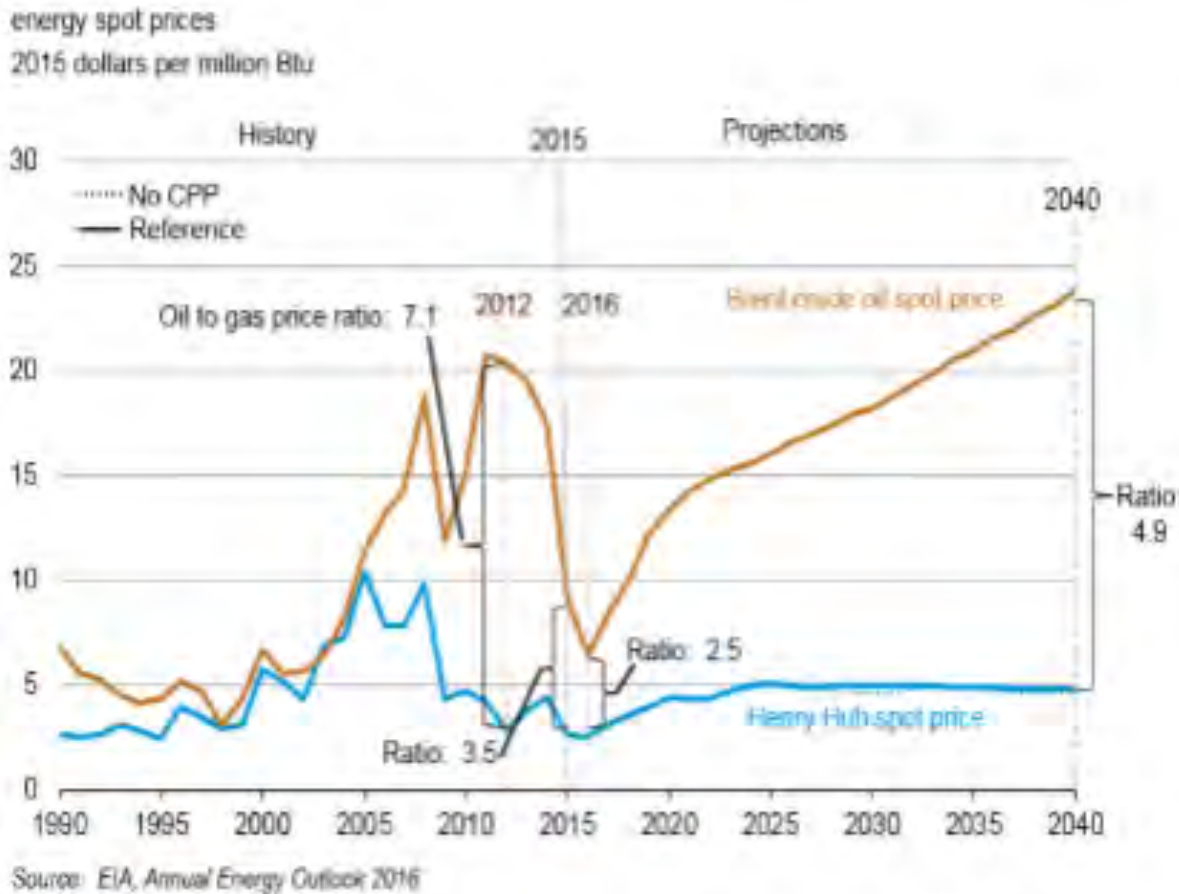
Industrial Sector Energy: Heat



Source: EIA, Annual Energy Outlook 2016

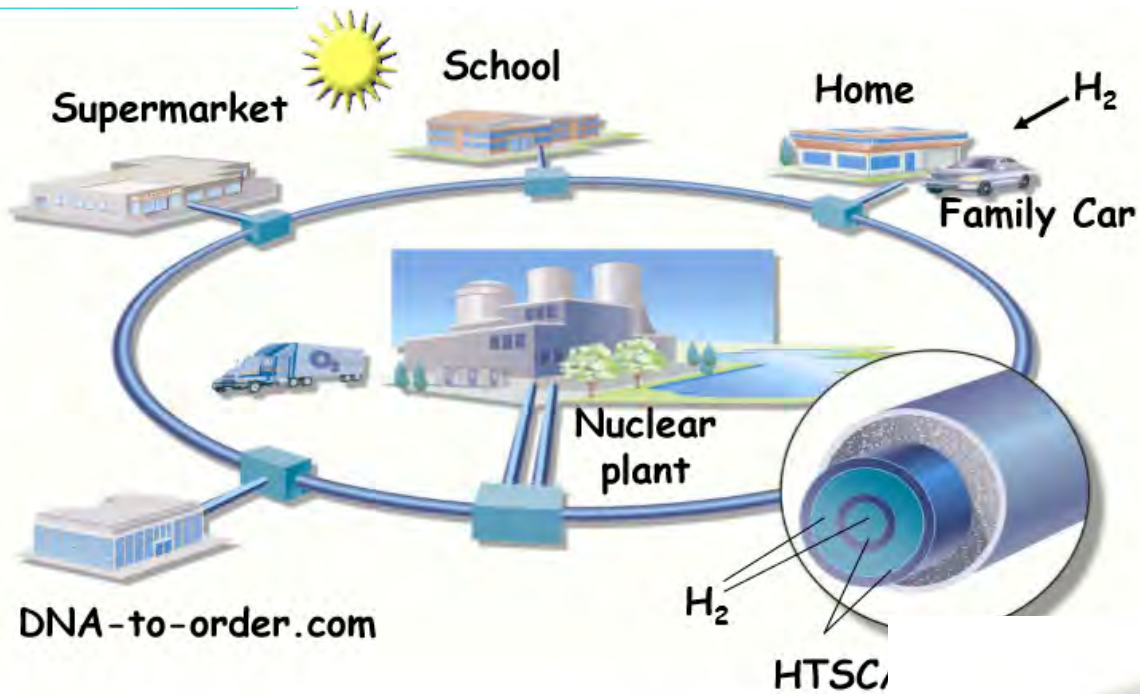
*Includes combined heat-and-power and lease, plant, and export liquefied gas
**Includes pipeline fuel

Transportation: Pressure on Liquid Fuels



Nuclear
Supported
Options:
BEV (Electricity)
HFCV (Hydrogen)

Nuclear – LH₂ – Electric - Transportation



Chauncey Starr & Paul
Michael Grant, EPRI

