

This Course and The U.S. Energy System

Lecture 1

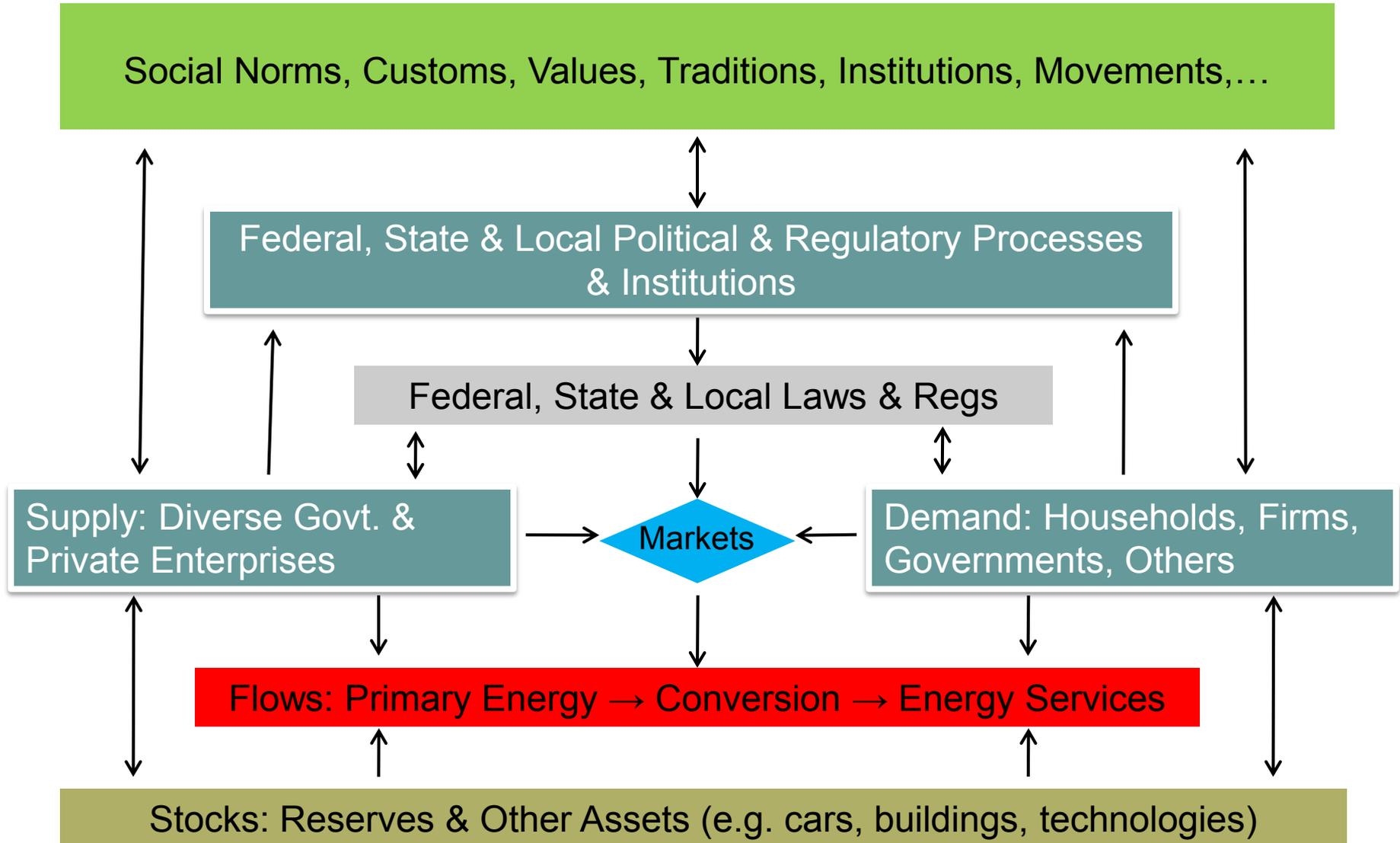
Discussion: Why Are We Here?

- How should we define “energy” in this course – and why?
- Why are you interested in energy?
- Does America face an “energy problem”? If so, what is it?
- Why haven’t all the smart people working in private business solved the problem?

Why Are We Here? (2)

- In the State of the Union address, President Obama again pushed a “clean energy standard” – a requirement that X% of American electricity come from “clean energy sources” by 20xx
 - What do you think he meant by “clean”?
 - Would this raise or lower the price of electricity?
 - What might be done to make this happen?
- What, if anything, does social science have to do with creating – or solving – the “energy problem”? With achieving Obama’s goal – or not?

The U.S. Energy System – A Social Science View



Course Objectives

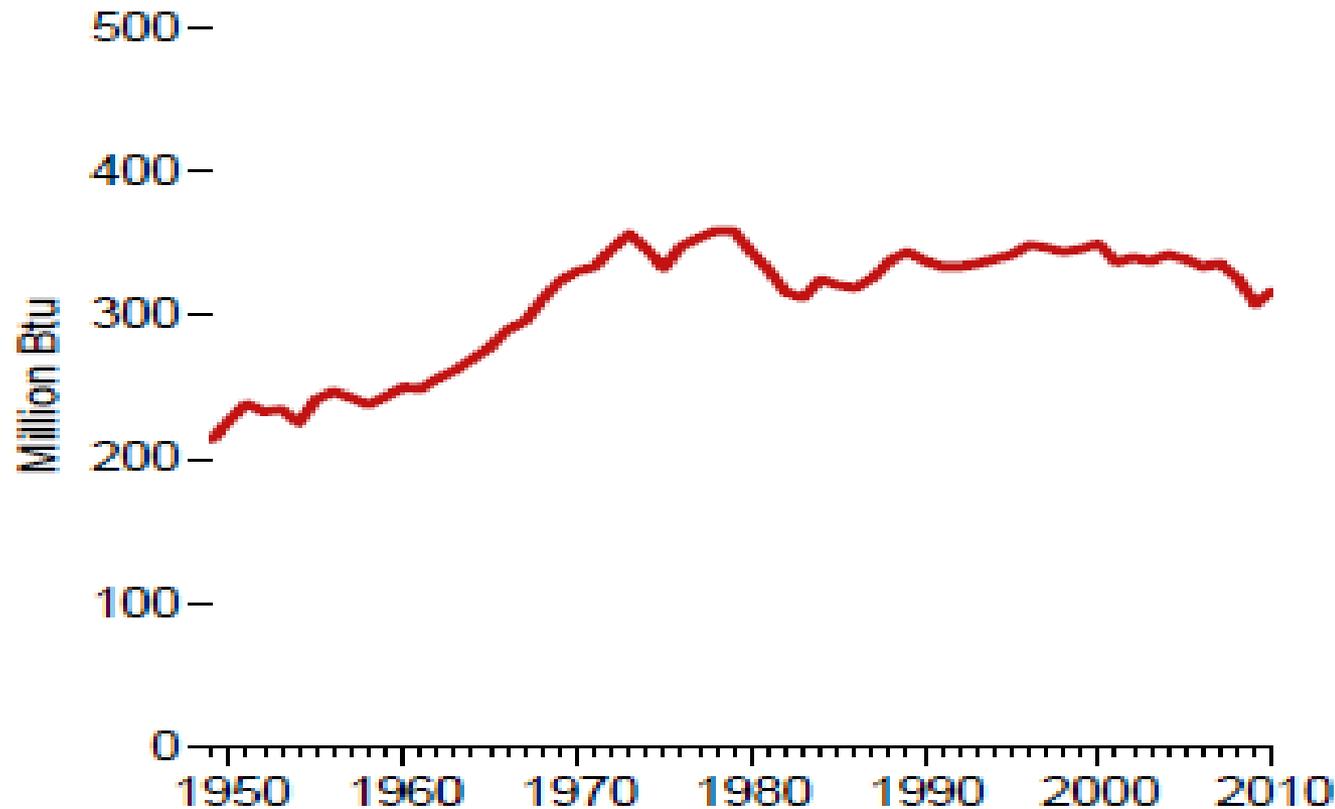
- Social science is useful for analyzing *systems with humans*, and as a source of tools to devise strategies for changing such systems
- Course objective: to prepare you to use the tools of the social sciences to understand and shape real energy decisions, markets, and policies
 - Tools: economics, management, sociology, & political science
 - Applied in the energy context to individuals, households, organizations, social movements, and governmental entities
- We won't try to predict your energy future; we will try to make you better able to shape it!

Outline & Grading

- Overview: Energy Systems & Policies – 5 sessions
- The Climate Problem – 2 sessions
 - Will play a climate policy negotiation game
 - One short paper based on that game (10% of the final grade)
- Decisions by Households & Organizations – 8 sessions
 - First in-class quiz (20%)
 - Select paper topics, form teams, submit outlines (10%)
- Primary Energy & Electricity – 4 sessions
- Public Policies: Determinants & Processes – 5 sessions
 - Second in-class quiz (20%)
 - Final (team) paper due (25%)
- Paper presentations & Course Debrief – 2 sessions
 - Paper presentations (5%)
- Attendance & participation will count for 10%

Some basic facts (AER 2010): energy/capita: flat in recent years

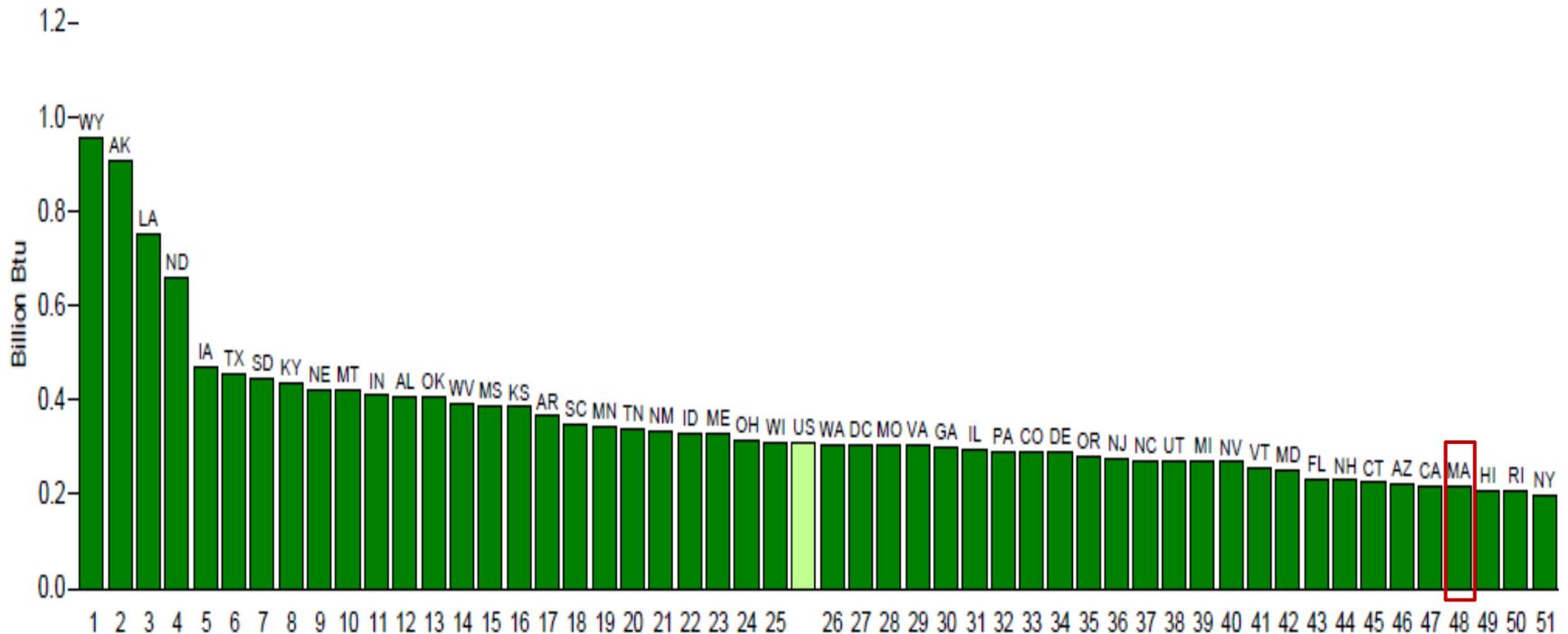
**Energy Consumption per Person,
1949-2010**



Source: U.S. Energy Information Administration. *Annual Energy Review 2010*. Washington, DC: Government Printing Office, 2010, p. 12.

Big Differences Among States – Why?

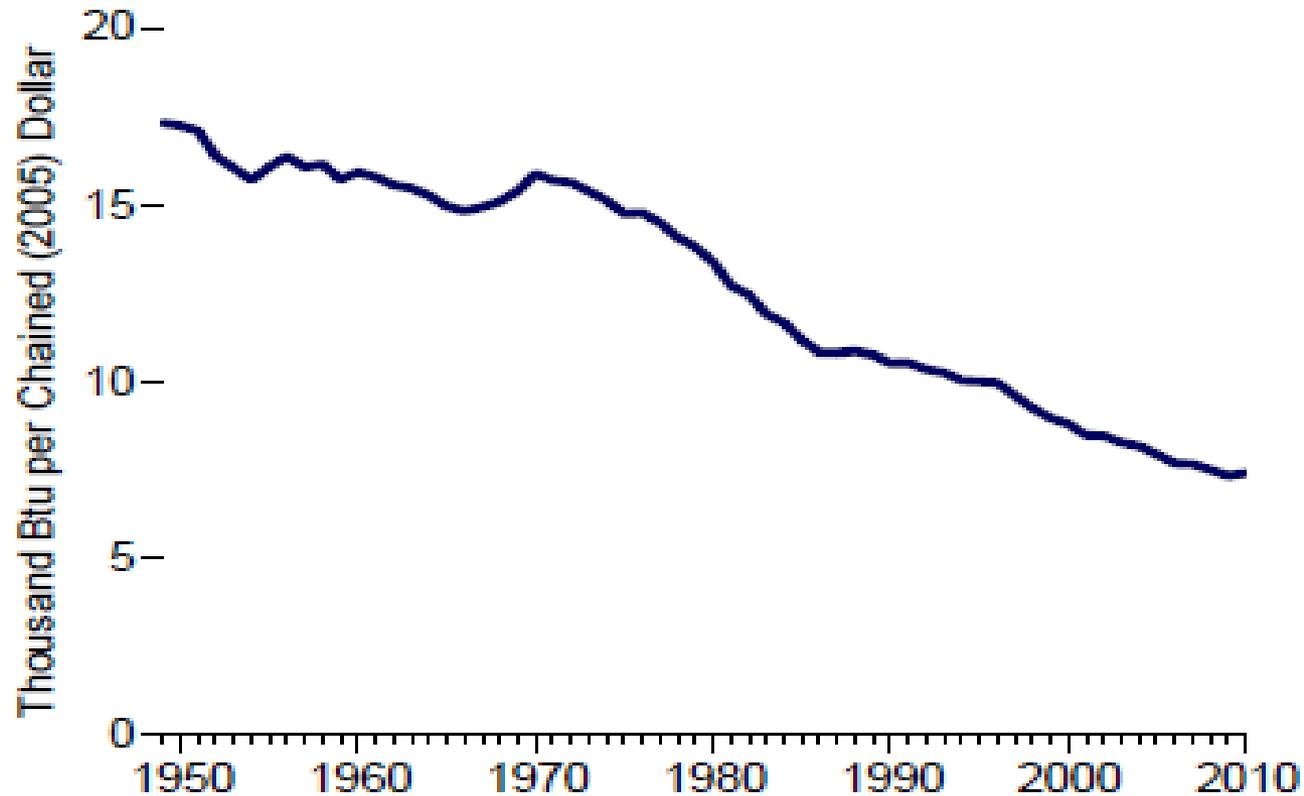
Consumption per Person



Source: U.S. Energy Information Administration. *Annual Energy Review 2010*. Washington, DC: Government Printing Office, 2010, p. 14.

Energy/GDP: declining for decades

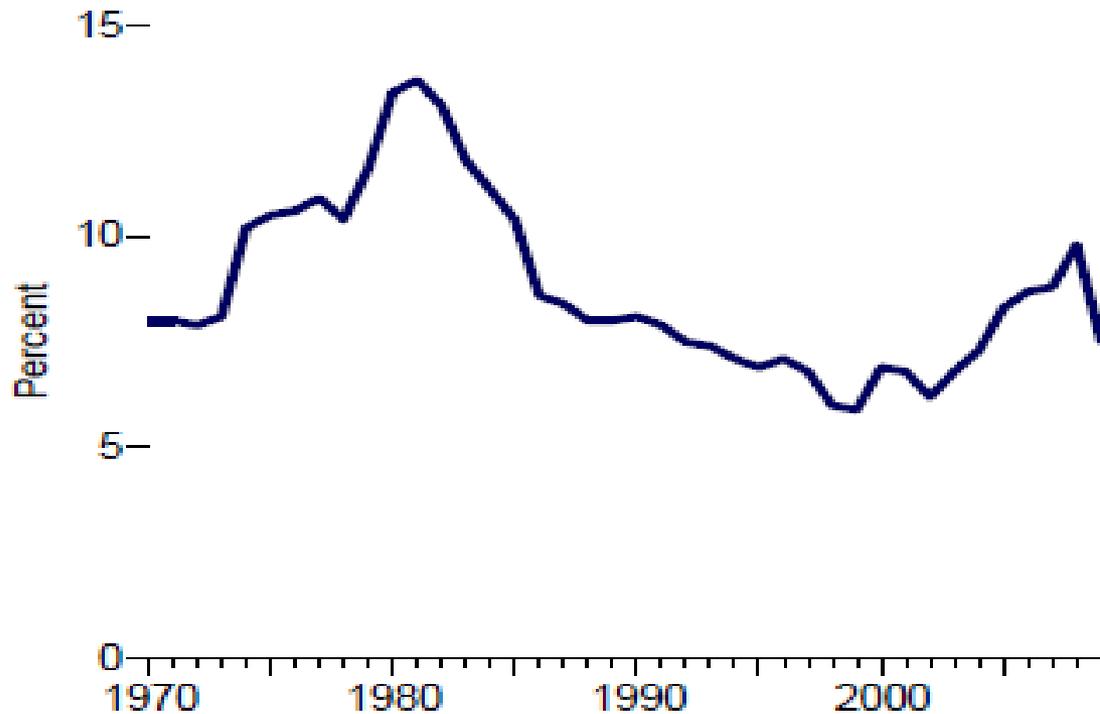
Energy Consumption per Real Dollar² of Gross Domestic Product, 1949-2010



Source: U.S. Energy Information Administration. *Annual Energy Review 2010*. Washington, DC: Government Printing Office, 2010, p. 12.

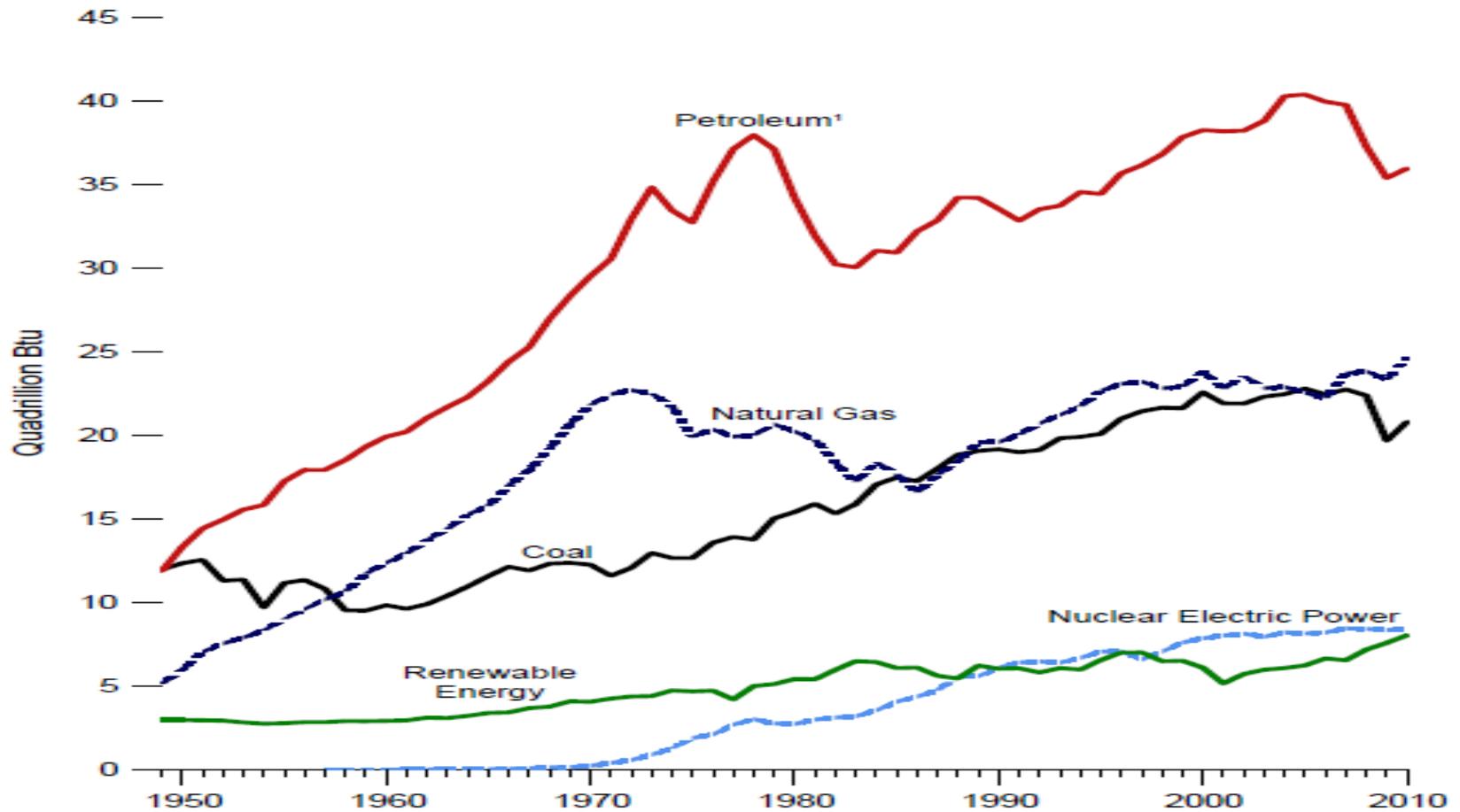
Energy \$\$/GDP: Not so Simple...

Energy Expenditures as Share of Gross Domestic Product, 1970-2009



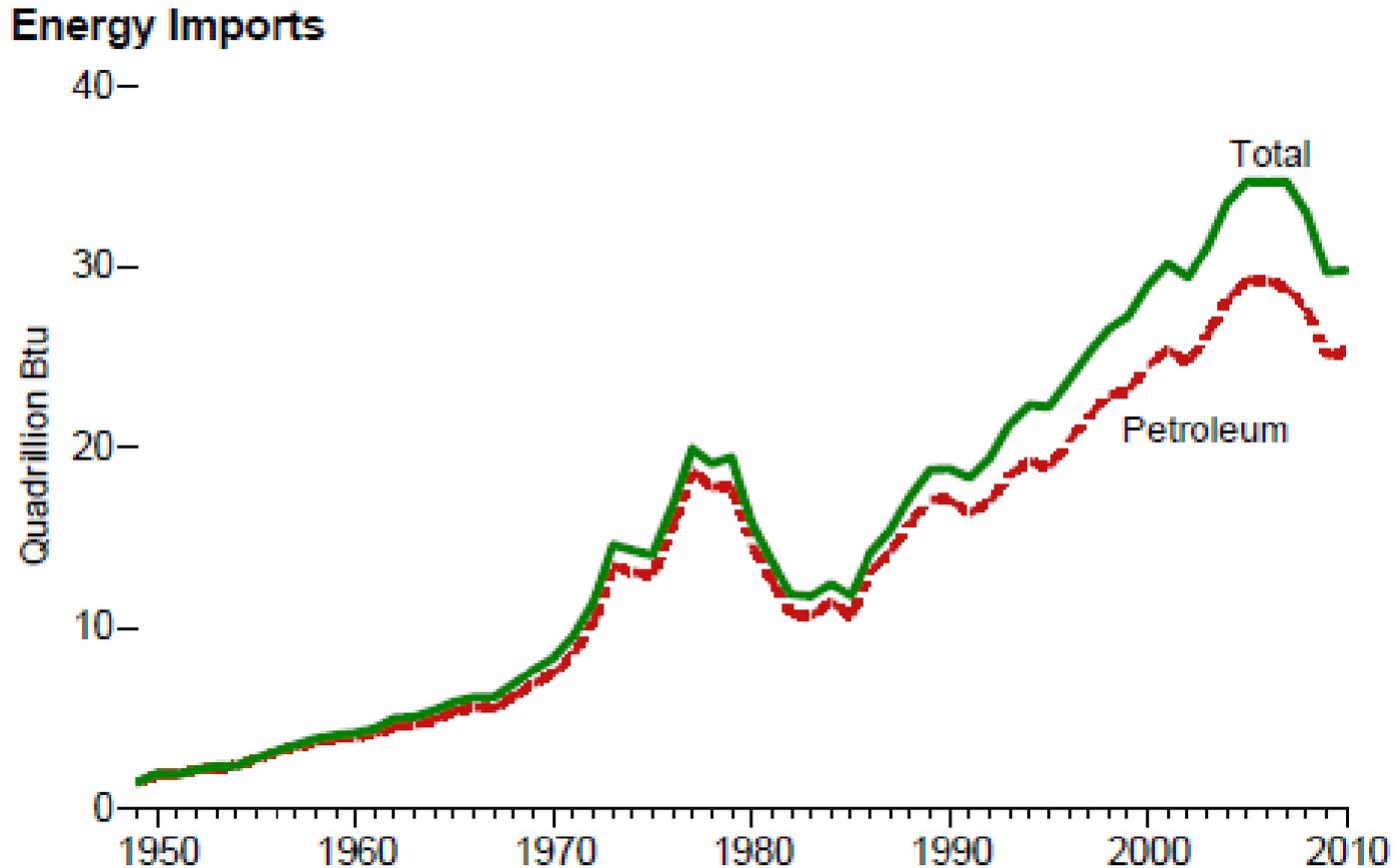
Sources of Energy Consumption: First wood, then coal, then...

By Major Source, 1949-2010



Source: U.S. Energy Information Administration. *Annual Energy Review 2010*. Washington, DC: Government Printing Office, 2010, p. 8.

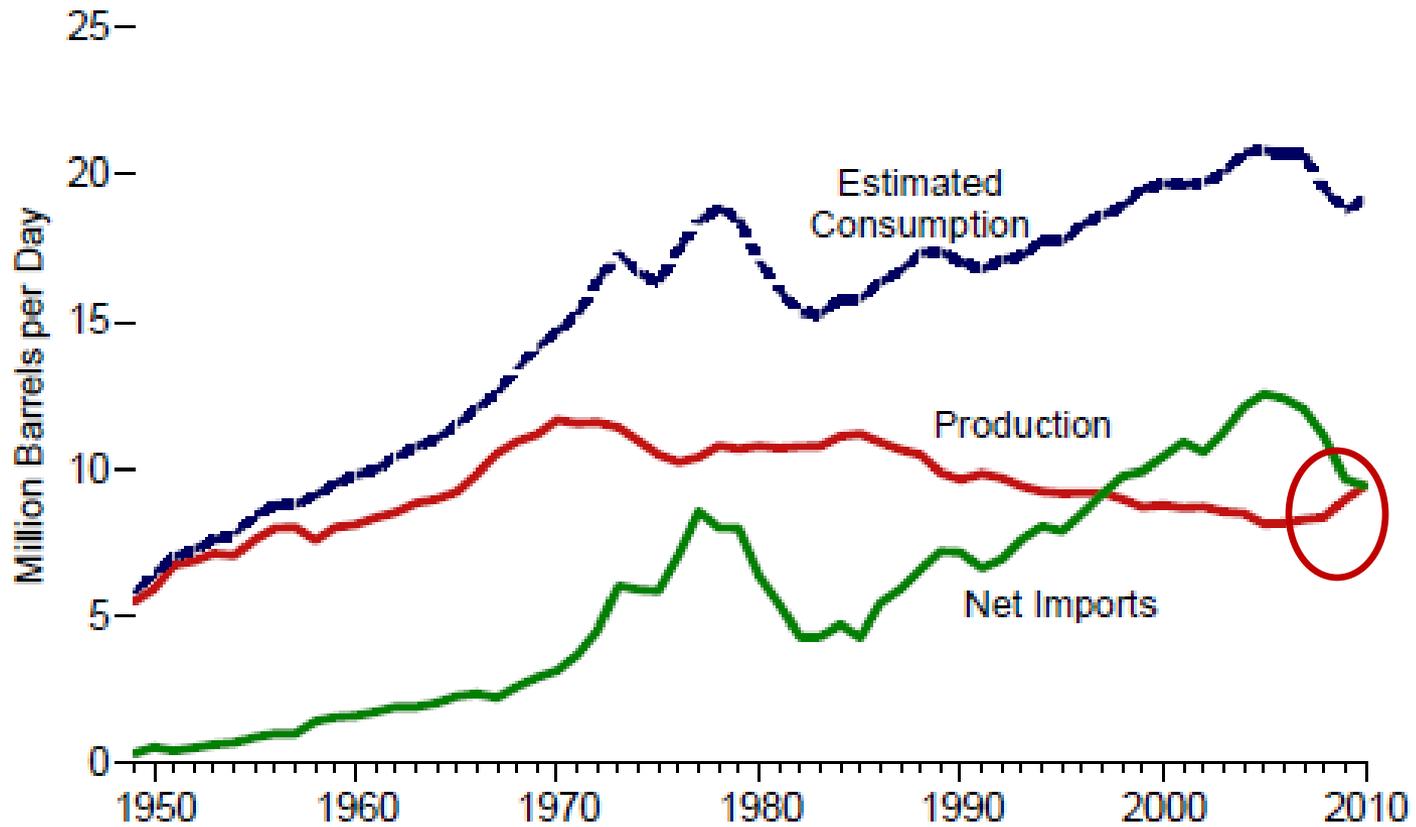
Primary Energy Now: Mainly Domestic + Gas from Canada, *Except for Oil*



Source: U.S. Energy Information Administration. *Annual Energy Review 2010*. Washington, DC: Government Printing Office, 2010, p. 10.

Oil Imports a Federal Concern Since 1974, but...

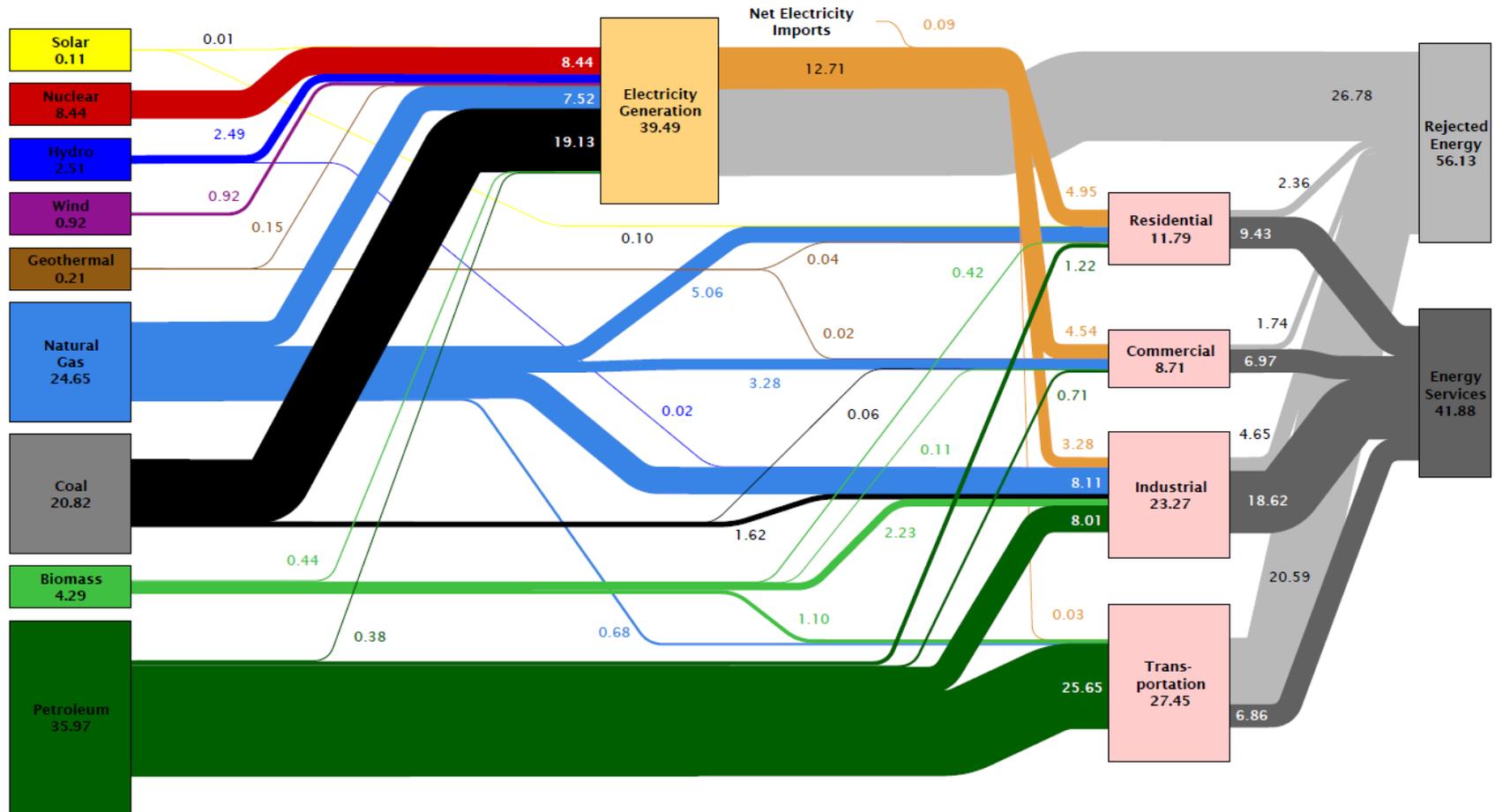
Overview, 1949-2010



Source: U.S. Energy Information Administration. *Annual Energy Review 2010*. Washington, DC: Government Printing Office, 2010.

Primary Energy to Energy Services, 2010

Estimated U.S. Energy Use in 2010: ~98.0 Quads



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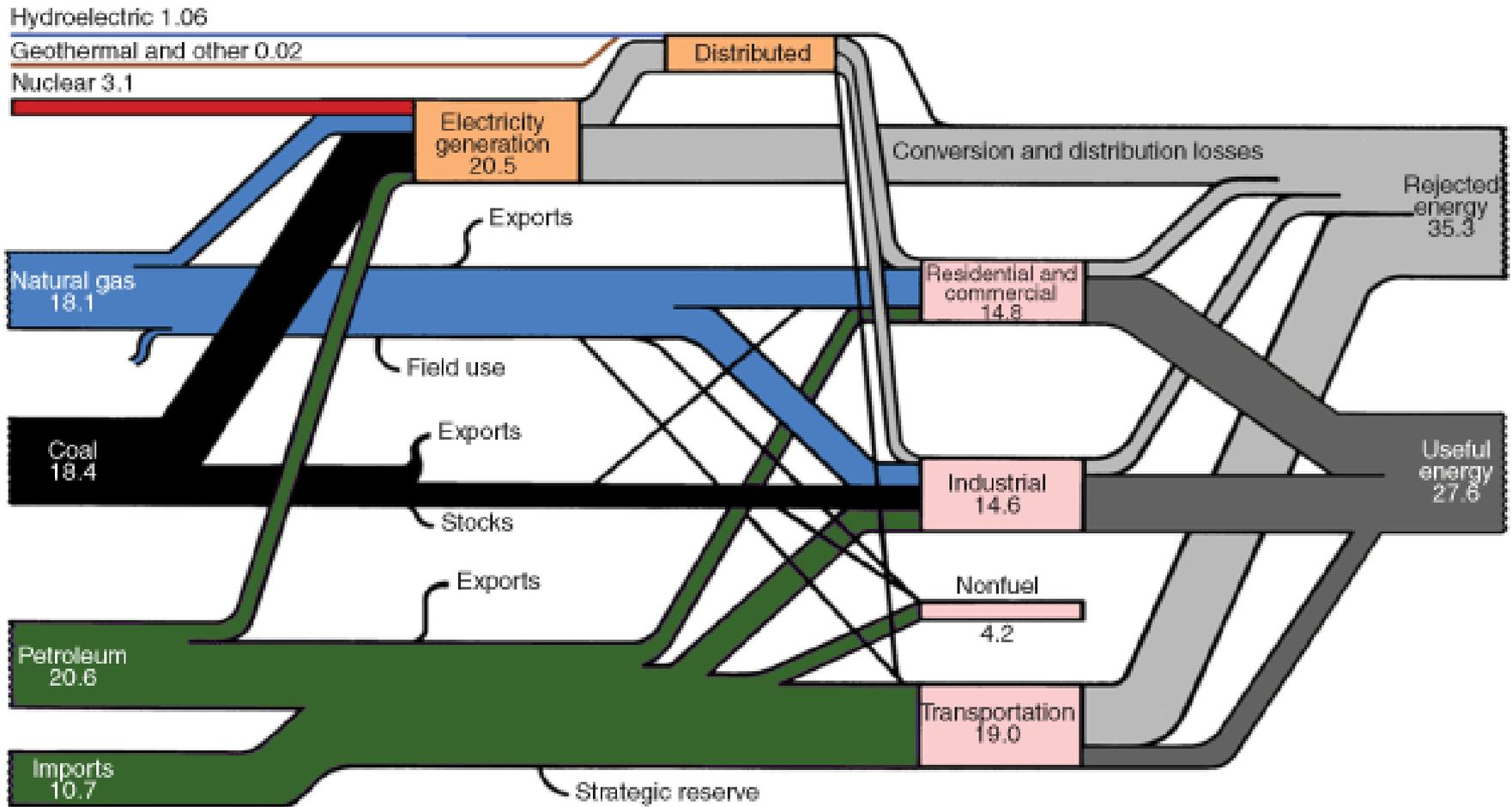
Industrial Energy Use, 2008 (EIA)

Industry	Share of Industrial Energy Demand (%)	Relative Energy-Intensity (Average = 1)
Refining	15.23	1.16
Food	5.00	0.29
Paper	9.74	2.11
Bulk Chemicals	25.15	2.82
Glass	1.30	1.78
Cement	1.50	5.52
Iron & Steel	5.20	1.63
Aluminum	1.14	1.06
Fabricated Metal	1.64	0.18
Machinery	0.82	0.08
Computer	1.15	0.08
Transport Equip.	1.78	0.09
Electrical Equip	0.25	0.07
Wood	1.40	0.51
Plastic	1.30	0.24
Other Mfg.	6.22	0.22
Agriculture	3.88	0.42
Construction	9.59	0.27
Mining	7.72	0.46

National Research Council, America's Energy Future (2009):

“...there has been a steadily growing consensus that our nation must fundamentally transform the ways in which it produces, distributes, and consumes useful energy.”

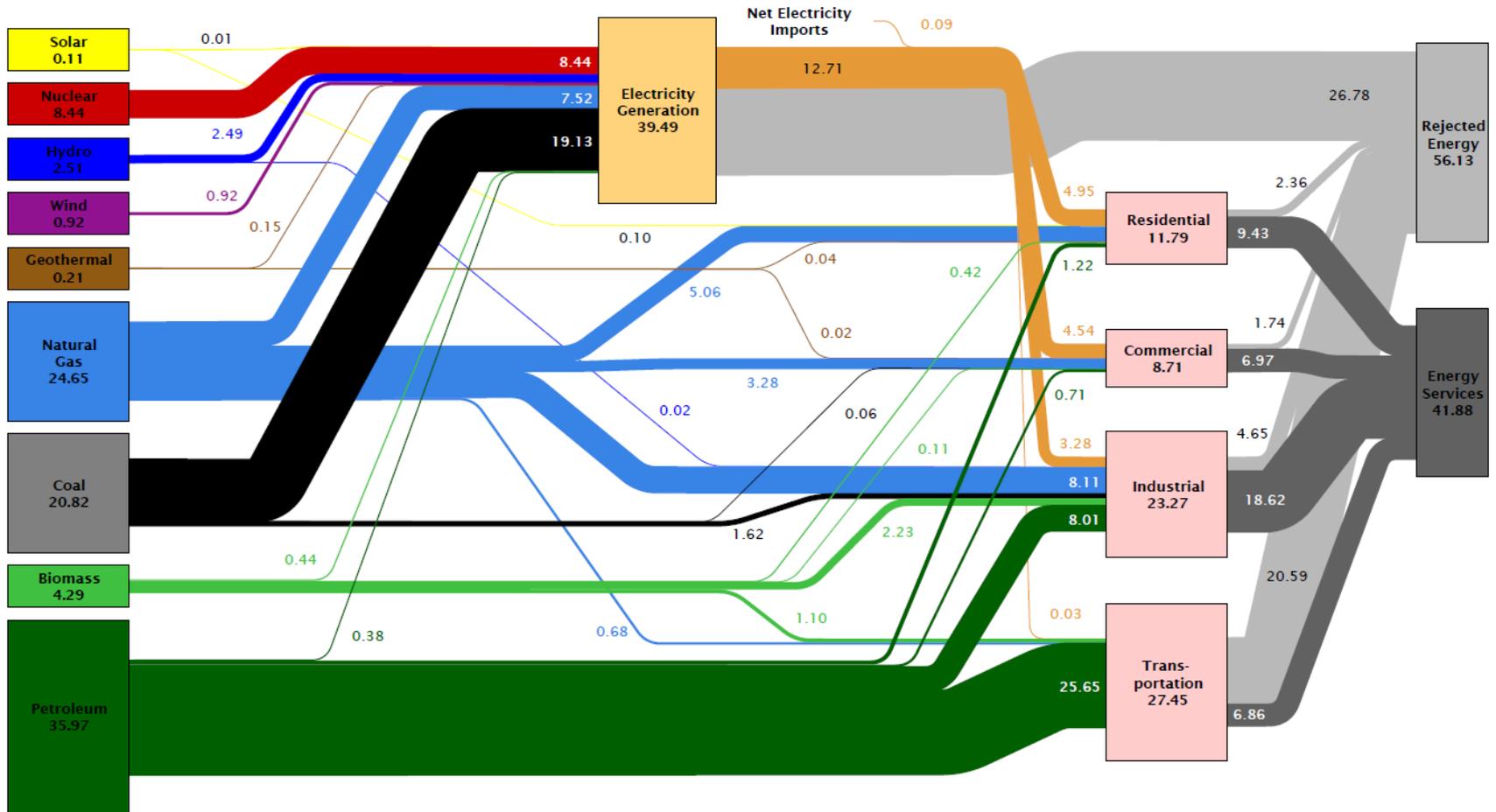
Is “transformation” possible? Compare 1982...



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... with 2010

Estimated U.S. Energy Use in 2010: ~98.0 Quads



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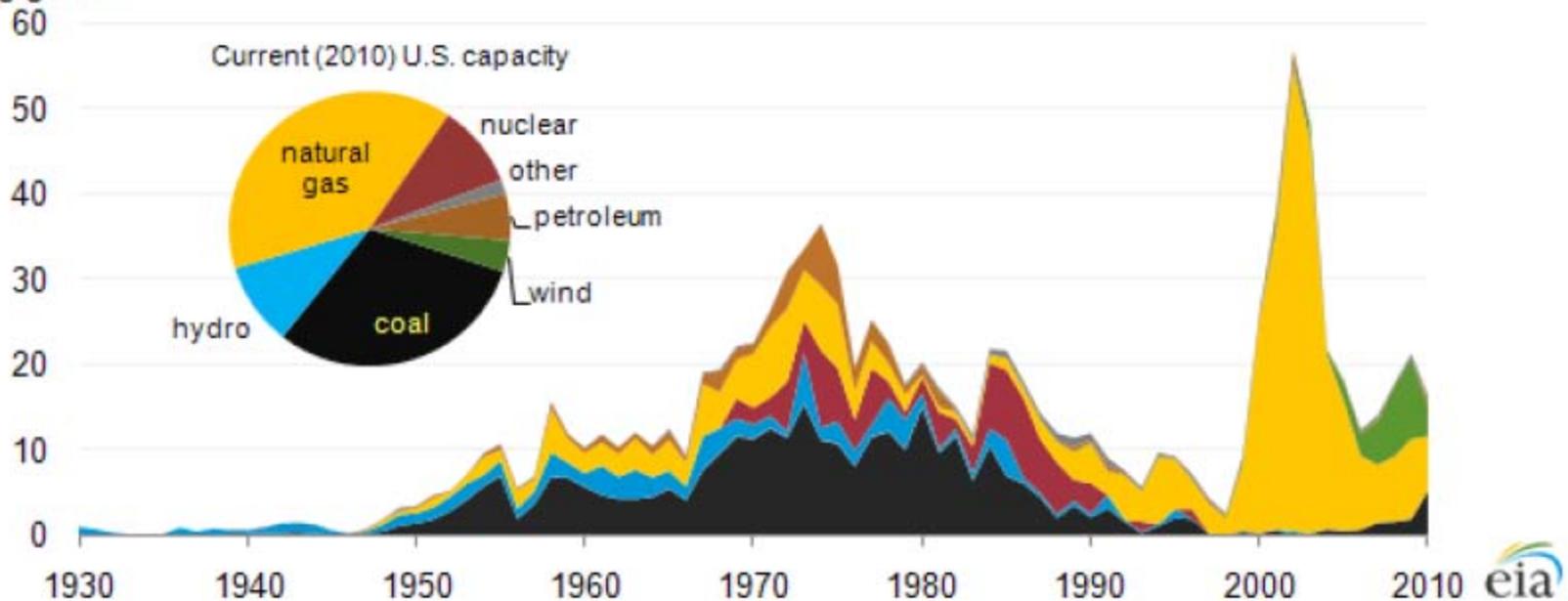
How Can “Transformation” Happen?

- Individuals demand more “clean/green” energy? At what price? From whom? How is it produced?
- New technologies supply cheap “clean/green” energy? Who develops, invests in them?
 - Government R&D? Who brings it to market?
 - Government picks/requires the “best” technologies? Good record?
 - Large energy firms – invested in today’s system?
 - Small startups – lacking massive funds?
- Environmental regulation stiffens? How? State or Federal?
Where are the votes?
- Regulation requires “clean/green” production? How? Where?
- Massive green social movement? Where does it come from?
- And what about energy security? Find more oil? And abandon Europe? Electric cars – powered by coal?

History Shapes Options and Costs:

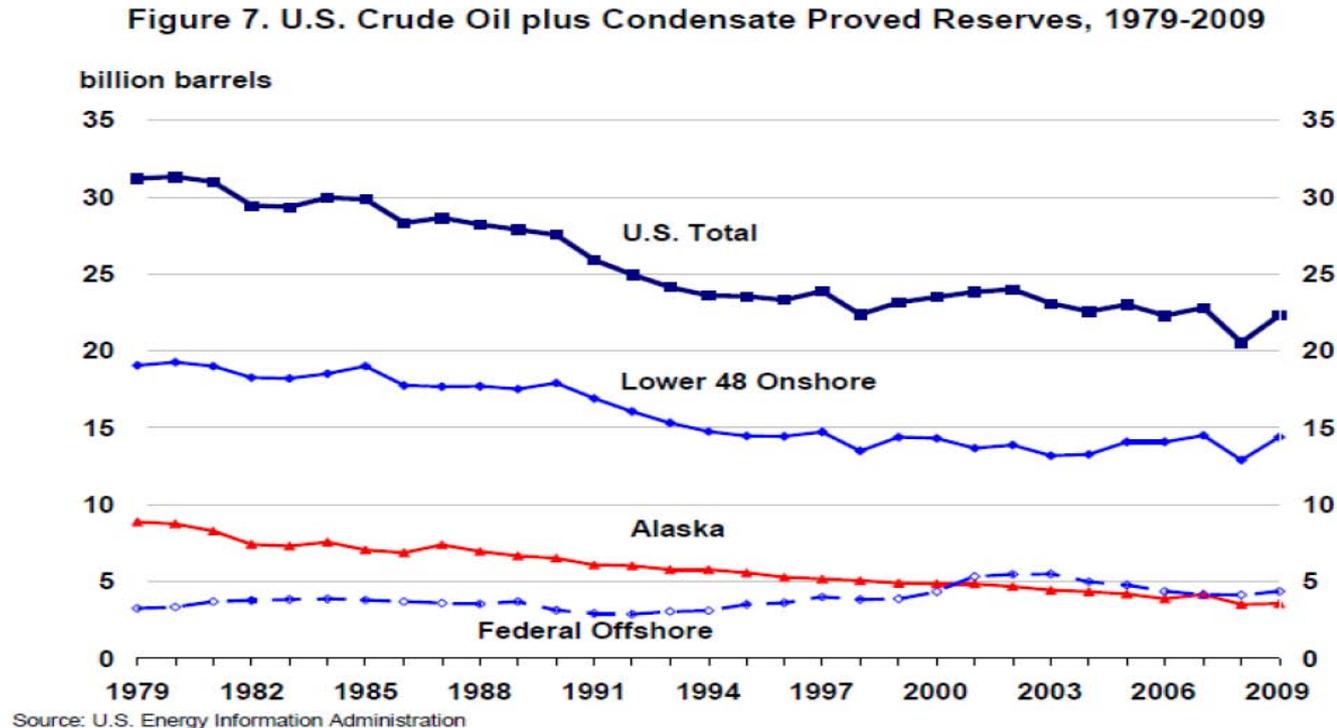
Eg. Lots of Old Coal-Fired Generators, Cheap Coal

Current (2010) capacity by initial year of operation and fuel type
gigawatts



History Shapes Options and Costs:

E.g., We Exploited U.S. Oil Reserves Intensively



From 1980 to 2009, **World Reserves** ↑ 208% (EIA)

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