Aspects of US Energy Policy: A Biased Primer

Terry Surles, Executive VP for R&D

Desert Research Institute

April 14, 2011

Presentation Will Cover

- General comments on energy and security
- Commentary on US political situation
- Current status of national energy activities
- State initiatives in energy and environment

The New Paradigm: We Can No Longer Ignore the Inter-Relationships

Is There a Limit to Where and How We Get Oil in the Future?: Per Capita Production

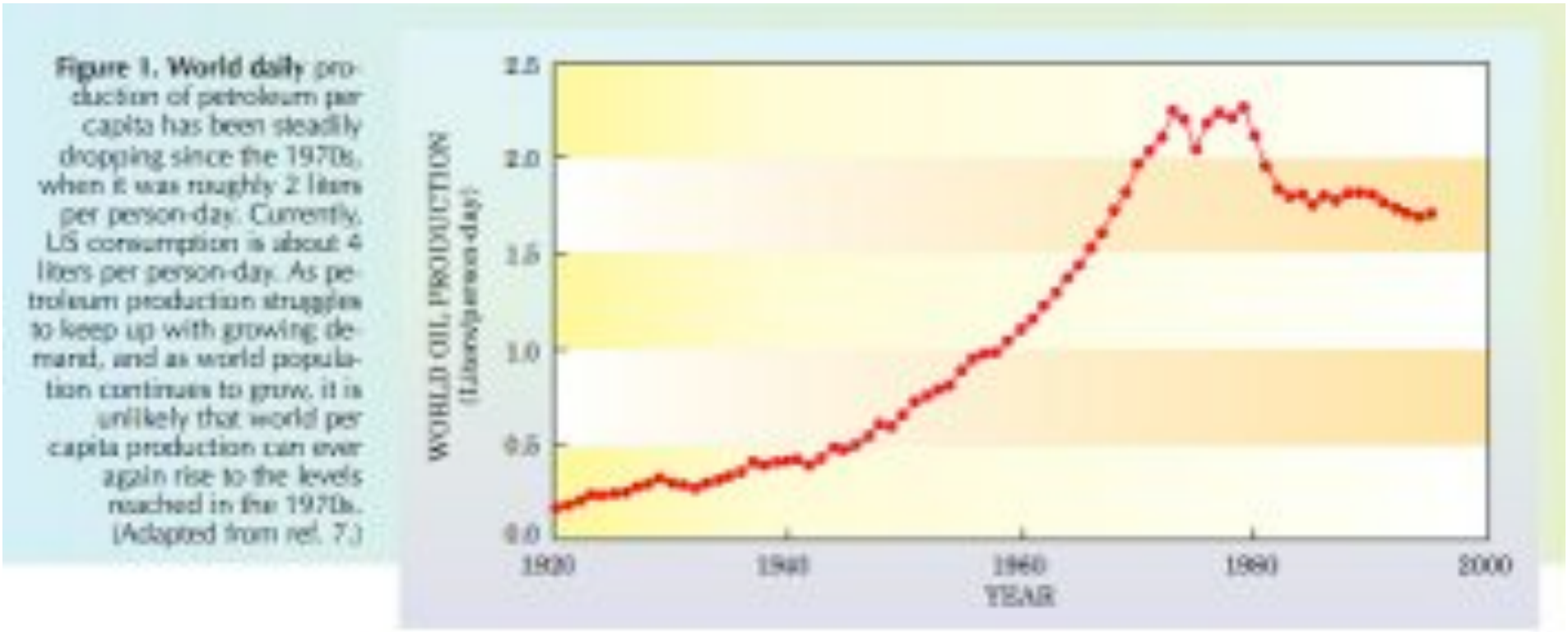


Figure 1. World daily production of petroleum per capita has been steadily dropping since the 1970s, when it was roughly 2 liters per person-day. Currently, US consumption is about 4 liters per person-day. As petroleum production struggles to keep up with growing demand, and as world population continues to grow, it is unlikely that world per capita production can ever again rise to the levels reached in the 1970s. (Adapted from ref. 7.)

Problem Confluence: Climate Change and Energy Security

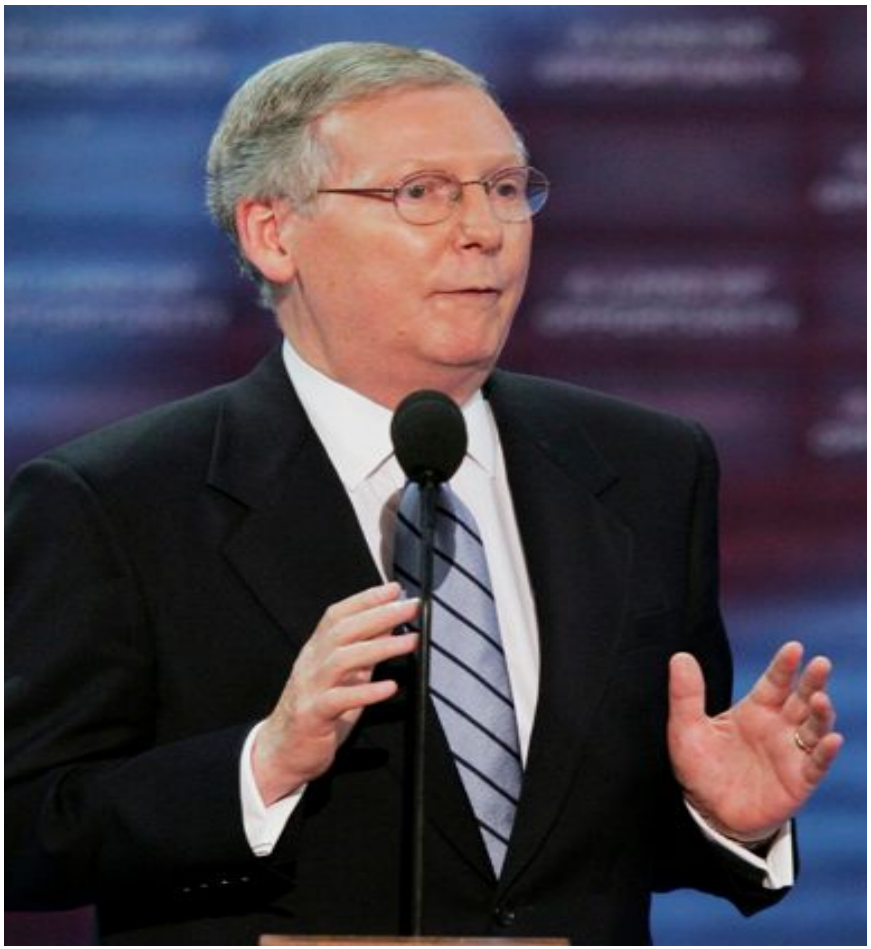
- Availability and price pressure on oil prices - disruption of international supply (political unrest) and domestic availability (hurricanes)
- Coal - domestic supplies lessen security issues, BUT exacerbate climate issues, geologic carbon sequestration is not yet proven on a large scale, limits and issues with water supplies
- Natural gas – US shale gas as a new paradigm?
- Nuclear – Benefits to climate, BUT increased concerns for public safety and on-going security issues due to concerns over proliferation risks, similar water issues as coal
- Bio-fuels - increased food/fuel/land/water competition, coupled with uncertainties related to future agricultural productivity
- Other renewable energy resources – indigenous resources benefit security, low carbon footprint benefits the climate, but at what cost and impact to the grid, logistics issues
- Efficiency and demand response (use of energy storage) – how much can we "squeeze out" over the next century

American Politics in the 1980s - Some Things Actually Got Done!

American Politics in the 21st Century

His “job” is to ensure that Obama is a one-term President

Mitch McConnell

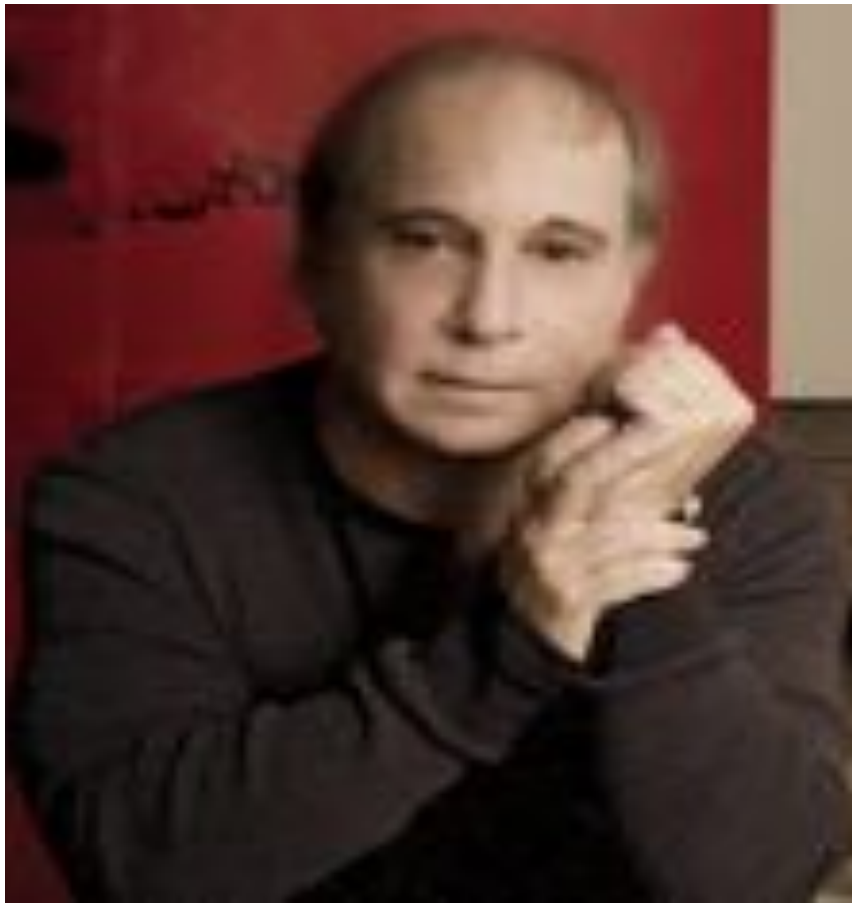


"Everyone is not entitled to an opinion. If they lack knowledge, they do not deserve to have an opinion."

Sir Winston Churchill

American Politics Redux: Blogs, Radio Talk Shows, Twitter, etc.

"A man hears what he wants to hear and disregards the rest"
The Boxer, 1969
By Paul Simon



What Is the US Doing About Energy and Security Problems: Reality Check

- Stimulus Funding (~$40B for energy) was a good idea but had predictable issues with implementation
- Despite Administration pronouncements, policy driven by regional and Congressional initiatives
  - Coal is king, despite concern about climate change
  - Corn-to-ethanol subsidies (and tariffs) have bipartisan support
- Congressional decisions strongly influenced by lobbyists and local considerations
  - Mish-mash of subsidies to all energy forms and resources
- National risk aversion drives other decisions
  - Drill for more off-shore oil, despite BP debacle
  - Big uncertainties with nuclear power

Effectively, US energy policy is to not have an energy policy - at least a coherent one!

EPAct 2005 - Focus on Coal and Nuclear (Bush and a Republican Congress)

- **$1 billion initially allocated 2006-2007**

  Round 1 awards included:

  - Duke Energy's Edwardsport IGCC project $133.5 M
  - Mississippi Power's Kemper County IGCC project $133 M
- **$650 million available for Round 2 (2007-2008)**

  Round 2 awards included:

  - Excelsior Energy's Mesaba project $133.5 M
- **$392 million remaining for Round 3 (2008-2009)**

  Round 3 to be awarded

  - IGCC – 2 projects
    - Sub-bituminous - $133.5 million (1 project)
    - Lignite - $133.5 million (1 project)
  - Advanced Combustion – $125 million (1 project)

  Round 3 status

  - No selections were made.

EPACT 2007 - Focus on Renewables Bush and a Democratic Congress

- 1st solicitation — *16 pre-applicants invited to submit applications - October 2008*
- 2nd round has 3 solicitations for $30.5 billion in loan guarantees *renewable energy, nuclear and 'front-end' nuclear power facility projects - June 2008*
- DOE 3rd round solicitation for $8.0 billion in loan guarantees - *targets innovative clean coal technologies*
  - Issue Date: September 22, 2008
  - Final Applications Due: March 23, 2009
  - Selections Expected: July 2009

2009 Economic Stimulus Bill
Obama and a Democratic Congress

Additional Sec. 48A Tax Credits

- $1.25 billion for clean coal
- 30% investment tax credit
- Projects must capture 65% of CO_2

Additional Sec. 48B Tax Credits

- $250 million for gasification projects
- 30% investment tax credit
- Projects must capture 75% of CO_2
- Projects that manufacture “transportation grade liquid fuels” eligible

New **CO_2 Sequestration** *Sec. 45Q Tax Credit*

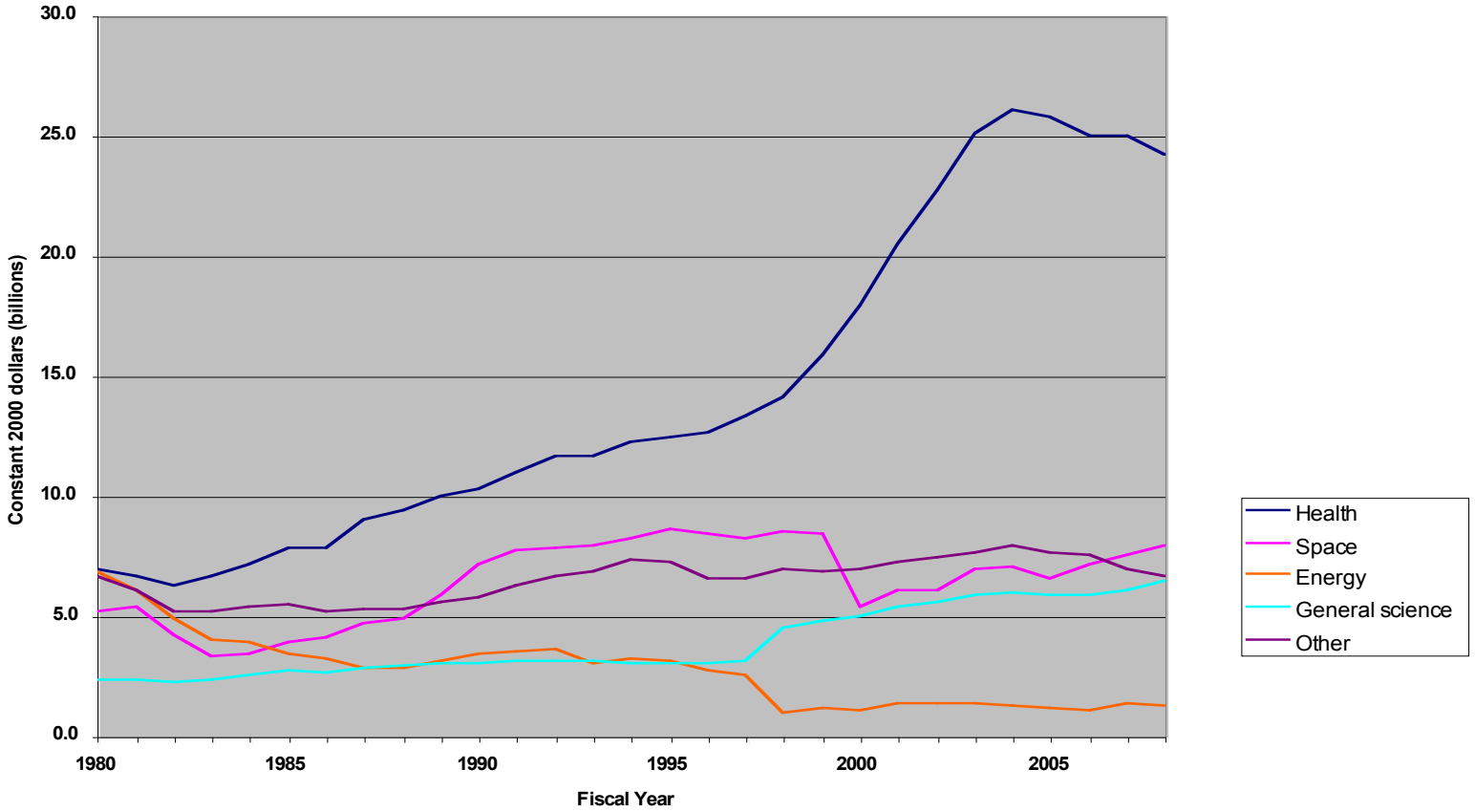
- Each metric ton of CO_2 captured & stored or used qualifies
  - $20/tonne CO_2 stored in saline formation or unmineable coal seam
  - $10/tonne CO_2 used in enhanced oil or gas recovery
- Project must sequester ≥ 500,000 tonnes of CO_2 during taxable year

Since Start of Obama Administration and Since January with a Republican House

- ARRA (stimulus) poured about $40B into energy technology development with significant funding for
  - Smart Grid - ~ $200M to ~ $4B
  - Energy efficiency and renewable energy
  - Tax credits by the bucket load!
- FY10 budget significantly increased funding
  - Energy efficiency and renewable energy
  - FutureGen re-start
- This week's (FY11) budget battle (the reductions in funding)
  - Energy efficiency and renewable energy: -$438M
  - Fossil energy: -$243M
  - Nuclear: -$56M
  - Electricity delivery: -$31M
  - Office of Science (climate change-related): -$35M

US Funds Energy Substantially, But Other Sectors Get More R&D Funds

Figure 1. Federal R&D Budget Authority by Budget Function: 1980-2008 (billions of 2000$)



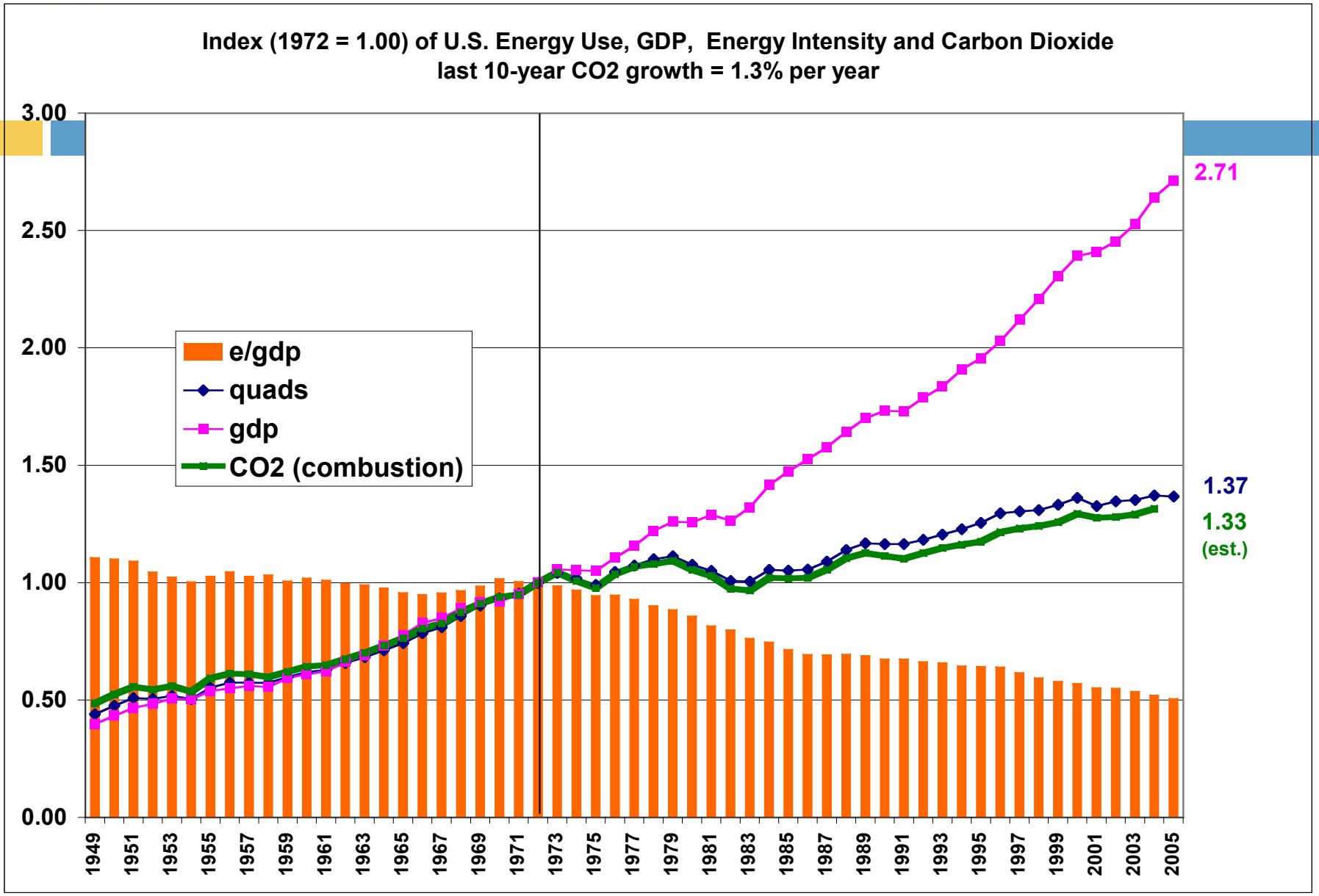
"Other" includes all nondefense functions not separately graphed such as agriculture and transportation. The 1998 increase in general science and decrease in energy and the 2000 decrease in space are the result of reclassification.

Technical Carbon Management Options: Comments on US and State-Based Efforts

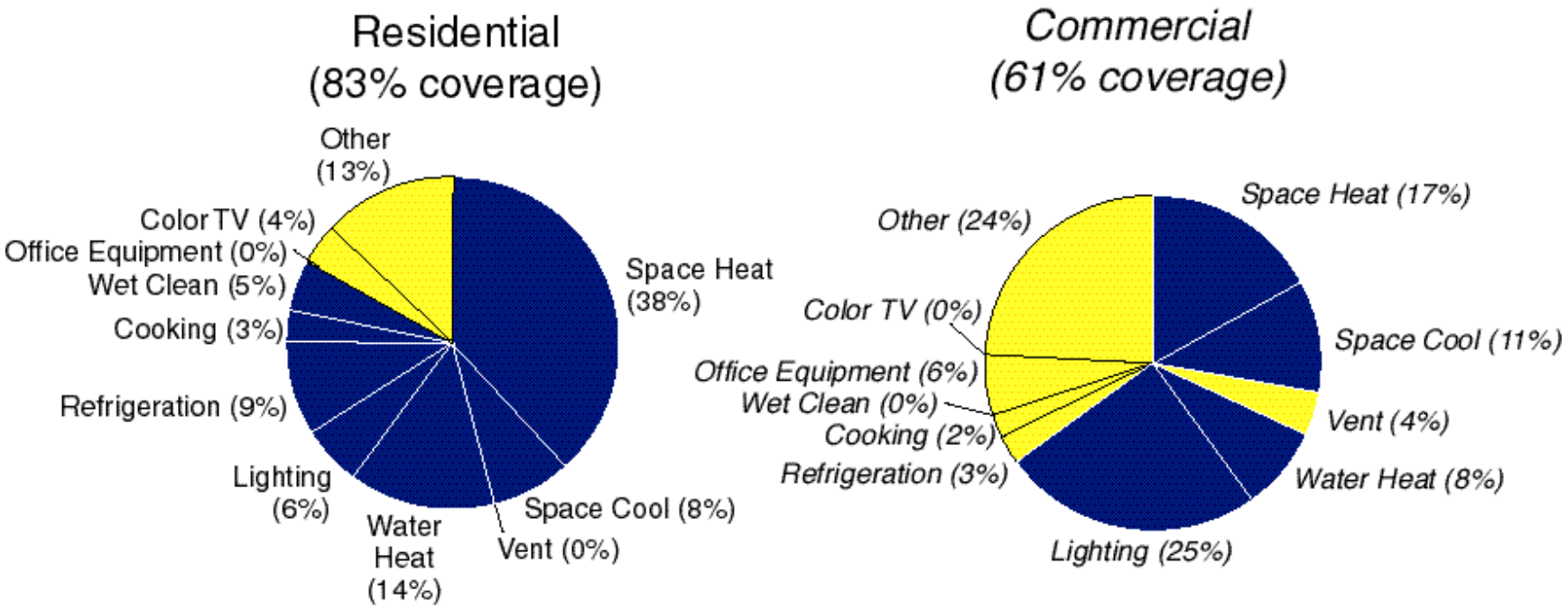
Reduce Carbon Intensity	Improve Efficiency	Carbon Storage
• Renewables	• Demand Side	• Capture & Store
• Nuclear	• Supply Side	• Enhance Natural Sinks
• Fuel Switching		

All options needed to meet:

- Affordable energy demand
- Environmental objectives
- Security objectives

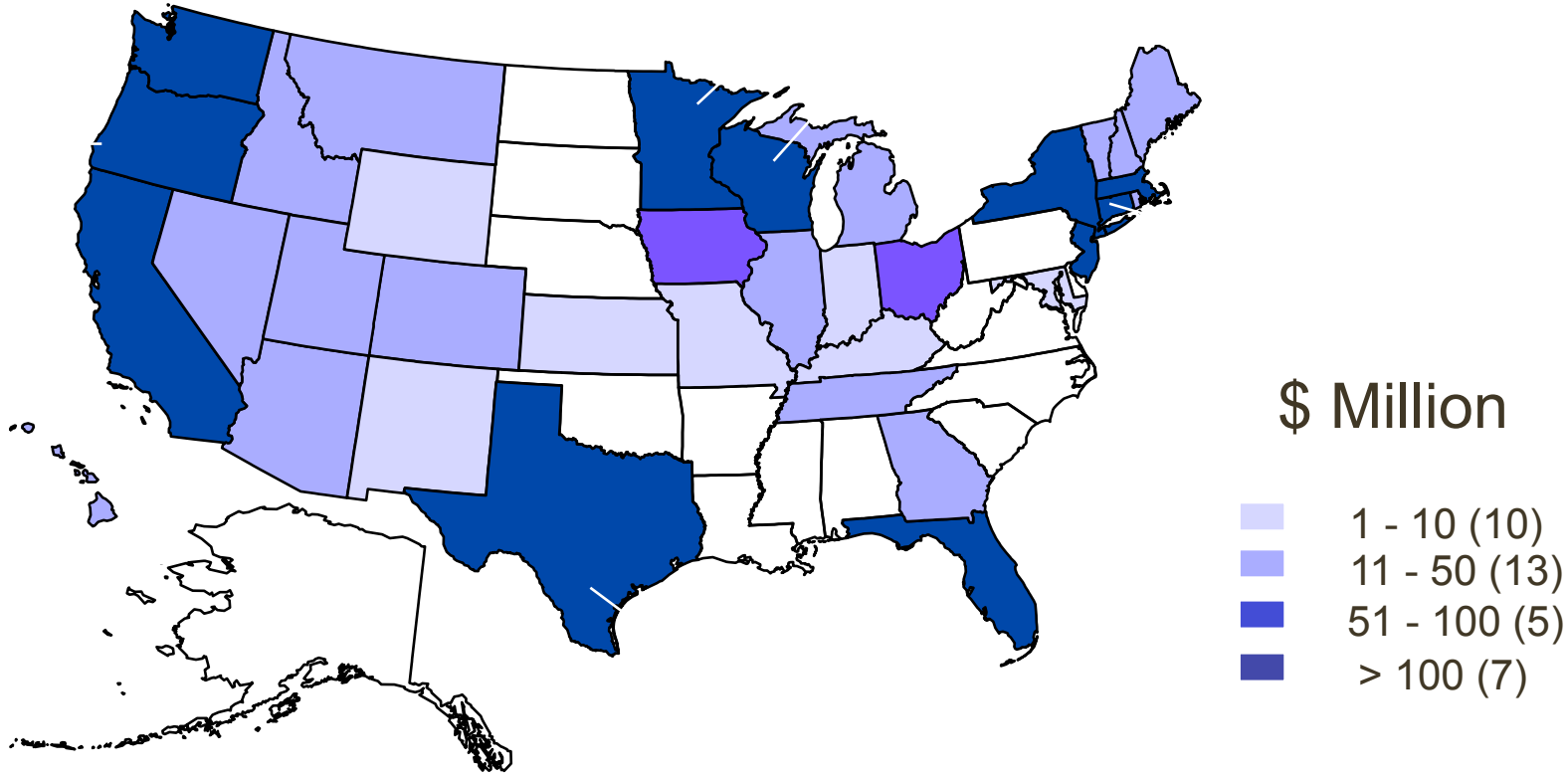

Index (1972 = 1.00) of U.S. Energy Use, GDP, Energy Intensity and Carbon Dioxide
last 10-year CO2 growth = 1.3% per year
3.00
2.50
2.00
1.50
1.00
0.50
0.00
e/gdp
quads
gdp
CO2 (combustion)
2.71
1.37
1.33
(est.)
1949
1951
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005

U.S. Energy Efficiency Standards Affect Products Using Most of Buildings' Primary Energy



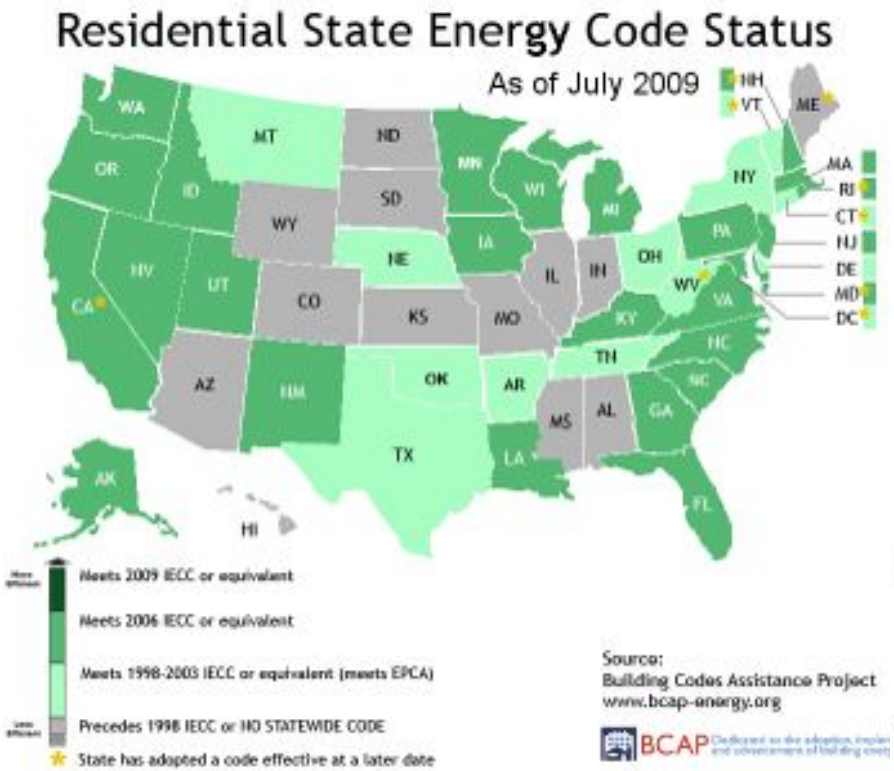
Utility Ratepayer-Funding for EE Varies Considerably Across U.S. States

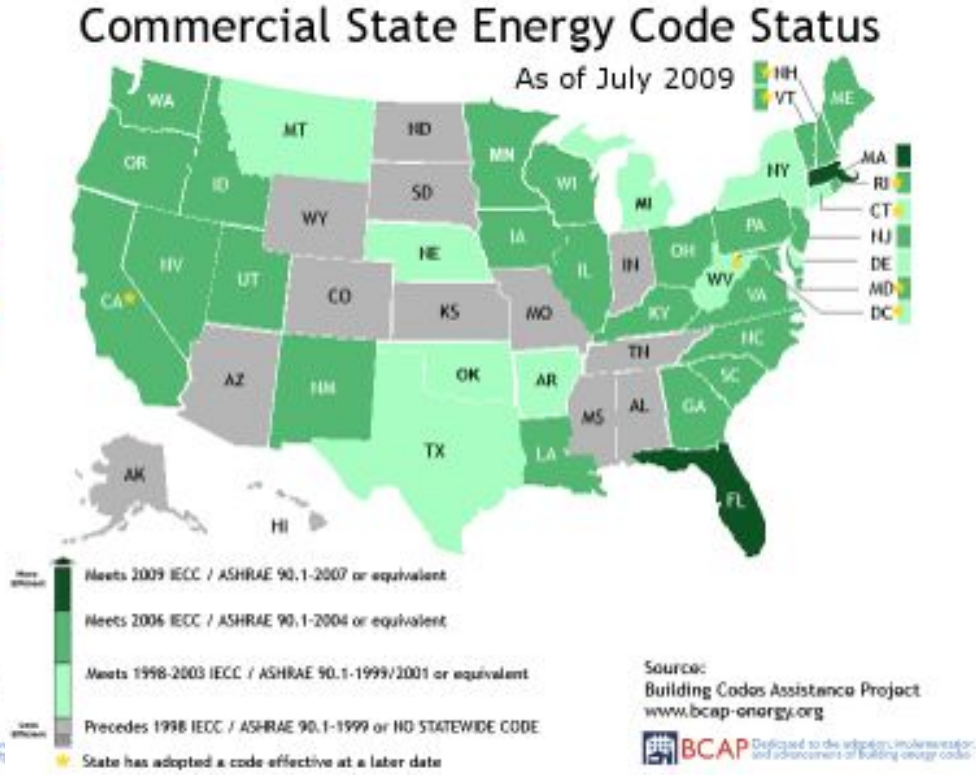
2008 Utility Ratepayer-Funded Energy Efficiency Budgets (Electric & Gas)



Building Energy Codes Vary Widely

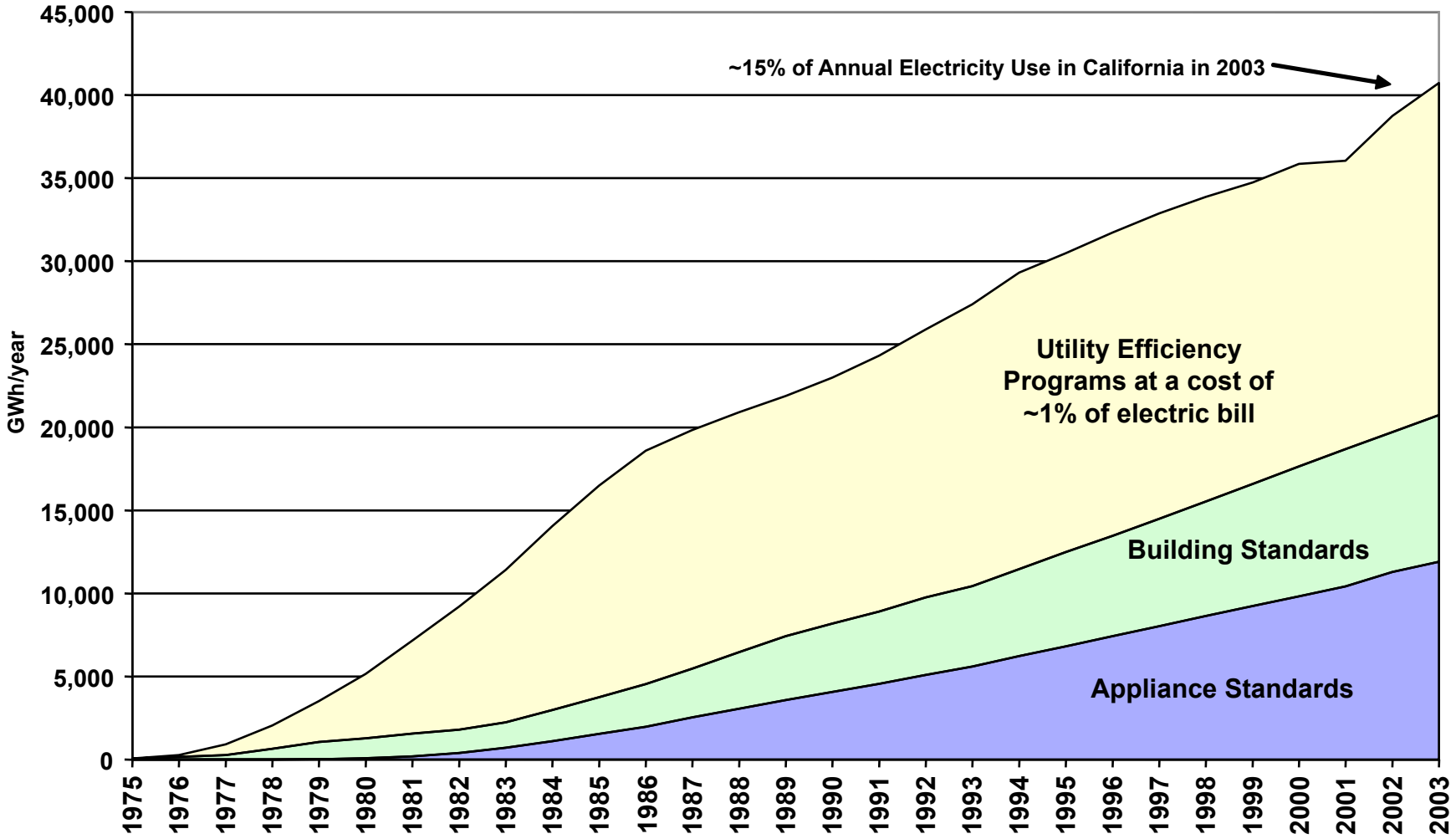
- Residential and commercial model building energy codes developed by IECC and ASHRAE, respectively; updated continuously
  - After each update, DOE required adopt as national code if efficiency gains would be made
- States must adopt current national code for commercial buildings, and must provide justification if residential code not adopted
  - But no consequences if these requirements are not fulfilled





California: Annual Energy Savings from Efficiency Programs and Standards

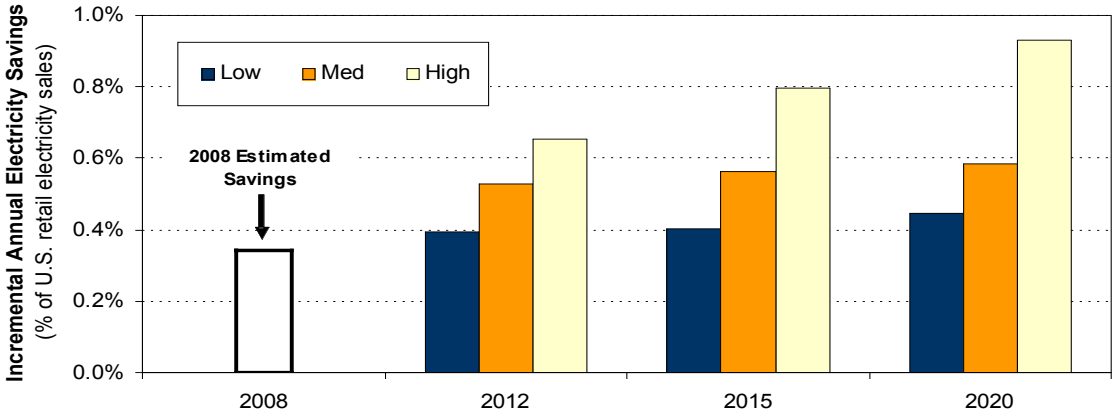
Source: A.H. Rosenfeld/California Energy Commission estimates



Electricity Savings from Ratepayer-Funded Programs Projected to Grow Substantially

- 2008 U.S. annual electricity savings = 0.34% of retail sales
  - **Represents 1st-yr. savings from measures in 2008**
  - **Some leading states achieved savings >1% (VT at 2.5%)**

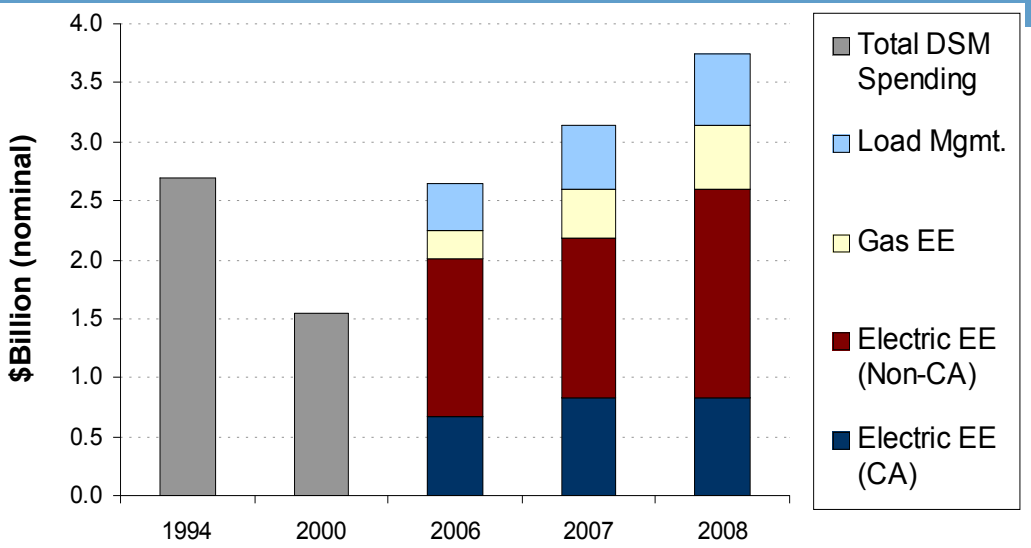
Projected Incremental Annual Electric Energy Efficiency Savings from Ratepayer-Funded Programs



- Annual electricity savings are projected to rise to 0.45%-0.93% of retail sales by 2020, with a Medium Case projection of 0.58%
  - **In comparison, EIA's AEO2009 reference case projects that U.S. retail electricity sales will grow by 1.1%/yr from 2010-2020 (though some ratepayer-funded EE savings may be implicitly included in that projection)**
- Cumulative savings by 2020 equal 4.7%-8.6% of EIA's reference case forecast of 2020 retail electricity sales (6.1% in Medium Case)

Total U.S. DSM Budgets Have Been Steadily Rising Over the Past Several Years

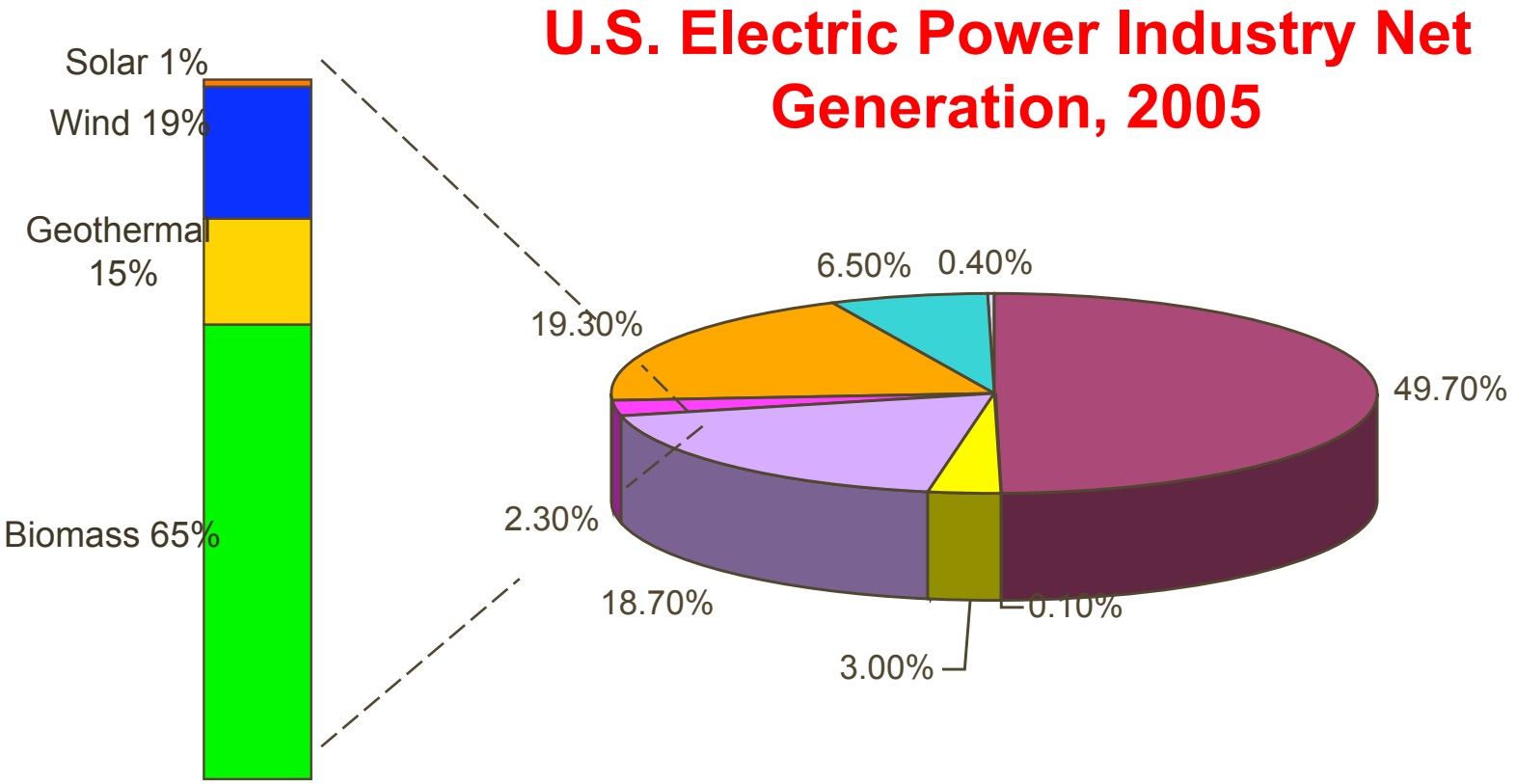
- DSM programs began in 1980s
  - Funded through utility rates
  - Established/overseen by state public utility commissions
- Utility EE budgets in 2008: $3.1B (electric + gas) plus $0.5B for load mgmt.



Sources/Notes: 1994 and 2000 data are from EIA and represent actual spending on DSM (EE plus load management); 2006-2008 data are from Consortium for Energy Efficiency and represent approved budgets.

- A proliferation of new state-level policies to support ratepayer-funded EE have been adopted in recent years
- LBNL projects state-level programs will yield cumulative savings in 2020 equal to 5-8% of total U.S. electricity consumption (excluding impact of stimulus bill funding)

US Renewable Electricity



Total = 4,055 Billion KWh
Electric Utility Plants = 63%
Independent Power Producers & Combined Heat and Power Plants = 37.0%

States (PUCs) More Aggressive in Developing Policy Instruments

- Renewable Portfolio Standards (RPS) now in over half of the 50 states - unlikely as a federal standard due to Commerce Clause in Constitution
- Feed-in Tariffs
- Net metering laws and regulations
- Power Purchase Agreements - national law
  - Under PRPA (now repealed - based on avoided cost)
  - New PPAs must take into account ancillary services - grid stability, reliability, Var support
- Transmission investments and access - use of Public Utility Commission process
- Enhancements: Stimulus funding of over $2B

California: Feed-in Tariffs Based on AB 1969 (for Renewables) and AB 1613 (for CHP)

What is a Feed-in-Tariff (FiT)?

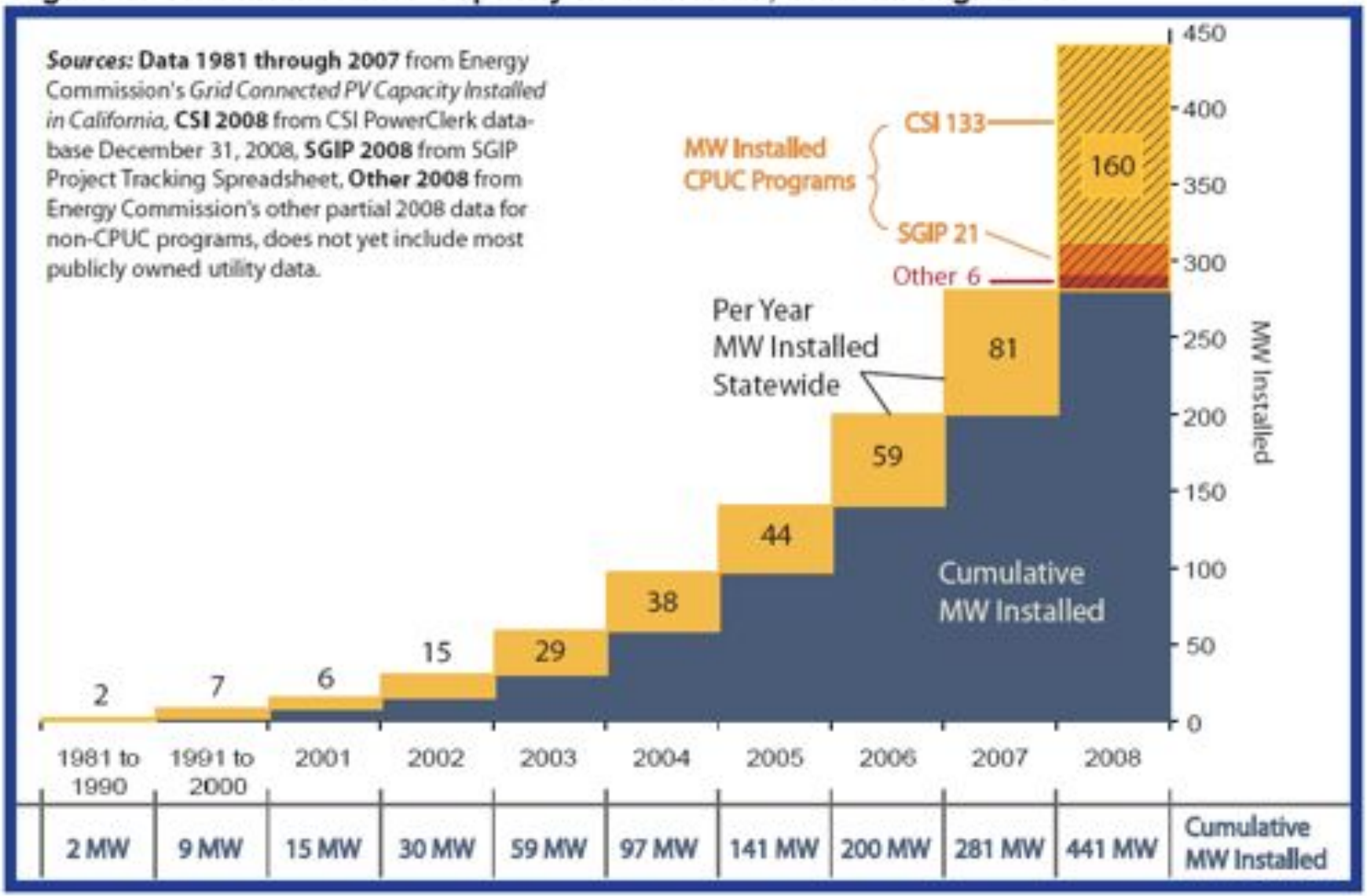
- Standard offer contract for the sale of electricity from a qualifying Distributed Generation facility (QF) to the utility grid
- Public Utilities Regulatory Policy Act (PURPA) of 1978 established QFs and outlined payment according to the avoided cost of power
  - In effect until national 2005 EPACT
- QF is non-utility generator with less than 80 MW capacity that utilizes cogeneration and/or renewable fuels
- AB 1969 authorized Feed-In Tariffs for small renewable generators (<1.5 MW) owned by public water and wastewater facilities and facilitates a streamlined interconnection process

Net Metering Program (CA) Designed to Increase Penetration of Renewable Resources

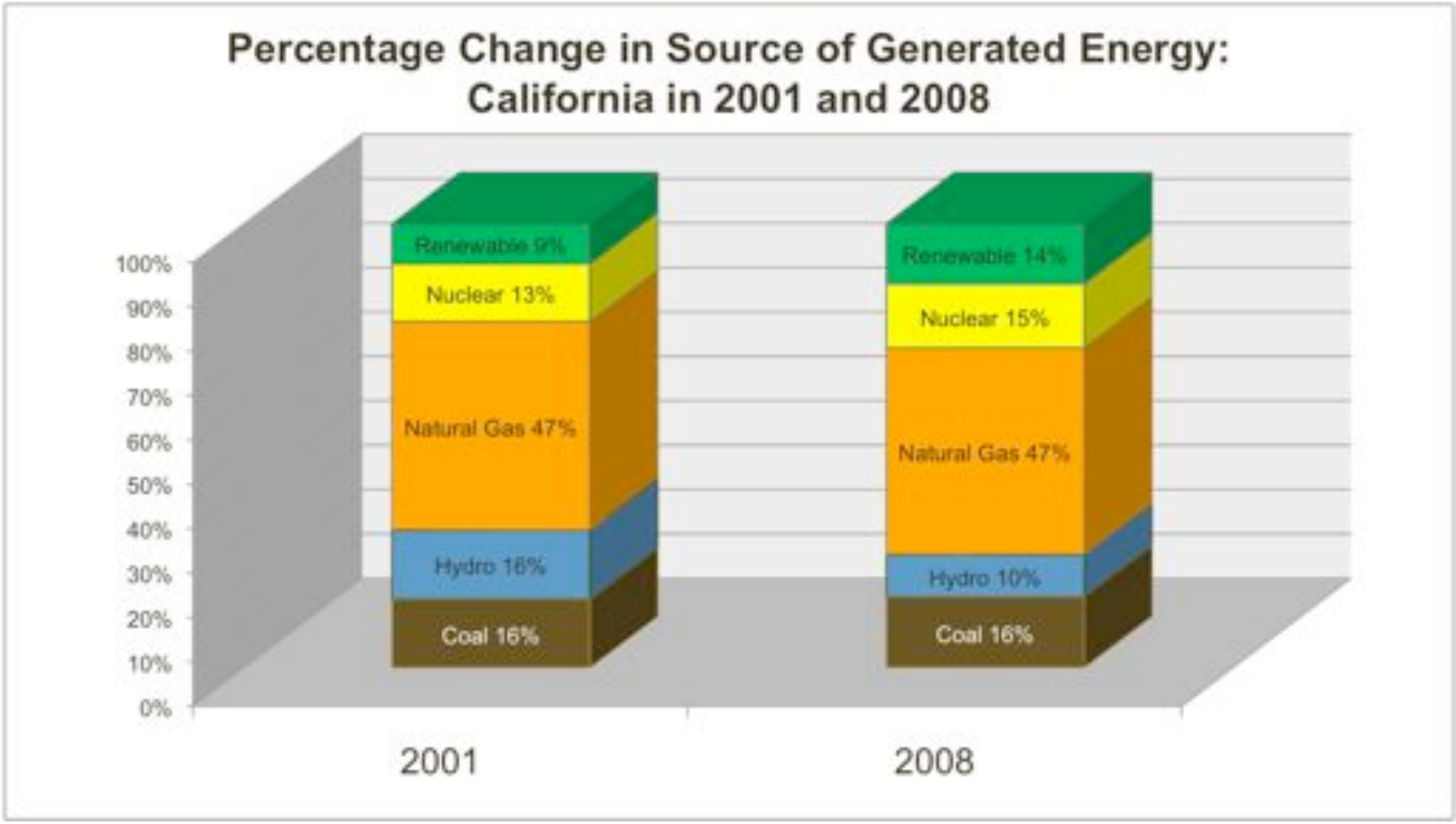
- Net metering laws, as amended, allow for up to 1 MW systems
  - Up to 10 MW for biogas digesters
- Eligible technologies are photovoltaic systems, wind, fuel cells, and biogas
- Limited to 2.5% of Investor Owned Utilities (IOUs) peak demand
- Net excess generation is carried forward for one year with any remaining given to the utility

DRI

Figure 1. Grid Installed PV Capacity in California, 1981 through 2008



California: Electricity Generation from Renewable Resources Is Increasing

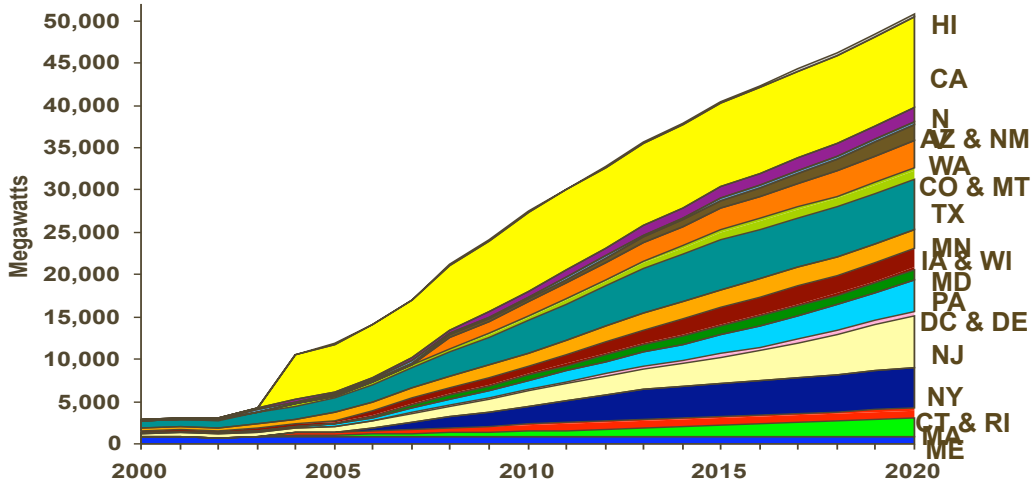


Transmission Planning Critical to Reach RPS Goals With As-Available Renewable Resources

- Transmission permitting based in state Public Utility Commissions
  - **Major problem** for siting cross-state transmission lines causes delays of up to ten years
  - CPUC, CalISO, and CEC, plus IOU and publicly utilities - multiplicity of permitting agencies even in one state!
- Renewable resources are often remote from load centers
- Renewable Energy Transmission Initiative (CA)
  - Purpose is to identify competitive renewable energy zones (CREZs) for transmission development
  - Solve “chicken and egg” problem of what comes first: transmission or generation (similar issue in Hawaii linking load on one island with renewable resource on another island)

What is Possible: Renewable Electricity in the US

Renewable Energy Expected From State Standards



Total Estimated Solar Capacity Driven by State RPS Set-Asides

(assuming full compliance with mandates)

2010: 400 MW to 500 MW

2015: 1,200 MW to 1,400 MW

2020: 2,800 MW to 3,200 MW

2030: 3,700 MW to 4,300 MW

Western Governor's Association 2015 Goal

Clean Energy – 30,000 MW

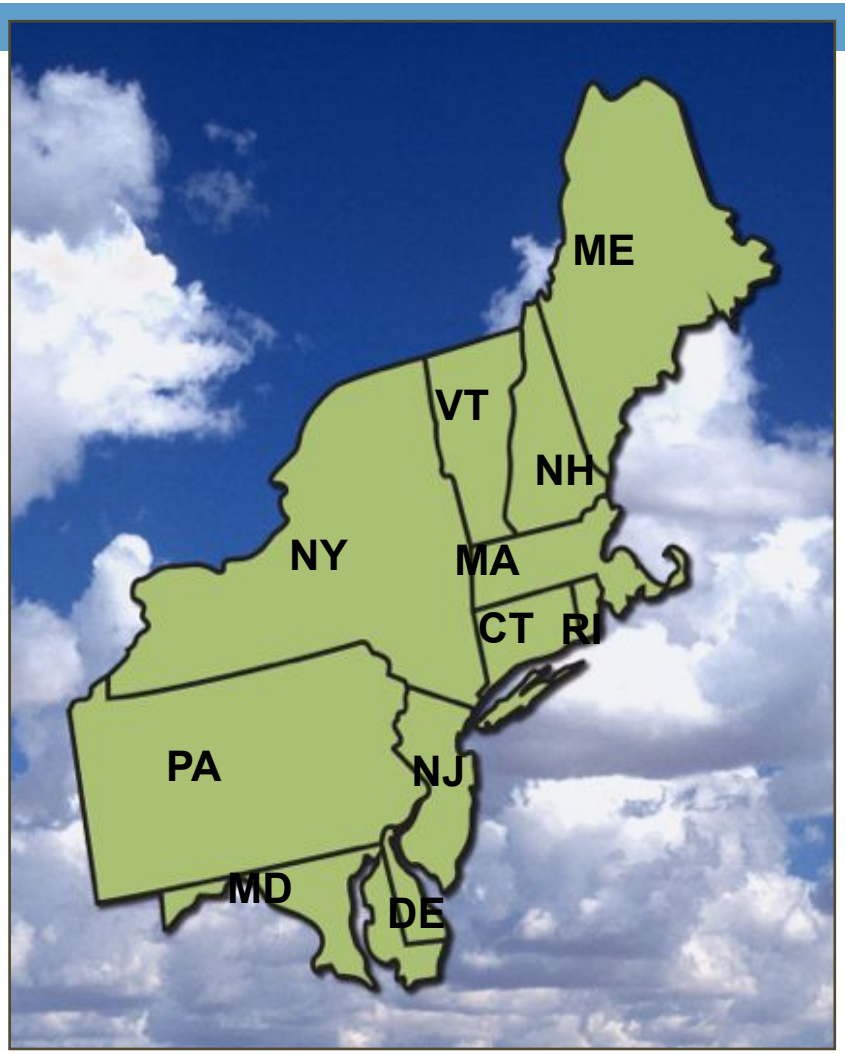
- Solar – 8,000 MW
- Wind – 5,000 to 9,000 MW
- Geothermal – 5,600 MW
- Energy Efficiency – 40,000 MW

A Number of Climate-Based Policy Activities Are Underway in the States

- RGGI – Northeastern US states
  - Good news: nine states and institutions coming together in a bi-partisan fashion, offsets in place (SF6, landfill gas, end use efficiency, methane from animal waste, etc.)
  - Bad news: very real concerns about “leakage,” only one sector (electricity) is planned for regulation
- AB 32 (California)
  - Good news: bi-partisan approach to address the problem
  - Bad news: little prior knowledge of how to link aggressive public policies to technological realities

Northeast Regional GHG Initiative (RGGI)

- 9 NE and Mid-Atlantic states:
  - CT, DE, MA, NH, NJ, NY, VT
  - MA and RI dropped out 2005, but will rejoined in 2007
  - Observer: PA
- Current Status:
  - 7 states signed MOU 12/05
  - Final “model rule” 8/15/06
  - RGGI start date 1/1/09
  - Only electric industry – greater than 25MW
    - Lots of off-sets
  - Carbon dioxide reductions
    - 2005 levels by 2009
    - 10% 2005 by 2019



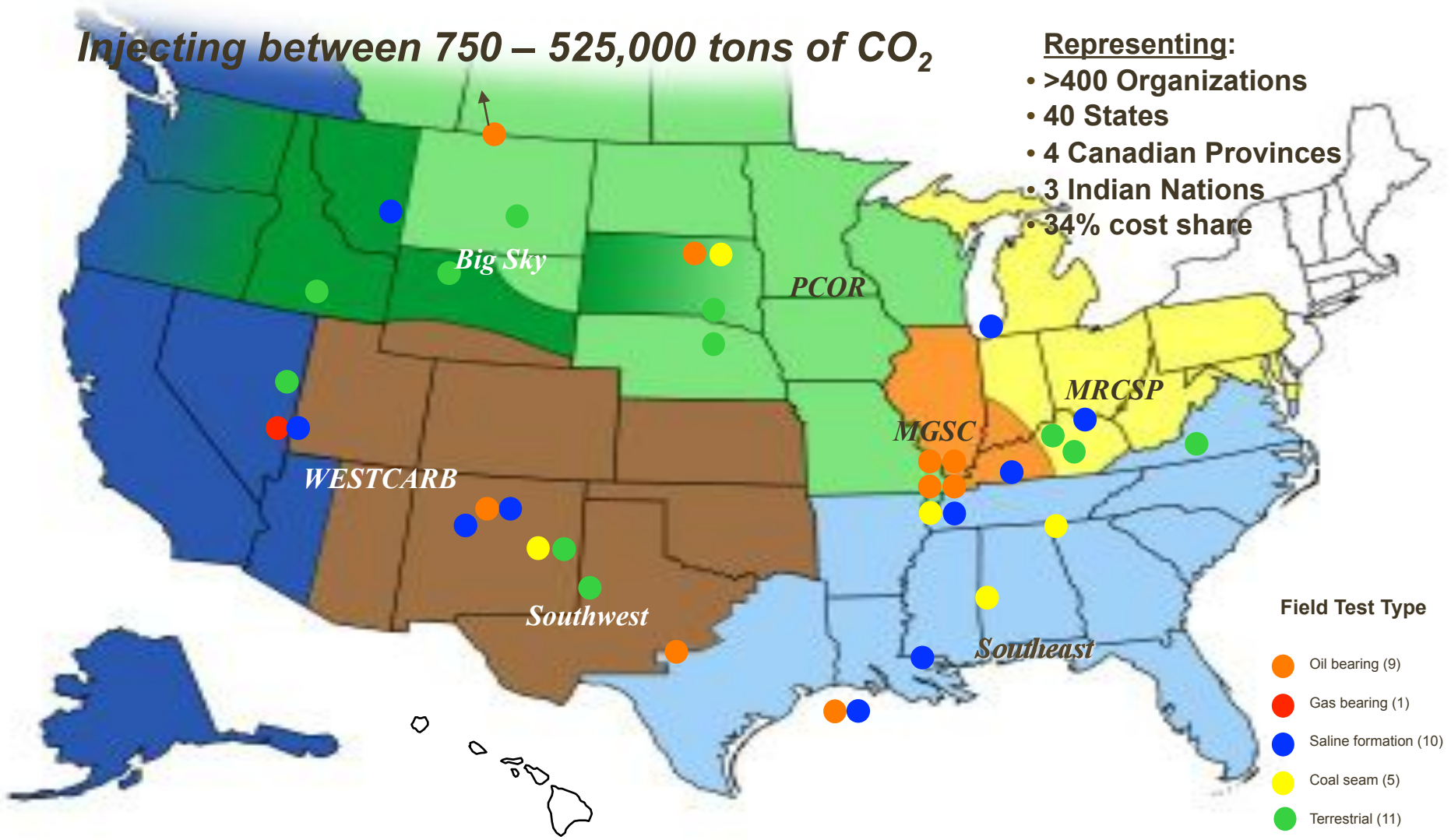
CA: First Mandatory State GHG Cap

- The Global Warming Solutions Act of 2006:
  - AB-32 passed legislature 8/31/06
  - Regulatory development 2007-2011
- Target: 1990 CO_2 emissions by 2020
- Survived "recall" initiative put before the CA voters in 2010
- Main elements:
  - All 6 GHGs
  - All industrial GHG emissions
  - "Load-based" GHG cap
  - Appears to allow GHG offsets
  - Encourages, but does not require GHG cap and trade program
  - Encourages linking of regional, national and international GHG emissions mitigation programs
  - Elements of "Command and Control" in initiative

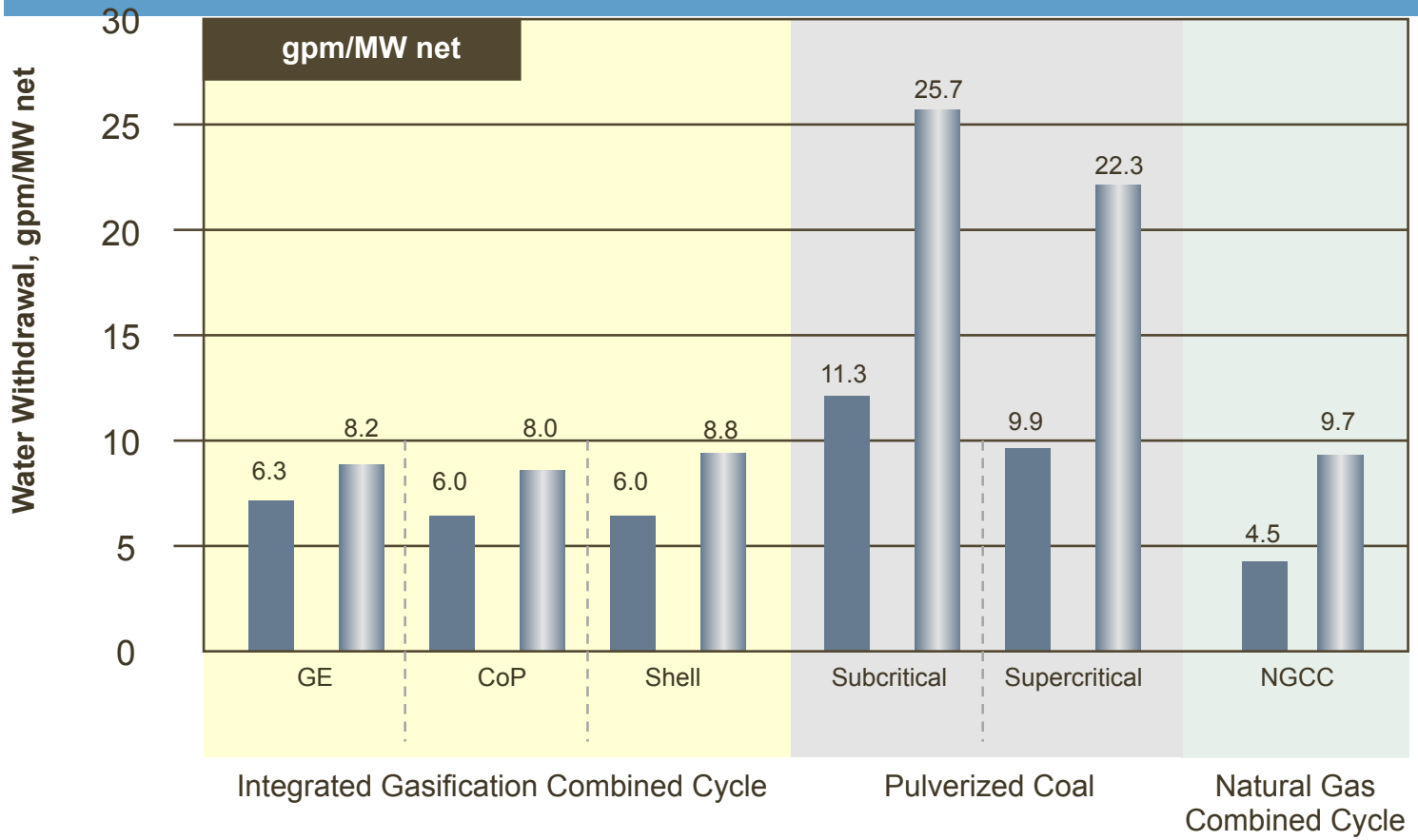
Generation III: Nuclear Power Economics

- Strong safety record
- High average capacity factor – 90%
- Decreasing production costs
  - 1.72 cents/KWH
- NRC license renewals continue
  - 48 complete
  - 38 filed or announced
- Was expecting new applications – much permitting done - Grand Gulf (1975)
  - Three units proposed or under construction
- Current situation bleaker due to risk averse nature of US politics
  - Demise of Yucca Mountain
  - Current on-site storage

Regional Carbon Sequestration Partnerships - Future of Coal in America?



Water/Energy Nexus: Power Plant Water Withdrawal Requirements - Now Worse Due to New 316(b) rules



Source: Coal and Performance Baseline for Fossil Energy Power Plants, Volume 1: Bituminous Coal and Natural Gas to Electricity; NETL, May 2007

Partnerships Critical For Addressing Overarching Issues Facing Energy Systems

Energy System Issues




Grid Modernization:
Renewable Technologies
Peak Demand

Global Climate Change

Energy Security:
Fuel Supplies, Critical Infrastructure Protection

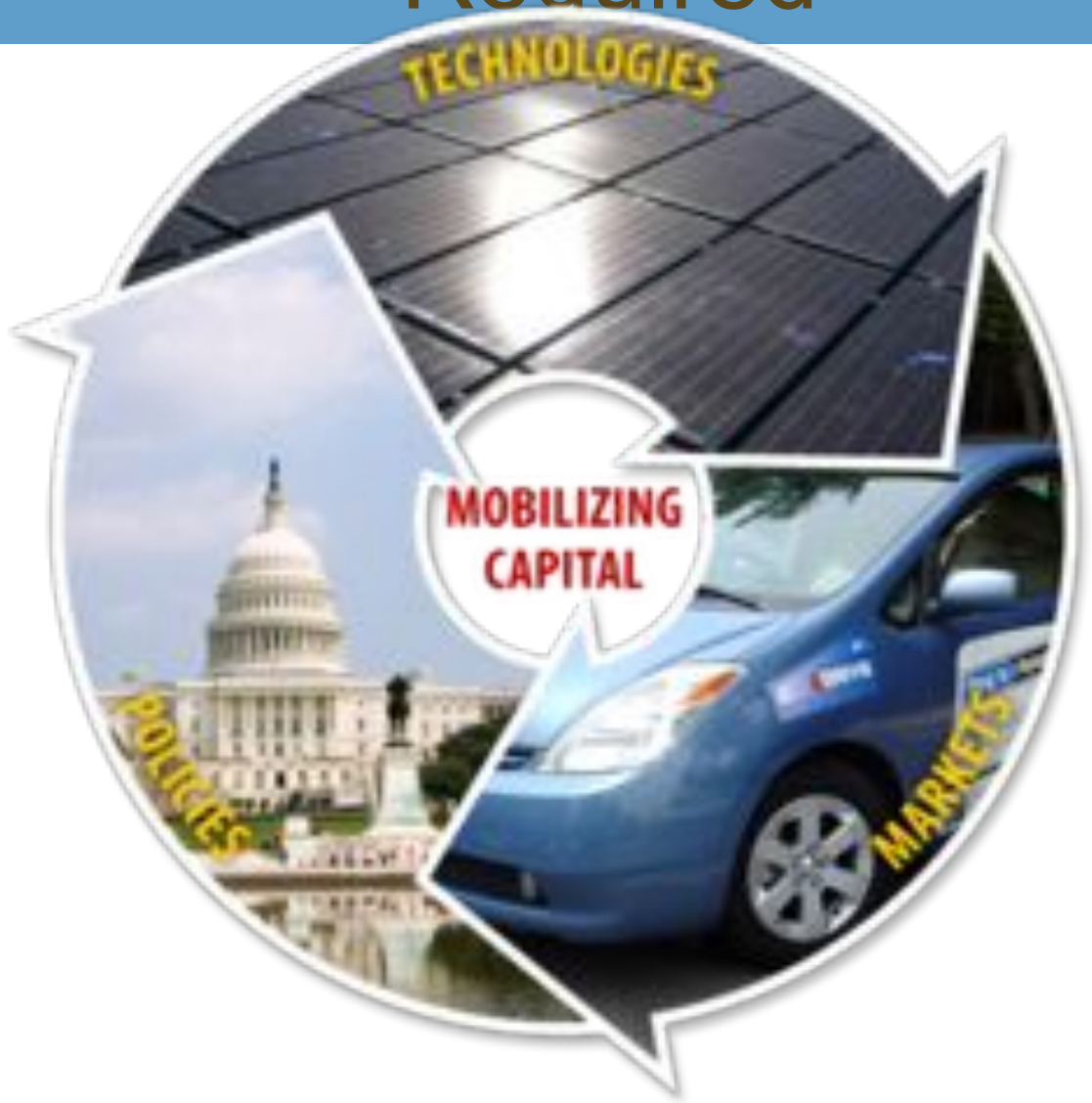
Environment Quality:
Life cycle analyses

None Of These Issues Can Be Resolved Without Partnerships

Government Remains Critical Part of Equation

- Financial instruments (loan guarantees, etc.) must be available to overcome “Valley of Death”
- Regulatory and institutional change needed
- Public/private partnerships for technology development
- Laws should promote the insertion of new, environmentally-acceptable technology
- Should lead public education and information dissemination
- Must link public policies with technology development and scientific findings

An Integrated Approach is Required



Basics for Sustainable, Secure Futures

- Environment – land, carbon, water, air
- Energy - security
- Economics – value to consumers, return on investment
- Equity - fairness
- Education – technical understanding, behavior