Australian National University

TODAY'S PUBLIC LECTURE

Clean energy technology policy: The economics of why and how

Dr Adele Morris
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Tuesday 13 March 2012 5.30-6.30pm followed by a refreshments

Weston Theatre, JG Crawford Bldng #132, Lennox Crossing, ANU

Presented by
the HC Coombs Policy Forum,
Crawford School of Economics and Government,
and the Research School of Economics
ANU College of Business and Economics, ANU

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HC Coombs Policy Forum

Clean Energy Technology Policy: The Economics of Why and How

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Fellow & Policy Director, Climate and Energy Economics Project
The Brookings Institution

13 March 2012

Source:

- Morris, Adele, Pietro S. Nivola, and Charles L. Schultze, "Clean Energy: Revisiting the Challenges of Industrial Policy," forthcoming, The Brookings Institution, 2012

Clean Energy Policy Economics:

What should be the problem we're trying to solve?

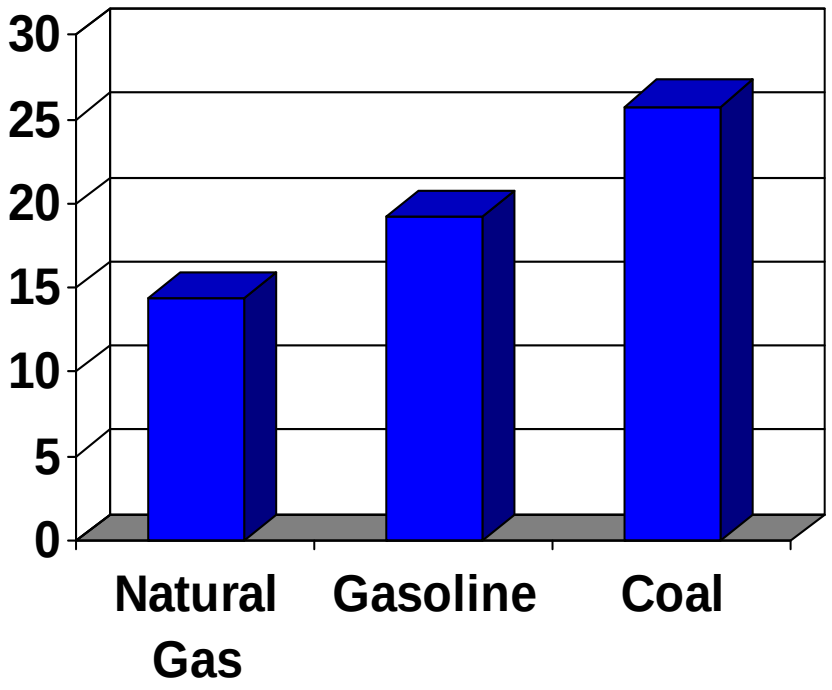
- How fiscally significant is clean energy policy?
- How do markets, left to themselves, get it wrong?
- How can government intervene efficiently?

What is clean energy?

- Low or no carbon
- Low environmental impact generally
- Low life cycle emissions
- Energy efficient goods

Clean energy?

- Nuclear
- Clean coal
- Natural gas
- New hydro



Policy tools to promote clean energy:

- Direct expenditures
- Tax subsidies
- Risk transfers
- Regulation
- Input subsidies
- Government procurement/contracts

Artist's conception of the six-square-mile Ivanpah solar facility in the Mojave Desert, to be located on U.S. Bureau of Land Management land. Source: *Los Angeles Times*

Examples of US Clean Energy Policy:

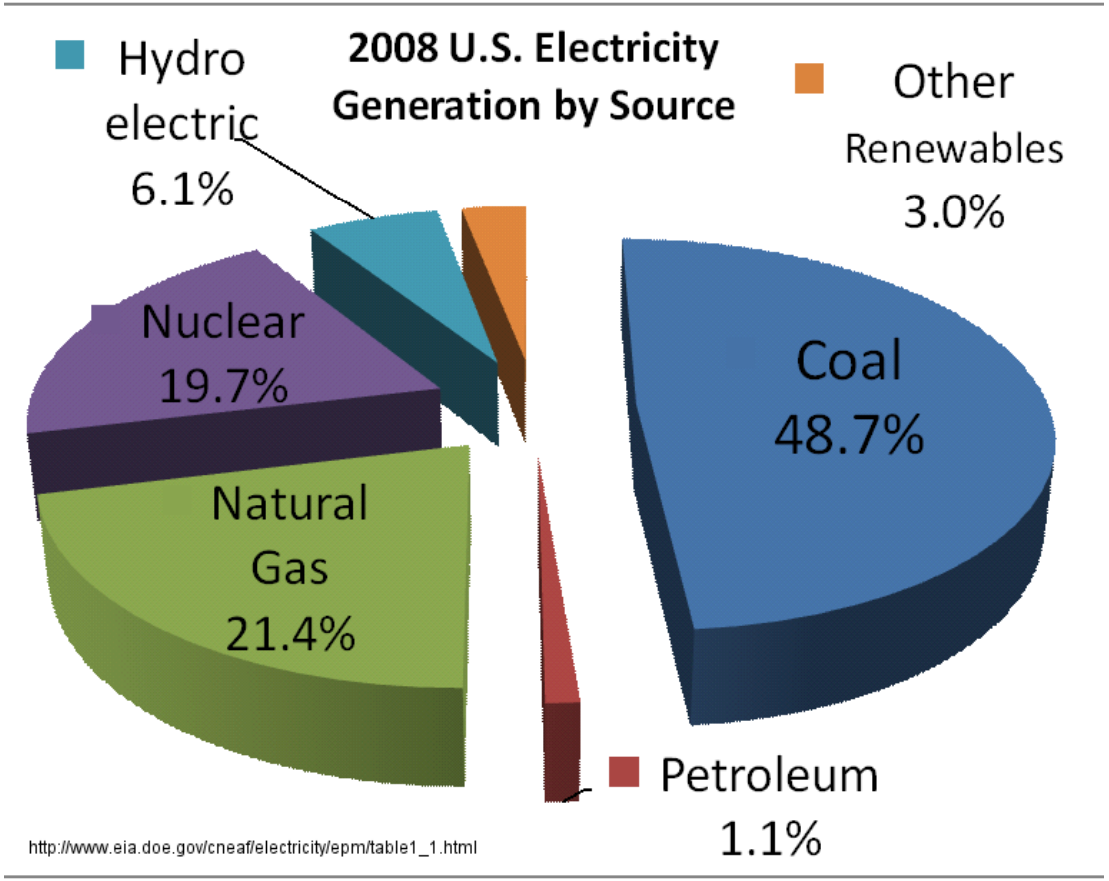
- Basic research
- Production tax credits for renewables
- Alternative fuel blending standards
- Assistance to low-income households for energy retrofits
- Energy labeling requirements for appliances
- Cap-and-trade program for SO_2 emissions
- Loan guarantees for solar and nuclear firms

Table ES1. Value of energy subsidies by major use, FY 2007 and FY 2010 (million 2010 dollars)

Subsidy and Support Category	FY 2007	FY 2010
Electricity-Related	7,663	11,873
Fuels and Technologies Used for Electricity Production	6,582	10,902
Transmission and Distribution	1,081	971
Fuels Used Outside the Electricity Sector	6,246	10,448
Conservation, End Use and LIHEAP	3,987	14,838
Conservation	369	6,597
End-Use/Other	1,342	3,241
LIHEAP	2,276	5,000
Total	**17,895**	**37,160**

Clean Energy Subsidies are Relatively Large

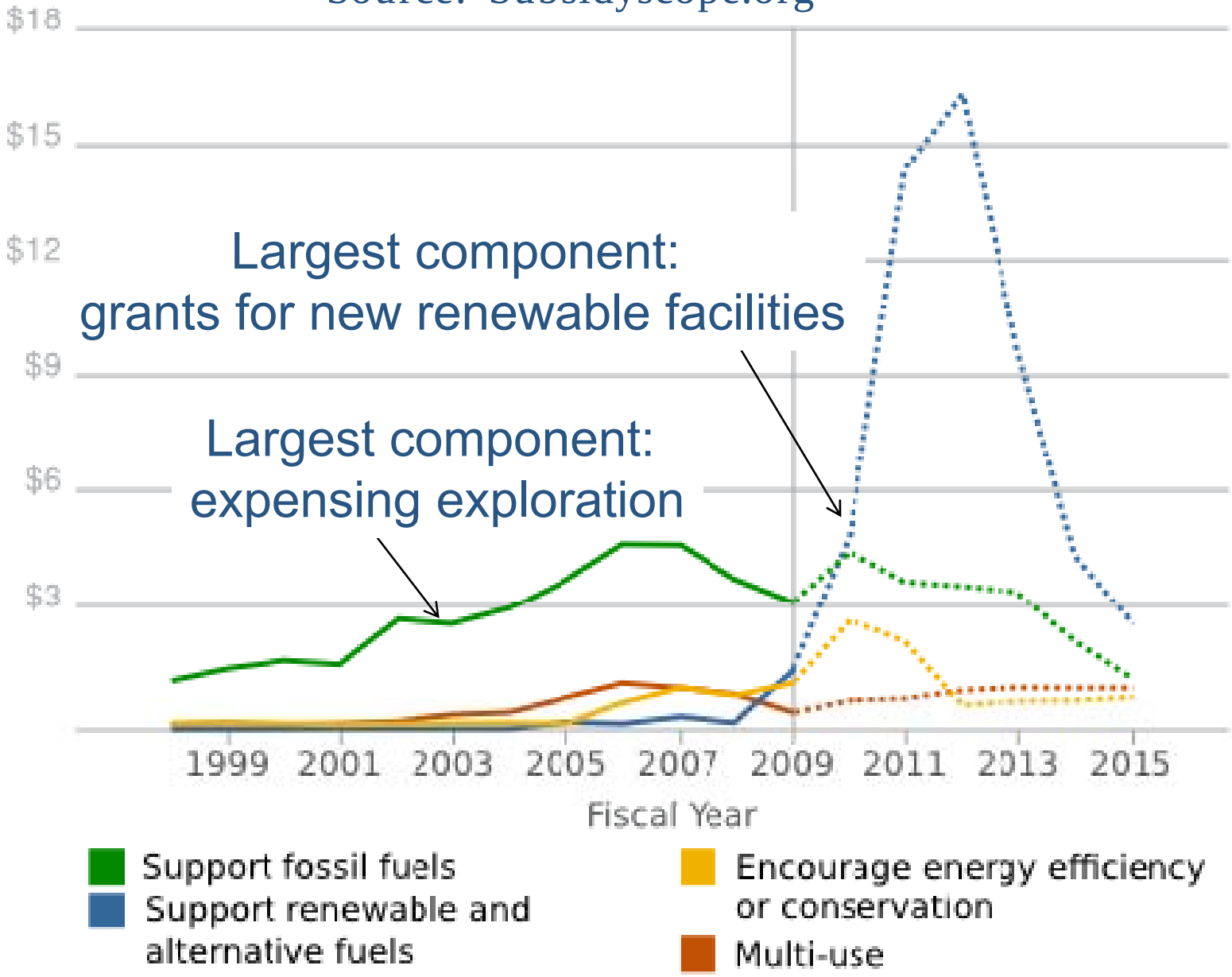
- Renewables were 10.3% of electricity generation in 2010 and received 55.3 % of federal subsidies.
- In 2009, renewable energy tax subsidies were 49 times greater than fossil fuel subsidies on a per BTU basis.



Sources: US Energy Information Administration; Congressional Research Service; Institute for Energy Research

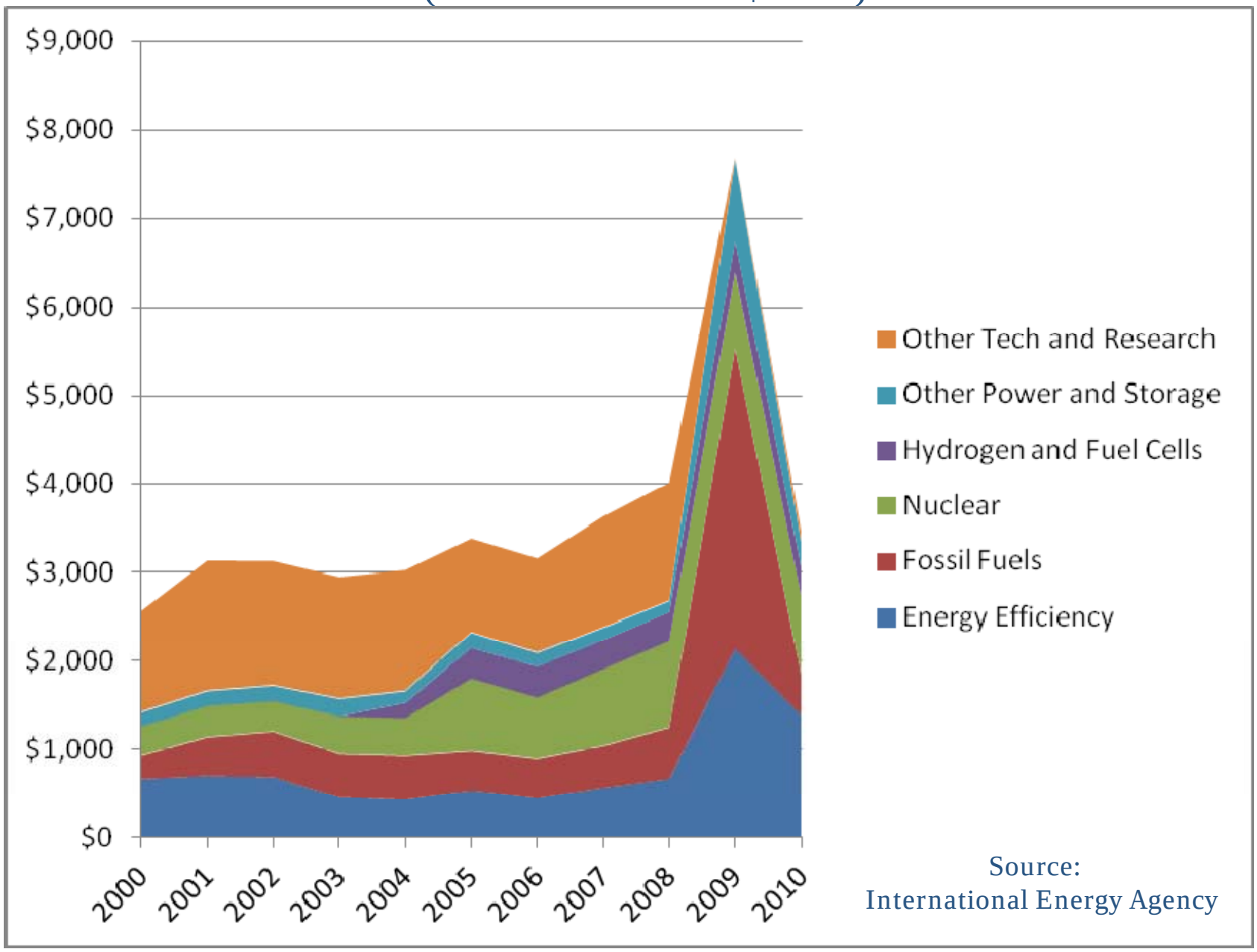
U.S. Energy Related Tax Expenditures ($ billions)

Source: Subsidyscope.org



U.S. Energy-Related R&D Spending 2000-2010

(in millions of US $2010)



Source:
International Energy Agency

Three common arguments for clean energy policy:

1. Greenhouse gas emissions from conventional energy
2. Energy security
3. Strategic industrial or trade potential

(Want to distinguish economic arguments from rent-seeking)

How do arguments for clean energy policy line up with economic principles?

1. Environmental damages from conventional energy
2. Energy security
3. Strategic industrial or trade potential

A. Market failures
   - » External costs
   - » Public goods

B. Macroeconomic risk from volatile oil price

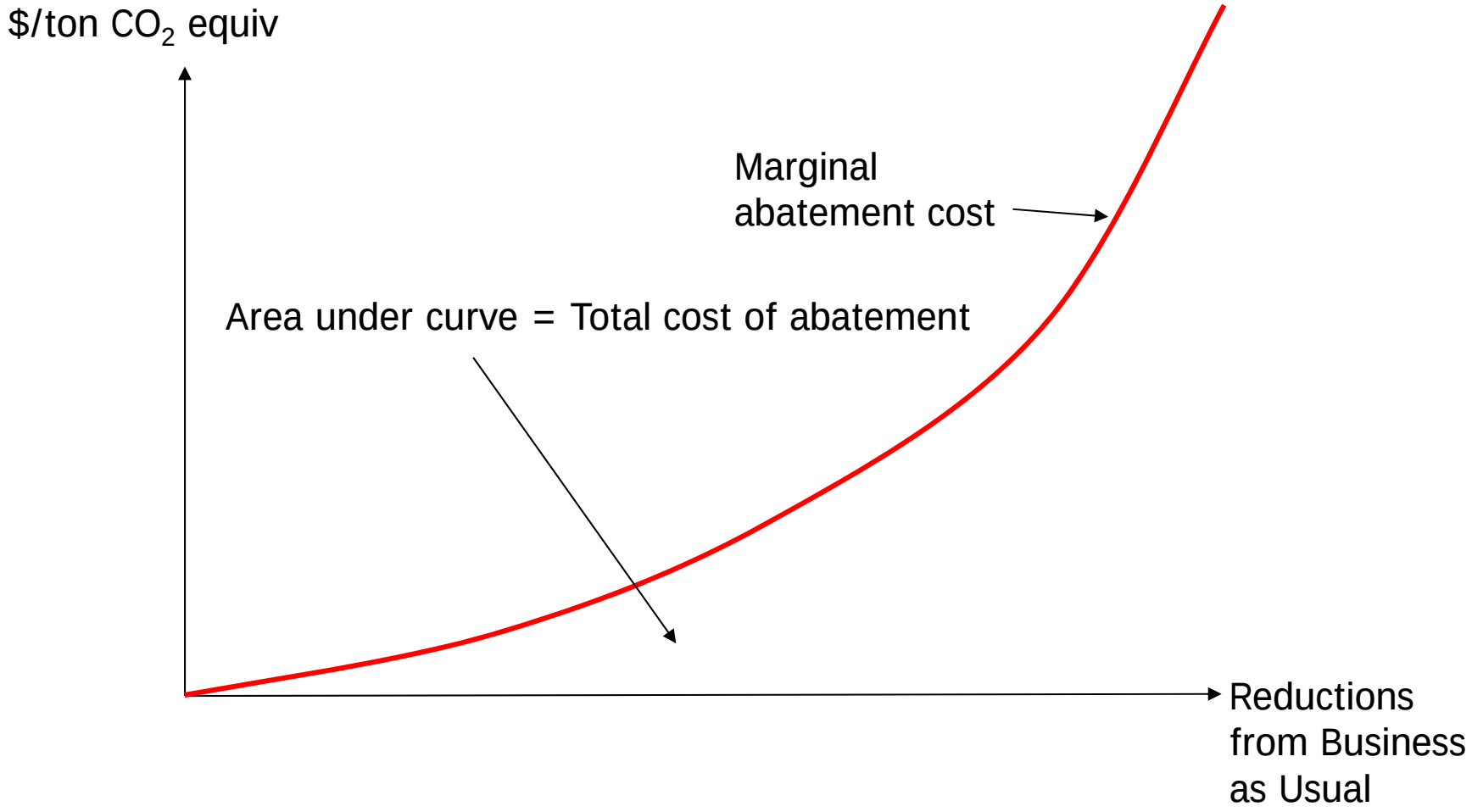
C. Distributional objectives
   - » Potential to benefit U.S. economy at expense of others

How strong are these arguments?

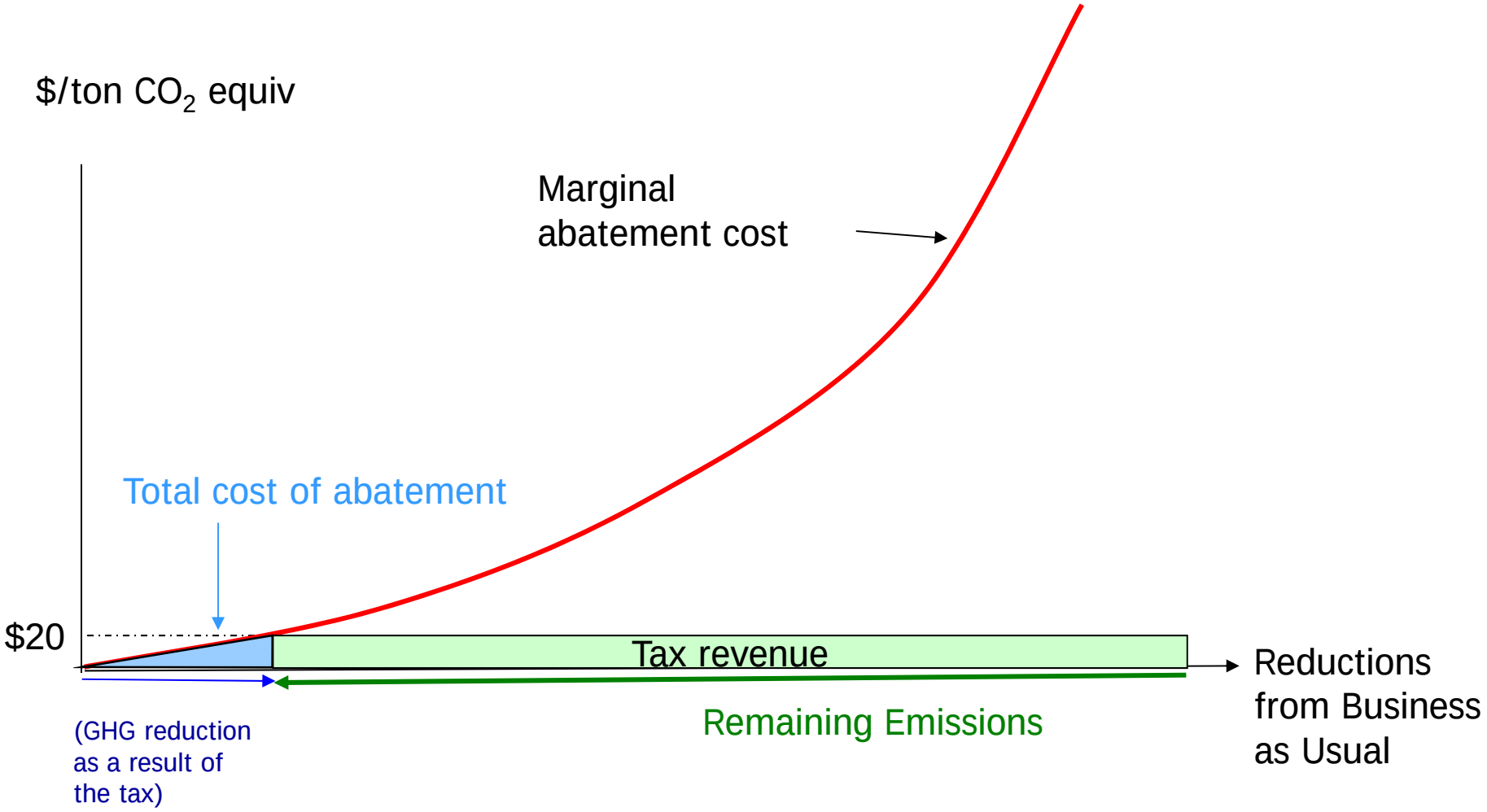
Rationale 1: Environmental Damages from Conventional Energy

- Prices don't reflect damage to the environment.
- Damages are *external costs.*
- An economy-wide price on greenhouse gases ensures that all economic decisions incorporate both private and social costs.
- US government estimates 2010 Social Cost of Carbon ≈ $4.70 to $64.90/ton CO_2

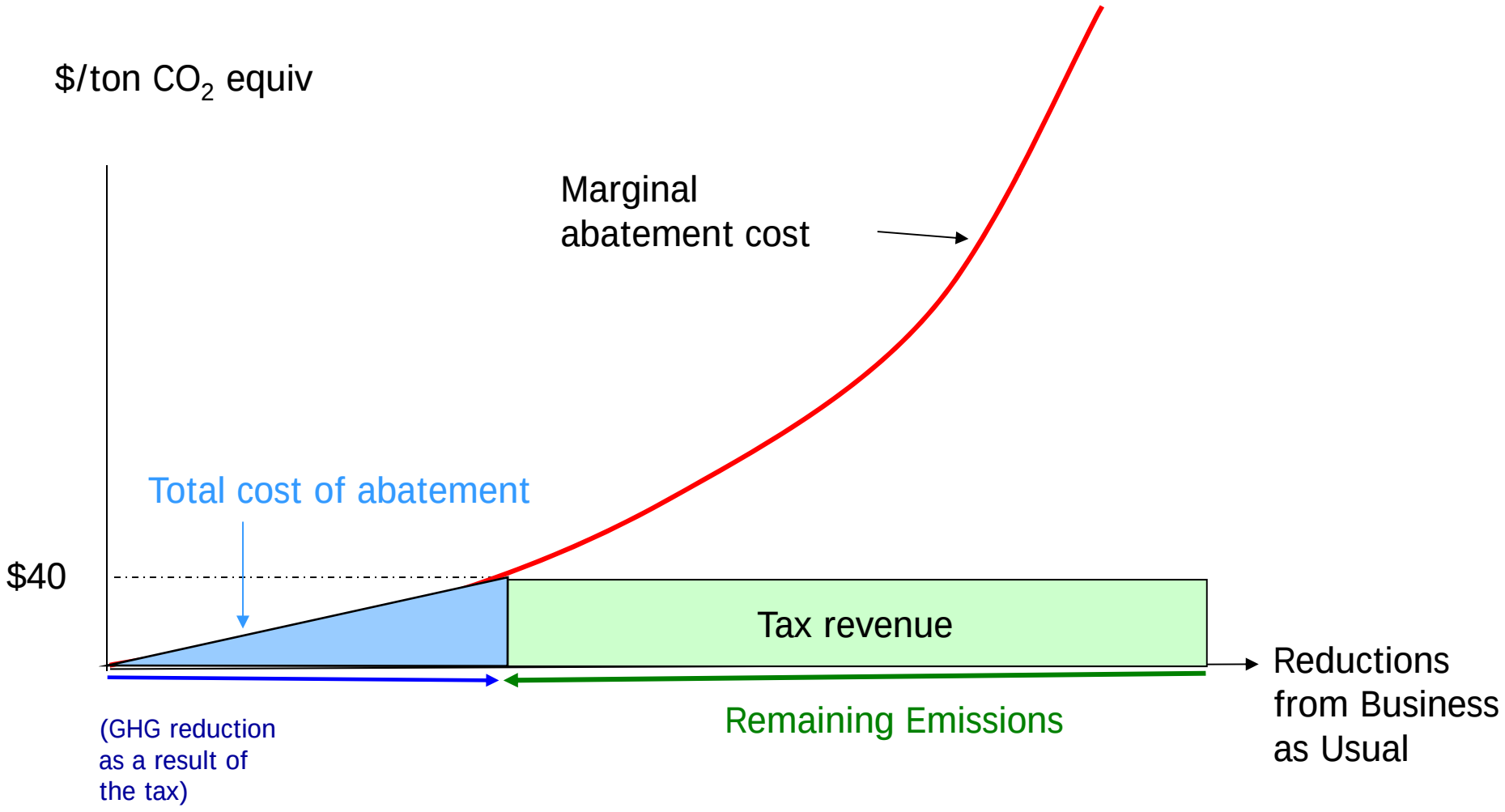
Greenhouse Gas Abatement Cost Curve



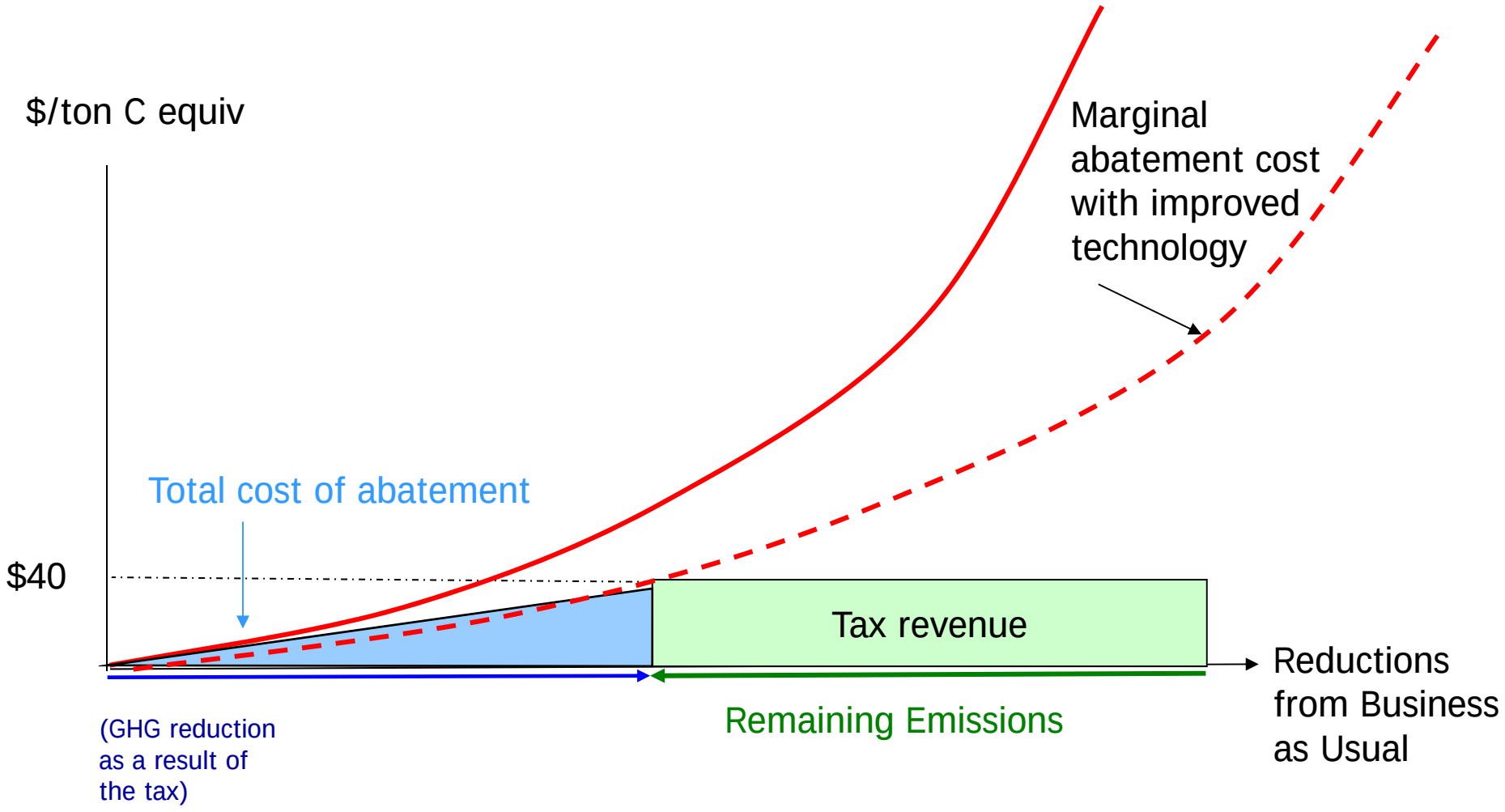
Example: Set a price on carbon and reduce emissions. Cost effective technology deploys.



Increasing carbon price lowers emissions further…



Improved technology lowers the marginal abatement cost – more abatement for the same price on carbon.



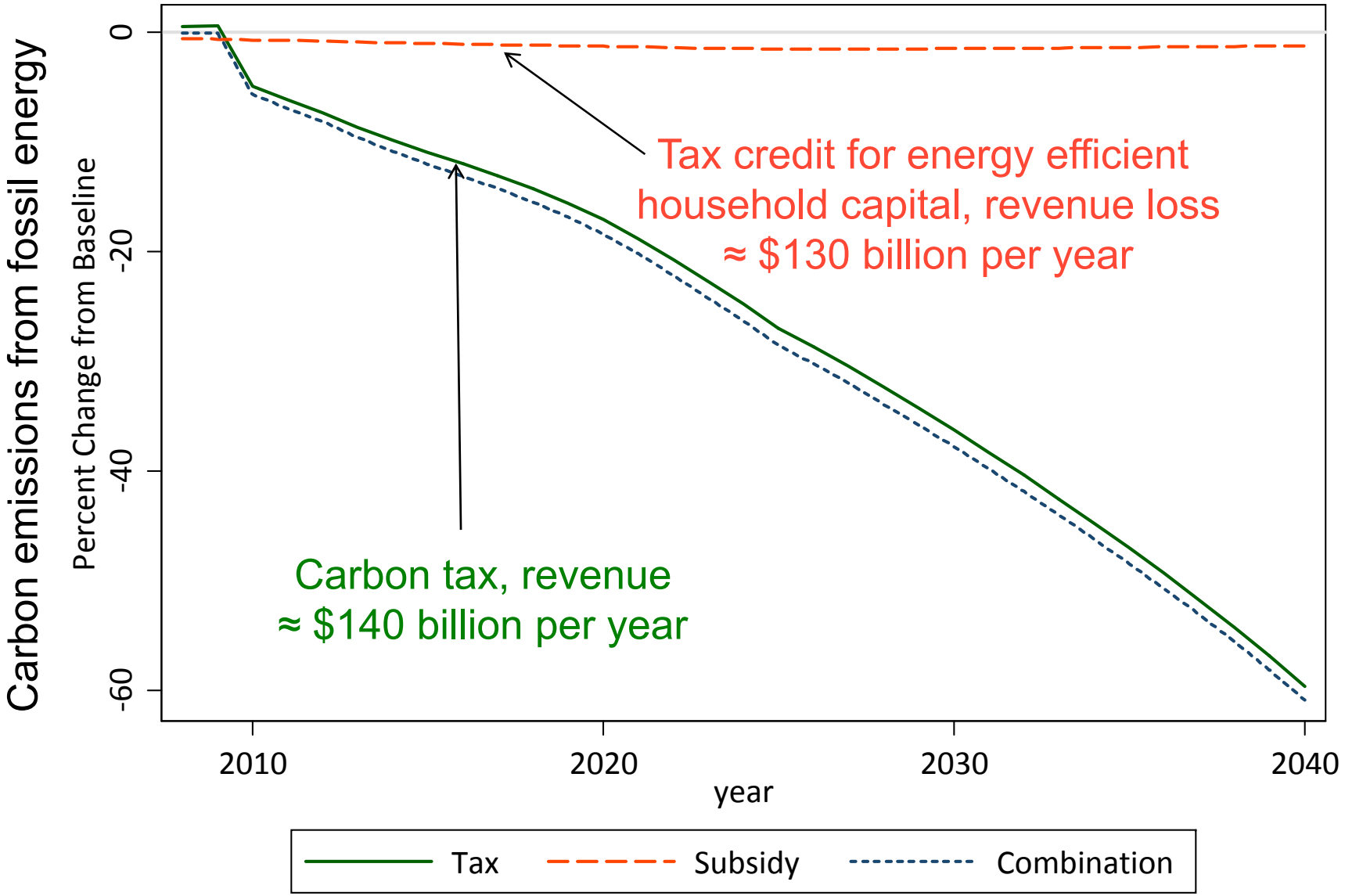
Price signal does the heavy lifting

- Firms invest in lowest cost abatement and cost effective R&D
- Government still needs to fund under-provided basic R&D
  - » Public good quality to basic research
  - » Cost effectively shift down cost curve
- No natural connection between carbon tax revenue and optimal R&D spending

Before a price signal takes effect:

- WWFD?
  - What would firms do if there was a price on carbon?
- Establish expectations where possible
- Don’t subsidize, mandate, or under-write risks of high cost abatement.

How do carbon emissions reductions from energy efficiency tax credits compare to reductions from a carbon tax?



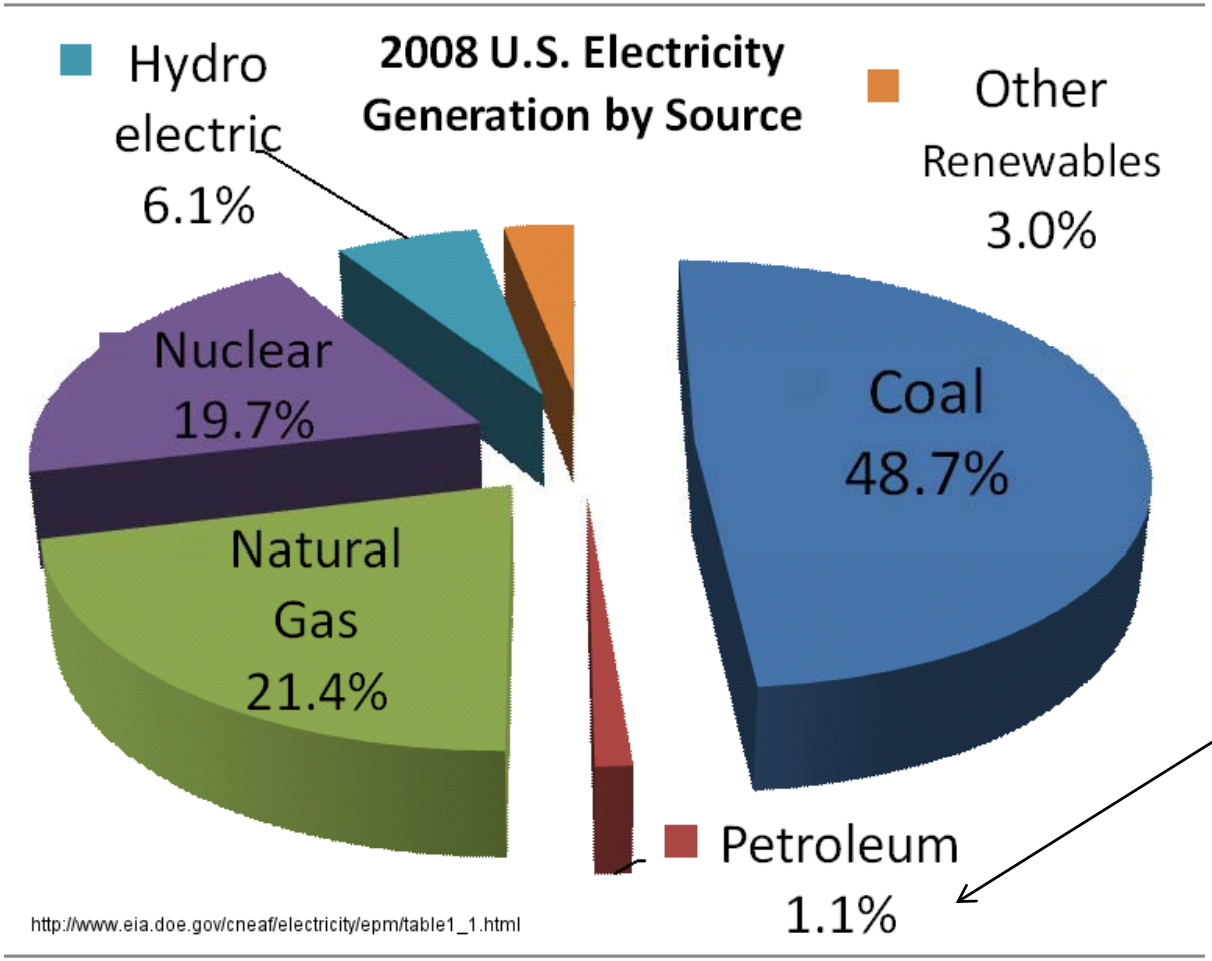
Source: McKibbin, W., A. Morris. and P. Wilcoxen, "Subsidizing Energy Efficient Household Capital: How Does It Compare to a Carbon Tax?" *The Energy Journal*. Vol 32. 2011

Why is a carbon tax so much more effective than tax credits?

- Tax affects characteristics of new equipment (like a tax credit) and use of existing equipment.
- Spurs fuel switching.
- With energy efficiency program, people spend some savings on energy, directly and indirectly.

Rationale 2: Energy security

- Electricity fuels in the U.S. are North American.



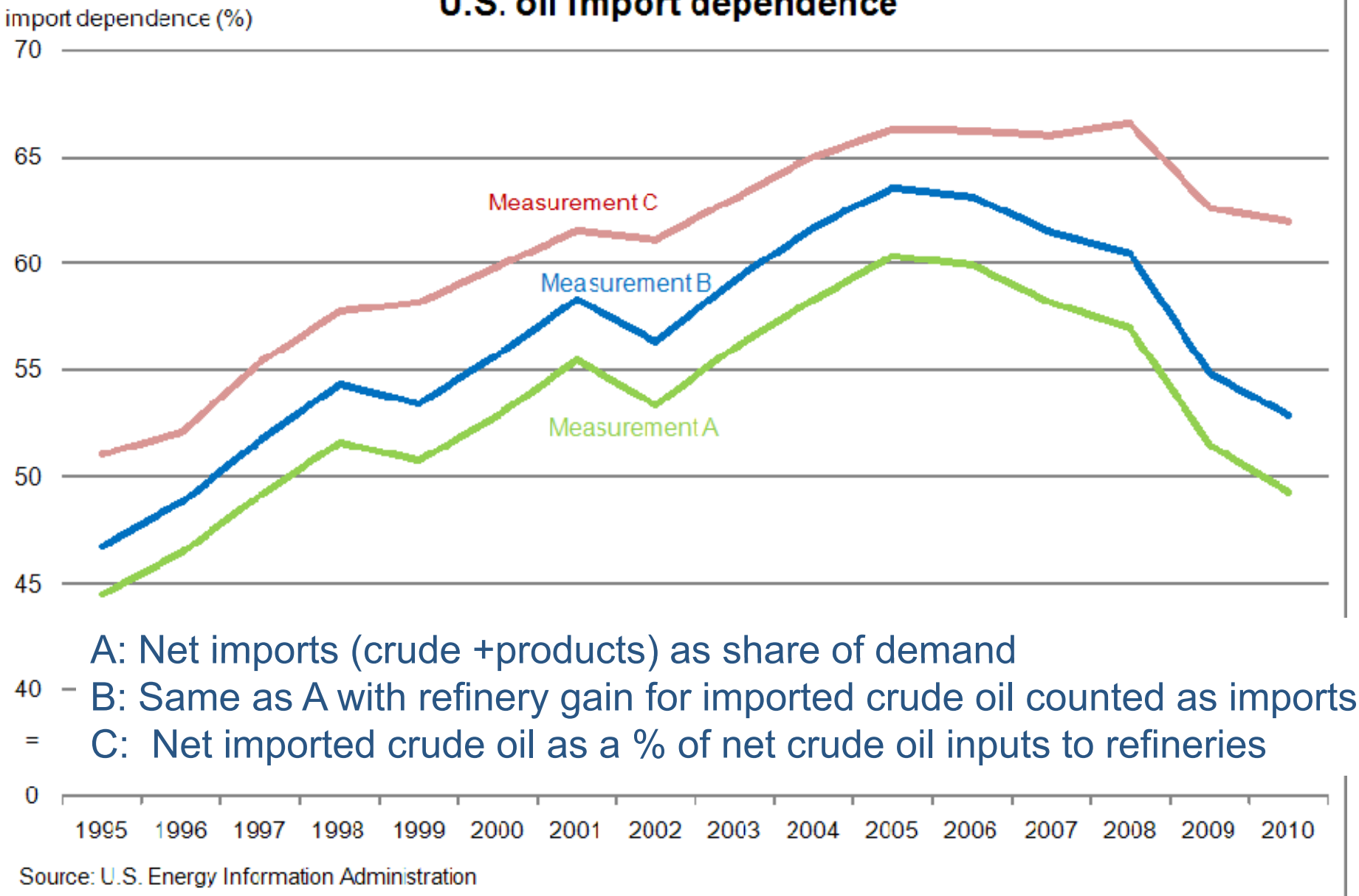
Minimal oil for electricity

Energy Security is About Oil

- Oil price problems are intermittent.
- Oil substitutes are expensive and require capital stock turnover.
- Oil substitutes aren't necessarily clean and may not compete if oil prices fall.
- US economy is less vulnerable to price shocks than in the 1970s.

Tesla: US Govt. Loan Guarantee, $465 million. Its electric cars sell for $58,000 to $109,000, minus $7,500 tax credit.

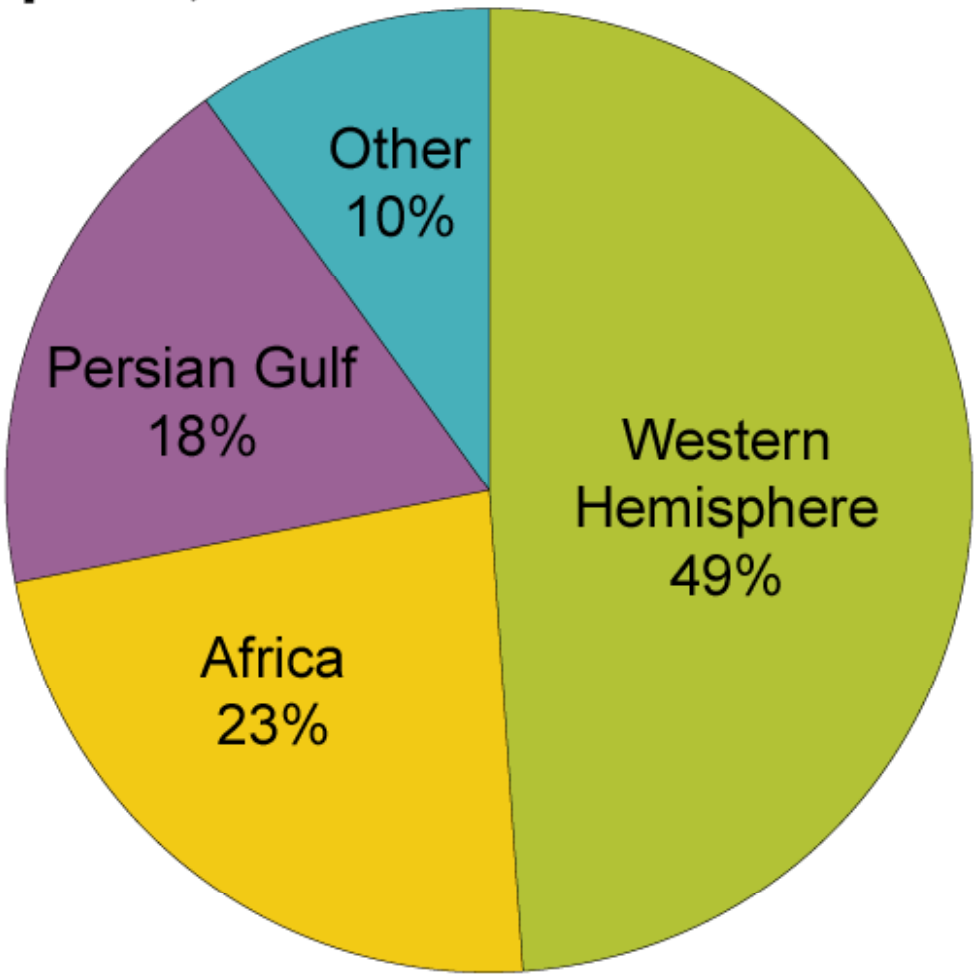
Figure 1. Three alternative measurements for U.S. oil import dependence



A: Net imports (crude +products) as share of demand
B: Same as A with refinery gain for imported crude oil counted as imports
C: Net imported crude oil as a % of net crude oil inputs to refineries

Source: U.S. Energy Information Administration

Sources of U.S. Net Petroleum Imports, 2010



Source: U.S. Energy Information Administration, *Petroleum Supply Monthly* (May 2011).

The five largest sources of net crude oil and petroleum product imports to the U.S. were:
Canada (25%)
Saudi Arabia (12%)
Nigeria (11%)
Venezuela (10%)
Mexico (9%)

Two kinds of significant macroeconomic costs arise from oil price spikes:

- (1) the simple loss of national income from a large jump in oil prices sustained for any length of time; and
- (2) the effects of large oil price shocks on inflation and output arising from "imperfections" and rigidities of the macroeconomic system.
- The most effective policy: the Federal Reserve's prompt response to any current or prospective inflationary threat.

Rationale 3: Clean energy investments can benefit the American economy.

- Fear that without clean energy policies, Americans will forfeit a growth opportunity to other countries.
- Belief that clean energy investments create jobs.
- Consistent with long tradition of industrial policy arguments.

However…

- Hard to influence long run comparative advantage with subsidies or regulation.
- In the long run, labor markets equilibrate. Policy can affect composition, but not number of jobs.
- First mover advantage in clean energy is unclear.
- Clean energy demand is a function of fickle policy.
- The cheaper clean energy is, the better for the environment and the US economy.

Source: www.chinesesolar.com

How does spending related to energy stack up against other forms of fiscal stimulus?

- Timely, targeted, and temporary?
  - » Energy efficiency retrofits could work.
  - » Renewable deployment, maybe, but electricity demand growth is low in recession.
  - » R&D not well suited to counter-cyclical spending
- Guaranteed loans for expanding commercial operations will help only those firms that are nearly competitive.

Finally, theory vs. practice

- "The trouble with picking winners is that each Congressman would want one for his district."
- Tens of billions wasted on synfuels, breeder reactors, hydrogen economy.
- Need to insulate spending from rent-seeking and fashion.

http://scherle.com/2009/the-hydrogen-economy

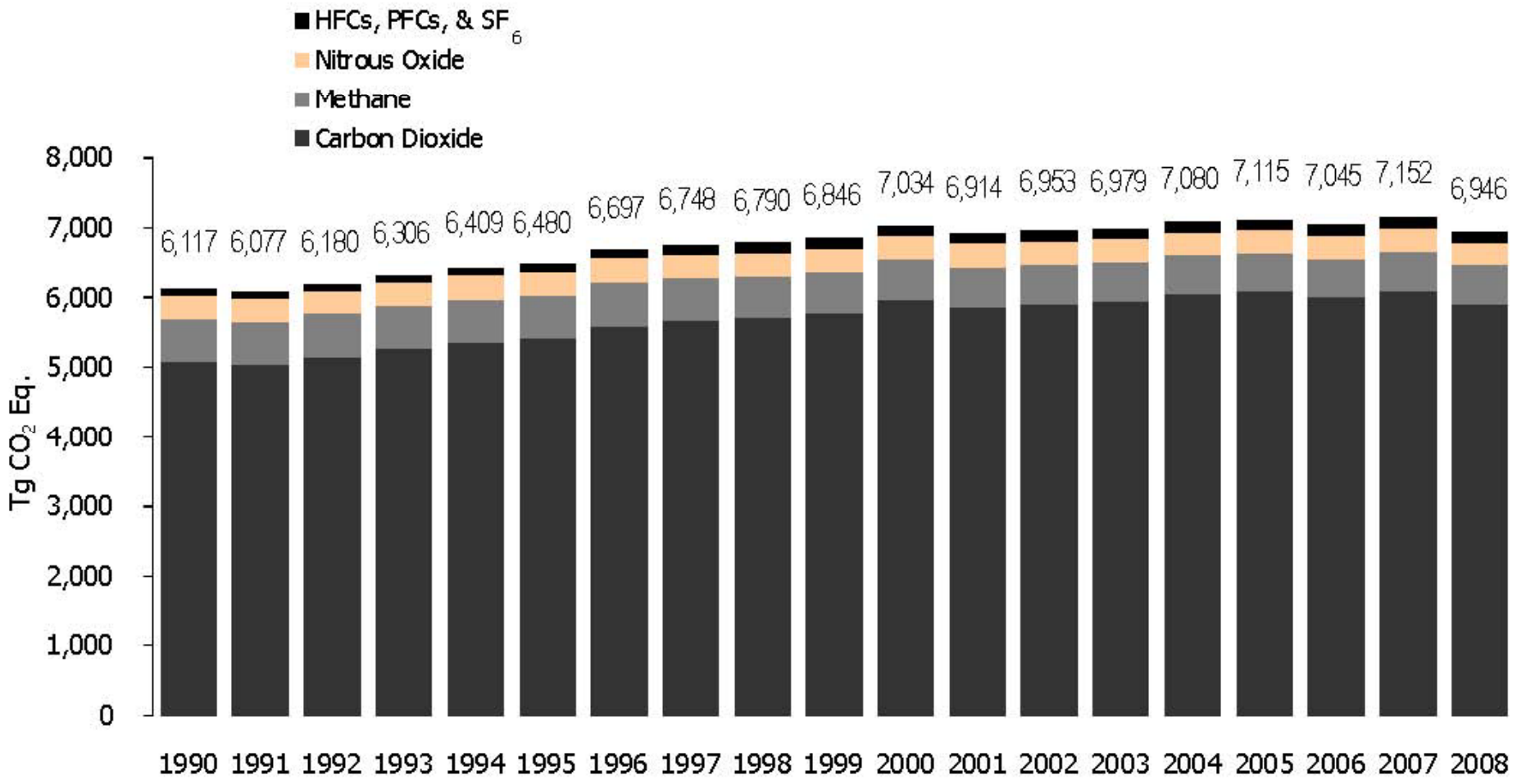
From 2004 to 2008 the U.S. government spent $1.2 billion on hydrogen vehicles.

Conclusions:

- The strongest economic rationale for promoting clean energy is its relatively lower environmental damages.
- The most efficient way to promote clean energy is to price greenhouse gas emissions and other pollution.
- Carefully select a portfolio of clean energy R&D investments independent of political whims.

Extra slides

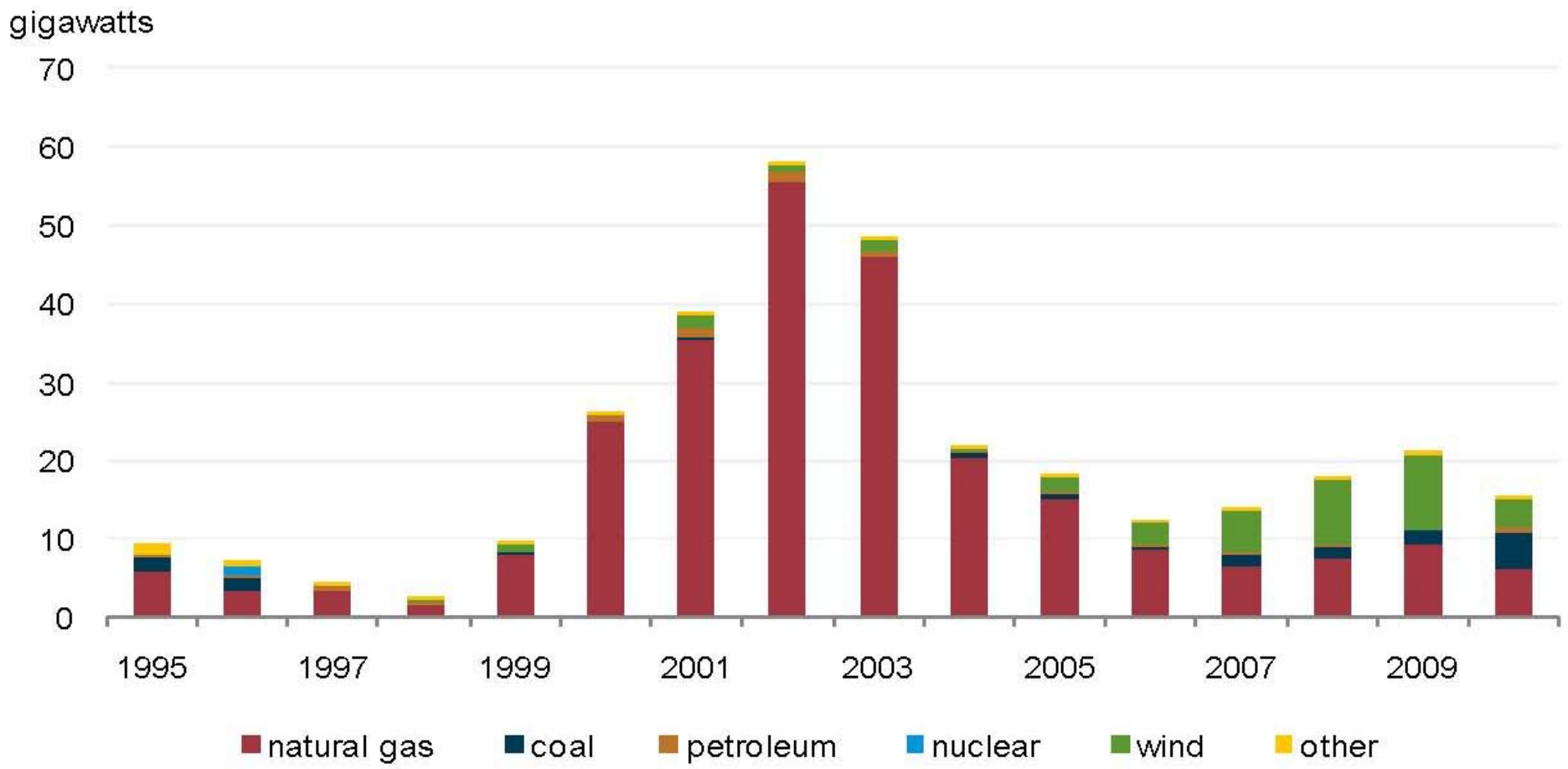
US Greenhouse Gas Emissions By Gas, 1990 - 2008



Source: EPA, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2008 (April 2010)

New U.S. Electricity Generation

Figure ES 1. Electricity generating capacity additions by year



Source: U.S. Energy Information Administration

Obama Clean Energy Standard Proposal

- Double the share of "clean energy" to 80 percent by 2035 (electricity only)
- Renewables (e.g. solar, wind, geothermal, biomass), nuclear power
- Partial credit for efficient natural gas and coal with carbon capture and sequestration
- Complementary measures: appliance efficiency standards, tax credits for energy efficiency upgrades, manufacturer efficiency upgrades

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