The Case for Fuel Neutrality

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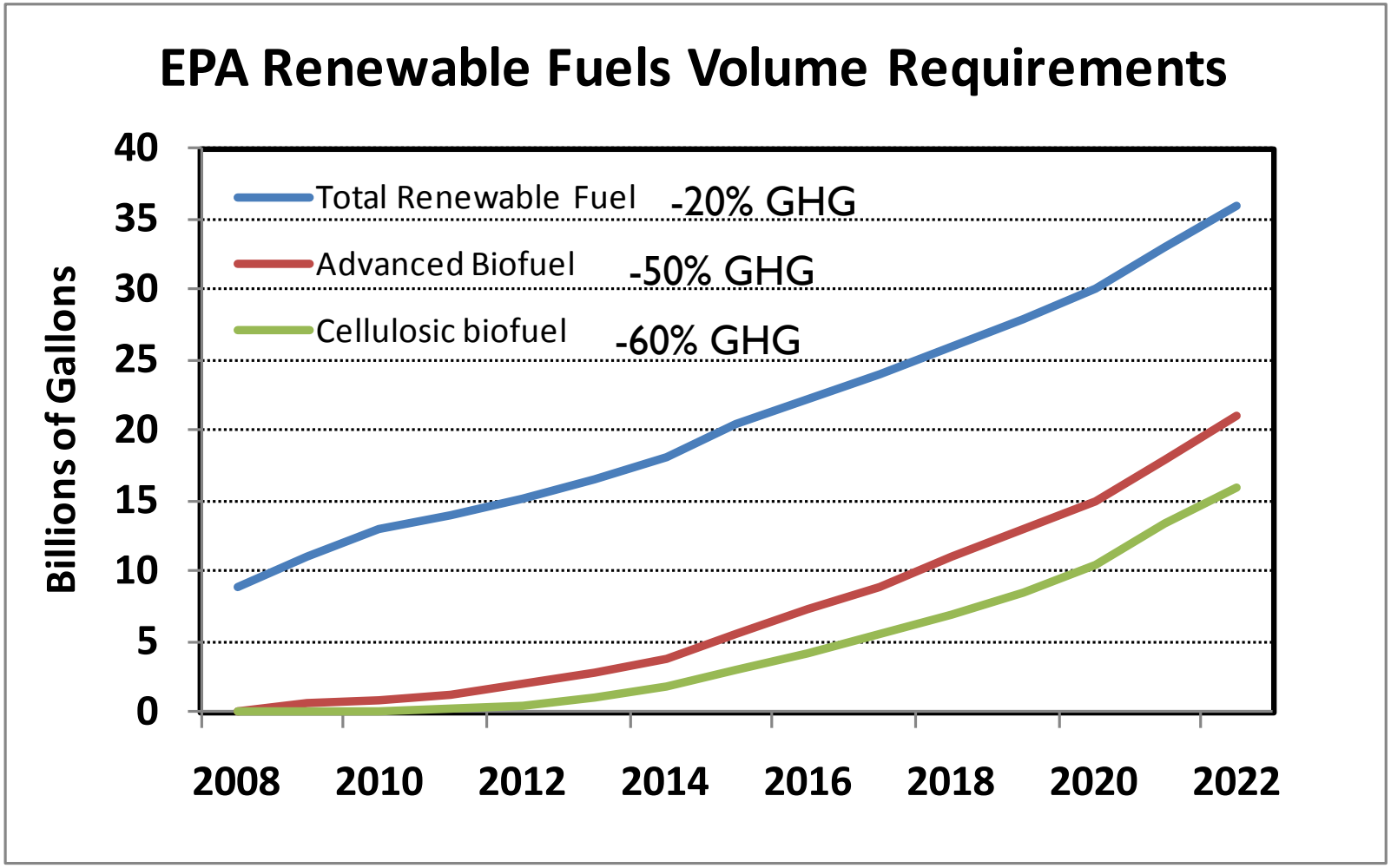
Why fuel neutrality?

- Economic efficiency
  - Marginal Social Cost = Marginal Social Benefit
  - MSCs equal across fuels & providers
- Fairness
  - Let the market (or economic efficiency) rather than politics decide.
- OK, but…
  - No such thing as fuel-neutral R&D
  - **Do markets really function efficiently?**
  - **What about "the chicken or the egg?" (Energy Transition)**

The Renewable Fuels Standard 2 is ambitious but cellulosic biofuel is off to a very slow start. 2011 requirement of 250 million gallons reduced to 6.6 million.

Although it has performance metrics, it is an approximation to a performance based standard.



California's Low Carbon Fuels Standard combines performance-based regulation and emissions trading.

- Goal: reduce transportation GHG emissions while equalizing MSC across fuels and suppliers.
- Argument over ability to estimate ILUC
  - Insufficient knowledge makes it difficult to realize the ideal of fuel neutrality.
  - But the RFS 2 has the same problem.
- Last year's ruling by federal judge:

  "impermissibly treads into the province and powers of our federal government, reaches beyond its boundaries to regulate activity wholly outside of its borders."
- !?

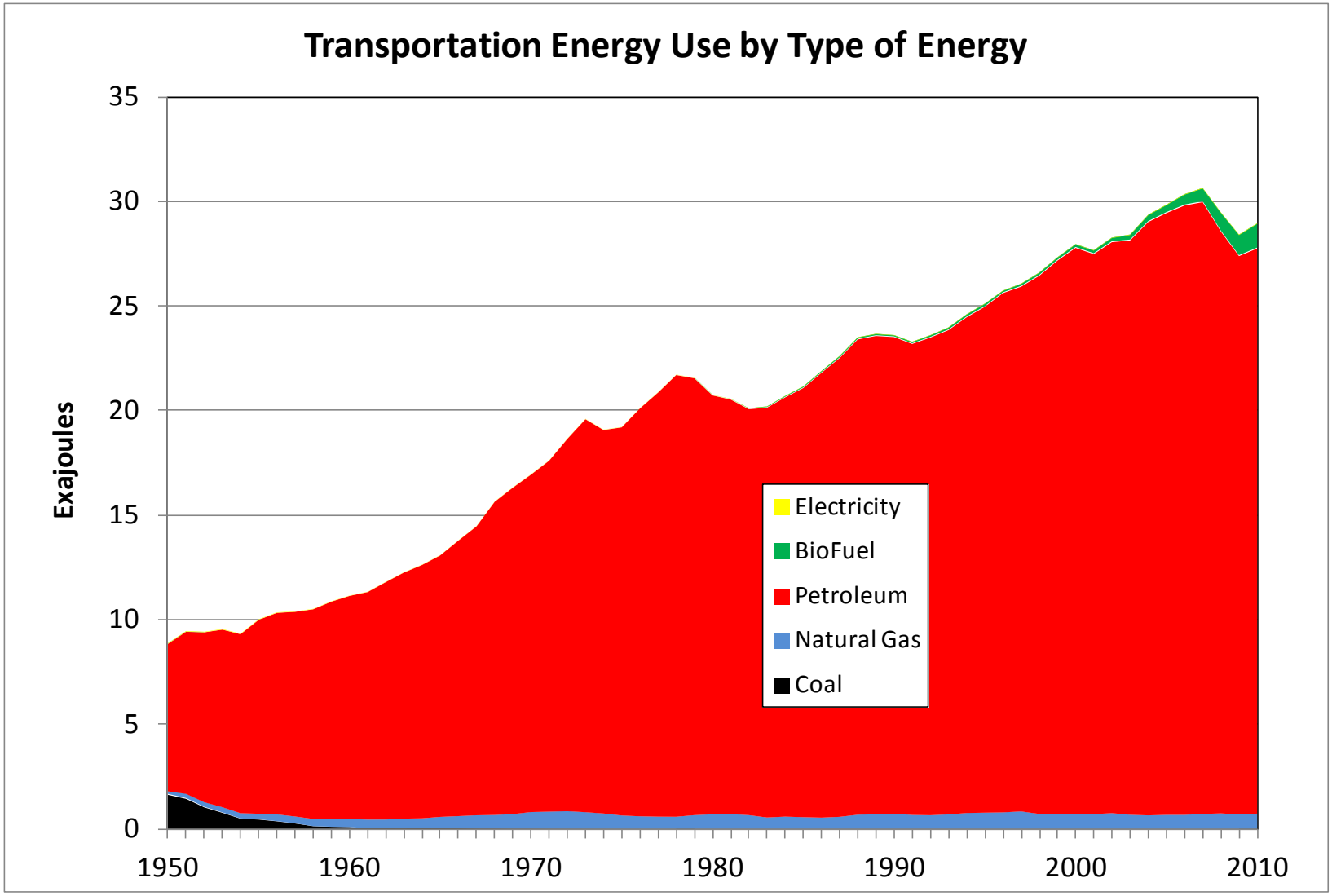
Efficient energy markets? (LDVs)

- Externalities
  - GHGs and climate change (~$50-$100B/yr. ???)
  - Air pollution, water, groundwater, etc.
- Oil market monopoly power (~$100-$500B/yr)
  - Not an externality
  - What's the solution?
- Undervaluing energy savings (~$200B/yr.)
  - Insights from behavioral economics
  - What's the solution?
- The long-term goals require advanced technologies.
  - 50% reduction in oil use by 2030
  - 80% reduction in GHGs by 2050 versus 2005
  - Markets tend to under-invest in R&D.
  - We don't know how technology will evolve.

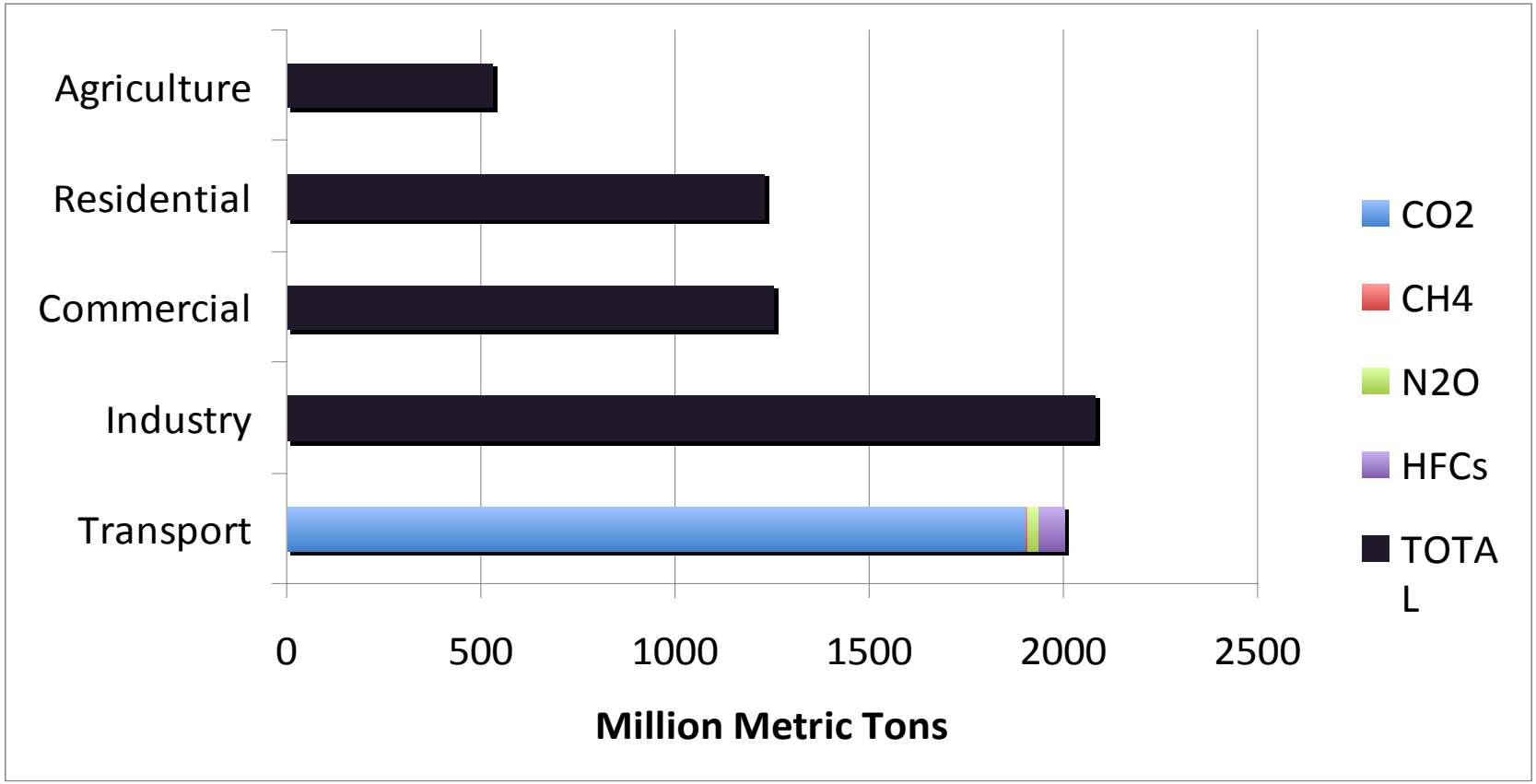
Transportation's GHG, particulate and smog-forming emissions are overwhelmingly due to burning petroleum in internal combustion engines.

All are regulated but none are priced.

When it comes to transportation externalities, it's about petroleum, which our transportation sector consumes at the rate of 6,300 gallons per second.



The U.S. transportation system emits more CO_2 than any country in the world except China. Nearly all of transportation's GHG emissions are CO_2.

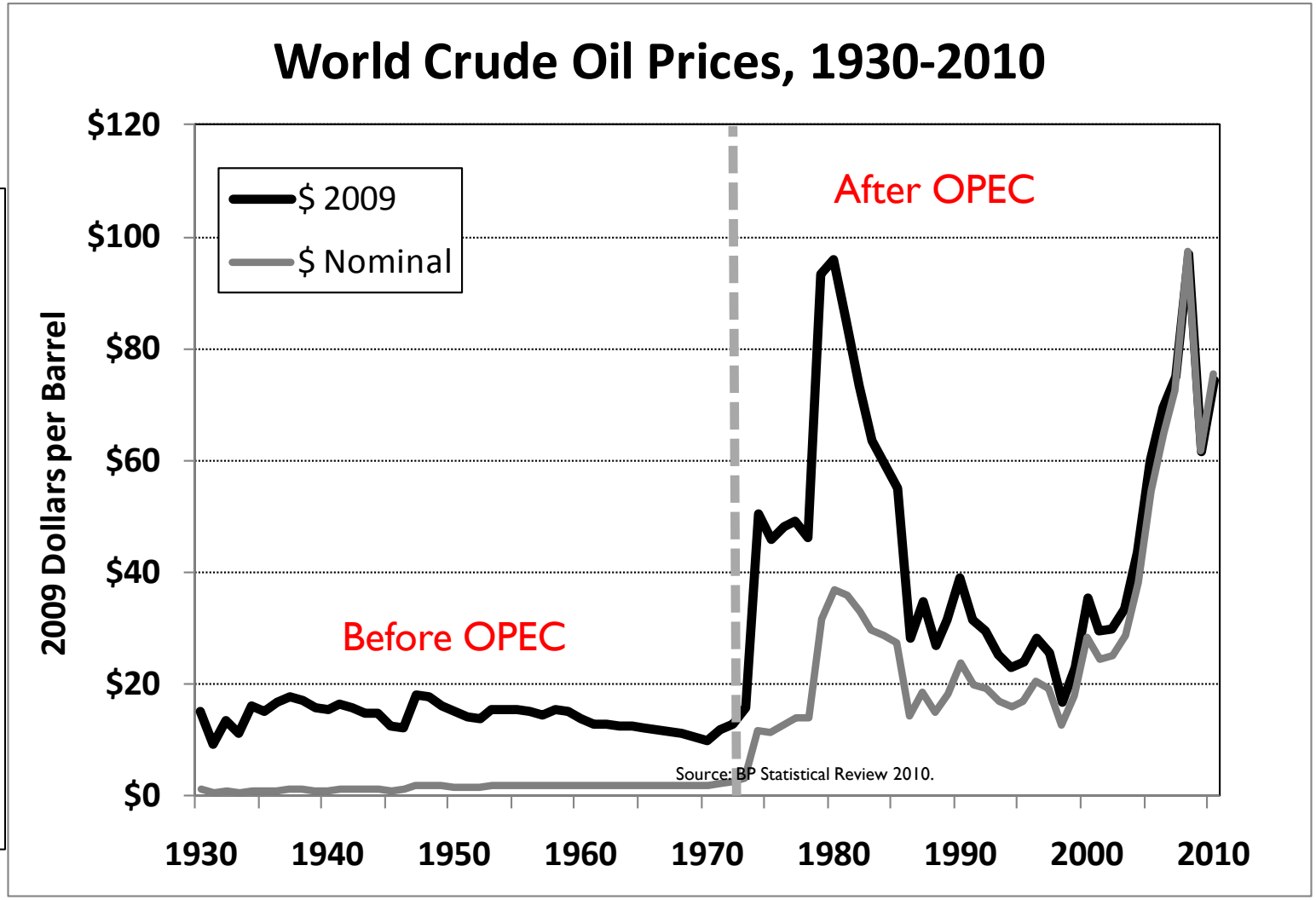


Oil dependence costs hundreds of billions of dollars most years.

Oil dependence is not an externality but a failure of competition.

"The real problem we face over oil dates from after 1970: a strong but clumsy monopoly of mostly Middle Eastern exporters operating as OPEC." Prof. M. Adelman, MIT, 2004.
RANDOM WALK? (Hamilton, 2009 *Energy Journal*, 30(2), 179-206).

Algeria
Angola
Ecuador
Iran
Iraq
Kuwait
Libya
Nigeria
Qatar
Saudi Arabia
UAE
Venezuela

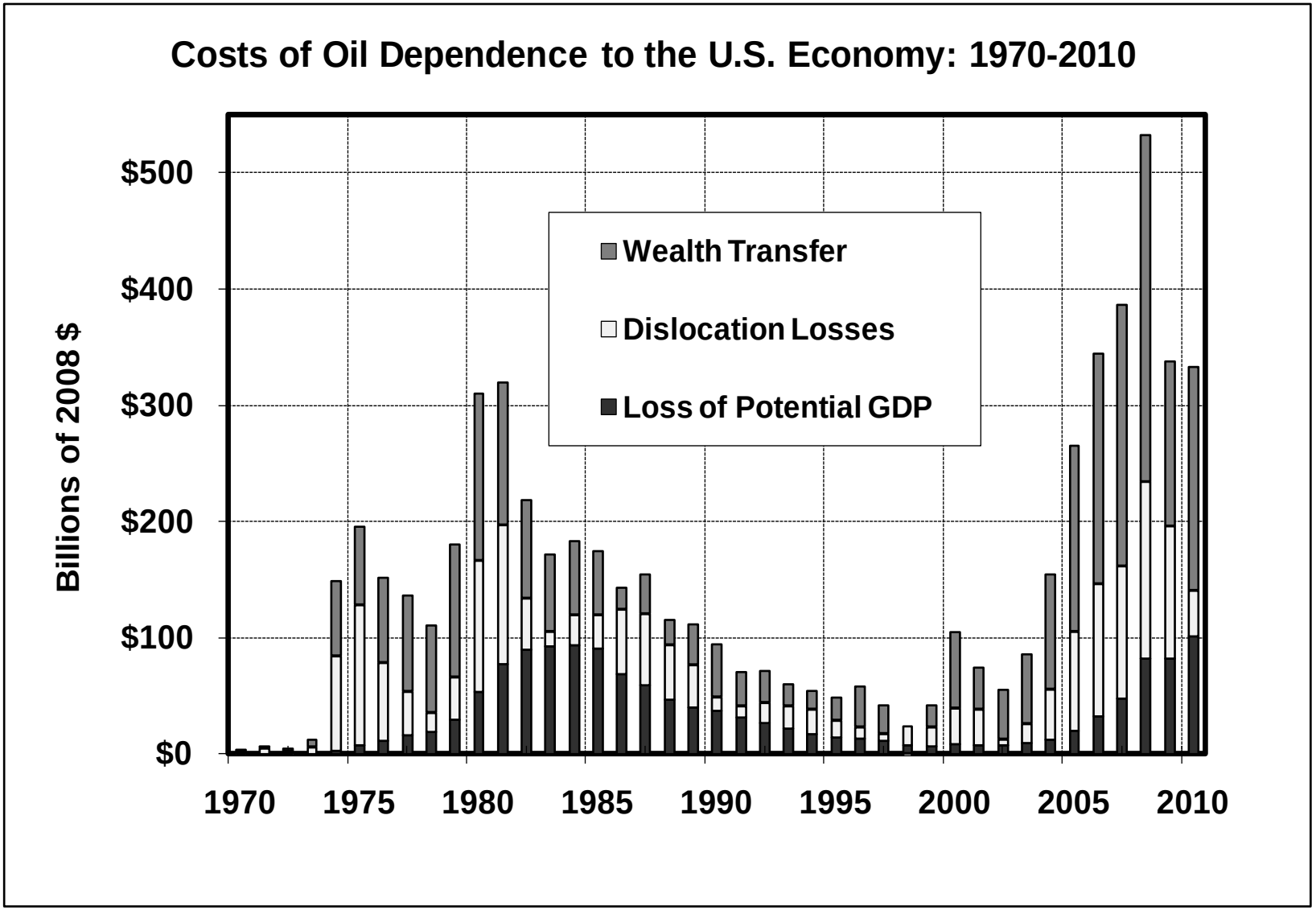


What is oil dependence?

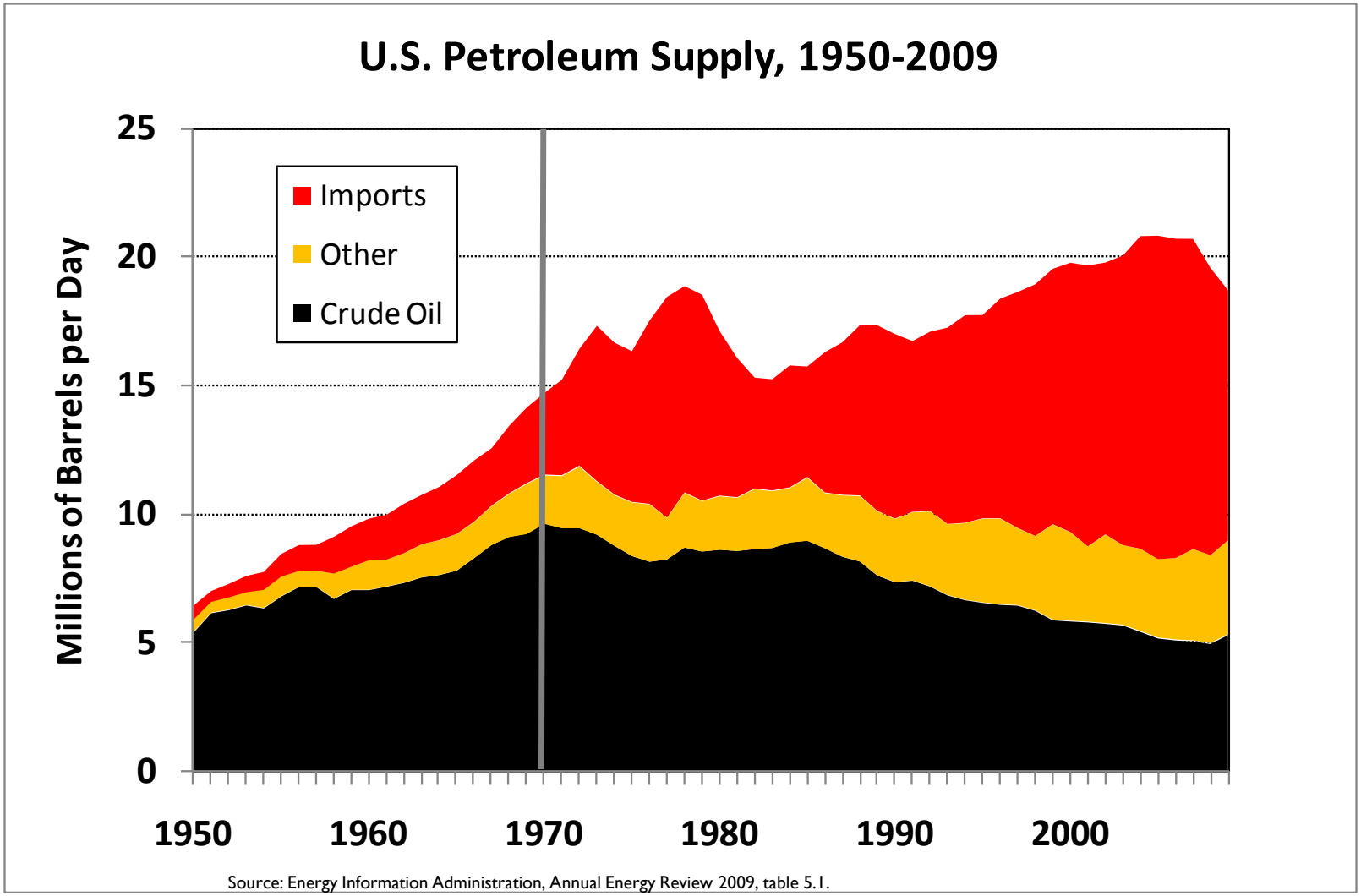
Oil dependence is primarily an **economic problem** with major national security implications caused by,

- use of **market power** by oil producing states,
- importance of oil to the economy and,
- lack of economical substitutes for oil.
- Oil dependence is NOT an externality.

Oil dependence cost the US more than $500 billion in 2008.
Oil independence doesn't mean using no oil or importing no oil.

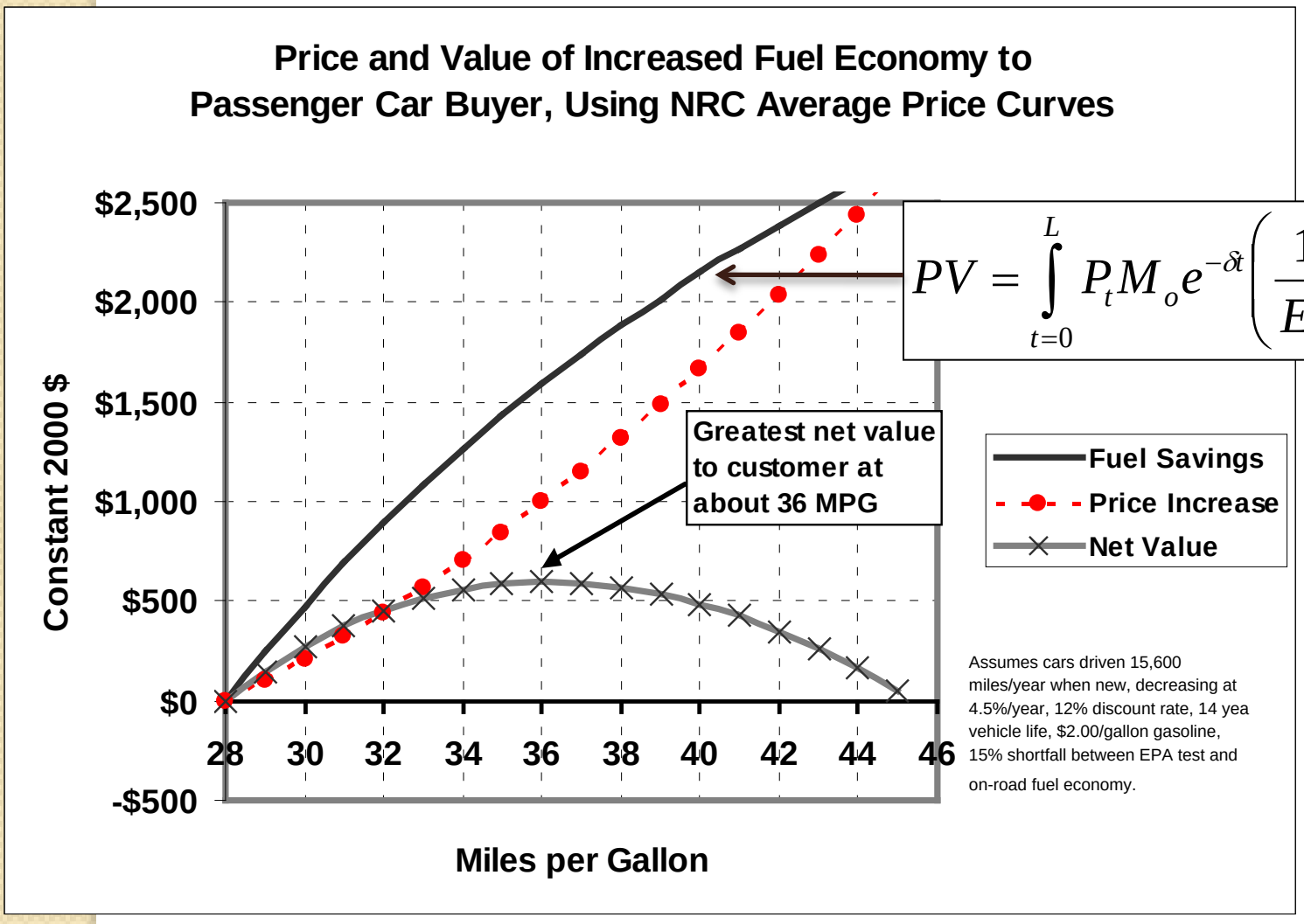


The cartel's market power was strengthened by growing world demand, its increasing market share and…the peaking of US crude oil production in 1970.



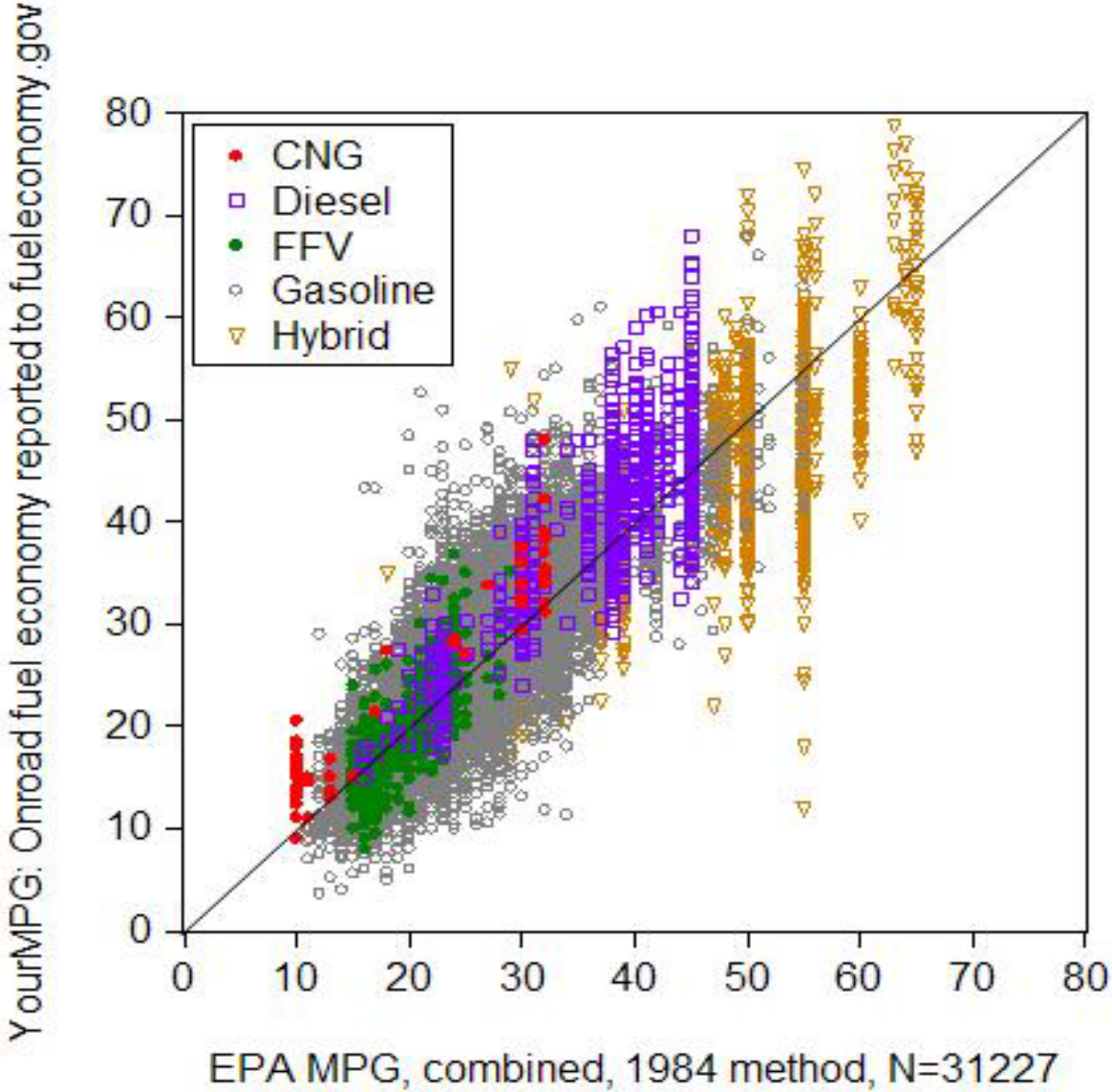
Behavioral economics explains the “energy paradox”: Consumers do not seem to be willing to pay for cost-effective energy efficiency improvements.

If there is no uncertainty, the net value of higher fuel economy is the **difference** between the present value of future fuel savings and the price increase. (NRC, 2002)

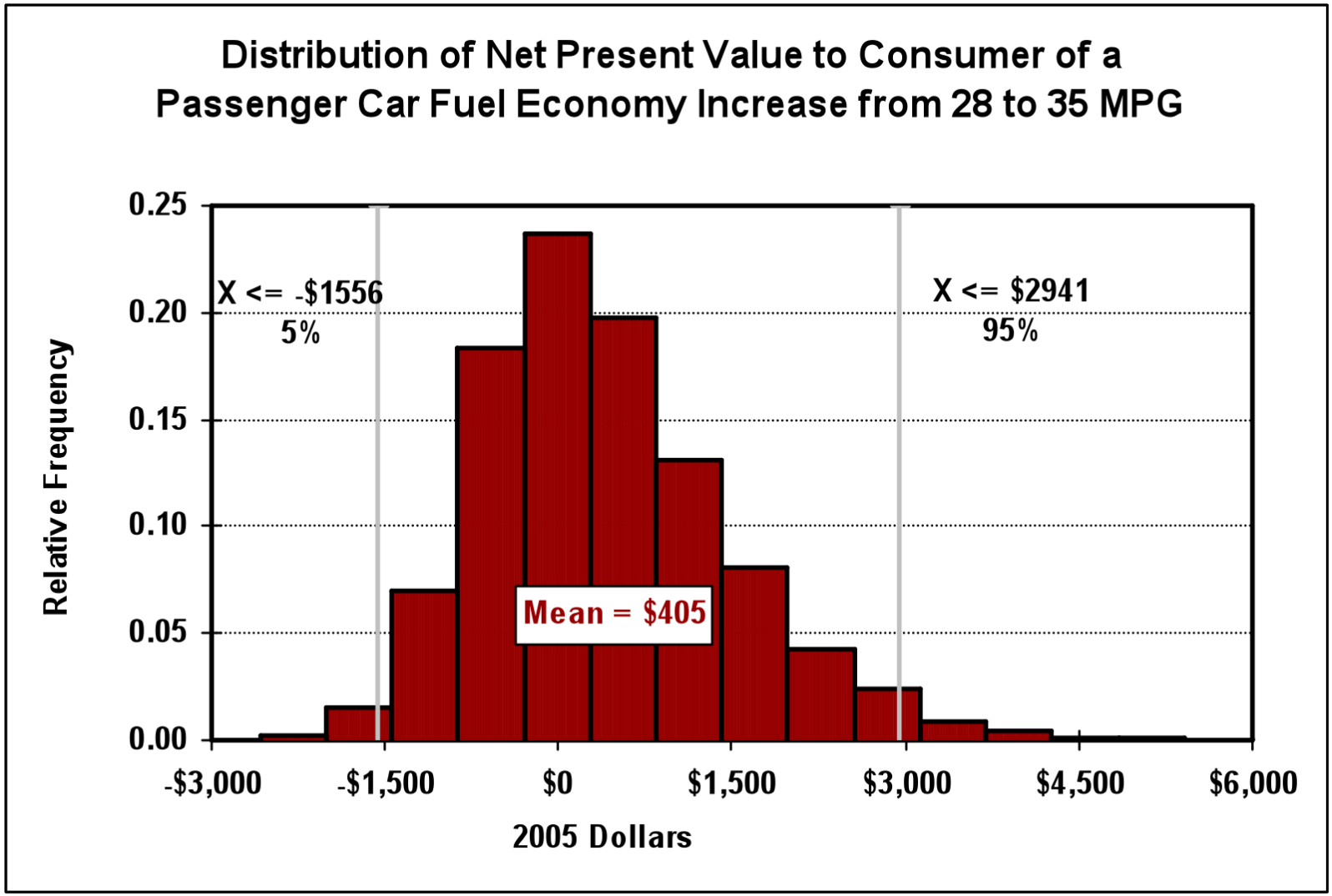


$$PV = \int_{t=0}^{L} P_t M_o e^{-\delta t} \left(\frac{1}{E_o} - \frac{1}{E_1} \right) e^{-rt} dt$$

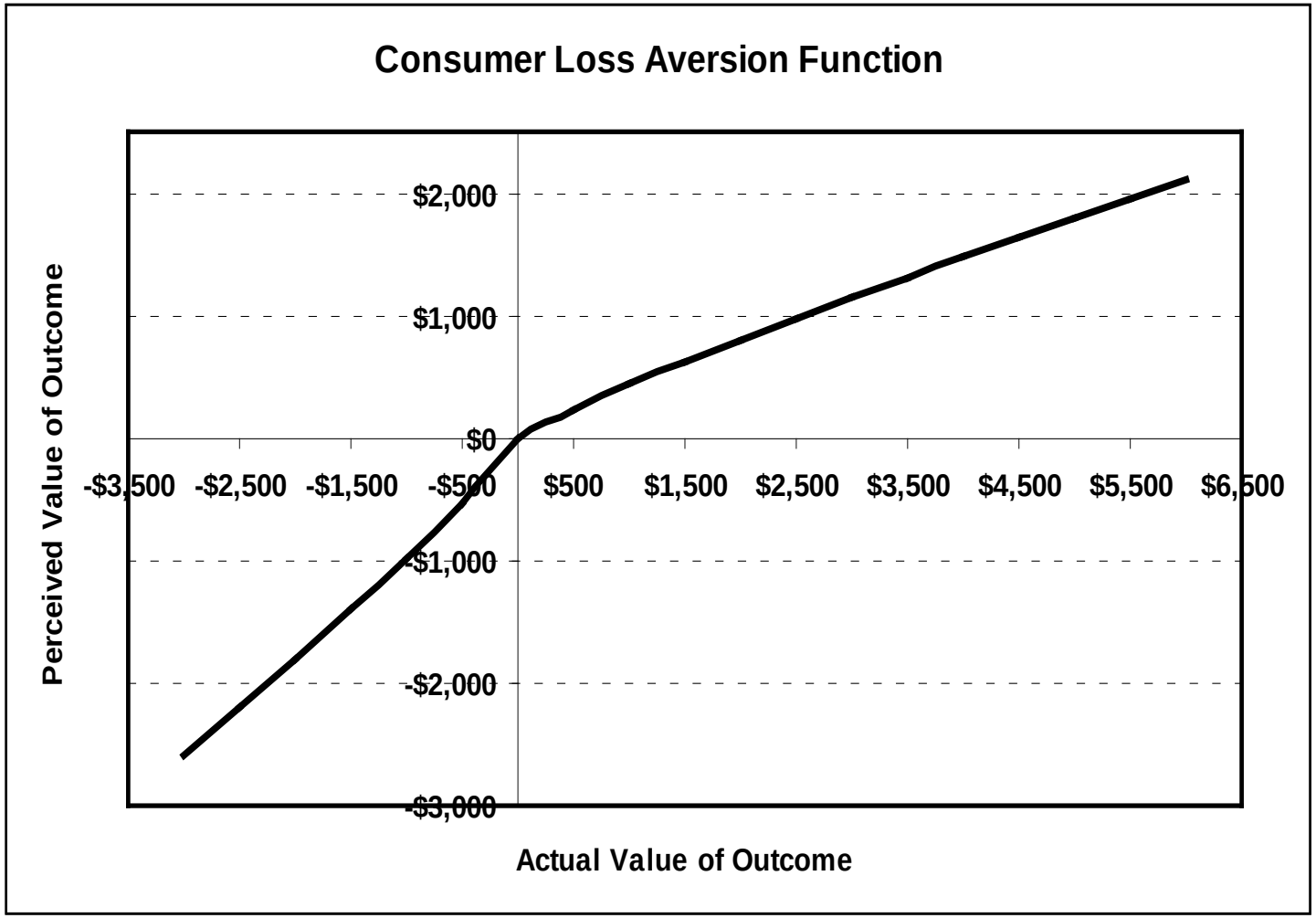
www.fueleconomy.gov 's voluntarily posted "Your MPG" data illustrate the degree to which "your mileage may vary". There's a label but actual fuel economy is far from certain.



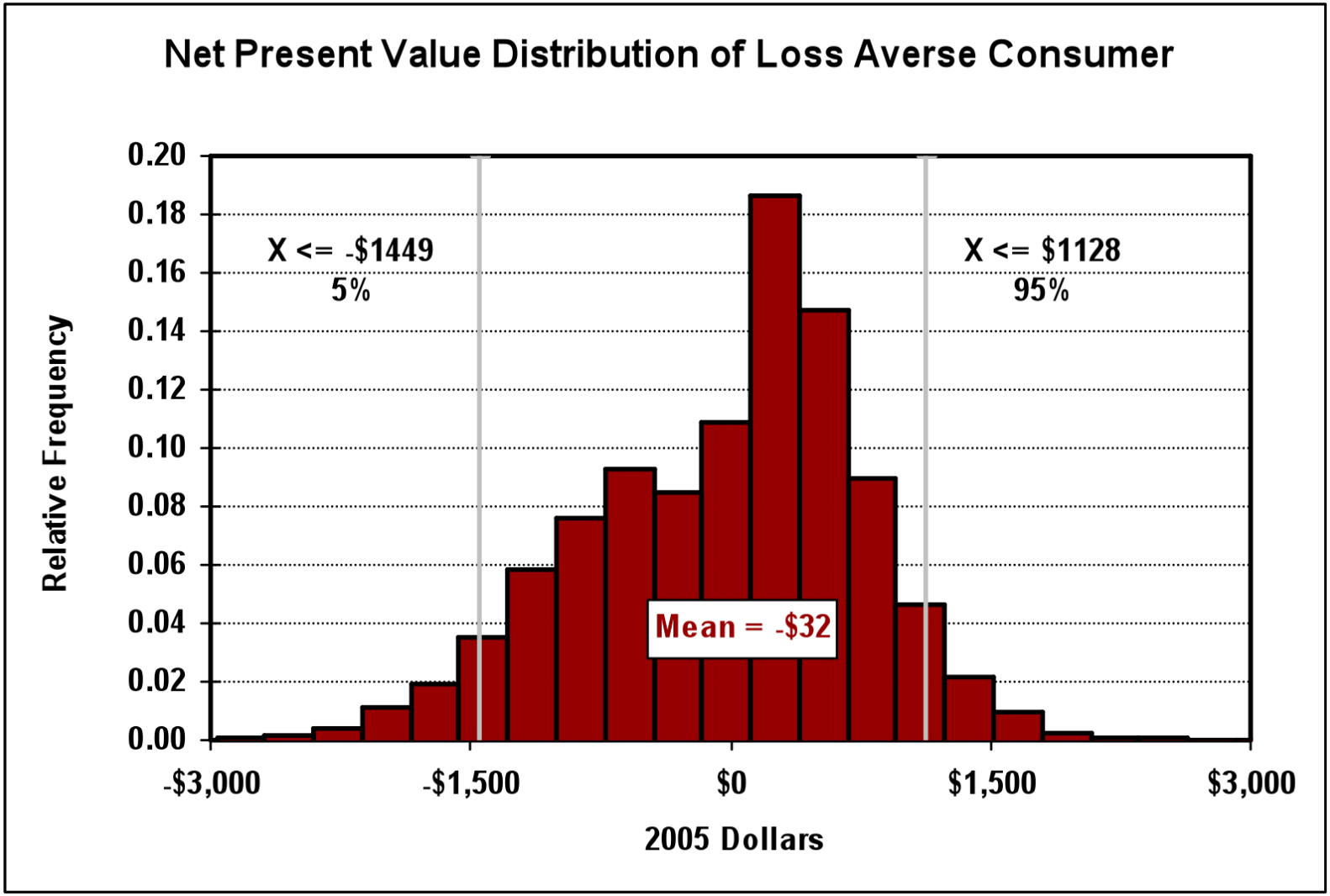
Including uncertainty, 25% increase in new car fuel economy gives greatest value with a net present *expected* value of $405.



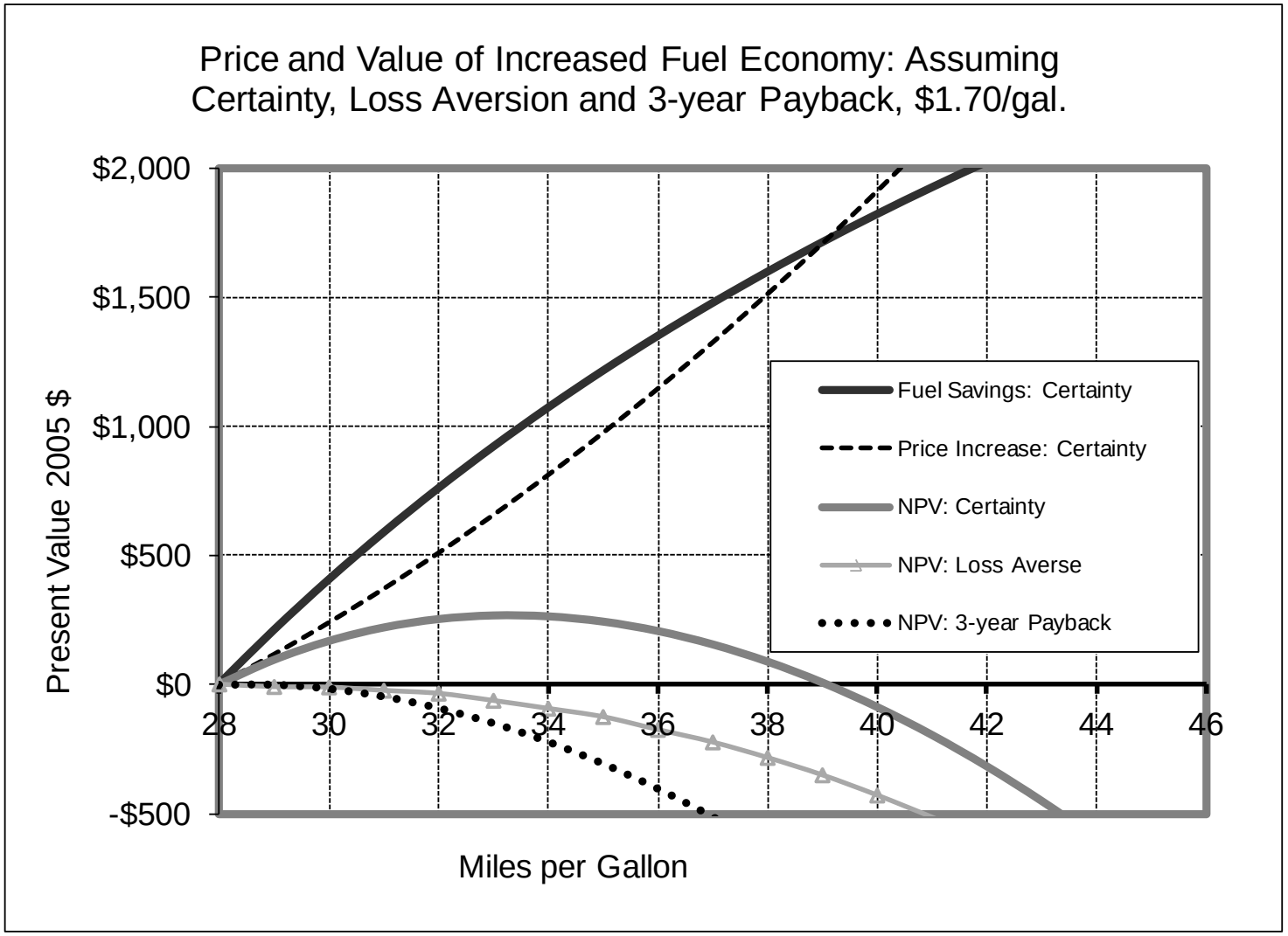
According to prospect theory (2002 Nobel Prize in Economics), typical consumers magnify potential losses relative to gains and exaggerate the probability of loss. "A bird in the hand is worth two in the bush."



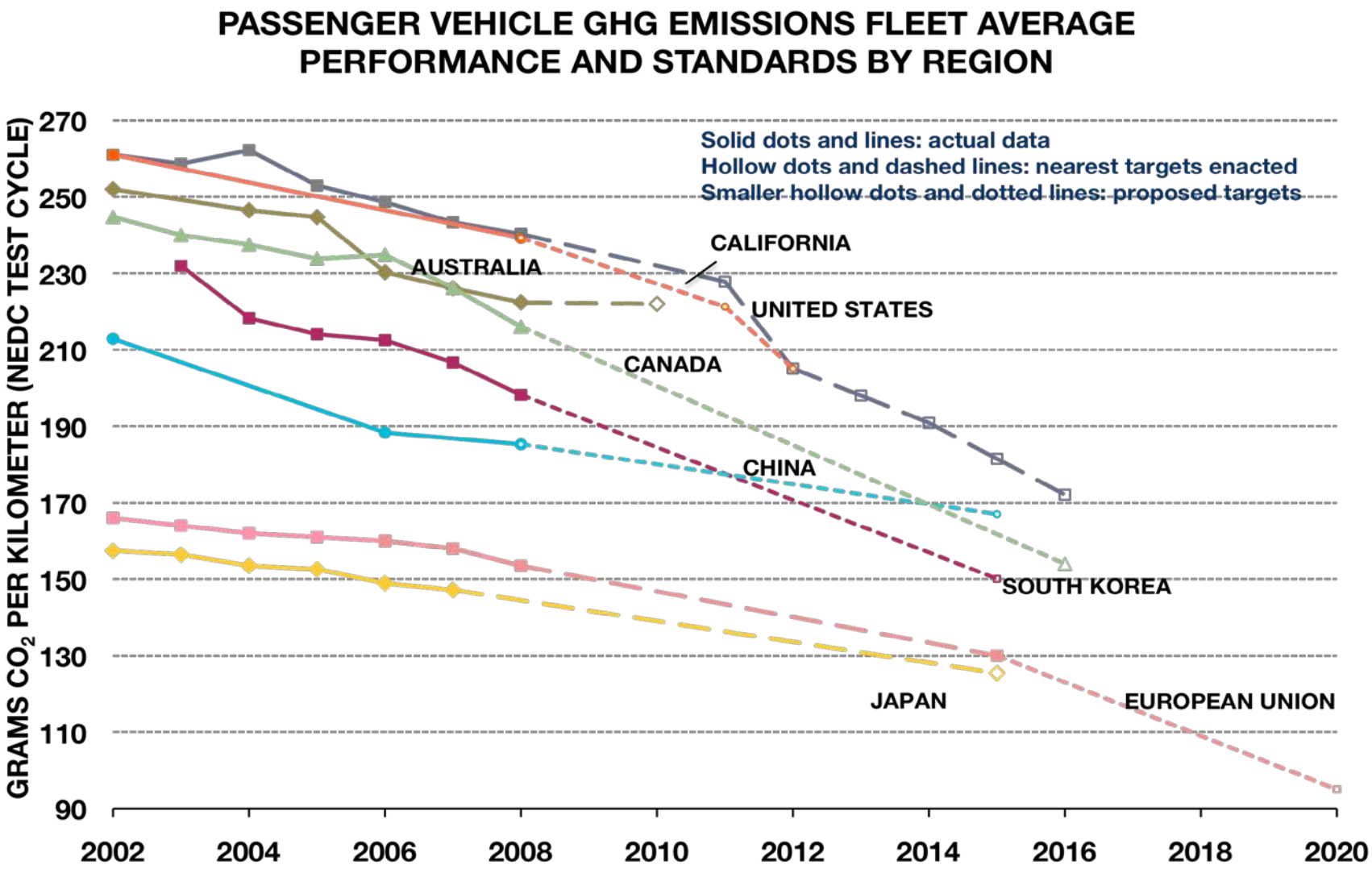
Loss-averse markets would decline the increase in MPG, as would a consumer requiring a three-year payback.



The undervaluing of energy efficiency implies under-utilization of cost-effective technologies and under-investment in energy efficiency R&D.



Every major automobile manufacturing nation has fuel economy or CO_2 emissions standards.



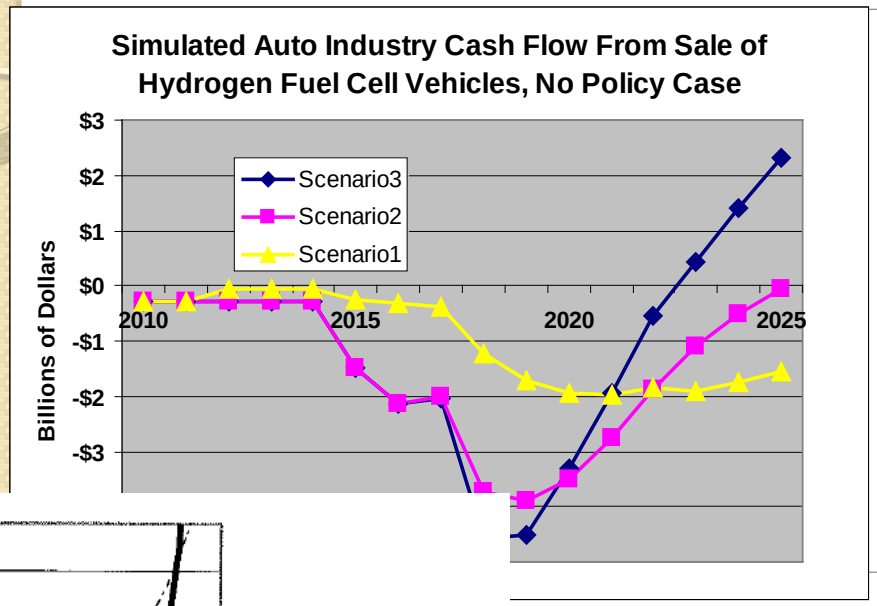
These "imperfections" in real-world energy markets have important implications for policies.

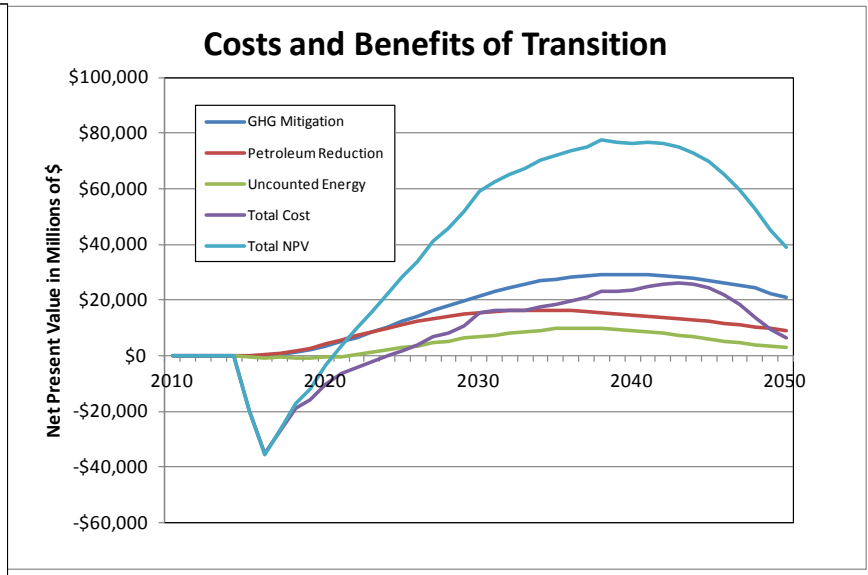
- Pricing externalities alone is not sufficient.
- Fuel economy/emissions standards circumvent the problem of undervaluing future fuel savings.
- The same applies to feebates which can translate expected future costs to a certain present cost.
- Low carbon fuel standards are a fuel neutral policy whose effectiveness remains to be seen.
- BUT ENERGY TRANSITIONS (requiring new vehicle technology and a new fuel supply infrastructure) ARE DIFFERENT.

There are real economic barriers to displacing the incumbent technology.

- Scale economies
- Learning by doing
- Lack of choice diversity
- Risk aversion
- Fuel availability
- Uncertainty of technological change
- + market imperfections

Transition costs for alternative fuels can prevent or significantly delay a transition, yet they do not appear to be large relative to total potential social benefits.





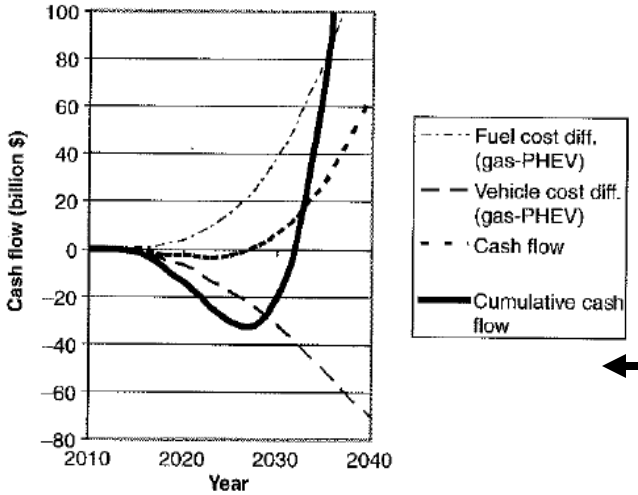


FIGURE 4.10 Cash flow analysis for PHEV-10, Maximum Practical Case, Optimistic technical assumptions. The break-even year is 2028, and the buydown cost is $33 billion.

NRC 2008 →

← NRC 2010

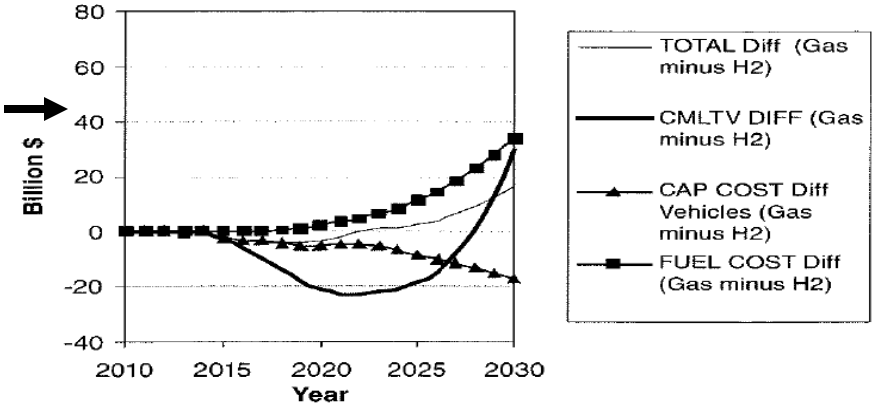
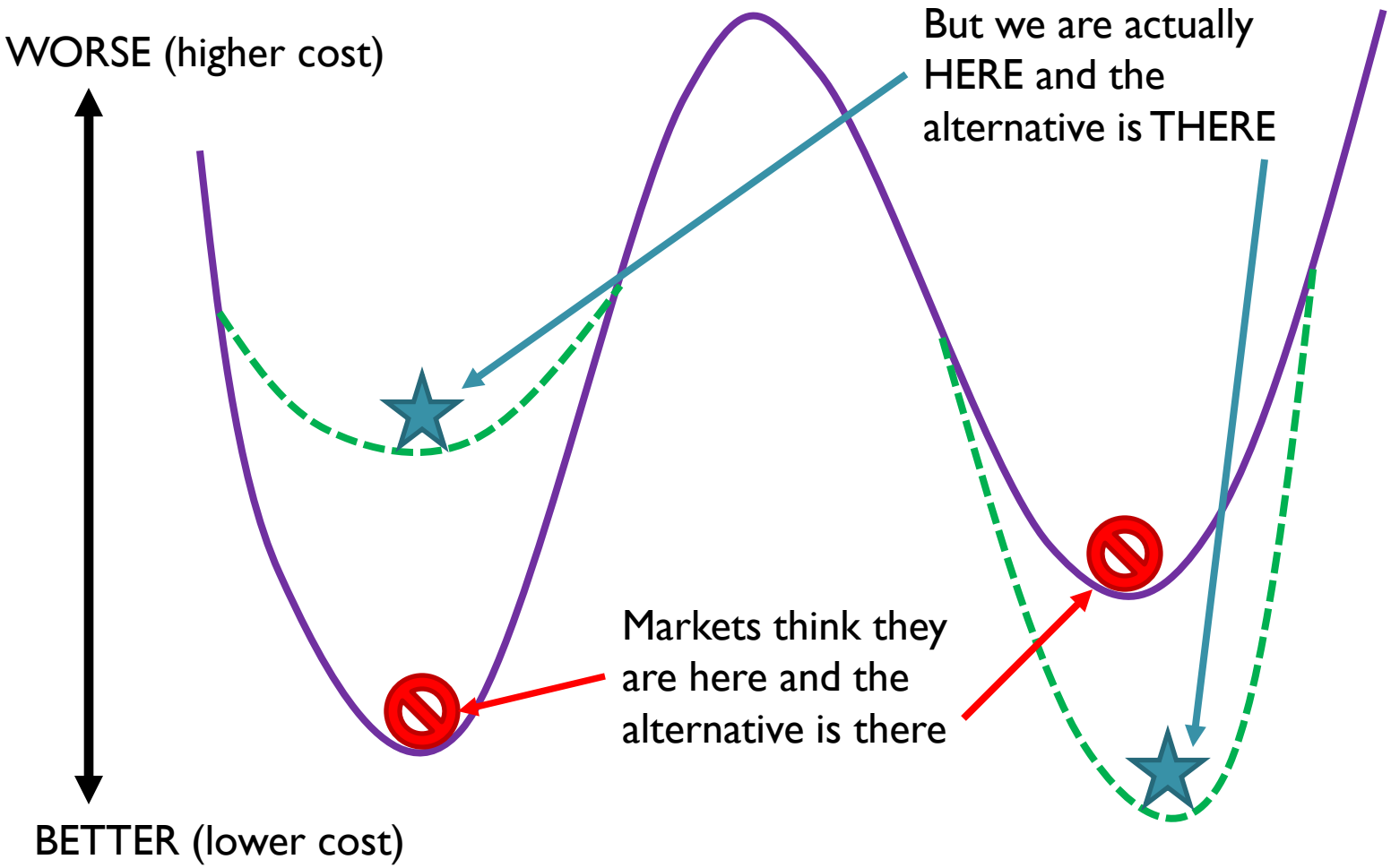


FIGURE 6.13 Cash flows for Case 1.

Can this problem be solved fuel neutrally? Maybe, but probably not.



Is fuel neutrality an illusion?

- No, it's still the right goal, it's just not as simple as it should be.
- MSC = MSB and MSC_i = MSC for all i, are still the rules for efficiency.
- For "drop-in" fuels market signals or performance standards should work well.
- The larger the transition barriers and especially to solve the chicken or egg problem, the more likely it is that fuel neutral policies alone will not get the job done.

THANK YOU.