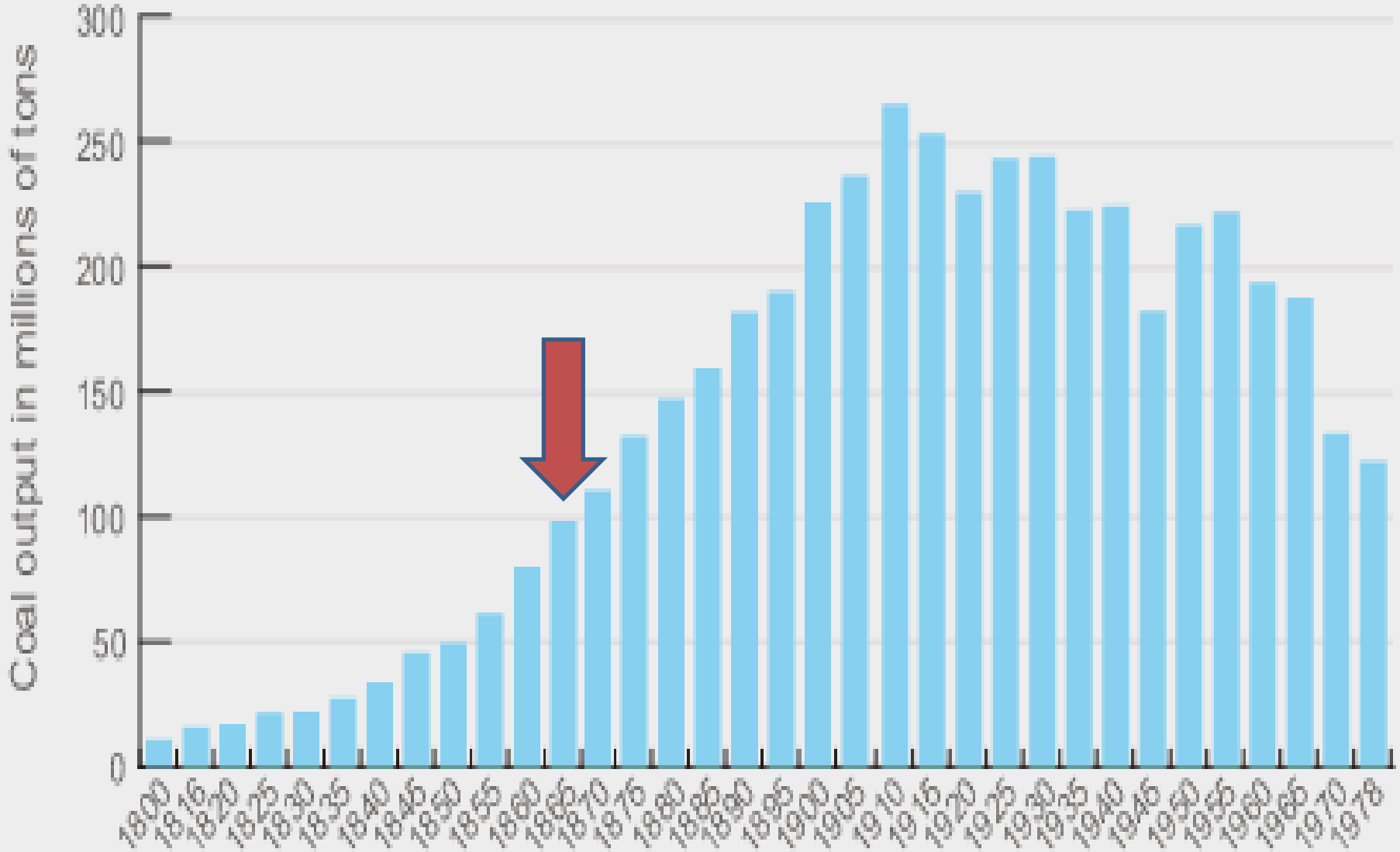
The Challenge of Conservation

Jevons Paradox,
The Samaritan Problem,
& Utility Economics

Jevons' Paradox

- In 1865 Stanley Jevons warned the British government that increases in the efficient mining and use of coal (steam engines) would lead to NOT less coal use – but rather to MORE coal use.

UK coal production, 1800-1978



Source: Stevenson & Cook, *The Longman Handbook of Modern British History*, 1714-1980

Jevons' Paradox

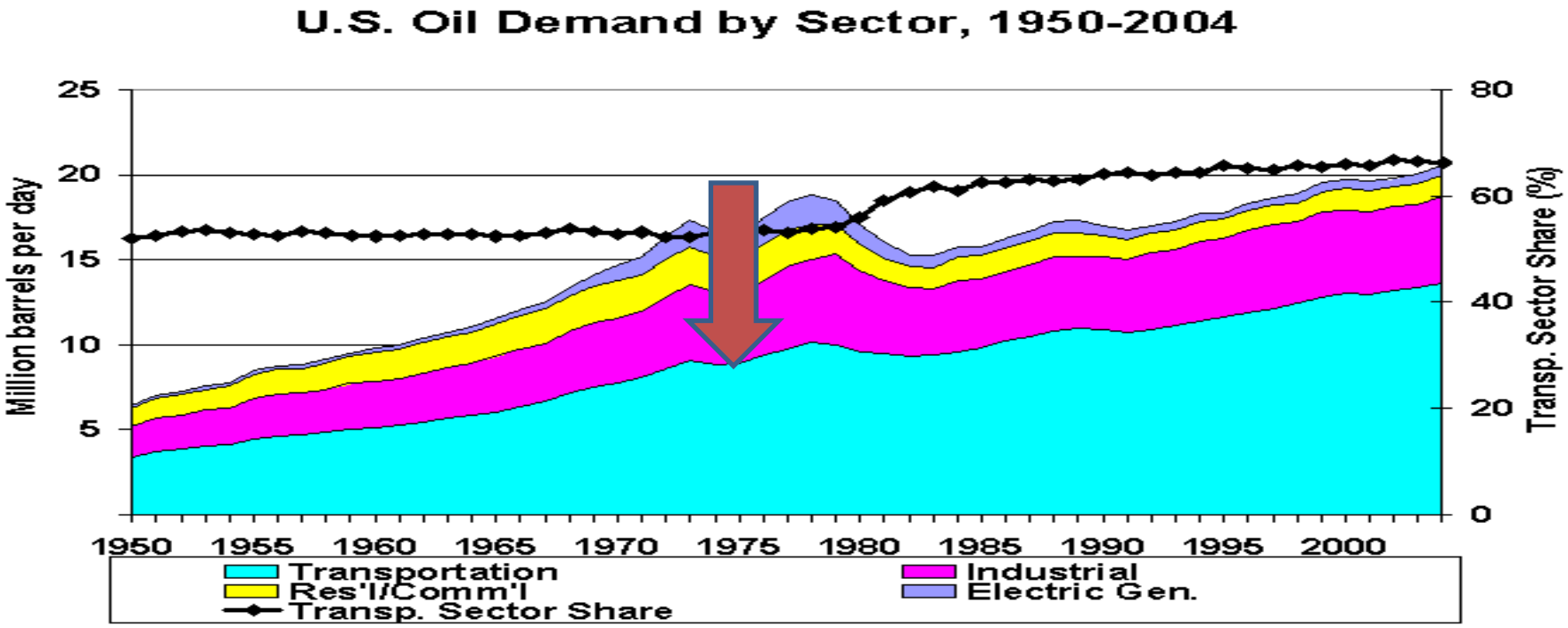
- As a result of Stanley Jevons' brilliant insight, nothing changed.
- Until The Great Smog, Dec. 5-9 1952
  - > 4,000 dead
- Estimates of 10,000+ premature deaths annually for over 100 years in UK

Jevons' Paradox

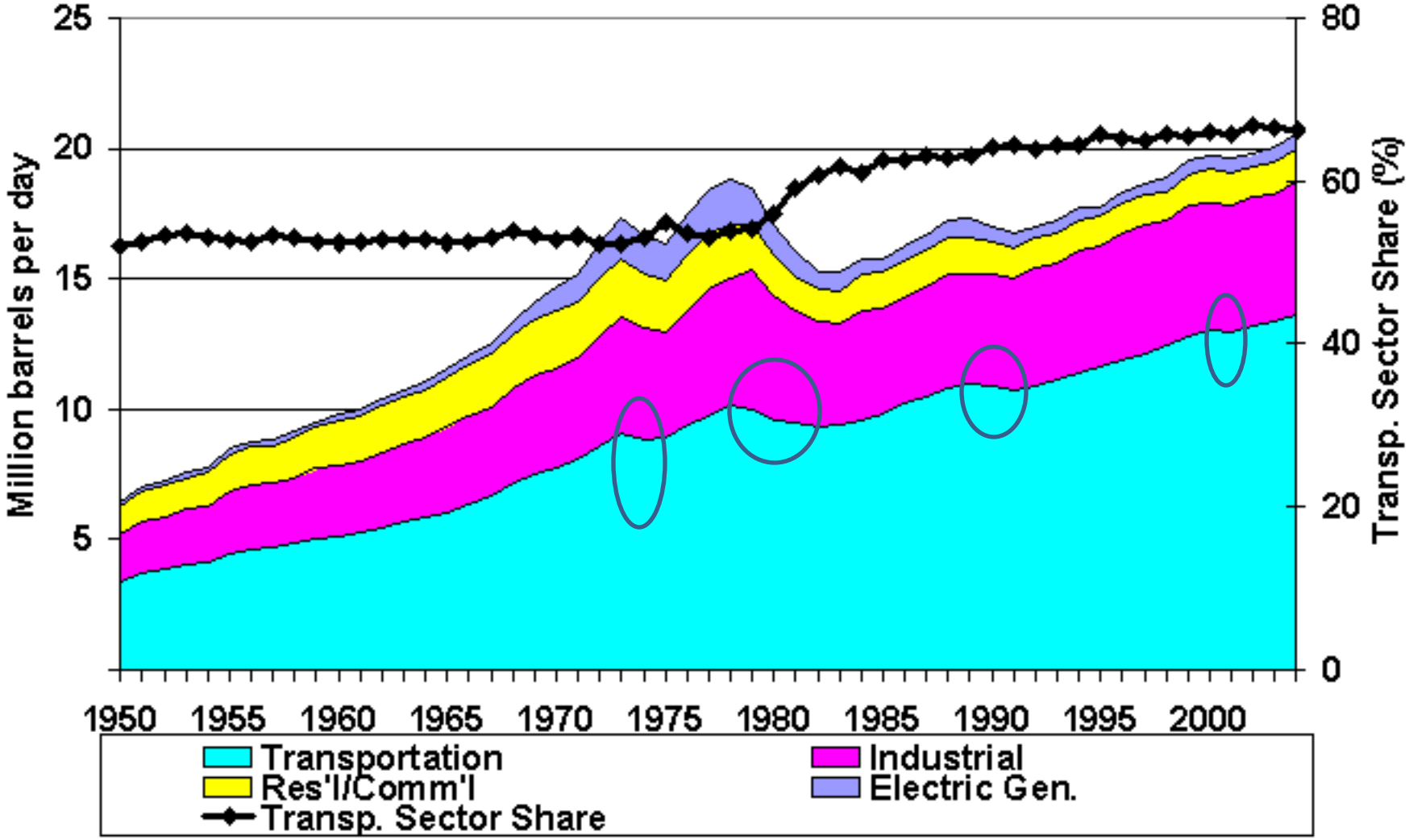
- Increases in efficiency do not lead to reductions in usage of a resource – increases in efficiency lead to more usage.

Jevons' Paradox & Gasoline

- Oil Shocks of 1973-4 led to 1975's Corporate Average Fuel Economy (CAFE) standards.



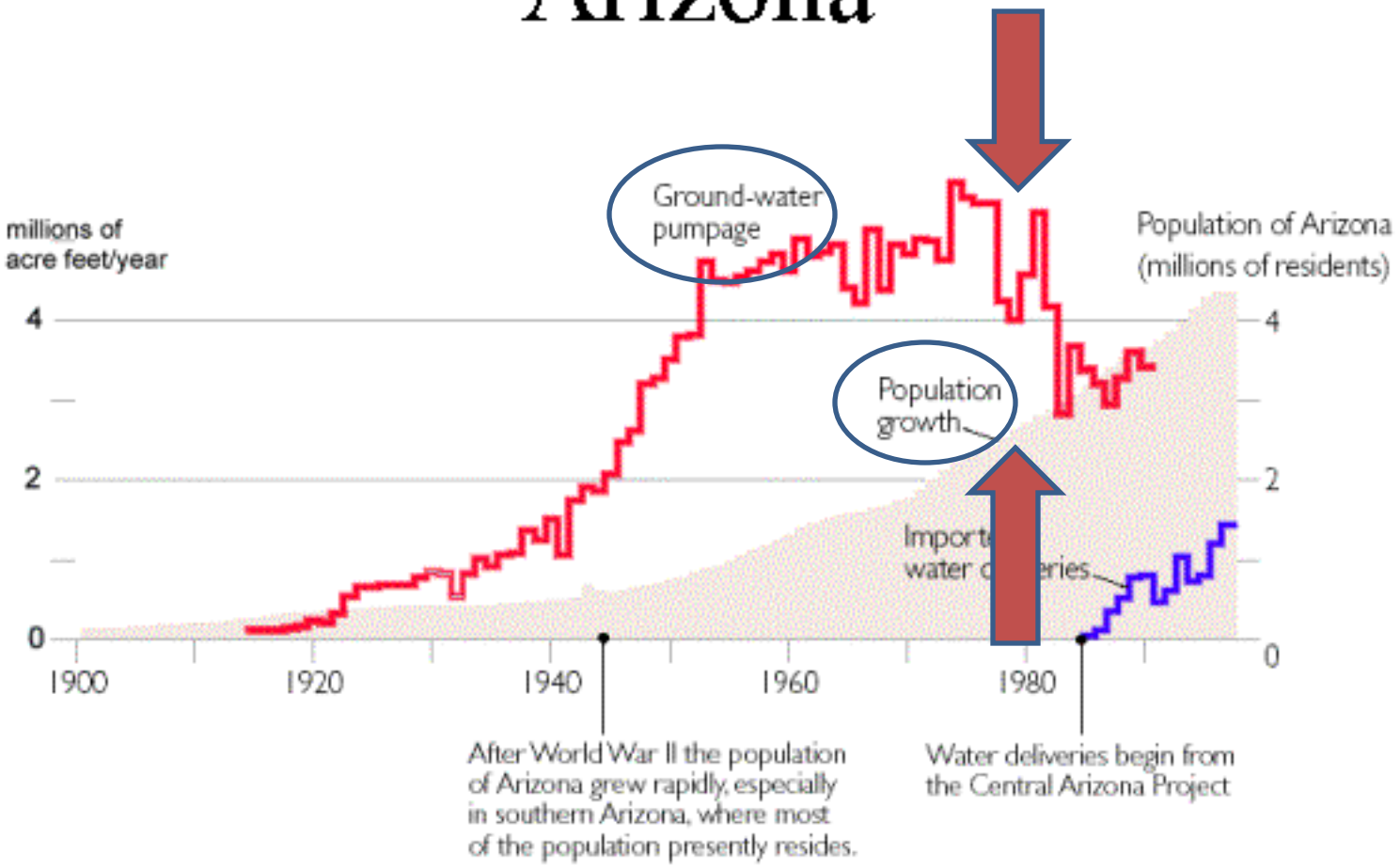
U.S. Oil Demand by Sector, 1950-2004



Jevons' Paradox & Water

- Arizona, 1980, Groundwater Management Act recognized that aquifers were being overdrawn in five areas
  - Creation of "Active Management Areas"
  - Led to created of Groundwater Replenishment Districts, and
  - Assured Water Supply (Certificates & Designations)

Population and water use in Arizona



USGS circ. 1182

Rational Self Interest

- Let people retain the economic benefits of conserving resources, and individuals will choose to do so. Or not…

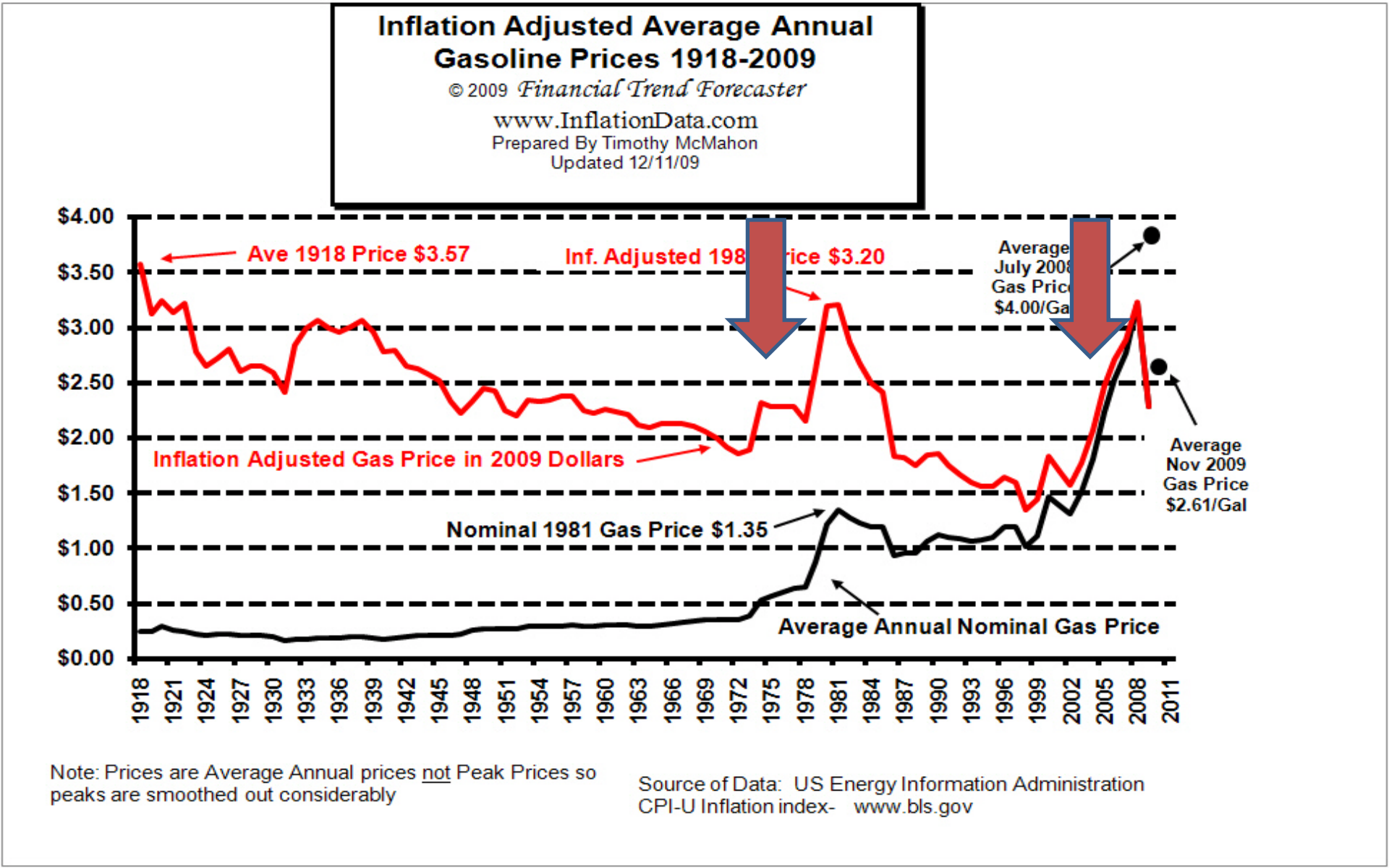
Rational Self Interest, CAFE Standards, and Vehicle Purchases

- 1976 Top selling vehicle in U.S.
  - 17.8 mpg average (Motor Trend)

- 2006 Top selling vehicle in U.S.
  - 14.0 mpg average (fueleconomy.gov)

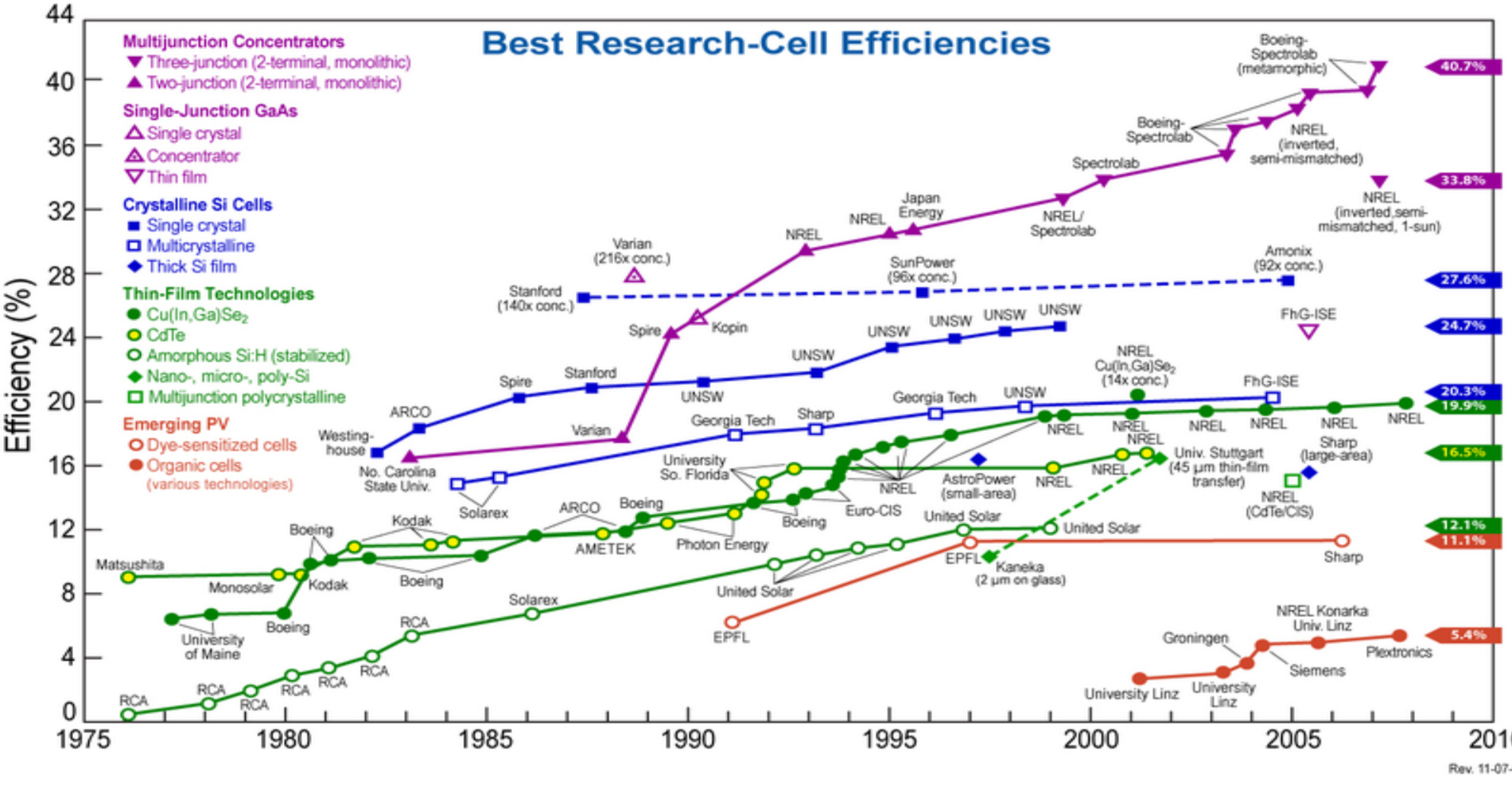
Rational Self Interest?

No, Gas Wasn't Cheaper



Rational Self Interest and Solar PV

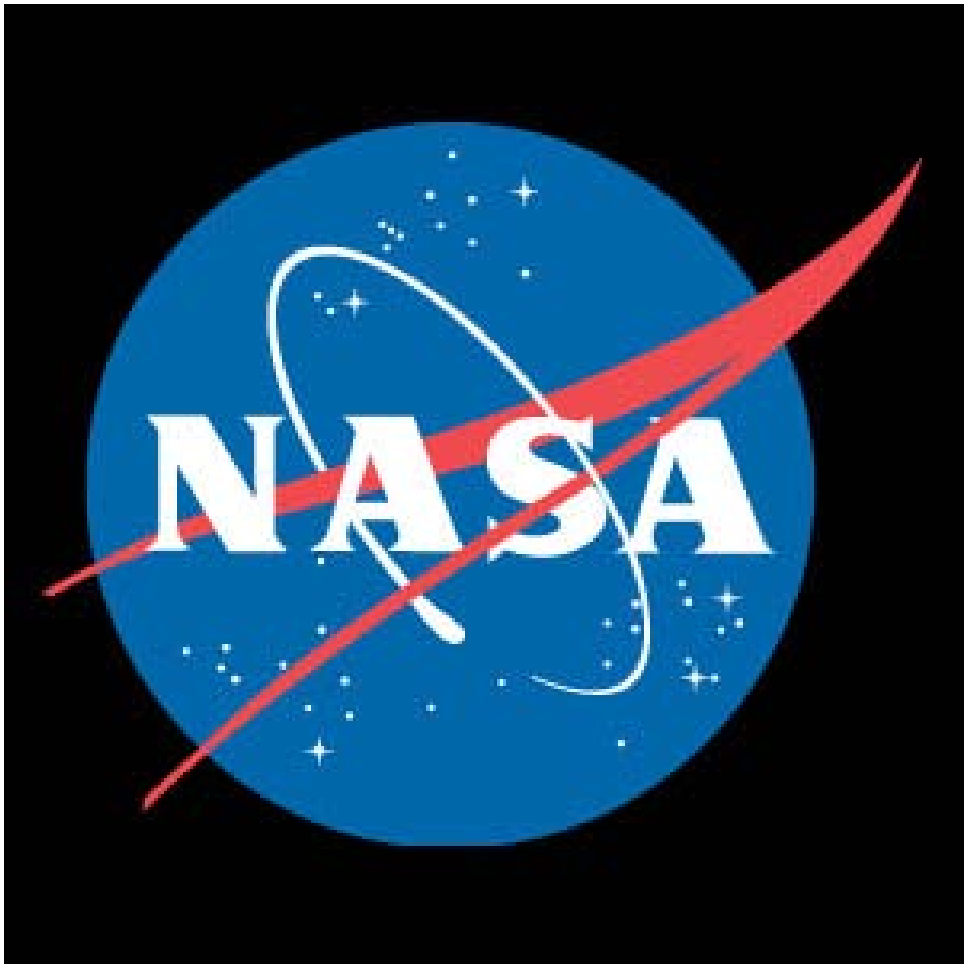
Increasingly efficient for 35 years – yet only recently is installed capacity increasing. Why?



Rational Self Interest & The Samaritan Problem

E.g., what people report they give to charity, and what charities receive.

- 2009, National Taxpayer Advocate report to Congress:
  - $17 billion in **overstated** charitable contributions
- 2009, NASA budget:
  - $17.6 billion



The Samaritan Problem

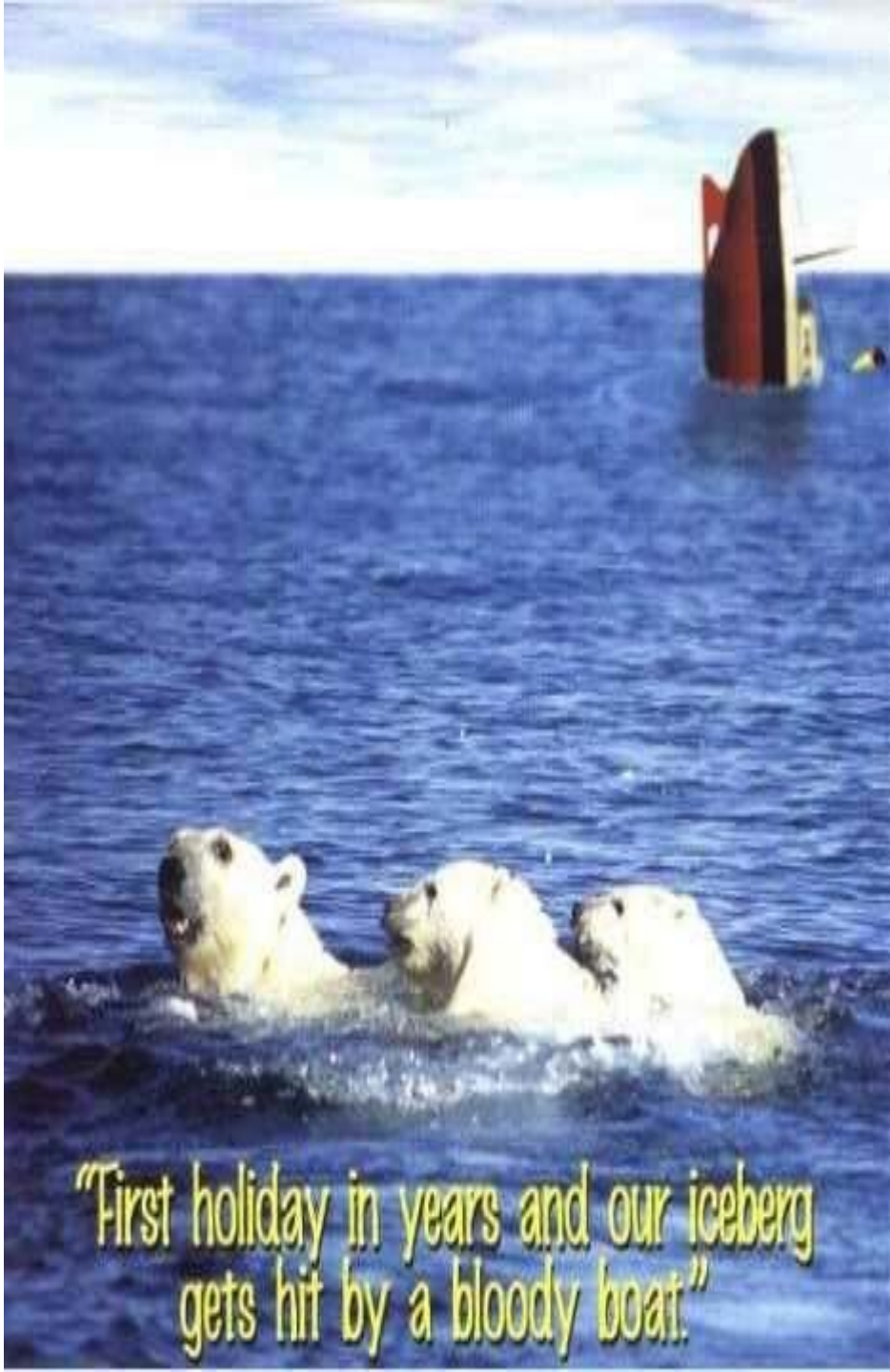
- Water – Use It Wisely
  - 84% aided recall in a 2007 Study by BBC
    - 81% support allowing medical marijuana
      - ABC News/Washington Post, Jan 12-15 2010

Samaritans & Water

- 63% knew it was a water conservation program & they scored higher on questions about water conservation
  - 65% approval rating for President Obama on his inauguration. Rasmussen, 1/21/09
  - 65% think “unanswered questions” surround JFK assassination, ABC News, Nov 16, 2003

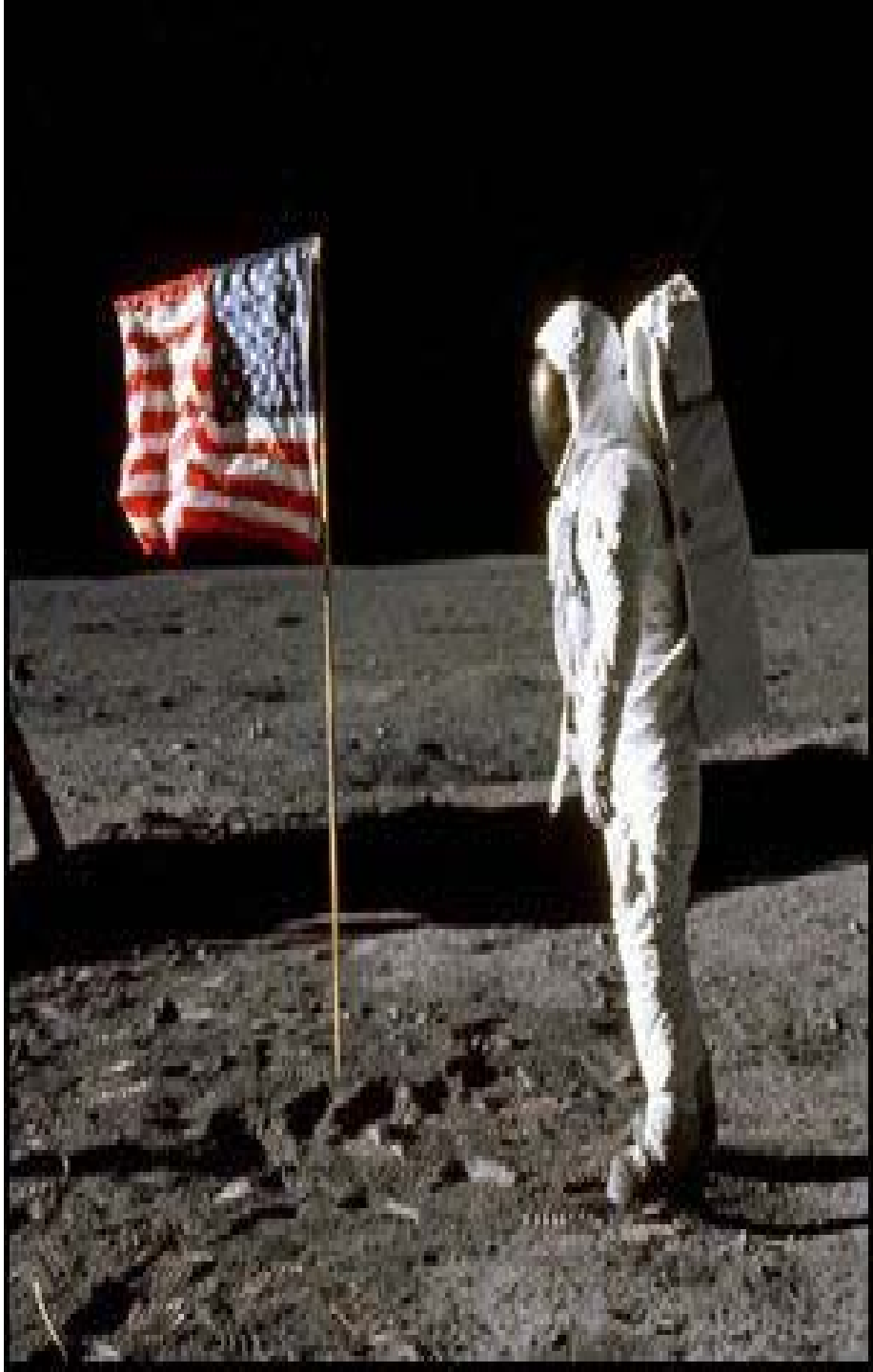
Samaritans & Water

- 44% said they had ‘taken steps’ to change their water use
  - 41% say global warming “not a serious problem”; Rasmussen, Dec 2009



Samaritans & Water

- 91% of those said they had decreased their usage as a result
  - 94% believe that men landed on the moon, Gallup Poll, 1999



Jevons' and Samaritan Paradoxes & Water

- To measure Water – Use It Wisely's impact
  - Full regression analysis on the 1,400 households in the survey
  - Quantified the actual water usage rates between "aware/unaware", "knowledgeable/not informed", and "acted to conserve/haven't acted" consumers
  - The results?

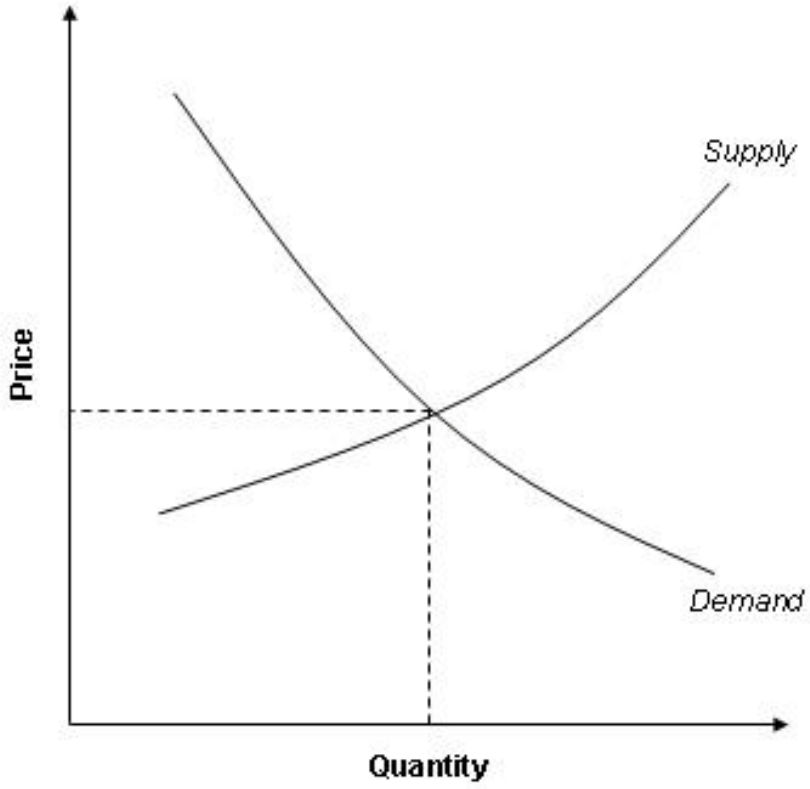
- “did not produce any substantial or statistically significant differences.”
- “Indistinguishable” differences between aware and unaware households; and between active and not-active conservation households.

Jevons & Samaritan Paradoxes solved by Utility Economics

- Utility Economics
  - Cost Sharing
  - Responsibility Assigned to One Entity
  - Economic Incentives to Responsible Entity
    - Utility earn returns, or faces consequences
    - Ratepayers receive reliable and adequate service

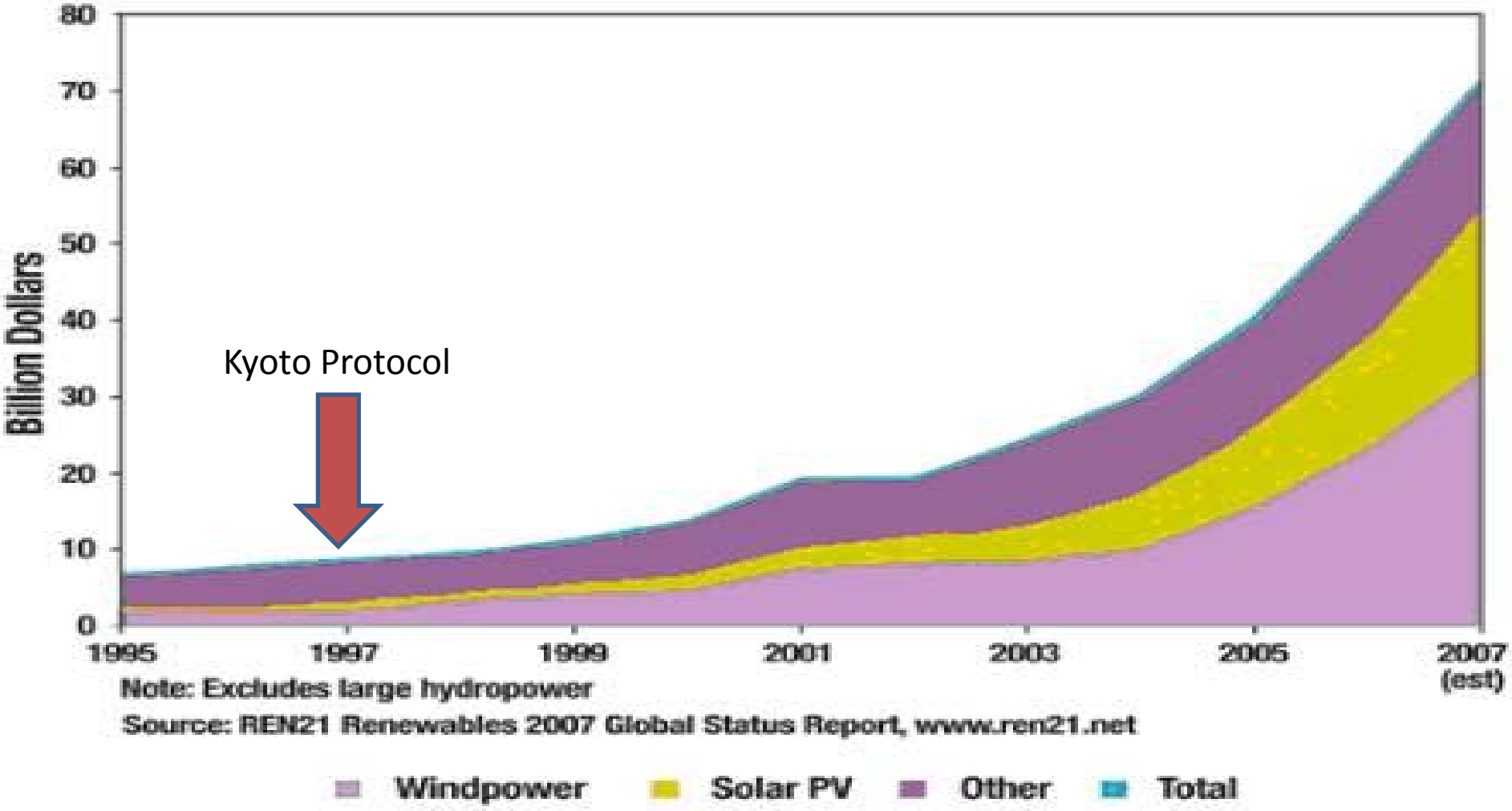
Economics Conserve Resources

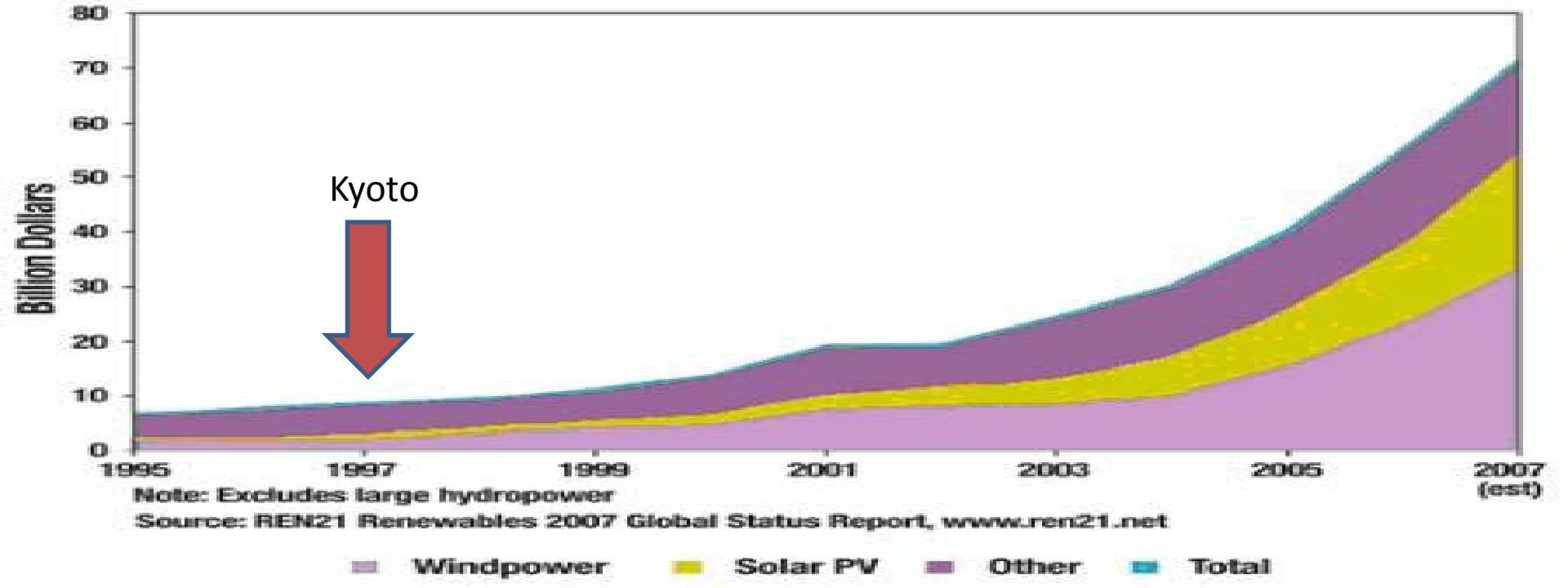
By creating economic incentives for rational utilization, we assure more rational usage.

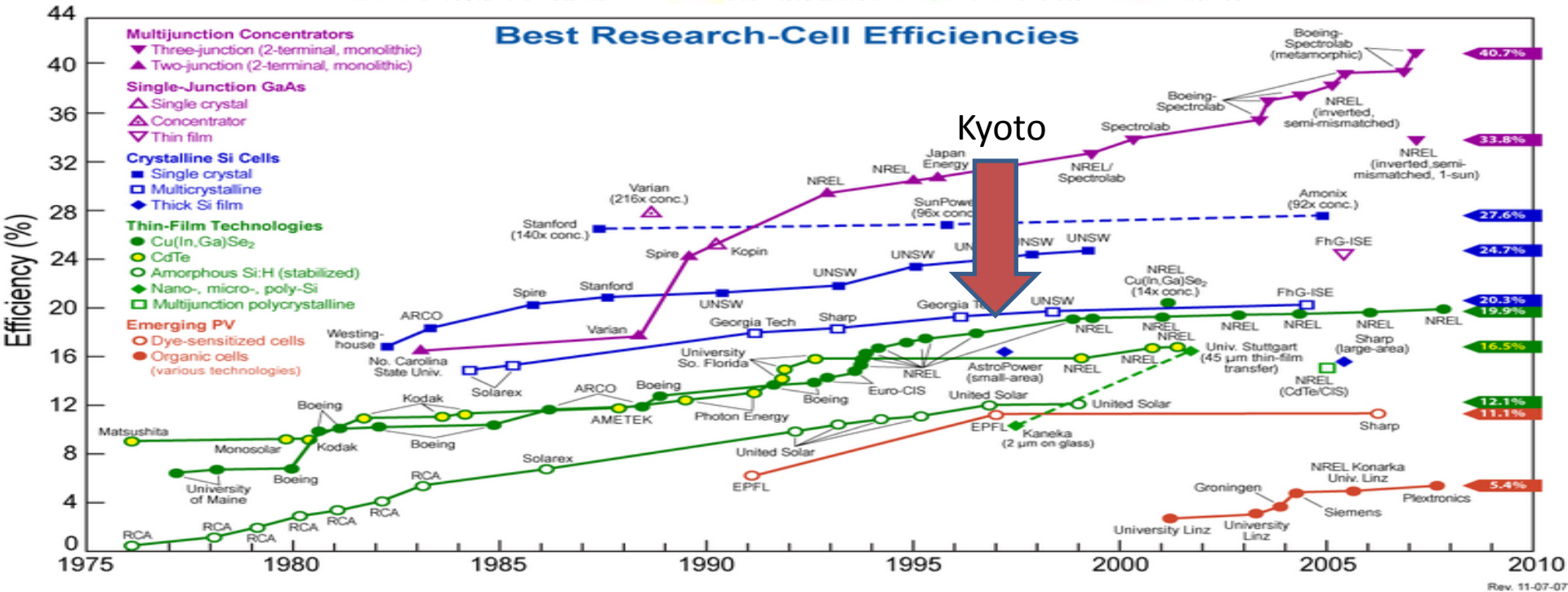


Utility Economics

Utility-scale economic incentives based on utility responsibility and incentives.




Billion Dollars
Kyoto
1995
1997
1999
2001
2003
2005
2007 (est)
Note: Excludes large hydropower
Source: REN21 Renewables 2007 Global Status Report, www.ren21.net
Windpower
Solar PV
Other
Total


Best Research-Cell Efficiencies
Efficiency (%)
Kyoto
Multijunction Concentrators
Three-junction (2-terminal, monolithic)
Two-junction (2-terminal, monolithic)
Single-Junction GaAs
Single crystal
Concentrator
Thin film
Crystalline Si Cells
Single crystal
Multicrystalline
Thick Si film
Thin-Film Technologies
Cu(In,Ga)Se2
CdTe
Amorphous Si:H (stabilized)
Nano-, micro-, poly-Si
Multijunction polycrystalline
Emerging PV
Dye-sensitized cells
Organic cells
(various technologies)
1975
1980
1985
1990
1995
2000
2005
2010
40.7%
33.8%
27.6%
24.7%
20.3%
19.9%
16.5%
12.1%
11.1%
5.4%
Rev. 11-07-07

Utilities & Large Energy Providers "entered the renewable game"

- Post-Kyoto, countries required utilities and energy providers to increase their use of renewable energy, that's why it is booming
- Water has not been affected… enter Global Water Resources.