



FROM SFC TO FUTUREGEN: Technology Lessons Learned, Learnable, Or Ignored?

Resources for the Future

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FROM *ENERGY: THE NEXT TWENTY YEARS*

Government is thus presented with a delicate problem. There are good reasons for spending public funds on energy RDD&D But there are also good reasons to conclude that government is unlikely to improve on private decision making in the selection of what energy RDD&D to do. How then to spend public funds responsibly if the public (represented by the government) is not well equipped to decide what to do or how to do it?



Starts and Stops in Energy Technology Policy

COAL UTILIZATION

- Synthetic Fuels Corporation (1979-1985)
- Clean Coal Technology Program (1987)
- Clean Coal Power Initiative (2001)
- Future Gen (2003)

NUCLEAR TECHNOLOGY

- Clinch River Breeder Reactor (1970-1983)
- Advanced Liquid Metal Reactor Program (1989-1994)
- Global Nuclear Energy partnership (2006-2008)

BIOFUELS

- Alcohol Fuels (Energy Security Act 1980)
- Oxygenated fuels(Clean Air Act Amendments 1990)
- Biofuels (EPAct 2005; EISA 2007)

VEHICLE TECHNOLOGY

- Virtually pollution-free car (Nixon 1970)
- Reinventing the Car (Carter 1977-1980)
- Partnership for a New Generation of Vehicles (Clinton 1993-2000)
- FreedomCar (Bush 2003)



DOE'S TRACK RECORD: THE BIG SUCCESSES

- Diamond Drill Bits
- Efficient Electronic Ballasts
- Efficient Refrigeration



THE FIRST 25 YEARS: THE TRACK RECORD IN BRIEF

- Spent \$12 billion in energy efficiency and fossil fuel RDD&D
- Produced \$42 billion in realized economic benefit
- Of which
 - .03% produced 75% of benefit
 - Half realized no benefit



TECHNOLOGY SUCCESSES WITH MINIMUM DOE HELP

- Efficient Gas Turbine
- 3-D Seismic Imaging
- Deep Water Drilling
- Improved Reservoir Characterization
- Improved Oil and Gas Drilling
- Oil Refinery Optimization
- Longwall Coal Mining
- Coal Cleaning
- More Efficient Electric Motors
- Higher Mileage Automobiles
- Synthetic Lubricants
- Efficient Gas Furnaces
- Efficient Industrial Processes



TECHNOLOGY SUCCESSES WITH MODERATE DOE HELP

- Coal-bed Methane
- Flue Gas Cleanup
- Atmospheric Fluidized Bed
- Tight Gas Fracturing
- Effective Insulation
- More Efficient Windows
- More Efficient Buildings



THE INNOVATION PROCESS

- IS
 - Incremental
 - Assimilative
 - Cumulative



THE INNOVATION PROCESS

- IS
 - Incremental
 - Assimilative
 - Cumulative
- BUT IS NOT RDD&D



Align Private Incentives with Public Goals

- Best – focus on outcomes
- Less good – focus on means



Fund Mission-motivated Basic Research

- Classic non-appropriability rationale
- Design features crucial
 - Stress high potential, high risk
 - Encourage interdisciplinary participation



Assist specific technologies with care

- Target specific market failures (they do exist— assuming there's a market)
- Limit loss exposure when serving markets that don't yet exist (synfuels and FutureGen)
- Don't pick winners (but picking losers is OK)



Lessons Learned

- Shift gears – innovation is not RDD&D
- Incentives and basic research are the longest policy levers
- Applied research gets too much attention