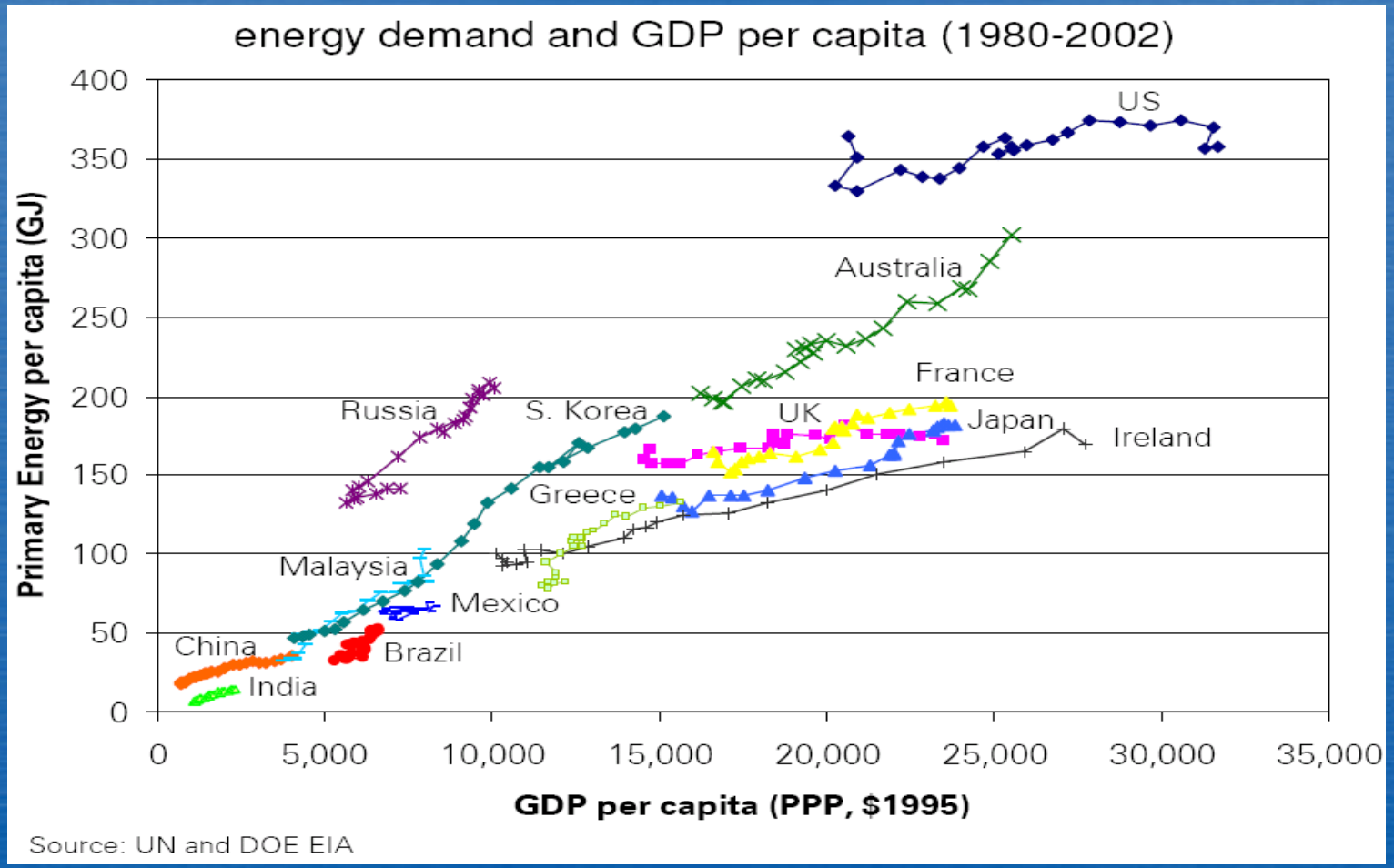
Energy—A (Mostly) National Perspective

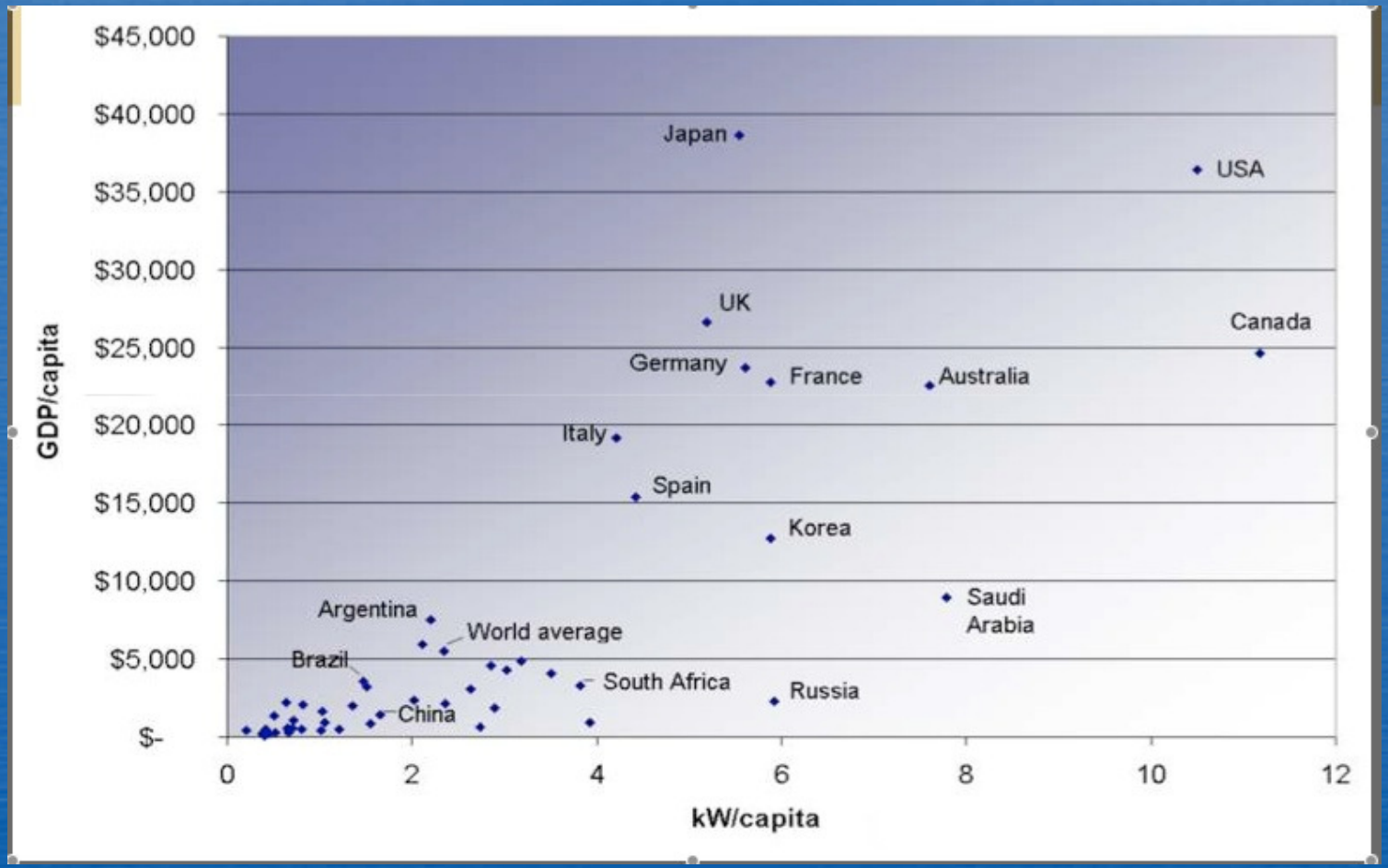
Harold Schobert

Johnstown, PA, November 2008

Energy Consumption Relates to Societal Well-being



GDP Correlates with Energy Use

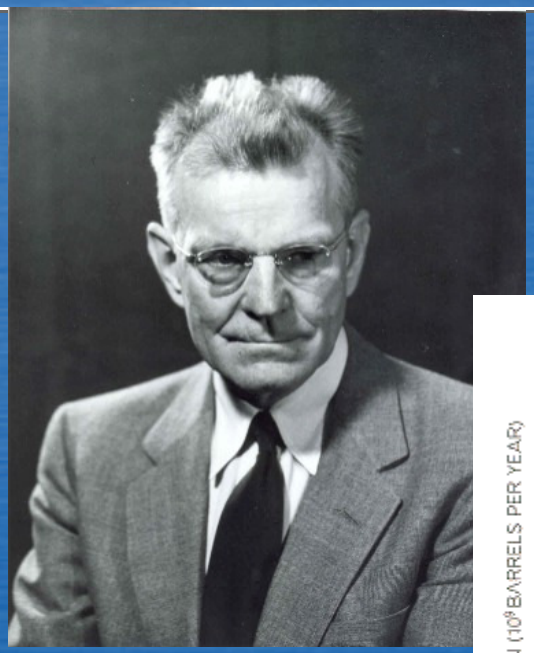


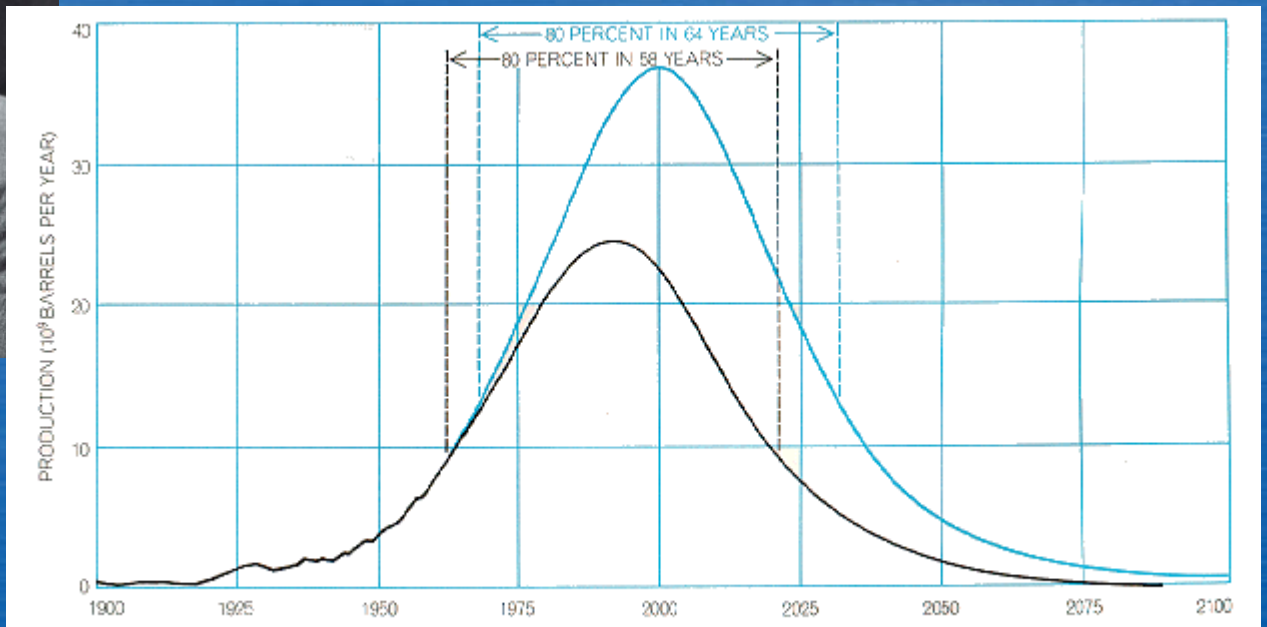
Petroleum:
Are We in an Energy Crisis Now?

- Extensive, potentially explosive, turmoil in many petroleum-producing regions of the world.
- China is now an aggressive and voracious player in world petroleum markets.
- Saudi production is likely “max-ed out.”
- Domestic oil production peaked in 1970.

M. King Hubbert

"Our ignorance is not so vast as our failure to use what we know."





CYCLE OF WORLD OIL PRODUCTION is plotted on the basis of two estimates of the amount of oil that will ultimately be produced. The colored curve reflects Ryman's estimate of $2{,}100 \times 10^9$ barrels and the black curve represents an estimate of $1{,}350 \times 10^9$ barrels.

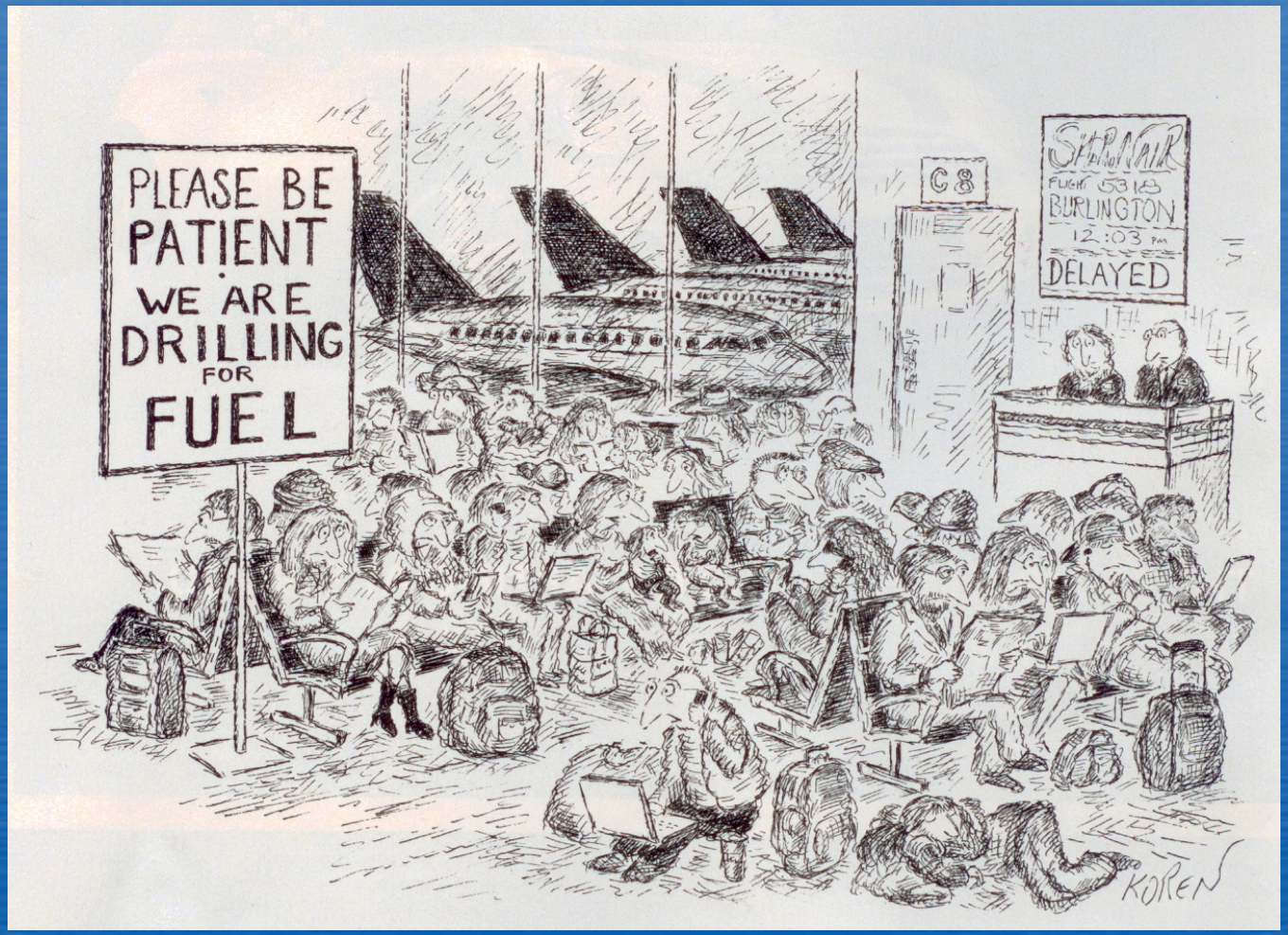
Peak Oil

- Hubbert predicted that domestic oil production would peak in 1969. The peak was actually reached in 1970.
- Predictions now suggest that world-wide peak oil will occur sometime between 2005 and 20??.
- Have we hit peak oil already?

Have we hit the world peak?

- After the CEO of Total (the French oil major) two more CEOs of an oil major came out this Thursday to give stark warnings that mean that **peak oil is happening right now**. In addition, the chief economist of the International Energy Agency (the IEA), one of the main cheerleaders of the "there's more than enough oil" camp until now, is giving an extraordinarily pessimistic interview in the Financial Times, following the recent publication of their latest *World Energy Outlook*.

We can’t drill our way out…

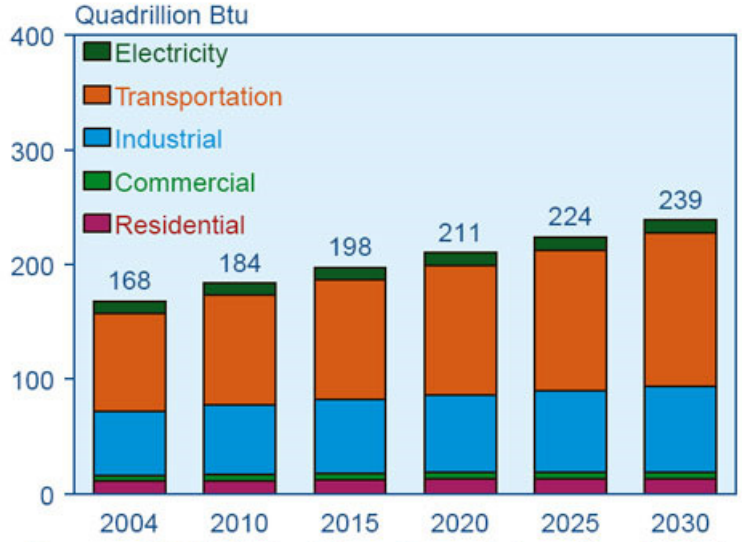


Regardless of When the Peak Hits, Demand is Rising Steadily

- Rapid modernization of China and India directly affects half the world's population.
- The Tata "Nano" will soon go on sale in India and elsewhere at ≈$2,500.

Transportation today depends on liquid fuels

Figure 33. World Liquids Consumption by Sector, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

- EIA predicts that transportation will continue to dominate use of liquid fuels.
- Liquids are likely easier to displace from other energy sectors.

“But man cannot live by trust alone. He has to have oil at reasonable prices as well.”

—*The Times of Zambia*
February 26, 1974

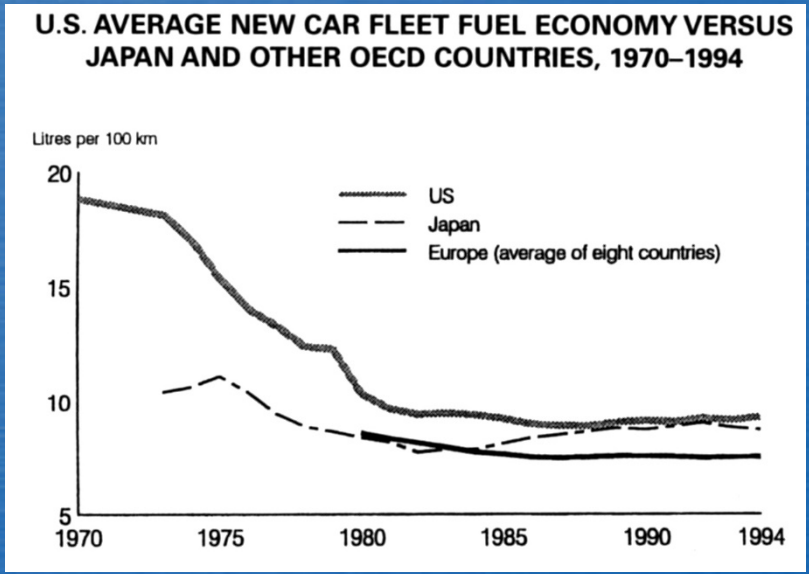
So Now What?

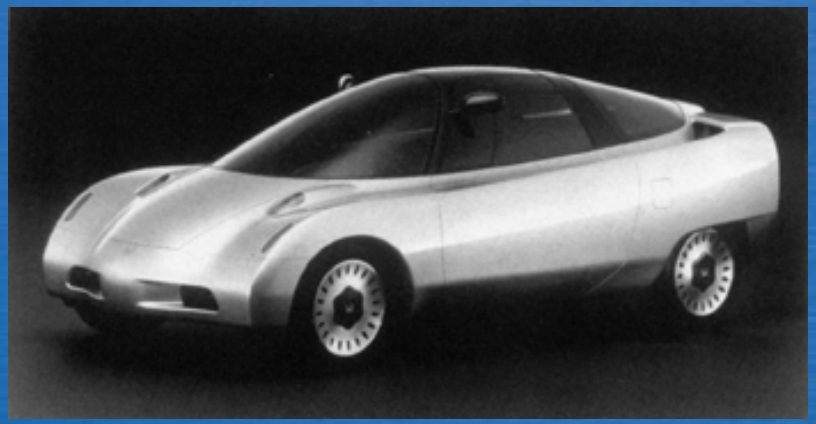
Conservation and efficiency.

The absolutely best source of “new” energy is to do a better job of conserving the energy resources we now have, and to make more efficient use of those resources.

Where Do We Go from Here?

Do a Better Job of Using What We've Got





- Energy conservation is the best source of new energy
- Gasoline-engine vehicles have been designed for 70-105 mpg

What Forms of Energy Are Available?

- Fossil (derives from biomass, which derives from solar)
- Biomass (derives from solar)
- Wind (from differential heating of atmosphere by the sun)
- Hydropower (from the hydrological cycle driven by solar water evaporation)
- ➢ Solar
- ➢ Nuclear

Alternative Fuels for Conventional Engine Technology

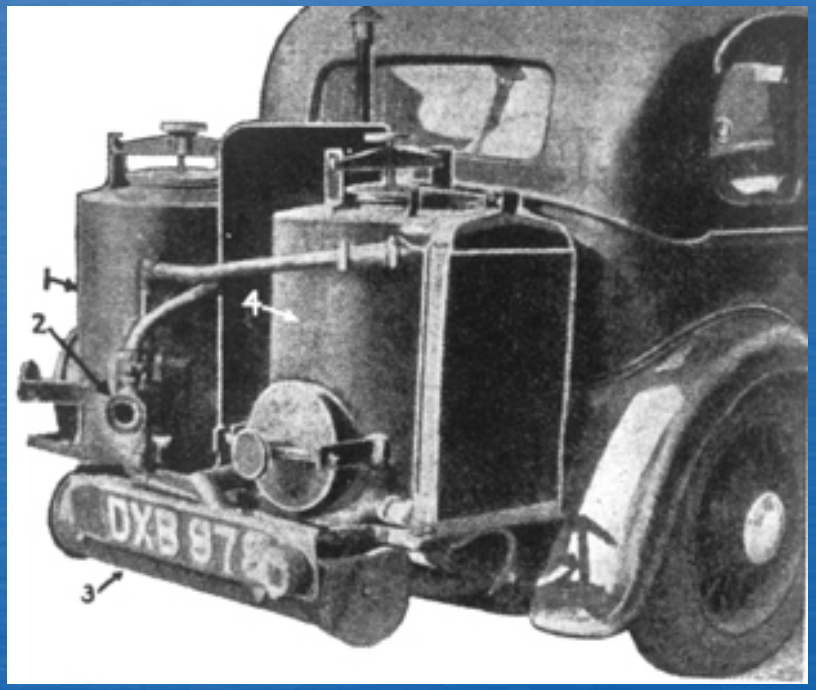
Photograph by Mark Heitz

- Alcohol fuels can be used in spark-ignition engines
- Ethanol is the leading contender – but, should we make it from corn?

Alternative Fuels for Conventional Engine Technology

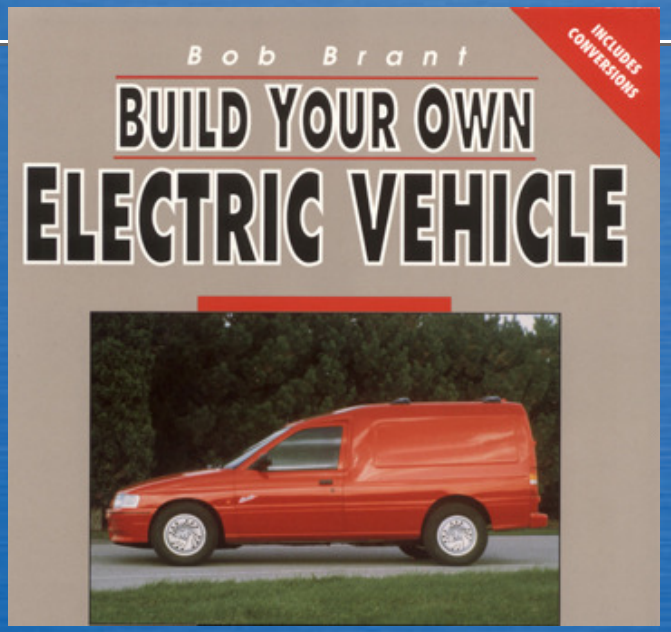
- Plant-derived oils can work well as fuels for diesel engines
- A leading choice is soy oil or “methyl soyate”

Alternative Fuels for Conventional Engine Technology



- Both spark-ignition and diesel engines can be adapted for gaseous fuels
- The current favorite is compressed natural gas

Changing the Technology: Electric Vehicles

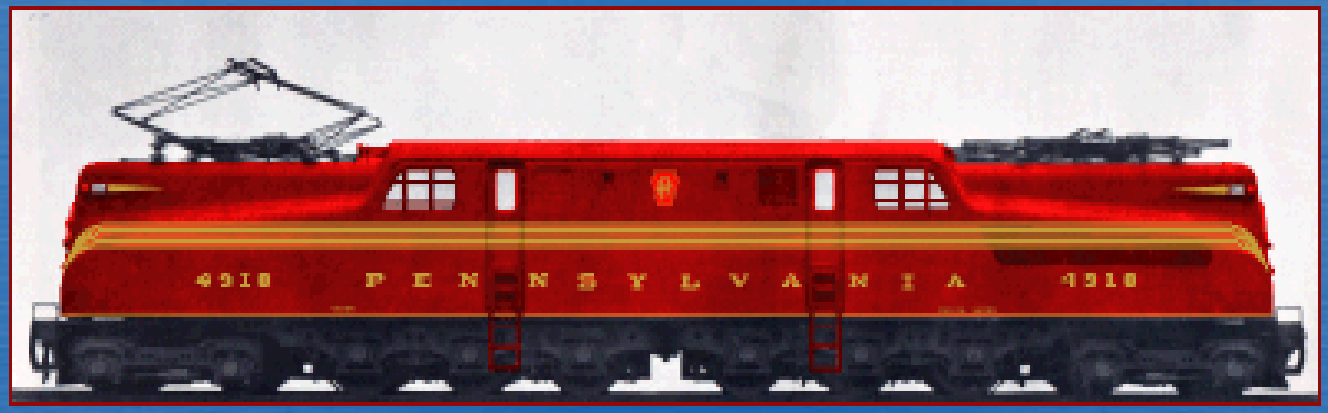


- Development of electric cars that rely on storage battery technology requires improvements in battery technology
- Issues include weight, driving range, and recharge time
- A fertile field for the do-it-yourselfer

Changing the Technology: Fuel Cell Vehicles

- Options include the hybrid vehicle or the “all-fuel-cell” vehicle?
- What will be the fuel for the fuel cell?
- Is hydrogen the energy source of the future?

Changing the Focus: Electric High-Speed Railways



- Electricity can be generated from many energy sources, providing the ultimate in flexibility
- The chicken-and-egg question: trains and riders

Pennsylvania—America's "energy keystone"

- Rich in energy resources, and
- Rich in human and corporate resources

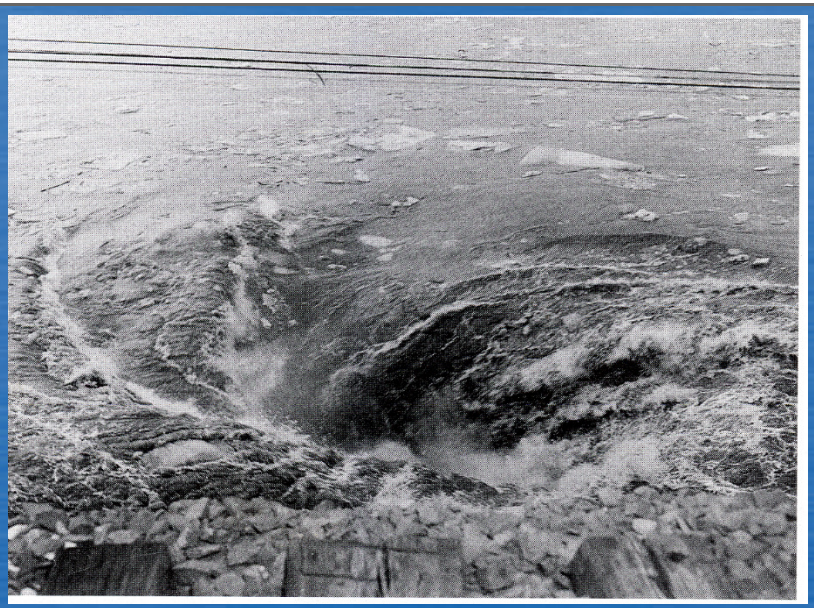
Pennsylvania's energy potential

- Abundant resources of coal and natural gas
- Biomass resources from agriculture and forest products
- Best potential for wind energy east of the Mississippi

Pennsylvania's energy potential

- Home to DOE's National Energy Technology Laboratory
- World-class energy research at Penn State and other universities
- Headquarters of world's largest producer of hydrogen
- Home to major international fuel cell company
- Dozens of other energy industries around the Commonwealth

Coal is Dead (?)…



The Knox Mine Disaster - January 1959

Should coal be dead? CTL—A “dirty lie”?

- Coal to liquids plants can be environmental nightmares….
- ….**if** we’re dumb enough to build them using 1960s technology.

Is Coal Dead?

"…theres a dance or two in the old dame yet"

Don Marquis

The song of mehitabel