

NMTC Jan 8, 2009

*Presentation to the
Northeastern Maryland Technology Council*

The Public Health
Implications of
After Peak Oil



Brian S. Schwartz, MD, MS
January 8, 2009



Overview

- What is “after peak oil” (APO)?
- What are the implications for food, agriculture, economies, and health?
- Will other energy options prevent all the dire predictions?
- Q&A and discussion

Who thinks oil will
be \$500 per barrel
within five years?

FORTUNE

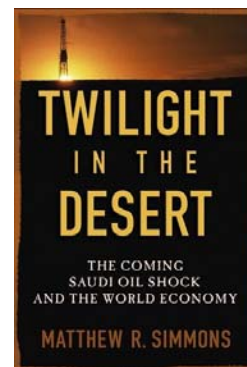
CNNMoney.com™

By [Brian O'Keefe](#), senior editor

LAST UPDATED: SEPTEMBER 22, 2008: 4:43 PM EDT

“Here comes \$500 oil”

“If Matt Simmons is right, the recent drop in crude prices is an illusion - and oil could be headed for the stratosphere. He's just hoping we can prevent civilization from imploding.”



2005

What is wrong with this picture?

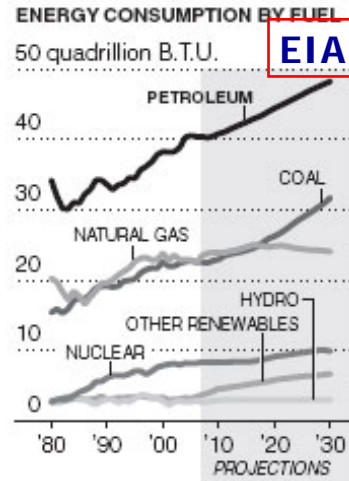
“In Units of Action, Not Just Talk, Oil is Still King”

New York Times
December 30, 2007

80% of total energy from fossil fuels
34% oil
25% coal
21% NG

In the Future: Oil

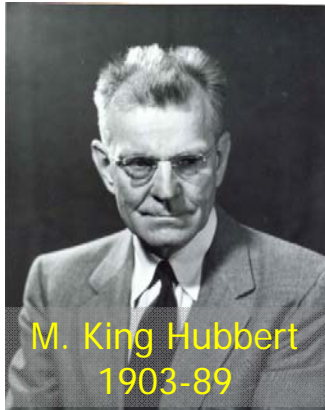
In the government's long-term forecasts for the country's sources of energy, petroleum is expected to remain dominant.



Source: Energy Information Administration THE NEW YORK TIMES

So, what's all this fuss about “peak oil”?

Who is this guy Hubbert and what is Hubbert's peak?



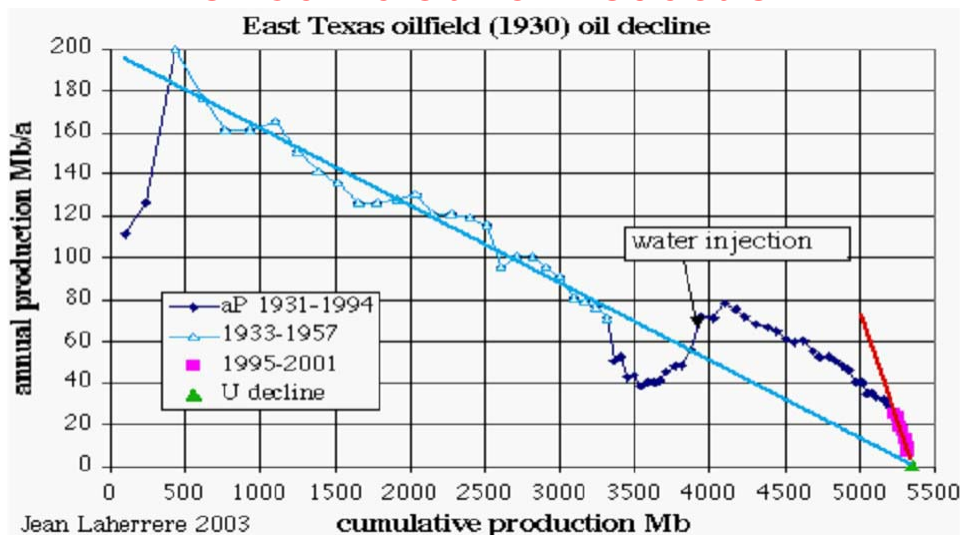
Shell Oil Co. geologist, in a speech to the American Petroleum Institute, March 8, 1956.

The U.S. was producing 7M barrels/d from 569 wells, the largest producer in history.

- He made a startling prediction: the **fossil fuel era would be of very short duration.**
- In 1956, he predicted U.S. oil production would peak in 1970.
- He was scoffed at ...
- **He was exactly correct.**

Some data from Keith Kohl, Energy & Capital, Nov 6, 2007

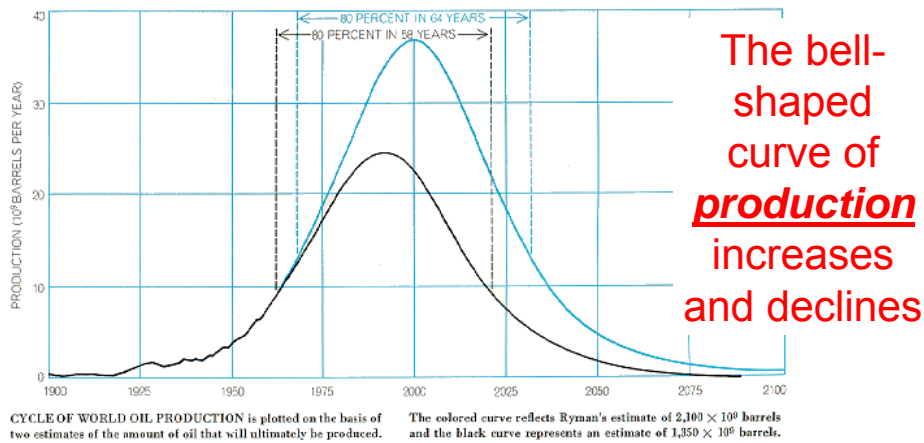
Hubbert's Method: Annual Production vs. Cumulative Production



METHOD #1

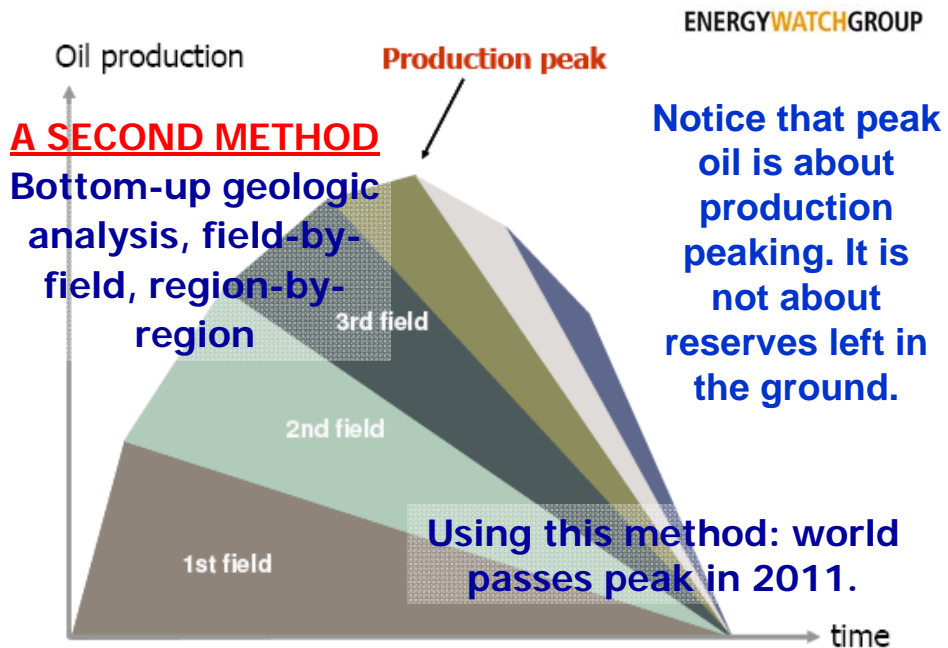
1930-2001

Energybulletin.net

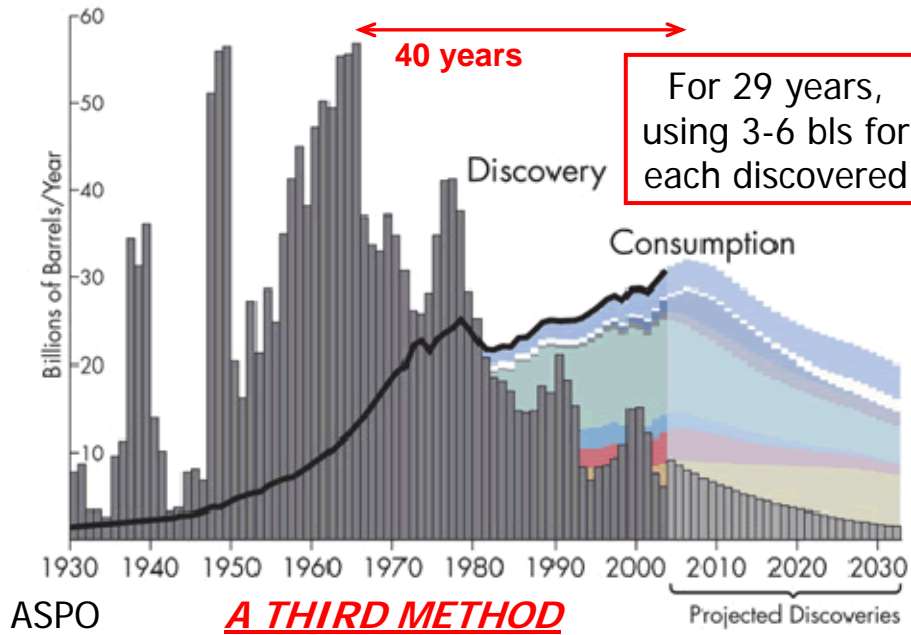


Scientific American, *Energy and Power*, 1971 – predicted world oil production (“flow”) would peak around **2000**.

Figure 3: Typical production pattern for an oil region

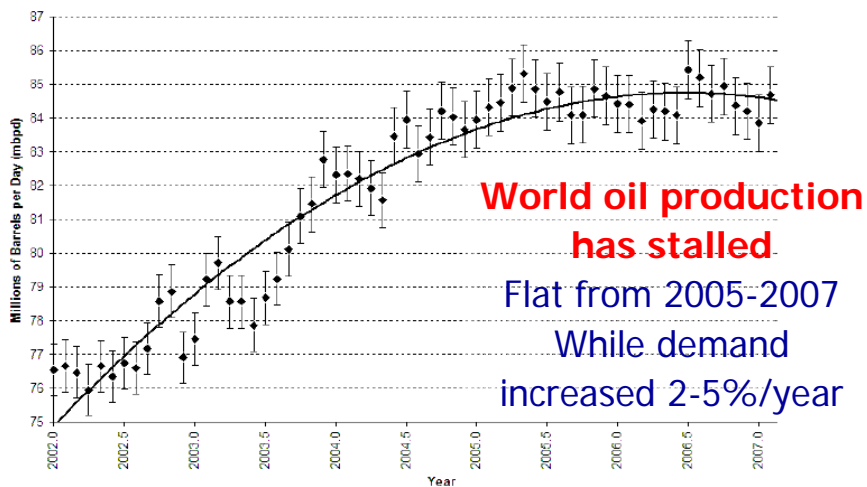


The Growing Gap Between Discovery & Production



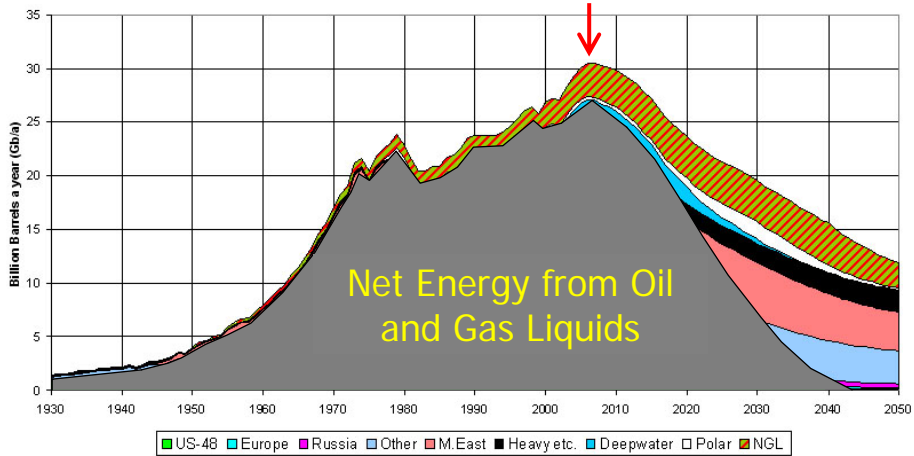
From John Kaufmann, Oregon Dept of Energy

Global Oil Production 2002-07



Source: www.UrbanSurvival.com, 5-21-07
Data from <http://www.eia.doe.gov/emew/international/contents.html>

**OIL AND GAS LIQUIDS 2004 Scenario
Updated by Colin J. Campbell, 2004-05-15**

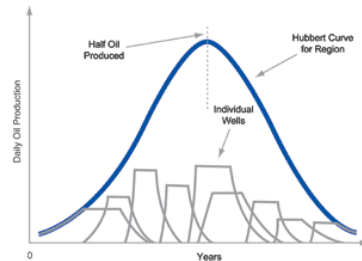


Bottom-up geologic analysis of whole world

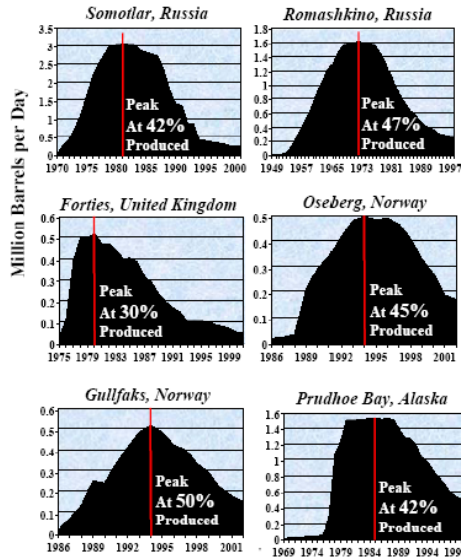
From Robert Costanza

Critical points:

1. Drilling more does not prevent production declines
2. Net energy decline is actually worse
3. Even if we are incorrect about reserves by as much as 30%, this just delays peak by 10-15 y
4. Importers get hurt first and worst



Already Peaked



- Two-thirds of oil-producing nations (45 of 64, including 15 of 23 largest)
- Two of world's five largest fields
- Saudi Arabia and the world's largest field Ghawar, probably very close

Adapted from John Kaufmann, Oregon Dept of Energy

Passing Peak

- In each of largest oilfields ever discovered:
 - Plateau lasted < 10 y
 - Production declined > 50% within 10 y
 - Fall off can be even more rapid (10% within 6 months at Cantarell)
- There is very little excess capacity in any country
- Once Ghawar passes peak, the world has

Wildly Fluctuating Prices

- In 2008, we hit historic highs; peak in July 2008 – \$147
- Blamed on
 - The weak dollar
 - “Speculators”
 - Increasing demand in China and India
 - Geopolitical tensions – Israel vs. Iran
- Did we hear any of our political leaders explain it as a geologic reality?
- Huge declines since then – destruction of demand (not miraculous supply side fix)

Conclusions

ENERGYWATCHGROUP

- The major result from [our] analysis is that world oil production peaked in 2006.
- Production will start to decline at a rate of several percent per year. By 2020 ... global oil supply will be dramatically lower.
- This will create a supply gap ... [cannot] be closed ... [from other energy sources] in this time frame.
- The world is at the beginning of a structural change of its economic system ... [that] will influence almost all aspects of our daily life.

Is this at all controversial?
Does everyone believe we
are about to pass peak?

Peak Oil Forecasts (from >30)

T. Boone Pickens (oil & gas investor).....	2005
K. Deffeyes (retired Princeton professor/Shell geologist).....	2005
E.T. Westervelt (US Army Corps of Engineers).....	Now
S. Bakhtiari (Iranian National Oil Co. planner).....	Now
S. Wrobel (investment fund manager).....	2010
C. Campbell (retired Texaco & Amoco geologist).....	2010
C. Skrebowski (editor Petroleum Review).....	2010
L.M. Meling (Statoil [Norway] geologist).....	2011
R.H.E.M. Koppelaar (Dutch oil analyst).....	2012
Volvo Trucks	< 10 y
C. de Margerie (Total [France] executive).....	< 10 y
S. al Hussein (retired VP Saudi Aramco).....	2015
Merrill Lynch	2015
UBS (brokerage, financial).....	2025
CERA (energy consulting [Daniel Yergin]).....	2030
ExxonMobil	no signs
J. Browne (BP CEO).....	who knows
OPEC	deny theory



What is known about peak oil & public health?

Peak oil, climate change, public
health and well-being

The Journal of the Royal Society for the Promotion of Health 2006; 126; 62

**“This will affect everything in our
carbon addicted culture. Its effects
will have much more important
chronic impacts than acute climate
change effects and its consequences
are likely to be unevenly distributed
...”**

Dominic Harrison

Peak Petroleum and Public Health

Howard Frumkin, Jeremy Hess, Stephen Vindigni

- “Prices ... will be volatile, rising in the long run, but dropping from time to time when high prices cause destruction of demand. Alternative sources such as tar sands ... will be disfavored, given the threat of global climate change. Geopolitical instability in petroleum-producing regions could threaten the supply of petroleum, causing sudden interruptions in supply and aggravating long-term scarcity. In a society that depends heavily on automobile travel, petroleum scarcity could be profoundly unsettling.”

Energy and the Public's Health: Making the Connection

COMMENTARY

PUBLIC HEALTH REPORTS / JANUARY–FEBRUARY 2009 / VOLUME 124

Michael T. Osterholm, PhD, MPH; Nicholas S. Kelley, MSPH

Two conclusions: “(1) the connections among the global just-in-time economy, energy availability, & public health are far more extensive than almost anyone can imagine; and (2) the public health community has been largely absent from this consideration and discussion of energy issues.”

What We Face

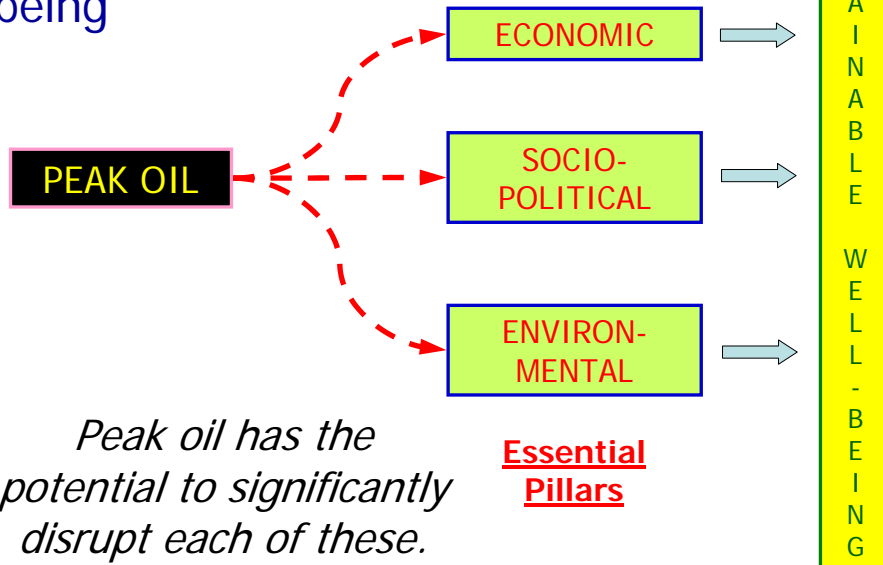
- Climate change
 - After peak oil
 - A built environment highly reliant on cheap and plentiful oil
 - Declining ecosystems
 - Accelerating biodiversity and species losses
- **A complex set of interlinked challenges**
- **“Converging catastrophes”**

Our Major Ecological Challenges Have Been Masked by Cheap Energy

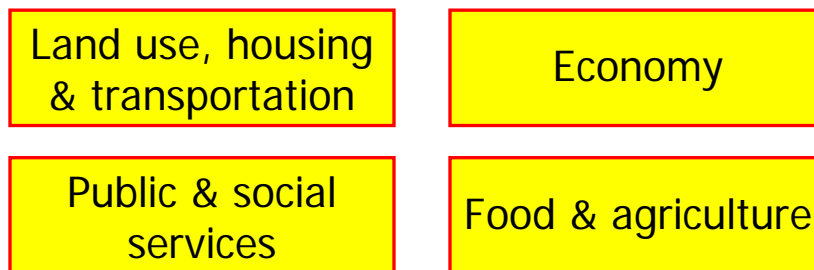
- **Losing topsoil?** → Use energy for fertilizers and food transport
- **Running out of water?** → Use energy to drill a deeper hole and pump out water
- **Oceanic fish species declining?** → Use energy to trawl deeper and farther
- **Getting warmer?** → Use energy to cool
- **Sea-level rising?** → Use energy to build bigger walls
- **International competition over resources?** → Use energy to fight wars

Adapted from Peak Oil Survival

John Holdren: The three ESSENTIAL pillars of sustainable human well-being

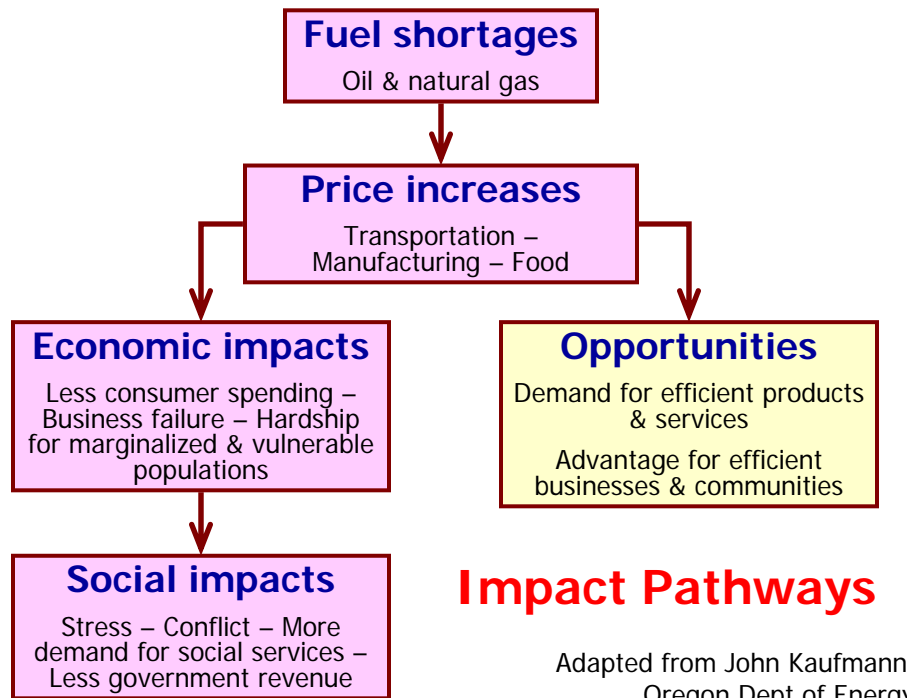


Energy Inputs Are Critical to All Aspects of Our Lives



In addition, oil and gas are used to make virtually everything we use in our daily lives

Adapted from John Kaufmann, Oregon Dept of Energy



APO & Agriculture

The Green Revolution

- 1950-1984, world grain production ↑ 250%
 - Virtually all productive land on planet is now exploited for agriculture
- There was a 50-fold increase in energy input
- New models used – industrial agriculture – that lead to degradation of land and water
- On average, we invest 10 kcal of fossil fuel energy for every 1 kcal of food energy derived
 - Ratio worse for meat, can be > 100
- In U.S. in 1900, ~40% of population involved in farming, now 1%

400 gallons of oil equivalents per person per year in US

- 31% for manufacture of inorganic fertilizer
- 19% for operation of field machinery
- 16% for transportation
- 13% for irrigation
- 08% for raising livestock (not including feed)
- 05% for crop drying
- 05% for pesticide production
- 08% miscellaneous

Fossil Fuels & Agriculture



Does not include energy for packaging, refrigeration, transportation to retail outlets, and household cooking

Expected Impacts: Food & Agriculture

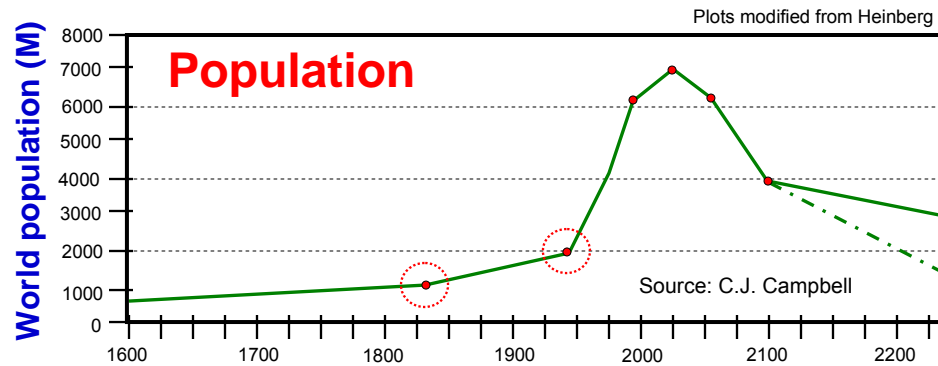
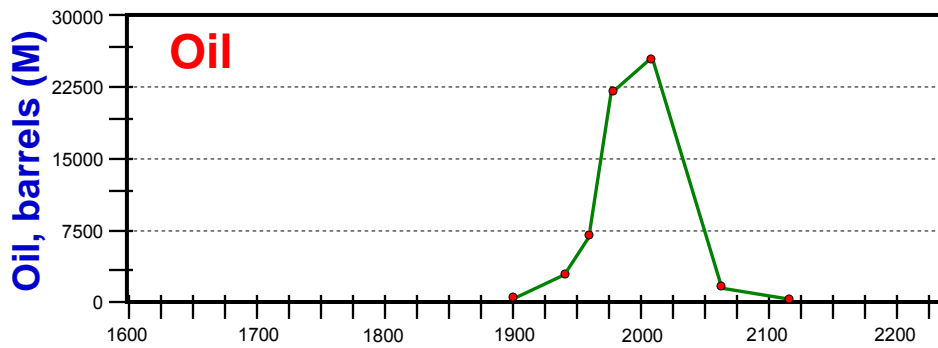
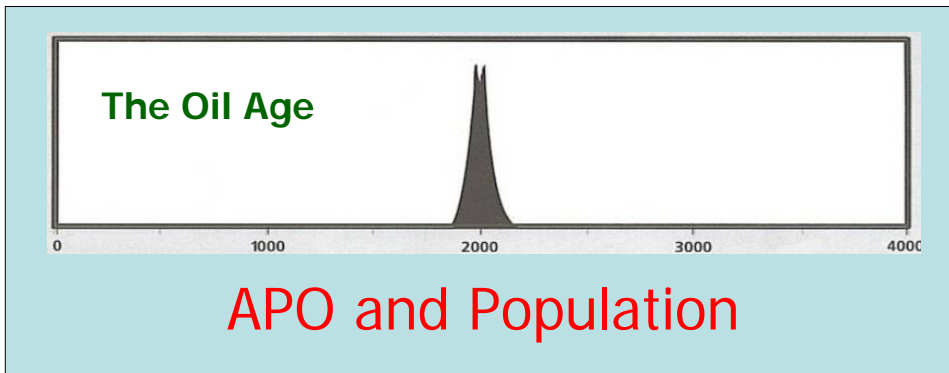
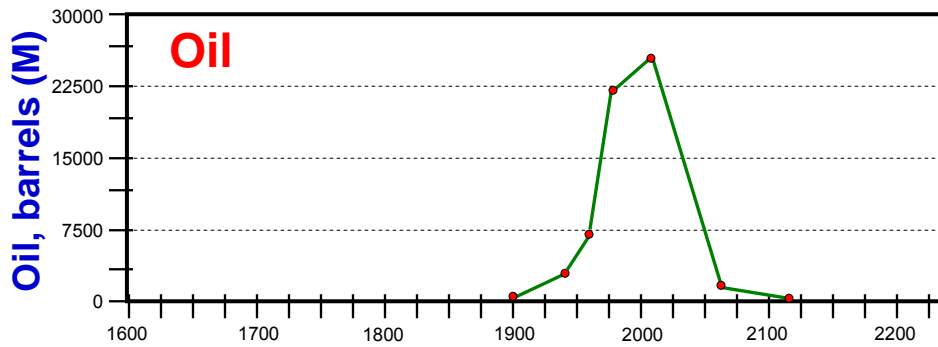
- Higher food prices
- Decrease in amount & variety of food
- Decrease in nutrition, especially for poor
- Changes in food retailing
- More household food production, preservation, preparation



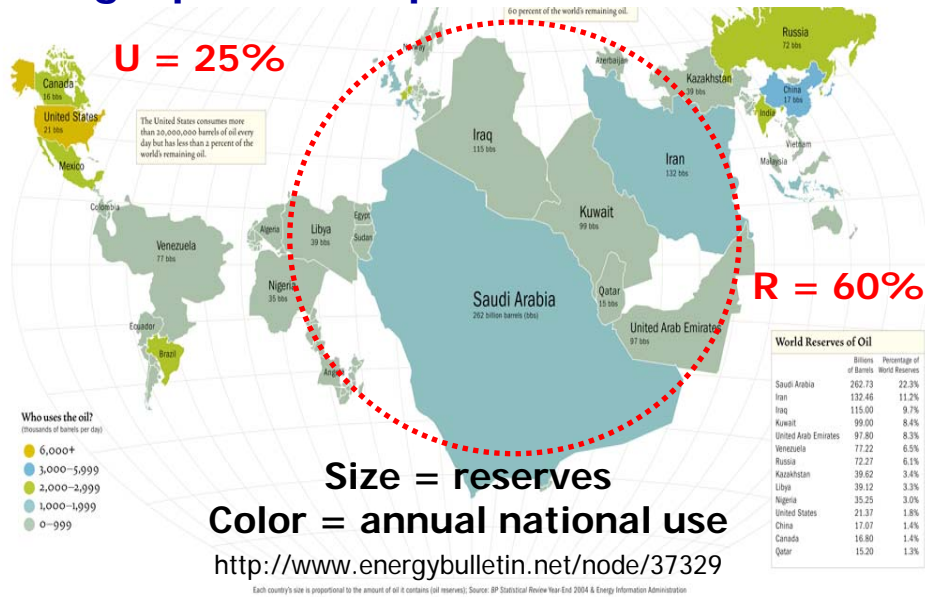
April 9, 1973

Adapted from John Kaufmann, Oregon Dept Energy

NMTC Jan 8, 2009



**Who has the oil? Who uses the oil?
The geopolitical implications seem obvious.**



Implications for war and terrorism



Our reliance on oil threatens our national interests and security.

© 2007 David Horsey, Seattle Post-Intelligencer

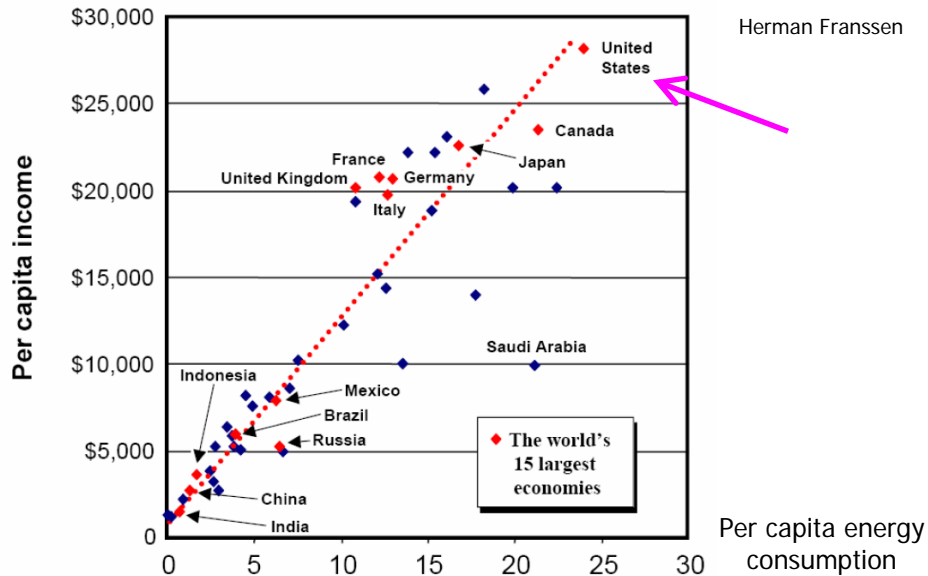
THE WALL STREET JOURNAL.

U.S. Military Launches Alternative-Fuel Push. Dependence on Oil Seen as Too Risky. By YOCHI J. DREAZEN. *May 21, 2008 Page A1*

“Some Pentagon officers have embraced planning around the "peak oil" theory ... that the world's oil production is about to plateau ... Earlier this year, they brought ... investment banker Matthew Simmons to the Pentagon for a presentation ... he warned that under the theory **“energy security becomes an oxymoron.”**”

Implications for Economies

Admiral Hyman Rickover May 1957: "A reduction of per capita energy consumption has always in the past led to a decline in civilization and a reversion to a more primitive way of life."



Peaking and the World Economy

Adapted from Robert L. Hirsch

- The brief 1973 & 1979 oil interruptions caused inflation, unemployment, recession, high interest rates
 - Impacts of APO will be more persistent, not prone to conventional economic solutions
- Many predict that the year of conventional oil peaking will mark the start of world recession.
- Over past 30 years, world GDP grew at 3%/yr, world oil use at 1.5%/yr
- After peaking, oil production will decline
 - World GDP will likely go down with it

Is this the End of Consumer Society?

- Will we be getting fruit from Chile in the winter?
- Will we be getting inexpensive consumer goods from China?
- What will your over-sized house be worth?
- What will your house that requires a 100-mile commute be worth?
- Will we face a (never-ending) economic downturn?
- What will financial markets do?
- What pressures will these issues put on families?
- What pressures will these issues put on politicians?

What about other energy options?

To Maintain Industrial Society, Energy Must ...

- Be rapidly scalable to needed capacity
- Have a high EROEI
- Be transportable, storable, energy-dense
 - Oil is very energy dense, infrastructures are in place
- Be renewable
 - If not, only postpones the problem (e.g., nuclear)
- Be ecologically sane
 - Oil sands and shales are not

Adapted from McBay

EROEI: Energy returned on energy invested

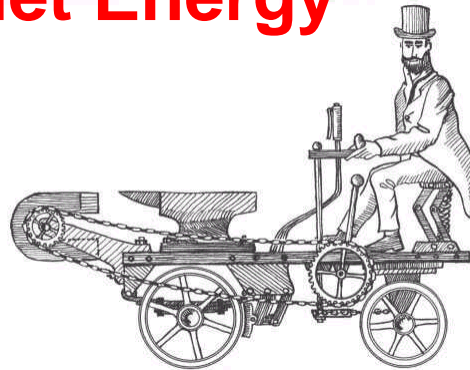
Energy used to
capture resources
cannot exceed the
energy derived from
those resources.

Adapted from John Kaufmann,
Oregon Dept of Energy



EROEI: Net Energy

Earlier oil	100
Middle East oil now	30
Natural gas	20
Coal	10 - 20
Hydropower	10 - 40
Wind	5 - 10
Nuclear	5
Oil sands	3
Biodiesel	3
Solar photovoltaic	1 - 5
Shale oil	1.5
Corn ethanol	1.2



www.physics-book.com



www.virtualhorses.com

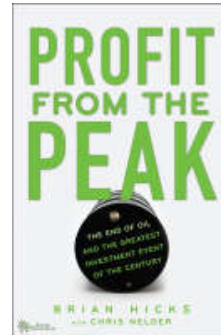
Bad news ...

Many believe there are
no alternatives that
meet all these criteria

We are likely in for a bit
of pain ...

“A Harsh Reality”

- **Oil:** Peaking in the next three years, possibly already past peak
- **Natural gas:** Peaking in the next three to 13 years
- **Coal:** Peaking in the next 13 years
- **Nuclear:** Probably peaking in the next 10 years, with many variables, but its use won't increase substantially



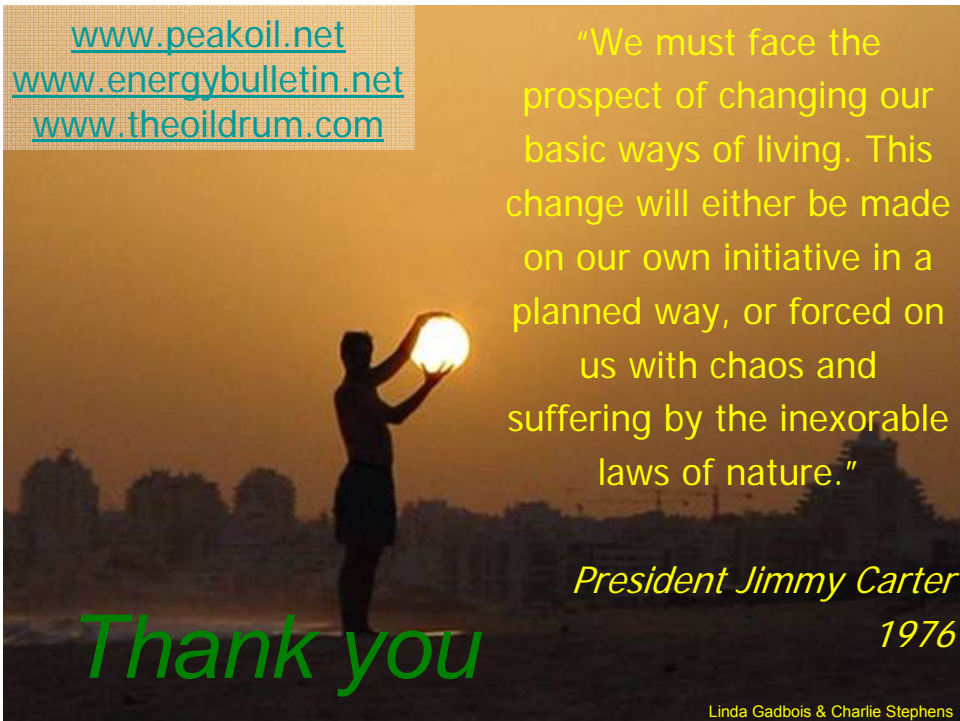
2008

Conclusions

- Serious concerns expressed by many competent, unbiased professionals
- Oil peaking will happen, timing is uncertain
- Although focus has been on liquid fuels, supplies of natural gas, coal, & uranium are finite too
- The risks to economies, food, public health are very large but have not been rigorously evaluated; and will interact with climate change & other problems
- Probably not possible to mitigate all risks now – too late
- Due to costs and declining energy resources, we probably only get one chance to get the next energy regime right

Final Comments

- If you are not yet convinced, learn more; you eventually will be
- Most Americans, even many of our leaders, still do not know about this
- Dramatic changes are coming (relocalization)
- We must stop investing in projects with limited usefulness – e.g., highway expansions, inter-county connector
- We need to make the energy transition
- We need to build community resilience
- What you can do: consume differently, build skills, get civically engaged, spread the word



www.peakoil.net
www.energybulletin.net
www.theoil drum.com

"We must face the prospect of changing our basic ways of living. This change will either be made on our own initiative in a planned way, or forced on us with chaos and suffering by the inexorable laws of nature."

President Jimmy Carter
1976

Thank you

Linda Gadbois & Charlie Stephens

CONFERENCE
“Peak Oil and Health”
Johns Hopkins Bloomberg School
of Public Health
March 12, 2009

“My grandfather rode a camel, my father rode a camel, I drive a Mercedes, my son drives a Land Rover, his son will drive a Land Rover, but his son will ride a camel.”

—Sheikh Rashid bin Saeed Al Maktoum (1912-1990)
Prime Minister of United Arab Emirates 1979-1990