Presentation to the
Northeastern Maryland Technology Council

The Public Health Implications of
After Peak Oil

Brian S. Schwartz, MD, MS
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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

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

“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.”
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

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.*


**Hubbert’s Method: Annual Production vs. Cumulative Production**

![Graph showing annual vs. cumulative production](image)

**METHOD #1** 1930-2001

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**Figure 3: Typical production pattern for an oil region**

A SECOND METHOD
Bottom-up geologic analysis, field-by-field, region-by-region

Notice that peak oil is about production peaking. It is not about reserves left in the ground.

Using this method: world passes peak in 2011.
The Growing Gap Between Discovery & Production

For 29 years, using 3-6 bls for each discovered

From John Kaufmann, Oregon Dept of Energy

Global Oil Production 2002-07

World oil production has stalled
Flat from 2005-2007
While demand increased 2-5%/year

Source: www.urbansurvival.com. 3-21-07
Data from http://www.eia.doe.gov/emeu/international/conventional.html
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

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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

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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

- 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. Bakhtiar (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 Husseini (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

"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

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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

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

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

Peak oil has the potential to significantly disrupt each of these.

Energy Inputs Are Critical to All Aspects of Our Lives

- Land use, housing & transportation
- Economy
- Public & social services
- Food & agriculture

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

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**Fuel shortages**

- Oil & natural gas

**Price increases**

- Transportation
- Manufacturing
- Food

**Economic impacts**

- Less consumer spending
- Business failure
- Hardship for marginalized & vulnerable populations

**Opportunities**

- Demand for efficient products & services
- Advantage for efficient businesses & communities

**Social impacts**

- Stress
- Conflict
- More demand for social services
- Less government revenue

**Impact Pathways**

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%
Fossil Fuels & Agriculture

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

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

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The Oil Age

APO and Population

Source: C.J. Campbell
Plots modified from Heinberg

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

U = 25%
R = 60%

Size = reserves
Color = annual national use
http://www.energybulletin.net/node/37329

Implications for war and terrorism

Our reliance on oil threatens our national interests and security.

© 2007 David Horsey, Seattle Post-Intelligencer

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“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

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

http://www.pbs.org/wnet/nature
EROEI: Net Energy

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<th>Source</th>
<th>EROEI</th>
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<td>Middle East oil now</td>
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<tr>
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<td>20</td>
</tr>
<tr>
<td>Coal</td>
<td>10 - 20</td>
</tr>
<tr>
<td>Hydropower</td>
<td>10 - 40</td>
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<tr>
<td>Wind</td>
<td>5 - 10</td>
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<tr>
<td>Biodiesel</td>
<td>3</td>
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<tr>
<td>Solar photovoltaic</td>
<td>1 - 5</td>
</tr>
<tr>
<td>Shale oil</td>
<td>1.5</td>
</tr>
<tr>
<td>Corn ethanol</td>
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</tr>
</tbody>
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Bad news …

Many believe there are no alternatives that meet all these criteria.

We are likely in for a bit of pain …

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“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

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

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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

“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

www.peakoil.net  
www.energybulletin.net  
www.theoildrum.com

Thank you

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“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