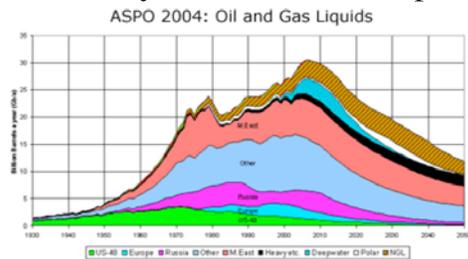


Peak Oil: Causes, Consequences, and Ways to Avert Catastrophe



Prof. Kevin Wehr, CSUS

Peak Oil

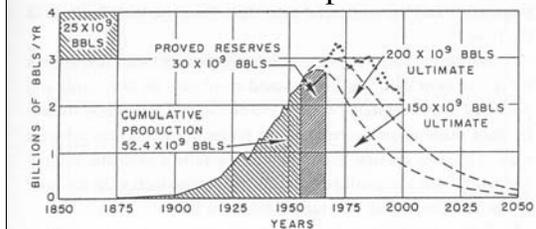
- The concept of “peak oil” is relatively straightforward:
 - As we pump oil we first take the cheap, easy, and high quality crude
 - As production continues we move through the cheap towards the expensive and eventually to the bottom of the barrel.
 - As we move through this process costs rise monotonically at first, then geometrically, and finally exponentially.

Hubbert’s peak

- Shell oil geologist and Princeton professor, M. King Hubbert predicted in 1956 that within 20 years domestic US production of oil would “peak”-- meaning that production of the cheap, light, high quality oil at the top of the reserves would be exhausted, leaving only the thick, heavy, expensive oil at the bottom of the fields.



Hubbert’s peak

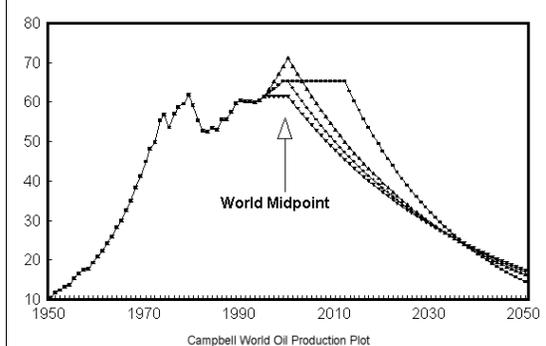


- Hubbert’s original 1956 graph: actual production is in small circles above his estimates--differences are due to the oil shocks and conservation of the 1970s and the new discoveries in Alaska.

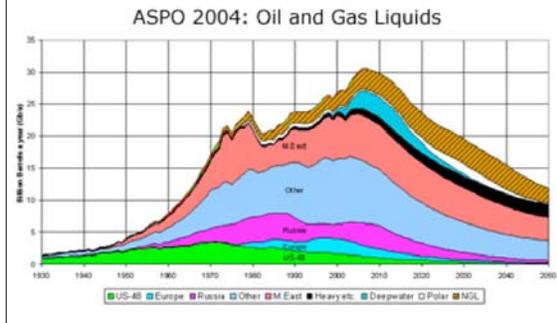
Hubbert’s peak

- In 1971 his prediction came true: the government agency that regulated pumping of oil quietly announced a “100% allowable for the next month.”
- This meant that fields could be pumped at maximum rates, meaning that subsequent production would steadily decline.

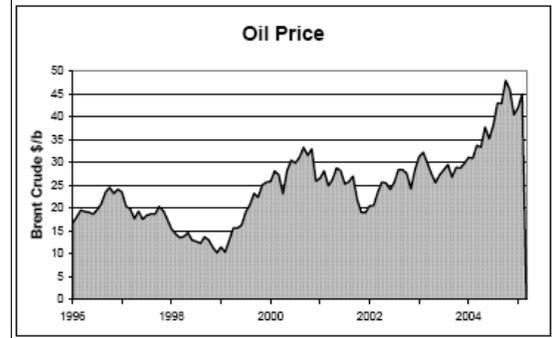
Peak Oil



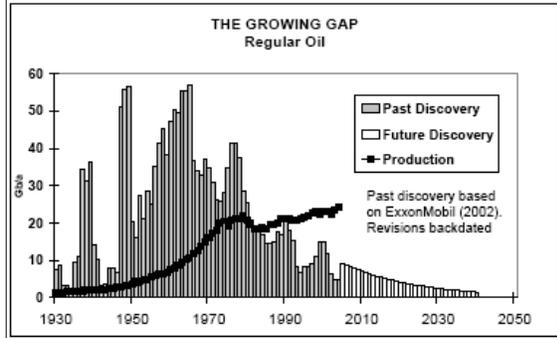
Peak Oil



Peak Oil



Peak Oil



Peak Oil: Merging means trouble

- December 1998: BP and Amoco merge
- April 1999: BP-Amoco and Arco merge
- December 1999: Exxon and Mobil merge
- October 2000: Chevron and Texaco merge
- November 2001: Phillips and Conoco merge
- September 2002: Shell acquires Penzoil-Quaker State
- February 2003: Frontier Oil and Holly merge
- March 2004: Marathon acquires 40% of Ashland
- April 2004: Westport Resources acquires Kerr-McGee
- July 2004: Analysts suggest BP-Amoco and Shell should merge
- August 2005: Chevron-Texaco/Unocal merge \$18b

Oil dependency

- Sure, we're a "car culture"...so what?
- Our reliance on autos to the exclusion of public transport or non-fossil fuel based transportation means that we are, in Bush's term, addicted to oil.
- In the 1950s Firestone and GM colluded to buy up existing public transit systems, shutting them down and forcing the building of freeways.

Oil dependency

- The food we eat travels an average distance of 1500-2000 miles to our tables
- For every calorie of food energy that we produce, 10 calories of oil was used to produce it:
 - Pesticides
 - Fertilizers
 - Diesel tractors
 - Freight hauling

Oil dependency

Does the current administration know about all of this?

In late 1999, Dick Cheney stated:

By some estimates, there will be an average of two-percent annual growth in global oil demand over the years ahead, along with, conservatively, a three-percent natural decline in production from existing reserves. That means by 2010 we will need on the order of an additional 50 million barrels a day.

Matt Simmons, a Bush energy advisor said in 2003:

It is past time. As I have said, the experts and politicians have no Plan B to fall back on. If energy peaks...it will be a tremendous jolt to our economic well-being and to our health — greater than anyone could ever imagine...The solution is to pray. Under the best of circumstances, if all prayers are answered there will be no crisis for maybe two years. After that it's a certainty.

Bush is right

- In the 2006 State of the Union address Bush warned that we are *addicted to oil*.
- The proposed solution is alternative energy and reduction of foreign oil reliance
- We became a net importer of oil in 1958, and since then we have spent \$3 trillion importing oil.
- First quarter 2006: we import 58% of our oil:
 - Mexico and Canada send us the most oil at about 15% of the total each
 - Saudi Arabia, Nigeria, and Venezuela account for about 10-15% each
 - The Mid-East accounts for about 20% (almost all of which comes from Saudi Arabia)

Bush is right

- Sadly, Bush's proposal--reducing our dependence on foreign oil--was hollowed out the next morning by Bush's press secretary, who told gathered reporters that the President had not meant the comment literally.
- This dependency has driven us to extremes, almost as crack addicts selling the furniture for another hit...the furniture, in our case is ANWR

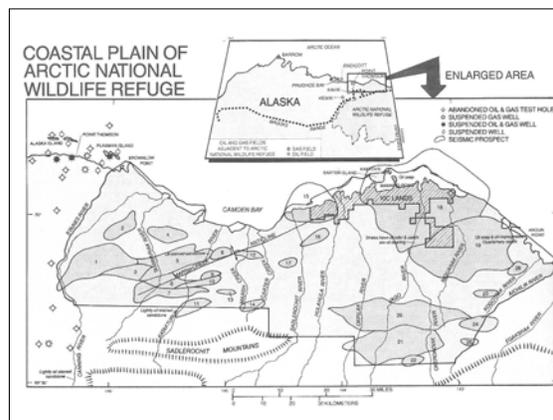
What hath oil wrought?

- 1867: Lincoln's Secretary of State William Seward annexed Alaska territory from Russia for \$7.2 million (called both "Seward's Folly" and "Seward's Icebox").
- 1923: 23 million acres designated as the National Petroleum Reserve of Alaska.
- 1953: Interior dept. surveyed conservation areas.
- 1959: Alaska officially became the 49th state
- 1960: Secretary Seaton designated the "Arctic National Wildlife Range"—the first label officially given to the present day ANWR

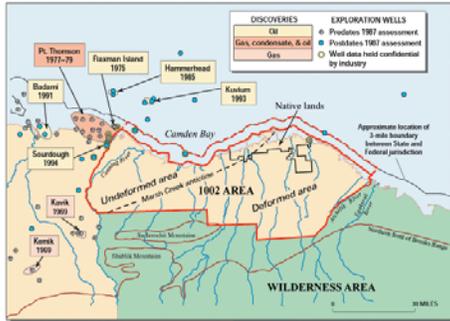
Arctic National Wildlife Refuge

19 million acres in northeastern Alaska:

- Migratory birds,
- Caribou
- Three species of bear
- Dall sheep, muskoxen, wolves, arctic foxes, red foxes, wolverines...
- and OIL.



Geologic Outline of the ANWR



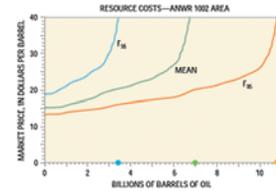
How much oil is in ANWR?

- A 1987 USFWS/BLM/USGS report found a high likelihood of 4.2 billion barrels (bb) of oil, other studies have suggested up to 29 bb of oil.
- The most authoritative recent study by USGS (1998) found the amount of *technically recoverable* oil to be 4.2 – 11.8 bb of oil.

- But there's oil and then there's oil: *economically recoverable* deposits amount to only 3.2 bb

- The US uses about 7 bb of oil each year.

- **Drilling ANWR would supply the US for 6 months!!**

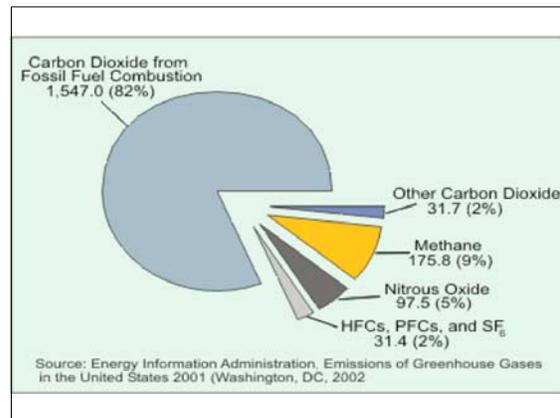
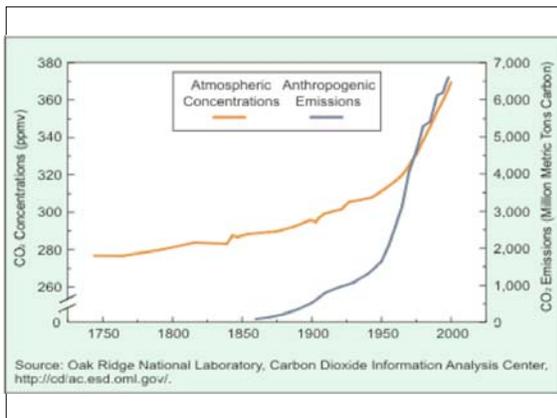


Reasons why...

- Alaska's economy is lubricated by oil revenue: 80% of its operating funds comes from oil taxes and royalties.
- President Bush has made ANWR a centerpiece of his energy policy (under the heading of reducing our dependence on foreign oil).
- Gov. Murkowski (while still Senator): "If you think that oil is staying in the ground, you're smoking marijuana."
- And he was right: in March 2006 the Senate passed a budget bill containing provisions for drilling ANWR, a goal that has been supported by the House for years.

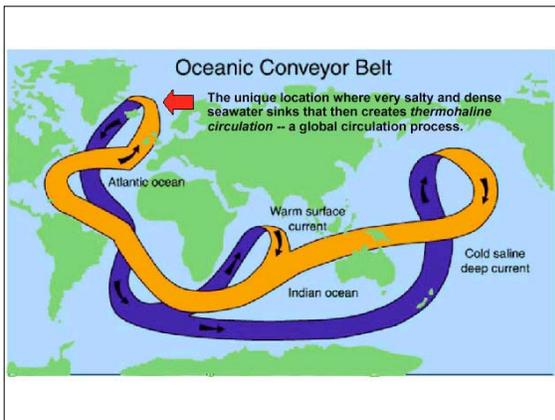
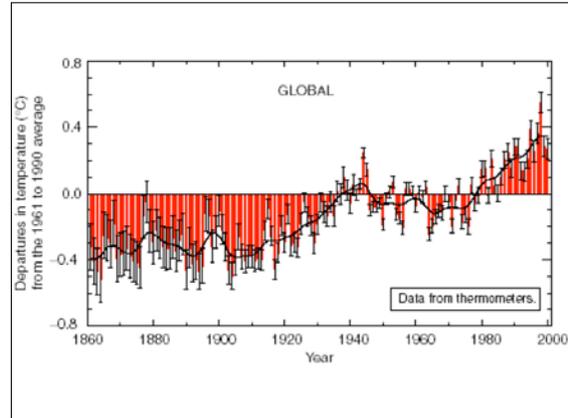
What hath oil wrought?

- Carbon loading of the atmosphere from the burning of fossil fuels (including coal) is largely responsible for global warming.
- This warming of just a few degrees will have massive impacts on our way of life, from the reduction of farming in the temperate zones, to the possibility of a complete shift in life on earth.



But how bad is it right now?

- NAS initiated climate change study in 1979
 - They found that “if CO₂ continues to increase [there] is no reason to doubt that climate changes will result and no reason to believe that these changes will be negligible. ...
- Temperatures could increase by between 2°-8° F and due to built-in time delay could take decades
 - “We may not be given a warning until the CO₂ loading is such that an appreciable climate change is inevitable”



What hath oil wrought?

- Oil is Nigeria’s main export (primarily to the US), worth 95% of foreign earnings.
- Contracts with Shell Oil amount to most of the revenue that the government brings in.
- \$12 Billion in oil is pumped every year
- Standard of living remains stagnant because oil money is used to service \$40+ Billion in debt Nigeria owes to IMF and World Bank

What hath oil wrought?

- Shell blamed movements by the Ogoni people, who desired clean up lands near the oil wells, for loss of 15 million barrels of oil in 1992 and 1993.
- 8 Ogoni leaders, including Ken Saro-Wiwa, were executed by Nigeria after a secret trial

RIVERS STATE OF NIGERIA

GOVERNMENT HOUSE
FACTS SHEET

RESTRICTED RESTRICTED RESTRICTED

RIVERS STATE INTERNAL SECURITY TASK FORCE, GOVERNMENT HOUSE, PH.

M E M O

TO: HIS EXCELLENCY THE MILITARY ADMINISTRATOR RIVERS STATE

FROM: THE CHAIRMAN RIVERS STATE INTERNAL SECURITY (RSIS)

SUBJECT: RSIS OPERATIONS: LAW AND ORDER IN OGONI, ETC

OBSERVATIONS:

- POLICE IN OGONI REMAIN INEFFECTIVE SINCE 1993.
- SHELL OPERATIONS STILL IMPOSSIBLE UNLESS RUTHLESS MILITARY OPERATIONS ARE UNDERTAKEN FOR SMOOTH ECONOMIC ACTIVITIES TO COMMENCE.

RECOMMENDATIONS/STRATEGIES:

- INTRA-COMMUNAL/KINGDOM FOMULAE ALTERNATIVE AS DISCUSSED TO APPLY.
- WASTING OPERATIONS DURING RIISOP AND OTHER GATHERINGS MAKING CONSTANT MILITARY PRESENCE JUSTIFIABLE.
- WASTING TARGETS CUTTING ACROSS COMMUNITIES AND LEADERSHIP CHANGES ESPECIALLY VOCAL INDIVIDUALS IN VARIOUS GROUPS.
- DEPLOYMENT OF 400 MILITARY PERSONNEL (OFFICERS AND MEN).

OK, so what?

- Some suggest that we are no longer in the middle-late Holocene...we are actually in an era that should be called Anthropocene, an era characterized by the effect of humans on the climate.
- We are on a carbonation bender and it's got to stop. But how do we stop it?

The End of Suburbia

- If you are a pessimist, the party is coming to an end--Cassandra was right:
 - The end of suburbia
 - Collapse of the economy
 - Globalization-->localization
 - No more cheap food
 - No more cheap long-distance transportation
 - But perhaps there are positive unintended consequences as well...

The Ultimate Resource

- If you are an optimist, this challenge is simply an opportunity:
 - As costs go up, there emerge new pressures towards innovation, and strong incentives for research and development
 - Cost side crisis will yield new technologies that will let the party continue
 - We should thus encourage immigration, research, and consumption is just not a problem

What is to be done?

- Photovoltaic cells
- Nuclear
- Hydrogen
- Space-based Solar Power
- Increase auto fuel efficiency
- Carbon Capture and Storage
- Wind power, especially VAWT

What is to be done?

- None of these address the systemic treadmill of production.
- We have to face the possibility of giving up much of what we consider to be "necessities of life" and learn to live simply and locally.

What is to be done?

- No more BAU:
- Give up our cars?
- Give up cheap food?
- Give up warm houses in the winter?
- Give up bananas? ... or worse, *coffee*?

What is to be done?

- Alternative technology: yes!
- But we also need to step off of this treadmill:
 - Buy smarter. But also buy less.
 - Vote.
 - Vote with your dollars.
 - Use your voice and take action:
 - “Never doubt that a small group of committed citizens can change the world. Indeed, it’s the only thing that has.”

Margaret Meade