

# The Oil Drum

DISCUSSIONS ABOUT ENERGY AND OUR FUTURE



## Exponential Growth and Oil Limits in a Finite World

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June 16, 2010

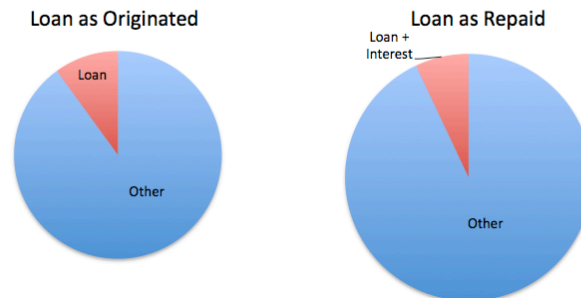
# Outline

- Exponential Growth
- Limits to growth
- Where are we now?
- What is ahead?
- Climate change

# Exponential Growth

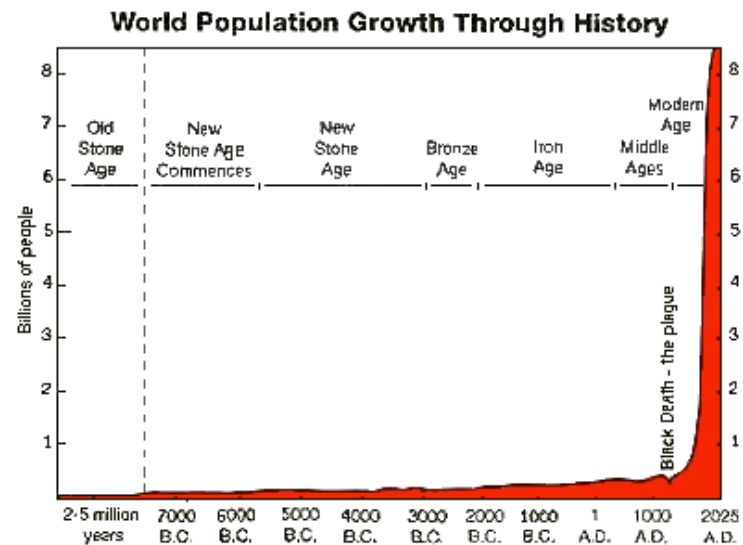
- Fundamental to our current economic system
- Current monetary system is debt-based
  - Money is loaned into existence
  - Pay back borrowed money with interest
  - To finance this, need exponential growth

Repaying loans is easy in a growing economy



# Exponential Growth

- Also where population is trending
- Fossil fuels enabled greater food production
- Fossil fuels also enabled better medical care



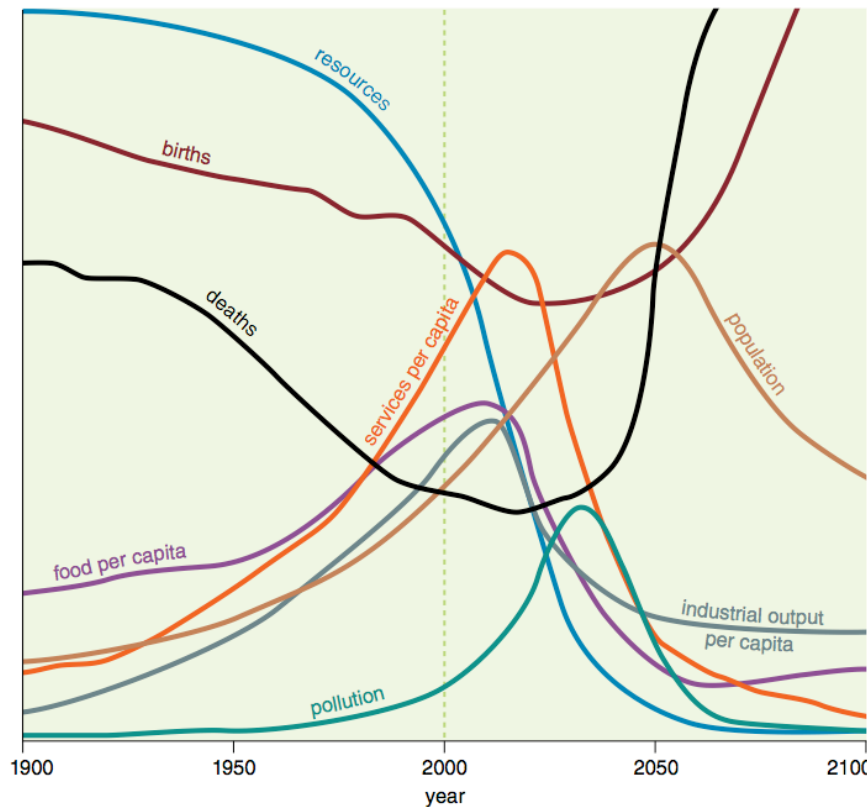
<http://www.susps.org/overview/numbers.html>

# Limits to Growth

- Fresh water is limited
- Oil and natural gas are reaching limits
- Ores are at lower and lower concentrations
- Soil is suffering depletion, erosion
- Climate is stressed by higher CO<sub>2</sub>
- Oceans are polluted, acidifying, losing fish
- Capital for solutions is limited

# Limits to Growth

- Analysis by Meadows et al in 1972
- Recent analysis shows expected trends



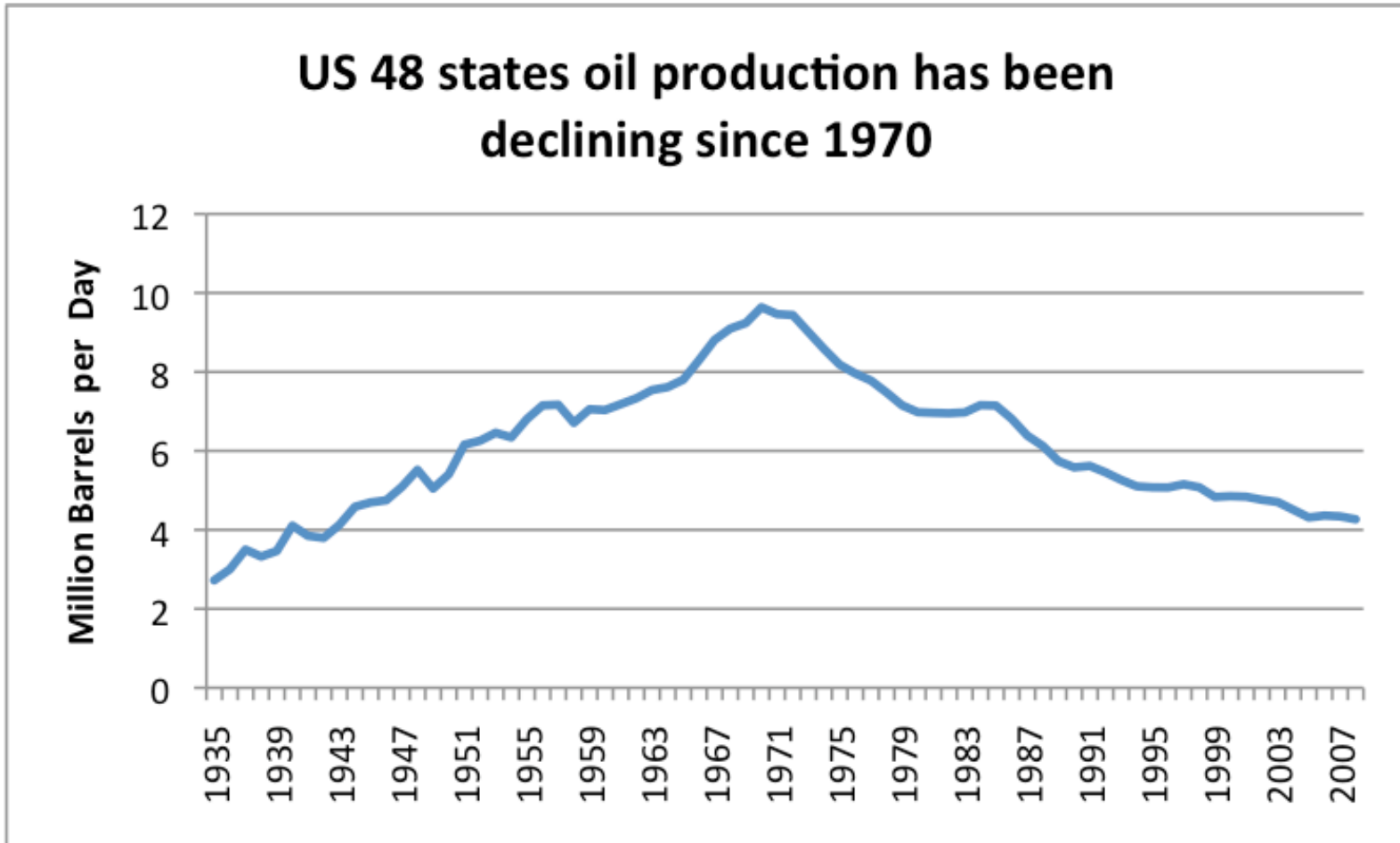
parameter	predicted	actual
population	6.9 billion	6.7 billion
birth rate per 1,000 people	35	45
death rate per 1,000 people	11	8.5
<b>values vs. 1970 levels</b>		
resources	0.53	
copper		0.5
oil		0.5
soil		0.7
fish		0.3
pollution	3.0	
CO <sub>2</sub>		2.1
nitrogen		2
per capita industrial output	1.8	1.9

<http://www.esf.edu/efb/hall/2009-05Hall0327.pdf>

# Where are we now?

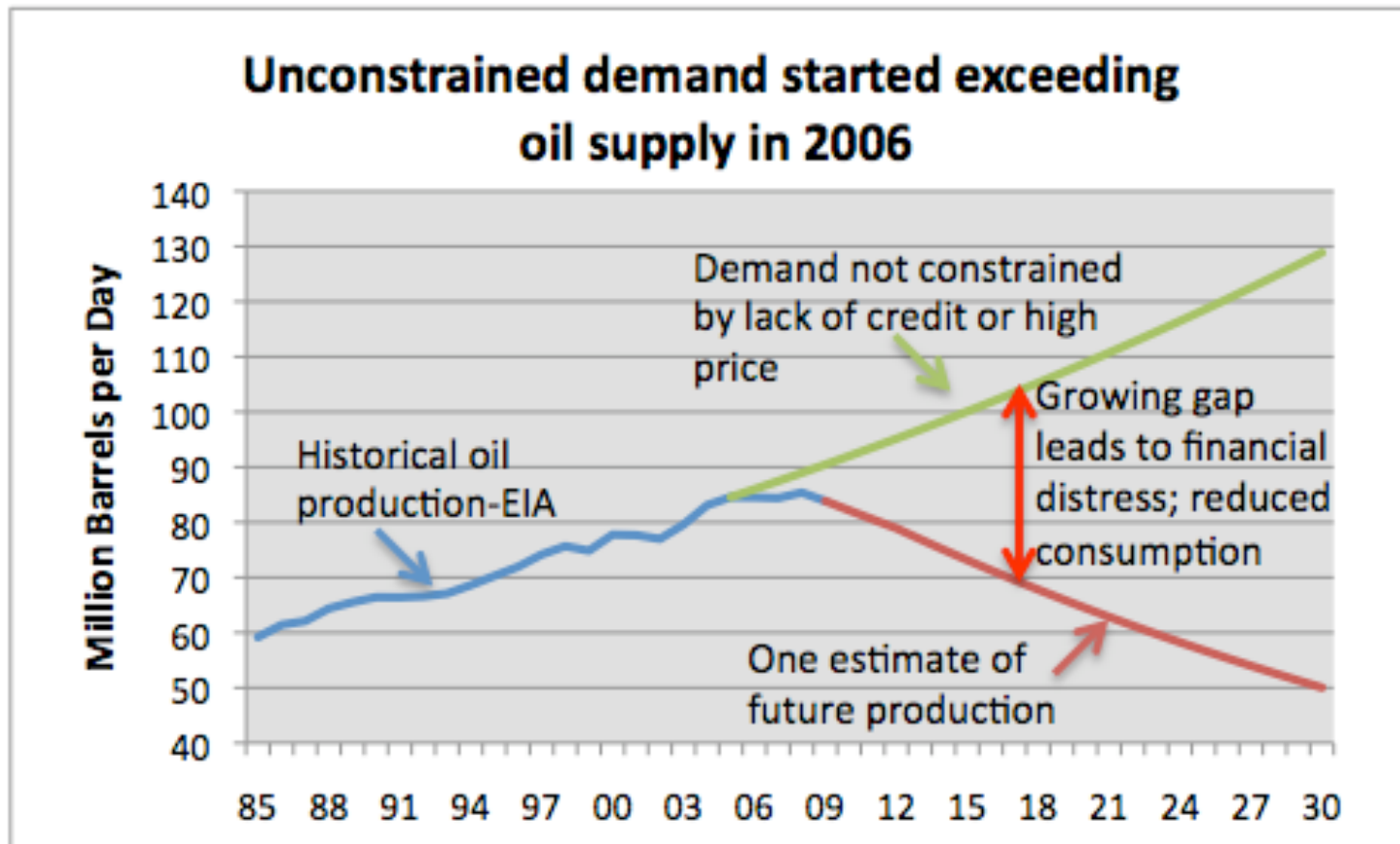
- Huge problems in many area
  - Ocean condition poor
  - Ore grades declining
  - Dropping water tables
- Climate has received much of the publicity
- Oil production cannot be expanded except with very large investment
  - Huge problem since it is our primary transportation fuel

In country after country, oil production has risen and then declined



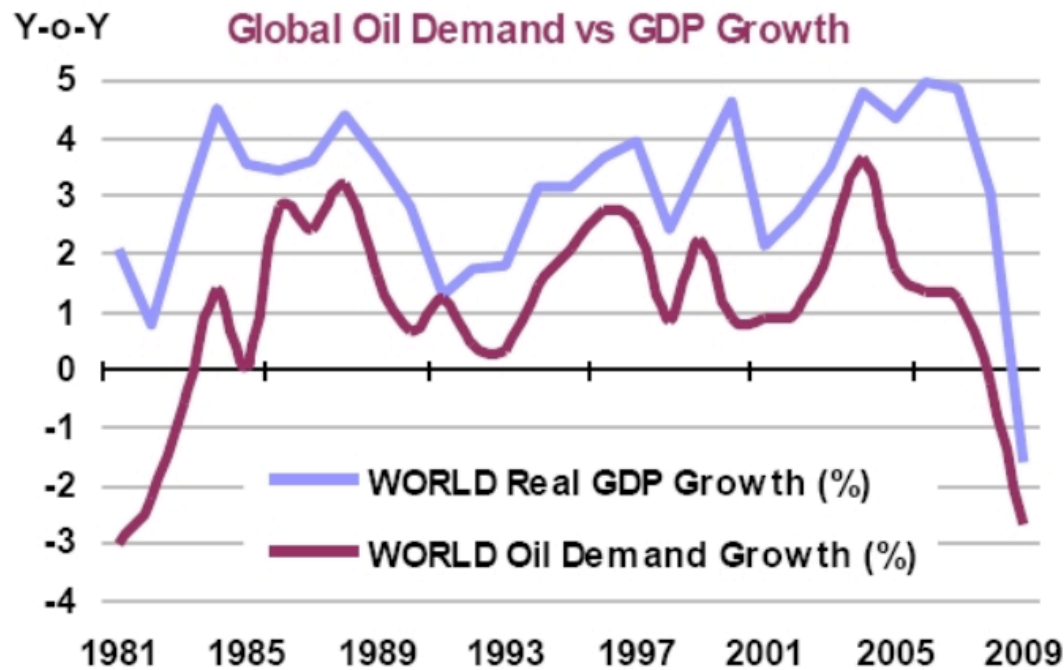


In my view, world oil supply is already falling behind unconstrained demand



In my view, current financial distress is mostly a result of this growing oil gap

### Oil Demand Correlates With Global GDP

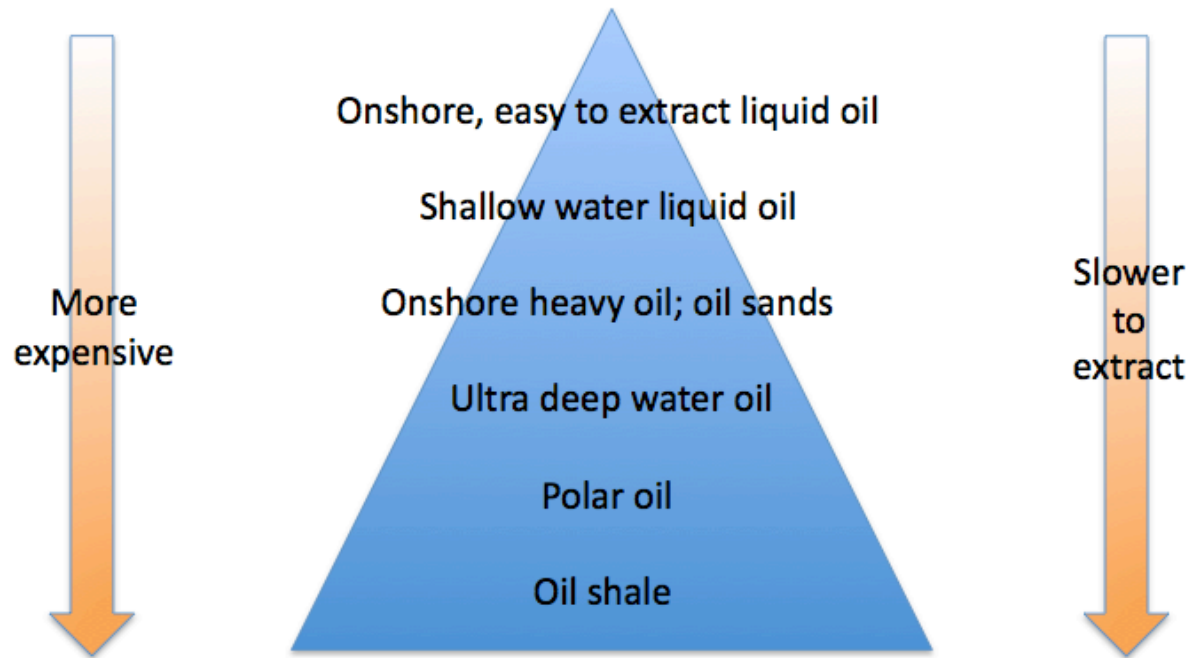


Source: International Energy Agency (IEA)

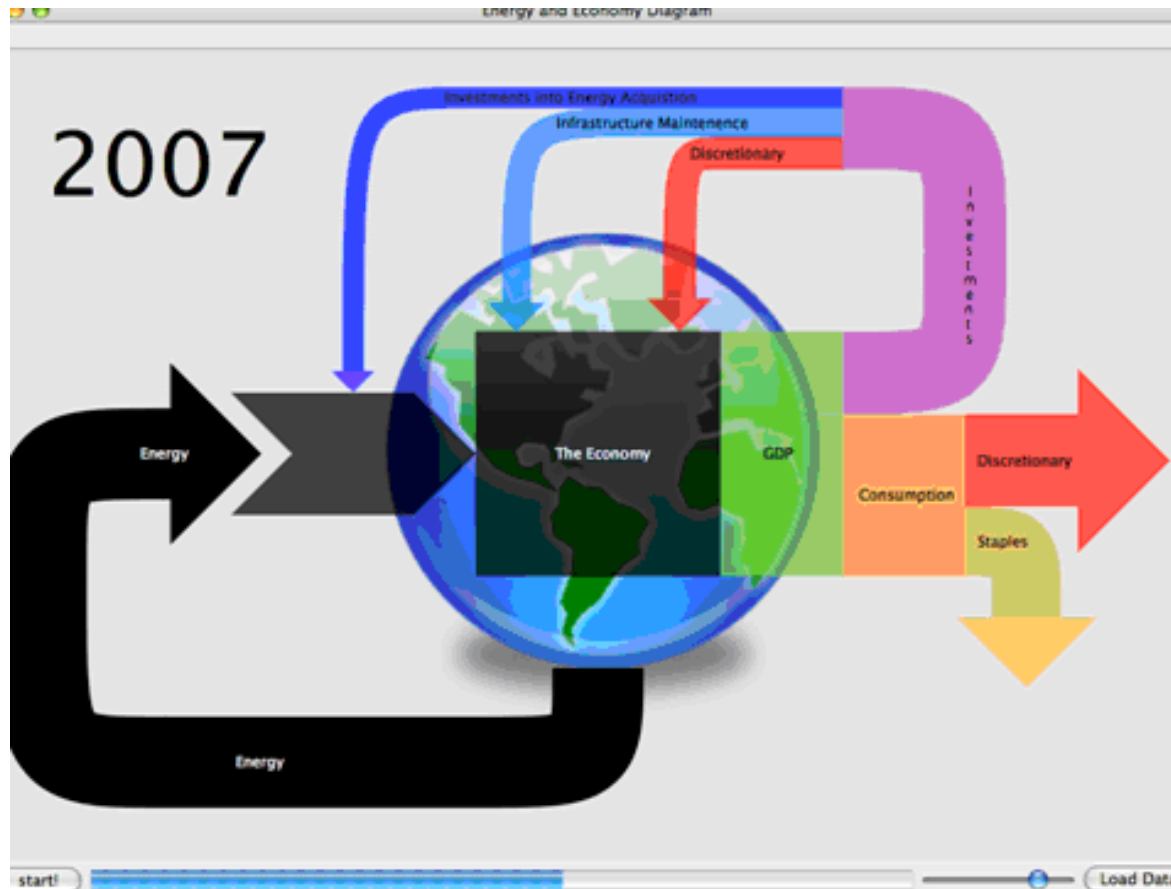
[http://aspo-usa.com/2009proceedings/Dave\\_Cohen\\_Oct\\_12\\_2009.pdf](http://aspo-usa.com/2009proceedings/Dave_Cohen_Oct_12_2009.pdf)

# How can this happen?

A huge amount of oil is available



# Prof. Charles Hall's view of feedback loops—need leftover energy for society

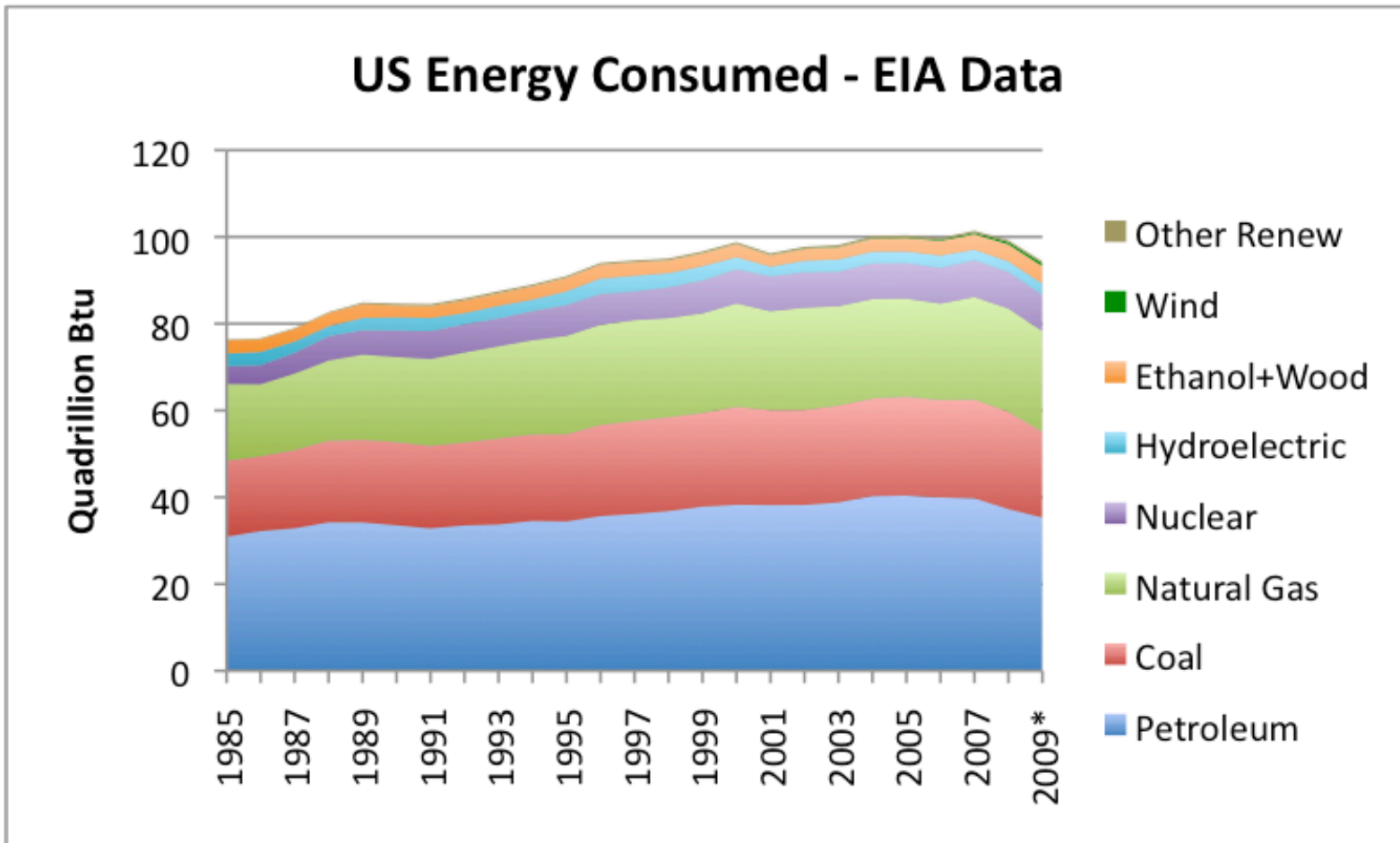


<http://www.theoilrum.com/node/3412>

# Major impacts of oil limits are financial

- Lower growth -> Hard to pay back debt
- Huge outstanding debt -> In danger of default
- Likely to affect
  - Banks
  - Insurance companies
  - International trade
- Economic growth likely to change to decline

# Renewables are tiny, high priced



# What is ahead

- In my view, a financial crash is likely
- Debt now exceeds repayment ability of borrowers, without growth
  - Municipalities
  - Laid off and underemployed workers
  - Many world governments
- Timing – probably within five years
- Likely to affect international trade

# What's Ahead – the Good News

- Carbon Dioxide emissions are likely to crash as world finances crash
  - US emissions declined 7% in 2009, according to EIA
  - With continued recession or depression, more large declines are likely



# What's Ahead – the Bad News

- Population is likely to crash as well
  - World depends on oil for food, transportation
- International trade essential for high tech items like computers
- We are now in “overshoot” in use of world’s resources
- Crash likely to play out over a fairly long time period – 20 to 40 years ???

# Climate Change

- Models assume continued exponential growth
  - Oil, natural gas, and coal
- Models implicitly assume none of the other converging crises will hit first
- Existence of climate models makes its impacts more “real”

# Climate change - Likely result

- CO2 likely to rise much less rapidly than models suggest
- World temperatures may rise
  - Hard to predict, if models wrong
- World's population likely to be much lower by 2050
  - Eventually may drop to 5% of current population

# World leaders have been aware of oil problem for many years

- Too awful to talk about
- Perhaps climate change “solutions” would fix oil limits too
- Overshoot followed by collapse is a problem in the natural world
  - Happens when a limiting resource is exhausted
  - Can be an issue for humans as well