

# Energy limits and their impact on ratemaking

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March 22, 2011

# Outline

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1. Energy issues are already affecting insurers
2. Our energy / exponential growth problem
3. Implications for ratemaking
4. Mitigations have had little impact (optional)

# 1. Energy issues are affecting insurers already

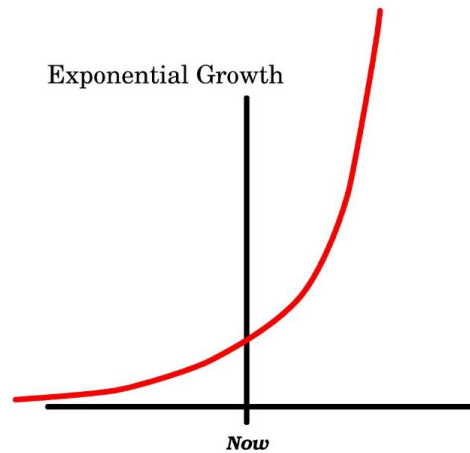
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- } Deepwater-Horizon Blowout, 2010
- } “Fracking” causing earthquakes
- } Recession of 2008-2009
  - } Auto claims down during recession
  - } Workers compensation impacts
  - } Homeowners—falling home values, unoccupied homes
  - } Reduced investment income
- } New types of coverages
  - } Solar panels
  - } Electric cars
  - } Homeowners raising chickens

## 2. Our Energy/Exponential growth problem

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- } Exponential growth is 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, exponential growth is needed

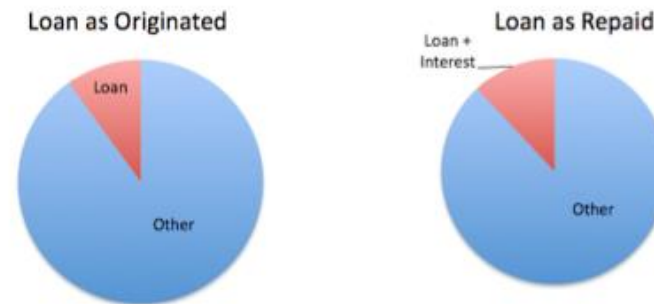
# World financial system depends on growth

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Repaying loans is easy in a growing economy



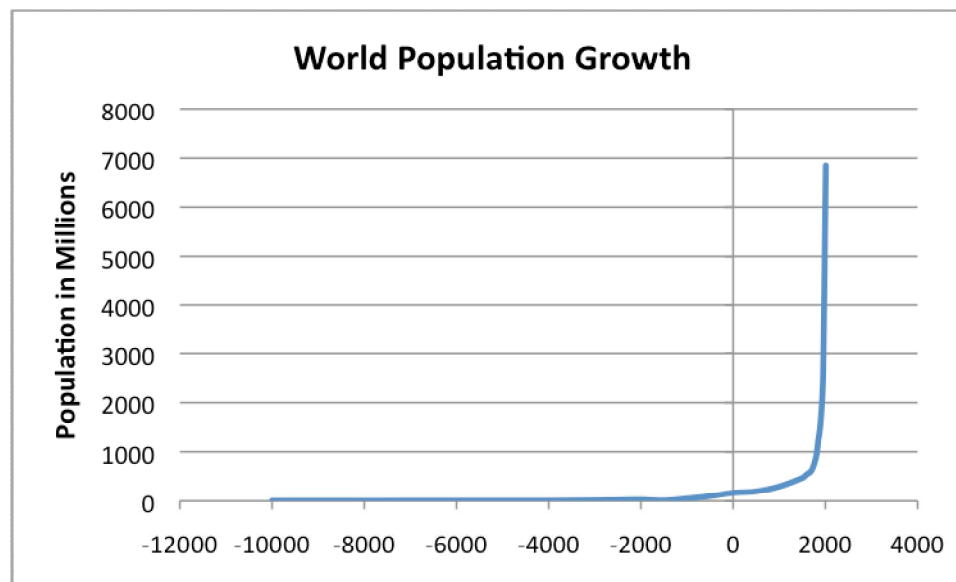
Repaying loans is much more difficult in a shrinking – or flat - economy



# Exponential Growth

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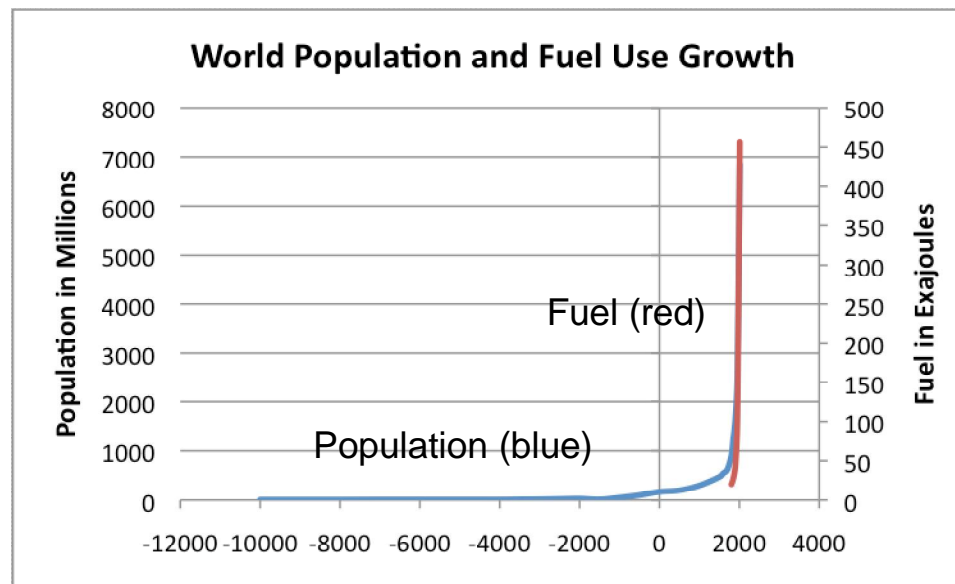
- } Also where population is trending
- } Fossil fuels enabled greater food production
- } Fossil fuels also enabled better medicine



Source: Based on data from US Census Bureau website.

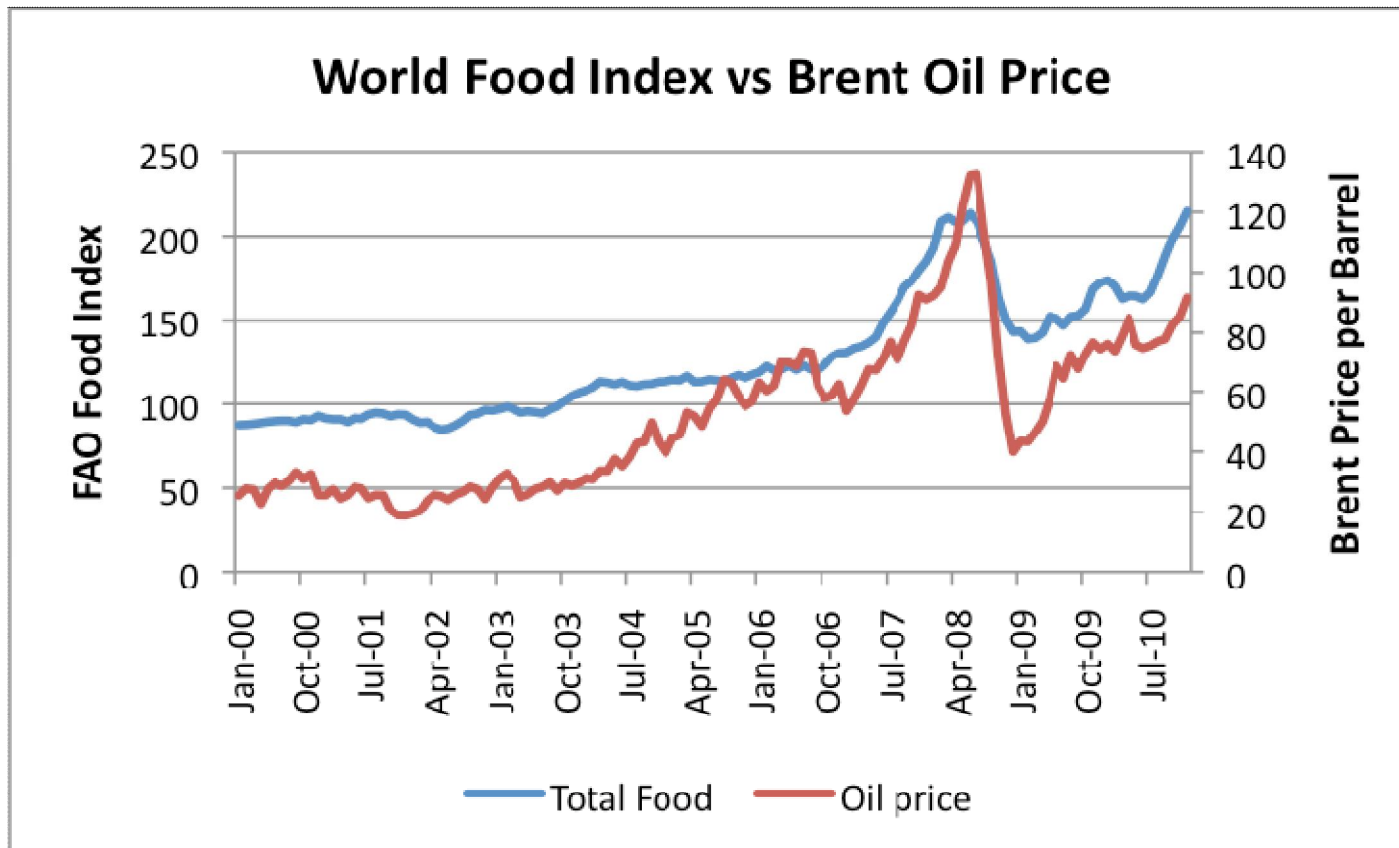
# Population growth corresponds very closely to growth in fuel use

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Note: Population from US Census Bureau website; fuel use from Energy Transitions: History, Requirements, Prospects, Appendix A by Vaclav Smil; Praeger, 2010.

# Food prices correlate closely with oil prices



FAO Food index from <http://www.fao.org/worldfoodsituation/wfs-home/foodpricesindex/en/>  
Brent spot oil price from US Energy Information Administration.



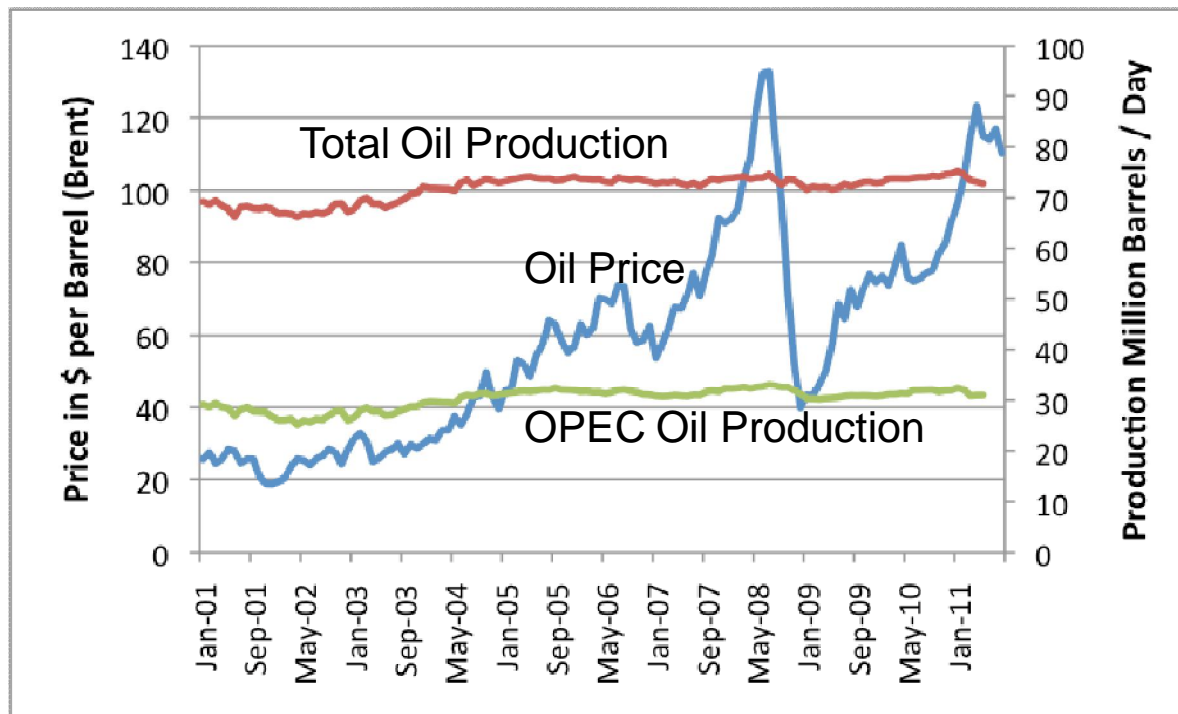
# We are reaching limits in many areas

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- } Fresh water is limited
- } Oil and natural gas become more expensive to extract
- } Ores are at 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

## One of these limits is world oil production

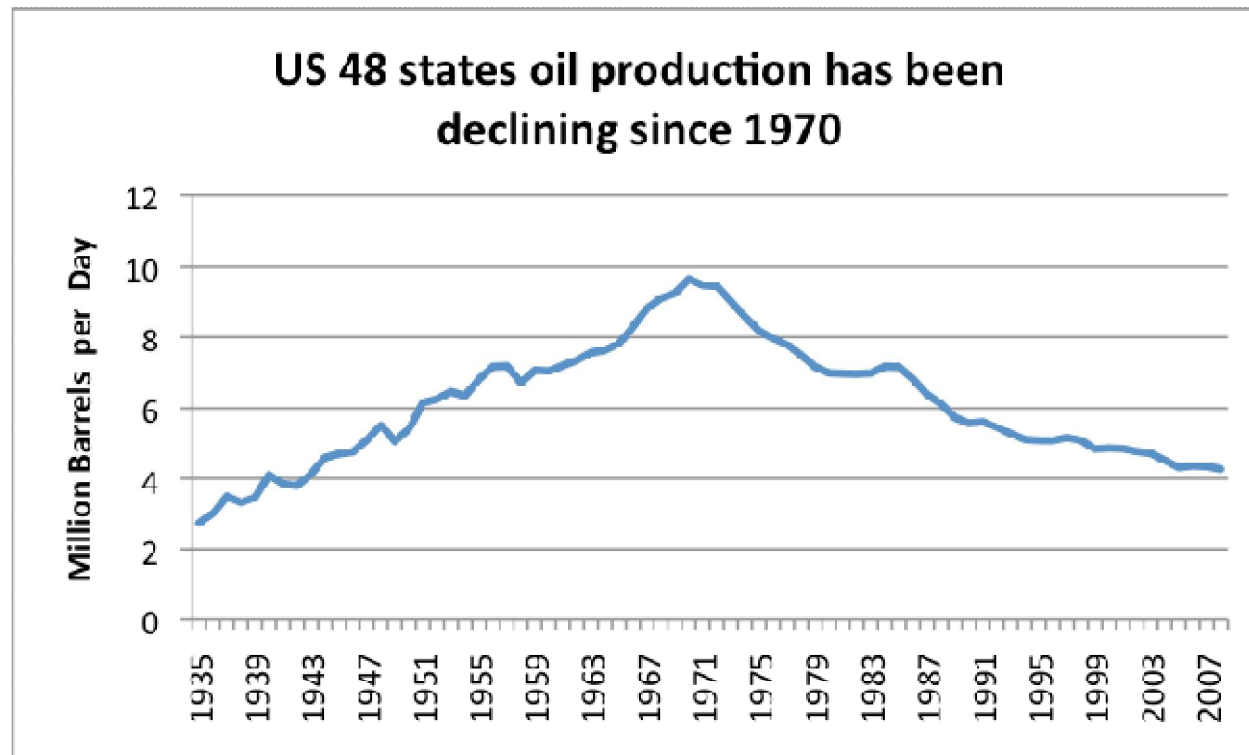
- } Oil production stopped growing in late 2004
- } OPEC didn't come to the rescue



Source: Graph based on US Energy Information Administration data

# Leveling of oil production not entirely unexpected

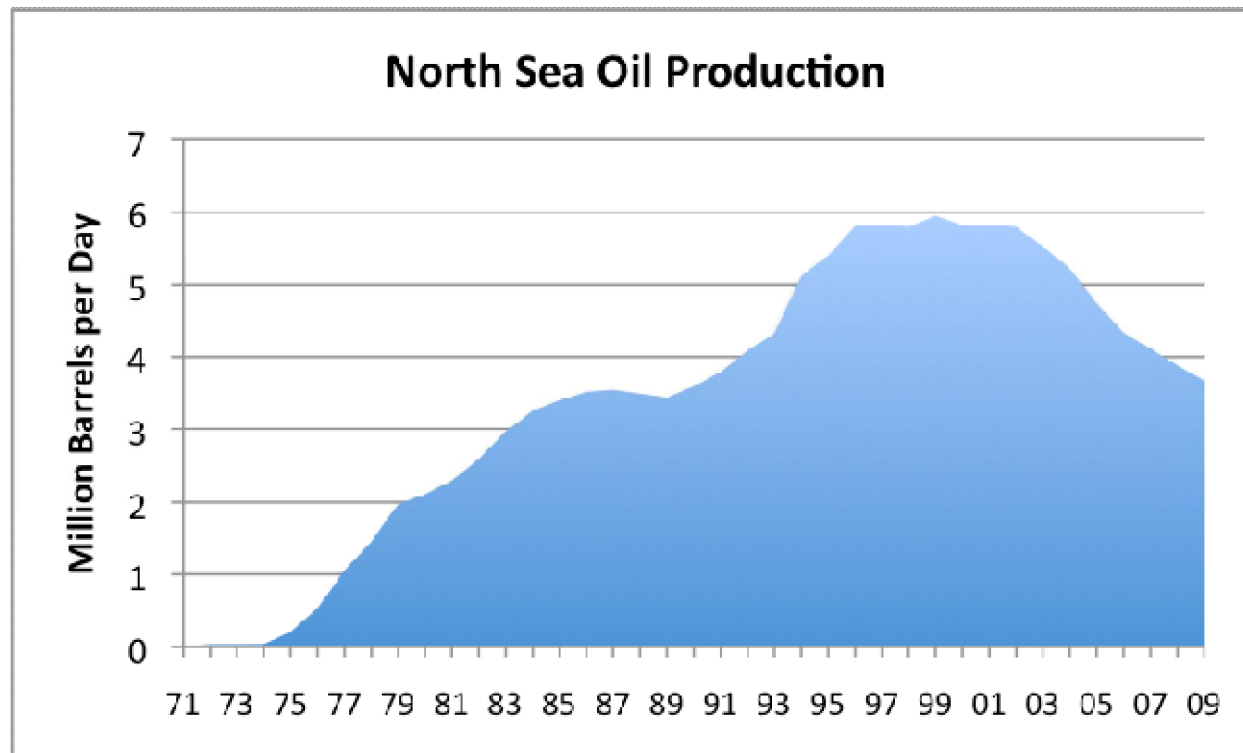
- } Oil production in many countries has reached a peak and started declining



Source: Based on data of US Energy Information Administration.

# Oil production in other areas also tends to rise and decline

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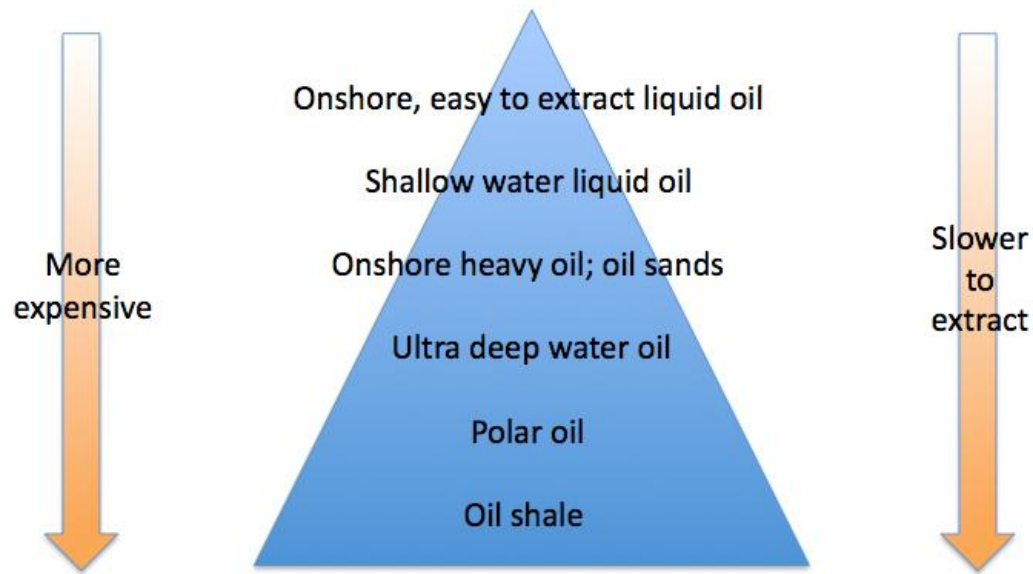


Note: Based on data of US Energy Information Administration.

# How could this happen?

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A huge amount of oil is available



## But in practice there are huge obstacles

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- } Cheap oil is mostly gone
- } Expensive oil seems to cause recession
- } Major investment needs to be made, well in advance of when oil is needed
- } Prices haven't been high enough, long enough, to support huge investment needed
- } Low-hanging fruit picked to solve 1970s crisis

# Respected authorities are talking about a possible future problem

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} But are missing the issue that we already have a current problem.



'Peak Oil' and the German Government

**Military Study Warns of a Potentially Drastic Oil Crisis**

*This post is a contribution to Honda's "Racing Against Time" thought leadership series. The Oil Drum was selected to provide a unique perspective on how we should approach the discussion of oil as a finite energy source. During the first week of*



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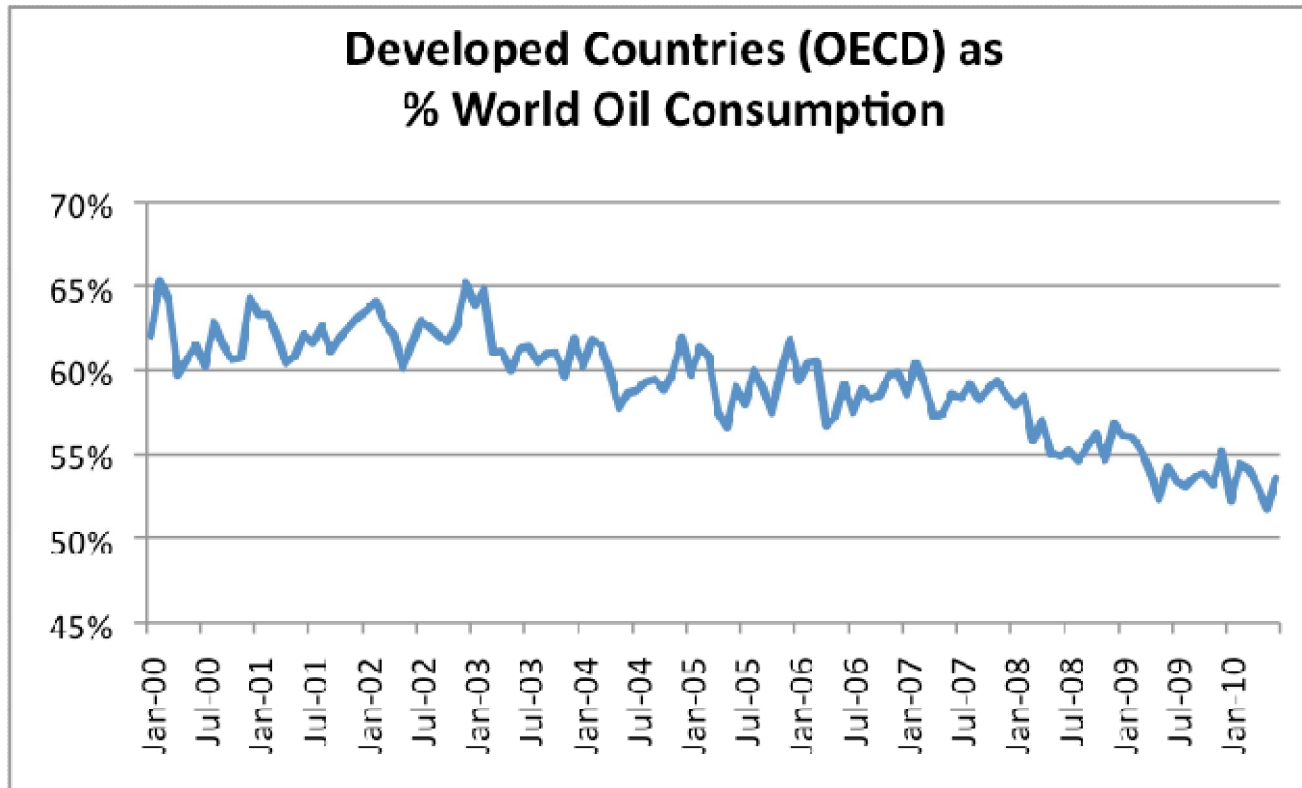
[guardian.co.uk](http://guardian.co.uk)

**US military warns oil output may dip causing massive shortages by 2015**

- Shortfall could reach 10m barrels a day, report says
- Cost of crude oil is predicted to top \$100 a barrel

# To make matters worse, China, India, and OPEC are taking more of the oil

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Source: Based on International Energy Statistics shown on EIA website



# Oil has many uses

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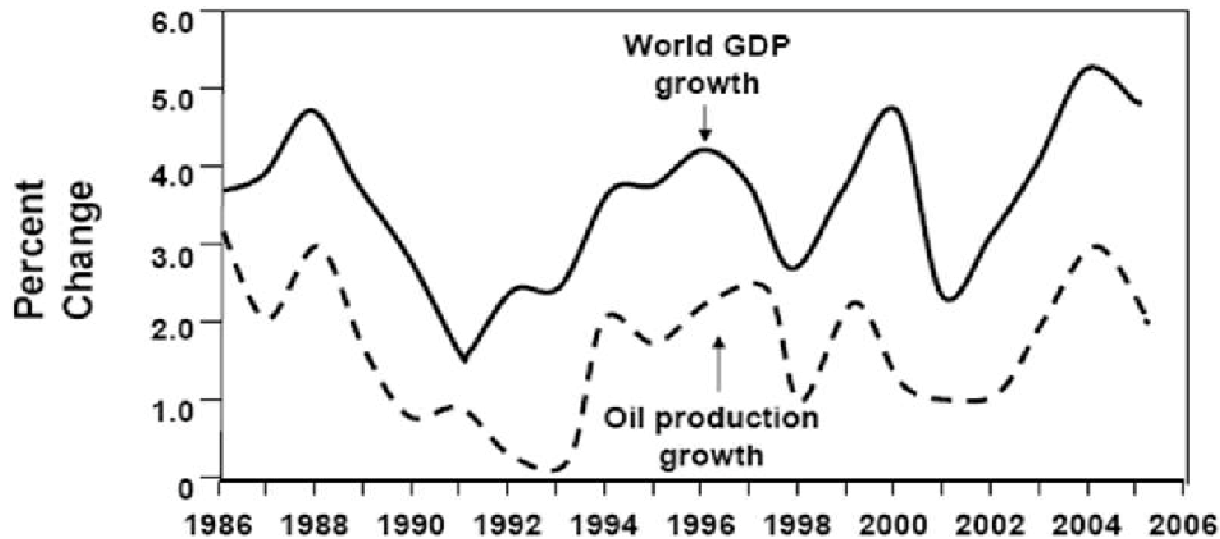
## Food Uses

- } Fertilizer
- } Pesticides
- } Herbicides
- } Diesel for tractors
- } Fast transport to market
- } Diesel for irrigation
- } Fuel for refrigeration
- } Asphalt for roads

## Other Uses

- } Medicines
- } Plastics
- } Gasoline
- } Synthetic cloth
- } Building materials
- } Easier metal extraction and working
- } Diesel for earth movers

## World GDP Growth & World Oil Production Growth Have Tracked For Decades.



For 1995-2006, Deutsche Bank calculated:

$$\frac{\% \text{ Change in World GDP}}{\% \text{ Change in Oil Supply}} \sim 2.5 \Rightarrow \text{Order of magnitude of 1}$$

Source: Robert Hirsch

# Research suggests that oil prices over \$80 - \$85 barrel cause US recessions

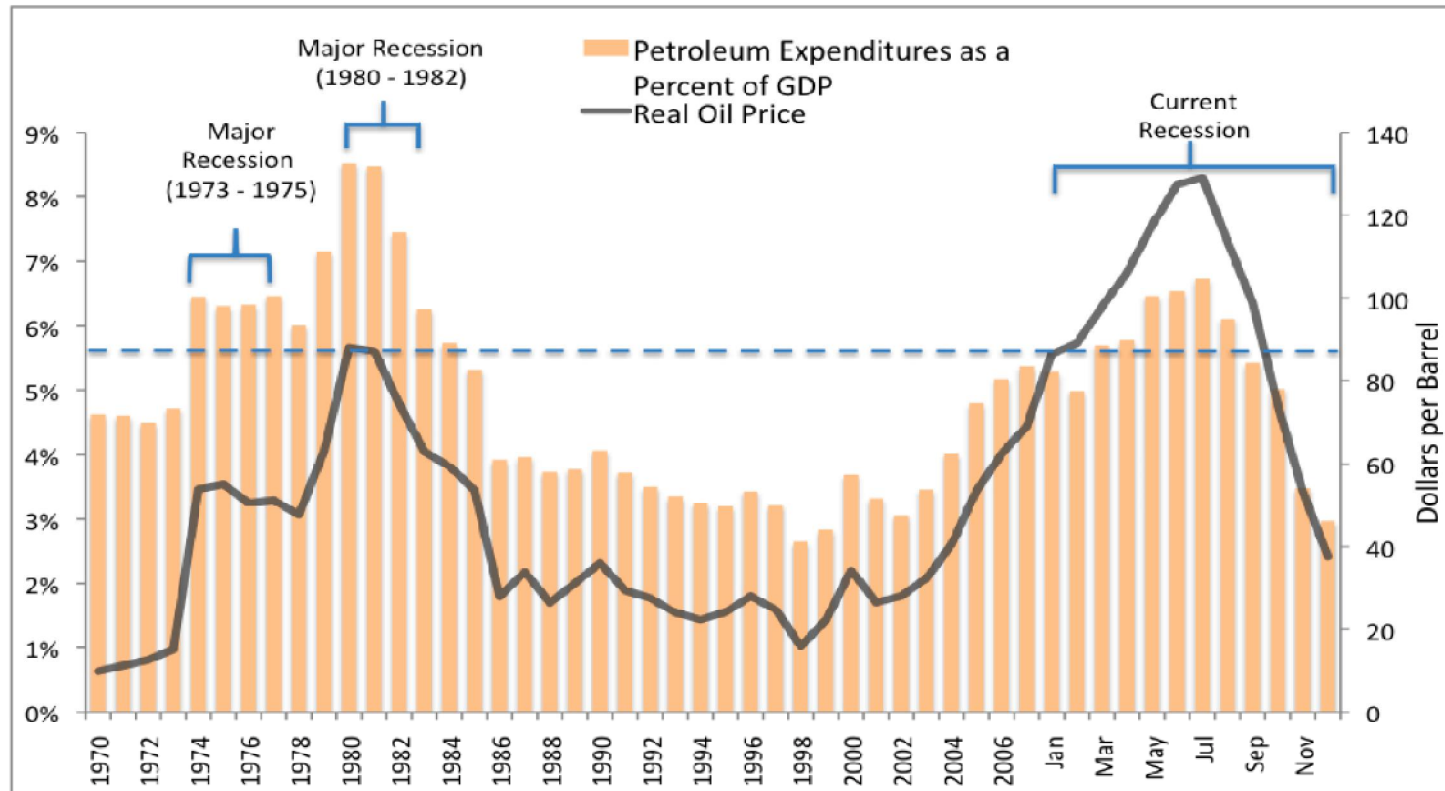


Figure 1. Petroleum expenditures as a percent of GDP in the U.S. and real oil price.

Source: David Murphy <http://netenergy.theoil Drum.com/node/5304>

# Some oil problems are hidden

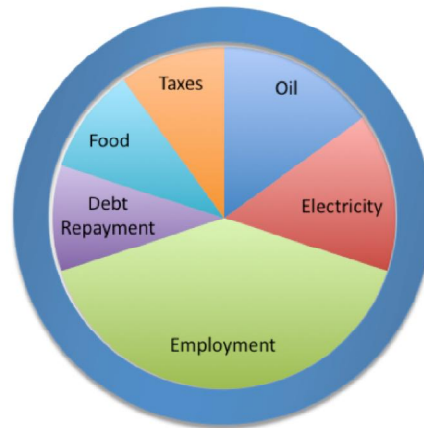
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- } Everyone expects very high prices and inadequate supply
- } Real problem: Economy cannot afford even moderately high oil prices
  - } Result looks like excessive oil supply
  - } People cannot afford the oil that is available
  - } Oil prices don't keep going higher
  - } Related to energy needed to produce the oil
    - } Can't spend more than one barrel of oil to get a barrel of oil
- } If oil prices kept going higher, substitutes and more oil would be found
- } Recession, debt defaults can also be symptoms of oil problems.

# Liebig's Law of the Minimum

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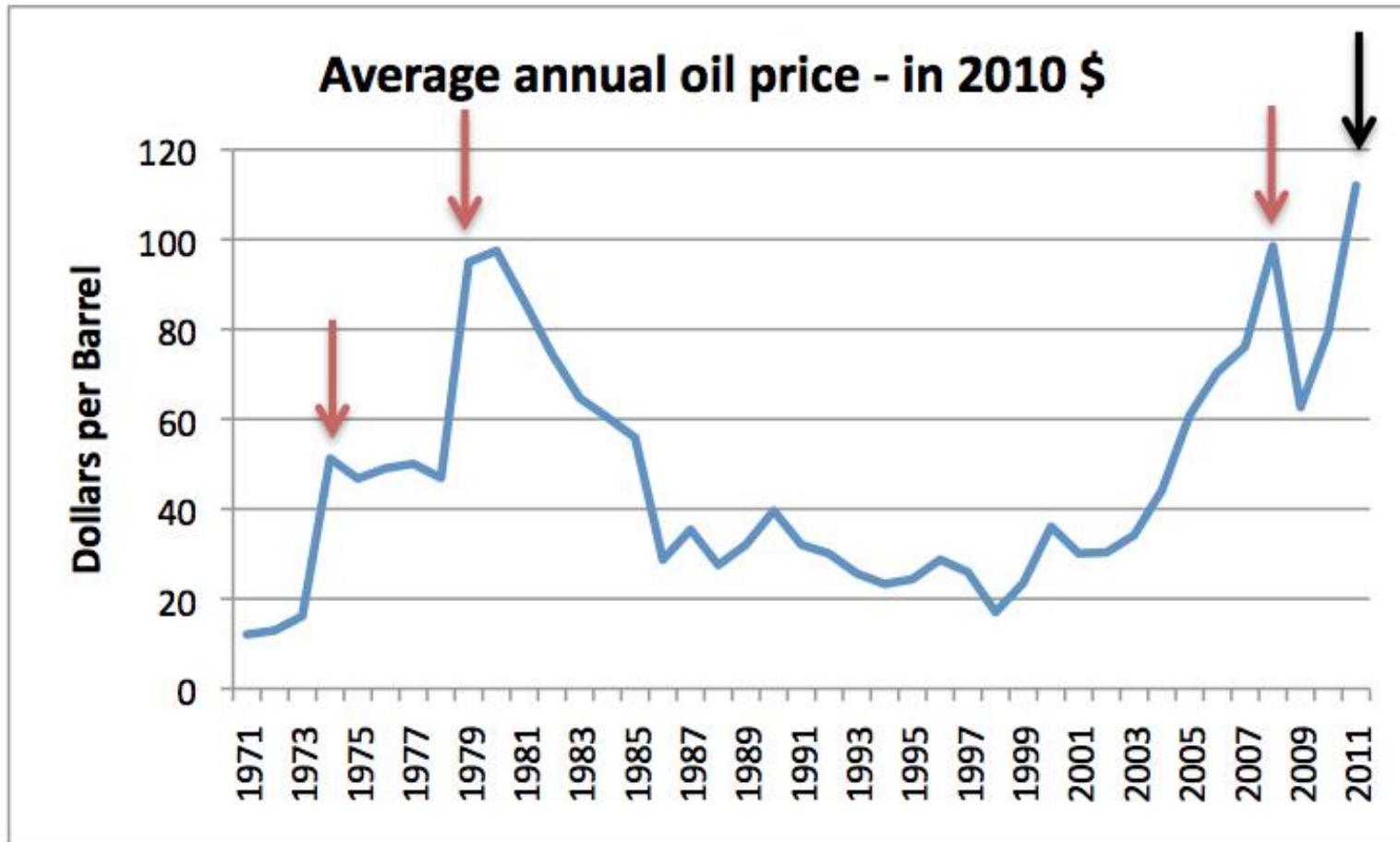
- } Agricultural yield is proportional to the amount of the most limiting nutrient
- } Chemical reactions – output limited by the reagent with smallest quantity



- } Does limited oil supply constrict economic output?
  - } High price restricts consumer's ability to purchase oil

# Recession seems likely in the near term

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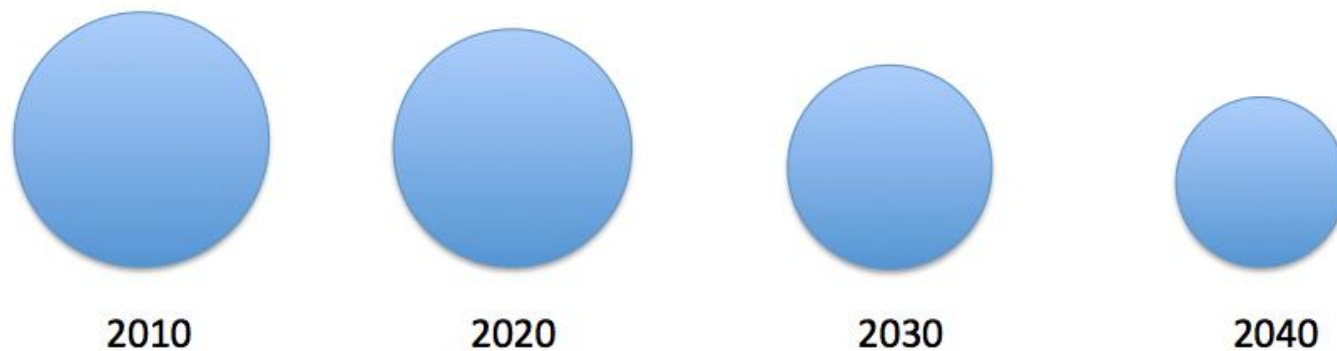
# Longer term, growth may turn to contraction

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Scenario 1: What most assume will happen



Scenario 2: Alternative that should also be considered



### 3. Implications for ratemaking

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- } Expect more recession, or recession-growth-recession
- } Expect governments to be in worse financial shape
  - } Not repair roads as well
  - } May default on their bonds
  - } May not fix damage after catastrophes
- } Expect some periods of high oil prices
  - } Affect general inflation rate, goods made with oil
- } Expect more defaults on bonds held on insurer balance sheets
  - } Difficulty with bonds likely to make long tail lines hard to write



# Implications for ratemaking (Cont.)

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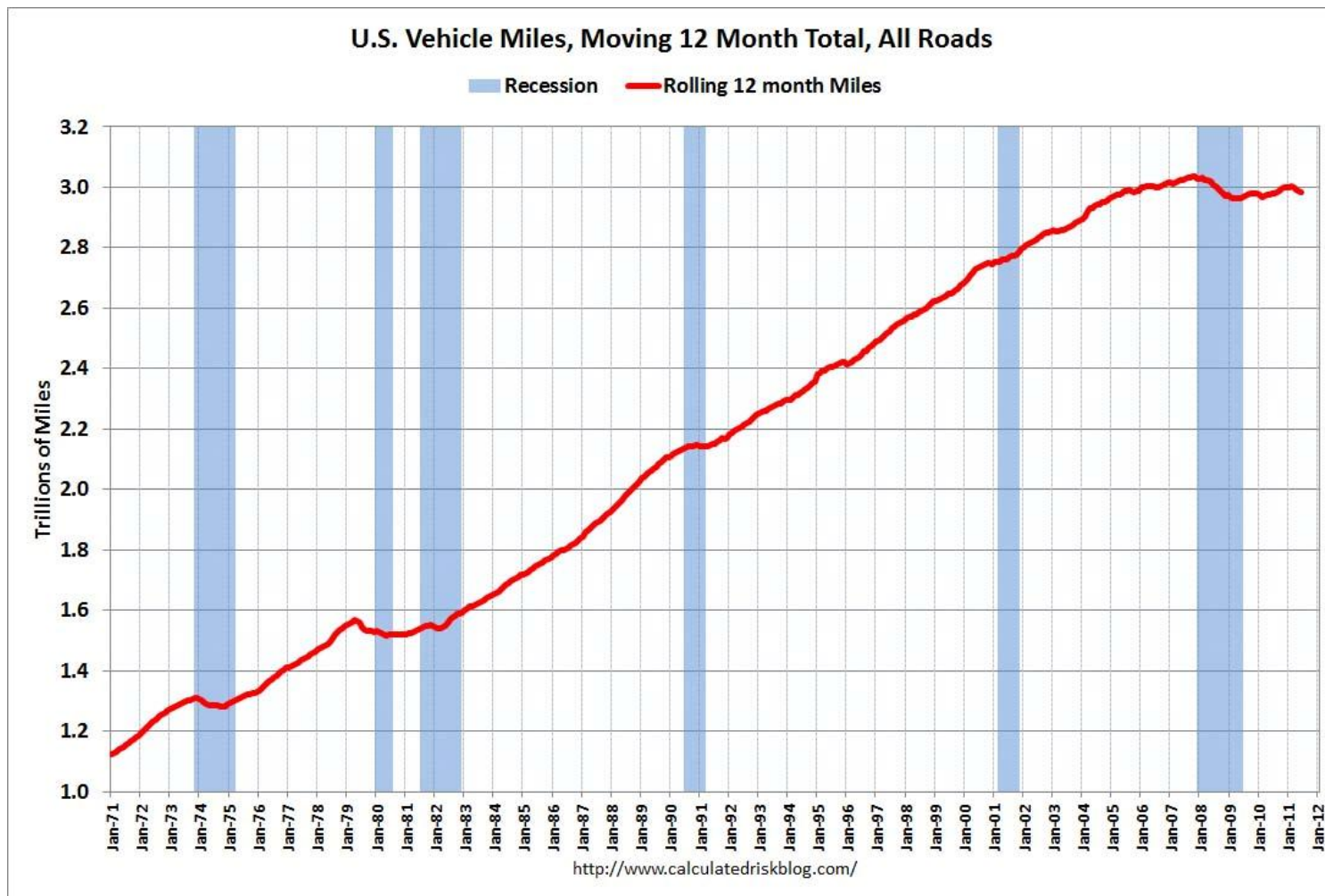
- } Many new coverages
- } Homes with Solar PV
  - } Don't want to overlook in rating
  - } May present theft risk if on the ground
- } Homes with Wind Turbines
  - } Tend to cause vibration if on top of buildings
  - } Need way to rate, if separate structures
- } Electric cars
  - } Probably very low mileage, second or third car
  - } Not attractive to thieves
- } Shared cars, boats, homes

# Implications for homeowners ratemaking

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- } House prices will stay low
  - } Defaulting loans, poor maintenance
  - } More fraud
  - } More claims due to causes like leaky roofs
- } Shift in mix toward older homes
  - } Raise average loss amount
- } Poorer homeowners may “shop” rates more
  - } Raise loss ratio
- } Crime rate may increase, due to more unemployed people
  - } But more people will be at home occupying homes during day

# Implications for Private Passenger Auto Ratemaking



# Implications for private passenger auto ratemaking (other)

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- } Deteriorating roads
- } Insureds may be more fraud prone
- } May be more theft claims
- } Auto repair costs likely to rise with the price of oil
- } Vehicle maintenance suffer
  - } Lead to more crashes (tire blowouts, etc.)
- } Governments may issue more tickets, helping auto rates.

# Catastrophe pricing

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- } Governments likely to be slower to fix roads, provide basic services
  - } Business interruption may last much longer
- } Near term (<10 year) climate change models probably OK
  - } These are what is important for pricing
  - } Longer term models assume too much oil, coal, NG
  - } What would models say with realistic assumptions?

# Ratemaking for long-tail lines

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- } Rising oil prices push up long term inflation rates
- } Defaulting bonds cause investment returns to fall
- } Long term outlook dim
- } May see return to quick payout lines

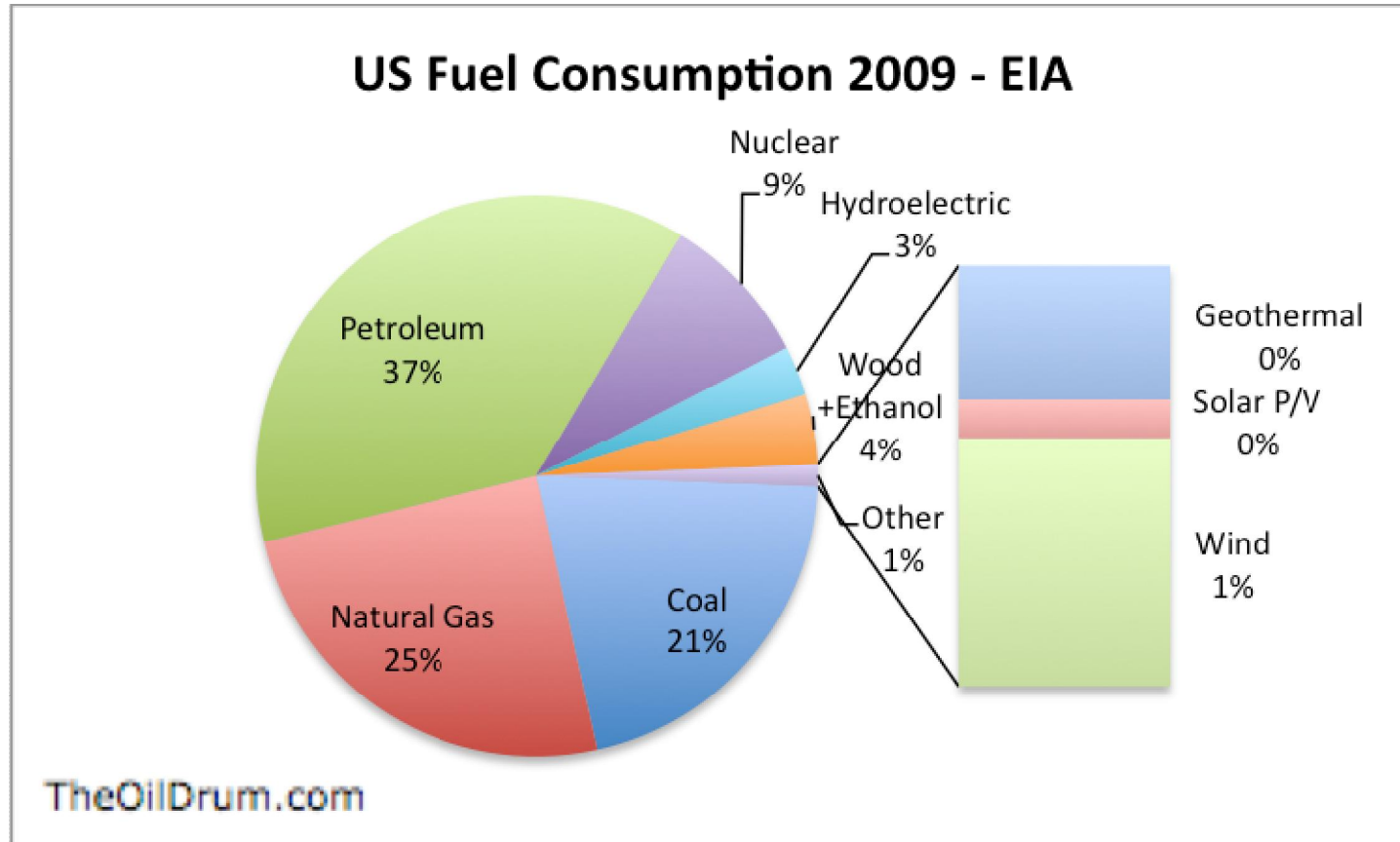
# General Impacts

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- } Some insurance companies may fail
  - } Post-insolvency assessment funds likely not to work
- } Pension plans and 401(k) plans for employees do poorly
- } Basic issue: Exponential growth cannot continue in a finite world
  - } Oil is a piece of this
  - } But so is population, water supplies, financial system
  - } A solution would be great, but it is not clear that one exists.

## 4. Mitigation has had little impact

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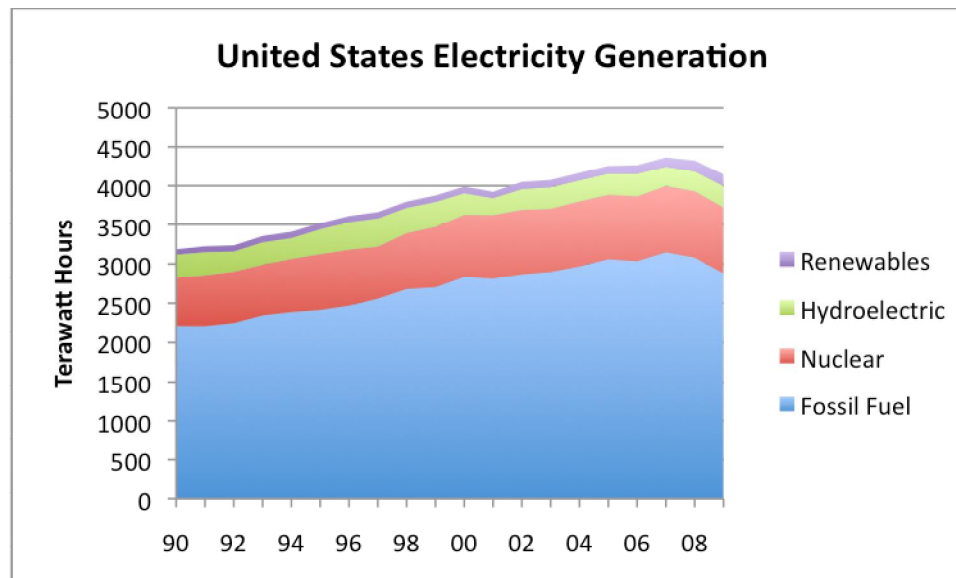




# Mitigation Issues

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- } Oil is our single largest energy source
- } There are no good substitutes for oil
  - } Wind, solar, natural gas, coal won't run today's cars
  - } Ethanol is only 2% of current energy supply
- } Even within electricity, renewables are a small share



# Renewables tend to be expensive

| IEA, Forecasted cost of electricity generation in OECD countries in 2015. All figures in <b>US dollar cent per kWh</b> | Median Costs at 5% interest rate | Cost Range at 5% interest rate | Median Costs at 10% interest rate | Cost Range at 10% interest rate |
|--|----------------------------------|--------------------------------|-----------------------------------|---------------------------------|
| Nuclear Electricity  | 5.9                              | 2.9 - 8.2                      | 9.9                               | 4.2 - 13.7                      |
| Coal Electricity   | 4.4                              | 3.6 - 8.0                      | 5.8                               | 4.9 - 10.4                      |
| Natural Gas Electricity  | 7.6                              | 5.9 - 9.2                      | 8.1                               | 6.7 - 10.7                      |
| Onshore Wind Electricity   | 9.7                              | 4.8 - 16.3                     | 13.7                              | 7.0 - 23.4                      |
| Offshore Wind Electricity  | 14.5                             | 10.1 - 18.8                    | 19.0                              | 14.6 - 26.1                     |
| Photovoltaic Solar Electricity   | 21.5                             | n/a                            | 33.3                              | n/a                             |
| Thermal Solar Electricity  | 13.6                             | n/a                            | 24.3                              | n/a                             |

Source: <http://www.theoil Drum.com/node/7275>

## To read more

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- } [OurFiniteWorld.com](http://OurFiniteWorld.com) – my own site
- } [TheOilDrum.com](http://TheOilDrum.com) – a group site I write at as “Gail the Actuary”