

Our Electricity Problem: Getting the Diagnosis Correct

Gail Tverberg from OurFiniteWorld.com – Oct. 15, 2015

Everyone believes our primary problem is climate change

- ▶ What if there is a different, major issue, facing us much sooner?
- ▶ Like treating prostate cancer in a 60 year-old patient
 - ▶ Patient also has an aortic aneurysm
 - ▶ Aortic aneurysm could kill him near term
 - ▶ Miss the second, important diagnosis
- ▶ Maybe we need to examine the situation more closely

A finite world works differently from one without limits



We are familiar with the problem with maps.
But how about economics?

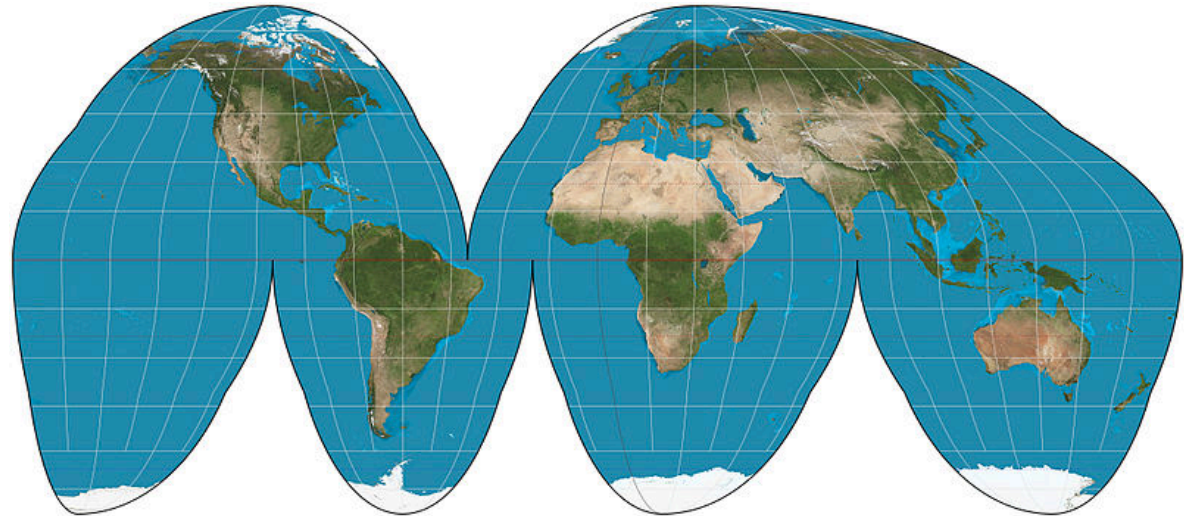


Image source: Wikipedia

Some ways limits operate

- ▶ Sailing – Circle the globe and come back to beginning

- ▶ Throw ball into air
 - ▶ Goes up
 - ▶ Then comes back down

- ▶ Star grows brighter
 - ▶ Eventually reaches limit
 - ▶ Collapses back to nothing

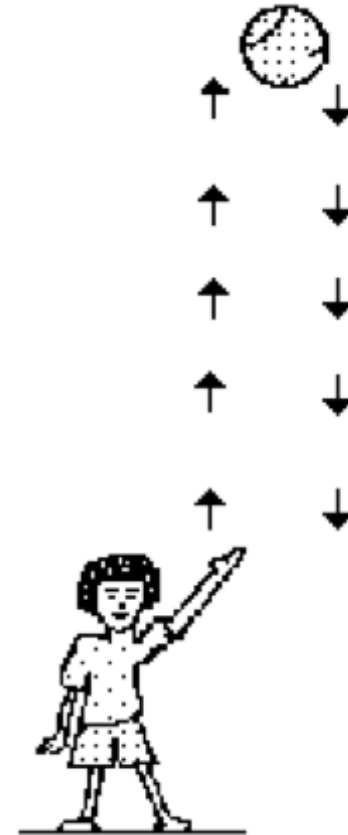
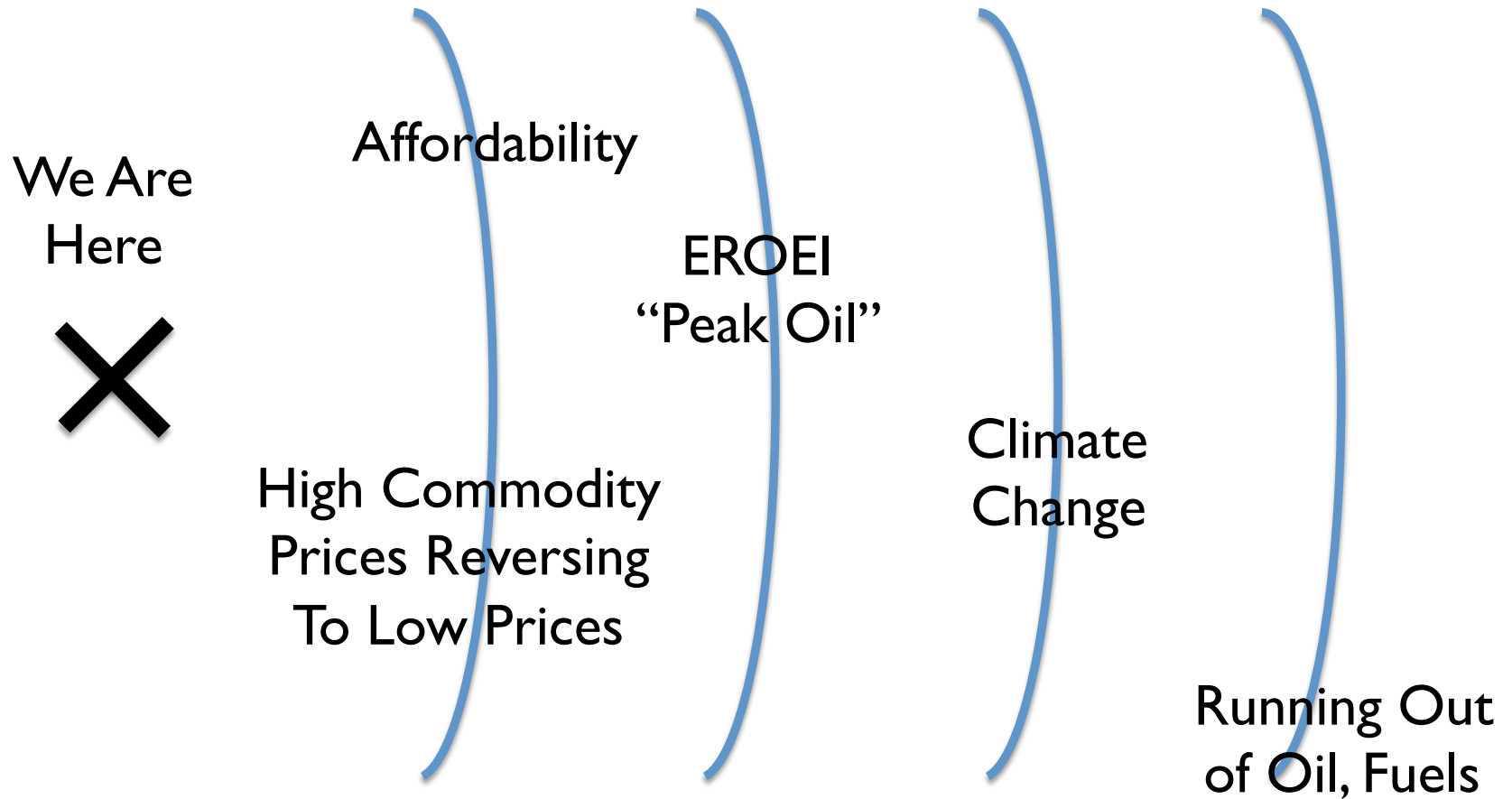


Image: J. Elfick, University of Queensland
Australia

Standard story of limits **misses the turning point**

- ▶ Assumes prices of energy products will rise endlessly
- ▶ Assumes we need to supplement high-priced fossil fuels with high-priced renewables
- ▶ Data strongly suggests that energy prices have a turning point
 - ▶ **Affordability becomes a problem**
 - ▶ Prices of commodities rise, then fall (turning point!)
 - ▶ Leads to bankruptcies of fossil fuel producers, merchant electricity producers
 - ▶ Substituting high-cost renewables makes the problem **worse**
 - ▶ **Danger is widespread bankruptcies**
 - ▶ Problems may spread to overall financial system, international trade

Affordability is the **first** energy-related limit of a finite world



Customers must be able to **afford** goods that use commodities

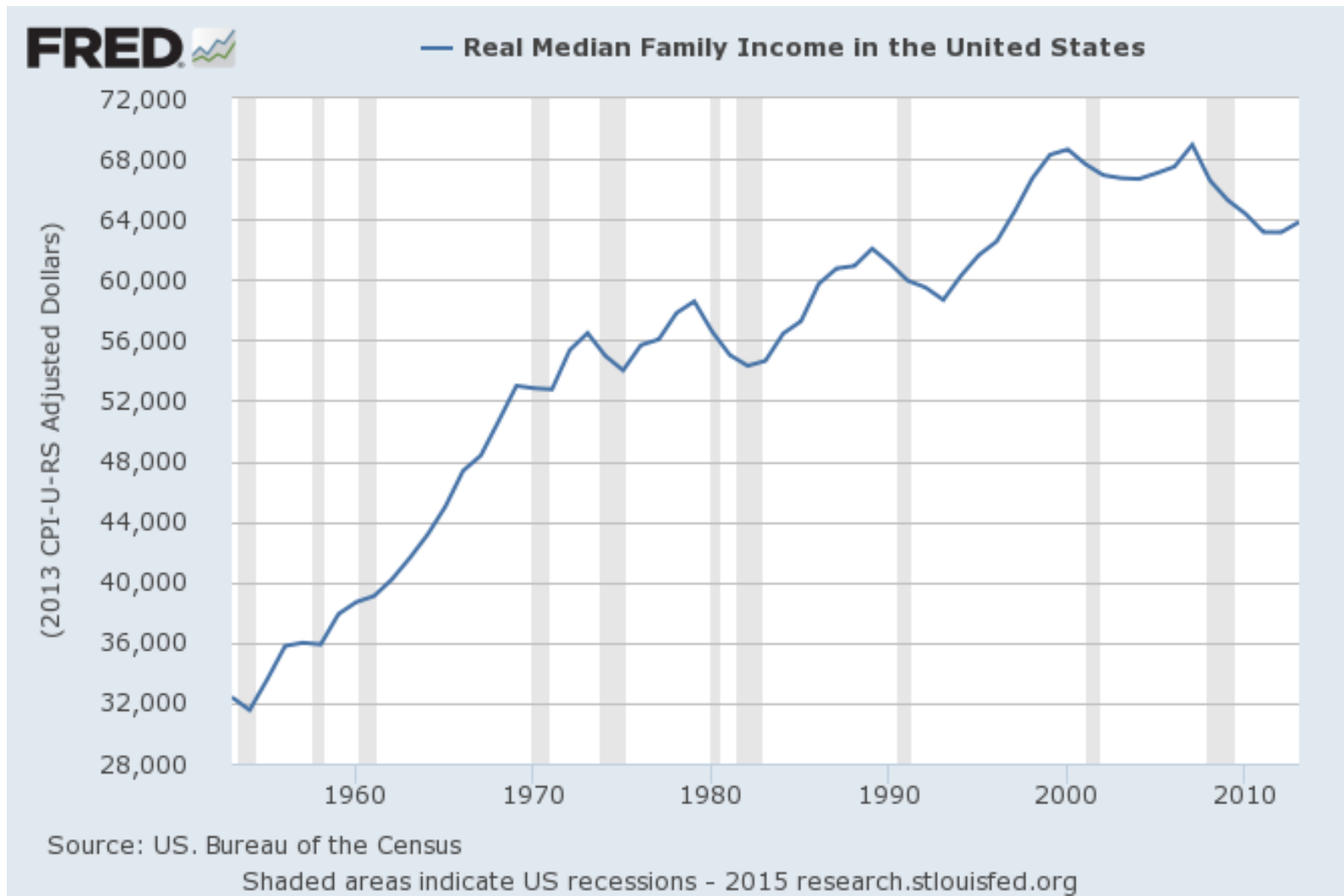
- ▶ **Examples**

- ▶ Homes
- ▶ Cars
- ▶ Schools
- ▶ Factories
- ▶ Roads

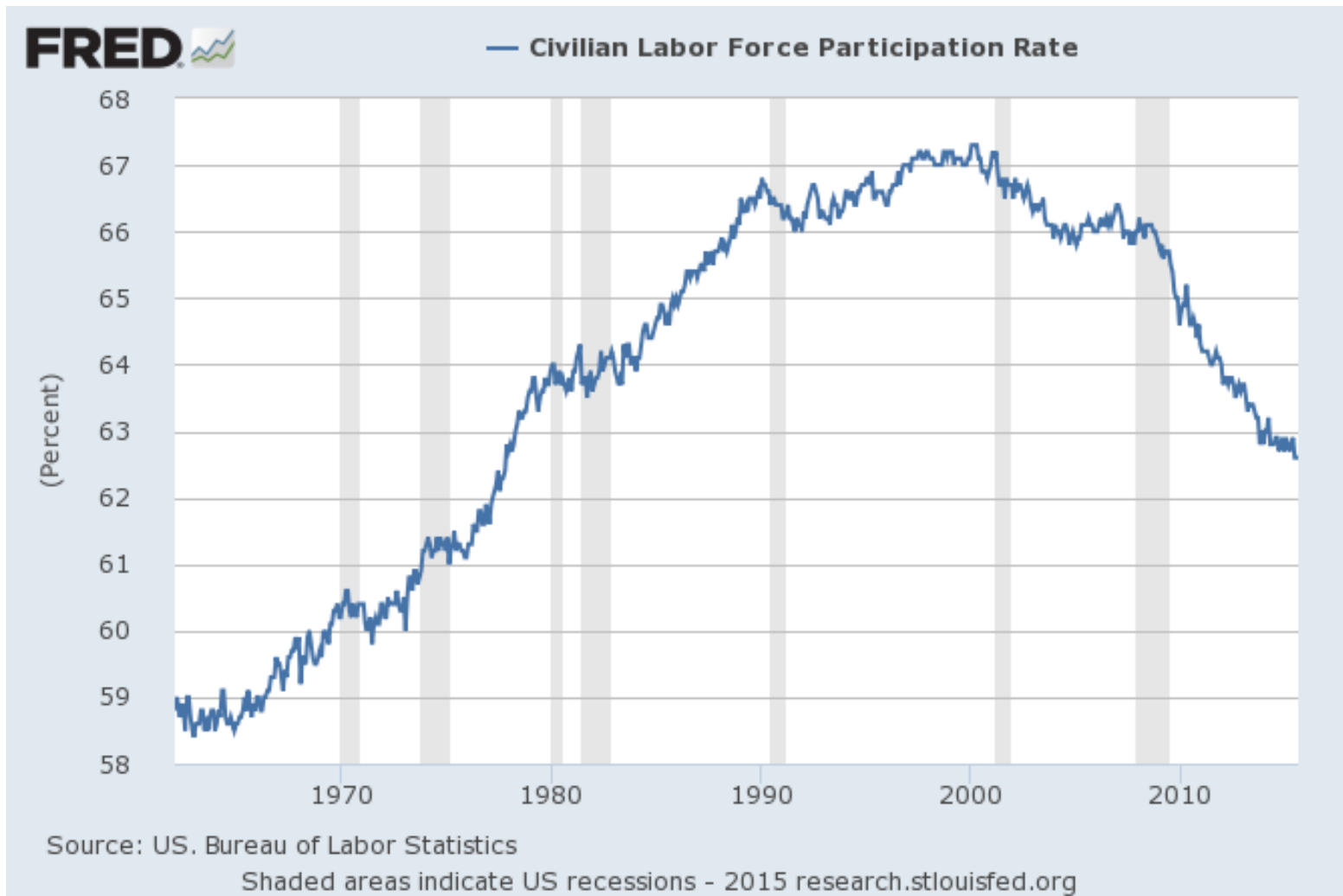
- ▶ **Being able to afford these goods depends on**

- ▶ Enough workers, earning high enough wages
- ▶ Availability of debt

Family income has been falling since 2007, dipped between 1999 and 2007

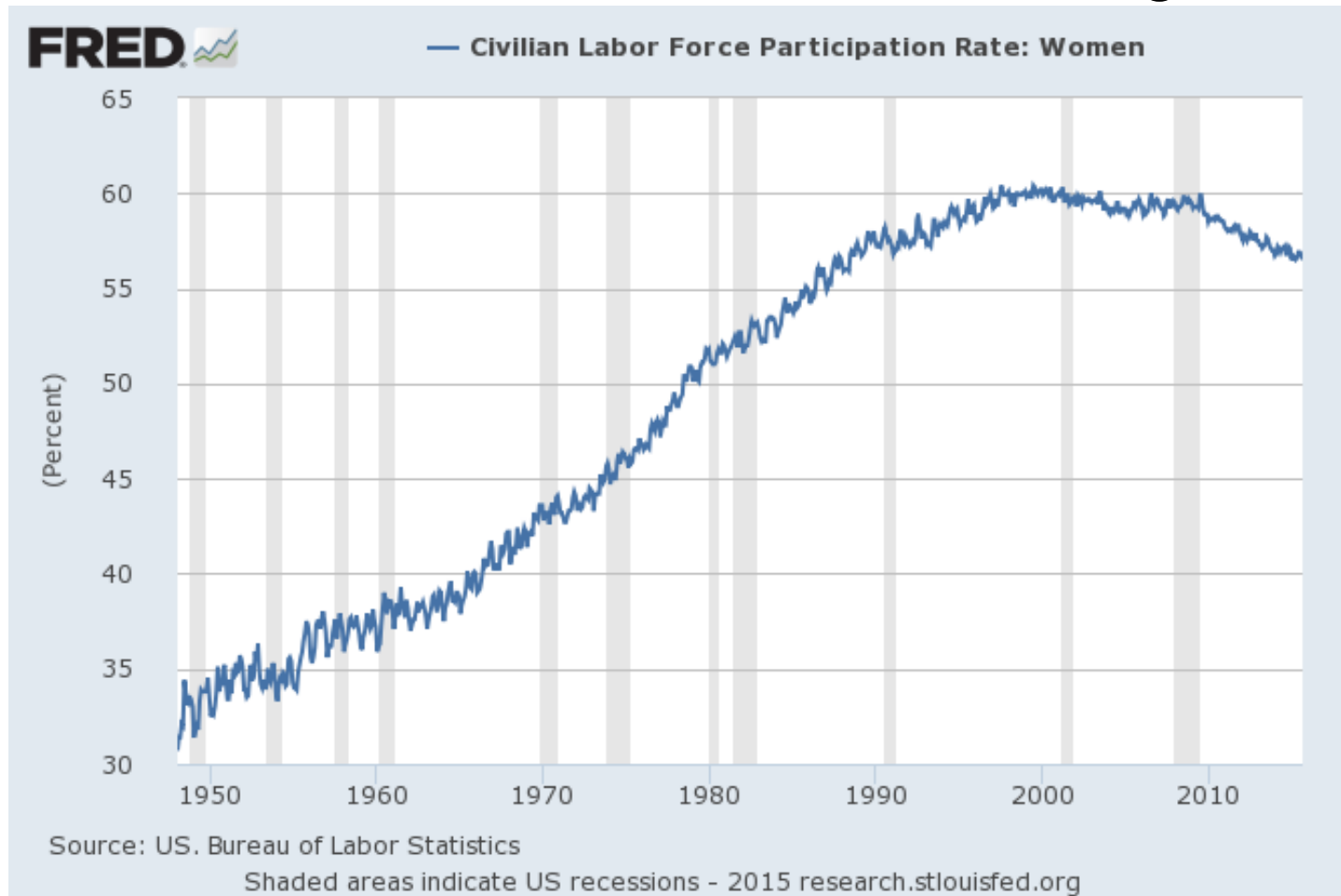


Labor force participation rate has been falling since 2000

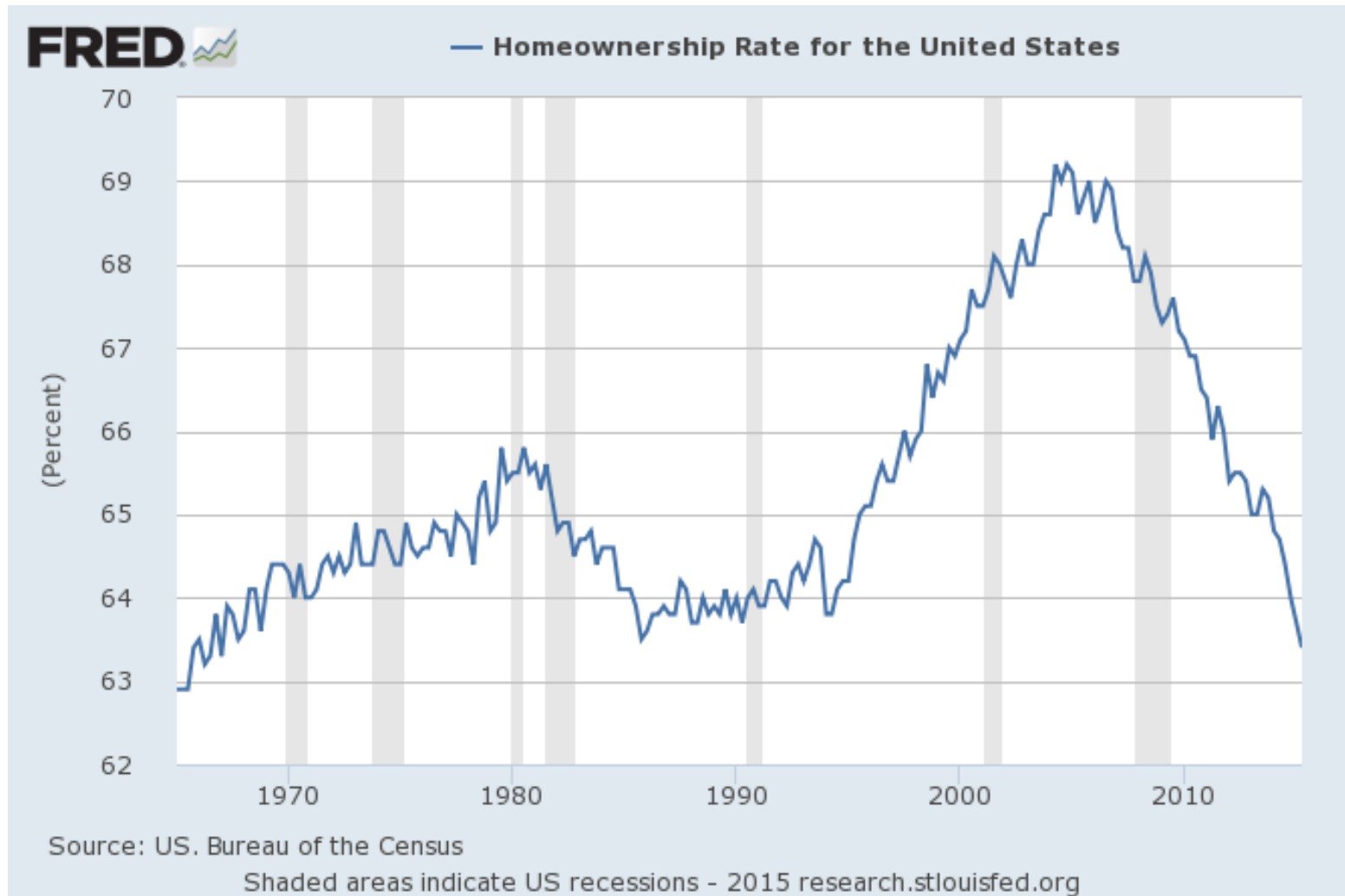


Share of women in labor force grew until 1999; downward trend since 2008

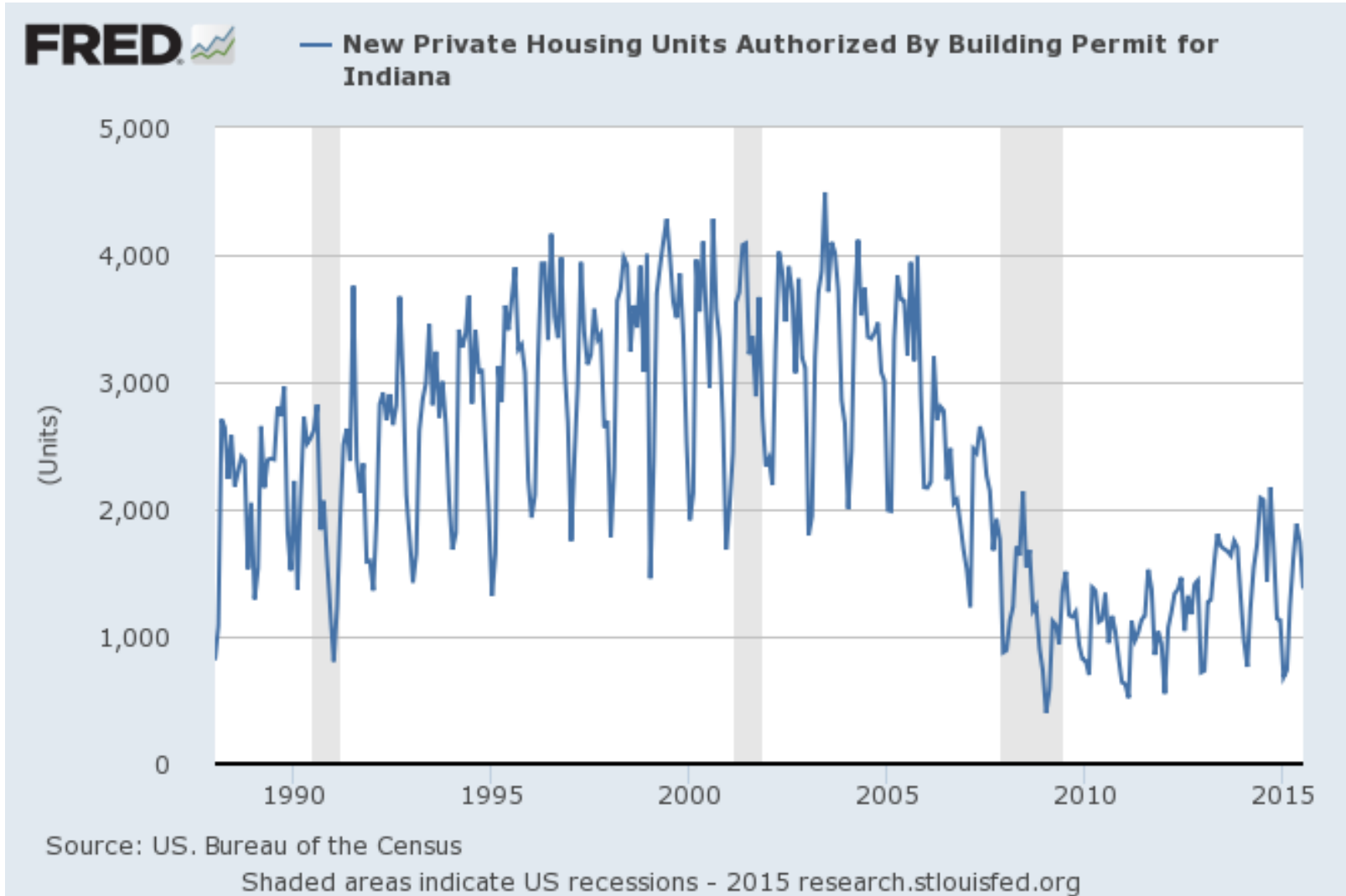
- ▶ Childcare became unaffordable as median wages fell?



Home ownership rates are down

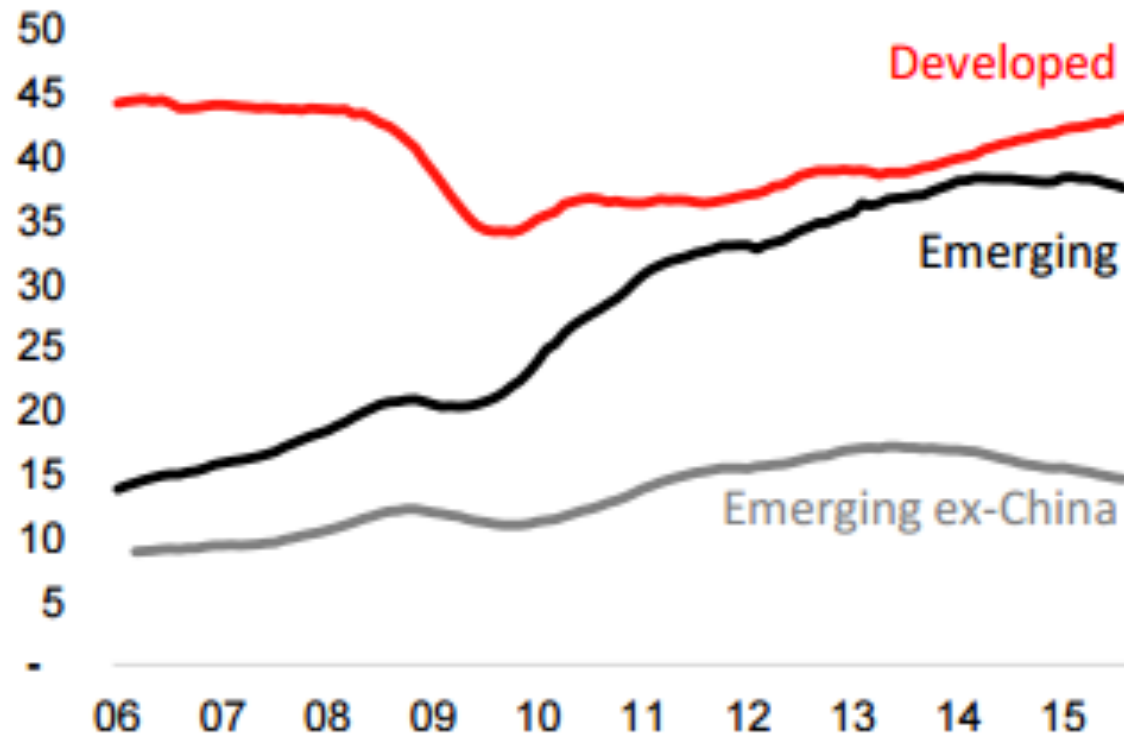


Number of new homes is down (Indiana)



Auto purchases are rising in the United States, but falling worldwide

Fig 4 Car sales, rolling 12m total, million units

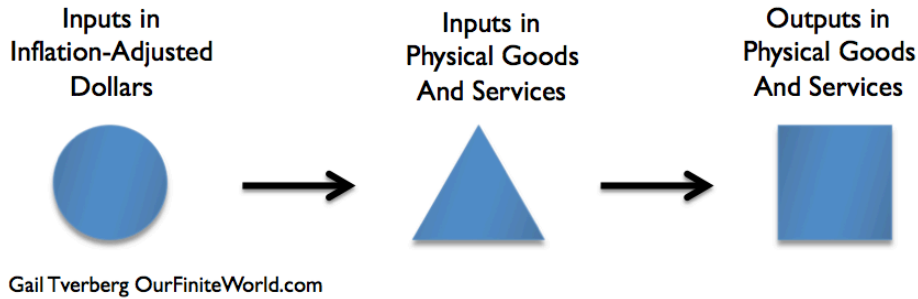


Source: National data, Macquarie Research, September 2015

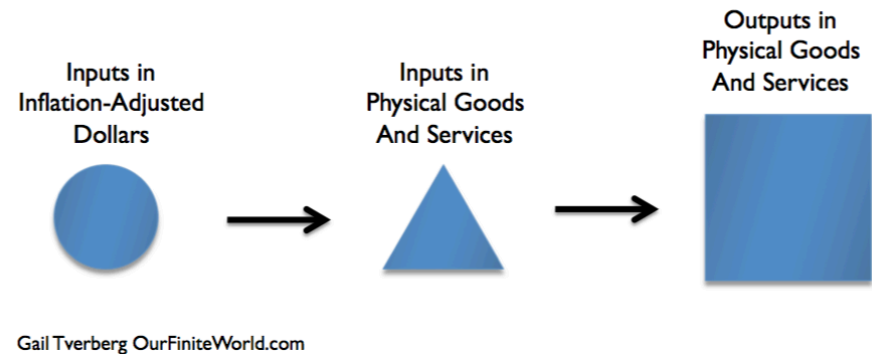
Source: [http://www.macrobuare downsiness.com.au/2015/09/global-car-sales-roll-over/](http://www.macrobuare.com.au/downsiness.com.au/2015/09/global-car-sales-roll-over/)

Increased efficiency => economic growth; Growing inefficiency => economic contraction

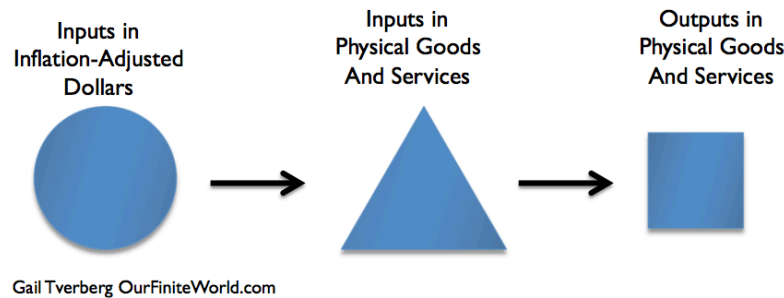
Base Case



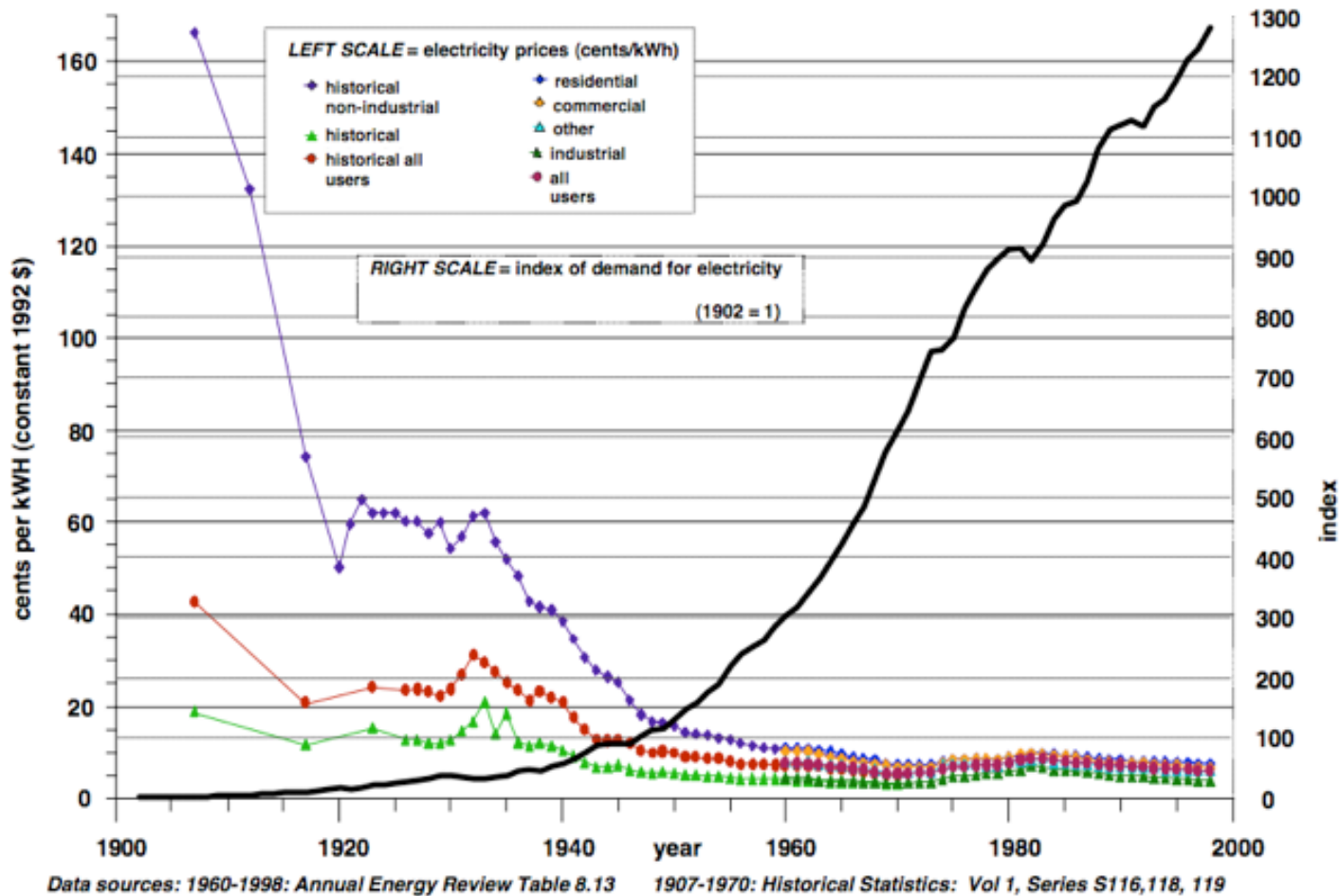
Increased Efficiency



Growing Inefficiency

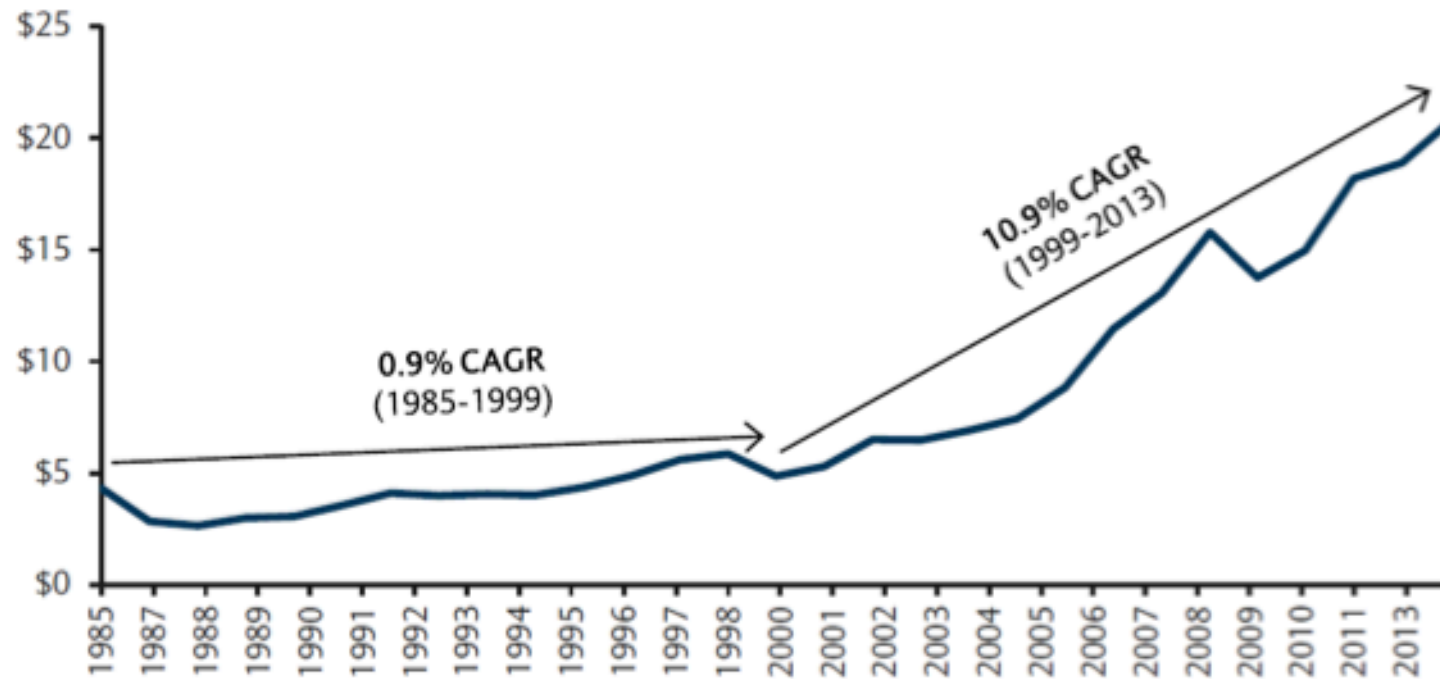


Growing efficiency of electricity production, 1900 – 1998, contributed to econ. growth



Source: R. Ayres and B. Warr, Accounting for growth: the role of physical work.

Big turn around in oil extraction costs, starting about 1999, source of inefficiency



Source: IEA, Barclays Research

E&P Capex per Barrel

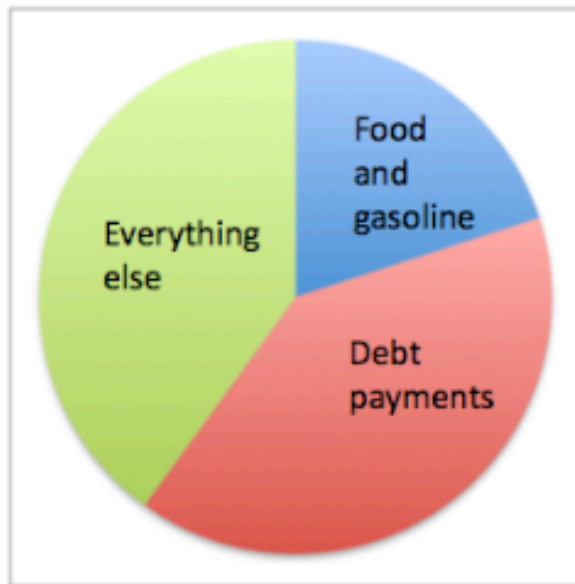
Source: Barclays Capital

Note: CAGR = Compound Annual Growth Rate, Image by Steve Kopits of Westwood Douglas

Higher energy costs of any kind squeeze budgets

Theory says oil price can increase—
but our pocketbooks disagree

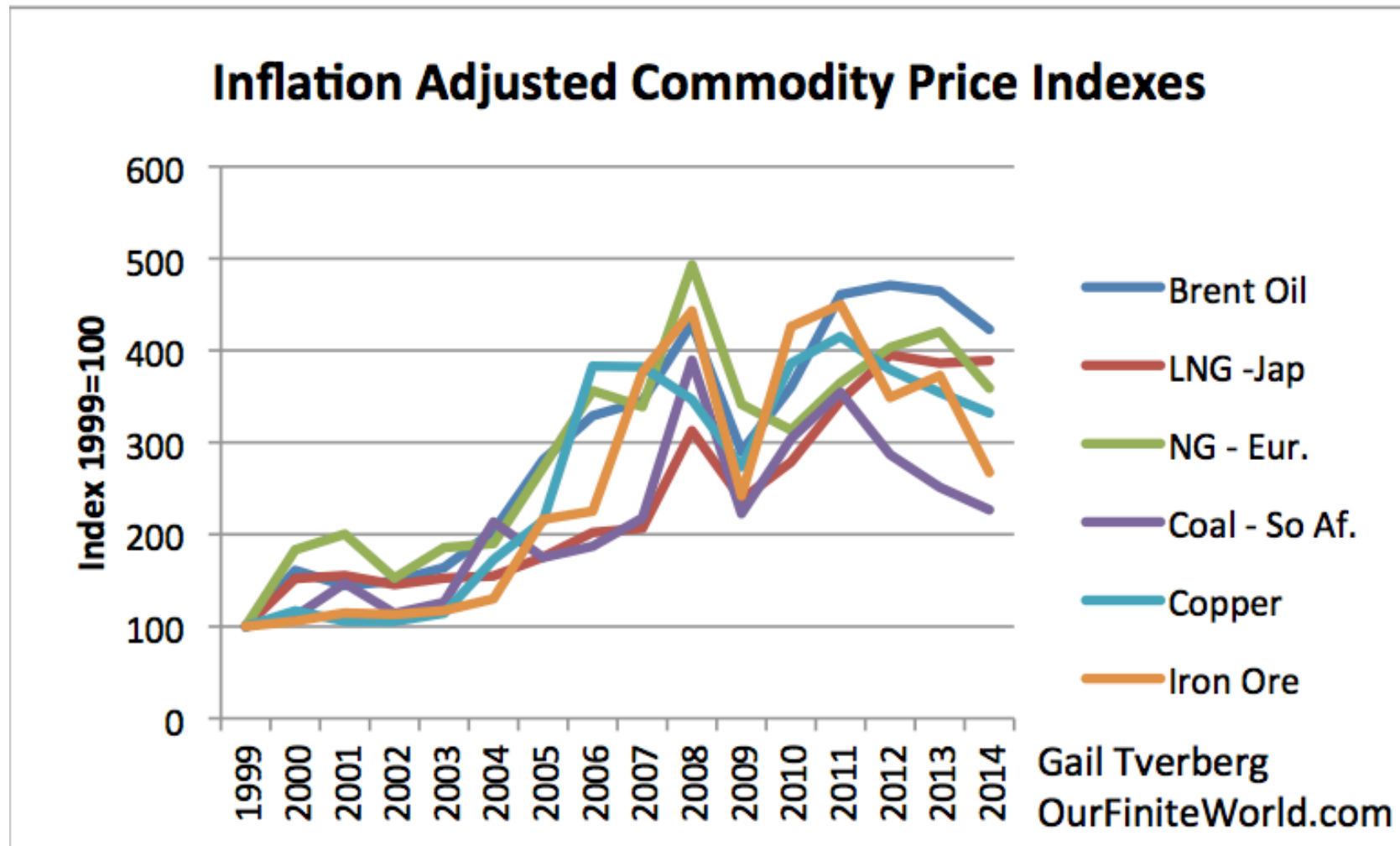
Low oil price budget



High oil price budget



Falling affordability affects all commodities at once – including natural gas and coal



Based on IMF Pink Sheet data.

Other factors besides rising energy costs contribute to falling affordability

- ▶ Rising “overhead”
 - ▶ More higher education, at high cost
 - ▶ Higher cost of medical care
 - ▶ Growing share of elderly
- ▶ Diminishing returns for other than energy
 - ▶ Fresh water—need desalination
 - ▶ Metals – require use of lower quality ores
 - ▶ Fish – catch larger number of smaller fish
 - ▶ Pollution control – more use of high-priced renewables
- ▶ Reduced wages due to globalization; automation

Implications for natural gas and electricity

1. Don't expect much growth in future natural gas supply

- ▶ Problem is low prices, because of affordability issues
 - ▶ No reason for affordability to get better
- ▶ Low price problem widespread
 - ▶ In the US
 - ▶ In Europe and Japan, for US imports
- ▶ Expect most natural gas to stay in the ground, forever
- ▶ **Don't expect a coal to natural gas transition**
 - ▶ Can't get the price up high enough, long enough

Henry Hub natural gas price history shows prices lower after 2008

Henry Hub Natural Gas Spot Price

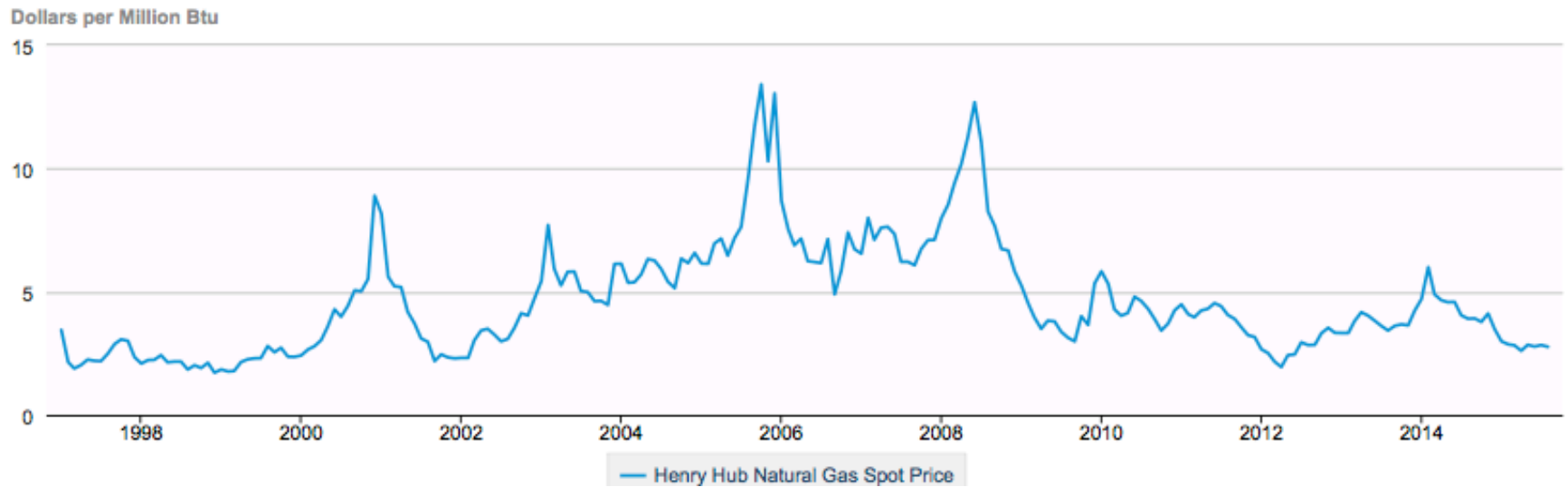
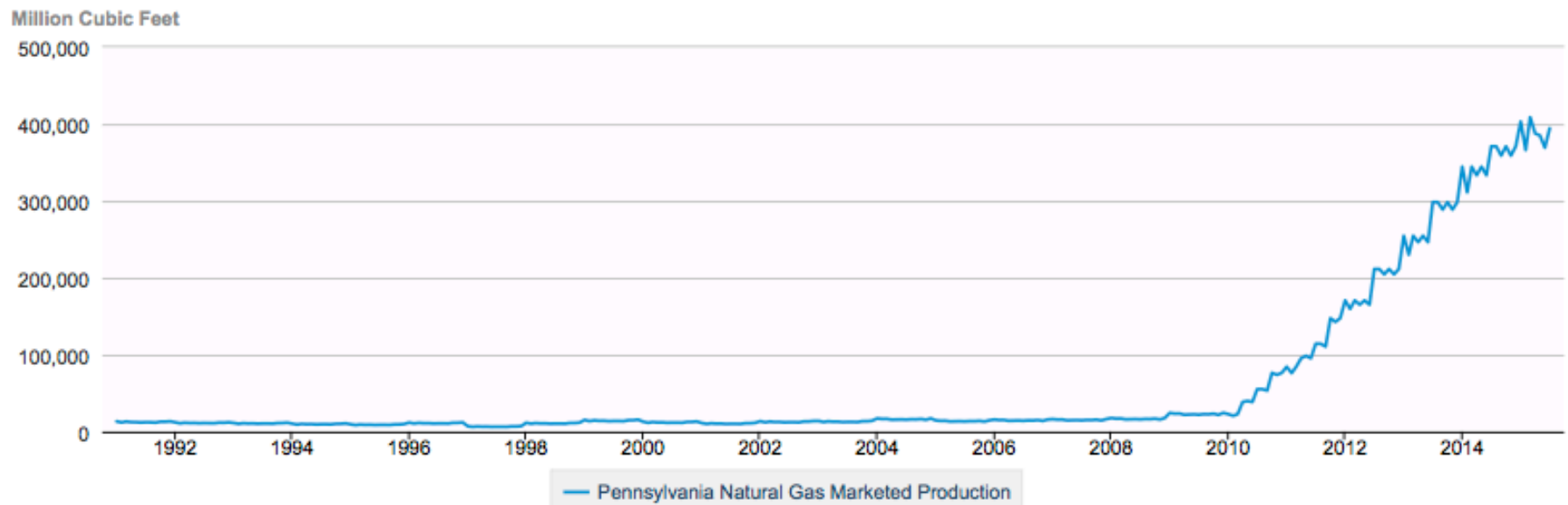


Chart by US Energy Information Administration Oct. 6, 2015

Pennsylvania (Marcellus Shale) production seems to be “topping out” – low prices

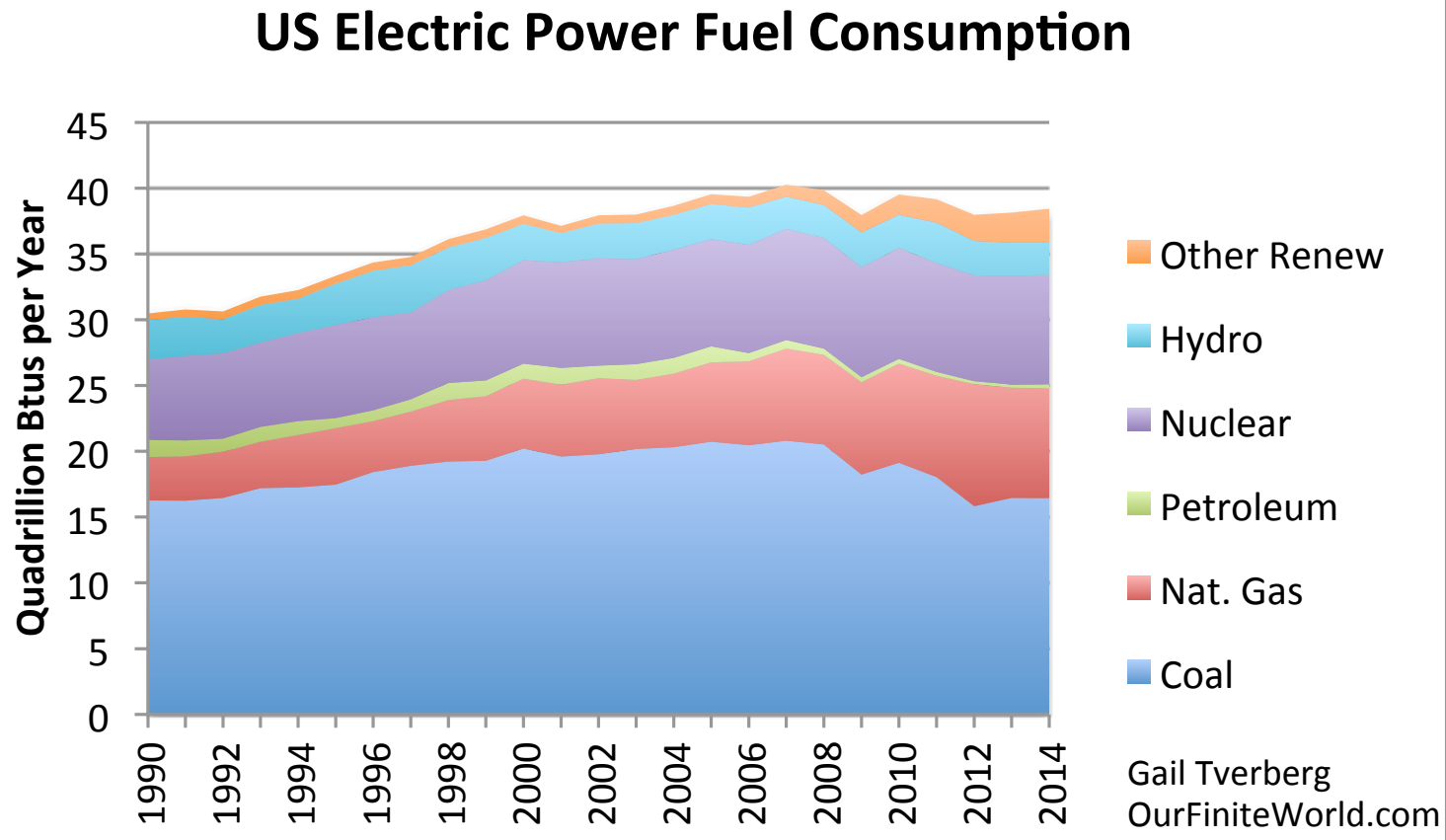
Pennsylvania Natural Gas Marketed Production



Note: Chart prepared by US Energy Information Administration

2. Expect use of coal to continue to decline in US electricity generation.

- ▶ Coal declined from 53% of total to 43% since 2004.



Based on US EIA data.

Coal prices are too low for most producers

- ▶ One cause—falling Chinese coal imports
- ▶ Bankruptcies likely
 - ▶ Alpha Natural Resources – already
 - ▶ Patriot Coal
 - ▶ Arch Coal
 - ▶ Glencore (international impact)
- ▶ Little reason for price condition to get better
 - ▶ Affordability of end products (houses, etc.) basic issue
 - ▶ Also over-production in face of falling demand
 - ▶ Derivatives, debt distort production incentives

3. Expect coal and natural gas supply difficulties because of bankruptcies.

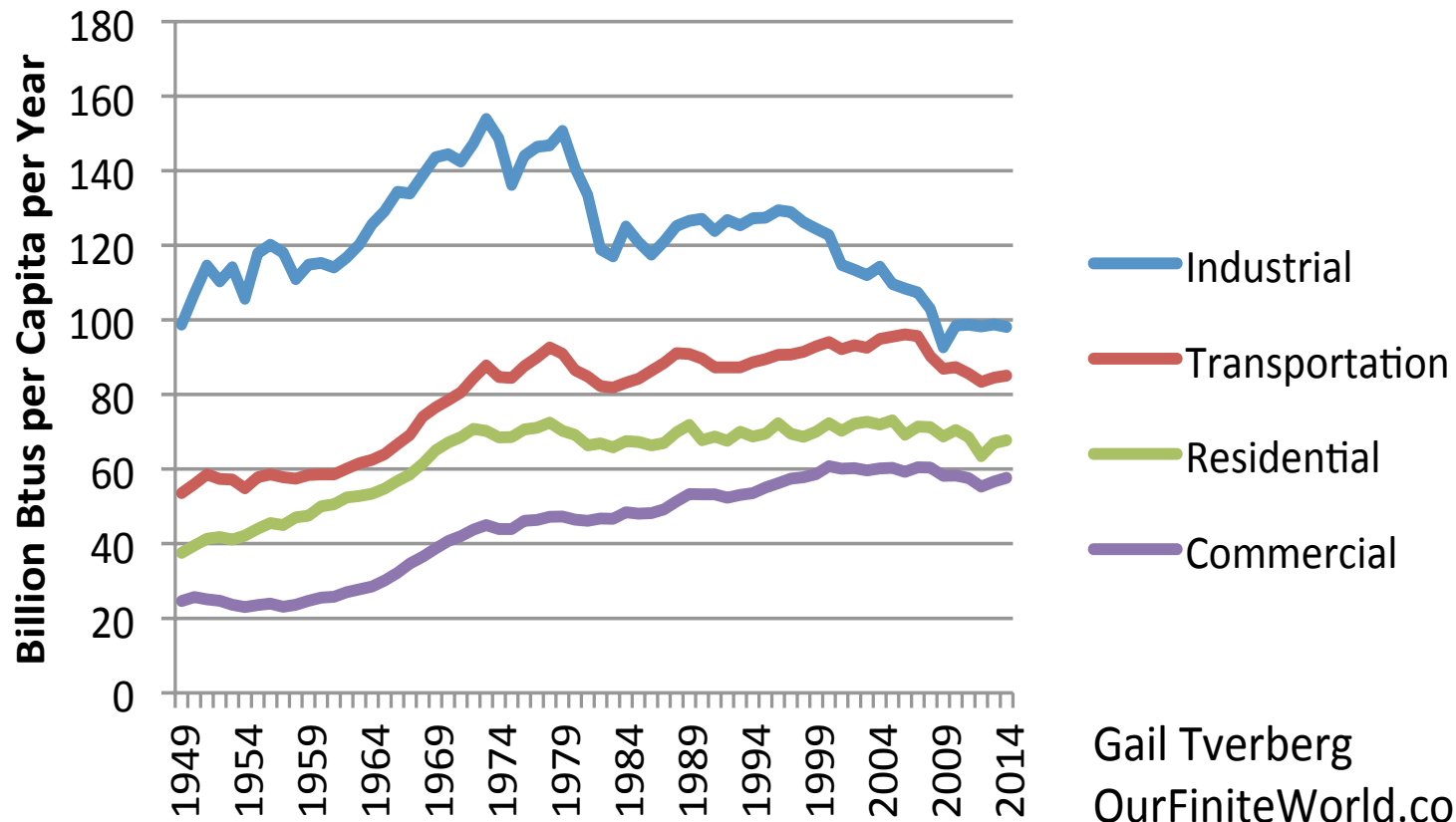
- ▶ Expect defaults on contracts for both coal and natural gas
- ▶ Natural gas – bankruptcy can lead to *no new wells*
 - ▶ New buyers can't get financing at current low prices
 - ▶ Some continuing production from old wells, but not enough
- ▶ Coal – bankruptcy often leads to mine closures
- ▶ Fuel producers usually need loans to support operations
 - ▶ Need high prices for several years before lenders are willing to lend again

4. Expect other types of bankruptcy-related problems as well

- ▶ Expect difficulty in getting parts for existing equipment
 - ▶ Replacement parts for wind turbines
 - ▶ Replacement parts related to solar PV installations
 - ▶ Replacement parts for coal, natural gas, nuclear generation
 - ▶ Transmission-related replacement parts
- ▶ Some **customers** may have financial difficulty
 - ▶ Trend in electricity demand likely to be **flat or down**, not up
 - ▶ Do not believe upward trend forecast by EIA and IEA!
 - ▶ May be government pressure to continue supplying electricity to those who cannot pay

Energy consumption by industrial sector has been falling since 1970s

US Per Capita Energy Consumption by Sector



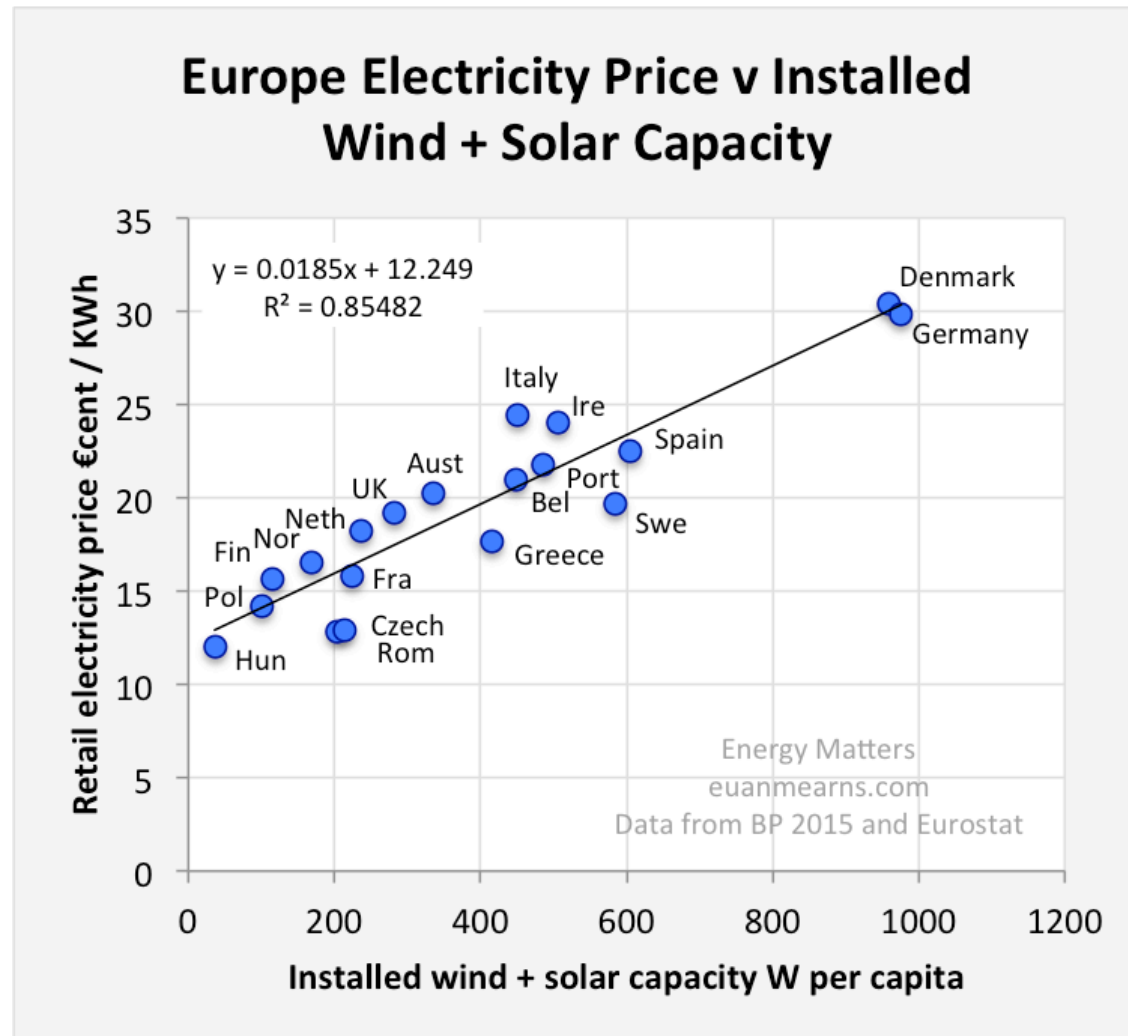
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Based on US Energy Information Administration data.

5. Promised subsidies for wind, solar PV are likely to disappear

- ▶ If affordability affects workers, governments are affected as well
 - ▶ Governments cannot collect as high taxes as hoped for
 - ▶ Something must be eliminated
 - ▶ Subsidies likely to be cut
- ▶ High cost compared to coal and natural gas makes high-priced renewables look like a waste of money
 - ▶ Near-term cutback in subsidies seems likely

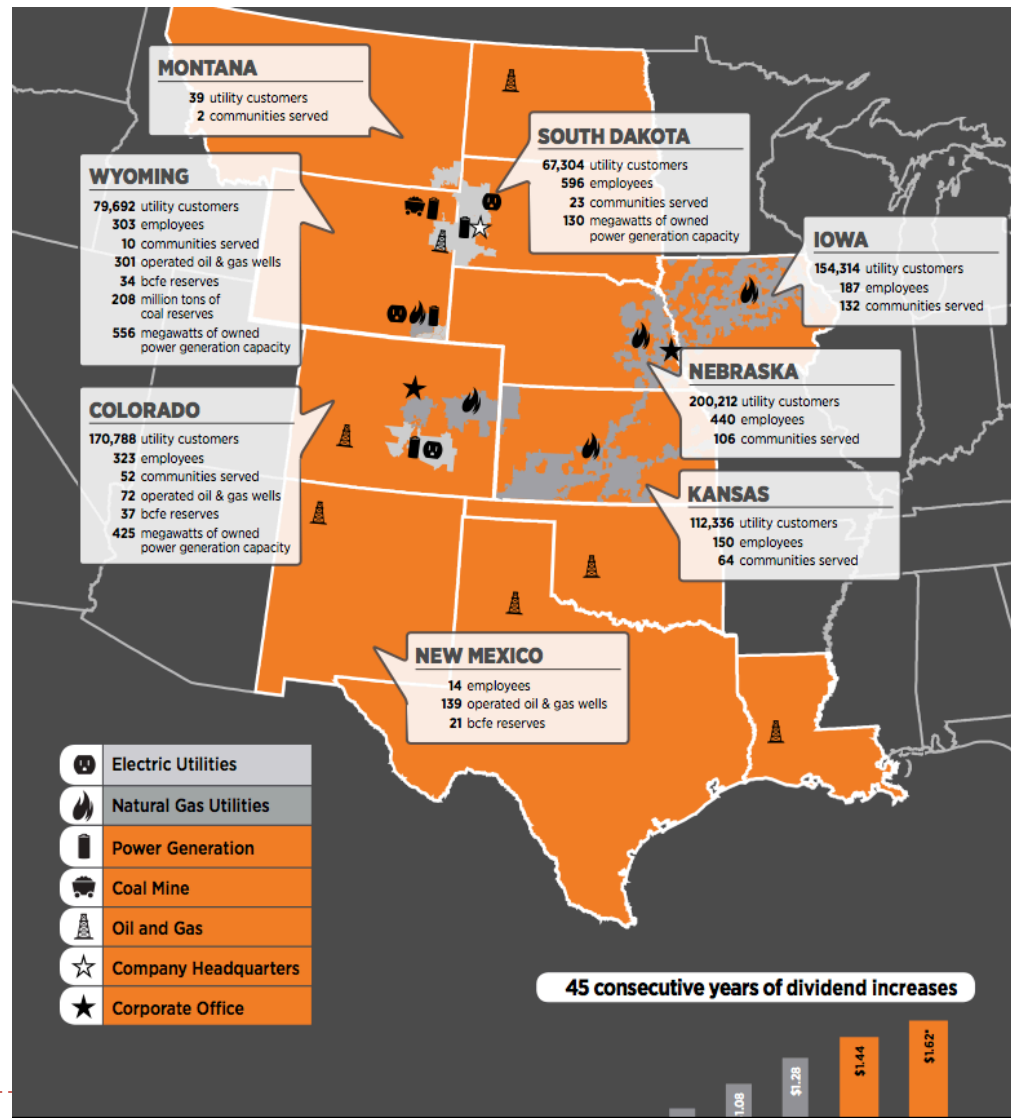
Overall cost of wind, solar PV (including transmission etc.) tends to be high



6. Ideal structure for electricity providers is that of vertically integrated utility

- ▶ Utility would have power to set prices on cost-plus basis
 - ▶ Gets around problem of low commodity prices
 - ▶ Allows electric grid to continue to operate, as long as possible
- ▶ Vertical integration would solve quite a bit of “bankrupt supplier” problem
- ▶ Example – Utility owning city hydroelectric dam
- ▶ Another example - Black Hills Corporation

Map from Black Hills Corporation's Annual Report



7. On-site generation of electricity by multiple industrial organizations is problematic

- ▶ Each industrial organization will need to deal with bankrupt suppliers and parts providers
- ▶ Difficult for electricity providers to obtain an adequate price for backup generating services
 - ▶ Savings to existing electricity companies is small, if some industrial organizations opt out
 - ▶ Primary savings is on **fuel**
 - ▶ Also, may be savings if **annual** peak can be cut
 - ▶ Credit should reflect **savings to the system**

7. On-site generation of electricity by multiple industrial organizations is problematic (cont.)

- ▶ If only daily peak is cut, savings are minimal
 - ▶ Peaker plants need adequate profit
 - ▶ Leads to bankruptcy of peakers or need for subsidy
- ▶ If overall electricity demand is falling, transmission costs per kWh are likely to rise
 - ▶ If some industrial customers leave, trend exacerbated
- ▶ Another possibility – no grid connection at all for industrial organization
 - ▶ Eliminates problem of proper charge for backup

Conclusions

- ▶ Perhaps a major diagnosis has been missed.
- ▶ If our problem is low prices and bankruptcies, rather than high prices, then different solutions are needed.
 - ▶ Cost-plus pricing of the type used by utilities appears helpful.
- ▶ Renewables need replacement parts. They can't be expected to last longer than other types of production.
- ▶ Don't expect natural gas to replace coal.
- ▶ I have omitted discussion of financial and international trade issues. They may be important.

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