



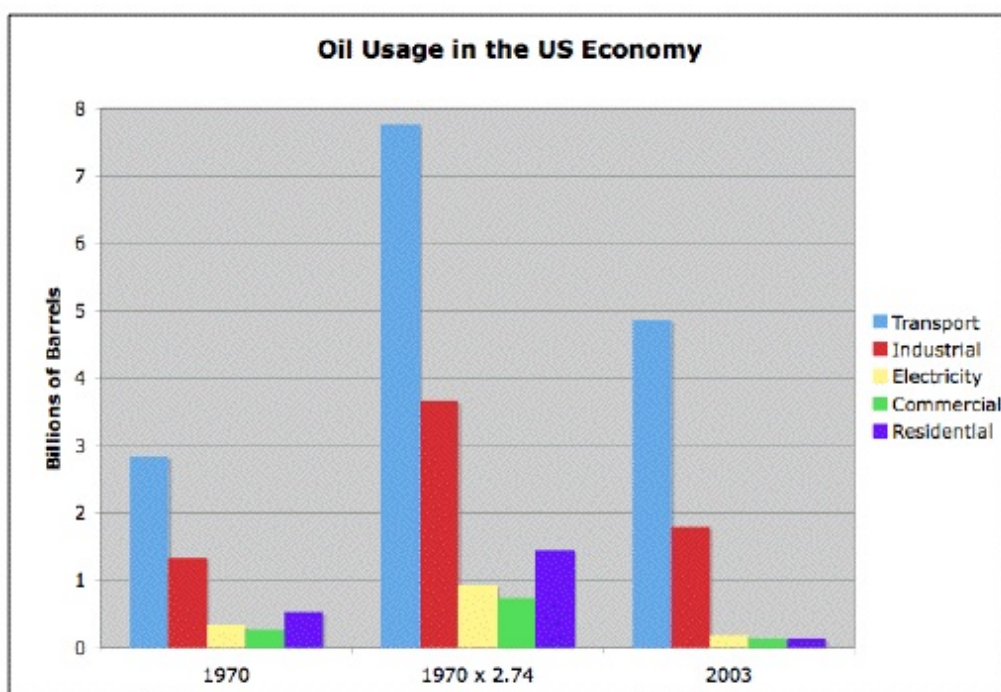
Why Oil Intensity Changed in the US Economy

Posted by [Stuart Staniford](#) on October 21, 2005 - 4:09am

Topic: [Economics/Finance](#)

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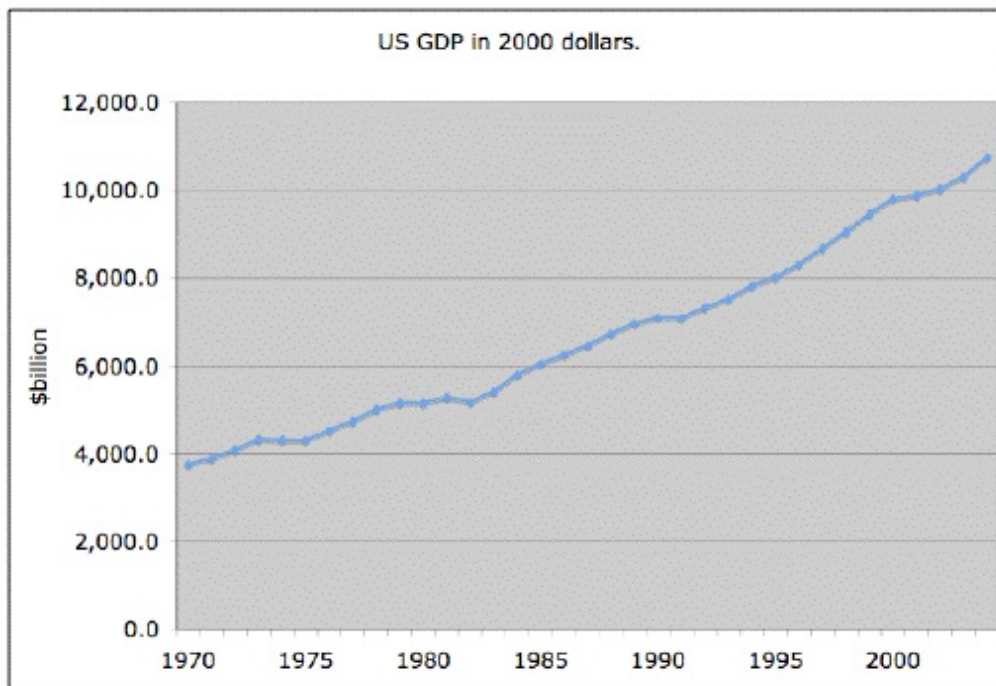
Ok, so let's make a bit more thorough effort to understand what the main effects are that allow the economy to use less oil to make GDP than it used to. My goal is to get us to the point where we understand most of the change and then I'll get bored and stop.



Source: [EIA](#)

This post is a continuation of a series that began with a [discussion of the stability of the mix of consumer spending](#) and then moved on to [consider the productivity and efficiency of transportation](#).

The first thing we want to understand is exactly what constant dollar GDP has done. For those of us willing to grant at least some credence to federal statistics, the [Bureau of Economic Statistics](#) has the story:

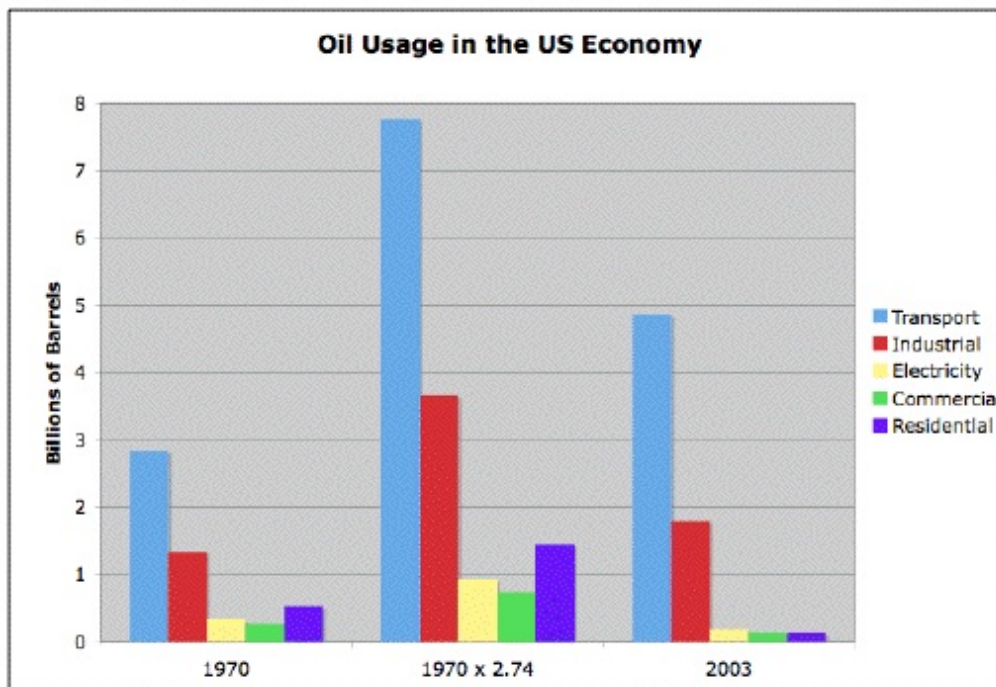


I'm going to operate from 1970 to 2003, as that's the period covered by all the series I need.

Over those 33 years, real GDP increased by a factor of 2.74. In the same period, US oil consumption has gone from 5.36 billion barrels to 7.31 billion barrels ([according to the EIA](#)).

That's an increase by a factor of 1.36. So oil intensity has decreased with a multiplier of $1.36/2.74 = 0.50$.

So we have a 50% reduction to explain. Now let us look at the changing mix of usages to see where that's coming from (the graph shown above, but repeated here for convenience).



The first grouping is usage by sector in 1970. Transport includes aviation, railroad, and highway, but highway is the great bulk, aviation is only 1/10 as big, and railroad is, well, let's blush and hope our European readers don't notice. Industrial is a whole big variety of things. A material

amount of oil used to be used for generation of electricity. Then we have residential and commercial use of oil. These last two are overwhelmingly heating of buildings.

The second group is what 2003 oil usage would be if it had simply been scaled by the 2.74 multiplier increase in GDP from 1970 to 2003. Then the third grouping is actual 2003 usage.

Now the breakdown of our 50% reduction in oil intensity is as follows. (The following numbers are all percentage points, not fractions of the 50%).

- 20% is due to increased transportation efficiency - 2003 transportation oil usage is only 0.63 of what we would have expected just GDP scaling from 1970. That is mainly due to the 0.7 multiplier applied to gallons/mile in highway vehicles since 1970 (as [discussed last night](#)), but a little is due to improved aviation efficiency also.
- 13% is due to reduced use in residential and commercial buildings, almost all of it heating. These sectors got 0.09 and 0.19 multipliers respectively (ie they got mostly eliminated as the graph makes clear). This represents a mixture of improved building efficiency (insulation and draft-proofing) and fuel switching away from oil (primarily to natural gas).
- 5% is due to reduced use in electricity generation - a 0.20 multiplier (again, not much left). This is fuel switching to uranium, coal, and natural gas.
- 13% is due to reduced oil intensity of industry (a 0.49 multiplier). This presumably represents a mixture of
 - Improved efficiency in industrial processes.
 - Fuel switching by industry
 - Dematerialization of the industrial sector (industry producing smaller, higher-tech, higher value products).
 - Improved insulation and draft-proofing of industrial facilities to reduce heating needs
 - Offshoring the nasty dirty oil-intensive parts of industry.

Having explained 37% of the reduction as strictly due to efficiency and fuel switching in the non-industrial sectors, I will let our fine team of commenters continue the good fight over how much of the 13% living in the industrial sector is due to which of those five factors.

A final observation. Our esteemed economic patriarch [quoth](#):

Moreover, since oil use, as I noted, is only two-thirds as important an input into world GDP as it was three decades ago, the effect of the current surge in oil prices, though noticeable, is likely to prove significantly less consequential to economic growth and inflation than the surge in the 1970s.

So to me this would imply that if we were to have another series of oil shocks like we did in the 1970s, and thus we desired to get another 50% reduction in oil intensity out of the economy, Dr Greenspan is saying that would be easier now that it was then. He's got to be wrong. Last time 18% came from reducing building heating and electricity generation. We cannot do that again - those uses are almost gone. So the next time it would have to come almost entirely from transportation and industrial gains; those groups would need to step up to the plate in a bigger way than before. Since transportation is now 2/3 of usage, that would have to be a big factor. This was where we did the least reduction last time (0.69 - we only dropped it 31%), presumably because we were less willing to do that than other things. And since we seem to have been [remarkably resistant to behavioral changes](#), presumably we'd pretty much have to find the transportation part in increased vehicle fuel efficiency, or else economic contraction if we can't get



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