The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

How limited global oil supply may affect climate change policies

Posted by Gail the Actuary on August 28, 2010 - 10:45am
Topic: Policy/Politics
Tags: climate change, oil prices, oil supply, peak oil [list all tags]

On Wednesday, August 25, I gave a presentation called How limited global oil supply may affect climate change policies at the MIT-NESCAUM Endicott House Symposium on climate change.

The audience included leaders from governmental, industrial, academic, and non-governmental (NGO) sectors. They were very concerned about climate change, but not very aware of, or concerned about, the issue of resource limits.

In my talk, I pointed out where the "standard" view of the economic response to peak oil goes wrong. People expect that if there is an oil shortage, prices will rise and then substitutes, or additional supply, or technological solutions will be found. But what if these solutions take decades or even generations to implement? Oil from new fields is not instantly available; new biofuels do not scale up quickly; and technological innovations take decades to make a meaningful difference in the overall picture.

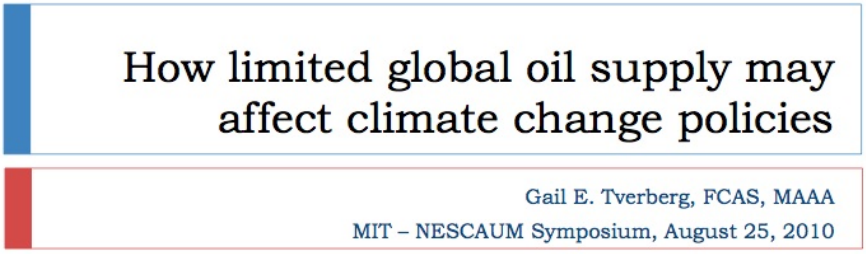
In the absence of a quick response of substitute supply or technical innovation, it seems to me that other responses come into play--ones that explain the recent financial distress we have been seeing. When oil prices rise but are not met with immediate solutions leading back to lower prices, consumers respond by reducing discretionary spending, or by defaulting on debt. Either of these responses tends to lead to recession, reduced oil demand, and a reduction in oil price. Eventually growth in demand (perhaps from China and India) can be expected to raise prices again, but again, new oil supply /new technology /new substitutes are likely to be delayed, so that higher prices are likely to give rise to reduced discretionary spending and debt defaults, and more recession.

Because of these impacts, the expectation for the future should be for oscillating prices, but not necessarily very oil high prices. Recession can be expected to improve, and then get worse again. If the expectation for the future is this type of economic situation, perhaps views regarding needed climate change policy should be revised to match the new economic reality.

Furthermore, because the world is a closed system, with limits, there is the possibility that world oil supplies will actually decline in not too many years. The likelihood of this decline gives rise to a greater sense of urgency of the need to reduce oil use--one cannot just wait and hope that future technological innovation will fix the situation. It may be that lifestyle changes will also be needed, reflecting a lower standard of living. Climate policies may need to be rethought to match the way a world with limits can really be expected to act.

Dr. Richard Gibbs, one of the symposium co-chairs, kicked off the symposium by talking about

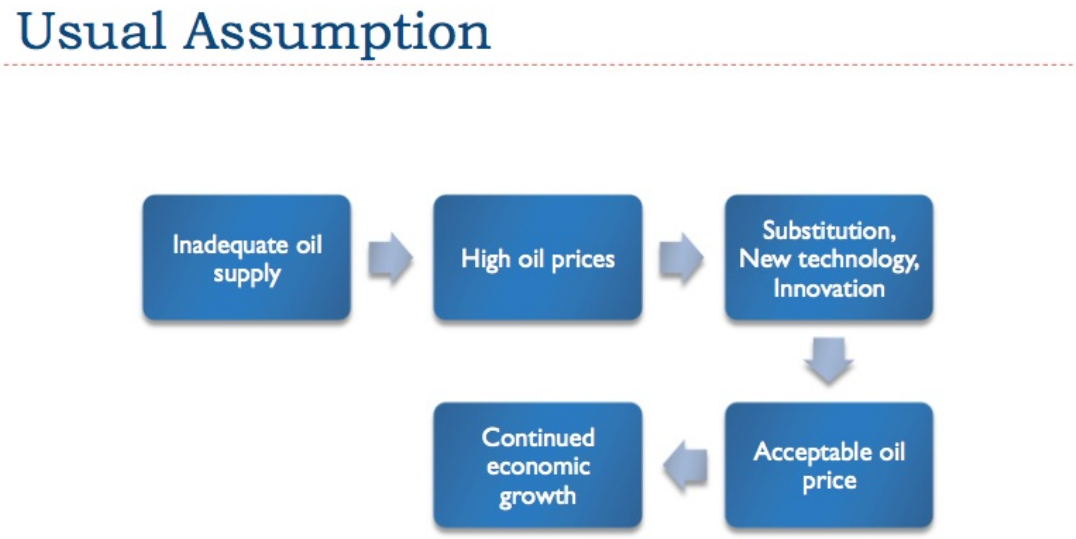
the fact that the world is a closed system, and we are now dealing with pollution and excess greenhouse gases as symptoms of the limits inherent in a closed system. My job was to try to extend this idea--to explain that oil is subject to limits as well, and to point out that, in fact, we seem to be reaching some of these limits.



Slide 1

My name is Gail Tverberg. I am an editor for The Oil Drum website--a website that talks about "Energy and Our Future". My background is as an actuary.

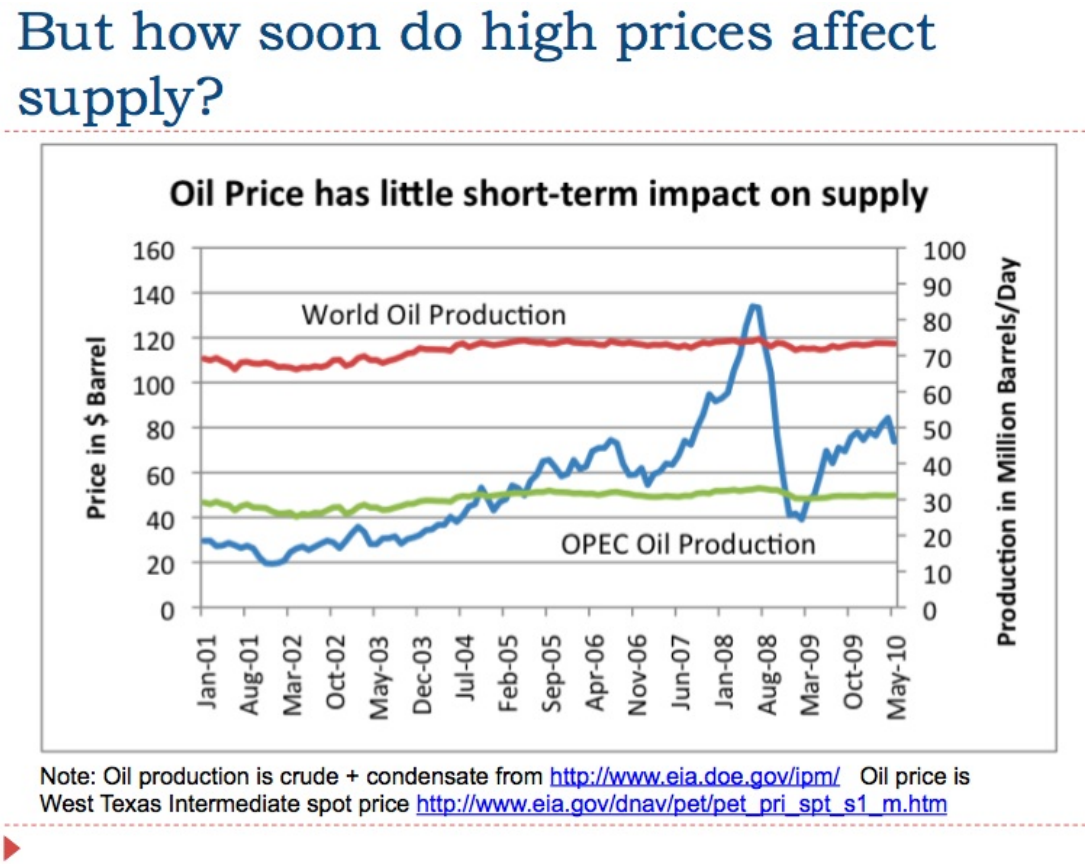
Dick Gibbs started the symposium talking about the world being a closed system, because it reaches limits in many ways. I would like to talk to you today about one of the limits we are now reaching--namely oil supply limits.



Slide 2

When most people think about oil supply, it seems to me that they expect a scenario, pretty much like what I show on Slide 2. Inadequate oil supply will lead to high oil prices. High oil prices will lead to various kinds of remedies, including more oil extraction, new substitutes, new technology, and other innovation. One might expect that pretty quickly, an acceptable oil price would return, and the economy would return to economic growth.

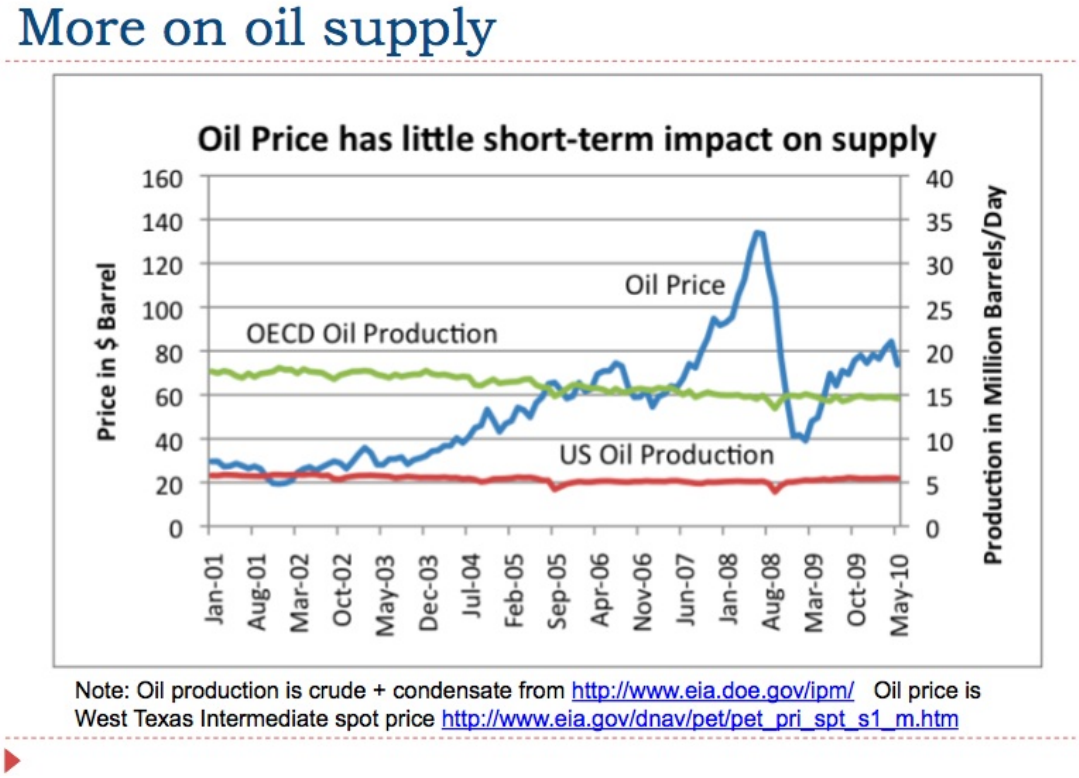
The problem with this scenario, as I will show in the next few charts, is that there is a fairly long time lag between high oil prices and new supply or substitutes.



Slide 3

Let's look at crude oil supplies, and oil prices. In this slide I show world oil production and OPEC oil production, along with world oil prices. It is pretty clear from this chart that as oil prices rose between 2004 and mid-2008, there was very little increase in world crude oil supply. In fact, it was pretty much flat.

OPEC doesn't seem to have raised its supply very much in response to the higher oil prices either, except a million barrels a day or so at the end. One might suspect that their statements about high spare capacity overstates the extent that they can really ramp up supplies, when oil prices are tight. But they are willing to drop production when oil prices decline, and the portion of their oil supply that is most expensive to produce becomes less profitable.

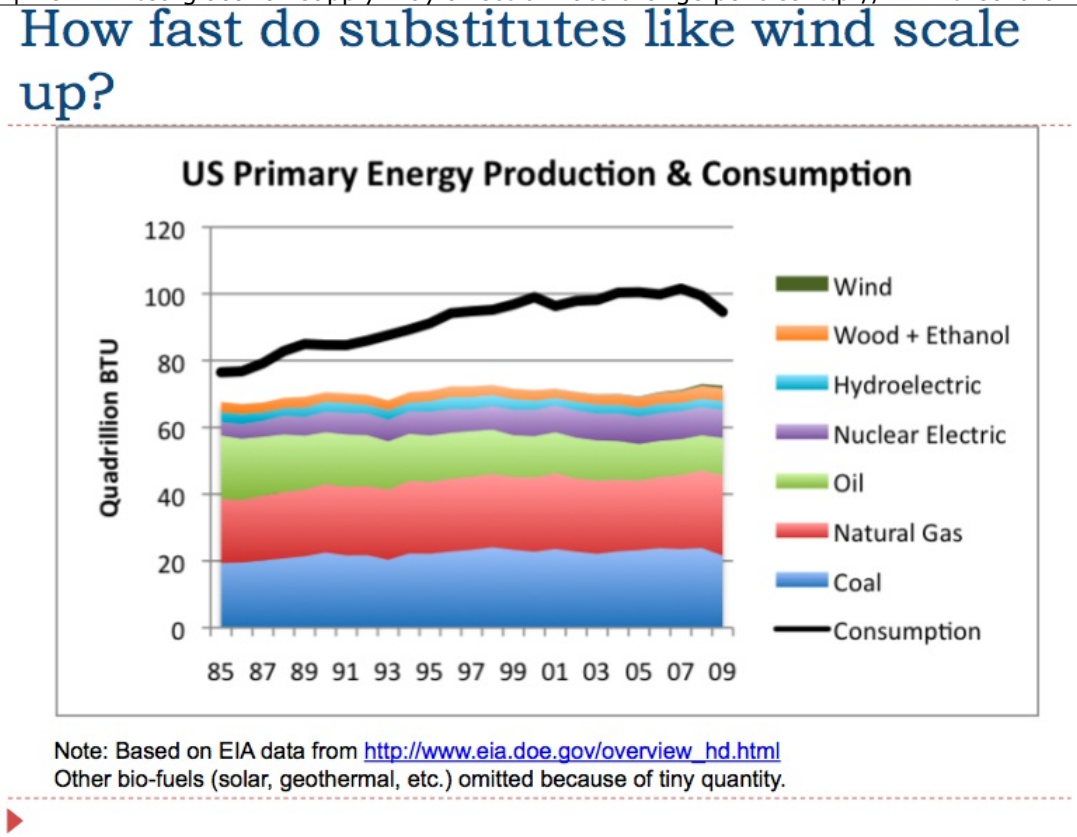


Slide 4

This is a similar slide, showing crude oil production of OECD (that is, developed countries in total) and the US.

OECD crude oil production, in spite of the rising prices, is trending down over the period, with some leveling in the last year.

US oil production is fairly flat (except for when hurricanes hit) but if you look closely, you can see that US production has increased a bit in 2009 and 2010. This is at least, in part, in response to higher oil prices several years earlier, because it takes several years to add sufficient wells to create an increase in oil supply. The recent increase in US crude oil production reflects increased oil production in the deepwater Gulf of Mexico and in the Bakken shale oil (North Dakota).

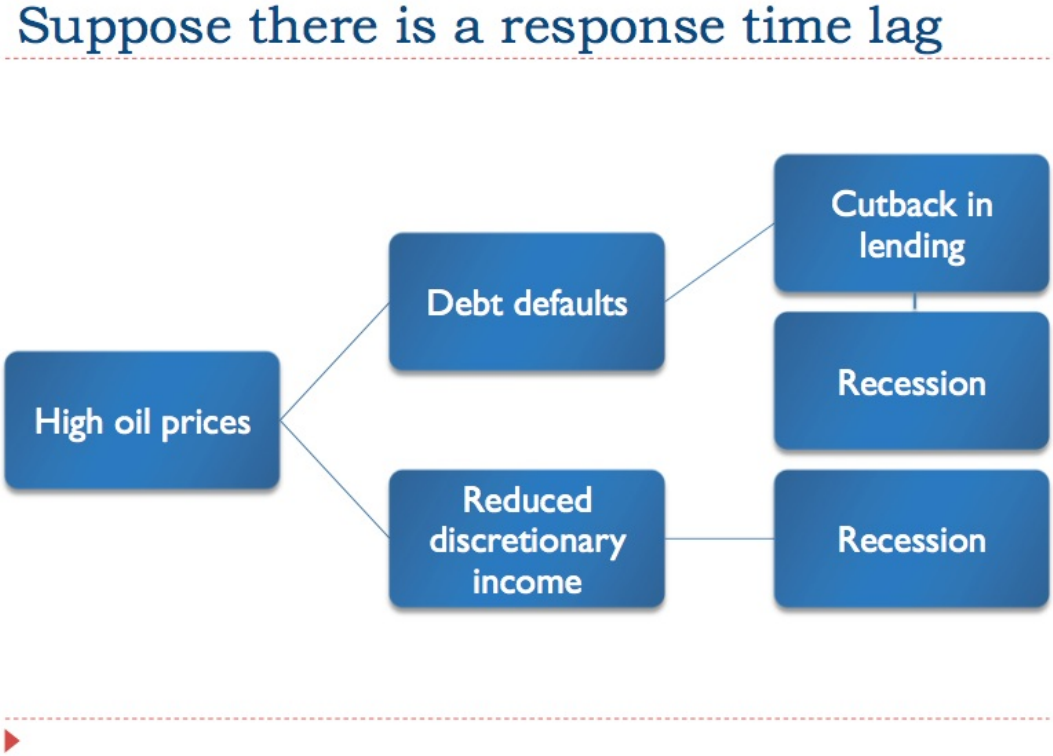


Slide 5

Wind energy is the tiny dark green line that is visible only in recent years, just above the line I call "wood and ethanol" on the chart. (It is called "biomass" in the EIA report it comes from.) The "wood and ethanol" line does not rise very quickly either.

Other ways of measuring the rise in wind energy would give a little more favorable picture. For example, the percentage would be a little higher, if we looked only at electricity, or the amount of energy were measured differently from the way the EIA does it. But no matter how one measures it, it is not coming close to replacing fossil fuels.

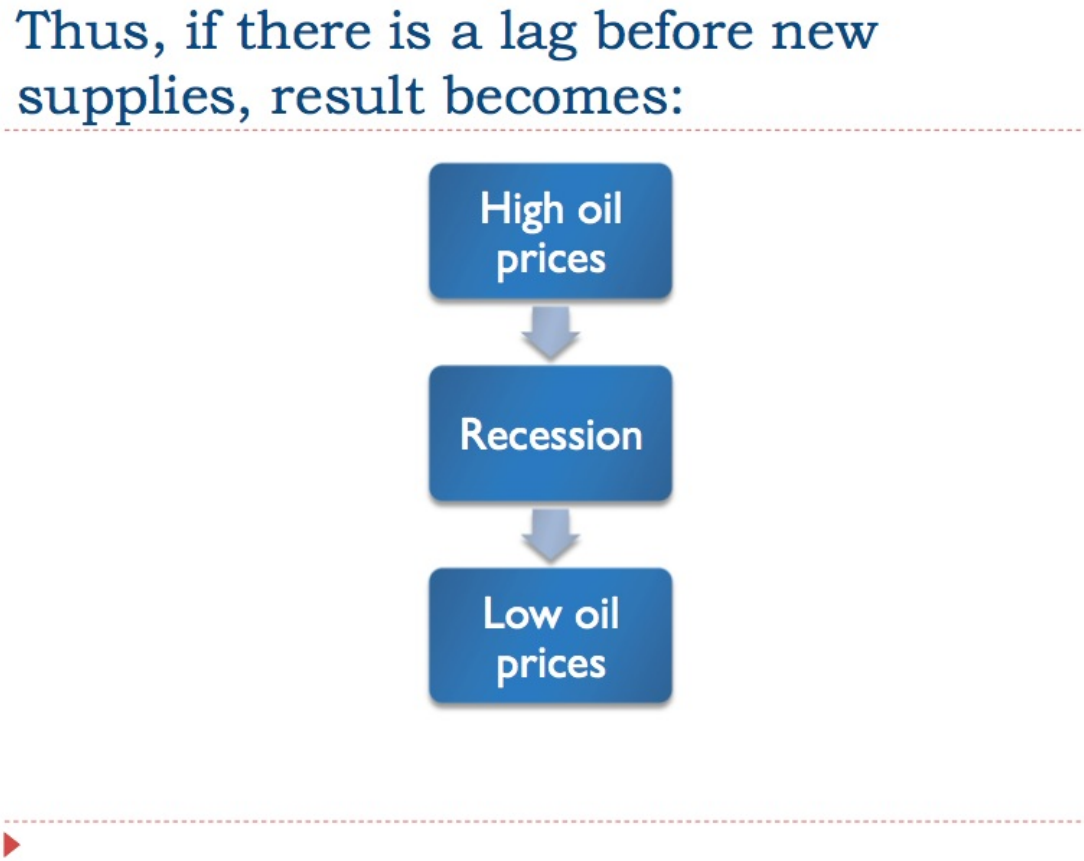
The thick black line at the top is US energy consumption, and the difference between US consumption and US production is imports. One can see from the chart that imports were dropping in 2008 and 2009, during the recession. Oil represents the US's major type of energy imports, so the decline in imports to a significant extent reflects a decline in *oil* imports. During this period, world crude oil production was flat, and demand from developing nations was increasing, so a decline in oil imports should not be a surprise.



Slide 6

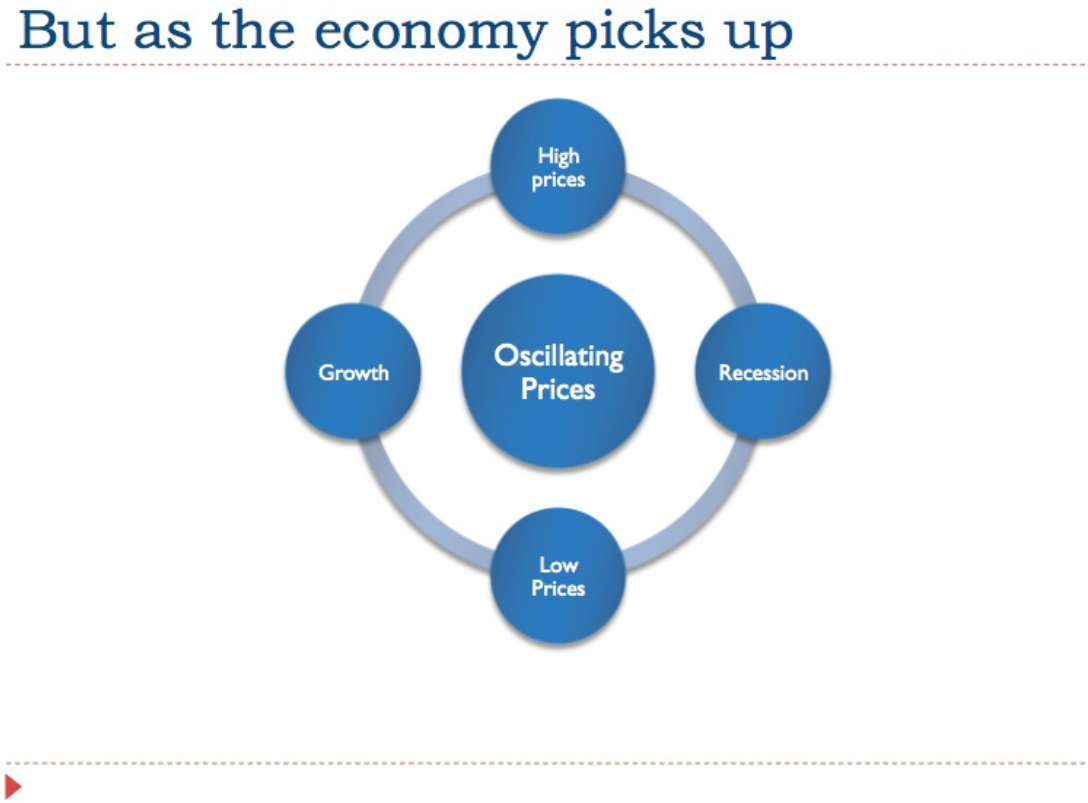
This slide shows my view of two different responses to high oil prices, if high oil prices are not immediately remedied by substitutes, or more oil production, or new technology. One outcome is debt defaults, as people and businesses find it more difficult to pay back loans, when they are faced with paying higher oil and other energy costs (since costs tend to rise together). This leads to a cutback in lending, as banks' capital is eroded, and banks realize it is not prudent to make loans to marginal buyers. With less loans available for buying new cars, and financing new business opportunities, businesses lay off workers, and recession ensues.

Another common response to high oil prices is reduced discretionary spending. If oil prices (and thus food prices, and perhaps home heating prices) are also higher, people respond by cutting back where they can. They may go out to restaurants less, or go on fewer vacations. This reduced spending on discretionary items also has a recessionary impact.



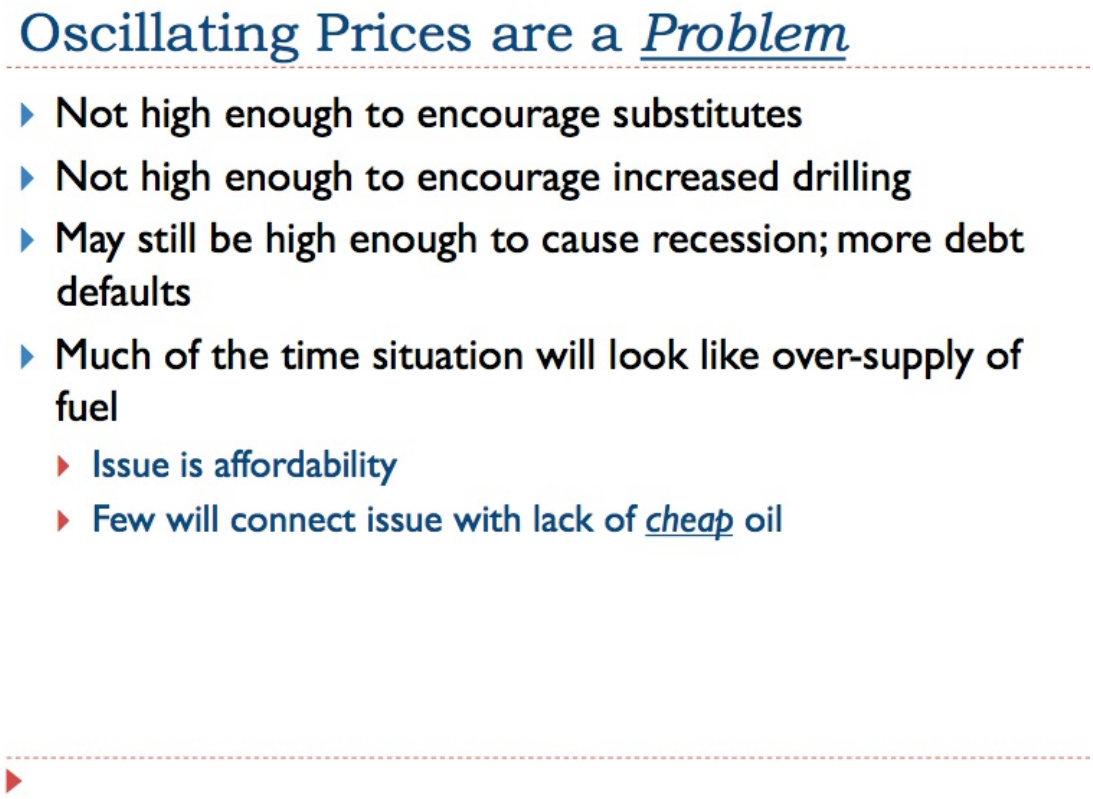
Slide 7

If we step back and look at the situation, we have high oil prices, leading to recession and to low oil prices.



Slide 8

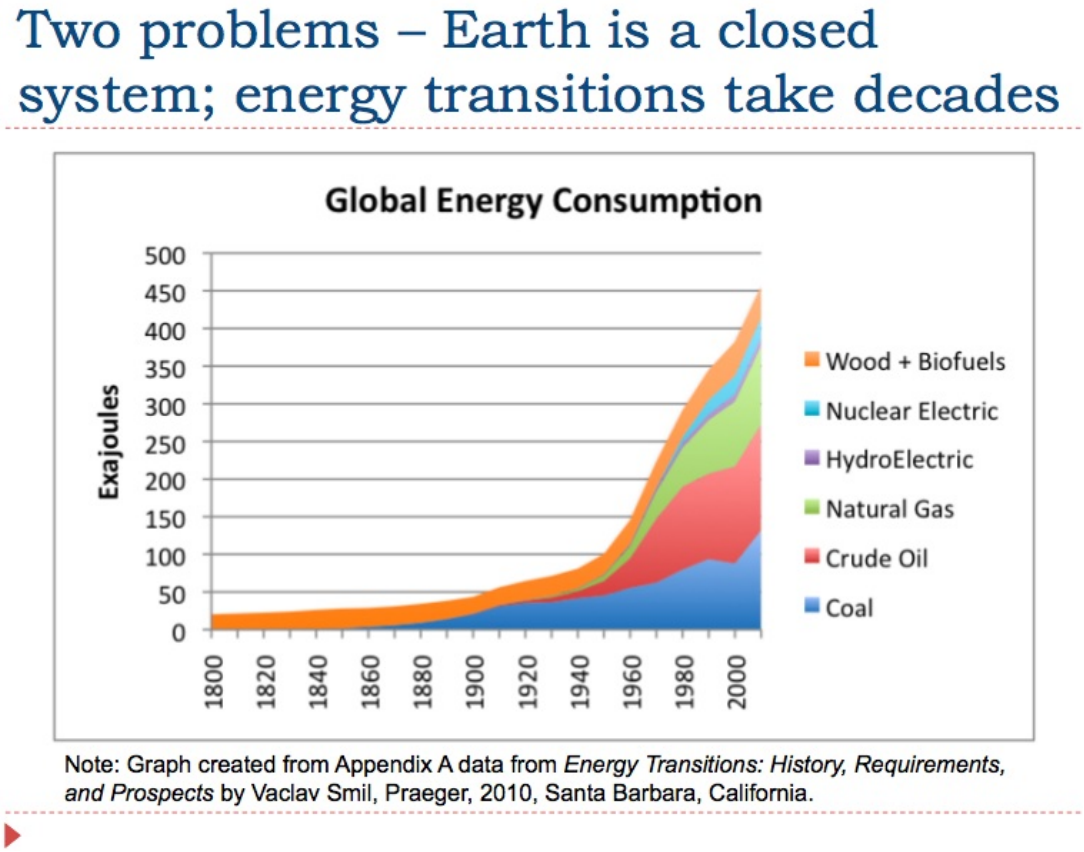
Eventually, one might expect that demand will rise, perhaps from the developing world, and put upward pressure on prices again. Again, there is little immediate response in terms of additional supply or alternatives, so one sees a pattern of oscillating prices developing.



Slide 9

Oscillating prices are a problem, because they do not give clear price signals. They aren't high enough to encourage substitutes on a large scale.

One thing that is particularly confusing to consumers is that looking at inventories and other conventional measures of oil, the situation appears to be an over-supply of oil. That is in fact true--there is an over-supply of expensive oil, oil that many customers cannot really afford. What is really needed is a bigger supply of *inexpensive* oil.



Slide 10

There are really two problems.

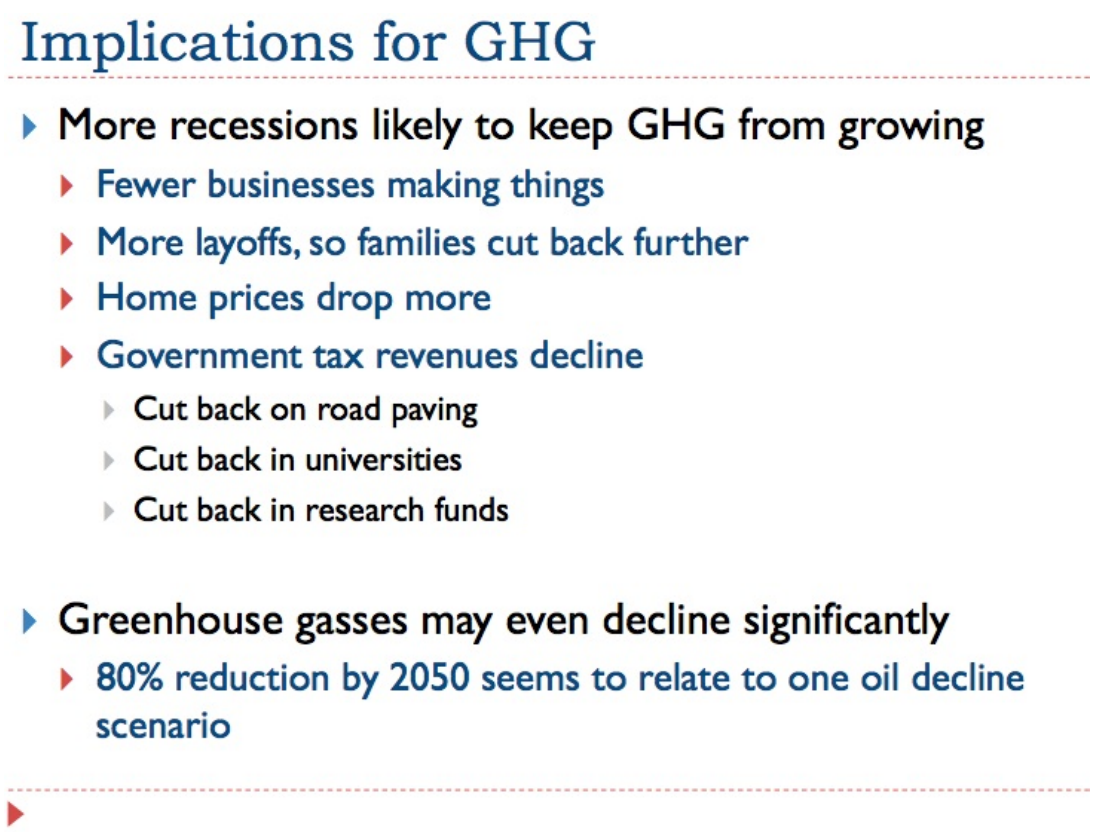
One is that the world is a closed system--what some of us would call a finite system. There is still considerable oil left, but the oil that is left is more and more expensive (in $$ and resources) to extract, because we remove the "easy oil" first. At this point, and price threshold where recession occurs seems to be about $85 a barrel. This limit is related to low Energy Return on Energy Invested (EROEI). While it would be nice if prices could keep rising indefinitely, we know that at some point, it will take more than a barrel of oil to produce a barrel of oil, and at that point, it will not make sense to continue to extract oil, even if there still seems to be plenty available.

The amount of energy needed to produce a barrel of oil includes the energy of the infrastructure that needs to be in place (transportation for example) as well as the direct energy used in production. This need for infrastructure brings the EROEI requirement up to something like 3:1 or 5:1, rather than just 1:1. And it looks as though we are getting close to limits on both an EROEI and dollar basis--close enough that high prices cause recession rather than a quick shift to increased production; close enough that EROEI for oil from the tar sands seems to be in the 3:1 to 5:1 EROEI range already.

A likely outcome is that production of oil will at some point in the not too distant future, start to decline, rather than just stay flat, as it becomes more and more difficult to find oil that can be extracted at affordable prices and an adequate energy return.

The second problem is that energy transitions take decades, or longer. We first started using coal before 1800, but use did not scale up to a high level until 1910, over 100 years later. Natural gas use began by 1890, but it was not until 1970 that it reached 2.2% of world energy supply. Vaclav Smil, who has written over 50 science books, has written a recent book on this problem, called

Energy Transitions: History, Requirements, and Prospects.

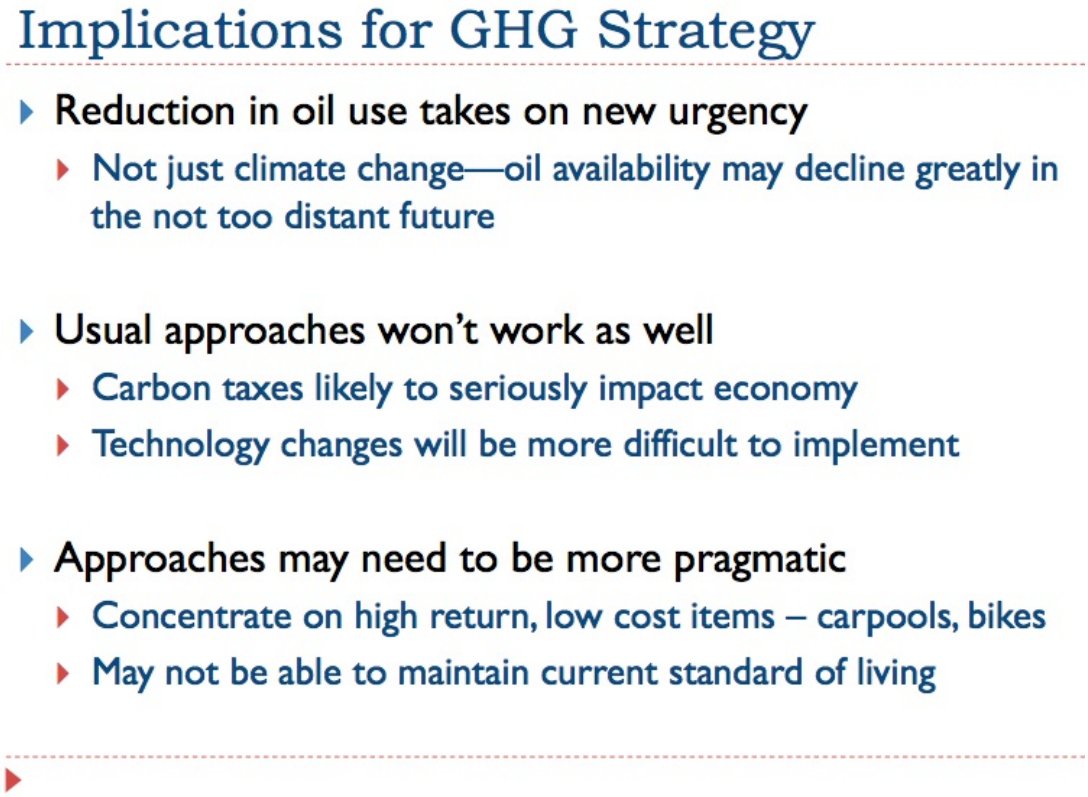


Slide 11

As oil production remains flat, and the amount of oil that the developed world is able to buy declines, it seems to me that we are likely to see more and more of the economic problems that we have experienced in the recent past. We can expect more and more business closures, more layoffs, and probably lower home prices.

Governments can be expected to act fairly differently, as their sources of revenue dry up. For example, road maintenance is likely to suffer, with more and more roads returning to gravel, and funding for higher education and research is likely to decline.

If there really is a significant reduction in oil supply, it is quite possible that new greenhouse gasses emitted may decline significantly, without any particular government action.



Slide 12

I don't claim to be an expert in climate change policies, but it seems to me that policies will need to be rethought, in the light of a very different future economic scenario than most have considered, and also in light of the possibility of declining oil supplies available to the US. If the decline in oil availability is a current, and near future concern, then the need for change takes on a much greater sense of urgency, than if one is simply trying to meet a 2050 climate goal.

It seems to me that the usual approaches may not work as well, and more pragmatic approaches may be needed. It is not at all clear than we will be able to maintain our current standard of living, as oil supplies decline.

Implications for GHG strategy (cont.)

- Natural gas and coal will decline at some point as well
  - Oil decline may affect coal and gas
  - Directly, or through financial system, international trade
- Likely approach will be to tax oil and gas producers
  - Impact will be to cut oil and gas production
    - Likely to cut production, cause more price oscillations
    - May send economy down further
    - Make it more difficult to pay for imports
  - Won't help alternatives
  - Doesn't seem helpful

Slide 13

Natural gas and coal supplies can be expected to decline at some point as well. There are a great many connections between different types of fossil fuel uses, so a decline in oil production may bring about a decline in natural gas and coal production as well, although we cannot know this for certain at this time. There are a number of interconnections that may cause extraction of various fuel types to move together. For example, if the credit system is impaired because of debt defaults caused by indirect impacts of declining oil supply, this could lead to less demand for all kinds of fuels, as occurred during the recent recession. There are other connections as well. For example, oil is used to transport coal to its destination, and to mine metals used in making coal and natural gas extraction equipment.

Almost everyone agrees that comprehensive energy legislation, including cap and trade, is not likely to be passed this year in the US. Instead, we see the US, like many other countries, is badly in need of additional tax revenue, and the oil and gas industry appears to be a likely candidate for more taxes (since it is easier to tax large, unpopular businesses, than to tax voters). So a likely outcome seems to be higher taxes on the oil and gas industry. But we need to think about this. The connection that everyone hopes for--lower production leading to higher prices--doesn't seem to be a very robust one. Instead, by raising taxes, we may produce more price oscillation, and more recession. This outcome is not likely to help alternatives at all, and will likely make our balance of payments situation worse.

So we really need to think through climate change policy approaches carefully, in light of the closed system of that we are working in.