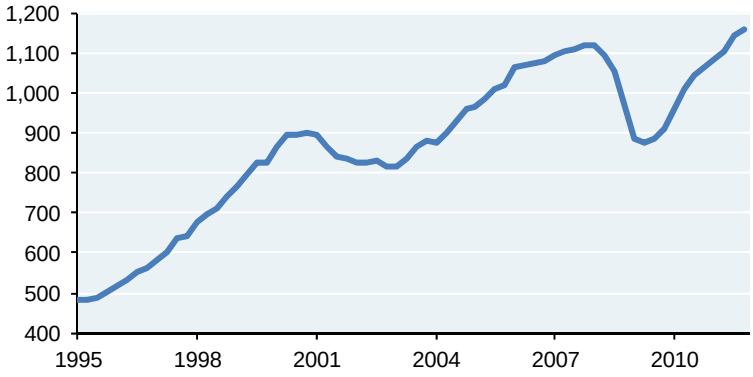
**Topics: oil markets, Iran, and a Congressional press release for the times we live in**

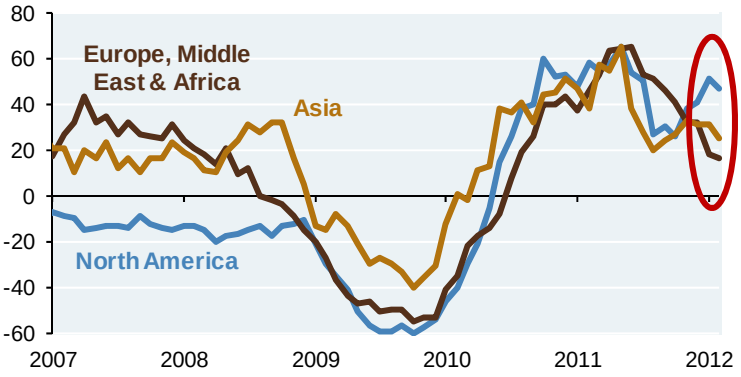
Most of this week's note deals with oil prices and Iran, but I did want to point out a trend that is illustrative of how things are going globally. One of the strongest aspects of the US recovery has been the rebound in business spending on equipment and software. As highlighted by our friends at Hamiltonian Associates, sales by Caterpillar's dealer network are a proxy for global trends. Caterpillar's US sales are leading the pack for the first time in a while, Asia is moderating, and Europe trails with a distinctly negative trend. We expect a recovery in US payrolls this year, and eventually, in labor incomes. The US recovery may be weak by historical standards, but expectations are pretty low (2.2% growth in 2012). We expect the US to exceed expectations, and for Europe ex-Germany to disappoint them. Absent a blow-up in Iran, this view seems like it's on track.

**US business spending on equipment and software**
Billions, Real 2005 USD




Source: Bureau of Economic Analysis.

**Caterpillar dealer reported machine sales**
Percent change, YoY

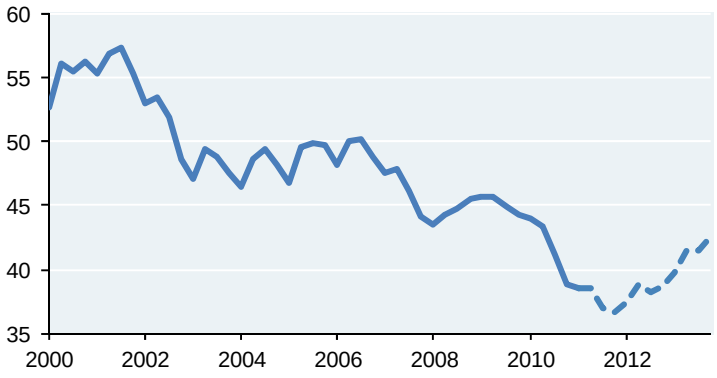



Source: Bloomberg, Hamiltonian Associates.

**"Iranium enrichment": another hurdle for global markets to surmount**

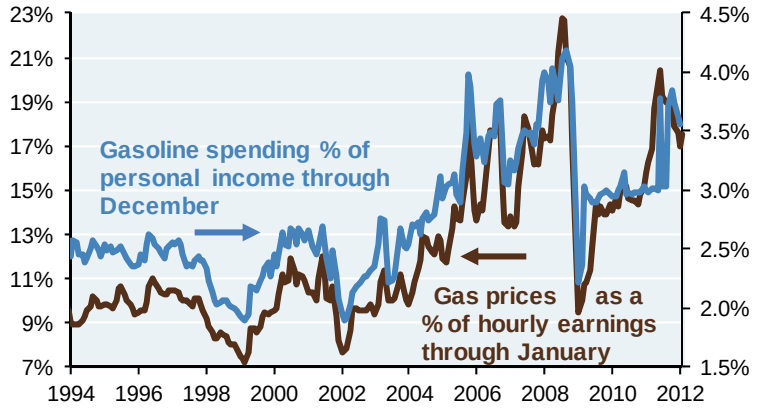
The near-term fundamentals don't point to higher oil prices. Oil demand has been revised down a bit, particularly in the OECD, and non-OPEC supply growth is a little higher in 2012 than in recent years. After netting all the supply and demand factors, it looks like there will be a global oil inventory build in 2012 (see chart below), not something we would normally associate with rising oil prices. However, even before we get to Iran, there are other factors contributing to higher prices: a pick-up in global growth expectations for 2013 and beyond; the explosion of Central Bank balance sheets and associated reflation goals (see last week's EoTM); and the possibility that China's will build strategic crude oil reserves to the IEA standard of 90 days from their current level of 14. Note as well that the inventory build is a small one, nowhere near 2002-2007 levels.

**Global oil inventories to build (modestly) in 2012**
Days of demand




Source: IEA, ISI Energy Research.

**Impact of rising energy prices on the US consumer**




Source: US Department of Energy, BLS, BEA.

That's why Iran is a risk: a disruption would make oil markets even tighter, and drive gasoline prices up further. Even before the February spike, gasoline prices relative to earnings and income were starting to bite (2nd chart). The private sector can handle *some* gasoline price increases, but probably not much more than what we've seen already. The spread between retail and wholesale gasoline prices is low ($0.35, compared to a $0.35-$1.00 range), suggesting further retail increases may be in store.

**People like me now spend a lot of time on conference calls with geopolitical experts of different stripes.** On one call, speakers raised the probability of military action from 30% to 50%. On another call, speakers mentioned that the US has "run out of senior military advisors to send to Israel, all requesting that Israel not attack unilaterally", and believe Israel won't. A paper by Matt Kroenig in Foreign Affairs magazine entitled "*Time to Attack Iran; Why a Strike is the Least Bad Option*"

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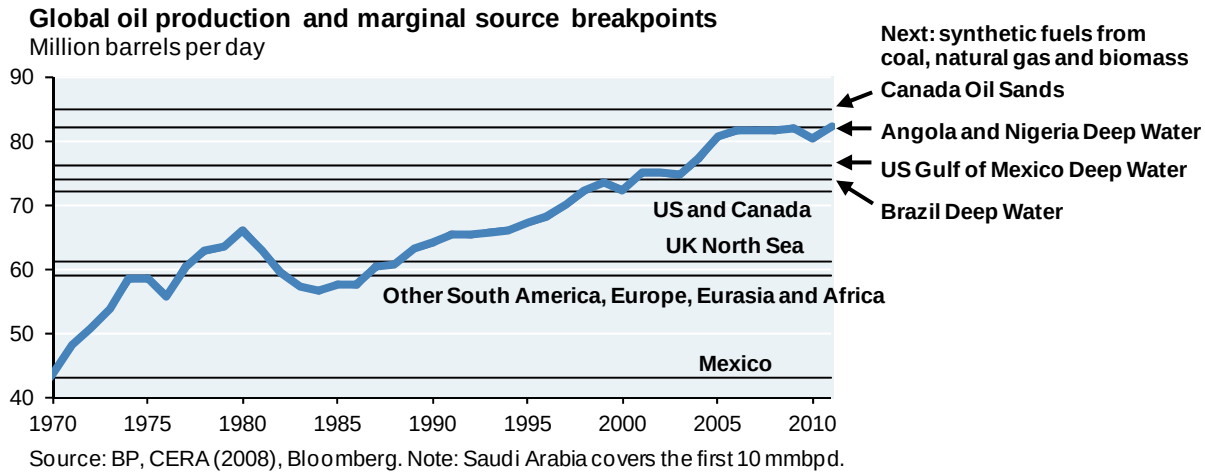
resulted in a firestorm of criticism from multiple sides. With sanctions appearing to work (Iran's inflation, currency collapse, fewer buyers of its oil and a potential ban on Iranian banks from the global SWIFT payments network), won't the US want to wait and see? Most of the US military establishment *seems* to take this view. The conjecture is endless. Here are a few points I found to be of greatest relevance as we sift through this:

- **The US and Europe appear to take the Israeli attack threat seriously**. Economic recoveries are just beginning to form in both regions, and there are elections coming up, so for politicians to ratchet up sanctions and drive up oil and gasoline prices, they must be very concerned that without tougher sanctions, the Israelis might act.
- **Iran's Fordow facility is key to understanding the debate about the effectiveness of military action, and why some are nervous that the "window for action is closing"**. Fordow is estimated to be 80-90 meters below grade, and is suspected of being ready for uranium enrichment. The Iranians reportedly have ~80 kg of 20% enriched uranium ($UF_6$), and need 25 kg more to convert it into enough uranium metal ($UF_4$) for a nuclear bomb. The most powerful *conventional* weapon in the US arsenal is the Massive Ordnance Penetration device (MOP), a 30,000 pound bomb with 5,000 pounds of explosives. It travels at twice the speed of sound, and is designed to penetrate rock and concrete before detonating. However, **it would probably take 4 of these weapons**, dropped in succession by B-2 bombers in the same exact spot, to destroy Fordow[1].
- **Military strikes could quickly escalate to engulf the entire region**. While the Israel-Iran and US-Iran dimensions are important to understand, so too are the Sunni-Shia issues in play. Any complicity by Sunni countries in conjunction with US action (airspace, attack plans and logistics, etc.) might be seen as acts of war by Iran.
- The **Strait of Hormuz** carries 20% of the world's oil (17 million bpd). There are active and de-activated pipelines in Saudi Arabia, Iraq and the UAE that could divert around 5-6 mm bpd, and strategic petroleum reserves could be released. Even so, a military battle in the Strait could cause oil prices to rise $20-$30, according to EIA and GAO 2007 estimates.

To be fair to all the analysts, journalists and think tanks, there is no reason to expect greater foresight now than during the Cuban Missile Crisis, Iraq War or other military standoffs. This is a binary market risk that in our view justifies material consideration in portfolio allocations, and that's about all we know. Our 2012 Outlook section on this issue was entitled "*Learning to Live with a Nuclear Iran*", and that may very well be where this ends up.

As a reminder, since 2001, rising oil prices have coincided with a gradual exhaustion of conventional oil to meet marginal demand, sharp increases in operating and commodity input costs for oil companies, deeper exploratory and developmental wells, reliance on a shrinking number of deepwater fields, rising E&P spending by US oil majors to meet rising EM demand, etc. A simplified version of this dynamic appears below: as oil production rises to meet global demand, the sources for the marginal barrel become more expensive and more complicated. **Without getting into the whole Peak Oil thing, I do think there is evidence that the marginal cost of oil will be a speed bump on growth in the years ahead, if oil production has to rise over 90 million barrels per day to support demand and the building of strategic reserves.**



Source: BP, CERA (2008), Bloomberg. Note: Saudi Arabia covers the first 10 mmbpd.

[1] Austin Long at Columbia University walked me through the geodynamics of the MOP and how many would be needed to penetrate the Fordow facility. His calculations are a function of soil hardness/density, the weapon's mass and impact velocity, the shape of its cone, and the percentage of each penetration that collapses back in as "spoil", blocking the hole created by previous weapons. The estimate of 4 MOPs is based on the assumption of a modest amount of gravel spoilage, and less dense soil. Higher soil density and gravel estimates could require 2-4 more bombs.

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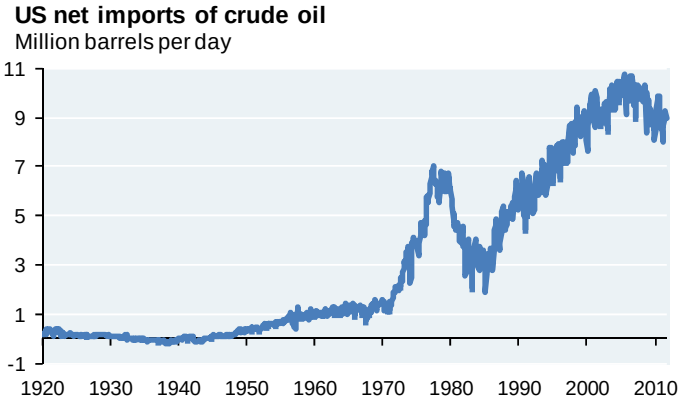
**Output from the Congressional Centrifuge**

In the midst of all the above, **House Minority Leader Nancy Pelosi** issued the following press release:

> "Independent reports confirm that speculators are driving up the cost of oil, hurting consumers and potentially damaging the economic recovery. Wall Street profiteering, not oil shortages, is the cause of the price spike. In fact, U.S. oil production is at its highest level since 2003, and millions of acres have been cleared for additional development. We need to take strong action to protect consumers from this speculation. Unfortunately, Republicans have chosen to protect the interests of Wall Street speculators and oil companies instead of the interests of working Americans by obstructing the agencies with the responsibility of enforcing consumer protection laws. They have also repeatedly opposed our efforts to end billions of dollars in outdated taxpayer subsidies for oil companies enjoying record profits.
>
> We support efforts by the Obama Administration to expand domestic energy resources, including natural gas and renewable sources like wind and solar that create jobs in America and will end our dangerous dependence on foreign energy supplies. This can be achieved because today, the United States currently has more oil and gas rigs at work than the rest of the world combined, and imports of foreign oil have decreased.
>
> We call on the Republican leadership to act on behalf of American consumers and join our efforts to crack down on speculators who care more about their profits than the price at the pump even if these spikes harm the American consumer and our economy."

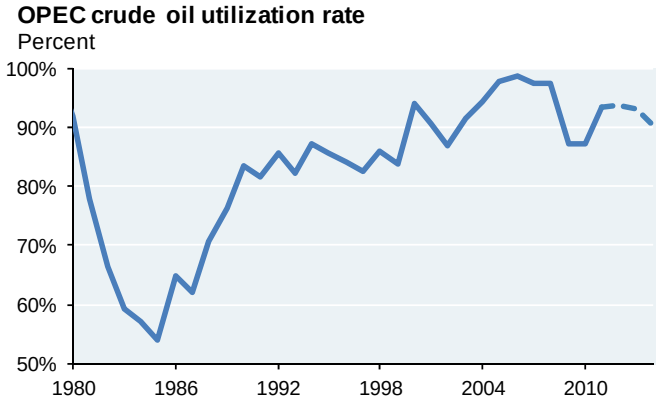
**I am of course not going to comment directly on this, for many reasons, including not wanting to spend my days at California's solar-powered detention facility in Chuckawalla Valley. However, for anyone interested in the specific points raised in this press release, I have included some charts on the unfortunately binding constraints of science and energy economics. Enjoy.**

1. Some analysts project an additional 1-2 mm bpd in US crude production from shale oil and deepwater Gulf wells. How much of a dent has rising US production made on net US oil imports so far?



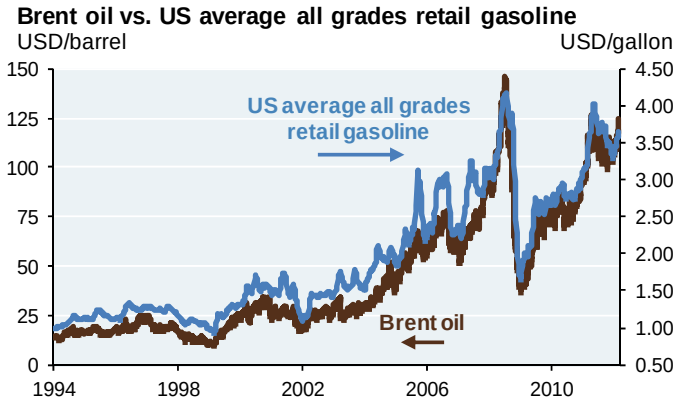

Source: US Energy Information Administration.

2. Iran accounts for 3-4% of global oil exports. If Iranian exports were taken offline, OPEC utilization rates would approach 98%. What does this imply about how sensitive oil markets might be to Iran?



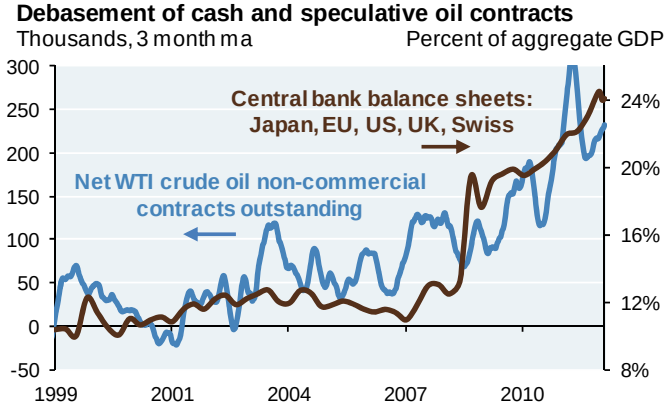

Source: IEA, ISI Energy Research.

3. Are gasoline prices currently out of whack relative to crude oil prices, given the increase in the latter?




Source: US Department of Energy, Bloomberg.

4. What impact might unlimited money printing and negative real interest rates have on investor appetite for real assets like oil/gold?




Source: Country sources, CFTC, J.P. Morgan Private Bank.

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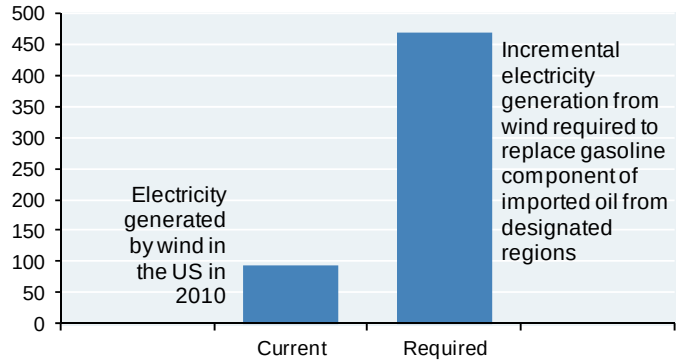
5. **Now let's get to the interesting part**. **The press release implies that natural gas and renewable energy can reduce American dependence on foreign oil ("*end*" is the word used).** This is an appealing proposition, particularly with Brent oil prices now 5 times higher than natural gas prices on a BTU basis. So, let's assume that the US wanted to cease all oil imports from Venezuela, Russia and the Persian Gulf. This would reduce oil imports by ~30%. If Americans still wanted to drive around just as much, absent an increase of 2.8 million bpd in US domestic crude production, electricity would have to replace the foregone gasoline. **Ergo**: how much wind power or natural gas would be needed, assuming electric cars at 200 watt hours per km? And what policies would be needed on fracking, eminent domain, and subsidies for high voltage direct current power lines to transmit electricity at acceptable loss rates?

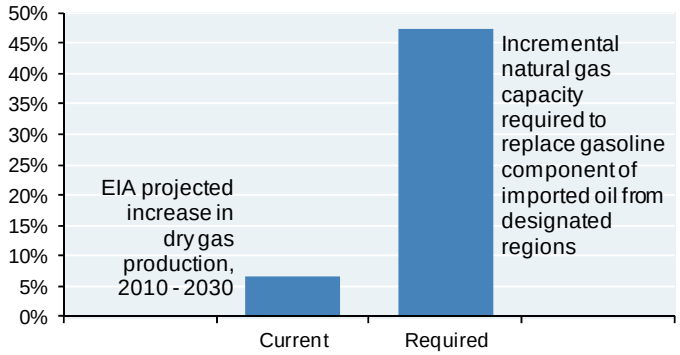
*Note: the charts below only account for the foregone **gasoline** component of the imported crude oil. Gasoline is only around 45%-50% of total refined products. The US would **also** have to come up with suitable domestic or foreign replacements for the rest of the barrel: jet fuel, heating oil, fuel oil, lube oils, asphalt, etc. This topic is often neglected in discussions about reducing reliance on foreign oil: we do a lot more with it than just drive cars.*

**Required increase in wind power**
Terawatt hours of electricity




Source: EIA, J.P. Morgan Private Bank.

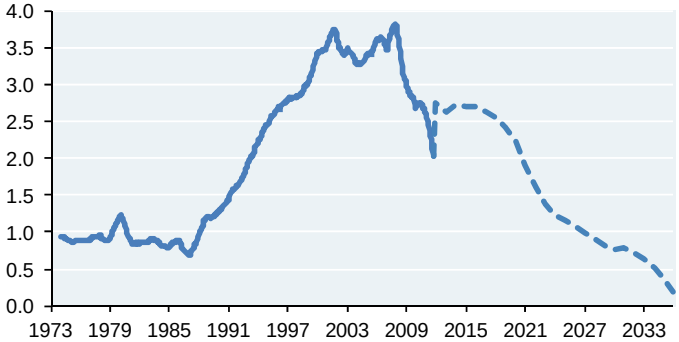
**Required increase in domestic natural gas production**




Source: EIA, J.P. Morgan Private Bank.

6. While US natural gas production has been rising, how much natural gas does the US still import, and how long is the US projected by the EIA to be a gas importer?

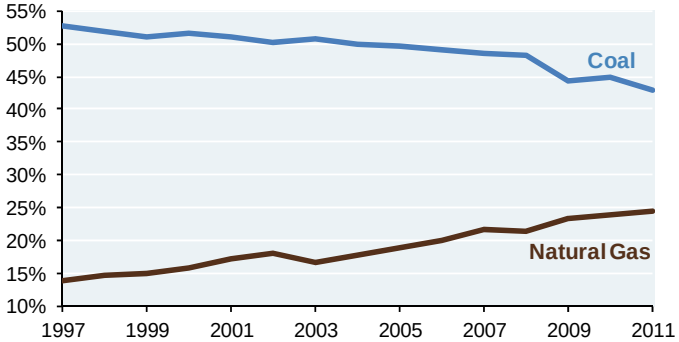
**US net imports of natural gas**
Cubic feet, trillions




Source: US Energy Information Administration.

7. Even if natural gas production rose faster then EIA projections, what are the tradeoffs of using natural gas to offset crude oil rather than coal, which has been the trend over the past decade?

**US electricity generation from coal and natural gas**
Percent of total US electricity generation




Source: US Energy Information Administration.

Michael Cembalest
Chief Investment Officer

| | |
|---|---|
| BLS | Bureau of Labor Statistics |
| BP | British Petroleum |
| CERA | Cambridge Energy Research Associates |
| E&P | Exploration and Production |
| IEA | International Energy Agency |
| OPEC | Organization of Petroleum Exporting Countries |
| BEA | Bureau of Economic Analysis |
| BTU | British Thermal Unit |
| EIA | US Energy Information Agency |
| GAO | Government Accountability Office |
| OECD | Organization for Economic Cooperation and Development |
| SWIFT | Society for Worldwide Interbank Financial Telecommunication |

Our computations for #5 above draw on the conversions and energy math included in the November 2011 Eye on the Market on energy policy, and our meetings with Vaclav Smil at the University of Manitoba.

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