

Oil Market Issues and Outlook

Select Committee on Energy Independence and Global Warming
US House of Representatives

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Summary

- Global oil demand has been rising at a rate of about 1.5%/year over the last 5 years and although demand growth is slowing noticeably in the OECD countries, it is still rising sharply in the developing nations (many of which have reached the point where accelerating wealth results in rapidly rising consumption) and this growth is being exacerbated by consumer subsidies.
- Global spare production capacity resides almost entirely in the OPEC countries and amounts to some 2.5 million barrels per day (mmb/d) or only about 3% of global demand. Much of OPEC's spare capacity consists of heavy high sulfur oil that is difficult to refine given that sophisticated spare refining capacity is also relatively low. Some of the higher-quality spare capacity is not available due to security and operational issues.
- Estimates of decline rates for "existing production" vary by fields and regions, and depend on definitional issues, but most of the work done recently suggests that base oil production is likely falling off at about a 5% rate. This rate may be faster now than in the past because of improved production techniques. This implies that the oil industry must work very hard to replace "base" production levels and even harder to meet growth in demand.
- New oil discoveries are being made in an ongoing process that includes the addition of reserves from existing fields as reservoir knowledge accumulates and recovery techniques improve. The line between what petroleum engineers consider conventional and unconventional blurs as technology changes. What matters most in these matters are costs and returns, not static definitions. Future projects are likely to be more complex and remote, resulting in higher costs per unit of energy produced.
- The level of investment required to meet historical levels of demand growth is being hampered by access issues. Conventional oil and natural gas resources are increasingly concentrated in a handful of non-OECD countries. The national oil companies and energy ministries in these countries play central roles in policy decisions about how to develop and produce their resources and these sovereign decisions do not always result in resource development patterns that are often seen in the OECD countries.
- Under our current assumption, we see global demand expanding from about 87mmb/d in 2008 to about 97mmb/d in 2015 and 111mmb/d in 2030. With the OECD nations possibly stuck at a supply level near 50mmb/d (a plateau in the 2010-2015 timeframe), most of the growth in supply to meet this demand will to come from OPEC, rising from some 35mmb/d of output in 2008 to 45mmb/d by 2015 and some 55mmb/d by 2030. Although supply growth above 95-100 mmb/d is not impossible, it will require a level of investment by the national oil companies that central-government budgets may not accommodate, or a return of the international oil companies to countries where they are currently either excluded or largely unwelcome.

Summary p.2

- We do not see a “peaking” of oil in the sense that production must imminently decline because of resource constraints. Such theories exclude the impacts of technology and prices. The world is not running out of energy resources, but there are accumulating risks to continuing expansion of oil and natural gas production from the conventional sources relied upon historically. To mitigate these risks, expansion of all economic energy sources will be required, including coal, nuclear, renewables, and unconventional oil and natural gas.
- Consumers in the US are already reacting to higher gasoline prices by reducing vehicle miles traveled, buying more fuel efficient vehicles, and increasing their use of mass transportation where it is available. Policies designed to moderate the growing demand for energy by increasing efficiency of transportation, residential, commercial, and industrial uses should be encouraged.
- In our view, there is a tug of war occurring in the oil markets based on two distinct views of how the marginal price of oil is set. One view is that “marginal cost of supply” should dominate, and we see this price being driven by changing cost and access issues; for now it might be near \$85/barrel. The other view is that prices are rising toward the level required to destroy demand, or to get it to slow dramatically. This could require oil prices in excess of \$150/barrel that would presumably bring demand growth under control over the next 5 years and thus eliminate the market worry (expectation) that demand growth trends are running well in excess of supply growth trends.
- Since we think that demand is showing signs of slowing, our forecast for next year is that oil prices should average about \$105/barrel but we see the risk to the upside. We offer the warning that since 1999, the analyst community has consistently underestimated the crude oil prices by an average of circa 31%. Our forecast for the longer-term is predicated on the belief that prices will eventually settle toward the cost of marginal supply, or \$85/barrel (real).
- The underlying drivers for prices now are very diverse and involve fundamental supply and demand issues, many of which we have already discussed: (1) OPEC production and spare capacity issues; (2) demand growth in China and the Middle East (subsidies on consumer prices; fast economic growth); (3) lags in capital spending in the oil industry and the erosion of that spending by cost inflation; (5) central bank policies (unsustainable economic growth fostered by cheap money, and the weak US dollar); (6) geopolitical issues in countries like Russia, Venezuela, Iran, Iraq, Nigeria, and elsewhere; and (7) policy decisions (corn ethanol as an example of unintended consequences, and the inability to open up federal lands to energy leasing, etc).
- Among the drivers for prices, I have excluded “speculation” in the sense of rising funds flow into futures from index and hedge funds. The level of speculation in the crude oil markets has remained relatively constant in percentage terms as prices have risen, suggesting that this driver has not played as significant role in price determination. Volumes in futures do not matter nearly as much as sentiment, and that is being driven by consideration of the supply and demand fundamentals. If it appears that demand is slowing and supply is rising, speculation will put downward pressure on oil futures prices.

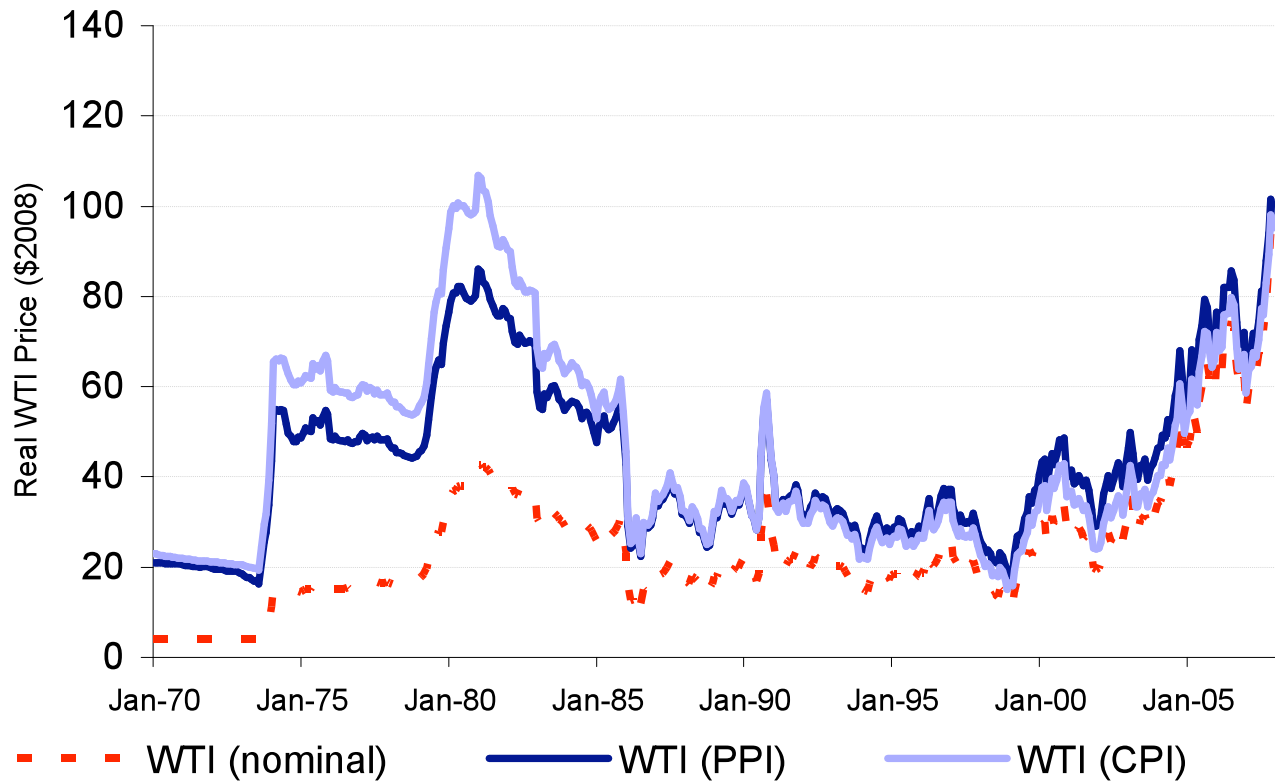
What Made the Bull Case in Oil?

Five key factors that drove oil higher

- **The emergence of China and other emerging market countries as new super-commodity consumers**
- **A strong base of oil demand in the US; and the role of oil non-OECD subsidies subsidies**
- **Underinvestment and lagging investment in new production and refining capacity**
- **Rising geopolitical risk**
- **Falling US dollar and low interest rates**

Oil Prices Adjusted for Inflation Are High

WTI crude oil adjusted by the US PPI and CPI



Source: Nymex, US Dept of Commerce

Oil Prices Adjusted for Income Measures Are Not Extreme

When Do Oil Prices Hit Extreme Levels?

Indicator	Oil price level
In real terms (PPI)	USD94
Analyst forecasting error	USD116
In real terms (CPI)	USD118
Versus the US dollar	USD120
Futures market forecasting error	USD130
Relative to per capita income	USD134
As a percent of US disposable income	USD145
As a share of the S&P500	USD145
As a percent of global GDP	USD150
Average	USD128

Risk Neutral Probabilities For WTI Dec'08

WTI crude oil price (USD/bbl)	Probability	
	Below	Above
USD50	0%	100%
USD60	0%	100%
USD70	1%	99%
USD80	3%	97%
USD90	7%	93%
USD100	14%	65%
USD125	41%	59%
USD150	68%	32%
USD200	92%	8%

Source: DB Global Markets Research

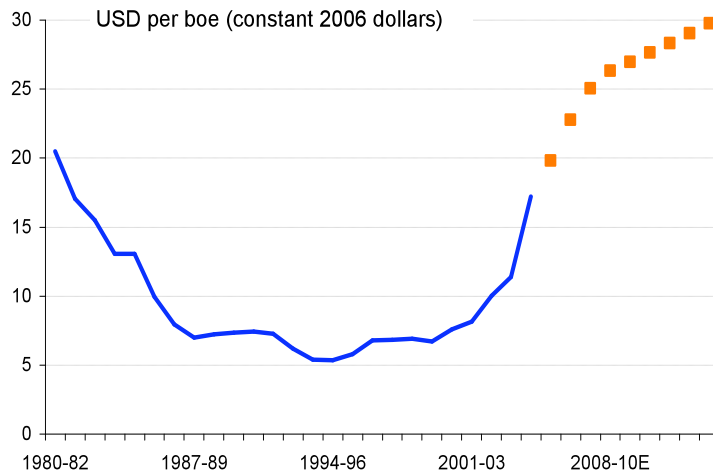
Outlook

- According to the variety of measures we track, on average oil prices start to move into extreme territory above USD128/barrel.
- At the moment, the WTI options market attaches a 8% probability of the Dec'08 WTI contract expiring above USD200/bbl.
- Meanwhile the WTI options market attaches only a 3% probability of the Dec'08 WTI contract expiring below USD80/bbl.

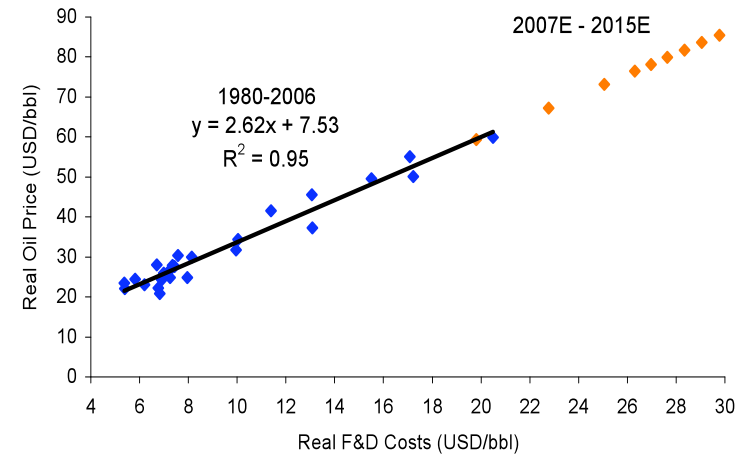
What Does It Cost to Find a Barrel?

Worldwide Finding Costs (USD/bbl)

Finding and development costs are rising rapidly and are expected to rise further over the next few years.



Oil Prices & Finding Costs Are Related



Source: DOE/EIA, Author

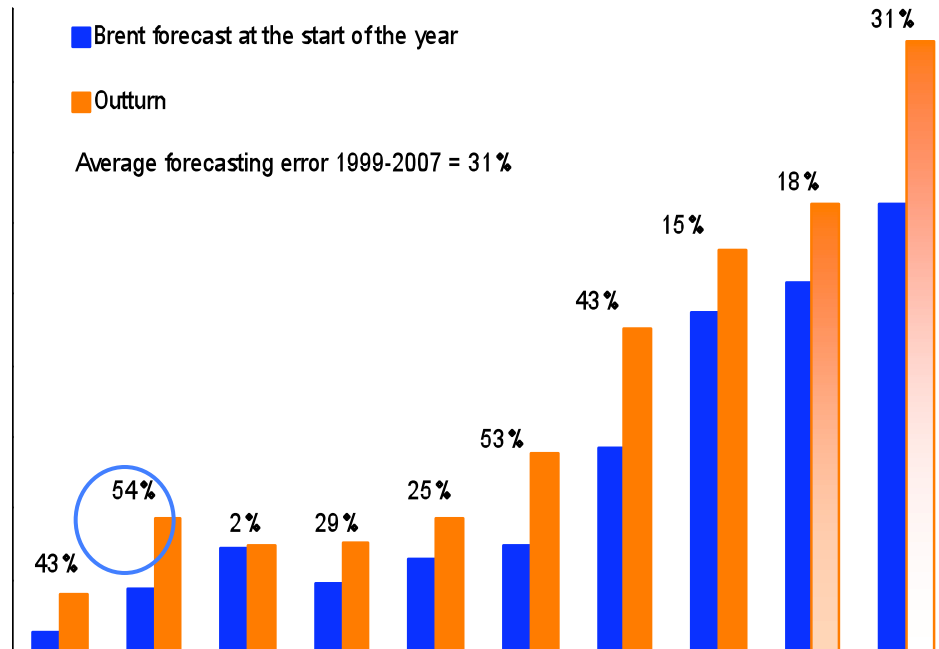
Outlook

- We estimate that finding and development costs have risen 20% per annum in real terms over the 2006 to 2008 period, and slower rates after that. This implies that F&D costs are likely to hit USD25/bbl in 2009 and possibly USD30/bbl in 2015.
- F&D costs have tended to be closely related to the oil price. Since 1980 we find that the oil price has tended to equal to 2.6x F&D costs plus USD7.5. This multiplier takes into account taxes and gross margin.
- To get oil to USD200/bbl on a cost basis seems like a stretch- F&D costs of USD40/bbl and a multiplier of 5x, however USD80/bbl in the 2012-13 timeframe is very consistent with this data and USD100/bbl oil is possible.

Analyst Forecasts Are NOT Making Oil Prices Go Up

Analyst Price Forecasts & Outcomes

Oil price forecasts have tended to be highly sensitive to the current oil price.



Source: DB Global Markets Research, Reuters

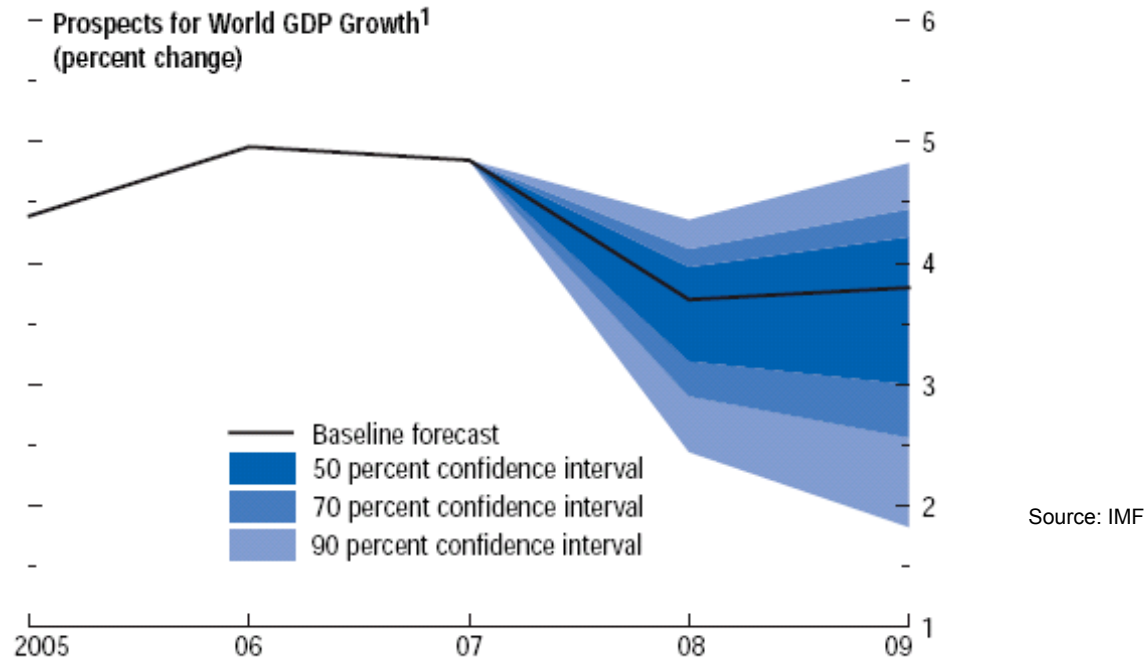
Outlook

- Since 1999, the analyst community has consistently under-estimated the crude oil price by an average of +31%.
- If this forecasting error persists it would imply the Brent crude oil price averaging USD96/barrel in 2008. However, if oil prices average USD116/bbl this year it would represent the largest forecasting error among the analyst community in recorded history.

Can a Recession Bring Down Oil Demand / Prices?

IMF's View of Global Economic Risks

The US accounts for about 22% of global GDP.



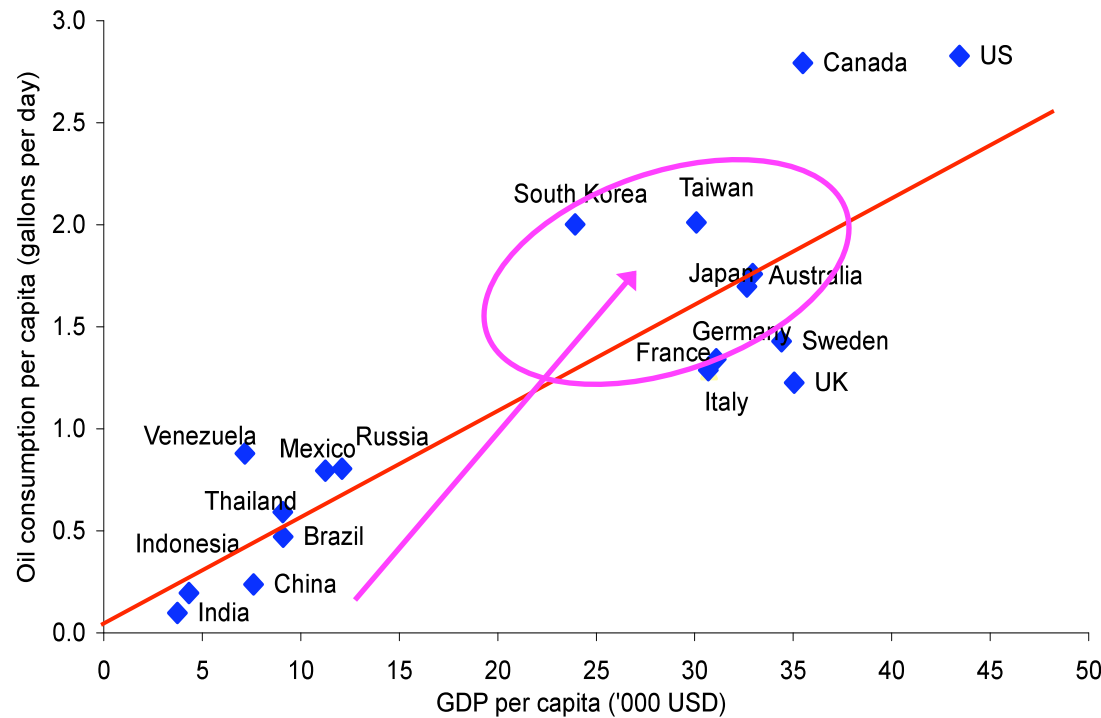
Outlook

- Average economic growth levels over the last few years have exceeded 5% compared to a long-term
- Nearly half of the world's GDP is now generated outside the "advanced economies" measured on a purchasing power parity. Will US troubles spill over?
- According to the IMF, risks to the global outlook have moved "squarely to the downside" for 2008-09. Latest IMF confidence levels suggest a low risk of sub 2.0-2.5% world growth.
- Global oil demand tends track about 2% below global GDP growth.

Long-Term Still Looks Relatively Bullish for Oil Demand

Per Capita Oil Consumption Relative to GDP

Twenty five years ago, South Korea and Taiwan were where China and India are now.



Source: IMF, IEA

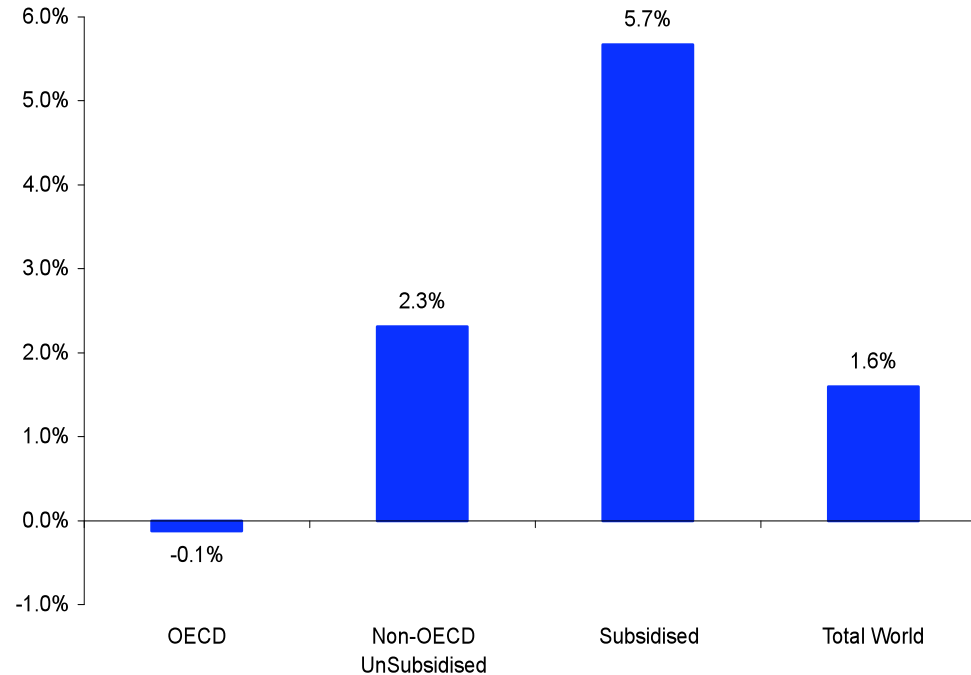
Outlook

- One third of the world's population is just entering the middle class and want the oil-consuming lifestyle that goes with that.
- The questionable characteristics of Asian financing - subsidized loans and the tendency to prioritize full employment and expansion of market share above rates of return, efficiency and profitability - have not disappeared since 1998.
- Some economists argue that sooner or later that this too-rigid system in China will crack, just as occurred at different times in Japan, South Korea, Thailand, Malaysia, Taiwan and Indonesia.

Oil Demand & Consumer Price Subsidies

Oil demand growth has been strongest in countries with price controls

If consumer subsidies are removed in countries like China and India, oil demand growth could slow below consensus forecasts.



Source: IEA, Author

Outlook

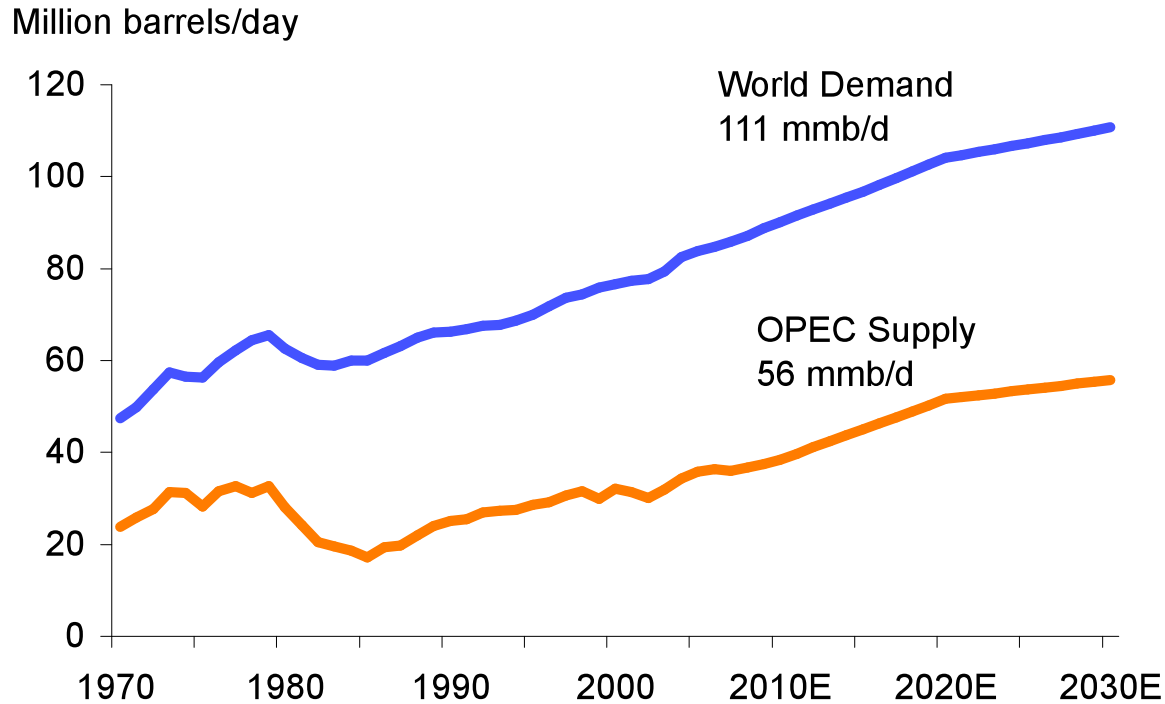
- Of the roughly 87mmb/d of oil use in 2008, 47mmb/d in the unsubsidised OECD and has the lowest growth rate, 25mmb/d is subsidised, and the remaining 15mmb/d in the non-OECD is mostly unsubsidised. The demand growth rates from 2000-2008E are highest in the non-OECD subsidised countries.
- The 25mmb/d of subsidised oil consumption is split roughly 2/3 to importing nations and 1/3 to oil exporters. The oil exporters have less incentive to reduce their subsidies in a period of high oil prices. All of the growth in oil demand in 20087 is coming from the group of subsidised nations.

Addicted to Oil

Oil demand projected using recent historical growth rates

Over the coming decades, energy demand will grow to increasingly higher levels as economies and populations expand. This will pressure the supply system and require increased emphasis on energy use efficiency.

NPC 2007



Outlook

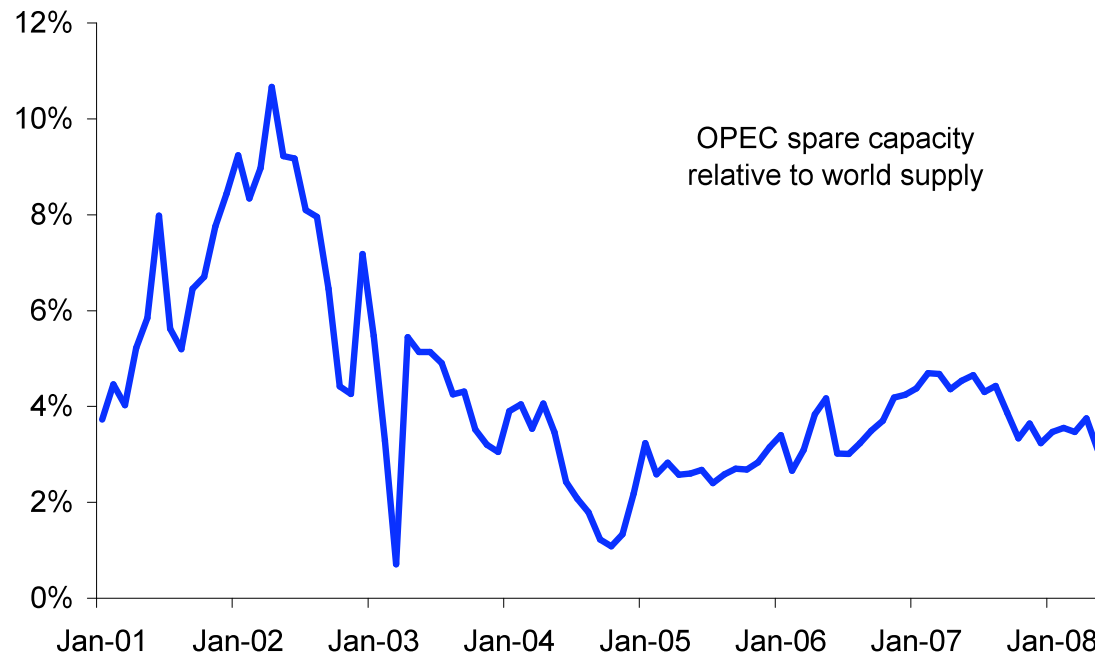
- Increasing reliance on OPEC post 2010
- Rising doubts about ability of supply to reach the levels implied by demand

OPEC Spare Capacity

Spare capacity is currently about 2.5 mmb/d, but most of that is not useable

Spare capacity is mainly in heavy, high sulfur crude oil that can only be processed in sophisticated refineries.

There is a mismatch between spare refining capacity and spare oil production capacity.



Source: IEA, Author

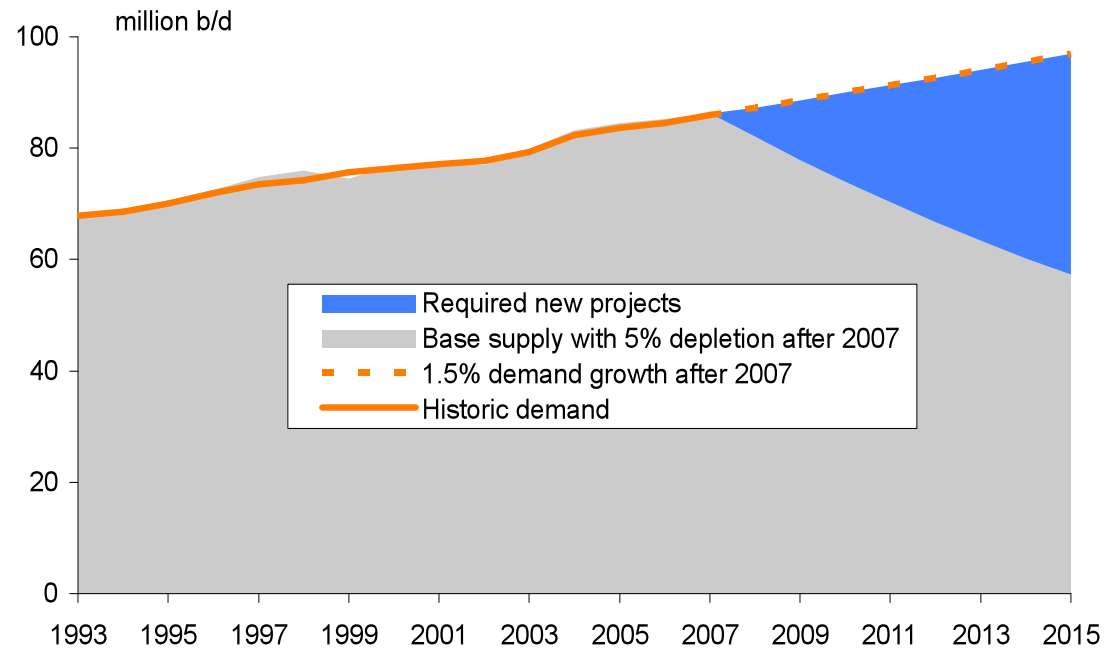
Outlook

- OPEC effective spare capacity (excluding Iraq, Indonesia, Nigeria and Venezuela which face ongoing security, operational or investment issues) has now slipped below 2 mmb/d, about 3.5% of global demand. Much of the spare capacity is very difficult to refine.
- OPEC (and especially Saudi Arabia) is investing in new capacity, but the pace of development may not keep up with demand. OPEC faces the same infrastructure bottlenecks that are derailing project completions globally.
- Many analysts believe that refining capacity growth could exceed demand growth in 2008-09, and this should help free-up some effective spare capacity.

The Global Oil Challenge

Fighting the natural depletion curve: Not impossible, but not easy

With demand growing by 1.5% annually, and a 5% average depletion rate on all fields currently in production, OPEC output will have to rise by 10mmb/d and non-OPEC stay on plateau to make up the difference.



Source: IEA, Author

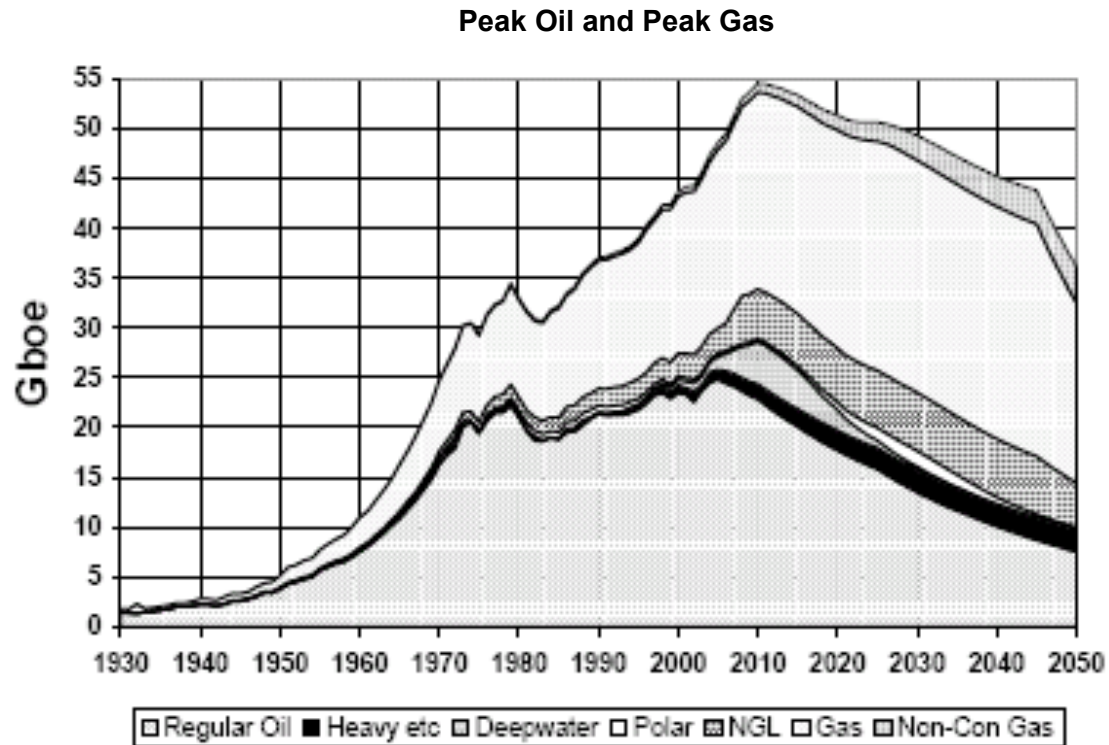
Outlook

- Global oil supply has grown by 1.5%/ year since 1992. But the challenges over the next ten years to supply in both the non-OPEC countries (the US, the North Sea, Mexico, and Russia) and in OPEC (Nigeria, Venezuela, Iraq, Iran) are serious.
- Output growth from new projects in non-OPEC areas such as in the Caspian Sea, Sakhalin Island in far-eastern Russia, Africa, Brazil, and the US Gulf of Mexico will help push non-OPEC supplies by 2-3mmb/d from today's level of 50mmb/d, but not much higher.
- OPEC's current production of 35mmb/d might have to reach 45mmb/d by 2015 and although this is not impossible, it will require a level of investment by the national oil companies that central-government budgets may not accommodate, or a return of the international oil companies to countries where they are currently either excluded or largely unwelcome.

Peak Oil?

Not enough of a good thing?

Some analysts think that global oil production will peak within the next few years.



Source: Association for the Study of Peak Oil

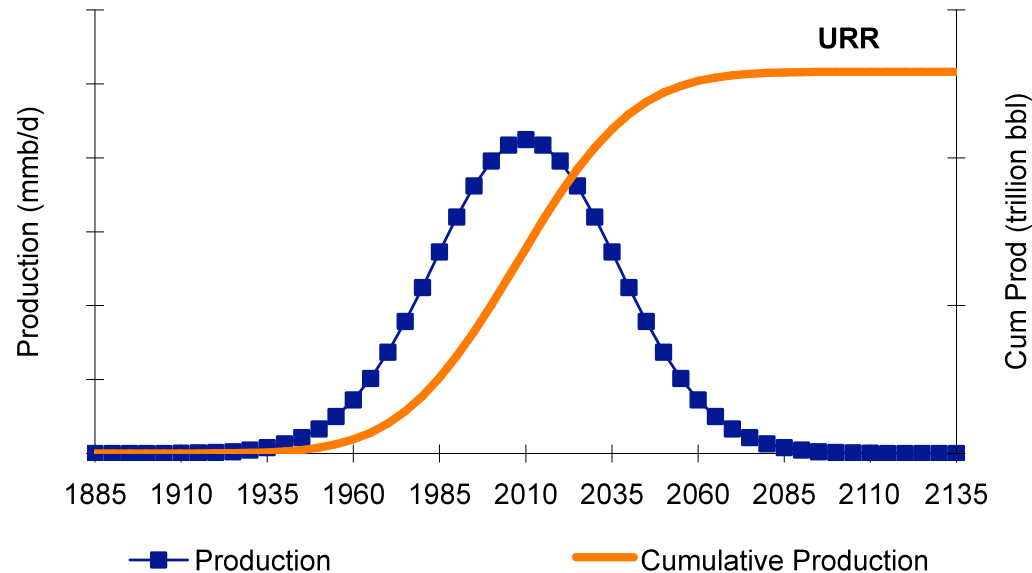
Are We Really Running Out? **Probably Not**

“Peak Oil” Theory

(1) requires a “final” estimate of the level of ultimately recoverable reserves (URR)... but URR estimates have been rising.

(2) assumes that once half of the world’s reserves have been used up, production must fall... but that point keeps moving ahead in time.

Hubbert Peak Curve (Idealized)



Source: Author

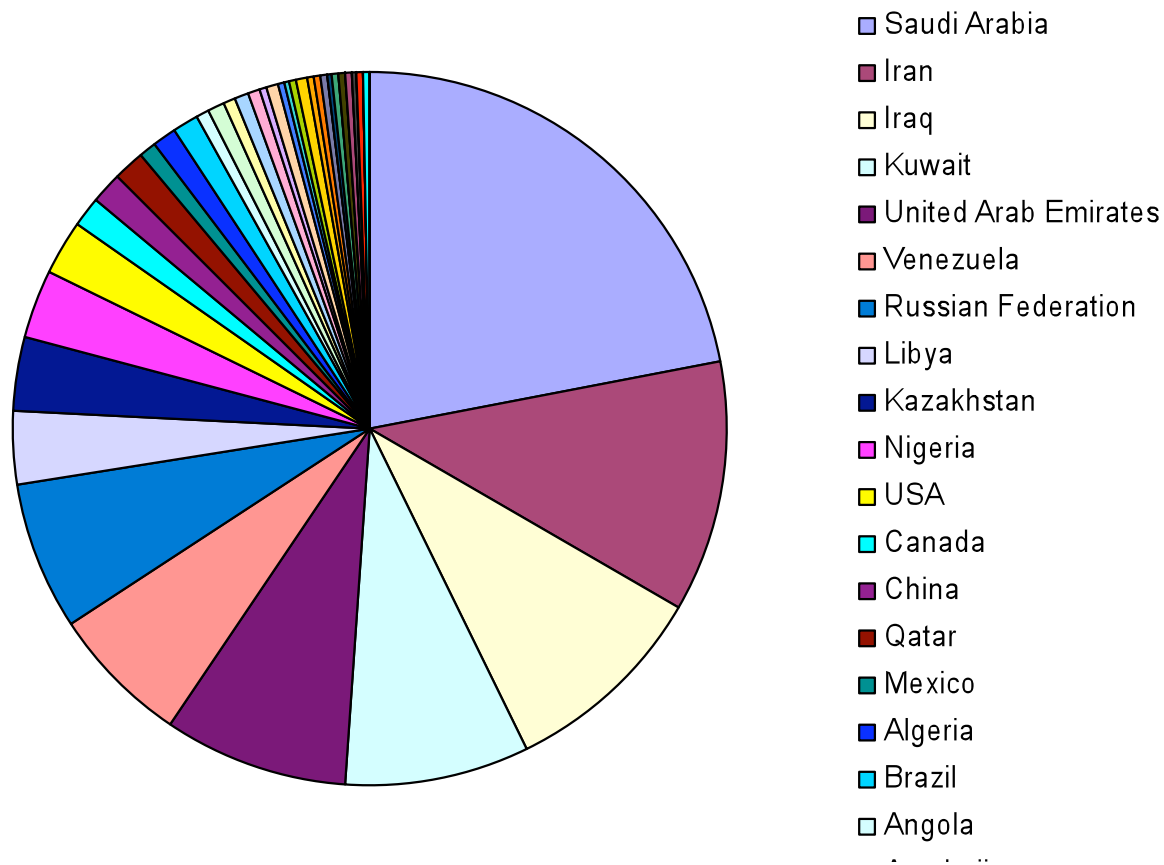
Outlook

- King Hubbert, a geologist for Shell and the USGS, used a bell curve to correctly predict the 1972 peak in US oil production. Followers have attempted to extend Hubbert’s methodology to forecast a world oil peak this decade.
- Most famous among Hubbert’s followers is geologist Colin Campbell, whose views about oil resources have been disseminated through the press and have influenced many opinion makers.
- Hubbert models do not account for changes in technology, costs, prices, or politics - all of which can have a huge impact on the actual shape of the production curve. Hubbert peak oil models assume a symmetric curve.
- Increases in subsoil knowledge, the spread of technological progress, and the advancement of drilling – along with political decisions and oil price changes – have shown time and again that peak production can be increased and delayed.

The Geopolitics of Oil

Remaining oil reserves are in places where risks often accumulate

Iran is the 2nd largest reserve holder, the 4th largest oil producer, and the 5th largest exporter.

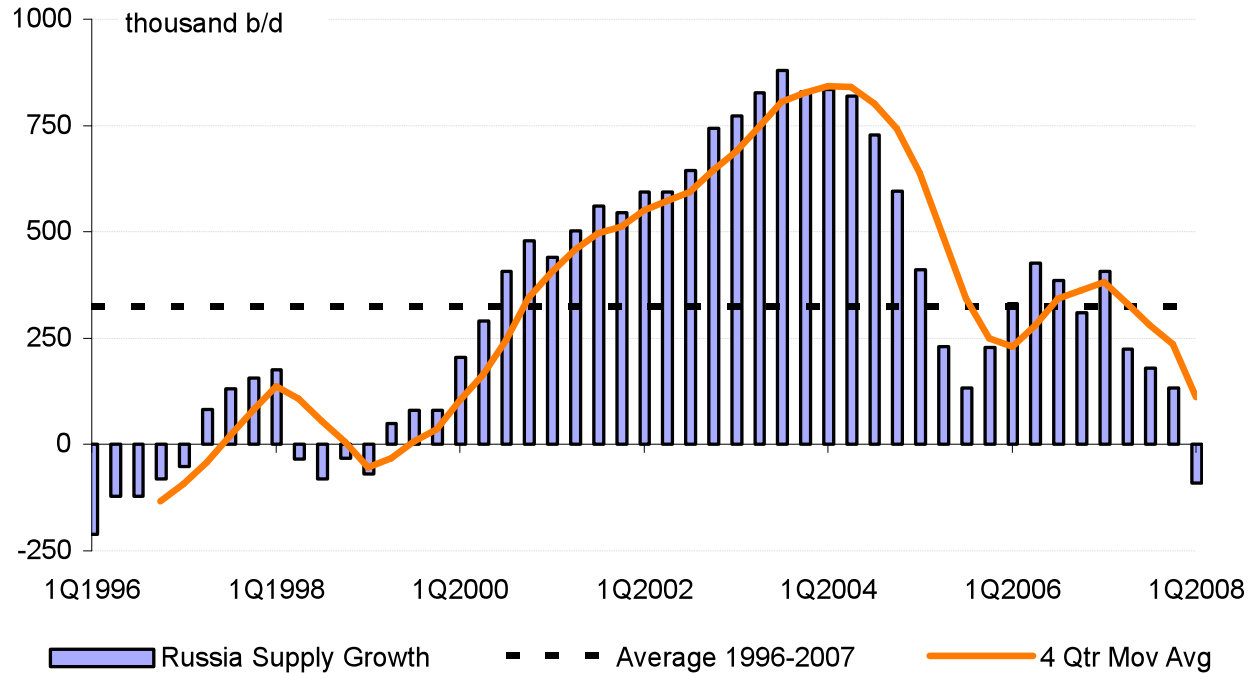


Source: BP Statistical Review

The Geopolitics of Oil

Russian production declines for the first time in a decade

President Putin's oil policies in his first term worked ..but in his second term have been a disaster.



Source: IEA

Outlook

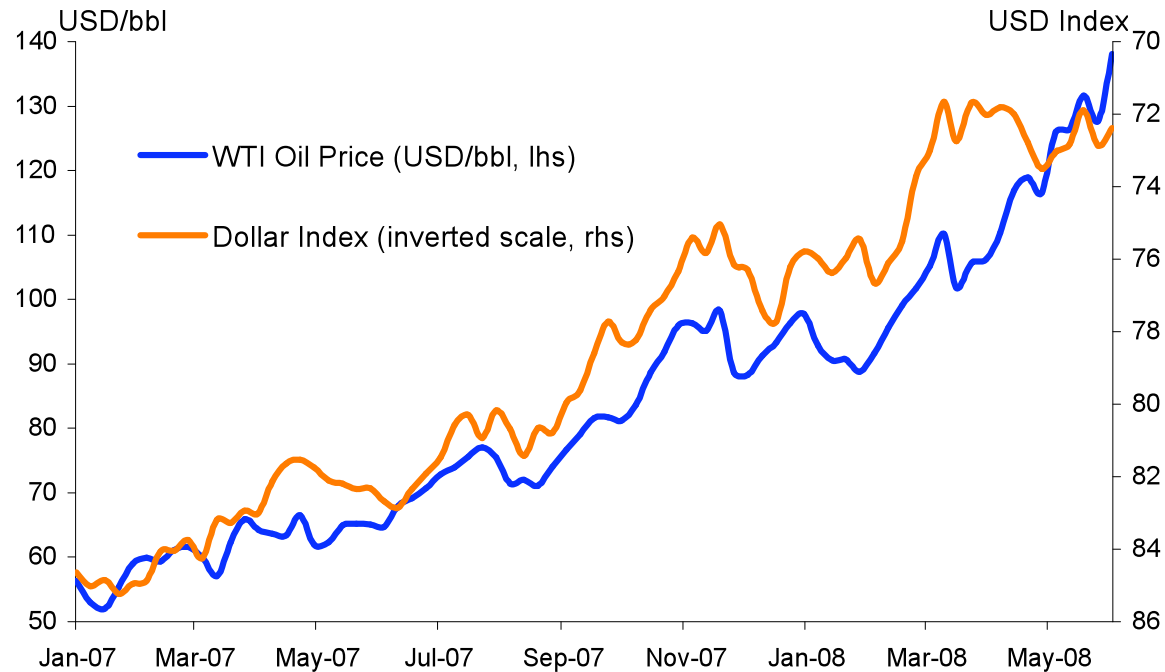
- The Russian government's policy of hostility to its own oil entrepreneurs, growing disdain for foreign capital, and desire to maximize taxes regardless of the impact on capital investment has brought an end to the growth in production.
- Although "peak oil" proponents are citing the development as proof that global production is faltering because of geological constraints, we see the situation as offering strong evidence that oil production problems are being driven more by "above the ground" problems.

Weak Dollar Is Driving Oil Higher

What is the falling dollar doing to commodities and oil?

The dollar-oil regression is not perfect, but traders like it...

...and a recent study by the IMF says that gold and oil are sensitive to movements in the dollar.



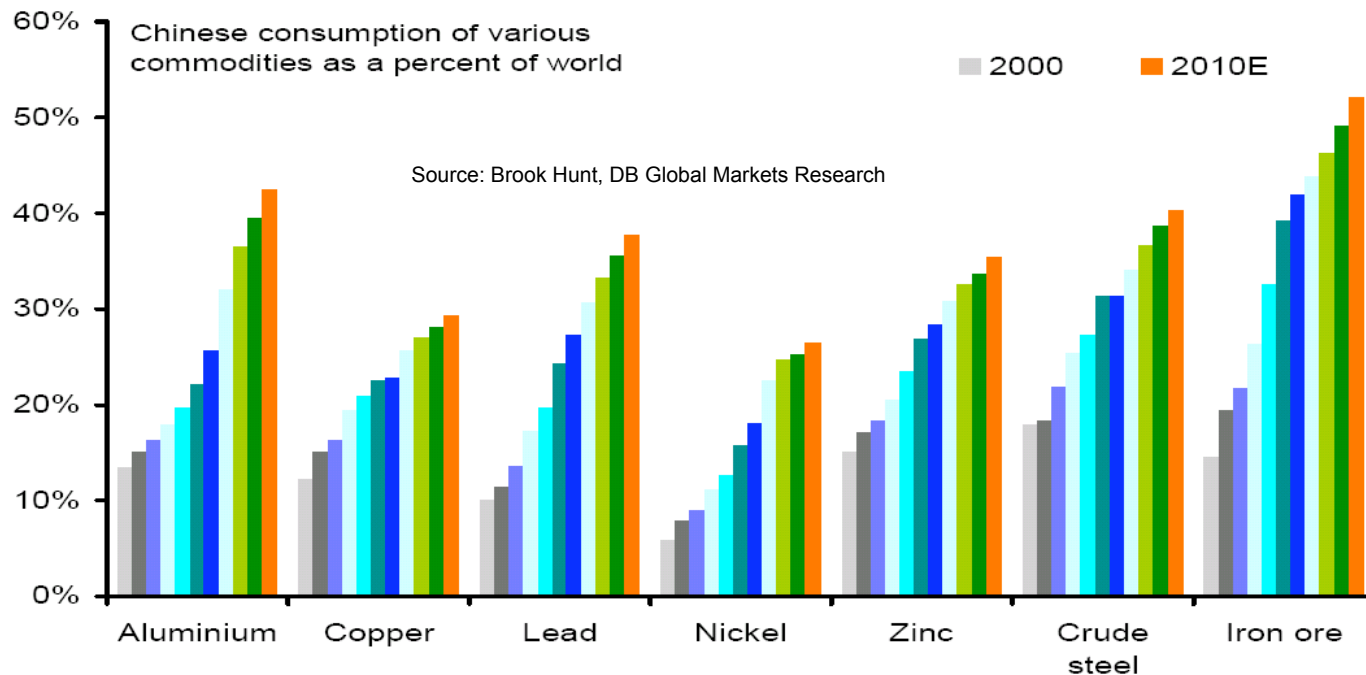
Source: Nymex, Bloomberg

Outlook

- According to the IMF, in the long run, a 1% depreciation in the US dollar is associated with increases for gold and oil prices of more than 1%.
- In the short run, the elasticity is close to 1, but higher for gold than for crude oil, says the IMF.

Iron Ore ...lessons for the oil outlook?

China's voracious appetite for iron ore



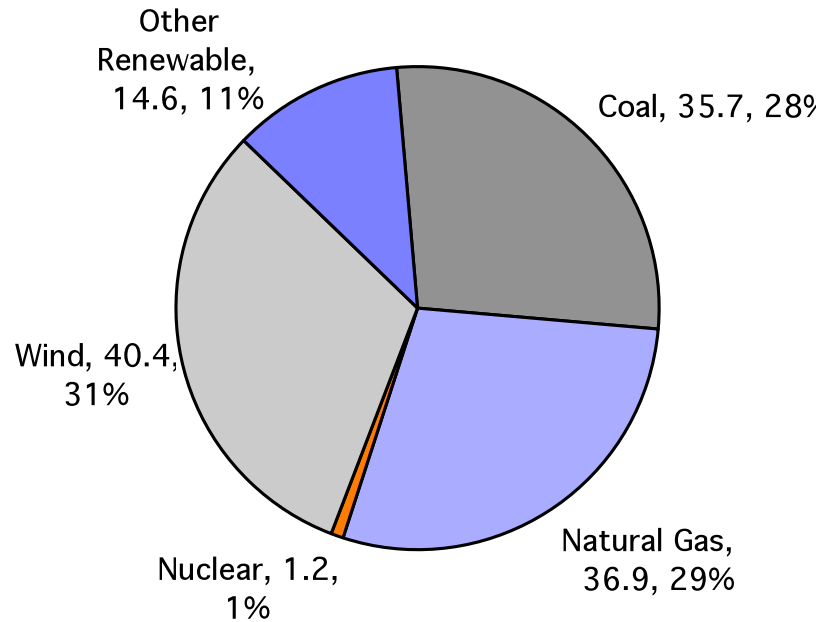
Outlook

- Iron ore is one of the most abundant commodities in the world. During this decade China has become the world's largest consumer and importer of iron ore. Since 2001, China's share of world use of iron ore has risen from 15% to over 45%.
- Global iron ore demand has been rising strongly in response to the global surge in steel production, most notably in China.
- On the supply side, unexpected operating problems in a number of mines and the difficulties in bringing new productive capacity on stream will likely continue.
- We expect iron ore prices will continue to move higher in response to tight market fundamentals. We note that there is no developed futures market in iron ore.

US Power Outages

Planned US Electricity Capacity Additions (Giga Watts)

Inability to get coal plants permitted, is increasing the potential for power shortages after 2010.



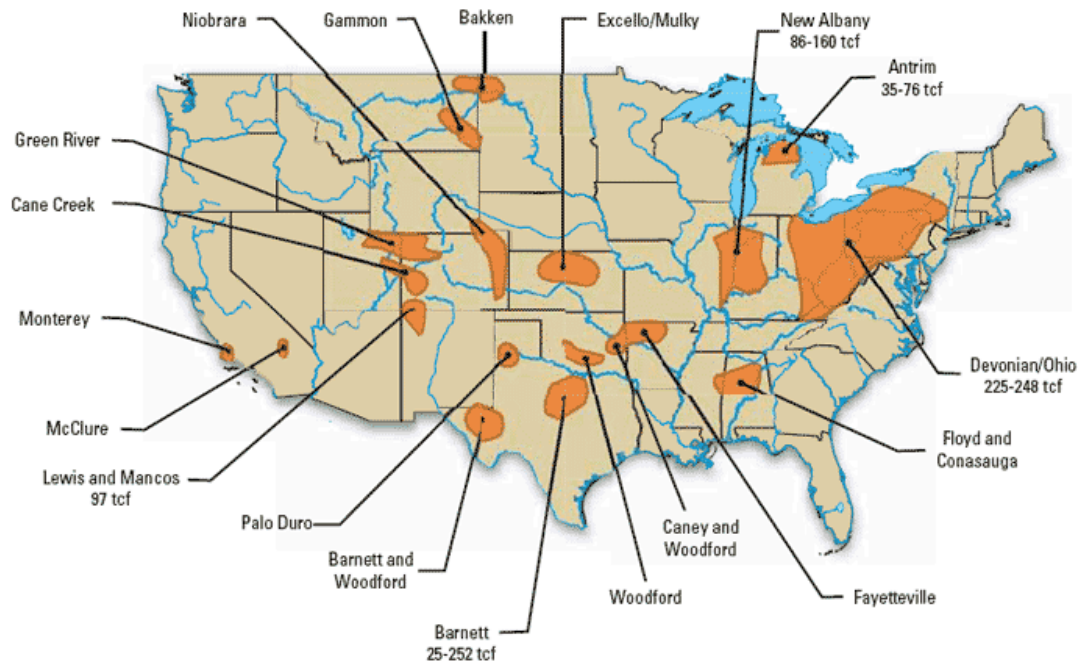
Source: Wood Mackenzie

Outlook

- There are 129 GW currently under development or proposed in North America out to 2013.
- Coal plants are 28% of the mix. Wind looks big, but for peak availability purposes, only 10-15% of that can be counted on reliably. If we can not get coal plants permitted, the potential for power shortages after 2010 rises dramatically.
- Nuclear has growing potential (but not until well after 2013, and maybe not then, depending on energy policies).
- Demand growth requires at least 75 GW of power additions.

US Gas Supply Bubble Coming?

Major US shale basins... some analysts think a production surge is coming



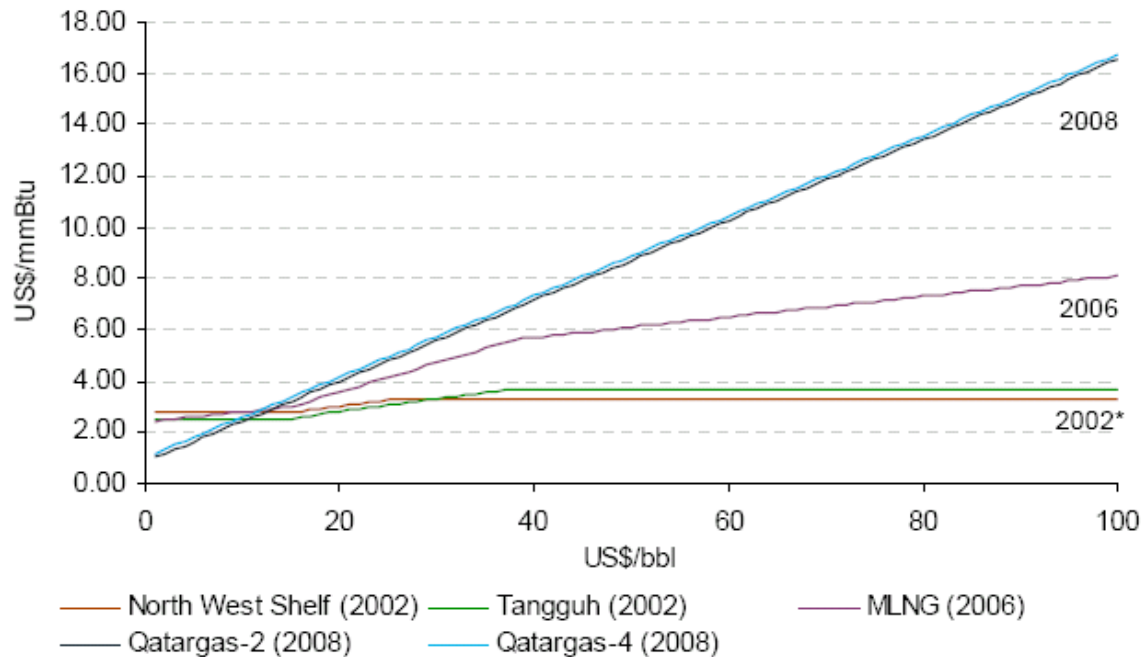
Source: Schlumberger

Outlook

- Independent natural gas producers are increasingly optimistic about their ability to develop shale plays around the US.
- The Barnett shale in Texas has been a huge success. DOE's gas supply models may be underestimating the potential strength of domestic production.

LNG Pricing Issues

China's deal with Qatar could have global implications for natural gas prices



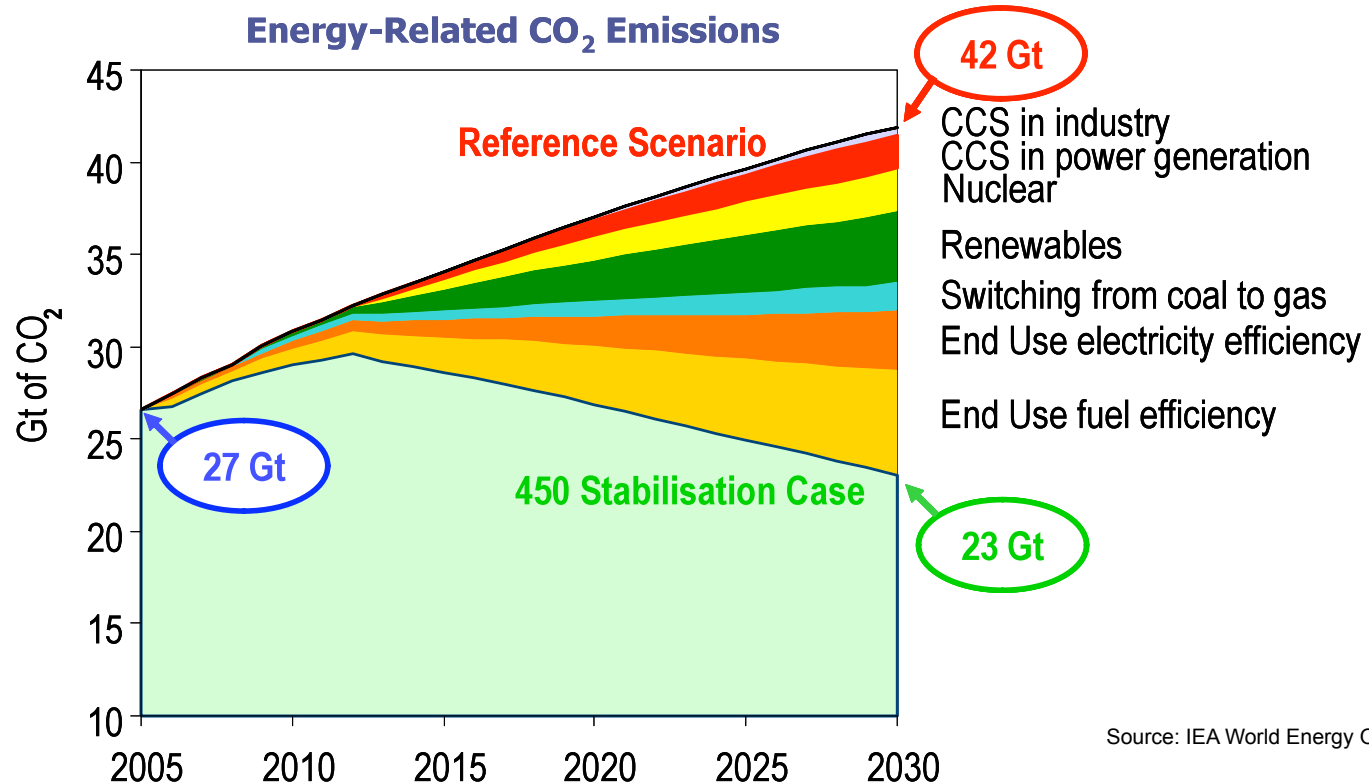
Source: Wood Mackenzie

Outlook

- PetroChina and China National Offshore Oil Company (CNOOC) signed agreements for a total of 5 mmtpa of Qatari LNG. China has accepted that in order to procure LNG for near term delivery, market prices have to be paid – there is no cheap LNG in the current climate.
- Qatar's pricing demands for oil/gas parity terms in new long term contracts has not discouraged a huge buyer.
- China's moves should set alarm bells ringing in Japan where most buyers have been refusing to commit to medium or long term volumes at these price levels, and something of a stand-off between Japan and Qatar has prevailed.

Energy Implications of Stabilizing Carbon Dioxide

Accomplishing This Goal Probably Requires A Complete Energy Policy Rethink



Outlook

- Fossil fuels account for about 80% of the world's total energy use.
- Most forecasts (DOE/EIA, ExxonMobil, IEA) expect this percentage to remain relatively stable over the next 20-25 years.
- Even with double-digit growth in wind and solar power, and a strong effort on biofuels, the necessity continues for conventional oil and natural gas to meet requirements for population and economic growth.

What Are the Policy Prescriptions?

There is no single, easy solution to the global challenges ahead

- Encourage energy efficiency across all sectors
- Encourage all fuels – diversity is key
- Price externalities (carbon is an externality)
- Encourage trade and investment
- Avoid “easy” solutions that make problems worse
- Establish global standards for measuring carbon
- Enhance science & engineering capabilities

Source: Author

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Adam Sieminski

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