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Tom Whipple will be in China from April 15th through May 6th. During that time, ASPO-USA Co-Founder Steve Andrews is preparing Peak Oil Review and the Mid-Week Update, while Ray Long is publishing the daily Peak Oil News.

1. Oil and the Global Economy

Futures prices of both oil and natural gas reversed the trends of the prior week. In fact, both sets of prices ended up where they started mid-month, during a period of increased volatility. Oil prices on the New York Mercantile Exchange started the month at just under \$98, dropped in two steps to \$87 by mid-month, then recovered sharply last week to close at \$93. On the London ICE, Brent crude started the month near \$109, fell 10% to below \$97 before settling Friday at \$103.16. The spread between the NYMEX and Brent, now at \$10/barrel, is near its low for the year.

NYMEX natural gas prices closed at a yearly high on April 19th at \$4.41, then pulled back roughly 5% last week to close at \$4.17. The summer refill season which starts at the end of the nation's heating season—typically in early April—is off to its slowest start in several years. Stockpiles reported last Thursday were 31.8% below the previous year and 5.1% below the five-year average.

Bullish factors cited as driving last week's oil price recovery include an uptick in US GDP growth (from 0.4% in Q4 of last year to 2.5% in the first quarter of this year); a 3.2% uptick in consumer spending; lower-than-expected first-time jobless claims; a large 1.8% decrease in gasoline stockpiles as demand rose 4.4% to 8.75 mb/day; and the continuing geopolitical risk to Middle East supplies from Syria's civil war.

Ironically, the list of economic forces likely depressing US demand and prices starts with the GDP growth number cited above: our 2.5% increase was less than the 3% figure which analysts expected; and as one analyst pointed out, most of the growth came as a function of business inventory builds early in the quarter. Another economic constraint included a decline in government outlays for the 10th time in 11 quarters, led by a steep 11.5% drop in military spending—the steepest annual decline in military outlays since the Korean War. Two other down-side factors include an increase in US crude oil inventories to the highest level since 1990

plus an increase in US oil production to 7.33 mb/day—the highest since April 1992. The bears' take-away is that the economy remains in the slow and uneven growth plaguing it since the Great Recession.

On the oil business front, the head of Vitol Group, the world's largest privately held oil trader, offered that he could see prices moving either side of \$100/barrel. Oil companies reported first-quarter production and profits. Chevron profits were down 4.5%, profits flat for Exxon and Conoco Phillips, with production relatively flat for all three. Total said oil and gas production was down 2%.

2. The Middle East

The United Arab Emirates, in line with a statement last week from their oil minister that the days of easy and cheap oil are gone, is planning to produce up to 25% of its power from nuclear energy by 2021. Switching a large fraction of power generation to nuclear will reduce domestic reliance on fossil fuels and ensure the UAE has both enough oil to export as well as to supply a 400,000 b/day expansion of their oil refinery. The UAE also plans to increase its oil production capacity from 2.8 million b/day today—Bloomberg's estimate—to 3.5 mbd by 2017.

In Syria, the lack of a normal oil sector plays a small role in generating the region's many refugees. Syria's oil exports, which once provided a quarter of all government revenue, have almost completely ended. At present it's unclear which Syrian rebel factions control the oil fields and whether shipments can be resumed. Despite that uncertainty, the EU announced last Monday that it would authorize oil imports and related investments in Syria's oil industry. The EU's stated goal is to help the civilian population and support the opposition in that country.

This announcement irritated Russia. Syria hopes to clinch more financial aid from its Russian and Iranian allies soon, but still has enough foreign reserves to pursue its war on rebels trying to oust President Bashar al-Assad, the central bank governor said.

Yet two years after the start of the uprising against President Bashar al-Assad, the UN reports that over 4 million Syrians are homeless, short of food and reliant on aid within the country, while an additional 1.1 million have fled the country. Farming is reportedly collapsing, strengthening the outflow of refugees.

In Iraq, an unstable social and security situation in the northern sector once again raises the reality that the country could split apart. Two days of violence last week lead to 100 more deaths, many of them the result of clashes involving security forces. A repeat of relentless violence that defined the 2006-2007 era could emerge. With the Kurds' 30,000 Peshmerga fighters mobilized and in a standoff on the internal border that demarks Kurdistan from the south, a potential flashpoint in disputed areas like Kirkuk is at hand. The range of deteriorating problems puts Iraq's aggressive oil production targets and the nation's future at risk.

3. LNG developments

In the US, Dominion announced it is proceeding with its LNG export project at its Cove Point terminal in Maryland. Construction should start in 2014 on the \$3.4-3.8 billion project, with an in-service date of 2017. Cove Point has signed 20-year conditional agreements with affiliates of Japanese and Indian importers. Cheniere Energy has been converting its Sabine Pass LNG port in Louisiana into an export facility with hopes to begin shipping by 2016.

India's Petronet LNG reported last week that it has signed a preliminary agreement with United LNG for the long-term supply of LNG via its offshore Main Pass Energy Hub in the Gulf of Mexico. The \$14 billion project will receive gas by pipeline, store it in underground formations and liquefy it on six floating vessels located 16 miles off the Louisiana coast. Construction of the first liquefaction ship is scheduled to begin this year with start-up by mid-2017. The Main Pass Energy Hub has already been authorized to export LNG to countries that have free trade agreements with the US.

In Russia, Rosneft claims the government can grow the economy by liberalizing LNG options for Asian markets. Two weeks ago Rosneft and Japanese company Marubeni Corp. signed an MOU on the implementation of a new LNG project in Russia's Far East. The project would allow the possibility for joint exploration and development in Rosneft's oil and gas fields. At present, Gazprom operates Russia's only LNG plant, located on Sakhalin Island on the east coast. Gazprom officials met last week with Japanese officials to discuss an LNG project planned for Vladivostok, also on Russia's eastern shore.

4. Pipelines

Keystone XL: In the latest round in the fight over this cross-border pipeline, the House Natural Resources Committee voted 24-17 last week in favor of a bill to make it easier for TransCanada to build the pipeline and harder for President Obama to delay it. But the issue isn't resolved yet as counterpunches keep coming from both sides.

Polls conducted by Washington-based Woodrow Wilson International Center for Scholars found that 74% of Americans support the pipeline compared with 68 percent of Canadians. The survey also found that most Americans said they care more about North American energy independence than reducing greenhouse gases contributing to climate change.

Critics of the pipeline project state they gathered over 1 million comments against the Alberta-to-US pipeline, showing what they called grassroots opposition to the \$5.3 billion project. API countered with a web-based mass mailing effort that stimulated the sending of 230,000 electronic letters to Secretary of State John Kerry urging his approval of the pipeline. In the face of the ongoing back-and-forth, TransCanada Corp. said last Friday it was delaying the in-service date for its proposed pipeline to the second half of 2015 as it awaits the final U.S. decision.

Given ongoing difficulties over US approvals plus resistance to a pipeline through British Columbia to the Pacific, provincial Energy Minister Ken Hughes said his government was in separate talks with the Northwest Territories to explore building an oil pipeline to a port on the Arctic ocean. Is this inspiration or desperation?

British Columbia: Local critics say their elected leaders need to take a stronger stand about proposed oil pipeline development plans from Alberta to the west coast. Pipeline company Kinder Morgan expects to spend about \$5.5 billion to increase the capacity of its existing 750,000 bp/day Trans Mountain pipeline by roughly 20%. They also plan to twin the current 715-mile pipeline to expand access to Asian markets. Native groups and others have challenged the proposals over concerns for potential environmental effects of expanded oil activity in the region.

Pegasus spill: When roughly 5,000 barrels of oil spilled during late March in a Mayflower, Arkansas residential neighborhood from a break in Exxon Mobil's Pegasus pipeline, it briefly stoked the national debate about pipelines. Installed during the 1940s, Pegasus was carrying diluted tar sands oil from Canada. But Exxon's fast

response and apparently adroit handling of the spill's aftermath has muted local and national reaction. Last week, Exxon said it has removed most of the residual oil and is focusing on cleanup operations, signaling its shift from the emergency phase to longer-term remediation and restoration operations.

5. Quote of the Week

- "We are moving into an environment where \$90/b Brent [crude oil] will become more of a ceiling for the market. But it's hard to pick where the bottom will be." (4/23 #2)
- Ed Morse, global head of commodity research for Citi Group
- "There's plenty of oil in the ground, but you need the price to produce." As a result, Preel said, "high prices remain probably in the long term" despite the marked increase in oil supplies from the US. Oil prices at "roughly" \$100/barrel are required for future upstream investments in unconventional oil production as well as for the sustainability of producer governments. (4/23 #3)
- Xavier Preel, vice president for Middle East E&P at France's Total

6. The Briefs (clips from recent Peak Oil News dailies are indicated by date and item #)

- **Total energy rigs** drilling in the U.S. slipped by four to 1,754 last week. Oil rigs increased by 10 to 1,381. The number of gas rigs fell for the first time in three weeks, declining by 13 to 366, according to Baker Hughes Inc. (4/27 #5)
- **China:** The U.S. EIA said oil production from China is expected to reach about 4.5 million barrels/day this year and 4.7 million bpd by 2035. (4/23 #7)[*Editor's note: dartboard alert?*]
- **China's** plan to build a second aircraft carrier and the **Indian navy's** recent test-firing of a submarine-launched cruise missile should be ringing alarm bells in the Persian Gulf. Beijing and New Delhi are squaring off militarily in the Indian Ocean, the key energy artery from the Middle East and Africa to the Asian giants who need the oil and gas to fuel their expanding economies. (4/27 #2)
- In the **Kurdish region of Iraq**, a second test well by Anglo-Turkish company Genel Energy confirms a "significant oil discovery" in the rapid appraisal process. (4/26 #5)
- **Demand for OPEC oil** will recover before the end of the decade, as a flood of crude from the US' shale oil boom will eventually stabilize and demand looks set for more growth over the next seven to eight years, David Dalton, a BP regional president said Monday. (4/22 #9)
- **India's crude imports** from Iran plunged by more than 26% in the 2012-13 financial year (April-March) as US and European sanctions on Tehran combined to make it difficult for Indian refiners to ship Iranian oil. (4/25 #7)
- **Ghana**, West Africa's second-biggest economy, expects oil production to more than double to 250,000 barrels a day by 2021. \$20 billion will be spent to raise production at the Jubilee field and other sites. (4/26 #7)
- **Venezuelan** President Nicolas Maduro put the country's electricity supplies on an emergency footing after Caracas and outlying areas plunged into darkness amid repeated blackouts. Maduro said a 90-

day state of emergency in the country's power sector would allow the government to address infrastructural problems. (4/27 #3)

- **U.K. North Sea** oil and gas production has dropped by more than half since its peak of around 4.6 million barrels of oil equivalent (BOE) a day in 1999. Within five years, fields enabled by new technology being employed west of the Shetland Islands are expected to help the country's production rebound back above two million barrels of oil equivalent a day by 2017, compared with 1.55 million b/day last year. (4/26, #20)
- The second area driving the North Sea revival is in **Norwegian waters**, where Sweden's Lundin Petroleum found a new field in 2010 (John Sverdrup) with 1.7 to 3.3 billion barrels of oil, the largest discovery in three decades. As a result of that and more recent activity, Norway expects their total oil and gas production to bottom out at 3.7 million BOE a day this year and rebound to 3.8 million barrels by 2017. (4/26 #20)
- **Exxon Mobil** began production at its Kearl oil sands project in Alberta, which is projected to produce 4.6 billion barrels of recoverable oil in the next 40 years. The C\$12.9 billion project has been beset by equipment transport and weather delays plus rising costs. (4/27 #6)
- **Drilling Technology:** Unlike traditional rigs on rails that only allow movement from left to right or front to back, Schramm's T500XD has a walking subbase which lifts the entire rig six inches, allowing the rig to turn. The rig can "walk" at a pace of 30 feet per hour and move a full 360 degrees, rather than just moving forward and back or side to side. (4/27 #9)
- The development of **shale oil and gas** reserves around the world will generally be much slower than in North America, Royal Dutch Shell has warned. Chevron has suggested commercial production from shale in Europe is unlikely to start this decade. (4/23 #4)
- Tesoro Corp. plans to build **a complex in Washington** that would unload 120,000 barrels per day of crude from trains and put it on vessels, the latest move to get excess oil from North Dakota to refining centers on the West Coast. Shipping costs: \$13/barrel. (4/23 #15)
- **In the European Union**, energy generated from renewable resources in 2011 increased to 13% of the gross energy consumption from the 27 member countries. That's now within 7% of 2020 targets. It's also up from 7.9 percent in 2004 and 12.1 percent in 2010. (4/26 #17)
- Japan, which has spent about \$700 million on **methane-hydrate R&D** over the past decade, has the world's biggest hydrate-research program. In mid-March, Japan's Chikyu test ended a week early, after sand got in the well mechanism. But by then the researchers had already retrieved about 4 million cubic feet of natural gas from methane hydrates, at double the expected rate. Japan's Ministry of Economy, Trade, and Industry set 2018 as a target date for commercializing methane hydrate. (4/25 #14) *[Another dartboard alert?]*

6. Commentary: Interview with Steven Kopits, by Steve Andrews

Q: You're dialed in right now on the issue of compression of capital expenditures—or capex compression—in the oil industry. Can you give us a quick definition of what that is?

Kopits: Capex compression is a term we use to describe the reduction of upstream spending by the oil companies when their exploration and production costs are rising faster than their oil revenues. That's what's happening today. Hess is divesting oil producing properties to increase profits; BP has shelved the deepwater Mad Dog Phase 2 project in the Gulf of Mexico. This is occurring because oil prices haven't been increasing, and costs have. So oil companies are looking at their portfolio of projects and deciding to postpone or cancel some of them. Were the oil supply rising quickly and oil prices falling, this sort of capital restraint would be normal—the usual boom-bust cycle of the industry. But oil is still in short supply, and very few of the large oil companies have been able to hold oil production over the last few years—even as they were investing massively in oil exploration and production. Now, they are actually reducing investment in upstream projects, even in the face of historically high oil prices and falling production. That's capex compression.

Q: And here I thought investments in exploration and development were still on their way up. What's changed?

Kopits: In aggregate, upstream spend is still rising, but at a decreasing pace.

If we look at the issue more broadly though, there are some things happening in the oil business that are beginning to validate views that we, and analysts like Chris Skrebowski, have held regarding economic peak oil.

Peak oil does not occur when we run out of oil. Peak oil occurs when the marginal consumer is no longer willing to pay the cost of extracting and processing the marginal barrel of oil. And we can actually calculate what the related numbers are.

Q: How do we do that?

Kopits: To begin with, we refer to the price a nation's oil consumers are willing to pay as its "carrying capacity." For the US, carrying capacity is about \$95-100 Brent [per-barrel oil price in London]. If the oil price is above this level, oil consumption will decline—which is exactly what we see and what we predicted four years ago. But carrying capacity is not a static number. It changes over time, specifically, with three things: GDP growth, efficiency gains in the use of oil, and dollar inflation. So if GDP goes up, efficiency goes up and the CPI goes up, then the amount that consumers are willing to pay for oil will increase. For China, by the way, we estimate the carrying capacity at around \$115-120 / barrel Brent. So oil consumption will increase in China at \$115 Brent, but fall in the advanced economies—exactly the pattern we've seen in the last few years.

On the supply side, the global oil supply and related costs are determined primarily by two factors: geology and technology. Geology is driving costs by forcing us to frontier areas like ultra deepwater and the Arctic. Technology, on the other hand, is allowing us to access new resources like shale gas and shale / tight oil. So, for any given oil price, depletion will always drive us to more difficult geologies and thus higher costs. Technology, on the other hand, can move us back to easier geologies and lower costs. Hydrofracking of shale oil and gas wells, for example, has done just that.

Also, if you are so inclined, you can add above-ground constraints—Saudi policy or Venezuelan policy or Alaskan tax and royalty rates, for example. But assuming these latter factors are relatively constant, geology and technology will determine supply for any given oil price.

So, to sum all this up: we hit peak production when the marginal consumer is no longer willing to buy the marginal barrel.

Q: I think I've read in your work elsewhere that you believe the consumer is already there.

Kopits: The marginal consumer banged into the price of the marginal barrel, on a static basis, somewhere in 2011 at about \$110-115 Brent. And then, oil prices essentially stopped rising. Those of us who use supply-constrained forecasting weren't surprised. It's entirely consistent with the historical record. But I think many in the oil business still thought, somehow, that oil prices would continue to rise as they had done in the 2000s. After all, the oil supply is widely acknowledged as constrained, even by those who are not necessarily believers in peak oil. So why wouldn't prices continue to rise if we're supply short? Well, because there was a price at which the marginal global consumer would rather reduce oil consumption than pay more. And that price is around \$110-115 Brent, and from here on in, we should expect that number to rise only with the purchasing power of the marginal consumer.

On the other hand, the cost of extraction development has continued to increase. Last year costs increased somewhere between 10% and 13%, depending on who you talk to. Exxon's costs rose about 7% in excess of its increase in revenues, which were also falling. And Petrobras' costs were rising 10% to 13% faster than its revenues. So what we can see is that in the contest between technology and geology, in recent times geology has been winning. Oil has become more expensive to extract.

Q: But when costs increase to a certain level, production should fall; yet we haven't seen that.

Kopits: In fact, oil production is falling at most the of the oil majors. It was even down at 2% at Petrobras last year. But on a global scale, you're right. Oil production hasn't fallen—for three reasons. First, much of what passes for increased "oil" production is actually natural gas production. This includes natural gas liquids from "wet" natural gas wells; LNG [liquefied natural gas] from gas wells; and gas-to-liquids diesel made from natural gas. That's about half of global oil supply growth in the last six years right there. Check out any investor presentation from the majors. LNG features prominently.

Second, we started throwing *massive* amounts of upstream spend into this business. Upstream expenditures essentially went from \$250 billion around 2005 to about \$650 billion this year. In essence, by really jacking up how much money we were putting into the system, we were able to increase production...a little bit. To that we can add some changes in above-ground constraints, primarily in Iraq, which is a very important part of supply growth.

Finally, we made some important technological advances with hydrofracking technology. US tight oil production and Canadian oil sands growth represent just about 100% of net oil supply growth in the last two years.

But leaving these aside, the system hit a wall in 2005—Ken Deffeyes was really spot on with his prediction—and the way we maintained and only slightly grew production after that was essentially by throwing money at it.

This was facilitated by dramatic oil price jumps, from \$25 in 2002 to \$112 in 2012. But since 2011, depending on rapidly rising oil prices is no longer a viable strategy. The global economy has said, “this is how much we’ll pay and no more.” At the same time, geology just kept marching along right down the back half of Hubbert’s peak, and costs have continued to rise. That’s where we are today: price resistance from the consumer and E&P costs that just continue rising. Despite the very high oil price environment, the upstream financial performance at most of the oil majors, including Exxon and Petrobras, has deteriorated. True, Petrobras’ performance is distorted by government interference, but Exxon is arguably the most disciplined investor in the world. But both of them face deteriorating upstream performance for oil.

Q: Given that emerging reality, how are these companies responding?

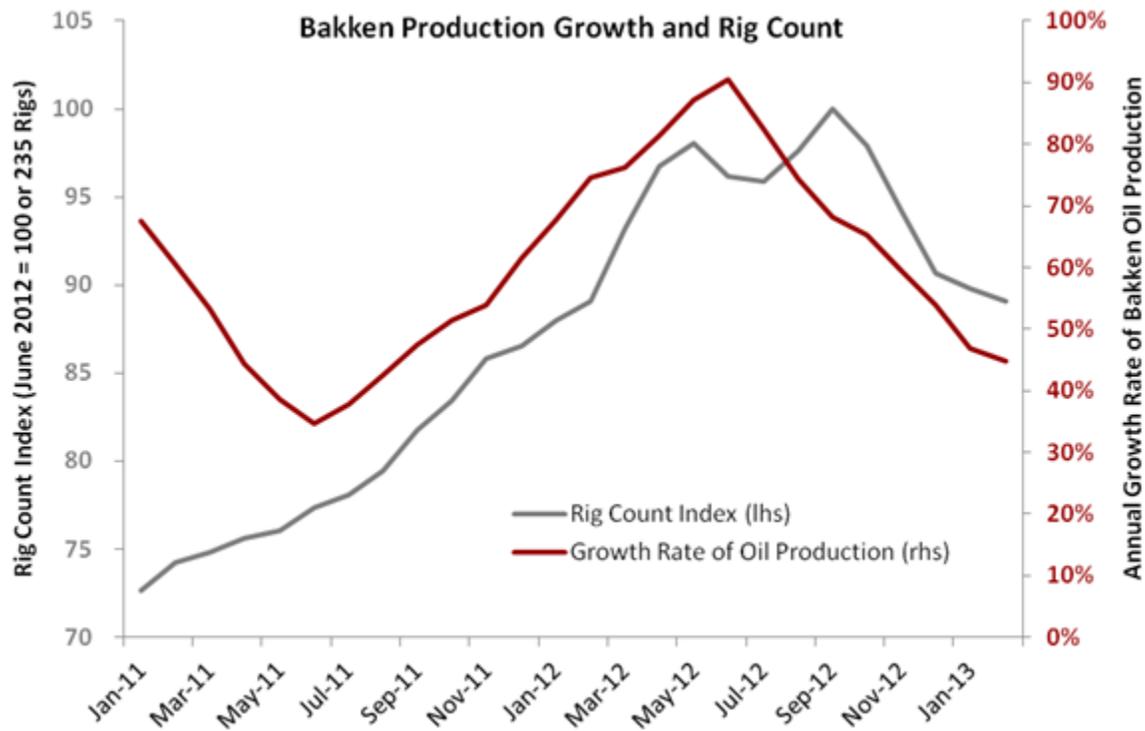
Kopits: Well, if you look at their capex plans then you see that Shell, BP, Total, Exxon and Hess are all cutting their upstream spend in their 2013-2017 plans going forward. Only Chevron is raising theirs, and only modestly. So in a world where we are struggling to increase global oil supply and the price itself remains high, the major oil companies are in fact beginning to carve back on their exploration and production investments. It’s capex compression.

Q: Why are they going that route?

Kopits: It’s because they’re not getting the bang for their buck. Their megaprojects—ultra deepwater and LNG—are often not able to hold the line on costs. The growing hit-list here includes Australia’s Browse, a \$45 billion LNG project that was just cancelled. It includes the Arctic, specifically Alaska, where Shell is sitting out the coming season, in part because they ran their drilling rig aground. But Statoil has said they won’t proceed in Alaska until Shell has shown some progress. ConocoPhillips has just cancelled a jack-up rig order that was intended for the Alaskan market. Total pulled out of Canadian oil sands at a loss. Then we see just last week that BP pulled the plug on Mad Dog Phase 2, which would have been one of the major developments in the Gulf of Mexico—a \$10 billion megaproject—and that cancellation was a surprise.

What we’re seeing is that the majors are looking at these high-cost projects, and they are beginning to take a more critical eye. This is very much in line with what our model says, which is that oil prices can’t rise much faster than GDP and inflation, plus or minus. And in fact geological costs, as you come down the back side of Hubbert’s peak, will increase and will do so at an accelerating rate. I think we are beginning to see that process now.

Even when we look at the “good-news” shale / tight oil, some investment is slowing. In the Bakken, for example, the rig count actually peaked in September of 2012, and the year-over-year production growth rate peaked at 90% three months earlier in June. Today the growth rate, while still impressive, is down to about 40%. If that trend continues, we could see single-digit growth in the Bakken much sooner than most think.



Q: So the shale oils won't be the ever-growing cavalry that everyone expects them to be?

Kopits: If you take the plain vanilla interpretation of this, unless the shales start picking up rapidly from non-exploited plays—not the Permian and the Eagle Ford and the Bakken, but places like the Utica and Monterey, where results have been disappointing, or some other plays or even abroad—you are looking at a world in which the marginal consumer is beginning to reject the marginal barrel. And if you run this out for a period of time, you will peak out the oil supply. I think the peak occurs in a finite time frame—not 2030, not 2020. Maybe 2014 or 2016—I'm not exactly sure, but sometime pretty soon, unless shale oil really takes off in new plays.

Q: So the story line getting a ton of ink of late—peak oil is dead....it isn't actually quite dead yet?

Kopits: No. But importantly, we're going to peak out production *not* because we're "running out of oil," but because the marginal consumer is not willing to pay for the marginal barrel. We seem to be pretty much at that level today.

We need to understand these dynamics better. What are the combined effects of flat oil prices and rising production costs, that's where I think the challenge is and where our professional work is focusing on the macro side...to better understand what these trends are, what they mean, and how companies in the industry should respond to it.

I'll give you an example. Normally, if you look at an oil production system, it tends to be symmetrical around the peak. The rate at which you *approach* the peak is the rate at which you *depart* from the peak. We haven't done that. What we've done is that we've approached the peak and we've leveled out production, the so-called "undulating plateau". But we've maintained that plateau by turning to non-oil liquids, by dramatic increases in upstream spend, and also by technological innovation related to hydrofracking. All of these, as of

today, look to be running their course. Even shale oil. Yes, it will grow for the next few years from the three majors plays in the US, but the peak of production growth is already behind us in the Bakken, for example. On current trends, Bakken production will be increasing by single digits within two years. Not a tragedy by any means, but not enough to move the global oil supply at that time, either.

Of course, we have one more arrow in the quiver after that: government take. Governments typically take 60-90% of revenues of oil production. There's nothing wrong with that, as in most cases the oil belongs to the respective government. But if the cost of production is increasing, then the value of reserves is falling. Put another way, current levels of government take, whether production or profit sharing, royalties, lease payments or taxes of any sort, are likely unsustainable. Oil companies will need tax relief in one form or another. Far from being able to raise taxes on oil companies, the sober reality is that governments are going to have to get used to getting less. Expect this theme to come front and center in the next couple of years. If government take is reduced quickly, then oil production levels could be sustained for a few more years.

But what then? What's the outlook for oil production globally? Will production at the high cost producers just ease off gently, or will global production rejoin the anticipated trend line from a 2005 peak sharply and quickly? Will the major oil companies invest just a bit less, or do they start culling their new project list aggressively and without material replacement?

I don't know what the answer to that is. But that's what we're trying to find out. That's the focus of our macro thinking today.

Steven, thanks for your time and your thoughts.

Steven Kopits has been Managing Director for the New York office of energy business advisors Douglas-Westwood since 2008. He is solely responsible for the views expressed here, which do not necessarily represent those of Douglas Westwood. He can be reached at steven.kopits@douglaswestwood.com