

Peak Oil Review

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1. Supply and demand

After six days of decline, oil prices rose 50 cents on Friday to close at \$49.93, down \$7.67 or 13 percent for the week. Oil prices now have fallen 66 percent since July 11th.

As more production and consumption numbers are released, it is becoming obvious that excess supply is behind the continuing drop in prices. Although subject to later revision, the IEA reports that total world liquids production increased by 1.81 million b/d in October to 86.4 million b/d at a time when consumption is declining. Average OECD consumption in 2008 from January through September is reported to be 1.11 million b/d less than in 2008. Most of this is from a 950,000 b/d drop in US consumption. Chinese consumption during the first 9 months of 2008 was up by only 50,000 b/d while Indian consumption was up by 200,000 b/d.

Beijing reports that demand for fuel has contracted sharply since September due to the credit crisis, and that stockpiles of crude and products have risen "significantly." Chinese imports of diesel and gasoline have dropped to the lowest level in 14 months.

Supplies for November delivery, however, appear to be contracting. Tanker tracker Petrologistics reports that crude shipments from OPEC will be down by nearly 1.2 million b/d this month. Although still above targets, the cartel is making progress towards implementing the 1.5 million b/d cut agreed on in October.

The export pipeline from northern Iraq to Ceyhan, Turkey was bombed by Kurdish insurgents last week. It may be back in operation after a 3 day outage. PEMEX reports that crude output fell 7.9 percent in October as the Cantarell field continued its 5-year decline. Cantarell's production is now down to 900,000 b/d from a high of 2.2 million b/d in December 2003. Yet another pipeline was blown up in Nigeria last week, shutting in about 90,000 b/d of production.

2. OPEC

As oil prices continue to fall, the average price received by OPEC is now approaching \$40 a barrel. A recent analysis by PFC Energy suggests that this price is well below what most of the members need to balance their budgets. Venezuela is said to need oil at \$102; Iran at \$83, the Saudis at \$54; Kuwait at \$52; and the UAE at \$45.

In deciding on the next round of production cuts, OPEC's first problem is non-OPEC production which would be under no obligation to make cuts. The fear is that as OPEC mandates production cuts, their market share would be taken over by relatively stable non-OPEC production. OPEC therefore seems to be making a major effort to involve non-OPEC exporters, particularly Moscow, in a decision to reduce production.

OPEC will meet November 29th in Cairo and then again in Oran on December 17th. Statements from various OPEC oil ministers suggest that a major cut (1.5 million b/d+) will be made at the Oran meeting, although a token cut may be made at the earlier Cairo meeting.

Although 2008 has been a good year for OPEC with estimated revenues of nearly \$1 trillion dollars, 46 percent above 2007 earnings, this is down from the \$1.2 trillion they were expecting. The larger OPEC countries have found ways to spend their windfalls as fast as they are earned

and are nearly totally dependent on their oil revenues to support large and restless populations. If worldwide demand continues to fall faster than OPEC can make real production cuts, then several OPEC members may soon be having as much or perhaps more trouble than the rest of the world.

3. Price forecasts

As oil prices spiraled upwards last spring, the press was full of stories about how high prices could go. Many thought \$200 a barrel or more before the end of the year sounded reasonable. Now the tables have turned and the game has become picking a bottom for 2009. The IEA's chief economist set the tone by expecting oil to remain under downward pressure next year as a weakening global economy reduces demand.

Various financial institutions are starting to throw around numbers like \$40 a barrel either soon or next spring. The Deutsche bank is even talking about \$30 a barrel as their "worst case" scenario. Goldman Sachs is saying \$50 a barrel for most of 2009 although much of the decline is behind us. Nobody seems to have much faith in OPEC production cuts.

At an average US price of \$1.92 a gallon, when adjusted for inflation, gasoline is already well below what it was selling for during the 1930's depression. US gasoline consumption is down about 2 percent and American consumers are receiving a major economic stimulus through prices that have now dropped more than 50 percent.

The serious problem, of course, is what \$30 or \$40 oil will do to investment. There are now daily reports of oil production and refining projects being cancelled due to low prices and lack of capital. The situation can only get worse. While worldwide oil consumption is dropping, it is not dropping as fast as investment in new production seems to be dropping. All this will come to a head in a few short years when serious oil shortages are bound to develop.

4. Detroit

The US automobile industry had one of the worst weeks in its history. After two days of appealing to the Congress for a \$25 billion bailout loan, US automobile executives were told to come back with a workable plan that would restructure the industry and convince lawmakers that any loan would do more than keep the industry on life support for a few more months.

By week's end, GM's board was reported to be weighing bankruptcy options. This in turn has started a debate over whether a corporation as large and complex as GM can actually operate under bankruptcy laws or whether it simply will have to shut down as quickly as possible, throwing millions out of work at GM—parts suppliers, dealers and other automobile companies that would be caught up in the turmoil. Some doubt that GM, despite heroic efforts to shut down plants and trim costs, has enough cash to survive more than a month or two.

5. More on the IEA Report

Two weeks after the IEA's *2008 World Energy Outlook* was published, lengthy commentary and analysis of the report's findings continue to pour in. All compliment the 190 staff analysts and statisticians that worked on the report along with many outside consultants that were brought in for the project. The general acknowledgement that current trends are unsustainable and the effort to work out depletion rates for major oil fields has broken new ground.

The effort to show how world oil production can continue to grow over the next 20 years is highly contrived. Broken down into pieces, the projection that world production can grow by another 20 million b/d includes many unlikely assumptions such as the Saudis coming up with 60 million b/d of new production in order to grow total output to 15 million b/d and offset depletion. The assumption that large amounts of new oil will be discovered and put into production is highly dubious.

More and more internal contradictions are turning up in the report. The most egregious is the statement that worldwide oil production from existing fields is declining at an average rate of 6.7 percent a year whereas the chart of future production sources shows a decline closer to 4 percent. The distinction is important since the future of the world's economy could hang on the difference.

The world's ability to produce or not produce 20 million b/d more oil 20 years from now could literally be a matter of life and death.

Many of these anomalies have already been brought to the IEA's attention. Hopefully at least some of these problems will be worked out prior to next year's edition.

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

- **U.S. fuel demand** fell 5.2 percent in the first 10 months of this year, the biggest drop since 1981, the American Petroleum Institute said. Deliveries of petroleum products, a measure of consumption, averaged 19.6 million barrels a day in the period, down from 20.7 million barrels a day a year earlier. Gasoline demand averaged 9.06 million barrels a day from January through October, down 2.6 percent from a year earlier. (11/20, #17)
- The drop in crude prices is threatening investment needed to boost global oil production, **Total CEO** Christophe de Margerie said. In the long term, de Margerie said crude prices will rise, making investment worthwhile in projects such as the Shtokman field in Russia and Canadian oil sands. (11/22, #4)
- After the **tanker Sirius Star** was seized by pirates on Nov. 15, Saudi Arabia said it will join a fleet of NATO warships on an anti-piracy mission, as hijackers bolstered defenses around a Saudi tanker captured off the East African coast. Since January, at least 91 vessels have been attacked in the Gulf of Aden, (11/22, #7; 11/21, #7)
- **Shippers** controlling almost a fifth of the global fleet of crude-oil supertankers may avoid Egypt's Suez Canal after an escalation in piracy off east Africa, potentially increasing the cost of delivery and reducing supply. (11/20, #7)
- **Pemex** is preparing 68 new drilling sites at a geologically challenging oil basin—Chicontepec — that the company hopes will offset declining production in other oil fields. (11/19, #11)
- **Brazil's Petrobras** said on Friday that they found light oil in two new offshore wells, expanding its "pre- salt" discoveries. There may be 1.5 billion to 2 billion barrels of recoverable oil equivalent in the new find. (11/22, #10)
- **Petrobras** has postponed construction tenders for 28 deep-sea drilling rigs to the coming year. (11/19, #10)
- The global financial crisis has put the brakes on **Brazil's biofuels** boom, drying up foreign investment and domestic credit, stalling new projects and prompting cash-strapped ethanol producers to indefinitely postpone \$30 to \$40 billion of expansions. (11/21, #21)
- Russia's **Gazprom** would like to avoid supply cuts to Ukraine in 2009 but will not continue deliveries without a new contract for 2009. (11/22, #19)
- **In Russia**, the collapse in the value of oil is likely to have several catastrophic consequences for the economy, including a possible devaluation of the ruble and a severe drop in living standards next year. (11/21, #15)
- **Russian** oil companies may cut production and exports should they become unprofitable, Energy Minister Sergei Shmatko said on Tuesday. (11/18, #13)
- **According to Lukoil**, a "significant" reduction in OPEC's oil production may drive the average price of crude back above \$80 a barrel next year, aiding the Russian economy. (11/20, #5)
- In the current economic climate, 66 out of 262 approved **wind farms** in the US have either been outright canceled or postponed. (11/22, #21)

- **Yemen** is facing an economic and political crisis as the country's oil resources near exhaustion. The World Bank predicts that Yemen's oil and gas revenues will plummet over the next two years and fall to zero by 2017 as supplies run out. (11/21, #10)
- **China**, the world's second-largest energy user after the U.S., is accelerating plans to cut fuel prices for the first time in two years as the nation's economy slows and oil costs fall. The government will separately introduce a tax on retail gasoline and diesel sales to replace road tolls and maintenance charges. (11/20, #13)
- In **Alaska**, falling oil prices will take a bite out of the state budget and put a damper on oil-field investment, Governor Palin told a conference of major North Slope oil operators on Wednesday. (11/20, #18)
- **Canada's** oil-rich province of Alberta is rolling back a large portion of the royalty hikes that were to take effect in January in order to encourage drilling in the province's sagging energy industry. (11/20, #20)
- The biggest oil companies including Saudi Aramco, Royal Dutch Shell Plc and Petroleo Brasileiro SA are accelerating **spending cuts and delaying projects** as the world enters a recession, said Morgan Stanley & Co. As many as 44 projects have been delayed and faced cuts in investments as of Nov. 18, compared with 19 in a Nov. 5 report. (11/19, #4)
- While the idea of running US vehicles on natural gas has lately received a great deal of attention, **powering our cars with electricity** is a more sensible option on all fronts-- national security, efficiency, climate stabilization, and economics. (11/20, #23)
- **Banks in Europe and Britain**, and their borrowers, face another blow as plunging oil prices tighten the spigot of petrodollar deposits. With oil prices having fallen, dollar flows into European banks will likely drop dramatically. Moreover, a global recession and financial crises mean that oil producers such as Russia and the Middle East states will have to spend money at home, further diminishing the money available to international banking. (11/20, #24)
- In West Virginia, Synthesis Energy Systems and Consol Energy shelved an \$800 million **coal-to-liquid fuels plant**, with Synthesis chief executive Tim Veil citing "the current state of U.S. credit markets." (11/19, #17)
- **Dubai**, the second largest of the seven sheikhdoms in the United Arab Emirates, is the most vulnerable place in the Gulf to lower oil prices as real estate prices and debt refinancing pose "real risks." (11/18, #5)
- **Petro-Canada** said it delayed to next year a decision whether to mine oil sands at the proposed C\$25.3 billion (\$20.6 billion) Fort Hills project in northeastern Alberta because of rising costs and falling oil prices. (11/18, #11)
- **Tokyo Electric Power Co.** received less liquefied natural gas and heavy fuel in October on expectations that the slowing economy will further reduce power demand. (11/17, #10)
- **Officials in California** have unveiled ambitious plans to turn the San Francisco Bay Area into one of the leading centers of electric vehicles in the world. If it succeeds, the strategy announced yesterday will see billions of dollars poured into a new power infrastructure that will turn the region away from fossil fuel and to renewable energy – and convince millions of people to switch to green technology. (11/23, #20)

Quote of the Week

- "Climate change says we should change, whereas peak oil says we will be forced to change."

-- Rob Hoskins, author of The Transition Town

Commentary: Alaska's Key to Oil Production—It's a Gas...

By Tom Standing

(Note: Commentaries do not necessarily represent ASPO-USA's positions; they are personal statements and observations by informed commentators)

The two-and-a-half year bout to rehabilitate pipelines on Alaska's North Slope appears to be over. Daily field-by-field production figures from Alaska's Department of Revenue show that production curtailments, especially in the Prudhoe Bay Unit, have given way to steady production at surprisingly high rates. During October 5-21, statewide crude production averaged 767,000 b/d, compared to 780,000 b/d in November 2007, the last month that was completely free of production curtailments. Production in the first half of November 2008 averaged 762,000 b/d—an impressive comeback that still leaves Alaskan oil production down 60+% from its peak production in 1988 (see Fig. 1)

But while a key to this rehabilitation has been repairing some of the pipelines serving the supergiant Prudhoe Bay field, the Kuparuk River unit, Colville River field and all their associated satellite fields, it's an enormous natural gas field that has really done the unsung heavy lifting.

Cooking With Gas

The longevity of Prudhoe Bay field can be attributed to the world class resource of natural gas on the North Slope. The immense gas cap above the Prudhoe Oil Pool was originally assessed at 26 trillion cubic feet (tcf). Such a volume amounts to 30% more than all the gas produced in the United States for 2007.

Without the gas cap, Prudhoe oil production would have ceased years ago. It provides the energy to maintain pressure in Prudhoe's reservoir, thereby sustaining oil production.

From the first day that Prudhoe oil flowed toward Valdez, gas that was co-produced with the oil was injected back into the gas cap. The gas had no pipeline to markets, so reinjection was always part of the production strategy at Prudhoe. The resulting expansion of the gas cap is one mechanism by which oil is displaced in the reservoir and brought to the surface. Gas compression during reinjection is energy-intensive, so some produced gas is burned to force the gas back into the reservoir rock. Gas would have to be compressed to perhaps 6,000 lbs per square inch to inject it into the reservoir.

As gas-oil-ratios (GOR) increased at Prudhoe, the original gas compression plant (the world's largest at the time) soon was overtaken by increasing volumes of produced gas. Gas-handling capacity was quadrupled with a series of expansions during 1988-92, and augmented again in 1999. Prudhoe's GOR now is 25 times higher than during 1978-85.

Throughout the 1980s, operations were phased in whereby natural gas was injected directly into the oil reservoir, either to maintain pressure, or to achieve a "miscible phase" of gas and oil that expands in the reservoir and then is pushed toward wellbores and to the surface. Miscible injection is a major process in enhanced oil recovery (EOR) for reservoirs with specific properties, particularly in West Texas, where major volumes of oil have been extracted that would otherwise have remained in the ground.

At Prudhoe Bay however, EOR has contributed barely 10% of production rates in recent years. Conventional pressure maintenance dominates the production mechanism at Prudhoe. After more than two decades of gas injection, a phenomenal 53 tcf has been reinjected. That's **twice** the size of the producible volume of the gas cap. In other words, we've effectively cycled all the gas in the field twice through the compression/reinjection system.

In 1984 operators began field-wide waterflooding at Prudhoe to maintain reservoir pressure and push oil toward wellbores. Again, natural gas provided energy for the pumps to inject water into the reservoir rock two miles below the surface. Injection rates varied, but have increased slightly over the years, reaching 1.9 million b/d of water in 2002. In the 1980s, 1 bbl of injected water

yielded 1.5 bbl of oil; now 1 bbl of water gives only 0.2 bbl of oil. Cumulative water injected into Prudhoe is 11.3 billion bbl.

From Alaska's production and injection statistics, we can estimate roughly how much gas has been burned to power Prudhoe's injection systems. As of September 2008, 58.1 tcf has been co-produced with oil, while 53.2 tcf has been reinjected into the reservoir. With no gas taken off for markets, the difference is the volume burned for field operations, about 5 tcf, or nearly 20% of the producible volume of Prudhoe gas.

Cook Inlet

Another angle to Alaska's "cooking" is oil production from the Cook Inlet. Tracking the history of the Cook Inlet reveals what **really** happens to oil provinces in late life after discoveries play out, production technology advances, and oil prices oscillate. Answer: they keep chugging away, but production rates decline steadily.

Until 1977, production came exclusively from the Cook Inlet; by mid-2008, cumulative production was 1.4 billion bbl. Initial discoveries came in 1957, but the bulk of discoveries were made during the mid-1960s. No meaningful discoveries came after 1970. The tally is 18 oil pools in 7 fields. The Hemlock Pool in the McArthur River field dominates, having produced 38% of Cook Inlet oil.

Cook Inlet production peaked in 1970 at 230,000 b/d, then slipped almost 6% per year through 1976. Operators were able to extend key reservoirs and coax out more oil with successful waterfloods, but production continued to slide about 4% per year through 1995 to 40,000 b/d. Annual declines of 3% brought production to 32,000 b/d in 2002, but the decline accelerated thereafter and is now at 13,000 b/d, a negligible 6% of peak rate.

Looking Ahead

The experience in Alaska is typical of conventional oil production globally. Natural gas is burned to power water and/or gas injection that will maintain reservoir reassurance and maximize oil production. Continued investments with advancing production technology may extract additional oil, but extraction rates slide relentlessly to miniscule rates, even with profitable operations. The North Slope will continue to yield oil as long as the gas resource is available. However, if, in 2019, the proposed natural gas pipeline begins taking 1 tcf per year as planned, little gas would be available to enhance oil extraction from Prudhoe and the other fields.

The existing Alaska oil pipeline could still be operated at a small fraction of today's rate, but a sudden production loss due to a cutoff of natural gas might force an end to oil production. If oil operations on the North Slope are to continue beyond 2020, major new resources will have to be discovered by 2015.

Tom Standing began his career as a chemical engineer in refinery operations and later shifted to work as an engineer for the San Francisco water system. He is self-taught in the sciences of petroleum production, geology and geochemistry.

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Figure 1

