

Peak Oil Review

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ASPO-USA's world oil conference is in Houston, October 17-20; visit www.aspo-usa.com

1. Crude and gasoline

It was another volatile week as oil prices first fell with the stock market and then spiked to a new intra-day high in New York of \$78.77 a barrel after US crude stocks fell by 6.3 million barrels --- ten times what analysts were expecting. After the report was digested, oil prices fell on profit-taking, increased gasoline stocks, and concerns about the US economy.

Gasoline, diesel and heating-oil stockpiles climbed in the week ended July 27 as refiners raised operating rates to 93.6 percent of capacity, the highest in 13 months. With US refineries doing well, concerns of gasoline shortages during the remainder of the summer driving season have subsided to be replaced by worries about the worldwide crude supply in the face of increasing demand. While the US commercial crude stockpile is still well above normal, it has been decreasing for the past month. If US refineries continue to process 16+ million b/d and US imports continue to average around 10.2 million b/d as they have in recent weeks, the US crude inventories would continue to decline by 5 million barrels per week.

The stock market fell on Friday after a report showing weaker-than-expected job growth was followed by reports of slowing service-sector growth and further turmoil in the mortgage market. Then oil fell on concerns that the US could be approaching a recession. The balance between tightening oil supplies and fears of an economic downturn probably will be the predominant force affecting oil prices for the rest of the summer.

2. The OPEC Meeting

The OPEC meeting scheduled for September 11th in Vienna could turn out to be a watershed event. Last fall OPEC cut production by about 1 million b/d in order to counter falling oil prices. Since the cuts, however, world demand has continued to grow by what may be a million b/d. An even higher price increase occasioned by OPEC production cuts has been avoided by greatly reduced oil consumption in poor countries and the drawdown in oil stockpiles outside the US.

Lately, there have been numerous reports speculating about what OPEC will decide about production levels at the September meeting. The "official" OPEC position still seems to be that the "market is well supplied" and that there is no obvious need for a production increase. Recently, however, the IEA and US Secretary Bodman have asked OPEC to increase production immediately in order to avert shortages in the near future. Bodman went so far as to say that \$80 oil would threaten the US economy.

Thus far responses from OPEC officials have been all over the board. The most conciliatory remarks came from the organization's Secretary General who said OPEC would be "uncomfortable" if oil prices went above \$80 a barrel. Other oil ministers, especially from countries that have little hope of raising production in the near term, have reiterated that high

prices stem from refining and geopolitical problems and that they are dead set against a significant production increase in September

At the September meeting, the issue of a production increase likely will depend on Saudi Arabia, as it is the only OPEC country that might be capable of significantly increasing output. Last week the Saudis announced that they expect to add half-a-million b/d to their maximum production capacity of 10.8 million bpd by year's end. If this is the true level at which the Saudis are able to produce marketable grades of oil for an extended period, then they may be able to increase production. Many observers are skeptical. Saudi willingness to increase production is a complicated question bound up with Iraq, Iran, arms sales, and a myriad of other factors.

3. In the Congress

On Saturday, the US House of Representatives passed legislation to increase the use of renewable energy and promote conservation at the expense of the oil and gas industry. The new bills include a provision that would require that 15 percent of electricity from private utilities come from renewable energy sources. Republicans called it a "no-energy bill" because it lacks new drilling incentives, and they derided the emphasis on renewables as "green pork." The White House and the electricity industry are strongly opposed to the Renewable Electricity Standard, saying that it would raise electricity prices and put unequal burdens on states.

A companion bill would repeal roughly \$16 billion in tax breaks for the oil industry enacted in 2005. Some of the money would be used to pay for the research grants and renewable-fuel projects. Republicans and oil-state Democrats criticized provisions in the tax portion of the House bill that would repeal reduced tax rates for major integrated oil companies, and drop foreign income tax deductions for companies that produce oil and natural gas overseas.

The House did not to allow a vote on an amendment requiring cars and light trucks to achieve a fleet average of 35 miles per gallon by 2019. The measure, similar to one the Senate passed in June, drew fierce opposition from automakers, the United Automobile Workers and, crucially, John D. Dingell. As chairman of the Energy Committee, Dingell says he wants to deal with fuel standards in global warming legislation later this year.

The House and Senate bills now go to a conference committee which will attempt to reconcile the differences. After reconciliation, the bills have to get through a possible Presidential veto. "This isn't even close to being over," said Tom Kuhn, president of the lobbying group for the utilities. Given the current balance of forces in Washington, it seems likely that nothing will really be settled until after the 2008 elections, unless much higher energy costs intervene first.

4. African Power Crisis

The twin scourge of drought and \$75 oil is causing unprecedented hardships all over Africa. This year at least 25 of the 44 sub-Saharan countries are facing serious electricity shortages.

Some nations, like Ghana, have tried to deal with their power crises by leasing gas generators, producing emergency power at exorbitant rates until new power plants can be built. In Nigeria, Angola and some other nations, virtually all businesses and many residents run private generators to supplement public service, adding to costs and increasing pollution. Daily electricity output in Nigeria has dropped 60 percent from its peak, and blackouts cost the economy \$1 billion a year.

In Kenya, Tanzania, Uganda and parts of West Africa, drought has shrunk rivers and cut the generating capacity of hydroelectric dams. Drought in Ghana has crippled gold and aluminum production and set off blackouts in Togo and Benin, which buy power from Ghana.

Zambia's plan, like those of most other nations, is to build its way out of the power crunch. It plans \$1.2 billion in generating upgrades and new capacity, financed mostly by China and India. South Africa plans more than \$20 billion in upgrades; Congo is contemplating a hydroelectric station that by itself would increase capacity outside South Africa by 50 to 75 percent. The best answer, most experts agree, would be for nations to cooperate on large regional power plants that could supply power more cheaply and efficiently than dozens of smaller ones. In the meantime, the situation is likely to get worse.

4. Energy Briefs

- **Germany's 500-year-old tradition of hard-coal mining** is dying out. With domestic coal long unprofitable because of cheap imports from Africa and Asia, the German government this year decided to gradually withdraw expensive subsidies that have kept its mines open for nearly a half-century.
- **The world's three largest fully publicly traded oil firms** are investing billions of dollars more this year but the extra spending has yet to result in higher production. Exxon, the only one to raise output last year, had a 1 percent second-quarter fall in production to 4.12 million boepd and BP's supply fell by 5 percent to 3.8 million boepd.
- **Shell** expects production to average "near the low end" of its target of 3.3 - 3.5 million boepd during 2007 because of problems in Nigeria and the reduction of its majority stake in the Sakhalin 2 project in Russia
- **Saudi Aramco** is expected to invite companies in August to help develop Manifa oilfield, with a potential production of 900,000 barrels of oil a day. The estimated \$10bn Manifa development program aims to add 900,000 barrels a day of heavy crude to Aramco's production by mid-2011.
- **China** has declared a moratorium on the construction of most ethanol plants. Chinese officials recognized that producing corn-based ethanol was dangerously driving up food prices. Unless the fuel can be produced with sorghum, batata, cassava and other "non-staple crops," it won't be produced in China at all.
- **Venezuela** managed to keep stable the number of oil rigs operating last year, but total new wells drilled fell and the company relied more on old ones to keep up production. While operating oil rigs increased by one to 76 rigs last year, the number of newly drilled wells fell 10.6% to 1,145 nationwide
- In **Mexico**, El Universal newspaper reports that experts of PFC Energy (Washington, D.C.) pointed out that investments for PEMEX exploration are running out of time. Even if heavy investments were made now, new oil fields would take from six to eight years to be ready. Consequently, Mexico may have to import oil to satisfy the internal market.
- **Beijing** will delay the startup of a \$1.2 billion refinery in east China by at least nine months, adding uncertainties to a joint-venture and oil supply deal with Saudi Arabia. The deal for Saudi Aramco to take a 25 percent stake in the project, and supply 80 percent of the crude supply for the plant, is not complete.
- **Russia** planted its national flag on the seabed more than 4km beneath the North Pole on Thursday, staking a symbolic claim to a vast swathe of Arctic territory believed to be rich in oil and minerals. A group of Russian explorers and scientists in mini-submarines became the first men to land on the sea bed of the North Pole.

- **Gazprom** said it received a "significant part" of a \$460 million debt owed by Belarus, averting a supply cut to the country. Belarus had asked Venezuela to help pay back the debt. In the first half of the year, Belarus paid for only 55 percent of its gas supplies according to Gazprom. At the same time, Gazprom said it paid Belarus about \$30 million a month for gas transit to Europe
- The **Iraqi parliament** has gone into summer recess without passing the oil law that Washington was pressing it to adopt. Passage of the law was billed as a "benchmark" in the battle to get Congress not to set a timetable for US troop withdrawals.
- **Venezuelan refineries** do not appear to be keeping up with rapidly increasing domestic demand for gasoline and other refined products. While Venezuela plans to build three oil refineries from scratch, so far the projects have not started.
- TXU's power generation business, Luminant, is teaming up with Shell's wind business to build a new 3,000 megawatt **wind turbine project** in the Texas Panhandle. The size of the project alone is noteworthy because it's almost equal to the 3,352 megawatts of wind capacity the state currently has.
- **Demand for ethanol climbed** to 427,000 bpd in May 2007, an increase of 22% over May 2006. As of 30 July 2007 there were 124 ethanol plants in operation in the US, with a combined production capacity of approximately 423,000 barrels per day. Since 2001, the amount of corn used to produce bio-ethanol in the US has risen 300%. In fact, in 2006 US corn crops for biofuel equaled the tonnage of corn used for export. In 2007 it is estimated it will exceed the corn for export by a hefty amount.

Quote of the Week

- "Supply is going no place, and demand is rising 2.5% to 3% a year."
-- Economist Philip Verleger Jr. of Aspen, Colo.

Statistic of the Week

- "US natural gas production is declining despite a large increase in the number of producing wells. The US natural gas peak was at 22 Tcf/a in 1973 with about 100,000 wells; 2005 production was at 19 Tcf/a with 400,000 wells."
-- Jean LaHerrere, ASPO-France

Commentary: The World Energy Modeling Project

By Dick Lawrence

Energy is at the foundation of every aspect of our present globalized economy. Without adequate energy, our still-growing world population, increasingly urbanized and industrialized, faces the prospect of reduced standards of living, declining access to food and clean water supplies, and contraction of global trade and GDP.

In the next decade and beyond, policy decisions will be made at national and global levels that have consequences to large segments of the Earth's human population and to the world environment. These decisions will directly and indirectly impact energy and resource availability, human well-being, and the sustainability of the environment on which all economies ultimately depend.

Understanding the complex relationships between energy, the economy, human living standards, and national policy decisions is a difficult task. Well-informed observers often arrive at opposite conclusions, even when in possession of the same facts. How can we cut through the morass of conflicting opinions and develop a better understanding of the consequences of policy decisions?

Increasingly, researchers turn to computer-based dynamic-systems modeling techniques when they are trying to understand complicated systems. Thirty-five years ago, colleagues of Jay Forrester at MIT published the results of a study called *Limits to Growth*, which attempted to look at the global human population and its relationships to resources, food supply, pollution, and more.

In the 1980s, Robert Kaufmann co-authored, with 3 others, a study of energy flow through the U.S. economy in *Beyond Oil* (last updated in 1992). That study was the inspiration for our proposal to model energy flow at the global level, first shown to ASPO members and attendees at the 2004 Berlin conference.

This year, ASPO-USA developed a *Request for Proposals* and distributed it to organizations and academic groups with the resources and skill sets to implement such a model. After reviewing the proposals, we decided to merge the capabilities of two responders into a combined project team. ASPO-USA brought the two groups together in mid-May of 2007 and officially launched the project.

The two teams are:

- Millennium Institute – main model development, building on the foundation of their T21-USA model, which has substantial energy components;
- State University of New York – Environmental Science and Forestry (SUNY-ESF) – creation of the “energy core” of the model, including EROI database and feedback paths. ESF will also develop new graphical user interfaces.

The teams will develop the North America model (U.S., Mexico, Canada) over the summer of 2007, performing initial model runs in September. They will then expand the scope of the model to the global level, completing development by (approximately) mid-2008.

We want the model to be capable of answering the following questions:

- Given the finite and future limited availability of fossil fuels, with growing supply-demand mismatch, what is the best use to which we can put remaining supplies of “cheap” oil and gas?
- How much of our present and near-term fossil-fuel supply should be diverted to developing sustainable / renewable energy resources in a way that minimizes negative impacts on food production, water supply, per-capita energy availability, and quality of life for residents in developed, developing and under-developed nations?
- What would be the consequences of delaying accelerated or “crash” programs by one or two decades? (see “the Hirsch Report”)
- What are the net-energy consequences for a variety of likely mixes of energy sources (i.e. a specified mix of conventional fossil fuels, biofuels, nuclear, and renewable, for example)?
- How much can biofuels (ethanol, biodiesel) contribute to energy supply without negatively impacting food supply or prices?
- To what extent do limits on water availability restrict energy development?
- What is the CO₂ emissions impact for likely future energy scenarios? (CO₂ emissions will be tracked for all scenario runs).
- What is the energy cost of CO₂ sequestration? Is it feasible on a large scale?
- Is a “hydrogen economy” feasible? What are the net-energy and environmental implications of different approaches to hydrogen production? How does the “hydrogen economy” compare with an all-electric transportation scenario?
- Can we substitute energy products from tar sands, shale oil and coal (CTL) for conventional liquid fuels? If so, how long would these resources actually last at different growth rates?
- As wealth flows into energy-exporting nations from energy importers, standards of living and demand for products and energy rises in the exporting countries. What are the consequences for availability of energy supply, and energy costs, for importing nations?

These are, of course, preliminary questions. Over time, new questions will be put to the model. A comprehensive and well-tested model will be able to answer new questions as they arise with only minimal modifications, if any.

The model incorporates complex relationships between energy, the economy, agriculture, industry, transportation, and the environment, including tracking CO₂ emissions for all scenarios. Like the groundbreaking *Limits to Growth* more than three decades earlier, its results are not predictions, but provide insight into the consequences of economic and energy policy decisions. The model provides guidance that permits investigators to better understand the impacts of regulation, financial investment and incentives, and energy policy, and to analyze the consequences of developing various future mixes of energy source.

Varying estimates of fossil fuel supply may constitute different scenarios – for example, using ASPO's estimate of recoverable oil and gas, vs. those of USGS/EIA, are two scenarios we can run to explore the consequences of those supply estimates. During a scenario run, decisions are made which influence the outcome. The results will be collected and analyzed to understand which decisions yield preferred outcomes. We will disseminate the results of model runs to a broad audience of academics, energy researchers, the public, and (most importantly) to policy-makers at all levels of government.

Recent studies, like “The Hirsch Report” commissioned by U.S. DOE (2005), warn of potentially serious consequences if we fail to respond in time to the threat of depletion of fossil fuel supplies. A model of world energy flow will permit a more detailed investigation of these scenarios and what energy policy decisions, and timing of implementation, will best reduce the impact of depletion.

Climate change is obviously a critical topic now getting enormous media and political attention. While it will not attempt to model the complex relationships between anthropogenic CO₂ emissions, climate, and the human economy, the model will monitor CO₂ emissions for all scenarios. The *consequences* of those emissions – temperature changes, regional and global weather changes, agricultural impacts – may be factored into some scenarios.

The model will account for and track flows of energy and materials based on physical laws (i.e. energy and matter cannot be created from nothing). It will access a database of EROI (energy return on energy invested) for all forms of energy – conventional, renewable, and unconventional. The model will show what is possible, given known constraints on energy availability, material resources, and financial capital.

We will develop the world energy model as an “open source” project – anyone with Internet access will be able to run the model and view the results of scenario runs.

One goal of the project is to develop a simple game-like user interface that makes the model accessible to those without experience in modeling complex systems. Others with more expertise will be able to go into the model, understand how it works, and develop their own scenarios. Model users from around the world will be able to communicate with each other using a web site dedicated to model discussion, modification, and operation.

Dick Lawrence is a co-founder of ASPO-USA.

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