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You May Be Interested

The following EPRINC report, “*A Series of Unfortunate Events*,” provides a summary of many of the key supply constraints that have led to \$100/barrel oil prices. Much like Lemony Snicket, just as one setback to world oil supply is resolved, several more emerge. The world oil market has experienced a perfect storm of bad luck over most of the last ten years beginning with a resurgence in resource nationalism which has been supplemented by civil strife and armed conflicts in several important producing regions in the world. These developments in the world oil market can be seen as a series of rolling supply disruptions which not only deny the market near term output, but are lowering expectations on medium term production gains and helping to drive up oil prices. In many cases, the immediate loss in output from any number of these unexpected events has much less effect on the world market than the resulting shift in expectations on the availability of new production over the next 5-10 years.

The longer term consequences of these unfortunate events are likely to threaten much needed additions in investment in the exploration and development of petroleum resources, an arena in which there is a growing consensus that the industry is already “effort constrained.” Some projects which present relatively high technical thresholds, extraordinary project completion risks, and very long lead times until initial production, may now be unable to attract adequate capital to go forward. This trend in unilateral contract changes, combined with growing limitations on access to resources, and in many cases unrealistic terms for new projects, is all adding to the so-called “Peak Oil” problem, which is now more about constraints above the ground than below.

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A Series of Unfortunate Events, or Plus ça change, plus c'est la même chose

The attached chart and graph provides a summary of developments over the last ten years that have removed substantial supplies of oil and gas from the world oil market. We characterize these supply problems as “a series of unfortunate events,” although others may view these supply constraints as variants in what is now often referred to as “resource nationalism.” The oil market seems to be undergoing a true Lemony Snicket¹ experience. As the market adjusts to a given supply disruption, several more problems quickly emerge. Over the last ten years, the world oil market has clearly experienced an unprecedented number of new and sustained impediments to upstream development, including, unilateral contract renegotiation, nationalization, lack of investment by national oil companies (e.g., Pemex, et al), restrictive access to resources (e.g., Russia, U.S.), war and civil strife (e.g., Iraq, Nigeria, Sudan), reduced excess production capacity among OPEC producers, and taxes that create uncertainty and constrain development of higher cost prospects (e.g., Alberta, Russia).

When these “unfortunate events” occur, the world oil market not only loses existing production, but expectations on the availability of future supplies are also revised downward. These ongoing events, which have now resulted in a sustained trend, prompted us to dig through our files to see if we had done some earlier work on the topic. A tattered mimeographed document prepared many years ago by *EPRINC* (then *PIRINC*), was circulated by the staff to our trustees and clearly shows that if you live long enough history does indeed repeat itself,

American petroleum investments abroad are exposed to unprecedented political, social and economic changes. There is the ever present “specter of communism.” Socialist and related nationalist movements all over the globe add their share to the ever growing difficulties. No longer can a foreign government investor depend on the protection by his government alone. No longer can a foreign government

¹ Lemony Snicket writes his own stories, and the unfortunate events in his life can be found in a series of 13 books, starting with *Bad Beginning* in 1999 and finishing up with *The End* in 2006. Many believe him to be a fictional character as no single individual could suffer such an enormous amount of bad luck. Developments in the world oil market over the last 10 years would suggest otherwise.

safeguard investments by guarantees, when political upheaval may remove it overnight. Policy making for petroleum companies today call for statesmanship of the highest order.

*In the domestic field the petroleum industry is entirely on the defensive. Again and again it has been shocked if not surprised by government and foundation sponsored theoretical publications. The recent Federal Trade Commission Study, 900 pages of complaints against alleged international oil cartel activities, is an example of a trend that can only continue. Many similar studies, such as the Yale published **“A National Policy for the Oil Industry”** (financed by Carnegie and Rockefeller foundations), or the Columbia University publications **“Concentration of Economic Power”** by David Lynch, and the cartel investigation of the 20th Century Fund are shaping the thinking and actions of legislators which in the end will only lead to lower oil production and higher prices.*

*Staff Memorandum to Board of Trustees of PIRINC
New York City
February 13, 1952²*

Resource nationalism can be defined as the recent (or perhaps recurring) trend in the international oil industry in which host countries use a number of extra-legal measures to unilaterally change the terms of their contracts with international oil companies (IOCs) developing indigenous oil and gas resources. Encouraged by the rapid escalation of oil prices in recent years, this trend is now spreading rapidly. Rising oil prices have emboldened governments to take a greater share of the revenue of projects negotiated in a time of substantially lower oil prices. In some cases, the host country has concluded that the existing contract terms do not adequately permit a fair distribution of the good fortune of rising prices and so contract terms should be changed. In other cases, adjustments in export duties, arbitrary and capricious fines, or other measures are used to redistribute income and even regain project control. Even in Canada and the U.S., investors are not totally immune from attempts by their respective legislative and administrative bodies to change previously agreed contract terms.

Operating companies, with some notable exceptions, have had little choice but to accept these new terms to protect residual value in their projects as existing legal alternatives are either too cumbersome or present further risks to remaining operations in the host country. Host countries presumably believe these unilateral adjustments are justified given rising oil prices or unexpected costs which reduce net revenue to the state.

² In 1952, gasoline sold for 27 cents/gallon, approximately \$2/gallon when adjusted by the CPI deflator.

The longer term consequences of these unilateral actions are much more than a redistribution of revenue. These actions are likely to result in further reductions in investment in the exploration and development of petroleum resources, an arena in which there is a growing consensus that the industry is already “effort constrained.” Projects which present relatively high technical thresholds, extraordinary project completion risks, and very long lead times until initial production, may now be unable to attract adequate capital to go forward. This trend in unilateral contract changes, combined with growing limitations on access to resource development, and in many cases unrealistic terms for new projects, is all adding to the so-called “Peak Oil” problem, which is now more about constraints above the ground than below.

In a kind of perfect storm of bad luck, the resurgence in resource nationalism has been supplemented by civil strife and armed conflicts in several important producing regions in the world. Iraq, Nigeria, and Sudan are all important producing regions experiencing production cuts and constrained exploration and development activity as a secure environment cannot be established to undertake operations.

Role of Expectations

Ultimately, prices in the world oil market are set by the fundamentals of supply and demand. However, crude oil prices at any given moment reflect a wide range of considerations that go well beyond immediate conditions in the market, but also include expectations on future events, including world demand, technological advances, availability of highly skilled workers, availability of future supplies, replacement cost of new supplies, technical and political risk, war and terrorism, among others. In many cases, the immediate loss in output from any number of unexpected events has much less effect on the world market, than the resulting shift in expectations on the availability of expanded output over the next 5-10 years.

It is our view that major price shifts in crude oil prices since the early 1970’s can be explained in part (perhaps largely) by major shifts in expectations on future output. For example, the important consequence of the 1973-74 Arab oil embargo was the structural shift in the ownership and control of the vast resources of the Gulf. The 1973-74 Arab oil embargo, by changing expectations on future production levels from the major Middle East oil producers, brought about a sustained increase in the value of oil. As Middle East reserves were nationalized and transferred to the control of the host countries, expectations on future production from the region were scaled back and prices responded accordingly.

The so-called second oil price shock in 1979 can be seen in a similar light as the Iranian revolution also sent a signal that the region was in for a period of instability and the prior view that future output from Iran and Iraq would expand substantially was no

longer likely. The point here is that in both cases, prices were affected by changing expectations on future production levels. The subsequent fall in oil prices in the mid-1980's can be linked to a fundamental shift in medium term expectations on demand (as consuming countries engaged in fuel substitution and conservation efforts), and Saudi Arabia was no longer willing to engage in highly restrictive output levels to protect the existing price structure.

From the 1980's until the 1999 oil price recovery, OPEC was unable to limit (or had collectively been unwilling to agree to a strategy of limiting) sufficient volumes of oil production to obtain price levels which were substantially above long run replacement costs. Part of the problem with OPEC is that it collectively does not (and cannot) arrive at a consensus on long-term production strategy because of the divergent long term interests of its membership and in the end any effective agreement requires a complicated set of negotiations and trade offs which are inherently unstable. Saudi Arabia, with its vast low cost reserves, should, and does, have a different and longer term outlook and strategy than, say, Iran.

Prices Take Off

Since mid-2004 the price of oil has risen dramatically as the world oil market has faced what can only be viewed as a perfect storm of bad luck. Virtually every major producing region has experienced variants of resource nationalism harming not only near term output, but shifting dramatically expectations on future production.

In the years just after the entry of the new millennium, world oil prices rose, in nominal terms, to approximately \$30/barrel. While this was substantially above the levels experienced in the 1990's it likely reflected some combination of rising demand and increases in replacement cost for new reserves as the industry moved to technically more challenging environments. Nevertheless, the supply outlook was generally positive with new discoveries and rising investment throughout the former Soviet Union, and prospects for expanded output in Latin America and Africa. Even in the U.S., there was a general sense that domestic opportunities in the U.S., such as prospective reserves in the Alaskan National Wildlife Reserve, North Slope gas, and even some offshore regions might provide new sources of supply.

This "era of positive expectations" came to an end in the mid 2000s as the world market began to face a much more pessimistic outlook on new supplies. The early days of the war in Iraq were accompanied by expectations that market would see an opportunity for substantial new investment opportunities for field rehabilitation. This positive expectation was soon reversed as the security situation remained too unstable to permit major new investment. At approximately the same time period, expectations on rising

opportunities for investment in oil and gas projects in Nigeria, Russia, Sudan, Venezuela, and even in the U.S. soon evolved into an environment where projects were postponed, access to resources were denied, and/or contract terms were changed. Within a few years, the era of positive expectations (2000-2004) began to transition into an era of negative expectations, and the bad news has continued into early 2008. Clearly, other forces are at play, including rising demand accompanying rapid economic growth in China and India, the relatively inelastic demand for petroleum in the U.S. (at least in the short term), and lagging capacity additions in Saudi Arabia, but all these factors pale in comparison to what can only be viewed as a “perfect storm” of a series of unexpected events.

The graph displayed on the last page of the report shows the forces at play that brought about much of the shift in expectations on new production. Note that by mid 2005 forecasts by EIA (and others) on production growth, made just a few years earlier, were unrealized, and combined with falling OPEC excess capacity helped to drive crude oil prices upward. Clearly, the discovery and development of new oil and gas fields are becoming both more expensive and technically more challenging, and “Peak Oil” concerns deserve a series examination, but the Lemony Snicket effect cannot be ignored. The market has seen more than its share of bad luck – and most of it has occurred above the ground.

CHART and GRAPH

A SERIES OF UNFORTUNATE EVENTS
OIL MARKET MOVES FROM POSITIVE TO NEGATIVE EXPECTATIONS

Era of Positive Expectations

Outlook in general (but not always) is positive; (1998-2004)

Era of Negative Expectations

Outlook in general (but not always) is negative; (after 2004)

Lost Production

Oil market production loses between the two eras, both from base level output and expected new output.

Country

Iraq

Produced 2.4 mmb/d 1999-2002. The U.S. invasion in 2003 offered promise of rapid investment in Iraqi oil sector as economic sanctions were removed.

Turmoil in Iraq drops output to 1.8 mmb/d, 2003-2006. Investment in field rehabilitation and new fields postponed.

Lost production between eras, 600,000 b/d, plus unrealized additional output from postponed investment and inability to do field rehabilitation work.

Nigeria

Production rose from 2.1 mmb/d to 2.4 mmb/d , 2000-2005, with expectations to achieve up to 4 mmb/d by 2010 commonly accepted prior to 2005.

Civil strife and attacks on oil infrastructure has hurt production and investment. Oil production declined in both 2006 and 2007 (2.11 mmb/d) after 2.4 mmb/d in 2005.

500,000 – 700,000 b/d due to shut in production, political instability and fighting, plus unrealized additional output from postponed investment.

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Era of Positive Expectations

Outlook in general (but not always) is positive; (1998-2004)

Era of Negative Expectations

Outlook in general (but not always) is negative; (after 2004)

Lost Production

Oil market production loses between the two eras, both from base level output and expected new output.

Venezuela

In 2002 oil production surpassed 3 Mm b/d and was showing potential for growth after several years of relatively consistent production.

A strike at the end of 2002 at PDVSA sent production into a nosedive. As of 2007 the country had recovered to slightly less than 2/3's of 2002's peak production. Recent nationalization has hurt investment, furthering Venezuela's production difficulties and growth potential.

Approximately 800,000 b/d decline in output, not restored after 2002-2003 strike, plus loss of previously expected output expansion after nationalizations in 2007, due to likely fall off in investment.

Russia

Russian production skyrocketed between 1999 and 2005, from 6.31 Mm b/d to 9.51 mmb/d. Privatization of Russia's energy sector brought in western investment and more efficient production and management methods. Output was projected at 10 Mm b/d by 2006 & expected to grow to 12 mmb/d by 2010.

Re-nationalization of Russian oil companies, most notably Yukos in 2004, scared off investment and slowed production growth. Russia has failed to reach 10 Mm b/d production as of January 2008 but has seen slight growth over the past few years. Russia's major fields in western Siberia remain in decline, eastern Siberia not yet producing oil.

Near term loss of output from re-nationalization approximately 200,000 – 400,000 b/d. Longer term loss unknown, but could be substantial, and loss in annual output over next 10 years may be as much as 1 million b/d.

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Era of Positive Expectations

Outlook in general (but not always) is positive; (1998-2004)

Era of Negative Expectations

Outlook in general (but not always) is negative; (after 2004)

Lost Production

Oil market production loses between the two eras, both from base level output and expected new output.

Sudan

A peace treaty signed in 2005 to end the country's civil war was expected to allow for development of previously inaccessible fields. The Sudanese government said in 2005 production would reach 600,000 b/d by 2006. Oil reserves were acknowledged to be in the billions, as opposed to the previously known 560 Mm barrels of proven reserves.

Fighting has continued and rebel groups have launched several recent attacks against oil infrastructure in Sudan, mostly run by Chinese companies. Production has yet to reach 600,000 b/d and has fallen about 200,000 – 250,000 b/d short of expectations over the past few years, but grew to 570,000 in 2007. New production has been slow come online as many new fields remain inaccessible due to fighting and many western countries have launched divestment initiatives.

200,000-250,000 b/d of additional output not realized, investment outlook remains limited and access to known reserves has declined.

Argentina -

Between 1991 and 1998 Argentina's crude oil production grew by approximately 80% to 917,000 b/d. After 2 years of slight decline, production picked up again in 2001.

During the two years following 2001 production remained constant. In 2004 Argentina nationalized the country's oil sector and created state oil company Ensara. Ensara has been poorly funded by the government.

Ensara controls all oil projects in the country. Oil production has been declining since 2004 and dropped below 800,000 b/d in 2007.

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Era of Positive Expectations

Outlook in general (but not always) is positive; (1998-2004)

Kazakhstan

After the fall of the Soviet Union Kazakhstan opened its borders to oil and gas exploration. A major discovery was made in the Caspian Sea of an estimated 13 billion barrels. Production from this field, Kashagan, was expected to begin in 2005 with a consortium of foreign oil companies and Kazakhstan's KazMunaiGaz.

Era of Negative Expectations

Outlook in general (but not always) is negative; (after 2004)

The government has implemented several restrictions against foreign oil companies over the past several years as it seeks to strengthen control of its energy resources. It is currently renegotiating the Kashagan deal it made several years ago with the consortium of foreign oil companies.

Lost Production

Oil market production loses between the two eras, both from base level output and expected new output.

Most of the delay in Kashagan oil output is due to technical problems. Difficult to determine future loss from government forced renegotiation of contract, but may result in a chill on investment levels for new resources.

U.S.

Opening ANWR to development, which has an estimated 10.4 billion barrels of crude reserves, was a major part of president Bush's energy policy when he took office in 2000.

Legislation that would allow drilling in ANWR (Arctic National Wildlife Refuge) has failed to be passed by Congress. Attempts at new offshore exploration have seen similar fates. In August 2007 Shell's right to drill 3 exploration wells in the Beaufort Sea near ANWR was revoked by U.S. courts.

Depending upon when ANWR leasing had occurred, loss in domestic production could be substantial, exact amount is unknowable since the prospect has not been drilled, but could be as much as 1 million b/d had leasing occurred ten years ago.

CHART (page 5 of 6)

Era of Positive Expectations

Outlook in general (but not always) is positive; (1998-2004)

Era of Negative Expectations

Outlook in general (but not always) is negative; (after 2004)

Lost Production

Oil market production loses between the two eras, both from base level output and expected new output.

**Canada
(Alberta)**

Canada has the second largest crude oil reserves in the world, 179.2 billion barrels, behind only Saudi Arabia. It is estimated that about 95% of those reserves are located in Alberta's oil sands deposits.

In 2007 the provincial government of Alberta introduced new royalty rates which will increase the government take by an additional 15 percent.. Alberta has already seen a loss of investment which will hinder future production in the region. 2007 oil and gas land sales were down over 50%.

Several companies, including Canada Natural Resources, Nexen, and Imperial Oil have announced reduced investment in the area. Loss of output unknown, but rising royalty rates likely to curtail future output growth.

Bolivia

1999-2006 saw natural gas production, a major part of Bolivia's economy, grow by nearly 400% to 466 bcf.

Nationalization of state energy resources in 2006 by president Evo Morales and the subsequent loss of foreign investment and management caused production growth to diminish. The government announced that it will be unable to meet contractual export requirements to Argentina and Brazil in 2008.

Lost production and exploration due to significant decline in investment. Loss of new production unknown, but likely to be substantial over the next 5 years.

CHART (page 6 of 6)

Era of Positive Expectations

Outlook in general (but not always) is positive; (1998-2004)

Era of Negative Expectations

Outlook in general (but not always) is negative; (after 2004)

Lost Production

Oil market production loses between the two eras, both from base level output and expected new output.

Mexico

Between 1995 and 2004 Mexican production increased from 3.08 mmb/d to 3.85 mmb/d. In September 2004, the EIA predicted production of 4 mmb/d in 2005.

Mexico's production has been in decline since 2004. The 4 mmb/d predicted for 2005 never materialized - instead output dropped to 3.78 mmb/d. Only 3.53 mmb/d were produced in 2007 and 3.39 mmb/d are expected to be produced in 2008. Some analyst believe Mexico's oil output has peaked, but the more serious problem is that Pemex, Mexico's state-owned oil monopoly, does not have the funds needed for exploration and development of new fields.

Much of Mexico's lost production comes from lack of funding for Pemex. Pemex's budget is subject to approval by the Mexican Congress. PEMEX operates on a very tight budget, large debt service, and no legal authority to bring in outside investors. We estimate lost of supply to the world market in the 2005-2010 time period at approximately 500,000 b/d, and possibly more.

Estimated Loss of Supplies to the World Market, 2005-2010

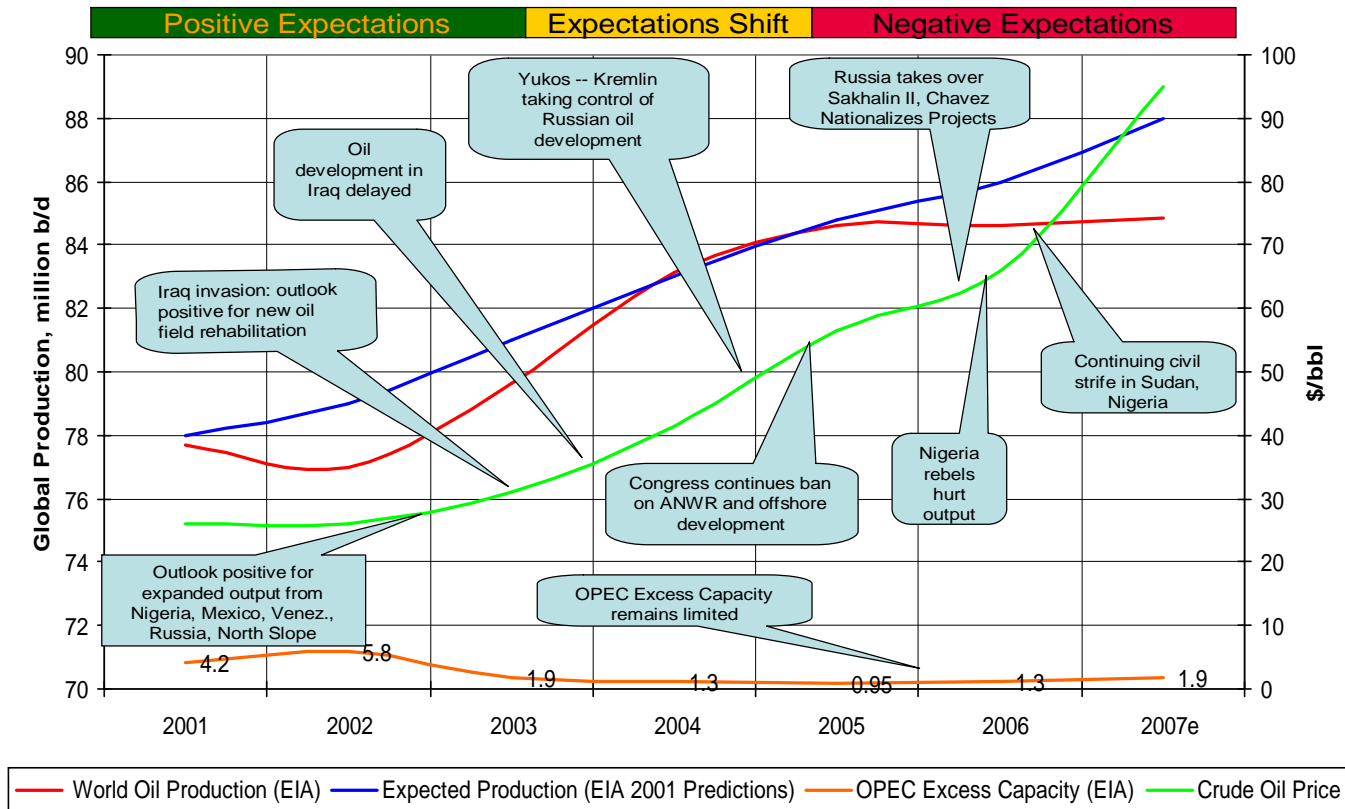
2.5 – 4.5 mmb/d³

Sources: Energy Information Administration, USGS, *Upstream Online*, *Oil and Gas Journal*, Institute for Energy Policy (Moscow), EPRINC

³ In the end the estimate of lost production is just that, an imprecise number. In many respects, the lost opportunities from these unfortunate events are much more than lost output, as producers lose opportunities to evaluate and extend new technology and gain information that can enhance future exploration in the region in question.

Graph

A Series of Unfortunate Events Leading to New Expectations



Sources: EPRINC data from chart above