

Beyond the Age of Petroleum

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This past May, in an unheralded and almost unnoticed move, the Energy Department signaled a fundamental, near epochal shift in US and indeed world history: we are nearing the end of the Petroleum Age and have entered the Age of Insufficiency. The department stopped talking about "oil" in its projections of future petroleum availability and began speaking of "liquids." The global output of "liquids," the department indicated, would rise from 84 million barrels of oil equivalent (mboe) per day in 2005 to a projected 117.7 mboe in 2030--barely enough to satisfy anticipated world demand of 117.6 mboe. Aside from suggesting the degree to which oil companies have ceased being mere suppliers of petroleum and are now purveyors of a wide variety of liquid products--including synthetic fuels derived from natural gas, corn, coal and other substances--this change hints at something more fundamental: we have entered a new era of intensified energy competition and growing reliance on the use of force to protect overseas sources of petroleum.

To appreciate the nature of the change, it is useful to probe a bit deeper into the Energy Department's curious terminology. "Liquids," the department explains in its International Energy Outlook for 2007, encompasses "conventional" petroleum as well as "unconventional" liquids--notably tar sands (bitumen), oil shale, biofuels, coal-to-liquids and gas-to-liquids. Once a relatively insignificant component of the energy business, these fuels have come to assume much greater importance as the output of conventional petroleum has faltered. Indeed, the Energy Department projects that unconventional liquids production will jump from a mere 2.4 mboe per day in 2005 to

10.5 in 2030, a fourfold increase. But the real story is not the impressive growth in unconventional fuels but the stagnation in conventional oil output. Looked at from this perspective, it is hard to escape the conclusion that the switch from "oil" to "liquids" in the department's terminology is a not so subtle attempt to disguise the fact that worldwide oil production is at or near its peak capacity and that we can soon expect a downturn in the global availability of conventional petroleum.

Petroleum is, of course, a finite substance, and geologists have long warned of its ultimate disappearance. The extraction of oil, like that of other nonrenewable resources, will follow a parabolic curve over time. Production rises quickly at first and then gradually slows until approximately half the original supply has been exhausted; at that point, a peak in sustainable output is attained and production begins an irreversible decline until it becomes too expensive to lift what little remains. Most oil geologists believe we have already reached the midway point in the depletion of the world's original petroleum inheritance and so are nearing a peak in global output; the only real debate is over how close we have come to that point, with some experts claiming we are at the peak now and others saying it is still a few years or maybe a decade away.

Until very recently, Energy Department analysts were firmly in the camp of those wild-eyed optimists who claimed that peak oil was so far in the future that we didn't really need to give it much thought. Putting aside the science of the matter, the promulgation of such a rose-colored view obviated any need to advocate improvements in automobile fuel efficiency or to accelerate progress on the development of alternative fuels. Given White House priorities, it is hardly surprising that this view prevailed in Washington.

In just the past six months, however, the signs of an imminent peak in conventional oil production have become impossible

even for conservative industry analysts to ignore. These have come from the take-no-prisoners world of oil pricing and deal-making, on the one hand, and the analysis of international energy experts, on the other.

Most dramatic, perhaps, has been the spectacular rise in oil prices. The price of light, sweet crude crossed the longstanding psychological barrier of \$80 per barrel on the New York Mercantile Exchange for the first time in September, and has since risen to as high as \$90. Many reasons have been cited for the rise in crude prices, including unrest in Nigeria's oil-producing Delta region, pipeline sabotage in Mexico, increased hurricane activity in the Gulf of Mexico and fears of Turkish attacks on Kurdish guerrilla sanctuaries in Iraq. But the underlying reality is that most oil-producing countries are pumping at maximum capacity and finding it increasingly difficult to boost production in the face of rising international demand.

Even a decision by the Organization of the Petroleum Exporting Countries (OPEC) to boost production by 500,000 barrels per day failed to halt the upward momentum in prices. Concerned that an excessive rise in oil costs would trigger a worldwide recession and lower demand for their products, the OPEC countries agreed to increase their combined output at a meeting in Vienna on September 11. "We think that the market is a little bit high," explained Kuwait's acting oil minister, Mohammad al-Olaim. But the move did little to slow the rise in prices. Clearly, OPEC would have to undertake a much larger production increase to alter the market environment, and it is not at all clear that its members possess the capacity to do that--now or in the future.

A warning sign of another sort was provided by Kazakhstan's August decision to suspend development of the giant Kashagan oil region in its sector of the Caspian Sea, first

initiated by a consortium of Western firms in the late '90s. Kashagan was said to be the most promising oil project since the discovery of oil in Alaska's Prudhoe Bay in the late '60s. But the enterprise has encountered enormous technical problems and has yet to produce a barrel of oil. Frustrated by a failure to see any economic benefits from the project, the Kazakh government has cited environmental risks and cost overruns to justify suspending operations and demanding a greater say in the project.

Like the dramatic rise in oil prices, the Kashagan episode is an indication of the oil industry's growing difficulties in its efforts to boost production in the face of rising demand. "All the oil companies are struggling to grow production," Peter Hitchens of Teather & Greenwood brokerage told the *Wall Street Journal* in July. "It's becoming more and more difficult to bring projects in on time and on budget."

That this industry debilitation is not a temporary problem but symptomatic of a long-term trend was confirmed in two important studies published this past summer by conservative industry organizations.

The first of these was released July 9 by the International Energy Agency (IEA), an affiliate of the Organization for Economic Cooperation and Development, the club of major industrial powers. Titled *Medium-Term Oil Market Report*, it is a blunt assessment of the global supply-and-demand equation over the 2007-12 period. The news is not good.

Predicting that world economic activity will grow by an average of 4.5 percent per year during this period--much of it driven by unbridled growth in China, India and the Middle East--the report concludes that global oil demand will rise by 2.2 percent per year, pushing world oil consumption from approximately 86 million barrels per day in 2007 to 96 million in 2012. With luck

and massive new investment, the oil industry will be able to increase output sufficiently to satisfy the higher level of demand anticipated for 2012--barely. Beyond that, however, there appears little likelihood that the industry will be able to sustain any increase in demand. "Oil look[s] extremely tight in five years' time," the agency declared.

Underlying the report's general conclusion are a number of specific concerns. Most notably, it points to a worrisome decline in the yield of older fields in non-OPEC countries and a corresponding need for increased output from the OPEC countries, most of which are located in conflict-prone areas of the Middle East and Africa. The numbers involved are staggering. At first blush, it would seem that the need for an extra 10 million barrels per day between now and 2012 would translate into an added 2 million barrels per day in each of the next five years--a conceivably attainable goal. But that doesn't take into account the decline of older fields. According to the report, the world actually needs an extra 5 million: 3 million to make up for the decline in older fields plus the 2 million in added requirements. This is a daunting and possibly insurmountable challenge, especially when one considers that almost all of the additional petroleum will have to come from Iran, Iraq, Kuwait, Saudi Arabia, Algeria, Angola, Libya, Nigeria, Sudan, Kazakhstan and Venezuela--countries that do not inspire the sort of investor confidence that will be needed to pour hundreds of billions of dollars into new drilling rigs, pipelines and other essential infrastructure.

Similar causes for anxiety can be found in the second major study released last summer, *Facing the Hard Truths About Energy*, prepared by the National Petroleum Council, a major industry organization. Because it supposedly provided a "balanced" view of the nation's energy dilemma, the NPC report was widely praised on Capitol Hill and in the media; adding to its luster was the identity of its chief author, former

ExxonMobil CEO Lee Raymond.

Like the IEA report, the NPC study starts with the claim that, with the right mix of policies and higher investment, the industry is capable of satisfying US and international oil and natural gas demand. "Fortunately, the world is not running out of energy resources," the report bravely asserts. But obstacles to the development and delivery of these resources abound, so prudent policies and practices are urgently required. Although "there is no single, easy solution to the multiple challenges we face," the authors conclude, they are "confident that the prompt adoption of these strategies" will allow the United States to satisfy its long-term energy needs.

Read further into the report, however, and serious doubts emerge. Here again, worries arise from the growing difficulties of extracting oil and gas from less-favorable locations and the geopolitical risks associated with increased reliance on unfriendly and unstable suppliers. According to the NPC (using data acquired from the IEA), an estimated \$20 trillion in new infrastructure will be needed over the next twenty-five years to ensure that sufficient energy is available to satisfy anticipated worldwide demand.

The report then states the obvious: "A stable and attractive investment climate will be necessary to attract adequate capital for evolution and expansion of the energy infrastructure." This is where any astute observer should begin to get truly alarmed, for, as the study notes, no such climate can be expected. As the center of gravity of world oil production shifts decisively to OPEC suppliers and state-centric energy producers like Russia, geopolitical rather than market factors will come to dominate the marketplace.

"These shifts pose profound implications for U.S. interests, strategies, and policy-making," the NPC report states. "Many

of the expected changes could heighten risks to U.S. energy security in a world where U.S. influence is likely to decline as economic power shifts to other nations. In years to come, security threats to the world's main sources of oil and natural gas may worsen."

The implications are obvious: major investors are not likely to cough up the trillions of dollars needed to substantially boost production in the years ahead, suggesting that the global output of conventional petroleum will not reach the elevated levels predicted by the Energy Department but will soon begin an irreversible decline.

This conclusion leads to two obvious strategic impulses: first, the government will seek to ease the qualms of major energy investors by promising to protect their overseas investments through the deployment of American military forces; and second, the industry will seek to hedge its bets by shifting an ever-increasing share of its investment funds into the development of nonpetroleum liquids.

The New 'Washington Consensus'

The need for a vigorous US military role in protecting energy assets abroad has been a major theme in American foreign policy since 1945, when President Roosevelt met with King Abdul Aziz of Saudi Arabia and promised to protect the kingdom in return for privileged access to Saudi oil.

In the most famous expression of this linkage, President Carter affirmed in January 1980 that the unimpeded flow of Persian Gulf oil is among this country's vital interests and that to protect this interest, the United States will employ "any means necessary, including military force." This principle was later cited by President Reagan as the rationale for "reflagging" Kuwaiti oil tankers with the American ensign during the Iran-

Iraq War of 1980-88 and protecting them with US warships--a stance that led to sporadic clashes with Iran. The same principle was subsequently invoked by George H.W. Bush as a justification for the Gulf War of 1991.

In considering these past events, it is important to recognize that the use of military force to protect the flow of imported petroleum has generally enjoyed broad bipartisan support in Washington. Initially, this bipartisan outlook was largely focused on the Persian Gulf area, but since 1990, it has been extended to other areas as well. President Clinton eagerly pursued close military ties with the Caspian Sea oil states of Azerbaijan and Kazakhstan after the breakup of the USSR in 1991, while George W. Bush has avidly sought an increased US military presence in Africa's oil-producing regions, going so far as to favor the establishment of a US Africa Command (Africom) in February.

One might imagine that the current debacle in Iraq would shake this consensus, but there is no evidence that this is so. In fact, the opposite appears to be the case: possibly fearful that the chaos in Iraq will spread to other countries in the Gulf region, senior figures in both parties are calling for a reinvigorated US military role in the protection of foreign energy deliveries.

Perhaps the most explicit expression of this elite consensus is an independent task force report, *National Security Consequences of U.S. Oil Dependency*, backed by many prominent Democrats and Republicans. It was released by the bipartisan Council on Foreign Relations (CFR), co-chaired by John Deutch, deputy secretary of defense in the Clinton Administration, and James Schlesinger, defense secretary in the Nixon and Ford administrations, in October 2006. The report warns of mounting perils to the safe flow of foreign oil. Concluding that the United States alone has the capacity to protect the global oil trade against the threat of violent

obstruction, it argues the need for a strong US military presence in key producing areas and in the sea lanes that carry foreign oil to American shores.

An awareness of this new "Washington consensus" on the need to protect overseas oil supplies with American troops helps explain many recent developments in Washington. Most significant, it illuminates the strategic stance adopted by President Bush in justifying his determination to retain a potent US force in Iraq--and why the Democrats have found it so difficult to contest that stance.

Consider Bush's September 13 prime-time speech on Iraq. "If we were to be driven out of Iraq," he prophesied, "extremists of all strains would be emboldened.... Iran would benefit from the chaos and would be encouraged in its efforts to gain nuclear weapons and dominate the region. Extremists could control a key part of the global energy supply." And then came the kicker: "Whatever political party you belong to, whatever your position on Iraq, we should be able to agree that America has a vital interest in preventing chaos and providing hope in the Middle East." In other words, Iraq is no longer about democracy or WMDs or terrorism but about maintaining regional stability to ensure the safe flow of petroleum and keep the American economy on an even keel; it was almost as if he was speaking to the bipartisan crowd that backed the CFR report cited above.

It is very clear that the Democrats, or at least mainstream Democrats, are finding it exceedingly difficult to contest this argument head-on. In March, for example, Senator Hillary Clinton told the *New York Times* that Iraq is "right in the heart of the oil region" and so "it is directly in opposition to our interests" for it to become a failed state or a pawn of Iran. This means, she continued, that it will be necessary to keep some US troops in Iraq indefinitely, to provide logistical and training

support to the Iraqi military. Senator Barack Obama has also spoken of the need to maintain a robust US military presence in Iraq and the surrounding area. Thus, while calling for the withdrawal of most US combat brigades from Iraq proper, he has championed an "over-the-horizon force that could prevent chaos in the wider region."

Given this perspective, it is very hard for mainstream Democrats to challenge Bush when he says that an "enduring" US military presence is needed in Iraq or to change the Administration's current policy, barring a major military setback or some other unforeseen event. By the same token, it will be hard for the Democrats to avert a US attack on Iran if this can be portrayed as a necessary move to prevent Tehran from threatening the long-term safety of Persian Gulf oil supplies.

Nor can we anticipate a dramatic change in US policy in the Gulf region from the next administration, whether Democratic or Republican. If anything, we should expect an increase in the use of military force to protect the overseas flow of oil, as the threat level rises along with the need for new investment to avert even further reductions in global supplies.

The Rush to Alternative Liquids

Although determined to keep expanding the supply of conventional petroleum for as long as possible, government and industry officials are aware that at some point these efforts will prove increasingly ineffective. They also know that public pressure to reduce carbon dioxide emissions--thus slowing the accumulation of climate-changing greenhouse gases--and to avoid exposure to conflict in the Middle East is sure to increase in the years ahead. Accordingly, they are placing greater emphasis on the development of oil alternatives that can be procured at home or in neighboring Canada.

The new emphasis was first given national attention in Bush's latest State of the Union address. Stressing energy independence and the need to modernize fuel economy standards, he announced an ambitious plan to increase domestic production of ethanol and other biofuels. The Administration appears to favor several types of petroleum alternatives: ethanol derived from corn stover, switch grass and other nonfood crops (cellulosic ethanol); diesel derived largely from soybeans (biodiesel); and liquids derived from coal (coal-to-liquids), natural gas (gas-to-liquids) and oil shale. All of these methods are being tested in university laboratories and small-scale facilities, and will be applied in larger, commercial-sized ventures in coming years with support from various government agencies.

In February, for example, the Energy Department announced grants totaling \$385 million for the construction of six pilot plants to manufacture cellulosic ethanol; when completed in 2012, these "biorefineries" will produce more than 130 million gallons of cellulosic ethanol per year. (The United States already produces large quantities of ethanol by cooking and fermenting corn kernels, a process that consumes vast amounts of energy and squanders a valuable food crop while supplanting only a small share of our petroleum usage; the proposed cellulosic plants would use nonfood biomass as a feedstock and consume far less energy.)

Just as eager to develop petroleum alternatives are the large energy companies, all of which have set up laboratories or divisions to explore future energy options. BP has been especially aggressive; in 2005 it established BP Alternative Energy and set aside \$8 billion for this purpose. This past February the new spinoff announced a \$500 million grant--possibly the largest of its kind in history--to the University of California, Berkeley, the University of Illinois and Lawrence Berkeley National Laboratory to establish an Energy

Biosciences Institute with the aim of developing biofuels. BP said the institute "is expected to explore the application of bioscience [to] the production of new and cleaner energy, principally fuels for road transport."

Just about every large oil company is placing a heavy bet on Canadian tar sands--a gooey substance found in Canada's Alberta province that can be converted into synthetic petroleum--but only with enormous effort and expense. According to the Energy Department, Canadian bitumen production will rise from 1.1 mboe in 2005 to 3.6 mboe in 2030, an increase that is largely expected to be routed to the United States. Hoping to cash in on this bonanza, giant US corporations like Chevron are racing to buy up leases in the bitumen fields of northern Alberta.

But while attractive from a geopolitical perspective, extracting Canadian tar sands is environmentally destructive. It takes vast quantities of energy to recover the bitumen and convert it into a usable liquid, releasing three times as much greenhouse gases as conventional oil production; the resulting process leaves toxic water supplies and empty moonscapes in its wake. Although rarely covered in the US press, opposition in Canada to the environmental damage wreaked by these mammoth operations is growing.

Environmental factors loom large in yet another potential source of liquids being pursued by US energy firms, with strong government support: shale oil, or petroleum liquids pried from immature rock found in the Green River basin of western Colorado, eastern Utah and southern Wyoming. Government geologists claim that shale rock in the United States holds the equivalent of 2.1 trillion barrels of oil--the same as the original world supply of conventional petroleum. However, the only way to recover this alleged treasure is to strip-mine a vast wilderness area and heat the rock to 500

degrees Celsius, creating mountains of waste material in the process. Here too, opposition is growing to this massively destructive assault on the environment. Nevertheless, Shell Oil has established a pilot plant in Rio Blanco County in western Colorado with strong support from the Bush Administration.

Life After the Peak

And so we have a portrait of the global energy situation after the peak of conventional petroleum, with troops being rushed from one oil-producing hot spot to another and a growing share of our transportation fuel being supplied by nonpetroleum liquids of one sort or another. Exactly what form this future energy equation will take cannot be foreseen with precision, but it is obvious that the arduous process will shape American policy debates, domestic and foreign, for a long time.

As this brief assessment suggests, the passing of peak oil will have profound and lasting consequences for this country, with no easy solutions. In facing this future, we must, above all, disavow any simple answers, such as energy "independence" based on the pillage of America's remaining wilderness areas or the false promise of corn-based ethanol (which can supply only a tiny fraction of our transportation requirements). It is clear, moreover, that many of the fuel alternatives proposed by the Bush Administration pose significant dangers of their own and so should be examined carefully before vast public sums are committed to their development. The safest and most morally defensible course is to repudiate any "consensus" calling for the use of force to protect overseas petroleum supplies and to strive to conserve what remains of the world's oil by using less of it.