

## Oil & Gas Industry Year End Overview and Trends for 2008

**December 3, 2007** — As we approach the holiday season, we want to offer you best wishes for a happy, healthy, and prosperous 2008. We'd also like to share some perspectives about the past year and how we see trends in the oil and gas industry shaping up in the New Year.

Today's major oil companies are in a situation similar to IBM's in the 1980s. At that time, the mainframe computer business was profitable and clearly wasn't going away, but it was facing increasing outside pressures. More than 25 years later, mainframes are, indeed, still around. So what went wrong for IBM back then? The company's intensive focus on mainframes caused it to miss some of the most interesting things happening around it, such as the rise of Microsoft and Intel. Similarly, oil companies today are focused largely on transportation fuels, which we believe will be among the last energy applications to change. However, decarbonization of stationary, energy-intensive applications; the advent of transportation batteries; and the potential overlap of the two will create an interesting future that will require vision beyond the current core focus. The key question is whether today's major oil companies will win in this scenario, or whether they will be defeated by this generation's version of Bill Gates.

The oil marketplace is now being defined by two sets of factors, each set of which is sufficiently powerful to dramatically reshape the market. The first set — scarcity and volatility — was the focus of our letter last year, in which we explored shortages in a number of key areas, including oil supply, refining capacity, human capital and capabilities, and service and supply company capacities. This year, we see the scarcity trend lines continuing across the board, in some cases with a surprisingly stubborn persistence.

The future will be defined by the second set of factors — the potential of carbon policy and energy security policy to alter the energy marketplace *permanently*. Despite ever-higher prices, demand for oil has proved inelastic in Organisation for Economic Co-operation and Development (OECD) countries, while in emerging economies, especially China and India, demand growth continues unabated, with a growth rate roughly six times that of developed economies.

To cope with this exploding growth, the global effort to mitigate carbon's environmental impact is intensifying. In the U.S., which imports more than 12 million barrels a day — consuming roughly one-quarter of global supply — the goal of reducing carbon output is joined to the goal of reducing dependence on foreign oil sources. Both goals are gaining prominence in public consciousness and in state and federal legislative arenas. Indeed, corporate average fuel economy (CAFE) standards, ethanol use mandates, and carbon trading regimes are likely topics for the 2008 U.S. presidential and congressional elections, with a high potential for legislative action in a new Congress.

The diverse and potent challenges represented by these dynamics require actions with three distinct time lines.

## **Phase I: Improve Capacity and Maximize Efficiencies in the Current Core Business**

Productivity from traditional oil fields in the United States, the North Sea, Mexico, and elsewhere is declining. Major finds of traditional oil have not kept pace with declines, and the cost of extracting oil – even from relatively accessible fields – is rising. Consequently, extending mature field reserves and lives, strengthening maintenance effectiveness, and increasing production uptime are ever-higher priorities. Digitization of traditional oil fields is proving to be key in boosting production and increasing reserve recovery. A majority of U.S. supermajors are in various stages of real-time operations and digital oilfield programs.

In addition to enhancing uptime and recovery, digitization also improves the productivity of engineers, leveraging better information and data-mining technologies to shift the work mix to higher-value activities. This is an increasingly important goal, given continuing talent shortages combined with the increasing demands of field maturity and project complexity. Other innovations in human capital productivity are available to the oil industry: Techniques such as lean manufacturing, proven in the automotive and other industries, are now finding their way to the oil business, offering opportunities to stabilize, optimize, and innovate core process productivity, as well as to eliminate waste and rework. Further, innovations in organizational levers such as talent development and structure have been deployed more aggressively to offset the current human capital crisis.

Further, capital project management and strategic sourcing have arisen as critical elements in the face of rampant inflation in engineering, procurement, and construction (EPC) and materials costs, compounding the trend toward project complexity. Leading companies are adopting portfolio approaches to projects, using standardization and modularization to improve efficiencies and optimize engineering and construction capacity. Stage-gate review processes have been tuned to better address front-end loading opportunities and advantages, and to ensure that companies optimize their functional and technical excellence.

## **Phase II: Continue Advances in Unconventional Resources and Address Infrastructure**

Access and maturity challenges are encouraging exploration and extraction in more complex and remote locations. Deeper drilling, deep-water drilling, and unconventional sources of oil (e.g., sands and other extra-heavy oil) are all part of oil resource development that is far removed from U.S. refineries and pipelines, and that has other special requirements. Moreover, the use of biofuels, especially ethanol, as a replacement for oxygenates as well as a gasoline substitute adds to the strain on the oil infrastructure – refineries, distribution hubs, and pipelines – in the U.S. Because the infrastructure was largely a product of postwar expansion, its age suggests the need for heightened emphasis on integrity and additional capital infusion to support new resource and biofuel demands – and perhaps, ultimately, CO<sub>2</sub> sequestration.

As oil prices rise, incentives for unconventional projects grow. The challenge of balancing expanding energy needs with growing opposition to carbon emissions promises to become more complex, and the industry will need to develop practices, including technologies and supply chain initiatives, that reduce dependence on carbon-based fuels and mitigate their effects. However, this process is not without uncertainties. At what price point does coal become an attractive alternative to gas? Or to liquids? At what environmental threshold does nuclear power become an attractive alternative to coal?

In the near term, the most viable nontraditional energy options include oil sands, other extra-heavy oil, and biofuels. Biofuels, supported by government mandates and subsidies, have expanded rapidly. For example, the number of ethanol plants increased from 81 in January 2005 to 130 at the end of 2007. However, biofuels face infrastructure challenges. Most U.S. biofuel production facilities are located in the Midwest to cut down on the cost of transporting corn and soybeans to the refineries, whereas the major

consumption centers are on the East and West coasts—and ethanol cannot be transported through existing pipelines. Furthermore, additional expansion of U.S. corn-based biofuels has significant drawbacks, including pressure on food prices, land limitations, and high resource intensity. Lower-cost biomass, derived from materials such as switchgrass or wood chips, provides lower resource intensity and a less-pronounced carbon footprint. But despite intense interest and R&D funding from the federal government, such cellulosic ethanol has yet to be produced commercially. Companies should carefully consider their participation in biofuels development in light of both current economic considerations and the longer-term potential shift in the role of liquid transportation fuels (discussed below).

The landscape is changing irrevocably. Among many reflections of the new reality is the creation of senior alternative energy positions in several leading companies, and greater discussion of the transition from being oil companies to being energy companies.

### **Phase III: Pursue Decarbonization and Electrification**

It appears inevitable that there will be a tipping point at which global oil demand outstrips supply. Because of the growth of both industrial output and consumer appetite in developing nations, demand is likely to continue accelerating. China has already surpassed the U.S. in consumption of grain, coal, and steel. At current growth rates, Chinese consumers could put 1 billion cars on the road before mid-century. If even a sizable fraction of that market is realized—in China *alone*—the impact on oil supply and carbon production will be staggering.

More efficient use of oil and gas is not a comprehensive strategy for the long term. To meet long-term energy demand, the focus on coal (with carbon capture and sequestration), possibly shale (subject to emissions and other technological advances), renewable technologies, and nuclear power will intensify, with a commensurate increase in R&D funding from both private and public sources. The future of the internal combustion engine, the workhorse of the 20th century, is in doubt.

Hybrid vehicles will grow more commonplace as batteries improve and higher gasoline prices prevail. Over time, hybrids are likely to give way to plug-in hybrids as battery technology continues to improve, liquid fuel costs remain high, and power costs (especially overnight when plug-ins would be “refueled”) become relatively low. These forces will drive a transition from a liquid-based transportation system to a power-based system, and potentially drive the evolution of today’s oil companies into tomorrow’s energy companies.

Finally, it is difficult to imagine a post-carbon scenario that does not include renewed emphasis on nuclear power. Newer alternative technologies will be challenged to meet the relentless growth in energy demand. Nuclear power’s ability to scale, compared to other options, makes it a strong candidate to play a vital role in the future energy mix.

Visionary companies are already engaged in scenario planning in order to prepare for a post-carbon future. In fact, Booz Allen has conducted “wargames” with several companies to determine the potential impact of federal regulation of carbon emissions and help companies formulate their strategies for this eventuality.

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The combination of oil scarcity and increased greenhouse gas emissions effectively demands an alternative energy future. That future will undoubtedly arrive in fits and starts. Yet its basic outlines are already evident, and companies with vision will begin laying a new foundation now by placing bets on an array of non-oil and non-gas energy sources and technologies.

There is much to do in the near term to achieve heightened performance in conventional oil and gas production, to expand the role of unconventional resources, and to address the changing needs of our aged energy infrastructure. For those companies able to take the long view, further opportunities are available to create step-change improvements in competitive position and industry leadership, if they make strategic choices grounded in a thorough understanding of future industry paths.

We hope you find these thoughts helpful and worth mulling over. We would be pleased to discuss them further or to answer any questions you might have.

Sincerely,

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