

■ Trends and Challenges for the Oil and Gas Industry

Loretta R. Cross, CPA, CIRA, CDBV –
lcross@srr.com
Atiba K. Henry – ahenry@srr.com
Lidiya Deane – ldeane@srr.com

The Technology Revolution in Oil and Gas ■ ■ ■

The last decade has seen enormous advances in technology related to finding, estimating, and producing oil and gas. A decade ago, many of these technologies would have seemed like scenes from a Sci-Fi novel. But today, they are realities. They range from supercomputers to nanotechnology. Seismic imaging technologies let drillers find oil and gas trapped miles underground and undersea. Oil rigs “walk” from one drill site to the next.

Here are a few of the technologies that will reshape the way that oil companies do business in 2014 and beyond.

The Digital Oilfield

Imagine an oilfield where all the components integrate and communicate constantly on a platform from which companies can manage, measure, and track all of the data coming from all over the oilfield.

- Instruments constantly read data from wellheads, pipelines, and mechanical systems.
- Information is evaluated by computers, which send analytics to real-time operations centers that fine-tune oil flows to optimize production and reduce downtimes, cutting operating costs by up to 25 percent while improving productivity by five percent.

The investment to make this happen is occurring now. According to *Oil and Gas Investor*, total upstream energy IT support spending is about \$0.25 per barrel of oil. Experts at Booz Allen Hamilton believe digital oilfield technologies could increase the net present value of oil and gas assets by 25 percent.

The New Normal

The days of so-called “easy” or conventional oil are dwindling; so the oil and gas industry has focused on developing technological solutions, thereby increasing the world’s producible reserves and creating the “new normal” of exploration and production. Oil companies of all sizes have used technology to find quantities of oil and natural gas so substantial that worries about running out have dissipated. Here are some of the technologies that are making that possible:

- **Development of the Subsea Oilfields** — Subsea oil and gas technology is advancing to meet the requirements of increasingly demanding production environments: deeper water, greater distances from shore, and higher reservoir temperatures and pressures. Oil companies are cognizant of the risks and rewards. Over 100,000 people attended the Offshore Technology Conference in 2013, a multi-day conference focused on drilling rigs, remote underwater vehicles, and crew safety. At the conference this year, Dr. Phaneendra Kondapi, an adjunct professor of subsea engineering at

the University of Houston, presented findings that moving fluid processing to the floor of the sea was the most sought-after technology being developed and improved today. Moving processing to the ocean floor reduces infrastructure costs and production costs, greatly improving return on investment.

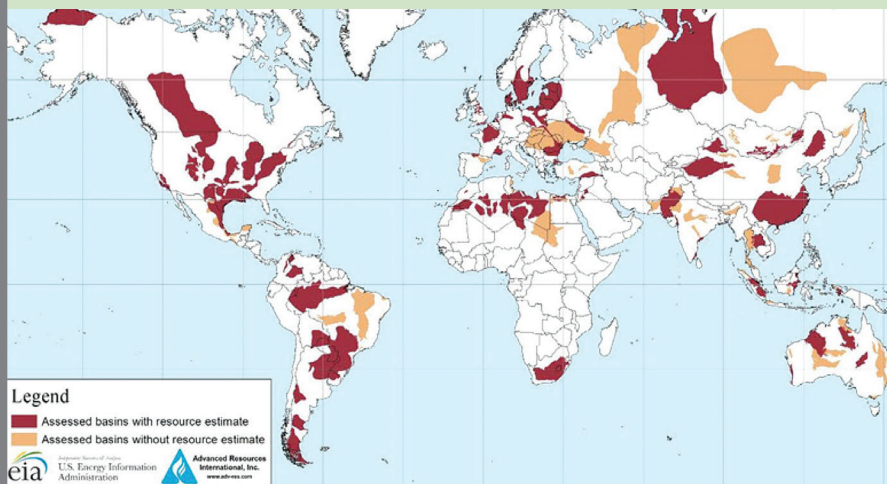
■ **The Shale Play** — Exploitation of shale basins using hydraulic fracturing (“fracking”) and horizontal drilling techniques has pushed U.S. crude output to its highest level since 1989. The resurgence in production helped the U.S. meet 87 percent of its energy needs in the first five months of 2013, on pace to be the highest annual rate since 1986, according to the Energy Information Administration. These techniques have changed the risk profile of drilling for oil and gas. For example, in the Bakken there is a 99 percent success rate of finding producible oil. With this success rate, rigs are used like a sewing machine putting together a patchwork quilt, just moving from section to section drilling a well and then moving to the next patch. Large shale basins in other countries have yet to be developed. As they begin to be developed, we can expect the supply and demand curve for oil and gas to be impacted.

developed, such as steam or chemicals tailored to the properties of the rock and gas. These techniques are being used on older fields, where the exploration and drilling risks are minimal and the infrastructure to get oil and gas to market is already in place. This reduces the risk and the infrastructure cost, making it an attractive investment.

4D Seismic Technology

The expense of exploration in deeper waters and the value of residual oil in existing fields are among the drivers of seismic technology development. Seismic technology is used by petroleum geologists and geophysicists to map and interpret potential hydrocarbon reserves. The size and scale of seismic surveys has increased alongside the increases in computing power during the last 25 years. 3D technology looks at oil and gas reserves as if it is a cube with height, width, and depth. 4D technology adds time as a component, which shows how a reservoir will change over time. The industry’s increasing acceptance and application of 4D seismic techniques in both exploration and production indicates that time-lapse 3D exploration and reservoir monitoring are coming of age as a tool to minimize drilling risk and to maximize the return on investment.

Figure 1. Map of basins with assessed shale oil and shale gas formations, as of May 2013



Source: United States basins from U.S. Energy Information Administration and United States Geological Survey; other basins from ARI based on data from various published studies.

Workforce Challenges ■ ■ ■

An aging workforce coupled with a boom in new oil and gas development is creating challenges for energy companies in the areas of recruitment, retention, and training. The oil and gas industry is facing a shrinking talent pool for those with specialized expertise. A large percentage of the individuals who have the institutional and technological “know-how” of their organization’s specific risks and operations are looking toward retirement. Nearly 90 percent of senior human resources executives at 22 top international oil and gas companies believe this problem is one of the top business issues facing their companies¹. The chart on the following page illustrates the average years of industry experience by discipline area.

As such, many oil and gas companies are undertaking strategic initiatives to attract a new generation of workers, including increasing salaries, offering attractive perks, and aggressively recruiting and training. The companies are eager to identify key university programs, offer scholarships and sponsorships for top students and their respective universities, and actively participate in conferences and training workshops.

■ **Enhanced Oil Recovery** — Conventional production recovers approximately 35 percent of the original oil in place. The rest remains trapped in the rock. Boosting oil recovery could unlock around 300 billion barrels of oil, according to the International Energy Agency. New techniques of unlocking that trapped oil are being

¹ Oilcareer.com and Air Energi, *Global Oil and Gas Workforce Survey*, 2013.

Years of Industry Experience by Discipline Area

| | 0-4 years | 5-9 years | 10-19 years | 20+ years |
|------------------|-----------|-----------|-------------|-----------|
| Construction | 27.8% | 19.6% | 21.8% | 30.8% |
| Project Control | 23.7% | 25.1% | 27.1% | 24.1% |
| Geoscience | 25.5% | 24.5% | 21.6% | 28.4% |
| Subsea/Pipelines | 23.4% | 25.1% | 21.8% | 29.7% |

Source: Hays Oil Industry research report

Salary and Wage Increases

As the global energy demand has steadily increased, the competition for talent among top energy companies has also increased. As a result, employees' salary packages for skilled labor have seen an upward trend over the last several years, a trend that is expected to continue in the foreseeable future. According to a recent survey of oil and gas personnel performed by Hays, Plc., approximately 65 percent of the respondents experienced annual salary increases with over 50 percent of the increases being in excess of five percent. Going forward, the number of employees receiving salary increases per year between five percent and 10 percent is expected to increase approximately 30 percent, while the number of employees receiving salary increases of more than 10 percent is expected to increase approximately 28 percent².

Additionally, the industry has seen a significant jump in the benefits provided to employees, where such benefits include bonuses, commissions, tax assistance, pensions, health insurance, housing, hardship allowance, hazardous danger pay, meal allowance, schooling, and training. Bonuses, as a percentage of total packages, have increased from 4.78 percent to 5.80 percent, representing a 21 percent one-year increase. In addition, the number of employees receiving bonuses has increased approximately 35 percent over the last year due to energy companies' realization that bonuses can be a primary instrument to attract talent³.

Perks

Today's top college graduates are looking for more than just high salaries; perquisites are now considered by many *de rigueur*. These enriched benefit packages offered by oil companies assist employees in managing financial and day-to-day concerns and allowing their staff to focus on job productivity. Companies like Exxon Mobil, Chevron,

BP, Conoco Philips, and many others are building state-of-the-art campuses where employees can bank, shop for dinner to take home, exercise, or obtain onsite childcare. The new Exxon Mobil campus will even allow employees to hold wedding receptions and personal events in its conference center.

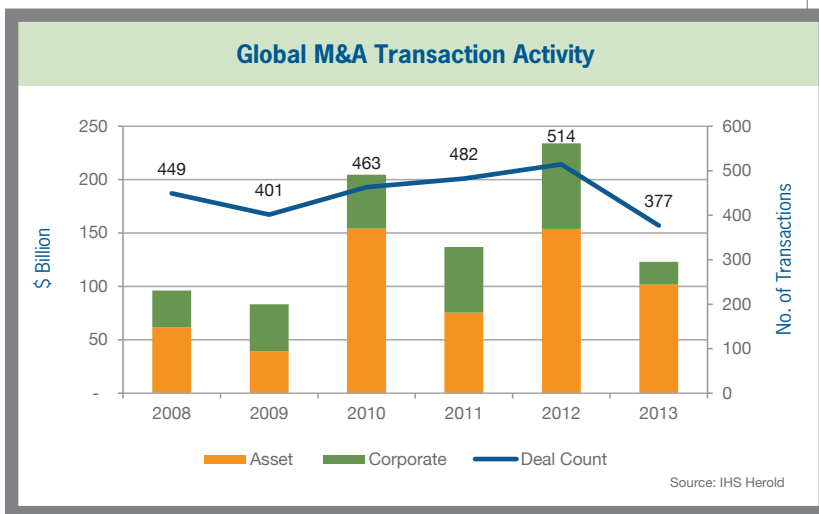
Training

Due to the rapidly changing technology used in the oil industry, providing adequate training programs to enhance employees' capabilities to handle day-to-day activities plays an essential role in the entire energy sector. According to a recent survey conducted by Society of Petroleum Engineers, the majority of the survey's participants indicated that appropriate training was critical to employees' development. In particular, approximately 60 percent of the respondents indicated that technical training is the most vital training needed in the oil and gas industry, followed by management/finance training³, and soft-skills development training. As a result, oil companies have increased the percentage of their budget spent on training and development programs in order to retain and reward most qualified employees. For example, in 2012, ExxonMobil spent \$88 million to train its 76,000 employees, a 10 percent increase from 2011⁴. Going forward, oil companies are expected to continue to increase spending related to training programs in order to enhance employees' operational and business skills.

Capital Markets ■ ■ ■

We now look at several indicators of capital markets activities for oil and gas companies, including merger and acquisition ("M&A") activity, private equity ("PE") investment, and initial public offerings ("IPO") in order to gauge how active the market has been and to assess our expectations for the near term.

Merger and Acquisition Market Activity for the Exploration and Production Industry



² Hays, Plc., *Oil & Gas Global Salary Guide 2013*.

³ SPE Research, *Training and Development Training Survey*, Dec. 2012.

⁴ ExxonMobil website.

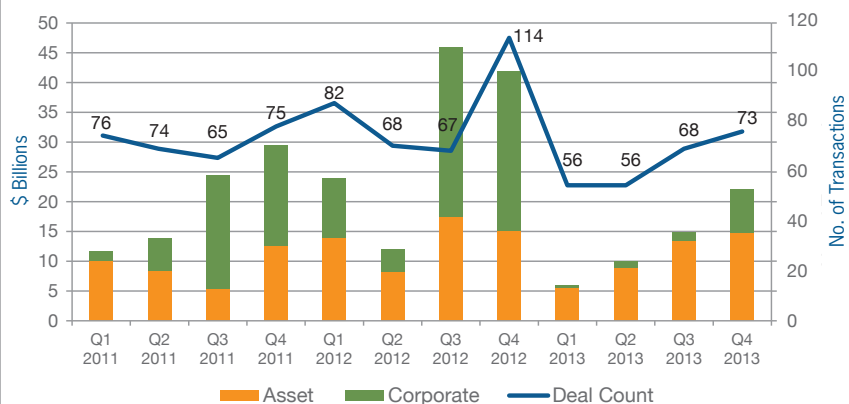
A new focus on development (as opposed to acquisition) has led to a decrease in global M&A transaction activity for 2013 according to data from IHS Herold. In terms of deal count, there were 377 deals in 2013, well below the 514 in 2012, indicating a 27 percent decrease. The 2013 deal count represented a five-year low for oil and gas M&A transaction activity. North America remains the primary locale for transactions, representing 64 percent and 67 percent of total volume in 2012 and 2013, respectively. Transaction value also decreased significantly in 2013. Total transaction value in 2013 was \$123 billion, down 53 percent from the \$234 billion in 2012.

The decline in deal activity can also be seen in North America. On a year-over-year basis, deal activity and transaction values were lower in 2013 compared to 2012. Additionally, this decline has impacted the deal size ranges as shown in the table below.

It should be noted that there was an above average number of U.S. transactions completed in the fourth quarter of 2012, due largely to sellers rushing to close deals in advance of the increase in tax rate on long-term capital gains (which rose from 15 percent to a net 23.8 percent effective January 1, 2013). The largest deal of 2013 took place in the fourth quarter and involved Devon Energy Corporation's acquisition of GeoSouthern Energy Corporation for \$6 billion.

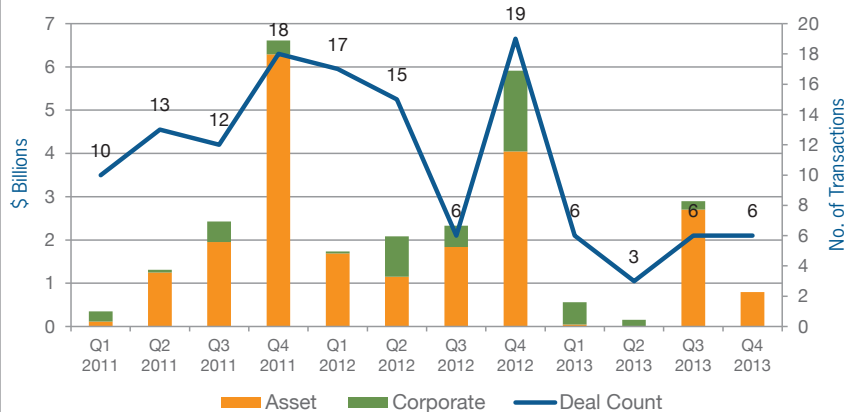
In Europe, deal volume was significantly lower compared to North America but the overall trend was the same, with both quarter-over-quarter and year-over-year transaction volume and value lower in 2013 compared to 2012. Transaction volume in Europe was down 68 percent from 2012, while transaction value declined a similar 65 percent from the prior year.

North America M&A Transaction Activity



Source: IHS Herold

Europe M&A Transaction Activity



Source: IHS Herold

North American Transactions

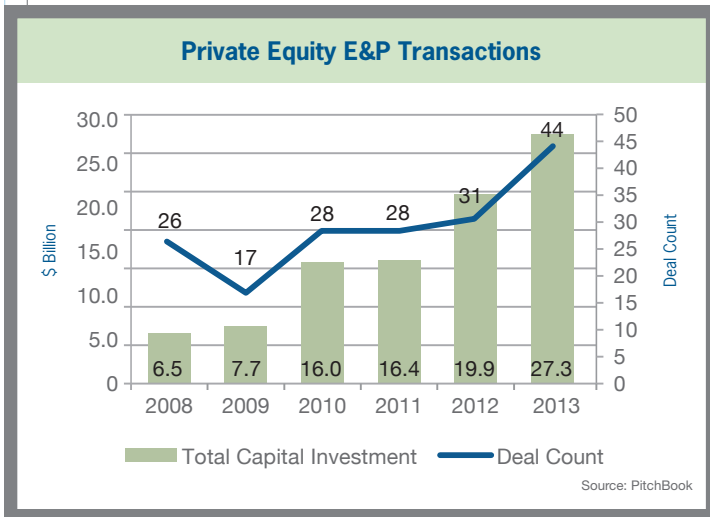
| Deal Size | 2011 | 2012 | 2013 |
|--------------------|------------|------------|------------|
| 1 Billion + | 13 | 22 | 6 |
| \$500M to \$999.9M | 12 | 20 | 21 |
| \$250M to \$499.9M | 17 | 29 | 25 |
| \$100M to \$249.9M | 49 | 54 | 42 |
| \$50M to \$99.9M | 32 | 31 | 40 |
| \$25M to \$49.9M | 39 | 42 | 33 |
| \$20M to \$24.9M | 51 | 52 | 43 |
| Under \$10M | 77 | 81 | 43 |
| Total | 290 | 331 | 253 |

Overall deal volume is down due to the aforementioned tax law changes, as well as (presumably) a shift in the strategic focus of companies from acquisition to integration; i.e. to developing the assets that were purchased over the past couple years in order to complete the cycle of consolidation and actually realize anticipated operational and market synergies.

We anticipate that 2014 will see an uptick in transactions as deal fundamentals are strong and credit and debt financing continues to be available on extremely favorable terms. The annual energy outlook survey from BDO USA LLP indicated that almost three-quarters (71 percent) of the chief financial officers queried are more optimistic about their companies' ability in 2014 to access capital and credit, versus 51 percent in 2013. The big jump in enthusiasm appears to be driven by an improvement in U.S. capital markets and a "healthy" global demand for domestic resources.

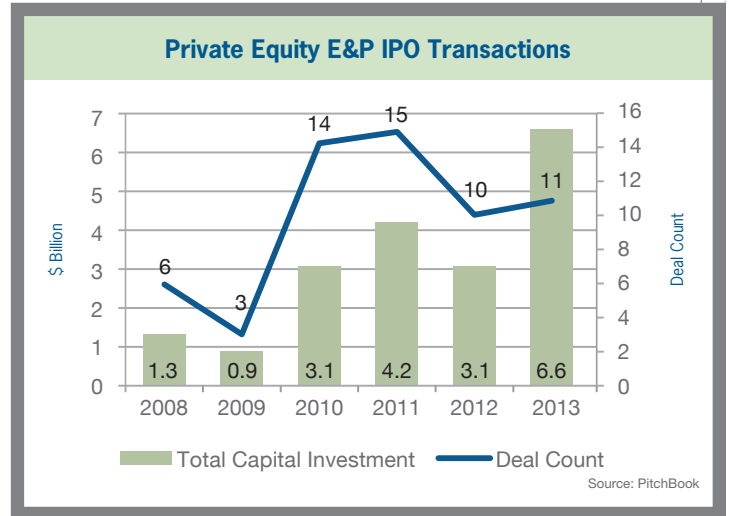
Available Capital and Private Equity Involvement

A significant amount of the North American shale plays are still in the early stages of development and, as such, require a large amount of capital in order to accelerate development. There is over \$700 billion in capital requirements forecasted by industry participants for U.S. current projects⁵. PE firms are eager to provide such capital. PE investment has played and will continue to play a large role in the oil and gas industry going forward. Fifty-five percent of executives polled in a recent survey believe that the industry's need for capital is driving the investment by PE in oil and gas projects⁶. PE firms specializing in exploration and production executed 44 deals valued at \$27.3 billion in 2013, up from 31 deals valued at \$19.9 billion in 2012, according to figures from PitchBook. This trend is expected to continue.



Initial Public Offerings

PE firms that invested in 2009-2011 are now beginning to exit their investments, often via taking their portfolio companies public. There were 11 private equity-backed exploration and production companies IPOs in 2013, with \$6 billion in capital raised compared to the 10 IPOs in 2012, which raised only \$3.1 billion.



Conclusion

The oil and gas business continues to be one of the most dynamic and critical industries in the world. In the words of Jim Yong Kim, president of the World Bank Group, "Energy is a critical part of boosting prosperity and eradicating poverty." The challenges and opportunities that the industry has before it are being addressed by technology, capital investment, and talent management. It will be exciting to see what the future brings for this industry and the impact it will have on the worldwide economy.

Loretta R. Cross, CPA, CIRA, CDBV is a Managing Director in the Valuation & Financial Opinions Group at Stout Risius Ross (SRR). She has more than 30 years of experience in strategic, operational, financial and litigation consulting. Ms. Cross can be reached at +1.713.221.5141 or lcross@srr.com.

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⁵ Ernst & Young, Financing the Future Energy Landscape: Private Equity Trends in Oil and Gas.

⁶ Ernst & Young, Financing the Future Energy Landscape: Private Equity Trends in Oil and Gas.