



BRIDGING THE GAP: THE DIGITAL OILFIELD & ITS DATA

The world's appetite for oil & gas is one that will never be quenched. So new sources of oil and gas must be found and tapped to help the industry find the supply that meets the demand.

Of the small amount of crude oil directly consumed in the United States, nearly all is refined into petroleum products such as gasoline, diesel fuel, heating oil, and jet fuel, which are then consumed. Liquids produced from natural gas processing are also consumed as petroleum products. Renewable biofuels, such as ethanol and biodiesel, can be used as a substitute for or an additive to refined petroleum products¹.

Falling crude and product prices and rising incomes have driven higher U.S. oil demand in recent years. Through the first five months of 2015, the price of crude averaged \$52 per barrel, compared to \$100 over the same time in 2014. Real GDP per capita incomes increased 2 percent in 2014².

Many diverse factors combine to determine prices in a globally integrated world oil market. Roughly 60 percent of the world's oil supply is traded internationally, and particular sources of oil can be interchangeable within the limits set by the oil's quality. Consequently, the price of oil is global.

New supplies, or disruptions to existing supplies, will impact prices around the world, no matter where those events occur and change in demand in any particular country is likely to affect prices globally³.

With energy consumption growing, pressures are tightening on the oil and gas industry as the de-

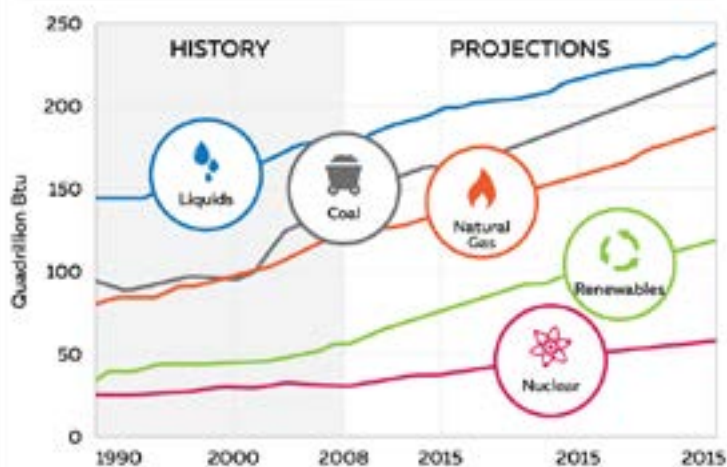
However, today's operational realities require this to be done with more transparency, greater investment in safety and with larger consideration for the environment and the bottom line than ever before.

As of now, the oil and gas industry remains confident in its ability to grow and meet demand and is exercising great caution in certain areas as it is seeing higher costs as a barrier to growth.

Resource scarcity is a one-way trend and new reservoirs are increasingly inaccessible. Over time, a

Experts are in agreement: While the industry can meet demand in the near future, the outlook becomes more uncertain in the longer term.

World Energy Consumption By Fuel, 1990-2035



Source: Institute for Energy Research

mand for hydrocarbon fuels continually rise, despite extraction becoming more challenging. While the high cost of energy has enabled commercial exploitation of shale gas, traditional oil and gas companies must go further and deeper to locate new fields.

higher proportion of reservoirs will require sophisticated enhanced recovery techniques that provide accurate information on workflows, effective knowledge management, the elimination of inefficiencies and real time decision-making⁴.

How does this traditionally manual industry meet the demand in a time and cost-effective way that will not negatively impact the consumer?

The answer is the **Digital Oilfield**.

In this document, we answer these key questions: What is the digital oilfield? The paramount information the digital oilfield collects and some of its pitfalls as well as the great crew change. We will also touch on why a fully functional digital oilfield is imperative to the industry's ability to continue to meet supply and demand and to the industry's future growth.

1 <http://www.eia.gov/tools/faqs/faq.cfm?id=33&t=6>

2 <http://www.forbes.com/sites/judeclemente/2015/06/21/u-s-oil-demand-in-2015-and-beyond/>

3 Congressional Research Service, <https://www.fas.org/sgp/crs/misc/R40187.pdf>

4 http://www.energyglobal.com/upstream/exploration/01072014/The_digital_oilfield_understanding_the_potential/

WHAT IS THE DIGITAL OILFIELD?

Loosely defined, the digital oilfield is 'the use of technology to manage production, personnel and safety, allowing for reduced costs, increased production and improved efficiency in the oil and gas sector.'

This simplified definition encompasses many of the business needs the digital oilfield serves but doesn't dive into the complex workings of a technology and process that has global impact and reach.

The purpose of the digital oilfield is to maximize oilfield recovery, eliminate non-productive time, and increase profitability through the design and deployment of integrated workflows. The digital oilfield combines business process management with advanced information technology and engineering expertise to streamline and in many cases, automate the execution of tasks performed by cross-functional teams⁵.

The term 'digital oilfield' has been used to describe a variety of things and its definition has encom-

passed an equally wide variety of tools, tasks and disciplines. All of them attempt to describe various uses of advanced software and data analysis techniques to improve the profitability of oil and gas production. Common reoccurring themes of the digital oilfield include:

- Operational efficiency
- Production optimization
- Collaboration
- Decision support
- Data integration
- Workflow automation

Digital oilfields will play a key role in the coming decades in enhancing efficiency ...



Ahmed Hashmi, the head of upstream technology at BP said digital oilfields will play a key role in the coming decades in enhancing efficiency in operations and cutting expenses for oil and gas production. Mr. Hashmi, who does extensive research and has been involved heavily in BP's digital oilfield implementation says he believes costs could be cut by almost 10 percent per barrel as the digital oilfield is implemented across fields in the industry⁶.

Cost reduction is a major growth driver for the digital oilfield market, according to a research report⁷, that says the entire oil and gas industry needs to optimize operations, increase efficiency and reduce operational costs. This research expects the digital oilfield technology to gain prominence during 2015-2019 as it offers high return on investment by increasing production efficiency. Integrating high-tech systems in oilfield production provides concise, real-time, accurate information and allows

5 http://petrowiki.org/Digital_oilfields

6 <http://www.oilgaspost.com/2014/06/06/realising-potential-digital-oilfield/>

7 <http://www.reportsnreports.com/reports/402771-global-digital-oilfield-market-2015-2019.html>

for better control and continuous monitoring of subsea infrastructure⁸.

The report continues by stating 'in the era of ever-growing demand for energy and the end of easy oil, digital oilfields help maximize oilfield recovery, eliminate non-productive time and increase ROI and profitability through integration workflow and design. The workflows combine business process management with advanced information technologies to streamline or automate various operations performed by different functional teams.

The global market for the digital oilfield is expected to rise at a healthy compound annual growth rate of 7.9 percent through 2019.

A second research report on the digital oilfield market indicates the global market for the digital oilfield is expected to rise at a healthy compound annual growth rate of 7.9 percent through 2019 and 5.6 percent for projections up to 2024. The Middle East and APAC regions are expected to show the highest growth rate for the period under consideration in this report. The report also clearly indicates this astounding growth is dependent on the implementation of digital oilfield technology⁹.

Estimates from the recent Digital Oilfields World Summit suggest that in 2015, the digital oilfield services market will have grown by 40 percent to more than \$3.18 billion. The bottom-line benefit of deploying these services is projected to be a 25 percent increase in the net present value to: reduce E&P costs and shorten schedules; raise productivity; slash downtime (which can cost up to several million US dollars per day); make better use of the shrinking pool of experienced technical staff; improve worker safety and health; extend the life-

time of 'brown fields' (which previously would have reached the end of their economic life); undertake more complex projects to access reserves in difficult environments¹⁰.

DATA IN THE DIGITAL OILFIELD

The modern digital oilfield uses real-time operations data from the field in a continuous cycle of production analysis, optimization and detailed reservoir management. SCADA or distributed control systems acquire diverse operational data from permanent subsurface well instrumentation, flowline network sensors and surface facilities; as well as managed field actuator equipment such as control valves.

This capability supports real-time operation control and shutdown in an immediate timescale. Beyond that, field data can be integrated into production management software over the medium term to allow accurate and ongoing evaluation, analysis and optimization to take place. Over longer timescales of months to years, assets integrate field data to construct, calibrate and run numerical subsurface simulators and economics to plan the best field development scenarios¹¹.

Oil and gas companies must capture and manage more data than ever before—and that information is being churned out at an ever-increasing velocity. According to industry analyst firm IDC¹², the digital universe now includes 2.7 zettabytes of data. (A zettabyte equals almost 1.1 trillion gigabytes.) Companies are struggling to store, analyze, and gain useful information from these huge volumes of data¹³.

In the Microsoft 'Global Enterprise Big Data Trends' report¹⁴, nearly 300 IT decision makers from a variety of industries were surveyed and 62 percent of respondents currently store at least 100 terabytes of data, and 32 percent expect the amount of data they store to double in the next two to three years. And the vast majority of these professionals view the ability to use growing data volumes as an important business asset.

For O&G firms, advances in instrumentation, process automation, and collaboration are increasing

8 <http://www.prnewswire.com/news-releases/digital-oilfield-market-growing-at-5-cagr-to-2019-509594671.html>

9 <http://www.reportsnreports.com/reports/215337-global-digital-oil-field-market-by-services-automation-instrumentation-information-technology-geography-forecasts-to-2022.html>

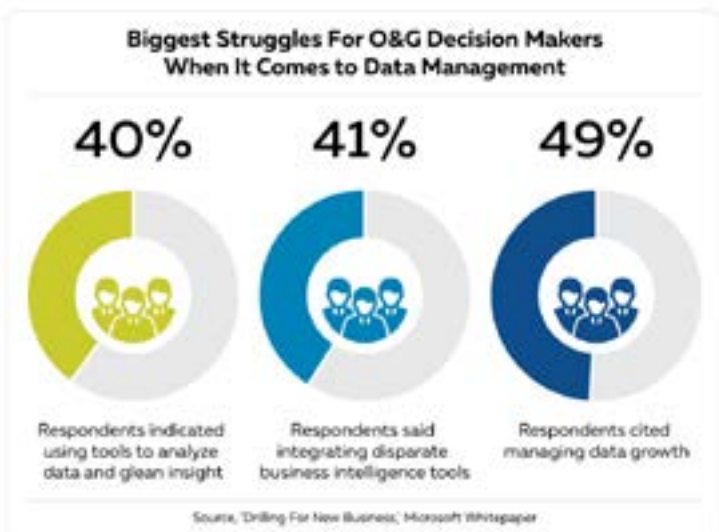
10 <http://offcommnews.com/article/8624-future-digital-oilfield-services/>

11 http://www.slb.com/~media/Files/software/industry_articles/201408_digital_oilfield.pdf

12 Vesset, Dan and Benjamin S. Woo. "Worldwide Big Data Technology and Services 2012-2015 Forecast." IDC, March 2012

13 http://download.microsoft.com/download/D/3/4/D34E7DEE-3E2B-45AD-8B5E-40606F648610/DrillingforNewBusinessValue_O-G_BIWhitepaper.pdf?WT.z_evt=WhitePaperClick

14 http://news.microsoft.com/download/presskits/bigdata/docs/bigData_021113.pdf



data volumes even faster. Experts believe these volumes are growing by a factor of five each year¹⁵. The data volume is coming from sensors, spatial and GPS coordinates, weather services, seismic data, and various measuring devices. Other sources include data market feeds, social media, email, text, images and multimedia. Much of this data is 'unstructured' or 'semi-structured,' which means it's difficult or costly to either store in traditional data warehouses or routinely query and analyze¹⁶.

Millions of smart elements can be sending real-time data 24/7, so data sets and data flow can be huge. Since a single rig can generate one terabyte of data each day, the total amount of data that passes through a digital oilfield can be potentially petabyte-sized (10¹⁵ bytes) or larger per day¹⁷.

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Today there are hundreds of technologies developed to improve efficiency, assist deep water drilling and provide better information for improved safety and disaster response, as well as improve information sharing and remote operations. However, for many companies, challenges still remain in rolling out the digital oilfield concept to all its operations, as well as effectively managing the increased amount of data being recorded¹⁸.

Shell sees the digital oilfield of the future as encompassing increased fiber optic wells and Advanced Reservoir monitoring, as well as ensuring all assets have the 'appropriate level of smartness' applied to them. BP has similar goals to roll out its Field of the Future Technologies across its assets. If the oil price remains low, optimizing all this technology and wealth of data it provides for enhanced oil recovery, increased safety and efficiency will remain paramount¹⁹.

DIGITAL OILFIELD & THE GREAT CREW CHANGE

It is estimated that more than 231,000 years of cumulative experience and knowledge will be lost to the oil and gas industry in the next 10 years due to retirement of petroleum engineers and other technical staff²⁰.

It is estimated 71 percent of the workforce in oil and gas is 50 years of age or older according to an IPAA survey. Furthermore, a survey conducted by Oil & Gas IQ²¹ found that roughly 50 percent of all geophysicist and engineers in the oil and gas industry will retire by 2018.

This raises large concerns within the industry as lack of knowledge sharing to a younger, less-experienced generation of worker within the oilfield could potentially pose problems in productivity, safety and overall business continuity.

Dubbed 'the great crew change,' the problem grows as crews go forth into places where drilling is more challenging, like the Arctic and below oceans.

And as demand for more experienced workers is rising, their numbers are declining. A survey by

15 Brown, Brad, Jacques Bughin, Angela Hung Byers, Michael Chui, Richard Dobbs, and James Manyika. "Big Data: The Next Frontier for Innovation, Competition, and Productivity." McKinsey Global Institute, McKinsey & Co.

16 http://download.microsoft.com/download/D/3/4/D34E7DEE-3E2B-45AD-8B5E-40606F648610/DrillingforNewBusinessValue_O-G_BIWhitepaper.pdf?WT.z_evt=WhitePaperClick

17 <http://offcommnews.com/article/8624-future-digital-oilfield-services/>

18 <http://www.offshore-technology.com/features/featurea-history-of-the-digital-oil-field-4436910/>

19 <http://www.offshore-technology.com/features/featurea-history-of-the-digital-oil-field-4436910/>

<https://ubr.universia.net/article/viewFile/895/1021>

231,000 years of cumulative knowledge will be lost to the oil and gas industry in the next 10 years.

Schlumberger Business Consulting finds 22,000 experienced geoscientists and engineers will leave the field in coming years as retirement age approaches.²²

To offset the Great Crew Change, it's forecasted the industry needs to hire 10,000 new petrochemical professionals every year through 2020 to offset retirements and meet expansion.

In February 2015, Pearson Partners International released survey results of more than 200 senior

executives across the industry who said a shortage of talent is one of the industry's biggest challenges over the next five years. The Great Crew Change is identified as the number one talent-related challenge, followed by a lack of technical talent, such as engineers and geoscientists, and a lack of leadership talent.²³

The oil industry acknowledges some of these gaps and further breakthroughs can be found in the analysis of the data being supplied by the digital oilfield by using it in smarter, faster ways. However, resistance regarding workflows and analysis approaches remains in place, as it has for the last many years.

Breaking into the oil and gas industry is difficult for analysts, but the need and potential for reward are great. More than 20,000 companies are associated with the oil business, and almost all of them need data analytics and integrated technology throughout the oil and gas lifecycle.²⁴

As digital oilfields and analytics expand horizon-

The Oil & Gas Industry By The Numbers



Source: <http://www.forbes.com/sites/drillinginfo/2015/05/04/the-great-crew-change-why-its-even-more-complicated-now/>

21 <http://www.oilandgasiq.com/strategy-management-and-information/white-papers/oil-gas-recruitment-the-great-crew-change/>

22 <http://www.npr.org/2012/04/20/150871935/as-workers-age-oil-industry-braces-for-skills-gap>

23 <http://www.ogfj.com/articles/print/volume-12/issue-4/features/the-great-crew-change.html>

24 <http://www.analytics-magazine.org/november-december-2011/695-how-big-data-is-changing-the-oil-a-gas-industry>

tally to encompass every aspect of operations and engineering, they will also expand vertically within the organization to touch every functional discipline, from accounting and finance, to executive management.

Digital oilfields will become digital companies, with all information pertaining to the acquisition, development, production, and disposition of oil & gas assets being managed in a centrally-administered system with BPM processes, orchestrated workflows, and notifications.

Changes to a production plan in one asset will, through the design of increasingly more sophisticated workflows that include economic analysis, roll up to a revised portfolio optimization plan maintained by the Finance Department, with changes in expected Net Present Value being made immediately available to executive decision-makers.²⁵



ABOUT DIGITAL INTELLIGENCE SYSTEMS, LLC (DISYS)

As DISYS' longest-established area of expertise, our Energy vertical has an extensive track record of partnership building solutions that address the key industry issues of today. As the world experiences large-scale diversification in the Energy sector, DISYS deploys solutions that enable management of energy in all forms. In particular, DISYS is helping the oil and gas industry traverse energy diversification by implementing solutions that preserve profitability while creating long-term, sustainable outcomes for the future. Our clients recognize that diversification is critical to business success and DISYS has diversified our solutions to keep pace with the myriad ways clients are approaching transition.

Whether expanding product offerings, consolidating networks or expanding global operations, DISYS is creating powerful application development, infrastructure, and resource management solutions that remain focused on regulatory compliance and safety – all in support of operational efficiency and business optimization efforts occurring globally.

For our Energy clients, DISYS is solving the following industry concerns:

Operational efficiency: Global process optimization through deployment of digital and mobile productivity tools and solutions. Centralized project management through DISYS' proprietary CDMS tool offers improved management and support of dispersed implementation teams and ensures issue-free project delivery.

Transformation: Business transformation models that combine process integration, optimized resource management and low-risk project rollout. Diverse pricing models offer clients the ideal mix of low-risk, speedy implementation and cost containment.

Organizational consolidation: Technology and asset relocation and support services for global and domestic relocation activities using our Datacenter Operations Framework. 100% adherence to critical safety guidelines resulting in zero productivity loss for touch-labor services.

Increased customer-engagement: Our Mobile Development Library enables app development that puts utility consumption and optimization efforts in consumer hands. Business Intelligence solutions that provide in-depth insight into consumer behavior – enabling the refinement of consumer marketing and acquisition efforts.

²⁵ http://petrowiki.org/Digital_oilfields