RESERVOIR SOLUTIONS



Please see Mexico Reserves Conference on page 5

NEWS from Press Reports

WSJ, Forbes send mixed signals on production forecasts

Early this year the Wall Street Journal asserted that oil and gas companies, in large part, are overestimating their reserves and production from unconventional plays.

"Two-thirds of projections made by the fracking companies between 2014 and 2017 in America's four hottest drilling regions appear to have been overly optimistic, according to the analysis of some 16,000 wells operated by 29 of the biggest producers in oil basins in Texas and North Dakota," stated the WSJ article.

That translates to 10 percent less oil and gas than forecast
— an underperformance of 1-billion BOEs.

Forbes countered with an editorial stating that modeling entities around the world, including big banks, systematically underestimate production growth for shale oil and gas.

The WSJ aggregated and analyzed financial information at company levels in the U.S. while Forbes took a 30,000-ft view of industry, looking at forecasts from the U.S. Energy Information Administration and others. Different sets of metrics yielded different answers.

Spending outpaces revenues

The WSJ used interviews and industry sources to identify the culprits -- quicker-than-assumed production-decline rates, over-concentrations of well densities and forecasting based on insufficient sample sizes of wells.

"Academic research has suggested that data from at least 60 wells, producing for six months or more, would be needed for accurate forecasts," WSJ stated. "Yet some companies and analysts have made predictions based on fewer than 10 wells."

The WSJ also said that the 29 tracked companies spent \$112 billion more in cash than generated from operations in the last 10 years, according to a financial information source.

"The Journal's findings suggest current production levels may be hard to sustain without greater spending because operators will have to drill more wells to meet growth targets," stated the WSJ.

The publication also stated that producers began using the term EURs (estimated ultimate recoveries) when prices dropped this decade to de-emphasize reserves, which are commercially recoverable under current economic conditions.

The *Journal* found that some producers factored in 50-year field lives into the EUR calculations to pad them out — that, despite economic realities that 80 percent of a well's lifetime production from unconventional reservoirs occurs in the first two years, by some accounts.

The WSJ also noted that the enterprise value (EV) of selected U.S. oil companies in 2017 averaged 2.8 times the value of proved reserves compared to 1.7 times in 2007. The wider the

value gap, the weaker the financial fundamentals. The formula for EV is market capitalization plus total debt less cash and cash equivalents.

Fracking depreciation dodge

To question the financial health of the industry, Sightline Institute, a nonprofit think tank, pointed to what it depicted as a less-than-transparent oil and gas accounting system. Two months ago, Sightline posted a blog, "The Fracking Depreciation Dodge," which stated that oil and gas companies in the shale "use a variety of accounting tricks to distract investors from the fundamental weakness of their business models."

Specifically, the institute examined accounting concepts involving capital expenditures and depreciation. "Capex doesn't really count as spending at all. It is considered an investment rather than an expense. After a company makes a capital expenditure, its accounts show a decrease in cash, but an offsetting increase in the value of its capital assets," the blog stated. "Massive capital outlays will affect cash balances. But they will have no immediate effect on a company's tally of profits and losses."

Furthermore, Sightline stated that a company that overestimates well productivity can keep its depreciation expenses artificially low for years—making it seem more profitable than it actually is. Unit-of-production depreciation is ripe for gaming, the organization added, remarking that abuse of this accounting method can lead to writedowns over time.

While Sightline characterizes oil and gas accounting for capex

and DD&A as "tricks," by some accounts, it fails to acknowledge that most investors are savvier than that.

on Oil and Gas Reserves

For a primer on oil and gas accounting fundamentals, including depreciation, please see "Basic Petroleum Accounting for Petroleum Engineers," SPE technical paper No. 162907-MS, 2012, by **Dan Olds**, managing senior vice president at Ryder Scott. It is available for purchase at www.onepetro.org/.

No cause for panic

Forbes pointed to surging U.S. oil production growth as evidence that shale economics are not eroding. The editorial cited gained efficiencies, lower break-even points (BEPs) and better technology as mitigating factors.

"In the wake of the price collapse of 2014-2017, oil and gas companies have been forced to cut their breakeven costs to stay afloat," Forbes stated. "There were over 100 E&Ps that went belly-up during the period. Now, our shale producers have breakevens of just \$50 to \$55 per barrel, down from over \$80 a few years back."

A BEP does not account for sunk costs, such as acreage and overhead, making it a "more forgiving" hurdle rate than life-cycle economics. Still, signs are that cost recovery is strengthening.

Rystad Energy, the primary source for the WSJ article, stated earlier this year that the average well completed over the last two years in Wolfcamp A is profitable at \$45 a barrel. Wolfcamp in the Delaware Permian Basin is a so-called "hotspot."

Forbes stated that "the Shale Revolution has been rising so quickly that EIA predictions for 5, 10, or 15 years down the

road are being surpassed in a single year's time. ...We are now producing 80 percent more crude oil than the EIA predicted we would be back in 2012."

Earlier this year, the EIA Annual Energy Outlook 2019 stated, "U.S. crude oil production continues to set annual records through 2027 and remains greater than 14-million barrels per day through 2040.

Lower 48 onshore tight oil development continues to be the main source of growth in total U.S. crude oil production."

In March, the Paris-based International Energy Agency (IEA) issued its annual oil market forecast, which focuses on international energy supply and demand.

The IEA report stated, "The United States will lead oil-supply growth over the next six years, thanks to the incredible strength of its shale industry, triggering a rapid transformation of global oil markets. By 2024, the United States will export more oil than Russia and will close in on Saudi Arabia – a

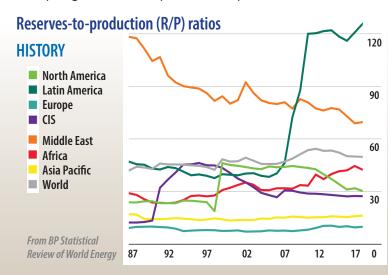
pivotal milestone that will bring greater diversity of supply in markets."

The Forbes editorial added that shale may be the safest long-term investment of all, because significant-scale replacements simply do not exist. At press time, the article was posted at https://www.forbes.com/sites/judeclemente/2019/01/13/u-s-shale-oil-and-natural-gas-underestimated-its-whole-life/#693cf144b596.

For a related article, please see "Permian Basin: Is the sky really falling?" at https://www.ryderscott.com/wp-content/up-loads/2018NL_October.pdf?r=false. It covers the industry debate on how to best forecast oil and gas production from tight formations — an issue that has intensified, as evaluators pore over a growing cache of historical well data.

IOCs highgrade portfolios, petroleum reserves drop

S&P Global *Platts* news service recently reported that some IOCs (international oil companies) are high-grading their oil and gas property portfolios while moving away from a strategy of stockpiling reserves to replace annual production.



"Where a company's production-to-reserve (sic) ratio, or reserves life, was once a proxy for business sustainability, many now see exposure to stranded assets in reserves either too expensive or polluting to extract," stated *Platts*. The ratio of reserves divided by production is used as a metric to check whether a producer is maintaining a sufficient inventory of assets.

"Shell ...has only replaced its annual production with new reserves twice since 2011 ...," *Platts* reported. "The Anglo-Dutch supermajor is now able to maintain just 8.4 years *Please see Reserves Life Ratio on page 8*



April – June 2019 / Vol. 22, No. 2

JVs get nod over debt, equity

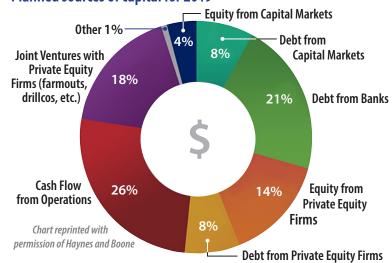
Results of the spring borrowing-base redeterminations survey of Haynes and Boone LLP yielded the following expectations for reserves-based lending:

- Most respondents comprising producers, oilfield service companies, energy lenders, private equity firms and others — expect spring borrowing bases to remain the same or slightly decline.
- Producers have hedged 40 to 60 percent of their production, making it less likely that borrowing bases will dramatically change.
- Sourcing capital through joint-venture transactions is gaining favor, as equity and debt go by the wayside.
- 2019 will be a difficult year to monetize assets.

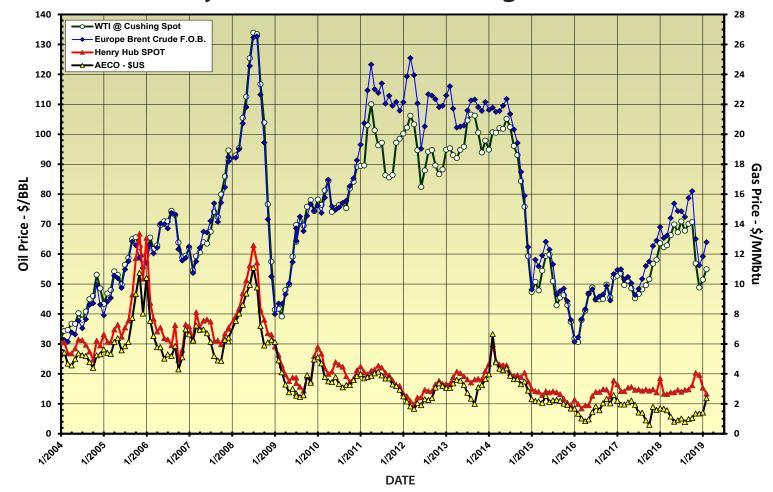
For the full survey results, which include charts and graphs, please go to http://www.haynesboone.com/-/media/files/energy_bankruptcy_reports/borrowing_base_redetermina-

tions_survey.ashx?la=en&hash=855F00BF4B92E6EA14A5C8B-30B2268A4EA0C43E7.

Planned sources of capital for 2019



Price history of benchmark oil and gas in U.S. dollars



Published, monthly-average, cash market prices for WTI crude at Cushing (NYMEX), Brent crude and Henry Hub and AECO gas.

Ryder Scott Mexico Reserves Conference – Cont. from page 1

Miles Palke

5:30 p.m. - 6:15 p.m.

2019 Mexico	Conference -	Schedule	of Events
"Evaluation	Challenges in	a Changing	World"

Evaluation chancinges in a changing world						
DAY 1 - Thursday, May 16, 2019						
Time	Speaker	Affiliation	Topic			
11:00 a.m. – 12:00 p.m.			Registration			
12:00 p.m. – 12:15 p.m.	Guale Ramirez Executive Vice President	Ryder Scott Co. LP	Welcome and Open Conference			
12:15 p.m. – 1:30 p.m.	Dan Olds / Guale Ramirez Mng. Sr. VP - Member PRMS Cmte / Exec. VP	Ryder Scott Co. LP	The NEW (approved June 2018) SPE-PRMS Reserves Definitions			
1:30 p.m. – 2:30 p.m.			Lunch			
2:30 p.m. – 3:30 p.m.	Dan Olds / Guale Ramirez Mng. Sr. VP - Member PRMS Cmte / Exec. VP	Ryder Scott Co. LP	The NEW (approved June 2018) SPE-PRMS Reserves Definitions			
3:30 p.m. – 4:15 p.m.	Herman Acuña Managing Senior VP	Ryder Scott Co. LP	Maturation of Resources from Exploration to Delineation and Development			
4:15 p.m. – 4:45 p.m.			Coffee & Networking			
4:45 p.m. – 5:30 p.m.	Steve Phillips Mna. Senior VP - Head of Geoscience	Ryder Scott Co. LP	Building a Geostatic Model for the Purpose of			

. – 8:15 p.m. Drinks and Heavy Hors d'oeuvres

Ryder Scott Co. LP

Building a Dynamic Simulation Model for the

Purpose of 1P, 2P & 3P Reserves Estimation

6:15 p.m. – 8:15 p.m.			Drinks and Heavy Hors d'oeuvres
	DAY 2 -	Friday, May 17,	2019
Time	Speaker	Affiliation	Topic
7:30 a.m. – 8:00 a.m.			Breakfast
8:00 a.m. – 8:15 a.m.	Guale Ramirez Executive Vice President	Ryder Scott Co. LP	Welcome to Second Day of Conference
8:15 a.m. – 9:00 a.m.	Hector Moyano / Juan M. Gavilan Manager / Leader Reservoir Development	Pan American Energy LLC / Hokchi Energy - Mexico	Building a Model for the Certification of Reserves of the Hokchi Field, an Offshore Field in the Gulf of Mexico
9:00 a.m. – 9:45 a.m.	Gildardo Guerrero Cruz Mexico Operations Consultant	Consultant	Potential for Reserves Growth in the Onshore Southern Region
9:45 a.m. – 10:15 a.m.			Coffee & Networking
10:15 a.m. – 11:00 a.m.	Carlos Morales CEO	Petrobal	Navigating a Different Boat - The Private Perspective
11:00 a.m. – 11:45 a.m.	Stefano Volterrani Vice President	GX Technology	Extracting the Maximum Information from your Seismic Data
11:45 a.m. – 12:30 p.m.	Adan Oviedo Consultant	Consultant (Former Subdirector for Exploration at Pemex E&P)	Exploration Prospectives in the SE basins, where Mexico produces 95% of its reserves
12:30 p.m. – 1:45 p.m.			Lunch
1:45 p.m. – 2:30 p.m.	Herman Acuña Managing Senior VP	Ryder Scott Co. LP	Evaluating Reserves and Resources for Unconventional Plays
2:30 p.m. – 3:15 p.m.	Sandeep Khurana Vice President	Granherne	One Gulf Reaching 50 Billion BOE and Growing
3:15 p.m. – 3:45 p.m.			Coffee & Networking
3:45 p.m. – 4:30 p.m.	Enzo Aconcha Senior Geologist	Ryder Scott Co. LP	Case Study of a Tertiary Field in the Southern Region - A Joint Project with GX Technology
4:30 p.m. – 5:15 p.m.	Gelacio Martin / Salvador Macias Directors	Comisión Nacional de Hidrocarburos (CNH) - Mexico	CNH: Reserves Books
5:15 p.m. – 5:30 p.m.	Guale Ramirez Executive Vice President	Ryder Scott Co. LP	Thanks - Conference Closing

5:30 p.m. - 7:00 p.m. Drinks and Hors d'oeuv

Petroleum engineers: Unsung but advancing the quality of life

Scott Wilson, senior vice president at Ryder Scott, penned an editorial, "Why We Matter," in the March JPT magazine published by the Society of Petroleum Engineers. It is an ode to every petroleum engineer who helps satisfy the world's energy demands through development of hydrocarbon resources.

"When worldwide oil and gas consumption reached record levels yet again in 2017, SPE members were there when it counted, helping to generate



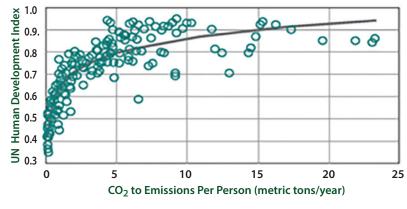
Scott Wilson

more light and power for billions of people across the world," he wrote.

Wilson, a petroleum engineer, looks back to a time when society was lifted out of poverty by cheap energy. "For more than five generations, the oil and gas industry has helped raise living standards; protected environments by replacing firewood with natural gas and propane; and provided food to hungry people by increasing farming productivity, transportation, refrigeration, and packaging," he wrote. "Before hydrocarbons, the great whales were almost hunted to extinction to provide oil for lamps."

The first part of Wilson's theme is that petroleum engineers matter despite being rebuffed by Western societies with ideas about energy that don't always square with science and current economics — two pillars of the reserves evaluation sector.

The second part focuses on a review confirming that higher CO₂ emissions correlate with a greater quality of life for third world countries, emerging economies and beyond that until the population becomes highly industrialized and enriched.



The relationship between CO_2 emissions per person and quality of life as expressed in the United Nations Human Development Index.

At that point, as the population emits more CO₂, incremental benefits diminish. Please see chart from the United Nations Human Development Index study showing the leveling out of quality of life.

Wilson questions whether those upscale populations have forgotten what life was like without fossil fuels. As an example of an underappreciation of the industry, Wilson referred to a 2018 proposal in Colorado that "ostensibly in the name of safety, would have pushed the oil and gas industry out of the state by cutting off access to future drilling locations."

Please see the proposition, which was defeated, at https://dcgop.org/proposition112/.

Before the referendum, Wilson decided to canvass his neighborhood in the Denver suburbs to make the case for fossil fuels, asking each neighbor how he or she felt about effectively banning the oil and gas industry. Through his man-on-the-street interviews, he discovered what public relations practitioners have confirmed for some time now, and that is emotional appeals are more persuasive than logical ones and ultimately, drive decision-making.

"I quickly realized some were motivated by fear and beliefs not rooted in reality. To them, this sinister new trend known as 'fracking' was responsible for sinkholes, pipeline leaks, all earthquakes and inclement weather," he wrote.

"While each person ... was polite and talked with me until I had 'worn out my welcome,' this vocal minority seemed uninterested in information that might challenge their beliefs."

Wilson observed paradoxes in Western cultures enriched by oil and gas that shun the industry at every turn. Among his examples are the yellow-vest protests in France and oil antagonism in Norway and the U.K.

Wilson sees parallels in the overreaction to the
Fukushima Daiichi nuclear disaster caused by a tsunami. "After
the disaster, Germany announced it would close all its zeroemission nuclear plants by 2022, even though only one of
17 active plants was near an ocean," he wrote.

Wilson wraps up the editorial with his failed attempt to switch to solar power as an alternative, cheaper energy source. "It was only after I installed a solar hot water system that I realized the cost to run the two electric circulating pumps was more than the cost of gas to heat an equivalent amount of hot water," he wrote.

Wilson concluded, "We provide a product that makes lives better for billions of people, and will continue to do so for decades to come." The 1,700-word article, at press time, was published at https://www.spe.org/en/jpt/jpt-article-detail/?art=5158.

Two petroleum engineers join Ryder Scott



Edward M. Polishuk

Edward M. Polishuk joined the Ryder Scott Denver office as a senior petroleum geoscientist after working there as a contractor. He has deep, hands-on knowledge of Rocky Mountain assets and evaluates oil and gas reserves. He also analyzes A&D opportunities.

Polishuk is an expert in the DJ Basin, and designed a robust spacing-stacking-completion design for the play. He has additional experience in the Permian, Eagle Ford, Delaware, Scoop/Stack, Marcellus/Utica, Bakken, Powder River, Piceance, San Juan and Uinta basins and plays.

Before joining Ryder Scott, he had been an oil and gas consultant since 2016 at GMG Energy in Denver. Polishuk evaluated prospects and conducted investigations for private investment companies. The work involved data room analysis and evaluations of acquisition candidates and joint ventures.

Before that, Polishuk was a development manager/senior engineer at Bonanza Creek Energy Inc. starting in 2012. He generated type curves, EUR projections, PUD capturing and spacing and PDP forecasting, and was involved in subsurface modeling and spacing studies.

He assigned reserves and resources to more than 3000 locations for four target horizons. Polishuk also was involved in asset and project management as well as engineering and geoscience work.

During 2006 to 2012, he worked at Encana Oil & Gas USA Inc. where he started as a lead reservoir engineer evaluating DJ, Paradox and west Texas basins. Polishuk forecast production, and quantified and analyzed oil and gas assets. He also conducted portfolio analysis, analyzed economics, managed AFEs, conducted economic modeling, evaluated potential acquisitions, optimized well performance and spacing and performed subsurface modeling.

After that, he was group lead, strategic planning for the South Rockies Business Unit for two years. Polishuk evaluated reserves, managed business development and analyzed JV and A&D opportunities. He conducted divestiture modeling for property sales packages up to \$2.5 billion in value. He was the lead economic modeler and coordinator for \$10 billion in funding deals for midstream JVs in the Piceance and DJ basins.

At his most recent position at Encana, he was senior reservoir engineer in charge of reserves, A&D and all engineering functions for the maturation of a new deep-exploration resource play in the Piceance Basin — from conceptualization to commercial exploitation. Polishuk was also in charge of asset management for a Niobrara/Mancos deep exploration program.

Before he worked at Encana, Polishuk was a senior reserve and economic analyst in 2002 for Williams Cos. Inc. Polishuk audited and analyzed economic projections, prepared budget forecasts and designed and tracked finances and performance measures.

In 2005, he became a reservoir engineer for Williams. Polishuk forecast production and evaluated reserves of the Piceance Highlands asset. He also monitored well performance and assisted with well bore and completion designs.

In 2000, he was an engineering advisor for two years at Ogre Partners Ltd. where he became an advanced user of the economic and reserve analysis software.

Polishuk was an asset team leader at Statoil Energy Inc. during 1995 to 1999. He conducted project management and implemented 40-to-80 well annual drilling programs in the Appalachian Basin. He was involved in full-cycle prospect generation, budgeting, economics, and completion design.

Polishuk was also involved in reserves management, reservoir characterization, production forecasting and enhancement of gas assets with a focus on tight gas sands and fractured Devonian shale reservoirs. He also worked in A&D and field operations for Statoil.

Polishuk has a BS degree in geology from Virginia Polytechnic Institute and State University. He is a member of SPE.



Beau Utley

Beau Utley has rejoined Ryder Scott as a petroleum engineer after a year's absence during which he led technical evaluations and analyzed transactions at a private investment firm in Houston. He originally joined Ryder Scott in 2015.

Before that, Utley worked at Encino Energy LLC as a reservoir engineer where he evaluated reserves for borrowing base redeterminations and reporting to the U.S. SEC.

He also worked at EnerVest Ltd. beginning in 2012 as a reservoir engineer responsible

for assets in Oklahoma, Texas, Arkansas and Kansas. Utley prepared reserves and cashflow forecasts for PDP wells and estimated upside value. He was involved in the technical evaluation of more than \$350 million in acquisitions. He also estimated reserves for filing with the U.S. SEC and for internal reporting.

Before that, Utley was a petroleum engineer at Constellation Energy Partners LLC where he provided reservoir engineering analysis and economic evaluation for all properties and potential acquisitions. That included estimating reserves under rules of the U.S. SEC and guidelines of the SPE-PRMS.

He also was a production engineer at Samson Resources Co. where he performed production surveillance and project management for more than 300 oil and gas wells in northwest Oklahoma and southern Kansas. Utley also analyzed and recommended artificial lift designs and designed and implemented well stimulation treatments and recompletions.

He has a BS degree in petroleum engineering from the University of Oklahoma and an MBA degree from the University of Houston. Utley is a member of SPE.

RESERVOIR SOLUTIONS



Ryder Scott Co. LP 1100 Louisiana, Suite 4600 Houston, Texas 77002-5294

Phone: 713-651-9191; Fax: 713-651-0849 Denver, Colorado; Phone: 303-623-9147 Calgary, AB, Canada; Phone: 403-262-2799

E-mail: info@ryderscott.com Web site: www.ryderscott.com PRSRT STD US POSTAGE PAID HOUSTON TX PERMIT NO 11296

Reserves Life Ratio – Cont. from page 3

of current production with its proved reserves, the lowest reserves life ratio of its oil major peers."

Also, Shell claims the U.S. Securities and Exchange Commission is penalizing the company by not allowing it to book reserves committed to its LNG terminals unless a third-party sales contract is in place, reported *Platts*. The supermajor is integrated and markets a lot of its own gas — a practice that it contends keeps some reserves off the books.

Platts also cited other IOCs that "take a more traditional view of growing their reserves," among them ExxonMobil Corp., which had 14 years of production in early 2018, and ENI SpA, which considers reserves to be a "marker of business sustainability."

For the full article, please see, "Oil majors wrestle with reserves as industry health measure" at https://blogs.platts.com/2019/02/28/oil-majors-reserves-health-measure/.

Publisher's Statement

Reservoir Solutions newsletter is published quarterly by Ryder Scott Co. LP. Established in 1937, the reservoir evaluation consulting firm performs hundreds of oil and gas reserves studies a year. Ryder Scott multidisciplinary studies incorporate geophysics, petrophysics, geology, petroleum engineering, reservoir simulation and economics. With 115 employees, including 80 engineers and geoscientists, Ryder Scott has the capability to complete the largest, most complex reservoir evaluation projects in a timely manner.

Board of Directors

Don P. Roesle Chairman and CEO

Dean C. Rietz President

Guale Ramirez Executive V. P.

George F. Dames
Technical Coordinator
– Advising Senior V.P.

Herman G. Acuña Managing Senior V.P.

Larry Connor Technical Coordinator – Advising Senior V.P.

Dan Olds Managing Senior V.P.

Eric Nelson
Managing Senior V.P.

Reservoir Solutions

Editor: Mike Wysatta Business Development Manager

Ryder Scott Co. LP 1100 Louisiana, Suite 4600 Houston, TX 77002-5294 Phone: 713-651-9191; Fax: 713-651-0849

Denver, CO; Phone: 303-623-9147

Calgary, AB, Canada; Phone: 403-262-2799 E-mail: info@ryderscott.com