

# RESERVOIR SOLUTIONS

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Ryder Scott Conference  
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## 12th Annual Ryder Scott Reserves Conference

Sept. 14th

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## Proved reserves do not exist unless they are economic. Or do they?

Petroleum reserves evaluators may be facing radical change to the basic definition of proved reserves shortly. The Society of Petroleum Engineers was deliberating in July whether to recommend that the concept of sub-economic proved reserves be included in its soon-to-be revised Petroleum Resources Management System (PRMS).

Under the current system, a company can develop a project on a 2P expected basis that meets investment thresholds, even though the 1P reserves may not be economic. In that case, an evaluator assigns zero proved reserves to the project, even though commercial 2P volumes exist.

"This disconnect can be confusing and potentially misleading because reserves information becomes misaligned with the company commitment and the economics associated with the development activity," said **Ian McDonald**, vice president, reserves at Nexen Energy ULC.

McDonald is a member of the SPE Oil & Gas Reserves Committee (OGRC) charged with making revisions to the PRMS. The OGRC is discussing preliminary plans to

If the committee's proposed change makes the final cut and then is adopted by cosponsors, "proved" will exist when the proved-plus-probable case meets the minimum investment evaluation criteria of the 2P economic limit test. "Proved economic" will exist when proved reserves meet minimum investment evaluation criteria.

McDonald cited the implications of changes to the economic definition as follows:

- Low/best/high cases become a reflection of project commitment and can include uneconomic proved reserves if the project's 2P case is economic.
- Allows for low/best/high cases of committed 2P economic investment to be stochastically or probabilistically added.
- If the 2P case is uneconomic, the project cannot be considered to have reserves.

"This recommended change is quite concerning. Where do

proved economic and 2P reserves also must satisfy a company's 2P reserves ELT.

"When you hit the economic limit, you perform the ELT to determine what is economic and what is not," said McDonald. "To have proved economic reserves, you must have a positive net operating cash flow so it's no different than what we do now."

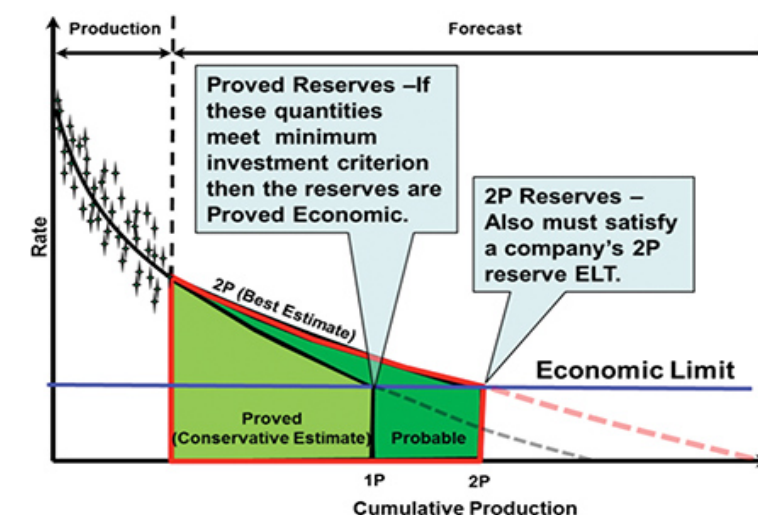
McDonald said that there is a debate at the committee level as to what economic criterion has to be met. Is it a \$1 positive cash flow or 10 percent rate of return? SPE may take a hands-off approach since companies set their own targeted investment criteria and returns.

"The idea is that a \$1 positive cash flow might be considered as economic for proved reserves. When you are talking about proved reserves, a conservative estimate, the fact that it is economic by whatever measure in itself would be OK. It's not perfect and you may not expect a strong rate of return,"

said McDonald.

The other side of the return-on-investment argument is that a company must be committed to the project so there has to

reserves conference in May. At that time, an SPE draft version of the PRMS was scheduled to be nearing completion by an OGRC subcommittee. The next step is for the draft to be shared with sister societies and with stakeholders, including market regulators, during a comment period. Regulators of the London, Hong Kong, Australia and other stock exchanges accept reserves and cash flows prepared under SPE-PRMS



## SPE deliberating whether to

recommend that for a committed oil and gas investment, a company could assign and disclose the project's range of reserves without conducting a separate test for 1P, 2P and 3P categories.

"That means that the proved reserves cash flow would not need to be positive if a development commitment exists, 2P case meets investment thresholds and the reserves meet other definitions," said McDonald. On a company aggregate basis, proved reserves quantities would increase, but their economic value would decrease.

A development commitment means that if the project has been "approved for development," all necessary approvals have been obtained, capital funds have been committed, and implementation of the development project is underway, according to SPE.

McDonald said that the OGRC thinking was that once a project meets commercial criteria, including economics, based on a best estimate of recoverable resources, then all associated resources estimates would become classified as reserves. "Proved" and "proved economic," both in existence in the 2007 PRMS, have been highlighted in the unfinished draft to clarify when proved reserves are economic.



you draw the line insofar as booking quantities that are uneconomic?" said McDonald.

While the discussed revisions do not allow for the assignment of proved economic reserves below the economic limit, they permit the booking of proved volumes if the net operating cash flow is positive.

The economic limit occurs at the peak of the cumulative net operating cash flow, which is defined as production revenue, after any royalties, less operating costs. Please see graph on Page 3. Produced volumes must have positive net operating cash flows once developed.

"An economic limit test (ELT) must be conducted for each uncertainty level — low, best and high — and is one of the criteria to qualify production profiles," said McDonald. Proved reserves have to meet a minimum investment criterion to be

## introduce concept of sub-economic proved reserves

be more than \$1 breaking-even point for the case associated with the commercial decision. "There must be some way to measure this so there is a meaningful ROI or minimum criteria for proved reserves," said McDonald.

In addition to the concept of sub-economic proved reserves, other issues the OGRC is discussing and debating for the PRMS update include the following:

- How should fuel gas and process gas be considered for reserves?
- Should unconventional resource concepts — including discovery, flow test requirements, etc. — be considered as requiring unique definitions?
- Should "standalone" possible reserves be contingent resources?
- How should scenario and incremental evaluation methods be interpreted? What has changed?
- Should resources be required to be broken out by project maturity subclass?

McDonald made his remarks at the Ryder Scott Canada



Ian McDonald

guidelines. They are expected to take a close look at the new guidelines and weigh in.

Presentations from the Calgary conference, including McDonald's, are posted at [www.ryderscott.com/presentations](http://www.ryderscott.com/presentations).

*Editor's Note: At press time, SPE had not released its draft of the 2017 PRMS for public comments. This article is based on a presentation by Ian McDonald, a member of the OGRC. Any*

*expressed opinions are those of Mr. McDonald exclusively. They do not reflect the views of Ryder Scott, nor do they necessarily reflect the views of the OGRC. While the article may provide some insight into possible planned changes in the PRMS, it is not intended to report on any final decisions by OGRC.*



# Oil price jump imminent barring OPEC production surge, says Pursell

"The industry thinks that low prices mean supply is not falling. Supply and demand are much tighter. The global market is more balanced. It's not math. It's arithmetic," said **David Pursell** at the Ryder Scott Canada reserves conference in May.

The managing director at Tudor, Pickering, Holt & Co., said that he expected \$80 a barrel of oil by late 2016. Pursell hasn't backed off that number since at least last September, when he told Ryder Scott reserves conference attendees in Houston that "this is the big tent revival portion of the show. Oil prices will be better."

Then, WTI crude was \$45 a barrel, and nine months later, the price had recovered to a \$50 range, making up lost ground, with a little more than six months to go to reach \$80 by year end.

Pursell cautioned against using the NYMEX futures prices to guide oil price expectations.

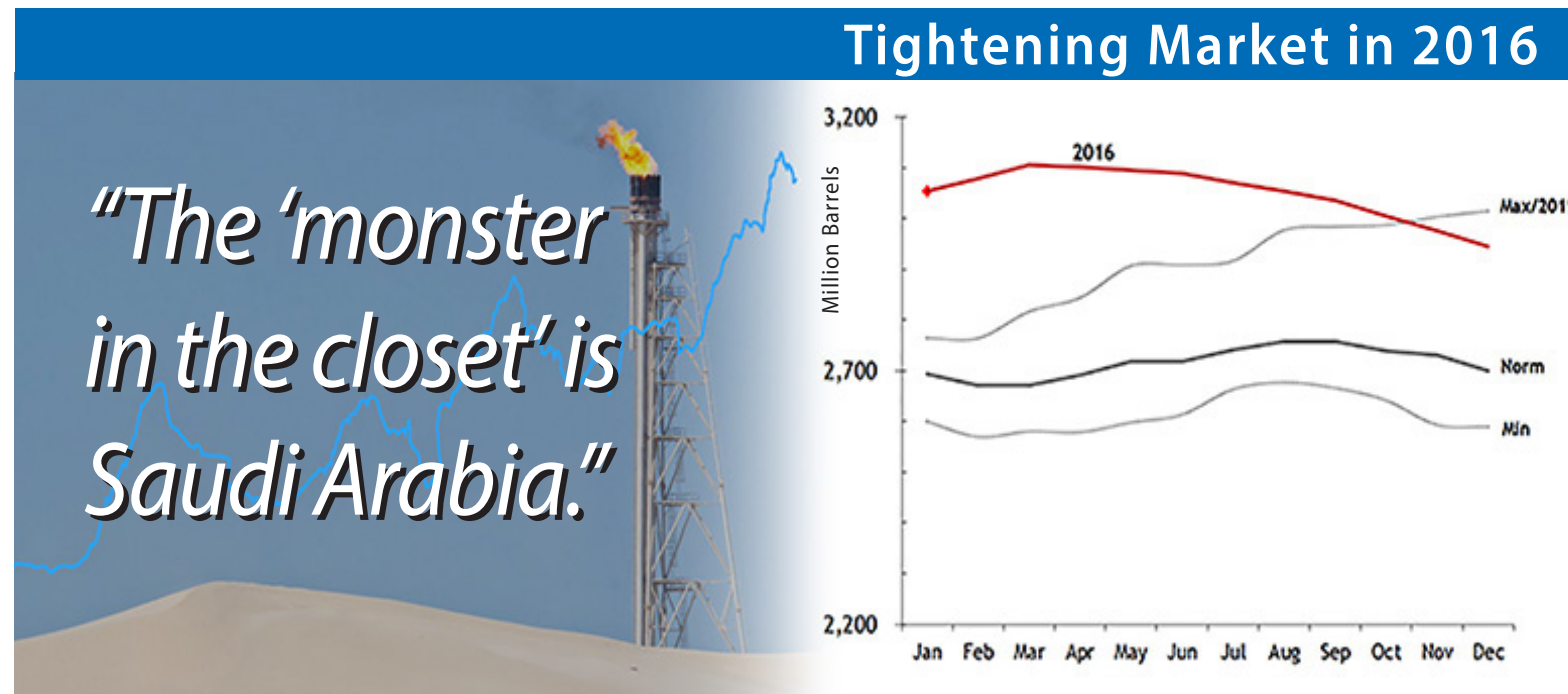
"I think that you have to suspend disbelief and don't look at the forward curve. It's very inaccurate. I wish I could wave that pen (neuralyzer) in 'Men in Black' (movie) so you forget all you know about oil price history and (price) formation. Then I could convince you pretty quickly," said Pursell.

## Consumption underestimated

The TPH model assumes annual demand growth will increase 1 million B/D, which is consistent with other analyst's forecasts, said Pursell, who added that year-to-year demand is harder to predict than supply.

The month of June, however, brought some welcome surprises on the demand side from the U.S. Energy Information Administration. The EIA upped its estimates of historical global consumption to 1.4 million B/D in 2015 while forecasting further growth in 2016-17 to 1.5 million B/D. Swelling appetites for oil in China and India, non-OECD (Organization of Economic Cooperation and Development) countries, are helping to drive global demand.

Pursell said, "If consensus is right at 1.3 million B/D,



*"The 'monster in the closet' is Saudi Arabia."*

*TPH base case supply and demand outlook shows inventory draws are at our doorstep.*

then buckle up. For demand, we are comfortable with 2016 global growth of 850,000 B/D" — a more modest prediction.

The world's biggest consumer of petroleum, by far, is the U.S., one of 34 member countries in the OECD.

"In 2015, we had nearly a 2 percent global demand growth with much of that coming from the U.S.," said Pursell. "The average fuel economy for new car fleets did not increase materially. Light trucks and SUVs sales are back to historical highs. I have to say that 25 percent of Priuses are traded in for SUVs."

## Surplus is shrinking

"The corrections to historical consumption by the EIA bring the surplus down significantly," said **Fred Ziehe**,



David Pursell

technical coordinator – advising senior vice president and pricing expert at Ryder Scott. "Furthermore, the volumes from the latest EIA reports show the same trend. Maybe, just maybe, the 'oil price bubble' is building again."

In June, the International Energy Agency said that supply surpassed consumption by 800,000 BOPD as of May, which is a much slower pace than 1.5 million BOPD expected earlier this year. Stronger than expected oil demand growth and unforeseen supply cuts caused the drop, said the IEA.

See the above TPH graph on tightening market this year.

## Monster in the closet

OPEC production is at an all-time high. Pursell said that OPEC, with less visible capacity, will need to produce at record levels as the market tightens in the second half of 2016 and in 2017. "We are at high inventory levels and the market is oversupplied, but not that much," remarked Pursell, whose own calculations last May indicated a 620,000-B/D global oversupply.

The TPH model last year underestimated OPEC production, including 1.5 million-B/D growth from Saudi Arabia and Iraq, said Pursell.

The model's 2016 base case assumptions for \$80 a barrel by year end are that U.S. production is down by 750,000 B/D, the rest of non-OPEC is down 200,000 B/D, OPEC production is flat at current levels plus 500,000 B/D from the neutral zone while demand grows 1 million B/D.

The near-term concern is Saudi Arabia. "The 'monster in the closet' for the rest of the year is Saudi Arabia," said Pursell. "If the Saudis ramp production a million B/D in the next three or four months, then the fundamentals of price improvement will be delayed, oil is back to \$30 the rest of the year and we won't see meaningful recovery until the back half of 2017."

What is Saudi Arabia's sustainable capacity? Saudi Aramco CEO Amin Nasser recently said that to satisfy growing demand in countries such as the United States and India, the national oil company will boost production. Saudi's output has held fairly steady in 2015-16 at about 10 million B/D. The Saudis say they have about 12.5 million B/D in sustainable capacity and could easily raise production. "That's not remotely true," said Pursell.

*Bloomberg* reported June 24 that "despite near record production, the kingdom's oil inventories ... declined for six consecutive months, the longest stretch since the Joint Organizations Data Initiative started tracking Saudi supply levels nearly 15 years ago."

The news service also reported that according to JODI data, Saudi Arabia in April supplied the market with about 10.5 million B/D compared to production of 10.2 million B/D leading to a further drop in stocks.

*Editor's Note: Price forecasts are highly uncertain by their nature. Ryder Scott does not endorse, use or encourage reliance on the price forecast in this article.*



# 12th Annual Ryder Scott Reserves Conference on Sept. 14<sup>th</sup>

## Climate change, oil prices and “uneconomic” proved reserves on tap at RS conference

The audience at the 12th Annual Ryder Scott Reserves Conference this September will hear views on global warming, uneconomic proved reserves and why lower oil prices for longer won’t happen — all topics that would spark an instant debate in oil and gas circles. Experts in petroleum engineering, investment banking and law will share their respective insights with an expected full audience at the Hyatt Regency hotel in downtown Houston on Wednesday, Sept. 14.

The lineup even includes a weather meteorologist. Neil Frank, chief meteorologist for the Houston television station KHOU for more than 20 years, will opine on global warming. He was also a director at the National Hurricane Center and has received numerous awards and recognitions. See full lineup and agenda on Page 7.

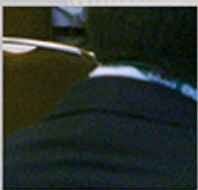
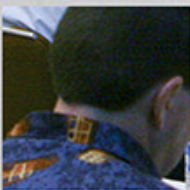
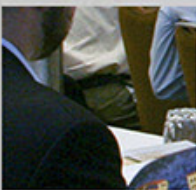
The day-long event is essential for those wanting to keep in step with the latest issues in estimating and reporting oil and gas reserves. For instance, Jeff Wilson, managing senior vice president at Ryder Scott, will discuss a proposal to revise a system of reserves classifications that includes a new category of “sub-economic proved reserves,” an oxymoron to most.

At press time, the Society of Petroleum Engineers was deliberating, in short order, whether to release a draft of its revised Petroleum Resources Management System with that category for industry comments. Wilson is on a subcommittee of the SPE Oil and Gas Reserves Committee working on the draft.

Please see related article, “SPE deliberating whether to introduce concept of sub-economic proved reserves,” on Page 2.

Conference attendees will receive digital versions (PDF files) of the presentations on USB drives. All presentations, except any withheld by a given speaker, will be posted on the Ryder Scott website at [www.ryderscott.com/presentations](http://www.ryderscott.com/presentations).

Please see Reserves Conference on page 8



## Other details:

**When:** Wednesday, Sept. 14<sup>th</sup>, 7 a.m. to 6 p.m.

**Ethics Hour:** 4:15 p.m. to 5:15 p.m.

**Cocktail Reception:** 5:15 p.m. to 7 p.m.

**Where:** Hyatt Regency Hotel, Imperial Ballroom, 1200 Louisiana St., Houston, Texas 77002

## Schedule of Events

### “Evaluation Challenges in a Changing World”

Time	Speaker	Affiliation	Topic
7 a.m. – 8 a.m.			Conference Check In and Light Breakfast
8 a.m. – 8:30 a.m.	Don Roesle CEO	Ryder Scott Co. LP	Welcome and Introduction
8:30 a.m. – 9:15 a.m.	W. John Lee Professor	Texas A&M University	Use of Reliable Technology in Reserves Estimation and Reporting
9:15 a.m. – 10 a.m.	Brandon Blossman Managing Director	Tudor, Pickering, Holt & Co.	Crude Oil - Why Lower for Longer Won't Happen
10 a.m. – 10:30 a.m.			Break
10:30 a.m. – 11 a.m.	Geoff Roberts Managing Dir. & Head of U.S. A&D	BMO Capital Markets	U.S. M&A Market Perspectives
11 a.m. – 11:30 a.m.	David Haugen Sr. VP and Mgr. Calgary Office	Ryder Scott Canada	Canadian M&A Market Perspectives
11:30 a.m. – 12:30 p.m.			Buffet Luncheon
12:30 p.m. – 1:15 p.m.	Jeff Wilson Managing Sr. VP	Ryder Scott Co. LP	Changes and New Definitions in SPE-PRMS
1:15 p.m. – 2 p.m.	Marc Folladori Senior Counsel	Haynes and Boone LLP	Reflecting the Times: A Review of Recent SEC Staff Comments
2 p.m. – 2:15 p.m.			Break
2:15 p.m. – 3 p.m.	David Fulford Sr. Reservoir Engineer	Apache Corp.	Machine Learning for Production Forecasting: Accuracy Through Uncertainty
3 p.m. – 3:45 p.m.	Neil Frank Senior Meteorologist	Independent Meteorologist	Global Warming: Fact or Fiction?
3:45 p.m. – 4 p.m.			Break
4 p.m. – 5 p.m.	Linda Schoonmaker Partner	Seyfarth Shaw LLP	Ethics: Pressing Issues in Turbulent Times
5 p.m. – 7 p.m.			Cocktail Reception



Reserves Conference – Cont. from page 7

**Larry Connor**, technical coordinator and advising senior vice president, manages the event. Email requests, questions or comments to [RSCConfHouston@ryderscott.com](mailto:RSCConfHouston@ryderscott.com).

Attending licensed petroleum engineers will receive six to eight hours of CEUs (Continuing Education Units). State-licensed engineers are required annually to maintain their licensing through continuing education.

For instance, the Texas Board of Professional Engineers requires that licensed engineers earn 15 professional development hours (PDHs) per year and at least one hour must be in professional ethics, roles and responsibilities of professional engineering or review of the Texas Engineering Practice Act and board rules. Those who attend the ethics presentation at the reserves conference will receive one PDH, which fulfills the one-hour annual requirement.

EEDCA applications to be presented at SPE-ATCE Sept. 28



**He Zhang**, senior petroleum engineer at Ryder Scott, will present, “Effective Applications of Extended Exponential Decline Curve Analysis (EEDCA) to Both Conventional and Unconventional Reservoirs,” (SPE 181536) at the Society of Petroleum Engineers annual meeting in Dubai on Sept. 28. A full article on EEDCA, including the equation, was published in the October 2015 Reservoir Solutions newsletter at [https://www.ryderscott.com/wp-content/uploads/2015NL\\_Oct.pdf](https://www.ryderscott.com/wp-content/uploads/2015NL_Oct.pdf)

This new method, which was introduced by Zhang et. al (SPE 175016) last year, provides similar results to other DCA techniques, but is simpler and requires less effort. EEDCA is able to match early and late time well performance without any requirement to switch decline models for shale producers. Theoretically, it can arrive at the final decline, call it  $\beta_e$  or  $D_{min}$ , sooner than the modified hyperbolic method, which is in wide

use as the preferred, reliable industry method. **Eric Nelson, Dan Olds** and **Dean Rietz**, all from Ryder Scott, and **W. John Lee**, professor at Texas A&M University, were coauthors of the latest paper. It further investigates the utility of EEDCA by presenting algorithms to illustrate

field-observed and decreasing b-factors over time as well as the value of  $D_{min}$  for shale.

The paper also offers equations to calculate the theoretical switching point from the hyperbolic to the exponential model. The authors have demonstrated the derivations by more than 130 example shale wells in the Barnett, Haynesville, Eagle Ford (gas window) and Wolfcamp shale plays.

EEDCA can revert to the standard exponential equation thereby making it a robust approach, particularly if incorporated into existing evaluation software. “In shale early life, EEDCA can become a three-parameter equation similar to the Arps hyperbolic equation. That makes it easier to do curve fitting,” said Zhang.

Also to be presented is the application of EEDCA to conventional reservoirs, such as tight-gas accumulations. *Please see EEDCA applications on page 12*

Investment in Alberta O&G more attractive than in competing provinces thanks to new royalty framework

Light Oil, Vertical Well Outcomes

		ARF	MRF	Sask	BC
Royalty % Gross Revenue		17.52%	13.40%	15.84%	11.68%
Royalty % Value*		48.80%	33.36%	44.14%	27.98%
NPV <sub>10</sub> (\$MM)		1.2298	1.3929	1.1688	1.4259
*Value = Gross Revenue less opex and capex					

Ryder Scott Canada conducted a study of Alberta’s new Modernized Royalty Framework equations introduced in April and found that they improve the competitiveness of investing in the province’s oil and gas. The Calgary-based firm compared the MRF, which only applies to wells spudded in 2017 and thereafter, to the existing framework and to the current British Columbia and Saskatchewan royalty regimes.

“We asked the question that, all else being equal, how does the impact of different royalty regimes on company cash flow vary,” said **John MacDonald**, vice president at Ryder Scott Canada.

The new MRF model emulates the revenue-minus-cost global standard for sharing profits from production between oil and gas companies and resource owners. Under MRF, all wells have a 5-percent royalty until gross revenue from all products equals an industry average drilling and completion cost allowance ( $C^*$ ). Thereafter, royalty depends on rate and commodity price. Once the well rate declines to a maturity threshold, the royalty reduces as the rate continues to fall.  $C^*$  is a function of total vertical depth, total lateral length and total proppant placed.

Oil sands wells operating under the conventional royalty regime will be included under MRF however the details have not been released by the government.

MacDonald and **Vitaliy Charkovskyy**, reserves evaluator at RS Canada, created a hypothetical vertical well for light oil, heavy oil and dry gas. For each well type, they created a cost and performance profile consisting of a production profile, capital-cost and operating-cost profiles plus a vertical depth. Those profiles were evaluated under existing and MRF

royalty burdens in Alberta as well as in Saskatchewan and British Columbia. Then they graphed the resulting company cash flow to examine the competitiveness of each royalty regime.

Historically, increasing prices have influenced Alberta to change its royalty structure. “As oil prices increased, so did the criticism that royalty rates were too low so the government raised and lowered them again during a period of change and upset,” said MacDonald. “The new mandate is different and not as simple as going up or down. The purpose is to provide optimal returns to Albertans as owners of the resource.”

The MRF is to be calibrated to target the same industry returns and provincial revenues as the current royalty regulations, added MacDonald at the Ryder Scott Canada reserves conference in May.

His comparisons led to the following conclusions:

- Investment in an Alberta vertical, light oil well will be more attractive than in Saskatchewan and is substantially closer to the value in British Columbia
- Investment in an Alberta vertical, heavy oil well will be even more attractive than in Saskatchewan.
- Investment in an Alberta vertical, sweet dry gas well will be even more attractive than in British Columbia or Saskatchewan.

*Please see Investment in Alberta on page 12*



John MacDonald





## New manager at Ryder Scott Canada is David Haugen



David Haugen

The new manager of Ryder Scott Canada petroleum consultants is **David P. Haugen**, also named a senior vice president. “David plans to lend more visibility to our Canadian operations,” said Dean Rietz, president at Ryder Scott Co. LP. “Over his 26-year petroleum engineering and management career, David has gained professional recognition throughout the western Canadian oil and gas region and we are pleased to have him on board.”

Haugen, P. Eng., has been involved in petroleum reserves and resources characterization, acquisitions and divestitures, property valuations and unconventional gas development and planning. He has conducted detailed engineering and economic evaluations of oil and gas properties throughout the Western Canada Sedimentary Basin.

Haugen joined Ryder Scott from Quicksilver Resources Canada Inc. where he was vice president, engineering. He previously managed the corporate reserves position for Quicksilver’s U.S. and Canadian properties and held key roles for regulatory reporting, internal and external audits and the eventual marketing and sale of the company’s Canadian assets.

Before that, he was the team lead, market development – natural gas economy at EnCana Corp., which he joined in 2000. In that position, he evaluated and directed gas economy

market development initiatives for the United States and Canada and led an evaluation team that was advancing business initiatives for increasing the use of gas in transportation.

Haugen was also a team lead planning at Encana where he built and led a new group that provided technical and business support during the construction of the company’s North American budget portfolio. While there, he was also an engineering advisor in the Bighorn business unit and a team lead for the Cutbank Ridge and Horseshoe Canyon coalbed-methane resource plays.

Haugen started his career in 1989 working for Coles Gilbert Associates Ltd., Wascana Energy Inc. and Northrock Resources Ltd. over an 11-year span in which he conducted detailed engineering and economic evaluations of various oil and gas properties in the WCSB.

Haugen has a B.Sc. degree in petroleum engineering from the University of Alberta and has been a registered professional engineer in APEGA since 1991. He is also a member of the Society of Petroleum Engineers.

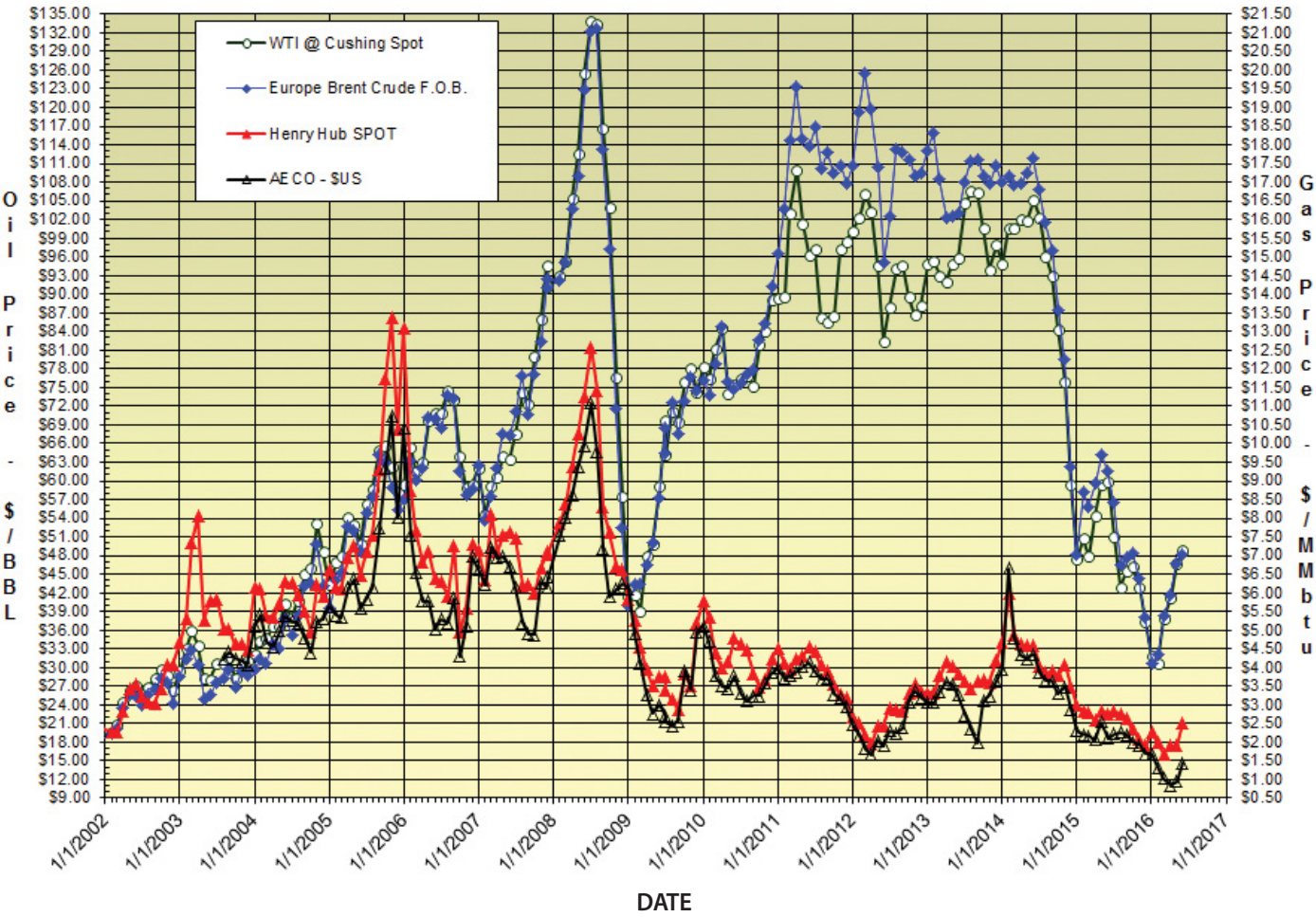
Contact Haugen at [Dave\\_Haugen@ryderscott.com](mailto:Dave_Haugen@ryderscott.com) or at phone number, 403-262-2799, ext. 1025.

## RS employees in Houston and Calgary offices promoted

The following employees at Ryder Scott were promoted to the following positions:

- **Tom Talley** to senior vice president – group coordinator
- **Brett Gray, Phillip Jankowski and Tiffany Kallus** to vice president – project coordinator
- **Claudia Oramas, He Zhang, Pablo Castellon, Laurymar Perez-Mejias and Vitaliy Charkovskyy** to senior petroleum engineer
- **Anton Siyatskiy** to senior reserves evaluator
- **Shane Bruner** to senior economist
- **Sonja Kucinar** to senior engineering technician
- **Annie Henderson** to engineering technician
- **Joey Hunter** to assistant accounting manager
- **David Chan** to senior desktop support specialist
- **Kevin Dean** to senior office services technician

## 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.



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### **EEDCA applications – Cont. from page 8**

Zhang will announce his findings Wednesday, Sept. 28, from 11:30 a.m. to 11:55 a.m., at the Dubai World Trade Centre in Room Al Ain J.

*Editor's Note: EEDCA is at an experimental stage and requires further field testing. Ryder Scott continues to test the implementation, but does not necessarily endorse EEDCA and does not use it for reserves evaluations at this time.*

### **Investment in Alberta – Cont. from page 9**

- Investment in light and heavy oil and dry gas will be more attractive under the MRF than under the current system.

The MRF release on April 21 was not the final word – just the release of the general equations. In his slide presentation, MacDonald cited a dozen “loose ends” that the government has yet to tie up.

His presentation and others from the conference are posted on the Ryder Scott website at [ryderscott.com/presentations](http://ryderscott.com/presentations).

### **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 multi-disciplinary studies incorporate geophysics, petrophysics, geology, petroleum engineering, reservoir simulation and economics. With 130 employees, including 90 engineers and geoscientists, Ryder Scott has the capability to complete the largest, most complex reservoir-evaluation projects in a timely manner.

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