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**OGJ**  
**150/100**

**PIPELINE**  
**ECONOMICS**



**IRAN SEEKS RESOURCE DEVELOPMENT**  
**BHP REDUCES DELAWARE CASING STRING**  
**AFPM Q&A ADDRESSES FCC PROCESSES**  
**OLEFIN PRICES HOLD STEADY**



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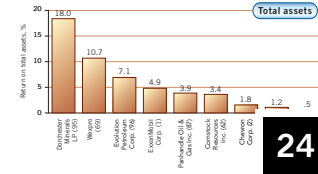
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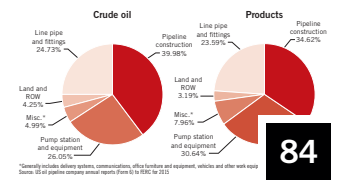
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## COVER

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**OIL, GAS & Petrochem equipment**

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**My Petro Family Photo Contest Winner:**  
The Petro Family Photo Contest is a fun way to share your memories and experiences with the industry. The winner will receive a \$1,000 prize and a special award.

**Offshore chemical improves secondary tertiary recovery with reduced impact:**  
A new chemical formulation has been developed to improve secondary and tertiary recovery of oil in offshore fields. It is designed to be environmentally friendly and has a low carbon footprint.

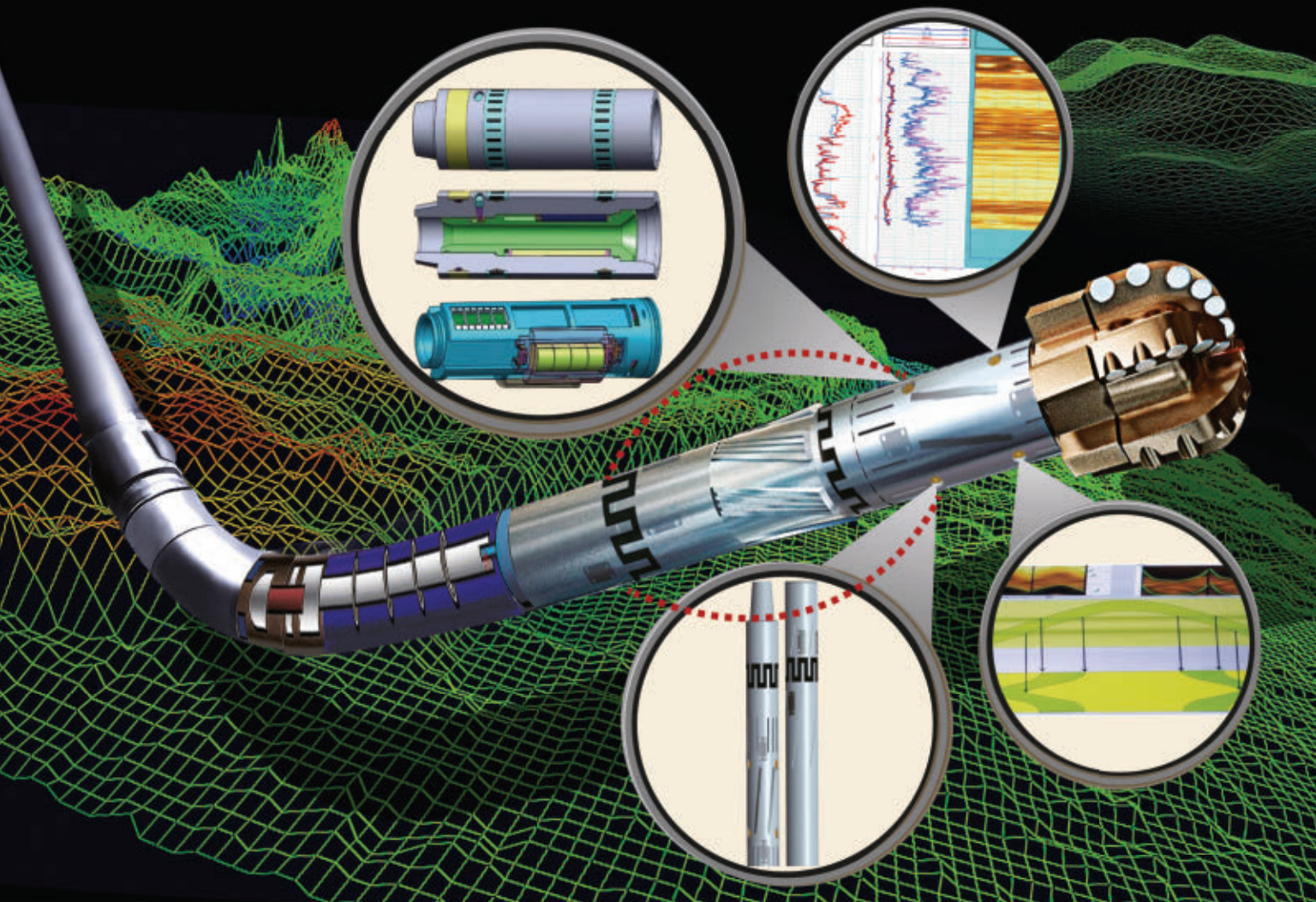
**How closed-reduction technology cuts hydraulic fracturing equipment noise:**  
A new technology has been developed to reduce the noise levels of hydraulic fracturing equipment. This will help reduce the impact of noise on the surrounding community.

**OG&PE  
P1**



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- 🔥 High resolution and fast data transmission and conducive to directional drilling





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The background of the advertisement is a photograph of an offshore oil rig at sunset. The sun is a large, bright white circle on the right side of the frame, casting a golden glow over the entire scene. The rig's silhouette is dark against the bright sky, with its complex lattice structure and various platforms visible. The water in the foreground is dark and reflects the light from the sun. In the top left corner, there is a white rectangular box containing the Siemens logo. Below the logo is a thin white horizontal line. The overall color palette is dominated by warm tones of orange, yellow, and brown, with the white of the Siemens logo and the sun providing high contrast.

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**GENERAL INTEREST** QUICK TAKES**Blackstone targets Midland, Delaware basins**

Blackstone Energy Partners LP, an affiliate of multinational private equity firm Blackstone Group LP, has partnered with a seasoned oil and gas executive and a producing firm to target acreage in the Midland and Delaware basins of West Texas and southern New Mexico.

Blackstone and Jay Still, a former senior executive for Pioneer Natural Resources Co. and Laredo Petroleum Inc., have formed Dallas-based, Midland basin-focused Guidon Energy and acquired 22,000 gross acres (16,000 net) in the core of Martin County, Tex.

Blackstone and affiliated funds have committed \$500 million of capital to Guidon, “with the potential to commit significantly more” in future acquisitions. The firm plans to “develop its leasehold through manufacturing styled horizontal well development.”

Separately, Blackstone and an affiliate of Jetta Operating Co. Inc. have formed Jetta Permian LP, a Fort Worth-based firm focused on the Delaware basin. With \$1 billion committed in capital, Jetta’s strategy includes pursuing asset and leasehold acquisition opportunities, farm-in deals, and partnerships or joint ventures with existing operators and landowners.

Blackstone is among a horde of entities to recently target Permian basin acreage. In the Midland basin alone, Pioneer Natural Resources, Laredo Petroleum, Callon Petroleum Co., QEP Resources Inc., SM Energy Co., Concho Resources Inc., and Parsley Energy Inc. have all made moves this summer to expand their positions.

Denver-based PDC Energy Inc. last month entered the Delaware basin by agreeing to purchase two units managed by energy-focused private equity firm Kimmeridge Energy Management Co. LLC for \$1.5 billion (OGJ Online, Aug. 24, 2016). Silver Run Acquisition Corp., Houston, agreed in July to acquire a controlling interest in Delaware producer Centennial Resources Production LLC (OGJ Online, July 22, 2016).

Drilling has concurrently ramped up in the Permian, with more than two thirds of all rigs added during the recent US rig count rebound coming in the basin.

**EnVen Energy to buy Shell’s Brutus, Glider assets**

EnVen Energy Ventures LLC, an affiliate of Houston-based EnVen Energy Corp., has agreed to acquire 100% of the record title interest in Gulf of Mexico Green Canyon Blocks 114, 158, 202, and 248 from Shell Offshore Inc., an affiliate of Royal Dutch Shell PLC, for \$425 million in cash.

The deal, expected to close in October, includes the Brutus tension leg platform (TLP), the Glider subsea production system, and the oil and gas lateral pipelines used to evacuate production from the TLP. The Brutus and Glider assets have a combined current production estimate of 25,000 boe/d.

Earlier this year, Shell temporarily shut in production to Brutus after an oil spill from a subsea flow line at Glider field was detected (OGJ Online, May 17, 2016).

**Timor Gap arbitration begins in The Hague**

The long-running dispute between Australia and Timor Leste concerning maritime boundaries in the Timor Sea started to be played out Aug. 29 in the Permanent Court of Arbitration in The Hague.

Timor Leste triggered the compulsory conciliation for the disputed territory in the so-called Timor Gap under the United Nation’s Convention on the Law of the Sea in April.

The Timor Gap holds natural gas fields with resources estimated to be worth \$40 billion.

Australia previously has refused to negotiate a permanent sea boundary with Timor Leste and temporary revenue-sharing arrangements were agreed by the two countries in 2002 and again in 2006.

Timor Leste says the 2006 treaty should be abandoned and charges the Australian government with illegal bugging of the Timor Leste cabinet rooms during negotiation that gave the Australians an unfair advantage.

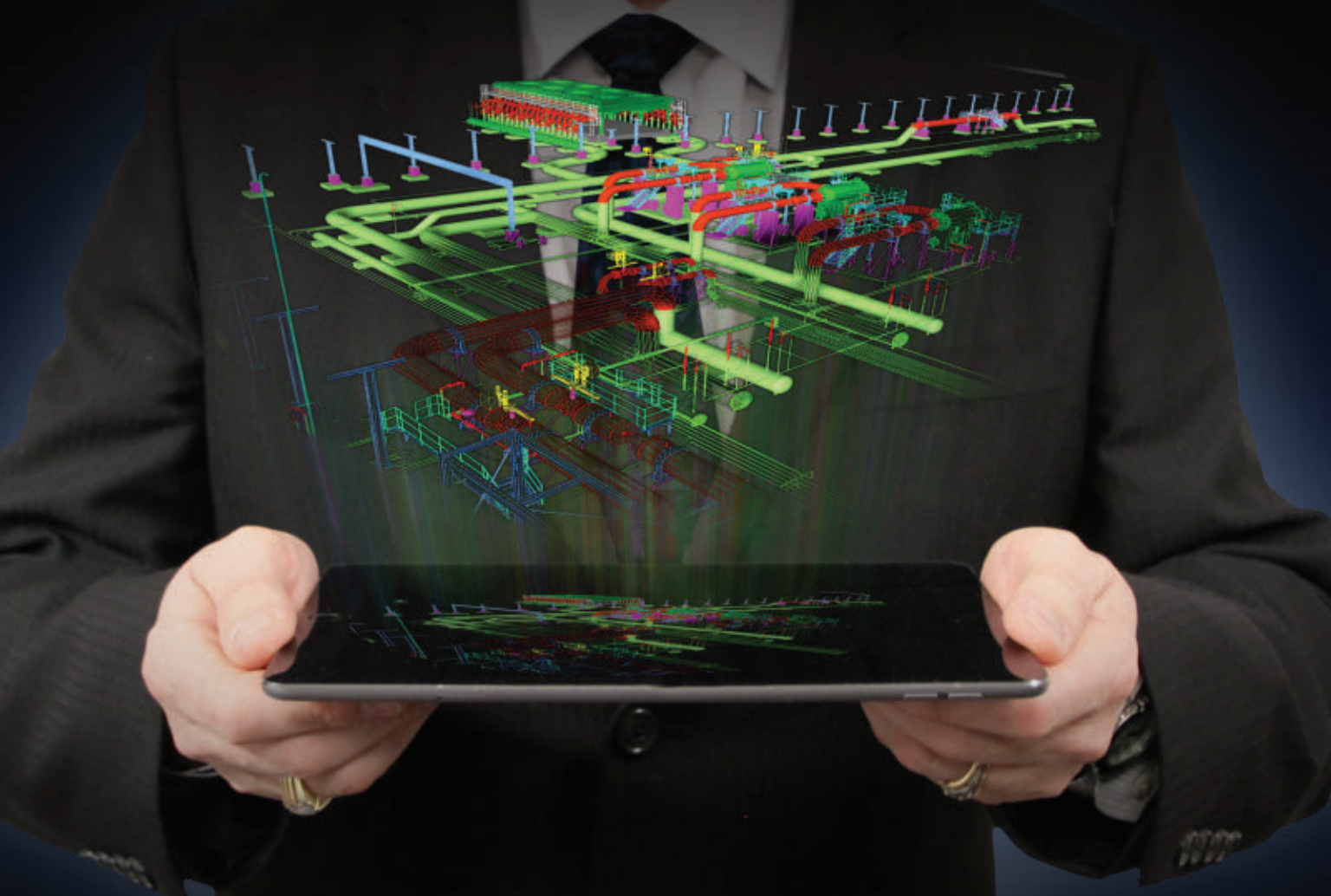
The Hague commission doesn’t have the ability to force Australia to agree to any boundaries that may be prescribed by the court’s panel of commissioners, however there are indications that the Australian government may be softening its position.

Foreign Minister Julie Bishop is reported as saying that Australia considers the decision of the compulsory conciliation binding on both sides.

Another interpretation of this statement is that the Australians are confident its argument that the 2002 and 2006 treaties



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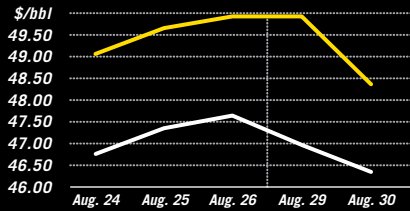
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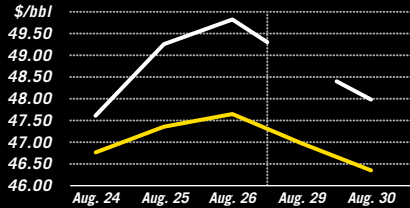
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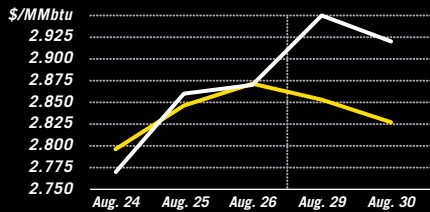
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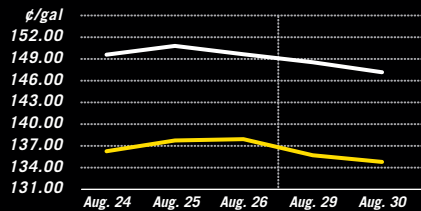
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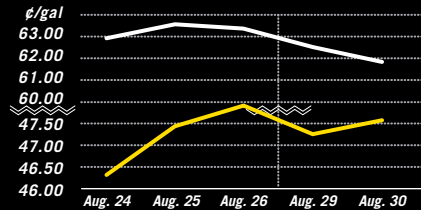
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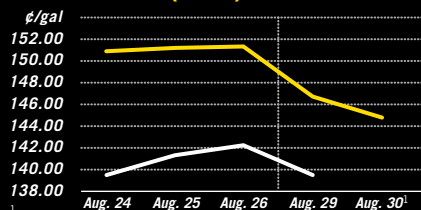
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<sup>1</sup> Not available <sup>2</sup> Reformulated gasoline blendstock for oxygen blending  
<sup>3</sup> Nonoxxygenated regular unleaded

## US INDUSTRY SCOREBOARD — 9/5

Latest week 8/19	4 wk. average	4 wk. avg. year ago <sup>1</sup>	Change, %	YTD average <sup>1</sup>	YTD avg. year ago <sup>1</sup>	Change, %
<i>Product supplied, 1,000 b/d</i>						
Motor gasoline	9,736	9,567	1.8	9,457	9,141	3.5
Distillate	3,705	3,705	—	3,747	3,943	(5.0)
Jet fuel	1,746	1,667	4.7	1,622	1,568	3.4
Residual	280	224	25.0	293	207	41.5
Other products	5,287	5,121	3.2	4,966	4,860	2.2
TOTAL PRODUCT SUPPLIED	20,754	20,284	2.3	20,085	19,719	1.9

*Supply, 1,000 b/d*

Crude production	8,513	9,386	(9.3)	8,852	9,400	(5.8)
NGL production <sup>2</sup>	3,571	3,265	9.4	3,438	3,139	9.5
Crude imports	8,494	7,498	13.3	7,939	7,300	8.8
Product imports	2,270	2,233	1.7	2,182	2,115	3.2
Other supply <sup>2,3</sup>	2,707	2,410	12.3	2,205	2,322	(5.0)
TOTAL SUPPLY	25,555	24,792	3.1	24,616	24,276	1.4
Net product imports	(1,631)	(1,604)	—	(1,713)	(1,549)	—

*Refining, 1,000 b/d*

Crude runs to stills	16,748	17,110	(2.1)	16,244	16,200	0.3
Input to crude stills	17,011	17,032	(0.1)	16,467	16,443	0.1
% utilization	92.9	94.3	—	90.3	91.5	—

Latest week 8/19	Latest week	Previous week <sup>1</sup>	Change	Same week year ago <sup>1</sup>	Change	Change, %
<i>Stocks, 1,000 bbl</i>						
Crude oil	523,594	521,093	2,501	450,761	72,833	16.2
Motor gasoline	232,695	232,659	36	214,434	18,261	8.5
Distillate	153,257	153,135	122	149,836	3,421	2.3
Jet fuel-kerosine	41,751	41,649	102	41,694	57	0.1
Residual	40,493	39,050	1,443	39,719	774	1.9

*Stock cover (days)<sup>4</sup>*

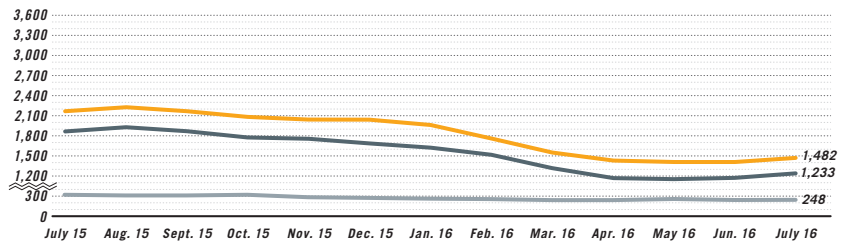
	Latest week	Previous week <sup>1</sup>	Change	Same week year ago <sup>1</sup>	Change	Change, %
Crude	31.3	31.2	0.3	26.7	17.2	—
Motor gasoline	23.9	23.8	0.4	22.4	6.7	—
Distillate	41.4	41.1	0.7	40.4	2.5	—
Propane	104.8	99.9	4.9	99.6	5.2	—

*Futures prices<sup>5</sup> 8/26*

	Latest week	Previous week <sup>1</sup>	Change	Same week year ago <sup>1</sup>	Change	Change, %
Light sweet crude (\$/bbl)	47.38	47.17	0.21	41.38	6.00	14.5
Natural gas, \$/MMBtu	2.79	2.62	0.17	2.72	0.07	2.8

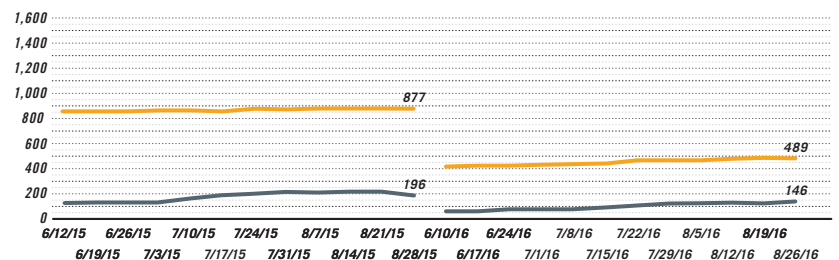
<sup>1</sup>Based on revised figures. <sup>2</sup>OGJ estimates. <sup>3</sup>Includes other liquids, refinery processing gain, and unaccounted for crude oil. <sup>4</sup>Stocks divided by average daily product supplied for the prior 4 weeks. <sup>5</sup>Weekly average of daily closing futures prices.  
Source: Energy Information Administration, Wall Street Journal

## BAKER HUGHES INTERNATIONAL RIG COUNT: TOTAL WORLD / TOTAL ONSHORE / TOTAL OFFSHORE



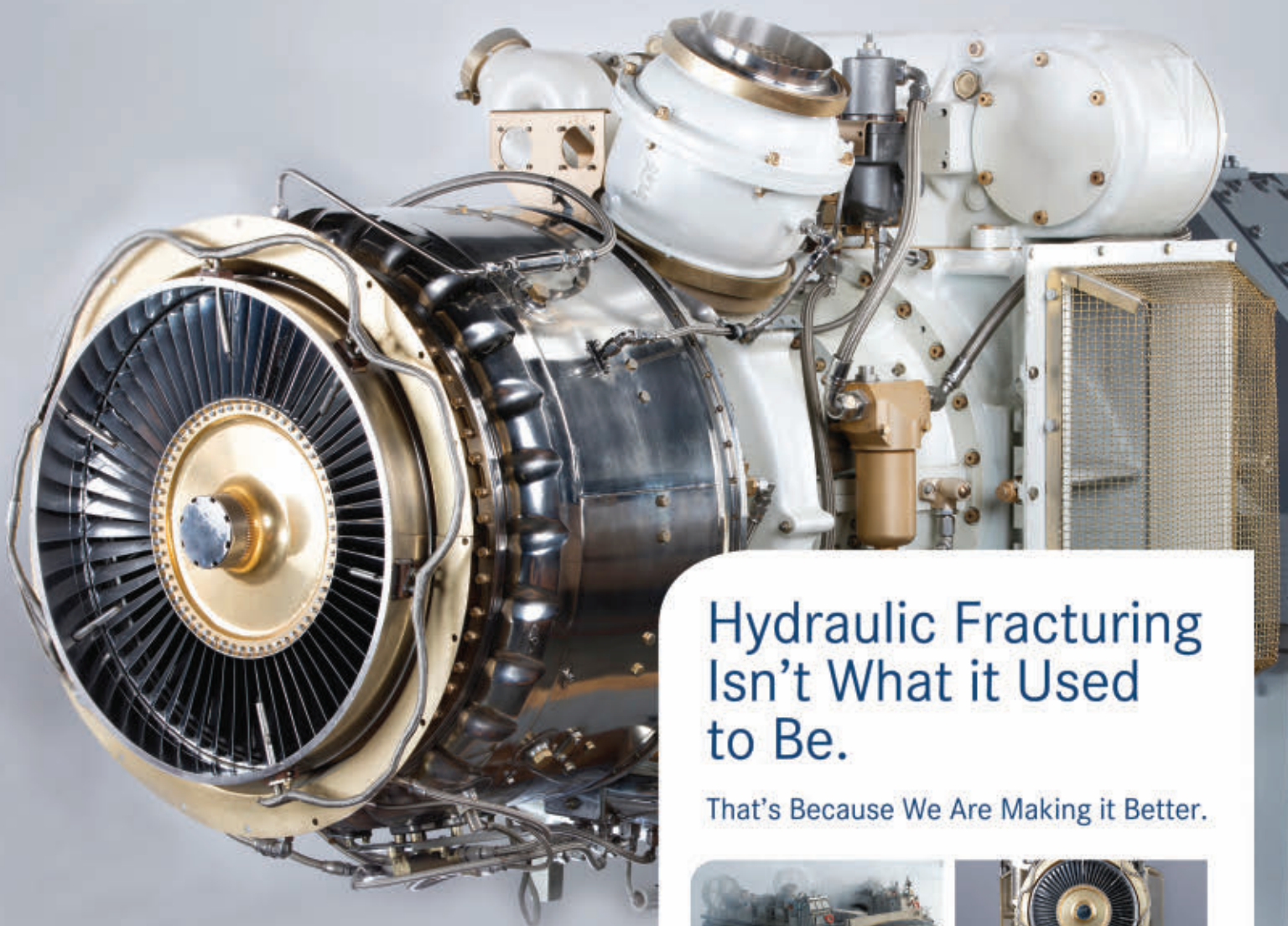
Note: Monthly average count

## BAKER HUGHES RIG COUNT: US / CANADA



Note: End of week average count





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are valid in international law will prevail.

However, it is likely in the broader sense that any decision made by the court in this dispute could have repercussions by setting a precedent for other ongoing territorial disputes in the South China Sea. **OGJ**

## **EXPLORATION & DEVELOPMENT** QUICK TAKES

### **Statoil to ramp up Barents Sea activity in 2017**

Statoil ASA plans to step up exploration efforts in several parts of the Barents Sea in 2017-18. The Blamann (PL849) prospect in the Goliat area, Koigen Central in PL718 on Stappen High, and the Korpjell prospect in PL859 each hold promise for future exploration.

The Norwegian operator in January was awarded the Blamann prospect in the 2015 APA round and plans to drill an exploration well in 2017 (OGJ Online, Jan. 25, 2016). The company also reported it will partner with Eni SPA on an exploration well in the Goliat license PL229. In all, Statoil plans to drill 5-7 wells in the Barents Sea within the next year, and has a suitable rig on contract.

Statoil has entered or increased its share in five licenses in the Norwegian part of the Barents Sea within the past several months. Jez Avery, Statoil head of exploration, cited the new acreage “demonstrates our belief in continued exploration potential on the NCS.”

Statoil entered License 722 of the Hoop area by acquiring 35% interest from Point Resources; bought 25% from ConocoPhillips Skandinavia AS and 20% from OMV (Norge) AS in Licenses 615 and 615B in Hoop, bringing its total stake in both licenses to 80%; and bought 30% from ConocoPhillips Skandinavia AS and 10% from DEA Norge AS in Licenses 718 and 720 in the Stappenhydden area, bringing its total operated interest in both licenses to 60%.

The operator completed a comprehensive exploration campaign in the Barents Sea in 2013-14 with no impact discoveries, but it did add volumes to Johan Castberg through the Drivis discovery (OGJ Online, May 2, 2014).

The firm has worked on reducing costs through technology development. Avery said, “The wells to be drilled in the southeastern part of the Barents Sea next year seem to be the most inexpensive offshore exploration wells throughout Statoil.”

### **Det norske finds oil at Langfjellet in North Sea**

Det norske oljeselskap ASA encountered a 109-m gross oil column in the Vestland Group while drilling exploration well 25/2-18 S on the Langfjellet prospect in the North Sea.

A technical sidetrack was drilled to collect data, and the well is being prepared for a sidetrack and well test. Preliminary volume estimates for the discovery range 24-74 million boe.

The licensees will evaluate the discovery with regard to potential development with other discoveries in the area. Following the drilling results at Langfjellet, the licensees have identified further prospectivity within the license.

Det norske is operator and holds 90% working interest in PL442. Lotos Exploration & Production Norge AS holds the remaining interest.

### **Petrobras, Statoil sign upstream MOU**

Statoil ASA and Petroleo Brasileiro SA (Petrobras) have signed a memorandum of understanding to serve as a framework for the evaluation of joint participation in future tenders for exploration areas and the increase of upstream collaboration in producing fields in the Santos and Campos basins offshore Brazil.

“The agreement also sets out a potential framework for cooperation on value creating opportunities in the gas value chain,” Statoil said.

The MOU follows an agreement signed in July whereby Statoil acquired Petrobras’s 66% operated interest of the BM-S-8 offshore license in the Santos basin, subject to government approval (OGJ Online, July 29, 2016).

The companies aim to capture value through application of technology and simplification of operational activities, Statoil noted. Petrobras and Statoil currently are partners in 13 blocks in either exploration or production; 10 in Brazil and three abroad. **OGJ**

## **DRILLING & PRODUCTION** QUICK TAKES

### **Funding lapses blamed for Libyan output woes**

Libya’s reconstituted government is receiving blame for failure of oil production to recover from a slump caused by civil war and for the related loss of income.

The Petroleum Facilities Guard said it will close Gulf and Al Wafa oil fields in southern Libya because it hasn’t been paid for security services, Reuters reported.

The group earlier reached an agreement with the Presidency Council to open the Ras Lanuf, Es Sidra, and Zuetina terminals, but Reuters said the facilities remain closed (OGJ Online, Aug. 1, 2016).

The security force had claimed to be blockading the terminals to resist corruption and illicit oil sales. As part of the agreement to reopen the ports, it was to receive funds said to be overdue salary payments.

Libyan oil production has fallen below 400,000 b/d. Before civil war began in 2010, it was 1.6 million b/d.

National Oil Corp. Chairman Mustafa Sanalla said funding shortfalls by the Presidency Council, formed at the end of last year with support from the United Nations, was damaging Libyan oil fields.

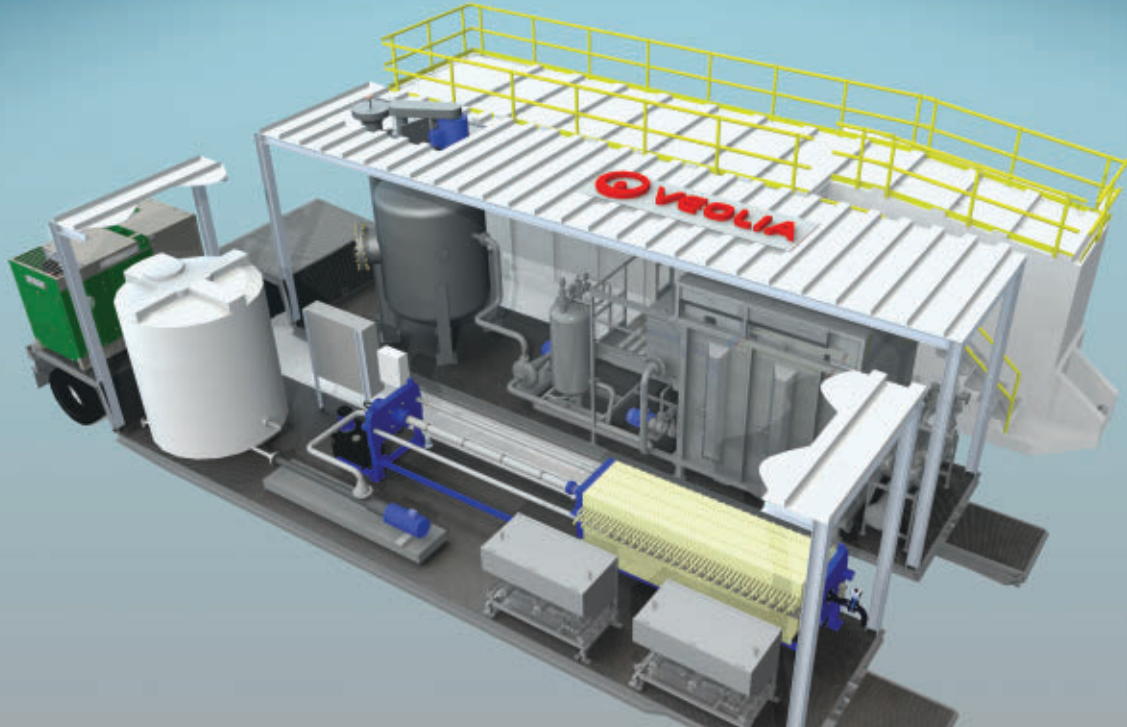
“The Financial Arrangements Committee of the Presidency Council needs to explain the delay because every day our country loses over \$10 million because of the shortfall, and that is money we will never recover,” he said in a statement.

According to Sanalla, NOC budget shortfalls have cut production in fields operated by subsidiaries Sirte Oil Co. and Arab Gulf Oil Co. by 229,000 b/d.

“Systemic underinvestment, combined with the blockades on our major oil fields, is going to impose enormous costs on



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the oil sector in future to recover lost capacity,” he said. “Because of changes in the reservoirs, some oil is going to be lost to us forever. We have a very long to-do list once stability is restored.”

### **Statoil starts production from Gullfaks Rimfaksdalen**

Statoil ASA has started production from its Gullfaks Rimfaksdalen natural gas and condensate development in the North Sea. The project, southwest of the Gullfaks A platform, had been slated to start up on Dec. 24.

Development comprises a standard subsea template with two simple gas production wells and the potential for tie-in of two more wells. The well stream is connected to the existing pipeline leading to the Gullfaks A platform.

Gas and condensate are transported in existing pipelines to the processing plant at Karsto north of Stavanger. Gas is then exported to European markets.

The cost of development was \$443 million compared with the \$575 million originally estimated in the plan for development and operation (PDO) (OGJ Online, Dec. 16, 2014). Recoverable reserves from the project total 80 million boe, most of which is gas.

“The volumes from Gullfaks Rimfaksdalen help us reach our ambition of maintaining production and a high activity level on the [Norwegian Continental Shelf] beyond 2030,” said Arne Sigve Nylund, Statoil executive vice-president for development and production, Norway. “We have a well-developed infrastructure and we will keep realizing opportunities in the North Sea.”

Statoil operates Gullfaks Rimfaksdalen with 51% interest. Partners are Petoro AS 30% and OMV AG 19%.

### **Statoil boosts Johan Sverdrup output expectations**

Statoil ASA said it has cut its planned spending on Johan Sverdrup field in the North Sea to ensure profitability even if oil prices were to fall drastically. Statoil also forecast as much as a 40% increase in initial daily production capacity.

The field’s Phase 1 production capacity was estimated at 440,000 b/d compared with a previous estimate of 315,000-380,000 b/d, Statoil said. First-phase planned spending was cut to 99 billion kroner from the previous 123 billion kroner.

Total spending, including Phase 2 investment and production expansion, was listed at 140-170 billion kroner, down from 170-220 billion kroner, Statoil said.

Executives calculated the project will be profitable at below \$25/bbl, down from Statoil’s February forecast of below \$30/bbl. Brent crude oil for October delivery closed on the London market Aug. 26 at \$49.92/bbl. Oil is traded in US dollars.

The North Sea field, discovered in 2010, is estimated at 1.9-3 billion boe. Production drilling has started on the first of a total of 35 wells to be drilled during Phase 1 (OGJ Online, Mar. 1, 2016).

Partners in the project include operator Statoil 40.0267%, Lundin Norway 22.6%, Petoro 17.36%, Det norske oljeselskap 11.5733%, and Maersk Oil 8.44%.

### **Shell tests Ormen Lange gas compression, power pilot**

Norske Shell successfully finished a multiyear test of a subsea natural gas compression system with a full subsea power supply, transmission, and distribution system supplied by GE Oil & Gas for a pilot on Ormen Lange field offshore Norway.

The pilot was designed to test a full-scale integrated subsea compression system in submerged conditions with gas. Norske Shell ran the pilot with its partners Petoro AS, Statoil ASA, DONG Energy, and ExxonMobil Corp. The pilot started in 2011 at Shell’s testing station at Nyhamna, Norway.

GE said the system enables operators to conduct gas compression on the seabed, reducing the need to provide additional power generation from nearby offshore platforms.

Technologies that were successfully tested included a 12.5-Mw vertically orientated centrifugal compressor, subsea switchgear, subsea variable speed drives, and subsea uninterruptible power supply.

Ormen Lange, producing since 2007, is among the largest gas fields in development on the Norwegian Sea’s continental shelf. The field is 120 km northwest of Kristiansund (OGJ Online, Nov. 30, 2007). **OGJ**

## **PROCESSING** QUICK TAKES

### **Fire hits Rompetrol Rafinare Petromidia refinery**

Rompetrol Rafinare SA, a subsidiary of Kazakhstan’s state-owned KazMunayGas, is investigating a fire that broke out at a major processing unit of its 5 million-tonne/year Petromidia refinery in Navodari, Romania, on the Black Sea.

The Aug. 22 fire, which killed one worker and left three others injured, occurred at pipeline PM-100-025-80-40H next to valve 100-FV-071 at the refinery’s vacuum distillation unit (VDU) during repair work to eliminate a leak in the unit’s flowline, Rompetrol and KazMunayGas said in separate releases.

A preliminary investigation into the incident indicates all equipment was operating within normal parameters and that the workers were executing repairs in accordance with established rules and procedures using a special device for isolating the flowline when a spill of distillate ignited, the firms said.

Contrary to various media reports, official results of the government’s initial investigation into the incident confirm the fire was not preceded by an explosion, according to Rompetrol.

Rompetrol is cooperating with a series of Romanian government agencies on a full-scale investigation into the causes of the fire as well as assessment of material damages to the VDU, which remains shuttered.

While other units at the refinery continue to operate at reduced capacity, Rompetrol’s technical teams currently are evaluating necessary measures required to safely maintain operations on a medium to long-term basis, the company said.

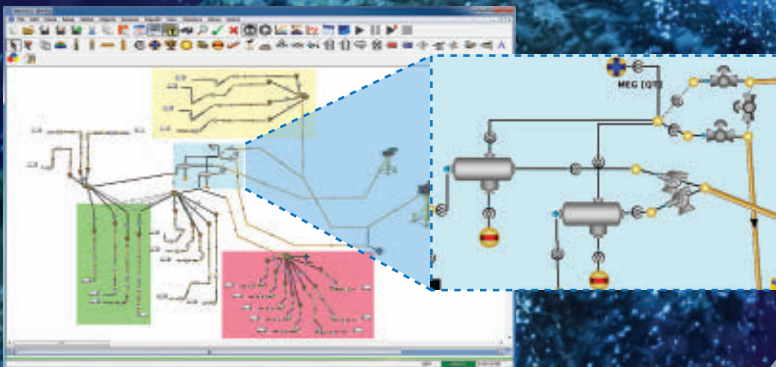
Rompetrol disclosed no details regarding current operating rates at the refinery or an estimated timeframe for when it would determine the extent of damage to impacted installations.

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## Sadara commissions mixed-feed cracker at Jubail

Sadara Chemical Co., a joint venture of Saudi Aramco and Dow Chemical Co., has commissioned Saudi Arabia's first mixed-feed cracker (MFC) at the company's Jubail integrated chemical complex in Jubail Industrial City II, in the Eastern Province (OGJ Online, July 26, 2011).

Entered into operation on Aug. 28, the MFC includes 12 furnaces, seven of which will be used to crack ethane, with the remaining five liquid furnaces dedicated to cracking naphtha, Sadara said.

Three of the five liquid furnaces, however, are equipped to switch between gas and liquid feedstock to further enable Sadara to adjust its production levels of chemicals between naphtha-based and ethane-based feedstock in accordance with market demand, the company said.

One of 26 manufacturing units in Sadara's \$20 billion complex, the MFC is designed to allow flexible cracking capabilities for on site production of more than 3 million tonnes/year of high-quality chemical products and performance plastics, including polyurethanes (isocyanates, polyether polyols), propylene oxide, propylene glycol, elastomers, linear low-density polyethylene (LLDPE), low-density polyethylene, glycol ethers, and amines (OGJ Online, July 22, 2014).

Commissioning of the MFC follows startup of the complex's first production unit in late-2015, when the polyethylene plant—which uses proprietary processing technology from Dow Chemical—began producing LLDPE, according to a Dec. 8, 2015, release from Sadara.

## Matador commissions Delaware basin gas plant

Matador Resources Co., Dallas, has commissioned its Black River cryogenic natural gas processing plant at the Rustler Breaks prospect area of the Delaware basin in Eddy County, NM.

The Black River plant, which has an inlet capacity of 60 MMcfd, entered operation during the week of Aug. 22-26 on time and on budget, Matador said.

Nearly twice the size of a previous processing plant Matador built at its Wolf prospect area of Loving County, Tex., and later sold to an affiliate of EnLink Midstream LLC, the Black River plant will process Matador's own Rustler Breaks gas production as well as that of third-party producers in the region, the company said (OGJ Online, Aug. 4, 2016).

Alongside the new gas plant, Matador also confirmed it has completed installation, testing, and startup of a 15-mile, 12-in. natural gas line that extends the length of and already is gathering production from its Rustler Breaks acreage. **OGJ**

### TRANSPORTATION QUICK TAKES

## RasGas starts LNG deliveries to Italy's Toscana FSRU

RasGas Co. Ltd. delivered its first LNG cargo on Aug. 23 via the Al Thakhira LNG tanker to the Toscana floating storage regasification unit (FSRU) offshore Italy.

International energy trading company DufEnergy Trading

SA, Lugano, Switzerland, received the cargo.

Located 22 km off the Italian coast between Livorno and Pisa, FSRU Toscana is permanently anchored to the seabed through a mooring system, with a single point of rotation at the bow.

Qatar's RasGas, a Qatari joint stock company established in 2001 by Qatar Petroleum and ExxonMobil RasGas Inc., has an integrated shipping fleet consisting of 27 long-term chartered LNG vessels.

## Protests halt Energy East Montreal hearing

Canada's National Energy Board canceled a hearing in Montreal over the proposed Energy East Pipeline on Aug. 29 when protestors disrupted the meeting (OGJ Online, July 15, 2016).

One protestor charged the head table and was arrested, along with two others.

TransCanada proposes the 4,500-km system, involving conversion and construction, to carry 1.1 million b/d of crude from Alberta and Saskatchewan to refineries and terminals in eastern Canada.

The project faces opposition from politicians, environmentalists, and aboriginal groups.

## Video released for crude-by-rail first-responders

The American Petroleum Institute released a new video designed to help first responders to accidents involving crude oil shipments by rail.

"The video gives first responders a look at specific tank car markings and other visual depictions of what to consider when responding to an incident, should one occur," API Midstream Group Director Robin Rorick said.

It complements an instructor-led course API and the American Association of Railroads released in 2015 that educates firefighters, cleanup crews, and other first responders on the characteristics of crude oil, the rail cars in which it is shipped, considerations and strategies for spill response and firefighting, and the importance of following training and the incident command system.

Federal regulators and lawmakers also have moved to improve training and procedures for first responders who try to combat environmental and other impacts when crude is accidentally spilled during a rail shipment.

The US Pipeline & Hazardous Material Safety Administration recently proposed new oil spill response and information procedures for high-hazard flammable trains in coordination with the Federal Railroad Administration (OGJ Online, July 22, 2016).

The US Senate approved legislation this spring that Sen. Heidi Heitkamp (D-ND) introduced in 2015 to improve emergency first responders' capacity to act following accidents involving rail shipments of crude oil and other hazardous materials (OGJ Online, May 11, 2016). It referred S. 546 to the US House Transportation and Infrastructure Committee for further action. **OGJ**





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EAGE First Conference on Geophysics for Mineral Exploration and Mining, Barcelona, web site: [www.eage.org/event/?eventid=1420](http://www.eage.org/event/?eventid=1420) **4-8.**

European Association of Geoscientists & Engineers (EAGE) First Conference on Geophysics for Mineral Exploration & Mining, Barcelona, web site: [www.eage.org/event/index.php?eventid=1420&Opendiv=s3](http://www.eage.org/event/index.php?eventid=1420&Opendiv=s3) **4-8.**

22<sup>nd</sup> European Meeting of Environmental and Engineering Geophysics, Barcelona, web site: [www.eage.org/event/index.php?eventid=1419&Opendiv=s3](http://www.eage.org/event/index.php?eventid=1419&Opendiv=s3) **4-8.**

SPE Offshore Europe, Aberdeen, web site: [www.offshore-europe.co.uk/](http://www.offshore-europe.co.uk/) **5-8.**

SPE Intelligent Energy Conference, Aberdeen, web site: [www.intelligentenergyevent.com/](http://www.intelligentenergyevent.com/) **6-8.**

NACE Egypt Corrosion Conference, Cairo, web site: [egyptcorrosion.nace.org/](http://egyptcorrosion.nace.org/) **6-8.**

AAPG SEG International Conference & Exhibition 2016, Cancun, web site: [www.aapg.org/publications/blogs/events/article/articleid/23667/](http://www.aapg.org/publications/blogs/events/article/articleid/23667/) increase-your-exposure-exhibition-and-sponsorship-opportunities-available/ **6-9.**

AAPG SEG 2016 International Conference & Exhibition, Cancun, web site: [www.aapg.org/events/conferences/ice/announcement/articleid/20311/aapg-seg-2016-international-conference-exhibition-cancun](http://www.aapg.org/events/conferences/ice/announcement/articleid/20311/aapg-seg-2016-international-conference-exhibition-cancun) **6-9.**

23rd Annual India Oil & Gas Review Summit & International Exhibition, Mumbai, web site: [www.oilgas-events.com/india-oil-gas](http://www.oilgas-events.com/india-oil-gas) **9-10.**

International Conference on Chemical Engineering, Phoenix, web site: [chemicalengineering.conferenceseries.com/](http://chemicalengineering.conferenceseries.com/) **12-14.**

Geomodel 2016, Gelendzhik, Russia, web site: [www.eage.org/event/index.php?eventid=1448&Opendiv=s3](http://www.eage.org/event/index.php?eventid=1448&Opendiv=s3) **12-15.**

IADC Advanced Rig Technology Conference & Exhibition, Galveston, Tex., web site: [www.iadc.org/event/2016-iadc-advanced-rig-technology-conference-exhibition/](http://www.iadc.org/event/2016-iadc-advanced-rig-technology-conference-exhibition/) **13-14.**

ESOPE International Exhibition & Symposium for the Pressure Equipment Industry, Paris, web site: [esope-paris.com/](http://esope-paris.com/) **13-15.**

SPE Deepwater Drilling & Completions Conference, Galveston, Tex., web site: [www.spe.org/events/ddc/2016/](http://www.spe.org/events/ddc/2016/) **14-15.**

2nd Annual IoT in Oil & Gas, Houston, web site: [energyconferencenetwork.com/iot-in-oil-and-gas-2016/](http://energyconferencenetwork.com/iot-in-oil-and-gas-2016/) **14-15.**

Rio Oil & Gas Expo & Conference, Rio de Janeiro, web site: [www.whereinfair.com/rio-oil-gas-expo/rio-de-janeiro/2016-Sep/](http://www.whereinfair.com/rio-oil-gas-expo/rio-de-janeiro/2016-Sep/) **14-16.**

Society of Petroleum Resources Economists Meeting, Houston, web site: [www.spreconomists.org/events.htm](http://www.spreconomists.org/events.htm) **15.**

International Conference on Oil & Gas Transportation, Zurich, web site: [waset.org/conference/2016/09/zurich/ICOGT](http://waset.org/conference/2016/09/zurich/ICOGT) **15-16.**

Turbomachinery & Pump Users Symposium, Houston, web site: [tps.tamu.edu/event-info](http://tps.tamu.edu/event-info) **15-17.**

Iran International Petroleum Congress (IIPC), Tehran, web site: [www.iranpetroleumcongress.com/](http://www.iranpetroleumcongress.com/) **19-21.**

Oil & Gas Anti-Corruption Compliance Exchange, Houston, web site: [oilgasanticorruption.com/](http://oilgasanticorruption.com/) **20-21.**

Center for Offshore Safety Forum, Houston, web site: [www.centerforoffshoresafety.org/Events/2016%20COS%20Forum](http://www.centerforoffshoresafety.org/Events/2016%20COS%20Forum) **20-21.**

The CWC World LNG & Gas Series: Asia Pacific Summit, Singapore,

web site: [asiapacific.cwclng.com/](http://asiapacific.cwclng.com/) **20-23.**

2016 Deloitte Oil & Gas Conference, Houston, web site: [www2.deloitte.com/us/en/pages/energy-and-resources/events/oil-and-gas-conference.html](http://www2.deloitte.com/us/en/pages/energy-and-resources/events/oil-and-gas-conference.html) **21.**

IADC Drilling HSE&T Europe Conference & Exhibition, Amsterdam, web site: [www.iadc.org/event/euro-hset-2016/](http://www.iadc.org/event/euro-hset-2016/) **21-22.**

SPE Liquids-Rich Basins Conference—North America, Midland, Tex., web site: [www.spe.org/events/lrbc/2016/](http://www.spe.org/events/lrbc/2016/) **21-22.**

International Conference on Petroleum Industry & Energy, Los Angeles, web site: [www.waset.org/conference/2016/09/los-angeles/ICPIE](http://www.waset.org/conference/2016/09/los-angeles/ICPIE) **22-23.**

Eastern Section, American Association of Petroleum Geologists 2016 Annual Meeting, Lexington, Ky., web site: [www.esaapgmtg.org/](http://www.esaapgmtg.org/) **25-27.**

Corrosion Technology Week 2016, Houston, web site: [ctw.nace.org/](http://ctw.nace.org/) **25-29.**

Operational Excellence in Refining & Petrochemicals, Houston, web site: [www.opexin-refiningandpetrochem.com](http://www.opexin-refiningandpetrochem.com) **26-28.**

SPE Annual Technical Conference & Exhibition (ATCE), Dubai, web site: [www.spe.org/atce/2016/](http://www.spe.org/atce/2016/) **26-28.**

SPE Annual Technical Conference & Exhibition, Dubai, web site: [www.spe.org/events/](http://www.spe.org/events/)

[calendar/](http://calendar/) **26-28.**

US-China Oil & Gas Industry Forum (OGIF), Tysons Corner, Va., web site: [www.cvent.com/d/hfqw6c](http://www.cvent.com/d/hfqw6c) **27-29.**

Flexible & Cost Effective Well Site Facilities Onshore 2016, Houston, web site: [www.facilities-design-onshore.com](http://www.facilities-design-onshore.com) **28-29.**

3rd Annual Unconventional Production & Well Site Facilities Design, Onshore 2016, Houston, web site: [www.facilities-design-onshore.com/program/](http://www.facilities-design-onshore.com/program/) **28-29.**

Global Oil & Gas South East Europe & Mediterranean Conference, Athens, web site: [www.oilgas-events.com/Global-Oil-Gas-Black-Sea-Mediterranean-Conference/](http://www.oilgas-events.com/Global-Oil-Gas-Black-Sea-Mediterranean-Conference/) **28-29.**

International Conference on Petroleum & Petrochemical Engineering, London, web site: [www.waset.org/conference/2016/09/london/ICPPE](http://www.waset.org/conference/2016/09/london/ICPPE) **29-30.**

International Conference on Geophysics, Vancouver, web site: [geophysics.conferenceseries.com/](http://geophysics.conferenceseries.com/) **29-30.**

**OCTOBER 2016**

ICOGPE 2016: 18th International Conference on Oil, Gas & Petrochemical Engineering, Barcelona, web site: [www.waset.org/conference/2016/10/barcelona/ICOGPE](http://www.waset.org/conference/2016/10/barcelona/ICOGPE) **3-4.**

SPE African Health, Safety, Security, Environment & Social Responsibility Confer-

ence & Exhibition, Accra, Ghana, web site: [www.spe.org/events/en/2016/conference/16hsea/homepage.html](http://www.spe.org/events/en/2016/conference/16hsea/homepage.html) **4-6.**

Kazakhstan International Oil & Gas Conference (KIOGE) 2016, Almaty, Kazakhstan, web site: [kioge.kz/en/conference/about-conference](http://kioge.kz/en/conference/about-conference) **5-6.**

USEA 9<sup>th</sup> Annual Energy Supply Forum, Washington, DC, web site: <https://www.usea.org/event/usea-9th-annual-energy-supply-forum> **6.**

International Conference on Geosciences, Orlando, web site: [geosciences.conferenceseries.com/](http://geosciences.conferenceseries.com/) **6-7.**

Cyber Security for Critical Assets LATAM, Rio de Janeiro, web site: [www.criticalcybersecurity.com/latam/](http://www.criticalcybersecurity.com/latam/) **6-7.**

23rd World Energy Conference, Istanbul, web site: [www.wec2016istanbul.org.tr/](http://www.wec2016istanbul.org.tr/) **9-13.**

International Conference on Oil Reserves & Energy Management, New York, web site: [www.waset.org/conference/2016/10/new-york/ICOREM](http://www.waset.org/conference/2016/10/new-york/ICOREM) **10-11.**

The 2016 API Tank, Valves, & Piping Conference & Expo, Las Vegas, web site: [www.api.org/events-and-training/calendar-of-events/2016/tvp](http://www.api.org/events-and-training/calendar-of-events/2016/tvp) **10-13.**

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SEG International Exhibition and 86th Annual Meeting, Dallas, web site: [www.seg.org/web/annual-meeting-2016/](http://www.seg.org/web/annual-meeting-2016/) **16-21.**

International Conference on Oil Reserves & Production, London, web site: [www.waset.org/conference/2016/10/london/ICORP](http://www.waset.org/conference/2016/10/london/ICORP) **17-18.**

The 8<sup>th</sup> Saudi Arabia International Oil & Gas Exhibition (SAOGE), Dammam, web site: [www.saoe.org/](http://www.saoe.org/) **17-19.**

SPE Well Construction Fluids 2025 Forum: Meeting the Challenges, Dubai, web site: [www.spe.org/events/16fmel/](http://www.spe.org/events/16fmel/) **17-19.**

2016 Fall Committee on Petroleum Measurement Standards Meeting, Los Angeles, web site: [www.api.org/Events-and-Training/Calendar-of-Events/2016/fallcopm](http://www.api.org/Events-and-Training/Calendar-of-Events/2016/fallcopm) **17-21.**

Permian Basin International Oil Show, Odessa, Tex., web site: [www.pboilshow.org](http://www.pboilshow.org) **18-20.**

The 37<sup>th</sup> Oil & Money Conference, London, web site: [www.oiland-](http://www.oiland-)

[money.com/](http://money.com/) **18-19.**

Society of Petroleum Engineers (SPE) African Health, Safety, Security, Environment & Social Responsibility Conference & Exhibition, Accra, Ghana, web site: [www.spe.org/events/hsea/2016/](http://www.spe.org/events/hsea/2016/) **18-20.**

IADC Well Control Europe Conference & Exhibition, Copenhagen, web site: [www.iadc.org/event/2016-well-control-europe/](http://www.iadc.org/event/2016-well-control-europe/) **19-20.**

SPE Latin America & Caribbean Heavy Oil & Extra Heavy Oil Conference, Lima, web site: [www.spe.org/events/](http://www.spe.org/events/)

[laho/2016/](http://laho/2016/) **19-20.**

Arctic Technology Conference (ATC), St. John's, Newfoundland & Labrador, web site: [www.arctictechnology-conference.org/](http://www.arctictechnology-conference.org/) **24-26.**

SPE Russian Petroleum Technology Conference & Exhibition, Moscow, web site: [www.spe.org/events/rpc/2016/](http://www.spe.org/events/rpc/2016/) **24-26.**

SPE North America Artificial Lift Conference & Exhibition, The Woodlands, Tex., web site: [www.spe.org/events/alce/2016/](http://www.spe.org/events/alce/2016/) **25-27.**

SPE Asia Pacific Oil & Gas Conference &

Exhibition (APOGCE), Perth, web site: [www.spe.org/events/apogce/2016/](http://www.spe.org/events/apogce/2016/) **25-27.**

The 10th Element Oilfield Engineering with Polymers Conference, London, web site: [oilfieldpolymers.nace.org/](http://oilfieldpolymers.nace.org/) **25-27.**

Produced Water Quality Recycling & Reuse, Denver, web site: [www.produced-water-quality-recycling-reuse-rockies.com/](http://www.produced-water-quality-recycling-reuse-rockies.com/) **26-27.**

Bottom of the Barrel Technology Conference (BBTC) Middle East & Africa 2016, Manama, web site: [www.bbtc-mena.biz](http://www.bbtc-mena.biz) **26-27.**

International Conference & Expo on Oil & Gas, Rome, web site: [oil-gas.conferenceseries.com/](http://oil-gas.conferenceseries.com/) **27-28.**

Gulf Safety Forum (GSF) 2016, Doha, web site: [www.gulfsafetyforum.com/](http://www.gulfsafetyforum.com/) **30-31.**

23rd Africa Oil Week Africa Upstream Conference 2016, Cape Town, web site: [www.oilgas-events.com/Find-an-Event/Africa-Oil-Week/](http://www.oilgas-events.com/Find-an-Event/Africa-Oil-Week/) **Oct 31-Nov 04.**

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web site: [www.spe.org/events/en/2016/conference/16tctce/homepage.html](http://www.spe.org/events/en/2016/conference/16tctce/homepage.html) **1-3.**

4th Iran Europe Oil & Gas Summit, Berlin, web site: [www.iran-summit.com](http://www.iran-summit.com) **1-3.**

2<sup>nd</sup> International Conference & Expo on Oil & Gas, Istanbul, web site: [oil-gas.omics-group.com/](http://oil-gas.omics-group.com/) **2-3.**

7th Annual Summit Operational Excellence in Oil & Gas, Houston, web site: [www.opex-inoilandgas.com](http://www.opex-inoilandgas.com) **7-9.**

The Abu Dhabi International Petroleum Exhibition & Conference, (ADIPEC), Abu Dhabi, web site: [www.adipec.com/](http://www.adipec.com/) **7-10.**

RefComm Mumbai 2016, Mumbai, web site: [refiningcommunity.com/refcomm-mumbai-2016/](http://refiningcommunity.com/refcomm-mumbai-2016/) **7-11.**

International Petroleum Technology Conference (IPTC), Bangkok, web site: [www.iptcnet.org/pages/about/future-dates.php](http://www.iptcnet.org/pages/about/future-dates.php) **14-16.**

4th East Africa Oil & Gas Summit & Exhibition, Nairobi, web site: [eaogs.com/](http://eaogs.com/) **15-17.**

International Conference on Oil, Gas & Petrochemistry, Dubai, web site: [www.waset.org/conference/2016/11/dubai/ICOGP](http://www.waset.org/conference/2016/11/dubai/ICOGP) **16-17.**

21<sup>st</sup> Annual Oil & Gas of Turkmenistan (OGT) Conference 2016, Ashgabat, web site: [ogt.](http://ogt.)

[theenergyexchange.co.uk/](http://theenergyexchange.co.uk/) **16-17.**

Project Financing in Oil & Gas, London, web site: [www.smi-online.co.uk/energy/uk/conference/Project-Financing-in-Oil-and-Gas](http://www.smi-online.co.uk/energy/uk/conference/Project-Financing-in-Oil-and-Gas) **21-22.**

International Conference on Shale Oil & Gas Engineering, London, web site: [www.waset.org/conference/2016/11/london/ICSOG](http://www.waset.org/conference/2016/11/london/ICSOG) **24-25.**

5<sup>th</sup> International Conference on Petroleum Geology & Petroleum Industry, Dubai, web site: [petroleumgeology.conferenceseries.com/](http://petroleumgeology.conferenceseries.com/) **24-25.**

Oil & Gas Safety & Health Conference 2016 OSHA Exploration & Production, Houston, web site: [www.oshasafetyconference.org/Events/ugm/Osha2016/default.aspx](http://www.oshasafetyconference.org/Events/ugm/Osha2016/default.aspx) **29-30.**

OSEA2016 Exhibition & International Conference, Marina Bay Sands, Singapore, web site: [www.osea-asia.com](http://www.osea-asia.com) **Nov. 29-Dec. 2.**

SPE Thermal Well Integrity & Design Symposium, Banff, Alta., web site: [www.spe.org/events/en/2016/symposium/16twid/homepage.html](http://www.spe.org/events/en/2016/symposium/16twid/homepage.html) **Nov. 29-Dec. 1.**

Society of Petroleum Engineers (SPE) Middle East Artificial Lift Conference & Exhibition, Manama, Bahrain, web site: [www.spe.org/events/meal/2016/](http://www.spe.org/events/meal/2016/) **Nov. 30-Dec. 1.**

## DECEMBER 2016

International Conference on Energy Engineering & Oil Reserves, Hong Kong, web site: [www.waset.org/conference/2016/12/hong-kong/ICEEOR](http://www.waset.org/conference/2016/12/hong-kong/ICEEOR) **5-6.**

Energy Technologies, Hong Kong, web site: [www.waset.org/conference/2016/12/hong-kong/ICORET](http://www.waset.org/conference/2016/12/hong-kong/ICORET) **5-6.**

Kurdistan-Iraq Oil & Gas Conference & Exhibition, London, web site: [www.cwckioig.com/conference/](http://www.cwckioig.com/conference/) **5-7.**



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# Safety lies in execution



**CHRISTOPHER E. SMITH**  
Managing Editor-Technology

The world's current focus on safety is justifiably intense. A string of terrorist attacks on soft targets across Europe over the past year has created an environment in which two of the United States' busiest airports—JFK in New York City and LAX in Los Angeles—were shut down during normal operating hours by ultimately false reports of active shooters.

Nobody was hurt in either airport incident. Part of the reason lies in the caution which led to evacuations of both premises when it appeared danger to human life was immediate and real. But part of it also lies in the fact that ultimately there was no danger present.

False alarms are part of any active safety culture. Pipeline, refinery, exploration and production, and other energy operators necessarily balance their frequency and associated costs with the potential threat being monitored and its consequences. This is part of integrity management programs across the oil and gas industry and elsewhere.

## Opportunities everywhere

Former Navy SEAL Brandon Webb was among those at JFK the night of the non-shooter. He knew better than most how to act in such a situation and got himself and those in his immediate vicinity to safety. He wrote an essay detailing the events that unfolded and explaining to fellow travelers what they could do to prepare themselves for anything similar. Webb pointed out some flaws in the official reaction, but his bottom line was that the incident could be “a valuable learning tool for the Port Authority of New York to improve” its response plan.<sup>1</sup>

The 2016 “API-AOPL Annual Liquids Pipeline Safety Excellence Performance Report & Strategic Plan” noted that corrosion-caused pipeline incidents potentially affecting people or the environment outside of operator facilities are down 68% since 1999. At the same time, however, such incidents have risen since their low in 2010, and the report lays out four goals liquid pipeline operators will be pursuing to get the trend pointed down-

ward again, breaking each down into concrete actionable segments:

- Improve inspection technology.
- Enhance threat identification and response.
- Expand safety culture and management practices.
- Boost response capabilities.

Then there's Kazakhstan's President Nursultan Nazarbayev who in late August marked the twenty-fifth anniversary of his country's nuclear disarmament by launching an international prize promoting global peace and security at the international “Building a Nuclear Weapons-Free World” conference in Astana. The prize rewards international statesmanship characterized by cooperation, compromise, empathy, and a shared hope in the possibility of harmonious coexistence.

## One path forward

Companies, governments, and other entities that truly practice safety do so continuously and across the scope of their enterprises. Effective safety practices are routine but never rote and require continual internal monitoring to maintain this balance. As an employee of Company X or a citizen of Country Y, how do we achieve Outcome Z? By conducting our own activities safely, by requiring those in our presence to do so as well—regardless of whether they are up or down a particular chain of command—and by simultaneously maintaining whatever safety structure might be in place while remaining mindful of events and individuals that might lay outside of it.

It is only to the degree that we personally make these steps part of our everyday lives—at home, at work, while travelling—that we should allow ourselves to rest comfortably at night. **OGJ**

## References

1. “Active shooter panic. Navy SEAL at JFK, and lessons learned on personal travel safety,” Special Operations Forces Report, Aug. 15, 2016.



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# Biden boosts LNG

US Vice-President Joe Biden raised a large question during his Aug. 24 speech in Latvia urging Europeans to buy LNG from the US instead of pipeline gas from Russia: As the second-ranking official of an administration phobic about fossil energy, can he really mean it?

Hailing the start of US exports of LNG to Europe and leaving no room for confusion about the target of his message, Biden said, “Europe needs diverse sources of gas—not new pipelines that lock in greater reliance on Russia.”

## Nord Stream 2

Biden referred to the proposed Nord Stream 2 project—twin 48-in. pipelines to carry gas from giant Bovanenkovo field in northern Russia 750 miles across the Baltic Sea to Europe. The system’s 5.3 bcf/d of capacity would match that of the existing Nord Stream system, which began transporting gas in November 2011.

“Russian gas can and should be part of the European market, but that market needs to be open and competitive,” Biden said. “So we’re eager to continue working with our partners to help the region secure the energy future you deserve.”

The vice-president’s remarks came a little more than a year after an appeal in Washington, DC, by the Lithuanian ambassador for US officials to accelerate development of LNG exports. “We need LNG from America now,” said the official, Zygimantas Pavilionis. “We can’t wait another 10 years.”

For Baltic-state officials in attendance, therefore, Biden’s enthusiasm for American LNG had to be heart-warming. For Europeans, meanwhile, official support for a major new gas supply had to be comforting. And for Russian officials who might have been paying attention, the poke at Nord Stream 2 had to be irritating.

American gas producers and LNG developers naturally welcomed Biden’s trumpeting of their industry. But they have reason to think it somewhat hollow. While Biden was in Riga marketing US gas, the administration he serves stayed busy adding to the many difficulties of supply development.

In Riga, Biden hailed North America’s “abundance of gas,” which has allowed the US to move

“from anticipating massive imports of [LNG] to becoming the world’s fastest-growing exporter.” Yet production of natural gas from federal land has fallen each year since 2007, largely because the administration has slowed oil and gas leasing and permitting and raised or considered raising royalty rates and fees. And federal permitting of LNG projects remains slow. This isn’t behavior consistent with a desire to boost sales of US gas in Europe or anywhere else.

The administration also is toughening its regulation of emissions of methane and other gases from oil and gas wells. Methane, in fact, has become a new obsession because its potency as a greenhouse gas is 25 times that of carbon dioxide, even though its combustion yields less CO<sub>2</sub> than that of other hydrocarbon fuels and its concentration in the atmosphere is trivial. Tougher emission regulation will raise costs of producing gas at a time of depressed prices. The administration would achieve the same effect if it succeeded in its persistent efforts to raise industry taxation.

Federal regulation of the well-completion technique crucial to new gas supply, hydraulic fracturing, remains a concern for producers. The Bureau of Land Management and Environmental Protection Agency have considered it. BLM’s plan is under litigation, and the EPA has concluded that the completion technique poses no widespread threat to water supply. But EPA’s Scientific Advisory Board recently challenged the finding, essentially on the basis that the agency didn’t measure what it couldn’t find.

## Legal challenge

The White House Council on Environmental Quality, meanwhile, has recommended expansion of National Environmental Protection Act reviews to consider climate change. Doing so might breach statutory authority. It certainly would increase the vulnerability of projects involving hydrocarbons to legal challenge from environmental activists.

Development of gas supply faces more resistance from Washington, DC, than it should, especially if Washington is serious about helping US gas compete in Europe. Nord Stream 2 doesn’t have these problems. **OGJ**





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# OGJ150 suffered huge losses in 2015; capital spending, reserves down

**Conglin Xu**  
Senior Editor-Economics

**Laura Bell**  
Statistics Editor

A steep, dramatic downturn in oil and natural gas prices maintained its momentum in 2015, making for a challenging year for the OGJ150 group of US oil and gas producers.

The current OGJ150 group posted a total net loss of \$154.62 billion in 2015 compared with earnings of \$75.05 billion in 2014 and \$89.65 billion in 2013. Total revenue and total assets for the group declined 36.75% and 17.1%, respectively, compared with 2014 results.

In light of difficult market conditions, the OGJ150 companies took significant actions to reduce capital spending and drilling in 2015. Nevertheless, the group's oil and gas production continued to increase over the year, reflecting efficiency gains of shale production and retreating to the most productive areas.

Meanwhile, sustained low oil and gas prices have reduced proved liquids and gas reserves reported by the OGJ150 companies, as low prices have curtailed drilling and made recovery economics more challenging.

Industry deterioration has shrunk the OGJ150 list. There are 137 companies that qualified for this edition of the OGJ150. Last year's group contained 143 firms. Ten companies dropped out from last year's list, while three new companies joined the list this year.

To qualify for the OGJ150, oil and gas producers must be

headquartered in the US, publicly traded, and hold US oil or gas reserves. Companies appear on the list ranked by total assets but also are ranked by revenues, stockholders' equity, capital expenditures, earnings, production, reserves, and US net wells drilled.

As always, data for this year's list reflect the prior year's operations.

## *Changes to the group*

Three companies appear in the OGJ150 for the first time. They include Antero Resources Corp., Parsley Energy Inc., and Rice Energy Inc. The highest-ranking of these, Antero Resources, sits at No. 15 with yearend 2015 assets totaling \$14.15 billion.

Ten companies previously included in the OGJ150 no longer appear on the list this year. New Source Energy Partners LP filed Chapter 11 and terminated its registration to the US Securities and Exchange Commission. Daleco Resources Corp. and Breitling Energy Corp. dropped off the list due to a lack of current filings. Cross Border Resources Corp. was acquired by Red Mountain Resources Inc. Eagle Rock Energy Partners LP was merged with Vanguard Natural Resources LLC. Rosetta Resources Inc. was merged into Noble Energy Inc. Treaty Energy Corp. changed its name to Trimerica Energy Corp. Fidelity Exploration & Production Corp. sold its US producing properties.



### SOME KEY CHANGES FROM 2015 OGJ150

Table 1

How company appeared on last year's list	Why change?	How company appears on this year's list
Cross Border Resources Corp.	Acquired by	Red Mountain Resources Inc.
Eagle Rock Energy Partners LP	Merged with	Vanguard Natural Resources LLC
Rosetta Resources Inc.	Merged with and into	Noble Energy Inc.
Treaty Energy Corp.	Changed name	Trimerica Energy Corp.

The following companies sold their US producing properties, liquidated, or became private since the last survey

Fidelity Exploration & Production Co.  
FX Energy Inc.  
Legend Oil and Gas Ltd.

Historical spreadsheets of data presented here are available for purchase from PennEnergy Research Center. Visit [www.ogjonline.com](http://www.ogjonline.com), and click the link "Energy Industry Surveys in Excel" under the "Industry Surveys" section.



## TOP 20 IN TOTAL REVENUE

Table 2

Rank	Company	Total revenue, \$1,000
1	ExxonMobil Corp.	268,882,000
2	Chevron Corp.	138,477,000
3	ConocoPhillips	30,935,000
4	Devon Energy Corp.	13,145,000
5	Chesapeake Energy Corp.	12,764,000
6	Occidental Petroleum Corp.	12,699,000
7	EOG Resources Inc.	8,757,428
8	Anadarko Petroleum Corp.	8,698,000
9	Hess Corp.	6,561,000
10	Apache Corp.	6,366,000
11	Marathon Oil Corp.	5,861,000
12	Pioneer Natural Resources Co.	4,825,000
13	Antero Resources Corp.	3,954,858
14	Noble Energy Inc.	3,133,000
15	Southwestern Energy Co.	3,133,000
16	Murphy Oil Corp.	3,033,080
17	Linn Energy LLC	2,883,334
18	Continental Resources Inc.	2,680,167
19	California Resources Corp.	2,403,000
20	Whiting Petroleum Corp.	2,050,798
<b>Total</b>		<b>541,241,665</b>

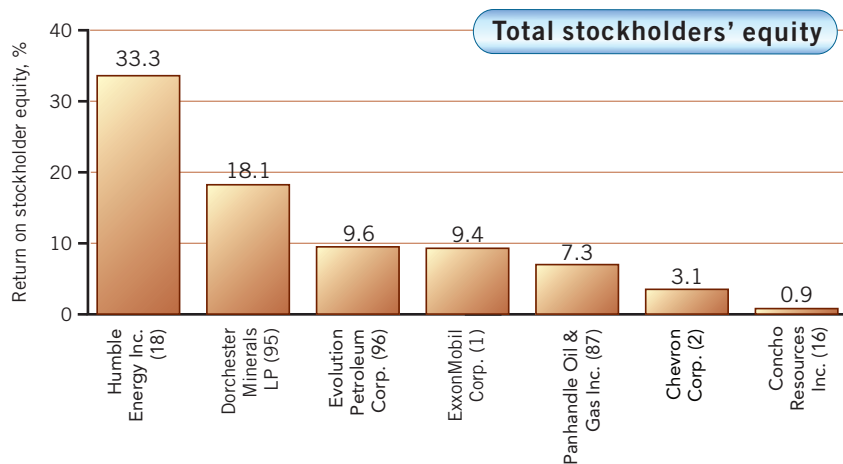
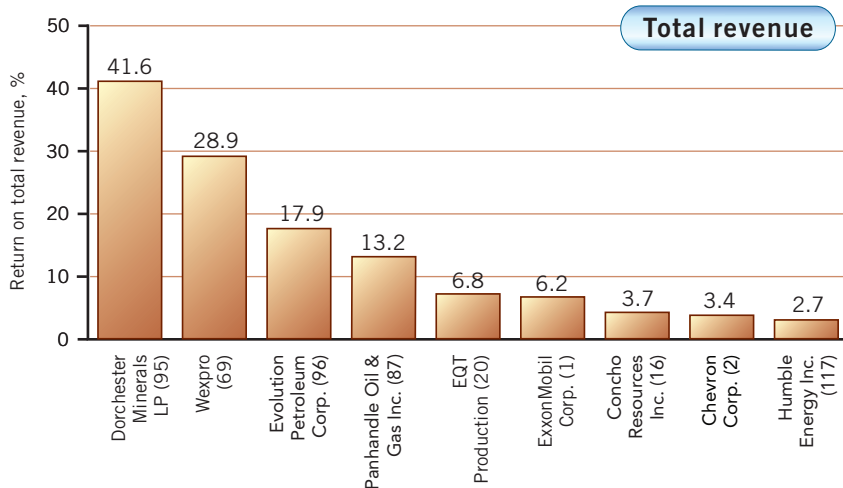
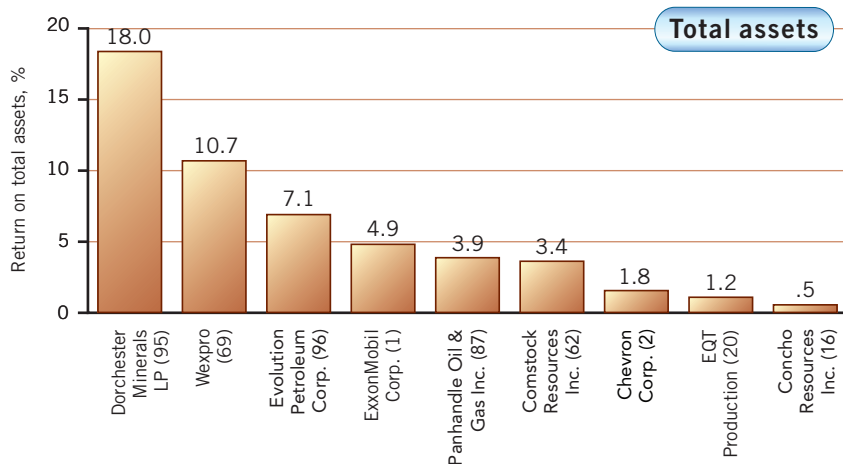
## TOP 20 IN ASSETS— MARKET CAPITALIZATION<sup>1</sup>

Table 3

Rank	Company	Market capitalization, \$1,000
1	ExxonMobil Corp.	323,960,200
2	Chevron Corp.	169,377,947
3	ConocoPhillips	57,708,640
4	Anadarko Petroleum Corp.	24,693,214
5	Occidental Petroleum Corp.	51,632,321
6	Hess Corp.	15,282,850
7	Marathon Oil Corp.	12,678,130
8	Devon Energy Corp.	13,376,000
9	EOG Resources Inc.	38,924,493
10	Noble Energy Inc.	14,121,816
11	Apache Corp.	16,811,180
12	Chesapeake Energy Corp.	2,985,110
13	Pioneer Natural Resources Co.	18,729,227
14	Continental Resources Inc.	8,570,600
15	Antero Resources Corp.	6,039,375
16	Concho Resources Inc.	11,993,276
17	Murphy Oil Corp.	3,862,174
18	Whiting Petroleum Corp.	1,948,806
19	Linn Energy LLC	457,972
20	EQT Production <sup>2</sup>	468,954
<b>Total</b>		<b>793,622,285</b>

<sup>1</sup>As of Dec. 31, 2015. <sup>2</sup>Parent company data.

## TOP COMPANIES IN RETURN ON...\*



\*Includes companies whose accounting methods vary. Excludes companies whose results were inflated by identifiable extraordinary gains. Excludes royalty trusts. Numbers in parentheses indicate rank by total assets.

## TOP 20 IN NET INCOME AND STOCKHOLDERS' EQUITY

Table 4

Rank	Company	Net income, \$1,000	Rank	Company	Stockholders' equity, \$1,000
1	ExxonMobil Corp.	16,551,000	1	ExxonMobil Corp.	176,810,000
2	Chevron Corp.	4,710,000	2	Chevron Corp.	153,886,000
3	Antero Resources Corp.	979,996	3	ConocoPhillips	40,082,000
4	Kinder Morgan CO <sub>2</sub> Co. LP	657,000	4	Occidental Petroleum Corp.	24,350,000
5	EQT Production	104,865	5	Hess Corp.	20,401,000
6	Wexpro	98,900	6	Marathon Oil Corp.	18,553,000
7	Concho Resources Inc.	65,900	7	Anadarko Petroleum Corp.	14,457,000
8	Sabine Royalty Trust	45,965	8	EOG Resources Inc.	12,943,035
9	Comstock Resources Inc.	41,029	9	Devon Energy Corp.	10,989,000
10	EV Energy Partners LP	21,333	10	Noble Energy Inc.	10,370,000
11	Synergy Resources Corp.	18,042	11	Pioneer Natural Resources Co.	8,375,000
12	San Juan Basin Royalty Trust	17,000	12	Antero Resources Corp.	7,286,678
13	Permian Basin Royalty Trust	16,050	13	Concho Resources Inc.	6,942,551
14	Dorchester Minerals LP	13,255	14	Murphy Oil Corp.	5,306,728
15	Panhandle Oil and Gas Inc.	9,321	15	Whiting Petroleum Corp.	4,758,588
16	Cross Timbers Royalty Trust	8,129	16	Continental Resources Inc.	4,668,900
17	Evolution Petroleum Corp.	4,992	17	Apache Corp.	4,228,000
18	Avalon Oil & Gas Inc.	100	18	QEP Resources Inc.	3,947,900
19	Humble Energy Inc.	1	19	WPX Energy Inc.	3,535,000
20			20	Energen Corp.	2,895,860
	<b>Total</b>	<b>23,362,878</b>		<b>Total</b>	<b>534,786,240</b>

20 FASTEST-GROWING COMPANIES<sup>1</sup>

Table 5

Rank by total assets	Company	Stockholders' equity			Net income			Long-term debt	
		2015 \$1,000	2014	Change, %	2015 \$1,000	2014	Change, %	2015 \$1,000	2014
15	Antero Resources Corp.	7,286,678	5,473,830	33.1	979,996	675,835	45.0	4,362,550	4,708,513
96	Evolution Petroleum Corp.	52,103	51,878	0.4	4,992	3,597	38.8	—	—

<sup>1</sup>Companies were selected on the basis of growth in stockholder's equity. Only companies with positive net income for both 2014 and 2015 were considered. Companies were not considered if they had a decline in net income for 2015, were subsidiaries of another company, or became public within the last year. <sup>2</sup>Fiscal yearend June 30.

FX Energy Inc. was acquired by Orlen Upstream, a wholly owned subsidiary of PKN Orlen SA. And Legend Oil & Gas Ltd. discontinued its oil and gas exploration, development, and production operations in October 2015.

The 2016 OGI150 contains eight limited partnerships (LP). The largest LP is Breitburn Energy Partners LP with assets of \$4.87 billion at yearend 2015. The smallest LP, Apache Offshore Investment Partner, had assets of \$13.17 million at yearend 2015.

There are five royalty trusts in the compilation. These are San Juan Basin, Cross Timbers, VOC Energy, Permian Basin, and Sabine Oil & Gas.

There also are four subsidiaries of non-US energy companies or of companies operating mainly in other industries. These are Seneca Resources Corp., EQT Production Co., Kinder Morgan, and Wexpro Co.

**Group financial performance**

Yearend 2015 assets for the OGI150 group totaled \$1.25 trillion, a decrease of 17.1% from yearend 2014. The group's revenue for 2015 totaled \$582.54 billion, down 36.73% from a year earlier.

Combined stockholder equity declined 22.74% from a



year ago to \$559.14 billion. Twenty-nine firms posted negative stockholder equity, as their liabilities exceeded their assets. This compares with 13 firms with negative stockholder equity in 2014.

The group reported a collective net loss of \$154.62 billion for 2015 compared with earnings of \$75 million for 2014 and earnings of \$89 million for 2013.

One hundred one companies in the group, or 84% of the total, posted a net loss in 2015. This compares with 55 such firms in last year's compilation. Seventy-two of the firms recorded net loss in excess of \$100 million compared with 16 such firms in last year's OGI150.

The largest loss was reported by Apache Corp. For the year ending 2015, the Houston independent producer reported a net loss of \$23.52 billion. Devon Energy Corp., meanwhile, reported the secondary largest loss of \$15.2 billion.

There are only five firms in the group with net income of more than \$100 million; in last year's group, there were 48 such companies.

The group's 2015 return on assets was -12.3% compared with 4.9% for 2014 and 6.2% for 2013. Return on stockholders' equity was -27.6% compared with 10.4% a year earlier.



## TOP 20 IN SPENDING AND US NET WELLS DRILLED

Table 6

Rank	Company	Capital, exploratory spending, \$1,000	Rank	Company	US net wells drilled
1	Chevron Corp.	29,504,000	1	Chevron Corp.	896.0
2	ExxonMobil Corp.	28,013,000	2	ExxonMobil Corp.	697.0
3	ConocoPhillips	10,050,000	3	Anadarko Petroleum Corp.	618.9
4	Anadarko Petroleum Corp.	6,067,000	4	EOG Resources Inc.	481.0
5	Devon Energy Corp.	5,308,000	5	Chesapeake Energy Corp.	428.0
6	Occidental Petroleum Corp.	5,272,000	6	ConocoPhillips	416.0
7	EOG Resources Inc.	5,013,163	7	Occidental Petroleum Corp.	408.0
8	Apache Corp.	4,578,000	8	Southwestern Energy Co.	347.4
9	Hess Corp.	4,321,000	9	Devon Energy Corp.	341.1
10	Marathon Oil Corp.	3,476,000	10	Apache Corp.	317.0
11	Chesapeake Energy Corp.	3,095,000	11	Linn Energy LLC	305.0
12	Continental Resources Inc.	3,042,747	12	California Resources Corp.	286.1
13	Noble Energy Inc.	2,979,000	13	Marathon Oil Corp.	280.0
14	Freeport McMoran Inc.	2,948,000	14	Concho Resources Inc.	273.0
15	Murphy Oil Corp.	2,549,736	15	Continental Resources Inc.	270.5
16	Whiting Petroleum Corp.	2,455,218	16	Whiting Petroleum Corp.	267.8
17	Concho Resources Inc.	2,443,704	17	EQT Production	239.5
18	Pioneer Natural Resources Co.	2,110,000	18	Pioneer Natural Resources Co.	230.0
19	EQT Production	1,852,100	19	Noble Energy Inc.	218.0
20	Antero Resources Corp.	1,849,976	20	Hess Corp.	181.0
<b>Total</b>		<b>126,927,644</b>	<b>Total</b>		<b>7,501.3</b>

## TOP 20 IN LIQUIDS RESERVES

Table 7

Rank	Company	US liquids reserves, million bbl	Rank	Company	Worldwide liquids reserves, million bbl
1	ExxonMobil Corp.	2,378.0	1	ExxonMobil Corp.	12,954.0
2	ConocoPhillips	1,938.0	2	Chevron Corp.	4,262.0
3	EOG Resources Inc.	1,470.7	3	ConocoPhillips	2,778.0
4	Chevron Corp.	1,386.0	4	Occidental Petroleum Corp.	1,639.0
5	Occidental Petroleum Corp.	1,101.0	5	EOG Resources Inc.	1,480.5
6	Anadarko Petroleum Corp.	850.0	6	Devon Energy Corp.	1,212.0
7	Marathon Oil Corp.	752.0	7	Marathon Oil Corp.	1,055.0
8	Whiting Petroleum Corp.	709.6	8	Anadarko Petroleum Corp.	1,053.0
9	Continental Resources Inc.	700.5	9	Apache Corp.	992.0
10	Devon Energy Corp.	670.0	10	Hess Corp.	827.0
11	Antero Resources Corp.	613.0	11	Whiting Petroleum Corp.	709.6
12	Range Resources Corp.	602.3	12	Continental Resources Inc.	700.5
13	Apache Corp.	584.5	13	Antero Resources Corp.	613.0
14	California Resources Corp.	525.0	14	Range Resources Corp.	602.3
15	Chesapeake Energy Corp.	497.2	15	California Resources Corp.	525.0
16	Pioneer Natural Resources Co.	438.3	16	Chesapeake Energy Corp.	497.2
17	Noble Energy Inc.	432.0	17	Noble Energy Inc.	496.0
18	Hess Corp.	420.0	18	Murphy Oil Corp.	492.6
19	Concho Resources Inc.	367.8	19	Pioneer Natural Resources Co.	438.3
20	Linn Energy LLC	311.6	20	Concho Resources Inc.	367.8
<b>Total</b>		<b>16,747.6</b>	<b>Total</b>		<b>33,694.8</b>

**Group operations**

Capital and exploration expenditures of the group decreased 29.5% to \$161.21 billion during 2015. The number of US net wells drilled by the group last year totaled 11,329, down 37% from 18,012 a year earlier.

Compared with a year ago, the group's total worldwide liquids reserves were down 7.42% in 2015 to 39.57 billion bbl. The group's combined US liquids reserves decreased 11.61% to 22.58 billion bbl.

Independents' proved oil reserves were impacted most with downward revisions. According to Ernst & Young LLP's US oil and gas reserves study 2016, the largest downward revisions in 2015 on an absolute basis were reported by ConocoPhillips at 269 million bbl, Occidental Petroleum Corp. at 248 million bbl, and Continental Resources Inc. at

246.8 million bbl (OGJ Online, June 14, 2016).

Worldwide proved gas reserves for the OGJ150 group decreased 17.33% to 199 tcf in 2015. Group gas reserves in the US dropped 20.23% to 145.49 tcf.

The largest downward revisions for proved gas reserves in 2015, on an absolute basis, came from ExxonMobil Corp. at 6.7 tcf, Chesapeake Energy Corp. at 4.2 tcf, and Southwestern Energy at 3.5 tcf. The largest 2015 gas reserves addition came from Antero Resources at 2.3 tcf, and EQT Production at 2 tcf.

The OGJ150 companies' worldwide liquids production increased 6.89% in 2015 to 3.52 billion bbl compared with 3.29 billion bbl a year earlier. The group's US liquids production increased 11.37% to 2.17 billion bbl.

Worldwide gas production of the group moved up 3.54%

## TOP 20 IN LIQUIDS PRODUCTION

Table 8

Rank	Company	US liquids production, million bbl	Rank	Company	Worldwide liquids production, million bbl
1	Chevron Corp.	183.0	1	ExxonMobil Corp.	716.0
2	ConocoPhillips	176.0	2	Chevron Corp.	514.0
3	EOG Resources Inc.	131.5	3	ConocoPhillips	272.0
4	Anadarko Petroleum Corp.	130.0	4	Occidental Petroleum Corp.	186.0
5	ExxonMobil Corp.	119.0	5	Anadarko Petroleum Corp.	163.0
6	Devon Energy Corp.	110.0	6	Devon Energy Corp.	151.0
7	Occidental Petroleum Corp.	93.0	7	EOG Resources Inc.	131.9
8	Marathon Oil Corp.	76.0	8	Apache Corp.	129.3
9	Chesapeake Energy Corp.	69.6	9	Hess Corp.	101.0
10	Hess Corp.	68.0	10	Marathon Oil Corp.	92.0
11	Apache Corp.	64.8	11	Chesapeake Energy Corp.	69.6
12	Continental Resources Inc.	53.5	12	Noble Energy Inc.	57.0
13	Whiting Petroleum Corp.	52.7	13	Continental Resources Inc.	53.5
14	Pioneer Natural Resources Co.	52.5	14	Whiting Petroleum Corp.	52.7
15	Noble Energy Inc.	43.0	15	Pioneer Natural Resources Co.	52.5
16	California Resources Corp.	43.0	16	Murphy Oil Corp.	49.8
17	Freeport McMoran Inc.	38.0	17	California Resources Corp.	43.0
18	SM Energy Inc.	35.3	18	Freeport McMoran Inc.	38.0
19	Concho Resources Inc.	34.5	19	Newfield Exploration Co.	36.0
20	Linn Energy LLC	33.2	20	SM Energy Inc.	35.3
<b>Total</b>		<b>1,606.6</b>	<b>Total</b>		<b>2,943.7</b>

## TOP 20 IN GAS PRODUCTION

Table 9

Rank	Company	US gas production, bcf	Rank	Company	Worldwide gas production, bcf
1	ExxonMobil Corp.	1,254.0	1	ExxonMobil Corp.	2,548.0
2	Chesapeake Energy Corp.	1,070.0	2	Chevron Corp.	1,784.0
3	Southwestern Energy Co.	899.0	3	ConocoPhillips	1,404.0
4	Anadarko Petroleum Corp.	854.0	4	Chesapeake Energy Corp.	1,070.0
5	ConocoPhillips	671.0	5	Southwestern Energy Co.	899.0
6	Devon Energy Corp.	579.0	6	Anadarko Petroleum Corp.	859.0
7	Cabot Oil & Gas Corp.	566.0	7	Devon Energy Corp.	587.0
8	EQT Production	562.0	8	Cabot Oil & Gas Corp.	566.0
9	Chevron Corp.	478.0	9	EQT Production	562.0
10	Antero Resources Corp.	439.0	10	EOG Resources Inc.	475.7
11	Range Resources Corp.	362.7	11	Apache Corp.	447.1
12	EOG Resources Inc.	337.3	12	Antero Resources Corp.	439.0
13	Consol Energy Inc.	285.0	13	Noble Energy Inc.	433.0
14	WPX Energy Inc.	277.0	14	Range Resources Corp.	362.7
15	Ultra Petroleum	269.0	15	Occidental Petroleum Corp.	360.0
16	Noble Energy Inc.	258.0	16	Marathon Oil Corp.	286.0
17	Linn Energy LLC	234.0	17	Consol Energy Inc.	285.0
18	Rice Energy Inc.	201.3	18	WPX Energy Inc.	277.0
19	QEP Resources Inc.	181.1	19	Ultra Petroleum	269.0
20	SM Energy Inc.	173.6	20	Linn Energy LLC	234.0
<b>Total</b>		<b>9,951.0</b>	<b>Total</b>		<b>14,147.5</b>

to 17.92 tcf. US gas production for the group was up 5.91% to 13.36 tcf.

### Top 20 companies by assets

The top 20 companies in the OGJ150 as ranked by yearend 2015 assets posted collective assets of \$1.07 trillion, down 13.38% from a year earlier. The assets of the 20 firms, led by ExxonMobil, Chevron Corp, and ConocoPhillips, represent 85% of the assets of all OGJ150 companies.

ExxonMobil again tops the OGJ150 group with assets of \$336.75 billion. At the end of 2014, the company's assets totaled \$349.49 billion. Chevron's yearend 2015 assets totaled \$266.1 billion, slightly up from a year ago. ConocoPhillips' total assets at the end of 2015 totaled \$97.48 billion, down



from \$116.54 billion a year ago.

Hess Corp., ranked No. 9 a year earlier, moved to No. 6, despite a \$4.38-billion decrease in its total assets. Marathon Oil Corp. moved to No. 7 in this year's list from No. 10 a year earlier, while its year-end assets actually went down by \$3.7 billion.

Noble Energy's total assets increased from \$22.55 billion at the end of 2014 to \$24.19 billion at the end of 2015. Noble Energy's acquisition of Rosetta Resources accounted for the largest transaction activity during the year (OGJ Online, May 11, 2015).

This group of 20 contains three companies that were not included in the top 20 of the previous edition of the OGJ150. They are Antero Resources, Concho Resources, and EQT Production.



**TOP 20 IN GAS RESERVES**

Table 10

Rank	Company	US gas reserves, bcf
1	ExxonMobil Corp.	19,380.0
2	Antero Resources Corp.	9,533.0
3	EQT Production	9,110.3
4	Cabot Oil & Gas Corp.	7,856.0
5	ConocoPhillips	7,518.0
6	Range Resources Corp.	6,277.7
7	Chesapeake Energy Corp.	6,041.0
8	Anadarko Petroleum Corp.	5,991.0
9	Southwestern Energy Co.	5,917.0
10	Devon Energy Corp.	5,808.0
11	Consol Energy Inc.	5,060.2
12	Chevron Corp.	4,242.0
13	EOG Resources Inc.	3,489.8
14	Continental Resources Inc.	3,151.8
15	Noble Energy Inc.	2,711.0
16	Linn Energy LLC	2,619.0
17	Ultra Petroleum	2,336.3
18	WPX Energy Inc.	2,190.2
19	Seneca Resources Corp.	2,142.1
20	QEP Resources Inc.	2,108.9
<b>Total</b>		<b>113,483.3</b>

Rank	Company	Worldwide gas reserves, bcf
1	ExxonMobil Corp.	35,626.0
2	Chevron Corp.	25,946.0
3	ConocoPhillips	11,924.0
4	Antero Resources Corp.	9,533.0
5	EQT Production	9,110.3
6	Cabot Oil & Gas Corp.	7,856.0
7	Range Resources Corp.	6,277.7
8	Chesapeake Energy Corp.	6,041.0
9	Anadarko Petroleum Corp.	6,021.0
10	Southwestern Energy Co.	5,917.0
11	Devon Energy Corp.	5,821.0
12	Noble Energy Inc.	5,549.0
13	Consol Energy Inc.	5,060.2
14	EOG Resources Inc.	3,825.9
15	Apache Corp.	3,430.4
16	Occidental Petroleum Corp.	3,368.0
17	Continental Resources Inc.	3,151.8
18	Linn Energy LLC	2,619.0
19	Marathon Oil Corp.	2,462.0
20	Ultra Petroleum	2,336.3
<b>Total</b>		<b>161,875.6</b>

EQT Production is now ranked No. 20 vs. No. 28 a year ago, with its total assets increased to \$8.99 billion at yearend 2015 from \$8.15 billion at yearend 2014.

**Leaders in earnings**

The list of the top 20 earners during 2015 varies greatly from a year ago, indicating the dramatic deterioration in US oil

and gas producers' financial positions.

The collective net income of this year's top 20 earners was \$23.36 billion compared with \$82.38 billion for the prior year's top 20. Most of the top earners in last year's compilation reported losses in 2015. ConocoPhillips, ranked No. 3 in last year's list, reported a net loss of \$4.37 billion in 2015.

ExxonMobil, Chevron, and Antero Resources reported

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the highest 2015 earnings in this year's OGJ150 group. ExxonMobil and Chevron reported 2015 earnings of \$16.55 billion and \$4.71 billion, respectively, down from \$33.62 billion and \$19.31 billion, respectively, a year ago. Antero Resources' earnings climbed 45% to \$979.99 million in 2015 from \$675.83 million in 2014.

Except for ExxonMobil, Chevron, and Kinder Morgan, the remaining 17 companies qualified for the list of the top 20 earners did not qualify a year ago.

Except for ExxonMobil, Chevron, Antero Resources, and EQT Production, the remaining 16 companies in the top 20 by net income list are not ranked in the top 20 by assets.

Also, half of the current top 20 earners are either royalty trusts, LP, or subsidiaries. There was only one LP shown in last year's top 20 earner list.

**Top 20 in production, reserves**

ExxonMobil leads this year's OGJ150 group in worldwide liquids production and reserves, worldwide gas production and reserves, as well as in US gas production and reserves.

Following ExxonMobil in worldwide liquids production are Chevron, ConocoPhillips, Oxy, and Anadarko Petro-



leum Corp. The worldwide liquids reserves holders in the OGJ150 group that follow ExxonMobil are Chevron, ConocoPhillips, Oxy, EOG Resources Inc., and Devon Energy.

Chevron tops the group in US liquids production and ExxonMobil ranks No. 1 in US liquids reserves. ConocoPhillips and EOG rank at No. 2 and No. 3, respectively, in both categories.

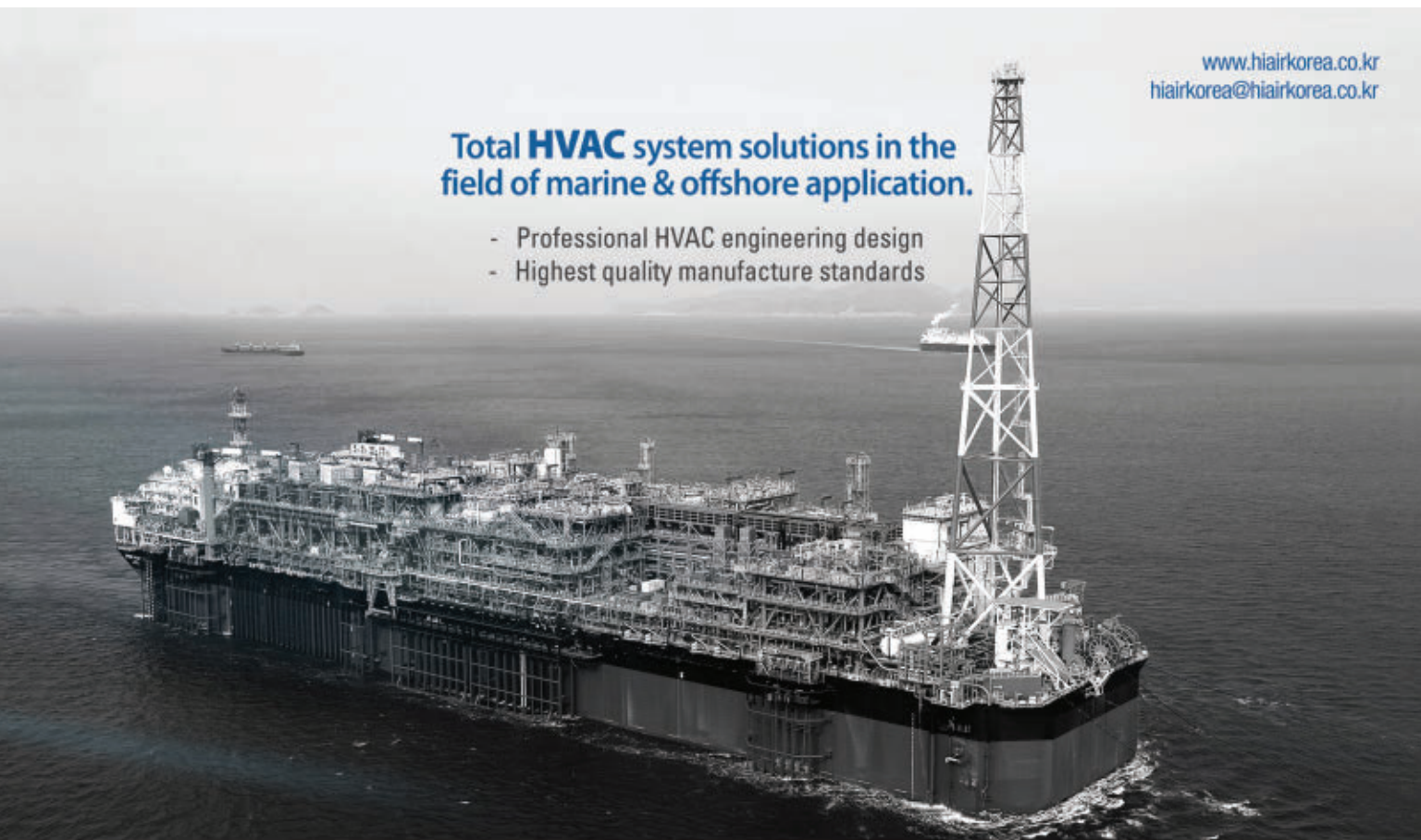
Following ExxonMobil in US gas production are Chesapeake, Southwestern, Anadarko, and ConocoPhillips. Second in US gas reserves is Antero Resources, followed by EQT Production, Cabot Oil & Gas Corp., ConocoPhillips, and Range Resources Corp.

**Top 20 in capital spending, drilling**

The collective outlays of the top 20 capital and exploratory spending leaders totaled \$126.93 billion in 2015, down from \$176.23 billion in 2014 and \$170.63 billion in 2013.

Chevron, ExxonMobil, and ConocoPhillips were the leading three companies in spending last year, followed by Anadarko, Devon Energy, Oxy, and EOG.

Chevron's spending was \$29.5 billion in 2015, down from 2014 outlays of \$35.4 billion. ExxonMobil decreased



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its 2015 outlays to \$28 billion from \$34.62 billion in 2014. ConocoPhillips reduced its 2015 spending to \$10 billion from \$17 billion in 2014.

With a count of 896 wells, Chevron leads the OGJ150 group in the number of net wells drilled in the US during 2015. This compares with 1,125 net wells the company drilled in the prior year.

With 697 net wells drilled in the US last year, ExxonMobil is second on the list, followed by Anadarko, EOG, Chesapeake, and ConocoPhillips.

The top 20 drilled 7,501 net wells in 2015, down from 11,991 net wells in 2014 and 12,138 in 2013.

### **Fastest-growing firms**

The list of fastest-growing companies ranks firms based on growth in stockholder equity. For a company to appear on this list, it must have posted positive net income in both 2014 and 2015, and it must have had an increase in net income in 2015. Limited partnerships, newly public companies, and subsidiaries are not included.

Normally a list of the top 20 fastest-growing companies in the OGJ150, only two of the firms qualified for the list this year. These are Antero Resources and Evolution Petro-

leum Corp. None of the companies were on the list last year.

Antero Resources, ranked No. 15 in total assets, reported stockholders' equity of \$7.28 billion for 2015 compared with \$5.47 billion in 2014. The company's earnings climbed 45% to \$979.99 million in 2015 from \$675.83 million in 2014.

As of Dec. 31, 2015, Antero Resources held about 569,000 net acres of oil and gas properties in the Appalachian basin in West Virginia, Ohio, and Pennsylvania. The company's 13.2 tcf of proved reserves at yearend 2015 were 4% higher than the prior year and comprised of 72% gas, 27% NGLs, and 1% oil. Production for 2015 totaled 545 bcfe, a 48% increase over 2014 levels.

Evolution Petroleum, the second fastest-growing company and No. 96 based on total assets, posted an increase in stock equity of 0.4% to \$51.87 million and net income increased 38.8% from a year ago to \$4.99 million. **OGJ**



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## OGJ150

Rank by total assets		Company	Total assets \$1,000	Total revenue		Net income		Stockholders' equity		Capital & expl. spending	
2015	2014			Rank	\$1,000	Rank	\$1,000	Rank	\$1,000	Rank	\$1,000
1	1	ExxonMobil Corp.	336,758,000	1	268,882,000	1	16,551,000	1	176,810,000	2	28,013,000
2	2	Chevron Corp.	266,103,000	2	138,477,000	2	4,710,000	2	153,886,000	1	29,504,000
3	3	ConocoPhillips	97,484,000	3	30,935,000	110	(4,371,000)	3	40,082,000	3	10,050,000
4	4	Anadarko Petroleum Corp.	46,414,000	8	8,698,000	115	(6,812,000)	7	14,457,000	4	6,067,000
5	5	Occidental Petroleum Corp.	43,437,000	6	12,699,000	116	(7,829,000)	4	24,350,000	6	5,272,000
6	9	Hess Corp.	34,195,000	9	6,561,000	105	(3,007,000)	5	20,401,000	9	4,321,000
7	10	Marathon Oil Corp.	32,311,000	11	5,861,000	97	(2,204,000)	6	18,553,000	10	3,476,000
8	7	Devon Energy Corp.	29,532,000	4	<sup>1</sup> 13,145,000	119	(15,203,000)	9	10,989,000	5	5,308,000
9	11	EOG Resources Inc.	26,975,244	7	<sup>2</sup> 8,757,428	112	(4,524,515)	8	12,943,035	7	5,013,163
10	12	Noble Energy Inc.	24,196,000	14	3,133,000	103	(2,441,000)	10	10,370,000	13	2,979,000
11	6	Apache Corp.	18,842,000	10	6,366,000	120	(23,528,000)	17	4,228,000	8	4,578,000
12	8	Chesapeake Energy Corp.	17,357,000	5	12,764,000	118	(14,635,000)	23	2,397,000	11	3,095,000
13	17	Pioneer Natural Resources Co.	15,154,000	12	4,825,000	57	(273,000)	11	8,375,000	18	2,110,000
14	16	Continental Resources Inc.	14,919,808	18	2,680,167	61	(353,668)	16	4,668,900	12	3,042,747
15	—	Antero Resources Corp.	14,155,224	13	3,954,858	3	979,996	12	7,286,678	20	1,849,976
16	22	Concho Resources Inc.	12,641,876	24	<sup>1</sup> 1,803,573	7	65,900	13	6,942,551	17	2,443,704
17	14	Murphy Oil Corp.	11,493,812	16	3,033,080	101	(2,270,833)	14	5,306,728	15	2,549,736
18	19	Whiting Petroleum Corp.	11,389,085	20	2,050,798	99	(2,219,268)	15	4,758,588	16	2,455,218
19	15	Linn Energy LLC <sup>3</sup>	9,976,946	17	2,883,334	114	(4,759,811)	96	(268,901)	41	608,889
20	28	EQT Production	8,995,853	29	<sup>1</sup> 1,540,889	5	104,865	—	—	19	1,852,100
21	24	QEP Resources Inc.	8,425,500	21	2,018,600	51	(149,400)	18	3,947,900	27	1,141,100
22	25	WPX Energy Inc.	8,350,000	23	1,888,000	93	(1,726,000)	19	3,535,000	28	1,124,000
23	13	Freeport McMoran Inc.	8,141,000	22	1,994,000	117	<sup>1</sup> (14,189,000)	—	—	14	2,948,000
24	18	Southwestern Energy Co.	8,110,000	15	<sup>3</sup> 1,133,000	113	(4,556,000)	25	2,282,000	21	1,798,000
25	21	California Resources Corp.	7,053,000	19	2,403,000	108	(3,554,000)	107	(916,000)	53	401,000
26	26	Range Resources Corp.	6,900,031	26	1,598,068	76	(713,685)	22	2,759,658	29	1,030,644
27	30	Consol Energy Inc.	6,892,284	40	726,921	73	<sup>4</sup> (678,857)	—	—	35	832,446
28	20	Denbury Resources Inc.	5,918,824	32	1,257,560	111	(4,385,448)	37	1,248,912	48	476,398
29	35	Oasis Petroleum Inc.	5,649,375	37	789,735	40	(40,248)	24	2,319,342	36	819,847
30	32	SM Energy Inc.	5,621,643	28	1,556,965	64	(447,710)	30	1,852,401	24	1,493,608
31	36	Cabot Oil & Gas Corp.	5,261,899	31	<sup>1</sup> 1,357,150	48	(113,891)	28	2,009,188	31	955,602
32	27	Cimarex Energy Co.	5,243,286	30	1,452,619	102	(2,408,948)	21	2,797,678	30	979,044
33	38	Memorial Resources Development Corp.	5,082,849	39	732,189	59	(297,890)	32	1,467,921	34	839,989
34	29	BreitBurn Energy Partners LP	4,872,412	33	1,108,715	104	(2,583,339)	33	<sup>5</sup> 1,405,895	62	269,350
35	23	Newfield Exploration Co.	4,768,000	27	1,557,000	107	(3,362,000)	34	1,379,000	22	1,607,000
36	37	Kinder Morgan CO <sub>2</sub> Co. LP	4,706,000	25	1,699,000	4	<sup>6</sup> 657,000	—	—	37	725,000
37	34	Energen Corp.	4,613,693	34	878,554	81	(945,731)	20	2,895,860	26	1,154,373
38	—	Rice Energy Inc.	3,970,531	49	<sup>5</sup> 502,141	56	(267,999)	40	624,571	25	1,246,274
39	33	Halcon Resources Corp. <sup>8</sup>	3,458,692	46	<sup>5</sup> 550,278	96	(1,922,621)	62	52,414	39	659,419
40	44	Gulfport Energy Corp.	3,334,734	41	710,118	88	(1,224,884)	27	2,038,837	23	1,579,129
41	31	Sandridge Energy Inc.	2,991,155	38	768,709	109	(4,321,051)	108	(1,187,733)	32	879,201
42	57	RSP Permian Inc.	2,979,571	65	283,992	35	(18,254)	29	1,858,584	33	855,743
43	50	Memorial Production Partners LP	2,906,003	55	358,147	63	(395,491)	39	<sup>5</sup> 645,492	64	241,299
44	39	Unit Corp.	2,808,509	35	854,231	72	(626,948)	35	1,313,580	45	561,453
45	46	Diamondback Energy Inc.	2,758,412	51	446,733	69	(547,790)	26	2,108,973	52	419,241
46	43	Vanguard Natural Resources LLC	2,709,297	45	566,643	95	(1,883,174)	88	(87,435)	77	113,283
47	45	Seneca Resources Corp. <sup>9, 10</sup>	2,549,374	42	695,995	70	(556,974)	—	—	80	88,100
48	—	Parsley Energy Inc.	2,514,192	67	266,057	44	(73,031)	31	1,586,641	54	382,550
49	56	PDC Energy	2,370,543	44	600,133	43	(68,280)	36	1,287,197	42	604,668

Worldwide liquids production		Worldwide natural gas production		Worldwide liquids reserves		Worldwide natural gas reserves		US liquids production		US natural gas production		US liquids reserves		US natural gas reserves		US net wells drilled	
Rank	Million bbl	Rank	Bcf	Rank	Million bbl	Rank	Bcf	Rank	Million bbl	Rank	Bcf	Rank	Million bbl	Rank	Bcf	Rank	Wells
1	716.0	1	2,548.0	1	12,954.0	1	35,626.0	5	119.0	1	1,254.0	1	2,378.0	1	19,380.0	2	697.0
2	514.0	2	1,784.0	2	4,262.0	2	25,946.0	1	183.0	9	478.0	4	1,386.0	12	4,242.0	1	896.0
3	272.0	3	1,404.0	3	2,778.0	3	11,924.0	2	176.0	5	671.0	2	1,938.0	5	7,518.0	6	416.0
5	163.0	6	859.0	8	1,053.0	9	6,021.0	4	130.0	4	854.0	6	850.0	8	5,991.0	3	618.9
4	186.0	15	360.0	4	1,639.0	16	3,368.0	7	93.00	25	155.0	5	1,101.0	32	1,019.0	7	408.0
9	101.0	21	228.0	10	827.0	28	1,554.0	10	68.00	33	105.0	18	420.0	43	505.0	20	181.0
10	92.00	16	286.0	7	1,055.0	19	2,462.0	8	76.00	28	128.0	7	752.0	30	1,151.0	13	280.0
6	151.0	7	587.0	6	1,212.0	11	5,821.0	6	110.0	6	579.0	10	670.0	10	5,808.0	9	341.1
7	131.9	10	475.7	5	1,480.5	14	3,825.9	3	131.5	12	337.3	3	1,470.7	13	3,489.8	4	481.0
12	57.00	13	433.0	17	496.0	12	5,549.0	15	43.00	16	258.0	17	432.0	15	2,711.0	19	218.0
8	129.3	11	447.1	9	992.0	15	3,430.4	11	64.82	23	160.6	13	584.5	22	1,572.8	10	317.0
11	69.60	4	1,070.0	16	497.2	8	6,041.0	9	69.60	2	1,070.0	15	497.2	7	6,041.0	5	428.0
15	52.54	29	147.2	19	438.3	31	1,356.5	14	52.54	26	147.2	16	438.3	27	1,356.5	18	230.0
13	53.52	26	164.5	12	700.5	17	3,151.8	12	53.52	22	164.5	9	700.5	14	3,151.8	15	270.5
29	18.00	12	439.0	13	613.0	4	9,533.0	29	18.00	10	439.0	11	613.0	2	9,533.0	32	124.0
21	34.46	33	107.0	20	367.8	29	1,534.1	19	34.46	31	107.0	19	367.8	25	1,534.1	14	273.0
16	49.80	28	156.1	18	492.6	25	1,688.8	23	25.70	56	31.90	24	274.3	56	232.4	35	111.8
14	52.72	51	41.13	11	709.6	40	665.7	13	52.72	50	41.13	8	709.6	38	665.7	16	267.8
22	33.20	20	234.0	21	311.6	18	2,619.0	20	33.20	17	234.0	20	311.6	16	2,619.0	11	305.0
41	9.450	9	562.0	33	144.4	5	9,110.3	41	9.450	8	562.0	33	144.4	3	9,110.3	17	239.5
26	24.30	23	181.1	26	251.9	23	2,108.9	26	24.30	19	181.1	26	251.9	20	2,108.9	21	178.8
27	20.40	18	277.0	28	218.0	21	2,190.2	27	20.40	14	277.0	28	218.0	18	2,190.2	28	136.0
18	38.00	37	90.00	29	207.0	53	274.0	17	38.00	36	90.00	29	207.0	52	274.0	69	16.00
35	12.97	5	899.0	54	49.70	10	5,917.0	35	12.97	3	899.0	54	49.70	9	5,917.0	8	347.4
17	43.00	38	84.00	15	525.0	39	715.0	16	43.00	37	84.00	14	525.0	37	715.0	12	286.1
25	24.44	14	362.7	14	602.3	7	6,277.7	25	24.44	11	362.7	12	602.3	6	6,277.7	26	141.3
48	7.270	17	285.0	43	97.13	13	5,060.2	48	7.270	13	285.0	43	97.13	11	5,060.2	29	134.3
24	25.25	74	8.093	24	282.3	83	38.31	24	25.25	74	8.093	22	282.3	83	38.31	71	15.00
31	16.09	66	14.00	30	184.9	59	199.8	31	16.09	66	14.00	30	184.9	59	199.8	42	64.30
20	35.30	24	173.6	25	260.7	33	1,264.0	18	35.30	20	173.6	25	260.7	29	1,264.0	22	165.9
54	6.096	8	566.0	51	55.73	6	7,856.0	54	6.096	7	566.0	51	55.73	4	7,856.0	30	132.8
23	31.73	25	169.0	27	232.1	30	1,517.0	21	31.73	21	169.0	27	232.1	26	1,517.0	36	100.4
59	4.580	35	98.27	48	67.31	35	973.8	59	4.580	34	98.27	48	67.31	33	973.8	57	30.30
34	13.14	50	41.88	32	148.7	42	543.2	34	13.14	49	41.88	32	148.7	40	543.2	50	45.00
19	36.00	31	124.0	22	291.0	32	1,305.0	22	30.00	29	124.0	23	281.0	28	1,305.0	27	139.0
30	16.71	105	0.309	53	51.20	112	0.526	30	16.71	105	0.309	53	51.20	112	0.526	23	161.0
28	18.09	54	35.60	23	282.4	48	433.9	28	18.09	53	35.60	21	282.4	47	433.9	25	151.3
—	—	22	201.3	—	—	24	1,700.0	—	—	18	201.3	—	—	21	1,700.0	49	48.00
33	13.48	69	10.12	37	133.7	74	78.44	33	13.48	69	10.12	37	133.7	74	78.44	48	49.00
47	7.323	27	156.2	72	24.19	26	1,560.1	47	7.323	24	156.2	72	24.19	23	1,560.1	53	38.00
32	14.64	36	92.10	34	139.0	34	1,113.8	32	14.64	35	92.10	34	139.0	31	1,113.8	33	124.0
52	6.850	83	4.991	35	136.9	68	133.5	52	6.850	83	4.991	35	136.9	68	133.5	43	63.60
51	6.907	43	50.88	36	134.3	46	461.5	51	6.907	42	50.88	36	134.3	45	461.5	65	21.00
43	9.057	40	65.55	52	54.42	45	484.9	43	9.057	39	65.55	52	54.42	44	484.9	54	34.99
38	10.76	76	7.931	38	132.0	66	149.5	38	10.76	76	7.931	38	132.0	66	149.5	44	63.00
46	7.497	34	106.6	41	122.5	27	1,554.2	46	7.497	32	106.6	41	122.5	24	1,554.2	64	23.60
69	3.034	30	139.6	66	33.72	22	2,142.1	69	3.034	27	139.6	66	33.72	19	2,142.1	37	100.0
114	0.006	116	0.010	113	0.098	113	0.157	114	0.006	116	0.010	113	0.098	113	0.157	46	52.00
39	9.819	56	33.30	31	162.7	41	660.7	39	9.819	55	33.30	31	162.7	39	660.7	31	125.8

## OGJ150

Rank by total assets		Company	Total assets \$1,000	Total revenue		Net income		Stockholders' equity		Capital & expl. spending	
2015	2014			Rank	\$1,000	Rank	\$1,000	Rank	\$1,000	Rank	\$1,000
50	49	Carrizo Oil & Gas Inc.	2,026,905	52	429,203	86	(1,155,154)	46	444,054	38	674,612
51	59	EV Energy Partners LP	1,923,602	72	177,971	10	21,333	38	998,559	83	67,923
52	42	Laredo Petroleum Inc.	1,813,287	43	607,066	98	(2,209,936)	54	131,447	43	588,017
53	65	Legacy Reserves LP	1,625,902	58	339,108	75	(701,541)	92	(179,677)	44	577,186
54	47	Sanchez Energy Corp.	1,542,343	50	475,779	90	(1,454,627)	100	(456,169)	40	656,136
55	60	Bill Barrett Corp.	1,515,229	71	208,457	68	(487,771)	44	549,416	58	324,534
56	48	Stone Energy Corp.	1,410,169	47	545,229	85	(1,090,915)	87	(39,789)	46	522,047
57	70	Clayton Williams Energy Inc.	1,294,769	70	232,372	47	(98,196)	48	299,598	70	179,827
58	64	Bonanza Creek Energy Inc.	1,273,367	64	1,292,679	78	(745,547)	50	209,407	51	425,918
59	66	Eclipse Resources Corp.	1,266,412	68	255,321	82	(971,410)	41	620,554	49	475,659
60	52	W&T Offshore Inc.	1,208,022	48	507,265	84	(1,044,718)	102	(526,491)	66	230,161
61	51	Chaparral Energy Inc.	1,204,739	61	324,315	89	(1,333,844)	103	(620,357)	60	313,481
62	58	Comstock Resources Inc.	1,195,850	53	1,420,290	9	41,029	91	(171,258)	63	264,210
63	74	Approach Resources Inc.	1,174,984	77	131,336	52	(174,104)	42	607,967	73	151,178
64	72	Matador Resources Co.	1,140,861	62	318,534	74	(679,524)	45	488,959	50	432,715
65	73	Rex Energy Corp.	1,098,506	73	1,171,993	62	(361,033)	53	160,231	68	221,099
66	68	Magnum Hunter Resources Corp.	1,060,158	75	154,281	79	(783,872)	97	(312,484)	72	167,545
67	41	Ultra Petroleum	971,486	36	839,111	106	(3,207,220)	111	(2,991,937)	47	494,025
68	55	Exco Resources Inc.	954,126	60	328,331	87	(1,192,381)	104	(662,323)	59	317,590
69	76	Wexpro	920,600	57	342,000	6	98,900	—	—	87	46,400
70	54	Sabine Oil & Gas <sup>12</sup>	797,721	59	337,211	100	(2,239,643)	110	(2,302,948)	57	332,771
71	77	Callon Petroleum Co.	788,594	76	1,137,512	55	(240,139)	47	362,758	67	227,292
72	69	Triangle Petroleum Corp. <sup>13</sup>	753,148	56	358,129	80	(822,340)	95	(264,582)	65	231,238
73	89	Synergy Resources Corp. <sup>14</sup>	746,449	78	124,843	11	18,042	43	572,397	69	201,587
74	63	Northern Oil and Gas Inc.	733,945	66	275,057	83	(975,355)	93	(197,602)	61	289,055
75	53	Midstates Petroleum Co. Inc.	679,167	54	365,260	94	(1,797,195)	109	(1,326,066)	56	336,922
76	62	Swift Energy Co.	524,998	69	244,721	92	(1,653,971)	105	(852,724)	75	139,688
77	61	Penn Virginia Corp.	517,725	63	305,298	91	(1,582,961)	106	(915,121)	55	364,844
78	82	Gastar Exploration Inc.	430,868	81	107,294	65	(459,507)	89	(120,185)	74	148,182
79	78	Contango Oil & Gas Co.	416,756	79	116,505	60	(335,048)	49	237,843	81	77,820
80	71	Resolute Energy Corp.	390,983	74	154,644	77	(742,279)	94	(203,281)	84	67,636
81	81	PetroQuest Energy Inc.	379,319	80	115,969	58	(294,700)	90	(163,067)	79	90,672
82	87	Mid-Con Energy Partners LP	327,086	82	96,838	46	(95,495)	55	130,498	92	13,893
83	86	Venoco Inc. <sup>16</sup>	295,276	88	60,720	66	(464,363)	101	(483,710)	90	29,405
84	91	Abraxas Petroleum Corp.	267,872	87	67,032	50	(127,110)	58	84,465	82	69,391
85	88	Earthstone Energy Inc.	264,944	90	49,390	49	(116,655)	51	199,873	85	61,060
86	98	Ring Energy Inc.	250,866	94	31,021	30	(9,053)	52	186,231	78	109,333
87	96	Panhandle Oil and Gas Inc. <sup>10</sup>	238,825	86	70,882	15	9,321	56	127,005	89	30,801
88	79	Warren Resources Inc. <sup>17</sup>	234,462	83	93,994	71	(619,963)	98	(323,564)	88	36,112
89	95	PrimeEnergy Corp.	226,795	84	79,108	34	(13,150)	61	62,901	91	14,550
90	92	Black Hills Corp. <sup>18</sup>	208,956	92	43,500	53	(179,958)	—	—	71	168,925
91	93	Forestar Group Inc. <sup>18</sup>	144,436	89	52,939	54	(184,396)	—	—	86	49,776
92	99	Yuma Energy Inc.	119,621	96	23,719	32	(11,005)	60	64,225	93	13,541
93	84	Goodrich Petroleum Corp.	98,973	85	77,650	67	(479,424)	99	(408,085)	76	118,407
94	103	VOC Energy Trust	93,456	103	8,627	29	19(7,990)	57	2093,456	—	0
95	104	Dorchester Minerals LP	73,729	93	131,863	14	13,255	59	573,171	—	0
96	108	Evolution Petroleum Corp. <sup>21</sup>	69,915	95	27,877	17	4,992	63	52,103	94	8,650
97	110	Reserve Petroleum Co.	38,188	104	18,451	23	(1,885)	64	33,225	101	2,300
98	111	Lucas Energy Inc. <sup>22</sup>	37,938	112	13,001	27	(5,128)	65	26,605	102	2,015



Worldwide liquids production		Worldwide natural gas production		Worldwide liquids reserves		Worldwide natural gas reserves		US liquids production		US natural gas production		US liquids reserves		US natural gas reserves		US net wells drilled	
Rank	Million bbl	Rank	Bcf	Rank	Million bbl	Rank	Bcf	Rank	Million bbl	Rank	Bcf	Rank	Million bbl	Rank	Bcf	Rank	Wells
40	9.767	63	21.81	39	129.8	54	244.9	40	9.767	63	21.81	39	129.8	53	244.9	40	74.90
68	3.367	49	43.59	49	58.29	37	747.0	68	3.367	48	43.59	49	58.29	35	747.0	73	14.60
37	11.88	61	26.82	44	88.71	57	222.0	37	11.88	61	26.82	44	88.71	57	222.0	38	82.40
56	5.613	44	50.69	57	43.89	38	721.6	56	5.613	43	50.69	57	43.89	36	721.6	87	3.800
36	12.92	52	37.59	45	88.56	56	234.5	36	12.92	51	37.59	45	88.56	55	234.5	34	116.0
81	1.339	77	7.765	47	67.37	73	98.00	81	1.339	77	7.765	47	67.37	73	98.00	47	51.30
44	8.392	53	36.46	64	36.73	70	121.9	44	8.392	52	36.46	64	36.73	70	121.9	83	6.480
58	4.807	80	5.794	62	38.54	81	48.15	58	4.807	80	5.794	62	38.54	81	48.15	63	24.70
45	7.748	65	14.11	46	77.31	67	144.2	45	7.748	65	14.11	46	77.31	67	144.2	39	79.30
62	4.401	45	49.48	79	12.45	52	274.1	62	4.401	44	49.48	79	12.45	51	274.1	55	33.90
42	9.400	46	46.20	60	42.10	58	205.4	42	9.400	45	46.20	60	42.10	58	205.4	90	2.300
50	7.069	64	18.79	40	125.8	62	178.2	50	7.069	64	18.79	40	125.8	62	178.2	58	30.00
74	2.314	42	55.69	74	21.98	47	452.7	74	2.314	41	55.69	74	21.98	46	452.7	45	53.60
66	3.576	68	13.26	42	104.0	50	376.0	66	3.576	68	13.26	42	104.0	49	376.0	66	21.00
60	4.492	60	27.70	56	45.64	55	236.9	60	4.492	60	27.70	56	45.64	54	236.9	51	44.20
61	4.478	47	44.61	55	45.66	49	406.5	61	4.478	46	44.61	55	45.66	48	406.5	61	26.50
75	2.279	55	34.78	85	9.611	61	181.4	75	2.279	54	34.78	85	9.611	61	181.4	96	1.500
67	3.533	19	269.0	67	32.02	20	2,336.3	67	3.533	15	269.0	67	32.02	17	2,336.3	24	155.1
73	2.342	32	109.9	76	20.44	36	784.7	73	2.342	30	109.9	76	20.44	34	784.7	59	29.20
94	0.464	41	62.10	96	3.192	43	532.6	94	0.464	40	62.10	96	3.192	41	532.6	85	5.800
55	6.000	39	66.20	68	31.20	44	514.3	55	6.000	38	66.20	68	31.20	42	514.3	56	32.10
71	2.789	85	4.312	59	43.35	78	65.54	71	2.789	85	4.312	59	43.35	78	65.54	60	27.10
63	4.378	86	3.115	58	43.58	86	31.82	63	4.378	86	3.115	58	43.58	86	31.82	70	15.20
76	1.970	78	7.344	71	27.69	63	174.0	76	1.970	78	7.344	71	27.69	63	174.0	75	13.00
57	5.169	84	4.652	50	56.81	79	50.90	57	5.169	84	4.652	50	56.81	79	50.90	67	18.60
49	7.267	58	28.40	61	40.96	60	195.5	49	7.267	58	28.40	61	40.96	60	195.5	41	74.00
64	3.840	48	43.84	77	18.33	51	311.7	64	3.840	47	43.84	77	18.33	50	311.7	68	17.10
53	6.304	72	9.713	65	36.67	82	42.15	53	6.304	72	9.713	65	36.67	82	42.15	52	38.60
72	2.637	67	13.76	63	37.80	72	108.5	72	2.637	67	13.76	63	37.80	72	108.5	62	26.40
77	1.891	62	22.62	83	10.19	69	126.1	77	1.891	62	22.62	83	10.19	69	126.1	76	9.000
65	3.670	82	5.193	69	30.81	91	13.86	65	3.670	82	5.193	69	30.81	91	13.86	92	2.000
91	0.529	57	<sup>15</sup> 30.99	98	1.806	64	<sup>15</sup> 167.2	91	0.529	57	<sup>15</sup> 30.99	98	1.806	64	<sup>15</sup> 167.2	74	13.88
79	1.623	97	0.571	75	21.11	96	6.827	79	1.623	97	0.571	75	21.11	96	6.827	72	15.00
80	1.383	100	0.418	81	12.29	99	4.941	80	1.383	100	0.418	81	12.29	99	4.941	89	3.000
78	1.678	87	3.015	70	30.69	76	75.03	78	1.678	87	3.015	70	30.69	76	75.03	79	8.000
84	1.080	88	2.143	82	10.35	92	13.34	84	1.080	88	2.143	82	10.35	92	13.34	80	7.200
89	0.665	99	0.473	73	22.31	93	12.54	89	0.665	99	0.473	73	22.31	93	12.54	77	9.000
90	0.664	71	9.745	84	9.959	71	120.2	90	0.664	71	9.745	84	9.959	71	120.2	81	6.970
85	0.980	59	28.03	78	12.94	65	163.7	85	0.980	59	28.03	78	12.94	65	163.7	95	1.600
87	0.907	101	0.372	87	6.252	88	23.28	87	0.907	101	0.372	87	6.252	88	23.28	88	3.600
93	0.473	70	10.06	91	5.202	77	73.41	93	0.473	70	10.06	91	5.202	77	73.41	78	8.720
83	1.158	90	1.967	92	5.179	95	7.957	83	1.158	90	1.967	92	5.179	95	7.957	84	6.300
98	0.322	89	1.994	86	8.966	87	25.77	98	0.322	89	1.994	86	8.966	87	25.77	104	0.510
82	1.228	73	8.667	95	3.834	85	31.85	82	1.228	73	8.667	95	3.834	85	31.85	82	6.700
92	0.493	104	0.329	90	5.448	105	2.571	92	0.493	104	0.329	90	5.448	105	2.571	—	—
86	0.972	79	6.747	89	5.678	80	49.37	86	0.972	79	6.747	89	5.678	80	49.37	—	NA
95	0.452	117	0.007	80	12.45	118	0.005	95	0.452	117	0.007	80	12.45	118	0.005	—	—
105	0.084	93	0.758	107	0.462	102	3.638	105	0.084	93	0.758	107	0.462	102	3.638	97	1.300
88	0.739	—	—	94	4.579	104	2.977	88	0.739	—	—	94	4.579	104	2.977	93	2.000

## OGJ150

Rank by total assets		Company	Total assets \$1,000	Total revenue		Net income		Stockholders' equity		Capital & expl. spending	
2015	2014			Rank	\$1,000	Rank	\$1,000	Rank	\$1,000	Rank	\$1,000
99	—	Red Mountain Resources Inc. <sup>21</sup>	33,551	99	12,738	41	(43,030)	73	6830	95	8,120
100	102	US Energy Corp.	33,132	100	10,296	45	(92,840)	67	15,475	99	3,620
101	118	Hydrocarb Energy Corp. <sup>23</sup>	31,135	110	3,942	33	(12,629)	82	(1,089)	100	2,413
102	113	Spindletop Oil & Gas Co.	25,889	106	5,944	28	(5,777)	66	18,469	103	1,114
103	107	Glori Energy Inc.	22,264	101	9,002	39	(36,255)	74	6,511	96	5,220
104	106	EnerJex Resources Inc.	21,834	108	4,879	42	(51,922)	84	(2,534)	105	252
105	122	Mexco Energy Corp. <sup>22</sup>	21,471	111	3,390	21	(341)	68	13,207	97	4,778
106	124	Apache Offshore Investment Partnership	13,175	115	1,623	20	(228)	69	<sup>5</sup> 10,691	111	30
107	112	Tengasco Inc.	12,003	105	6,164	37	(24,721)	72	7,460	104	570
108	123	Royale Energy Inc.	11,670	114	1,713	24	(2,011)	83	(2,225)	98	3,753
109	127	Cross Timbers Royalty Trust	11,512	102	8,884	16	<sup>19</sup> 8,129	70	<sup>20</sup> 10,542	—	0
110	125	Daybreak Oil & Gas Inc. <sup>24</sup>	10,874	113	2,294	26	(4,205)	85	(7,067)	108	107
111	126	San Juan Basin Royalty Trust	10,544	97	19,437	12	<sup>19</sup> 17,000	71	<sup>20</sup> 8,724	—	0
112	119	FieldPoint Petroleum Corp.	10,520	109	3,969	31	(10,983)	79	877	106	235
113	117	Adams Resources & Energy Inc. <sup>19</sup>	8,930	107	5,063	36	<sup>1</sup> (19,016)	—	—	—	0
114	128	Sabine Royalty Trust	6,113	91	48,386	8	<sup>19</sup> 45,965	76	<sup>20</sup> 5,180	—	0
115	121	Houston American Energy Corp.	5,560	117	449	25	(3,830)	75	5,495	107	169
116	116	Lilis Energy Inc.	3,928	118	396	38	(32,361)	86	(14,344)	109	98
117	—	Humble Energy Inc.	3,420	120	37	19	1	81	3	112	3
118	132	Avalon Oil & Gas Inc. <sup>22</sup>	2,747	119	110	18	100	77	1,690	—	0
119	130	Permian Basin Royalty Trust	2,145	98	17,796	13	<sup>19</sup> 16,050	80	<sup>20</sup> 681	—	0
120	131	Pioneer Oil & Gas <sup>10</sup>	1,087	116	478	22	(704)	78	1,031	110	39
—	94	American Eagle Energy Corp. <sup>25</sup>	NA	—	NA	—	NA	—	NA	—	NA
—	—	American Natural Energy Corp. <sup>26</sup>	NA	—	NA	—	NA	—	NA	—	NA
—	120	Armada Oil Inc. <sup>27</sup>	NA	—	NA	—	NA	—	NA	—	NA
—	133	Blacksands Petroleum Inc. <sup>28</sup>	NA	—	NA	—	NA	—	NA	—	NA
—	101	Cubic Energy Inc. <sup>29</sup>	NA	—	NA	—	NA	—	NA	—	NA
—	—	Dune Energy Inc. <sup>30</sup>	NA	—	NA	—	NA	—	NA	—	NA
—	85	Emerald Oil Inc. <sup>30</sup>	NA	—	NA	—	NA	—	NA	—	NA
—	100	Escalera Resources Co. <sup>31</sup>	NA	—	NA	—	NA	—	NA	—	NA
—	—	GeoPetro Resources Co. <sup>28</sup>	NA	—	NA	—	NA	—	NA	—	NA
—	83	Miller Energy Resources Inc. <sup>32</sup>	NA	—	NA	—	NA	—	NA	—	NA
—	115	Pegasi Energy Resources Corp. <sup>28</sup>	NA	—	NA	—	NA	—	NA	—	NA
—	—	Petron Energy II Inc. <sup>28</sup>	NA	—	NA	—	NA	—	NA	—	NA
—	97	PostRock Energy Services Corp. <sup>33</sup>	NA	—	NA	—	NA	—	NA	—	NA
—	75	Quicksilver Resources Inc. <sup>30</sup>	NA	—	NA	—	NA	—	NA	—	NA
—	134	TN-K Energy Group Inc. <sup>28</sup>	NA	—	NA	—	NA	—	NA	—	NA
—	135	United American Petroleum Corp. <sup>28</sup>	NA	—	NA	—	NA	—	NA	—	NA
—	109	Zaza Energy Corp. <sup>28</sup>	NA	—	NA	—	NA	—	NA	—	NA
<b>Totals</b>			<b>1,250,367,489</b>		<b>582,541,066</b>		<b>(154,618,220)</b>		<b>559,142,590</b>		<b>161,210,944</b>

NA = Not Available. (s) indicates less than 500 bbl or 500 mcf. <sup>1</sup>Operating. <sup>2</sup>Net operating. <sup>3</sup>Filed Chapter 11, May 2016. <sup>4</sup>Before interest and taxes. <sup>5</sup>Partners equity <sup>6</sup>Before depreciation, depletion and amortization. <sup>7</sup>Includes liquids. <sup>8</sup>Filed Chapter 11, July 2015. <sup>9</sup>Subsidiary of National Fuel Gas Co. <sup>10</sup>Fiscal yearend Sept. 30. <sup>11</sup>Sales. <sup>12</sup>Filed Chapter 11 debtor in possession, July 2015. <sup>13</sup>Fiscal yearend Jan. 31, 2016. <sup>14</sup>Changed fiscal yearend to Dec. 31 but all data is for Aug. 31. <sup>15</sup>Includes NGL.






## THE OJ150 COMPANY INDEX

Rank by total assets	Company	Head- quarters city				
84	Abraxas Petroleum Corp.	San Antonio				
113	Adams Resources & Energy Inc.	Houston				
—	American Eagle Energy Corp.	Littleton, Colo.				
—	American Natural Energy Corp.	Tulsa				
4	Anadarko Petroleum Corp.	The Woodlands, Tex.				
15	Antero Resources Corp.	Denver				
11	Apache Corp.	Houston				
106	Apache Offshore Investment Partnership	Houston				
63	Approach Resources Inc.	Ft. Worth				
—	Armada Oil Inc.	Dallas				
118	Avalon Oil & Gas Inc.	Minneapolis, Minn.				
55	Bill Barrett Corp.	Denver				
90	Black Hills Corp.	Rapid City, SD				
—	Blacksands Petroleum Inc.	Houston				
58	Bonanza Creek Energy Inc.	Denver				
34	BreitBurn Energy Partners LP	Los Angeles				
31	Cabot Oil & Gas Corp.	Houston				
25	California Resources Corp.	Los Angeles				
71	Callon Petroleum Co.	Natchez, Miss.				
50	Carrizo Oil & Gas Inc.	Houston				
61	Chaparral Energy Inc.	Oklahoma City				
12	Chesapeake Energy Corp.	Oklahoma City				
2	Chevron Corp.	San Ramon, Calif.				
32	Cimarex Energy Co.	Denver				
57	Clayton Williams Energy Inc.	Midland, Tex.				
62	Comstock Resources Inc.	Frisco, Tex.				
16	Concho Resources Inc.	Midland, Tex.				
3	ConocoPhillips	Houston				
27	Consol Energy Inc.	Canonsburg, Pa.				
79	Contango Oil & Gas Co.	Houston				
14	Continental Resources Inc.	Oklahoma City				
109	Cross Timbers Royalty Trust	Ft. Worth				
—	Cubic Energy Inc.	Dallas				
110	Daybreak Oil & Gas Inc.	Spokane, Wash.				
28	Denbury Resources Inc.	Plano, Tex.				
8	Devon Energy Corp.	Oklahoma City				
45	Diamondback Energy Inc.	Midland, Tex.				
95	Dorchester Minerals LP	Dallas				
—	Dune Energy Inc.	Houston				
85	Earthstone Energy Inc.	The Woodlands, Tex.				
59	Eclipse Resources Corp.	State College, Pa.				
—	Emerald Oil Inc.	Denver				
37	Energen Corp.	Birmingham,				
104	EnerJex Resources Inc.	Ala.				
9	EOG Resources Inc.	San Antonio				
20	EQT Production	Houston				
—	Escalera Resources Co.	Pittsburgh				
51	EV Energy Partners LP	Denver				
96	Evolution Petroleum Corp.	Houston				
68	Exco Resources Inc.	Houston				
1	ExxonMobil Corp.	Dallas				
112	FieldPoint Petroleum Corp.	Irving, Tex.				
91	Forestar Group Inc.	Austin				
23	Freeport McMoran Inc.	Austin				
78	Freeport McMoran Inc.	Phoenix				
—	Gastar Exploration Inc.	Houston				
—	GeoPetro Resources Co.	Houston				
103	Glori Energy Inc.	San Francisco				
93	Goodrich Petroleum Corp.	Houston				
40	Gulfport Energy Corp.	Houston				
39	Halcon Resources Corp.	Oklahoma City				
6	Hess Corp.	Houston				
115	Hess Corp.	New York				
117	Houston American Energy Corp.	Houston				
101	Humble Energy Inc.	Paron, Ark.				
36	Hydrocarb Energy Corp.	Houston				
52	Kinder Morgan CO <sub>2</sub> Co. LP	Lakewood, Colo.				
53	Laredo Petroleum Inc.	Tulsa				
116	Legacy Reserves LP	Midland, Tex.				
19	Lilis Energy Inc.	Denver				
98	Linn Energy LLC	Houston				
66	Lucas Energy Inc.	Houston				
7	Magnum Hunter Resources Corp.	Irving, Tex.				
64	Marathon Oil Corp.	Houston				
43	Matador Resources Co.	Dallas				
33	Memorial Production Partners LP	Houston				
105	Memorial Resources Development Corp.	Houston				
82	Mexco Energy Corp.	Midland, Tex.				
75	Mid-Con Energy Partners LP	Dallas				
—	Midstates Petroleum Co. Inc.	Dallas				
17	Miller Energy Resources Inc.	Tulsa				
35	Murphy Oil Corp.	Irving, Tex.				
10	Newfield Exploration Co.	Knoxville, Tenn.				
74	Noble Energy Inc.	El Dorado, Ark.				
29	Northern Oil and Gas Inc.	The Woodlands, Tex.				
5	Oasis Petroleum Inc.	Houston				
87	Occidental Petroleum Corp.	Los Angeles				
48	Panhandle Oil and Gas Inc.	Wayzata, Minn.				
49	Parsley Energy Inc.	Houston				
—	PDC Energy Resources Corp.	Houston				
77	Pegasi Energy Resources Corp.	Los Angeles				
119	Penn Virginia Corp.	Oklahoma City				
—	PetroQuest Energy Inc.	Austin				
13	Pioneer Natural Resources Co.	Denver				
120	Pioneer Oil & Gas	Denver				
—	PostRock Energy Services Corp.	Irving, Tex.				
89	PrimeEnergy Corp.	South Jordan, Utah				
21	QEP Resources Inc.	Oklahoma City				
—	Quicksilver Resources Inc.	Houston				
26	Range Resources Corp.	Denver				
99	Red Mountain Resources Inc.	Ft. Worth				
97	Reserve Petroleum Co.	Farmers Branch, Tex.				
80	Resolute Energy Corp.	Oklahoma City				
65	Rex Energy Corp.	Denver				
38	Rice Energy Inc.	State College, Pa.				
86	Ring Energy Inc.	Canonsburg, Pa.				
108	Royale Energy Inc.	Midland, Tex.				
42	RSP Permian Inc.	El Cajon, Calif.				
70	Sabine Oil & Gas	Dallas				
114	Sabine Royalty Trust	Houston				
111	San Juan Basin Royalty Trust	Dallas				
54	Sanchez Energy Corp.	Ft. Worth				
41	Sandridge Energy Inc.	Houston				
47	Seneca Resources Corp.	Oklahoma City				
30	SM Energy Inc.	Williamsville, NY				
24	Southwestern Energy Co.	Denver				
102	Spindletop Oil & Gas Co.	Spring, Tex.				
56	Stone Energy Corp.	Dallas				
76	Swift Energy Co.	Lafayette, La.				
73	Synergy Resources Corp.	Houston				
107	Tengasco Inc.	Denver				
—	TN-K Energy Group Inc.	Greenwood Village, Colo.				
72	Triangle Petroleum Corp.	Crossville, Tenn.				
67	Ultra Petroleum	Denver				
44	Unit Corp.	Houston				
—	United American Petroleum Corp.	Tulsa				
100	Vanguard Natural Resources LLC	Austin				
46	Venoco Inc.	Riverton, Wyo.				
83	VOC Energy Trust	Houston				
60	W&T Offshore Inc.	Denver				
88	Warren Resources Inc.	Austin				
69	Wexpro	Houston				
18	Whiting Petroleum Corp.	Salt Lake City, Utah				
22	WPX Energy Inc.	Denver				
92	Yuma Energy Inc.	Tulsa				
—	Zaza Energy Corp.	Houston				



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# OGJ100 posts lower 2015 earnings, higher oil production

**Conglin Xu**

Senior Editor-Economics

**Laura Bell**

Statistics Editor

The OGJ100 list allows comparison of size and performance of prominent oil and gas companies around the world. OGJ does not attempt to rank the firms by assets or revenues because many do not report financial results. Instead of being ranked as in the OGJ150, the companies are grouped by region according to the location of their corporate headquarters.

Financial results are available for most of the companies profiled in four of the regions: Canada, Europe, Latin America, and Asia-Pacific. Propelled by low commodity prices, each of these groups of companies reported declines in revenues, earnings, and capital spending in 2015 vs. 2014. In addition, each group posted lower yearend total assets from a year earlier. However, oil production in most regions except Latin America increased during 2015.

All financial results in this report are shown in US dollars. Stronger US dollars in 2015 to many currencies negatively impact the results.

## **Regional performances**

The 21 companies headquartered in Canada posted a collective net loss of \$18 billion in 2015 compared with earnings of \$12.85 billion in 2014. Seventeen of the companies reported losses for 2015. EnCana Corp. reported the largest loss of \$5.16 billion, including aftertax impairments of \$4.13 billion.

The Canadian group's combined capital spending declined 46% last year, and their total assets at yearend 2015 were down 22% from a year earlier. The group's worldwide crude oil and condensate production increased about 5% year-on-year, while oil and condensate reserves decreased nearly 10%.

Three Canadian companies included previously in the OGJ100 no longer appear this year. Talisman Energy Inc. was acquired by Spanish integrated energy company Repsol SA in May 2015. Canadian Oil Sands Ltd. was taken over by Suncor Energy Inc. And Pembina Pipeline Corp. was dropped as a midstream company.

In 2015, the group of 29 companies based in Europe

posted a nearly 80% decline in earnings from a year ago. The group's spending during 2015 was down 17% compared with a year ago, while its total production was stable. Dragon Oil PLC was excluded from the Europe group as it was acquired by the Emirates National Oil Co. in June 2015.

Earnings of Royal Dutch Shell PLC, the largest Europe-based company by assets, declined to \$2.2 billion in 2015 from \$14.73 billion in 2014. BP PLC reported a net loss of \$6.4 billion for 2015 compared with net income of \$4 billion in 2014. Eni SPA reported a net loss of \$9.5 billion for 2015 compared with net income of \$1.5 billion in 2014.

Earnings of Latin American oil and gas companies were hit the hardest. During 2015, Mexico's Petroleos Mexicanos (Pemex) recorded a net loss of \$41 billion compared with last year's net loss of \$18 billion. The company's crude oil production totaled 827.4 million bbl, a decrease of 6.7% compared with 2015.

The largest company in the Asia-Pacific area as ranked by its \$368.4 billion in yearend 2015 assets is PetroChina Co. Ltd., which posted a 66% decline in earnings last year and a 5% decline in yearend assets.

The combined 2015 earnings of the group of firms based in Asia-Pacific fell about 70% from 2014, while the subgroup's total oil production increased 6% year-over-year.

## **Leaders in oil reserves**

With estimated proved crude reserves of 300.9 billion bbl, Petroleos de Venezuela SA (PDVSA) continues to head the list of companies with the largest proved oil reserves, followed by Saudi Aramco, National Iranian Oil Co., and Iraq National Oil Co. These are the same entities that lead the list a year ago.

In Russia, OAO Lukoil's proved crude oil reserves decreased 7.4% to 12.58 billion bbl from a year ago, while OAO Gazprom's estimated oil reserves increased.

PetroChina Co. Ltd.'s proved crude oil reserves declined 24% to 8.52 billion bbl during 2015. **OGJ**





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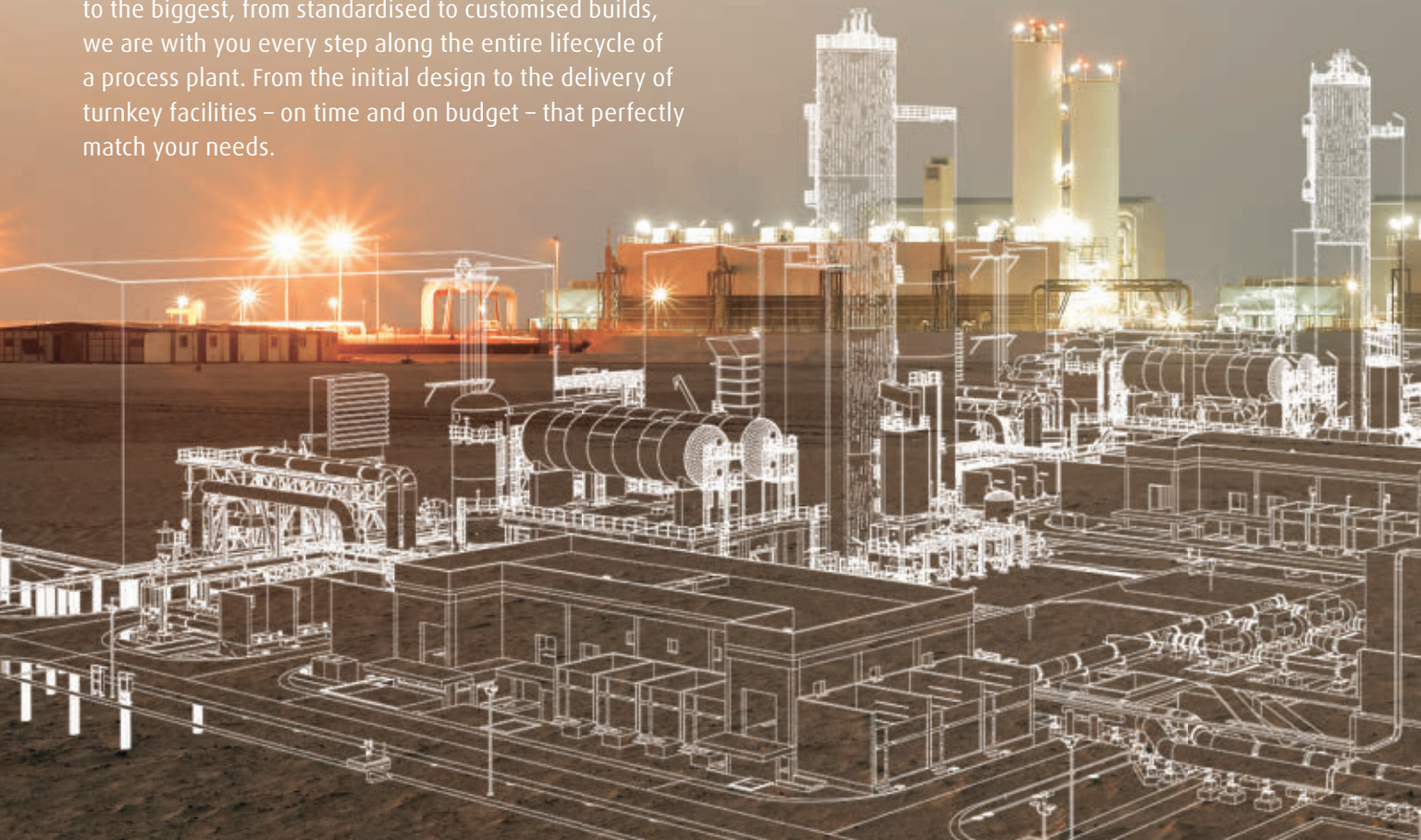
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## OGJ100

## LEADING OIL AND GAS COMPANIES OUTSIDE THE US

Country	Company	Total assets		Total revenues		Total net income		Capital and exploratory expenditures	
		2015	2014	2015	2014	2015	2014	2015	2014
<b>CANADA</b>									
Canada	Advantage Oil & Gas Ltd.	1,095.8	1,255.1	91.4	177.4	15.5	64.4	137.4	191.4
Canada	ARC Resources Ltd.	4,284.0	5,457.2	1,031.5	1,713.3	(247.5)	328.5	371.2	826.7
Canada	Baytex Energy Ltd.	3,963.6	5,375.4	641.6	1,319.9	(453.4)	69.6	376.2	660.9
Canada	Bonavista Energy Trust	2,544.7	3,821.4	394.2	837.5	(542.7)	4.1	226.7	551.8
Canada	Canadian Natural Resources Ltd.	42,805.8	51,936.8	8,928.0	16,273.8	(460.0)	3,389.7	3,397.0	8,806.8
Canada	Cenovus Energy Inc.	18,625.1	21,305.3	9,434.2	16,945.9	446.3	641.9	1,237.8	2,638.2
Canada	Crescent Point Energy Corp.	12,721.5	14,206.9	2,341.9	3,633.4	(628.4)	439.0	1,159.2	1,871.0
Canada	EnCana Corp.	15,644.0	24,531.0	4,422.0	8,019.0	(5,165.0)	3,426.0	2,232.0	2,526.0
Canada	Enerplus Resources Fund	1,864.0	3,478.1	741.7	1,518.9	(1,100.1)	258.0	359.6	705.7
Canada	Gran Tierra Energy Inc.	1,146.1	1,714.1	277.4	562.3	(268.0)	(171.3)	156.6	391.5
Canada	Harvest Energy Trust	2,836.7	4,392.7	263.1	769.2	(1,306.3)	(379.8)	165.9	600.4
Canada	Husky Energy Inc.	23,871.6	33,515.6	11,821.0	20,785.1	(2,780.3)	1,085.3	2,170.1	4,333.5
Canada	Imperial Oil Ltd.	31,175.5	35,225.6	19,417.3	31,891.9	810.3	3,265.5	2,162.1	4,563.9
Canada	Paramount Resources Ltd.	2,008.3	2,760.2	264.6	286.9	(650.9)	(61.9)	356.7	812.3
Canada	Pengrowth Energy Trust	3,286.3	5,322.9	535.3	1,059.7	(789.4)	(499.4)	132.7	779.9
Canada	Penn West Exploration Ltd.	4,278.8	8,499.7	764.8	1,776.4	(1,910.8)	(1,495.1)	339.4	631.5
Canada	Peyto Energy Trust	2,424.6	2,697.9	498.9	675.1	99.4	225.9	428.8	595.6
Canada	Sherritt International Corp.	2,953.6	4,558.0	242.6	393.1	(1,499.7)	(250.2)	57.1	69.7
Canada	Suncor Energy Inc.	55,986.6	68,735.1	21,433.6	34,932.2	(1,440.7)	2,328.5	4,814.6	6,005.5
Canada	Touchstone Exploration Inc.	72.6	121.0	18.2	25.9	(16.0)	(49.4)	3.5	30.2
Canada	Vermilion Energy Trust	3,039.7	3,784.1	630.9	1,131.6	(156.9)	232.3	351.6	593.3
<b>LATIN AMERICA</b>									
Argentina	Techint Tecpetrol SA <sup>6</sup>	29,928.0	34,026.0	19,108.0	23,826.0	NA	NA	2,405.0	2,455.0
Argentina	YPF SA	32,319.0	24,407.1	16,952.0	17,576.0	407.2	1,053.5	6,665.0	6,480.0
Barbados	Barbados National Oil Co. Ltd. <sup>6</sup>	NA	213.0	NA	364.0	NA	14.8	NA	3.2
Brazil	Petroleo Brasileiro SA (Petrobras)	227,347.0	298,676.7	81,236.1	126,966.1	(8,798.5)	(8,126.7)	19,274.9	32,805.0
Colombia	Ecopetrol	37,882.8	47,106.2	16,044.0	28,038.1	1,005.0	3,429.3	4,389.5	5,981.4
Cuba	Cubapetroleo	NA	NA	NA	NA	NA	NA	NA	NA
Ecuador	Petroleos del Ecuador	9,661.6	8,604.0	9,284.0	15,742.0	752.0	4,807.0	NA	NA
Mexico	Petroleos Mexicanos (Pemex)	103,197.0	144,610.0	67,786.0	107,809.0	(41,413.0)	(18,042)	11,823.6	18,790.2
Suriname	State Oil Co. Suriname Ltd.	2,261.0	2,003.6	582.5	1,056.4	23.0	275.9	260.0	349.1
Trinidad and Tobago	Petroleum Co. of Trinidad & Tobago Ltd. (Petrotrin) <sup>2</sup>	5,874.0	7,134.6	3,096.8	4,602.1	(156.5)	(49.5)	203.4	267.7
Venezuela	Petroleos de Venezuela SA (PDVSA)	NA	NA	NA	NA	NA	NA	NA	NA
<b>EUROPE</b>									
Azerbaijan	State Oil Co. of Azerbaijan Republic (SOCAR)	25,621.4	15,433.5	21,228.0	25,441.8	(1,144.7)	817.0	3,075.5	1,887.3
Austria	OMV AG	35,469.8	40,967.9	24,462.1	43,458.3	(1,362.8)	637.7	3,006.9	4,637.1
Denmark	Dong Energy AS	21,456.7	24,362.8	10,308.5	10,896.1	(1,758.4)	(858.7)	2,720.1	2,496.0
Denmark	Maersk Oil & Gas	62,408.0	68,844.0	40,308.0	47,569.0	925.0	5,195.0	1,408.0	6,137.0
Finland	Neste Oil <sup>9</sup>	7,376.5	7,858.4	12,087.2	18,164.8	1,004.5	705.5	582.0	505.8
France	Total SA	224,484.0	229,798.0	143,421.0	212,018.0	4,786.0	4,250.0	28,033.0	30,509.0
Germany	RWE Dea AG	62,951.8	68,375.5	47,188.9	52,646.6	2,104.5	2,054.7	2,198.9	2,491.6
Germany	Wintershall AG	NA	NA	NA	NA	NA	NA	NA	NA
Greece	Hellenic Petroleum SA	8,718.7	9,340.8	7,930.2	11,469.8	50.7	(442.0)	179.4	164.4
Hungary	MOL Group PLC	13,512.3	17,807.7	14,112.9	18,639.1	(1,117.8)	(194.8)	1,301.8	1,832.0
Ireland	Tullow Oil PLC	11,347.8	11,421.7	1,606.6	2,212.9	(1,036.9)	(1,639.9)	1,884.5	2,940.8
Italy	Eni SPA	146,370.6	176,925.1	73,558.9	112,765.6	(9,537.5)	1,562.2	11,700.6	13,630.6
Netherlands	Royal Dutch Shell PLC	340,157.0	353,116.0	264,960.0	421,105.0	2,200.0	14,730.0	28,861.0	37,339.0
Norway	Statoil ASA	109,179.8	131,881.7	54,527.8	83,230.9	(4,212.7)	2,940.5	14,083.7	16,386.9
Poland	Polish Oil & Gas Co.	12,696.3	13,890.7	9,461.4	9,908.3	553.8	815.6	NA	NA
Portugal	Galp	13,891.9	15,992.0	16,958.2	21,934.8	167.4	(143.4)	1,393.2	1,404.9
Romania	OMV Petrom SA	9,880.7	11,638.6	4,360.2	5,813.5	(174.5)	785.1	936.0	1,683.8

Worldwide oil production Million bbl		Worldwide natural gas production Bcf		Worldwide oil reserves Million bbl		Worldwide natural gas reserves Bcf	
2015	2014	2015	2014	2015	2014	2015	2014
0.1	0.1	51.1	47.7	<sup>1</sup> 12.1	<sup>1</sup> 8.4	1,206.5	1,101.7
<sup>1</sup> 14.4	<sup>1</sup> 16.1	162.0	147.7	<sup>1</sup> 127.9	<sup>1</sup> 126.6	1,592.5	1,532.8
<sup>1</sup> 24.4	<sup>1</sup> 23.4	33.5	23.8	203.6	212.8	343.6	314.4
<sup>1</sup> 8.4	<sup>1</sup> 9.1	122.8	114.5	<sup>1</sup> 91.2	<sup>1</sup> 93.3	1,026.0	1,094.4
<sup>1</sup> 114.0	<sup>1</sup> 112.0	630.0	568.0	<sup>1</sup> 1,062.0	<sup>1</sup> 1,136.0	6,106.0	6,001.0
24.0	26.0	161.0	175.0	243.0	276.0	721.0	796.0
53.9	46.9	34.7	27.0	538.0	490.3	324.6	226.8
60.5	35.7	677.0	980.0	478.8	454.7	4,584.0	6,463.0
<sup>1</sup> 16.8	<sup>1</sup> 15.9	129.4	127.8	<sup>1</sup> 142.5	<sup>1</sup> 135.1	808.6	896.3
<sup>1</sup> 7.1	<sup>1</sup> 7.3	0.3	1.0	<sup>1</sup> 38.1	<sup>1</sup> 36.9	4.6	1.0
<sup>15</sup> 8.7	<sup>15</sup> 10.8	<sup>5</sup> 38.0	<sup>5</sup> 36.0	<sup>15</sup> 58.9	<sup>15</sup> 70.1	<sup>5</sup> 255.0	<sup>5</sup> 253.8
<sup>1</sup> 61.3	<sup>1</sup> 82.4	251.6	226.7	309.0	415.0	2,328.7	2,661.8
<sup>1</sup> 5.0	<sup>1</sup> 6.0	45.0	57.0	<sup>1</sup> NA	<sup>1</sup> NA	NA	NA
<sup>1</sup> 6.3	<sup>1</sup> 2.2	58.7	40.3	<sup>1</sup> 107.9	<sup>1</sup> 109.5	710.6	703.8
<sup>1</sup> 11.1	<sup>1</sup> NA	66.5	NA	71.5	106.7	461.4	593.9
17.0	20.0	60.0	80.0	116.0	292.0	353.0	602.0
<sup>1</sup> 2.4	<sup>1</sup> 2.8	173.0	150.5	38.5	46.3	2,017.9	1,806.7
<sup>1</sup> NA	<sup>1</sup> NA	NA	NA	<sup>1</sup> NA	<sup>1</sup> NA	NA	NA
<sup>1</sup> 41.0	<sup>1</sup> 38.0	11.0	10.0	283.0	343.0	38.0	53.0
0.6	0.5	—	—	8.8	10.5	—	0.2
<sup>1</sup> 10.4	<sup>1</sup> 10.5	48.6	39.7	<sup>1</sup> 79.5	<sup>1</sup> 76.1	395.8	370.9
NA	NA	NA	NA	NA	NA	NA	NA
91.1	89.3	569.4	546.8	608.0	601.0	3,072.0	3,016.0
0.3	0.3	0.8	0.8	2.5	2.8	5.0	5.2
<sup>1</sup> 812.9	<sup>1</sup> 784.8	1,158.8	1,078.9	<sup>1</sup> 10,946.0	<sup>1</sup> 13,956.0	13,152.7	14,974.6
228.7	225.6	284.1	290.9	NA	NA	NA	NA
<sup>7</sup> 52.0	<sup>7</sup> 52.0	<sup>7</sup> NA	<sup>7</sup> NA	NA	NA	NA	NA
<sup>7</sup> 198.2	<sup>7</sup> 203.0	<sup>7</sup> 17.5	<sup>7</sup> 20.4	<sup>7</sup> 8,273.0	<sup>7</sup> 8,273.0	<sup>7</sup> 388.5	<sup>7</sup> 388.5
827.4	886.5	2,336.4	2,384.1	<sup>7</sup> 9,977.0	<sup>1</sup> 10,292.0	8,610.0	10,859.0
6.2	6.1	NA	NA	84.0	100.0	NA	NA
NA	NA	NA	NA	NA	NA	<sup>7</sup> 11,503.0	<sup>7</sup> 12,240.0
<sup>7</sup> 968.0	<sup>7</sup> 979.3	<sup>7</sup> 918.3	<sup>7</sup> 772.6	<sup>7</sup> 300,900.0	<sup>7</sup> 300,000.0	<sup>7</sup> 201,300.0	<sup>7</sup> 198,359.0
59.3	60.5	242.7	255.1	NA	NA	NA	NA
<sup>15</sup> 55.4	<sup>15</sup> 57.8	309.5	309.7	<sup>16</sup> 604.3	<sup>16</sup> 615.8	2,375.0	2,658.5
10.1	10.6	178.6	181.0	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA
<sup>14</sup> 451.5	<sup>13</sup> 77.4	2,209.7	2,213.0	5,605.0	5,303.0	32,206.0	33,590.0
NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA
<sup>1</sup> 17.2	<sup>1</sup> 15.4	120.5	116.2	<sup>1</sup> 187.0	<sup>1</sup> 200.4	918.5	1,000.3
23.9	22.9	17.4	27.3	<sup>3</sup> 287.6	<sup>3</sup> 307.6	<sup>3</sup> 205.8	<sup>3</sup> 226.4
331.0	302.0	1,709.0	1,541.0	3,559.0	3,226.0	18,295.0	18,545.0
<sup>4</sup> 495.5	<sup>4</sup> 488.0	3,058.8	3,379.0	<sup>1</sup> 3,359.0	<sup>1</sup> 3,939.0	37,375.0	40,316.0
<sup>1</sup> 324.0	<sup>1</sup> 306.0	1,600.0	1,565.0	<sup>2</sup> 2,091.0	<sup>1</sup> 1,942.0	14,624.0	16,919.0
NA	NA	NA	NA	NA	NA	NA	NA
14.5	8.5	6.7	3.4	236.6	203.4	236.3	174.0
<sup>1</sup> 30.4	<sup>1</sup> 30.9	187.9	188.6	<sup>1</sup> 361.2	<sup>1</sup> 371.7	1,542.9	1,722.0



## OGJ100

## LEADING OIL AND GAS COMPANIES OUTSIDE THE US

Country	Company	Total assets		Total revenues		Total net income		Capital and exploratory expenditures	
		2015	2014	2015	2014	2015	2014	2015	2014
Russia	AO Gazprom	232,061.2	259,079.4	82,651.8	95,418.1	10,958.0	2,683.3	22,332.7	21,544.7
Russia	AO Lukoil	68,325.4	80,893.9	78,238.8	93,967.9	3,984.0	6,726.9	8,174.1	9,832.0
Russia	AO Rosneft	131,163.5	149,123.5	70,086.4	93,936.2	4,844.8	5,974.5	8,097.4	9,098.3
Russia	OJSC Surgutneftegas	50,414.3	51,498.3	13,312.4	14,724.6	10,225.2	15,221.0	NA	NA
Spain	Compania Espanola de Petroleos SA (CEPSA)	NA	NA	NA	NA	NA	NA	NA	NA
Spain	Repsol YPF SA	68,495.3	62,790.9	45,326.6	57,228.0	(1,332.4)	1,950.7	NA	NA
Sweden	Lundin Petroleum AB	4,785.3	5,092.0	569.3	785.2	(866.3)	(431.9)	1,479.3	2,046.1
Turkey	Turkish Petroleum Corp.	NA	8,462.9	NA	3,474.0	NA	276.7	NA	3,245.0
United Kingdom	BG Group PLC	59,676.0	61,486.0	16,148.0	19,289.0	2,328.0	(1,051.0)	5,904.0	8,877.0
United Kingdom	BP PLC	261,832.0	284,305.0	225,982.0	358,678.0	(6,400.0)	4,003.0	18,648.0	22,546.0
United Kingdom	Cairn Energy PLC	2,308.2	3,017.4	NA	NA	(515.5)	(381.1)	385.2	432.1
United Kingdom	Premier Oil PLC	5,305.9	6,087.6	1,067.0	1,629.0	(1,104.0)	(210.0)	1,070.1	1,195.5
<b>AFRICA</b>									
Algeria	Sonatrach	NA	NA	NA	NA	NA	NA	NA	NA
Angola	Sonangol EP	NA	NA	NA	NA	NA	NA	NA	NA
Egypt	Egyptian General Petroleum Corp.	NA	NA	NA	NA	NA	NA	NA	NA
South Africa	Sasol Ltd. <sup>4</sup>	26,640.0	26,368.4	<sup>8</sup> 15,251.8	<sup>8</sup> 19,069.2	2,446.3	2,783.0	NA	NA
Libya	National Oil Corp.	NA	NA	NA	NA	NA	NA	NA	NA
Morocco	Office National des Hydrocarbons et des Mines (ONHYM)	NA	NA	NA	NA	NA	NA	NA	NA
Nigeria	Nigerian National Petroleum Corp.	NA	NA	NA	NA	NA	NA	NA	NA
<b>MIDDLE EAST</b>									
Abu Dhabi	Abu Dhabi National Oil Co.	NA	NA	NA	NA	NA	NA	NA	NA
Bahrain	Bahrain National Oil Co.	NA	NA	NA	NA	NA	NA	NA	NA
Dubai	Emirates National Oil Co.	NA	NA	NA	NA	NA	NA	NA	NA
Iran	National Iranian Oil Co.	NA	NA	NA	NA	NA	NA	NA	NA
Iraq	Iraq National Oil Co.	NA	NA	NA	NA	NA	NA	NA	NA
Israel	Ministry of Energy & Infrastructure	NA	NA	NA	NA	NA	NA	NA	NA
Kuwait	Kuwait Petroleum Corp. <sup>6</sup>	NA	NA	NA	NA	NA	NA	NA	NA
Oman	Petroleum Development Oman LLC	NA	NA	NA	NA	NA	NA	NA	NA
Qatar	Qatar Petroleum Corp.	NA	NA	NA	NA	NA	NA	NA	NA
Saudi Arabia	Saudi Aramco	NA	NA	NA	NA	NA	NA	NA	NA
<b>ASIA PACIFIC</b>									
Australia	Australia Worldwide Exploration Ltd. <sup>4</sup>	998.2	1,133.4	219.4	310.4	(177.3)	58.9	186.3	135.7
Australia	BHP Billiton Petroleum <sup>4</sup>	43,183.0	47,046.0	11,447.0	14,833.0	<sup>9</sup> 1,802.0	<sup>9</sup> 5,287.0	5,359.0	6,423.0
Australia	Santos Ltd.	15,984.1	18,278.2	2,401.3	3,353.0	(1,966.8)	(764.8)	2,792.8	1,487.1
Australia	Woodside Petroleum Ltd.	23,839.0	24,082.0	5,030.0	7,435.0	26.0	2,414.0	561.0	5,567.0
China	China National Offshore Oil Corp. Ltd. (CNOOC)	102,245.3	106,786.6	26,384.2	44,243.5	3,115.9	9,698.1	10,135.9	17,028.9
China	PetroChina Co. Ltd.	368,412.6	387,521.7	<sup>2</sup> 265,543.4	<sup>3</sup> 3,677,853.1	6,477.5	19,175.4	31,124.4	46,997.5
China, Taiwan	China National Petroleum Corp. (CNPC)	NA	26,374.2	NA	37,703.0	NA	(1,067.8)	NA	398.1
India	Gujarat State Petroleum Corp. Ltd. <sup>6</sup>	6,812.1	6,329.2	2,402.9	2,671.3	32.3	(38.5)	632.1	1,192.5
India	Oil & Natural Gas Corp. Ltd. <sup>6</sup>	54,164.3	53,985.7	26,763.4	30,197.6	2,839.6	4,437.7	NA	NA
India	Oil India Ltd. <sup>6</sup>	5,810.8	5,806.6	1,563.6	1,596.2	402.6	496.4	284.3	209.4
Indonesia	MedcoEnergi	2,909.8	2,702.5	628.5	750.7	(186.2)	8.8	134.8	333.7
Indonesia	Pertamina	45,519.0	50,696.0	41,763.0	69,996.0	1,442.0	1,477.0	NA	NA
Japan	Japan Petroleum Exploration Co. Ltd. <sup>6</sup>	6,140.5	6,435.4	2,540.9	2,684.6	246.5	282.5	815.0	1,235.0
Malaysia	Petronas <sup>6</sup>	137.5	153.6	57,530.7	94,037.6	4,845.8	13,603.0	NA	NA
Myanmar	Myanma Oil & Gas Enterprise	NA	NA	NA	NA	NA	NA	NA	NA
New Zealand	New Zealand Oil & Gas Ltd. <sup>4</sup>	328.9	403.8	78.8	90.7	(4.2)	8.8	16.3	71.2
Pakistan	Pakistan Oilfields Ltd. <sup>4</sup>	544.4	598.6	303.2	367.5	83.0	133.3	NA	17.7
Pakistan	Pakistan Petroleum Ltd.	2,431.7	2,443.8	1,024.8	1,238.8	336.3	531.7	241.0	225.2
Thailand	PTT Exploration & Production PCL	19,642.0	23,271.0	5,483.9	7,530.6	(854.6)	677.5	1,914.8	7,054.7

NA=not available. All financial data are given in millions of US dollars. End of period exchange rates are used. Fiscal yearend is Dec. 31 unless otherwise noted. <sup>1</sup>Includes NGL. <sup>2</sup>Fiscal yearend is Sept. 30. <sup>3</sup>Proved and probable. <sup>4</sup>Fiscal yearend is June 30. <sup>5</sup>After royalty. <sup>6</sup>Fiscal yearend is Mar. 31. <sup>7</sup>Estimate. <sup>8</sup>Turnover. <sup>9</sup>Underlying EBIT.

Worldwide oil production Million bbl		Worldwide natural gas production Bcf		Worldwide oil reserves Million bbl		Worldwide natural gas reserves Bcf	
2015	2014	2015	2014	2015	2014	2015	2014
535.1	511.1	15,714.7	16,353.9	<sup>3</sup> 16,638.8	<sup>3</sup> 16,161.2	<sup>8</sup> 837,118.4	<sup>8</sup> 830,256.9
749.0	727.0	847.0	825.0	12,585.0	13,594.0	23,838.0	23,946.0
1,474.4	1,489.6	2,207.1	2,002.3	<sup>1</sup> 24,700.0	<sup>1</sup> 24,950.0	56,820.2	49,934.0
448.0	451.5	335.0	335.5	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA
75.6	48.9	745.2	465.7	588.0	441.0	10,353.0	6,368.4
9.8	6.5	11.64	12.49	<sup>1</sup> 3657.2	<sup>1</sup> 3172.7	<sup>3</sup> 169.0	<sup>3</sup> 88.5
NA	12.3	NA	8.9	NA	NA	NA	NA
<sup>1</sup> NA	<sup>1</sup> 80.9	NA	841.0	<sup>1</sup> NA	<sup>1</sup> 1,687.9	NA	11,550.0
<sup>5</sup> 711.0	<sup>6</sup> 665.4	<sup>2</sup> 7,830.0	<sup>2</sup> 5,591.5	<sup>1</sup> 9,560.0	<sup>1</sup> 9,817.0	<sup>5</sup> 44,197.0	<sup>5</sup> 44,695.0
NA	NA	NA	NA	NA	NA	NA	NA
<sup>1</sup> 10.9	<sup>1</sup> 11.5	57.0	64.0	<sup>1</sup> 252.4	<sup>1</sup> 3144.9	436.9	571.9
<sup>7</sup> 441.5	<sup>7</sup> 404.1	<sup>7</sup> 4,530.8	<sup>7</sup> 2,760.0	<sup>7</sup> 12,200.0	<sup>7</sup> 12,200.0	<sup>7</sup> 159,054.3	<sup>7</sup> 159,054.0
<sup>7</sup> 649.5	<sup>7</sup> 610.2	<sup>7</sup> 48.0	<sup>7</sup> 48.0	<sup>7</sup> 9,524.0	<sup>7</sup> 8,423.0	<sup>7</sup> 9,711.0	<sup>7</sup> 9,711.0
<sup>7</sup> 250.8	<sup>7</sup> 244.6	1,260.0	1,260.0	<sup>7</sup> 4,400.0	<sup>7</sup> 4,400.0	<sup>7</sup> 77,200.0	<sup>7</sup> 77,200.0
NA	NA	NA	NA	NA	NA	NA	NA
<sup>7</sup> 147.4	<sup>7</sup> 175.2	<sup>7</sup> 547.1	<sup>7</sup> 583.5	<sup>7</sup> 48,363.0	<sup>7</sup> 48,363.0	<sup>7</sup> 53,144.0	<sup>7</sup> 53,147.6
NA	NA	NA	NA	<sup>7</sup> 0.7	<sup>7</sup> 0.7	<sup>7</sup> 51.0	<sup>7</sup> 51.0
<sup>7</sup> 662.5	<sup>7</sup> 693.0	<sup>7</sup> 1,594.4	<sup>7</sup> 1,548.2	<sup>7</sup> 37,062.0	<sup>7</sup> 37,070.0	<sup>7</sup> 186,609.8	<sup>7</sup> 180,490.0
<sup>7</sup> NA	<sup>7</sup> NA	NA	NA	<sup>7</sup> 92,200.0	<sup>7</sup> 92,200.0	<sup>7</sup> 200,000.0	<sup>7</sup> 200,000.0
<sup>7</sup> 18.4	<sup>7</sup> 17.8	<sup>7</sup> 519.0	<sup>7</sup> 521.0	<sup>7</sup> 124.6	<sup>7</sup> 124.6	<sup>7</sup> 3,250.0	<sup>7</sup> 3,250.0
<sup>7</sup> NA	<sup>7</sup> NA	NA	NA	<sup>7</sup> 4,000.0	<sup>7</sup> 4,000.0	<sup>7</sup> 3,785.0	<sup>7</sup> 3,785.0
<sup>7</sup> 1,150.3	<sup>7</sup> 1,137.7	8,004.7	7,514.7	<sup>7</sup> 158,400.0	<sup>7</sup> 157,530.0	<sup>7</sup> 1,183,019.0	<sup>7</sup> 1,201,382.0
<sup>7</sup> 1,279.0	<sup>7</sup> 1,135.2	<sup>7</sup> 35.4	<sup>7</sup> 31.9	<sup>7</sup> 142,503.0	<sup>7</sup> 143,069.0	<sup>7</sup> 111,522.0	<sup>7</sup> 111,522.0
NA	NA	NA	NA	<sup>7</sup> 13.9	<sup>7</sup> 11.5	7,027.0	10,064.0
<sup>7</sup> 1,043.4	<sup>7</sup> 1,046.5	<sup>7</sup> 597.1	<sup>7</sup> 530.7	<sup>7</sup> 101,500.0	<sup>7</sup> 101,500.0	<sup>7</sup> 63,000.0	<sup>7</sup> 63,000.0
<sup>7</sup> 358.1	<sup>7</sup> 346.2	<sup>7</sup> NA	<sup>7</sup> 1,232.1	<sup>7</sup> 5,306.0	<sup>7</sup> 5,151.0	<sup>7</sup> 24,300.0	<sup>7</sup> 24,910.0
<sup>7</sup> 239.4	<sup>7</sup> 258.8	6,302.5	6,144.6	<sup>7</sup> 25,244.0	<sup>7</sup> 25,244.0	<sup>7</sup> 860,000.0	<sup>7</sup> 871,585.0
3,723.0	3,467.5	2,912.3	2,840.8	261,100.0	261,100.0	297,600.0	294,000.0
2.1	1.9	15.0	18.7	32.0	28.5	171.3	134.7
<sup>9</sup> 8.6	<sup>9</sup> 4.1	786.6	839.3	524.3	610.5	7,190.2	9,561.5
<sup>5</sup> 12.0	<sup>5</sup> 9.6	247.4	220.8	<sup>5</sup> 60.0	<sup>5</sup> 44.0	2,401.8	3,036.8
20.3	20.0	432.0	435.7	127.6	124.9	5,827.9	5,263.3
401.3	340.2	443.1	434.3	<sup>5</sup> 2,830.2	<sup>5</sup> 3,039.8	<sup>5</sup> 6,992.9	<sup>5</sup> 6,730.8
971.9	945.5	3,131.0	3,028.8	8,521.0	10,593.0	77,525.0	71,098.0
NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA
228.1	226.6	930.5	1,170.6	3,784.0	3,821.6	15,109.2	15,830.0
NA	NA	NA	NA	303.9	334.8	872.9	840.0
8.1	8.1	47.7	51.6	91.4	95.2	660.5	711.8
101.6	98.6	694.3	588.7	94.2	129.4	876.8	973.2
<sup>5</sup> 14.0	<sup>5</sup> 8.0	<sup>5</sup> 68.4	<sup>5</sup> 54.1	53.0	54.0	885.4	808.4
NA	NA	NA	NA	NA	NA	NA	NA
<sup>7</sup> 7.3	<sup>7</sup> 7.3	NA	NA	<sup>7</sup> 50.0	<sup>7</sup> 50.0	<sup>7</sup> 10,000.0	<sup>7</sup> 10,000.0
NA	NA	NA	NA	<sup>3</sup> 5.0	<sup>3</sup> 2.8	<sup>3</sup> 41.1	<sup>3</sup> 33.1
2.3	2.2	26.0	28.4	NA	NA	NA	NA
5.5	4.7	305.1	311.7	<sup>1</sup> 17.2	<sup>1</sup> 40.2	2,022.6	2,250.0
39.0	40.0	618.0	571.0	180.0	187.0	3,591.0	3,814.0

# Colorado antioil initiatives fall short of qualifying for ballot

**Nick Snow**

Washington Editor

Two proposed initiatives that would have increased restrictions on oil and gas activity in Colorado failed to make the Nov. 8 ballot because they did not collect enough valid signatures, Secretary of State Wayne W. Williams announced. Proponents have 30 days to appeal the decision to the Denver District Court, Williams said on Aug. 29.

Officials of the Colorado Oil & Gas Association (COGA) and the Colorado Petroleum Council (CPC) separately welcomed the news. “That sound you hear is the state of Colorado breathing a collective sigh of relief,” COGA Pres. Dan Haley said.

Backers submitted the signatures in early August (OGJ Online, Aug. 9, 2016). Initiative No. 75 would have let local governments to prohibit, control, or impose moratoriums on oil and gas development; enact local laws that are more restrictive than state laws; and bar the state from preempting such law.

Initiative No. 78 would have changed Colorado’s setback requirements for any new oil and gas development to at least 2,500 ft from the nearest occupied structure or other specified or locally designated area, and authorize the state or a local government to require that any such new development be more than 2,500 ft away from such structures.

Citizens who were trying to get an issue on the ballot had to submit 98,492 voter signatures, Williams said. Supporters of the two measures collected more than that for each proposal, but not enough to compensate for the number of signatures that were rejected during a 5% random sample for each proposed initiative, he said.

Williams said the proposals were among nine citizen-initiated measures that were submitted for the November ballot. The other seven efforts were successful, he added.

## **An effective statewide ban**

CPC Executive Director Tracee Bentley said the proposals effectively would have banned oil and gas development in the state.

“Short-sighted initiatives like these do nothing more than hurt Colorado’s economy and our nation’s position as the world’s leader in production of oil and gas and in the reduction of carbon emissions, which are at near 20-year lows,” Bentley said. “Oil and gas companies have a long history of working collaboratively with local government and communities and we will continue to do so.”

Colorado oil and gas producers, who operate under some of the most stringent rules in the US, have proven that it

is not an either-or situation, Bentley said. “We can produce clean, safe, affordable energy while being good environmental stewards,” she said. “Moving forward, it’s important that we put in place policies that further Colorado’s leadership on these critical issues and benefit consumers, both in our state and nationally.”

Haley said the cycle of constant campaigning and political uncertainty is over. “Coloradans have sent a clear message that they don’t want to resolve these complex issues at the ballot box. The good news is that after this long and unnecessary battle, our state emerges as the winner.”

COGA’s president said, “Property owners no longer have to worry about losing their constitutionally protected rights. Local and state governments will continue to get severance and other tax funding for schools, parks, libraries, and roads. And working families across the state are protected from the consequences of driving a vital industry out of state. Industry, and Colorado’s business community, finally will be able to enjoy some of the certainty needed to operate now.” **OGJ**

## Biden pledges continued US support for Baltic States’ energy progress

**Nick Snow**

Washington Editor

US Vice-President Joseph R. Biden Jr. applauded the three Baltic nations’ recent energy diversification progress and pledged continued US support for Latvia, Lithuania, and Estonia. “Not long ago, this region was known as the ‘energy island,’ cut off from the rest of Europe. And the Baltic States know as well as any nation the national security consequences of being energy dependent,” he said during an Aug. 24 address at the National Library of Latvia in Riga.

“But recently, you’ve made significant progress in diversifying your energy sector to ensure you are no longer dependent on any one nation,” Biden said. “Here in Latvia, you’ve taken important steps to liberalize your gas sector, which will allow the formation of a fully integrated regional market in the Baltics. And with the inauguration of Lithuania’s LNG terminal—appropriately named ‘Independence’—you took a huge leap forward to end the Baltic region’s energy reliance on Russia.”

Biden said the three countries’ progress since the Soviet



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Union's collapse is impressive, but added that there's more work to be done. "It's important you follow through on your efforts to diversify energy supplies and increase connections to Europe so that no country can use energy to undermine your sovereignty. And the time to act is now, because this is a transformative moment in global energy markets," he stated.

The vice-president's remarks came more than a year after Lithuania's ambassador to the US told a Washington audience that US policymakers must move more aggressively to export more oil and gas so European nations can continue reducing their dependence on Russian supplies (OGJ Online, June 11, 2015). "We need LNG from America now," Zygimantas Pavilionis said. "We can't wait another 10 years."

Diversification will be the key, Latvian Economic Affairs Minister Dana Reizniece-Ozola said a month later at a Washington breakfast briefing hosted by LNG Allies. Russian gas giant Gazprom is using its still-dominant position to hold onto operations in other Eastern European countries as well as hers, she said.

### **More suppliers needed**

"We have long-term supply agreements, which are good. But we pay more—up to 40% at some times of the year—for gas than, say, Germany," Reizniece-Ozola said. "It's imperative that discussions take place to bring more gas suppliers to Europe."

North America will be the world's energy epicenter for the 21st century, partly due to its abundance of gas, Biden said. "We've moved from anticipating massive imports of [LNG] to becoming the world's fastest-growing exporter," he told his audience in Riga. "For the first time, gas from the US is being used here in Europe. And every country in Europe can now buy that American resource."

"That's critical, because Europe needs diverse sources of gas—not new pipelines that lock in greater reliance on Russia," Biden said, an apparent reference to the 1,200-km Nord Stream 2 pipeline project that Gazprom and two German firms began to build in 2010 across the Baltic Sea from Vyborg, Russia, to Greifswald, Germany (OGJ Online, Apr. 9, 2010).

The two offshore pipelines have a combined 55 billion cu m/year capacity, with the first going into operation in November 2011 and the second in October 2012. Both bypass the Baltic States and Eastern Europe.

"Russian gas can and should be part of the European market, but that market needs to be open and competitive," Biden said. "Everyone has to play by the rules. So we're eager to continue working with our partners to help the region secure the energy future you deserve."

### **'Stability and security'**

Officials from US associations that promote more LNG exports from this country to Europe separately expressed their

approval of Biden's remarks. "America's growth in gas production means that through LNG exports, we can give our allies stability and security in the global natural gas market," American Petroleum Institute Executive Director for Market Development Martin J. Durbin said on Aug. 25.

"America's shale revolution is growing our economy, spurring environmental improvements, and strengthening our own energy security. US LNG will give our allies an opportunity to achieve those some goals," he noted.

Fred H. Hutchison, executive director of LNG Allies and Our Energy Moment, said that Biden, "as he often does, hit the ball out of the park on this one."

Hutchison told OGJ, "As he noted, US LNG exports are beginning in earnest and will expand greatly in the next few years. On the receiving end, LNG import terminals in Lithuania and Poland are now operational and the requisite interconnecting pipelines are either in place or under development."

He said, "All that remains—and of course, this is where the real challenge lies—is to hammer out firm commercial agreements benefiting both sides. Fortunately, there are lots of serious negotiations under way. We remain very optimistic that some positive announcements are forthcoming. After all, we see the US as the low-cost LNG provider for many years to come." **OGJ**

## Victoria government to place permanent ban on fracking

**Rick Wilkinson**

OGJ Correspondent

Victorian Labor Premier Daniel Andrews has announced that his government will introduce a permanent ban on hydraulic fracturing and all exploration and development of unconventional gas throughout the state.

Andrews said the fracking ban will be introduced to the state's Parliament later this year. Until the legislation is passed, the existing moratorium on onshore unconventional gas exploration and development will remain in place.

Andrews went even further, saying his government also will extend the current moratorium on onshore gas exploration and development until mid-2020.

He said in the meantime extensive technical, environmental, and scientific studies on the risks, benefits, and impacts of onshore gas will be undertaken before a final decision on conventional work is made.

Andrews described the ban as "historic," "a first for Australia," and "just common sense."

He said, “Our farmers produce some of the world’s cleanest and freshest food. We won’t put that at risk with fracking. We have listened to the community and we’re making a decision that puts farmers and our clean, green brand first.”

A 2015 state parliamentary enquiry into the unconventional gas industry received more than 1,600 submissions, most of them opposing fracking.

### **Industry reactions**

Environmental groups are united in their applause of the government decision, but the Australian Petroleum Production & Exploration Association (APPEA) has slammed the move, saying the government had played politics.

APPEA Chief Executive Officer Malcolm Roberts noted that every independent scientific inquiry confirms that, properly regulated, unconventional gas is safe.

“Activist fear campaigns can create confusion and uncertainty in the community, but our political leaders have a responsibility to rise above such campaigns and support an honest, factual debate. The decision is short-term politics that will leave Victoria exposed to unnecessarily high energy prices.”

The Australian Energy Council also lamented the move, declaring it short-sighted and ignoring the important role gas will play in supporting renewables integration and reducing carbon emissions as the energy sector transforms.

The most surprising reaction to the ban came from the Labor government of neighboring South Australia.

South Australia Treasurer and Minister for Mineral Resources and Energy Tom Koutsantonis said he strongly believed that the approval or otherwise of gas exploration and extraction projects should be left to independent experts rather than to politicians.

Koutsantonis, a vocal advocate for unconventional gas exploration, said South Australia was open for business. “I encourage any exploration companies affected by this decision to consider coming to South Australia where the assessment and approval of projects is left to expert regulators,” he said. **OGJ**

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## Report estimates losses if US adopts ‘keep-it-in-the-ground’ policy

**Nick Snow**

Washington Editor

It would cost the US an estimated \$11.3 billion/year of royalties, 380,000 jobs, and \$70 billion/year of gross domestic product if proposals to stop oil, natural gas, and coal extraction from federal lands and offshore water were adopted, the US Chamber of Commerce’s Institute for 21st Century Energy said in a recent report.

Twenty-five percent of US oil, gas, and coal production would be halted under such policies that have been advanced by a number of environmental organizations, the institute said.

“American voters deserve to understand the real-world impacts of the proposals that candidates and their allies make,” said Karen A. Harbert, the Energy Institute’s president as the organization released the first report in its Energy Accountability Series on Aug. 24.

“In an effort to appeal to the ‘keep-it-in-the-ground’ movement, a number of prominent politicians have proposed ending energy production on federal lands, onshore and off,” Harbert said. “Their proposals will have a direct, harmful effect on the American economy, and in particular decimate several states that rely heavily on revenues from federal land production. Given the implications, these policy proposals should not be taken lightly.”

Certain states and regions would be disproportionately affected by a cessation on federal-lands energy development, the report noted. For instance, Wyoming would lose \$900 million in annual royalty collections, which represents 20% of the state’s annual expenditures. New Mexico could lose \$500 million, 8% of its total General Fund revenues. Colorado would lose 50,000 jobs, while the Gulf states—Texas, Louisiana, Mississippi, and Alabama—would lose 110,000, it said.

“Since 2010, the share of energy production on federal lands has dipped because of increasing regulatory hurdles from the Obama administration,” Harbert said. “Nevertheless, production on federal lands and waters still accounts for a quarter of all oil, gas, and coal produced. If that were to end, it would hit western and Gulf Coast states particularly hard, and could result in production moving overseas, which would harm our national security and affect prices.”

### **Two scenarios presented**

The report provides two scenarios. The first examines the economic output that would be lost or placed at risk if energy development was immediately stopped on all federal acreage. The second analyzes the cumulative impacts of immediately ceasing new leasing while leaving existing leases in place.

While the aforementioned figures apply to the first scenario, the second also has major impacts, with \$6 billion in lost revenues over the next 15 years, and nearly 270,000 jobs lost, the Energy Institute said.

The report uses publically available data on jobs, royalties, and production levels and the IMPLAN macroeconomic model. A technical appendix explains the methodology and sources of data.

The Energy Institute said that the report is the first in a series that will attempt “to better understand (and quantify where possible) the real world, economy-wide consequences of living in a world in which candidates’ rhetoric on critical



energy issues were to become reality.

“Too often, there is a temptation to dismiss statements made by candidates as things said ‘off the cuff, or in the ‘heat of the moment,’ or offered up merely to ‘appeal to their base.’ This is incredibly cynical, and it needs to change,” it said. “A candidate’s views and the things he or she says and does to win the support of interest groups have a real impact on how policy is shaped, and ultimately implemented.

“That is especially true on energy issues today, as groups continue to advance a ‘Keep It In the Ground’ agenda that, if adopted, would force our country to surrender the enormous domestic benefits and clear, global competitive advantages that increased energy development here at home have made possible,” the Energy Institute said. “Accordingly, candidates and public opinion leaders should be taken at their word, and this series will evaluate what those words mean.” **OGJ**

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## WoodMac cuts Norway capital investment forecast by \$50 billion

Research and consulting firm Wood Mackenzie Ltd. has slashed \$50 billion from its oil and gas capital investment forecast for Norway during 2016-20, reflecting the deferral or scrapping of more than 10 projects.

“Companies are seeking lower-cost solutions, be that from cheaper market rates or different development options,” commented Malcolm Dickson, WoodMac principal analyst for upstream oil and gas.

The firm notes that some 3 billion bbl in pre-final investment decision (FID) projects await sanction, and timing is crucial in determining the costs required for development. “The best time to FID from that point of view is before 2018, after which we expect demand to pick up in line with oil-price recovery,” Dickson said. “This will push costs up in the global supply chain, and there could be a demand crunch at that point.

“Mid-2017 is the bottom if you believe in oil-price recovery as we do,” Dickson said. “That means that cost inflation will begin to creep into fields from 2018 onwards. FID in the next year or so would make sense to capture lower costs. However, cost optimization can trump everything.”

Dickson said that “too many of those projects” break even at more than \$50/bbl, noting that “simplification, standardization, and optimization—not cyclical benefits—are the keys to new investment.”

Dickson observes many companies are now “moving to lower cost drilling techniques, scaling down vessel spec, and moving from large platforms to subsea.” Examples of optimization include more efficient drilling in exploration, with

wells drilled 50% faster than in 2013, along with new technological approaches such as Asgard’s subsea compression, which adds around 300 million boe to the project (OGJ, May 2, 2016, p. 56).

WoodMac cites as an example Asgard operator Statoil ASA as among the companies benefitting from use of standardized and simplified well designs to cut time and costs. The Norwegian oil and gas firm also on Aug. 29 reported plans for reduced spending and increased production capacity on Johan Sverdrup field (OGJ Online, Aug. 29, 2016). Statoil executives calculated Johan Sverdrup will be profitable at below \$25/bbl, down from the company’s February forecast of below \$30/bbl.

WoodMac’s research shows that subsea equipment, drilling, and seismic will see the most cost deflation in 2016. Based on the firm’s recent survey, independent oil companies are more optimistic about further deflation in 2017, while the supply chain foresees an earlier demand uptick curtailing deflation. **OGJ**

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## Renaissance gets fourth block in Mexico

Renaissance Oil Corp., Vancouver, BC, has signed a license contract for the formerly productive Ponton block in Veracruz, Mexico, and is preparing development plans to restart output.

Ponton, 25 km southeast of Panuco, becomes the fourth block Renaissance operates in Mexico. The others are in the Chiapas-Tabasco area.

Past production from the 2,965-acre Ponton block totaled 800,000 bbl of 34° gravity oil. The license, for which Renaissance received an option in Mexico’s mature-blocks auction in December 2015, covers the full stratigraphic column (OGJ Online, Jan. 4, 2016).

Pemex developed Ponton field with 14 wells in the 1970s. Production came from the Upper Jurassic San Andres formation, at an average reservoir depth of 1,266 m, and the Lower Cretaceous Tamaulipas Inferior formation, 925 m.

Renaissance has identified additional drilling and work-over opportunities. It is committed to drill one development well and conduct other development activities.

The company has opened field operations office in Villahermosa, Tabasco, near its Chiapas blocks, which produced an aggregate average of 1,700 boe/d in July, about 45% oil.

Renaissance completed a 90-day transition period to become operator with 100% interests in those blocks: Mundo Nuevo, Topen, and Malva. It has an agreement to sell production to Pemex.

On the Mundo Nuevo block, 42 km southwest of Villa-

hermosa, Tabasco, Renaissance has identified “numerous” development locations and is required to drill one well.

Mundo Nuevo field produces from a Middle Cretaceous fractured carbonate reservoir at an average depth of 2,580 m. Pemex drilled 14 wells in the field and produced as much as 15,000 b/d of natural gas liquids in the early 1980s.

Production last May was 215 b/d of light oil and 2.7 MMcfd of gas.

The Topen block covers 6,251 acres 45 km southwest of Villahermosa.

Pemex developed Topen field with five wells drilled into Upper Cretaceous fractured carbonate at an average depth of 3,300 m. Production peaked at more than 1,500 b/d of medium crude oil in the mid-1980s.

Average Topen production last May was 225 b/d of light oil and 500 Mcfd of gas.

Renaissance has identified development well locations, potential for field extensions, and a previous untested area supported by seismic amplitude analysis. Its work commitment includes one development well.

The 5,239-acre Malva block is 61 km southwest of Villahermosa. Malva field, an Upper Cretaceous limestone reservoir, produced more than 2,000 b/d of light crude in the late 2000s from four Pemex wells. Average reservoir depth is 2,680 m.

Malva produced 265 b/d of light oil and 2.7 MMcfd of gas in May.

Renaissance has identified further drilling and optimization opportunities for the field. It is committed to drilling two wells. **OGJ**

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## Agencies release SoCal winter energy reliability plan

**Nick Snow**

Washington Editor

California state and local agencies released an action plan to keep natural gas and electrical service reliable this winter in Southern California while operations remain limited at the Aliso Canyon underground gas storage facility near Los Angeles. They also scheduled an Aug. 26 public workshop about it in Diamond Bar, east of Los Angeles.

The Southern California Gas Co. operation remains prohibited from injecting and storing more gas until a comprehensive safety review is completed and the facility’s wells are deemed safe or removed from service, the California Energy Commission, California Public Utilities Commission (CPUC), California Independent System Operator, and Los Angeles Department of Water & Power jointly said on Aug. 22.

The action plan found that while risks to energy systems still exist due to the uncertainty of weather and system conditions without Aliso Canyon, conservation and other mitigation measures will help to meet the energy needs of Southern California this winter, they indicated.

Their announcement came as US Rep. Brad Sherman (D-Calif.), whose district includes the San Fernando Valley, recommended several steps to the Oil, Gas, and Geothermal Resources Division in California’s Department of Conservation to strengthen gas storage regulation in the Golden State.

The US Department of Energy and US Pipeline & Hazardous Materials Safety Administration launched an interagency taskforce to examine gas-storage safety in early April after a leak from the Aliso Canyon storage facility took months to stop and forced the evacuation of the nearby Porter Ranch housing division (OGJ Online, Apr. 4, 2016).

The four agencies said their plan calls for implementing 10 new measures to reduce the possibility of gas and power interruptions this winter. The measures are in addition to ones that were implemented this summer. They include:

- Encouraging gas conservation during cold weather.
- Strengthening the demand response program.
- Extending noncore balancing rules.
- Adding balancing rules for core customers.
- Establishing a maximum consumption level for power generators.
- Requiring reports on restoring pipeline service.
- Identifying additional gas supplies.
- Preparing to buy LNG.
- Updating the Aliso Canyon withdrawal protocol.
- Monitoring gas use at area refineries.

The Aliso Canyon facility, which is the state’s largest and ranks fifth nationwide, has operated for decades to provide gas to local customers and power plants, and has never before been constrained at current levels, the agencies noted. A CPUC order preserved 15 bcf of gas there for use during peak demand periods to avoid energy interruptions.

In his Aug. 22 letter to State Oil and Gas Supervisor Kenneth Harris, Sherman made several suggestions for the division’s gas storage program regulation discussion draft, including the idea that no one gas storage facility should be so large that its closure would adversely affect the statewide economy or cause a significant portion of the state to be without heating, cooling, or electricity.

He also recommended that each well have both a deep subsurface positive pressure safety valve and a surface safety valve so that wells can be shut off in the event of a leak, and that each well be equipped with appropriate gauges and monitors that the public could view online. **OGJ**

# Kentucky refinery implements rail transport system

**Robert Brelsford**

Downstream Technology Editor

Continental Refining Co. has expanded logistics for receiving and distributing petroleum products to and from its 5,985-b/d refinery in Somerset, Ky., by implementing the use of railcars linked to the Somerset Rail Park in Ferguson, Ky., along the Norfolk-Southern Railroad lines.

Alongside enabling both receipt of crude oil to the refinery and delivery of petroleum products to customers more efficiently, the use of rail-to-truck and truck-to-rail transloading via the rail park also will reduce overall inbound and outbound shipping costs for the company, Continental Refining said.

The refinery, which initiated the new intermodal transportation method on July 27, currently is using the system for delivery of gasoline-blending components as well as for delivery of transmix, a type of fuel produced when different fuels mix together in the fuel distribution system, the company said.

Part of the company's initiative to further broaden its national distribution in reach and efficiency, the expanded logistics system is scheduled for continued growth into this year's fourth quarter as the Somerset refinery increases its use of railcars to up to 10 cars/week, the independent refiner said.

Expansion of Somerset's logistics system follows Continental Refining's announcement earlier in the year that it will add a crude unit and hydrotreater as part of its strategy to increase production of low-sulfur fuels at the refinery (OGJ Online, Mar. 29, 2016).

While the crude unit will not alter the refinery's overall nameplate crude-oil processing capacity, it will help to triple its ability to process transmix, which is a more difficult fuel to process than other types and cannot be sold without additional processing.

Intended to further equip the refinery to prevent transmix fuel mixtures from creating bottlenecks in the fuel distribution system, the new crude unit was due to be completed sometime during this year's second quarter, the company said in March.

A proposed 3,500-b/d distillate hydrotreater designed to double the refinery's current naphtha hydrotreating capacity for processing high-sulfur distillate and boosting production of ultralow-sulfur diesel is scheduled to be completed by yearend.

The Somerset refinery previously completed upgrades to receive transmix for production of finished low-sulfur marine diesel in 2014, at which time Continental Refining said it would invest \$60 million through 2019 on additional upgrading projects at the plant. **OGJ**



Continental Refining Co. has expanded logistics for its 5,985-b/d refinery in Somerset, Ky. Photo from Continental Refining.

## Petrotrin makes 3D seismic available to oil, gas firms

**Curtis Williams**

OGJ Correspondent

Trinidad and Tobago's state-owned Petrotrin LLC has reported that it will make available to interested oil and gas companies the results of its extensive 3D seismic with a view to partnering in future exploration of its acreage.

In an interview with OGJ, Petrotrin Chairman Andrew

Jupiter revealed that the company is strapped for cash and short on technical expertise and therefore felt the best option was to move into greater uses of enhanced oil recovery and also make the 3D seismic available.

"Part of Petrotrin's strength is the acreage that we control. We have spent a lot of money acquiring data via a 3D seismic program," Jupiter said. "We believe that we should make the data available to our partners who have been



working with us as lease operators, or farmouts, but also to other companies that may have an interest. This is necessary because we believe that fresh eyes, fresh interpretation may help unlock more and more oil.”

Petrotrin on its web site has boasted that it had conducted the most extensive 3D seismic coverage in the history of its operations in both its Land North West District and Trinmar-North Marine operations offshore.

It said the results from these seismic surveys have informed a robust Petrotrin portfolio of drilling and exploitation opportunities both onshore and offshore.

The company also had enhanced the data by using prestack depth migration, which is a model-based seismic imaging methodology that works well for complex geological structures, such as subsalt layers and basement fractures. It is more expensive and time consuming, but is more likely to precisely determine the structure reservoirs.

Jupiter said Petrotrin was going after EOR because “where oil has already been produced there is more oil to be found.”

He said, “Most experts will agree that we have only produced somewhere between 15 and 20% of our oil in place. So in the past we have found oil and we have only been able to bring to market less than one fifth of the oil in the ground. We believe that using EOR, we will be able to produce another 10-15% of oil in place.”

He revealed that Petrotrin was in discussions with two companies that are interested in working with it to bring on additional crude oil using EOR.

Jupiter added that Petrotrin has approved Range Resources Inc. using EOR on two farm-out fields that it operates on behalf of Petrotrin as it tries to get more oil out of the ground. **OGJ**



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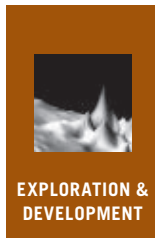
# Iran seeks field revitalization, new development

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Oklahoma State University  
Stillwater, Okla.



The National Iranian Oil Co. (NIOC) aims to boost production by 1 million b/d from green fields. In the absence of production data, the only viable method to estimate a field's production potential is reservoir modeling, which is time-consuming. Analysts prefer an early estimate of the production potential of newly discovered or undeveloped fields for future planning or preliminary production design. In the case of Iran, such an estimate would also be helpful to exploration companies.

Iran's proven reserves at end-2014 measured 1,201.4 tcf, 18.2% of the global total. Iran's 157.8 billion bbl of proven oil reserves are the fourth largest worldwide.<sup>1</sup> International sanctions against Iran hindered investment by major operating companies in the country's oil and gas fields. The US and EU lifted sanctions on Iran in January 2016.

Production of newly discovered fields remains problem-

atic in many regions. More than 90% of new offshore discoveries in the past 10 years have been oil fields. The high cost of drilling and completing offshore wells makes gas fields less attractive to investors. A successful discovery well, depending on the size of the field, often requires additional wells to delineate the resource and collect data about productive formations within the reservoir. Production from a new field can often take up to 5 years to start.

This article investigates the ultimate production potential of Iran's oil and gas fields with a focus on the current state of Iran's oil and gas industry and the country's proposed petroleum contract framework.

## New opportunity

Exploration companies are looking at new investment opportunities in Iran's oil and gas fields now that sanctions have been lifted.

Many independent oil companies viewed Iran's current buy-back framework as higher risk than alternatives presented in other Middle Eastern countries.

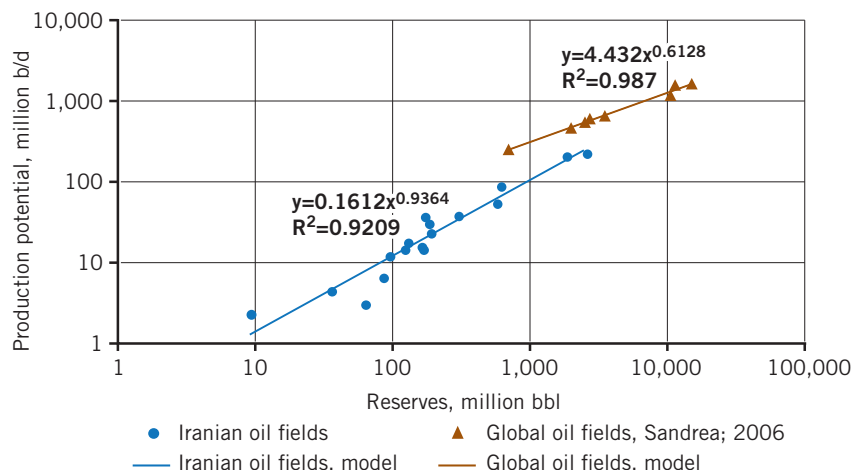
The new Iran Petroleum Contract (IPC) was announced during the Tehran Summit in November 2015. According to NIOC, the draft of the IPC has already been shared with some of the major petroleum companies for review and feedback.<sup>2</sup> The major objectives of the new contract are to attract

foreign investment, encourage the rapid development of shared oil and gas fields, increase production levels through improved oil recovery (IOR) and enhanced oil recovery (EOR) methods, and promote the transfer of technology through partnerships and training. NIOC is offering 24 project packages containing 50 field development plans under the new contract, including 30 undeveloped fields. It has also introduced 18 new blocks for exploration and development.<sup>2</sup>

Table 1 lists the gas fields proposed by NIOC for the IPC, holding 213 tcf of gas-in-place. Iran's gas production is about 16.7 bcfd.<sup>1</sup> Total gas production is expected to increase by 13.4 bcfd, an 80% jump, by virtue of the IPC.

## OIL PRODUCTION COMPARISON

FIG. 1



Iran has the largest gas network in the Middle East, its more than 22,000 km of high-pressure pipelines giving it the potential to become a regional gas hub.

More than 70% of Iran's oil production comes from fields greater than 50 years old. To compensate for an 8-10% decline rate due to natural depletion, the country needs major investment.<sup>3</sup> Iran's Petroleum Minister last year announced that Iran needs to attract \$180 billion to revive its oil, gas, and petrochemical industries by 2020. NIOC expects to increase crude oil production to 5.7 million b/d from redevelopment projects within 3-5 years.

The initial oil-in-place volume of the IPC-proposed oil fields, mainly located onshore, exceeds 210 billion bbl (Table 2). Most of these fields are developed, producing a combined 884,800 b/d. But the NIOC report does not declare the production potential of the developed fields, which must be determined by the contractors. NIOC is urging operators to evaluate the possibility of using enhanced oil recovery methods such as gas lift, downhole pump, or hydraulic fracturing to optimize production.

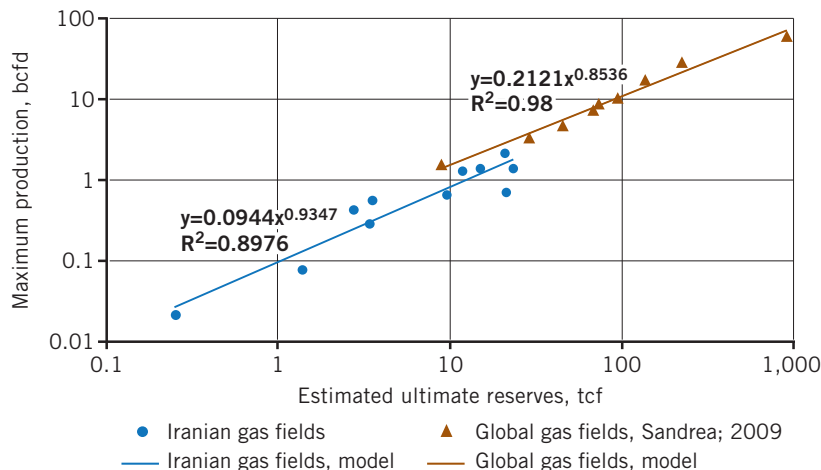
### Oil production

This article draws a correlation between production potential and ultimate reserves in some of Iran's developed oil and gas fields, referencing three independent studies of oil and gas fields in other regions published in Oil & Gas Journal by Rafael Sandra. In 2006, the study "Early new field production estimation could assist in quantifying supply trends," (OGJ, May 22, 2006, p. 30) showed the relationship between ultimate recovery and peak production in mature fields. In 2009, Sandra published "New tool determines reserves of mature oil and gas fields" (OGJ, Mar. 23, 2009, p. 33) and "Equation aids early estimation of gas field production potential" (OGJ, May 22, 2009, p. 34). These articles combined provide a substantial tool to reasonably predict oil and gas reserves in Iran's aging fields.

The plateau production level is defined as 85% of the maximum production value of a given field and is associ-

## GAS PRODUCTION COMPARISON

FIG. 2



## NIOC'S PROPOSED IPC GAS FIELDS

Table 1

Field	Gas in place, bcf	Estimated gas production, MMcfd	Estimated condensate production, thousand b/d
Karun	2,369.00	120	10.00
Qaleh-Nar	1.10	80	9.00
Kuh-e-Asmari	0.95	30	0.18
Ahwaz	2.30	100	31.00
Karanj	1.00	60	2.60
Pazanan	3.00	200	10.00
Bibi-Hakimeh	2.30	135	9.70
Binak	1.20	50	6.80
Milaton	1.20	55	4.80
Halegan	4,630.00	440	5.90
Sefid-Baghon	2,370.00	160	4.20
Sefid-Zakhor	8,291.00	353	5.50
Dey	1,753.00	180	2.50
Aghar, 2nd phase*	25,790.00	776	4.70
Tang-e-bijar*	8,170.00	106	2.97
<b>Total onshore</b>	<b>53,386.05</b>	<b>2,845</b>	<b>109.85</b>
Farzad-A	10,488.00	1,000	—
Balal	6,250.00	500	—
North Pars	57,068.00	3,600	—
Golshan	22,500.00	2,000	—
Ferdowsi	8,800.00	500	—
Kish	55,000.00	3,000	—
<b>Total offshore</b>	<b>160,106.00</b>	<b>10,600</b>	<b>—</b>
<b>Total</b>	<b>213,492.05</b>	<b>13,445</b>	<b>—</b>

\*Developed fields.  
Source: Compiled from IPC, 2015

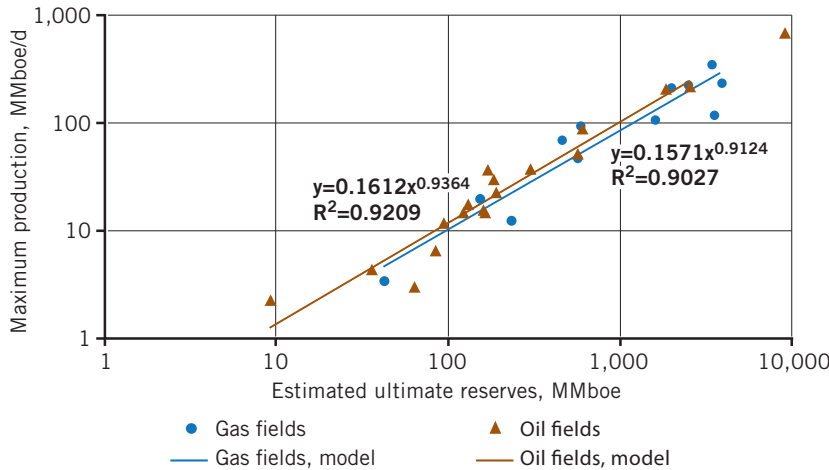
ated with a period of flat production.<sup>4</sup> Previous studies have shown a strong correlation between ultimate recoverable reserves (K) and the maximum production potential of oil or gas fields ( $q_{max}$ ) (see equation), where  $\alpha$  and  $\beta$  are constants to be determined through curve fitting of the model with available data from previously developed fields. The units for K and q are millions and thousands of b/d of oil, respectively. Knowing the reserves and the annual production potential of a field, one can also obtain field depletion rate.<sup>4</sup>

Sandra's first study analyzed the production history of eight oil fields having reliable production histories. The



IRAN OIL, GAS

FIG. 3



EQUATIONS

$$q_{\max} = \alpha K^{\beta}$$

posed model to predict the maximum production of 18 newly developed fields around the world. The average variation between the model prediction and the field data was 17.5%. Some researchers have argued that published values of production potential for newly developed fields often correspond to “name-plate” production capacities and do not reflect the peak production capacity of a given field (OGJ, May 22, 2006, p. 30).

NIOC'S PROPOSED IPC OIL FIELDS

Table 2

Field	Oil in place, million bbl	Current production, thousand b/d	Estimated production, thousand b/d
Susangerd	6,996	—	30
Jufair	3,514	1.3	17
Sepehr	838	—	15
Band-e-Karkheh	3,468	—	15
Arvand	1,114	—	10
Sohrab	736	—	5
South Azadegan	25,642	50.0	600
Changuleh	2,367	—	50
Darquin Phase 3	2,566	—	60
Darquin Phase 1, 2	5,379	150.0	160
Aban	138	9.0	tbd*
Paydar	1,047	5.5	tbd
West-Paydar	952	28.0	tbd
Danan	3,738	8.0	tbd
Cheshmeh-Khosh	3,740	72.0	tbd
Dalpari	367	14.0	tbd
Naft-Shahr	580	5.5	tbd
Sumar	441	0.5	tbd
Dehloran	5,184	24.0	tbd
Ahwaz-Bangestan	37,280	180.0	tbd
Mansuri-Bangestan	15,142	60.0	tbd
Ab-Teymour	15,258	60.0	tbd
<b>Total Onshore</b>	<b>136,487</b>	<b>667.8</b>	<b>tbd</b>
South Pars oil layer	4,163	—	65
Ferdowsi	31,700	—	70
Golshan	4,505	—	25
Salman	4,148	47.0	tbd
Foroozan	3,432	27.0	tbd
Soroosh	14,230	46.0	tbd
Nowrooz	4,201	28.0	tbd
Dorood	11,007	69.0	tbd
<b>Total Offshore</b>	<b>77,386</b>	<b>217.0</b>	<b>tbd</b>
<b>Total</b>	<b>213,873</b>	<b>884.8</b>	<b>tbd</b>

\*tbd = to be determined. Source: Compiled from IPC, 2015

Production model application

The study underlying this article performed a similar analysis, selecting some of Iran’s oil fields from the literature.<sup>5</sup> In most cases, these fields had more than 40 years of reliable production history. Reservoirs selected for the analysis included only limestone, dolomite, and lime reef rock types with medium to strong aquifer support.

Fig. 1 compares a correlation obtained from selected oil fields in Iran with selected oil fields in Sandra’s 2006 study. Fields in the current study ranged from 93,000 b/d to 224,000 b/d production, with a correlation coefficient above 0.92. Although the slope of the trend line for the Iranian oil fields is higher than that of the 2006 study’s fields, the intercept with the vertical access is much lower.

Extrapolation of the correlation obtained for the selected oil fields in the 2006 study may not be appropriate, however, since the proposed correlation over predicts. The peak production potential of Iran’s oil fields is also questionable. Lack of investment after

fields’ oil reserves ranged from 0.7 to 15 billion bbl (OGJ, May 22, 2006, p. 30). The coefficients  $\alpha$  and  $\beta$  were obtained by plotting the maximum production vs. the estimated ultimate reserves of the fields (Fig. 1). The correlation coefficient ( $R^2$ ) is above 0.987, and the average difference between the model prediction and the actual data is 5%.

A similar correlation verified the reliability of the pro-

Iran’s revolution and the Iran-Iraq war are the two main factors that contributed to the selected fields’ low performance.

Gas production

The 2009 study applied the same model to a group of seven mature giant gas fields in the US and UK (OGJ, May 22, 2009, p. 34). Reserves were already determined by decline

rate analysis. For gas fields,  $q_{\max}$  is expressed in billions of cubic feet/day and K in trillions of cubic feet. Reserves for selected fields ranged from 9 to 920 tcf.

This study took a similar approach for some of Iran's onshore gas fields. Fig. 2 compares the trend of Iran's gas fields with that presented in the 2009 study. The curves show a similar slope, but the intercept of Iran's gas fields with the vertical axis is lower than that of the selected US and UK gas fields. Performance of the gas fields used in the previous study was well-correlated despite having reserves greater than 10 tcf. The pattern for Iran's gas fields is more sporadic.

The global trend suggests a higher production potential for Iran's gas fields. This discrepancy can be attributed to technical or economic difficulties related to gas production in Iran. Maximum production from Iran's gas fields has also been limited by domestic demand's seasonal nature. Although most of country's gas fields were developed after the Iran-Iraq war, limited resources deprived Iran of proper field development.

US sanctions, the lack of investment in field maintenance, and scarcity of rigs also contributed to lower field potential. Ultimate reserves for some of these fields have been revised, signifying uncertainty regarding ultimate recovery. Upward revisions of reserve estimates for the Aghar and Tang-e-bijar fields, proposed recently for inclusion in the IPC, suggest that their maximum production potential (and that of other Iranian fields) has not been fully achieved.

The comparison study from 2009 compiled all the data (a combination of sandstone and carbonate reservoirs in oil and gas fields) into a single plot using barrel-oil equivalents. An intersection between the oil and gas trend lines occurred at 10 billion boe (60 tcf), but the author initially expected to observe a parallel line for oil and gas fields.

In a similar approach, this study selected Iranian oil and gas fields with limestone and dolomite as the main rock type. Contrary to the 2009 study, the trend lines of Iran's oil and gas fields are almost parallel (Fig. 3). The production potential of Iran's oil and gas fields is lower than the global pattern, but the results confirm the intuitive expectation that the trend line for oil and gas fields would be parallel.

Production performance in some of Iran's oil and gas fields reveals a relation between ultimate reserves and production potential. The proposed relations are applicable for oil fields with reserves of 0.1-2.5 billion bbl, and for gas fields with reserves of 0.3-23 tcf. The model presents a quick estimate of the reserves for developed fields in the region. Such estimates provide informative analysis for exploration companies considering the oil and gas fields newly included in the IPC. **OGJ**

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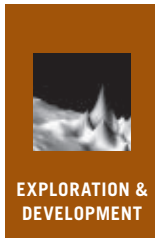
Zahra Minager (minagar@okstate.edu) is a graduate student at Oklahoma State University, Stillwater, Okla. She holds a BS degree in mathematics from Islamic Azad University, Iran.



# Cross-border reserves development benefits from collaboration on rules, fiscal regimes

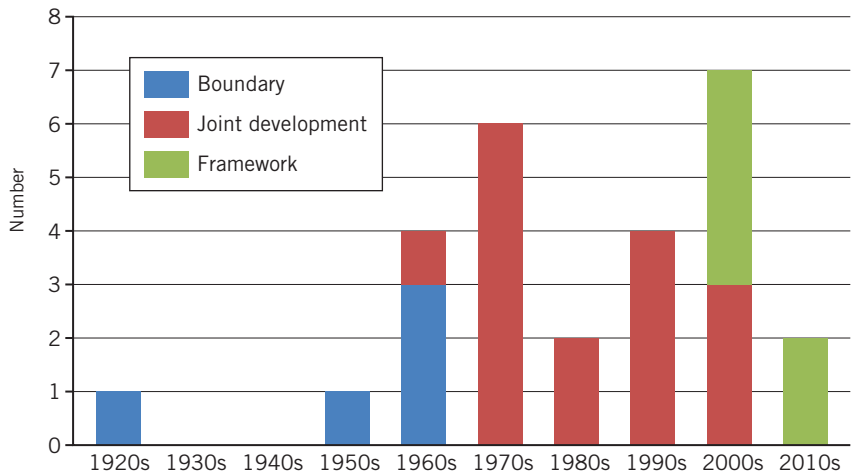
**David Auty**  
**Carlos Canales**  
 Canales Auty  
 Mexico City

Framework agreements for transboundary hydrocarbon resources (THR) can provide access to new acreage in potentially attractive areas. In December 2012, a minority staff report from the US Senate Committee on Foreign Relations reported that Mex-



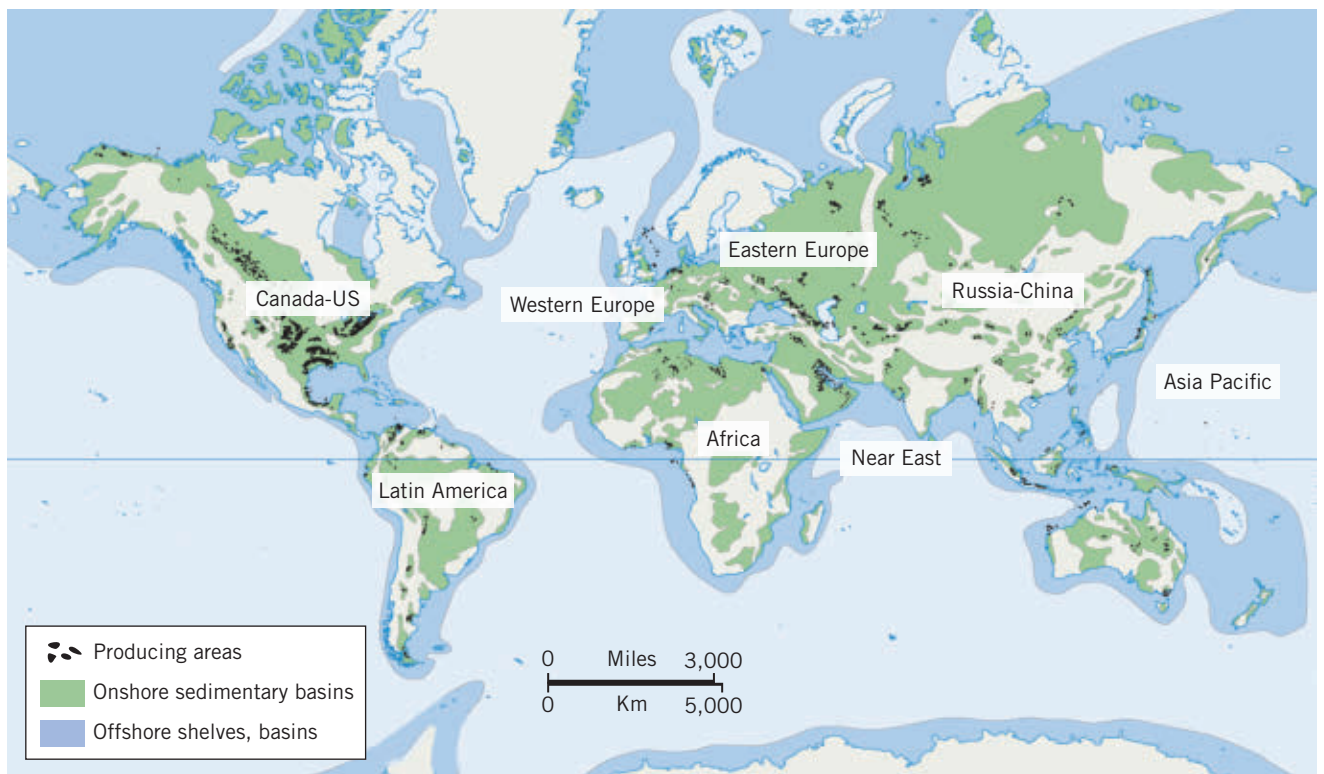
**TRANSBOUNDARY HYDROCARBON AGREEMENTS**

FIG. 1



**GLOBAL BASINS**

FIG. 2





ico could double its estimated 10.5 billion bbl of proven oil reserves once the country's unconventional and additional deepwater resources become proven. The 2014 US-Mexico agreement opened more than 1.5 million acres in the Gulf of Mexico that were previously off limits because of border issues.

According to the International Energy Agency (IEA), 60% of oil and gas producing countries have reserves which either straddle defined international boundaries or are in contested regions. Geopolitical and environmental uncertainties introduced by cross-border plays make companies reluctant to explore them.

As a result, large areas remain undeveloped. Progressive governments aware of these issues have sought to resolve them and expedite oil and gas development.

### Political boundaries

Political boundaries are governed by the United Nations principle of permanent sovereignty, which provides nations the right to freely exploit their natural resources in accordance with national interests. In the subsurface, oil and natural gas does not adhere to political demarcations. Resources migrate across borders as reservoir fluids move from high to low pressure areas.

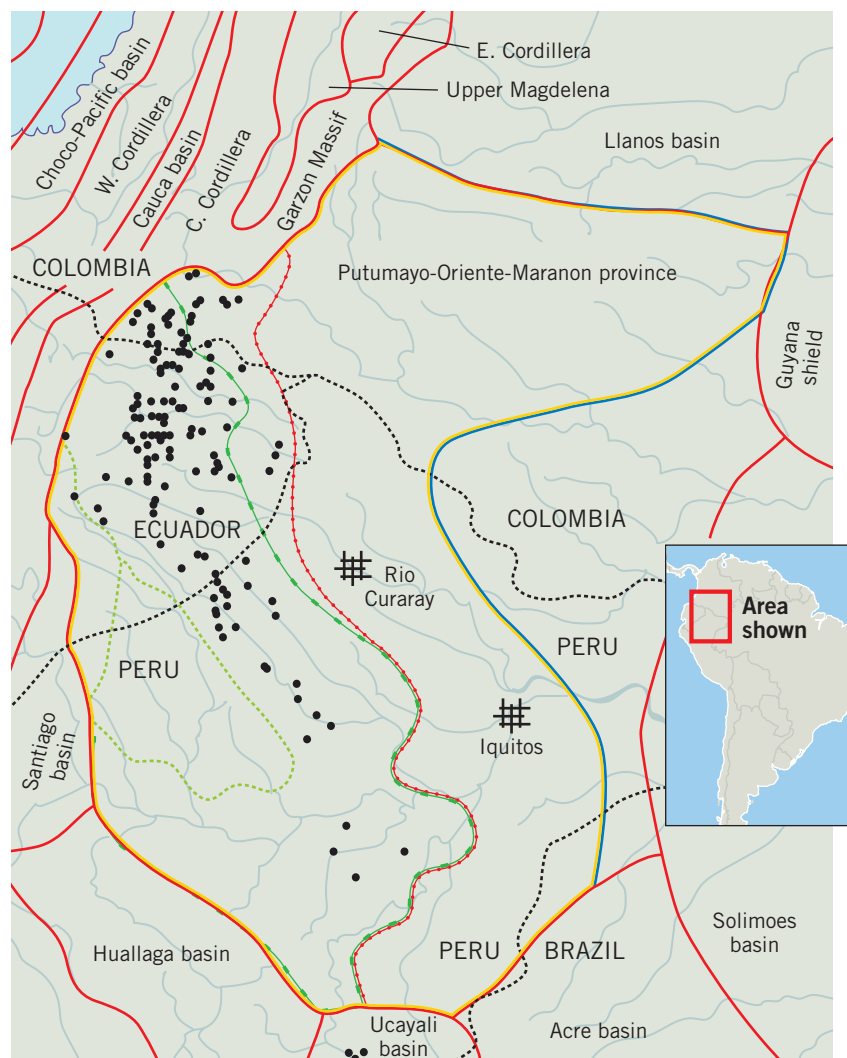
Sovereign nations unitize reserves covering multiple blocks within their borders under compulsory national laws, but internationally there are typically no such obligations.

With large financial gains at stake, political disputes concerning sovereignty of THRs are common. The risk of such disputes often deters investors and can make financing exploration and development nearly impossible. For example, a sovereignty dispute between Venezuela and Guyana is affecting Exxon's Liza-1 discovery (OGJ Online, May 20, 2015). The International Court of Justice will hear in September 2016 a similar maritime border dispute between Kenya and Somalia.

Since the early years of the oil and gas industry governments have benefited from working together to make exploration investments more secure in border regions (Fig. 1). Initial bilateral agreements were simple such as the 1958 Bahrain-Saudi Arabia boundary agreement establishing equal sharing of the net revenue from oil production.

## MARANON BASIN THRS

FIG. 3



Over time, however, agreements have become more robust in establishing a clear regulatory framework for both exploration companies and the financial community. In many cases, these initial boundary agreements have developed into joint development agreements for hydrocarbon reservoirs in areas of contested sovereignty and, more recently, framework agreements for THRs along undisputed boundaries.

### Onshore application

Opportunities exist globally for THR agreements (Fig. 2). Modern framework agreements such as the US-Mexico, UK-Norway, and Trinidad and Tobago-Venezuela agreements have focused on offshore areas. Some of the precursors to these agreements—the boundary agreements between Saudi Arabia, Kuwait, and Bahrain—apply to onshore exploration and development. These early agreements identified ar-

## MEXICO-US ONSHORE THRS

FIG. 4



areas where hydrocarbon resources would be shared equally but did not address regulatory frameworks and coordination between governments. The continued need for onshore framework agreements is perhaps greater than in offshore areas. Onshore operations are more visible and the general public is more likely to raise objections, particularly over environmental and social issues. Sensitive rainforest regions are areas in which THR treaties could benefit onshore operations. Public pressure could result in developing policies centered on conservation. Alternately, exploration companies can provide expertise and, with government cooperation, build an effective development framework.

The Marañon basin is in the dense rainforests shared by Colombia, Ecuador, and Peru (Fig. 3). The region has the potential to share infrastructure such as the North Peruvian Pipeline. The proper development framework could bring about the cost reductions and limited environmental im-

pacts needed to attract investment.

Mexico's unconventional basins (Fig. 4) have seen limited exploration activity but data show the border region has similar potential to the adjacent Eagle Ford shale in the US. A framework agreement similar to the US-Mexico offshore agreement could further unconventional development in northern Mexico.

Kenya, Tanzania, Uganda, and Somalia share basins and would benefit from framework agreements (Fig. 5) and the subsequent likely reduction of political conflict. The dispute between Kenya and Somalia regarding their maritime border has deterred investors from this region's Lamu basin for more than 6 years.

Oil and gas companies should increase their understanding of regional issues and help governments improve development frameworks. Governments should focus on providing a regulatory environment attractive to exploration capital.

### Acreage opportunities

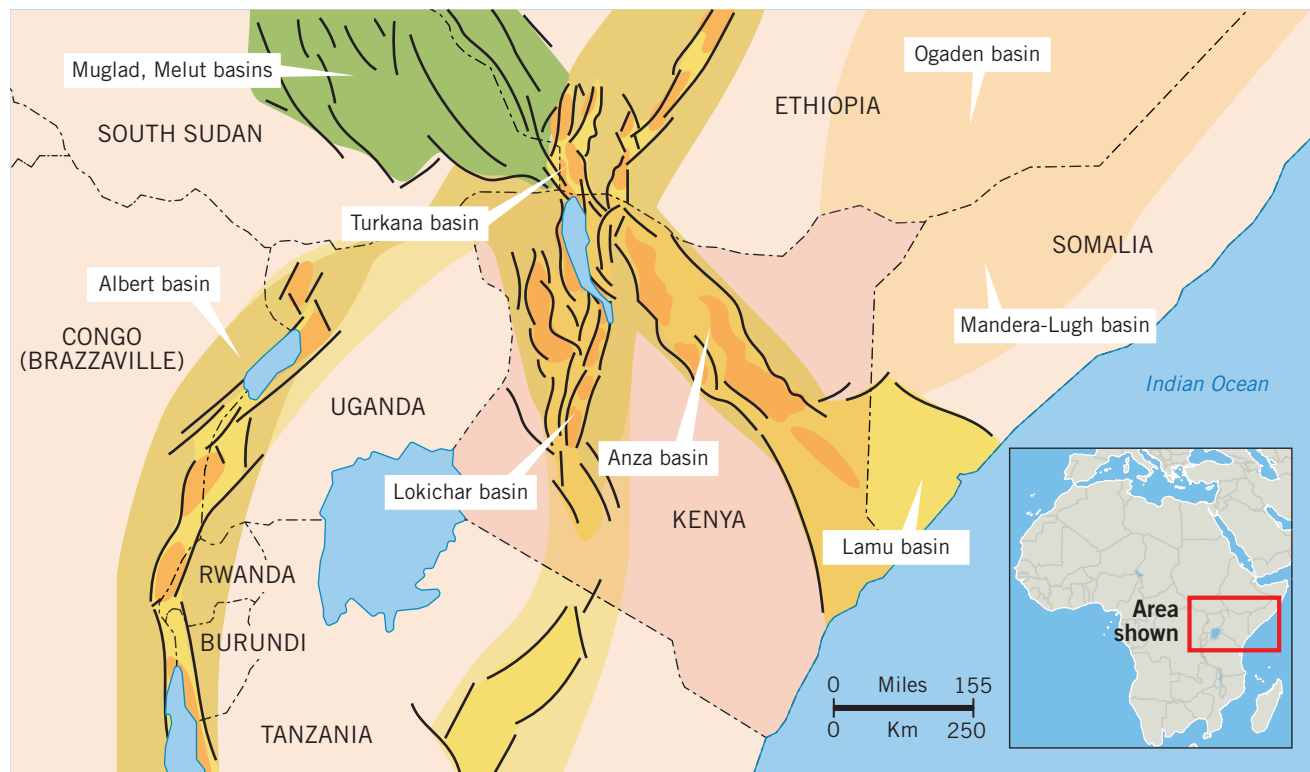
In recent years exploration companies have moved toward unconventional plays and frontier regions. These operations often incur higher risks and costs. Many THRs, however, are found in traditional oil and gas producing countries with low political risk and frequently in basins where a large amount of geophysical data

and analysis has already been conducted for other producing fields. This reduces exploration and production costs, making THRs attractive investment targets. The governments of the UK and Norway understood this when they developed a regulatory framework to attract investment to marginal THR fields in the North Sea in 2006 (OGJ Online, July 11, 2005). This framework allowed development of the Enoch and Blane fields by Paladin Resources.

In 2014 the US and Mexico developed a framework for the highly technical and costly deepwater THRs in the Gulf of Mexico. The framework covers the maritime border within the Perdido fold belt, where Petroleos Mexicanos (Pemex) estimates reserves of 8-13 billion bbl of oil. The Tiaras-1 field, the first development to which the framework was applied, is 3 km south of the international border and within 15 km of Royal Dutch Shell PLC's Perdido field complex. Pemex discovered noncommercial indications of

## AFRICA ONSHORE THRS

FIG. 5



oil and gas in April 2016. But the results were otherwise encouraging and further exploration activity is expected in the area.

### Cross-boundary development

THR development requires collaboration among the governments involved and exploration companies interested in exploring these resources. Fully understanding the risks, jointly developing solutions to the identified problems, and outlining the benefits to all parties is paramount to successful THR exploration and development.

Most of the difficulties involved center on issues of sovereignty and investor security. Each THR will have its own specific version of these issues requiring a tailored solution. Exploration companies capable of presenting concise development plans that cater to these concepts will find governments are willing to establish clear regulatory frameworks to minimize operational risks, making THR projects executable.

### Sovereignty, cooperation

THRs present governance problems by nature. Existing agreements have developed a best practice approach that establishes a joint commission of high-ranking government officials to oversee THRs and make decisions on matters such as approving unitization agreements (Fig. 6).

These commissions are often too distant to manage day-to-day activities or review technical matters, requiring subcommittees to report on these issues and make recommendations. The subcommittees are not necessarily permanent and may cover a wide range of topics such as geophysical analysis, regulations, and operational compliance.

To ensure proper governance, subcommittees include technical experts both from the involved governments and independent parties. Disputes on technical matters, such as the existence and extent of a THR and the subsequent reserve allocation, are typically resolved by an independent expert, often with authorization to make binding decisions. To resolve disagreements between the governments over nontechnical matters a tribunal or arbitration may occur.

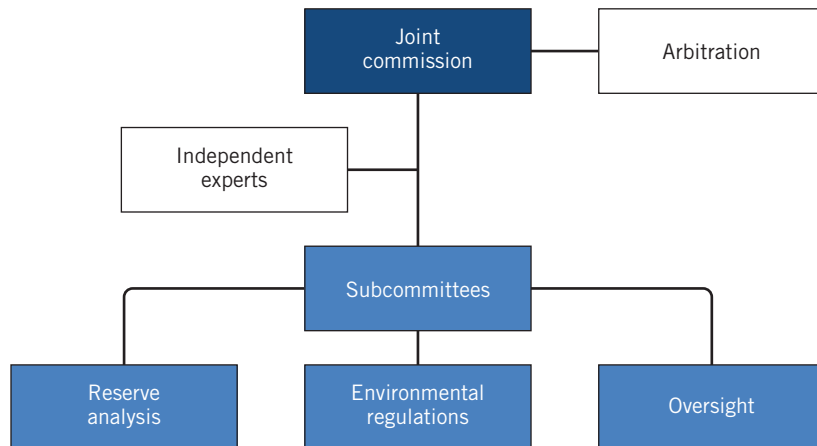
Projects are affected by the clarity and transparency of governance, and analysis exposes failings in most modern THR treaties. The Trinidad and Tobago-Venezuela agreement, for example, failed to establish timeframes for making exploration decisions and governing committees with timeframes have not adhered to them. Only two steering committee meetings have occurred in 6 years. The agreement initially required bimonthly meetings.

In the case of the US-Mexico agreement, uncertainty as to whether joint commissions are required to make



## THR AGREEMENT ORGANIZATION

FIG. 6



unanimous or majority decisions could generate delays and provide grounds for legal action. Failure to understand these risks can increase the potential for political problems and limit THR treaties' success.

Exploration companies are reluctant to commit resources to seismic acquisition and drilling with no clear framework in place ensuring a stable investment environment. To avoid inactivity of this type, governments have an imperative to establish a methodology for reserve allocation once exploration proves the resources. Advanced THR treaties evaluate a reserve allocation proposal made by the operators based on the exploration data. The fiscal implications of these data, however, can often lead governments to question an operator's motives.

Each government will also have different levels of knowledge and capabilities and varying goals for resource development. Companies that can develop unique approaches to manage the sometimes difficult relationships between neighboring countries will be more successful in THR projects.

Operators gain knowledge across the project life cycle. Knowing when and how reserves allocation should be updated is vital for all parties, given its effect on fiscal take for the governments and financial returns for the operators.

### Rules, boundaries

Capital investments require clear rules. Sovereignty concerns in THR projects are a source of uncertainty, exposing the operator to multiple sets of potentially conflicting regulations. Governments should define THR's location and jointly agree on a single set of regulations within this area.

Establishing too small an area could place some THRs outside the agreed upon acreage. The US-Mexico agreement established an area within 3 miles of the delimitation line. Presumably, Mexico and the US would argue the law of capture applies for THRs beyond the 3 miles, but the uncertainty

creates additional risks, potentially deterring future investments in exploration and development.

Underlying fiscal terms are vital to successful THR agreements. Options include developing a new fiscal regime for the specific THR or applying each country's existing fiscal system to the reserve allocation on a proportional basis. The former of these would be more desirable for exploration companies as it would simplify development, but the politics involved are complex and time consuming. As a result, the latter is normally the case.

Reserve allocation can expose complications in the governing process. The operator normally proposes

the reserve allocation, which can be a conflict of interest as the greater portion of reserves could be allocated to the more favorable fiscal regime. As reservoir knowledge improves, reallocation may become necessary, potentially altering the financial outcome of future production and ultimately the proportion of profits divided by all parties. When fiscal systems are applied proportionately, exploration companies should include constraints on future reallocations to mitigate profitability risks.

Rules guiding environmental policy, public participation, supervision, and oversight should also be clear. Development plans, approval processes, and other operational regulations need to be identified. Many of these may not have an impact on long-term profitability, but in the absence of a clear understanding, deviation from the stated policies could affect a project severely. As an example, imagine an incident such as the Macondo blowout if it occurred in a transboundary region. Conflicts in supervision, regulations, and oversight in the event of a crisis could lead to delayed mitigation, long legal cases, project delays, and higher costs.

Subcommittees responsible for developing regulations within THRs should receive ample legal and technical support.

### Field development

Proper reservoir management benefits operators and governments as the increased production generates more revenue and broadens the tax base.

Some agreements mandate the shared use of infrastructure. Rather than treating each field as an individual project, agreements may require open access to other infrastructure to avoid the waste of constructing new platforms, pipelines, and gathering systems. Regardless of ownership, it may be more efficient to expand capacity of existing in-

frastructure, reducing capital costs and environmental degradation by limiting infrastructure redundancies.

Most THR agreements also apply mandatory health, safety, and environment (HSE) rules. Clarity on conservation and environmental regulations provides further security of investment. Where transnational regulations are involved, best practices can be subjective and uncertainties or disconformities should be well-defined.

In recent years, holistic environmental assessments have been deployed to assess the link between exploration, its cost and benefits, and its eventual impact on the local environment. In the UK and Norway, strategic environmental assessments are tools by which the governments determine environmental policies, programs, and plans to provide a basis for an environmental impact assessment (EIA).

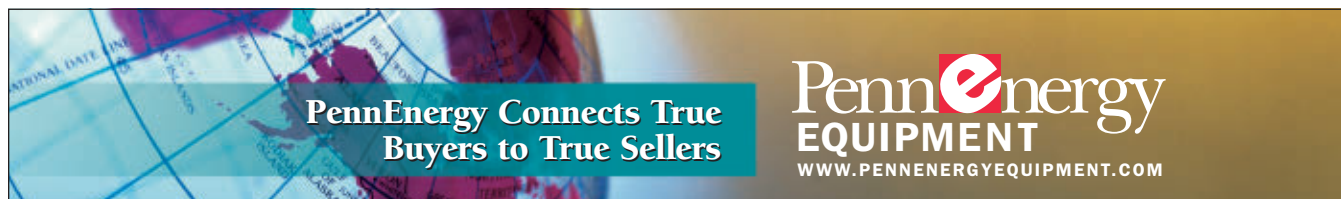
EIA components such as subsequent mitigation actions and monitoring procedures need to be interpreted. When a THR agreement includes the environmental legislation of more than one country, the regulations and guidelines that will govern the agreement must be made clear. **OGJ**

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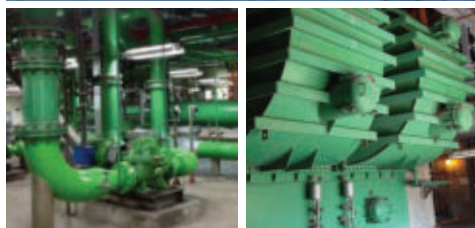
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**BHP Billiton** saved costs by eliminating one intermediate casing string in a Delaware basin field test. Photo from BHP Billiton.

## BHP eliminates intermediate casing string in Permian pilot

**Paula Dittrick**

Upstream Technology Editor

BHP Billiton Petroleum eliminated an intermediate casing string in a Permian basin pilot by switching to an oil-based mud (OBM) from a water-based mud.

Legacy casing design involved four strings, including two intermediate casing strings in the vertical part of the well.

The switch to OBM enabled use of only one intermediate casing string, which saved casing and service costs and reduced rig time.

Luke Bibler, BHP drilling engineer, told OGJ, “Invert emulsion fluids are a viable option for certain Permian basin wells.”

Good offset control and knowledge of area injection wells is key, he said. If water flow from injection wells is higher than 10 bbl/hr, BHP’s cost to maintain the drilling fluid becomes too high.

A three-well pilot in July 2015 provided BHP with \$114,000 in savings on State Pish lease in Reeves County, Tex. The lease is near Orla, about 40 miles north of Pecos, Tex.

When BHP’s Permian basin program reaches development mode, OBM likely will be deployed where practical, Bibler said. “In the current oil-price environment, the cost of tangibles such as





casing, casing accessories, and services has depressed significantly,” Bibler said. “This has decreased the [proportion of] savings obtained by eliminating the 9<sup>5</sup>/<sub>8</sub>-in. casing string.”

BHP has one drilling rig working in Permian’s Wolfcamp shale, which offers a variety of geological zones. Horizontal drilling and hydraulic fracturing have made Wolfcamp’s development feasible.

BHP has increased its Permian liquids production while slowing development activity in the Delaware basin. Andrew Mackenzie, BHP Billiton Ltd. chief executive officer, said BHP has responded to low oil prices by reducing onshore US rigs. “We are well positioned to bring on shale volumes as markets tighten,” MacKenzie told analysts during a June earnings call.

## 4-STRING LEGACY DESIGN, WOLFCAMP

FIG. 1

Casing Size	4-string design	Formation	Mud
11 <sup>3</sup> / <sub>8</sub> -in. 47-lb-ft J55		650-ft estimated groundwater protection depth	8.5-9.2 ppg spud mud
9 <sup>5</sup> / <sub>8</sub> -in. 40-lb-ft J55		2,800-ft Lamar, potential salt water flows	9.5-10 ppg brine
7 <sup>5</sup> / <sub>8</sub> -in. 29.7 lb-ft P110		4,800-ft Brushy Canyon 6,500-ft Bone Springs 7,000-ft Mid Avalon, natural fractures, sensitive to high mud weight 9,600-ft Wolfcamp 9,700-ft X sand	8.9-9.1 ppg cut brine

Source: BHP Billiton

### Eagle Ford knowledge swap

Eliminating an intermediate string in

## Wood Mackenzie says Delaware basin oil offers economic potential

**Paula Dittrick**

Upstream Technology Editor

At least one analyst believes the Wolfcamp shale, particularly the Delaware basin within the Permian basin, offers among the best economic potential of tight oil plays to help sustain US operators through distressed oil prices. Benjamin Shattuck, analyst with Wood Mackenzie Ltd. in Houston, said focus on the Wolfcamp play has shifted since 2014 from the Midland basin to the Delaware basin, which straddles West Texas and New Mexico.

“Operators are talking the most now about the Delaware,” Shattuck told OGJ, adding that cost reductions and productivity improvements continue in the Midland basin.

During recent earnings calls, operators touted Delaware basin efficiency improvements in both drilling and completions. “I would certainly agree with that,” Shattuck said. “Service prices are down roughly 40-45%. Operators are drilling much faster. Average penetration rates in the Delaware basin are up 20-25%

compared to 2 years ago. A well that would have cost \$10-11 million to drill 2 years ago is going to be closer to \$6.5-7.5 million today.”

A few operators have drilled 10,000-ft laterals in the Delaware basin, Shattuck said, adding that the Delaware presents more completion complexities for operators than the Midland basin.

“It’s a much deeper formation in the Delaware, which makes it more difficult from a technical perspective to drill out that far,” Shattuck said. “Operators just are not seeing quite the same replicability,” in the Delaware basin as they have in the Midland basin.

He noted some leasing terms constrain lateral lengths in the Delaware basin to 4,500-5,000 ft. “It’s a very fragmented leasing pattern out there,” Shattuck said. “Building a position that would support longer laterals has been at the forefront of some operators minds, but it is still a limiting factor in a lot of cases today.”

The Permian basin has a larger inventory of wells with superior economics than other tight oil plays,

### ESTIMATED INDUSTRY SPENDING, 2016

Play	\$ billion
Midland Wolfcamp	7.29
Delaware Wolfcamp	2.56
Delaware Bone Spring	5.97

Source: Wood Mackenzie Ltd.

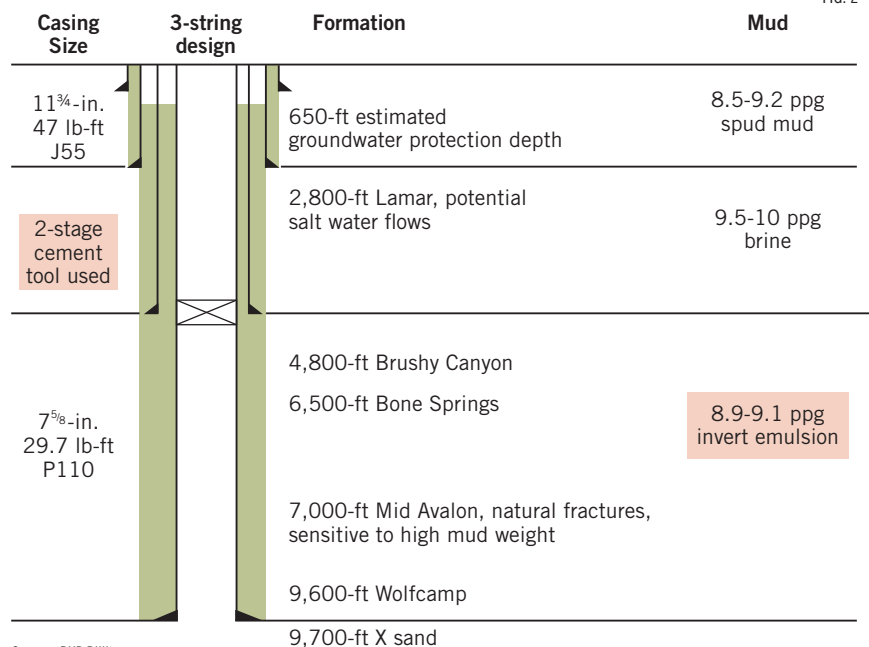
he said. “It’s a juvenile play from the unconventional perspective,” which has helped keep operators interested in the Permian. “It would be the oldest play from a conventional perspective.”

WoodMac’s expectations for producers’ 2016-17 spending in the Permian basin have fallen 37% compared with 2015, Shattuck said. Other US unconventional plays are down more than 50%.

“We’ve moved into such a dynamic environment that small changes in the price of oil can have a pretty profound impact on our expectations for spending,” Shattuck noted. “The best way to look at it today is how much spending fell out of our expectations as the price of oil fell.”

### 3-STRING DESIGN, WOLFCAMP

FIG. 2



Source: BHP Billiton

Permian legacy casing design stemmed from techniques BHP engineers first developed in the South Texas Eagle Ford shale.

BHP is applying knowledge gained in Eagle Ford to build operational and technical expertise of the Permian during the oil price slump. Its Permian production as of mid-2015 was 30,000 boe/d, a company report showed.

Recent progress in BHP's Wolfcamp program includes better well placement, extended lateral lengths, and optimized completions, leading to increased recovery and predictable well performance.

Salt zones and nearby injection wells required BHP to use a higher mud weight while drilling shallow, first-intermediate sections. "Injection wells communicate with our wells, causing water flows upwards of 300 b/hr depending on proximity and drilling mud weight," Bibler said. "In the deeper, second-intermediate section, there are weak zones (Avalon) that require a lighter mud weight to drill and then set casing."

BHP needed an OBM for drilling through salt zones without washing out of the hole and gaining weight. The mud also needed the ability to absorb fluid associated with certain injection wells. The goal was to allow drilling fluid to maintain a light weight for drilling the weak, deeper zones without a requirement to case off the shallower sections.

Cement costs increased using the OBM. A two-stage cement tool was needed to lift cement to the surface in the pilot. OBM cuttings are required to be hauled off the drillsite compared disposal in an onsite reserve pit, which added cost. OBM also costs more than water-based mud.

The wellhead was designed to house four casing strings. A packoff was needed to eliminate the 9 5/8-in. string. **OGJ**

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# US DUC inventory likely to shrink over next 8-12 months

**Artem Abramov**  
Rystad Energy  
Oslo, Norway

Many drilled but uncompleted (DUC) oil horizontal wells across US shale plays will become commercial if light, sweet crude oil prices remain at \$40-50/bbl on the New York Mercantile Exchange.

Companies would have to spend an estimated \$15 billion to complete an existing DUC inventory of about 3,700. Actual near-term spending is expected to be less. Operators are on track to spend \$12.7 billion in the next 8 months on DUCs if spending stays at the June level.

Producers likely will boost completion spending when they become confident of a sustained oil price recovery. A total first-year production potential of 1.15 million b/d exists in DUC wells.

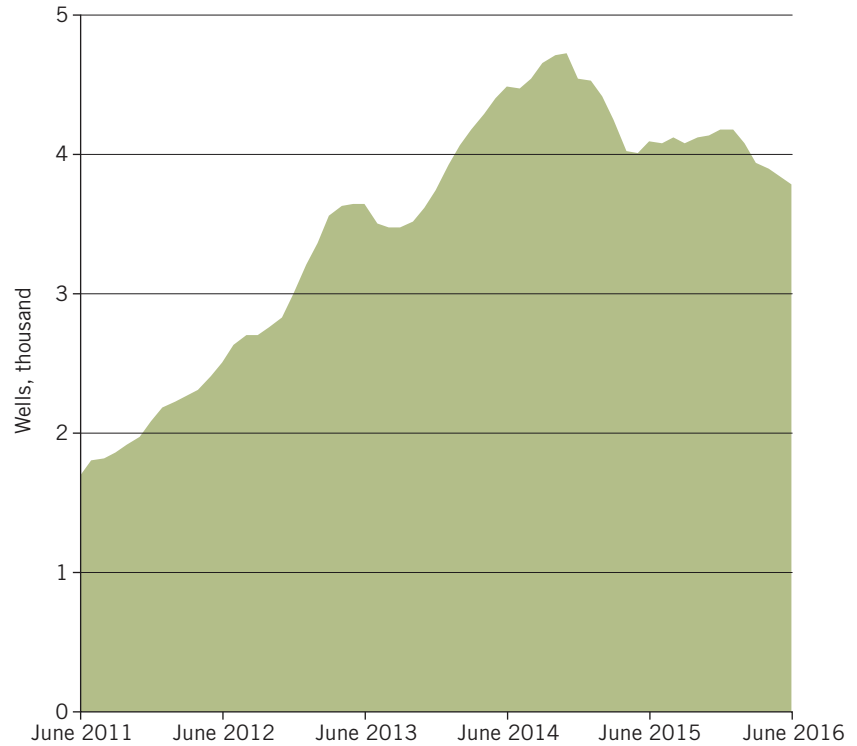


About 90% is commercial at \$50/bbl, 80% at \$40/bbl, and 55%, or 650,000 b/d, at \$30/bbl. The Permian basin offers the largest cumulative DUC production potential of the US shale plays at 340,000 b/d.

Economics vary considerably across a given play. The Permian basin contains both very high-quality acreage and areas far from commerciality. Within the Permian, operators have focused attention on both the Delaware basin and the Midland basin.

The Delaware basin on average exhibits slightly better well-economics

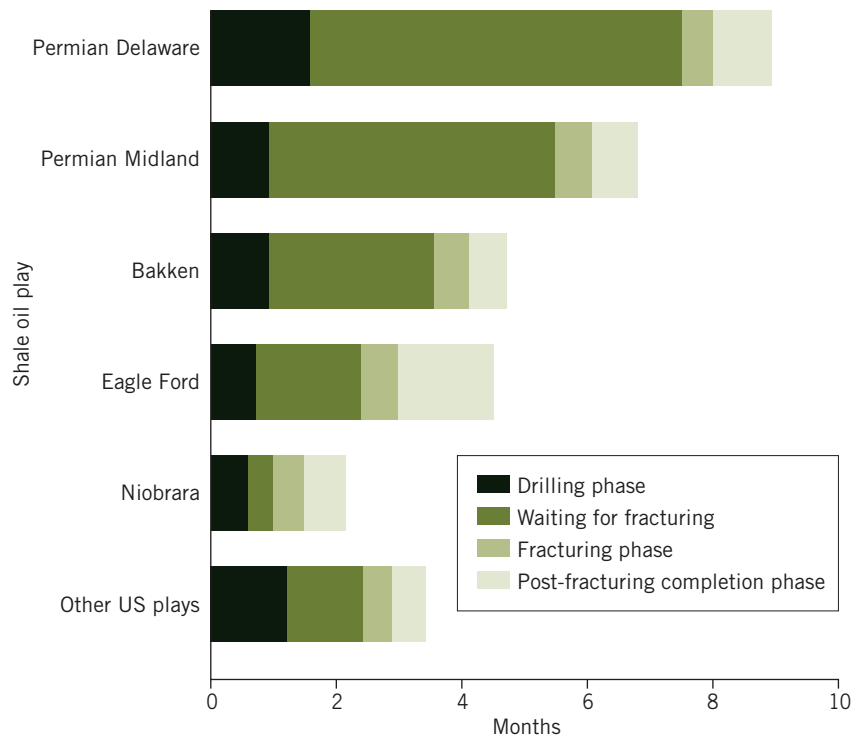
OIL DUC INVENTORY IN US SHALE



Source: Rystad Energy NASWellCube

FIG. 1

AVERAGE SPUD-TO-COMPLETION TIME, 2010-14



Source: Rystad Energy NASWellCube

FIG. 2



than the Midland basin.

The Bakken formation has 290,000 b/d of cumulative potential. It offers the most attractive DUC economics with an average breakeven price of \$28/bbl. Only 10% of potential Bakken DUC production requires breakeven prices higher than \$38/bbl.

DUC inventory outside the three largest liquid plays can add an estimated 200,000 b/d of first-year production at an average breakeven price of \$61/bbl.

The Denver-Julesburg basin offers DUC production potential of 100,000 b/d. An average DUC well in Weld County, Colo., exhibits a breakeven price just below \$30/bbl. Total Colorado oil output will expand by 55,000 b/d in the first year if all these wells are completed simultaneously. A more realistic gradual ramp-up in activity will likely generate 5,000-10,000 b/d in monthly additions over 10-12 months.

Light, sweet oil prices in early June reached about \$51/bbl, triggering significant completion of DUC wells across shale plays. That completion activity will result in additional oil production for several months.

If prices recover further, the pressure-pumping market might face a spike in demand for hydraulic fracturing, which could prompt higher service contracts.

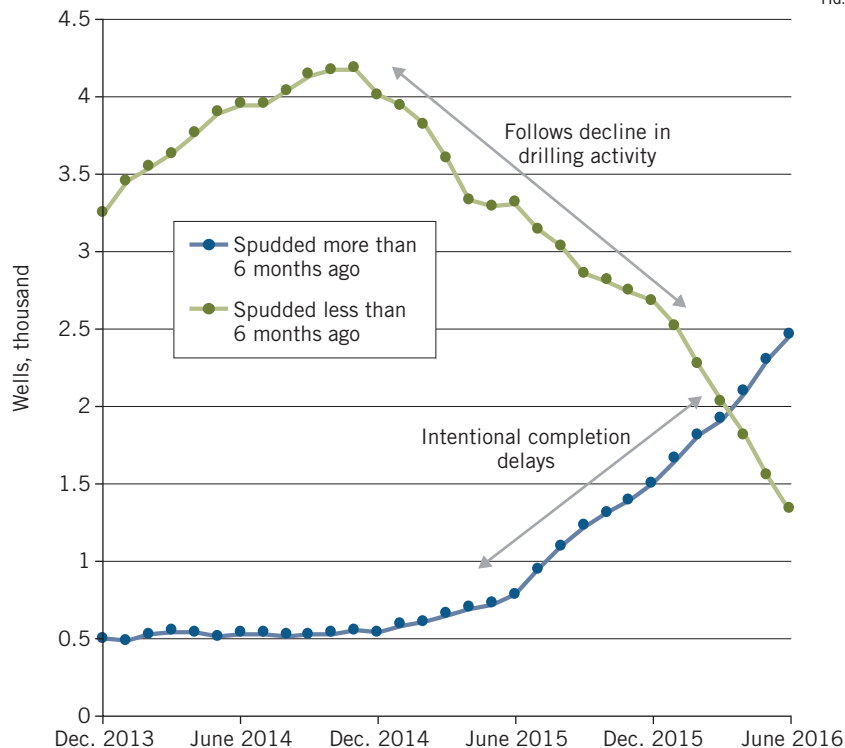
Anadarko Petroleum Corp. decided in early 2016 to complete DUCs rather than focus on new drilling, saying a significant part of its new drilling had turned uncommercial. Anadarko completed 46 DUCs during the first quarter while drilling only 26 new wells.

Whiting Petroleum Corp. resumed completion operations in the Williston basin in late June as part of a 44-well participation agreement with an unidentified partner. On July 28, Whiting also announced a separate 30-well participation agreement in its Pronghorn area of the Williston basin.

Whiting plans to add a Pronghorn-area rig in October, saying it would increase activity in the second half and complete 16 gross (12.5 net) DUC

## OIL DUC INVENTORY, WELL AGE FROM SPUD

FIG. 3



Source: Rystad Energy NASWellCube

wells in the Williston basin.

### DUCs climbed

US completion expenditures grew before 2015. At the end of 2014, operators were spending more than \$5 billion/month on horizontal oil well completions.

The DUC inventory reached an estimated required capex of \$22 billion as of Dec. 31, 2014, but producers started trimming completion budgets in 2015, decreasing completions every month before stabilizing spending in June-August.

The anticipated drop in the DUC inventory will show up as a sudden production gain.

Gains in an individual producer's shale production tend to happen abruptly. Many mid-size shale operators lack continuous completion-services agreements so well stimulation happens in intervals.

A fracturing crew works wells on several adjacent pads simultaneously,

resulting in numerous wells coming onstream at about the same time and yielding a significant production increase.

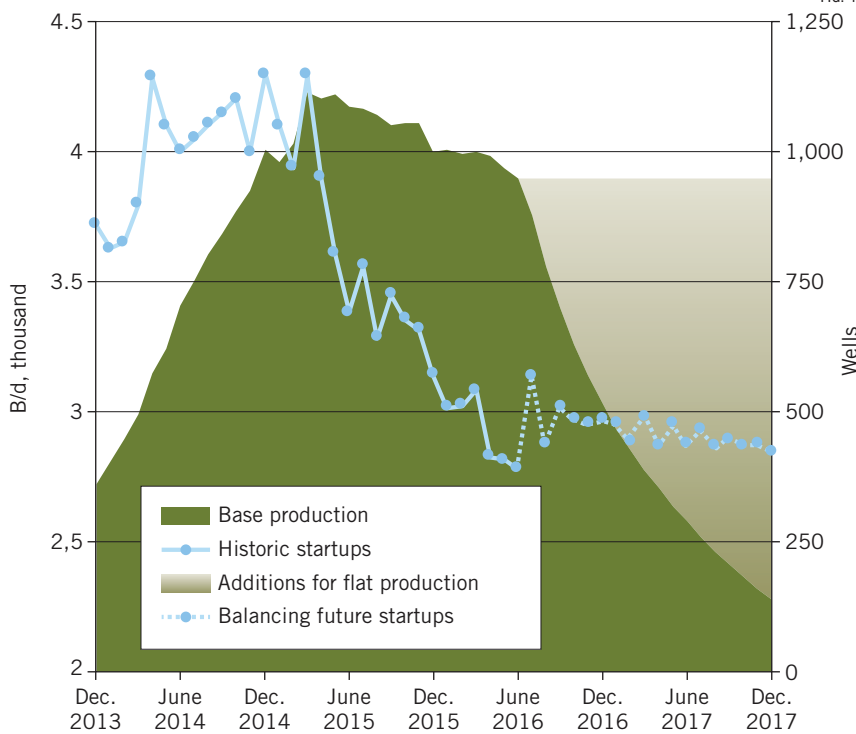
An operator might wait several weeks or months before deciding to complete more wells. Meanwhile, drilling activities continue and DUC inventory builds.

Fig. 1 shows the almost monthly growth in the DUC inventory for US unconventional oil plays from June 2010 through November 2014, reaching 4,700 wells by late 2014.

A 4-month DUC backlog developed 2010-14 because of a mismatch between drilling and completion schedules. Operators need time for field testing to develop the most efficient completion design for individual wells within plays and subplays, accounting for delays between spud and completion. Infrastructure issues also contributed to delays.

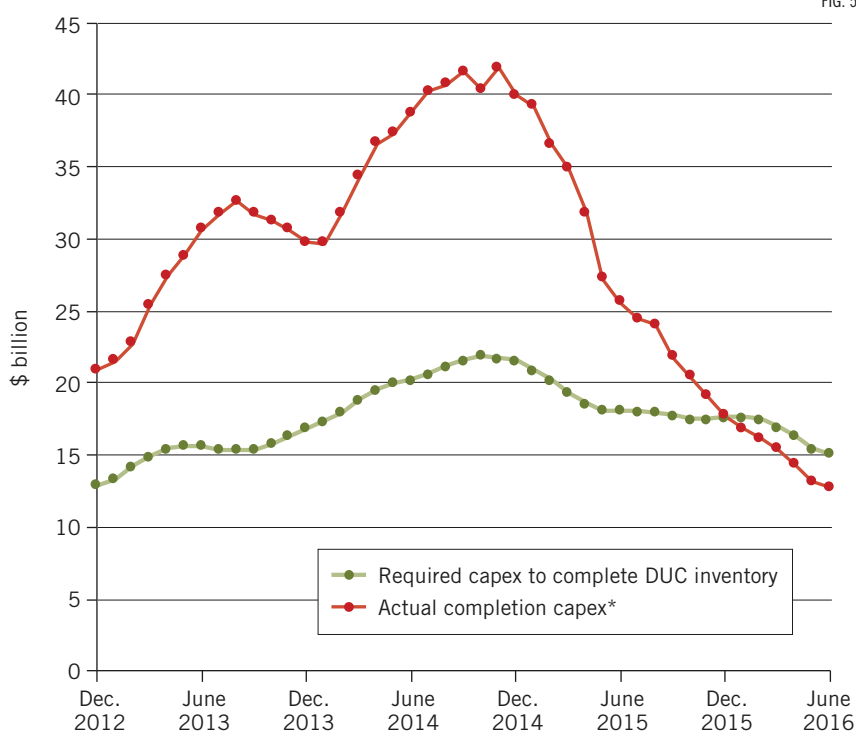
More wells were completed than spudded in early 2015. The DUC in-

**BALANCING HORIZONTAL STARTUPS**



Source: Rystad Energy NASWellCube Premium

**CAPEX REQUIREMENTS**



Source: Rystad Energy NASWellCube Premium  
\*Monthly completion capex multiplied by 8 to indicate feasibility of DUC inventory completion within 8 months.

FIG. 4

FIG. 5

ventory stabilized at 4,000-4,200 wells in the second half of 2015. Operators in shale plays intentionally delayed completions because of low oil prices.

This article uses spud dates rather than total depth or rig release dates in its DUC calculations. State regulators typically require reporting of spud and completion dates.

**DUC phases outlined**

Fig. 2 shows a typical spud-to-completion timeframe in several phases for horizontal oil wells completed 2010-14 across major US shale plays.

Average drilling time ranged from 2 to 6 weeks. The subsequent wait-for-frac phase was the largest source of completion delay in most plays, reflecting producers' intentional slowdown.

The exception was the Niobrara, where most activity came from a handful of DJ basin operators with developed infrastructure. The DJ basin average time from rig release to the beginning of well stimulation was less than 2 weeks.

In the mature Bakken and Eagle Ford plays, the time averaged 2.6 and 1.7 months, respectively. Some emerging shale formations within the Permian basin took 4.6-6 months because of the time required for field testing.

A completion crew takes an average of 1-2 months to ready a well for production. Delays become unlikely once producers commit to completion spending. But production decline resulting from completion delays is not straightforward. The DUC inventory can be split into two groups: wells spudded more than 6 months ago and wells spudded less than 6 months ago.

Fig. 3 shows how these two parts of the DUC inventory evolved December 2013-June 2016.

The new part of the DUC inventory grew during 2014. A peak of 4,200 wells occurred in the fourth-quarter 2014.

As drilling activity collapsed, the number of DUC wells spudded less than 6 months ago also fell. DUCs

decreased by almost 70% from the fourth-quarter 2014 to June 2016.

The number of old DUC wells held stable in 2014–early 2015, fluctuating around 500 wells. As intentional completion delays mounted, however, the number of old DUCs started growing rapidly, increasing 400% by June 2016. More than 2,400 wells were spudded longer than 6 months ago, almost 65% of the entire DUC inventory. In fourth-quarter 2014, old wells accounted for 10% of the DUC inventory.

The DUC inventory is huge relative to drilling and completion activity. Fig. 4 shows historical oil production from horizontal wells across US shale liquids plays. It also shows the number of monthly well startups. If no new wells are added, production will decline from 3.89 million b/d to 2.25 million b/d, or 42%, by December 2017.

About 400 oil horizontal well startups/month occurred in the second-quarter 2016, down more than 60% from fourth-quarter 2014.

Third-quarter 2016 startups would have to increase to an average of 500/month to maintain production at 3.89 million b/d. As base production matures, the balancing number of startups will decrease to 430 wells/month by fourth-quarter 2017.

Flat production through Dec. 31, 2017, would require 8,200 new horizontal oil wells, more than twice the current DUC inventory.

Production additions from the DUC inventory alone could maintain US shale oil output at current levels only for 7-8 months. Significant drilling activity would be required to offset production declines after that.

Fig. 5 shows the total completion capex that would have been required to bring the entire horizontal oil DUC inventory onstream from December 2012 through June 2016.

The actual US shale oil monthly completion capex was multiplied by 8 to indicate feasibility of DUC inventory completion within 8 months if spending stays constant with June levels. **OGJ**

**The author**

Artem Abramov (artem.abramov@rystadenergy.com) is a Rystad Energy senior analyst focused on upstream exploration and production data from governmental sources along with empirical research of well-



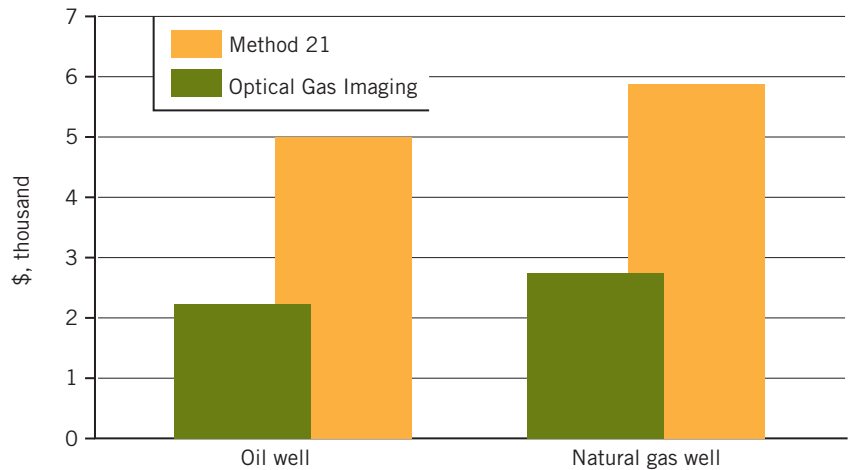
production profiles. Abramov is product manager for the NASWellCube, Rystad Energy’s shale well database. He holds an MS in financial economics (2013) from BI Norwegian Business School, Oslo, and a BS in applied mathematics (2011) specializing in statistics from Novosibirsk State University, Russia.

**Correction**

Fig. 1 and Fig. 2 in the article “Proposed EPA methane regulations will add costly requirements to upstream operations,” (OGJ, Feb. 2, 2016, p. 48) contained errors. The corrected art appears below:

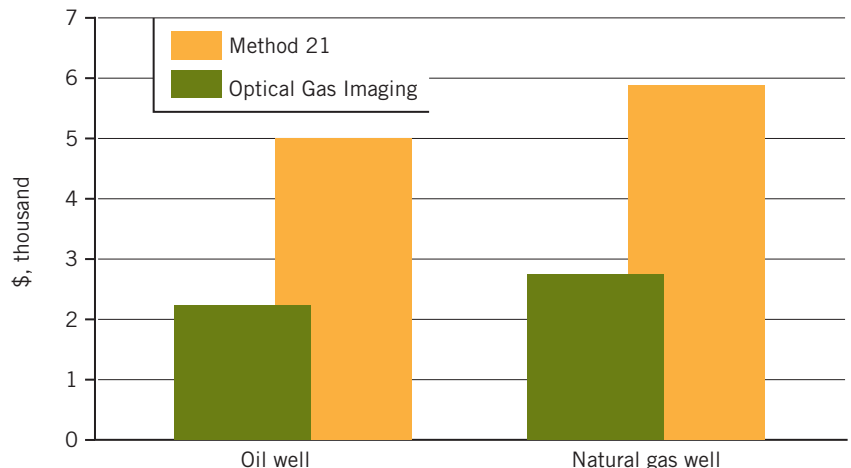
**COMPLIANCE COST/WELL/YEAR WELL A**

FIG. 1



**COMPLIANCE COST/WELL/YEAR WELL A**

FIG. 1



# Discussion expands to crude, vacuum distillation, and coking

This second of three articles presenting selections from the 2015 American Fuel and Petrochemical Manufacturers Q&A and Technology Forum (Oct. 4-7, New Orleans) highlights discussion surrounding processes associated with crude and vacuum distillation, coking, and refiners' experiences with desalting and wastewater treatment.

The first installment, based on edited transcripts from the 2015 event (OGJ, Aug. 1, 2016, p. 52), addressed hydroprocessing operations, with an extended focus on safety, phosphorous poisoning, and meeting the US Environmental Protection Agency's more stringent Tier 3 gasoline standards taking effect Jan. 1, 2017. The final installment (OGJ, Oct. 3, 2016) will highlight processes associated with fluid catalytic cracking (FCC).

The session included five industry-expert panelists from refining companies and other technology specialists responding to selected questions and then engaging attendees in discussion of the relevant issues (see accompanying box).

The only disclaimer for panelists and attendees was that they discuss their own experiences, their own views, and the views of their companies. What has worked for them in their plants or refineries might not be applicable to every situation, but can provide sound guidelines for what would work to address specific issues.

## Crude distillation

*Please describe your experience with the occurrence of phosphorus and barium fouling in the distillate section of the crude tower. What steps have you taken to identify and mitigate the problem?*

**Watts** I know this topic generated a lot of discussion in our hydrotreating session yesterday. I am mainly going to focus on the crude side of it. Basically, it starts with analyzing processed crudes for impurities to manage and minimize fouling coming from salts, asphaltene precipitation, and other impurities.

Regarding corrosion, we obviously look at total acid number (TAN) of the crude, organic chlorides, amines, and ammonia. We do not always do a full analysis on the crudes we are processing day in and day out, however, since we have a long history on those crudes. When we are looking at new crudes, we do a more detailed analysis.

We also look for catalyst poisons, mainly to make sure we do not have high levels of silica, phosphorus, arsenic, and other materials that would cause accelerated loss of catalyst life.



We then look at downstream impacts on those units. Overall, our goal is to manage equipment reliability and catalysts between turnaround cycles.

Last year, we took a short outage to replace a piece of equipment on one of our crude units. We were a little over 5½ years into the run since the last turnaround cycle. When we started up after the outage, we saw that the top section of the crude tower differential pressure had increased to 5 psi. Before the outage, it was 2 psi, and that was for the top 20 trays

of the crude tower.

We had experience with trays fouling prior to this outage. When we would shut down the unit for turnarounds, we would see that the top six to eight trays had some fouling from salts that deposited on the trays.

Next we did a tower scan and a more detailed pressure survey which showed that liquid had started to back up in the tower just below the kerosene pumparound section around Tray 20. As we were scanning the tower, we basically adjusted the liquid loading in the tower. We dropped the pumparound and the top reflux. Once we did that, we saw that the pressure drop returned to a normal range. The tower was no longer flooding.

## The panel

Bruce Allred, production engineering manager, Suncor Energy Inc.

Michael Braden, desalting expert, Nalco Champion

Maureen Price, director of downstream process engineering, Fluor Corp.

Ed Watts, refinery process engineering technical team leader, LyondellBasell Industries NV

John Weber, refinery planning manager, Marathon Petroleum Corp. (MPC)

## The respondents

Nagashyam Appalla, Reliance Industries Ltd.

Bill Cates, Hunt Refining Co.

James Doherty, LyondellBasell Industries NV

Harold Eggert, Athlon Solutions LLC

Samuel Lordo, Nalco Champion

Eberhard Lucke, CH2M Hill Inc.

Jessica Naquin, Valero Energy Corp.

James Prorok, Husky Energy Inc.

Jeffrey Zurlo, GE Water & Process Technologies



**Houston Refining LP**, a wholly owned subsidiary of LyondellBasell Industries NV, completed planned maintenance earlier in the year at the crude and coking units of its 268,000-b/d full-conversion Houston refinery, which is configured to process heavy, sour crudes into low-sulfur gasoline, diesel, and jet fuel (OGJ Online, Apr. 4, 2016).

Before the outage, we actually had noticed an increase in fouling in our kerosine pumparound exchangers. We talked to some of the operators after we saw the pressure drop increase in the tower top. We also had some issues with valves closing when they were isolating the kerosine pumparound exchangers. We did an analysis of that stream, and basically, we saw a combination of corrosion products and hydrocarbons. We also discovered trace levels of phosphorus as high as 800 ppm. As I said, this occurred April 2014, but we have been able to continue running the crude tower.

To manage this increased pressure drop and fouling, we have adjusted our kerosine pumparound. Before April 2014, we typically ran that pumparound at a rate of 1,300 bbl/hr or higher. Currently, we are running the pumparound at the minimum (750 bbl/hr), so obviously our kerosine production has dropped off. We have also lowered our top reflux in the tower and adjusted the heater-outlet temperature and stripping steam to the tower to reduce the vapor load for certain crudes.

We have a planned outage in first-quarter 2016, as it will have been a little over 7 years since the previous turnaround. We have worked with a company to redesign the trays, which we plan to replace. We will also be able to verify the fouling during the scheduled maintenance outage.

**Braden** We have conducted deposit analysis on samples in the jet kerosine trays and found the phosphorus component, along with iron and sulfur. The phosphorus usually comes from an upstream additive that is used in the fracing aspect of the water-sensitive clay formations. They use a mono- and diphosphate ester to help with the fracing process that can be complexed with an inorganic material and removed from the crude. During the manufacturing of the mono- and diphosphate esters, a triphosphate ester is also formed. This triphosphate ester is oil-soluble and cannot be complexed.

The triphosphate ester is the material coming in with the crude once it passes through the desalter, but once it gets into the heat exchangers and into the towers, it starts decomposing. Specifically, it starts hydrolyzing to phosphoric acid, so essentially, phosphoric acid distills up-tower, deposits onto the tray, and then precipitates at the jet kerosine trays. When the phosphorus-containing deposits increase in size, they begin closing the holes in the trays.

Some refiners will replace the trays with trays containing larger holes, therefore allowing you to get more flow in the jet because the jet fuel has a phosphorus spec. We try to mitigate the phosphorus from distilling up the tower by injecting a



chemical additive that complexes the phosphorus to keep it in the resid fraction. If you want to know a little more about that approach, contact your chemical vendor.

**Weber** We have had some practical experience in the kerosine section. The first time we experienced it in 2011, we went into a tower for turnaround and found fouling in the kerosine section, with no other fouling occurring above or below. It didn't cause an operational problem, and we actually didn't analyze foulant that was on the tray at that time.

At another MPC refinery, the crude unit ran at reduced rates for economic reasons for about a month. When we attempted to return the unit to full rates, flooding was observed in the kerosine section. We were referred to the Canadian Crude Quality Technical Association (CCQTA), which immediately said, "Oh yes, you have phosphorus issues." After further discussion, it was discovered that CCQTA has extensive experience with phosphorus contamination. Its website indicates that, since 1995, they have had a project on phosphorus fouling and have worked with some Canadian producers to help minimize it.

A similar incident occurred at a third refinery. One of the remedies we have implemented is installation of fouling-resistant, fixed-valve trays in the kerosine section. In refineries that still have floating-valve trays, we try to keep vapor traffic up in the kerosine section. We have found occasions where the valves were found stuck open but, fortunately, had not caused an operational issue. It's when we ran at lower rates and velocities that the valves became stuck closed and caused flooding problems. We have also had experience with barium fouling in the wash section of the crude tower.

**Appalla** Is there an industry-accepted limit regarding monitoring the phosphorus content of crude? If so, does anyone distinguish the differences between volatile and nonvolatile phosphorus?

**Watts** I want to echo some of what John said. I did quite a bit of research on this and know that it is not a new issue. Information dating back to the mid-1990s indicates specification levels of 1-1.5 ppm. Based on work with our lab, we have not seen a detectable level of phosphorus on the crudes we have analyzed. We have not traced it back to a crude source.

**Braden** In our experience, the phosphorus compounds enter the refinery via the crude and normally come in slugs because of the fracing issue, so phosphorous content can be up to 50 ppm when you get a slug of highly phosphorous material. But our measurements normally show a phosphorous content of 1-3 ppm. We have run that by inductively coupled plasma (ICP) analysis. So phosphorous presence in crude is normally very, very low. Sometimes, however, you do get slugs. So when do you catch a slug? When do you see that? You just see the results of the slug coming through. It is hard to pick up.

**Appalla** What is the industry's experience on the cause of this fouling when using high-temperature corrosion inhibitors in the atmospheric tower?

**Lordo** The inhibitors that are used for high-temperature treatment are not really part of that particular description. As Mike indicated, those are triester compounds which come in with some of the fracing gels that are used in Western Canada or in clay formation-type crudes where they are water sensitive. In the US Lower 48, though, there is no fracing with phosphorus-based gels. Now we are targeting to look at phosphate esters being used for scale control and corrosion inhibitors.

I looked at crude-tracking data from one refinery that analyzed the phosphorous content of each crude batch that came in over the course of an entire year. Most of it was in the 1-3 ppm range, except in November, when it shot up to about 10-15 ppm for a 1-month period, after which it came right back down. During that timeframe, that refinery's crude tower had some issues which have yet to be resolved, so the tower will have to be taken offline for cleaning. But as far as the inhibitors go, most of them do not cause a problem. If you overtreat, then yes, you can have some issues.

**Price** Just a comment to Mr. Appalla from Reliance: If you have not visited the CCQTA website, I recommend that you do because it contains a lot of information about lab methods that might be helpful.

**Appalla** Yes, but the CCQTA only talks about the phosphorus coming from the Canadian crudes. Suppose you are not processing Canadian crudes. What are the other sources of it?

**Eggert** It is an odd question when you say barium and phosphorus in the same sentence. Why would you pick those two particular elements to examine? Like the panel has mentioned, not all phosphorus is going to end up fouling your trays. It is always coming in at a low level. Some of it is benign phosphorus, and some of it will contribute to tower fouling. What is currently being used—and the reason the barium came up—is that the phosphorus causing some of these problems is injected to prevent barium-sulfate scale upstream. It is a scale inhibitor. If you see barium and phosphorus, chances are it is from the production chemicals. The barium used to be called normally occurring radioactive material, or NORM. That is why we are looking for phosphorus and barium. It is the combination of the two that sends up a red flag.

**Zurlo** Just to clarify, you are right. The CCQTA talks about phosphate esters from Canadian crudes. One of the test methods it has on the website specifically identifies volatile phosphates. The CCQTA test separates the volatile phosphorus components from the general phosphate components by performing a distillation on the whole crude and analyzing the middle distillate cuts. Although the CCQTA work is done on Canadian crudes, the crude source really does not matter. What is important is if phosphate is in the crude; if it is volatile; and, if it can hydrolyze, complex, and form this



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fouling material. So it is not necessarily the source but more the effect of what type of phosphate is in the system.

**Cates** If I understood the question, what Mr. Appalla is really asking is, other than light, tight oils, where are they finding crudes containing phosphorus?

**Watts** I mentioned earlier that we have not traced it back to its source, at least in our refinery.

**Braden** The phosphate esters for the fracing are mainly coming from the Canadian side, the north coast of North America, and the south coast of Canada.

**Naquin** I have heard rumblings that the fouling would have less affinity for metallurgies. For example, if you have carbon steel or different variations of stainless trays or parts in the tower, sometimes the phosphorus fouling will not have the same affinity; so then, you will not have the same accumulation of the fouling in the tower. Does anyone have experience with those observations and any best practices?

**Watts** I do not have experience on the metallurgy. I would say that what we are doing is similar to what John said in that we redesign the trays to go to a fixed valve. So we avoid the potential – if you turn down, increase, or shut down a unit—of your valve getting locked in place; that is, if you have a floating valve. Obviously, that changes your flexibility on how you can run the crude unit when you reduce rates.

**Price** Once again, I am not an expert on this subject. Based on the experience of our clients, I think the jury is still out on the subject of phosphate fouling. People are finding, in some cases, that when they solve the fouling problem in their crude tower, the fouling problem migrates downstream to the exchanger. While exchanger fouling is not a good problem, it is solvable. If you can install a bypass and have the ability to do online cleaning of that exchanger, it will help to mitigate the impact on your unit throughput.

### ***Vacuum distillation, coking***

***What type of facilities have you used to cool hot vacuum residue going to storage to avoid plugging problems and facilitate reprocessing?***

**Watts** I am going to focus on a system we have and also some of the issues we have experienced. The majority of our resid produced off of the crude unit vacuum towers is sent through the hot resid system straight to the cokers. We have two crude unit trains. We process 120,000-140,000 b/d of crude on each unit. We have two cokers. Each coker has four drums.

One coker can process up to 40,000 b/d of resid on a four-drum operation. The other can process 60,000 b/d of resid on a four-drum operation.

Our cold resid system is where we send excess resid, but we also maintain that system during normal operation. So what we do is take uncut resid at about 400° F. and add cutter. A base cutter for us is heavy cycle oil from the FCC. That is typically the only place we send it. Then we make up, as needed, with distillate-range material. The majority of the time it is light cycle oil from the FCC. Basically, we target a maximum tank temperature. We have a temperature limit of 210° F., so we try to keep it around 200° F. When we are stacking a lot of resid, we can hit a viscosity spec. We have found that we need to add about 30-40% cutter to hit that spec.

We have three main modes of operation. The first is what I call resid-system balanced, or the mode in which we typically operate, where the coker is pacing the cold resid. Normally, we are sending 6,000-10,000 b/d to tank and pulling that equivalent amount back to the cokers.

Next, we have what I call resid-stacking mode. With the current system, we can stack up to 30,000 b/d of resid with a minimum of 30% cutter. That leaves about 21,000 b/d of resid you can stack.

The last mode, which we do not do very frequently, I call resid pull. This typically occurs after a short outage on the cokers. After the outage, we will pull back resid that was stacked.

Occasionally, the economics support going out and purchasing resid, but the way our refinery operates is that we are typically close to limits on the cokers when both crude units are at full rates because the resid yield is typically above 30%.

The last piece I want to talk about is how we minimize the potential for resid line plugging; basically, it is managing the temperature. As I said, we have limits on what we can send to the tank, but we operate in a relatively tight window. We try to keep the temperature above 190° F. Basically, we have added in orders for console operators to heat up the cold systems one time per shift, so they do that about twice per day. Resid is hard to meter. What we have done, based on operating experience and historical data, is set minimum-valve output limits where we are all alarmed if the resid rate gets too low. So for us, the biggest challenge for managing the hot and cold resid system is during major upsets, when we lose production of our main cutter source and significant coking capacity. This is typically where one or more of the cokers go to two-drum operation and where we are most likely to have issues with plugging in the sections of the hot or cold systems.

In fact, back in 2010, we had a refinery-wide emergency shutdown. We actually plugged up the hot system between one of the crude units and the cokers. It took a lot of money and time to unplug that system. In 2014, we also plugged up a small part of the cold system. The highest risk for us is when we have a major refinery outage because multiple asset or operating teams have to communicate with each other to make sure we get cutter in the lines.

**Price** I want to second what Ed said: The challenge of storing

hot resid is very difficult, although folks who make asphalt and store it have more chances to do this than others.

To overcome the difficulty in storing hot resid, many refiners in southern California will use a box cooler, diversion air coolers, or a tempered water bath. Normal cooling water cannot be used because it will cause extreme fouling on the water side, as well as plugging on the hydrocarbon side. The diversion air coolers incorporate special design features to ensure that the approach to pour point is adequate to prevent plugging on the hydrocarbon side. On an emergency basis, quenching with cold gas oil product is about the best option you have.

**Lucke** When you process cold vacuum residue in the coker unit, because of heat integration and the amount of cutter stock you need, do you have a limit, such as a percentage of total fresh feed, up to which you can process?

**Watts** A typical operation is where, I would say, you'd pull less than 10,000 b/d out of 90,000 bbl. I know that we pulled quite a bit more than that in the past—up to 20,000 bbl, or somewhere in that range—out of 90,000 bbl; so, a little over 20%.

**Doherty** To add to the point and answer the question, I work on the cokers with Ed. We would hit that limit. Sometimes, right before we got to that limit, we would see increased foaming on the cokers. That would limit our pull-back instead of a heat limit.

**Watts** I want to comment on what Maureen mentioned. I did not really add detail to how we cool off our resid. We add cutter. We have cooling water exchanges on the crude units. But a couple of years ago, we installed a temporary cooling system just before we sent the resid to the tank. We actually cool off the resid with glycol. That is a much better system in terms of reducing exchanger fouling. It allowed us to reduce our cutter significantly and also to stack more resid. With that system, we were able to stack as much as 40,000 b/d of resid. Without that system in place, we were limited to somewhere around 20,000 b/d.

### **Desalting, wastewater treatment**

*What strategies do you employ to purge solids from recovered oil at the wastewater treatment plant (WWTP) to avoid recycling solids back to the crude unit?*

**Braden** Oh, yes, solids: the bane of the refinery. The crude unit wants them out of the crude oil, and the WWTP would prefer not to have them. Essentially, we are talking about wastewater treatment solids. Some people call it recovered oil; some people call it slop oil; and, some people call it skimmed oil. So if I interchange these definitions, what I mean is recovered oil from the WWTP.

A little background here: this oil will be chemically stabilized due to the chemical treatment of the primary waste-

water treatment program. It is a water-in-oil emulsion. The solids and the water itself are chemically emulsified in the oil. If you do nothing and send it back to the crude unit, you will get massive upset. One barrel of untreated slop oil or recovered oil will give you back two barrels. So essentially, the refiners have to ask the question, "What are you going to do with the skimmed oil?"

First, if the refinery has a coker unit and the coker is not making anode-grade coke, then you could send that material as a coolant to the coker. Again, everyone has to be on board with that. The second option is to sell the skimmed oil to a remediator or have them buy it from you.

Typically, this recovered oil has a good dollar value for the refinery, so the refinery will want to recover the oil by removing the water and the solids.

There are two methods for recovering the oil that are viable for the refinery. One is tank treating. For tank treatment, the tank should be heated and have agitation. You will need a chemical additive to resolve the chemically stabilized emulsion. Do not be shocked if the chemicals needed to resolve the emulsion may be up to 3,000-5,000 ppm. You will need to add the chemical, thoroughly mix the chemical with the oily emulsion, and then let it stand at a minimum of 140° F. (but no greater than 180° F.) for about 72 hr. As a result, some solids will fall out. You will have a water layer and an oil layer. In between the oil and water layers, you will always have a rag layer. You will have to make a decision about what to do with that rag layer. It will contain a lot of emulsion and solids. Some refineries will put the rag layer into a different tank and wait another day, even though the oil itself will have less than 2% basic sediment and water (BS&W), just delaying the decision about what to do with the solids.

The other way is to remove the solids from the system entirely, which is your goal, by using a centrifuge method. This method is very similar to a tank method, although you do not wait for the separation. You use heat, chemical, and agitation. You need to let the treated slop oil stand for 1-3 hr, and then send it to a two-phase or a three-phase horizontal bowl centrifuge. A three-phase centrifuge is better.

In the waste-oil stream going to the centrifuge, you will have to add a high molecular-weight cationic polymer, usually emulsion polymer made down to a 0.5-1.0% solution. This chemical will take out solids in the rag layer as well as solids that fall out in the centrifuge. Because the centrifuge separates by specific gravity, that rag layer has its own specific gravity vs. the other three. You will have solids, water, rag, and oil. The emulsion polymer will mix the solids and the rag layer together, resulting in a specific gravity which is higher than water. You will then have solids plus the rag layer, water, and oil. The solids go out one end, and the liquid goes out the other.

In a three-phase centrifuge, the operator controls the flow rate of the waste oil stream and the chemical polymer injection. The BS&W on the recovered oil is typically less than



1%, and you can send the solids to a nonhazardous landfill if the oil content meets the required specifications. If it has too much oil on the recovered solids, the refinery alternatively could send it to a hazardous landfill.

**Allred** We have a full-time, three-phase separator on site in the refinery. It is owned and operated by a third party and it is in operation Monday-Friday during daytime hours. It is used primarily for our wastewater treatment system, collection of solids, and recovery of the oil in the water. We have found that just keeping the solids out of our system is well worth that expense. We have polymer and heat that helps remove those solids. There are times when we do a tank cleaning and keep this unit in operation around the clock to handle the solids coming out of the tank. By working through the weekends and extra hours, we are able to remove the solids and keep up with the daily needs of the wastewater treatment system. We have found that having that three-phase separator on site all the time has been well worth it for us.

**Weber** We also have an outside third party who manages the solids. I do not really have anything else to add.

**Appalla** I have two questions. The first is: Has any refinery deployed the system of skimming the rag layer online, and if so, what is the destination for the skimmed rag layer? Secondly, you have talked about deploying centrifuge separation, but a centrifuge works on the principle of the particle size. If the particles are very small, say less than 10  $\mu\text{m}$ , does chemistry really work for coagulating and dropping the particles in a cyclone?

**Braden** To clarify your second question first, you are asking about removing the 10  $\mu\text{m}$ -sized particles? Typically, wastewater treatment can remove down to 4  $\mu\text{m}$ . Filters can get below that if you have the right filter system. But as a centrifuge, it really depends on the polymer you select and the agitation. Because you feed the emulsion polymer based on the flow, it is tough to say the degree of particle size that is removed. We have not really measured the particle size that is recovered in the crude. We do know that the filterable solids are very low using a 0.45  $\mu\text{m}$  filter, but we have not looked at particle size. The primary goal for a refinery is to look at their specification of less than 2% BS&W. That is a normal specification for consideration as recovered. For some refineries, the minimum BS&W could be a little higher or a little lower. Could you repeat the first question please?

**Appalla** If the solids are bound to create the problem at the interface by forming a rag layer, it does not allow the emulsion to separate. So what is the best way is to skim out the rag layer online? Has anyone deployed continuous skimming of the rag layer online and routing it to some destination? Where is the best destination to route the rag layer?

**Braden** Some refiners will have a rag-layer draw on their desalters to remove an increasing rag-layer volume in the desalter. At Nalco Champion, we recommend using the correct desalter emulsion breaker that will allow the rag-layer volume to remain at steady state. For Nalco Champion, an increasing rag-layer volume is a sign of a poor emulsion-breaker selection. Our goal is to have no oil undercarry and a steady-state rag layer.

**Watts** For our refinery, we manage the rag layer by adjusting the mix valves, washwater, and desalter chemistry to minimize the potential for oil undercarry. We don't skim the interface to remove the rag layer. The question he is asking is: If you have a rag layer at the desalter, rather than trying to bleed it all out the bottom, do you have a skimmer at the interface to continue to remove the rag layer? And if you do that, what is the destination for that material?

**Braden** Good question. Usually the rag layer is put into a different tank, and we wait for it another day. This rag layer is normally not chemically stabilized and can be fairly easy to separate; however, it may take a secondary emulsion breaker to drop the solids and release the oil.

**Lordo** We are referring to what is commonly called cuff draw, which is a pipe located at the interface. You pull off that pipe and actually send it to a different tank, as Mike indicated. Typically, you can treat it as it goes to the tank, which is preferable to building inventory in a slop tank, which would make it more of a challenge to handle. You would pull the rag out of the desalter and send it to a separate tank. Sometimes it is a brine tank, so you can mix the emulsion with water and flip the emulsion a little. So there are a couple of strategies you can utilize with the cuff draw, but they are gaining popularity with the high-solid crudes.

**Braden** Usually that is not chemically stabilized, so it is easily separated.

**Allred** I just have a quick comment about the second question. Our trigger point is 1% BS&W. So when we run it through the centrifuge to recover the oil, we test that oil. If it is greater than 1%, we will send it back through the centrifuge. If it is less than 1% BS&W, we will send it on to a crude tank.

**Prorok** Nalco treats our desalters, and we do a draw of the cuff layer to remove iron. We still make petroleum-grade coke for anodes. We take the cuff, which is about 10% oil and 90% brine, and send it to the free-water separator, which breaks the oil and water mixture, leaving us with a high-solids oil. The oil goes to a storage tank, which feeds the centrifuge. The oil from the centrifuge still has a significant number of fines. We have pilot-tested a ceramic membrane for a final polishing step to get the fine solids out of the oil. **OGJ**

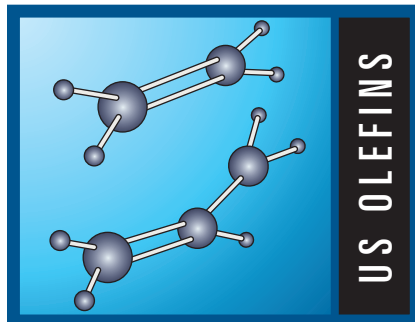
# Olefin prices steady despite higher feedstock, production costs

**Dan Lippe**

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Olefin prices in the US Gulf Coast market did not reflect the big increases in feedstock prices and production costs during first-half 2016. Between February and May, propane prices were up 18¢/gal (54%), while natural gasoline prices strengthened 28¢/gal (40%). Spot prices for ethylene in Mont Belvieu, Tex., however, increased by only 5.4¢/lb (27.5%), with net transaction prices in May only 4.3¢/lb more than in February. Propylene prices varied within narrow ranges of just 2-3¢/lb.

US ethylene producers posted a third consecutive quarter of nearly perfect operational performance in first-quarter 2016 at an average operating rate of 97%. But as Petral Consulting Co. predicted, industry operating rates fell to 88% during second-quarter 2016 amid a series of planned maintenance turnarounds (OGJ, Mar. 7, 2016, p. 62). Reduced



production levels, however, had limited impact on ethylene prices.

Only one new propane dehydrogenation (PDH) plant came on-line on the Gulf Coast during first-half 2016, but by midyear, propylene supply in reportable Gulf Coast storage was 150-200 million lb higher compared with yearend 2015. With propylene exports remaining at historically high levels during the first 6 months of the year, however, producers were able to avoid the price collapse many feared would accompany startup of new production.

## Ethylene production

Petral Consulting tracks US ethylene production via a monthly survey of operating rates and feed slates. Results of the monthly survey show ethylene production was 165.3 million lb/day in first-quarter 2016, up 1.8% from second-quarter 2015. For second-quarter 2016, survey results showed ethylene production at 152.0 million lb/day, 8.1% less from the previous quarter.

Compared with first-half 2015, US ethylene production was 1.48 billion lb (10.9%) higher during first-quarter 2016 but 350 million lb (2.5%) lower in the second quarter.

Production losses in first-quarter 2016 due to turnarounds and unplanned maintenance registered their lowest levels of the previous eight quarters at just 209 million lb.

As Petral Consulting accurately projected in March, however, planned maintenance in second-quarter 2016 at five units with combined capacity of 8 billion lb/year (12.6% of overall name-plate capacity) contributed to production losses of 1.29 billion lb during the period. Planned maintenance downtime alone accounted for 1.16 billion lb (90%) of total production losses for the quarter (Table 1).

Ethylene production from plants in Texas during first-quarter 2016 was 115 million lb/day before falling to 105 million lb/day in the second quarter amid planned maintenance at four

## ETHYLENE PRODUCTION

Table 1

2015-16	Heavy feed	Light feed million lb/quarter	Total
1 Qtr.	1,127.0	12,438.5	13,565.5
2 Qtr.	1,156.2	13,023.5	14,179.7
3 Qtr.	1,151.4	13,581.2	14,732.6
4 Qtr.	852.4	13,922.6	14,775.0
1 Qtr.	1,193.1	13,847.6	15,040.7
2 Qtr.	1,025.9	12,803.8	13,829.7

Source: Petral Consulting monthly survey

## US ETHYLENE PRODUCTION\*

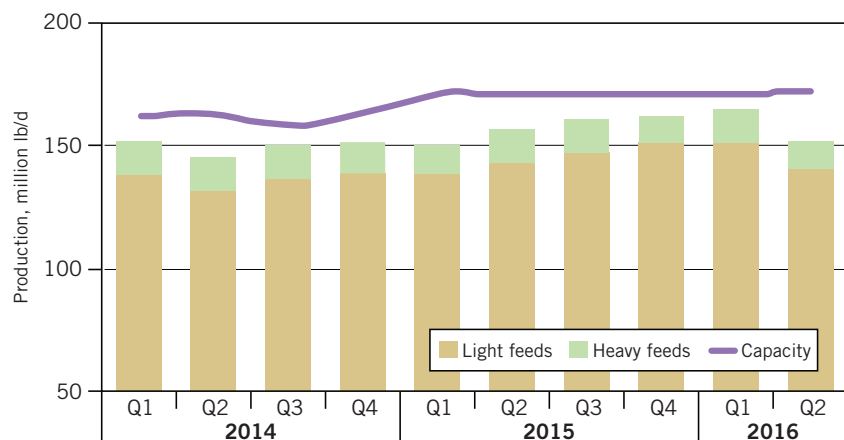


FIG. 1

\*Cracker production from fresh feed.  
Source: Petral Consulting Co.

plants, which accounted for 70% of production losses during April-June.

Production from ethylene plants in Louisiana averaged 44 million lb/day in first-quarter 2016 but fell to 41 million lb/day during the second quarter, also as a result of scheduled maintenance.

Fig. 1 shows trends in ethylene production.

### Feedstock prices

Save for ethane, spot prices for ethylene feedstock in first-half 2016 generally tracked crude oil prices. Spot prices for West Texas Intermediate (WTI) rose from a low of \$30.50/bbl in February to nearly \$49/bbl in June.

After hitting a low of about 70¢/gal in February, spot prices for natural gasoline (representative of light, paraffinic naphtha feed) averaged 77¢/gal in first-quarter 2016 before tracking rallying crude prices higher during the second quarter to average 97¢/gal. Similarly, propane prices in Mont Belvieu increased from a first-quarter average of 39¢/gal to average 49¢/gal in the second quarter.

Spot prices for purity ethane fell to 16¢/gal in first-quarter 2016 but increased to average 20¢/gal in the second quarter. The dip in purity ethane prices in the first quarter was consistent with the decline in wellhead natural gas prices and shrinkage values.

Although natural gas prices remained near record lows in April-May, purity ethane prices increased to 19-20¢/gal before rising to 22-23¢/gallon in June.

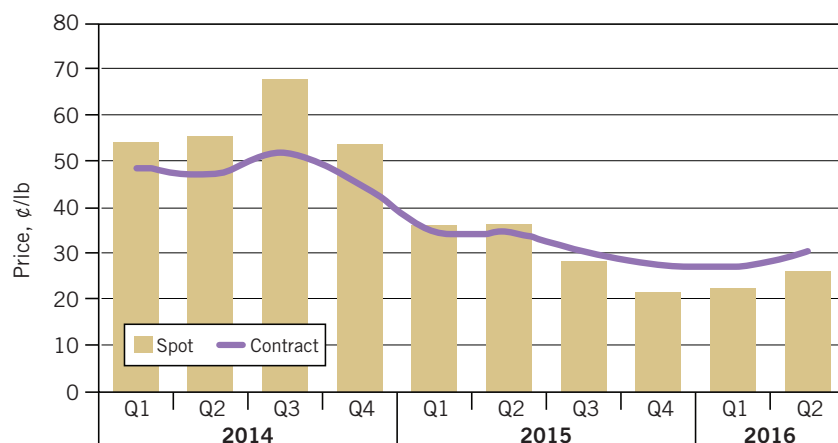
Natural gas storage injection rates were 4-5 bcfd below average during second-quarter 2016, and prices in the Houston Ship Channel increased to \$2.50-2.75/MMBtu in late June. Gas-plant ethane recovery costs (basis gas plants in West Texas and New Mexico) in late June were 6¢/gal higher compared with April-May.

Propylene prices during first-half 2016 held even more stable than ethylene, with spot prices for polymer-grade propylene seemingly immune to large swings in crude and motor gasoline prices. Spot prices for polymer-grade propylene averaged 29¢/lb during the first quarter and 30¢/lb in the second quarter, while refinery-grade propylene spot prices averaged 19¢/lb in the first quarter and 20¢/lb in the subsequent quarter, according to PetroChem Wire's daily olefin price reports.

Contract settlements for purity butadiene fell to 26¢/lb in first-quarter 2016 but increased to 33¢/lb in the second quarter. Spot prices for aromatics also tracked swings in crude prices during first-half 2016, with prices for toluene falling to 196¢/gal in the first quarter before rising to 222¢/gal during the second quarter.

Ethylene production costs based on purity ethane feeds

## ETHYLENE PRICES



Source: PetroChem Wire, Petral Consulting market research

## ETHYLENE PRODUCTION COSTS

Table 2

2015-16	Ethane	Propane	n-Butane	Pentane +
	¢/lb			
1 Qtr.	9.9	7.6	3.8	20.8
2 Qtr.	9.9	6.5	2.8	29.5
3 Qtr.	10.4	7.4	6.1	21.4
4 Qtr.	9.9	8.8	10.8	23.7
1 Qtr.	9.3	9.1	9.1	16.3
2 Qtr.	11.0	12.7	9.2	23.5

Source: Petral Consulting estimates

**Feedstock prices**, coproduct values, and ethylene plant yields determine ethylene production costs. Petral Consulting maintains direct contact with the olefin industry and tracks historic trends in spot prices for ethylene and propylene. We use a variety of sources to track trends in feedstock prices.

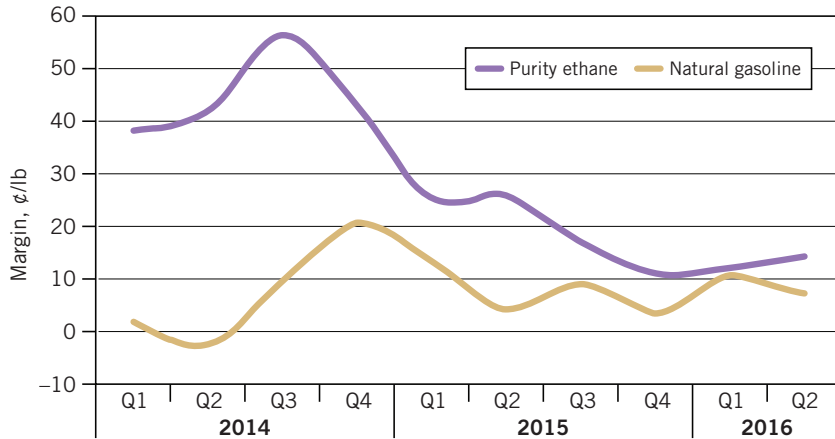
Some ethylene plants have the necessary process units to convert all coproducts to purity streams. Some ethylene plants, however, do not have the capability to upgrade mixed or crude streams of various coproducts and sell some or all their coproducts at discounted prices. We evaluate ethylene production costs in this article based on all coproducts valued at spot prices.

during the first two quarters of 2016 averaged 9¢/lb and 11¢/lb, respectively. Purity ethane provided producers with a cost savings of 7¢/lb vs. natural gasoline in first-quarter 2016 and 12¢/lb during the second quarter. While production costs for purity ethane and propane were equal in the first quarter, purity ethane production costs were 1.5-2.0¢/lb lower vs. propane in the second quarter.

Production costs for purity propane averaged 9¢/lb during first-quarter 2016 before increasing to 13¢/lb in the second quarter to yield ethylene producers a cost savings of 7¢/lb vs. natural gasoline for the first quarter and 10-12¢/lb in the second quarter.

**ETHYLENE PROFIT MARGIN\***

FIG. 3



\*Spot price less cash cost.  
Source: Petral Consulting analysis

**ETHYLENE FEED SLATE DEMAND**

Table 3

2015-16	Ethane	Propane 1,000 b/d	n-Butane	Naphtha, gas oil
1 Qtr.	1,035.5	444.3	162.0	1,641.8
2 Qtr.	1,085.5	444.3	161.0	1,690.8
3 Qtr.	1,114.5	457.3	160.2	1,731.9
4 Qtr.	1,166.0	448.6	127.4	1,742.0
1 Qtr.	1,178.0	455.4	162.1	1,795.6
2 Qtr.	1,103.0	404.0	136.9	1,643.9

Source: Petral Consulting monthly survey

Despite dropping to 14-15¢/lb in January-February alongside weaker pricing for crude and unleaded regular gasoline, production costs for natural gasoline during the second quarter increased to 20¢/lb in March, and by second-quarter's end, averaged 22-24¢/lb (Table 2).

**Ethylene pricing, profit margins**

After rallying in response to rising feedstock costs in the first 3 months of 2016, spot prices for ethylene eased before stabilizing within a narrow range during the second quarter. PetroChem Wire daily reports showed spot prices for ethylene in Mont Belvieu averaged 17-18¢/lb in January before jumping to 27-28¢/lb in March. During second-quarter 2016, spot prices remained in a range of 24-26¢/lb.

With all ethylene pipelines in service and production rates in Louisiana and Texas at near record-high levels in first-quarter 2016, spot prices for ethylene at Choctaw Dome maintained premiums of 1.5-2.5¢/lb vs. Williams Hub in January-February and averaged 1.66¢/lb for the 3-month period. Although Louisiana's ethylene production in second-quarter 2016 was 3 million lb/day (7%) lower compared with the previous quarter, ethylene spot prices at Choctaw Dome fell to a discount of 1.1¢/lb vs. Williams Hub in April before recovering to a premium of 1.3¢/lb in June.

Consistent with the declining feedstock costs, net trans-

action prices (NTP) fell to 24-26¢/lb in January-February to hit their lowest levels since January 2003. Market expectations of an impending production decline during second-quarter 2016 as a result of heavy planned maintenance prompted producers to increase NTP to 29.75¢/lb in March for a first-quarter average of 26.75¢/lb. April NTP was 30.5¢/lb. After dipping to 30¢/lb in May, NTP rebounded in June to average 30.25¢/lb in the second quarter.

Margins based on NTP for purity ethane averaged 17.4¢/lb in the first quarter (vs. 19.8¢/lb in third-quarter 2015) and 19.2¢/lb for the second quarter (vs. 17.6¢/lb in fourth-quarter 2015). Margins vs. propane also barely changed in first-half 2016, averaging 17.6¢/lb and 17.5¢/lb in the first and second quarters, respectively. Margins for natural gasoline and light naphtha of similar quality improved to 11¢/lb in first-quarter 2016 but fell to 6-7¢/lb in the second quarter.

Fig. 2 shows historic trends in ethylene prices (spot prices and NTP). Fig. 3 shows profit margins based on spot ethylene prices and variable production costs.

**Olefin-plant feed slate trends**

Petral Consulting's monthly survey of plant operating rates and feed slates showed ethylene industry demand for fresh feed increased to a new record high of 1.8 million b/d in first-quarter 2016 before receding to 1.64 million b/d during the second quarter alongside a decline in ethylene production rates. Demand for fresh feed in first-quarter 2016 was 41,800 b/d (2.4%) more than fourth-quarter 2015, while demand in the second quarter was 151,800 b/d less than the previous quarter.

Demand for NGL feeds (ethane, propane, and normal butane) was 1.63 million b/d in first-quarter 2016 and 1.51 million b/d in the second quarter. Demand for NGL feed in first-quarter 2016 was almost unchanged vs. fourth-quarter 2015, but demand in the second quarter of 2016 was 126,500 b/d lower compared with the first quarter of the year. NGL feeds accounted for 91-92% of fresh feed during first-half 2016 (Table 3).

Fig. 4 shows historical trends in ethylene feed.

**US propylene production**

Coproduct propylene supply depends primarily on the use of propane, normal butane, naphtha, and other heavy feeds. The monthly survey shows demand in first-quarter 2016 was 455,500 b/d for LPG feeds (propane and normal butane) and 162,100 b/d for heavy feeds. In second-quarter 2016, demand for LPG feeds declined by about 40,000 b/d to 414,000



b/d, while demand for heavy feeds fell by 25,000 b/d from the first quarter to 137,000 b/d.

Total demand during first-quarter 2016 for feeds with high-propylene yield was 617,600 b/d, or 29,800 b/d (5.1%) higher vs. fourth-quarter 2015. Demand for LPG and heavy feeds in second-quarter 2016 was down by 66,500 b/d (10.8%) from the first quarter to 551,000 b/d.

Petral Consulting estimates overall coproduct supply increased 1.2 million lb/day in first-quarter 2016 to 22.8 million lb/day. Although ethylene production reached a new record high in first-quarter 2016, demand for LPG and heavy feeds was 16,000 b/d less than in fourth-quarter 2015, with coproduct supply also 0.7 million lb/day lower vs. the last quarter of 2015. Coproduct supply during first-quarter 2016 was 87 million lb (4.4%) higher compared with fourth-quarter 2015, but declining ethylene production rates during second-quarter 2016 reduced coproduct supply by 240 million lb (13%) from the first quarter to 20.0-20.5 million, its lowest level since second-quarter 2012.

Coproduct supply from NGL feeds accounted for about 75% of overall coproduct supply for first-half 2016, averaging 17 million lb/day during the first quarter before falling to 15.0-15.5 million lb/day in the second quarter. Production from NGL feeds in first-quarter 2016 was only 22 million lb (1.4%) less vs. fourth-quarter 2015, while second-quarter production was 150 million lb (9.8%) lower from the preceding quarter (Table 4).

### PDH plants, refineries

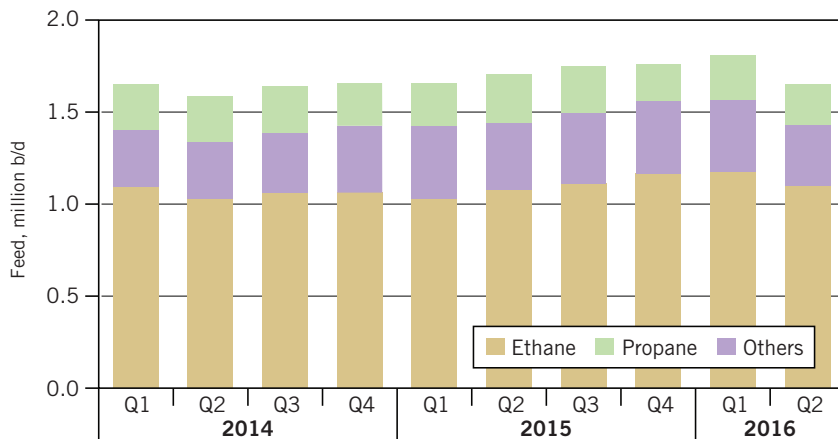
Based on PetroChem Wire's daily reports, Petral Consulting estimates propylene production from PDH plants at the US Gulf Coast was 6 million lb/day in first-quarter 2016 but dropped to 4.5 million lb/day in the second quarter, with an overall available production capacity of 8.4 million lb/day for first-half 2016.

Production in first-quarter 2016 was 250 million lb (2.75 million lb/day, or 85%) more than in fourth-quarter 2015, with production during the second quarter 130 million lb (1.44 million lb/day, or 24%) less compared with the previous quarter. The decline in propylene production from PDH plants reinforced the drop in coproduct supply from ethylene plants to result in an overall decline of coproduct and PDH supply during second-quarter 2016 of 370 million lb (4 million lb/day).

Refinery propylene sales into the merchant market are a function of:

- Fluid catalytic cracking unit (FCCU) feed rates (most important variable).

## US ETHYLENE PLANT FEED SLATE



Source: Petral Consulting

FIG. 4

## COPRODUCT PROPYLENE FROM ETHYLENE PLANT

Table 4

2015	From light feeds	From heavy feeds	Production (est.)
	Million lb/quarter		
1 Qtr.	1,492.9	549.4	2,042.3
2 Qtr.	1,529.2	548.4	2,077.6
3 Qtr.	1,614.0	552.1	2,166.1
4 Qtr.	1,564.1	426.2	1,990.3
1 Qtr.	1,541.9	534.1	2,076.0
2 Qtr.	1,390.5	445.0	1,835.5

Source: Petral Consulting

- FCCU operating severity (important but not directly measurable).
- Economic incentive to sell propylene rather than use it as alkylate feed.

Economic factors affect operating severity and are generally of secondary importance.

Statistics from the US energy Information Administration (EIA) indicate US refineries operated FCCUs at 4.9 million b/d in first-quarter 2016, an increase of 133,700 b/d (2.8%) from fourth-quarter 2015. FCCU feed rates increased during the first quarter despite a 246,000-b/d drop in crude runs compared with the last quarter of 2015.

EIA weekly reports show refinery crude runs increased to 16.4-16.5 million b/d in second-quarter 2016, during which period Petral Consulting estimates fresh feed to FCC units increased to 4.9-5.1 million b/d.

Regionally, EIA statistics showed feed rates for FCC units in the US Gulf Coast and Midcontinent at 3.46 million b/d in first-quarter 2016, 28,300 b/d (0.8%) higher than fourth-quarter 2015. Petral Consulting estimates feed rates for these FCC units were 3.55-3.65 million b/d in second-quarter 2016, or about 150,000 b/d (4.3%) more than in the previous quarter.

While spot prices for refinery-grade propylene in the Houston Ship Channel market fell below unleaded regu-

## PROPYLENE PRODUCTION, SALES

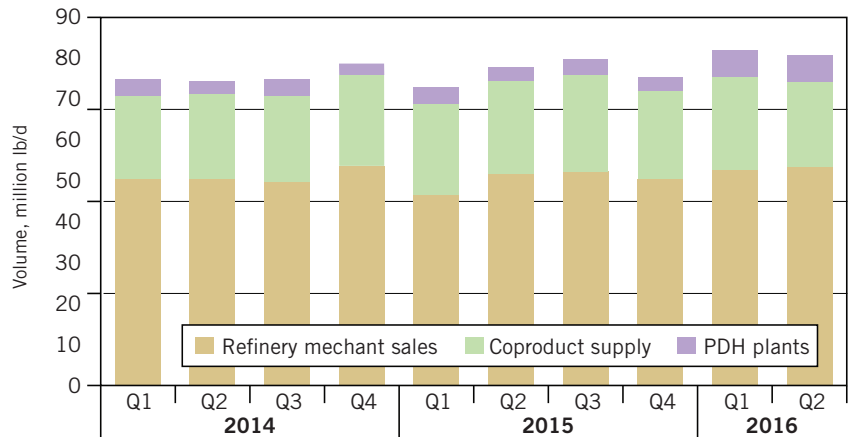


FIG. 5

Source: US Energy Information Administration, Petral Consulting estimates

## REFINERY PROPYLENE PRODUCTION

Table 5

2015	Texas Gulf Coast	South Louisiana	Other areas	Total
1 Qtr.	1,698.7	1,393.2	1,094.3	4,186.3
2 Qtr.	1,722.8	1,694.4	1,300.5	4,717.7
3 Qtr.	1,810.7	1,760.5	1,256.7	4,827.8
4 Qtr.	1,758.1	1,730.9	1,167.5	4,656.5
1 Qtr.	1,905.6	1,654.3	1,260.8	4,820.7
2 Qtr.	1,981.6	1,654.0	1,364.4	5,000.0

Source: EIA Petroleum Supply Monthly & Petral estimates

lar gasoline prices in April 2015 and remained discounted through yearend 2015, spot prices were unchanged in first-quarter 2016 (19¢/lb) despite a drop in unleaded regular gasoline prices in the Gulf Coast pipeline market to 15-17¢/lb in January and February. Spot prices for refinery-grade propylene increased to 20¢/lb in second-quarter 2016 but gasoline prices increased to 23-24¢/lb in May and June.

Even though refinery-grade propylene prices remained at discounts to motor gasoline prices in the Gulf Coast pipeline market, refineries maintained propylene supply at high ratios vs. FCCU feed rates.

Before 2015 some refineries curtailed refinery-grade propylene supply when prices fell below gasoline prices. During the second and third quarters of 2015, refinery-grade propylene supply from refineries in the Gulf Coast and Midcontinent was 8.36 billion lb, 332 million lb (4.1%) more than the same period in 2014. While spot prices for refinery-grade propylene were again discounted 3-4¢/lb vs. motor gasoline in May-June 2016, Petral Consulting estimates refinery-grade propylene supply from Gulf Coast and Midcontinent refineries was 48-49 million lb in second-quarter 2016, some 3.0-3.5 million lb/day (316 million lb, or 7.7%) more than in 2015 (Table 5).

### Propylene economics, pricing

EIA statistics for refinery-grade propylene and Petral Con-

sulting's estimates for coproduct supply and PDH plant production indicate total US propylene production of 82 million lb/day in first-quarter 2016, declining to 79-80 million lb/day in second-quarter 2016. The most significant changes in US propylene supply for first-half 2016 vs. 2015 resulted from increases in refinery supply and PDH plant production.

Fig. 5 shows trends in coproduct and refinery merchant propylene sales, as reported by EIA.

Two factors greatly influence propylene pricing. Refinery-grade propylene supply tracks seasonal variations in refinery crude runs and FCCU feed rates. Seasonal variations in refinery crude runs and FCCU feed rates are reasonably predictable, and propylene supply-demand balances are usually tighter in winter than in summer.

Propylene price relationships vs. unleaded regular gasoline vary directly with seasonal variations in the propylene supply-demand balance.

Under normal market conditions, propylene in reportable US Gulf Coast storage varies by  $\pm 25\%$  of the midrange of long-term historic inventory levels. Occasionally, however, inventory levels fall outside the historic range. When inventory in reportable storage at the Gulf Coast increases to more than 770 million lb, spot prices for refinery-grade propylene tend to decline and premiums vs. unleaded regular gasoline weaken.

On January 1, propylene inventory in reportable Gulf Coast storage was 544 million lb, 20% below the 3-yr average, according to EIA. On May 1, however, inventory in reportable Gulf Coast storage increased to 691 million lb, 1.8% above the 3-yr average.

The inventory swell was short-lived, however, as operating problems and planned maintenance work on PDH plants as well as ethylene plant turnarounds during second-quarter 2016 reduced polymer-grade propylene supply by almost 400 million lb. During the same quarter, Gulf Coast and Midcontinent producers increased refinery-grade propylene supply by only 140 million lb. Propylene inventory in reportable Gulf Coast storage varied within a narrow range of 600-750 million lb from the start of May through late June, according to EIA weekly statistics.

Propylene buyers and sellers anticipate predictable changes in supply due to plant turnarounds and seasonal variations in refinery-grade propylene supply. While inventory was a neutral consideration in first-quarter 2016, sellers anticipated a decline in refinery-grade propylene supply. Contrary to normal seasonal patterns, refinery-grade propylene supply was steady in first-quarter 2016, moving spot prices lower to 16.5-17.5¢/lb in February vs. 18-19¢/lb in fourth-quarter 2015. Unleaded regu-

lar gasoline prices, however, fell by even more, leaving refinery-grade propylene prices at premiums of 1-3¢/lb.

While refinery-grade propylene inventory in reportable Gulf Coast storage easily could have declined by 300 million lb during second-quarter 2016 to hit a historic low, supply remained steady, falling below the 3-yr average only occasionally. As a result, spot prices for refinery-grade propylene during the second quarter held within a range of 19-20¢/lb but remained at discounts of 2-5¢/lb vs. unleaded regular gasoline prices.

In first-quarter 2016, contract benchmark pricing for polymer-grade propylene averaged 30.0-31.5¢/lb, unchanged vs. fourth-quarter 2015. The decline in coproduct supply and PDH production during second-quarter 2016, however, provided support for stronger contract price settlements across the period, with contract prices settling at 32.5¢/lb for April and May before increasing to 33¢/lb for June.

### Polymer exports

The most important end-use markets for ethylene and propylene are production of polyethylene and polypropylene. US production of polyethylene and polypropylene has exceeded domestic demand for at least 30 years, and export markets have always absorbed the surplus in US supplies.

During 2017-20, petrochemical companies in North America will start up 20 billion lb/year of new ethylene and polyethylene capacity. Since polyethylene demand in domestic markets is stagnant, US exports of ethylene-based products such as polyethylene and ethylene glycol will become increasingly important. Recognizing the need to prepare for the surge, producers and chemical industry marketing firms began increasing exports of key derivative products in second-half 2015. Exports of polyethylene, in particular, continued to increase during first-half 2016.

US chemical companies also plan to increase PDH capacity by 4 billion lb/year (12 million lb/day). In contrast

to equivalent expansion of ethylene-derivatives capacity for new ethylene plants, most projects to expand PDH capacity do not include any equivalent expansion of propylene-derivatives capacity. PDH producers instead will export polymer-grade propylene as necessary to maintain a balanced market at the US Gulf Coast.

### Polyethylene

According to US International Trade Commission (ITC) statistics, US exports of polyethylene (high-density polyethylene, low-density polyethylene, and linear low-density polyethylene) during 2010-14 were relatively constant at 18-20 million lb/day, 45-

50% of which moved to Canada and Mexico. US polyethylene exports remained within this range during first-half 2015 before rising to 20-25 million lb/day in second-half 2015 and 24-27 million lb/day for most of first-half 2016, averaging 25.3 million lb/day January-May. Exports in first-half 2016 were up 2.3 million lb/day (10%) from second-half 2015.

In January-May, combined polyethylene exports to Canada and Mexico averaged 11.5 million lb/day but accounted for only 41% of total exports.

As Petral Consulting previously forecast, destinations other than Canada and Mexico have become important outlets for US polyethylene exports. In

## NELSON-FARRAR COST INDEXES<sup>1</sup>

### Refinery construction (1946 basis)

*Explained in OGI, Dec. 30, 1985, p. 145.*

	1962	1980	2013	2014	2015	May 2015	Apr. 2016	May 2016
<b>Pumps, compressors, etc.</b>	222.5	777.3	2,221.1	2,271.9	2,313.6	2,313.3	2,336.9	2,336.0
<b>Electrical machinery</b>	189.5	394.7	516.7	515.8	516.5	517.7	513.2	513.7
<b>Internal-comb. engines</b>	183.4	512.6	1,046.8	1,052.9	1,062.3	1,062.2	1,037.0	1,036.3
<b>Instruments</b>	214.8	587.3	1,509.9	1,533.6	1,554.4	1,565.9	1,594.8	1,597.3
<b>Heat exchangers</b>	183.6	618.7	1,293.3	1,305.0	1,305.0	1,305.0	1,221.2	1,221.2
<b>Misc. equip. average</b>	198.8	578.1	1,317.5	1,335.8	1,350.3	1,352.8	1,340.6	1,340.9
<b>Materials component</b>	205.9	629.2	1,538.7	1,571.8	1,434.9	1,448.6	1,389.9	1,432.6
<b>Labor component</b>	258.8	951.9	3,123.4	3,210.7	3,293.8	3,267.6	3,383.5	3,392.8
<b>Refinery (inflation) index</b>	237.6	822.8	2,489.5	2,555.2	2,550.2	2,540.0	2,586.1	2,608.7

### Refinery operating (1956 basis)

*Explained in OGI, Dec. 30, 1985, p. 145.*

	1962	1980	2013	2014	2015	May 2015	Apr. 2016	May 2016
<b>Fuel cost</b>	100.9	810.5	1,123.7	1,264.8	915.9	885.3	774.1	784.0
<b>Labor cost</b>	93.9	200.5	308.3	312.8	319.2	307.8	355.0	348.6
Wages	123.9	439.9	1,506.4	1,541.3	1,584.4	1,560.8	1,682.2	1,627.0
Productivity	131.8	226.3	489.1	493.1	497.1	507.0	473.9	466.8
<b>Invest., maint., etc.</b>	121.7	324.8	905.3	939.4	948.0	944.2	933.6	941.8
<b>Chemical costs</b>	96.7	229.2	502.6	472.3	434.6	430.3	402.2	406.5
<b>Operating indexes<sup>2</sup></b>								
Refinery	103.7	312.7	661.8	688.5	660.0	650.9	651.5	654.0
Process units	103.6	457.5	802.6	865.3	748.1	732.7	704.2	708.6

<sup>1</sup>These indexes are published in the first of each month and are compiled by Gary Farrar, OGJ Contributing Editor.

<sup>2</sup>Add separate index(es) for chemicals, if any are used. Indexes of selected individual items of equipment and materials are also published on the Quarterly Costimating page in first issues for January, April, July, and October.

first-half 2016, exports to rest-of-world (ROW) destinations averaged 15 million lb/day, 2.3 million lb/day (18%) up from second-half 2015. Northeast Asia and Northwest Europe were important destinations for these increased ROW shipments.

### Propylene, polypropylene

ITC statistics show US exports of propylene monomer were 2.1 million lb/day in 2007 but declined steadily 2008-14 to only 0.6 million lb/day in 2014 and 0.3 million lb/day in first-quarter 2015.

Propylene exports emerged as an important balancing mechanism for the US Gulf Coast market. During the balance of 2015, propylene monomer exports averaged 2.1 million lb/day, 1.1 million lb/day (384 million lb) up from 2014. If exports had remained at 2014 levels, inventory in second-half 2015 would have increased to more than 900 million lb on January 1 and would have continued to increase in first-half 2016.

In January-May 2016, exports of propylene monomer were 2.0-2.4 million lb/day, up 221 million lb from the same period in 2015.

ITC statistics show 2014-15 US exports of polypropylene averaged 5.9 million lb/day. Similar to the geographic disposition of US polyethylene exports, Mexico and Canada were the primary destinations for these shipments.

US polypropylene exports to all destinations averaged 5.80-5.85 million lb/day in second-half 2015 before falling to 4.96 million lb/day in first-quarter 2016. Exports to Mexico and Canada decreased to 4.13 million lb/day, accounting for about 83% of total exports during the period.

### Second-half 2016

The outlook for ethylene during second-half 2016 depends on trends in production costs and demand for derivatives. Additionally, production always depends on downtime for turnarounds and unplanned maintenance problems.

Three of five ethylene plants (with a combined capacity of about 7 billion lb/year, or 19 million lb/day) that were offline in April and May for planned maintenance returned to service by end-June and early July. While maintenance at two of the plants has carried over, work likely is to be completed and the plants back in operation by end-September.

One or two plants are likely to shut down for planned maintenance in third-quarter 2016 but total capacity offline will be less than in May, which was the peak month for planned maintenance in second-quarter 2016. Petral Consulting expects US ethylene production will rebound in second-half 2016 to average 158-162 million lb/day in the third quarter and 162-166 million lb/day in the final quarter.

The economic outlook for ethylene is a function of feedstock and coproduct prices, with trends in crude oil prices determining price trends for both feedstock and coproducts. After a brief rally in May-June, crude prices fell \$3-5/bbl in July and will likely remain weak. Prices for Dated Brent

and WTI should average \$40-45/bbl in second-half 2016 vs. \$46-51/bbl in May and June.

Ethane prices, however, are likely to be weaker in third-quarter 2016 compared with the previous quarter. Ethane inventory in US Gulf Coast storage increased for 6 consecutive months (November 2015-April 2016) to reach 33 million bbl on May 1 (8.3 million bbl up from November 1 and nearly 10 million bbl above the historic inventory midrange). Unless purity ethane prices fall to 15-16¢/gal in third-quarter 2016, inventory probably will continue to increase. If ethane prices are consistently 15-16¢/gal in the third quarter, profit margins for most ethylene producers will be 2-3¢/lb more than if ethane prices hold steady at 18-20¢/gal.

In sharp contrast, propane-inventory build rates in US Gulf Coast storage during second-quarter 2016 remained consistently less than the 3-yr average. Prices rallied to 48-51¢/gal in the second quarter alongside a 12-13¢/lb rise in production costs. Propane prices in Mont Belvieu are likely to hold steady at 48-50¢/gal unless waterborne exports from US Gulf Coast terminals fall sharply in third-quarter 2016.

Prices for natural gasoline and refinery-sourced light naphtha of similar quality will average 95-100¢/gal in second-half 2016, 40-45¢/gal below spot prices for unleaded regular gasoline in the Gulf Coast pipeline market during the third quarter and 30-35¢/gal less in the fourth quarter.

Spot prices for ethylene in second-half 2016 will average 24-28¢/lb. Prices in this range provide break-even margins based on production costs for natural gasoline and light naphtha feeds.

The outlook for propylene is based on a rebound in coproduct supply as ethylene production rates rebound in second-half 2016. Refinery-grade propylene supply will remain near its seasonal peak in third-quarter 2016 but production in the fourth quarter likely will decline by 2 million lb/day. Production from PDH plants will remain an unpredictable variable. As long as exports of propylene monomer remain steady, or increase as necessary to maintain the supply-demand balance, propylene prices will remain within the ranges established during first-half 2016. **OGJ**

### The author

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Lippe began his professional career in 1974 with Diamond Shamrock Chemical Co., moved into professional consulting in 1979, and has served petroleum, midstream, and petrochemical industry clients since. He holds a BS (1974) in chemical engineering from Texas A&M University and an MBA (1981) from Houston Baptist University. He is an active member of the Gas Processors Suppliers Association.





# Natural gas pipeline profits, construction both up

**Christopher E. Smith**  
 Managing Editor, Technology

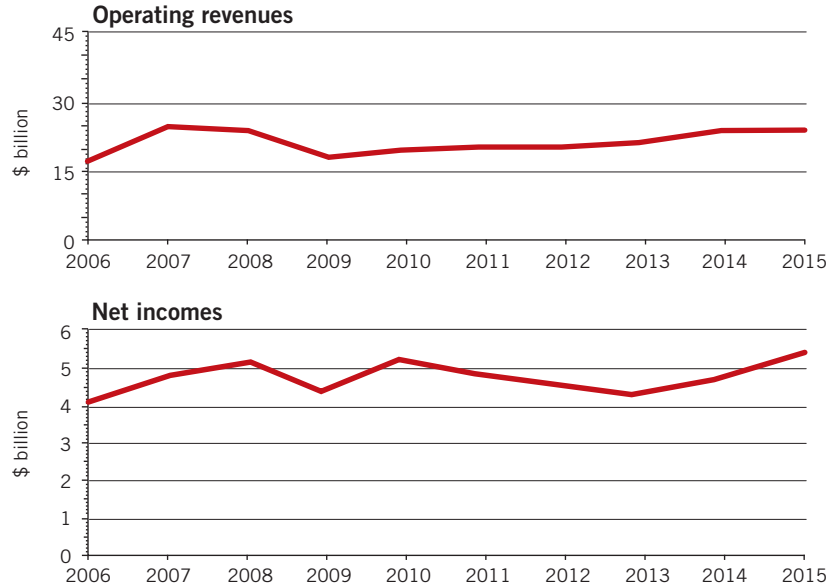
Natural gas pipeline operators' net income continued to rise despite the first drop in revenues since 2009. Additions to gas pipeline operators' systems also grew, up nearly 46% from 2014. This increase came despite a \$2.4-million/mile rise in pipeline construction costs as pressure continued to be felt to bring gas to market.

US oil pipeline operators' net incomes, however, fell more than 30% in 2015 despite revenues increasing for the tenth time in as many years, up more than 14% for 2015. Investment in oil pipeline carrier property also slowed, rising roughly \$8.5 billion after climbing about \$17 billion the year before.

The bulk of the net income losses

## NATURAL GAS PIPELINE PERFORMANCE

FIG. 1



Source: US FERC Forms 2 and 2A, gas pipeline company reports



### IN THIS REPORT . . .

**Pipeline revenues, incomes—2015**

**US pipeline costs**

**US pipeline costs:  
 estimated vs. actual**

**US compressor construction costs**

**US compressor costs:  
 estimated vs. actual**

**US interstate mileage**

**Investment in US oil pipelines**

**10 years of land construction costs**

**Top 10 interstate oil lines**

**Top 10 interstate gas lines**

**Oil pipeline companies**

**Gas pipeline companies**

## TOP 10 US INTERSTATE OIL PIPELINE COMPANIES—2015

Company	Mileage	Company	Trunkline traffic, million bbl-miles	Company	Income, \$1,000
1 Magellan Pipeline Co. LP	10,421	Colonial Pipeline Co.	879,841	Enbridge Energy LP	805,136
2 Mid-America Pipeline Co. LLC	8,068	Enbridge Energy LP	639,681	Sunoco Pipeline LP	502,726
3 Plains Pipeline LP	8,008	TransCanada Keystone Pipeline LP	218,190	Chevron Pipe Line Co.	482,486
4 Sunoco Pipeline LP	6,491	Magellan Pipeline Co. LP	155,715	Seaway Crude Pipeline Co.	444,889
5 Colonial Pipeline Co.	5,600	Plantation Pipe Line Co.	137,066	Plains Pipeline LP	413,288
6 Phillips 66 Pipeline LLC	5,086	Explorer Pipeline Co.	134,966	Shell Pipeline Co. LP	396,203
7 ExxonMobil Pipeline Co.	4,958	Plains Pipeline LP	130,787	Enterprise Crude Pipeline LLC	368,927
8 Enterprise TE Products Pipeline Co. LLC	4,872	Sunoco Pipeline LP	89,675	Mid-America Pipeline Co. LLC	368,640
9 BP Pipelines (North America) Inc.	4,289	Mid-America Pipeline Co. LP	85,239	Valero Terminaling and Distribution Co.	336,211
10 Centurion Pipeline LP	4,190	Marathon Pipe Line LLC	82,102	Colonial Pipeline Co.	315,875
<b>Total</b>	<b>61,983</b>		<b>2,553,262</b>		<b>\$4,434,381</b>
<b>Part of all companies</b>	<b>37.61%</b>		<b>55.64%</b>		<b>66.30%</b>
<b>Top 10 totals-2014</b>	<b>61,732</b>		<b>2,427,222</b>		<b>\$4,676,349</b>

Source: US FERC Form 6: Annual Report of Oil Pipeline Companies, Dec. 31, 2015.

## TOP 10 US INTERSTATE GAS PIPELINE COMPANIES—2015

Company*	Transmission mileage	Company*	Volumes moved for fee, MMcf	Company*	Net income, \$1,000
1 Northern Natural Gas Co.	14,761	Transcontinental Gas Pipe Line Corp.	4,673,755	Transcontinental Gas Pipe Line Corp.	383,776
2 Tennessee Gas Pipeline Co.	11,881	Texas Eastern Transmission LP	3,272,139	Texas Eastern Transmission LP	383,511
3 El Paso Natural Gas Co.	10,225	Tennessee Gas Pipeline Co.	3,131,981	Tennessee Gas Pipeline Co.	346,581
4 Texas Eastern Transmission LP	9,648	ANR Pipeline Co.	1,927,922	Dominion Transmission Inc.	302,343
5 Columbia Gas Transmission LLC	9,617	Natural Gas Pipeline Co. of America	1,492,392	Columbia Gas Transmission LLC	257,309
6 Transcontinental Gas Pipe Line Corp.	9,302	Columbia Gas Transmission LLC	1,460,089	Florida Gas Transmission Co. LLC	236,786
7 Natural Gas Pipeline Co. of America	9,117	El Paso Natural Gas Co.	1,419,808	Rockies Express Pipeline LLC	174,893
8 ANR Pipeline Co.	8,882	Dominion Transmission Inc.	1,287,635	Duke Energy Ohio Inc.	172,512
9 Southern Natural Gas Co.	6,985	Texas Gas Transmission LLC	1,119,869	Northern Natural Gas Co.	160,453
10 Gulf South Pipeline Co. LP	6,663	Rockies Express Pipeline LLC	1,058,794	Southern Natural Gas Co.	148,128
<b>Total</b>	<b>97,081</b>		<b>20,844,384</b>		<b>\$2,566,292</b>
<b>Part of majors</b>	<b>51.61%</b>		<b>44.29%</b>		<b>47.71%</b>
<b>Part of all companies</b>	<b>49.83%</b>		<b>43.10%</b>		<b>47.37%</b>
<b>Top 10 totals-2014</b>	<b>96,113</b>		<b>19,488,209</b>		<b>\$2,241,218</b>

\*All FERC-classified as "major."

Source: US FERC Forms 2 & 2A: annual reports for natural-gas companies, Dec. 31, 2015.

came from just two companies—Breit-Burn Operating LP losing roughly \$2.3 billion on its way to going out of business and TransCanada Keystone Pipeline LP losing about \$830 million—the rest of the segment registering a combined year-on-year gain when these companies results are excluded.

### Details

The sharp drop in oil pipeline profits as compared with revenues saw earnings as a percent of revenue plunge to 30.38%, by far the lowest level in the past 10 years. Natural gas pipeline operators saw their profits climb more than 13% to roughly \$5.4 billion, the highest level seen in the past decade, despite a 1.7% drop in revenues (Fig. 1).

Proposed new-build natural gas mileage was 12.8% higher than 2015's announced build, despite the higher construction costs, while planned horsepower additions

### US INTERSTATE PIPELINE MILEAGE

Year	Miles		Total <sup>1</sup>
	Gas <sup>1,2</sup>	Oil	
2006	189,012	140,407	329,419
2007	192,189	147,235	339,424
2008	192,384	146,822	339,206
2009	192,673	148,622	341,295
2010	190,305	147,524	337,829
2011	192,203	149,571	341,774
2012	191,195	151,912	343,107
2013	189,087	152,016	341,103
2014	189,366	160,521	349,887
2015	188,105	164,801	352,906

<sup>1</sup>FERC-defined major gas pipelines only; transmission mileage. See GAS COMPANIES table for definition . . . of major and nonmajor companies and details of companies reporting mileage for 2015. <sup>2</sup>Revised from initial publication.

Source: US FERC annual reports: Form 6, oil pipelines; Forms 2 & 2A, gas pipelines.

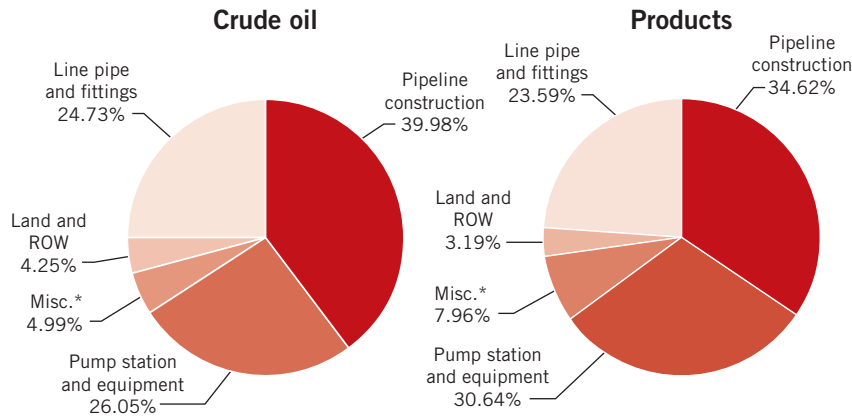
jumped more than 42% as compressor construction costs fell.

More expensive labor was the primary driver of higher pipeline construction costs, rates nearly doubling to \$3.6 million/mile from \$2.0 million/mile. Miscellaneous costs and right of way costs also rose, but not to the extent of labor. The roughly \$2.4-million increase in total estimated \$/mile land pipeline construction costs brought them to \$7.65 million per mile, 46% higher than 2015.

Actual land pipeline construction costs for projects completed in the 12 months ending June 30, 2016, were roughly \$400,000/mile more than estimated costs. Higher than expected labor and ROW costs more than made up for lower than estimated materials and miscellaneous charges. Actual compressor station costs were nearly identical to estimated costs for projects completed by June 30, 2016.

## OIL PIPELINE INVESTMENT

FIG. 2



\*Generally includes delivery systems, communications, office furniture and equipment, vehicles and other work equipment, and other property. Source: US oil pipeline company annual reports (Form 6) to FERC for 2015

## PIPELINE COMPANY REVENUES, INCOMES

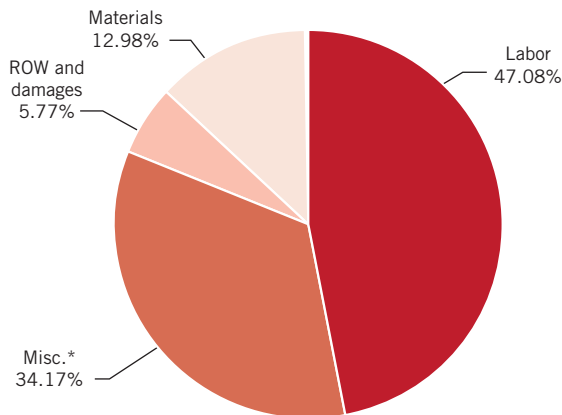
Table 2

	Gas		Oil	
	Operating revenues, \$1,000	Net income, \$1,000	Operating revenues, \$1,000	Net income, \$1,000
2006	17,122,586	4,015,253	8,516,563	3,743,115
2007	21,736,725	4,765,815	8,996,329	3,756,749
2008	19,797,663	5,104,772	9,243,677	3,931,602
2009	18,953,292	4,657,340	9,986,799	4,131,409
2010	19,790,011	5,210,388	11,219,154	4,582,285
2011	20,545,763	4,888,125	12,562,252	6,109,055
2012	20,969,959	4,764,796	14,007,060	6,423,112
2013	21,273,449	4,302,305	15,733,837	6,980,508
2014	24,514,239	4,776,194	19,281,113	9,572,871
2015	24,093,370	5,417,841	22,019,267	6,688,711

Source: US FERC annual reports (Forms 2, 2A, and 6) by regulated interstate natural gas and oil pipeline companies.

## PIPELINE CONSTRUCTION COSTS—ESTIMATED

FIG. 3



\*Generally includes surveying, engineering, supervision, administration and overhead, interest, contingencies and allowances for funds used during construction (AFUDC), and regulatory filing fees. Source: US FERC construction permit filings, July 1, 2015, to June 30, 2016



panies: revenue, income, volumes transported, miles operated, and investments in physical plants. These data are gathered from annual reports filed with FERC by regulated oil and natural gas pipeline companies for the previous calendar year.

Data is also gathered from periodic filings with FERC by those regulated natural gas pipeline companies seeking FERC approval to expand capacity. OGJ keeps a record of these filings for each 12-month period ending June 30.

Combined, these data allow an analysis of the US regulated interstate pipeline system.

- Annual reports. Companies that, in FERC's determination, are involved in the interstate movement of oil or natural gas for a fee are jurisdictional to FERC, must apply to FERC for approval of transportation rates, and therefore must file a FERC annual report: Form 2 or 2A, respectively, for major or non-major natural gas pipelines; Form 6 for oil (crude or product) pipelines.

The distinction between "major" and "nonmajor" is defined by FERC and appears as a note at the end of the table listing all FERC-regulated natural gas pipeline companies for 2015 at the end of this article.

The deadline to file these reports each year is in April. For a variety of reasons, a number of companies miss that deadline and apply for extensions, but eventually file an annual report. That deadline and the numerous delayed filings explain why publication of this OGJ report on pipeline economics occurs later in each year. Earlier publication would exclude many companies' information.

- Periodic reports. When a FERC-regulated natural gas pipeline company wants to modify its system, it must apply for a "certificate of public convenience and necessity." This filing must explain in detail the planned construction, justify it, and—except in certain instances—specify what the company estimates construction will cost.

Not all applications are approved. Not all that are approved are built. But, assuming a company receives its certificate and builds its facilities, it must—again, with some exceptions—report back to FERC how its original cost estimates compared with what it actually spent. OGJ spends the year July 1 to June 30 monitoring these filings, collecting

## US pipeline data

At the end of this article, two large tables (beginning on p. ??) offer a variety of data for US oil and gas pipeline compa-



**The Arab Republic of Egypt**  
**Ministry of Petroleum and Mineral Resources**



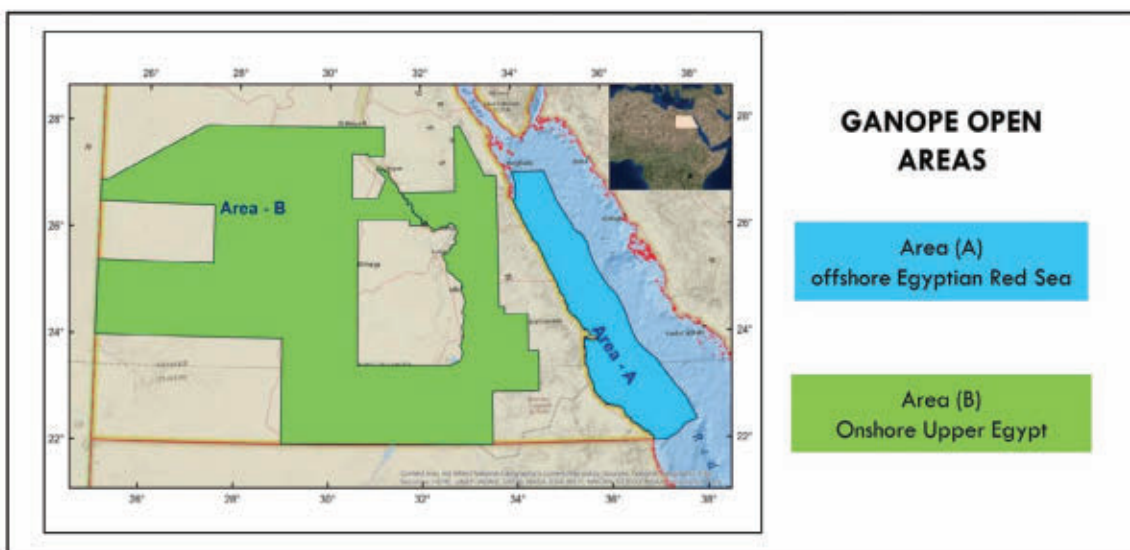
**Ministry of  
Petroleum and  
Mineral Resources**

**Ganoub El Wadi Petroleum Holding Company**

**Announcement For**

**NON-EXCLUSIVE MULTI-CLIENT SEISMIC SURVEY PROJECT, IN  
GANOPE OPEN AREAS**

Ganoub El Wadi Petroleum Holding Company requests Geophysical Service Companies and Service providers to propose program to collect new geophysical data and to reprocess and update the existing data. GANOPE OPEN AREAS based on Request for Proposal process (RFP) are divided into two separate regions as follows: Area (A) Offshore Egyptian Red Sea and Area (B) Onshore Upper Egypt as shown in the map and according to Non-Exclusive Multi-Client basis.



Interested Companies can review the technical data. The cost of the RFP documents is Two Thousands (2,000) US\$ and is Non-Refundable, starting from Tuesday, August 9<sup>th</sup>, 2016 at Ganope Premises:

**El Nour Street from El Nozha Street, Nasr City, Cairo, Egypt P.O.B.: 3011 El Horria.**

More Information of Ganope Multi-client Project, Ganope Open Area Coordinates and Available Data can be obtained through Ganope website: [www.ganope.com](http://www.ganope.com)

**The closing date will be on Thursday, December 15<sup>th</sup>, 2016 at 12:00 noon, Cairo local time**

**For more information, please contact:**

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**INVESTMENT IN OIL PIPELINES—2015**

Table 3

	Company and investment, \$					Total, \$	%
	A	B	C	D	E		
<b>CRUDE PIPELINES</b>							
Land	36,850,998	120,398	6,388	3,746,451	5,559,457	46,283,692	0.35%
Right of way	471,694,801	945,777	300,181	24,046,001	11,641,957	508,628,717	3.90%
Line pipe	2,912,538,299	23,369,478	7,069,114	52,276,186	53,623,900	3,048,876,977	23.35%
Line pipe fittings	127,427,424	1,579,699	2,842,458	16,821,123	32,049,842	180,720,546	1.38%
Pipeline construction	4,772,724,348	58,784,278	8,623,572	224,264,906	154,846,498	5,219,243,602	39.98%
Buildings	254,657,171	5,518,523	2,439,857	20,640,114	26,118,077	309,373,742	2.37%
Boilers	—	—	—	—	—	—	0.00%
Pumping equipment	352,587,614	11,106,948	9,745,032	46,231,679	16,901,027	436,572,300	3.34%
Machine tools and machinery	—	—	—	32,353	—	32,353	0.00%
Other station equipment	1,961,761,412	32,492,536	8,037,073	287,832,305	79,279,740	2,369,403,066	18.15%
Oil tanks	456,880,414	9,640,931	—	108,548,505	19,642,320	594,712,170	4.56%
Delivery facilities	9,318	14,454	—	16,807	—	40,579	0.00%
Communication systems	11,132,351	1,234,476	—	1,901,275	1,106,698	15,374,800	0.12%
Office furniture and equipment	26,396,228	507,431	1,199,953	749,371	296,326	29,149,309	0.22%
Vehicles and other work equip.	69,093,093	687,185	549,644	3,476,103	—	73,806,025	0.57%
Other property	11,545,376	3,281,169	—	207,758,024	930,620	223,515,189	1.71%
<b>Total investment-2015</b>	<b>11,465,298,847</b>	<b>149,283,283</b>	<b>40,813,272</b>	<b>998,341,203</b>	<b>401,996,462</b>	<b>13,055,733,067</b>	<b>100.00%</b>
<b>Total carrier property—2015</b>	<b>12,673,589,561</b>	<b>159,510,200</b>	<b>42,919,845</b>	<b>1,118,880,281</b>	<b>455,989,867</b>		
<b>Total investment-2014</b>	<b>9,818,708,755</b>	<b>131,740,632</b>	<b>40,769,662</b>	<b>891,840,975</b>	<b>397,225,445</b>	<b>11,280,285,469</b>	
<b>PRODUCT PIPELINES</b>							
Land	7,118,186	9,669,624	1,139,188	5,704,480	14,838,971	38,470,449	0.45%
Right of way	—	23,200,720	64,013,598	12,047,614	132,947,981	232,209,913	2.74%
Line pipe	418,365,068	87,758,800	679,883,935	106,395,197	295,543,264	1,587,946,264	18.74%
Line pipe fittings	163,298,041	64,358,552	94,558,341	6,560,328	82,105,536	410,880,798	4.85%
Pipeline construction	1,303,752,675	228,236,547	679,776,546	148,106,371	573,418,134	2,933,290,273	34.62%
Buildings	55,369,214	18,076,907	14,728,136	21,509,948	56,316,104	166,000,309	1.96%
Boilers	—	—	—	—	—	—	0.00%
Pumping equipment	124,586,808	40,586,685	252,751,005	38,050,468	80,074,677	536,049,643	6.33%
Machine tools and machinery	—	—	—	—	—	—	0.00%
Other station equipment	468,189,655	191,110,514	152,213,005	138,200,230	374,786,761	1,324,500,165	15.63%
Oil tanks	262,178,184	97,984,418	8,459,201	56,722,184	309,967,424	735,311,411	8.68%
Delivery facilities	—	—	12,152,740	34,715,491	192,107,677	238,975,908	2.82%
Communication systems	9,475,364	1,719,838	3,650,692	13,327,756	31,893,161	60,066,811	0.71%
Office furniture and equipment	47,213,966	2,113,663	35,828,410	6,922,808	3,525,933	95,604,780	1.13%
Vehicles and other work equip.	21,440,156	5,291,732	18,068,780	18,000,517	11,170,729	73,971,914	0.87%
Other property	3,679,445	—	29,155,751	—	6,935,844	39,771,040	0.47%
<b>Total investment-2015</b>	<b>2,884,666,762</b>	<b>770,108,000</b>	<b>2,046,379,328</b>	<b>606,263,392</b>	<b>2,165,632,196</b>	<b>8,473,049,678</b>	<b>100.00%</b>
<b>Total carrier property—2015</b>	<b>2,951,521,607</b>	<b>874,221,603</b>	<b>2,112,357,134</b>	<b>511,346,925</b>	<b>2,313,377,737</b>		
<b>Total investment-2014</b>	<b>2,796,966,847</b>	<b>754,141,725</b>	<b>1,998,837,677</b>	<b>583,338,262</b>	<b>2,128,652,246</b>	<b>8,261,936,757</b>	

Sources: US FERC Forms 6, Annual Report of Oil Pipeline Companies, Dec. 31, 2014, and 2015.

them, and analyzing their numbers.

OGJ's exclusive, annual Pipeline Economics report began tracking volumes of gas transported for a fee by major interstate pipelines for 1987 (OGJ, Nov. 28, 1988, p. 33) as pipelines moved gradually after 1984 from owning the gas they moved to mostly providing transportation services.

Volumes of natural gas sold by pipelines have been steadily declining, so that, beginning with 2001 data in the 2002 report, the table only lists volumes transported for others.

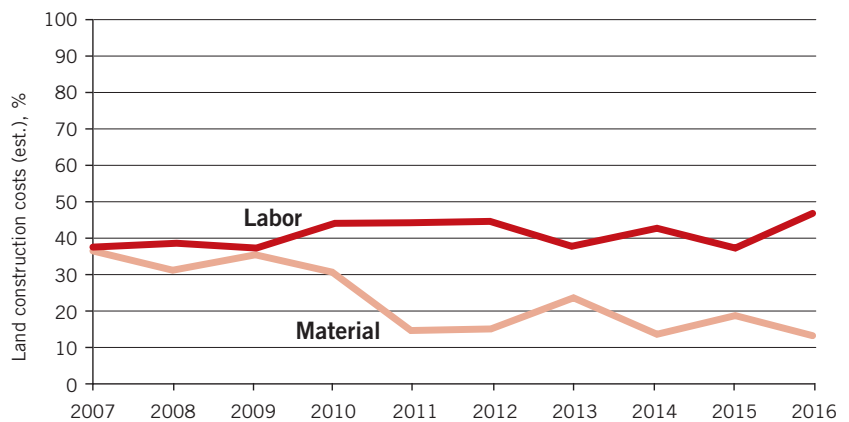
The company tables also reflect asset consolidation and merger activity among companies in their efforts to improve transportation efficiencies and bottom lines.

**Reporting changes**

The number of companies required to file annual reports with

**MAJOR COST COMPONENTS—10 YEARS**

FIG. 4



Source: US FERC

FERC may change from year-to-year, with some companies becoming jurisdictional, others nonjurisdictional, and still others merging or being consolidated out of existence.

## US PIPELINE COSTS, ESTIMATED

Table 4

Size, in.	Location <sup>1</sup>	Length, miles	\$				ROW & damages	Total	\$/mile
			Material	Labor	Misc. <sup>2</sup>				
<b>LAND PIPELINES</b>									
4	Pennsylvania	4.88	150,605	1,149,540	613,838	257,047	2,171,030	444,883	
	South Carolina	5.00	284,525	1,693,643	1,683,832	544,799	4,206,799	841,360	
6-30	Pennsylvania-West Virginia	7.87	8,133,000	34,760,000	17,701,771	1,200,000	61,794,771	7,851,940	
12	Louisiana-Mississippi	51.78	11,203,427	32,056,680	21,351,501	1,592,820	66,204,428	1,278,571	
	South Carolina	55.00	8,971,797	46,646,137	25,484,993	5,751,434	86,854,361	1,579,170	
12-30	Mass.-NH-Conn. (lat.)(L)	58.00	38,060,000	220,446,000	191,025,000	117,916,000	567,447,000	9,783,569	
12-36	WV-Virginia	29.20	17,219,213	135,180,459	91,983,781	16,175,337	260,558,790	8,923,246	
16	New York (lat.)	7.80	3,244,637	15,110,700	11,494,570	2,084,848	31,934,755	4,094,199	
20	New York	1.20	607,114	3,604,780	1,761,759	101,000	6,074,653	5,062,211	
	Pennsylvania /R/	21.00	9,792,291	52,477,600	22,961,374	8,370,878	93,602,143	4,457,245	
	North Carolina-Virginia	77.60	22,502,610	216,184,650	148,987,763	11,421,595	399,096,618	5,142,998	
24	New York /R/	7.00	2,363,550	14,152,672	5,853,727	938,000	23,307,949	3,329,707	
30	Louisiana (lat.)	3.00	2,897,992	9,874,969	6,991,431	573,560	20,337,952	6,779,317	
	West Virginia /R/	3.85	4,555,018	25,243,061	8,214,385	2,752,179	40,764,643	10,588,219	
	Pennsylvania-West Virginia	37.50	27,127,894	175,000,000	76,978,540	5,639,785	284,746,219	7,593,233	
	Pennsylvania-New York	131.00	117,371,000	468,842,000	361,612,000	89,540,000	1,037,365,000	7,918,817	
	NY-Mass.-NH	188.00	182,445,000	1,108,390,000	784,008,000	168,967,000	2,243,810,000	11,935,160	
36	Ohio (L)	4.40	3,694,111	14,568,330	14,413,735	4,958,710	37,634,886	8,553,383	
	Ohio	4.60	4,001,317	14,803,627	19,672,497	3,068,658	41,546,099	9,031,761	
	Pennsylvania (L)	7.00	9,994,396	35,558,432	35,928,854	5,938,321	87,420,003	12,488,572	
	Ohio	9.06	6,636,303	26,511,841	29,984,975	5,348,005	68,481,124	7,558,623	
	Pennsylvania (L)	12.91	18,278,688	49,564,160	60,535,886	8,851,748	137,230,482	10,629,782	
	Pennsylvania (L)(lat.)	41.00	49,277,000	187,655,000	115,201,000	24,640,000	376,773,000	9,189,585	
	Texas	66.00	73,543,447	2,012,730	203,846,401	11,539,694	290,942,272	4,408,216	
	Pennsylvania-New Jersey	114.00	127,241,054	552,912,900	164,814,512	93,623,611	938,592,077	8,233,264	
	West Virginia	170.10	124,422,852	814,408,049	533,288,314	96,276,251	1,568,395,466	9,220,432	
	North Carolina	181.50	163,079,520	648,108,235	419,060,826	24,867,143	1,255,115,724	6,915,238	
	Ohio-Michigan	255.90	195,540,774	514,196,619	798,040,506	157,679,166	1,665,457,065	6,508,234	
42	New York-Connecticut	6.30	8,684,775	76,936,367	85,039,846	17,429,504	188,090,492	29,855,634	
	Louisiana (lat.)	42.70	80,000,000	160,000,000	104,545,279	—	344,545,279	8,068,976	
	Texas	274.00	479,138,899	468,203,355	323,960,732	39,828,080	1,311,131,066	4,785,150	
	WV-Va.-NC	292.80	344,491,422	1,498,099,754	1,011,071,411	54,409,763	2,908,072,350	9,931,941	
	WV-Virginia	301.00	310,661,868	1,286,512,363	768,720,119	109,641,667	2,475,536,017	8,224,372	
<b>Total projects—land</b>		<b>2472.95</b>	<b>\$2,455,616,099</b>	<b>\$8,910,864,653</b>	<b>\$6,466,833,158</b>	<b>\$1,091,926,603</b>	<b>\$18,925,240,513</b>	<b>\$7,652,901</b>	
<b>Total land-2015 report</b>		<b>2192.16</b>	<b>\$2,219,997,036</b>	<b>\$4,335,957,101</b>	<b>\$4,093,624,445</b>	<b>\$829,195,731</b>	<b>\$11,478,774,316</b>	<b>\$5,236,285</b>	
<b>OFFSHORE PIPELINES</b>									
<b>Total projects—offshore</b>		—	—	—	—	—	—	—	
<b>Total—all projects</b>		<b>2472.95</b>	<b>\$2,455,616,099</b>	<b>\$8,910,864,653</b>	<b>\$6,466,833,158</b>	<b>\$1,091,926,603</b>	<b>\$18,925,240,513</b>	<b>\$7,652,901</b>	
<b>2015-report total, all projects</b>		<b>2192.16</b>	<b>\$2,219,997,036</b>	<b>\$4,335,957,101</b>	<b>\$4,093,624,445</b>	<b>\$829,195,731</b>	<b>\$11,478,774,316</b>	<b>\$5,236,285</b>	

<sup>1</sup>L = loop; R = replacement; lat. = lateral. <sup>2</sup>Generally includes surveys, engineering, supervision, interest, administration, overheads, contingencies, allowances for funds used during construction (AFUDC), and FERC fees.

Source: US FERC construction-permit applications, July 1, 2015, to June 30, 2016.

Such changes require care be taken in comparing annual US petroleum and natural gas pipeline statistics.

Institution by FERC of the two-tiered (2 and 2A) classification system for natural gas pipeline companies after 1984 further complicated comparisons (OGJ, Nov. 25, 1985, p. 55).

Only major gas pipelines are required to file miles operated in a given year. The other companies may indicate miles operated, but are not specifically required to do so.

For several years after 1984, many non-majors did not describe their systems. But filing descriptions has since become standard, and most provide miles operated.



Reports for 2015 show an increase in FERC-defined major gas pipeline companies: 96 companies of 169 filing, from 93 of 165 for 2014.

The FERC made an additional change to reporting requirements in 1995 for both crude oil and petroleum products pipelines. Exempt from requirements to prepare and file a Form 6 were pipelines with operating revenues at or less than \$350,000 for each of the 3 preceding calendar years. These companies must now file only an "Annual Cost of Service Based Analysis Schedule," which provides only total annual cost of service, actual operating revenues, and total throughput in both deliveries and barrel-miles.

In 1996 major natural gas pipeline companies were no lon-

## US COMPRESSOR-CONSTRUCTION COSTS, ESTIMATED

Table 5

Location	Horsepower	Equipment material	Labor	Land \$	Misc. <sup>1</sup>	Total	\$/hp
Pennsylvania-Maryland	4,000	8,372,310	9,492,113	88,840	6,508,169	24,461,432	6,115
South Carolina <sup>2</sup>	2,800	5,119,494	3,577,670	—	2,956,316	11,653,480	4,162
South Carolina	3,600	2,664,760	6,581,278	—	3,752,368	12,998,406	3,611
Tennessee	4,700	12,791,000	12,547,000	963,000	10,464,000	36,765,000	7,822
Pennsylvania	5,247	14,699,040	16,368,653	10,904,540	22,837,767	64,810,000	12,352
Pennsylvania <sup>2</sup>	7,000	12,406,331	11,350,282	168,990	6,926,959	30,852,562	4,408
Massachusetts	7,700	22,903,949	22,598,948	9,460,605	48,582,012	103,545,514	13,447
Ohio <sup>2</sup>	9,400	13,198,344	13,001,377	123,703	22,287,386	48,610,810	5,171
New Jersey <sup>2</sup>	10,494	2,075,580	3,502,888	215	2,361,317	7,940,000	757
Louisiana	15,900	22,696,396	10,872,913	710,427	18,484,663	52,764,399	3,319
Kentucky	16,875	18,693,370	16,335,912	11,000	37,266,832	72,307,114	4,285
Texas	18,089	20,321,000	12,496,000	118,000	7,757,877	40,692,877	2,250
Connecticut <sup>2</sup>	18,800	46,104,441	40,312,354	290,000	42,278,580	128,985,375	6,861
Ohio	18,800	27,193,732	20,671,489	1,727,796	35,787,486	85,380,503	4,542
New York	21,600	33,635,000	15,628,000	2,879,000	18,837,000	71,000,600	3,287
North Carolina	21,745	40,348,631	38,042,198	6,332,097	34,420,550	119,143,476	5,479
Massachusetts	23,000	27,060,000	19,352,000	14,208,000	18,757,000	79,377,000	3,451
Ohio	26,000	30,700,605	16,441,915	1,850,000	34,032,505	83,025,025	3,193
Ohio	26,000	30,700,605	16,441,915	1,850,000	34,032,505	83,025,025	3,193
Ohio	26,000	30,700,605	16,441,915	1,850,000	34,032,505	83,025,025	3,193
West Virginia <sup>2</sup>	26,000	28,414,766	29,194,742	1,402,632	15,599,403	74,611,543	2,870
New York	30,000	62,224,000	28,595,000	510,000	28,773,000	120,102,000	4,003
New York	30,000	57,546,000	32,463,000	1,347,000	28,364,000	119,720,000	3,991
Pennsylvania	31,300	38,150,000	19,005,000	1,800,000	22,442,349	81,397,349	2,601
West Virginia	31,800	170,409,689	126,210,816	3,024,816	195,068,823	494,714,144	15,557
Pennsylvania	32,000	70,564,000	29,611,000	2,252,000	33,256,000	135,683,000	4,240
Virginia	40,645	74,600,010	38,042,198	8,626,757	30,503,123	151,772,088	3,734
Massachusetts	41,000	46,455,000	20,593,000	3,906,000	23,916,000	94,870,000	2,314
Massachusetts	41,000	46,455,000	20,593,000	3,906,000	23,916,000	94,870,000	2,314
New Hampshire	41,000	47,098,000	20,593,000	3,596,000	23,977,000	95,264,000	2,324
New York	41,000	45,471,000	21,614,000	2,939,000	23,695,000	93,719,000	2,286
West Virginia	41,000	51,313,831	14,168,759	1,500,000	35,745,876	102,728,466	2,506
West Virginia	41,000	47,076,331	11,789,552	1,500,000	32,602,072	92,967,955	2,268
Pennsylvania <sup>2</sup>	42,000	42,212,336	31,767,152	538,493	19,147,229	93,665,210	2,230
Pennsylvania	47,700	56,747,435	36,375,000	960,000	9,876,458	103,958,893	2,179
Kentucky	51,800	64,521,366	42,695,423	695,718	65,753,042	173,665,549	3,353
Ohio	52,000	53,153,771	21,866,703	1,850,000	46,800,262	123,670,736	2,378
West Virginia	55,015	65,941,887	40,293,213	17,605,005	45,386,592	169,226,697	3,076
Texas	83,597	73,421,277	876,690	555,000	79,161,825	154,014,792	1,842
West Virginia	89,600	88,698,133	21,097,927	1,500,000	54,234,572	165,530,632	1,847
West Virginia	228,300	190,376,269	115,926,988	3,655,603	147,300,463	457,259,323	2,003
Ken.-Tenn.-Miss.	238,000	265,183,323	163,368,955	4,599,534	241,195,216	674,347,028	2,833
Texas	600,000	239,569,450	234,101,678	9,244,060	161,980,367	644,895,555	1,075
<b>Total, land projects</b>	<b>2,239,507</b>	<b>2,331,831,503</b>	<b>1,433,407,503</b>	<b>130,960,991</b>	<b>1,824,550,300</b>	<b>5,728,556,151</b>	<b>2,558</b>
<b>2015-report total, land projects</b>	<b>1,701,613</b>	<b>2,126,410,886</b>	<b>970,777,543</b>	<b>43,600,408</b>	<b>1,600,029,434</b>	<b>4,740,880,271</b>	<b>2,786</b>
<b>TOTAL, ALL PROJECTS</b>	<b>2,239,507</b>	<b>2,331,831,503</b>	<b>1,433,407,503</b>	<b>130,960,991</b>	<b>1,824,550,300</b>	<b>5,728,556,151</b>	<b>2,558</b>
<b>2015-report total, all projects</b>	<b>1,701,613</b>	<b>2,126,410,886</b>	<b>970,777,543</b>	<b>43,600,408</b>	<b>1,600,029,434</b>	<b>4,740,880,271</b>	<b>2,786</b>

<sup>1</sup>Generally includes surveys, engineering, supervision, interest, administration, freight, taxes, overheads, contingencies, allowances for funds used during construction (AFUDC), and FERC fees. <sup>2</sup>Addition.

Source: US FERC construction-permit applications, July 1, 2015, to June 30, 2016

ger required to report miles of gathering and storage systems separately from transmission. Thus, total miles operated for gas pipelines consist almost entirely of transmission mileage.

FERC-regulated major natural gas pipeline mileage rose slightly in 2015 (Table 1), final data showing an increase of 3,019 miles, or 0.86%.

### Rankings; activity

Natural gas pipeline companies in 2015 saw operating revenues fall nearly \$421 million or roughly 1.7% from 2014, reversing the gains seen the past few years. Net incomes, however, continued to grow, climbing nearly \$642 million (about 13.4%).

Oil pipeline earnings fell nearly \$2.9 billion (roughly 30%) despite a more than \$2.7 billion (14.2%) increase in revenues (Table 2). The fall in earnings more than erased the

segment's substantial 2014 earnings increase.

Crude deliveries for 2015 increased by nearly 1.6 billion bbl or 17%, while product deliveries rose 402 million bbl (5.8%).

OGJ uses the FERC annual report data to rank the top 10 pipeline companies in three categories (miles operated, trunkline traffic, and operating income) for oil pipeline companies and three categories (miles operated, gas transported for others, and net income) for natural gas pipeline companies.

Positions in these rankings shift year to year, reflecting normal fluctuations in companies' activities and fortunes. But also, because these companies comprise such a large portion of their respective groups, the listings provide snapshots of overall industry trends and events.

For instance, earnings for the Top 10 oil pipeline companies slipped just 5% compared with the 30% overall drop,

10 YEARS OF LAND CONSTRUCTION COSTS<sup>1</sup>

Table 6

Size	Year	ROW	Material	Labor	Misc.	Total	Low High	
							Range, \$/mile	
Average cost, \$/mile								
8 in.	2016	—	—	—	—	—	—	—
	2015	55,289	153,115	603,317	179,045	990,765	766,056	1,273,258
	2014	17,717	608,268	119,685	988,189	<sup>2</sup> 1,733,858	—	—
	2013	71,443	188,261	69,541	1,533,654	1,862,899	1,762,637	4,246,500
	2012	—	—	—	—	—	—	—
	2011	—	132,884	917,910	582,952	<sup>2</sup> 1,633,746	—	—
	2010	—	—	—	—	—	—	—
	2009	—	—	—	—	—	—	—
	2008	17,438	378,698	199,342	114,617	<sup>2</sup> 710,095	—	—
	2007	—	—	—	—	—	—	—
12 in.	2016	68,779	188,942	737,056	438,626	1,433,403	1,278,571	1,579,170
	2015	469,849	278,164	1,837,630	1,365,782	3,951,424	2,900,135	4,928,073
	2014	772,578	721,073	4,777,695	4,263,874	<sup>2</sup> 10,535,221	—	—
	2013	64,313	319,004	784,464	380,252	<sup>2</sup> 1,548,033	—	—
	2012	75,246	213,859	612,119	419,950	<sup>2</sup> 1,321,173	—	—
	2011	—	—	—	—	—	—	—
	2010	—	—	—	—	—	—	—
	2009	—	—	—	—	—	—	—
	2008	178,757	195,406	566,193	466,159	1,406,515	541,392	4,186,636
	2007	—	—	—	—	—	—	—
16 in.	2016	267,288	415,979	1,937,269	1,473,663	<sup>2</sup> 4,094,199	—	—
	2015	357,891	380,604	1,395,814	2,180,469	4,314,779	3,175,990	14,996,594
	2014	574,745	483,528	2,911,085	2,807,562	6,776,920	6,471,863	7,325,147
	2013	81,810	286,739	533,749	636,324	1,538,623	1,005,653	5,882,153
	2012	126,033	302,558	748,967	302,760	<sup>2</sup> 1,480,318	—	—
	2011	278,231	305,235	1,004,152	1,328,691	2,916,309	2,007,514	3,885,413
	2010	263,135	222,719	885,769	966,447	<sup>2</sup> 2,338,069	—	—
	2009	226,517	417,899	1,480,926	586,626	<sup>2</sup> 2,711,968	—	—
	2008	421,484	1,182,666	1,689,992	1,552,542	<sup>2</sup> 4,646,684	—	—
	2007	—	—	—	—	—	—	—
20 in.	2016	199,333	329,680	2,728,127	1,740,590	4,997,730	4,457,245	5,142,998
	2015	324,055	425,218	985,093	1,689,816	3,424,182	2,476,789	6,049,136
	2014	473,329	632,417	2,264,767	2,142,928	5,513,441	2,723,642	11,975,448
	2013	103,333	338,025	998,560	701,317	<sup>2</sup> 2,141,235	—	—
	2012	8,941	275,292	69,647	1,349,884	<sup>2</sup> 1,703,765	—	—
	2011	97,553	402,232	1,208,048	816,998	2,524,831	1,773,309	7,970,976
	2010	64,198	1,194,239	1,663,457	1,504,568	<sup>2</sup> 4,426,461	—	—
	2009	164,377	820,867	1,993,079	1,061,331	4,039,654	3,866,474	7,528,043
	2008	23,219	869,178	941,096	491,932	<sup>2</sup> 2,325,425	—	—
	2007	—	—	—	—	—	—	—
24 in.	2016	134,000	337,650	2,021,810	836,247	<sup>2</sup> 3,329,707	—	—
	2015	157,746	633,298	1,930,386	1,006,423	3,727,853	1,877,375	9,056,833
	2014	231,155	523,863	1,516,691	1,075,740	3,347,449	1,469,338	6,181,322
	2013	73,560	623,116	805,886	912,622	2,415,184	1,922,659	4,681,258
	2012	181,741	701,303	1,910,324	1,143,928	3,937,296	2,254,386	4,481,436
	2011	283,312	409,840	1,603,609	1,482,417	3,779,177	1,873,984	11,877,953
	2010	—	—	—	—	—	—	—
	2009	65,567	530,093	1,085,736	663,240	2,344,636	1,975,000	3,399,653
	2008	—	—	—	—	—	—	—
	2007	25,467	351,083	324,023	453,737	1,155,030	830,872	4,301,932
30 in.	2016	736,129	920,316	4,919,086	3,406,645	9,982,176	6,779,317	11,935,160
	2015	658,419	977,539	3,792,172	2,457,962	7,886,092	6,684,118	13,416,935
	2014	268,605	690,850	2,155,315	2,036,710	5,151,482	4,600,017	8,873,792
	2013	—	—	—	—	—	—	—
	2012	290,807	1,020,108	3,218,952	3,242,493	7,772,360	6,356,657	35,732,500
	2011	390,263	745,675	3,648,578	2,276,889	7,061,405	6,384,345	7,177,507
	2010	160,922	769,453	1,601,563	966,007	<sup>2</sup> 3,497,944	—	—
	2009	384,467	624,980	912,342	113,283	2,035,073	1,955,746	3,917,264
	2008	83,016	1,091,147	356,539	472,278	2,002,981	1,684,461	2,264,167
	2007	156,303	1,371,819	1,328,831	922,647	3,779,600	1,546,833	4,715,909
36 in.	2016	504,104	895,253	3,301,095	2,763,844	7,464,296	4,408,216	12,488,572
	2015	1,083,005	1,130,531	2,010,998	2,181,621	6,406,155	5,411,030	16,151,288
	2014	— <sup>3</sup>	1,106,103	3,061,029	1,683,401	5,760,613	346,243	5,876,636
	2013	93,529	1,400,946	2,182,912	1,938,652	5,616,040	3,461,864	79,188,232
	2012	—	—	—	—	—	—	—
	2011	519,369	937,500	2,864,358	3,059,234	7,380,462	7,072,552	7,848,259
	2010	107,000	1,641,171	1,544,020	1,051,506	<sup>2</sup> 4,343,697	—	—
	2009	499,329	1,083,073	1,084,429	892,446	3,559,276	3,284,505	3,600,324
	2008	170,489	994,375	1,098,096	511,589	2,774,549	2,427,457	9,013,608
	2007	97,746	869,995	628,204	893,293	2,489,238	1,857,468	4,056,369

<sup>1</sup>Estimates; based on FERC construction-permit applications for a 12-month period ending June 30 of each year. <sup>2</sup>Only one project proposed during this period for this diameter. <sup>3</sup>One of the projects of this diameter did not list ROW as a discrete category.

suggesting—when combined with the concentration of losses in just two companies—that smaller operators fared better than their larger counterparts. The Top 10 companies'

share of the segment's total earnings ballooned to almost two-thirds along the way, up from roughly 48% in 2014.

Net income as a portion of natural gas pipeline operating



revenues rebounded to 22.49% in 2015, up from 2014's 11-year+ low of 19.48%. The percentage of income as operating revenues for oil pipelines plunged to 30.38% from 2014's record 49.64%.

Net income as a portion of gas-plant investment continued to rise, reaching 3.43% in 2015, up from the previous year's 3.14% and continuing the rebound off the 17-year low of 2.93% in 2013. Net income as a portion of investment in oil pipeline carrier property fell to 7.15%, approaching 1998's level of 6.8% after having reached 11.3% in 2014.

Major and nonmajor natural gas pipelines in 2015 reported total gas-plant investment of roughly \$158 billion, the highest level ever, up from \$152 billion in 2014, about \$147 billion in 2013, more than \$142 billion in 2012, \$138.6 billion in 2011, \$124.7 billion in 2010, almost \$121.3 billion in 2009, and nearly \$105.8 billion in 2008.

Investment in oil pipeline carrier property continued to surge in 2015 despite the downturn in earnings, surpassing \$93 billion, more than double the values seen just 5 years before. Carrier property in 2014 totaled nearly \$85 billion after hitting \$68 billion in 2013, topping \$54 billion in 2012, hitting roughly \$49 billion in 2011, more than \$45 billion in 2010, roughly \$42 billion in 2009, \$39 billion in 2008, almost \$36 billion in 2007, and beginning its current upward momentum in 2006 to \$32.7 billion from the lowest level seen since at least 1997, \$29.5 billion in 2005.

OGJ for many years has tracked carrier-property investment by five crude oil pipeline and five products pipeline companies chosen as representative in terms of physical systems and expenditures (Table 3). In 2003, we added the base carrier-property investment to allow for comparisons among the anonymous companies.

The five crude oil pipeline companies in 2015 increased their overall investment in carrier property by nearly \$1.8 billion (15.7%), slowing the gains seen in 2014 and 2013 but outpacing the segment as a whole. All of the companies increased investment in carrier property, but more than \$1.6 billion of the overall gain came from a single operator.

The five products pipeline companies saw their overall investment in carrier property slow more dramatically in 2015, adding just \$211 million, or 2.6%.

Comparisons of data in Table 3 with previous years' must be done with caution as mergers, acquisitions, and sales can make comparisons with previous years' data difficult.

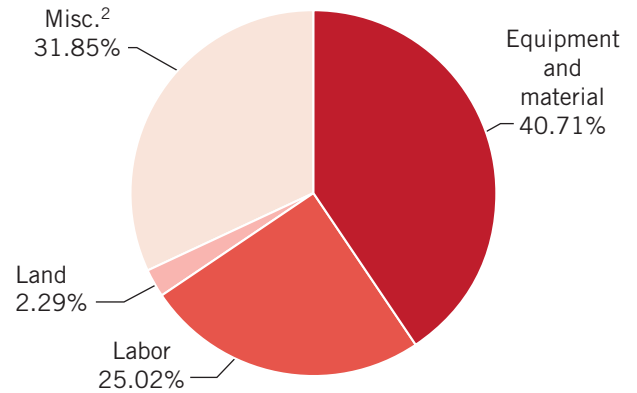
Fig. 2 illustrates how investments in the crude oil and products pipeline companies were divided.

**Construction mixed**

Applications to FERC by regulated interstate natural gas pipeline companies to modify certain systems must, except

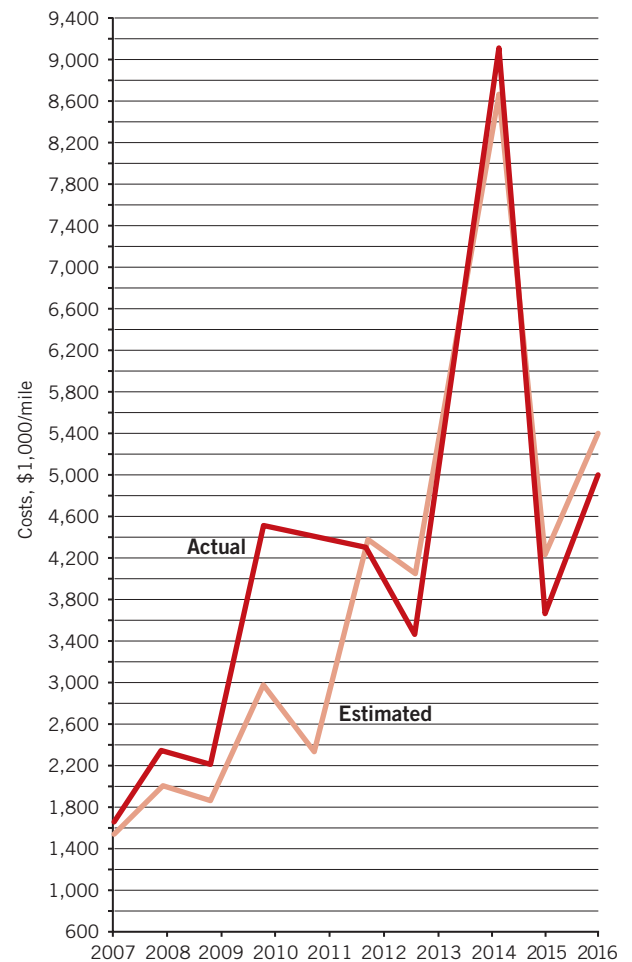


**COMPRESSOR CONSTRUCTION COSTS—ESTIMATED<sup>1</sup>** FIG. 5



<sup>1</sup>Onshore only. <sup>2</sup>Generally includes surveying, engineering, supervision, administration and overhead, interest, contingencies and allowances for funds used during construction (AFUDC), and regulatory filing fees. Source: US FERC construction permit filings, July 1, 2015, to June 30, 2016

**ESTIMATED, ACTUAL COST TRENDS—10 YEARS\*** FIG. 6



\*Land and offshore pipeline construction as of June 30 of each year for the previous 12 months. Source: US FERC

US PIPELINE COSTS: ESTIMATED VS. ACTUAL, 2015-16<sup>1</sup>

Table 7

Size, in.	Location	Length, miles	Materials	Labor	Misc. <sup>2</sup> \$	ROW & damages	Total	\$/mile
<b>Land pipelines</b>								
8	Nevada (lat.)	35.2						
	Estimated		6,914,341	17,232,716	6,282,666	590,999	31,020,722	881,271
	Actual		4,701,794	17,690,000	7,128,928	610,279	30,131,001	855,994
12, 16	New York-Penn. (lat.)	17.12						
	Estimated		2,998,071	14,929,277	9,696,804	2,444,507	30,068,659	1,756,347
	Actual		3,484,102	20,720,184	11,034,818	2,611,822	37,850,926	2,210,919
20	Oregon (lat.)	24.30						
	Estimated		8,956,000	25,058,000	17,801,000	2,538,000	54,353,000	2,236,749
	Actual		7,909,000	29,144,000	16,743,000	3,025,000	56,821,000	2,338,313
20	New Jersey	2.40						
	Estimated		2,586,698	11,023,251	13,313,043	1,818,084	28,741,076	11,975,448
	Actual		2,109,697	25,599,665	9,715,198	4,341,706	41,766,266	17,402,611
20	Mississippi	0.76						
	Estimated		1,100,243	1,794,432	1,415,325	211,673	4,521,673	5,949,570
	Actual		1,372,616	1,061,440	1,423,871	330,361	4,188,288	5,510,905
24	Virginia	100.00						
	Estimated		58,787,289	89,444,396	81,269,592	5,426,643	234,927,920	2,349,279
	Actual		46,938,203	124,196,390	61,232,427	13,084,489	245,451,509	2,454,515
24	Pennsylvania /R/	23.00						
	Estimated		11,544,089	33,427,875	16,640,071	3,621,000	65,233,035	2,836,219
	Actual		10,673,070	42,190,794	13,202,261	3,742,218	69,808,343	3,035,145
26	Pennsylvania-NJ	19.00						
	Estimated		55,848,000	7,731,000	190,158,000	14,758,000	268,495,000	14,131,316
	Actual		59,523,003	6,582,751	214,964,418	18,652,821	299,722,993	15,774,894
26	New York	0.38						
	Estimated		1,282,166	16,586,858	5,824,174	28,355	23,721,553	62,425,139
	Actual		1,285,540	18,477,572	5,006,623	25,380	24,795,115	65,250,303
30	Ohio	76.00						
	Estimated		44,688,070	157,491,993	119,422,574	27,998,646	349,601,283	4,600,017
	Actual		38,569,864	138,069,046	151,943,034	58,993,172	387,575,116	5,099,673
30	New York (L)	3.10						
	Estimated		4,608,100	11,627,450	10,268,204	1,005,000	27,508,754	8,873,792
	Actual		4,222,505	12,177,721	5,287,827	742,135	22,430,188	7,235,545
42	Pennsylvania (L)	11.47						
	Estimated		18,057,409	58,445,706	59,494,912	1,847,500	137,845,527	12,017,919
	Actual		13,264,642	62,831,513	18,787,576	6,327,274	101,211,005	8,823,976
42	New Jersey (L)	6.92						
	Estimated		10,693,345	26,596,687	35,624,052	9,172,667	82,086,751	11,862,247
	Actual		6,735,476	57,703,646	16,358,164	10,391,874	91,189,160	13,177,624
42	New Jersey (L)	6.31						
	Estimated		8,781,084	35,143,757	39,999,834	10,124,344	94,049,019	14,904,757
	Actual		6,328,143	114,058,779	23,904,189	13,723,017	158,014,128	25,041,859
42	Pennsylvania (L)	5.27						
	Estimated		8,956,100	19,564,751	24,202,151	929,970	53,652,972	10,180,830
	Actual		8,282,292	24,342,293	10,551,808	2,942,344	46,118,737	8,751,183
<b>Total land, miles</b>		<b>331.23</b>						
	<b>Estimated</b>		<b>245,801,005</b>	<b>526,098,149</b>	<b>631,412,402</b>	<b>82,515,388</b>	<b>1,485,826,944</b>	<b>\$4,485,786</b>
	<b>Actual</b>		<b>215,399,947</b>	<b>694,845,794</b>	<b>567,284,142</b>	<b>139,543,892</b>	<b>1,617,073,775</b>	<b>\$4,882,027</b>
<b>Offshore pipelines</b>								
26	New York	2.79						
	Estimated		9,906,018	128,150,126	44,997,591	219,070	183,272,805	65,689,177
	Actual		9,932,049	142,757,244	38,681,039	196,087	191,566,419	68,661,799
<b>Total offshore, miles</b>		<b>2.79</b>						
	<b>Estimated</b>		<b>9,906,018</b>	<b>128,150,126</b>	<b>44,997,591</b>	<b>219,070</b>	<b>183,272,805</b>	<b>65,689,177</b>
	<b>Actual</b>		<b>9,932,049</b>	<b>142,757,244</b>	<b>38,681,039</b>	<b>196,087</b>	<b>191,566,419</b>	<b>68,661,799</b>
<b>Total, miles</b>		<b>334.02</b>						
	<b>Estimated</b>		<b>255,707,023</b>	<b>654,248,275</b>	<b>676,409,993</b>	<b>82,734,458</b>	<b>1,669,099,749</b>	<b>4,997,005</b>
	<b>Actual</b>		<b>225,331,996</b>	<b>837,603,038</b>	<b>605,965,181</b>	<b>139,739,979</b>	<b>1,808,640,194</b>	<b>5,414,766</b>

<sup>1</sup>Actual cost data must be filed within 6 months following final hydrostatic test of pipeline. Not all projects proposed (estimated costs) are built (actual costs). L = loop, lat. = lateral, R = replacement. <sup>2</sup>Generally includes surveys, engr., supervision, interest, freight, taxes, administration and overheads, contingencies, allowances for funds used during construction (afudc), and regulatory fees.

Source: US FERC; for completed-project costs filed between July 1, 2015, and June 30, 2016, under CFR Section 157.20(c)(4).

in certain instances, provide estimated costs of these modifications in varying degrees of detail.

Tracking the mileage and compression horsepower applied for and the estimated costs can indicate levels of construction activity over 2-4 years. Tables 4 and 5 show companies' estimates during the period July 1, 2015, to June 30, 2016, for what it will cost to construct a pipeline or install new or additional compression.

These tables cover a variety of locations, pipeline sizes, and compressor-horsepower ratings.

Not all projects proposed are approved. And not all projects approved are eventually built.

Application mileage filed in the 12 months ending June 30, 2016, continued the increases started last year.

- Nearly 2,500 miles of pipeline were proposed for land construction, the highest level since more than 2,700 miles were proposed in 1998. No new offshore work was submitted. The land level was up from the 2,192 miles proposed for land construction in 2015 and the 523 miles of pipeline proposed for land construction in 2014.

- New or additional compression proposed by the end of June 2016 measured more than 2.4 million hp, up from the 1.7-million hp proposed the year before and more than triple the then high of roughly 706,000 hp proposed in 2014.

Putting the uptick in US gas pipeline construction in perspective, Table 4 lists 33 land-pipeline "spreads," or mileage segments, compared with:

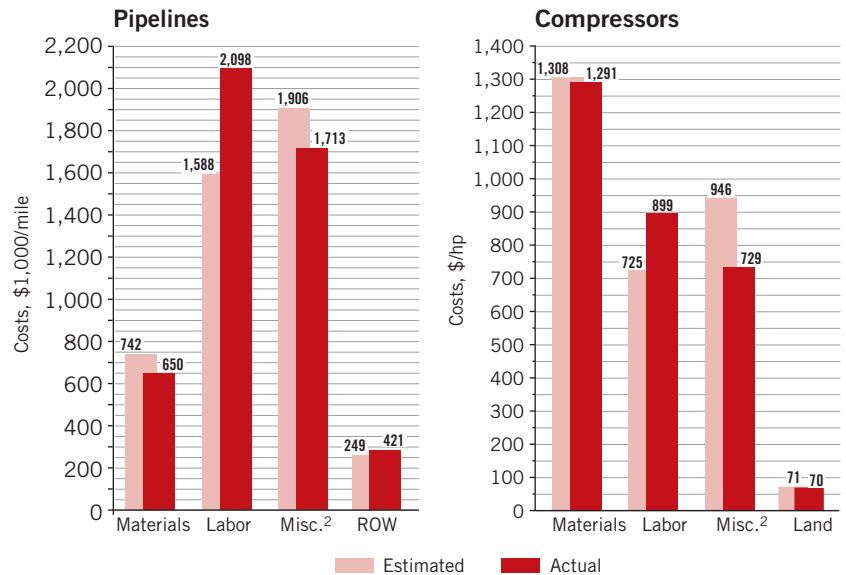
- 46 land and 0 marine projects (OGJ, Sept. 7, 2015, p. 114).
- 31 land and 0 marine projects (OGJ, Sept. 1, 2014, p. 122).
- 26 land and 2 marine projects (OGJ, Sept. 2, 2013, p. 117).
- 11 land and 0 marine projects (OGJ, Sept. 3, 2012, p. 118).
- 31 land and 0 marine projects (OGJ, Sept. 5, 2011, p. 97).
- 8 land and 0 marine projects (OGJ, Nov. 1, 2010, p. 108).
- 21 land and 0 marine projects (OGJ, Sept. 14, 2009, p. 66).
- 19 land and 0 marine projects (OGJ, Sept. 1, 2008, p. 58).
- 25 land and 1 marine project (OGJ, Sept. 3, 2007, p. 51).

Nine of the spreads in 2016 measured 100 miles or more, as interest in building large transmission lines remained; four of the proposed projects included more than 200 miles of pipe each.

For the 12 months ending June 30, 2016, the 33 land

## COMPONENT COSTS: ESTIMATED VS. ACTUAL<sup>1</sup>

FIG. 7



<sup>1</sup>Onshore only. For construction cost filings made before July 1, 2016. <sup>2</sup>Generally includes surveying, engineering, supervision, administration and overhead, interest, contingencies and allowances for funds used during construction (AFUDC), and regulatory filing fees. Source: US FERC

projects would cost an estimated \$18.9 billion, as compared with 46 land projects for \$11.5 billion a year earlier.

It is helpful to remember that these statistics cover only FERC-regulated pipelines. Many other pipeline construction projects were announced in the 12 months ending June 30, 2016, but may have lied outside FERC's jurisdiction.

A report released in April 2016 on behalf of the Interstate Natural Gas Association of America concluded that the US and Canada will require annual average midstream natural gas, crude oil, and NGL infrastructure investment of \$26 billion/year, or \$546 billion (in 2015 dollars) total, from 2015 to 2035. Most of this expenditure (roughly 61%) will be dedicated to natural gas development, with crude oil getting roughly 30% and NGL-related assets about 9%.

Included in the \$26 billion/year are:

- \$7.3 billion/year for new oil and gas lease equipment.
- \$6.25 billion/year for expanded gas and liquids mainline capacity.
- More than \$3 billion/year for new oil and gas gathering lines.
- Nearly \$2 billion/year for new laterals.
- \$3.55 billion/year for LNG export plants.
- \$1.5 billion/year for gas processing plants.
- \$900 million/year for NGL fractionation plants.
- \$550 million/year for underground gas storage, crude oil storage, and NGL export terminals.

The report also forecast the need for about 296,000 miles



US COMPRESSOR-STATION COSTS: ESTIMATED VS. ACTUAL, 2015-16<sup>1</sup>

Table 8

Location	Size, hp	Materials	Labor	Misc. <sup>2</sup> Cost, \$	Land	Total	\$/hp	
New Jersey <sup>3</sup>	2,000	Estimated	512,916	885,948	1,187,613	--	2,586,477	1,293
		Actual	1,269,944	1,398,582	612,011	1,114	3,281,651	1,641
Pennsylvania <sup>3</sup>	3,500	Estimated	5,207,130	3,159,136	1,874,167	--	10,240,433	2,926
		Actual	5,235,096	4,799,279	1,171,596	--	11,205,971	3,202
New York <sup>3</sup>	7,700	Estimated	12,445,482	4,688,500	4,685,310	--	21,819,292	2,834
		Actual	12,903,807	6,201,760	4,265,896	--	23,371,463	3,035
Mississippi	8,000	Estimated	16,281,894	8,170,513	18,284,591	618,150	43,355,148	5,419
		Actual	16,982,052	15,361,433	12,131,381	211,513	44,686,379	5,586
Indiana <sup>3</sup>	10,915	Estimated	14,407,000	12,905,000	7,896,000	53,000	35,261,000	3,231
		Actual	11,901,000	14,531,000	5,156,000	62,000	31,650,000	2,900
Indiana <sup>4</sup>	13,220	Estimated	18,307,000	14,746,000	10,320,000	--	43,373,000	3,281
		Actual	14,619,000	15,252,000	5,534,000	--	35,405,000	2,678
New York <sup>3</sup>	15,400	Estimated	24,170,974	10,913,900	7,488,985	--	42,573,859	2,765
		Actual	23,909,935	12,845,461	6,246,641	--	43,002,037	2,792
Pennsylvania <sup>3</sup>	16,000	Estimated	24,204,985	8,958,920	15,590,605	--	48,754,510	3,047
		Actual	23,964,967	19,936,700	9,864,439	25,653	53,791,759	3,362
Ohio	18,800	Estimated	24,183,454	16,878,777	20,063,736	1,021,000	62,146,967	3,306
		Actual	25,193,517	23,335,644	16,992,017	1,205,179	66,726,357	3,549
Alabama <sup>3</sup>	20,500	Estimated	26,005,620	10,306,934	13,108,356	--	49,420,910	2,411
		Actual	29,001,749	10,175,793	9,231,706	77,164	48,486,412	2,365
Pennsylvania <sup>3</sup>	20,500	Estimated	22,917,701	10,236,720	15,532,381	--	48,686,802	2,375
		Actual	21,761,418	13,853,495	9,653,194	25,311	45,293,418	2,209
Virginia <sup>3</sup>	21,000	Estimated	23,701,377	8,799,430	15,285,607	275,021	48,061,435	2,289
		Actual	24,783,028	13,738,737	11,514,056	193,521	50,229,342	2,392
Pennsylvania <sup>3</sup>	30,000	Estimated	43,117,838	14,880,694	22,292,648	--	80,291,180	2,676
		Actual	39,936,562	21,948,218	12,009,625	52,550	73,946,955	2,465
Florida	44,000	Estimated	30,123,086	32,763,044	52,898,030	13,462,121	129,246,281	2,937
		Actual	30,339,564	33,163,493	54,810,612	13,462,121	131,775,790	2,995
<b>Total</b>	<b>218,335</b>							
	<b>Estimated Actual</b>	<b>\$285,586,457</b>	<b>\$158,293,516</b>	<b>\$206,508,029</b>	<b>\$15,429,292</b>	<b>\$665,817,294</b>	<b>\$3,050</b>	
		<b>\$281,801,639</b>	<b>\$196,365,802</b>	<b>\$159,193,174</b>	<b>\$15,316,126</b>	<b>\$662,852,534</b>	<b>\$3,036</b>	

<sup>1</sup>Actual cost data must be filed within 6 months following commissioning of installed compression equipment. Not all projects proposed (estimated costs) are built (actual costs). <sup>2</sup>Generally includes surveys, engr., supervision, interest, freight, taxes, administration and overheads, contingencies, allowances for funds used during construction (AFUDC), and FERC fees. <sup>3</sup>Addition. <sup>4</sup>Replacement.

Source: US FERC; for completed-project costs filed between July 1, 2015, and June 30, 2016, under CFR Section 157.20(c)(4).

of pipeline 2015-2035, including 23,000 miles of new natural gas transmission lines, 39,000 miles of new pipeline for gas, oil, and NGL transport, and 257,000 of new gas and oil gathering line to collect incremental production from roughly 752,000 new oil and gas wells.<sup>1</sup>

Against this backdrop, estimated \$/mile costs for new projects as filed by operators with FERC remained historically high. For proposed onshore US gas pipeline projects in 2015-16 the average cost was \$7.65 million/mile, up from both the 2014-15 average cost of \$5.2 million/mile and the

2013-14 average cost of \$6.6 million/mile. In 2012-13 the average cost was \$4.1 million/mile as compared with \$3.1 million/mile in 2011-12; \$4.4 million/mile in 2010-11; \$5.1 million/mile in 2009-10; and \$3.7 million/mile in 2008-09.

### Cost components

Variations over time in the four major categories of pipeline construction costs—material, labor, miscellaneous, and right-of-way (ROW)—can also suggest trends within each group.



Materials can include line pipe, pipe coating, and cathodic protection.

“Miscellaneous” costs generally cover surveying, engineering, supervision, contingencies, telecommunications equipment, freight, taxes, allowances for funds used during construction (AFUDC), administration and overheads, and regulatory filing fees.

ROW costs include obtaining rights-of-way and allowing for damages.

For the 33 land spreads filed for in 2015-16, cost-per-mile projections rose in all categories except material. In 2011 miscellaneous charges passed material to become the second most expensive cost category and they retained this position through 2016:

- Material—\$992,991/mile, down from \$1,012,698/mile 2014-15.
- Labor—\$3,603,334/mile, up from \$1,977,938/mile for 2014-15.
- Miscellaneous—\$2,615,028/mile, up from \$1,867,393/mile for 2014-15.
- ROW and damages—\$441,548/mile, up from \$378,255/mile for 2014-15.

The continued rise in miscellaneous costs is driven by companies increasing the amount set aside for contingencies in their estimates.

Table 4 lists proposed pipelines in order of increasing size (OD) and increasing lengths within each size.

The average cost-per-mile for the projects rarely shows clear-cut trends related to either length or geographic area. In general, however, the cost-per-mile within a given diameter decreases as the number of miles rises.

Lines built nearer populated areas tend to have higher unit costs. Additionally, road, highway, river, or channel crossings and marshy or rocky terrain each strongly affect pipeline construction costs.

Fig. 3, derived from Table 4, shows the major cost-component splits for pipeline construction costs.

Labor spiked as a portion of land construction costs, reinforcing its place as the single most expensive category. Labor’s portion of estimated costs for land pipelines jumped to 47.08% in 2016 from 37.77% in 2015, 42.36% in 2014, 38.84% in 2013, 44.61% in 2012, 44.27% in 2011, and 44.61% in 2010. Material costs for land pipelines, meanwhile, eased to 12.98% from 19.34% in 2015, 13.6% in 2014, 23.2% in 2013, 15.99% in 2012, and 14.54% in 2011.

Fig. 4 plots a 10-year comparison of land-construction unit costs for the two major components, material and labor.

Fig. 5 shows the cost split for land compressor stations based on data in Table 5.

Table 6 lists 10 years of unit land-construction costs for natural gas pipeline with diameters ranging from 8 to 36 in. The table’s data consist of estimated costs filed under CP

dockets with FERC, the same data shown in Tables 4 and 5.

Table 6 shows that the average cost per mile for any given diameter may fluctuate year to year as projects’ costs are affected by geographic location, terrain, population density, or other factors.

### Completed projects’ costs

In most instances, a natural gas pipeline company must file with FERC what it has actually spent on an approved and built project. This filing must occur within 6 months after the pipeline’s successful hydrostatic testing or the compressor’s being put in service.

Fig. 6 shows 10 years of estimated vs. actual costs on cost-per-mile bases for project totals.

Tables 7 and 8 show actual costs for pipeline and compressor projects reported to FERC during the 12 months ending June 30, 2016. Fig. 7, for the same period, depicts how total actual costs (\$/mile) for each category compare with estimated costs. The spike in both categories for 2014 stems from a larger than usual proportion of the pipeline mileage completed that year being in high-cost urban northeast US settings.

Actual labor costs for pipeline construction were more than \$500,000/mile higher than estimated costs for the same projects. Overall actual costs were nearly 9% higher than projected costs for the 12 months ending June 30, 2016, despite lower material and miscellaneous costs.

Some of these projects may have been proposed and even approved much earlier than the 1-year survey period. Others may have been filed for, approved, and built during the survey period.

If a project was reported in construction spreads in its initial filing, that’s how projects are broken out in Table 4. Completed projects’ cost data, however, are typically reported to FERC for an entire filing, usually but not always separating pipeline from compressor-station (or metering site) costs and lumping various diameters together.

The 12 months ending June 30, 2016, saw more than 218,000 hp completed, roughly flat from the year before. Actual compression costs were just \$14/hp (0.46%) lower than estimates (Table 8). **OGJ**

### References

1. ICF International, “North American Midstream Infrastructure Through 2035; Leaning into the Headwinds,” Apr. 12, 2016.







# OIL PIPELINES (CONTINUED)

Company	Miles of pipeline			Deliveries, 1,000 bbl			Total trunkline traffic,			Fiscal data, \$, 1,000			
	Gathering	Trunk	Total	Crude	Products	Total	Crude	Carrier Products	Total	Property	Operating	Revenue	Income
Point Arguello Pipeline Co.			28	730		730	20		20	303,398	422	1,119	-9,386
Portland Pipe Line Corp.			166	22,025		22,025	3,656		3,656	42,920	44	8,995	2,441
Powder River Crude Services LLC (new)			60	1,132		1,132	68		68	58,268	58,268	574	-2,316
Premcor Pipeline Co.			55	7,521		7,521	94		94	22,160	2,218	1,456	108,233
QEPM Gathering LLC			60							9,153		4,723	65,111
Razorback LLC										20,917	72	6,613	8,771
Red Butte Pipe Line Co.			804	13,108		13,108	1,197		1,197	29,417	1,654	29,417	2,197
Red River Crude Pipeline LLC (new)			800	5,970		5,970	536		536	218,014	1,273	11,063	9,015
Regency Liquids Pipeline LLC			88	172,656		172,656				53,702	31,274	5,901	5,601
Rio Grande Pipeline Co.			249	4,292		4,292	6,890	957	957	59,004	3,178	13,082	39,078
Rocky Mountain Pipeline System LLC			1,885	71,708		71,708	4,518	254	6,990	268,366	7,469	78,604	9,625
SALA Gathering Systems LLC			597	7,569		7,569	4,772		4,772	60,146	4,473	21,200	9,625
Sanders Pipeline Co.			9	15,905		15,905	29		29	1,934		3,092	-13
Seaway Crude Pipeline Co.				3,140		3,140	88,452		88,452	2,936,698	700,062	613,325	444,889
Seminole Pipeline Co.			1,248	75,925		75,925	43,880		43,880	415,968	6,798	86,471	20,368
SFP LP			2,470	410,942		410,942	66,550		66,550	1,865,553	18,289	306,097	201,725
Shil Shoa Pipeline Co.			501	13,015		13,015	10,477	66	10,113	375,087	-366,448	174,550	396,203
Shelly-Belvoir Pipeline Co. LLC			121	72,485		72,485	4,258		4,258	2,051	26,807	26,807	8,333
SILC Pipeline LLC			572	9,737		9,737	5,670		5,670	97,958	4,831	27,998	15,078
Sorrento Pipeline Co. LLC			93	27,175		27,175	2,363		2,363	253,913	312	18,952	10,996
Southex 66 Pipeline Co. Ltd.			716	71,273		71,273	2,906		2,906	360,457	27,351	42,076	12,893
SP 49 Pipeline LLC			755	76,254		76,254	12,996		12,996	240,726	16,562	108,143	75,663
Suncor Energy (USA) Pipeline Co.			31	3,845		3,845	112		112	38,415		5,125	3,314
Sunoco Pipeline LP			313	22,615		22,615	3,844		3,844	245,999	45,940	33,974	7,264
SunVt Pipeline LLC			6,491	801,729		801,729	66,377	23,298	89,675	4,867,262	2,747,230	781,464	502,726
Talgrass Pony Express Pipeline LLC			27	13,694		13,694	370		370	85,664	140,723	6,450	3,752
Tapstone Midstream LLC (new)			765	86,581		86,581	58,632		58,632	1,453,710	112,521	299,010	159,023
Targa NGU Pipeline Co. LLC			20							33,811	1,433	1,433	1,863
Tesorro High Plains Pipeline Co.			155	54,164		54,164	2,656		2,656	43,319	710	16,963	12,512
Tesorro Logistics Northwest Pipeline LLC			775	26,509		26,509	29,628		29,628	323,055	429,794	99,959	27,218
Texas Express Pipelines LLC			1,104	50,522		50,522	29,266		29,266	317,833	4,260	41,864	5,267
Thunder Creek NGL Pipeline LLC (new)			593	50,437		50,437	29,437		29,437	987,743	10,370	123,293	81,649
Total Petrochemicals Pipeline USA Inc.			108	688		688	74		74	16,948	16,948	2,751	-2,095
TransCanada Keystone Pipeline LP			14				636		636	361	169,969	561	162
Tri-States NGL Pipeline LLC			1,869	202,489		202,489	218,190		218,190	7,522,803	169,969	1,150,543	-930,347
UNEV Pipeline LLC			64	64,574		64,574	2,690		2,690	50,100	428	25,043	14,139
USG Wheatland Pipeline LLC			167	15,282		15,282	2,270	2,270	2,270	181,051	1,032	36,385	22,117
Valero MKS Logistics LLC			427	7,847		7,847	3,063	3,063	3,063	345,268	798	34,963	16,173
Valero Partners Lucas LLC			22	1,652		1,652	36		36	12,456	32	2,159	886
Valero Partners PAPS LLC			73	19,551		19,551	3,077	162	3,239	58,341	411	13,281	5,924
Valero Partners Wynnewood LLC			17	70,368		70,368	1,196		1,196	132,193	8,621	27,954	19,939
Valero Terminating and Distribution Co.			24	114,750		114,750	787		787	84,848	182	24,173	16,964
Ventura Pipeline US LP			30	20,393		20,393	611		611	33,764	138	8,438	4,142
Victoria Express Pipeline LLC			55	27,733		27,733	37		37	3,822	11	6,789	336,211
Wesco Pipeline LLC			80	11,975		11,975	566		566	98,232	27,278	6,759	1,358
West Shore Pipe Line Co.			56	11,379		11,379	637		637	81,860	14,005	17,257	9,922
West Texas 66 Pipeline Co.			606	119,295		119,295	2		2	132,256	22,448	72,994	21,267
West Texas LPG Pipeline LP			625	6,970		6,970	116	11,766	11,882	43,465	2,653	10,433	47,750
Western Refining Pipeline LLC			532	142,303		142,303	44,140	2,076	2,076	161,768	52,174	64,275	23,289
White Cliffs Pipeline LLC			2,303	80,218		80,218	33,034	33,034	33,034	273,768	2,782	97,108	47,507
Wildcat Liquids Caddo LLC			457							161,654	119,984	19,711	26,317
Williams Bayou Ethane Pipeline LLC			36	2,601		2,601	818		818	26,059	119,984	9,931	223,838
Williams Ohio Valley Pipeline LLC			1,052	43,783		43,783	22,878		22,878	602,932	-111,279	206,395	151,717
WILPRISE Pipeline Co. LLC				358		358	15		15	30,744	67,945	6,508	4,585
Wolverine Pipe Line Co.			50	3,674		3,674		15		6,405	111	7,964	-14,514
Wood River Pipe Lines LLC			30	13,396		13,396	184		184	160,845	10,592	7,964	-4,668
Yellowstone Pipe Line Co.			628	140,751		140,751	402		402	25,302	5,572	5,572	3,766
Zydec0 Pipeline Co. LLC			1,723	40,476		40,476	65	10,325	10,660	190,791	10,660	95,313	32,061
			698				8,483	11,283	11,348	14,214	14,214	48,624	10,041
			446	283,966		283,966	34,311	8,483	8,483	114,715	8,893	45,188	15,050
										416,602	33,353	246,997	170,586
<b>2014 Totals</b>			<b>56,517</b>	<b>164,801</b>	<b>18,147,664</b>	<b>7,882,758</b>	<b>2,250,052</b>	<b>4,588,807</b>	<b>\$93,484,855</b>	<b>\$14,592,416</b>	<b>\$22,019,267</b>	<b>\$6,688,711</b>	
<b>2014 Totals</b>			<b>56,375</b>	<b>160,609</b>	<b>16,169,511</b>	<b>6,280,818</b>	<b>2,133,547</b>	<b>4,192,863</b>	<b>\$84,910,293</b>	<b>\$20,226,648</b>	<b>\$19,281,113</b>	<b>\$9,572,871</b>	

Crude and total mileages represent 81.8 miles of Trans-Alaska Pipeline, operated by Alyeska Pipeline Service Co., Anchorage. This figure is included in column total only once to avoid duplication. Sources: US FERC Form No. 6: Annual Report of Oil Pipelines, Dec. 31, 2015.



# GAS PIPELINES

Company	Transmission system, miles	Total compression stations		Volumes trans. for others, MMcf	Fiscal data, \$1,000			Net income	
		Transmission	Other		Operating & maintenance expenses	Operating revenue			
Algonquin Gas Transmission LLC <sup>1</sup>	1,132	7	—	776,582	2,153,233	146,968	69,116	308,948	108,216
Alliance Pipeline LP <sup>1</sup>	967	10	—	688,769	2,060,686	—	78,272	289,140	81,772
American Midstream (AltaTerm) LLC	295	—	—	18,675	31,291	225	2,790	2,937	—
American Midstream (Midla) LLC	370	—	—	35,095	47,061	—	4,973	2,874	-5,220
ANR Pipeline Co. <sup>1</sup>	8,882	44	10	1,927,922	3,820,359	241,203	412,181	604,360	42,220
ANR Storage Co. <sup>1</sup>	16	3	3	—	151,224	5,377	9,467	20,663	18,308
Arlington Storage Co. LLC	—	—	—	—	—	—	—	—	—
Bear Creek Storage Co. <sup>1</sup>	—	—	1	—	179,489	8,915	7,026	27,707	10,894
Big Sandy Pipeline LLC <sup>1</sup>	69	1	1	24,353	214,006	518	6,011	41,021	15,822
Bison Pipeline LLC <sup>1</sup>	302	—	—	42,490	675,324	4,297	4,962	80,693	30,765
Black Hills Shoshone Pipeline LLC (new)	30	—	—	9	881	—	33	169	60
Black Marlin Pipeline Co.	52	—	—	12,142	22,837	—	426	1,160	537
Blue Lake Gas Storage Co.	—	—	1	—	105,102	50	3,955	31,150	15,280
Bluewater Gas Storage LLC	—	—	—	—	—	—	—	—	—
Boardwalk Storage Co. LLC	—	—	—	—	—	—	—	—	—
Bobcat Gas Storage	—	—	—	—	—	—	—	—	—
Cadeville Gas Storage LLC	—	—	—	—	—	—	—	—	—
Caledonia Energy Partners LLC	—	—	—	—	—	—	—	—	—
Central Pipelines Minnesota Inc.	—	—	—	—	—	—	—	—	—
Central Kentucky Transmission Co.	30	—	—	4,432	5,861	525	898	1,085	50
Chandeleur Pipe Line Co. <sup>1</sup>	215	—	—	13,557	1,023	—	124	178	14
Cheniere Creole Trail Pipeline LP	94	—	—	7,522	57,203	—	1,489	5,571	658
Cheyenne Plains Gas Pipeline Co. LLC <sup>1</sup>	413	3	—	148,899	701,228	116,475	18,717	1,117	-50,580
Cimarron River Pipeline LLC <sup>1</sup>	655	24	—	98,460	432,338	457	12,376	77,952	26,323
Clear Creek Storage Co. LLC	—	—	—	—	162,295	3,256	32,019	25,987	-12,805
Colorado Interstate Gas Co. <sup>1</sup>	4,225	24	7	903,139	29,611	—	1,733	2,161	-1,206
Columbia Gas Transmission LLC <sup>1</sup>	9,617	66	24	1,460,089	1,496,910	9,526	165,456	396,430	110,849
Columbia Gulf Transmission Co. <sup>1</sup>	3,500	12	—	562,692	6,306,936	813,068	561,367	1,104,543	257,309
Crossroads Pipeline Co.	203	1	—	15,535	1,387,103	191,080	80,360	165,391	35,583
Dauphin Island Gathering Partners <sup>1</sup>	119	—	—	27,894	38,876	261	1,695	2,542	-215
DBM Pipeline LLC <sup>1</sup> (new)	9	—	—	14,971	127,837	690	7,797	3,758	-15,552
Destin Pipeline Co. LLC <sup>1</sup>	273	2	—	308,207	8,477	187	824	44,597	-791
Discovery Gas Transmission LLC <sup>1</sup>	260	—	2	377,810	517,631	1,400	17,422	44,597	-2,561
Dominion Carolina Gas Transmission LLC (formerly Carolina Gas Transmission Corp.) <sup>1</sup>	1,479	5	—	155,563	406,747	41,714	24,871	67,176	18,229
Dominion Cove Point LNG LP <sup>1</sup>	136	2	—	106,324	1,233,825	4,658	69,231	296,711	108,422
Dominion Transmission Inc. <sup>1</sup>	3,610	68	54	1,287,635	5,592,265	239,000	268,947	893,379	302,343
Duke Energy Kentucky Inc. <sup>1</sup>	—	—	—	7,561	445,878	11,306	64,674	466,754	46,176
Duke Energy Ohio Inc. <sup>1</sup>	—	—	—	—	1,935,849	94,073	202,615	1,432,340	172,512
East Cheyenne Gas Storage LLC	—	—	—	—	—	—	—	—	—
Eastern Shore Natural Gas Co.	1,526	21	—	304,997	1,165,801	102,064	44,726	175,880	57,855
Egan Hub Storage LLC	442	—	—	49,833	249,054	5,835	15,732	46,844	11,345
El Paso Natural Gas Co. <sup>1</sup>	10,225	54	1	1,419,808	3,555,770	56,748	196,457	634,211	142,570
Elba Express Co. LLC <sup>1</sup>	191	1	—	91,957	635,094	46	4,013	89,065	43,921
Empire Pipeline Inc. <sup>1</sup>	269	1	—	226,326	515,149	44,985	8,496	81,829	28,675
Enable Gas Transmission LLC <sup>1</sup>	5,881	44	3	835,159	2,513,051	128,063	239,645	447,766	60,217
Enable Mississippi River Transmission LLC <sup>1</sup>	—	—	—	—	—	—	—	—	—
Equitrans LP <sup>1</sup>	1,557	15	2	256,131	703,407	23,589	65,711	97,161	3,842
ETC Field Services LLC (new)	900	4	26	749,495	1,204,937	114,614	77,846	309,077	105,844
ETC Tiger Pipeline LLC <sup>1</sup>	197	4	—	367,891	1,111,897	5,443	14,858	280,182	131,126
Fayetteville Express Pipeline LLC <sup>1</sup>	185	1	—	447,998	971,429	200	6,935	167,883	66,931
Florida Gas Transmission Co. LLC <sup>1</sup>	5,325	29	1	981,496	6,323,588	67,338	140,360	816,488	236,786
Freebird Gas Storage LLC	—	—	—	—	—	—	—	—	—
Garden Banks Gas Pipeline LLC <sup>1</sup>	50	—	—	102,156	100,942	160	5,565	10,515	2,992
Gas Transmission Northwest Corp. <sup>1</sup>	1,378	13	—	793,407	1,774,586	65,503	36,536	197,348	64,107
Golden Pass Pipeline LLC <sup>1</sup>	59	—	—	25	741,943	—	7,855	92,606	49,286
Golden Triangle Storage Inc.	—	—	—	1,986	—	—	—	—	—
Granite State Gas Transmission Inc.	86	—	—	17,429	39,419	230	1,910	6,375	1,207
Great Lakes Gas Transmission LP <sup>1</sup>	2,115	14	—	453,813	2,076,414	4,454	49,961	176,901	41,444
Guardian Pipeline LLC <sup>1</sup>	262	3	—	84,526	646,843	96	12,008	66,579	20,317
Gulf Crossing Pipeline LLC <sup>1</sup>	374	4	—	427,365	1,715,568	3,690	83,936	229,883	53,063

**GAS PIPELINES (CONTINUED)**

Company	Transmission system, miles	Total compression stations		Volumes trans. for others, MMcf	Gas plant	Additions	Fiscal data, \$1,000		Net income
		Transmission	Other				Operating revenue	Operating & maintenance expenses	
Gulf LNG Pipeline LLC	—	—	—	—	1,895	—	147	—	—
Gulf Shore Energy Partners LP	6,663	37	9	1,009,937	4,358,759	131,524	177,741	956	449
Gulf South Pipeline Co. LP <sup>1</sup>	10	—	—	11,287	5,100	41	1,777	479,579	81,841
Gulf States Transmission Corp.	745	3	—	437,221	2,067,308	1,912	18,553	214	179
Gulfstream Natural Gas System LLC <sup>1</sup>	18	—	—	—	38,268	2,073	2,504	275,805	83,477
Hampshire Gas Co.	—	—	1	—	165,563	1,115	3,341	6,548	1,364
Hardy Storage Co.	—	—	1	—	468,873	34	17,154	23,355	6,244
High Island Offshore System LLC <sup>1</sup>	66	—	—	1,672	271,990	1,102	6,067	16,010	-4,232
High Point Gas Transmission LLC <sup>1</sup>	405	—	—	101,521	—	—	—	16,413	2,912
Hiland Partners Holding LLC <sup>1</sup>	—	—	—	—	—	—	—	—	—
Honeye Storage Corp.	—	—	—	—	13,647	17	1,837	4,926	1,609
Horizon Pipeline Co. LLC	28	1	—	31,843	98,843	1,005	3,291	11,710	2,335
Iroquois Gas Transmission Systems LP (IPOC agent) <sup>1</sup>	416	7	—	335,529	1,275,538	9,765	28,675	201,149	51,312
Jackson Prairie Underground Storage Project	—	—	1	—	109,097	3,041	4,132	—	—
Kern River Gas Transmission Co. <sup>1</sup>	1,718	12	—	881,526	2,839,554	25,268	42,887	359,998	-4,132
Kinder Morgan Illinois Pipeline LLC	29	—	—	4,066	19,871	2	1,554	3,289	91,592
Kinder Morgan Louisiana Pipeline LLC <sup>1</sup>	136	—	—	960	1,039,494	77	5,911	233,545	111,290
Kinefica Energy Express LLC <sup>1</sup>	1,264	—	—	149,020	777,744	3,514	25,774	52,197	9,509
KO Transmission Co.	92	—	—	48,208	20,539	29	842	1,744	347
KPC Pipeline LLC	1,000	1	—	5,974	87,197	3,260	7,165	11,094	477
LA Storage LLC	—	—	—	—	—	—	—	—	—
Lake Charles LNG Co. LLC <sup>1</sup>	—	—	—	—	1,297,840	-240	18,042	216,141	94,781
Leaf River Energy Center LLC	—	—	—	—	—	—	—	—	—
Lucerne Residue Pipeline (new)	—	—	—	9,539	—	—	—	—	—
Maritimes & Northeast Pipeline LLC <sup>1</sup>	346	7	—	78,028	1,164,424	547	18,847	166,460	59,517
MarkWest New Mexico LP <sup>1</sup>	8	—	—	41,504	6,217	—	331	1,182	306
MarkWest Pioneer LLC <sup>1</sup>	50	2	—	89,377	157,956	—	1,906	10,824	2,508
Midcontinent Express Pipeline LLC <sup>1</sup>	512	5	—	448,801	2,317,809	-1,334	31,400	247,260	55,526
Midwestern Gas Transmission Co. <sup>1</sup>	400	7	—	264,793	250,154	11,118	11,118	33,606	7,499
MIGC Inc.	239	11	—	26,470	45,600	-2,624	3,298	9,500	2,352
Millennium Pipeline Co. LLC <sup>1</sup>	253	3	—	514,756	1,255,159	5,475	21,573	206,169	59,976
Mississippi Canyon Gas Pipeline LLC <sup>1</sup>	45	—	—	77,170	57,619	263	2,441	7,460	3,125
Mississippi Hub LLC	—	—	—	—	—	—	—	—	—
MoGas Pipeline LLC	—	—	—	11,493	104,680	50	5,601	16,796	5,625
Mojave Pipeline Co. <sup>1</sup>	468	1	—	122,028	249,177	1,174	2,685	16,418	4,744
Monroe Gas Storage Co. LLC	—	—	—	—	—	—	—	—	—
National Fuel Gas Supply Corp. <sup>1</sup>	1,508	22	16	539,765	1,396,775	187,166	70,246	212,643	52,442
National Grid LNG LLC	—	—	—	—	58,113	5,777	3,951	8,230	1,381
Natural Gas Pipeline Co. of America <sup>1</sup>	9,117	48	12	1,492,392	4,015,890	74,346	275,948	577,940	127,972
Nautilus Pipeline Co. LLC <sup>1</sup>	101	—	—	142,415	128,673	—	2,992	7,510	-1,278
NGO Transmission Inc.	—	—	—	5,345	29,162	1,803	2,961	5,114	95
North Baja Pipeline LLC <sup>1</sup>	86	1	—	122,541	197,303	414	6,017	38,210	15,107
Northern Border Pipeline Co. <sup>1</sup>	1,409	18	—	1,045,147	2,566,342	15,162	46,311	285,510	83,105
Northern Natural Gas Co. <sup>1</sup>	14,761	47	5	1,051,617	3,838,370	193,912	235,942	659,878	160,453
Northwest Pipeline LLC <sup>1</sup>	3,890	43	1	762,750	3,309,568	46,092	127,775	472,999	112,470
OKtex Pipeline Co. LLC	116	1	—	36,626	8,767	—	1,562	2,879	523
Ozark Gas Transmission LLC <sup>1</sup>	367	4	—	26,835	183,205	307	12,962	13,870	-1,772
Paiute Pipeline Co.	860	6	—	32,840	211,005	2,712	18,619	34,552	7,239
Panhandle Eastern Pipe Line Co. LP <sup>1</sup>	5,996	23	—	606,922	1,945,159	54,884	164,064	334,947	145,602
Panther Interstate Pipeline Energy LLC	55	—	—	—	22,591	—	216	—	-315
Perryville Gas Storage LLC	—	—	—	—	—	—	—	—	—
PGPipeline LLC	—	—	—	3,266	5,853	22	268	1,205	369
Pine Needle LNG Co. LLC	—	—	—	—	121,388	4,559	5,056	17,877	3,889
Pine Prairie Energy Center LLC <sup>1</sup>	—	—	—	—	—	—	—	—	—
Point Arguello Natural Gas Line Co.	27	—	—	828	150,777	—	1,782	1,737	-409
Portland Natural Gas Transmission System <sup>1</sup>	296	—	—	76,485	494,042	—	8,210	73,105	12,860
Questar Overthrust Pipeline Co. <sup>1</sup>	1,888	3	—	516,487	455,263	343	9,373	74,254	26,248
Questar Pipeline Co. <sup>1</sup>	2,559	14	6	302,059	1,215,566	51,606	61,462	175,293	57,584
Questar Southern Trails Pipeline Co.	488	4	—	27,554	121,547	1,060	9,024	5,846	-5,770

# GAS PIPELINES (CONTINUED)

Company	Transmission system, miles	Total compression stations		Volumes trans. for others, MMcf	Gas plant	Fiscal data, \$ 1,000		Net income
		Transmission	Other			Operating & maintenance expenses	Operating revenue	
Rager Mountain Storage Co. LLC	—	—	—	—	1,318	50	1,303	—
Raton Gas Transmission Co. Inc.	—	—	—	1,041	—	—	—	-40
Red River Energy LLC	—	—	—	131,710	—	—	—	—
Rendevous Pipeline Co. LLC	—	—	—	—	—	—	—	—
Roberts Ranch Pipeline (new)	—	—	—	—	—	—	—	—
Rockies Express Pipeline LLC	1,712	14	5	1,058,794	7,066,285	146,299	93,262	794,978
Ruby Pipeline LLC	683	4	4	294,089	3,727,587	4,282	27,139	344,086
Sabine Pipe Line LLC	125	4	4	57,919	74,554	344	6,700	2,941
Saltville Gas Storage Co. LLC	—	—	—	—	120,416	1,291	8,573	20,209
Sea Robin Pipeline Co. LLC	852	2	—	97,658	663,039	3,253	13,442	38,082
SG Resources Mississippi LLC	—	—	—	—	—	—	—	—
Serita Gas Pipeline LLC	61	—	—	28,610	173,654	2,077	1,396	34,777
Southeast Supply Header LLC	287	4	2	381,922	1,276,582	24,489	12,854	115,096
Southern LNG Co. LLC	—	—	—	—	685,871	165	24,511	170,076
Southern Natural Gas Co. <sup>1</sup>	6,985	38	1	993,266	3,542,908	19,800	176,861	579,860
Southern Star Central Gas Pipeline Inc.	5,655	32	9	344,151	1,543,588	60,369	103,115	255,792
Southwest Gas Storage Co.	—	—	4	—	227,317	7,924	10,496	45,946
Southwest Gas Transmission Co. LP	9	—	—	5,395	2,168	—	74	414
Stagecoach Pipeline and Storage Co. LLC	71	4	—	455,781	537,687	5,374	21,230	85,518
Steckman Ridge LP	—	—	—	—	—	—	—	—
Stingray Pipeline Co. LLC	370	—	2	—	295,962	71	9,501	14,049
Tallgrass Interstate Gas Transmission LLC	4,655	21	2	126,405	704,651	12,149	53,272	102,653
TC Offshore LLC	232	1	—	199,527	477,447	1,980	27,062	27,855
Tennessee Gas Pipeline Co. <sup>1</sup>	11,801	76	3	3,131,981	7,789,832	367,950	352,694	1,240,187
Texas Eastern Transmission LP <sup>1</sup>	9,648	70	6	3,272,139	9,747,367	956,441	1,289,354	1,289,354
Texas Gas Transmission LLC <sup>1</sup>	5,731	25	7	1,119,869	2,995,069	39,648	105,586	417,602
Triblazer Pipeline Co.	454	3	—	280,881	348,929	204	12,956	32,681
Trans-Union Interstate Pipeline LP	—	—	—	63,923	—	—	—	—
Trans-Colorado Gas Transmission Co. <sup>1</sup>	312	8	—	81,580	441,929	745	7,599	37,579
Transcontinental Gas Pipe Line Co. LLC	9,302	51	9	4,673,755	10,659,188	1,348,250	620,697	1,543,799
Transwestern Pipeline Co. LLC	2,597	28	—	484,965	2,316,783	16,714	66,376	212,253
Tres Palacios Gas Storage LLC <sup>1</sup>	—	—	—	—	—	—	—	—
Trunkline Gas Co. LLC	2,192	17	—	633,081	1,365,408	45,698	59,707	156,915
Tuscarora Gas Transmission Co.	305	4	—	41,837	205,659	160	6,363	27,556
UGI LNG Inc.	—	—	—	—	—	—	—	—
UGI Storage Co.	—	—	—	10,415	—	—	—	—
USG Pipeline Co. LLC	16	—	—	2,152	5,550	—	711	609
Vector Pipeline LP <sup>1</sup>	333	5	—	541,913	829,570	4,502	12,148	93,174
Venice Gathering System LLC	125	—	—	11,549	88,125	494	3,318	3,838
Viking Gas Transmission Co. <sup>1</sup>	674	8	—	72,668	225,993	8,531	12,813	29,452
WBI Energy Transmission Inc. <sup>1</sup>	3,457	25	9	290,494	582,159	16,695	35,364	100,555
West Texas Gas Inc.	812	—	—	14,058	184,335	9,953	81,749	98,430
Western Gas Interstate Co.	236	—	—	5,047	8,949	546	855	1,773
WestGas InterState Inc.	11	—	—	2,911	724	—	68	177
White River Hub LLC	11	—	—	461,343	58,024	210	1,790	11,373
WTG Hugoton LP	152	1	14	34,713	118,408	123	5,981	7,447
Wyckoff Gas Storage Co. LLC (new)	—	—	—	—	—	—	—	—
Wyoming Interstate Co. Ltd. <sup>1</sup>	849	12	—	821,399	946,384	2,355	29,651	144,320
Young Gas Storage Co. Ltd.	11	1	—	—	48,697	151	2,810	8,168
<b>2015 Totals-majors (96)</b>	<b>188,105</b>	<b>1,218</b>	<b>238</b>	<b>47,059,808</b>	<b>\$152,823,263</b>	<b>\$6,444,494</b>	<b>\$6,683,666</b>	<b>\$23,509,666</b>
<b>2014 Totals-majors (93)</b>	<b>189,366</b>	<b>1,204</b>	<b>234</b>	<b>45,216,247</b>	<b>\$147,219,957</b>	<b>\$4,466,596</b>	<b>\$6,967,716</b>	<b>\$23,916,417</b>
<b>2015 Totals-all</b>	<b>194,836</b>	<b>1,266</b>	<b>260</b>	<b>48,364,890</b>	<b>\$157,882,340</b>	<b>\$6,624,366</b>	<b>\$7,165,241</b>	<b>\$24,093,370</b>
<b>2014 Totals-all</b>	<b>195,194</b>	<b>1,226</b>	<b>256</b>	<b>46,293,010</b>	<b>\$151,986,076</b>	<b>\$4,542,395</b>	<b>\$7,474,131</b>	<b>\$24,514,239</b>

<sup>1</sup>Major natural gas pipeline companies as defined above (and in FERC Accounting and Reporting Requirements for Natural Gas Companies, para. 20-01.1, effective Feb. 2, 1985, beginning with 1984 reporting year). Beginning with 1996, major companies were required to file mileage for transmission systems only. NR = not reported. Source: FERC Forms 2 and 2A for major and nonmajor natural gas pipeline companies. Under criteria established for the 1984 reporting year (OGJ, Nov. 25, 1985, p. 80), major pipeline companies are those whose combined gas sold for resale and gas transported for a fee exceeded 50 bcf at 14.73 psi (60 degree sign F.) in each of the 3 previous calendar years. Nonmajors are natural gas pipeline companies not classified as majors and whose total gas sales of volume transactions exceeded 200 MMcf at 14.73 psi (60° F.) in each of the 3 previous calendar years.

## KOBELCO COMPRESSORS AMERICA, INC.

Kobelco Compressors America, Inc. (KCA), a supplier of rotary screw compressor packages in the oil and gas industry, announced the grand opening of our new state of the art service facility in the Houston area. The new 6,000 sq. ft. facility in La Porte opens for business in September 2016 and will be able to handle multiple compressor overhauls simultaneously.

The much needed service center will provide quicker turnaround time to address the needs of Kobelco's expanding customer base in Texas and the surrounding regions. With the building's completion, customers will have closer and easier access to Kobelco's know-how, customer service and compressor overhauls, ensuring reliable operation and optimum performance for many years.

The site aligns with Kobelco's Mission Statement, "To be a leading global provider of quality and innovative engineered compressor systems that deliver superior value for our customers, employees and investors."

## PROSERV

Energy services company Proserv has won two significant contract wins in the Gulf of Mexico. The deals with Talos Energy and Hess Corporation will see Proserv carry out work at the operators' respective Phoenix and Conger field expansion developments.

The delivery of these contracts will be a truly collaborative effort involving Proserv's global team of subsea controls and communications experts in Great Yarmouth, UK; Trondheim, Norway and Houston, USA.

Proserv will provide subsea communications and controls solutions to support the brownfield upgrade of the Phoenix field for Talos Energy. Specifically, the company will design, manufacture and supply an Open Communications Hub (OCH) and Electrical Distribution Units to interface with the existing subsea infrastructure previously supplied by Proserv. The design, manufacture and supply of the OCH will be delivered by Proserv's

dedicated controls team in Houston with support from the company's engineering and project teams in Trondheim.

The award with Hess Corporation calls for Proserv to provide a Subsea Control Module (SCM) and associated tree mounted equipment for the expansion of the Conger field. The design and manufacture of the SCM will be carried out by Proserv's team of subsea experts in Great Yarmouth. The tree mounted equipment and the final testing, servicing and the integration of equipment will be performed at Proserv's controls facility in Houston.

Over the past three years, Proserv has provided Hess Corporation with controls solutions for Hess' Tubular Bells, Stampede and now, Conger projects in the Gulf of Mexico.

The workscopes for both projects will be delivered later this year, in line with key project milestones.

Proserv, which operates worldwide through 26 operating centers based in 11 countries, has a 40year track record in delivering worldclass solutions for the energy industry, particularly in the subsea, production and drilling market sectors.

## HUNTING

Hunting, the international energy services company, today announced that its Titan Division's select fire perforating system recently set a new Canadian ecoil perforating record with a 52 CFA gun string deployed by Titanium Tubing Technology Ltd. for Teine Energy Ltd. in Kindersley, Saskatchewan.

Titanium achieved the record, previously held by Tucker Energy Services in Canada, after deploying the guns' string in one run with 60.3mm ecoil. By using Hunting's Titan Division ControlFire® switch system, the company was able to perforate in a single trip rather than in the typical two to three runs.

Titan's ControlFire® switch system is the latest in perforating switch technology that uses unique switch identification logic to selectively perforate multiple intervals in one trip. Each

ControlFire® switch provides realtime

confirmation and skipover capabilities through a surface perforating command and control panel.

## PERMASENSE

Permasense, a leading provider of remote corrosion and erosion monitoring solutions to the global energy industry, has completed the first installation of the ET210 Integrity Monitoring System in the UK North Sea, on Total's Alwyn platform.

Total has produced over one billion barrels of oil from the Alwyn area since 1987. Permasense has installed 12 sensors to deliver continuous wall thickness and temperature measurements from topside and surface equipment directly to desk.

The ET210 system delivers continuous measurements directly to desk, eliminating the costs and safety risks associated with manual inspection methods. The high quality and frequency of the data delivered offers users a realtime insight into the impact of operations—including flowrates, sand and acid levels on equipment integrity. This information provides operators with a platform for enhanced decisionmaking to maximize production rates, minimize downtime, and reduce the risk of corrosion or erosionrelated incidents.

## TRENDSETTER ENGINEERING

As a global provider of specialized subsea solutions to the oil and gas industry, Trendsetter Engineering has been supplying Subsea Accumulator Modules (SAM) throughout the world, including Arctic environments.

Trendsetter's SAM systems have been deployed in a variety of roles, including as a simple BOP stand-by

unit and as a key component to augment subsea pig launch systems.

Depending on the project, the SAM can be utilized as a simple stand-by source of hydraulic power or can be equipped with complex controls and acoustic communications.

The recent Rig Specific Requirements prescribed in the Well Control Rule have placed additional

demands on a rig's BOP accumulation and flow requirements including



the following: § 250.734(b)(2) - Have the accumulator capacity located subsea...; The accumulator capacity must operate each required shear ram, ram locks, one pipe ram, and disconnect the LMRP and have the capability of delivering fluid to each ROV function via flying leads

Trendsetter Engineering has responded to this requirement by making SAM equipment available for industry access. The systems have been used in the past to ensure compliance in the Alaskan arctic by remotely accessing a BOP Panel on a submerged BOP. The flexibility of compact design allows the ability to modify the SAMs to suit the application, making them ideal for any application.

Whether renting a SAM from Trendsetter's existing inventory, or purchasing one designed for a particular application, Trendsetter has the expertise and track record to provide you with a SAM unit that will ensure you maintain regulatory compliance.

## **FUGRO**

Fugro has been awarded a contract by Total E&P Uruguay B.V. to support its drilling campaign offshore Uruguay. The contract provides for ROV and tooling services in the Raya1 field in 3,400 meters' water depth.

Fugro is supplying two state-of-the-art 200hp FCV 4000D workclass ROV systems and subsea tooling, which are installed on board the Maersk Venturer drilling ship, and a field support vessel.

In addition to specialist tooling tasks, Fugro is performing a range of activities typically required during drilling operations such as bullseye checks, seabed survey, and general cleaning on and around the subsea BOP. Realtime video provided by Fugro and Total telecom network enables Total to observe critical operations from its onshore office should it be needed.

## **GE OIL & GAS**

GE Oil & Gas subsidiary, PT. VetcoGray Indonesia, has been awarded a field decommissioning contract with Premier Oil Indonesia (Premier Oil Natuna Sea B.V.), to support the shutdown of four subsea wells in the Anoa Field, offshore Indone-

sia. The trees were among the first to be installed by GE in the Asia Pacific region in the 1990's.

The deal will see GE Oil & Gas prepare the field's subsea production trees for removal, supporting the removal of flowlines and production umbilicals, installation of intervention hot stab assemblies and provision of annulus and flowline flanges. Once the wells have been made ready for decommissioning, the tree caps, subsea trees (XTs) and tubing hangers will be removed, cement plugs set and the seabed cleared to comply with local regulations.

Prior to commencing the first phase of work, GE Oil & Gas will conduct interface testing with customer-supplied tooling and newly-manufactured tools, ensuring the trees are ROV-enabled for the wider decommissioning campaign, anticipated to begin in Q2, 2017.

## **IDOX**

An intelligent search and navigation portal for engineering content, OnLink, an Idox solution, launched 15 August 2016. The OnLink portal has been designed with engineers in mind to deliver a 'single view of documents'. By linking content from the Enterprise Content Management (ECM) and external systems, such as ERP and asset management systems, related information can be searched and viewed quickly and easily from one place.

In a market where costs are tightly controlled, it is more important than ever for companies to leverage the investments already made in software. OnLink complements an existing Engineering Content Management (ECM) system and is a simple add-on with no requirement to change or upgrade systems – all content remains in the source repository. It instantly brings value and intelligence to drawings and documents by linking P&IDs to associated engineering content through tags, hotspots and hyperlinks. This increases the speed and efficiency with which engineers can search and access documents, cutting down on project delays and errors as well as improving decision-making and adherence to compliance and safety regulations.

## **ASSTEAD TECHNOLOGY**

Ashtead Technology has successfully completed a subsea integrity management project to support BP's Quad 204 redevelopment of the Schiehallion and Loyal fields, West of Shetland.

Ashtead, a leading independent provider of subsea technology and equipment, deployed its new Deflection Monitoring System (DMS), to capture critical data required to safely deploy and install two subsea manifolds at water depths of 400m. The technology was launched to the market earlier this year.

The system monitors deflection, heading, pitch, roll, depth and other parameters of subsea structures in real time. This allows informed decisions to be made during critical operations, ensuring specified tolerances and safety requirements are taken into account.

The DMS was optimized to the exact pressures and water depths required for the scope of work at Ashtead's UKAS accredited calibration laboratory before it was launched from a vessel and lowered 400m onto the seafloor. The project was completed on time and allowed the subsea manifolds to be installed within 24 hours of the DMS being deployed. The entire project was controlled remotely via radio frequency and acoustic data links, removing the need for direct ROV or diver support intervention in order to gather attitude measurements.

Ashtead utilized a range of communication and positioning tools to enhance the accuracy of data collected and to ensure maximum performance of the subsea structure once in place.

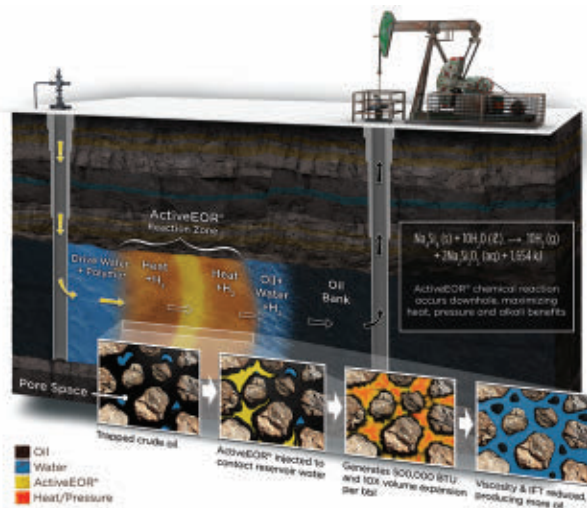
This new approach to the installation and integrity management of subsea systems was developed by Ashtead Technology as part of its range of value-added services to significantly reduce risk and cost in subsea operations.

Quad 204 is a major UKCS redevelopment incorporating a new FPSO and upgrade of the subsea infrastructure. It will enable the potential recovery of an additional 400 million barrels of resource from the existing Schiehallion and Loyal fields and extend production through to 2035.

# OIL, GAS & petrochem equipment®

WHAT'S NEW FOR ONSHORE & OFFSHORE: UPSTREAM, MIDSTREAM, DOWNSTREAM OPERATIONS

## What's New In Equipment, Products, Systems & Services for Upstream, Midstream & Downstream



### Oilfield chemical improves secondary, tertiary recovery with reduced impact

ActiveEOR enhanced oilfield chemical is announced to “improve secondary and tertiary recovery while significantly reducing environmental impact.” Heat, high-pressure gas, and alkali are generated downhole, directly within an oil zone to maximize oil recovery.

ActiveEOR is injected downhole as a hydrocarbon slurry to reach deep into a reservoir. This can be as a Huff’n Puff process or chemical flood. It penetrates reservoir pore spaces. Upon reaction with water, heat, and high-pressure hydrogen gas is rapidly released. A soluble alkali silicate is generated to help reduce viscosity and interfacial tension as well as to increase oil mobility. All reaction products are generated directly in the oil zone to eliminate heat loss and maximize production benefits.

Compared to conventional steam projects, the oilfield chemical also provides an efficient way to deliver heat to reservoirs at any depth. It likewise delivers energy to post-CHOPS (cold heavy oil production with sand) reservoirs in the form of heat and gas. An ActiveEOR slurry is injected cyclically (via Huff’n Puff) to leverage the wormhole network to distribute the material throughout the oil zone.

**SiGNa Chemistry Incorporated:** New York  
 For FREE Information, select #1 at [ogpe.hotims.com](http://ogpe.hotims.com)

### My Petro Family Photo Contest Winner:

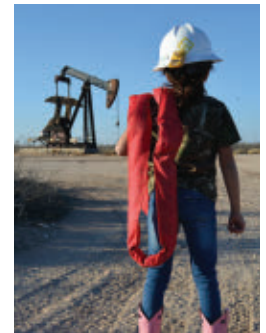
VZ Environmental garnered the largest number of votes to win OG&PE’s “My Petro Family” Photo Contest.

Explanation of this photo, titled

“Strong Women: May we know them.

May we be them. May we raise them.” is provided

on Pages 6 and 7 along with our other photo contest winners.



### New sound-reduction technology cuts hydraulic fracturing equipment noise

Quiet Fleet is newly announced to “dramatically reduce noise emissions during hydraulic fracturing.”

Using patent-pending sound reduction technology developed by this company, it is incorporated directly into equipment — where noise levels are cut by a factor of 3 compared to a conventional fracturing fleet. This is declared “achieved without any impact to operational performance or rig up time.”

**Liberty Oilfield Services:** Denver

For FREE Information, select #2 at [ogpe.hotims.com](http://ogpe.hotims.com)

## NEW OIL &amp; GAS INSTRUMENTS

## High-temp charge gas turbine accelerometers

Gas turbine or 900°F/482°C applications and environments are handled by Model 357A100 Accelerometers.

The new very high temp differential charge designs feature a UHT-12 sensing element to serve machinery protection and power generation condition monitoring.

UHT-12 crystal technology features absence of pyroelectric noise spikes up to 900°F/482°C. Its sensitivity remains more consistent over a wide temperature change. Shear mode crystals are isolated from base strain and transverse measurement errors. There is no depletion of oxygen at high temperatures to eliminate the need for a vent or window in the housing.

**IMI Sensors, PCB Piezotronics Division: Depew NY**

[For FREE Information, select #4 at ogpe.hotims.com](#)



## Automated shear history simulator simplifies fracturing fluid analysis

Model 5600-AUTO Shear History Simulator is on the market to "simplify the process of preparing and loading water-based fracturing fluids into rotational viscometers."

Simulators feature 2,000 psi maximum operation at ambient and include multiple tubing configurations, four shear history tube assemblies, convenient manifold connection to a Model 5550 viscometer, plus panel-mounted computer with touchscreen interface and automatic loop-flushing.

Frac fluid rheology is affected by a range of factors and conditions, so models are especially useful in determining how well fracturing fluids perform in transporting proppants.

Additional 5600-AUTO specifics are free for the asking.

**Chandler Engineering AMETEK Oil & Gas: Broken Arrow OK**

[For FREE Information, select #5 at ogpe.hotims.com](#)



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Or call 800-999-2900



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## TRULY PORTABLE BTU ANALYZER FOR NATURAL GAS IN PRODUCTION AND AT CUSTODY TRANSFER



The new AMETEK Chandler Engineering Model 292B portable natural gas chromatograph is compact and light weight, yet it includes fully integrated sample handling and onboard storage for up to 1,000 sample runs. A 5" full-color display shows sample results, raw and calibration data, analytical reports and real-time chromatograms. Advanced software accurately calculates heating value, relative density, and compressibility using industry standard methods. Precise monitoring and control yields exceptional sensitivity and peak performance. Connectivity includes USB and Ethernet, plus compatibility with HP printers. AMETEK Chandler Engineering. Tel: 412-828-9040. [www.ametekpi.com](http://www.ametekpi.com)

[#403 at ogpe.hotims.com](http://www.ametekpi.com)

## THE SMARTEST ALTERNATIVE IN TOTAL TANK LEVEL MEASUREMENT



AMETEK Drexelbrook's new total tank level system (TLS) uses the latest in magnetostrictive technology to provide unparalleled accuracy when measuring total tank level, interface tank level and temperature. Made of durable polymer and stainless steel, this rugged tank probe offers total and interface level sensors, five temperature sensors, in lengths up to 50 feet. It is ideal for oil, oil/water, condensate or petrochemical applications. The TLS meets FM and FMc Class I Div 1 standards and is the most accurate ( $\pm 1$ mm), cost-effective alternative to flexible stainless steel cable probes. And where needed, a rigid 316SS probe is available. AMETEK Drexelbrook. Tel: 800-334-2748 or 215-674-1234. [www.drexelbrook.com](http://www.drexelbrook.com)

[#404 at ogpe.hotims.com](http://www.drexelbrook.com)

## MODEL 5100 GAS ANALYZER MEASURES MOISTURE IN BULK GAS, HYDROCARBON STREAMS



Using tunable diode laser absorption spectroscopy (TDLAS), this unit offers high specificity, sensitivity and fast response speeds. The 5100 Portable's application-specific gas cells are available in a wide range of path lengths, and a reference cell for laser line-lock eliminates measurement errors caused by laser wavelength shifting as ambient temperature varies. Gas sampling accessories allow customization, the back lit LCD displays four 20-character lines of data, and a membrane keypad makes parameter input and display selection easy. The unit weighs only 11 lb., has a battery life of eight hours, and a USB 2.0 interface. The 5100 is factory calibrated and calibration is NIST traceable. AMETEK Process Instruments. Tel: 412-828-9040. [www.ametekpi.com](http://www.ametekpi.com)

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## NEW WAVE GUIDE OPTION ELIMINATES SIGNAL INTERFERENCE FROM TANK NOZZLES



Impulse® wave-guided radar level systems from AMETEK Drexelbrook generate total level, distance or volumetric outputs, unaffected by variations in process material electrical characteristics. Adding the Wave Guide option eliminates nozzle interference, making tank nozzle configuration immaterial and negating the need for more expensive coaxial probe systems. Reliable and accurate to  $\pm 3$  mm, Impulse series transmitters provide continuous level measurement of liquids to ranges up to 50 ft. (15 m) at operating temperatures ranging from  $-40^{\circ}$  to  $392^{\circ}$ F ( $-40^{\circ}$  to  $200^{\circ}$ C) and pressures up to 580 psig (40 bar). Five different sensor types are available, constructed of Type 316SS or Hastelloy C for Class I, Div 1 hazardous environments requiring either intrinsically safe or explosionproof installation. AMETEK Drexelbrook. Tel: 800-334-2748 or 215-674-1234. [www.drexelbrook.com](http://www.drexelbrook.com)

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## INTRINSICALLY SAFE PRESSURE TRANSMITTER OPERATES IN HAZARDOUS LOCATIONS



AMETEK PMT Model IDT intrinsically safe pressure transmitters offer superior accuracy ( $\pm 0.2\%$  full-scale) for critical applications, and all meet FM US, FM Canada, ATEX and IECEx standards for worldwide acceptance. Pressure ranges are available from vacuum to 5,000 psi, including exclusive 0-1, 0-3 and 0-6 psi units. Factory calibration eliminates the need for field calibration for plug-and-play reliability, and EN61326-1 RFI/EMI protection enables the Model IDT's use in high-noise environments. Standard units include Type 316SS housing and all wetted materials. Hastelloy and Monel diaphragms are available as options. Yet, in spite of their many advantages, PMT Model IDT intrinsically safe transmitters remain surprisingly economical. AMETEK PMT Products. [www.ametekpmt.com](http://www.ametekpmt.com)

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## THE NEW THERMOX® WDG-V COMBUSTION ANALYZER OFFERS IMPROVED CONTROL PLUS UNPARALLELED PROCESS SAFETY



The WDG-V measures excess oxygen, hydrocarbons and combustibles in flue gas, to help improve burner efficiency and operating safety. Logs of historical operating data can help operators decide when preventive maintenance is needed, significantly reducing operating costs. Specifically designed for wet, dirty gas applications, probes are available at lengths up to 108" (274cm) at temperatures to  $1875^{\circ}$ F ( $1024^{\circ}$ C), and to 72" (152cm) for temperatures to  $3000^{\circ}$ F ( $1760^{\circ}$ C). The WDG-V also features automatic calibration, analog outputs, multiple alarms, self-diagnostics, and local or remote interface as well as a variety of network communications protocols. AMETEK ThermoX. Tel: 412-828-9040. [www.ametekpi.com](http://www.ametekpi.com)

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AMETEK U.S. Gauge all-welded process gauge with integrated seal offers lower cost than gauges and seals purchased separately. In addition, the combination unit reduces the number of potential leak paths, increasing field reliability. The rugged Model XR-81 gauge with PET case, Type 316L SS socket and seamless Bourdon tube is mounted and welded onto an M&G diaphragm seal, available with either Type 316L SS or Hastelloy® C wetted parts. Offered in 15 ranges, from 0–30" Hg vac. to 0–5000 psi. AMETEK U.S. Gauge. Tel: 215-293-4100. [www.ametekusg.com](http://www.ametekusg.com)

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### NEW VAPOR PRESSURE TESTER IDEAL FOR MOBILE LABS



The Grabner® MINIVAP VP Vision portable vapor pressure tester works on gasoline, jet fuel, crude oil, liquefied petroleum gas and solvents, without the need for a pressure regulator. The VP Vision is certified to function in cold climates as well as hot, humid climates, withstands vibrations and heavy shock loads from any direction, and provides an extended pressure range of 0–2000 kPa with repeatability of ±0.2 kPa. Its combination of rugged design and precision make it ideal for mobile labs as well as military applications. AMETEK Grabner Instruments. Tel: +43 1 282 16 27-0. [www.grabner-instruments.com](http://www.grabner-instruments.com)

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### IPS-4 DUAL UV/VIS AND NIR PROCESS SPECTROPHOTOMETER



New IPS-4 spectrophotometer detects and quantifies thousands of chemical species, up to eight at once, to verify feedstock, intermediate, and final product quality. It includes 22-key keypad, analog output, web-based queries, alarm contacts, Ethernet, RS232, RS485, and three digital signal ports, plus multilingual interface. UV/VIS and NIR versions have fully integrated sampling systems. Tel: 412-828-9040. [www.ametekpi.com](http://www.ametekpi.com)

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### Nuclear gauges add communication protocols

LevelPRO & DensityPRO nuclear gauges are easily integrated into control schemes with the addition of new communication protocols.



Equipped with profibus and foundation fieldbus, the gauges integrate into a plant's control system for a variety of self-diagnostic and communications for such midstream applications as Akyl settlers, column trays, distillation columns, coke drums, desalters, tower bottom density, or crude density. Protocols deliver archiving, trend analysis, process optimization, predictive maintenance, and asset management.

**Thermo Fisher Scientific:** Franklin MA

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### Integrated wireless temperature sensing for heat trace applications

Improve heat trace applications process safety, system integrity maintenance, and measured installation cost savings with newly announced fully integrated wireless temperature sensing systems.



For both conventional and hazardous duty, the solutions serve both new and expanding heat trace systems. Portability of wireless transmitters permits temperature profile optimization throughout plant piping systems. Adding redundant wireless temperature sensors to the heater circuits is said to significantly improve process safety and integrity.

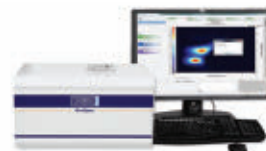
The system includes IntelliTrace ITAS or ITLS Heat Trace Control Panel and specific industrial wireless transmitters paired with appropriate temperature sensors.

**Chromalox:** Pittsburgh PA

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### Expanded NMR core analyzer range improves shale measurements

This instrumentation manufacturer and Green Imaging Technologies introduce GasSpec12 nuclear magnetic resonance core analyzers to help achieve adequate sensitivity in low porosity rock measurements.



These NMR core analyzers retain proven Q-Sense technology and Green Imaging Technologies' software. They accommodate 1/2 to 6-in.-diameter samples. The 12 MHz unit delivers increased sensitivity when working with low porosity samples while 20 MHz instruments offer best short echo performance to allow analysis of the tightest rocks.

**Oxford Instruments Industrial Analysis:** Oxon UK

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# At PBIOS:

Stop by Permian Basin Oil Show Booth D26 for information on OG&PE magazine, (Oil & Gas Journal's Products Section) [OGPE.com](http://OGPE.com) all-products website, weekly e-Newsletter, and other PennWell Petro Products. We'd be pleased to meet you!



# "My Petro Family" Photo Contest Winners

These seven highly diverse photographs garnered the most votes in OG&PE's "My Petro Family" Photo Contest.

Thanks to our entrants for taking the time to send their photos and caption — and to our voters.

While our most recent photo contests had themes specific to equipment, products, and services — our editorial focus going on 63 years — one of our young, progressive colleagues suggested "people" are the energy which truly drive said products and services both in the field, onshore and offshore, up and downstream. As these photos salute the humanity of oil and gas, we appreciate this opportunity to share them.



## "My Petro Family" Photo Winner:

**Strong women:**  
May we know them.  
May we be them.  
May we raise them.

Eric Hernandez, a VZ Environmental employee, captured this photo of his 8 year old daughter, Little Miss Liberty at a family ranch in West Texas.

Growing up around "oil pump jack thingies", she enjoys living the West Texas and cowgirl way of life. Under the West Texas sun, Liberty prefers a hard-hat, boots and jeans just like her daddy.

Carol Van Zandt, founder of VZ Environmental is proud to encourage and celebrate young women's involvement in the oil and gas industry.

**VZ Environmental** specializes in innovative containment solutions. As the industry leader, VZE provides products such as patented drive-over foam walled containments, above ground frac ponds, patented airborne dust filters, restraints and safety trailers.



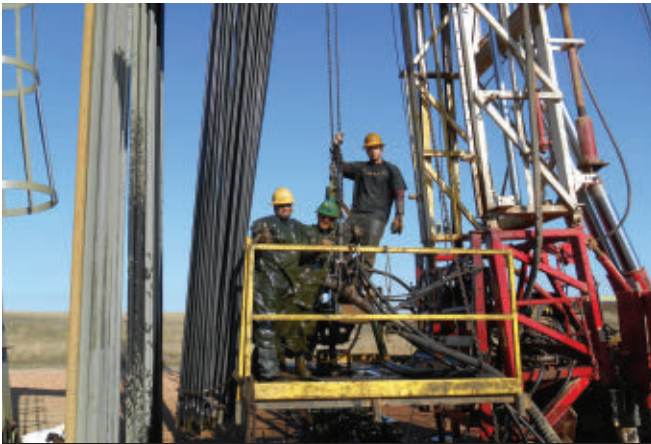




2) Hydro Engineering Consultant, Jordan  
**Makkah Site colleagues.** In front of building.



3) Loadmaster Engineering: **Offshore challenges.**  
Team work starting a new offshore project.



4) Blue Diamond Petroleum Services: **Just another day in the patch.** My crew still smiling after having the well come in on them and them being able to stab the TIW valve.



5) Countrymark Refining and Logistics LLC: **CountryMark.** Pipeline Maintenance Crew ensure the integrity of CountryMark's pipeline system is reliable and safe.



6) Sapura Kencana Petroleum: **Top view of Engineering family.** With full engineering team that delivers offshore projects with models of completed projects.



7) Total Rod Concepts Incorporated: **API Certification for TRC FSR.** Employees responsible for receiving API certifications for the Fiberflex fiberglass sucker rods.



## Widely-applicable pressure relief systems

For more than 40 years this company has manufactured **pressure relief systems** for a broad range of applications including chemical.

Its standard and special, **rupture discs** are rugged with breaking points geometry (buckling pins) — developed by this firm — to allow up to 98% operating pressure ratio.

Because the manufacturer does not use bite-type seals but rather metal-on-metal seats — leaktightness is ensured and the disc can be removed, inspected, and reinstalled.

**REMBE GmbH Safety + Control:** Brilon Germany

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## Hydraulic set, mechanically held, ESP production packers

**DLESP Packers** with secondary bores are for ESP feedthrough cable and optional chemical feedthrough lines. Because no tubing manipulation is required to set the packer — a wellhead can be installed and flanged-up before setting.

DLESP is available with a variety of tubing connections. It features a sequential upper slip release system to release each slip individually to reduce pull required to release it.

Angles on the production packer's upper slips and upper slip body result in the slips releasing smoothly from the casing. Full DLESP data are free.

**D&L Oil Tools:** Tulsa OK

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## Trellis Energy, Blackstone launch standalone company to integrate, optimize, and manage natural gas transactions

Trellis Energy, formerly a part of the global IT services and business consulting firm Blackstone Technology Group, has launched a separate corporate entity, wholly owned by Blackstone.

The new firm will continue to provide **Trellis natural gas transaction management platform**. It manages energy transactions and automates critical processes in natural gas production, gathering, and various delivery from pipeline to storage and end users behind city gate including gas supply planning and optimization. The company will also absorb Blackstone's digital services practice for the energy sector in order to provide energy companies with software and services for big data analysis, mobile, cybersecurity, and the Grid of Things (GoT).

**Trellis Energy:** San Francisco

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## Electrostatic separators remove slurry oil's FCC catalyst fines

**Gulftronic electrostatic separators** are designed to provide refineries more marketable options and to increase revenue from upgraded clarified oil products. They remove all FCC catalyst fines from slurry oil.

The separators' technology uses an electrostatic process to polarize, capture, and remove all catalyst fines (down to submicron level) that resist separation by conventional mechanical filtration processes.

Models are impervious to fouling by asphaltenes and coke particles. This feature helps produce clarified oil feedstock for various marketable products including carbon black, needle coke, fuel oil, and electrode pitch.

Gulftronic also eliminates sedimentation of catalyst fines as hazardous sludge from refinery storage tanks to reduce settling tank waste collection and disposal. Performance is guaranteed certified below 100 ppm clarity.

**General Atomics Electromagnetic Systems:** San Diego

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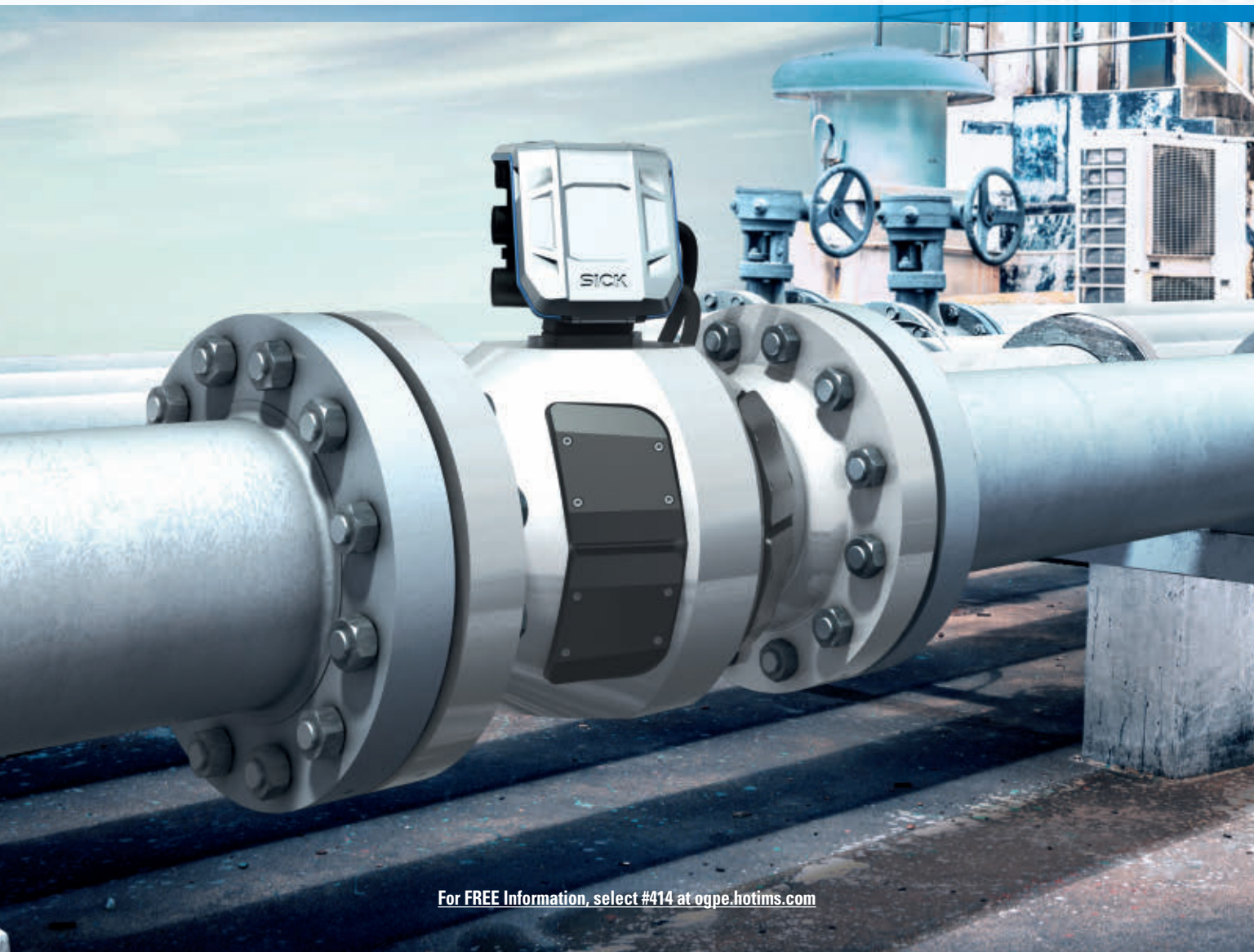


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## Lightweight fire protection: New low cost fire retardant carbon fibre composites

ROCCS 10/40 lightweight carbon fiber composite material is capable of withstanding a fire of 2200°F for over 2 hours.

ROCCS 10/40 weighs 15kgs per sq metre and at a price of less than US \$1000 per sq metre, significantly improves safety conditions at an affordable price.

ROCCS 10/40 is available in sheet panel form or in molded net shapes to meet any design demands. The lightweight panels are easy to transport, store and assemble and require no specialist equipment.

**Carbon Fibre Preforms:** Henley, Arden UK

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## Expanded vessel tracking and management

PortVision 360 vessel tracking and management has expanded to give new real-time analytics and reporting capabilities via add-on modules to meet specialized application needs.

It builds on a 2007 release to enhance efficiency, reduce cost, plus increase safety and security by delivering valuable information and knowledge about vessel and terminal activities. The new version makes it easier to answer questions about vessel movements and events — anywhere in the world.

**PortVision/Oceanering:** Houston

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## Improved workwear for women in fire service, industrial operations

Updated lines of flame-resistant women's clothing are newly developed under the Workrite FR and Workrite FM Fire Service brands.

The lines include shirts with vertical darts in the front and contoured seams in the back as well as pants featuring a lower rise and more tailored fit in the waist, seat, and thighs. The protective clothing fits properly so it won't catch on equipment, impair movement, or leave skin exposed to hazards — and comply with safety standards.

**Workrite Uniform Company:** Oxnard CA

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## Integrated compliance solutions, software, services — new brand



This single-source provider of integrated Operator Qualification (OQ), drug and alcohol, and safety compliance management announces its new branding, logo, color scheme, design, and updated website.

For energy and utilities, its focus is delivery of integrated compliance solutions that combine software and services to help meet industry regulatory requirements and enhance workforce and community safety.

For 15 years the organization's focus, along with increasingly complex and evolving industry regulations and client feedback — has led to its expanded solutions portfolio as well as complementary training solutions. These address needs to monitor contractor and employee DOT/PHMSA and OSHA compliance, deliver and track related training, maintain records, and demonstrate their compliance to regulators.

**VeriForce LLC:** Shenandoah TX

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## Highly differentiated engineered completions solution lowers costs, increases production

Fracture ID with Drillbit Geomechanics is announced to deliver critical oil and gas reservoir properties to E&P companies — for lower drilling and completion costs plus increased hydrocarbon recoveries.

The technology analyzes at-the-bit vibrations for detailed reservoir characterization. This provides “basis for improved unconventional resource development economics through informed frac stage and perf cluster placement,” it's declared.

An industry standard downhole data logger is used to collect data in the normal course of drilling from which high resolution mechanical rock properties measurements can be made.

**Fracture ID:** Denver

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## Efficient glycol-from-natural-gas reclamation

A new two-stage treatment technique and system efficiently reclaims glycol from natural gas.



It works without precoating as a suspension is thickened with candle filters in the first stage, then further treated with a horizontal leaf filter. Final product is crumbly and has low volume. Apart from the precipitated salts and water, it contains very little glycol for safe disposal, according to the developer.

The new, fully automatic, maintenance-free configuration no longer needs precoat material to be purchased and handled. Compact design enables use on offshore platforms.

Complete reclamation process/system details are yours free.

**BHS-Sonthofen:** Sonthofen Germany

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## Strainers remove pipeline debris to safeguard meters, instruments, valves

**LoDP Strainers** remove pipeline debris before fluid goes through meters, instruments and control valves.

The 2 to 24-in. inlet and outlet, ANSI 150 to 2500 designs have a lower pressure drop than conventional strainers.

LoDP's perforated plate provides basket stability while mesh in the target area helps reduce pressure drop. Mesh and perforated plate sizes are from 0.0015 40 microns to 0.5 in.

The strainers come standard in carbon steel material. Stainless, Monel or other materials are available as are blind and quick open closures.

LoDPs also filter-out particles and debris before oil and gas go to process.

**WFMS: Sugar Land TX**

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## Clean air solutions for dust, mist, fume collection

This free 16-page **Clean Air Solutions brochure** illustrates and describes one manufacturer's core products line: **dust, mist, and fume collection equipment**. All are cited to serve a full range of manufacturing industries and operations.

It overview the company's flagship lines of Farr Gold Series dust collectors and HemiPleat filters as to applications, features, and benefits.

Handte EM Profi coolant (emulsion) mist collector and Handte Oil Expert oil mist collectors are showcased to clean up mists generated in machining centers.

Handte Vortex and Venturi wet scrubbers are presented for wet collection of highly flammable and combustible dusts.

The clean air solutions literature is downloadable.

**Camfil Air Pollution Control: Jonesboro AR**

[For FREE Literature, select #250 at ogpe.hotims.com](#)



## Multifunctional performance enhancing diesel additive

OCTCET35 is formulated to improve diesel fuel efficiency, enhance Cetane level, clean entire fuel systems, and extend the life of oil.

The **multifunctional performance enhancing additive** boasts scientific test results from more than 17 labs on three continents, backed by practical test and usage exceeding 10-million miles / 100,000 hr of runtime.

It contains 35% oxygen by weight to deliver oxygen at the moment of combustion to enrich the oxygen environment in the combustion chamber. This makes diesel work longer, cleaner, and more efficiently with reduced emissions, smoke, smoke opacity, friction, and wear. OCTCET35 details are yours free.



**OCTCET Incorporated: Houston**

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## New industrial cleaning, rescue services for Midwest US

To fill a void in the Midwest United States, this **industrial cleaning contractor** now offers a wide range of services.

Its owner has worked in construction and industrial service his entire life and has focused on pipeline operations the past 14 years.

Services include confined space rescue to site restoration and maintenance as well as removal of unwanted materials. Other offerings include above-ground storage tank cleaning, environmental cleanup, ground thawing, project management.

**Outdoor Industrial & Rescue Services:** Devils Lake ND

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## Heavy-duty motor oils introduced with ISOSYN advanced technology

Delo 400 API CK-4 and FA-4 heavy-duty motor oils were unveiled in August. Two full synthetic meeting and four synthetic blend meeting Delo oils are offered in varying viscosities.

Also introduced was next-generation ISOSYN Advanced Technology. It combines the provider's formulation expertise, high performance additive chemistry, and premium base oils to help extend durability of critical diesel engine parts. It also enables increased durability through better oxidation control, anti-wear protection and piston control — extending drain intervals compared to API CJ-4 oils.

**Chevron Products Company:** San Ramon CA

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## Quick disconnect couplings expansion

An expansion of the FD85 Thread to Connect Couplings Series now includes 1 1/4 and 2-in. body sizes.

They are designed to help prevent downtime caused by leaks, pressure drops, contamination, or difficult assemblies in oil and gas uses. These include on hydraulic systems of land-based drilling rigs. They are fire-rated for use next to well bores, it's noted.

All sizes, including 3/4, 1-in., and 1 1/2-in. now carry a Lloyd's Registry Certificate for oil and gas as standard. This assures performance to industry standards to reduce costly equipment malfunction or failure downtime. Each mating will also carry the <BOP> marking to indicate couplings are approved for blowout prevention applications. The Lloyd's Registry Certificate for fire conditions as outlined in API 16D and EUB Directive 36 Appendix 3 certifies products as capable of maintaining pressure when exposed to 700°F for 5-min.

**Eaton:** Eden Prairie MN

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## Open grid step nosing protects heavy traffic areas in wet or oily conditions

New **U-Tred Series II nosing** is for use on the edges of open grid-type steps to protect heavy traffic areas.

It accommodates 50-mm and 100-mm centers grid-mesh patterns to function in wet or oily environments.

Double-action anti-slip cleats for extra grip are featured so U-Tred provides a very hard wearing step definition. Unlike conventional nosing, the new version easily installs in seconds, declares the manufacturer.

U-Tred II comprises high-strength galvanized steel. For increased visibility, treads are powder-coated in a bright safety yellow. They will not crack or release hazardous splinters like fiberglass types, it's noted.

**AMCO: Australian Manufacturing Company:**

Castle Hill Australia

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## Shielded solid insulated medium voltage switchgear = power distribution managing

Premset is newly announced as "the first global product to use solid and shielded insulation" as a **medium voltage switchgear** for power distribution management.

The earth shielded system offers outstanding safety, efficiency, and easy use. Premset's main circuit components are insulated by a layer of solid material covered by an external conductive coating with ground potential. There is no electric field in the ambient air because live conductors and the ground are confined within the switchgear enclosure.

**Schneider Electric:** Nashville TN

[For FREE Information, select #29 at ogpe.hotims.com](#)

## New, fast, simple use flash point testers

Setaflash Series 3 flash point testing instruments are rugged, fast, and reliable to use — even with minimal experience.

Suited for lab or portable flash point testing, the series features a simpler user interface with color digital display and touchscreen icons to guide you through a straight forward testing process. A test typically takes less than 2 min to perform. It requires 2-ml test sample to keep wastage and cost to a minimum

For easy recordkeeping, Series 3 has 1GB memory to store up to 100,000 test results which can be transferred via USB for data analysis or printing from a computer.

**Stanhope-Seta:** Chertsey UK

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## Geotextile coatings are secondary containment option for oilfield

Fast-set, spray-applied **polyurea coatings** wet-out geotextiles and create a durable, flexible and seamless liner for secondary containment.



Among coatings benefits are leak prevention and containment of wastewater, fuels, or chemical spills. They serve in various oilfield duties as well as fuel loading and unloading stations.

Formulations include cold weather version, one for use in moist early morning or humid conditions as well as a low shrinkage configuration. All are 100% solids, zero VOCs.

**Chemline:** St. Louis MO

[For FREE Information, select #31 at ogpe.hotims.com](#)

## Shale sweet spot technical service commercialized for reservoir evaluation

Shale SweetSpotter service reservoir-evaluation analysis technology is now available for unconventional oil and gas.

The downhole technical service uses lasers and sophisticated detectors to identify locations where hydrocarbons occur in shale formations. It allow producers to focus on development efforts, reduce drilling costs, optimize production, as well as reduce the number of hydraulic fracturing stages and associated water usage.

Shale SweetSpotter employs the firm's Reservoir Raman System on which you may request free information along with downhole service specifics.

**WellDog:** Laramie WY

[For FREE Information, select #32 at ogpe.hotims.com](#)

## Remote-location-applicable nearshore survey boats

As a "flexible nearshore survey option, suited to a wide range of jobs, and remote locations" are **high spec Horizon Echo survey boats**.

Custom designed models are equipped to carry out full geophysical shallow water surveys. They can also perform ROV surveys.



The boat has a hull-mounted survey-grade echosounder with additional bow and side mounts for geophysical equipment. With two winch-powered towing davits on board, Horizon Echo's sidescan sonar and magnetometer are easily deployed and recovered — along with grab samplers or other water sampling equipment.

Boats are easily launched from land or from a mother-ship crane and include standard SOLAS safety features.

**Horizon Geosciences:** Sharjah UAE

[For FREE Information, select #33 at ogpe.hotims.com](#)

## Explosionproof portable LED flood system with 360° visibility

EPL-3X100LED-4-HDL-100

4-foot explosionproof portable LED flood lighting systems produce a combined total of 21,000 lumens.



Using three 48-in. LED light heads, each 100-w fixture is mounted to a portable powder-coated frame constructed from non-sparking aluminum.

LED lights within the unit produce a brilliant flood pattern to illuminate enclosed areas and hazardous locations where flammable vapors, gases, and dusts may be present.

Systems can be positioned upright to provide intense flood beam with 360° coverage or laid on their side to provide light within tanks and enclosed work areas.

**Larson Electronics:** Kemp TX

[For FREE Information, select #34 at ogpe.hotims.com](#)

## Vinyl Ester linings launched for challenging midstream applications

Hempaline Defend Vinyl Ester Linings are new and specifically designed for 'challenging applications.'

In wet or dry environments they protect internal surfaces of flue gas desulfurization units, ductwork, or stacks as well as tanks and secondary containment areas.

The lining range includes glass and mineral-flaked filled coatings as well as fiberglass-reinforced.

Complete Hempaline Defend information is yours free.

**Hempel:** Lyngby Denmark

[For FREE Information, select #35 at ogpe.hotims.com](#)

## Cordless 2 1/2-inch band saws with 'safety break' and blade guard

MBS 18LTX 2.5 cordless band saws are on the market for use on any 2.5-in. pipe or under.

Models come standard with a 'safety break' that stops the blade in under a second, as well as a full blade guard to protect users from blade slippage or from coming in contact with the cutting teeth.



This light weight, well balanced, ergonomically designed saw quickly and easily cold cuts small-diameter metal and plastic pipes, conduit, threaded rod, angle iron, and channel.

It features Ultra-M technology for applications that typically demand more power, enhanced battery life, and longer run times. It also comprises soft grip handle for increased comfort in operation plus tool-less blade changing lever.

**Metabo Corporation:** West Chester PA

[For FREE Information, select #36 at ogpe.hotims.com](#)

## August "Advertiser Product & Service Followup"

Companies featured here advertised their equipment, products, or services in August 1 Oil & Gas Journal's OG&PE products section. These summaries give you an opportunity to receive free information or literature on leading manufacturers' and service providers' oil and gas specialties. Go to [OGPE.com](http://OGPE.com) — Click "Product Info" (white typeface) at top. You will receive prompt, complete response from these valued OG&PE media partners — and/or to visit their websites.

### Process gas compressors, reciprocating compressors, compressor valves, services

"A compressor from BORSIG ZM Compression is a lifelong decision — commitment for life."

The manufacturer's expansive line includes process gas compressors as well as reciprocating compressors acc. API 618, up to 16,000 kW, 1,000 bar and 115,000 m<sup>3</sup>/h. BORSIG Blue-Line combines compressor unit control system, emergency shutdown, machinery protection and condition monitoring.

Compressor valves are offered as are complete services.  
**BORSIG ZM Compression GmbH:** Berlin [Borsig.de/zm](http://Borsig.de/zm)  
 For FREE Information, select #38 at [ogpe.hotims.com](http://ogpe.hotims.com)

### TORRENT Deluge Valves = Advanced fire protection; video demonstration link available

Uncompromising advanced fire protection performance is consistently delivered by TORRENT Deluge Valves in fire protection systems from fire-water supplies to foam solution, seawater, foam concentrate or other corrosive liquids.

Inquiring here will link you to a demonstration video to see 400Y's certified and approved flow control in deluge, pressure control deluge, remote on-off remote control, pre-action systems, pressure reduction and pressure relief.

**BERMAD UK Ltd.:** Berkshire UK [Bermad.com](http://Bermad.com)  
 For FREE Information, select #39 at [ogpe.hotims.com](http://ogpe.hotims.com)

### Valves, fittings, tubing proven for extreme oil, gas, petrochemical conditions and pressures

Count on proven HiP valves, fittings, and tubing to handle extreme conditions and pressures throughout oil, gas, and petrochem operations.

Our name represents high pressure in all petroleum conditions, demands, and applications. For over 60 years we have continued to provide leak-free operation at up to 150,000 psi.

No one does valves, fittings, and tubing better.  
**High Pressure Equipment Company:** Erie PA  
[High Pressure.com](http://High Pressure.com)

For FREE Information, select #40 at [ogpe.hotims.com](http://ogpe.hotims.com)

### Optimal filtration for maximum performance: JONELL Filtration Group consistently delivers

Optimize your filtration performance in oil and gas production, refinery and petrochemical, or gas processing and transmission operations with JONELL Filtration Group products, technologies, and services.

Specifically JONELL is available to optimize filtration performance in refinery fuel gas, catalyst protection, amine gas treating, compressor protection, final product protection, and glycol dehydration.

**JONELL Filtration Group:** Houston [JonellInc.com](http://JonellInc.com)  
 For FREE Information, select #41 at [ogpe.hotims.com](http://ogpe.hotims.com)

### For ultimate machinery vibration, position, protection: Sentry G3 ticks all the right boxes

Sentry G3 ticks all the right vibration monitoring, turbine supervisory, and overspeed protection boxes for outstanding machinery protection.

Designed to protect your critical plant and equipment with a system that offers best function and features, G3 comprises universal module for all vibration, position, speed, and temperature measurements. It incorporates fully independent channel signal processing and alarm function as well.

**SENSONICS LTD.:** Hertfordshire UK [Sensonics.co.uk](http://Sensonics.co.uk)  
 For FREE Information, select #42 at [ogpe.hotims.com](http://ogpe.hotims.com)

### Rugged solenoid valves control oil/fuel oil, biofuel, natural gas, hot liquids/gases

Magnatrol high quality, two-way bronze and stainless steel valves control the flow of oil/fuel oil, biofuel, natural gas, solvents, hot liquids and gases, corrosive fluids, water, steam, and other sediment-free fluids.

The rugged, field-proven models handle up to 400°F and 500 psig in flanged ends or NPT threads from 3/8 to 3 in. All feature continuous duty coils for all AC/DC voltages.

**Magnatrol Valve Corporation:** Hawthorne NJ  
[Magnatrol.com](http://Magnatrol.com)

For FREE Information, select #43 at [ogpe.hotims.com](http://ogpe.hotims.com)

**Click the link to request free information or literature  
 or go to directly to manufacturer/service provider websites**



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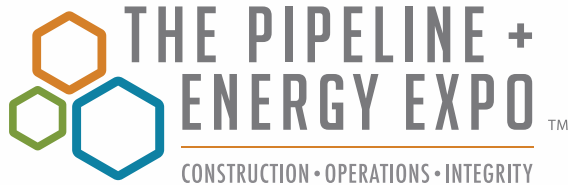
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Additional analysis of market trends is available through **OGJ Online**, *Oil & Gas Journal's* electronic information source, at <http://www.ogj.com>.



## IMPORTS OF CRUDE AND PRODUCTS

	— Districts 1-4 —		— District 5 —		— Total US —		
	8-19 2016	8-12 2016	8-19 2016	8-12 2016	8-19 2016	8-12 2016	8-21* 2015
	1,000 b/d						
Total motor gasoline.....	777	550	23	60	800	610	630
Mo. gas. blending comp.....	683	405	17	60	700	465	604
Distillate.....	161	67	63	25	224	92	123
Residual.....	152	110	138	58	290	168	222
Jet fuel-kerosine.....	10	44	34	138	44	182	136
Propane-propylene.....	69	146	21	18	90	164	63
Other.....	966	885	112	71	1,079	955	874
<b>Total products.....</b>	<b>2,135</b>	<b>1,802</b>	<b>391</b>	<b>370</b>	<b>2,527</b>	<b>2,171</b>	<b>2,048</b>
<b>Total crude.....</b>	<b>7,254</b>	<b>7,296</b>	<b>1,388</b>	<b>898</b>	<b>8,642</b>	<b>8,194</b>	<b>7,199</b>
<b>Total imports.....</b>	<b>9,389</b>	<b>9,098</b>	<b>1,779</b>	<b>1,268</b>	<b>11,168</b>	<b>10,366</b>	<b>9,247</b>

\*Revised.  
Source: US Energy Information Administration  
Data available at PennEnergy Research Center.

## EXPORTS OF CRUDE AND PRODUCTS

	8-19-16	Total US 8-12-16	*8-21-15
	1,000 b/d		
Finished motor gasoline	454	454	419
Jet fuel-kerosine	156	156	133
Distillate	1,266	1,266	1,223
Residual	362	362	414
Propane/propylene	668	668	505
Other oils	995	995	1,001
<b>Total products</b>	<b>3,901</b>	<b>3,901</b>	<b>3,695</b>
<b>Total crude</b>	<b>677</b>	<b>677</b>	<b>477</b>
<b>Total exports</b>	<b>4,578</b>	<b>4,578</b>	<b>4,172</b>
<b>NET IMPORTS</b>			
Total	6,591	5,786	5,075
Products	(1,374)	(1,730)	(1,647)
Crude	7,965	7,516	6,722

\*Revised.  
Source: Oil & Gas Journal  
Data available at PennEnergy Research Center.

## CRUDE AND PRODUCT STOCKS

District	Crude oil	— Motor gasoline —			— Fuel oils —		Propane-propylene
		Total	Blending comp.	Jet fuel, kerosine	Distillate	Residual	
		1,000 bbl					
PADD 1.....	20,116	69,114	62,113	9,997	61,846	10,567	7,067
PADD 2.....	152,435	48,362	42,130	6,866	29,668	1,209	29,088
PADD 3.....	272,639	77,958	69,386	14,510	44,536	23,814	56,526
PADD 4.....	26,731	6,973	5,216	798	3,267	183	<sup>1</sup> 3,454
PADD 5.....	51,674	30,287	27,952	9,580	13,940	4,720	—
<b>Aug. 19, 2016.....</b>	<b>523,595</b>	<b>232,694</b>	<b>206,797</b>	<b>41,751</b>	<b>153,257</b>	<b>40,493</b>	<b>96,135</b>
<b>Aug. 12, 2016.....</b>	<b>521,093</b>	<b>232,658</b>	<b>206,913</b>	<b>41,648</b>	<b>153,136</b>	<b>39,048</b>	<b>93,744</b>
<b>Aug. 21, 2015<sup>2</sup>.....</b>	<b>450,761</b>	<b>214,434</b>	<b>187,958</b>	<b>41,693</b>	<b>149,836</b>	<b>39,719</b>	<b>95,724</b>

<sup>1</sup>Includes PADD 5. <sup>2</sup>Revised.  
Source: US Energy Information Administration  
Data available at PennEnergy Research Center.

## REFINERY REPORT—AUG. 19, 2016

District	REFINERY OPERATIONS		REFINERY OUTPUT			
	Gross inputs	Crude oil inputs	Total motor gasoline	Jet fuel, kerosine	Fuel oils	Propane-propylene
	1,000 b/d		1,000 b/d			
PADD 1.....	1,090	1,097	3,277	91	357	151
PADD 2.....	3,752	3,734	2,656	282	1,073	398
PADD 3.....	8,783	8,712	2,054	869	2,626	976
PADD 4.....	589	591	343	44	178	<sup>1</sup> 190
PADD 5.....	2,723	2,544	1,698	500	616	—
<b>Aug. 19, 2016.....</b>	<b>16,937</b>	<b>16,678</b>	<b>10,028</b>	<b>1,786</b>	<b>4,850</b>	<b>1,715</b>
<b>Aug. 12, 2016.....</b>	<b>17,127</b>	<b>16,865</b>	<b>10,393</b>	<b>1,849</b>	<b>4,939</b>	<b>1,722</b>
<b>Aug. 21, 2015<sup>2</sup>.....</b>	<b>16,980</b>	<b>16,658</b>	<b>9,974</b>	<b>1,588</b>	<b>4,907</b>	<b>1,630</b>
	<b>18,320 Operable capacity</b>		<b>92.5 utilization rate</b>			

<sup>1</sup>Includes PADD 5. <sup>2</sup>Revised.  
Source: US Energy Information Administration  
Data available at PennEnergy Research Center.

## OGJ CRACK SPREAD

	8-26-16*	8-28-15*	Change	Change,
	\$/bbl			%
<b>SPOT PRICES</b>				
Product value	59.81	58.96	0.85	1.44
Brent crude	48.65	43.53	5.12	11.77
Crack spread	11.16	15.44	(4.28)	(27.71)

## FUTURES MARKET PRICES

	8-26-16*	8-28-15*	Change	Change,
	\$/bbl			%
<b>One month</b>				
Product value	63.09	60.84	2.25	3.70
Light sweet crude	47.32	40.79	6.53	16.00
Crack spread	15.77	20.05	(4.28)	(21.33)
<b>Six month</b>				
Product value	61.70	57.62	4.09	7.09
Light sweet crude	50.32	44.49	5.83	13.10
Crack spread	11.39	13.13	(1.74)	(13.28)

\*Average for week ending.  
Source: Oil & Gas Journal  
Data available at PennEnergy Research Center.

**OGJ GASOLINE PRICES**

	Price ex tax 8-24-16	Pump price* 8-24-16 ¢/gal	Pump price 8-26-15
(Approx. prices for self-service unleaded gasoline)			
Atlanta	149.5	198.9	234.8
Baltimore	155.9	206.9	241.2
Boston	153.0	197.9	244.2
Buffalo	146.9	207.9	255.2
Miami	142.0	196.9	247.5
Newark	162.0	194.9	233.8
New York	169.9	230.9	265.2
Norfolk	187.2	227.9	224.0
Philadelphia	137.1	205.9	261.8
Pittsburgh	155.1	223.9	258.8
Wash., DC	179.0	220.9	248.8
PAD I avg	158.0	210.3	246.9
Chicago	217.4	266.0	350.7
Cleveland	168.4	214.8	264.0
Des Moines	162.4	212.8	256.0
Detroit	163.5	212.5	261.2
Indianapolis	165.7	214.0	264.2
Kansas City	159.1	194.8	252.6
Louisville	167.2	211.6	274.2
Memphis	173.8	213.6	263.0
Milwaukee	153.3	204.6	278.3
Minn.-St. Paul	160.6	207.6	267.2
Oklahoma City	152.2	187.6	228.1
Omaha	157.0	203.1	248.6
St. Louis	161.9	197.6	264.7
Tulsa	161.2	196.6	226.4
Wichita	160.2	202.6	255.8
PAD II avg	165.6	209.3	263.7
Albuquerque	155.0	192.2	243.1
Birmingham	166.6	205.9	235.1
Dallas-Fort Worth	163.8	202.2	225.2
Houston	163.2	201.6	226.2
Little Rock	162.0	202.2	236.1
New Orleans	164.2	202.6	237.1
San Antonio	160.8	199.2	238.1
PAD III avg	162.2	200.9	234.4
Cheyenne	175.0	217.4	266.3
Denver	187.5	227.9	281.1
Salt Lake City	181.5	229.4	286.1
PAD IV avg	181.3	224.9	277.8
Los Angeles	245.0	304.0	381.1
Phoenix	181.6	219.0	274.1
Portland	178.5	228.0	302.7
San Diego	219.0	278.0	374.2
San Francisco	225.0	284.0	343.4
Seattle	198.1	261.0	313.0
PAD V avg	207.9	262.4	331.4
Week's avg	170.2	216.9	265.1
July avg	178.7	225.4	264.7
June avg	188.3	234.9	278.7
2016 to date	161.4	208.1	—
2015 to date	204.3	251.6	—

\*Includes state and federal motor fuel taxes and state sales tax. Local governments may impose additional taxes. Source: Oil & Gas Journal. Data available at PennEnergy Research Center.

**BAKER HUGHES RIG COUNT**

	8-26-16	8-28-15
Alabama	2	2
Alaska	4	13
Arkansas	—	4
California	5	13
Land	5	13
Offshore	—	—
Colorado	20	36
Florida	—	—
Illinois	2	2
Indiana	—	—
Kansas	—	13
Kentucky	1	2
Louisiana	42	71
N. Land	16	29
S. Inland waters	4	4
S. Land	6	9
Offshore	16	29
Maryland	—	—
Michigan	—	—
Mississippi	4	3
Montana	—	1
Nebraska	—	3
New Mexico	30	50
New York	—	—
North Dakota	27	72
Ohio	13	19
Oklahoma	62	105
Pennsylvania	19	35
South Dakota	—	—
Texas	237	386
Offshore	1	—
Inland waters	—	—
Dist. 1	19	48
Dist. 2	13	43
Dist. 3	5	19
Dist. 4	8	15
Dist. 5	3	7
Dist. 6	8	21
Dist. 7B	5	5
Dist. 7C	24	36
Dist. 8	131	153
Dist. 8A	12	16
Dist. 9	1	5
Dist. 10	7	18
Utah	3	4
West Virginia	7	17
Wyoming	9	25
Others ID-1, NV-1	2	1
<b>Total US</b>	<b>489</b>	<b>877</b>
<b>Total Canada</b>	<b>146</b>	<b>196</b>
<b>Grand total</b>	<b>635</b>	<b>1,073</b>
US oil rigs	406	675
US gas rigs	81	202
Total US offshore	17	30
<b>Total US cum. avg. YTD</b>	<b>484</b>	<b>1,083</b>

Rotary rigs from spudding in to total depth. Definitions, see OGJ Sept. 18, 2006, p. 46. Source: Baker Hughes Inc. Data available at PennEnergy Research Center.

**OGJ PRODUCTION REPORT**

	8-26-16 1,000 b/d	8-28-15 1,000 b/d
(Crude oil and lease condensate)		
Alabama	18	26
Alaska	480	408
California	550	571
Colorado	306	342
Florida	6	6
Illinois	21	26
Kansas	96	121
Louisiana	1,290	1,485
Michigan	16	18
Mississippi	51	66
Montana	59	76
New Mexico	360	423
North Dakota	1,060	1,179
Ohio	63	77
Oklahoma	255	421
Pennsylvania	16	19
Texas	3,555	3,743
Utah	81	99
West Virginia	21	20
Wyoming	188	235
Other states	50	46
<b>Total</b>	<b>8,542</b>	<b>9,407</b>

<sup>1</sup>OGJ estimate. <sup>2</sup>Revised. Source: Oil & Gas Journal. Data available at PennEnergy Research Center.

**US CRUDE PRICES**

	8-26-16 \$/bbl*
Alaska-North Slope 27°	30.62
Light Louisiana Sweet	43.01
California-Midway Sunset 13°	38.60
California Buena Vista Hills 26°	49.35
Wyoming Sweet	43.89
East Texas Sweet	41.50
West Texas Sour 34°	39.00
West Texas Intermediate	44.00
Oklahoma Sweet	44.00
Texas Upper Gulf Coast	37.75
Michigan Sour	36.00
Kansas Common	43.25
North Dakota Sweet	36.25

\*Current major refiner's posted prices except N. Slope lags 2 months. 40° gravity crude unless differing gravity is shown. Source: Oil & Gas Journal. Data available at PennEnergy Research Center.

**WORLD CRUDE PRICES**

OPEC reference basket	Wkly. avg.	8-26-16 \$/bbl	
		Mo. avg., June-16	July-16
<b>OPEC reference basket</b>	45.84	42.68	42.68
Arab light-Saudi Arabia	46.28	43.14	43.14
Basrah light-Iraq	44.63	41.37	41.37
Bonny light 37°-Nigeria	48.48	45.30	45.30
Es Sider-Libya	47.28	44.00	44.00
Girassol-Angola	48.30	45.09	45.09
Iran heavy-Iran	44.68	41.59	41.59
Kuwait export-Kuwait	44.50	41.37	41.37
Marine-Qatar	46.37	43.53	43.53
Meruy-Venezuela	38.22	36.71	36.71
Minas 34°-Indonesia	51.56	41.84	41.84
Murban-UAE	49.28	46.54	46.54
Oriente-Ecuador	44.03	40.72	40.72
Saharan blend 44°-Algeria	48.98	45.30	45.30
<b>Other crudes</b>			
Fateh 32°-Dubai	46.25	42.64	42.64
Isthmus 33°-Mexico	47.51	45.07	45.07
Brent 38°-UK	48.28	45.00	45.00
Urals-Russia	46.60	43.76	43.76
<b>Differentials</b>			
WTI/Brent	0.46	(0.10)	(0.10)
Brent/Dubai	2.03	2.36	2.36

Source: OPEC Monthly Oil Market Report. Data available at PennEnergy Research Center.

**US NATURAL GAS STORAGE<sup>1</sup>**

	8-19-16 bcf	8-12-16 bcf	8-19-15	Change, %
East	775	763	719	7.8
Midwest	875	861	761	15.0
Mountain	219	217	182	20.3
Pacific	310	313	345	(10.1)
South Central	1,171	1,185	1,068	9.6
Salt	292	305	287	1.7
Nonsalt	879	881	781	12.5
<b>Total US</b>	<b>3,350</b>	<b>3,339</b>	<b>3,075</b>	<b>8.9</b>
	<b>May-16</b>	<b>May-15</b>	<b>Change, %</b>	
<b>Total US<sup>2</sup></b>	<b>2,976</b>	<b>2,296</b>	<b>29.6</b>	

<sup>1</sup>Working gas. <sup>2</sup>At end of period. Source: Energy Information Administration. Data available at PennEnergy Research Center.

**REFINED PRODUCT PRICES**

	8-19-16 ¢/gal	8-19-16 ¢/gal
<b>Spot market product prices</b>		
Motor gasoline (Conventional-regular)	No. 2 Distillate	150.20
New York Harbor	Low sulfur diesel fuel	148.70
149.70	New York Harbor	151.20
Gulf Coast	148.70	151.20
Los Angeles	151.20	
Motor gasoline (RBOB-regular)	Kerosine jet fuel	138.40
New York Harbor	Gulf Coast	138.40
148.20		
No. 2 heating oil	Propane	46.00
New York Harbor	Mont Belvieu	46.00
144.40		

Source: EIA Weekly Petroleum Status Report. Data available at PennEnergy Research Center.

**IHS PETRODATA RIG COUNT**

	AUG. 26, 2016			
	Total supply of rigs	Marketed supply of rigs	Marketed contracted	Marketed utilization rate (%)
US Gulf of Mexico	104	50	37	74.0
South America	52	48	39	81.3
Northwest Europe	108	86	64	74.4
West Africa	70	52	27	51.9
Middle East	169	158	124	78.5
Southeast Asia	95	80	42	52.5
Worldwide	833	685	489	71.4

Source: IHS Petrodata. Data available at PennEnergy Research Center.

## PAGE REFINING MARGINS

	June 2016	July 2016	Aug. 2016	Aug. 2015	Change	Change, %
	\$/bbl					
<b>US Gulf Coast</b>						
Composite US Gulf Refinery.....	11.27	9.83	11.61	15.80	(4.19)	(26.5)
Mars (Coking) .....	12.21	10.88	12.26	16.83	(4.57)	(27.2)
Mars (Cracking) .....	8.50	7.94	9.10	12.86	(3.75)	(29.2)
Bonny Light .....	7.94	6.29	7.49	11.52	(4.03)	(35.0)
<b>US PADD II</b>						
Chicago (WTI).....	17.13	11.41	15.94	30.64	(14.70)	(48.0)
<b>US East Coast</b>						
Brass River .....	8.39	6.66	7.67	13.47	(5.80)	(43.1)
East Coast Comp .....	10.06	8.20	9.14	14.54	(5.40)	(37.2)
<b>US West Coast</b>						
Los Angeles (ANS) .....	15.02	8.87	7.06	22.98	(15.91)	(69.3)
<b>NW Europe</b>						
Rotterdam (Brent).....	2.58	0.66	1.03	6.68	(5.65)	(84.5)
<b>Mediterranean</b>						
Italy (Urals).....	4.51	2.76	3.16	7.78	(4.62)	(59.4)
<b>Far East</b>						
Singapore (Dubai).....	2.87	3.15	1.94	2.90	(0.96)	(33.1)

Source: Jacobs Consultancy Inc.  
Data available at PennEnergy Research Center.

## US NATURAL GAS BALANCE DEMAND/SUPPLY SCOREBOARD

	May 2016	Apr. 2016	May 2015	May 2016-2015 change bcf	Total YTD 2016	Total YTD 2015	YTD 2016-2015 change
<b>DEMAND</b>							
Consumption .....	1,992	2,109	1,875	117	12,290	12,596	(306)
Addition to storage .....	402	294	542	(140)	1,088	1,261	(173)
Exports .....	178	176	135	43	879	718	161
Canada .....	63	63	45	18	339	338	1
Mexico .....	105	103	87	18	507	372	135
LNG .....	10	10	3	7	33	8	25
<b>Total demand .....</b>	<b>2,572</b>	<b>2,579</b>	<b>2,552</b>	<b>20</b>	<b>14,257</b>	<b>14,575</b>	<b>(318)</b>
<b>SUPPLY</b>							
Production (dry gas) .....	2,262	2,208	2,282	(20)	11,243	11,119	124
Supplemental gas .....	5	5	5	—	25	26	—
Storage withdrawal .....	75	130	44	31	1,789	2,102	(313)
Imports .....	248	241	205	43	1,252	1,200	52
Canada .....	243	236	203	40	1,212	1,157	55
Mexico .....	—	—	—	—	—	—	—
LNG .....	5	5	2	3	40	43	(3)
<b>Total supply .....</b>	<b>2,590</b>	<b>2,584</b>	<b>2,536</b>	<b>54</b>	<b>14,309</b>	<b>14,447</b>	<b>(137)</b>

### NATURAL GAS IN UNDERGROUND STORAGE

	May 2016	Apr. 2016	Mar. 2016	May 2015	Change
	bcf				
Base gas .....	4,358	4,356	4,352	4,363	2,477
Working gas .....	2,976	2,655	2,496	2,296	680
<b>Total gas .....</b>	<b>7,334</b>	<b>7,011</b>	<b>6,848</b>	<b>6,659</b>	<b>3,157</b>

Source: DOE Monthly Energy Review.  
Data available at PennEnergy Research Center.

## US HEATING DEGREE-DAYS

	May 2016	Apr. 2016	May 2015	% change	— Total degree days YTD —		% change
	2016				2016	2015	
New England .....	252	605	147	71.4	3,695	4,590	(19.5)
Middle Atlantic .....	214	513	100	114.0	3,390	4,159	(18.5)
East North Central .....	221	506	159	39.0	3,593	4,306	(16.6)
West North Central .....	207	425	214	(3.3)	3,526	3,989	(11.6)
South Atlantic .....	59	152	22	168.2	1,596	1,826	(12.6)
East South Central .....	70	162	37	89.2	1,989	2,326	(14.5)
West South Central .....	17	61	14	21.4	1,129	1,470	(23.2)
Mountain .....	253	380	267	(5.2)	2,708	2,562	5.7
Pacific .....	177	241	206	(14.1)	1,716	1,583	8.4
<b>US average* .....</b>	<b>150</b>	<b>309</b>	<b>118</b>	<b>27.1</b>	<b>2,406</b>	<b>2,759</b>	<b>(12.8)</b>

\*Excludes Alaska and Hawaii.  
Source: DOE Monthly Energy Review.  
Data available at PennEnergy Research Center.

## WORLDWIDE NGL PRODUCTION

	May 2016	Apr. 2015	5 month average production		Change vs. previous year	
			2016	2015	Volume	%
	1,000 b/d					
Brazil .....	121	99	99	106	(7)	(6.6)
Canada .....	756	760	784	697	87	12.5
Mexico .....	300	301	302	334	(32)	(9.6)
United States .....	3,593	3,504	3,448	3,165	283	8.9
Venezuela .....	193	193	195	212	(17)	(8.2)
Other Western Hemisphere .....	229	226	216	230	(14)	(6.1)
<b>Western Hemisphere .....</b>	<b>5,192</b>	<b>5,083</b>	<b>5,044</b>	<b>4,744</b>	<b>299</b>	<b>6.3</b>
Norway .....	360	374	378	341	37	10.9
United Kingdom .....	77	74	74	59	14	24.1
Other Western Europe .....	13	13	13	12	1	6.6
<b>Western Europe .....</b>	<b>450</b>	<b>461</b>	<b>464</b>	<b>412</b>	<b>52</b>	<b>12.7</b>
Russia .....	763	792	816	711	104	14.6
Other FSU .....	170	170	170	156	14	8.8
Other Eastern Europe .....	15	15	15	15	—	—
<b>Eastern Europe .....</b>	<b>948</b>	<b>977</b>	<b>1,001</b>	<b>883</b>	<b>118</b>	<b>13.4</b>
Algeria .....	521	521	521	529	(8)	(1.4)
Egypt .....	202	202	202	201	1	0.4
Libya .....	50	50	50	50	—	—
Other Africa .....	150	154	148	133	16	11.8
<b>Africa .....</b>	<b>923</b>	<b>927</b>	<b>921</b>	<b>912</b>	<b>9</b>	<b>1.0</b>
Saudi Arabia .....	1,820	1,820	1,820	1,810	10	0.6
United Arab Emirates .....	641	641	641	641	—	—
Other Middle East .....	743	741	738	718	20	2.8
<b>Middle East .....</b>	<b>3,204</b>	<b>3,202</b>	<b>3,199</b>	<b>3,169</b>	<b>30</b>	<b>0.9</b>
Australia .....	53	51	51	48	3	6.7
China .....	12	12	12	12	—	—
India .....	122	122	122	102	20	19.8
Other Asia-Pacific .....	314	315	315	316	(1)	(0.4)
<b>Asia-Pacific .....</b>	<b>501</b>	<b>500</b>	<b>500</b>	<b>478</b>	<b>22</b>	<b>4.6</b>
<b>TOTAL WORLD .....</b>	<b>11,218</b>	<b>11,150</b>	<b>11,129</b>	<b>10,599</b>	<b>530</b>	<b>5.0</b>

Totals may not add due to rounding.  
Source: Oil & Gas Journal.  
Data available at PennEnergy Research Center.

## OXYGENATES

	May 2016	Apr. 2016	Change	YTD 2016	YTD 2015	Change
	1,000 bbl					
<b>Fuel ethanol</b>						
Production .....	30,228	28,059	2,169	148,096	143,608	4,488
Stocks .....	20,792	20,992	(200)	20,792	20,120	672
<b>MTBE</b>						
Production .....	1,611	1,623	(12)	7,379	5,342	2,037
Stocks .....	929	1,022	(93)	929	1,101	(172)

Source: DOE Petroleum Supply Monthly.  
Data available at PennEnergy Research Center.





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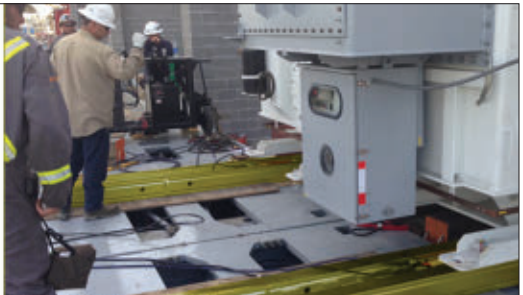
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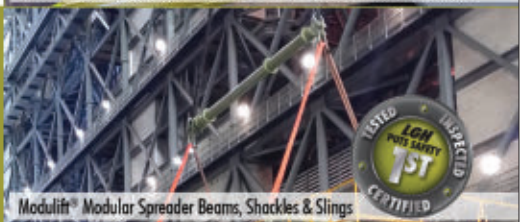
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NOTICE is hereby given pursuant to Section 216(1) of the BVI Insolvency Act, 2003, that creditors of the Company are required to submit their full names and addresses, full particulars of their debts or claims (if any) by 10 October 2016 to the contact below and if so required by notice in writing, creditors personally or their solicitors shall come in and prove their debts or claims at such time and place as shall be specified in such notice, or in default thereof they will be excluded from the benefit of any further distribution made before such debts are proved.

Dated: 12 August 2016

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## Colombian peace deal historic but doesn't ensure stability

by Bob Tippee, Editor

*Colombians will vote Oct. 2 on an agreement between their government and a guerrilla group to end a conflict that has disrupted the country, including its oil and gas industry, for 52 years.*

*The government, led by President Juan Manuel Santos, and the Revolutionary Armed Forces of Colombia (FARC) on Aug. 24 announced a final agreement ending hostilities that have killed an estimated 260,000 people and displaced 6.9 million.*

*The parties have been negotiating since 2012 in Havana. Despite a FARC ceasefire that began in July 2015, attacks on oil and gas facilities have continued.*

*Colombia produces about 1 million b/d of crude and other liquids. The US Energy Information Administration estimates pipeline attacks lowered production last year by 41,000 b/d.*

*Some disruption might have been the work of Colombia's second-largest insurgent group, the National Liberation Army (ELN). That group and the government announced last March that they had agreed to hold peace talks in Quito, Ecuador. But ELN militancy continues.*

*The breakthrough with FARC came with agreement on implementation. The parties already had agreed on other negotiating points.*

*FARC's 7,200 fighters now will move into 23 areas for monitoring by United Nations observers. They are to disarm within 180 days of their arrival in those areas, called concentration zones.*

*While the peace deal is historic, it doesn't ensure stability.*

*It has opponents resistant to amnesty for the rebels. They include Alvaro Uribe, who as president during 2002-10 weakened FARC with a military campaign.*

*Also, some FARC militants might migrate to the ELN or other rebel groups.*

*And the deal might not end attacks on oil equipment if the other groups stay active.*

*If the deal holds, kidnappings by FARC, including of oil workers, should end.*

*Until the government makes peace with the ELN, however, that menace won't disappear.*

*Negotiations, if they happen, will be messy and already face an impasse.*

*The government insists that the sporadic ELN renounce kidnapping. The group ominously refuses to negotiate with preconditions in place.*

(From the subscription area of [www.ogj.com](http://www.ogj.com), posted Aug. 26, 2016; author's e-mail: [bobt@ogjonline.com](mailto:bobt@ogjonline.com))



Nick Snow  
Washington Editor

## Kaine and the Atlantic OCS

Has US Sen. Timothy M. Kaine (D-Va.) changed his stance toward oil and gas leasing on the Mid-Atlantic US Outer Continental Shelf? It's possible, since he's now the vice-presidential nominee on the Democrats' 2016 ticket and not simply the Old Dominion's junior US senator.

Hillary Clinton's presidential campaign web site doesn't mention this issue specifically. But when someone from the environmental group 350.org asked Kaine after an Aug. 13 campaign event in New Hampshire if he would support a ban on offshore drilling, Kaine replied: "You know what? I actually am now in that position because the Obama administration decided not to do offshore drilling because [the US Department of Defense] objects, and I share those views."

How does this compare with his response on Mar. 15 when US Interior Sec. Sally Jewell deleted a proposed 2021 lease sale off Virginia from the 2017-22 OCS program that was being prepared because of DOD's concerns about possible interference with its activities there had grown?

Kaine, who is a Senate Armed Services Committee member, clearly was surprised. "I have long believed that the moratorium on offshore drilling, based on a cost-benefit calculation performed decades ago, should be reexamined," he said in a statement. "Today's announcement by the [US] Bureau of Ocean Energy Management suggests that they have grappled with this question and concluded that the risks of

such production outweigh potential gains."

He said he was "particularly struck by the material objections" of DOD to the incompatibility of drilling with naval operations off Virginia's coast, which BOEM cited as one of three principal reasons for its decision.

Noting that he has participated in this debate for more than a decade as Virginia's governor as well as one of its US senators, Kaine said that DOD nevertheless "has been relatively quiet during this public debate and has never shared their objections with me before," adding, "I look forward to additional discussions with DOD to understand its position."

### *His role has changed*

It's not certain whether Kaine had those discussions in the time since. He did, however, become the Democrats' 2016 vice-presidential nominee, which requires his working as part of an already established campaign that does not look favorably on the oil and gas industry.

Kaine's support of federal OCS lease sales off Virginia, by the way, has always looked more measured than that of the state's other US senator, Mark R. Warner (D). He nevertheless has backed calls for leasing as well as sharing of federal revenue with affected counties and communities.

His positions kept evolving throughout Kaine's political career. So may his views of oil and gas activity on the Atlantic OCS. **OGJ**

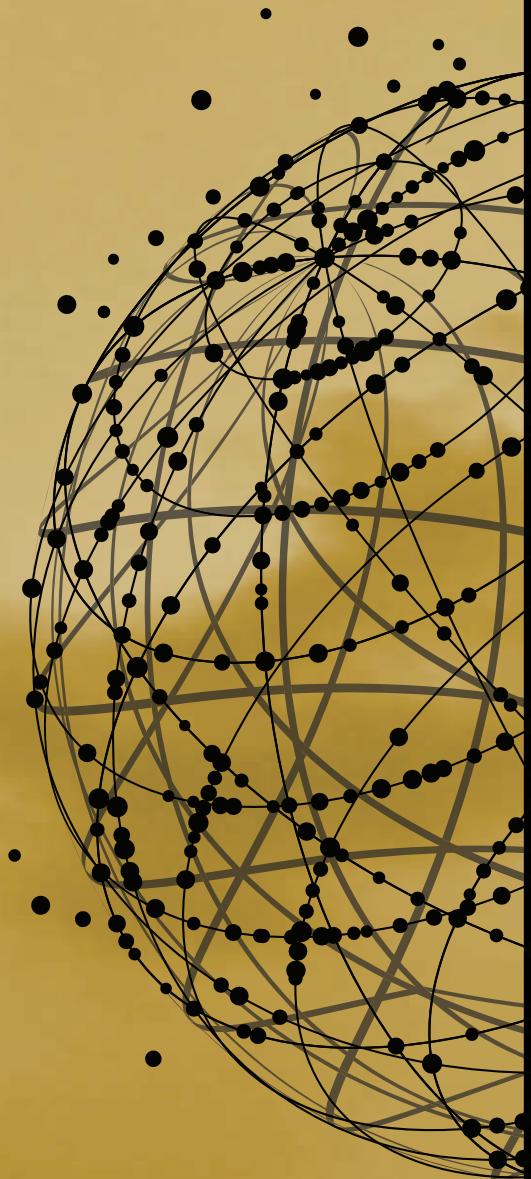
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## FEATURED SPEAKERS



**DAVE HAGER**

President and Chief Executive Officer, Devon Energy Corporation

Opening Session



**PATRICIA E. WALKER**

Chief Geoscientist, ExxonMobil

Women's Network Breakfast Event



**DR. GEHRIG SCHULTZ**

Founder and Chief Executive Officer of Surus Geophysical NBV

Global Affairs Committee Luncheon

For more information or to register call (918) 497-5542 or visit [SEG.ORG/AM](http://SEG.ORG/AM).

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# INVITATION LETTER

# PIPELINE WEEK™

## WELCOME TO THE 3RD ANNUAL PIPELINE WEEK!

In 2014 Pipeline Week was introduced, bringing GITA's GIS for Oil & Gas Pipeline Conference and the PODS User Conference together in a single venue. Through the efforts of a dedicated Conference Advisory Board, willing participation from the GITA and PODS leadership, including Boards of Directors, and the logistics and marketing excellence of PennWell, that event proved to be a resounding success. We experienced a sold out exhibit floor and record attendance levels never before seen by either of the conferences and we expect that success to continue in 2016.

The event will be hosted, for the second year, at the Woodlands Waterway Marriott Hotel & Convention Center in The Woodlands, Texas. This venue provides additional exhibition space, expanded hotel accommodations, and local attractions that will offer attendees a new experience and access to a larger variety of off-site entertainment options.

In addition to the excellent educational offerings, Pipeline Week also provides a unique set of networking opportunities, kicked off by the 3rd Annual Pipeline Week Golf Tournament. This year's tournament will be held at the beautiful Golf Trails of the Woodlands. The conference also features a Welcome Reception on Tuesday afternoon on the Exhibit Floor as well as the Wednesday Evening Casino Social Event, each offering a chance for conference attendees to unwind, catch up with old friends, and meet new ones without even leaving the conference site!

### **Now, on to the conference, the essence of Pipeline Week...**

As the Conference Chairs for GITA and PODS for this year's Pipeline Week event, we are pleased to welcome you to the 3rd annual Pipeline Week Conference and are excited to preside over Advisory Boards that have once again delivered on a promise to bring together an educational program.

The conference provides a dynamic environment where the international pipeline community can share real-world challenges and solutions. This year we have expanded the conference to include more joint PODS/GITA program sessions, providing technical sessions of interest to both organizations.

These technical sessions and joint presentations provide insight into approaches to complex problems, with case studies examining issues we are facing in the industry.

This year's technical and plenary sessions touch on a variety of topics ranging from opportunities provided through the use of up-and-coming technologies (drones usage, process automation, mobile computing, terrestrial and airborne LiDAR) to the more time-tested subjects of public awareness, regulatory compliance, and GIS best-practices within the pipeline industry. While the depth of subject matter is certainly impressive, it pales in comparison to the quality of those who will be delivering that information to you, as the 2016 program once again showcases some of the most knowledgeable, forward-thinking companies and individuals within the GIS and PODS communities.

On behalf of PODS and GITA Advisory Boards, we thank you for your continued support of GITA, PODS, and Pipeline Week. Each organization has worked very hard to ensure that this one event covers the needs of our respective members and, with a renewed focus on joint programming that will truly highlight the cooperation of the two organizations, this year's conference promises to be one that you don't want to miss!

We look forward to having the opportunity to thank you in person at this year's event in The Woodlands!

Sincerely and Appreciatively,



**MATTHEW THOMAS**

2016 Advisory Board Co-Chairman  
Associate Vice President  
Sr. Industry Manager for Pipelines  
Novara GeoSolutions



**PETER VEENSTRA**

2016 Advisory Board Co-Chairman  
PODS Board of Directors  
Principal GIS Technologist  
TRC

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## 4 WAYS TO REGISTER:

### 1. ONLINE:

[www.pipelineweek.com](http://www.pipelineweek.com)

### 2. EMAIL:

[registration@pennwell.com](mailto:registration@pennwell.com)

### 3. FAX:

Direct: +1.918.831.9161

Toll Free (U.S. only):  
+ 1.888.299.8057

### 4. MAIL:

PennWell

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Dallas, TX 75397-3059

FOR QUESTIONS  
REGARDING  
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+44 1992 656717

(or 01992 656717 from UK)

# WHY ATTEND PIPELINE WEEK?

NETWORK WITH  
**800+**  
ATTENDEES  
FROM 14  
COUNTRIES  
AND 35  
STATES

**OVER 50**  
EXHIBITING COMPANIES  
OFFERING THE  
MOST INNOVATIVE  
**PRODUCTS**  
AND SERVICES  
IN THE INDUSTRY

CHOOSE FROM MULTIPLE **CONFERENCE TRACKS**  
COVERING THE FOLLOWING CATEGORIES:

Asset Management  
Mobility  
Analytical Planning  
Regulatory Compliance  
Operational Awareness  
Integration/Interoperability  
Project Planning and Records Management  
Construction Standards/Data Standards  
Existing and Emerging Standards  
Pipeline Integrity/Integrity Management

## VISIT THE WOODLANDS!

For its third year, Pipeline Week will be turning back to The Woodlands, Texas! The Woodlands Waterway Marriott Hotel & Convention Center is located thirty minutes outside of Houston. Take advantage of this year's offerings and register today!

- Proximity to industry leader's corporate headquarters
- The best deals and fashion at the Woodlands Mall, across the street from the hotel
- Open air shopping, dining and entertainment on Market Street, adjacent to the hotel

## TOP 10 REASONS TO ATTEND PIPELINE WEEK

1. Participate in a productive and efficient week of connecting and networking with over 800 pipeline professionals.
2. Choose from 44 presentations on HOT TOPICS affecting your work, including: Integration/Interoperability, Regulatory Compliance/Pipeline Integrity, Asset Data Management, Project Planning/Records Management, and Integrating, Measuring and Structuring Pipeline Assets.
3. Win a \$500 American Express gift card! Attend the last conference session on Thursday and enter to win.
4. Explore the exhibit hall featuring the products and services of over 50 companies
5. Don't miss the Keynote Presentation on Tuesday in Waterway Ballroom 4. See details on page 11.
6. Get involved! Wednesday's REGULATORY PANEL DISCUSSION provides a great opportunity to get involved in the conversation about NTSB incident reports, OSHA and EPA best practices, recent API recommended practices, and PHMSA regulatory changes.
7. Meet your customers and co-workers on Monday at the Pipeline Week Golf Tournament.
8. Have the opportunity to ask questions of the developers of the PODS Data Model and interact with the staff and members of GITA, learn from their years of experience implementing PODS, and understand the constructs underpinning this industry standard.
9. Hear directly from pipeline operators as they discuss innovative and practical ways to address real-world pipeline data management challenges.
10. Network with pipeline operators and service providers from around the globe during the exhibit hall Casino night on Wednesday and Exhibit Hall reception on Tuesday night.



# SCHEDULE OF EVENTS

## MONDAY, SEPTEMBER 19, 2016

11:30 A.M. - 1:00 P.M.	Golf Tournament Lunch	Golf Trails of the Woodlands - Panther Trail
1:00 P.M.	Golf Tournament Shotgun Start	
3:00 P.M. - 6:00 P.M.	Registration Open	Town Center

## TUESDAY, SEPTEMBER 20, 2016

7:00 A.M. - 5:30 P.M.	Registration Open	Town Center
7:30 A.M. - 8:30 A.M.	Conference Breakfast	Town Center
7:30 A.M. - 12:00 P.M.	Exhibitor Move In	Exhibit Hall
8:30 A.M. - 9:45 A.M.	Opening Session & Keynote	Waterway Ballroom 4
9:45 A.M. - 10:00 A.M.	Conference Coffee Break	Waterway Pre-function
10:00 A.M. - 12:00 P.M.	Pipeline Week Open Forum	Waterway Ballroom 4
12:00 P.M. - 1:00 P.M.	Conference Delegate Lunch	Town Center
1:00 P.M. - 3:00 P.M.	Session 1	Waterway Ballrooms 1-4
3:00 P.M. - 6:00 P.M.	Exhibit Floor Open	Exhibit Hall
4:00 P.M. - 6:00 P.M.	Exhibit Floor Networking Reception	Exhibit Hall

## WEDNESDAY, SEPTEMBER 21, 2016

7:00 A.M. - 5:30 P.M.	Registration Open	Town Center
7:30 A.M. - 8:30 A.M.	Conference Breakfast	Town Center
8:30 A.M. - 10:15 A.M.	PODS User Conference Plenary	Waterway Ballroom 4
10:00 A.M. - 5:30 P.M.	Exhibit Floor Open	Exhibit Hall
10:30 A.M. - 12:30 P.M.	Session 2	Waterway Ballrooms 1-4
12:30 P.M. - 1:30 P.M.	Conference Delegate Lunch	Town Center
1:30 P.M. - 3:30 P.M.	Session 3	Waterway Ballrooms 1-4
3:30 P.M. - 4:15 P.M.	Conference Coffee Break	Town Center
4:15 P.M. - 5:15 P.M.	Regulatory Panel Discussion	Waterway Ballroom 4
5:30 P.M. - 7:30 P.M.	Networking Casino Social Event	Exhibit Hall

## THURSDAY, SEPTEMBER 22, 2016

7:00 A.M. - 12:00 P.M.	Registration Open	Town Center
7:30 A.M. - 8:30 A.M.	Conference Breakfast	Town Center
8:30 A.M. - 10:00 A.M.	GITA Oil & Gas Conference Plenary	Waterway Ballroom 4
9:00 A.M. - 12:00 P.M.	Exhibit Floor Open	Exhibit Hall
10:00 A.M. - 10:30 A.M.	Conference Coffee Break	Town Center
10:30 A.M. - 12:30 P.M.	Session 4	Waterway Ballroom 1-4

# NETWORKING OPPORTUNITIES

Pipeline Week features a variety of special events and networking opportunities designed to connect you with key companies and decision makers. From networking receptions located on the exhibit floor to delegate lunches and conference sessions, Pipeline Week will provide a wide range of opportunities to meet with colleagues, clients and potential customers.

## PIPELINE WEEK 3RD ANNUAL GOLF TOURNAMENT BENEFITTING THE GITA SCHOLARSHIP FUND

MONDAY, SEPTEMBER 19, 2016

### 18 HOLES OF CHAMPIONSHIP GOLF



Golf Trails of the Woodlands' Panther Trail Course boasts tree-lined fairways, challenging elevations and a unique island finishing green. Here, you'll find all the ingredients for a superb game; a sleek course, new contours, and fairways framed with over 20 acres of Texas wildflowers. Having been described as both "demanding and scenic" the course is highlighted by its 18th hole, which received praise as the "Best Par 4 in Houston." Additionally, Panther Trail™ was recently ranked one of the Top 5 courses to play in the Houston area.

Individual registration cost is \$115 and includes greens fees, cart (2 people per cart), practice range, lunch and beverages.

**YOU MUST REGISTER AND PAY FOR GOLF BEFORE COMPLETING PAIRING FORM.**

FOR DIRECTIONS TO PANTHER TRAIL, VISIT [WWW.CANONGATETEXAS.COM/CLUB-LOCATIONS/PANTHER-TRAIL/DIRECTIONS-84.HTML](http://WWW.CANONGATETEXAS.COM/CLUB-LOCATIONS/PANTHER-TRAIL/DIRECTIONS-84.HTML)

**GOLF TRAILS OF THE WOODLANDS - PANTHER TRAIL**  
2311 N. MILBEND DRIVE  
THE WOODLANDS, TX 77380

**SHOTGUN START**  
11:30 A.M - 1:00 P.M. LUNCH  
1:00 P.M. START TIME



## EXHIBIT FLOOR RECEPTIONS


### TUESDAY

#### EXHIBIT HALL RECEPTION

September 20, 2016 // 4:00 P.M. - 6:00 P.M.

### WEDNESDAY

#### EXHIBIT HALL CASINO PARTY

Sponsored by:  esri

September 21, 2016 // 5:30 P.M. - 7:30 P.M.

***COST: NO CHARGE | ALL ATTENDEES AND EXHIBITORS WELCOME TO ATTEND!***

Join your friends for a drink on the exhibit floor! Drinks and snacks will be available throughout the Exhibit Hall. These receptions are the perfect opportunity to network with industry colleagues and visit with exhibitors in a relaxed atmosphere.

<b>Matt Thomas, Co-chairman</b>	Novara GeoSolutions	
<b>Peter Veenstra, Co-chairman</b>	TRC	
<b>Ted Tomes, Incoming Co-chairman</b>	Anadarko	
Sam Acheson	Latitude Geographics	
Jeff Allen	Esri	
Joe Bentley	Columbia Pipeline Group	
Troy Bumgardner	Williams	
Justin Calvert	New Century Software	
Mick Collins	CIRCOR Energy	
Tom Coolidge	Esri	
Nicolas Guerrero Jr.	Zenderro Consulting LLC	
Chuck Harris	T.D. Williamson, Inc.	
Joseph Howell	Global Information Systems	
Nichole Killingsworth	Blue Sky Development	
Kathy Mayo	PODS Association	
Stacey McBride	New Century Software	

David Nemeth	Energy Transfer	
Andrew Norris	BHP Billiton	
Michael Ortiz	Plains All American Pipeline, L.P.	
Jacob Parakadan	Spectra Energy	
Kevin Partridge	Surveying And Mapping, LLC (SAM)	
Todd Porter	GITA	
Angela Remer	ddms	
Victoria Sessions	Noah Consulting	
Christopher E. Smith	Oil & Gas Journal	
Jay Smith	TRC	
Terry Strahan	GITA	





# CONFERENCE AT-A-GLANCE

MONDAY, SEPTEMBER 19, 2016		
3:00 P.M. - 6:00 P.M.	REGISTRATION OPEN - Town Center	
TUESDAY, SEPTEMBER 20, 2016 - CONFERENCE OPENS!		
7:30 A.M. - 5:30 P.M.	REGISTRATION OPEN - Town Center	
7:30 A.M. - 8:30 A.M.	CONFERENCE BREAKFAST - Town Center	
8:30 A.M. - 9:45 A.M.	OPENING SESSION & KEYNOTE - Waterway Ballroom 4	
	Welcome & Introductions: Chris Smith, Conference Director, Oil & Gas Journal Chairmen's Opening Remarks: Matthew Thomas, Novara GeoSolutions; Peter Veenstra, TRC Conference Keynote Speaker: <b>TBD</b>	
9:45 A.M. - 10:00 A.M.	CONFERENCE COFFEE BREAK - Waterway Pre-function	
10:00 A.M. - 12:00 P.M.	PIPELINE WEEK OPEN FORUM - Waterway Ballroom 4	
	Matthew Thomas, Novara GeoSolutions	Ted Tomes, Anadarko
	All conference attendees should participate in this opportunity for discussion about today's top issues. The forum environment is designed to facilitate an open exchange of information among all levels, from industry novices to the highly experienced. From the latest regulatory news to discussions on industry trends, this session is intended to set the stage for the conference by offering direct feedback into subjects that are most pressing to those in attendance.	
12:00 P.M. - 1:00 P.M.	CONFERENCE DELEGATE LUNCH - Towncenter	
1:00 P.M. - 3:00 P.M.	TRACK 1	TRACK 2
	Pipeline Integrity/Integrity Management - I	Asset Management - I
	Session Chair: Mike Ortiz, Plains All American Pipeline	Session Chair: Terry Strahan
3:00 P.M. - 4:00 P.M.	EXHIBIT HALL GRAND OPENING (Exhibit-Only Time) - Town Center	
4:00 P.M. - 6:00 P.M.	WELCOME RECEPTION/EXHIBITS - Town Center	
WEDNESDAY, SEPTEMBER 21, 2016		
7:00 A.M. - 5:30 P.M.	REGISTRATION OPEN - Town Center	
7:30 A.M. - 8:30 A.M.	CONFERENCE BREAKFAST - Town Center	
8:30 A.M. - 10:15 A.M.	PODS USER CONFERENCE PLENARY - Waterway Ballroom 4	
	Kathy Mayo, Executive Director, PODS Association; Other Presenters <b>TBD</b>	
	PODS Next Generation Standards and Data Model--Meeting Business Needs of Today and Tomorrow. Join this plenary for presentations and discussion of today's challenges and solutions.	
10:00 A.M. - 10:30 A.M.	CONFERENCE COFFEE BREAK/EXHIBITS OPEN - Town Center	
10:30 A.M. - 12:30 P.M.	TRACK 1	TRACK 2
	Pipeline Integrity/Integrity Management - II	Project Planning/Records Management/Operations I
	Session Chair: Sam Acheson, Latitude Geographics	Session Chair: Victoria Sessions, Noah Consulting
12:30 P.M. - 1:30 P.M.	CONFERENCE DELEGATE LUNCH - Towncenter	
1:30 P.M. - 3:30 P.M.	TRACK 1	TRACK 2
	Integrity Management Operations I	Asset Management - II
	Session Chair: Chuck Harris, T.D. Williamson	Session Chair: Nicolas Guerrero, Jr., Zenderro Consulting
3:30 P.M. - 4:15 P.M.	CONFERENCE COFFEE BREAK/EXHIBITS (Exhibit-Only Time) - Town Center	
4:15 P.M. - 5:15 P.M.	REGULATORY PANEL DISCUSSION - Waterway Ballroom 4	
	Justin Calvert, New Century Software	Moderator 2: Nichole Killingsworth, BSD Consulting
	Representatives from the pipeline operator community as well as the regulatory community will discuss various regulatory items in a panel setting. Discussion items will include actions taken after recent NTSB incident reports, OSHA and EPA best practices, recent API recommended practices, and	
5:15 P.M. - 5:30 P.M.	CONFERENCE COFFEE BREAK - <b>TBD</b>	
5:30 P.M. - 7:30 P.M.	NETWORKING CASINO PARTY - Town Center	
THURSDAY, SEPTEMBER 22, 2016		
7:00 A.M. - 12:00 P.M.	REGISTRATION OPEN - Town Center	
7:30 A.M. - 8:30 A.M.	CONFERENCE BREAKFAST - Town Center	
8:30 A.M. - 10:00 A.M.	GITA OIL & GAS CONFERENCE PLENARY - Waterway Ballroom 4	
	Moderator 1: Jeff Allen, Esri	Moderator 2: Andrew Norris, BHP Billiton
	Representatives from the pipeline operator community as well as the regulatory community will discuss various regulatory items in a panel setting. Discussion items will include actions taken after recent NTSB incident reports, OSHA and EPA best practices, recent API recommended	
10:00 A.M. - 10:30 A.M.	CONFERENCE COFFEE BREAK/EXHIBITS (Exhibit-Only Time) - Town Center	
10:30 A.M. - 12:30 P.M.	TRACK 1	TRACK 2
	Integrity Management Operations - II	Project Planning/Records Management/Operations - II
	Session Chair: Chris Smith, Oil & Gas Journal	Session Chair: Jay Smith, TRC

Peter Veenstra, TRC

TRACK 3

Pipeline Gathering/Energy Diversification

Session Chair: Tom Coolidge, Esri

EXHIBITS OPEN (3:00 P.M. - 6:00 P.M.)

TRACK 3

Integration/Interoperability

Session Chair: Stacey McBride, New Century Software

EXHIBITS OPEN (10:00 A.M. - 5:30 P.M.)

Moderator 3: - **TBD**

PHMSA regulatory changes.

EXHIBITS OPEN (9:00 A.M. - 12:00 P.M.)

Moderator 3: Jacob Parakadan, Spectra Energy practices, and PHMSA regulatory changes.

TRACK 3

Airborne

Session Chair: Kevin Partridge, SAM

## DOWNLOAD NOW - MOBILE APP AVAILABLE



With so much going on at this year's event, we've made it easier and more convenient for you to maximize your event experience.

1. Search for and download the Pipeline Week mobile app.  
*Search for "PLW" in the App Store or Google Play.*
2. Plan your entire day all from within the app.  
Here you will find:
  - Conference information
  - Interactive floor plan
  - Exhibitor profiles
  - Special events
  - Events social feed
  - Favorites
  - Notifications/Alerts
  - And much more...All in the palm of your hand!
3. Give us your feedback! Take the attendee or exhibitor survey, so that we can continue to improve Pipeline Week.



# OPENING SESSION AND KEYNOTE PRESENTATION

TUESDAY, SEPTEMBER 20, 2016 | 8:30 A.M. — 9:45 A.M. - WATERWAY BALLROOM 4

JOIN US FOR AN EXCELLENT KEYNOTE ADDRESS THAT WILL FOCUS ON CRITICAL REGULATORY ISSUES FACING THE OIL & GAS INDUSTRY AND WILL BE DELIVERED BY AN EXPERT IN THAT FIELD! ALL ATTENDEES ARE WELCOME!



## WELCOME & INTRODUCTION

Conference Management  
**CHRIS SMITH, OIL & GAS JOURNAL**

Chris Smith is Managing Editor, Technology at Oil & Gas Journal. His responsibilities include OGJ's annual Pipeline Economics and Worldwide Pipeline Construction reports, and oversight of the Journal's overall technology coverage. Smith has been at Oil & Gas Journal for 11 years and has worked in the industry for 23 years in a variety of commodity analysis and reporting roles. He has an undergraduate degree from the University of Houston and an MS from Georgetown University's School of Foreign Service.



## GITA WELCOME

**MATTHEW THOMAS, GITA CO-CHAIR, NOVARA GEOSOLUTIONS**

Matt is an Associate Vice President for Novara GeoSolutions and leads their office in Houston, Texas. He began his career in the oil and gas pipeline industry in 1999, joining Novara in May of 2015. Throughout his career, Matt has focused on the application of geospatial technologies and implementation of process improvement strategies in developing and implementing robust, integrated, enterprise-wide GIS solutions that aid in decision support, operational awareness, and pipeline safety.

In his years within the oil and gas industry, Matt has developed a deep understanding of pipeline integrity, risk management, land management, operational compliance, damage prevention, engineering & construction, data management, process improvement strategies, and GIS best practices. He is well-versed in industry best practices and has nearly two decades of experience applying those best practices both strategically and tactically within the multiple organizations with which he has had the privilege of collaborating.

Having served on the advisory board for Pipeline Week and its predecessor events since 2004, Matt is actively involved in the broader GIS community and is looking forward to furthering his service to this community as President of the national GITA organization, a role he will step into in 2017. He also actively contributes to key industry organizations such as PODS, INGAA, CGA, API/AOPL, and the Common Ground Alliance as he strives to help further GIS usage and GIS best practices across the infrastructure utilities sector.

Driven by his passion for innovation and the use of geospatial technology as a problem solving tool, Matt is committed to contributing as a leader and educator within the GIS community in providing sustainable solutions and effective technology to meet the ever-changing regulatory, operational, and performance-based needs of the pipeline industry.



## PODS ASSOCIATION WELCOME

**PETER VEENSTRA, PODS ASSOCIATION CO-CHAIR, TRC**

Peter Veenstra joined TRC in 2011. He has 21 years of experience working in the GIS industry, 14 in the oil and gas sector, both domestic and international. His primary experience comes from deploying enterprise pipeline GIS solutions. Peter has served as enterprise systems architect, consultant, director of software development, software architect, programmer and analyst. He is focused on providing GIS database design and implementation to support pipeline operations, integrity management, construction and maintenance. His skill set includes system integration strategies, pipeline data management concepts, regulatory requirements, enterprise systems architecture, GIS data structures, and cloud-based software solutions. Peter actively participates in industry

and data model committees, currently serving on the PODS Board of Directors, as chairperson of the PODS Next Generation initiative, and on the PODS Technical Committee for Governance. He regularly provides white papers and presentations at pipeline GIS conferences.



## TED TOMES, INCOMING GITA CO-CHAIR, ANADARKO

Beginning in 2017 Ted Tomes will assume the role of Pipeline Week Co-chair. Ted Tomes joined Anadarko Petroleum in 1998 as an IT Project Manager and has been working with GIS & Pipeline Integrity data for over 16 years. Ted is very passionate in identifying ways to improve Operational efficiency and increase Safety by utilizing spatial analysis and awareness. Currently, Ted serves as the Director, Corporate Spatial Data for Anadarko and is based in The Woodlands, Texas.

KEYNOTE PRESENTATION - TBD



# PIPELINE WEEK CONFERENCE PROGRAM

## TUESDAY, SEPTEMBER 20, 2016

7:30 A.M. – 8:30 A.M. Continental Breakfast - Town Center

8:30 A.M. – 9:45 A.M. Opening Session & Keynote - Waterway Ballroom 4

### Welcome & Introduction

Conference Management  
Chris Smith, Oil & Gas Journal

### GITA Welcome

Matthew Thomas, Co-Chairman, Novara GeoSolutions

### PODS Association Welcome

Peter Veenstra, Co-Chairman, TRC

### Keynote Presentation

Join us for an excellent Keynote Address that will focus on critical regulatory issues facing the oil & gas industry and will be delivered by an expert in that field! **ALL ATTENDEES ARE WELCOME!**

9:45 A.M. – 10:00 A.M. Coffee Break - Waterway Pre-function

10:00 A.M. – 12:00 P.M. Pipeline Week Open Forum - Waterway Ballroom 4

Moderators: Matthew Thomas, Novara GeoSolutions  
Ted Tomes, Anadarko  
Peter Veenstra, TRC

All conference attendees should participate in this opportunity for discussion about today's top issues. The forum environment is designed to facilitate an open exchange of information among all levels, from industry novices to the highly experienced. From the latest regulatory news to discussions on industry trends, this session is intended to set the stage for the conference by offering direct feedback into subjects that are most pressing to those in attendance.

12:00 P.M. – 1:00 P.M. Lunch - Town Center - Sponsored by: 

1:00 P.M. – 3:00 P.M. Session 1

## TRACK 1: PIPELINE INTEGRITY/INTEGRITY MANAGEMENT I - WATERWAY BALLROOMS 1 AND 2

Chair: Mike Ortiz, Plains All American Pipeline, LP

### A Case Study on Migration to PODS Spatial with Implementation of Efficiency and Quality Tools

Steve Dresie, GE Digital Solutions - PII

This presentation will review a completed project that was initiated to move a pipeline operator's existing oil and gas pipeline network and related integrity data from an APDM data model to a PODS Spatial model to support an enhanced pipeline integrity management system. It will examine driving reasons behind the migration and decision to expend the effort to adopt a new PODS model. The migration methods used during the project will be presented along with challenges faced and solutions employed.

### Additional Session TBD

### Chevron FDC: Compliance Driven Pipeline Maintenance and Inspection Data Collection

Paul Herrmann, Chevron Pipeline

Chevron Pipeline set out to implement an auditable, full-lifecycle solution to capture field data, then review and approve it before loading to PODS. Guided by PHMSA's Integrity Verification Process, they created a custom, integrated solution utilizing multiple technologies. Leveraging a seamless integration between the two vendors, Chevron's field-to-PODS workflow utilizes a staging environment to validate data before loading, supports meeting PHMSA requirements, and ensures data is trusted, verifiable, and complete.

### Using XYZ Mapping Technology for Precise Pipeline Locations

Tod Barker, T.D. Williamson

This presentation will focus on a case study of pipeline repairs using XYZ mapping data to accurately locate anomalies for investigation.

# TUESDAY, SEPTEMBER 20, 2016

1:00 P.M. – 3:00 P.M. **Session 1 (continued)**

## TRACK 2: ASSET MANAGEMENT I - Waterway Ballroom 3

Chair: Terry Strahan, GITA

### Approaching Asset Management Challenges with Unique Spatial Data Techniques

David Ellerbeck, Global Information Systems

This presentation will showcase spatial data type techniques with SDO and ST geometry, which are widely used in the industry today, and open up discussion in approaching asset management challenges in a new way.

### Connecting people, data, and systems

Hunter Hebert, Columbia Pipeline Group

This presentation will discuss how CPG and TRC have employed an innovative solution that brings together people, data, and systems into an environment that promotes transparency, discussion, and decision making. This solution represents the single version of the truth where all stakeholders, whether remote or in the office, have accurate and reliable visibility into the project as it progresses through its life cycle.

### Mastering Asset Management Data Using PODS

Victoria Sessions, Noah Consulting

This presentation will discuss how PODS plays into the success of mastering pipeline asset data. It will review the methodology, components, and processes to implement successfully a data mastering solution and identify which asset management data can and cannot be mastered. It will explore how assigning an enterprise unique identifier to each asset will allow you to locate the asset in every system where it is located.

### Harvest Pipeline is Empowering Users Across the Organization to Make Informed Decisions Using PODS Data

Luke Luedke, Harvest Pipeline Co.

The presentation will discuss how Geocortex and ArcGIS has allowed GIS and non-GIS users across Harvest Pipeline to access data, make informed decisions, and gain crucial understanding of the data stored in PODS.

## TRACK 3: PIPELINE GATHERING/ENERGY DIVERSIFICATION - WATERWAY BALLROOM 4

Chair: Tom Coolidge, Esri

### Potential Synergy of Utility Wind Electrical Energy and Oil/Gas Distribution Systems using GITA/PODS tools

Marvin Woods, Wayne County Airport Authority

This presentation will discuss how the areas in the continental US with the greatest land based wind energy potential directly overlap a great portion of the US oil and gas distribution infrastructure. It will demonstrate how the real-time asset management tools in PODS and geospatial information technology can be used as a platform or template that makes the integration of these two industries both possible and mutually profitable.

Reserved for Esri

Reserved for Esri

Reserved for Esri

3:00 P.M. – 4:00 P.M. **Exhibits - Exhibit Hall**

4:00 P.M. – 6:00 P.M. **Networking Reception - Exhibit Hall**

Join your friends for a drink on the exhibit floor! Drinks and snacks will be available throughout the Exhibit Hall.

# PIPELINE WEEK CONFERENCE PROGRAM

## WEDNESDAY, SEPTEMBER 21, 2016

7:30 A.M. – 8:30 A.M. **Continental Breakfast - Town Center**

8:30 A.M. – 10:15 A.M. **PODS User Conference Plenary - Waterway Ballroom 4**

Kathy Mayo, Executive Director, PODS Association

PODS Next Generation Standards and Data Model--Meeting Business Needs of Today and Tomorrow.  
Join this plenary for presentations and discussion of today's challenges and solutions.

10:00 A.M. – 10:30 A.M. **Coffee Break / Exhibits - Town Center**

10:30 A.M. – 12:30 P.M. **Session 2**

### TRACK 1: PIPELINE INTEGRITY/INTEGRITY MANAGEMENT II - WATERWAY BALLROOMS 1 AND 2

Chair: Sam Acheson, Latitude Geographics

#### Applying Unmanned Vehicles and Acoustics to the Management of Pipeline Integrity in Real Time

Jeff Barry, Geomorphic Solutions

This presentation will describe an approach that uses remote controlled unmanned vehicles and acoustical monitoring to collect depth of cover and river condition data safer, faster, and over a larger area than traditional surveying. It will show how these tools have successfully been deployed during both low water and flooding conditions collecting information that allows operators to make data-driven decisions in real-time.

#### Protecting Your Pipeline and Assets Against Risk Through Unmanned & Remote Sensor Monitoring

Dean Lioliou, ALS Oil & Gas

Using state-of-the-art fiber optic cabling, GIS software, and fiber data-interrogator units, ALS Oil & Gas employs distributed temperature sensing, distributed acoustic/vibration sensing and distributed strain sensing technologies to monitor and alert pipeline operators of critical events in real time that relate to assets, such as, pipeline conditions and leaks. The presentation will focus on how utilizing GIS technology with fiber-optic monitoring, conveys critical information to the operator. It will include actual samples of instrumented pipelines with GIS notification.

#### Geospatial Simulation Models for Consequence Management

Otto Huisman, ROSEN

This presentation will demonstrate the application of geospatial models to determine consequences of failure in pipeline risk models. It will also discuss the issues surrounding model complexity, quality, and resolution of input data. It will propose a simplified modelling approach which provides dynamic processing (changing conditions) at regular intervals along the pipeline. Specifically, gas release, explosion and ignition components are discussed, and their role in improving detailed risk estimations are shown using anonymized client data.

#### Look Beyond the Pipe as Source of Integrity Problem

Dipayan Mitra, Infosys

This presentation will describe an integrated ecosystem of methods, processes, and systems for objectively managing risks to pipeline integrity. It will also present a new perspective of pipeline integrity risk management wherein three dimensions of risks are introduced – Structural Risk, Operational Risk and Commercial risk – and will explain why such simple yet comprehensive approach will help create a holistic IM program.

### TRACK 2: PROJECT PLANNING/RECORDS MANAGEMENT/OPERATIONS I - WATERWAY BALLROOM 3

Chair: Victoria Sessions, Noah Consulting

#### Facilities Traceability: Mind the Gap Between As-built Redline Drawings and Documentation

Brett Vogt, Project Consulting Services Inc.

This presentation will show findings from multiple case studies that exhibit what is possible when advanced document management and field data collection is combined with industry experience to produce detailed traceability analyses ensuring that key records exist for all installed assets.

# WEDNESDAY, SEPTEMBER 21, 2016

10:30 A.M. – 12:30 P.M. Session 2 (continued)

## TRACK 2: PROJECT PLANNING/RECORDS MANAGEMENT/OPERATIONS I - ROOM TBD

### Achieving Traceability of Material and Construction in Real Time on Pipeline Projects Using Mobile Technologies

Abhay Chand, Petro IT Ltd.

This presentation will take an in-depth look at how material and construction traceability can be achieved in complex projects. It will discuss how effective solutions built around modern day technologies such as mobile devices, the Internet and geo-spatial technologies can help achieve a high level of material, manpower and quality management in real time.

### Redefining Efficiency Through Better Lifecycle Planning

Geoff Roberts, Oracle

Managing the total portfolio of work from an investment/business planning perspective thru to capital construction and operations all have impacts on the profitability of the organization. Understanding and managing those key drivers throughout the life of the asset will ensure opportunities/projects deliver on the goals ensuring ROI/cash flow etc. are effectively managed.

### Optimizing GIS for Business Intelligence for Capital Expansion Projects

Kent Strasser, TRC

This presentation will discuss how combining business intelligence tools with the Preliminary Pipeline Route Optimization environment and ArcGIS allows for faster analytical processes and more comprehensive results from a nationwide perspective.

## TRACK 3: INTEGRATION/INTEROPERABILITY - WATERWAY BALLROOM 4

Chair: Stacey McBride, New Century Software

### Effectively Leveraging CAD Data in a GIS World

Rene Ramirez, BSD Consulting Inc.

This presentation will focus on the many key points that either make or break a CAD migration to GIS. It will present guidelines for managing standards for a much smoother migration to GIS focusing on the pre-work involved and tools within the Arc Toolbox, as well as present some external conversion tools that simplify the process.

### Reduce Total Costs of Ownership via Integration of Intelligent Field Devices

James B. Morris, Rockwell Automation

This presentation will highlight the benefits and technology that enhance the integration of control, power and safety devices that is helping suppliers, integrators, EPC's and end users alike, to reduce time and costs starting with engineering and continuing through out the lifecycle of the equipment.

### Compliance is Key - Streamlining Data From Multiple Sources to PODS Spatial for Efficient Data Management

Matthew Stratmann, Summit Midstream Partners

Nichole Killingsworth, BSD Consulting Inc.

This presentation will focus on how regulatory compliance requirements have encouraged Summit Midstream to manage its data in PODS Spatial and the workflow that made it possible.

### Automated GIS-based Workflow Improvements

Jeff Puuri, Tensing USA

This presentation provides an example approach for integrating geospatial process data, collected during BPMN model execution, with GIS and other key enterprise software systems. The results are more robust visualization and analytical information products that can be used by pipeline operators for more informed decision making to enhance efficiency of operations, ensure regulatory compliance, and improve quality of customer service.

12:30 P.M. – 1:30 P.M. Lunch - Town Center



# PIPELINE WEEK CONFERENCE PROGRAM

WEDNESDAY, SEPTEMBER 21, 2016

1:30 P.M. – 3:30 P.M.

Session 3

## TRACK 1: INTEGRITY MANAGEMENT OPERATIONS I - WATERWAY BALLROOMS 1 AND 2

Chair: Chuck Harris, T.D. Williamson

### Investigating EMAT Dig Results for a Low Frequency ERW Seam Inspection

Sean Moran, T.D. Williamson

This presentation will demonstrate the value of TDW's EMAT and Multiple Dataset tools for seam assessments and results from a case study on a 16-in. seam inspection. It will also provide an overview of the EMAT technology and capabilities.

### MAOP/MOP Verification Analysis

Jerry Rau, RCP

MVA represents an alternative for meeting IVP requirements when material properties and pressure test records are missing or incomplete and do not meet the standards set under PHMSA guidance for traceable, verifiable and complete records. MVA satisfies the NTSB intent to ultimately establish an effective safety margin. This is a one-time, separate and distinct effort from the ongoing management of pipeline safety, integrity and reliability.

### Rational Test Pressure Levels for Mitigating the Pipe Manufacturing Defect Integrity Threat in Natural Gas Pipelines

Jing Ma, Kiefner & Assocs, Inc.

Pressure testing to 1.25 times the MAOP is adequate to mitigate the integrity threat posed by pipe-manufacturing defects. While there is strong evidence that this is sound for pipes operating at the highest stresses, a larger test-pressure ratio may be necessary for pipes operating at lower stresses. A probabilistic analysis has been implemented to enable the specification of a test-pressure ratio tailored to the operating stress level.

### Lessons Learned from ILI-to-Field Data Comparisons

Pamela Moreno, DNV GL

This presentation will evaluate the effect improvements in ILI tool technologies and analysis methodologies have had on comparisons of inspection results with field measurements.

## TRACK 2: PROJECT PLANNING/RECORDS MANAGEMENT/OPERATIONS I - WATERWAY BALLROOM 4

Chair: Nicolas Guerrero, Jr., Zenderro Consulting

### Pipeline Maintenance Tracking Through Mobil Applications

Matthew Thomas, Novara GeoSolutions

This presentation will frame the importance of point-of-service data collection as it relates to pipeline maintenance activities and will focus on improvements valuable to data handling. These improvements will be underscored by presenting a solution one particular US-based transmission pipeline operating company had developed and connected to their PODS database implementation.

### Sustainable Best Practices for MAOP Verification and Data Delivery

Luci Sanchez/Cindy Brann, Mosaic

This presentation will offer best practices for meeting MAOP verification standards through process reviews and improvements, preparing for PHMSA audits, and developing solutions for operational data management and integration.

### Zeroing in on the Spot: Innovations in Location Referencing for Man and Machine

Jeff Allen, Esri

This presentation will explore how improved location referencing for man and machines is enabling pipeline operators to conduct their business in innovative ways today while preparing them to be more business agile for tomorrow.

Reserved for Spectra Energy

Jacob Parakadan, Spectra Energy

3:30 P.M. – 4:15 P.M.

Coffee Break / Exhibits - Exhibit Hall

4:15 P.M. – 5:15 P.M.

Regulatory Panel Discussion - Waterway Ballroom 4

Moderators: Justin Calvert, New Century Software  
Nichole Killingsworth, BSD Consulting

Representatives from the pipeline operator community as well as the regulatory community will discuss various regulatory items in a panel setting. Discussion items will include actions taken after recent NTSB incident reports, OSHA and EPA best practices, recent API recommended practices, and PHMSA regulatory changes.

## WEDNESDAY, SEPTEMBER 21, 2016 (CONTINUED)

5:15 P.M. – 5:30 P.M. Exhibits - Exhibit Hall

5:30 P.M. – 7:30 P.M. **Exhibit Floor Casino Party** Sponsored by:  **esri**

Join your friends for a drink and games on the exhibit floor at Casino Night! Drinks and snacks will be available throughout the Exhibit Hall. This party is the perfect opportunity to network with industry colleagues and visit with exhibitors in a relaxed atmosphere.

## THURSDAY, SEPTEMBER 22, 2016

7:30 A.M. – 8:30 A.M. **Continental Breakfast - Town Center**

8:30 A.M. – 10:00 A.M. **GITA Oil & Gas Conference Plenary - Waterway Ballroom 4**

Moderators: Jeff Allen, Esri  
Andrew Norris, BHP Billiton  
Jacob Parakdan, Spectra Energy

10:00 A.M. – 10:30 A.M. **Coffee Break / Exhibits - Exhibit Hall**

10:30 A.M. – 12:30 P.M. **Session 4**

### TRACK 1: INTEGRITY MANAGEMENT OPERATIONS II - WATERWAY BALLROOMS 1 AND 2

Chair: Chris Smith, Oil & Gas Journal

#### Managing the Threat of Dents and Third-Party Damage

Dominic Wynne, ROSEN

In order to improve the detectability and reliable classification of third-party damage this presentation will provide a tailored approach not limited to detection and classification but also providing recommendations to safely manage dents and third-party damage as part of a wider pipeline integrity management system. It will also outline a case study demonstrating how a tailored integrity assessment using ILI and advanced assessment, as part of a wider pipeline integrity management system, can be used to give confidence of immediate and future integrity of a pipeline.

#### Use of Unstickable Liquigel Pigs on Unpiggable Pipelines

Buck Houchin, BlueFin Services

Many pipelines are virtually unpiggable with traditional mechanical pigs. Liquigel pigs are infinitely shear thinning and can flow through the tightest of restrictions without sticking. They conform to variable pipe diameters without losing functionality. There are base gel compositions that can dissolve paraffinic wax, asphaltenes, water formed scales and hydrates. Many liquigel pigs can be incorporated into mechanical pigging applications to provide lubrication and minimize bypass reducing run times by 50 to 60%.

#### Unique Technology for 3D Integrity Monitoring of Subsea Pipes

Trond Olsen, ClampOn

This presentation provides background information about ClampOn's development of its subsea corrosion-erosion monitoring system, and explains the measuring principles used. It also examines how combining several technologies and principles enables accurate monitoring of wall thickness loss in subsea installations, and fulfilling operators' need for continuous condition monitoring of subsea pipes.

#### Acoustic-based Detection of Stuck ILI tools and open valves

David Russell, CIRCOR Energy

A patented technique utilizing acoustic reflectometry which has been developed to detect blockages or partial blockages in gas pipelines can also locate lodged equipment. This presentation will discuss data from a case study, demonstrating the ability of the technique to clearly distinguish between open and closed subsea valves.



# PIPELINE WEEK CONFERENCE PROGRAM

THURSDAY, SEPTEMBER 22, 2016

10:30 A.M. – 12:30 P.M. Session 4

## TRACK 2: PROJECT PLANNING/RECORDS MANAGEMENT/OPERATIONS II - WATERWAY BALLROOM 3

Chair: Jay Smith, TRC

### An Integrated Approach for Assembling Traceable, Verifiable and Complete Pipeline Records

Thomas Eiken, ROSEN

Conventional ILI technologies are capable of delivering relevant information for MAOP/MOP calculation, such as wall thickness and diameter. However, until recently no economic means for accurately measuring strength existed. This presentation will discuss RoMat, a new inspection service that determines the yield strength for each pipeline joint.

### Refining the As-built Process and Documentation at CPG

Joe Bentley, Columbia Pipeline Group

At CPG, it was determined that the whole As-Built process needed an overhaul to make it more efficient in light of the increased construction activities on the horizon. The current tool needed to be adapted to fit the new process and not the other way around. The process had to have a holistic view, being useable by each process to manage their own workflows. This presentation will discuss how the new process and tool allow downstream work to happen when data/paperwork becomes available and not have to wait until the completion of the project cycle.

### Real-time Project Management for Pipeline Construction

Clifford Warwas, Global Information Systems

This presentation will focus on new developments in ProjectFit, Cheniere Energy's performance management solution. ProjectFit utilizes mobile technology in order to track performance on the ground as construction progresses and reports these results in real time to management via the ProjectFit portal.

### Securing the Nation's Infrastructure

Jason Credit, TRC

In the wake of cyber security incidents like Sony, Target and even the Baku-Tbilisi-Ceyhan pipeline explosion in Turkey, cyber security has become everyone's responsibility. The Critical Infrastructure Act, or H.R.3696, was passed by the house, is bound to pass the senate and require additional protections and reporting for pipeline oil and gas operators. This presentation will take a speculative glance at the new cyber security standards that could hit our industry and offer up affordable means to implement them.



# THURSDAY, SEPTEMBER 22, 2016

10:30 A.M. – 12:30 P.M. Session 4

## TRACK 3: AIRBORNE - WATERWAY BALLROOM 4

Chair: Kevin Partridge, SAM

### Airborne Geiger-mode LiDAR - Latest Advancements in Remote Sensing Technology

Randy Rhoads, Harris Corp.

This presentation will describe the processes and technologies Harris has developed over the past 15 years for efficiently producing high density point clouds from Geiger-Mode LiDAR data; how these capabilities can support the oil and gas industry in the upstream and midstream areas; and how the company's ENVI LiDAR software can be used to quickly extract 3D features from Geiger-Mode LiDAR data.

### Utilizing Aerially Acquired Colorized 3D Point Clouds for Pipeline Corridor Planning and Maintenance

Daniel Michalec, Woolpert

This presentation aims to illustrate state of the art aerial acquisition technologies, review case studies involving these technologies and derived datasets, and ultimately help educate operators on how these technologies can impact their pipeline operations, schedules, and budgets.

### Airborne Helicopter-mounted and Drone Surveys and Data Delivery in the Pipeline Industry

Carlos Femmer, John Chance Land Surveys Inc.

This presentation will focus on demonstrating the fundamentals of helicopter-mounted LiDAR and UAV survey data acquisition systems.

### Using Ultra-High Resolution (1-in. GSD or Better) Aerial Imagery for Asset Management

Trent Casi, Pictometry

This presentation will discuss the latest advances of ultra high-resolution aerial imagery at resolutions of 1 inch (2.5cm) or better. Advances in aerial sensors, lens, and software are making this type of imagery available now to the pipeline industry. This type of imagery will greatly reduce the amount of field work, reduce insurance costs, improve field worker safety, and lower new construction costs.

## Conference Alternates

### See Spot Track

Jason Dunn, Spot

This presentation will explain how SPOT is a simple pipeline and materials traceability application designed to set an industry standard for all data collection and communication revolving around pipe and pipe logistics.

### Right of Way in the Cloud

Teri Cameron, Contract Land Staff

This presentation will review a completed project that was initiated to move a pipeline operator's existing oil and gas pipeline network and related integrity data from an APDM data model to a PODS Spatial model to support an enhanced pipeline integrity management system. It will examine driving reasons behind the migration and decision to expend the effort to adopt a new PODS model. The migration methods used during the project will be presented along with challenges faced and discussion of solutions employed.

### Autonomous Survey Platforms, Automated Operations Portals, and GIS Data Deliveries for Cost-Efficient Subsea Asset Maintenance

Taylor Brown, DOF Subsea

This presentation will examine how autonomous and automated survey platforms, GIS data deliveries, and web-mapping portals are being used to connect GIS Analysts and Asset Managers alike with the information needed to maintain offshore assets.

### MAOP Implementation Lessons Learned

Michael Berg, RCP

This presentation will discuss RCP's turnkey process by which pipeline operating companies will have a traceable, verifiable, and complete MAOP data set. Instead of relying upon multiple people making independent interpretations of code, the MAOP will be calculated for every segment of pipe using the same algorithm. This brings consistency to the entire MAOP Process.



# 2016 FLOOR PLAN AS OF MAY 4, 2016

## THE WOODLANDS WATERWAY MARRIOTT HOTEL & CONVENTION CENTER | THE WOODLANDS, TX



## EXHIBIT HALL HOURS

TUESDAY, SEPTEMBER 20, 2016

- 7:30 A.M. – 12:00 P.M. .... EXHIBITOR MOVE IN (MUST BE A REGISTERED EXHIBITOR OR BOOTH STAFF)
- 3:00 P.M. – 6:00 P.M. .... EXHIBIT HALL OPEN
- 4:00 P.M. – 6:00 P.M. .... EXHIBIT HALL NETWORKING RECEPTION (OPEN TO ALL REGISTERED ATTENDEES AND VISITORS, AND EXHIBITORS)

WEDNESDAY, SEPTEMBER 21, 2016

- 10:00 A.M. – 5:30 P.M. .... EXHIBIT HALL OPEN
- 5:30 P.M. – 7:30 P.M. .... NETWORKING CASINO PARTY

THURSDAY, SEPTEMBER 22, 2016

- 9:00 A.M. – 12:00 P.M. .... EXHIBIT HALL OPEN

SPONSORED BY: 

# 2016 EXHIBITOR LIST AS OF MAY 4, 2016

COMPANY	BOOTH
CARTOPAC INTERNATIONAL, INC	411
DEEPWATER OPERATIONS CONFERENCE AND EXHIBITION	420
ESRI	503
G2 INTEGRATED SOLUTIONS	502
GEOFIELDS	615
GEONAMIC	507
GLOBAL INFORMATION SYSTEMS, LLC	609
INTERNATIONAL CONFERENCE ON PETROLEUM DATA INTEGRATION, INFORMATION AND DATA MANAGEMENT (PNEC)	420
M&H ENERGY SERVICES.	410
MAPSEARCH	420
MARKETING SOLUTIONS	420
NEW CENTURY SOFTWARE, INC	603
NOVARA GEOSOLUTIONS	508
NVI, LLC	403
OFFSHORE MAGAZINE	420
OIL & GAS FINANCIAL JOURNAL	420
OIL & GAS JOURNAL	420
PENNENERGY	420

COMPANY	BOOTH
PENNWELL BOOKS	420
PENNWELL CORPORATION	420
PETRO IT	402
PICTOMETRY	506
PIPELINE WEEK	420
POWER-GEN NATURAL GAS	420
QUANTUM SPATIAL	607
ROSEN	702
SPREADBOSS	610
SUBSEA TIEBACK FORUM & EXHIBITION	420
TOPSIDES, PLATFORMS & HULLS	420
WHITESTAR	703
WOOLPERT	606

# SPONSORS & SPONSORSHIP OPPORTUNITIES

## THANK YOU TO OUR 2016 SPONSORS!

(As of May 4, 2016)

### DIAMOND SPONSOR



### GOLD ATTENDEE BADGE HOLDER



### SILVER DELEGATE LUNCH – TUESDAY SPONSOR



To complete your exhibit package, take advantage of a variety of sponsorship opportunities designed to increase your visibility at the event. Sold on a first-come, first-served basis, sponsorship packages ensure prominent exposure of your company's product or brand to a key audience of decision-makers. Choose from one of the following packages, or contact your sales representative for custom options:

Golf Title .....	\$12,950	Silver Delegate Lunch – Wednesday .....	\$3,350
<i>Diamond Networking Event – Wednesday .....</i>	<i>SOLD</i>	Silver Bottled Water .....	\$3,350
Platinum Networking Event – Tuesday .....	\$7,500	Bronze Room Drop .....	\$3,000
Platinum Exhibit Floor Reception .....	\$7,500	Bronze Coffee Break (4 available) .....	\$1,750
Gold Show Guide .....	\$6,500	Exhibitor Branding Signage .....	\$1,500
<i>Gold Attendee Badge Holder .....</i>	<i>SOLD</i>	Golf-Beverage Cart .....	\$1,350
Gold Delegate Bag Package .....	\$5,500	Golf-Hole in One .....	\$950
Silver Hotel Key Card .....	\$4,500	Golf-Longest Drive .....	\$925
Silver Conference Breakfast – Tuesday .....	\$3,350	Golf-Closest to the Pin .....	\$925
Silver Conference Breakfast – Wednesday .....	\$3,350	Golf-Supporting Sponsor (4 available) .....	\$750
Silver Conference Breakfast – Thursday .....	\$3,350	Golf-Individual Hole (9 available) .....	\$295
<i>Silver Delegate Lunch – Tuesday .....</i>	<i>SOLD</i>		

### ALL SPONSORS RECEIVE:

- Daily recognition via PA announcements on exhibition floor
- Company logo placed on "Sponsor's Page" in Show Guide
- Opportunity to include literature, provided by sponsor, in delegate bags
- Company Logo included on all on-site event signage
- Company Logo & Hyperlink placed on Pipeline Week Event Website
- Company Logo and sponsorship included on multi-sponsor slide before all sessions
- Extensive event advertising in industry-leading magazines including the *Oil & Gas Journal* and *Oil & Gas Financial Journal*

### TO BOOK EXHIBIT SPACE OR SPONSORSHIPS, PLEASE CONTACT:

#### SARA LOWERY NG

Phone: +1 713 963 6277  
Cell: +1 713 725 8536  
Fax: +1 713 963 6212  
Email: saran@pennwell.com

#### JUSTUS SWANTNER

Phone: +1 713 963 6243  
Cell: +1 713 597 1367  
Fax: +1 713 963 6285  
Email: justuss@pennwell.com

# EXHIBITION OPPORTUNITIES

## COST TO EXHIBIT

Exhibit space rate is **USD \$27.00 per sq. ft.** for Geospatial Information & Technology Association (GITA) Business Affiliate Members and **USD \$31.00 per sq. ft.** for non GITA Business.

Include Pipeline Week as a key component of your marketing strategy. If your company has involvement in the following areas, this event is an essential platform for exhibiting your products and services:

- GIS Technology
- IT Analytics
- Geospatial Technology
- Mapping
- Pipeline Services
- Product Management
- Commercial Data
- Business Development
- Business Processing
- Engineering
- Drafting
- Operations Services
- Pipeline Integrity
- Compliance Data
- Regulatory Compliance
- Pipeline Solutions
- Asset Integrity
- Project Management
- Research
- Environmental
- Integrity Management
- Product Development
- Emergency Management
- Damage Prevention
- Architecture & Design

## EXHIBITORS RECEIVE:

- Exhibit space starts at 10' x 10' units
- Complimentary floor passes to distribute to your customers and prospective clients
- One (1) full conference registration for a member of your staff per each 100 sq. ft. of booth space
- Exhibit space includes 8' back drape and 3' side drapes,
- One (1) duplex electrical outlet (500 watts), booth ID sign,
- 100 sq ft of exhibit space, access to networking events.
- One (1) booth staff personnel pass per each 100 sq. ft. of booth space (does not include lunch)
- Company and booth listing on the Pipeline Week event website
- Extensive event advertising in industry-leading magazines including *Oil & Gas Journal* and *Oil & Gas Financial Journal*
- Booth backdrop, side dividers and company identification sign
- Basic Listing that includes:
  - 35 words/250 character listing in the printed Pipeline Week show guide
  - 50 words/300 character listing on the Pipeline Week event website

## INCREASE YOUR PRE-SHOW ONLINE EXPOSURE

- Customize booth info/detail
- Add/edit press releases
- Showcase products/services
- Announce company specials/contests/ giveaways at the show
- Bring your presence to life – add a video
- Leverage your social media presence within your company listing

Packages & Rates	Basic \$275	Gold \$495	Platinum \$995	Elite \$1,995
Company Description Online	50 words/ 300 char	100 words/ 800 char	150 words/ 1000 char	150 words/ 1000 char
Company Description in Show Guide	35 words/ 250 char	75 words/ 550 char	150 words/ 1000 char	150 words/ 1000 char

### FOR MORE INFORMATION, PLEASE CONTACT:

**SARAH RAUNIKAR**

Phone: +1 918 831-9740

Email: sarahr@pennwell.com

**DON'T MISS EXHIBITING AT OUR OTHER PETROLEUM EVENTS. SEE PAGE 28 OF THIS GUIDE FOR A LIST OF CONFERENCE AND EXHIBITION OPPORTUNITIES!**



# PLANNING YOUR TRIP TO THE WOODLANDS, TEXAS

## GET APPROVAL TO ATTEND

Attendance at Pipeline Week 2016 could be pivotal to your company's further success in the pipeline industry, and if you need senior management's approval for travel and training expenditures, it's worth it to develop a proposal so you can attend Pipeline Week 2016 in The Woodlands, Texas, USA. Here are 3 easy steps to gain approval to attend.

### 1. DO YOUR RESEARCH

- Identify conference sessions that satisfy your professional goals
- Locate exhibitors that address specific needs within your organization
- Prepare a list of benefits that you can achieve by attending Pipeline Week

### 2. SHOW HOW EVERYONE BENEFITS

- Demonstrate how your participation will help your team achieve its goals
- Share any new ideas or products that you learned about during the event upon your return

### 3. GAIN BUY-IN

We have already drafted a letter to your supervisor to help get you started go to:

[www.pipelineweek.com/getapprovalto-attend.html](http://www.pipelineweek.com/getapprovalto-attend.html)

## TRAVELING TO THE UNITED STATES

We recommend that attendees traveling from outside the U.S. build in ample time before your planned travel date to obtain necessary documentation. For information on requirements for entering the United States, visit [www.travel.state.gov/visa/visa\\_1750.html](http://www.travel.state.gov/visa/visa_1750.html)

Please note that residents of some countries will require a non-immigrant B-1 visa to be authorized for a temporary business visit. Residents of countries for which the visa requirement is waived will need to obtain a travel authorization via the Electronic System for Travel Authorization. For more information, please visit [www.cbp.gov/xp/cgov/travel/id\\_visa/esta/](http://www.cbp.gov/xp/cgov/travel/id_visa/esta/)

Please find the Pipeline Week Letter of Invitation Application at [www.pipelineweek.com](http://www.pipelineweek.com). Registration to Pipeline Week 2016 and payment are required prior to receiving an invitation letter.\*

\*Cancellation Policy: If you are unable to acquire a visa, PennWell will reimburse 100% of your registration fee if the Registration Department is notified BY FAX OR EMAIL by August 18, 2016. After this date, no refunds are available.

#### Registration Department

Fax: Direct +1.918.831.9161

Toll Free (U.S. Only) +1.888.299.8016

International: +44 1992 656717

(or 01992 656717 from UK)

Email: [registration@pennwell.com](mailto:registration@pennwell.com)

[www.pipelineweek.com](http://www.pipelineweek.com)

# TRAVELING FROM HOUSTON

If you're traveling from Houston, you're just a jaunt away!

From downtown Houston:

- Travel north on I-45 towards Dallas (about 30 mi)
- Exit 76B to merge onto Woodlands Parkway (1.3 mi)
- Turn right onto Six Pines Drive (0.4 mi)
- Turn right onto Lake Robbins Drive (0.1 mi)
- Arrive at The Woodlands Waterway Marriott Hotel and Convention Center, 1601 Lake Robbins Drive, The Woodlands, TX 77380

Parking Information:

- On-site parking, fee: USD\$ 6 hourly, USD\$ 20 daily
- Valet parking, fee: USD\$ 21 daily
- Complimentary off-site parking
- Other Transportation: Metro (bus station), MetroRail (subway), Amtrak (train station), and car rentals

# LOCAL ACTIVITIES AND ATTRACTIONS

Pipeline Week has returned to the Woodlands, Texas!

After the conference, take advantage of the local shopping and entertainment.

- The Woodlands Mall is conveniently located across the street from the hotel
- Open air shopping, dining and entertainment can all be found on Market Street, adjacent to the hotel
- The Cynthia Woods Mitchell Outdoor Pavilion is located one block from the hotel
- For information on additional, local activities, visit: <http://woodlandsevents.com/things-to-do-in-the-woodlands>



# REGISTRATION INFORMATION

## REGISTRATION NOW OPEN!

Registering for Pipeline Week is easy! Consult the table below to decide which registration option is right for you – the Full Conference Registration Option offers the best value.

## SPECIAL OFFER! REGISTER BY AUGUST 18, 2016, AND SAVE!

When registering, simply enter the following promotional code to secure your Early Bird Savings!  
See below for pricing. > CODE: PLW16PEG

## 4 WAYS TO REGISTER

TO DOWNLOAD THE REGISTRATION FORM, VISIT PIPELINEWEEK.COM AND SUBMIT VIA:



### 1. ONLINE:

[www.pipelineweek.com](http://www.pipelineweek.com)



### 2. EMAIL:

[registration@pennwell.com](mailto:registration@pennwell.com)



### 3. MAIL:

Pipeline Week 2016  
Registration Department  
PO Box 973059  
Dallas, TX 75397-3059



### 4. FAX:

Direct +1-918-831-9161

WHAT REGISTRATION TYPE IS RIGHT FOR YOU?	GITA'S OIL & GAS PIPELINE CONFERENCE* FULL-CONFERENCE	GITA'S OIL & GAS PIPELINE CONFERENCE* ONE DAY	EXHIBIT FLOOR VISITOR ONLY	GOLF TOURNAMENT (PANTHER TRAIL)
Early Bird Pricing (paid on or before 08/24/16)	\$595	\$325	\$50	\$115
Standard Pricing (paid on or after 08/25/16)	\$695	\$400	\$75	Individual registration cost includes greens fees, cart (two people per cart), practice range, lunch and beverages.
Keynote Session	✓	(if applicable)	✓	
Exhibit Hall Entrance	✓	✓	✓	
GITA's Oil & Gas Pipeline Conference* Tracks	✓	✓		
Networking Reception Tuesday	✓	(if applicable)	✓	
Networking Social Event Wednesday	✓	(if applicable)	✓	

### GITA MEMBER?

For additional pricing and details, and to obtain the member discount code, please login to your member account at [www.gita.org](http://www.gita.org). You can also go through online registration for pricing, but you must use the member code found on the website to secure your savings upon registering.

### PODS MEMBER?

There is no charge for PODS members to attend the PODS User Conference. For additional pricing and details, and to obtain the member discount code, please login to your member account at [www.pods.org](http://www.pods.org). You can also go through online registration for pricing, but you must use the member code found on the website to secure your savings upon registering.

Fees do apply for other conference sessions.

\*Includes access on registered day

### WANT TO ATTEND BOTH GITA AND PODS? COMBINED RATES ARE AVAILABLE!

GITA members and PODS members check your respective sites for discounted rates and details.

### NEED ADDITIONAL INFORMATION?

For questions regarding registration, contact:  
Registration Department (8:00 AM - 5:00 PM CST)  
Toll Free: +1-888-299-8016 (U.S. Only)  
Phone: +1-918-831-9160  
International: +44 1992 656717 (or 01992 656717 from UK)

**UPGRADE YOUR GITA FULL CONFERENCE REGISTRATION TO INCLUDE THE PODS ASSOCIATION USER CONFERENCE**

# HOTEL REGISTRATION FORM

## HOUSING REQUEST FORM



WWW.PIPELINEWEEK.COM | #PIPELINEWEEK

# SEPTEMBER 20-22, 2016

The Woodlands Waterway Marriott Hotel & Convention Center  
The Woodlands, Texas USA

To make your hotel reservation contact **Preferred Convention Services**, the official **Pipeline Week 2016** housing company. Discounted rates are available only through our office and cannot be guaranteed after **August 23, 2016** or until the conference room blocks are filled.

### HOTEL INFORMATION

**The Woodlands Marriott Waterway**  
\$260.00 Single/Double/Triple/Quad  
Room Tax: 15%

**Conference Location:** On-site

#### Airport Information:

- George Bush Intercontinental Airport (IAH): 22 miles
- Super Shuttle \$36.00 one-way; Taxi approx. \$75
- Houston Hobby Airport (HOU): 40 miles
- AFC Transportation \$90.00 one-way; Taxi approx \$100

#### Hotel Services:

- 100% Non-Smoking Hotel
- Ristorante Tuscany (Italian); Breakfast/Lunch/Dinner
- Room Service: 6:30am - 11pm
- Fitness Center; Indoor /Outdoor pool
- Business Center
- Concierge Service

#### Parking: (subject to change)

- Valet: \$19.00 per night
- Self: \$15.00 per night
- Offsite: Complimentary

### CONTACT INFORMATION

Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

Phone \_\_\_\_\_ Fax \_\_\_\_\_

Email \_\_\_\_\_

### 5 WAYS TO RESERVE

**Phone:** 888.763.7236 or 310.906.3847  
**Fax:** 310.906.3857  
**Email:** reservations@preferred1.com  
**Web:** www.preferred1.com/pennwell  
**Mail:** Pipeline Week 2016  
3528 Torrance Blvd., Suite 114  
Torrance, CA 90503

### GUEST INFORMATION

*Only 1 room per form. If multiple rooms are required, please make copies of this form. Room type and special requests are based on availability at the time of check-in.*

SELECT ONE: Exhibitor  Attendee  Other \_\_\_\_\_

#### ROOM TYPE DESCRIPTIONS

S = Single (1 person/1bed) D = Double (2 people/1 bed)  
D/D = Double/Double (2 people/2 beds) H = Hospitality Suite

Room Type \_\_\_\_\_

Arrival Date \_\_\_\_\_ Departure Date \_\_\_\_\_

Guest Name \_\_\_\_\_

Sharing With \_\_\_\_\_

#### Special Requests:

Non-Smoking  Low Floor  Early Arrival

Smoking  High Floor  Late Departure

Other \_\_\_\_\_

### GUARANTEE INFORMATION

Reservations will be guaranteed with the credit card provided. Advanced deposits will not be taken by the hotel.

Credit Card Type: AMEX Visa MasterCard Discover

Credit Card #: \_\_\_\_\_ Exp: \_\_\_\_\_

Cardholder: \_\_\_\_\_

Signature: \_\_\_\_\_

**Cancellation Information:** The credit card provided will be charged one nights room and tax if the reservation is cancelled 7 days or less prior to the confirmed arrival date. In addition, a \$45 processing fee will be assessed by PCS for all reservations cancelled on or after July 29, 2016.





## 2016 / 2017 GLOBAL PETROLEUM EVENTS CALENDAR

Energy burns at the root of PennWell's history. First printing our flagship publication – Oil & Gas Journal – in 1902, our petroleum division covers the topics, issues, challenges and solutions most critical to the international petroleum industry. With a network of global events throughout the world, PennWell collectively reaches more than 135,000 petroleum professionals in 75 countries, providing unparalleled positioning across the international petroleum market.

POWER-GEN Natural Gas  
August 23-25, 2016  
Columbus, OH, USA  
[www.power-gennaturalgas.com](http://www.power-gennaturalgas.com)



Subsea Tieback  
Forum & Exhibition  
March 21-23, 2017  
San Antonio, TX, USA  
[www.subseatiebackforum.com](http://www.subseatiebackforum.com)



Pipeline Week  
September 20-22, 2016  
The Woodlands, TX, USA  
[www.pipelineweek.com](http://www.pipelineweek.com)



Pipeline + Energy Expo  
April 4-6, 2017  
Tulsa, OK, USA  
[www.pipelineenergyexpo.com](http://www.pipelineenergyexpo.com)



Deepwater Operations  
Conference & Exhibition  
November 8-10, 2016  
Galveston, TX, USA  
[www.deepwateroperations.com](http://www.deepwateroperations.com)



International Conference on  
Petroleum Data Integration,  
Information and Data  
Management (PNEC)  
May 16-18, 2017  
Houston, TX, USA  
[www.pnecconferences.com](http://www.pnecconferences.com)



Topsides Platforms & Hulls  
Conference & Exhibition  
February 21-23, 2017  
New Orleans, LA, USA  
[www.topsidesevent.com](http://www.topsidesevent.com)



**CONNECT WITH US THROUGH SOCIAL MEDIA TO FIND OUT MORE ABOUT  
PENNWELL'S OFFSHORE AND OGJ EVENTS**

For further information please visit  
[www.offshoreoilvents.com](http://www.offshoreoilvents.com) or [www.ogjevents.com](http://www.ogjevents.com)



BE SURE TO USE THE OFFICIAL EVENT HASHTAG,  
**#PIPELINEWEEK!**

# EVENT CONTACTS

## OFFSHORE GROUP PUBLISHER AND VICE PRESIDENT:

### MARK PETERS

1455 W. Loop South, Suite 400  
Houston, TX 77027  
Phone: +1 713 963 6260  
Email: markp@pennwell.com

## CONFERENCE DIRECTOR:

### CHRIS SMITH

Phone: +1 713 963-6211  
Fax: +1 713 963 6201  
Email: chriss@pennwell.com

## CONFERENCE MANAGER:

### JESSICA TIPPEE

Phone: +1 713 963-6225  
Fax: +1 713 963 6201  
Email: jessicat@pennwell.com

## EVENT OPERATIONS MANAGER:

### ALLISON FOSTER

Phone: +1 918 831 9443  
Email: allisonc@pennwell.com

## EXHIBIT SERVICES MANAGER:

### SARAH RAUNIKAR

Phone: +1 918 831 9740  
Fax: +1 918 831 9729  
Email: sarahr@pennwell.com

## EVENT MARKETING MANAGER:

### RACHEL CAMPBELL

Phone: +1 918 831 9701  
Fax: +1 918 831 9729  
Email: rachelc@pennwell.com

## EXHIBIT & SPONSORSHIP SALES:

### SARA LOWERY NG

Phone: +1 713 963 6277  
Cell: +1 713 725 8536  
Fax: +1 713 963 6212  
Email: saran@pennwell.com

## JUSTUS SWANTNER

Phone: +1 713 963 6243  
Cell: +1 713 597 1367  
Fax: +1 713 963 6285  
Email: justuss@pennwell.com

## REGISTRATION DEPARTMENT

Direct: +1 918 831 9160  
Fax: +1 918 831 9161  
Toll Free: +1 888 299 8016  
International: +44 1992 656717 (or 01992 656717 from UK)  
Fax: +1 888 299 8057

## PENNWELL CORPORATE HEADQUARTERS

1421 S. Sheridan Road  
Tulsa, OK 74112  
Phone: +1 918 835 3161  
Web: www.pennwell.com

## PENNWELL PETROLEUM GROUP

1455 West Loop South, Suite #400  
Houston, Texas 77027  
Phone: +1 713 621 9720  
Toll Free: +1 800 736 6935  
Fax: +1 713 963 6285

# PIPELINE WEEK™

1421 South Sheridan Road  
Tulsa, OK 74112

PSRST STD  
US POSTAGE  
PAID  
LEBANON  
JUNCTION KY  
PERMIT #848

# JOINT GITA AND PODS ASSOCIATION CONFERENCE ON OIL & GAS, PIPELINES, AND DATA STANDARDS

## 4 WAYS TO REGISTER:

### 1. ONLINE:

[www.pipelineweek.com](http://www.pipelineweek.com)

### 3. FAX:

Direct: +1.918.831.9161

Toll Free ( U.S. only):  
+1.888.299.8057

International:  
+44 1992 656717  
(dial 01992 656717 from UK)

### 2. EMAIL:

[registration@pennwell.com](mailto:registration@pennwell.com)

### 4. MAIL:

PennWell

Pipeline Week 2016

PO Box 973059

Dallas, TX 75397-3059

REGISTER BY AUGUST 18TH AND SAVE!