



**FORECAST** AND **DATA 2017**  
EXECUTIVE SUMMARY



# Rebalancing of markets and a new U.S. administration will speed recovery

■ WORLD OIL EDITORIAL TEAM

The two-year oil price decline, and resulting plunge in activity and downsizing of assets and personnel by industry companies, appears to be over. Now, the industry is preparing to get back to work. A combination of OPEC's quota deal in late 2016, along with lower North American oil production, service/supply cost reductions, high-grading of prospects by operators, and operational efficiencies, has done much to prop up oil prices and encourage a rebound in activity.

We surmise that U.S. production has hit bottom and is slowly increasing again, averaging 8.9 MMbopd in fourth-quarter 2016, up from 8.7 MMbopd in the third quarter, **Fig. 1**. However, North America may have to continue in its new role as swing producer, and thus may be required to remain flexible. For instance, in West Texas, various analysts believe that Permian basin production is about 2.1 MMbopd, yet the region has the potential to double output. Nevertheless, based on the closing gap between supply and demand, the price of oil should continue to move upward.

Accordingly, given current economic realities, and the analysis of our surveys of U.S. operators, U.S. state agencies and international petroleum ministries/departments, *World Oil* forecasts the following:

- U.S. drilling will jump 26.8% higher, to 18,552 wells
- U.S. footage will increase 29.8%, to 151.5 MMft of hole.
- U.S. Gulf of Mexico E&P activity, focused on deepwater projects, will go up approximately 9.4%, with increasing well depths and footage.
- Canadian activity will begin to improve, gaining 21.6% to 4,212 wells.
- Global drilling should increase moderately to 39,742 wells, for a 6.1% pick-up.
- Global offshore drilling, reflecting stagnant capex outside North America, will only increase 1.4%, to 2,604 wells.

## U.S. MARKET FACTORS

The U.S. upstream market is a complex combination of technical, financial, political and logistical factors. What follows is a short discussion of the major factors affecting activity at the moment.

**Cycles.** During a recent presentation to IPAA's Supply & Demand Committee, IHS Energy's chief upstream strategist, Bob Fryklund, noted that the global upstream industry has alternated between bull and bear cycles over the last 57 years. Since 1960, there have been five discernable bull/bear runs, and we are in a third bear cycle. Fryklund said there have been

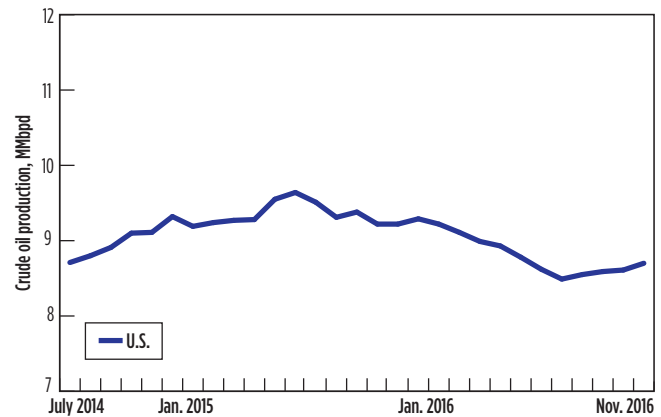
two bulls, but the duration of the bear cycles has been longer, as follows:

- 1960-1972, bear cycle
- 1973-1980, bull cycle
- 1981-1998, bear cycle
- 1999-2012, bull cycle
- 2013-????, bear cycle

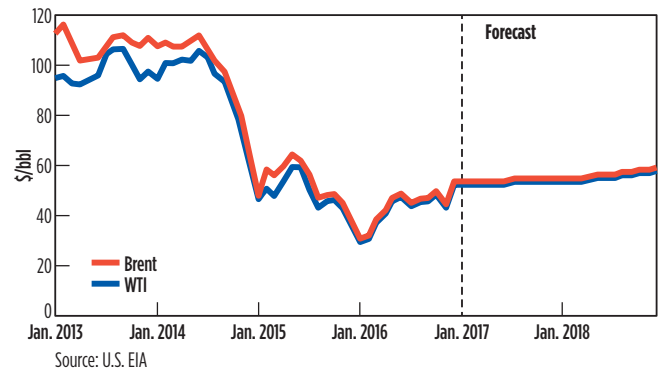
There is considerable debate as to whether the current bear cycle is already ending or will drag on for a while longer, and what the criteria are for declaring an end to the cycle.

**New market drivers.** The evolution of U.S. oil demand is something that demands more attention. In past years, GDP was the guide for predicting demand, but not anymore. There now appear to be several new drivers determining demand, including aging baby-boomers, the driving habits of younger

**Fig. 1.** U.S. oil production declined from the back half of 2015, and through much of 2016, but now it is beginning to increase again.



**Fig. 2.** Futures prices for WTI and Brent crude have improved considerably since their respective low points during 2016. *World Oil* estimates that WTI and Brent will average \$52.80/bbl and \$53.85/bbl, respectively, during 2017.



**Table 3.** Forecast of 2017 U.S. wells and footage to be drilled.

State or area	Total wells			Total footage, 1,000 ft			State or area	Total wells			Total footage, 1,000 ft		
	2017 forecast	2016 estimated <sup>4</sup>	% diff	2017 forecast	2016 estimated <sup>4</sup>	% diff		2017 forecast	2016 estimated <sup>4</sup>	% diff	2017 forecast	2016 estimated <sup>4</sup>	% diff
Alabama <sup>1</sup>	55	48	14.6	398.8	340.8	17.0	Oklahoma	1,809	1,306	38.5	20,984.4	15,019.0	39.7
Alaska	167	145	15.2	1,173.2	1,000.0	17.3	Pennsylvania	774	600	29.0	8,978.4	6,720.0	33.6
Alaska-offshore <sup>2</sup>	6	4	50.0	48.0	31.5	52.4	South Dakota	3	0	...	20.1	0.0	...
Arkansas	55	42	31.0	479.3	365.4	31.2	Tennessee	46	42	9.5	77.3	69.3	11.5
California	892	687	29.8	1,926.7	1,518.3	26.9	Texas <sup>1</sup>	7,799	6,170	26.4	94,402.3	74,173.5	27.3
California-offshore <sup>2</sup>	3	1	200.0	39.6	1.5	2,540.0	District 1	802	625	28.3	11,428.5	8,843.8	29.2
Colorado	1,012	755	34.0	11,891.0	8,833.5	34.6	District 2	638	515	23.9	9,825.2	7,892.4	24.5
Gulf of Mexico <sup>2</sup>	128	117	9.4	2,736.0	2,527.0	8.3	District 3	289	231	25.1	2,833.6	2,251.1	25.9
Illinois	242	235	3.0	435.6	357.2	21.9	District 4	224	188	19.1	3,024.0	2,519.2	20.0
Indiana	93	68	36.8	186.9	136.0	37.4	District 5	148	115	28.7	1,654.6	1,265.0	30.8
Kansas	1,374	1,309	5.0	4,067.0	3,560.5	14.2	District 6	204	158	29.1	2,397.0	1,817.0	31.9
Kentucky	299	265	12.8	867.1	715.5	21.2	District 7B	340	242	40.5	1,397.4	919.6	52.0
Louisiana <sup>1</sup>	506	401	26.2	5,190.0	4,079.7	27.2	District 7C	830	703	18.1	11,163.5	9,349.9	19.4
North	383	292	31.2	4,021.5	3,066.0	31.2	District 8	3,169	2,495	27.0	43,098.4	33,682.5	28.0
South	123	109	12.8	1,168.5	1,013.7	15.3	District 8A	708	517	36.9	4,248.0	2,843.5	49.4
Michigan	35	18	94.4	140.0	72.0	94.4	District 9	240	195	23.1	1,260.0	976.0	29.1
Mississippi <sup>1</sup>	63	53	18.9	620.6	519.4	19.5	District 10	207	186	11.3	2,072.1	1,813.5	14.3
Montana	22	13	69.2	243.1	143.0	70.0	Utah	105	96	9.4	916.7	838.1	9.4
Nebraska	54	48	12.5	243.0	216.0	12.5	Virginia	221	112	97.3	486.9	251.2	93.8
New Mexico	710	505	40.6	7,898.8	5,605.5	40.9	West Virginia	245	201	21.9	1,960.0	1,608.0	21.9
New York	51	35	45.7	91.8	74.6	23.1	Wyoming	466	365	27.7	5,207.6	4,019.0	29.6
North Dakota	925	671	37.9	18,731.3	13,587.8	37.9	Others <sup>3</sup>	12	1	1,100.0	83.4	7.4	1,027.0
Ohio	380	319	19.1	6,089.9	5,091.2	19.6	Total U.S.	18,552	14,632	26.8	196,614.8	151,481.9	29.8

<sup>1</sup> Excludes state and federal offshore wells, which are included in the GOM total.

<sup>3</sup> Includes Arizona, Florida, Missouri, Nevada and Oregon.

<sup>2</sup> Includes state and federal offshore wells.

<sup>4</sup> 2017 estimates are based on well counts furnished by state and federal regulatory agencies, and API.

people and federal fuel efficiency standards. Each item is having considerable effect, especially when one considers that about 55% of demand is for transportation. Baby-boomers are not traveling as frequently or as far, thus reducing demand. Similarly younger people are using less transportation and not doing as much personal driving, further suppressing demand. And increasingly stringent federal fuel standards are squeezing more performance out of fewer barrels. We expect these trends to continue.

The combination of OPEC's recent quota deal and a modest global oil production deficit should result in a slowly rising oil price during 2017-2018. Yet, it is likely that the industry will not see a sustained price above \$60/bbl through fourth-quarter 2018, unless an unforeseen event (like a war) occurs. While the U.S. EIA is predicting average prices of \$52.50/bbl for WTI and \$53.50/bbl for Brent during 2017, we at *World Oil* think that the range may be somewhat higher, at \$53.95 for WTI and \$55.00 for Brent, **Fig. 2**.

In natural gas markets, the U.S. landscape is dominated by Appalachian region supplies, not to mention associated gas produced from greater oil production across the country. According to EIA, the northeastern U.S. is expected to continue to add to reserves, which should result in strong output growth, all the way through 2030. Last year, marketed production, wet gas, averaged about 76.2 Bcfd, **Fig. 3**. The problem is that the U.S. may have too much gas, and now the question is whether this commodity can crack the \$4/Mcf barrier during the next

several years. The introduction and growth of LNG exports is helping to soak up some of the supply. Accordingly, EIA is calling for an average 2017 gas price of \$3.55/Mcf at the Henry Hub, while *World Oil* is forecasting a rate of \$3.47/Mcf, **Fig. 4**.

**Environmental issues.** The struggle between the industry and environmentalists used to focus on fracing. But in addition to that factor, activists are also concentrating on interrupting markets and infrastructure, particularly in the Northeast, which desperately needs more pipeline capacity. And how the new Trump administration will interact with these factions remains a wildcard, although we certainly got a hint from the recent resurrection of the Keystone XL pipeline project through Executive Order, as well as a mandate for finishing the Dakota pipeline. Yet, we expect plenty of additional pushback in this category from unhappy activists.

**Service sector recovery.** The service/supply sector has been hit hard over the last two years, with more than 200 companies going out of business. Profits have been meager or non-existent, and oil price weakness right before OPEC's quota deal in late 2016 probably delayed the sector's recovery by another couple of months.

Meanwhile, operators have been squeezing equipment manufacturers and service firms for lower costs and greater value. According to IHS, this has resulted over the last two years in an average \$30/bbl reduction in break-even prices for most plays.



IHS says the reduction can be attributed to the following factors and amounts:

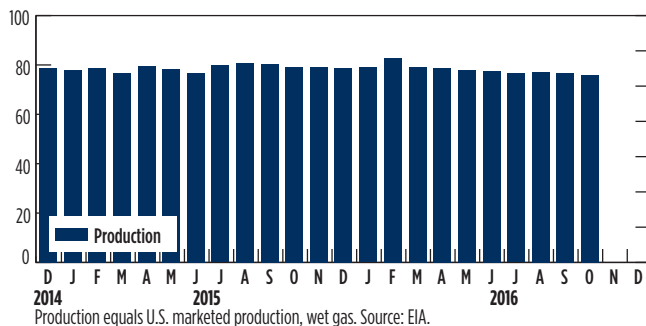
Service sector cost reductions	(40%) \$12
High-grading of prospects	(35%) \$11
Learning from projects	(6%) \$1.80
Operational efficiencies	(19%) \$5.70

In the next 18-24 months, IHS predicts the \$30/bbl cost reductions will shrink to \$24.90, as follows, because service companies will not be able to maintain the recent cost-cutting pace:

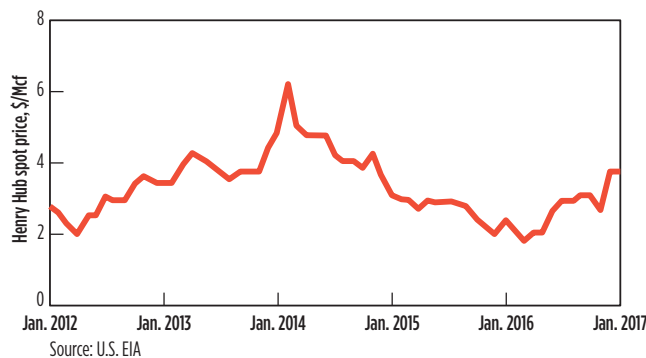
Service sector cost reductions:	(30%) \$9
High-grading of prospects:	(20%) \$6
Learning from projects	(8%) \$2.40
Operational efficiencies	(25%) \$7.50

**Play contributions.** Among unconventional plays, the Permian basin will certainly lead to U.S. supply growth. The Bakken should retain a steady pace, but other smaller plays are expected to lose ground. Meanwhile, a key piece of the supply situation is the need for additional infrastructure, particularly in the Marcellus shale and Permian basin. However, several transportation projects in the Marcellus region are moving slowly through the Federal Energy Regulatory Commission, stymied by a combi-

**Fig. 3.** Natural gas production in the U.S. has come down from its peak of just above 90 Bcfd, but there are signs that once transportation problems are solved, the output rate will again go above that figure, spurred by demand.



**Fig. 4.** Although it could be said that the U.S. is awash in natural gas, the futures price has nonetheless managed to creep above \$3/Mcf. World Oil predicts that the 2017 average will be \$3.47/Mcf.



nation of permit delays, lower drilling activity, lawsuits, timelines stretched out by operators and opposition from environmental groups. The situation is more flexible in the Permian, where there is the possibility of some expanded rail transportation of crude out of the region in the short term, until pipeline projects can expand capacity.

In any case, the major shale plays are likely to generate most of the new onshore liquids production. Indeed, IHS said that new, monthly, liquids production additions are averaging 115 boed/1,000 lateral ft in the Eagle Ford, 100 boed/1,000 lateral ft in the Permian, and 65 boed/1,000 lateral ft in the Bakken. And EIA reports that in January 2017, new-well oil production per rig has risen to 1,395 bpd in the Eagle Ford, 1,251 bpd in the Niobrara, 968 bpd in the Bakken and 652 bpd in the Permian. In addition, EIA said that new-well gas production per rig has risen to 12.7 MMcfd in the Marcellus and 8.7 MMcfd in the Utica. Is it any wonder then, that U.S. shale production has remained resilient and not declined at the rate of the rig count during the last two years?

**Rigs and fracing.** As of Jan. 20, 2017, the U.S. rig count was up 72% from its record low last May, said Baker Hughes, Fig. 5. Given the outlook for U.S. well count, the number of active rigs should rise another 25% to 30% this year. Something to keep an eye on will be the trend among drilling contractors to retire older units and replace them with higher-spec rigs that operators are insisting on increasingly.

The demand for hydraulic fracturing is likely to go up 40%, noted IHS. Yes, the U.S. pressure pumping fleet remains oversupplied, but there is an implied shortfall that is forecast for second-half 2018. Some of the cold-stacked pressure pumping equipment is coming back to the market, but other units were retired and won't be brought back to service. The more-sand-per-well trend is expected to continue.

**U.S. ACTIVITY OUTLOOK**

With the benchmark price of crude oil holding above \$50/bbl, and natural gas trading in the \$2.75-3.10/Mcf range, U.S. operators are putting rigs back to work in the Lower 48 at a fairly brisk pace. Much of the recovery will be in the shale plays, but improvement also will occur in shallow oil wells and conventional gas wells. Accordingly, *World Oil* forecasts a 26.8% jump in drilling, to 18,552 wells. This will make 2017 only the third year since the mid-1930s to see drilling fail to exceed 20,000 wells, but activity is definitely heading in the right direction. Spurred by the Permian basin, Texas will account for 42% of all drilling.

**Texas.** Drilling in the Lone Star State will rise 26.4%, with double-digit increases expected for all 12 of the Railroad Commission districts. While the gains are being led by the Permian, with some additional recovery in the Eagle Ford, there is also significant improvement underway in conventional activity (Districts 3, 4, 6, 7B, 9 and 10). In addition, gas-targeted drilling is making a moderate comeback.

**Permian basin.** The Texas side of the Permian continues to be a hotbed of activity. In 2016, operators drilled 3,198 wells in

Railroad Commission Districts 8 and 7C, more than originally anticipated. For 2017, we expect to see 3,999 wells drilled in these districts, an increase of 25% ft. Roughly 230 rigs are working actively in the Permian, and we expect up to 280 by the end of 2017. In addition, new, high-spec rigs are being brought in by contractors, according to instructions by operators. Oxy and Chevron have not been in the horizontal market until recently, so their growth will be substantial.

Most of the basins that are more mature than the Permian are using a greater share of multi-well pads to drill. But according to Halliburton, the Permian's share is only about two-and-a-half wells per pad, while average lateral length has increased from 3,971 ft in 2011 to 6,837 ft in second-quarter 2016. For 2017, the industry projects a 10% increase in average lateral length for the Permian. Furthermore, operators have continued to optimize in the Midland Wolfcamp, increasing proppant intensities and extending lateral lengths beyond the 8,000-ft average. Also affecting the pace of activity is the reduction in break-even economics. As noted by IHS, in 2015, only the first-quintile wells were economic. But now, the first-, second-, and most of the third-quintile wells are economic.

**Eagle Ford.** Now that oil prices have risen past the break-even figure and gone above \$50, drilling activity in the Eagle Ford shale of South Texas is showing signs of recovery. In the play's predominantly oil portion, concentrated in District 1, activity should increase 28.3%. We predict that operators will drill 802 wells with an average TD of 14,250 ft. In the gas-heavy Railroad Commission District 2, operators have said they plan to drill 638 wells to an average TD of 15,400 ft, a gain of 23.9%. Activity in District 4 is also forecast to increase 19.1%.

**Gulf of Mexico.** Activity has been at historically low levels in the Gulf over the last several years, and 2016 was the lowest yet, with just 117 wells tallied. Given low oil prices and still relatively high costs to operate in the province, exploration is suffering. And many potential development projects have been postponed. Yet, a core of deepwater development activity remains, and it will continue to form the bulk of work in the Gulf. We project that drilling will increase about 9%, to 128 wells.

**Oklahoma.** The developing SCOOP and STACK plays in western and south central Oklahoma continue to draw attention from large and mid-level independents. During 2017, we predict that drilling in the state will increase 38.5% overall, with 1,809 wells scheduled for an average TD of around 11,600 ft. As large operator Continental Resources noted in its recently released capital spending plan, new wells in its Oklahoma plays are able to generate rates of return, ranging from 55% to more than 100%, at prices of \$55/bbl for WTI crude and \$3.50/Mcf for natural gas. That's good, because these wells are not cheap to drill. Continental said that in the STACK, its average, budgeted, completed well cost is approximately \$9.0 million. Wells in the SCOOP play have an average, budgeted, completed well cost of \$10.3 million.

**North Dakota.** The Bakken shale remains the driving force in North Dakota's activity. Based on figures from state officials and

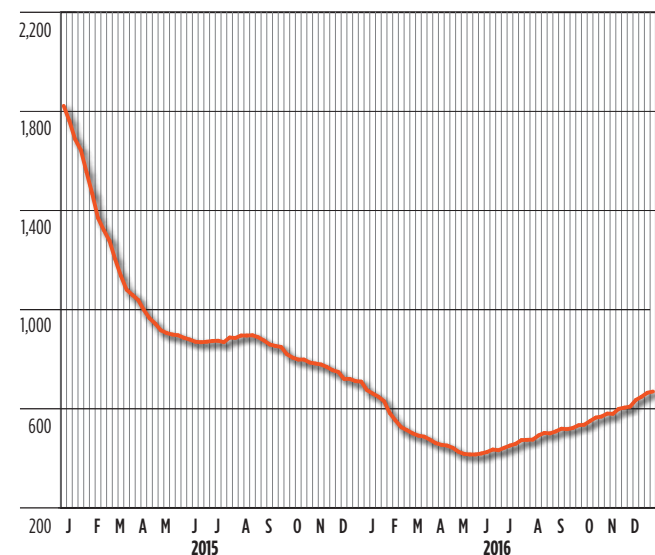
our own survey of operators, *World Oil* forecasts that drilling will total 925 wells in 2017, accounting for 18.7 MMft of hole. Average well depth, including lateral sections, will be approximately 20,250 ft. Reflecting the industry's concerted effort to get more bang for its buck, EIA reports that the average new-well oil production per rig in the Bakken has risen a remarkable 40%, from 690 bpd in January 2016 to 968 bpd in January 2017.

**Louisiana.** In the northern half of the state, several operators plan to increase activity in the Haynesville shale, to boost their natural gas reserves. Additionally, some small operators are drilling shallow oil wells. When it's all put together, activity in the northern half will be up a stout 31.2%. In the state's southern half, featuring conventional oil and deep gas wells, activity is recovering at a more measured pace. Wells drilled are forecast to increase 12.8%, to 123, while footage should gain 15.3%, to 1.17 MMft of hole.

**Northeastern states.** Activity continues to remain resilient in this region dominated by the Marcellus and Utica shales. In Pennsylvania, operators plan to drill 774 wells for a 29% increase. Footage will total approximately 9 MMft, or 11,600 ft/well, which is 3.6% more footage per well than in 2016. In Ohio, drilling should increase 19.1%, to 380 wells. Activity will be a mix of Utica shale wells and conventional, shallow oil drilling. And in neighboring West Virginia, gas-targeted activity is on the rebound, with about half of the wells in the Marcellus. Total wells should reach 245, up 21.9%.

**Rocky Mountain states.** With the improvement in oil prices, activity in this region is beginning to revive. As operators boost drilling in the prolific Niobrara shale, particularly in the DJ basin, Colorado will see its wells drilled rise 34.0%, to 1,012 wells. In addition, the state's southwestern portion is benefitting from a rebound underway in the San Juan basin, where both oil and gas

**Fig. 5.** The U.S. rig count has gained more than 50% since its low point in May 2016.



are showing new life. That trend is spilling over into northwestern New Mexico, a state that is already on the mend in its southeastern counties, thanks to the surge of work in its share of the Permian basin. New Mexico should see its wells drilled total 710, for an impressive 40.6% increase. And Wyoming is beginning to make a comeback from extremely low activity, with both oil and gas improving, and a 27.7% gain to 466 wells forecast.

**California/Alaska.** It's been a rough time in **California**, with activity last year plummeting to roughly one-fifth of 2014's level. Yet, the improvement in global oil prices is spurring a rebound in drilling among the state's heavy oil fields. The vast bulk of Californian drilling is accounted for by just four firms. So, as goes their fortunes, so goes California's drilling. Overall, the state will improve about 30%, to 892 wells. In **Alaska**, field projects are on a more long-term basis, so the fluctuations in activity have not been as great as experienced by other states. Steady oil development work continues on the North Slope and in the Cook Inlet, as operators strive to re-build the state's oil output. Drilling is forecast to increase 16.1%, to 173 wells.

## U.S. POLITICAL ISSUES/PRIORITIES

As the last eight years have shown us, it cannot be stressed enough, how important the U.S. regulatory climate is to the upstream industry, and how much of an impact it has on operations

and activity levels. The new Trump administration has stated that it intends to support American energy production while encouraging expectations that many of the recent federal regulatory and permitting challenges will be reconsidered and/or altered extensively. Industry associations have identified several key areas that will serve to guide energy policy in the years to come.

**Federal drilling/production regulations.** As stated by IPAA, additional federalizing of oil and gas production remains an ongoing challenge, even though it is not required to adequately regulate most activity. State programs already in place have demonstrated that cost-effective, environmentally protective regulation can manage oil and gas production without more federal intervention. Moreover, these programs provide a flexibility required by local geology and other variable conditions that national and federal regulations cannot address. Nevertheless, we expect fossil fuel opponents to continue to lobby to federalize regulations through petitions and litigation.

**Air emissions.** The Clean Air Act provides some of the most widespread regulatory authority that affects the industry. In recent years, revisions to the Ozone National Ambient Air Quality Standard, EPA methane regulations, and BLM venting/flaring regulations, have openly targeted oil and gas production. Industry is pursuing efforts to address the excesses of these regulatory

### Forecast of 2017 drilling outside the U.S.\*

Region or country	Wells forecast 2017	Wells drilled 2016	% diff.
<b>North America</b>	<b>4,414</b>	<b>3,612</b>	<b>22.2</b>
Canada	4,212	3,463	21.6
Cuba	13	13	0.0
Mexico	182	131	38.9
Others	7	5	40.0
<b>South America</b>	<b>2,249</b>	<b>2,223</b>	<b>1.2</b>
Argentina	896	933	-4.0
Bolivia	19	20	-5.0
Brazil	316	251	25.9
Chile	35	38	-7.9
Colombia	56	22	154.5
Ecuador	81	57	42.1
Peru	41	23	78.3
Trinidad & Tobago	56	71	-21.1
Venezuela	675	736	-8.3
Others	74	72	2.8
<b>Western Europe</b>	<b>433</b>	<b>403</b>	<b>7.4</b>
Austria	9	8	12.5
Denmark	14	12	16.7
France	10	6	66.7
Germany	29	22	31.8
Italy	15	6	150.0
Netherlands	30	27	11.1
Norway	208	217	-4.1
United Kingdom	110	101	8.9
Others	8	4	100.0
<b>Eastern Europe/FSU</b>	<b>9,758</b>	<b>9,448</b>	<b>3.3</b>
Albania	30	19	57.9
Croatia	8	7	14.3
Czech Republic	5	1	400.0
Former Soviet Union	9,558	9,279	3.0
Russian Federation	8,838	8,581	3.0
Others	720	698	3.2
Hungary	2	3	-33.3
Poland	41	33	24.2
Romania	88	83	6.0
Others**	26	23	13.0
<b>Africa</b>	<b>767</b>	<b>772</b>	<b>-0.6</b>
Algeria	252	255	-1.2
Angola	92	100	-8.0
Congo	19	20	-5.0

\*Some countries are estimated.

\*\*Includes Bulgaria, Slovakia, Slovenia and Serbia.

Region or country	Wells forecast 2017	Wells drilled 2016	% diff.
Egypt	273	289	-5.5
Gabon	8	6	33.3
Libya	17	16	6.3
Nigeria	50	48	4.2
South Sudan	n.a.	n.a.	...
Sudan	n.a.	n.a.	...
Tunisia	6	3	100.0
Others	50	35	42.9
<b>Middle East</b>	<b>3,002</b>	<b>3,096</b>	<b>-3.0</b>
Iran	n.a.	n.a.	...
Iraq	107	121	-11.6
Kuwait	617	636	-3.0
Neutral Zone	11	10	10.0
Oman	1,103	1,142	-3.4
Qatar	87	76	14.5
Saudi Arabia	600	625	-4.0
Syria	n.a.	n.a.	...
Turkey	169	167	1.2
UAE - Abu Dhabi	233	242	-3.7
UAE - Dubai	7	10	-30.0
Yemen	8	7	14.3
Others	60	60	0.0
<b>Far East/South Asia</b>	<b>19,009</b>	<b>17,817</b>	<b>6.7</b>
Brunei	43	50	-14.0
China	17,000	15,800	7.6
India	624	585	6.7
Indonesia	392	395	-0.8
Japan	4	4	0.0
Malaysia	44	43	2.3
Myanmar	27	30	-10.0
Pakistan	84	93	-9.7
Philippines	3	3	0.0
Thailand	755	786	-3.9
Vietnam	21	18	16.7
Others	12	10	20.0
<b>South Pacific</b>	<b>110</b>	<b>83</b>	<b>32.5</b>
Australia <sup>1</sup>	98	74	32.4
East Timor	3	2	50.0
New Zealand	3	2	50.0
Papua New Guinea	6	5	20.0
<b>World Total</b>	<b>39,742</b>	<b>37,454</b>	<b>6.1</b>

n.a.: Not available.

<sup>1</sup>Does not include a large number of shallow CBM wells.

programs through litigation and outreach to federal agencies. Environmentalists will attempt to delay or thwart these efforts.

**Endangered species act.** The Endangered Species Act (ESA) continues to be a persistent problem. The scope of the threat, and its potential to cause litigation forcing listing decisions, remains on the front burner. Some of these challenges should be more manageable with a Trump administration that is concerned with growth and a strong economy. Regardless, environmental groups will try to use the ESA aggressively, as a means of limiting land use across the country.

**Tax reform.** The incoming Trump administration and Republican leadership have prioritized tax reform in the 115th Congress. A key component of any reform should focus on providing a tax structure that supports capital investment. Bolstering tax provisions for intangible drilling costs and depletion allowances are methods that historically have successfully encouraged capital investment by U.S. operators.

## INTERNATIONAL FORECAST

Led by improvement in Canada, Western Europe, the FSU and the Far East, world drilling outside the U.S. is set to improve 6.1%, to 39,742 wells. Global offshore drilling, including the U.S., will be up 1.4%, at 2,604 wells.

**Canada** has seen activity drop to less than a third of its level in 2014, but rising oil prices are prompting a turn-around. Along with the Canadian Association of Petroleum Producers, we predict that Canadian drilling will jump 21.6% higher, to 4,212 wells. Improvement will be seen in most categories, including conventional oil and gas drilling, as well as shale plays. Offshore the East Coast, activity will remain relatively steady, as work progresses on the Hebron mega-development, as well as on incremental additions to existing fields. The decision on Jan. 24 by U.S. President Donald Trump to go ahead and approve construction of the Keystone XL pipeline should provide a major boost to oil sands activity in Alberta.

**Mexico's** plans to reinvigorate its energy sector were interrupted by the industry downturn, which prompted a steady decline in production and a rigorous spending reduction. However, the country did conduct its much-anticipated deepwater auction in December 2016. This fourth public tender offered 10 blocks, four in the Perdido belt and six in the frontier area of the Salina del Istmo basin. The auction proved successful, as eight of the 10 blocks were awarded to companies including Total, CNOOC, Chevron and Exxon Mobil. Looking broadly at the Mexican upstream sector, as well as considering state firm Pemex's plans, we expect drilling nationwide to jump 38.9% higher, to 182 wells.

Amid the global surplus, Petrobras' average oil production in **Brazil** reached an historical record in 2016, at 2.1 MMbpd, or

### Forecast of 2017 offshore drilling worldwide\*

Region or country	Wells forecast 2017	Wells drilled 2016	% diff.
<b>North America</b>	<b>180</b>	<b>170</b>	<b>5.9</b>
Canada	12	15	-20.0
Cuba	0	0	...
Mexico	31	33	-6.1
U.S. - Alaska	6	4	50.0
U.S. - California	3	1	200.0
U.S. - Gulf of Mexico	128	117	9.4
Others	0	0	...
<b>South America</b>	<b>117</b>	<b>99</b>	<b>18.2</b>
Argentina	3	3	0.0
Brazil	90	72	25.0
Chile	0	0	...
Colombia	1	0	...
Ecuador	1	0	...
Peru	4	2	100.0
Trinidad & Tobago	16	20	-20.0
Venezuela	1	1	0.0
Others	1	1	0.0
<b>Western Europe</b>	<b>356</b>	<b>345</b>	<b>3.2</b>
Denmark	14	12	16.7
France	0	0	...
Germany	2	2	0.0
Italy	1	2	-50.0
Netherlands	15	13	15.4
Norway	208	217	-4.1
United Kingdom	109	96	13.5
Others	7	3	133.3
<b>Eastern Europe/FSU</b>	<b>93</b>	<b>93</b>	<b>0.0</b>
Croatia	2	2	0.0
Former Soviet Union	84	88	-4.5
Russian Federation	n.a.	n.a.	...
Others	84	88	-4.5
Poland	2	1	100.0
Romania	3	1	200.0
Others	2	1	0.0
<b>Africa</b>	<b>214</b>	<b>218</b>	<b>-1.8</b>
Angola	92	100	-8.0

\*Some countries are estimated.

Region or country	Wells forecast 2017	Wells drilled 2016	% diff.
Congo	18	19	-5.3
Egypt	30	35	-14.3
Gabon	7	5	40.0
Libya	5	4	25.0
Nigeria	41	40	2.5
South Africa	3	2	50.0
Tunisia	0	1	-100.0
Others	18	12	50.0
<b>Middle East</b>	<b>311</b>	<b>318</b>	<b>-2.2</b>
Iran	n.a.	n.a.	...
Neutral Zone	5	5	0.0
Oman	0	0	...
Qatar	57	49	16.3
Saudi Arabia	68	73	-6.8
Turkey	1	0	0.0
UAE - Abu Dhabi	167	179	-6.7
UAE - Dubai	7	8	-12.5
Others	6	4	50.0
<b>Far East/South Asia</b>	<b>1,282</b>	<b>1,286</b>	<b>-0.3</b>
Brunei	16	17	-5.9
China	369	365	1.1
India	99	81	22.2
Indonesia	45	51	-11.8
Japan	1	0	...
Malaysia	44	43	2.3
Myanmar	3	3	0.0
Pakistan	0	0	...
Philippines	1	0	...
Thailand	680	706	-3.7
Vietnam	21	18	16.7
Others	3	2	50.0
<b>South Pacific</b>	<b>51</b>	<b>39</b>	<b>30.8</b>
Australia	46	37	24.3
East Timor	3	2	50.0
New Zealand	2	0	...
Papua New Guinea	0	0	...
<b>World Total</b>	<b>2,604</b>	<b>2,568</b>	<b>1.4</b>

n.a.---Not available.



0.75% above the prior year's average. If Petrobras' gas production, which reached 77 MMcmd, is included, total production in the country reached 2.63 MMboed, or 1% more than 2015's levels, which also was a new record for Petrobras. According to Petrobras, the main factor contributing to the increase was significant production growth in Lula field and Sapinhoá field, in the Santos basin's pre-salt layer, in addition to the Parque das Baleias area in the Campos basin. On Dec. 20, Petrobras announced that the BM-S-9 consortium led by Petrobras had started production at Lapa field, the third pre-salt producing field in the Santos basin. Overall, we predict that Brazilian drilling will gain 25.9%, to 316 wells.

Exxon Mobil has brought **Guyana** to the fore with the announcement of sizeable discoveries. In January 2017, Exxon announced positive results from its offshore Payara-1 well. Payara, which encountered more than 95 ft of high-quality, oil-bearing sandstone reservoirs, is the company's second oil find on the Stabroek Block and was drilled in a new reservoir. Exxon Mobil also reported that its Liza-3 appraisal well has identified an additional high-quality, deeper reservoir directly below Liza field, which contains between 100 MMboe and 150 MMboe. This additional resource is being evaluated for development.

While it wasn't impacted as badly by the downturn as its North American counterparts, **Argentina** has, nonetheless, felt the pressures. However, a report by IHS Markit laid bare the potential of the Vaca Muerta shale. According to the consultancy, the unconventional play could deliver about 560,000 bpd of liquids and 6 Bcfd by 2040. However, this would require a significant investment amounting to some \$8 billion in drilling and completion costs, alone. Argentina's drilling should amount to 896 wells, down 4%.

Oil production on the **Norwegian** Continental Shelf increased for a third consecutive year in 2016, and gas output held steady from the year prior, which was, in itself, a record year. According to the Norwegian Petroleum Directorate, investments on the Norwegian shelf totaled NOK 135 billion in 2016, which represents a NOK 50-billion decline from the levels seen in 2013 and 2014. Despite the drop in investment, explorers reported 18 discoveries in 2016. While just 36 exploration wells were spudded last year, 20 fewer than the year prior, recent licensing rounds reflect continued interest in the Norwegian shelf. Fifty-six production licenses were awarded in APA 2016, while 10 were awarded in the 23rd licensing round, all in the Barents Sea. Norwegian drilling will be down 4%, to 208 wells.

In October, the UK's Oil and Gas Authority (OGA) reported that 29 applications, covering 113 blocks, had been submitted as part of the 29th Frontier Licensing Round. OGA said the bids are being evaluated, with award announcements to be made as soon as possible in 2017. In December, the regulator announced that companies could apply for 14 new blocks in the Offshore 2016 Supplementary Round. Locations vary across the UKCS, from the southern North Sea to East of Shetland. Meanwhile, that regulator said the nation's remaining offshore potential is more than 3 Bboe in approximately 350 unsanctioned discoveries across the UKCS. The majority of these discoveries are small pools, containing less than 50 MMboe of technically recoverable reserves. In September, Maersk Oil

began drilling the first production well on the HPHT Culzean field, the largest discovery in the UK North Sea for over a decade. First gas is expected in 2019. British drilling should improve 8.9%, to 110 wells.

In **Denmark**, Maersk Oil plans to halt production from Denmark's largest gas field, Tyra, during fourth-quarter 2018. According to the company, an economically viable solution for full recovery of the field's remaining resources has not been identified. Production is consequently expected to cease on Oct. 1, 2018. Danish wells should be up slightly, to 14.

In a move that confounded skeptics, **Russia** pledged to cut production in a pact between both OPEC and non-OPEC nations at the end of last year. As part of the agreement, Russia agreed to curb its production by 300,000 bpd. As of Jan. 22, the world's largest producer was reported to have pared production by an average 100,000 bopd, a level it wasn't expected to reach until February. Meanwhile, Russian drilling surged last year, and it is expected to gain another 3% this year, to 8,838 wells. In September, Russia's northernmost active oil field was commissioned. The Vostochno-Messoyakhskoye field, developed by a Gazprom Neft/Rosneft JV, lies in the Gydan Peninsula, about 211 mi north of Novy Urengoy. Recoverable oil and condensate reserves are more than 340 million tonnes.

In December, SOCAR and AIOC (the **Azerbaijan** International Operating Company) signed a Letter of Intent for the future, additional development of Azeri-Chirag-Gunashli (ACG) field. Investment in the field stood at more than \$32 billion by the end of first-half 2016, with present production at about 620,000 boed.

In **Kazakhstan**, the much-delayed Kashagan field resumed production last year. Meanwhile, in July, Chevron announced that its 50% owned affiliate, Tengizchevroil (TCO), would proceed with the development of its Future Growth and Wellhead Pressure Management Project (FGP-WPMP), which will increase output at Tengiz oil field by about 260,000 bopd.

As drilling fell to a six-year low in 2016, E&P activity declined dramatically throughout Africa. Activity in **Ghana**, however, intensified slightly, as Tullow Oil achieved first oil from Tweneboa, Enyenra and Ntomme (TEN) fields in August. Despite a border dispute with Ivory Coast, Tullow's TEN project began producing on schedule. The company estimated average output at about 23,000 bopd in 2016, but plans to reach full capacity at 80,000 bopd by year-end.

Ongoing conflict and corruption in **Nigeria** have resulted in acute underinvestment. Militants have begun targeting Nigeria's infrastructure, causing production rates to plummet. Output fell to a 27-year low in 2016, from 2.2 MMbopd to about 1.4 MMbopd. By August, however, output had begun to rebound to approximately 2.1 MMbopd. Furthermore, Exxon Mobil reported a major discovery of between 500 MMbbl and 1 Bbbl of oil offshore Nigeria, in Owowo field in late September.

In **Angola**, Eni's West Hub Development Project began producing from its third field in January 2016. The project comprises five fields, which are connected to the N'Goma FPSO. Mpungi field brought the project's total production rate to approximately 100,000 boed during first-quarter 2016.



Estimates show that production in **Kenya** could reach approximately 85,000 bopd by 2027. In northern Kenya, Tullow Oil's Cheptuket-1 well struck oil in Block 12A last March. It was the first well to test the Kerio Valley basin. Last month, the company reported another discovery in northern Kenya that encountered 82 ft of net oil pay at a depth of nearly 2,297 ft.

Tullow Oil has discovered more than 1.7 Bbbl of oil, to date, in **Uganda**. However, the country's high tax burden on exploration companies has impeded its rate of development. Conversely, it was reported in August that Tullow Oil, Total and CNOOC were issued production licenses in the region, with plans to pump up to 230,000 bopd.

**Mozambique** struggled through a harrowing debt crisis in 2016. Nevertheless, E&P activity continued to move forward. Sasol commenced drilling its first of 13 wells in May. The campaign will see development of the Temane G8, Temane East, Inhassoro G6 and Inhassoro G10 reservoirs. The first plan of development in the Rovuma basin was approved last year. The Coral discovery, in Mozambique's Area 4, will see the drilling and completion of six subsea wells, as well as the construction and installation of an FLNG facility.

The bright spot for upstream work has been in the Middle East. Following OPEC's agreement to cut output, **Saudi Arabia** went from a record production rate of approximately 10.67 MMbopd in July, to below 10 MMbopd last month. This represents the Kingdom's lowest production rate in almost two years. Meanwhile the Kingdom's E&P operations have endured. In May, Saudi Aramco completed expansion of Shaybah oil field, increasing production capacity to 1 MMbopd. Saudi drilling will be down slightly from its peak level last year.

**Iran** had an eventful year in 2016, as international sanctions were lifted last January, spurring a push to regain market share. By April, Iranian production had reached 3.56 MMbopd—a 25% surge. By December, output had climbed to nearly 3.8 MMbopd, after OPEC allowed a 90,000-bopd boost in production amid other members' reductions.

According to Bloomberg, **Iraq** pumped 4.61 MMbopd in December 2016, but has since complied with the OPEC agreement to cut production. It had reportedly reduced production 210,000 bopd by the end of January 2017.

**Eastern Mediterranean.** As a major oil producer, **Egypt** has seen significant advancement in the development of its assets, particularly offshore. Since its discovery in August 2015, Eni's super-giant, 30-Tcf Zohr field has entered the appraisal phase. In February 2016, Eni completed its first appraisal well, Zohr-2, which encountered 1,000 ft of net pay. In May, Eni, with BP, made another gas discovery in the Baltim South Development that encountered approximately 205 ft of net gas pay.

Development of **Israel's** largest reserve, Leviathan, was hindered by an Israeli High Court ruling that claimed a clause in the government's regulation proposal would inhibit major regulatory changes for ten years. It was said in a statement, however, that Leviathan partners would work with the Israeli government to resolve the stability clause. Once resolved, development of Leviathan field can begin by the end of 2019. The field's POD was approved in June 2016.

Russia ousted Saudi Arabia as **China's** top oil supplier last year. According to data from the General Administration of Customs, Russia boosted shipments 24% from 2015, to 1.05 MMbpd. Meanwhile, the kingdom shipped 1.02 MMbpd. In July, BP signed a second PSC for shale gas exploration, development and production with China National Petroleum Corporation (CNPC). The PSC covers an area of approximately 1,000 km<sup>2</sup> at Rong Chang Bei in the Sichuan basin.

In December, Shell began production from the Malikai TLP, about 62 mi off the **Malaysian** coast. Malikai is Shell's second deepwater project in Malaysia, following the successful start-up of the Gumusut-Kakap platform in 2014. Malikai is expected to have peak production of 60,000 bopd. Meanwhile, Petronas' first FLNG, *PFLNG SATU*, successfully produced its first LNG from Kanowit gas field, offshore Sarawak.

After relinquishing its membership from OPEC in 2008, **Indonesia** returned to the fold. However, the nation requested its membership be temporarily suspended at the end of last year. Meanwhile, in July, BP announced that the FID had been approved for the Tangguh Expansion Project. It will add a third LNG process train and 3.8 mtpa of production capacity, bringing total plant capacity to 11.4 mtpa. The project also includes two offshore platforms, 13 new production wells, an expanded LNG loading facility and supporting infrastructure.

Like many operators around the world, oil producers used 2016 to purge high-cost fields throughout **Australia** (Fig. 6), selling old, depleted assets that once drew investors to the region. Exxon Mobil and BHP Billiton started the marketing process for about 13 fields, licenses and accompanying infrastructure held in the Gippsland basin JV in June. Complications and interruptions in production at existing fields took a toll, as well. In June, Chevron was forced to halt output at its \$54-billion Gorgon LNG development, due to a leak. Conversely, Falcon Oil & Gas had considerable success last year, as it spudded its Beetaloo W-1 vertical well in July. The well is part of the company's nine well drilling and evaluation program in the southern Beetaloo basin. Bengal Energy also made a discovery in Australia last year. In September, the company announced that the first four wells of its Cuisinier basin five-well drilling campaign had been classed as imminent producers in the Murta horizon. Australian drilling should improve 32% from an unusually low level in 2016. **WO**

**Fig. 6.** After a multi-year period of healthy offshore activity, Australian operators have been forced by the massive oil price downturn to shed a number of high-cost fields. Photo: Santos Ltd.

