



# Oil pipeline profits soar, natgas net softens

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Natural gas pipeline operators' net income reversed much of 2015's gains as revenues fell for the second straight year. Additions to gas pipeline operators' systems also softened, down more than 9% from 2015. This slowing came despite a \$1.7-million/mile drop in pipeline construction costs.

US oil pipeline operators' net incomes, however, soared in 2016, rising by more than 57% as huge losses experienced by two operators in 2015 rolled off the current year's ledger. Revenues rose for the eleventh time in as many years, up nearly 5% from 2015. Investment in oil pipeline carrier property continued to slow, rising roughly \$6 billion after climbing about \$8.5 billion the year before and \$17 billion in 2014.

## Details

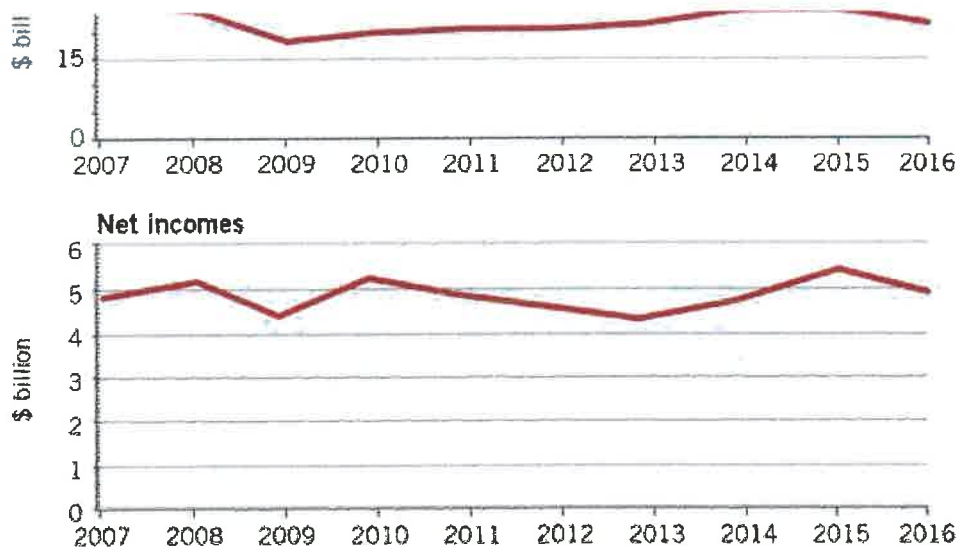
The sharp rise in oil pipeline profits as compared with revenues saw earnings as a percent of revenue surge to more than 45%. Natural gas pipeline operators meanwhile saw their profits drop more than 9% to about \$4.9 billion on revenues roughly 10.5% softer than 2015 (Fig. 1).

## NATURAL GAS PIPELINE PERFORMANCE

FIG. 1

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Source: US FERC Forms 2 and 2A, gas pipeline company reports

Proposed new-build natural gas mileage was roughly 20% of 2016's announced build, despite the lower construction costs. Planned compression horsepower additions also fell sharply, despite 10% lower

construction costs. Both totals were skewed by the lack of an estimated project cost filing as part of the Alaska Gasline Development Corp.'s Federal Energy Regulatory Commission (FERC) application to build an 800-mile pipeline to supply the Alaska LNG project.

A dramatic drop in outlays for labor was the primary driver of lower land pipeline construction costs, rates falling by nearly 50% to \$1.96 million/mile from \$3.6 million/mile. Material costs were the only category to rise, moving from \$989,000/mile to \$1.3 million/mile. The roughly \$1.71-million decrease in total estimated \$/mile land pipeline construction costs brought them to \$5.94 million per mile, 22% lower than 2016.

Actual land pipeline construction costs for projects completed in the 12 months ending June 30, 2017, were roughly \$120,000/mile more than estimated costs. For the second straight year, 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, also for the second consecutive year.

### US pipeline data

At the end of this article, two large tables (beginning on p. 79) offer a variety of data for US oil and gas pipeline companies: 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 FERC classifies as 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

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table listing all FERC-regulated natural gas pipeline companies for 2016 at the end of this article.

The deadline to file these reports each year is in April. For a variety of reasons, companies often 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 spent.

OGJ monitors these filings from July 1 to June 30 each year, collecting them, and analyzing their numbers.

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.

### TOP 10 US INTERSTATE OIL PIPELINE COMPANIES—2016

Company	Mileage	Company	Trunkline traffic, million bbl-miles	Company	Income, \$1,000
1 Magellan Pipeline Co. LP	10,054	Colonial Pipeline Co.	811,383	Enbridge Energy LP	948,434
2 Mid-America Pipeline Co. LLC	8,143	Enbridge Energy LP	723,817	Sunoco Pipeline LP	796,449
3 Plains Pipeline LP	8,102	TransCanada Keystone Pipeline LP	205,304	ExxonMobil Pipeline Co.	701,480
4 Sunoco Pipeline LP	6,399	Plains Pipeline LP	145,508	TransCanada Keystone Pipeline LP	654,226
5 Colonial Pipeline Co.	5,587	Exploror Pipeline Co.	143,255	Plains Pipeline LP	621,205
6 Phillips 66 Pipeline LLC	4,985	Magellan Pipeline Co. LP	139,329	Seaway Crude Pipeline Co.	513,257
7 Enterprise TE Products Pipeline Co. LLC	4,872	Plantation Pipe Line Co.	136,355	Mid-America Pipeline Co. LLC	366,867
8 ExxonMobil Pipeline Co.	4,353	Sunoco Pipeline LP	118,964	Magellan Pipeline Co. LP	339,036
9 Enbridge Energy LP	4,289	Enterprise TE Products Pipeline Co. LLC	107,261	Shell Pipeline Co. LP	334,292
10 BP Pipelines (North America) Inc.	4,190	Seaway Crude Pipeline Co.	89,063	Lone Star NGL Pipeline LP	302,160
<b>Total</b>	<b>60,975</b>		<b>2,820,230</b>		<b>\$5,577,408</b>
<b>Part of all companies</b>	<b>38.66%</b>		<b>54.92%</b>		<b>52.91%</b>
<b>Top 10 totals-2015</b>	<b>61,983</b>		<b>2,553,282</b>		<b>\$4,434,381</b>

Source: US FERC Form 6, Annual Report of Oil Pipeline Companies, Dec. 31, 2016

### TOP 10 US INTERSTATE GAS PIPELINE COMPANIES—2016

Company*	Transmission mileage	Company*	Volumes moved for fee, MMcf	Company*	Net income, \$1,000
1 Northern Natural Gas Co.	14,790	Transcontinental Gas Pipe Line Corp.	4,967,980	Texas Eastern Transmission LP	329,019
2 Tennessee Gas Pipeline Co.	11,771	Texas Eastern Transmission LP	3,654,651	Columbia Gas Transmission LLC	260,070
3 El Paso Natural Gas Co.	10,145	Tennessee Gas Pipeline Co.	3,279,402	Florida Gas Transmission Co. LLC	238,318
4 Texas Eastern Transmission LP	9,642	ANR Pipeline Co.	2,163,971	Dominion Transmission Inc.	217,011
5 Columbia Gas Transmission LLC	9,604	Columbia Gas Transmission LLC	1,759,599	Rockies Express Pipeline LLC	178,735
6 Transcontinental Gas Pipe Line Corp.	9,302	Natural Gas Pipeline Co. of America	585,023	Southern Natural Gas Co.	165,579
7 Natural Gas Pipeline Co. of America	9,117	El Paso Natural Gas Co.	457,358	Northern Natural Gas Co.	159,379
8 ANR Pipeline Co.	8,882	Rockies Express Pipeline LLC	243,039	Equitrans LP	141,667
9 Southern Natural Gas Co.	6,985	Dominion Transmission Inc.	190,821	Alliance Pipeline LP	39,635
10 Gulf South Pipeline Co. LP	6,663	Northern Natural Gas Co.	167,820	Texas Gas Transmission LLC	131,583
<b>Total</b>	<b>96,901</b>		<b>22,399,653</b>		<b>\$1,960,996</b>
<b>Part of majors</b>	<b>51.75%</b>		<b>48.36%</b>		<b>39.88%</b>

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#### Reporting changes

The number of companies required to file annual reports with FERC may change from year-to-year, with some companies becoming jurisdictional, others nonjurisdictional, and still others merging or being consolidated out of existence. Such changes require care be taken in comparing annual US petroleum and natural gas pipeline statistics.

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.

Reports for 2016 show a decrease in FERC-defined major gas pipeline companies: 90 companies of 165 filing, from 96 of 169 for 2015.

The FERC changed reporting requirements in 1995 for both crude oil and petroleum products pipelines. Exempt from requirements to prepare and file a Form 6 were those pipelines with operating revenues at or less than \$350,000 for each of the 3 preceding calendar years. These companies must now file 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 longer 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 fell slightly in 2015 (Table 1), final data showing a decrease of 851 miles, or 0.45%.

### US INTERSTATE PIPELINE MILEAGE

Table 1

Year	Miles		Total <sup>1</sup>
	Gas <sup>1,2</sup>	Oil	
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
2016	187,264	166,321	353,585

<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 2016. <sup>2</sup>Revised from initial publication.

Source: US FERC annual reports: Form 6, oil pipelines; Forms 2 & 2A, gas pipelines.

### Rankings; activity

Natural gas pipeline companies in 2016 saw operating revenues fall nearly \$2 billion or roughly 8.4% from 2015, accelerating the previous year's declines. Net incomes softened at roughly the same pace, falling about

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### PIPELINE COMPANY REVENUES, INCOMES

Table 2

	Gas		Oil	
	Operating revenues, \$1,000	Net income, \$1,000	Operating revenues, \$1,000	Net income, \$1,000
2007	21,736,726	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
2016	21,543,667	4,917,029	23,099,914	10,542,077

Source: US FERC annual reports (Forms 2, 2A, and 6) by regulated interstate natural gas and oil pipeline companies.

Crude deliveries for 2016 decreased by nearly 135 million bbl or 1.2%, while product deliveries rose 502 million bbl (6.9%).

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 10 oil pipeline companies rose 26% compared with the 58% overall increase, suggesting that the upswing was broad based. The top 10 companies' share of the segment's total earnings shrank accordingly, standing at 53% vs. the almost two-thirds share of earnings held in 2015.

Net income as a portion of natural gas pipeline operating revenues improved to 22.82% in 2016, the highest level seen since 2011. The percentage of income as operating revenues for oil pipelines surged to 45.64%, but remained below 2014's record 49.64%.

Net income as a portion of gas-plant investment eased to 3.28% in 2016, reversing the upward trend seen since the 17-year low of 2.93% in 2013. Net income as a portion of investment in oil pipeline carrier property rebounded to 10.59% but remained below 2014's recent high of 11.3%.

Major and nonmajor natural gas pipelines in 2016 reported total gas-plant investment of roughly \$158.5 billion, the highest level ever, up from \$158 billion in 2015, \$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 2016, surpassing \$99.5 billion, more than double the values seen just 5 years before. Carrier property in 2015 totaled \$93 billion, after reaching nearly \$85 billion in 2014, \$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.

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**INVESTMENT IN OIL PIPELINES—2016**

Table 3

	Company and investment, \$					Total, \$	%
	A	B	C	D	E		
<b>CRUDE PIPELINES</b>							
Land	59,766,389	120,398	6,388	5,309,537	5,751,216	70,953,928	0.50%
Right of way	482,991,072	945,777	300,181	61,021,318	11,921,448	627,179,796	3.75%
Line pipe	2,825,579,839	23,369,478	7,069,114	104,953,123	55,187,501	3,016,159,055	21.43%
Line pipe fittings	153,574,420	1,579,699	2,842,458	25,699,461	33,865,055	217,561,093	1.55%
Pipeline construction	4,672,600,016	62,461,142	8,623,572	480,783,530	160,822,305	5,385,290,565	38.27%
Buildings	271,885,813	5,525,869	2,439,857	35,861,912	27,052,465	342,765,916	2.44%
Boilers	---	---	---	---	---	---	0.00%
Pumping equipment	418,966,029	11,106,948	9,745,032	60,983,174	17,254,900	518,056,083	3.68%
Machine tools and machinery	---	---	---	59,991	---	59,991	0.00%
Other station equipment	2,630,482,107	32,652,288	8,054,766	405,087,381	86,333,243	3,162,609,785	22.47%
Oil tanks	533,177,808	10,409,584	---	117,938,887	22,514,719	684,040,998	4.86%
Delivery facilities	---	14,454	---	19,560	---	34,014	0.00%
Communication systems	12,694,736	1,234,476	---	3,705,376	1,069,569	18,704,157	0.13%
Office furniture and equipment	29,159,852	507,431	1,198,736	1,970,047	304,110	33,140,176	0.24%
Vehicles and other work equip.	75,544,977	718,176	551,644	4,822,979	---	81,637,776	0.58%
Other property	9,990,692	3,556,771	---	---	1,276,641	14,824,104	0.11%
<b>Total investment-2016</b>	<b>\$12,146,413,750</b>	<b>\$154,202,491</b>	<b>\$40,831,748</b>	<b>\$1,308,216,276</b>	<b>\$423,353,172</b>	<b>\$14,073,017,437</b>	<b>100.00%</b>
<b>Total carrier property--2016</b>	<b>\$13,065,750,740</b>	<b>\$164,718,217</b>	<b>\$42,938,321</b>	<b>\$1,118,880,281</b>	<b>\$480,246,727</b>	<b>\$14,878,634,086</b>	<b>100.00%</b>
<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>\$13,095,733,067</b>	<b>100.00%</b>
<b>PRODUCT PIPELINES</b>							
Land	7,134,674	7,386,253	1,139,188	5,704,480	13,364,466	34,729,061	0.38%
Right of way	---	26,161,459	70,077,816	12,050,114	140,814,793	249,104,182	2.74%
Line pipe	418,544,566	94,677,555	720,375,217	106,509,318	329,155,097	1,669,261,753	18.39%
Line pipe fittings	166,995,091	68,538,718	108,108,100	7,370,059	104,433,178	455,445,146	5.02%
Pipeline construction	1,354,322,174	309,779,470	724,371,562	149,110,496	657,090,071	3,194,673,773	35.20%
Buildings	56,503,443	18,698,615	14,935,927	22,040,433	65,899,120	178,077,538	1.95%
Boilers	---	---	---	---	---	---	0.00%
Pumping equipment	126,195,163	41,345,380	253,017,690	37,927,065	87,465,285	545,950,583	6.02%
Machine tools and machinery	---	---	---	---	---	---	0.00%
Other station equipment	496,848,897	198,969,730	155,982,694	147,817,597	411,464,604	1,411,083,522	15.55%
Oil tanks	276,787,977	109,420,819	8,459,201	58,713,250	348,764,942	802,146,189	8.84%
Delivery facilities	---	---	12,126,007	34,622,594	193,952,635	240,701,236	2.65%
Communication systems	9,676,868	1,780,757	3,648,193	12,981,173	42,727,670	70,814,661	0.78%
Office furniture and equipment	59,557,630	2,124,032	36,175,407	7,255,466	3,535,868	108,648,403	1.20%
Vehicles and other work equip.	22,645,741	5,014,651	18,193,702	10,559,295	12,522,924	68,936,313	0.76%
Other property	3,679,445	---	29,155,751	---	12,969,886	45,805,082	0.50%
<b>Total investment-2016</b>	<b>\$2,988,891,669</b>	<b>\$883,897,439</b>	<b>\$2,155,766,455</b>	<b>\$612,661,340</b>	<b>\$2,424,160,539</b>	<b>\$9,075,377,442</b>	<b>100.00%</b>
<b>Total carrier property--2016</b>	<b>\$3,098,810,779</b>	<b>\$902,813,858</b>	<b>\$2,181,665,648</b>	<b>\$617,754,839</b>	<b>\$2,497,894,552</b>	<b>\$9,299,939,676</b>	<b>100.00%</b>
<b>Total investment-2015</b>	<b>\$2,884,666,762</b>	<b>\$770,108,000</b>	<b>\$2,046,379,328</b>	<b>\$606,263,382</b>	<b>\$2,165,632,196</b>	<b>\$8,473,048,678</b>	<b>100.00%</b>

Sources: US FERC Forms 5, Annual Report of Oil Pipeline Companies, Dec. 31, 2015, and 2016.

The five crude oil pipeline companies in 2016 increased their overall investment in carrier property by more

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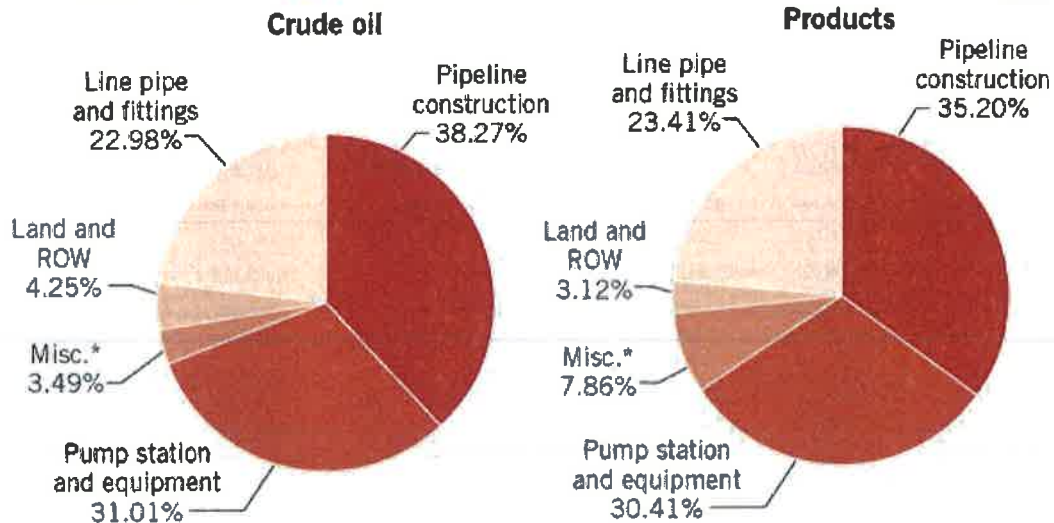
The five products pipeline companies saw their overall investment in carrier property accelerate in 2016, adding more than \$600 million, or 7.1%.

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.

## 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 2016.

### Construction mixed

Applications to FERC by regulated interstate natural gas pipeline companies to modify certain systems must, except in certain instances, provide estimated costs of these modifications in varying degrees of details.

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, 2016, to June 30, 2017, 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.

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- Roughly 530 miles of pipeline were proposed for land construction, with 22.3 miles of offshore work submitted. The land level was down sharply from the nearly 2,500 miles proposed for land construction in 2016 and the 2,192 miles proposed for land construction in 2015.

- New or additional compression proposed by the end of June 2017 measured nearly 600,000 hp, down sharply from the 2.2 million hp proposed the year before and retreating below the then high of roughly 706,000 hp proposed in 2014. Neither the proposed miles nor the proposed horsepower, however, included Alaska Gasline Development Corp.'s proposed pipeline, which did not file cost estimates with FERC.

## 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>									
6	Pennsylvania (R)	5.80	992,244	875,664	1,572,207	100,000	3,540,115	610,365	
8	Virginia	0.12	1,115,759	1,831,750	1,990,028	394,513	5,332,050	44,433,750	
	Pennsylvania-WV	3.37	1,208,821	590,164	21,090,146	2,082,748	24,971,879	7,410,053	
8, 12	Minnesota (L)	4.80	811,144	4,042,568	2,303,826	367,000	7,514,538	1,565,529	
12	Pennsylvania (R)	14.40	2,700,622	19,275,134	10,606,188	1,358,900	33,940,844	2,357,003	
12, 26	Florida (L) (lat.) (R)	7.72	6,064,391	17,200,638	14,693,084	—	37,958,113	4,916,854	
16	Louisiana (lat.)	0.17	320,779	34,788	559,818	—	915,385	5,384,618	
	Minnesota-ND	37.30	11,113,819	1,281,012	32,818,359	2,473,470	47,686,697	1,278,464	
16, 30	Oklahoma (lat.)	33.90	23,456,626	982,631	39,930,635	5,363,043	69,752,935	2,057,609	
20	Louisiana (lat.)	0.72	557,926	1,532,871	2,887,752	97,093	5,076,642	7,049,503	
	Washington (lat.) (R)	6.90	2,544,966	21,729,253	15,633,858	5,302,932	45,211,016	6,552,321	
Minnesota	Minnesota	7.86	4,129,774	25,230,999	15,326,165	5,178,691	49,865,629	6,344,228	
	Ohio	22.20	9,482,449	101,830,930	60,583,217	10,877,111	182,773,707	8,233,050	
24	New Jersey (lat.)	0.44	1,062,254	7,074,818	10,787,888	1,982,577	20,907,537	47,517,130	
	Illinois (lat.) (R)	0.54	1,704,000	1,917,000	1,537,000	—	5,158,000	9,551,852	
	Illinois-Missouri	59.00	21,841,132	95,649,483	63,661,010	11,276,935	192,428,560	3,261,501	
26	New Jersey (L)	0.16	376,297	2,004,672	1,365,463	4,019	3,750,451	23,440,319	
26, 42	Pennsylvania (L)	13.60	20,857,999	96,611,018	106,040,374	14,377,786	237,887,177	17,491,704	
30	Washington (R)	0.32	663,400	11,722,595	3,894,072	305,265	16,585,332	51,829,163	
	Texas (lat.)	0.50	1,073,683	1,280,204	2,043,079	203,089	4,600,055	9,200,110	
	Louisiana (lat.)	0.76	1,206,700	1,687,300	1,309,400	106,700	4,310,100	5,671,184	
36	Louisiana	11.00	114,496,245	89,618,474	122,712,087	8,976,815	335,803,621	30,527,602	
	Oklahoma	199.40	184,124,000	15,263,632	353,184,937	34,400,000	586,972,569	2,943,694	
42	Louisiana	11.00	79,006,078	121,438,120	171,073,767	7,045,955	378,563,920	34,414,902	
	Louisiana (lat.)	11.70	19,652,017	58,956,052	32,785,133	—	111,393,202	9,520,786	
	Louisiana (lat.)	15.10	30,504,233	91,512,698	50,889,703	—	172,906,634	11,450,770	
48	Louisiana	74.00	162,431,018	243,755,875	135,750,882	17,726,431	559,664,206	7,563,030	
<b>Total projects—land</b>		<b>528.18</b>	<b>\$703,499,376</b>	<b>\$1,034,930,343</b>	<b>\$1,277,030,078</b>	<b>\$130,011,073</b>	<b>\$3,145,468,914</b>	<b>\$5,944,045</b>	
<b>Total land-2016 report</b>		<b>2472.95</b>	<b>\$2,445,616,099</b>	<b>\$8,810,864,653</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>OFFSHORE PIPELINES</b>									
26	New York	23.33	51,887,204	276,422,014	188,294,661	544,155	517,148,057	22,166,655	
<b>Total projects—offshore</b>		<b>23.33</b>	<b>\$51,887,204</b>	<b>\$276,422,014</b>	<b>\$188,294,661</b>	<b>\$544,155</b>	<b>\$517,148,057</b>	<b>\$22,166,655</b>	

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Putting the slide in US gas pipeline construction in perspective, Table 4 lists 27 land-pipeline "spreads," or mileage segments, and 1 marine project compared with:

- 33 land and 0 marine projects (OGJ, Sept. 5, 2016, p. 89).
- 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)

Only one of the spreads in 2016 measured 100 miles or more, with delays in already planned large transmission lines suppressing the appetite for new proposals.

For the 12 months ending June 30, 2017, the 27 land projects filed would cost an estimated \$3.1 billion, as compared with 33 land projects for \$18.9 billion a year earlier.

These statistics cover only FERC-regulated pipelines. Many other pipeline construction projects were announced in the 12 months ending June 30, 2017, but may have lied outside FERC jurisdiction.

### 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
Texas	1,250	5,000,670	9,193,090	1,476,590	8,000,632	23,670,962	18,937
Virginia <sup>2</sup>	2,080	2,224,382	1,308,500	50,224	3,107,035	6,690,141	3,216
North Dakota	3,000	3,643,955	650,831	152,000	1,090,003	5,536,789	1,846
Louisiana	5,000	11,754,590	279,000	1,670,000	15,102,385	28,805,975	5,761
Illinois <sup>2</sup>	6,130	12,873,000	13,835,000	—	11,737,000	38,445,000	6,272
Virginia <sup>2</sup>	7,000	10,737,135	18,909,950	—	13,957,340	43,604,425	6,229
Texas	7,800	18,473,989	14,800,138	1,381,011	15,095,847	49,751,985	6,378
Texas	12,500	21,264,509	15,619,132	1,504,332	40,011,302	78,399,275	6,272
Texas	21,415	58,386,414	29,675,711	1,894,874	41,971,101	131,928,100	6,161
Texas	21,600	31,960,390	17,982,426	434,208	19,787,923	70,186,547	3,249
Maryland	24,370	36,371,417	27,323,948	2,690,863	32,404,362	98,790,590	4,054
Louisiana	41,000	57,248,123	44,809,237	4,488,407	61,356,043	167,901,810	4,095
New York	44,800	8,823,106	14,422,126	4,500,000	13,044,578	40,789,810	910
Pennsylvania-NJ	53,902	50,705,689	44,301,029	3,531,959	69,174,118	167,712,795	3,111
Louisiana	78,500	39,503,039	60,719,060	3,522,977	85,536,884	189,281,960	2,411
Oklahoma	118,440	120,352,980	2,285,052	3,488,160	89,277,540	215,403,732	1,819
Louisiana	151,000	81,215,509	121,877,937	2,215,804	135,750,882	341,060,132	2,259
<b>Total, land projects</b>	<b>598,537</b>	<b>\$559,669,890</b>	<b>\$428,799,077</b>	<b>\$31,524,819</b>	<b>\$648,405,343</b>	<b>\$1,674,289,068</b>	<b>\$2,787</b>
<b>2016-report total, land projects</b>	<b>2,239,507</b>	<b>\$2,331,831,503</b>	<b>\$1,433,407,503</b>	<b>\$130,860,891</b>	<b>\$1,824,550,300</b>	<b>\$5,728,556,151</b>	<b>\$2,588</b>
<b>Total all projects</b>	<b>598,537</b>	<b>\$559,669,890</b>	<b>\$428,799,077</b>	<b>\$31,524,819</b>	<b>\$648,405,343</b>	<b>\$1,674,289,068</b>	<b>\$2,787</b>

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A report released in April 2016 on behalf of the Interstate Natural Gas Association of America concluded that the United States 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 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 2016-17 the average cost was \$5.9 million/mile, down from the \$7.65 million/mile 2015-16 average costs but still more than the 2014-15 average cost of \$5.2 million/mile. In 2013-14 the average cost was \$6.6 million/mile as compared with \$4.1 million/mile in 2012-13, \$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.

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2011 miscellaneous charges passed material to become the second most expensive cost category and this year they passed sharply lower labor costs to become the most expensive category of all:

- Material-\$1,329,414/mile, up from \$988,947/mile for 2015-16.
- Labor-\$1,955,725/mile, down from \$3,603,334/mile for 2015-16.
- Miscellaneous-\$2,413,224/mile, down from \$2,615,028/mile for 2015-16.
- ROW and damages-\$245,684/mile, down from \$441,548/mile for 2015-16.

The continued rise in miscellaneous costs as a proportion of the total 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.

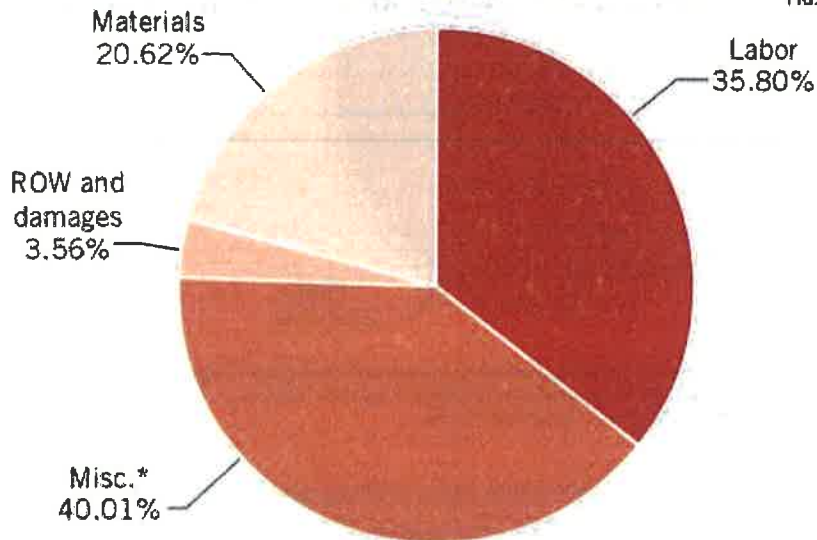
The average cost-per-mile for the projects rarely shows clear-cut trends related to either length or geographic area. In general, however, the cost-per-mile within a given diameter decreases as the number of miles rises. Lines built nearer populated areas also tend to have higher unit costs.

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.

**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, 2016, to June 30, 2017

Labor's slide as a portion of land construction costs positioned it for the moment as the second most expensive category. Labor's portion of estimated costs for land pipelines fell to 32.9% in 2017 from 47.08% in

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**MAJOR COST COMPONENTS—10 YEARS**

FIG. 4

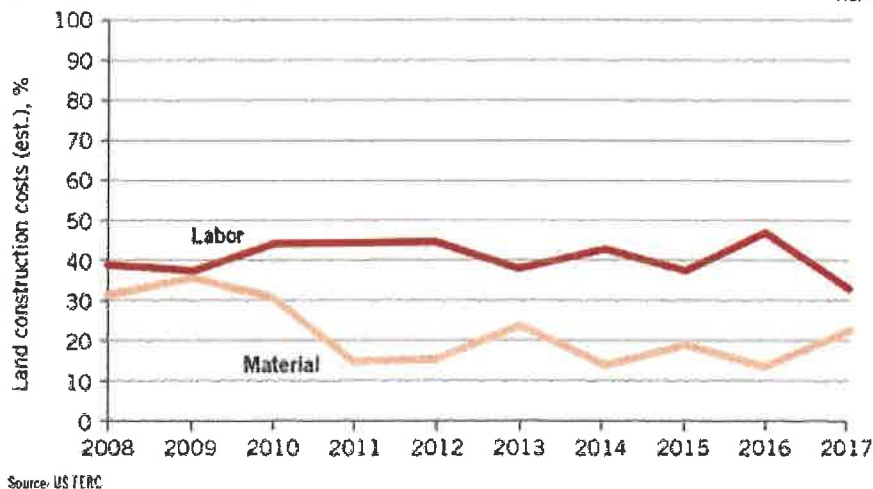
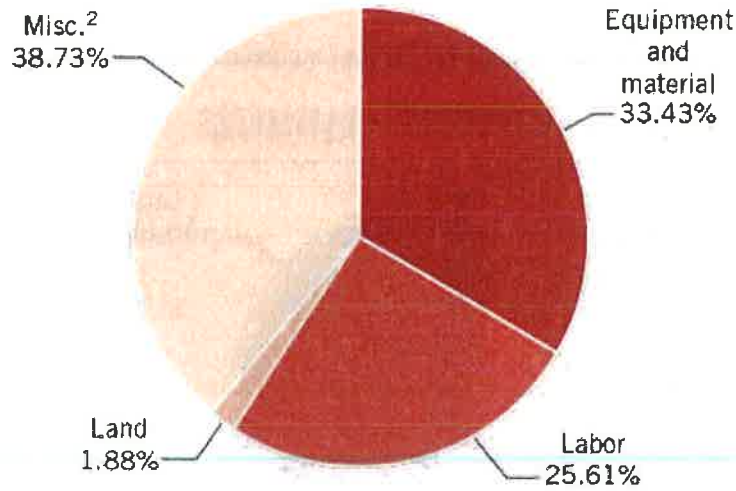


Fig. 4 plots a 10-year comparison of land-construction unit costs for material and labor.

Fig. 5 shows the cost split for land compressor stations based on data in Table 5.

### 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, 2016, to June 30, 2017

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.

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**10 YEARS OF LAND CONSTRUCTION COSTS<sup>1</sup>**

Table 6

Size	Year	ROW	Material	Labor Average cost, \$/mile	Misc.	Total	Range, \$/mile	
							Low	High
8 in.	2017	709,817	666,069	693,958	6,613,320	8,683,074	7,410,053	44,433,750
	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	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	1,633,746	—	—
	2010	—	—	—	—	—	—	—
	2009	—	—	—	—	—	—	—
	2008	17,438	378,698	199,342	114,617	710,095	—	—
12 in.	2017	94,368	187,543	1,338,551	736,541	2,357,003	—	—
	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	10,535,221	—	—
	2013	64,313	319,004	784,464	390,252	1,548,033	—	—
	2012	75,246	213,859	612,119	419,950	1,321,173	—	—
	2011	—	—	—	—	—	—	—
	2010	—	—	—	—	—	—	—
	2009	—	—	—	—	—	—	—
	2008	178,757	195,406	566,193	466,159	1,406,515	541,392	4,186,636
16 in.	2016	267,288	415,979	1,937,269	1,473,663	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	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	2,338,069	—	—
	2009	226,517	417,859	1,480,926	586,626	2,711,968	—	—
	2008	421,484	1,182,666	1,689,992	1,552,542	4,646,684	—	—
	20 in.	2017	66,012	305,167	35,116	890,797	1,297,093	1,278,464
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	2,141,235	—	—
2012		8,941	275,292	69,647	1,349,884	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	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	2,325,425	—	—
24 in.	2017	221,066	410,260	1,744,609	1,266,854	3,642,783	3,261,501	47,517,130
	2016	134,000	337,650	2,021,810	836,247	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	—	—	—	—	—	—	—
	2008	—	—	—	—	—	—	—
36 in.	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	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
	2017	206,164	1,419,298	498,489	2,261,868	4,385,818	2,943,694	30,527,602
	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	—	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	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	

<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

the values seen just 5 years before. Carrier property in 2015 totaled \$93 billion, after reaching nearly \$85 billion in 2014, \$68 billion in 2013, topping \$54 billion in 2012, hitting

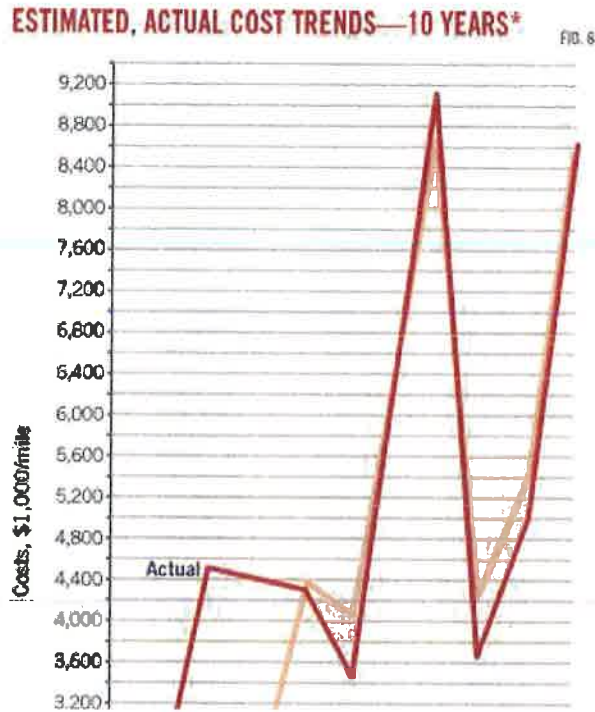
roughly \$49 billion in 2011, more than \$45 billion in 2010, roughly \$42 billion in 2009, \$39 billion in 2008, almost \$36 billion in 2007, and beginning its current upward momen-

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 ended up spending on an approved and built project. This filing must occur within 6 months after a pipeline's successful hydrostatic testing or a compressor's being put in service.

Fig. 6 shows 10 years of estimated vs. actual costs on cost-per-mile bases for project totals. The spike in both categories for 2014 and again this year stems from a larger than usual proportion of the pipeline mileage completed being in high-cost urban northeast US settings.



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Tables 7 and 8 show actual costs for pipeline and compressor projects reported to FERC during the 12 months ending June 30, 2017. Fig. 7, for the same period, depicts how total actual costs (\$/mile) for each category compare with estimated costs.

**US PIPELINE COSTS: ESTIMATED VS. ACTUAL, 2016-17<sup>1</sup>**

Table 7

Size, in.	Location	Length, miles	Materials	Labor	Misc. <sup>2</sup>	ROW & damages	Total	\$/mile	
			\$						
8	South Carolina	28.00	Estimated	2,762,509	20,896,941	9,088,522	2,903,245	35,651,217	1,273,258
			Actual	2,384,725	25,465,863	9,893,227	4,504,991	42,248,806	1,508,886
8	Wyoming (lat.)	2.50	Estimated	1,545,000	304,000	2,510,000	45,000	4,404,000	1,761,600
			Actual	934,531	928,980	2,394,127	9,821	4,267,459	1,706,984
10	Kentucky-Indiana (lat.)	30.00	Estimated	5,455,000	39,741,000	8,211,000	6,882,000	60,289,000	#DIV/0!
			Actual	4,332,000	30,408,000	6,135,000	5,772,000	46,647,000	#DIV/0!
12	Tennessee	10.20	Estimated	2,228,422	20,841,396	19,647,280	6,563,628	49,280,726	4,831,444
			Actual	1,938,280	16,896,903	11,194,023	3,666,782	33,695,988	3,303,528
12	Connecticut (lat.)(L)	1.30	Estimated	941,256	11,146,659	4,024,876	1,482,094	17,594,887	13,534,528
			Actual	947,077	10,795,031	3,556,597	1,342,885	16,641,590	12,801,223
14, 20	Kentucky (R)	32.00	Estimated	19,070,199	64,658,263	32,557,975	3,159,048	119,445,485	3,732,671
			Actual	13,578,417	69,710,203	23,178,172	5,575,154	112,041,946	3,501,311
16	Connecticut (lat.)(R)	9.10	Estimated	2,995,212	31,756,928	12,662,197	2,697,181	50,111,518	5,506,760
			Actual	3,062,171	31,102,681	13,306,850	2,572,200	50,033,902	5,498,231
16	Massachusetts (lat.)	0.91	Estimated	969,212	12,939,162	15,790,768	2,416,350	32,115,492	35,291,749
			Actual	461,331	18,699,433	6,004,293	1,381,130	26,548,187	29,171,634
16, 24	Massachusetts (lat.)	5.10	Estimated	3,533,715	52,050,431	41,585,464	16,077,628	113,247,238	22,205,341
			Actual	3,987,679	51,079,461	31,484,568	13,972,789	100,524,497	19,710,686
20	Pennsylvania-Maryland (lat.)	11.20	Estimated	4,517,914	18,854,141	12,472,523	5,084,742	40,929,320	3,654,404
			Actual	4,861,627	27,270,284	13,100,946	6,565,964	51,789,821	4,624,002
24	West Virginia	5.00	Estimated	8,258,014	17,025,549	17,767,364	2,233,250	45,284,167	9,056,833
			Actual	8,038,493	19,172,441	15,715,524	1,030,410	43,956,868	8,791,374
26	Maryland (L)	21.30	Estimated	12,498,000	71,424,000	37,036,000	10,984,000	131,942,000	6,194,460
			Actual	15,156,513	118,736,625	46,160,298	23,802,529	203,855,965	9,570,703
26	Connecticut (L)	2.00	Estimated	3,713,356	13,195,528	8,611,861	1,712,456	27,233,201	13,616,601
			Actual	3,711,663	12,734,148	8,504,740	1,651,684	26,602,236	13,301,118
26, 30	Pennsylvania (R)	10.08	Estimated	11,053,668	29,598,146	24,910,321	1,302,000	66,864,135	6,633,347
			Actual	6,946,611	36,905,059	19,292,091	2,085,913	65,229,714	6,471,202
42	New York-Connecticut (R)	4.50	Estimated	13,480,003	76,206,641	33,599,163	7,864,407	131,150,214	29,144,492
			Actual	14,498,026	77,897,867	33,299,791	6,544,967	132,200,651	29,377,922
42	New York (R)	3.30	Estimated	6,488,570	37,598,857	26,007,450	8,294,251	78,389,138	23,754,284
			Actual	4,799,115	44,323,854	26,310,477	7,797,052	83,230,498	25,221,363
Total land, miles		168.35	Estimated	151,076,868	709,391,723	449,807,811	110,704,408	1,420,780,808	\$8,438,447
			Actual	139,808,713	814,183,277	374,008,200	118,567,688	1,440,885,879	\$8,667,664
Offshore pipelines 14 Massachusetts		0.27	Estimated	521,934	6,873,406	9,054,585	1,545,988	17,995,913	66,651,530
			Actual	538,488	8,137,119	2,612,787	601,003	11,889,397	44,034,804
Total offshore, miles		0.27	Estimated	\$521,934	\$6,873,406	\$9,054,585	\$1,545,988	\$17,995,913	\$66,651,530
			Actual	\$538,488	\$8,137,119	\$2,612,787	\$601,003	\$11,889,397	\$44,034,804
Total, miles		168.62	Estimated	\$151,598,800	\$716,265,129	\$458,862,496	\$112,250,394	\$1,438,776,819	\$8,532,859
			Actual	\$136,447,201	\$822,320,398	\$378,618,987	\$117,168,692	\$1,482,565,276	\$8,614,371

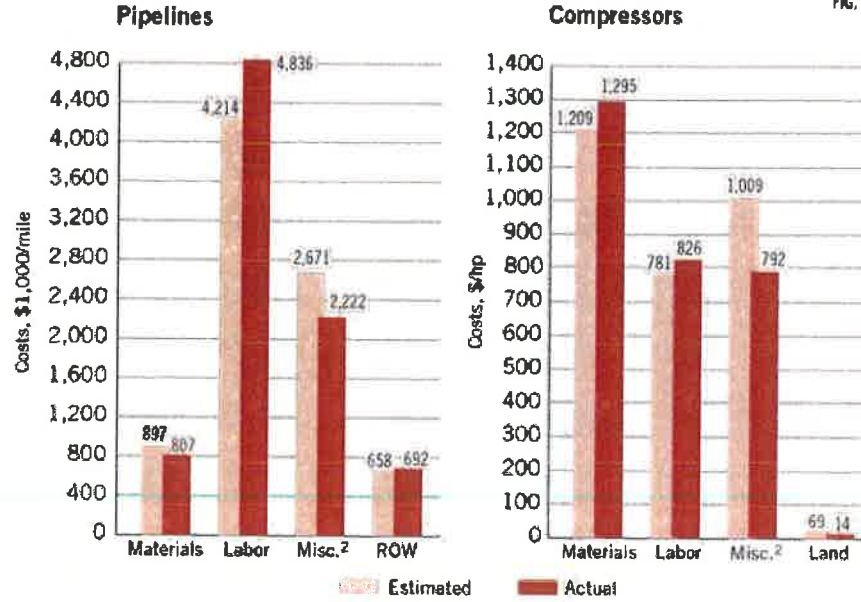
<sup>1</sup>Actual cost data must be filed within 6 months following final hydrostatic test of pipeline. Not all projects proposed (estimated costs) are built (actual costs). L = loop, lat. = lateral, R = replacement. <sup>2</sup>Generally includes surveys, engr., supervision, interest, freight, taxes, 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, 2016, and June 30, 2017, under CFR Section 157.20(c)(4).

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Actual labor costs for pipeline construction were more than \$600,000/mile higher than estimated costs for the same projects. Overall actual costs, however, were just 1.4% higher than projected costs for the 12 months ending June 30, 2017.

**COMPONENT COSTS: ESTIMATED VS. ACTUAL<sup>1</sup>**

FIG. 7



<sup>1</sup>Onshore only for construction cost filings made before July 1, 2017. <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

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

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**US COMPRESSOR-STATION COSTS: ESTIMATED VS. ACTUAL, 2016-17<sup>1</sup>**

Location	Size, hp	Materials	Labor	Misc. <sup>2</sup> Cost, \$	Land	Total	Table 8 \$/hp	
Maryland	4,000	Estimated	8,372,310	9,492,113	6,508,169	88,840	24,461,432	6,115
		Actual	10,814,683	10,861,012	6,660,680	34,381	28,370,756	7,093
West Virginia <sup>3</sup>	6,000	Estimated	10,551,554	9,545,221	10,020,512	—	30,117,287	5,020
		Actual	12,325,350	10,029,635	6,799,433	—	29,154,418	4,859
Virginia <sup>3</sup>	7,000	Estimated	9,452,088	12,954,320	8,211,781	—	30,618,189	4,374
		Actual	7,176,556	7,652,703	6,670,741	—	21,500,000	3,071
Connecticut <sup>3</sup>	7,700	Estimated	14,964,079	17,044,426	14,809,862	24,373	46,842,740	6,083
		Actual	15,263,633	20,330,731	15,311,389	13,873	50,919,626	6,613
Ohio <sup>3</sup>	10,000	Estimated	10,963,052	9,366,934	9,292,295	—	29,622,281	2,962
		Actual	13,372,346	8,032,783	9,271,778	—	30,676,907	3,068
New York <sup>3</sup>	10,320	Estimated	18,080,685	17,537,738	11,916,463	174,918	47,709,804	4,623
		Actual	17,647,082	21,516,412	12,633,386	9,623	51,806,503	5,020
Louisiana	10,915	Estimated	14,416,000	500,000	17,848,732	553,000	33,317,732	3,052
		Actual	13,934,955	525,000	14,923,152	650,413	30,033,520	2,752
Pennsylvania <sup>3</sup>	10,915	Estimated	14,070,293	15,940,023	11,164,742	—	41,175,058	3,772
		Actual	14,111,105	13,271,135	7,460,324	54,015	34,896,579	3,197
West Virginia <sup>3</sup>	12,552	Estimated	17,240,461	14,119,472	24,491,089	—	55,851,022	4,450
		Actual	26,899,651	16,760,777	10,100,566	17,399	53,778,393	4,284
Rhode Island <sup>3</sup>	15,900	Estimated	18,468,972	16,296,426	15,032,575	80,365	49,878,338	3,137
		Actual	18,550,028	16,755,504	16,663,075	4,108	51,972,715	3,269
Georgia	15,900	Estimated	19,944,960	298,652	26,248,102	658,268	47,149,982	2,965
		Actual	18,296,655	946,108	23,727,182	335,868	43,305,813	2,724
Connecticut <sup>3</sup>	15,900	Estimated	18,507,812	19,739,250	17,049,594	36,841	55,333,507	3,480
		Actual	18,644,410	19,742,909	16,836,124	15,841	55,239,284	3,474
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
Illinois	30,000	Estimated	27,205,000	15,293,900	16,157,300	1,863,000	60,519,200	2,017
		Actual	27,302,435	15,501,247	8,863,489	1,577,394	53,344,565	1,778
Georgia <sup>3</sup>	31,800	Estimated	34,729,493	435,639	31,416,870	330,964	66,912,966	2,104
		Actual	28,714,671	938,385	27,070,152	529,548	57,252,756	1,800
Louisiana	32,000	Estimated	35,489,980	13,100,210	22,577,804	1,267,470	73,535,464	2,298
		Actual	35,039,171	22,769,886	13,894,324	746,133	72,449,514	2,264
Louisiana <sup>3</sup>	32,000	Estimated	35,975,876	13,677,357	23,141,747	444,888	73,239,868	2,289
		Actual	59,769,947	22,937,597	13,040,855	6,336	95,754,735	2,992
Total	319,852	Estimated	\$386,914,721	\$249,888,808	\$322,768,658	\$4,047,988	\$965,639,863	\$3,018
		Actual	\$414,284,154	\$264,178,438	\$253,387,772	\$4,321,855	\$946,347,811	\$2,958

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<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.

Source: US FERC, for completed-project costs filed between July 1, 2016, and June 30, 2017, under CFR Section 157.20(c)(4).

The 12 months ending June 30, 2017, saw nearly 320,000 hp completed, roughly 50% more than the year before. Actual compression costs were \$60/hp (2%) lower than estimates (Table 8).

## References

1. ICF International, "North American Midstream Infrastructure Through 2035; Leaning into the Headwinds," Apr. 12, 2016.

## Oil Pipelines