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The Who's Who of Methane Pollution in the Onshore Oil and Gas Production Sector

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By Alison Cassady June 20, 2016



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Introduction and summary

Methane is a supercharged global warming pollutant that is 87 times more potent than carbon dioxide over a 20-year time scale.¹ In the United States, the oil and gas industry is the largest industrial source of methane pollution—releasing 33 percent of all methane emissions in 2014.²

As part of its broader climate change mitigation strategy, the Obama administration set a goal of reducing methane emissions from the oil and gas sector by 40 percent to 45 percent from 2012 emissions levels by 2025.³ In May 2016, the U.S. Environmental Protection Agency, or EPA, finalized limits on methane emissions from new sources in the oil and gas sector.⁴ Although the limits on pollution from new and modified sources are important, the EPA will also have to set strong standards for existing wells and equipment—meaning those that are already in operation—in order to achieve the administration’s methane emissions reduction goal. The EPA has initiated an information collection process to help shape a future rule-making on existing sources.⁵ The Bureau of Land Management, or BLM, also is moving forward with rules to reduce methane leaks from oil and gas production on public and Native American lands.⁶

The EPA already collects facility-level greenhouse gas data from the top emitting sectors of the U.S. economy through the Greenhouse Gas Reporting Program, or GHGRP. The Center for American Progress analyzed these data for 2014—the most recent data available—to identify which companies in the onshore oil and gas production sector are responsible for the most methane emissions and which regions of the country experience the most methane pollution.

The key findings for the 2014 data include:

- **The onshore oil and gas production sector’s methane emissions totaled more than 48 million metric tons of carbon dioxide equivalent, or CO₂e, in 2014.** This is the equivalent of 14 coal-fired power plants powered for one year, according to the EPA’s conservative methodology for calculating emissions equivalency.⁷

- **Eleven companies were responsible for almost half—49 percent—of the methane emissions reported from onshore oil and gas production in 2014.** The EPA collected methane emissions data from 211 companies in this sector in 2014.
- **ConocoPhillips, ExxonMobil Corp., Chesapeake Energy, EOG Resources Inc., and BP America ranked first through fifth for the most methane emissions from onshore production.** However, the biggest emitters were not necessarily the biggest natural gas producers. For example, ConocoPhillips—the top methane emitter from onshore oil and gas production—was the sixth largest natural gas producer in 2014. EOG Resources Inc., which ranked fourth for methane emissions, was the 14th largest natural gas producer that same year.
- **Some companies reported emitting more methane on a per-well basis than others.** For companies that reported at least 1,000 wells in 2014, the companies with the highest per-well emissions in the onshore oil and gas production sector included Lewis Energy Group, QEP Resources Inc., EOG Resources Inc., Samson Resources Corp., and EP Energy E&P Company.*
- **The parts of the country experiencing the most methane pollution from onshore oil and gas production include the following:** the Anadarko Basin of Colorado, Kansas, Oklahoma, and Texas; the Gulf Coast Basin of Louisiana and Texas; the San Juan Basin of Colorado and New Mexico; the Permian Basin of New Mexico and Texas; and the Appalachian Basin in the eastern part of the United States.
- **The San Juan Basin of Colorado and New Mexico experienced the most methane emissions per well in 2014,** followed by the Arkoma Basin of Arkansas and Oklahoma; the Strawn Basin of Texas; the Green River Basin of Colorado and Wyoming; and the Uinta Basin of Utah.

These EPA data show that oil and gas wells already in operation are releasing significant volumes of methane across the United States. The best way to curb these emissions is for the EPA to set strong mandatory standards for existing sources in the oil and gas sector in order to complement the new source standards finalized in May 2016. The BLM also should finalize a strong rule that ensures oil and gas companies find and repair wasteful methane leaks in their operations on public and Native American lands.

**Correction, June 21, 2016: This report incorrectly identified one of the methane emitters in the study. The company's correct name is Samson Resources Corp.*

Controlling methane emissions from the oil and gas sector

On May 12, 2016, the EPA finalized new source performance standards to directly regulate methane emissions from the oil and gas sector for the first time. These standards will limit methane pollution released from future oil and gas operations; they will not, however, apply to existing sources of pollution in the oil and gas industry. The EPA estimates that these rules will reduce methane emission by 510,000 short tons in 2025 alone.⁸

The EPA proposal for new and modified sources triggers section 111(d) of the Clean Air Act, which requires the EPA to reduce methane from wells, equipment, and facilities that are already in operation—also known as existing sources.⁹ The EPA has taken the first step toward setting standards for existing sources by initiating a formal information collection request that requires oil and gas companies to submit data about their operations to the EPA.¹⁰

In order to cut methane emissions from the oil and gas sector by 40 percent to 45 percent by 2025, the EPA will need to set limits for existing sources. In January 2016, the Clean Air Task Force, or CATF, estimated that emissions from the oil and gas sector will need to fall by an additional 75 million metric tons of CO₂e, after accounting for emissions reductions achieved by the new source performance standards.¹¹ The CATF identifies strong, enforceable limits on methane pollution from existing sources as the only way to close this gap.¹² Similarly, the Rhodium Group concluded that, even with significant voluntary efforts from the oil and gas industry, the United States would need to find 59 million to 70 million metric tons of additional reductions by 2025 in order to hit the 40 percent to 45 percent reduction goal.¹³

Notably, the BLM also has proposed a rule to reduce methane leaks from oil and gas production on public and Native American lands.¹⁴ The proposed rule would avert the waste of up to 56 billion cubic feet of natural gas annually, which is enough to supply up to approximately 760,000 households per year.¹⁵

Methane emissions from onshore oil and gas production

Methane emissions from existing oil and gas operations are a significant problem. ICF International estimates that by 2018, nearly 90 percent of the oil and gas sector's methane emissions will come from sources that were already in operation in 2011.¹⁶ After the EPA's methane limits for new and modified sources go into effect, methane pollution from 75 percent of the wells and oil and gas infrastructure in the United States will remain unregulated at the federal level.¹⁷

To better understand where some of these existing sources are located and who owns them, CAP analyzed 2014 data on methane emissions from the onshore oil and gas production sector as reported to the EPA Greenhouse Gas Reporting Program. Through the GHGRP, the EPA collects facility-level greenhouse gas data from the top emitting sectors of the U.S. economy.¹⁸ The EPA uses these data to inform domestic policy and improve the "U.S. Greenhouse Gas Inventory Report"—a comprehensive annual report submitted to the United Nations in accordance with the U.N. Framework Convention on Climate Change.

The GHGRP includes data on 211 companies from the onshore oil and gas production sector that reported methane emissions in 2014. CAP analyzed these data for onshore oil and gas production by both parent company and hydrocarbon basin, as detailed below. Onshore oil and gas producers must report emissions from natural gas well completions and workovers; well venting; and leaks from equipment such as pneumatic devices and pumps, tanks, dehydrators, and compressors. These reports likely underestimate methane emissions from this sector. (See Text Box below)

CAP's analysis shows that millions of tons of methane pollution will go unchecked from oil and gas production without additional emissions limits for existing sources in the oil and gas sector.

Why the data likely underestimate emissions from the onshore oil and gas production sector

The analysis presented in this report likely underestimates the amount of methane released by the onshore oil and gas production sector in 2014.

- **Only the largest emitters of methane and other greenhouse gases—those emitting more than 25,000 metric tons of CO₂e in the reporting year—report to the GHGRP.**¹⁹

As a result, these data may not include methane emissions from smaller producers.

- **The oil and gas producer data for 2014 do not include greenhouse gas emissions from completions and workovers of oil wells with hydraulic fracturing, although many of these wells coproduce natural gas and, therefore, methane.** For the 2014 reporting year, the EPA only required companies to report emissions from natural gas well completions

and workovers. In 2015, the EPA finalized a rule clarifying that companies must report emissions associated with completions and workovers with hydraulic fracturing for wells regardless of whether their primary product is oil or natural gas.²⁰

- **Some of the oil and gas wells may be so-called superemitters and far leakier than regulators or even the well owners themselves know.** The Environmental Defense Fund, or EDF, hired a leak detection company to fly a helicopter over 8,000 well pads across seven states and use an infrared camera to detect methane leaks. In April 2016, the EDF released its study of this experiment and revealed that experts found superemitter sites in every basin they examined. The EDF also concluded that “super-emitting sources are nearly impossible to predict. They can happen anywhere anytime as a result of malfunctioning equipment that goes unattended and sloppy mistakes in the field.”²¹

Methane emissions by oil and gas producer

In 2014, the U.S. onshore oil and gas production sector reported nearly 103 million metric tons of greenhouse gas emissions measured in CO₂e.²² Onshore oil and gas production is the largest contributor to the total greenhouse gas emissions footprint of the petroleum and natural gas systems sector, which also includes natural gas transmission, processing, underground storage, and other sources.²³

Methane emissions comprised almost half of the total greenhouse gas emissions from the onshore oil and gas production sector—more than 48 million metric tons of CO₂e, or 47 percent.²⁴ Although this marks a small decline from 2013, these methane emissions are the equivalent of 14 coal fired-power plants operating for one year, calculated by using the EPA’s conservative methodology for calculating emissions equivalency.²⁵

Table 1 displays the 11 oil and gas producers that reported the most methane emissions in 2014—led by ConocoPhillips, ExxonMobil Corp., Chesapeake Energy, EOG Resources Inc., and BP America. These 11 companies represent

almost half—49 percent—of the methane emissions reported from onshore oil and gas production in 2014. Their combined methane emissions are the carbon equivalent of burning almost 125,000 rail cars of coal or running almost seven coal-fired power plants for one year.²⁶

See Appendix A for a list of the top 100 oil and gas producers in terms of methane emissions for 2014.

TABLE 1
11 onshore oil and gas producers with at least
1 million metric tons of methane emissions in 2014

Metric tons of carbon dioxide equivalent

Rank	Parent company	2014 methane emissions	2014 emissions equivalent, railcars of coal burned
1	ConocoPhillips Corp.	4,653,752	24,783
2	ExxonMobil Corp.	3,491,197	18,592
3	Chesapeake Energy Corp.	2,767,333	14,737
4	EOG Resources Inc.	2,668,380	14,210
5	BP America	2,309,971	12,302
6	Anadarko Petroleum Corp.	1,743,867	9,287
7	EnerVest Operating Company	1,403,018	7,472
8	Southwestern Energy Company	1,159,863	6,177
9	Lewis Energy Group	1,154,730	6,149
10	Devon Energy Corp.	1,005,238	5,353
11	Samson Resources Corp.*	998,336	5,317

**Correction, June 21, 2016: This report incorrectly identified one of the methane emitters in the study. The company's correct name is Samson Resources Corp.*

Sources: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016). Emissions equivalencies were generated with U.S. Environmental Protection Agency, "Greenhouse Gas Equivalencies Calculator," available at <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator> (last accessed June 2016).

One would assume that the companies with the most natural gas production would be the largest methane polluters. However, the companies in the top five do not neatly align with the list of the top natural gas producers in 2014, as compiled by the Natural Gas Supply Association. For example, ConocoPhillips—the top methane emitter from onshore oil and gas production—was the sixth largest natural gas producer in 2014. EOG Resources Inc.—ranking fourth for methane emissions—was the 14th largest natural gas producer that same year. Devon Energy—the fifth largest natural gas producer in 2014—ranked 10th for methane emissions from onshore production in 2014.²⁷

In order to compare companies, CAP attempted to control for the production volume for each company by calculating the average amount of methane pollution emitted per well. To do this, CAP looked at the emissions data for the 66 companies—out of 211 companies—that reported owning or operating at least 1,000 wells in 2014. Table 2 shows that Lewis Energy Group—a privately held oil and gas producer that operates primarily in Texas—reported per-well methane emissions that were more than double the per-well emissions from the company that ranked second: Colorado-based QEP Resources Inc. ConocoPhillips—the company with the most methane emissions from the onshore oil and gas production sector in 2014—ranked 10th for the highest rate of methane emissions per well. (See Text Box below)

TABLE 2
10 onshore oil and gas producers with the
highest per-well methane emissions in 2014

For companies reporting at least 1,000 wells in 2014:
Metric tons of carbon dioxide equivalent

Parent company	2014 methane emissions	Number of wells	Methane emissions per well
Lewis Energy Group	1,154,730	1,682	687
QEP Resources Inc.	990,500	3,264	303
EOG Resources Inc.	2,668,380	9,221	289
Samson Resources Corp.*	998,336	3,545	282
EP Energy E&P Company LP	402,741	1,455	277
Cimarex Energy**	781,466	3,156	248
Southwestern Energy Company	1,159,863	5,539	209
PDC Energy	573,802	2,747	209
BP America	2,309,971	11,125	208
ConocoPhillips Corp.	4,653,752	22,863	204

**Correction, June 21, 2016: This report incorrectly identified one of the methane emitters in the study. The company's correct name is Samson Resources Corp.*

*** Cimarex Energy reported methane emissions for a jointly owned facility in Oklahoma but reported "0" wells. The emissions per-well figure for Cimarex does not include emissions from this facility, which amounted to just 310 metric tons of carbon dioxide equivalent.*

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016).

ConocoPhillips' efforts to cut methane emissions in the San Juan Basin of Colorado and New Mexico

ConocoPhillips released more methane emissions from onshore oil and gas production than any other company in 2014—a position it has held since at least 2011²⁸—and ranked 10th for most methane emissions per well. That said, the company's 2014 performance is a significant improvement from 2013. Between 2013 and 2014, ConocoPhillips reduced its methane emissions from the onshore oil and gas production sector by 40 percent.²⁹

ConocoPhillips achieved most of these reductions at its operations in the San Juan Basin of Colorado and New Mexico, where NASA discovered a methane cloud the size of Delaware in October 2014 hovering over the region.³⁰ The company reports that it invested and installed more efficient pneumatic devices—devices used to operate valves and control pressure, flow, and other parameters—and improved its

liquids unloading process, which is used to optimize conditions for gas production but can result in significant methane leaks.³¹

ConocoPhillips has shown that companies can use existing technology to reduce their methane pollution at wells that are already in operation. More remains to be done; however: The company remains the top methane emitter in the San Juan Basin of Colorado and New Mexico. The EPA and BLM will require these same type of technologies as part of their rule-makings on methane emissions from the oil and gas sector. Voluntary measures alone are not sufficient to drive across-the-board methane emissions reductions and ensure that all companies are detecting and repairing methane leaks in a timely manner on both public and private lands.

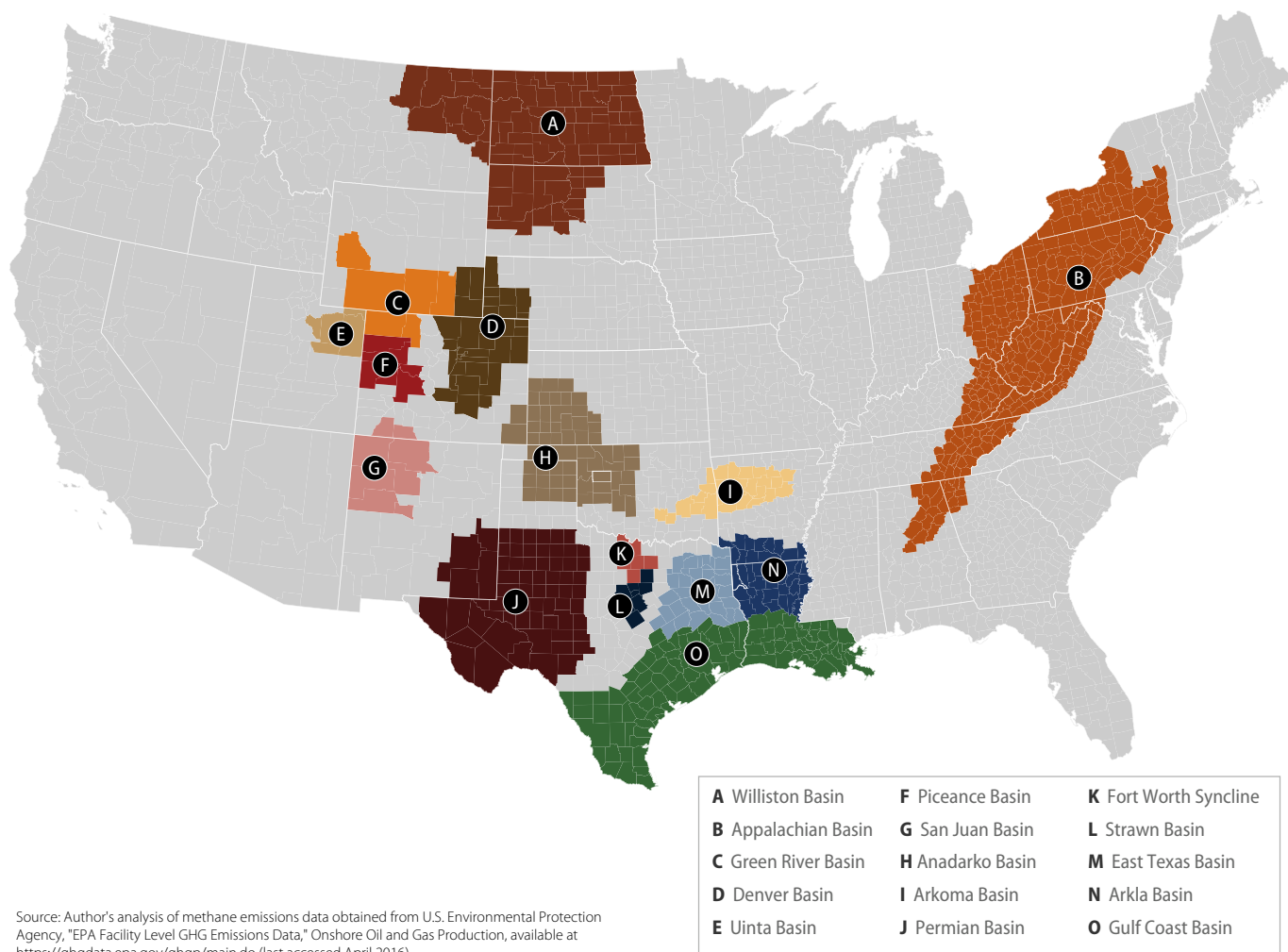
Methane emissions by oil and gas basin

Fifteen basins recorded at least 1 million metric tons CO₂e of methane in 2014. (See Table 3) The Anadarko Basin of Colorado, Kansas, Oklahoma, and Texas; the Gulf Coast Basin of Louisiana and Texas; and the San Juan Basin of Colorado and New Mexico each experienced more than 5 million metric tons CO₂e of methane pollution in 2014. Onshore oil and gas producers released 4.8 million metric tons CO₂e of methane in the Permian Basin of New Mexico and Texas and 3.5 million metric tons CO₂e of methane in the Appalachian Basin in the eastern part of the United States. These five basins accounted for more than half—52 percent—of the nation's methane pollution from onshore oil and gas production in 2014.

Table 3 also shows that certain basins have a higher rate of methane emissions per well than others. The San Juan Basin of Colorado and New Mexico experienced the most methane emissions per well in 2014—a total of 227 metric tons of CO₂e per well. The Arkoma Basin of Arkansas and Oklahoma, the Strawn Basin of Texas, and the Green River Basin of Colorado and Wyoming each had more than 200 metric tons of CO₂e per well.

FIGURE 1

Hydrocarbon basins with the most methane pollution from onshore oil and gas production, 2014



See Appendix B for a list of the companies that emitted the most methane in each of these 15 basins in 2014.

TABLE 3
15 oil- and gas-producing basins with at least
1 million metric tons of methane emissions in 2014

Metric tons of carbon dioxide equivalent

Basin	2014 methane emissions	Number of wells*	Methane emissions per well*
Anadarko Basin	5,855,333	43,536	128
Gulf Coast Basin	5,751,780	32,770	163
San Juan Basin	5,202,528	22,579	227
Permian Basin	4,782,622	112,230	40
Appalachian Basin	3,455,036	76,800	41
East Texas Basin	2,760,620	20,684	133
Arkoma Basin	2,462,511	11,471	212
Green River Basin	2,375,566	11,790	201
Uinta Basin	2,336,781	11,753	199
Denver Basin	1,909,847	22,253	85
Piceance Basin	1,837,649	13,486	136
Williston Basin	1,769,469	13,799	125
Strawn Basin	1,604,892	7,503	209
Fort Worth Syncline	1,557,056	8,619	181
Arkla Basin	1,381,239	8,369	165

* Forty-three of the 522 facility records did not include well count data. The per-well figures do not include emissions from those records.

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016).

Conclusion

As this report shows, the U.S. oil and gas industry released millions of tons of methane pollution in 2014 in regions across the country. These localized emissions have a powerful global impact, especially given methane's potent greenhouse effect. Curbing methane pollution from the oil and gas sector—as well as other sectors—will be key to slowing the rate of climate change. Recognizing this reality, the EPA has taken an important step by finalizing standards to limit methane pollution from oil and gas operations that will come online in the future. In order to address the bulk of the methane emissions from this sector, however, the EPA now must work expeditiously to limit pollution from the thousands of wells and facilities already in operation. The BLM also must finalize a strong rule that minimizes wasteful methane leaks from oil and gas operations on public and Native American lands.

Methodology

Data source

The author accessed GHGRP data on 2014 emissions from the onshore oil and gas production sector through the EPA's Facility Level Information on Greenhouse Gases Tool, available at <https://ghgdata.epa.gov/ghgp/main.do>, on April 22, 2016. The GHGRP includes data on 211 companies that reported methane emissions from 522 facilities in the onshore oil and gas production sector in 2014.

Basin data

Onshore oil and gas producers do not report their data on an individual facility-by-facility basis. Instead, they group their emissions data by hydrocarbon basin. For onshore oil and gas production, the facility report reflects all emissions from wells and associated equipment owned or operated by a single company in a specific hydrocarbon producing basin.³² The EPA relies on the American Association of Petroleum Geologists to define the hydrocarbon basins.³³

The author used the geologic names as presented in the GHGRP database but considered the basins coded in the EPA's GHGRP database as "160-Appalachian Basin" and "160A-Appalachian Basin (Eastern Overthrust Area)" to be one basin.³⁴

Parent companies

For parent companies, the author relied on the information that the facilities themselves provided to the EPA. The author did not modify the data if a company has been acquired; changed its name; or went out of business since reporting its 2014 data to the EPA. For joint ventures, the author attributed methane emissions to the company with the largest share in the operation.³⁵

Well-count data

Forty-three out of the 522 onshore oil and gas facilities that reported to the GHGRP did not include a well count or listed “0” as the well count. After consultation with the EPA, the author assumed these to be data reporting errors and excluded the methane emissions for these facilities from the per-well emissions analysis.

Carbon equivalencies

The methane emissions data in this report are expressed in carbon dioxide equivalent, as this is the format used by the EPA in the GHGRP database. To calculate the carbon dioxide equivalency for methane, the EPA uses the 100-year global warming potential, or GWP, as calculated in the Intergovernmental Panel on Climate Change’s, or IPCC’s, “Fourth Assessment Report.”³⁶

This GWP potential is conservative for two reasons. First, the IPCC “Fifth Assessment Report” revised the 100-year GWP to be higher in order to reflect methane’s potency.³⁷ Second, since methane persists in the atmosphere for a short period of time, it may be more appropriate to assess its potency based on a 20-year time scale rather than a 100-year scale.³⁸

About the author

Alison Cassady is the Director of Domestic Energy Policy at the Center for American Progress. Cassady joined the organization after working as a senior professional staff member for Rep. Henry Waxman (D-CA) and the U.S. House of Representatives Energy and Commerce Committee.

Appendix A

Top 100 onshore oil and gas producers with the most methane emissions in 2014, by metric tons of CO₂e

APPENDIX A

Top 100 onshore oil and gas producers with the most methane emissions in 2014

Metric tons of carbon dioxide equivalent

Rank	Parent company	2014 methane emissions	Number of wells	Methane emissions per well
1	ConocoPhillips Corp.	4,653,752	22,863	204
2	ExxonMobil Corp.	3,491,197	28,143	124
3	Chesapeake Energy Corp.	2,767,333	18,946	146
4	EOG Resources Inc.	2,668,380	9,221	289
5	BP America	2,309,971	11,125	208
6	Anadarko Petroleum Corp.*	1,743,867	16,210	98
7	EnerVest Operating Company	1,403,018	16,914	83
8	Southwestern Energy Company	1,159,863	5,539	209
9	Lewis Energy Group	1,154,730	1,682	687
10	Devon Energy Corp.	1,005,238	13,391	75
11	Samson Resources Corp.**	998,336	3,545	282
12	QEP Resources Inc.	990,500	3,264	303
13	Linn Energy LLC*	940,884	19,603	48
14	Encana Corp.	858,833	8,184	105
15	SandRidge Exploration and Production LLC	824,292	4,173	198
16	Cimarex Energy*	781,466	3,156	248
17	Chevron Corp.	736,235	35,677	21
18	WPX Energy Inc.	723,202	6,076	119
19	Atlas Energy Inc.	681,668	7,047	97
20	Apache Corp.	633,740	14,008	45

Rank	Parent company	2014 methane emissions	Number of wells	Methane emissions per well
21	PDC Energy	573,802	2,747	209
22	Occidental Petroleum Corp.	542,142	20,943	26
23	Marathon Oil Corp.	530,956	3,491	152
24	Pioneer Natural Resources Company	487,716	11,251	43
25	Diamondback Energy Inc.	432,156	682	634
26	EP Energy E&P Company LP	402,741	1,455	277
27	BHP Billiton Ltd.	388,082	2,457	158
28	Questar Corp.	385,940	769	502
29	Loews Corp.	385,869	6,069	64
30	Sabine Oil & Gas Company	356,739	870	410
31	CNX Gas Company	327,612	12,460	26
32	Energen Corp.*	323,001	1,471	185
33	Stephens Production Company	314,397	925	340
34	Yates Petroleum Corp.	291,487	2,892	101
35	BreitBurn Energy Partners LP	285,831	4,535	63
36	Noble Energy Company	279,921	7,986	35
37	Alta Mesa Holdings LP*	272,446	N/A	N/A
38	Compass Production Partners LP	268,554	1,421	189
39	Midstates Petroleum Company	267,539	457	585
40	Denbury Resources Inc.	263,967	3,639	73
41	Vanguard Natural Resources LLC	262,829	2,104	125
42	Foundation Energy Company LLC	244,670	1,731	141
43	COG Operating LLC	239,991	4,250	56
44	Newfield Exploration Company	229,770	4,303	53
45	Endeavor Energy Resources LP*	224,696	13,090	17
46	Seneca Resources Corp.*	212,822	N/A	N/A
47	Continental Resources Inc.	207,979	2,270	92
48	Shell Oil Company	205,070	17,893	11
49	Premier Natural Resources LLC	204,913	787	260
50	Unit Petroleum Company*	201,907	N/A	N/A
51	Parsley Energy Inc.	196,632	139	1,415
52	Exco Resources Inc.	186,091	5,318	35
53	Bill Barrett Corp.	185,227	590	314
54	Whiting Petroleum Corp.	180,822	1,829	99

Rank	Parent company	2014 methane emissions	Number of wells	Methane emissions per well
55	Hilcorp Energy Company	178,205	6,846	26
56	Chaparral Energy Inc.	177,426	1,855	96
57	Halcón Resources Corp.	172,299	518	333
58	Pennsylvania General Energy Company LLC	171,382	2,442	70
59	Jonah Energy LLC	159,627	2,139	75
60	Forest Oil Corp.*	152,587	510	290
61	Bonanza Creek Energy Inc.	146,188	812	180
62	Ultra Petroleum Corp.	144,940	1,895	76
63	Statoil	143,850	667	216
64	Comstock Resources Inc.	141,249	920	154
65	Hess Corp.	139,889	1,946	72
66	Sanguine Gas Exploration LLC*	135,132	N/A	N/A
67	Kaiser-Francis Oil Company	134,137	824	163
68	Templar Energy LLC	132,923	937	142
69	Merit Energy Company	131,626	8,671	15
70	Clayton Williams Energy Inc.*	122,392	N/A	N/A
71	Talisman Energy Inc.	121,716	679	179
72	RKI Exploration & Production	118,125	664	178
73	Cabot Corp.*	115,899	3,705	12
74	J-W Energy Company	115,310	1,018	113
75	Sanchez Oil & Gas Corp.	109,666	393	279
76	Nadel & Gussman LLC	109,318	461	237
77	BOPCO LP	105,163	861	122
78	Approach Resources Inc.	98,476	730	135
79	Samuel Gary Jr. & Associates Inc.	96,676	209	463
80	Enerplus Corp.	95,589	311	307
81	American Energy Partners LP	83,214	316	263
82	Penn Virginia Corp.	82,488	994	83
83	Memorial Resource Development Corp.	82,454	1,265	65
84	Valence Operating Company	80,855	592	137
85	MDU Resources Group Inc.	80,422	1,921	42
86	Legend Natural Gas LLC	78,620	814	97

Rank	Parent company	2014 methane emissions	Number of wells	Methane emissions per well
87	Elm Ridge Exploration Company LLC*	75,766	N/A	N/A
88	Discovery Natural Resources LLC	74,049	1,084	68
89	Dugan Production Corp.	73,644	819	90
90	SM Energy Company	71,512	1,587	45
91	Ursa Resources Group II LLC	70,450	330	213
92	Trendwell Energy Corp.*	70,342	N/A	N/A
93	Caerus Oil and Gas LLC	70,098	750	93
94	Antero Resources	69,952	653	107
95	Indigo Minerals LLC	69,483	429	162
96	BlueStone Natural Resources	68,590	630	109
97	Swift Energy Operating LLC	66,758	778	86
98	Laredo Petroleum Inc.	64,967	1,164	56
99	EQT Corp.	62,850	6,380	10
100	Range Resources Corp.	62,626	8,265	8

*These companies did not report well count data for at least one basin in 2014. For these companies, the emissions-per-well analysis does not include emissions from basins for which there are no well count data. If a company did not report any well count data, the column is marked as "not applicable."

****Correction, June 21, 2016:** This report incorrectly identified one of the methane emitters in the study. The company's correct name is Samson Resources Corp.

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016). CAP used the parent company names reported to the EPA and did not modify the parent company data to reflect mergers, acquisitions, or name changes.

Appendix B

Onshore oil and gas producers with at least 100,000 tons of methane emissions in 2014, by basin and metric tons of CO₂e

This only includes data for the 15 basins with at least 1 million metric tons of CO₂e of methane emissions in 2014.

APPENDIX B1

Anadarko Basin—Colorado, Kansas, Oklahoma, and Texas

Metric tons of carbon dioxide equivalent

Parent company	2014 methane emissions	Number of wells	Methane emissions per well
Chesapeake Energy Corp.	1,390,902	7,039	198
SandRidge Exploration and Production LLC	584,547	1,577	371
Apache Corp.	507,210	2,466	206
Samson Resources Corp.*	452,446	1,118	405
Cimarex Energy Company	321,700	1,192	270
BP America	258,001	1,393	185
Linn Energy LLC	222,395	8,571	26
Devon Energy Corp.	186,389	1,269	147
ConocoPhillips Corp.	182,366	2,121	86
Midstates Petroleum Company Inc.	178,896	393	455
Chaparral Energy Inc.	150,604	769	196
Sanguine Gas Exploration LLC**	135,132	N/A	N/A
Kaiser-Francis Oil Company	134,137	824	163
Templar Energy LLC	132,923	937	142
Unit Petroleum Company**	132,834	N/A	N/A
Marathon Oil Corp.	111,563	353	316
ExxonMobil Corp.	105,226	1,422	74
EOG Resources Inc.	102,282	453	226

***Correction, June 21, 2016:** This report incorrectly identified one of the methane emitters in the study. The company's correct name is Samson Resources Corp.

** These companies did not report well count data for the basin in 2014; as a result, CAP was unable to calculate per-well emissions for these companies.

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016). CAP used the parent company names reported to the EPA and did not modify the parent company data to reflect mergers, acquisitions, or name changes.

APPENDIX B2

Appalachian Basin—Alabama, Georgia, Kentucky, Maryland, North Carolina, New York, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia

Metric tons of carbon dioxide equivalent

Parent company	2014 methane emissions	Number of wells	Methane emissions per well
Atlas Energy Inc.	589,434	6,453	91
EnerVest Operating Company	567,908	10,926	52
CNX Gas Company	327,612	12,460	26
Chesapeake Energy Corp.	312,179	6,108	51
Seneca Resources Corp.*	212,822	N/A	N/A
Pennsylvania General Energy Company LLC	171,382	2,442	70
Southwestern Energy Company	158,206	1,213	130
Chevron Corp.	129,040	285	453
ExxonMobil Corp.	112,917	5,691	20

* These companies did not report well count data for the basin in 2014; as a result, CAP was unable to calculate per-well emissions for these companies.

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016). CAP used the parent company names reported to the EPA and did not modify the parent company data to reflect mergers, acquisitions, or name changes.

APPENDIX B3

Arkla Basin—Arkansas and Louisiana

Metric tons of carbon dioxide equivalent

Parent company	2014 methane emissions	Number of wells	Methane emissions per well
BHP Billiton	149,889	897	167
Compass Production Partners LP	149,866	727	206
Chesapeake Energy Corp.	146,351	910	161
QEP Resources Inc.	138,844	511	272
ConocoPhillips Corp.	117,766	409	288
J-W Energy Company	115,310	1,018	113

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016). CAP used the parent company names reported to the EPA and did not modify the parent company data to reflect mergers, acquisitions, or name changes.

APPENDIX B4

Arkoma Basin—Arkansas and Oklahoma

Metric tons of carbon dioxide equivalent

Parent company	2014 methane emissions	Number of wells	Methane emissions per well
Southwestern Energy Company	939,967	4,191	224
ExxonMobil Corp.	498,760	2,236	223
Stephens Production Company	314,397	925	340
BP America	165,748	1,214	137
Samson Resources Corp.*	140,940	241	585
BHP Billiton	125,033	967	129

***Correction, June 21, 2016:** This report incorrectly identified one of the methane emitters in the study. The company's correct name is Samson Resources Corp.

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016). CAP used the parent company names reported to the EPA and did not modify the parent company data to reflect mergers, acquisitions, or name changes.

APPENDIX B5

Denver Basin—Colorado, Nebraska, and Wyoming

Metric tons of carbon dioxide equivalent

Parent company	2014 methane emissions	Number of wells	Methane emissions per well
PDC Energy	573,802	2,747	209
Anadarko Petroleum Corp.	478,544	6,333	76
Noble Energy Inc.	262,461	7,831	34
Encana Corp.	145,259	1,578	92
Foundation Energy	142,453	1,024	139
Bonanza Creek Energy Inc.	126,777	525	241

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016). CAP used the parent company names reported to the EPA and did not modify the parent company data to reflect mergers, acquisitions, or name changes.

APPENDIX B6

East Texas Basin—Texas

Metric tons of carbon dioxide equivalent

Parent company	2014 methane emissions	Number of wells	Methane emissions per well
ExxonMobil Corp.	762,322	5,439	140
Linn Energy LLC	285,477	1,082	264
Sabine Oil & Gas Company	279,333	763	366
Samson Resources Corp.*	221,402	1,297	171
Anadarko Petroleum Corp.	165,316	2,180	76
Forest Oil Corp.	148,013	510	290
Devon Energy Corp.	121,843	1,243	98
Marathon Oil Corp.	105,102	413	254

***Correction, June 21, 2016:** This report incorrectly identified one of the methane emitters in the study. The company's correct name is Samson Resources Corp.

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016). CAP used the parent company names reported to the EPA and did not modify the parent company data to reflect mergers, acquisitions, or name changes.

APPENDIX B7

Fort Worth Syncline Basin—Texas

Metric tons of carbon dioxide equivalent

Parent company	2014 methane emissions	Number of wells	Methane emissions per well
EOG Resources Inc.	413,538	910	454
ConocoPhillips Corp.	298,981	722	414
EnerVest Operating Company	280,684	954	294
Devon Energy Corp.	271,034	4,469	61

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016). CAP used the parent company names reported to the EPA and did not modify the parent company data to reflect mergers, acquisitions, or name changes.

APPENDIX B8

Green River Basin—Colorado and Wyoming

Metric tons of carbon dioxide equivalent

Parent company	2014 methane emissions	Number of wells	Methane emissions per well
BP America	801,193	2,031	394
Questar Corp.	252,893	517	489
Linn Energy LLC	178,242	1,060	168
Anadarko Petroleum Corp.	160,553	841	191
QEP Resources Inc.	156,707	1,265	124
Ultra Petroleum Corp.	143,196	1,770	81
EOG Resources Inc.	131,632	727	181
BreitBurn Energy Partners LP	121,306	283	429

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016). CAP used the parent company names reported to the EPA and did not modify the parent company data to reflect mergers, acquisitions, or name changes.

APPENDIX B9

Gulf Coast Basin—Louisiana and Texas

Metric tons of carbon dioxide equivalent

Parent company	2014 methane emissions	Number of wells	Methane emissions per well
Lewis Energy Group	1,154,730	1,682	687
ConocoPhillips Corp.	918,017	3,103	296
EOG Resources Inc.	452,364	2,077	218
Alta Mesa Holdings LP*	272,446	N/A	N/A
Chesapeake Energy Corp.	270,447	1,271	213
Occidental Petroleum Corp.	169,841	1,480	115
Marathon Oil Corp.	162,539	998	163
Hilcorp Energy Company	159,197	6,664	24
EP Energy E&P Company LP	130,756	489	267
ExxonMobil Corp.	120,574	581	208
Sanchez Oil & Gas Corp.	109,666	393	279
Halcón Resources Corp.	104,301	285	366

* These companies did not report well count data for the basin in 2014; as a result, CAP was unable to calculate per-well emissions for these companies.

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016). CAP used the parent company names reported to the EPA and did not modify the parent company data to reflect mergers, acquisitions, or name changes.

APPENDIX B10

Permian Basin—New Mexico and Texas

Metric tons of carbon dioxide equivalent

Parent company	2014 methane emissions	Number of wells	Methane emissions per well
Diamondback Energy Inc.	432,156	682	634
Cimarex Energy Co.	388,449	1,604	242
Loews Corp.	385,869	6,069	64
COG Operating LLC	239,991	4,250	56
Yates Petroleum Corp.	227,661	1,695	134
Endeavor Energy Resources LP	223,301	13,090	17
Devon Energy Corp.	215,920	2,907	74
Parsley Energy Inc.	196,632	139	1,415
Pioneer Natural Resources Company	184,660	7,608	24
SandRidge Exploration and Production LLC	173,911	2,328	75
EOG Resources Inc.	163,364	914	179
Anadarko Petroleum Corp.*	149,880	N/A	N/A
EP Energy E&P Company LP	124,306	229	543
RKI Exploration & Production	115,045	588	196
ExxonMobil Corp.	108,679	4,343	25
Apache Corp.	102,581	11,237	9

* These companies did not report well count data for the basin in 2014; as a result, CAP was unable to calculate per-well emissions for these companies.

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016). CAP used the parent company names reported to the EPA and did not modify the parent company data to reflect mergers, acquisitions, or name changes.

APPENDIX B11

Piceance Basin—Colorado

Metric tons of carbon dioxide equivalent

Parent company	2014 methane emissions	Number of wells	Methane emissions per well
Encana Corp.	610,799	3,896	157
WPX Energy Inc.	536,143	4,689	114
Vanguard Natural Resources LLC	185,532	930	199
Occidental Petroleum Corp.	176,889	805	220

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016). CAP used the parent company names reported to the EPA and did not modify the parent company data to reflect mergers, acquisitions, or name changes.

APPENDIX B12

San Juan Basin—Colorado and New Mexico

Metric tons of carbon dioxide equivalent

Parent company	2014 methane emissions	Number of wells	Methane emissions per well
ConocoPhillips Corp.	2,655,605	9,864	269
BP America	1,045,493	3,425	305
ExxonMobil Corp.	514,969	1,788	288
Energen Corp.	271,772	1,471	185
WPX Energy Inc.	136,238	1,088	125
Chevron Corp.	131,153	1,297	101

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016). CAP used the parent company names reported to the EPA and did not modify the parent company data to reflect mergers, acquisitions, or name changes.

APPENDIX B13

Strawn Basin—Texas

Metric tons of carbon dioxide equivalent

Parent company	2014 methane emissions	Number of wells	Methane emissions per well
Chesapeake Energy Corp.	480,634	2,333	206
EOG Resources Inc.	390,384	941	415
ExxonMobil Corp.	306,030	1,742	176
EnerVest Operating Company	134,698	375	359
Premier Natural Resources LLC	111,302	296	376

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016). CAP used the parent company names reported to the EPA and did not modify the parent company data to reflect mergers, acquisitions, or name changes.

APPENDIX B14

Uinta Basin—Utah

Metric tons of carbon dioxide equivalent

Parent company	2014 methane emissions	Number of wells	Methane emissions per well
EOG Resources Inc.	519,267	1,304	398
Anadarko Petroleum Corp.	408,168	3,048	134
QEP Resources Inc.	392,056	847	463
EnerVest Operating Company	229,354	330	695
ExxonMobil Corp.	206,524	609	339
Bill Barrett Corp.	146,689	276	531
EP Energy E&P Company LP	118,337	545	217

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016). CAP used the parent company names reported to the EPA and did not modify the parent company data to reflect mergers, acquisitions, or name changes.

APPENDIX B15

Williston Basin—Montana, North Dakota, and South Dakota

Metric tons of carbon dioxide equivalent

Parent company	2014 methane emissions	Number of wells	Methane emissions per well
ExxonMobil Corp.	324,849	812	400
QEP Resources Inc.	210,791	273	772
Hess Corp.	134,906	1,029	131
Whiting Petroleum Corp.	131,034	1,520	86
Statoil	127,540	513	249

Source: Author's analysis of methane emissions data obtained from U.S. Environmental Protection Agency, "EPA Facility Level GHG Emissions Data: Onshore Oil and Gas Production," available at <https://ghgdata.epa.gov/ghgp/main.do> (last accessed April 2016). CAP used the parent company names reported to the EPA and did not modify the parent company data to reflect mergers, acquisitions, or name changes.

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