

Frackademia in Depth

An analysis of the oil and gas industry's case for fracking



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About the Public Accountability Initiative

The Public Accountability Initiative (PAI) is a non-profit, non-partisan research and educational organization focused on corporate and government accountability. In addition to publishing research on critical public accountability issues, PAI maintains LittleSis.org, an involuntary facebook of powerful people and tool for power research that was used to compile data for this report. PAI's work is funded by a variety of non-profit sources (all funding sources are listed at <http://public-accountability.org/about/funding>). PAI's research on the oil and gas industry and fracking is funded by the 11th Hour Project of the Schmidt Family Foundation and by the Park Foundation.

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Introduction

In the wake of New York State's decision to ban fracking, drilling proponents have criticized Governor Andrew Cuomo and his administration for basing the decision on "pseudo science" and "junk science." When asked about the New York fracking ban at his 2015 "State of American Energy" press conference, American Petroleum Institute President and CEO Jack Gerard called for "more thoughtful consideration as to economics, environment, and sound science – because the science is clearly on the side of development and on the side of industry."¹

Over the years, some of this science has proven less than reliable. In a trend that became known as "frackademia," several universities issued industry-friendly fracking studies that the institutions later retracted and walked back due to erroneous central findings, false claims of peer review, and undisclosed industry ties. The studies bore the hallmarks of an industry effort to manipulate and corrupt the scientific debate around fracking, much like the tobacco industry manipulated the scientific debate around the dangers associated with smoking.

This report suggests that those studies, rather than being isolated cases, were consistent with a larger pattern – pro-fracking scholarship is often industry-tied and lacking in scientific rigor. An in-depth look at frackademia reveals that many of these kinds of studies have been produced by industry and its allies in academia, in government, and in the consulting world.

The report approaches this topic by analyzing a broad set of fracking studies that the industry has put forward to help it make its case. Specifically, the report considers an extensive list of over 130 studies compiled by an oil and gas industry group, Energy in Depth. The list was specifically used to convince the government of Allegheny County, Pennsylvania, home of the city of Pittsburgh, to lease mineral rights under its Deer Lakes Park to Range Resources for gas drilling.² Though that decision was a relatively minor one in the context of the nationwide fracking debate, the list provides a telling window onto the fracking research that the industry believes is fit for public consumption, and which it uses to make the case that the science around the issue is settled.

The report assesses the relative independence and quality of the studies by identifying and classifying each study's industry ties – through funders, authors, and issuers – and determining whether it was peer-reviewed. The results of this analysis are summarized in an abridged data table below, and included in full in the online data table accompanying the report. The data suggests that even when the industry searches far and wide for studies to make its case, it ultimately must rely heavily on studies that are marred by conflicts of interest and lacking in academic rigor. Some key findings:

- **Most of the studies – 76% – had some degree of industry connection.**

Of the 137 unique studies on EID's list that could be located, 56 had strong ties to the oil and gas industry. Another 35 had industry ties that PAI classified as medium, and 13 studies had other industry ties that were present, but relatively weak. Studies classified as strongly tied to industry were funded or authored by industry sources, studies with medium ties were released by organizations with oil and gas funding or by consultants or banks tied to the industry, and studies

¹ "Transcript of Jack Gerard's 2015 State of American Energy press conference", American Petroleum Institute. Accessed at: <http://www.api.org/news-and-media/testimony-speeches/2015/jack-gerard-soae-2015-press-conference-transcript>

² "List of Hydraulic Fracturing Studies", Energy in Depth. Accessed at: <http://www.county.allegheny.pa.us/Studies.aspx>

with weak ties were produced in part by oil and gas contractors or otherwise had more attenuated ties than other studies. A more complete description of how studies were classified appears in the “Methodology” section below.

- **Only 14% of the studies listed were peer-reviewed.**

Of the 137 unique studies on EID’s list that could be located, only 19 were peer-reviewed. This suggests that there is a significant shortage of serious scholarly research supporting the case for fracking. Of the studies that were peer-reviewed, ten were tied to the industry - four with strong ties, two with medium ties, and another four with weak ties. One “study” was a comment on a previous study rather than a study in its own right, though it was published in a peer-reviewed journal, and so was counted among the peer-reviewed studies. Another study could not be located to determine whether it had been peer-reviewed.

- **Only one peer-reviewed study explicitly dealt with public health concerns, and it was industry-funded.**

In the wake of New York State’s fracking decision, which was based largely on its study of health concerns, the importance of public health studies has risen to the fore. Despite the size of EID’s list, there was only one peer-reviewed study that dealt specifically with public health concerns, and it was industry-funded. The other eight peer-reviewed studies that EID classified as “Public Health/Environment” dealt with methane emissions, though other studies on the list addressed water quality issues.

- **The list included retracted and discredited studies, including studies that made false claims of peer review.**

EID’s list of studies, compiled at some during 2014, includes two studies that resulted in corrective action by the universities that issued them – one was retracted, and the other led to the closing of the research institute that issued it. These studies were found to be marred by poor scholarship, undisclosed conflicts of interest, and false claims of peer review. In November 2012, the State University of New York at Buffalo shuttered its Shale Resources and Society Institute after it was revealed that the major conclusion of SRSI’s one published report was derived from a math error and that the report’s authors had undisclosed oil and gas ties. In December 2012 an independent panel convened by the University of Texas concluded that a report issued by UT’s Energy Institute “fell short of the standards of contemporary science.”

- **Prominent industry associations funded and issued studies.**

17 of the studies were either funded or issued by the American Petroleum Institute or the American Gas Association. This includes a set of guidelines and a PowerPoint presentation created by API for an industry workshop that were, nonetheless, presented as studies.

- **Government and industry hired the same consulting firms.**

ALL Consulting, IHS CERA, and ICF International were contracted by both government agencies and industry associations to produce 15 studies around natural gas included on EID’s list. Three of the studies were performed under government contracts while the rest were either commissioned by industry associations or think tanks connected to industry. The industry contracts with these firms raise conflict of interest concerns and illustrate how diverse partners, beyond academia, are being engaged to produce “frackademic” research.

- **The list inflates a generally weak scientific case by including studies multiple times and listing “studies” that were actually blog posts, non-binding guidelines, and PowerPoint presentations.**

Listed along with actual studies are a blog post from the oil-and-gas-funded Energy in Depth, a set of guidelines issued by the American Petroleum Institute, and an American Petroleum Association press release. There were also three PowerPoint-style presentations. Seven of the studies on EID’s list were included multiple times, sometimes under different subject headings, as if to strengthen EID’s case. One study, a 2013 examination of methane emissions at gas drilling sites convened by the Environmental Defense Fund, was listed three different times in the list’s “Public Health/Environment” section. The industry-funded study was published in a prestigious journal, Proceedings of the National Academy of Sciences, which published a correction after several authors failed to disclose significant financial conflicts of interest.

Below, PAI has profiled some of the studies from EID’s list as well as some of the organizations and people involved with funding, preparing, and publishing the studies. Though a comprehensive content analysis of all 138 studies is beyond the scope of this report, a data table of all the studies, how they were categorized, and current links to reports that PAI could locate is available on PAI’s website. The data table also identifies and classifies each study’s industry ties through funders, issuers, and authors, whether the study was peer-reviewed, and other notes on the studies. An abridged version of that data set is included in this report, identifying the studies included on Energy in Depth’s list, the organizations that issued them, and the type and extent of their ties to the oil and gas industry.

Methodology

In order to assess the body of research behind the industry's scientific case for fracking, PAI analyzed an extensive list of studies compiled by an industry group, Energy in Depth (EID).³ Range Resources submitted the list to the Allegheny County government in April 2014 as it was considering whether to lease mineral rights in its Deer Lakes Park to the company. The list resembles several other lists compiled by EID; PAI analyzed the Allegheny County version because it was used in the context of a policy proceeding. Since EID represents a large portion of the industry, however, it is likely that versions of the list have been used elsewhere in similar policymaking contexts.

The list is clearly designed to help convince legislators that there is a strong scientific case that fracking is safe. Its brief introductory paragraph states that "The production of oil and natural gas from deep shale formations and other "tight" reservoirs, and the use of hydraulic fracturing, have been closely regulated and extensively studied for many years." Unsurprisingly, the list does not include studies that are highly critical of fracking. As such, it provides a useful compendium of fracking studies that are industry-friendly, or at least not markedly unfavorable to industry.

PAI assessed the relative quality of the studies by determining whether they were peer-reviewed and analyzed the relative independence of the studies by researching their industry ties. Out of the 146 entries on the list provided to the Allegheny County government, 138 were unique. Of those, PAI analyzed 137 for financial and employment ties to the oil and gas industry, categorizing entries as having strong, medium, weak, or no industry connections based on the following classification system:⁴

Strong – Studies directly funded by oil and gas firms or trade groups; studies with authors who work for the oil and gas industry; studies that were issued by oil and gas companies or trade groups.

Medium – Studies released by organizations with oil and gas funding; studies released by organizations that contracted with oil and gas consultants or groups for research; financial analyses from banks for which investing in and financing oil and gas operations is a significant component of their business.

Weak – Studies produced only in part by an oil and gas industry contractor or studies where the author had past or indirect ties to industry.

None identified – When no oil and gas ties were identified during research, or when ties were so tenuous as to render it highly unlikely that they exerted any influence on the study's content.

³ The list itself does not identify an author, but it closely resembles other EID lists. In email correspondence with PAI researcher Robert Galbraith, Energy in Depth California Director David Quast said that the list presented to Allegheny County was produced by EID, "or at least it looks like it."

⁴ Two items on the list, one released by the National Oceanic and Atmospheric Administration (NOAA) and one released by PricewaterhouseCoopers (PwC), could not be located. The NOAA study was omitted from our analysis; however, the PwC study was included, as a report from a financial analyst such as PwC was extremely unlikely to be peer-reviewed and analysis of other PwC studies revealed oil and gas connections at that organization.

Studies that revealed no direct ties to the industry, but relied disproportionately on industry sources, are addressed in the “Anomalies” section below.

All unique studies found to possess industry connections were further coded by the type of connection. This coding classification is as follows:

‘F’ – funded directly by industry or industry trade groups.

‘A’ – written by authors employed by the oil and gas industry at the time of the report.

‘C’ – written by individual consultants or consulting firms with an energy industry focus or client base.

‘M’ – issued or prepared by a trade group or association with an oil and gas membership base.

‘I’ – issued and/or prepared by organizations that receive indirect or partial funding from industry. This includes think tanks that receive industry donations as part of their operating budget.

‘O’ – authored by individuals with past, attenuated, or indirect links to industry or were studies that relied disproportionately on industry information.

Studies may have more than one code.

The EID list contained three PowerPoint-style presentations, a blog post, and a set of well construction guidelines. Since these documents were included in this list, they were coded, but noted as nontraditional studies.

An abridged table is appended to this report, listing the names and issuing organizations of all 146 studies from EID’s list as well as how they were coded. The full dataset, available on PAI’s website, includes detailed notes on each study’s industry ties.

Further, the connections between the various people and organizations analyzed in preparing this report can be seen on LittleSis, PAI’s open database of who knows who in business and government. LittleSis (the opposite of “Big Brother”) tracks powerful people and organizations and the relationships between them. Using LittleSis, researchers can track and analyze complex sets of connections, such as those documented in this report. The data in this report can be found on LittleSis by viewing the profile pages for individuals and organizations on the site’s “Frackademia in Depth” list:
http://littlesis.org/list/783/Frackademia_in_Depth

Anomalies: Reports outside of the coding metrics

Four of the studies included in EID’s list were not directly linked to industry but disproportionately relied on information supplied by industry, featured commentary by industry representatives, or were subject to review by individuals connected to industry.

In 2011 the Michigan House of Representatives released a report detailing their investigation into Michigan's natural gas supply. "The Natural Gas Subcommittee Report on Energy and Job Creation" considered testimony and comments from stakeholders across the fracking debate, yet industry commentators outnumbered outside commentators three to one.

The UK House of Commons also released a report in 2011 detailing the extent of shale gas resources available in the UK. Although the report concluded that the UK's domestic shale reserves would not be a "game changer," the sources of testimony leaned heavily to industry. Ten of the 27 sources were from oil and gas companies and an industry-funded think tank.

In 2012 the National Research Council released "Induced Seismicity Potential in Energy Technologies," which examined the role of fracking in seismic events. The group selected to review and provide comments on the National Research Council's report included Brian Clark, Shawn Maxwell, and J. R. Anthony Pearson of Schlumberger, an oil services company, Dan Arthur of ALL Consulting, an industry-consultant, and John Bredehoeft of The Hydrodynamics Group, an industry contractor.

Credit rating agency Standard & Poor's 2013 report "Low-Cost Shale Gas Gives North American Petrochemical Producers Advantages Over Europe" was largely based on takeaways from a 2013 industry-sponsored IHS conference in Houston, Texas. IHS is an industry consultant that was responsible for seven of the reports on EID's list. The 2013 IHS World Petrochemical Conference referenced in S&P's report was sponsored by ExxonMobil Chemical and Polymerupdate, an industry news organization.

Summary Data

The following tables summarize key findings from PAI's analysis of the EID list:

Table 1: Strength of industry ties

Strength of industry ties	Number of studies	Percent of all studies
Strong	56	41%
Medium	35	26%
Weak	13	10%
None found	33	24%

Table 2: Type of industry ties

Codes	Number of studies	Percent of all studies
F (direct funding)	36	26%
A (author ties)	22	16%
C (industry consultant)	37	27%
M (industry member base)	18	13%
I (indirect funding)	20	14%
O (other)	10	7%

Table 3: Peer review

Peer-reviewed	Number of studies	Percent of all studies
Yes	19	14%
No	118	87%

Studies & “Studies”: The Industry’s Low Standards for Fracking Research

For a list that is supposed to make the case that fracking is “closely regulated and extensively studied,” the EID list includes numerous instances of research that do not meet conventional standards of scientific study.

Among the “studies” included are reports that were retracted and discredited by the institutions that published them after public controversy over their scholarship, guidance documents produced by the oil and gas industry, PowerPoint slideshows, and blog posts. Further, Energy in Depth included several studies on its list multiple times and under multiple subject headings. One study, “Measurements of methane emissions at natural gas production sites in the United States,” was listed three times in the “Public Health/Environment” section. Finally, the list includes several reports whose findings are either irrelevant or directly contradict the notion that fracking is so extensively studied and regulated as to render moot any further discussion of its safety.

Range Resources appears to have counted on policymakers not actually reading the studies and “studies” included in its list, and rather being swayed by the quantity of documents over the quality of the research or support for the industry’s position. It is difficult to otherwise account for their inclusion of discredited, duplicative, or irrelevant research.

This section details some examples of the kinds of “studies” included on EID’s list, and also serves as a useful guide to some of the more notable instances of “frackademia.”

“Environmental Impacts During Marcellus Shale Gas Drilling: Causes, Impacts, and Remedies” by Timothy Considine, Robert Watson, Nicholas Considine, and John Martin

Released in May 2012, the first study from the Shale Resources and Society Institute (SRSI) at the State University of New York at Buffalo claimed that fracking in Pennsylvania was becoming safer thanks to improved regulation and industry practices. The study was authored by University of Wyoming economist Timothy Considine, who was also the lead author of three other, industry-funded studies on EID’s list.⁵ In the press release for the report, Considine asserted that the data in the report “demonstrates, without ambiguity, that state regulation coupled with improvements in industry practices results in a low risk of an environmental event.”⁶

SRSI claimed in its press release that the study was peer-reviewed, but quickly retracted that claim after it was pointed out that the study was not, in fact, peer-reviewed, but rather had been subject to an informal review by a panel that included one of the co-directors of the institute.⁷ Soon thereafter PAI published a report, “The UB Shale Play,” detailing how Considine’s central conclusion, that the rate of environmental impacts from fracking in Pennsylvania had declined from 2008 to 2011, was not supported at all by the

⁵ These are the “Penn State Studies,” described below.

⁶ Cory Nealon, “UB’s Shale Resources and Society Institute Examines Violations in Developing Natural Gas in Pennsylvania’s Marcellus Shale”, University at Buffalo (May 15, 2012). Accessed at: <http://www.buffalo.edu/news/releases/2012/05/13434.html>

⁷ *Id.*

data in the study and was actually premised on a mathematical error.⁸ “The UB Shale Play” also pointed out how passages from the SRSI study had been copied without attribution from a previous report Considine had produced for the industry-funded Manhattan Institute.

After nearly six months of outcry from SUNY Buffalo students, faculty, and staff, and an investigation into the circumstances surrounding SRSI’s founding, funding, and staffing by SUNY trustees, the institute was closed in November 2012.

A more in depth discussion of the SRSI report and the ensuing investigation can be read in the PAI reports “The UB Shale Play” and “Investigation Obstructed,” available on our website.⁹

“Fact-Based Regulation for Environmental Protection in Shale Gas Development” by Charles Groat, Thomas Grimshaw, Matt Eastin, Ian Duncan, and Hannah Wiseman

Released under the headline “New Study Shows No Evidence of Groundwater Contamination from Hydraulic Fracturing,” this report from the Energy Institute at the University of Texas, Austin was a review of media coverage, public perception, and scientific investigations into environmental impacts of fracking and a summary of state regulations and enforcement.¹⁰ Energy Institute Director Raymond Orbach called the study “the first peer-reviewed analysis of the environmental impacts of hydraulic fracturing” and principal investigator Charles “Chip” Groat focused on the assertion that fracking had never contaminated groundwater when he presented the study at the February 2012 meeting of the American Association for the Advancement of Science. That claim was subsequently picked up and widely repeated in the press.

A PAI review revealed that this claim was very carefully parsed from one section of the 414-page report and dissembled the issue by using “hydraulic fracturing” to mean only the production phase where the well is injected with fracking fluid, as opposed to the entire drilling process (as laypeople tend to use the term). More noteworthy, PAI found that the report had not been subject to peer review, but was rather published in a draft form. Two of four sections, including the environmental impacts section that was supposed to support the contamination claim, were labeled “draft” on every page and were marked up in red ink pointing to unsourced claims and missing references. Most significantly, PAI found that Groat, the study’s leader and its public presenter, had failed to disclose to UT, AAAS, and readers of the report that he was a paid board member of Plains Exploration and Production, an oil and gas company that engages in fracking.

After PAI detailed its findings in a report titled “Contaminated Inquiry,” UT convened a panel to review the study. That panel found that the study “[fell] short of the generally accepted rigor required for the

⁸ Kevin Connor, Robert Galbraith, Benjamin Nelson, “The UB Shale Play”, Public Accountability Initiative (May 24, 2012). Accessed at: <http://public-accountability.org/2012/05/ub-shale-play/>

⁹ *Id.* and Robert Galbraith and Kevin Connor, “Investigation Obstructed”, Public Accountability Initiative (November 14, 2012). Accessed at: <http://public-accountability.org/2012/11/investigation-obstructed/>

¹⁰ Charles Groat and Thomas Grimshaw, “Fact-Based Regulation for Environmental Protection in Shale Gas Development”, University of Texas at Austin (February 2012). Accessed at: http://www.velaw.com/UploadedFiles/VEsite/Resources/ei_shale_gas_reg_summary1202%5b1%5d.pdf

publication of scientific work” and recommended that it be withdrawn.¹¹ Just before the reviewers’ report was released, Groat retired from UT Austin and Orbach resigned.¹²

It is unclear why a study that had been retracted and thoroughly discredited would be included on a list of studies supposedly intended to inform the public and policymakers.

“The Future of Natural Gas” by Ernest Moniz, Henry Jacoby, Anthony Meggs, et al.

In June 2011, the MIT Energy Initiative (MITEI) published “The Future of Natural Gas,” a report touting natural gas as a clean, abundant energy source that could provide a “bridge to a low-carbon future.” The study group, led by then-MITEI director (and current Secretary of Energy) Ernest Moniz, MIT professor of management Henry Jacoby, and Talisman Energy senior advisory Anthony Meggs, argued that an abundance of natural gas could be produced at a “relatively low cost,” and that doing so would provide an opportunity to reduce US power sector carbon dioxide emissions by up to 20 percent.¹³ The authors also advocated the expansion of liquefied natural gas (LNG) exports as “beneficial to US and global economic interests.”¹⁴ Environmental impacts of shale development were dismissed as “challenging but manageable,” and the authors devoted an entire appendix to countering a 2011 study from Cornell University that found, due to methane leaks associated with production and transportation, natural gas may actually be worse for the climate than coal.

MIT amplified the researchers’ pro-gas conclusions, releasing the study with the headline “Report: Natural gas can play a major role in greenhouse gas reduction,” and with a quote from Moniz: “Natural gas truly is a bridge to a low-carbon future.”¹⁵ This narrative was carried forward in the media, where a slew of stories repeated the bridge fuel claim.¹⁶ The *New York Times* public editor pointed to the study in a column criticizing the paper’s critical coverage of natural gas.¹⁷

“The Future of Natural Gas” was, in large part, funded by the oil and gas industry, and PAI found several undisclosed oil and gas ties among its authors. The study’s authors acknowledge “first and foremost” the American Clean Skies Foundation, a non-profit focused on “advanc[ing] America’s energy independence and a cleaner, low-carbon environment” (primarily through expanding natural gas usage) that was organized by Chesapeake Energy and its then-CEO, Aubrey McClendon, who is now the founder and head of American Energy Partners.¹⁸ At the time of the MIT report, ACSF was directed by a board of

¹¹ Norman Augustine, Rita Colwell, James Duderstadt, “A Review of the Processes of Preparation and Distribution of the Report ‘Fact-Based Regulation for Environmental Protection in Shale Gas Development’”, University of Texas at Austin (December 6, 2012). Accessed at: <http://www.utexas.edu/opa/wordpress/news/files/Review-of-report.pdf>

¹² “University of Texas Accepts Findings on Shale Gas Development Report”, University of Texas at Austin (December 6, 2012). Accessed at: <http://www.utexas.edu/news/2012/12/06/university-accepts-shale-g>

¹³ “The Future of Natural Gas”, Massachusetts Institute of Technology (June 2011). Accessed at: https://mitei.mit.edu/system/files/NaturalGas_Report.pdf

¹⁴ *Id.*

¹⁵ David L Chandler, “Report: Natural gas can play a major role in greenhouse gas reduction”, Massachusetts Institute of Technology (June 9, 2011). Accessed at: <http://newsoffice.mit.edu/2011/natural-gas-full-report-0609> and “MITEI-led study offers comprehensive look at the future of natural gas”, Massachusetts Institute of Technology (June 25, 2010). Accessed at: <http://newsoffice.mit.edu/2010/gas-report-0625>

¹⁶ See, e.g. Andrew Revkin, “An M.I.T. Plan for Natural Gas with Planet in Mind”, *New York Times* DotEarth Blog (June 9, 2011). Accessed at: <http://dotearth.blogs.nytimes.com/2011/06/09/an-m-i-t-plan-for-natural-gas-with-planet-in-mind/> and “Bright future for natural gas, study says”, United Press International (June 10, 2011). Accessed at: http://www.upi.com/Business_News/Energy-Resources/2011/06/10/Bright-future-for-natural-gas-study-says/UPI-78071307730357/

¹⁷ Arthur Brisbane, “Clashing Views on the Future of Natural Gas”, *New York Times* Public Editor’s Blog (July 16, 2011). Accessed at: http://www.nytimes.com/2011/07/17/opinion/sunday/17pubed.html?_r=0

¹⁸ “About”, American Clean Skies Foundation. Accessed at: <http://www.cleanskies.org/about/>

industry representatives, including McClendon himself and Chesapeake's senior vice president for corporate development and government relations, Thomas S Price, Jr. The MIT report's other funders were Hess and Exelon, which drill for gas and burn it for power generation respectively; the Gas Technology Institute, a research, development, and training organization for the gas industry; and the Colombian National Hydrocarbons Agency, which administers the country's oil and gas resources.

While the report's funders were acknowledged in the paper's forward, the research group and advisory council had several oil and gas industry conflicts of interest that went undisclosed.

Study chair Ernest Moniz took a position on the board of ICF International, a consulting firm with oil and gas ties, just prior to the report's release, earning \$288,022.50 from the company before becoming US Secretary of Energy.¹⁹ He also served as a paid advisor to Riverstone Equity Holdings, an energy-focused private equity firm with nearly all of its assets in the fossil fuel sector.²⁰ Moniz earned at least \$75,000 in the position.²¹ Moniz further served on the advisory board of NGP Energy Technology Partners, which invests in oil and gas companies, from 2006 to 2013, though he was not compensated for this position. NGP ETP is managed by Philip Deutch, the son of MIT professor and study group member John Deutch.²²

Study group co-chair Anthony Meggs, who presented the MIT report's finding that the environmental impacts of fracking are "challenging but manageable" at the 2011 press conference for the report, joined gas exploration and production company Talisman Energy as a senior adviser one month prior to the release of the report, in May 2011.²³ He later became executive vice president at Talisman, where he led studies of gas monetization options such as gas-to-liquids and LNG.²⁴ Meggs was BP's head of technology before joining MIT as a visiting engineer in 2008, and is currently a senior advisor to the oil and gas industry at the corporate consulting firm Marakon.²⁵

Study group member and MIT professor John Deutch sits on the board of liquefied natural gas (LNG) company Cheniere Energy, which became the first company approved by the US to export LNG from the lower 48 states just less than a year after the MIT report's release.²⁶ He currently owns approximately \$4

¹⁹ Moniz earned \$37,603 in fees in 2011, \$72,000 in 2012, and \$36,000 in 2013 according to SEC filings. Moniz was also compensated with 4,952 shares of ICF in 2011, which he sold in May 2013 at \$28.76 per share. See Form DEF 14A, ICF International (April 25, 2014). Accessed at: https://www.sec.gov/Archives/edgar/data/1362004/000143774914007219/ifci20140415_def14a.htm, Form DEF 14A, ICF International (April 26, 2013). Accessed at: <https://www.sec.gov/Archives/edgar/data/1362004/000119312513177600/d483771ddef14a.htm>, Form DEF 14A, ICF International (April 20, 2012). Accessed at: <https://www.sec.gov/Archives/edgar/data/1362004/000119312512171567/d335055ddef14a.htm>, and Form 4, Ernest Moniz (May 20, 2013). Accessed at: <https://www.sec.gov/Archives/edgar/data/1265177/000118143113029190/xsIF345X03/rrd380553.xml>

²⁰ "Riverstone Holdings, LLC", Whale Wisdom. Accessed at: <http://whalewisdom.com/filer/riverstone-holdings-llc>

²¹ Bryan Bender, "MIT's Ernest Moniz advised oil and gas investors" (March 30, 2013). Accessed at: <http://www.bostonglobe.com/news/politics/2013/03/30/omama-energy-pick-discloses-industry-ties/DZZakS0jOGacmzoqogxHFL/story.html>

²² "Investment Team", NGP Energy Technology Partners. Accessed at: <http://www.ngpetp.com/team.php>

²³ David L Chandler, "Report: Natural gas can play a major role in greenhouse gas reduction", Massachusetts Institute of Technology (June 9, 2011) and "Tony Meggs", LinkedIn. Accessed at: <https://www.linkedin.com/pub/tony-meggs/12/a16/a27>

²⁴ *Id.*

²⁵ *Id.*

²⁶ "Board of Directors", Cheniere Energy. Accessed at: <http://www.cheniere.com/corporate/directors.shtml> and Brian Wingfield and Joe Carroll, "Cheniere Wins Approval for Biggest U.S. Gas-Export Terminal", *Bloomberg Businessweek* (April 17, 2012). Accessed at: <http://www.businessweek.com/news/2012-04-16/cheniere-wins-u-dot-s-dot-approval-for-natural-gas-export-terminal>

million worth of Cheniere stock.²⁷ Deutch served on the advisory board of his son's oil and gas investment group, NGP Energy Technology Partners, with Moniz during the study, and still advises the firm.²⁸ Deutch also sat on the board of oilfield services company Schlumberger from 1997 until he retired in 2007 (current MIT president L. Rafael Reif joined the Schlumberger board in 2007, and owns approximately \$1.5 million in stock).²⁹

The advisory committee, though billed as a group of "leaders from industry, government and environmental groups," was dominated by individuals with oil and gas ties.³⁰ Further, the MIT Energy Initiative itself receives extraordinary amounts of funding – over \$150 million over its eight-year history – from oil and gas giants like BP and Chevron.³¹

PAI's report on the study, "Industry Partner or Industry Puppet?", can be found on our website.³²

The Penn State Studies by Timothy Considine, Robert Watson, et al.

From 2009 through 2011, Pennsylvania State University published a series of reports attempting to quantify and predict the economic impact of fracking in Pennsylvania. The studies were led by Timothy Considine, the lead author of the University at Buffalo study described above, and funded by the Marcellus Shale Coalition, an oil and gas lobbying group. As a whole, the Penn State studies predicted huge economic gains for Pennsylvania and hundreds of thousands of natural gas industry jobs. The studies also strongly recommended against levying a tax on natural gas at the wellhead – known as a "severance tax." The studies were widely cited by drilling proponents, both within Pennsylvania in the debate over whether to implement a severance tax and in other communities weighing the costs of fracking against its benefits, and to this day Pennsylvania remains the largest drilling state without a severance tax.

In 2010, before the publication of the second installment in the series, a landowner advocacy group, the Responsible Drilling Alliance, raised issues with Considine's numbers, his advocacy for a specific policy outcome vis-a-vis the severance tax, and his failure to disclose the study's funders while branding every page of the report with the Penn State logo.³³ After investigating the study, Penn State's Dean of the College of Earth and Mineral Sciences retracted the original version of the report, chastising Considine for failing to disclose his funders and for "cross[ing] the line between policy analysis and policy advocacy" for actively arguing against the severance tax. The study was reissued with a note about its funding and with the Penn State logo removed from all but the cover.

²⁷ Deutch's 55,577 shares of Cheniere were valued at \$73.40 at the market's close on January 26, 2015. See "Insider transactions: John M Deutch", United States Securities and Exchange Commission. Accessed at: <https://www.sec.gov/cgi-bin/own-disp?action=getowner&CIK=0001179111>

²⁸ "Strategic Advisory Board", NGP Energy Technology Partners. Accessed at: http://www.ngpetp.com/strategic_advisory_board.php

²⁹ Reif's 17,500 shares of Schlumberger were valued at \$83.68 at the market's close on January 26, 2015. See "Insider transactions: Rafael Reif", United States Securities and Exchange Commission. Accessed at: <https://www.sec.gov/cgi-bin/own-disp?action=getowner&CIK=0001396628>

³⁰ "The Future of Natural Gas Advisory Committee", LittleSis.org. Accessed at: http://littlesis.org/list/397/%22The_Future_of_Natural_Gas%22_Advisory_Committee

³¹ MITEI's "Founding Members" BP, Eni, ExxonMobil, Saudi Aramco, and Shell all committed \$5 million per year for five years to MITEI. In 2012, BP made a second \$25 million pledge. Other oil and gas companies have also contributed to MITEI in smaller increments. See "Members", Massachusetts Institute of Technology. Accessed at: <http://mitei.mit.edu/support/members>

³² Kevin Connor and Robert Galbraith, "Industry Partner or Industry Puppet?", Public Accountability Initiative. Accessed at: http://public-accountability.org/wp-content/uploads/industry_partner_or_industry_puppet.pdf

³³ "The Penn State Report", Responsible Drilling Alliance. Accessed at: http://responsibledrillingalliance.org/index.php?option=com_content&view=article&id=265:the-penn-state-report&catid=44&Itemid=235

Critics have also challenged the numbers Considine and his co-authors predicted with respect to the economic gains Pennsylvania would realize from the shale gas industry. They reported in the first installment of the series, titled “An Emerging Giant: Prospects and Economic Impacts of Developing the Marcellus Shale Natural Gas Play,” that the Marcellus shale gas industry generated a total economic impact of \$2.3 billion, 29,000 jobs, and \$240 million in state and local tax revenue through 2009. The study predicted the industry would create in excess of 48,000 jobs in 2009, 107,040 in 2010 and almost 175,000 jobs in 2020. However, a 2011 report from the Marcellus Shale Education & Training Center (MSETC), a collaboration of Pennsylvania College of Technology and Penn State Cooperative Extension, found fracking gains of “between 23,385 and 23,884 new jobs” in 2009, about 54% of Considine’s original estimate for that year, despite being based on the same gas company spending data Considine utilized in his reports.³⁴

The two iterations of the study that followed, “The Economic Impacts of the Pennsylvania Marcellus Shale Natural Gas Play: An Update” in 2010 and “The Pennsylvania Marcellus Natural Gas Industry: Status, Economic Impacts and Future Potential” in 2011, predicted even high employment and economic gains than the 2009 version. In the 2011 report, Considine and his co-authors projected that in 2020, the fracking industry would create 256,420 jobs, or 4% of the state’s entire labor force. These claims were subject to the same criticisms as Considine’s 2009 projections. Critics charged that Considine had changed settings on the software used to project the direct, indirect, and induced employment effects from fracking to overestimate how much gas industry spending was occurring within Pennsylvania and that he had double-counted indirect and induced jobs (i.e. jobs not in drilling itself, but supported by drilling, such as legal and financial work, and jobs created by increased spending in the economy, such as restaurant and entertainment work).³⁵

A 2011 report from the Ohio State University Swank Program in Rural-Urban Policy also took issue with Considine’s methodology more generally, saying “impact studies are not viewed as best practice by academic economists and would be rarely used in peer-reviewed studies by urban and regional economists.”³⁶

By 2012, support for Considine’s series had waned at Penn State, and the Marcellus Shale Coalition’s contract with the school was canceled in the fall that year. The Responsible Drilling Alliance, which had originally written about the study’s exaggerated economic benefits and lack of funding disclosure, filed a formal complaint with the Middle States Commission on Higher Education and no Penn State faculty members would join the study as co-authors.³⁷

Although the Penn State series of reports was canceled, Considine still carries water for the fracking industry. He is the lead author of another report from EID’s list, a projection of the economic benefit from

³⁴ Timothy W Kelsey, Martin Shields, James R Ladlee, and Melissa Ward, “Economic Impacts of Marcellus Shale in Pennsylvania: Employment and Income in 2009”, Marcellus Shale Training & Education Center (August 2011). Accessed at: <http://www.shaletec.org/docs/EconomicImpactFINALAugust28.pdf>

³⁵ Robert Galbraith, “Frackademics: Timothy Considine – Analyst or Advocate?”, Public Accountability Initiative (June 13, 2012). Accessed at: <http://public-accountability.org/2012/06/frackademics-timothy-considine-analyst-or-advocate/>

³⁶ Amanda L Weinstein and Mark D Partridge, “The Economic Value of Shale Natural Gas in Ohio”, The Ohio State University (December 2011). Accessed at:

http://aede.osu.edu/sites/aede/files/publication_files/Economic%20Value%20of%20Shale%20FINAL%20Dec%202011.pdf

³⁷ Jim Efstathiou Jr, “Penn State Faculty Snub of Fracking Study Ends Research”, *Bloomberg Businessweek* (October 3, 2012). Accessed at: <http://www.bloomberg.com/news/articles/2012-10-03/penn-state-faculty-snub-of-fracking-study-ends-research>

fracking in the same vein as the Penn State reports funded and published by the American Petroleum Institute.³⁸

Duplicate entries and “studies” that aren’t studies

As mentioned above, seven studies were included on EID’s list multiple times, sometimes in different sections of the list, making the list seem more extensive than it is. The study “Measurements of methane emissions at natural gas production sites in the United States,” published in the *Proceedings of the National Academy of Sciences* was listed three times in the “Public Health/Environment” section of EID’s list.

Other duplicate studies were: “Identifying Key Economic Impacts of Recent Increases in U.S. Natural Gas Production,” by the American Gas Association, which was included twice in the list’s “Manufacturing/Economy” section; “Benefits of Hydraulic Fracturing,” by the American Enterprise Institute, included once in the “Manufacturing/Economy” section and once in the “Public Health/Environment” section; “Shale Gas Production: Potential Versus Actual Greenhouse Gas Emissions,” an article from *Environmental Research Letters*, included twice in the “Public Health/Environment” section; “Characterizing Pivotal Sources of Methane Emissions from Natural Gas Production,” by API and ANGA, included twice in the “Public Health/Environment” section; “Assessing the greenhouse impact of natural gas,” from *Geochemistry, Geophysics, Geosystems*; and a 2011 draft of the Supplemental Generic Environmental Impact Statement for fracking prepared by the New York State Department of Environmental Conservation, included twice in the “Public Health/Environment” section.

Further, six of the documents presented as studies on EID’s list cannot be considered as such by even the most charitable definition. Listed along with actual studies are a blog post from Energy in Depth, a set of non-binding guidelines issued by the American Petroleum Institute, and an American Petroleum Institute press release. There were also three PowerPoint-style presentations, one prepared by API, one presented by ALL Consulting to the Groundwater Protection Council (see “The Consultants” and “The Government Players” below for more on these organizations), and one by the Energy Information Administration.

“Debunked” studies

The end of EID’s list is devoted to a section of studies the group claims have been debunked. Neither of the discredited studies from SUNY at Buffalo and UT Austin profiled above appear in EID’s “debunked” section; however, several peer-reviewed studies from reputable journals do. In fact, three of the studies EID claimed to have debunked come from two journals, *Groundwater* and *Climatic Change*, which published studies that EID included in its main list of research.

None of the studies listed as debunked appear to have been retracted by their publishers. The information provided as “debunking” the studies is limited to posts from the Energy in Depth blog and responses from the Marcellus Shale Coalition, an oil and gas lobbying group.

³⁸ Timothy J Considine, “The Economic Impacts of the Marcellus Shale: Implications for New York, Pennsylvania, and West Virginia” (July 14, 2010). Accessed at: <http://marcelluscoalition.org/wp-content/uploads/2010/09/API-Economic-Impacts-Marcellus-Shale.pdf>

Comparing the contents of the list of research the industry presents as legitimate science with the list of research it claims has been debunked reveals that the “debunked” list includes almost four times as many peer-reviewed studies, proportionally. Six of the 11 “debunked” studies (55%) were subject to peer review, while only 19 of the 137 locatable studies (14%) on the main list were.

Table 4: Peer review in EID’s main list of studies versus the studies it lists as “debunked”

	Peer-reviewed Studies	Non-peer-reviewed studies	Percent Peer-Reviewed
Main List	19	118	14%
“Debunked” List	6	5	55%

Key Players

The following section profiles some of the key players in industry, government, and consulting involved in financing and producing the reports.

A. The Industry

PAI found that 108 of the 138 unique reports compiled by Energy in Depth that comprise the oil and gas industry's scientific case for fracking had some degree of connection to the oil and gas industry, whether through funding, authorial ties, or institutional ties (see "Methodology" section above for more detail).

An examination of these reveals that several industry advocacy organizations played prominent roles in the development of many documents on the list. Industry players' roles ranged from being behind-the-scenes funders to being named publishers. In all, 26% of the studies were directly funded by the petroleum industry, 12% were indirectly funded, 16% had authors connected to industry, and 12% were issued by an organization with an industry membership base.

In this section we profile Energy in Depth, the industry public relations campaign that assembled the list of studies; the American Petroleum Institute, the oil and gas industry's largest lobbying organization which was involved with 13 of the reports and which funds Energy in Depth; and America's Natural Gas Alliance, which was involved with three of the studies on the list.

While the groups profiled below represent the highest profile industry players in frackademia, other organizations such as the American Gas Association, the Marcellus Shale Coalition, and various state-level Independent Oil and Gas Associations are also heavily involved. These other players' ties to the fracking public relations effort can be seen in the full dataset and on the organizations' respective profiles on LittleSis.

Energy in Depth

Energy in Depth (EID) is a public relations campaign launched in 2009 by the Independent Petroleum Association of America. Though it calls itself "a research, education and public outreach campaign focused on getting the facts out" about shale oil and gas, a memo obtained by DeSmogBlog in 2011 reveals that EID was conceived by IPAA as "a state of the art online resource center to combat new environmental regulations, especially with regard to hydraulic fracturing."³⁹ Since its inception, EID has been a reliable source of oil and gas industry spin, promoting industry-friendly research, attacking environmental activists, and producing a film, "Truthland," meant to rebut the anti-fracking documentary "Gasland."⁴⁰

³⁹ "About", Energy in Depth. Accessed at: <http://energyindepth.org/about/> and Brendan Demelle, "'Energy in Depth' Was Created By Major Oil and Gas Companies According to Industry Memo", DeSmogBlog (February 17, 2011). Accessed at: <http://www.desmogblog.com/%E2%80%98energy-depth%E2%80%99-was-created-major-oil-and-gas-companies-according-industry-memo>

⁴⁰ See, e.g. John Krohn, "UB Marcellus Study: The Numbers Don't Lie", Energy in Depth (June 13, 2012), Denise LaTourette, "Slotje: The Natural Gas Emperor of Narcissism", Energy in Depth (August 28, 2012). Accessed at: <http://energyindepth.org/marcellus/slotje-the-natural-gas-emperor-of-narcissism/>, and Benjamin Nelson, "Fracking Industry's Answer to 'Gasland': Devised by Astroturf Lobbying Group and Political Ad Agency", Public Accountability Initiative (June 13, 2012).

When it was first created, Energy in Depth was operated by a company called Dittus Communications, a subsidiary of the London communications firm Financial Dynamics.⁴¹ Financial Dynamics was later acquired by FTI Consulting, a business consulting firm, as its “strategic communications” segment.⁴² Today, Energy in Depth’s staff is made up of FTI employees, led by managing director Chris Tucker.⁴³

The campaign is split up into several smaller organizations, each focusing on influencing the fracking debate in a specific region. At the beginning of 2015, there were EID California, EID Illinois, EID Marcellus, EID Michigan, EID Mountain States, EID Ohio, and EID Texas in addition to the Washington D.C.-based national campaign, which aggregates content from the various field offices. The group’s modus operandi is to hire people from the regions EID is targeting to push its message, giving the semblance of grassroots activism to its coordinated national operation.⁴⁴ Through its local mouthpieces, EID employs “appeals to patriotism, the use of environmental imagery, and a claimed commitment to scientific reason” to “frame the shale gas extraction process in a positive light, all the while framing those who question or oppose the processes of shale gas extraction as irrational obstructionists,” according to a sociological examination of Energy in Depth published in the journal *Environmental Communication*.⁴⁵ These are published on EID’s various blogs and social media accounts as well as in op-ed columns in regional newspapers and online.

Though identified as a project of IPAA on its website, the memo leaked by DeSmog indicates that EID also receives support from the American Petroleum Institute and the Ohio Oil and Gas Association as well as from a number energy companies directly, including El Paso Corporation, XTO Energy (an ExxonMobil subsidiary), Occidental Petroleum, BP, Anadarko, Marathon, EnCana, Chevron, Talisman, Shell, Halliburton, and Schlumberger.⁴⁶ America’s Natural Gas Alliance provided indirect support to EID in 2012, giving Chesapeake Energy \$1 million for the “Truthland” project.⁴⁷ With the support of IPAA’s 10,000 members, representing 95% of the industry, and API’s 600 members, EID’s claims are arguably a representation of the gas industry’s position as a whole.⁴⁸

The list of studies making the oil and gas industry’s case that fracking is “tightly regulated and extensively studied” that PAI analyzed was originally published in 2013 on Energy in Depth’s California blog by FTI

Accessed at: <http://blog.littlesis.org/2012/06/13/fracking-industrys-answer-to-gasland-devised-by-astroturf-lobbying-group-and-political-ad-agency/>

⁴¹ “Financial Dynamics Acquires Dittus Communications, Expands Global Public Affairs Practice,” Financial Dynamics (December 5, 2005). Accessed at: <http://www.prnewswire.com/news-releases/financial-dynamics-acquires-dittus-communications-exapnds-global-public-affairs-practice-55256452.html>

⁴² “Strategic Communications”, FTI Consulting. Accessed at: <http://www.fticonsulting.com/services/strategic-communications/index.aspx>

⁴³ “Chris Tucker”, FTI Consulting. Accessed at: <http://www.fticonsulting.com/global2/professionals/chris-tucker.aspx>

⁴⁴ Jim Willis, “Energy in Depth Launches New Website, Major Grassroots Initiative for Northeast PA and Southern Tier of NY” (May 23, 2011). Accessed at: <http://marcellusdrilling.com/2011/05/energy-in-depth-launches-new-website-major-grassroots-initiative-for-northeast-pa-and-southern-tier-of-ny/>

⁴⁵ Jacob Matz and Daniel Renfrew, “Selling ‘Fracking’: Energy in Depth and the Marcellus Shale”, *Environmental Communication* (June 2014). Accessed at: <http://www.tandfonline.com/doi/abs/10.1080/17524032.2014.929157?journalCode=renc20#.VLIWkSvF-m1>

⁴⁶ Barry Russell, “Hydraulic Fracturing Under Attack”, Independent Petroleum Association of America (June 5, 2009). Accessed at: <http://www.desmogblog.com/sites/beta.desmogblog.com/files/HFUnderFire.pdf>

⁴⁷ Lee Fang, “The Fracking Industry’s Dishonest Response to ‘Gasland’”, *The Nation* (November 18, 2013). Accessed at: <http://www.thenation.com/blog/177242/fracking-industrys-dishonest-response-gasland>

⁴⁸ Jacob Matz and Daniel Renfrew, “Selling ‘Fracking’: Energy in Depth and the Marcellus Shale”, *Environmental Communication* (June 2014).

Consulting senior director and EID California lead David Quast.⁴⁹ Quast told PAI via email that the list that Range Resources provided to Allegheny County was also compiled by Energy in Depth.⁵⁰

American Petroleum Institute

The American Petroleum Institute sponsored or was otherwise involved with thirteen studies or 9.4% of all unique studies on the EID list. Only four of the studies were issued by API itself. The remaining nine studies were commissioned or partially funded by API but issued through a different source.

API is the primary oil and natural gas trade association with over 600 dues-paying member organizations from all sectors of the industry. Membership dues are calculated company-by-company based on their production and provided API with a \$225 million budget in 2012.⁵¹

API puts that budget to work. In 2012 API spent \$7 million on lobbying and a staggering \$85.5 million on public relations and marketing.⁵²

America's Natural Gas Alliance

The America's Natural Gas Alliance sponsored three studies in this group and is a major funder of the American Clean Skies Foundation, which issued a report in 2013. Two of the studies were commissioned in collaboration with API.

ANGA is a membership organization that represents natural gas exploration and production companies. Members include Devon Energy, Apache, Noble Energy, Range Resources, and Exxon's XTO Energy. ANGA received nearly \$77 million from its dues-paying members in 2012.⁵³

ANGA was also a major funding source behind "Truthland," the Energy in Depth-produced industry response to "Gasland."⁵⁴

B. The Consultants

The "frackademic" sector is not limited to academia. Many studies of fracking have been generated by consulting firms and think tanks that produce research for energy industry clients, applying their third-party brand and independent credibility to pro-fracking talking points. Some of these consultants contract

⁴⁹ David Quast, "Hydraulic Fracturing: Tightly Regulated, Extensively Studied", Energy in Depth (November 11, 2013). Accessed at: <http://energyindepth.org/california/hydraulic-fracturing-tightly-regulated-extensively-studied/>

⁵⁰ Email with David Quast, January 9, 2015.

⁵¹ "FAQ Membership", American Petroleum Institute. Accessed at:

http://www.api.org/globalitems/globalheaderpages/membership/faq-membership?_id=BB3CDD5C303546CEB222BD0CF9F210E2&_z=z&page=2 and Form 990, American Petroleum Institute (November 15, 2013). Accessed at: <http://www.guidestar.org/FinDocuments/2012/130/433/2012-130433430-09e4574e-90.pdf>

⁵² Erin Quinn, "Who needs lobbyists? See what big business spends to win American minds", Center for Public Integrity (January 15, 2015). Accessed at: <http://www.publicintegrity.org/2015/01/15/16596/who-needs-lobbyists-see-what-big-business-spends-win-american-minds>

⁵³ Form 990, America's Natural Gas Alliance (November 11, 2013). Accessed at: <http://www.desmogblog.com/sites/beta.desmogblog.com/files/ANGA%202012%20990.pdf>

⁵⁴ Lee Fang, "The Fracking Industry's Dishonest Response to 'Gasland'", The Nation (November 18, 2013).

to generate research both for the fracking industry and for governmental entities as well as independently publishing reports under their own name.

While this is not necessarily a conflict of interest, the fracking-driven expansion of the oil and gas industry is an important source of revenue and growth for consulting firms. For example, consultant IHS estimated in its Q4 2014 earnings call that its energy business accounts for about 40% of its total revenue.⁵⁵ With such a significant financial stake in fracking, questions arise about the objectivity of these consultants' analysis.

IHS Inc.

The consulting firm IHS and its subsidiaries IHS CERA (short for Cambridge Energy Research Associates) and IHS Global Insight issued or authored seven studies that were found on EID's list, more than any other single entity.

Of the six reports that were issued by IHS, one was commissioned by the US Conference of Mayors, a group that receives some funding from the energy industry through its Mayors' Business Council, and four were supported or contracted by oil and gas industry associations such as the American Gas Association, American Natural Gas Alliance, and American Petroleum Institute. An additional study was released by IHS as a "private study" and did not acknowledge a funder.

The seventh study, "Energy for Economic Growth," was issued by World Economic Forum for its Energy Industry Partnership Programme, which boasts an international membership of oil and gas corporations.⁵⁶ This study was written by IHS's Cambridge Energy Research Associates group with "perspective contributors" from Royal Dutch Shell, Saudi Aramco, Petróleo Brasileiro Petrobras, and DTEK.

As mentioned above, IHS derives a significant portion of its revenue from its energy segments. President and CEO Scott Key estimated that 40% of the firm's revenues, which totaled \$2.23 billion in 2014, came from its energy industry offerings - indicating the firm brought in more than \$892 million from its energy business last year.⁵⁷

In addition to its significant financial interest in fracking, several of IHS's prominent analysts have petroleum industry ties. Of the industry consultants that produced reports for both industry and government contracts, IHS' team of authors working on the studies in the EID list have the most connections to the oil and gas industry.

Mary Lashley Barcella, Director of North America Natural Gas at IHS CERA, was listed as a primary author or analyst in half of the IHS studies and was mentioned in the acknowledgments of another. Prior

⁵⁵ "IHS's (IHS) CEO Scott Key on Q4 2014 Results - Earnings Call Transcript", SeekingAlpha (January 13, 2015). Accessed at: <http://seekingalpha.com/article/2817906-ihss-ihc-ceo-scott-key-on-q4-2014-results-earnings-call-transcript>

⁵⁶ "Energy: Oil & Gas", World Economic Forum. Accessed at: <http://www.weforum.org/industry-partners/groups/energy-oil-gas/index.html>

⁵⁷ "IHS's (IHS) CEO Scott Key on Q4 2014 Results - Earnings Call Transcript", SeekingAlpha (January 13, 2015) and Form 10-K, IHS (January 16, 2015). Accessed at: <https://www.sec.gov/Archives/edgar/data/1316360/000131636015000007/q41410k.htm#s1CA43FA0E267060FEB200AFB0D0D3F2F>

to joining IHS CERA, Barcella held unspecified positions at the American Petroleum Institute, the American Gas Association, and “several energy consulting firms.”

Two of IHS’ primary authors, Ken Yeasting and Sam Andrus, previously had long careers at ANR Pipeline Company, which is now part of TransCanada’s extensive pipeline network. Another author, Andrew Slaughter, joined IHS after 14 years at Shell.

Surya Rajan, one of the authors of IHS’ EPA-critical “Mismeasuring Methane” report, joined IHS after 10 years with Marathon Oil. He left IHS three years later to join Baker Hughes as director of marketing strategy.

ICF International

ICF International is a consulting firm with dedicated oil and gas practices that, according to their website, serves major oil companies, midstream firms, and industry associations in addition to federal and state agencies.⁵⁸

ICF conducted four of the studies on EID’s list. One study was prepared for a government contract from the New York City Mayor’s Office of Long-Term Planning and Sustainability. ICF prepared two separate studies for the American Petroleum Institute (see API profile below) and another for the Interstate Natural Gas Association of America Foundation. The Interstate Natural Gas Association of America Foundation is charged with sponsoring research that “promotes natural gas use, and safe, efficient pipeline construction and operation”.⁵⁹ The Foundation’s parent organization, INGAA, is a natural gas industry trade group.

Although not published by ICF, “The Future of Natural Gas”, an MIT study that appears on EID’s list, used ICF computer models and was led by now-Energy Secretary Ernest Moniz while he sat on the ICF board of directors. See the section “Studies & ‘Studies’” above for more information on “The Future of Natural Gas.”

ALL Consulting

ALL Consulting is a self-described “full service professional services firm” that offers water management, engineering, and planning services to industry and government clients.⁶⁰

ALL issued or was otherwise involved in four “studies,” two of which were for government contracts. ALL Consulting collaborated the GWPC in 2009 on a study for the EPA and collaborated with oil services company, Schlumberger to review a study for the National Research Council in 2012. ALL also issued one un-commissioned study in 2008 and presented another to the GWPC in 2009 in the somewhat untraditional, 20-page outline format. It is unclear why the outline was included as a study in the EID list.

Brian Bohm, one of the primary authors from the un-commissioned 2008 study “Evaluating the Environmental Implications of Hydraulic Fracturing in Shale Gas Reservoirs,” is now a planning

⁵⁸ “Oil Markets”, ICF International. Accessed at: <http://www.icfi.com/markets/energy/oil-markets#tab-2-clients>

⁵⁹ “Foundation Governance & Administration”, Interstate Nature Gas Association of America. Accessed at: <http://www.ingaa.org/Foundation/16435/4942.aspx>

⁶⁰ “ALL Consulting”, ALL Consulting. Accessed at: <http://www.all-llc.com/page.php?5>

coordinator with Southwestern Energy.⁶¹ According to his LinkedIn account, Bohm continues to serve as a geologist/hydrogeologist at ALL Consulting.⁶² Another author on this report, Mark Layne, is credited with spearheading technical projects for Chevron in his ALL Consulting bio.⁶³ It is unclear whether those projects were related to his time with ALL or a previous employer.

C. The Government Players

Different governmental and quasi-governmental organizations also play roles in frackademia. From panels stacked with representatives from the oil and gas industry to agencies that rely on industry sources and industry-tied contractors for their analysis, organizations at both the state and federal level have also lent their own ostensibly objective branding to industry talking points. This section profiles some of the governmental organizations whose names appeared on EID's list of studies, including the Groundwater Protection Council, Interstate Oil and Gas Compact Commission, and the Secretary of Energy Advisory Board.

Groundwater Protection Council (GWPC) and the Interstate Oil and Gas Compact Commission (IOGCC)

GWPC issued three reports on the EID list and prepared another for US NETL. Although the studies listed did not receive industry funding (that PAI could identify), GWPC is connected to industry through two notable collaborations with the Interstate Oil and Gas Compact Commission. IOGCC is a multi-state, pro-drilling agency supported by oil and gas companies through conference sponsorships. The IOGCC 2014 annual conference brought in \$85,000 from eight different sponsors including Marathon Oil, XTO Energy, and BP.⁶⁴

GWPC and IOGCC are the collaborators behind the States First Initiative and FracFocus. The States First Initiative is a coalition of representatives from oil- and gas-producing states that advocates state-level regulation of oil and gas drilling over federal requirements.⁶⁵ The Initiative is favored by the oil and gas industry and is allied with the Consumer Energy Alliance, an industry front group.⁶⁶

FracFocus falls within the States First Initiative mission and is framed as “the national hydraulic fracturing chemical registry,” conjuring the image of a standardized or, at the very least, vetted database of information. In reality FracFocus is a voluntary disclosure database that allows for disclosure exemptions

⁶¹ “Brian Bohm”, LinkedIn. Accessed at: <https://www.linkedin.com/pub/brian-bohm/13/547/381>

⁶² *Id.*

⁶³ “Mark Layne, Ph.D, P.E.”, ALL Consulting. Accessed at: http://www.all-llc.com/e107_plugins/deptdir/deptdir.php?0.show..4

⁶⁴ “2014 Annual Conference: Columbus, Ohio”, Interstate Oil and Gas Compact Commission. Accessed at: <http://iogcc.publishpath.com/columbus> and “Sponsor Packet”, Interstate Oil and Gas Compact Commission. Accessed at: http://iogcc.publishpath.com/Websites/iogcc/images/2014Columbus/Columbus_Sponsor_Packet-_background.pdf

⁶⁵ Mark Niquette and Jennifer Oldham, “U.S. Governors Want States to Take Lead on Drilling Regulation”, *Bloomberg Businessweek* (February 19, 2014). Accessed at: <http://www.bloomberg.com/news/2014-02-19/u-s-governors-want-states-to-take-lead-on-drilling-regulations.html>

⁶⁶ “Allies”, States First Initiative. Accessed at: <http://www.statesfirstinitiative.org/#!allies/czie> and geoff Debricki, “Big Oil and Canada thwarted U.S. carbon standards”, Salon (December 15, 2011). Accessed at: http://www.salon.com/2011/12/15/big_oil_and_canada_thwarted_u_s_carbon_standards/

at the reporting company's discretion. FracFocus is supported with funding from oil and gas industry trade groups, American Petroleum Institute and America's Natural Gas Alliance.⁶⁷

A 2013 study by the Environmental Law Program at Harvard dismissed FracFocus as an ineffectual disclosure tool for states.⁶⁸ According to the study, states that use FracFocus give up disclosure control to website administrators who have more relaxed standards of reporting deadlines, allow companies to exempt disclosure, and lack consistency across disclosure requirements. From E&E's EnergyWire:

If states have deadlines for disclosure, FracFocus doesn't provide a way of verifying that the deadlines are met. If states require extra data, there's no place to put it on a FracFocus form, except in the "comments" section. And, the study says, the site lets operators decide when to conceal chemical ingredients as trade secrets. Because of that, the report says, trade secret claims are widely inconsistent.⁶⁹

US Secretary of Energy Advisory Board

The Energy Advisory Board provides advice and recommendations to the Secretary of Energy on research and development, economic and national security policy, and "any other activities and operations of the Department of Energy as the Secretary may direct."⁷⁰ Though the board does not make policy, its role is strictly advisory, it answers directly to the Secretary of Energy and can potentially exert a large amount of influence on the nation's energy policy. In 2011, then-Secretary of Energy Steven Chu created a Natural Gas Subcommittee of the SEAB "to make recommendations to improve the safety and environmental performance of natural gas hydraulic fracturing from shale formations."⁷¹ That subcommittee's final recommendations are included on EID's list of studies.

The Natural Gas Subcommittee included Daniel Yergin, the chairman of IHS CERA, a subsidiary of the industry and consulting giant profiled above; Kathleen McGinty, a former secretary of the Pennsylvania Department of Environmental Protection; Susan Tierney, managing principal of Analysis Group; Mark Zoback, a Stanford professor; Fred Krupp, the president of the Environmental Defense Fund; and Stephen Holditch, the head of the Department of Petroleum Engineering at Texas A&M.⁷² The subcommittee was chaired by former CIA director John Deutch, who also formerly held positions at the Department of Energy.

Of the seven people on the subcommittee, six have oil and gas ties. Deutch is a professor at MIT, and was a member of the study group that wrote the industry-funded MIT Energy Initiative study "The Future of Natural Gas," led by current Secretary of Energy Ernest Moniz. Deutch is also an advisor to NGP Energy Technology Partners, a private equity firm that invests in fracking companies run by his son, Phil,

⁶⁷ Mike Soraghan, "FracFocus has 'serious flaws,' Harvard study says", EnergyWire (April 23, 2013). Accessed at: <http://www.eenews.net/energywire/stories/1059979931>

⁶⁸ Kate Konschnik, Margaret Holden, and Alexa Shasteen, "Legal Fractures in Chemical Disclosure Laws", Harvard Law School (April 23, 2013). Accessed at: <http://blogs.law.harvard.edu/environmentallawprogram/files/2013/04/4-23-2013-LEGAL-FRACTURES.pdf>

⁶⁹ Mike Soraghan, "FracFocus has 'serious flaws,' Harvard study says", EnergyWire (April 23, 2013).

⁷⁰ "Secretary of Energy Advisory Board", United States Department of Energy. Accessed at: <http://energy.gov/seab/secretary-energy-advisory-board>

⁷¹ "Natural Gas Subcommittee of the Secretary of Energy Advisory Board", United States Department of Energy. Accessed at: <http://shalegas.energy.gov/>

⁷² "Members of the Subcommittee", United States Department of Energy. Accessed at: [datahttp://shalegas.energy.gov/aboutus/members.html](http://shalegas.energy.gov/aboutus/members.html)

and a director of Cheniere Energy.⁷³ Current Secretary of Energy Ernest Moniz advised NGPETP when he was at MIT before his 2013 appointment to the federal government.⁷⁴ Deutch also sits on the National Petroleum Council, an advisory body that “represents [oil and gas] industry views” to the Department of Energy.⁷⁵

McGinty is a director of NRG Energy, which uses natural gas in its power plants, and is an operating partner of Element Partners, a private equity firm invested in fracking services companies.⁷⁶ Tierney is also a member of the National Petroleum Council, and her firm, Analysis Group, has consulted for the Interstate Natural Gas Association of America and the Western States Petroleum Association.⁷⁷ Yergin’s IHS CERA consults for oil and gas companies as described above in “The Contractors.” Fred Krupp is tied to the industry through his organization, the Environmental Defense Fund, which brings in significant donations from people and organizations with a financial interest in drilling, some of whom have seats on EDF’s board. EDF trustee Katherine Lorenz is the president of the family foundation of George Mitchell, sometimes called “the father of fracking.”⁷⁸ Finally, Zoback was a co-founder of GeoMechanics International, and is currently an advisor to its parent company, Baker Hughes, an oilfield services provider.⁷⁹

⁷³ “John M Deutch”, LittleSis.org. Accessed at: http://littlesis.org/person/1145/John_M_Deutch

⁷⁴ “Ernest J Moniz”, LittleSis.org. Accessed at: http://littlesis.org/person/73472/Ernest_J_Moniz

⁷⁵ “John M Deutch”, LittleSis.org.

⁷⁶ “Kathleen A McGinty”, LittleSis.org. Accessed at: http://littlesis.org/person/61424/Kathleen_A_McGinty

⁷⁷ “Susan Tierney”, LittleSis.org. Accessed at: http://littlesis.org/person/85180/Susan_Tierney

⁷⁸ “Environmental Defense Fund”, LittleSis.org. Accessed at: http://littlesis.org/org/34975/Environmental_Defense_Fund

⁷⁹ “Mark Zoback”, LittleSis.org. Accessed at: http://littlesis.org/person/85181/Mark_Zoback

Abridged Table

This table lists the 137 unique studies included on the list provided by Range Resources to the Parks Committee of the Allegheny County Council in Pennsylvania, the organizations that issued them and the section of the list they appeared on. Studies were analyzed for industry ties and peer review and coded as described in the “Methodology” section above.

The full dataset, including detailed notes on the industry ties of the funders, authors, and publishers of the studies is available online at: <http://public-accountability.org/frackademia/>

Title	Year	Issuing Org	Topic (as listed by EID)	Peer-reviewed	Type of Industry Ties	Strength of Industry Ties
“2013 Annual Plan: Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Research and Development Program”	2013	US DOE	Water Quality & Use	No		None found
“2014 Sustainable Energy in America Factbook”	2014	Business Council for Sustainable Energy	Other	No	M	Strong
“A commentary on ‘The greenhouse-gas footprint of natural gas in shale formations’ by R.W. Howarth, R. Santoro, and Anthony Ingraffea”	2012	Climatic Change	Public Health/Environment	Yes?		None found
“A Commitment to Air Quality in the Barnett Shale”	2010	Texas Council on Environmental Quality	Public Health/Environment	No		None found
“A Comparative Study of the Mississippian Barnett Shale, Fort Worth Basin, and Devonian Marcellus Shale, Appalachian Basin”	2011	NETL	Overall	No	C	Medium
“A geochemical context for stray gas investigations in the northern Appalachian Basin: Implications of analyses of natural gases from Neogene- through Devonian-age strata”	2014	American Association of Petroleum Geologists Bulletin	Water Quality & Use	Yes	A	Medium

“Age of Gas”	2013	General Electric	Manufacturing/Economy	No	F	Strong
“Air Quality Impacts Occurring from Horizontal Well Drilling and Related Activities”	2013	WV DEP	Public Health/Environment	No		None found
“America’s New Energy Future: The Unconventional Oil & Gas Revolution and the US Economy”	2013	IHS	Water Quality & Use	No	F, C	Strong
“An Emerging Giant: Prospects and Economic Impacts of Developing the Marcellus Shale Natural Gas Play”	2009	Penn State	Manufacturing/Economy	No	F	Strong
“Assessing the greenhouse impact of natural gas”	2012	Geochemistry, Geophysics, Geosystems	Public Health/Environment	Yes		None found
“Assessment of New York City Natural Gas Market Fundamentals and Life Cycle Fuel Emissions”	2012	New York City Mayor's Office of Long-Term Planning and Sustainability	Other	No	C	Strong
“Barnett Shale supports over 83,000 jobs per year”	2011	Perryman Group	Manufacturing/Economy	No	C	Medium
“Baseline Groundwater Quality from 20 Domestic Wells in Sullivan County, Pennsylvania, 2012”	2013	USGS	Water Quality & Use	Yes		None found
“Benefits of Hydraulic Fracturing”	2013	American Enterprise Institute	Manufacturing/Economy	No	I	Medium
“Changing the Game? Emissions and Market Implications of New Natural Gas Supplies”	2013	Stanford	Public Health/Environment	No	F	Strong
“Characterizing Pivotal Sources of Methane Emissions from Natural Gas Production”	2012	API & ANGA	Public Health/Environment	No	F, M	Strong
“City of Fort Worth Natural Gas Air Quality Study”	2011	City of Fort Worth	Public Health/Environment	No	C	Weak

“Climate Impact of Potential Shale Gas Production in the EU”	2012	European Commission	Public Health/Environment	No	C	Medium
“Comment on “Hydrocarbon Emissions Characterization in the Colorado Front Range - A Pilot Study”	2012	Journal of Geophysical Research	Public Health/Environment	Yes	O	Weak
“Constraints on Upward Migration of Hydraulic Fracturing Fluid and Brine”	2013	Groundwater (NGWA)	Water Quality & Use	Yes	C	Medium
“Data Show Public Health Impacts from Natural Gas Production Overstated”	2011	Energy In Depth	Public Health/Environment	No	F, A	Strong
“Drilling for Jobs - What the Marcellus Shale could mean for New York”	2011	Public Policy Institute of New York State	Manufacturing/Economy	No	M	Medium
“Drilling Productivity Report for key tight oil and shale gas regions”	2014	EIA	Other	No		None found
“Driving on Natural Gas: Fuel Price and Demand Scenarios for Natural Gas Vehicles to 2025”	2013	American Clean Skies Foundation	Other	No	F, A	Strong
“Economic Considerations Associated with Regulating the American Oil and Natural Gas Industry”	2009	Advanced Resources International	Manufacturing/Economy	No	F	Strong
“Economic Impact of the Eagle Ford Shale”	2012	UT San Antonio	Manufacturing/Economy	No	F	Strong
“Economic Impacts of the Oil and Natural Gas Industry on the U.S. Economy in 2011”	2013	PricewaterhouseCoopers	Manufacturing/Economy	No	F, C	Strong
“Energy and Climate Change Committee - Fifth Report: Shale Gas”	2011	UK House of Commons	Other	No	O	None found
“Energy for Economic Growth”	2012	World Economic Forum	Manufacturing/Economy	No	A, C	Strong
“Energy in Pennsylvania: Past, Present, and Future”	2013	Pa DEP	Manufacturing/Economy	No	C	Medium
“Energy Rush: Shale Production and U.S. National Security”	2014	Center for a New American Security	Overall	No	I	Medium

“Environmental and Regulatory Considerations Associated with the American Oil and Natural Gas Industry”	2009	Advanced Resources International	Manufacturing/Economy	No	F	Strong
“Environmental Impacts During Shale Gas Drilling: Causes, Impacts and Remedies”	2012	SUNY Buffalo	Public Health/Environment	No	A	Strong
“Estimated Use of Water in the United States in 2005”	2009	USGS	Water Quality & Use	Yes		None found
“Evaluating the Environmental Implications of Hydraulic Fracturing in Shale Gas Reservoirs”	2008	ALL Consulting	Public Health/Environment	No	A, C	Medium
“Evaluation of impact of shale gas operations in the Barnett Shale region on volatile organic compounds in air and potential human health risks”	2013	Science of the Total Environment	Public Health/Environment	Yes	F	Strong
“Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs Study”	2004	US EPA	Water Quality & Use	No		None found
“Evaluation of Methane Sources in Groundwater in Northeastern Pa”	2013	Groundwater (NGWA)	Water Quality & Use	Yes	A, C	Strong
“Exporting the American Renaissance: Global Impacts of LNG Exports from the United States”	2013	Deloitte	Other	No	C	Medium
“Fact-Based Regulation for Environmental Protection in Shale Gas Development”	2012	UT Austin	Public Health/Environment	No	A, I	Strong
“Fueling the Future with Natural Gas: Bringing It Home”	2014	IHS	Overall	No	F, C	Strong
“Game changers: Five opportunities for US growth and renewal”	2013	McKinsey & Co.	Manufacturing/Economy	No	C	Medium
“How the Marcellus Shale Transformed the Domestic Natural Gas Landscape”	2014	Morningstar	Manufacturing/Economy	No		None found
“Hydraulic Fracturing Operations - Well Construction and Integrity Guidelines”	2009	API	Public Health/Environment	No	F, M	Strong

“Hydraulic Fracturing Study: PXP Inglewood Oil Field”	2012	Cardno ENTRIX	Overall	No	F	Strong
“Identifying Key Economic Impacts of Recent Increases in U.S. Natural Gas Production”	2012	American Gas Association	Manufacturing/Economy	No	M	Strong
“Impact of Shale Gas Development on Regional Water Quality”	2013	Science	Water Quality & Use	Yes		None found
“Impact of the Manufacturing Renaissance from Energy Intensive Sectors”	2014	IHS	Manufacturing/Economy	No	C, I	Strong
“Induced Seismicity and Hydraulic Fracturing for the Recovery of Hydrocarbons”	2013	Marine and Petroleum Geology	Seismicity	Yes	O	Weak
“Induced Seismicity Potential in Energy Technologies”	2012	National Research Council	Seismicity	No	O	None found
“Innovation in Oil and Natural Gas Production Assures Future Supplies”	2013	Manhattan Institute	Other	No	I	Medium
“Inventory and Extent of Hydraulic Fracturing In Coalbed Methane Wells In The Producing States”	1998	GWPC	Water Quality & Use	No	I	Medium
“Leveraging Natural Gas to Reduce Greenhouse Gas Emissions”	2013	Center for Climate and Energy Solutions	Public Health/Environment	No	F, M	Strong
“Life Cycle Analysis of Water Use and Intensity of Oil and Gas Recovery in Wattberg Field, Colo.”	2012	Colorado Energy & Water Consortium	Water Quality & Use	No	A, I	Strong
“Life Cycle Greenhouse Gas Inventory of Natural Gas Extraction, Delivery and Electricity Production”	2011	NETL	Public Health/Environment	No	A	Medium
“Life Cycle Greenhouse Gas Emissions and Freshwater Consumption of Marcellus Shale Gas”	2013	Environmental Science & Technology	Public Health/Environment	Yes	A	Strong
“Life Cycle Greenhouse Gas Emissions of Marcellus Shale Gas”	2011	Environmental Research Letters	Public Health/Environment	Yes	A	Weak
“Low-Cost Shale Gas Gives North American Petrochemical Producers Advantages Over Europe”	2013	Standard & Poor's	Manufacturing/Economy	No	O	None found

“Marcellus Royalty Payments Rising Rapidly”	2013	Allegheny Institute for Public Policy	Manufacturing/Economy	No		None found
“Marcellus Shale and Local Collection of State Taxes: What the 2011 Pennsylvania Tax Data Say”	2012	Penn State	Manufacturing/Economy	No		None found
“Marcellus Shale Drilling Productivity Report”	2014	US EIA	Other	No		None found
“Marcellus Workshop in NY: Best Practices for Ensuring Safe, Efficient Deployment of HF”	2009	API	Other	No	F, M	Strong
“Measurements of methane emissions at natural gas production sites in the U.S.”	2013	PNAS	Public Health/Environment	Yes	F, A	Strong
“Mismeasuring Methane: Estimating Greenhouse Gas Emissions from Upstream Natural Gas Development”	2011	IHS	Public Health/Environment	No	C	Strong
“Modern Shale Gas Development in the United States: A Primer”	2009	GWPC & ALL Consulting	Water Quality & Use	No	C, I	Medium
“Modern Shale Gas Development in the United States: An Update”	2013	NETL	Water Quality & Use	No		None found
“National Human Health Risk Evaluation for Hydraulic Fracturing”	2013	Gradient	Water Quality & Use	No	F, C	Strong
“Natural Gas and the Transformation of the U.S. Energy Sector: Electricity”	2012	NREL	Other	No	C	Weak
“Natural gas industry in West Virginia supports over two percent of state's employment”	2008	Marshall University	Manufacturing/Economy	No	F	Strong
“Natural Gas Liquids”	2013	Brookings	Overall	No	I	Medium
“Natural Gas Vehicles: Driving America to a More Prosperous, Secure, and Sustainable Future”	2013	Progressive Policy Institute	Other	No	O	Weak
“Nearly Every Manufacturer in the U.S. Will Benefit from Low-Cost Natural Gas”	2014	Boston Consulting Group	Manufacturing/Economy	No		None found
“New Dynamics of the U.S. Natural Gas Market”	2013	Bipartisan Policy Center	Manufacturing/Economy	No	C, I	Strong

“NGV Road Map For Pennsylvania Jobs, Energy Security and Clean Air”	2011	Marcellus Shale Coalition	Other	No	F, C, M	Strong
“North American Midstream Infrastructure through 2035: Capitalizing on Our Energy Abundance”	2014	ICF International	Manufacturing/Economy	No	F, C	Strong
“Northeastern Pennsylvania Marcellus Shale Short-Term Ambient Air Sampling”	2011	Pa DEP	Public Health/Environment	No		None found
“Oil & Natural Gas Transportation & Storage Infrastructure: Status, Trends, & Economic Benefits”	2013	IHS	Other	No	F, C	Strong
“Potential Economic & Fiscal Impacts of Natural Gas Production in Western Maryland”	2012	Maryland Petroleum Council	Manufacturing/Economy	No	M	Strong
“Potential Economic and Fiscal Impacts from Natural Gas Production in Broome County, New York”	2009	Broome County, NY	Manufacturing/Economy	No	A	Medium
“Pennsylvania Follow-up State Review”	2013	STRONGER, Inc	Public Health/Environment	No	F, A, M	Strong
“Prudent and Sustainable Water Management and Disposal Alternatives Applicable to Shale Gas Development”	2009	ALL Consulting	Water Quality & Use	No	C	Medium
“Realizing the Potential of North America's Abundant Natural Gas and Oil Resources”	2012	National Petroleum Council	Overall	No	M	Strong
“Realizing the Potential of U.S. Unconventional Natural Gas”	2013	Center for Strategic and International Studies	Overall	No	I	Medium
“Reduced Emissions from U.S. Power Plants Due to the Switch to Natural Gas”	2014	NOAA	Public Health/Environment	Unknown		Unknown
“Response of the U.S. Environmental Protection Agency to Petition for Promulgation of Rule Withdrawing Approval of Alabama's Underground Injection Control Program”	1995	US EPA	Water Quality & Use	No		None found

“Review of the Potential Public Health Impacts of Exposures to Chemical and Radioactive Pollutants as a Result of Shale Gas Extraction”	2013	Public Health England	Public Health/Environment	No		None found
“Revised Draft Supplemental Generic Supplemental Generic Environmental Impact Statement: Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs”	2011	NYS DEC	Public Health/Environment	No	C	Weak
“Shale & renewables: a symbiotic relationship”	2012	Citibank	Other	No	A	Medium
“Shale Energy: A Potential Game-Changer - Implications for the U.S. Transport & Logistics Industry”	2013	PricewaterhouseCoopers	Manufacturing/Economy	No	C	Medium
“Shale Gas and New Petrochemicals Investment: Benefits for the Economy, Jobs, and US Manufacturing”	2011	American Chemistry Council	Manufacturing/Economy	No	M	Strong
“Shale Gas Production Subcommittee Ninety Day Report”	2011	US Secretary of Energy Advisory Board Natural Gas Subcommittee	Overall	No	A	Strong
“Shale Gas Production: Potential Versus Actual Greenhouse Gas Emissions”	2012	Environmental Research Letters	Public Health/Environment	Yes	O	Weak
“Shale Gas, Competitiveness, and New US Chemical Industry Investment”	2013	American Chemistry Council	Manufacturing/Economy	No	M	Strong
“Shale Gas: A Game Changer for U.S. and Global Gas Markets?”	2010	US EIA	Manufacturing/Economy	No	A	Weak
“Shale Gas: A Renaissance in US Manufacturing?”	2011	PricewaterhouseCoopers	Manufacturing/Economy	No	C	Medium
“Shale Gas: Reshaping the US Chemicals Industry”	2012	PricewaterhouseCoopers	Manufacturing/Economy	No	C	Medium
“Shale Gas Monitoring Report”	2014	Pa DCNR	Public Health/Environment	No		None found

“Shallow Groundwater Quality and Geochemistry in the Fayetteville Shale Gas-Production Area, North-Central Arkansas, 2011”	2013	USGS	Water Quality & Use	Yes		None found
“Small Businesses Unleash America's Energy Employment Boom”	2014	Manhattan Institute	Manufacturing/Economy	No	I	Medium
“Southwestern Pennsylvania Marcellus Shale Short-Term Ambient Air Sampling Report”	2010	Pa DEP	Public Health/Environment	No		None found
“State Oil and Gas Agency Groundwater Investigations”	2011	GWPC	Water Quality & Use	No	I	Medium
“State Oil and Natural Gas Regulations Designed to Protect Water Resources”	2009	NETL	Water Quality & Use	No	C	Medium
“States' experience with hydraulic fracturing”	2002	Interstate Oil and Gas Compact Commission	Overall	No	I	Medium
“Strengthening Our Economy: The Untapped U.S. Oil and Gas Resources”	2008	ICF International	Manufacturing/Economy	No	F, C	Strong
“Study of Potential Impacts of Hydraulic Fracturing of Coalbed Methane Wells on Underground Sources of Drinking Water”	2004	US EPA	Water Quality & Use	No		None found
“Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources: Progress Report”	2012	US EPA	Water Quality & Use	No		None found
“The Arithmetic of Shale Gas”	2012	Yale	Manufacturing/Economy	No	A	Strong
“The Benefits of Natural Gas Production and Exports for Pa. Small Businesses”	2013	Small Business & Entrepreneurship Council	Manufacturing/Economy	No	O	Weak
“The Economic and Employment Contributions of Unconventional Gas Development in State Economies”	2012	IHS	Manufacturing/Economy	No	F, C	Strong
“The Economic Effects of Hydrofracturing on Local Economies: A Comparison of NY and PA”	2013	Manhattan Institute	Manufacturing/Economy	No	I	Medium

“The Economic Impacts of the Haynesville Shale on the Louisiana Economy in 2008”	2009	Louisiana DNR	Manufacturing/Economy	No	C	Medium
“The Economic Impacts of the Marcellus Shale: Implications for NY, PA, and WV”	2010	API	Public Health/Environment	No	F, M	Strong
“The Economic Impacts of the Pennsylvania Marcellus Shale Natural Gas Play: An Update”	2010	Penn State	Manufacturing/Economy	No	F	Strong
“The Financial Returns from Oil and Natural Gas Company Stocks Held by American and University Endowments”	2013	Sonecon	Manufacturing/Economy	No	F, C	Strong
“The Future of Natural Gas”	2011	MIT	Overall	No	F, A, M	Strong
“The Geopolitics of Natural Gas”	2012	Harvard & Rice	Other	No	A, I	Strong
“The Greenhouse Impact of Unconventional Gas for Electricity Generation”	2011	Environmental Research Letters	Public Health/Environment	Yes		None found
“The Impact of Marcellus Gas Drilling on Rural Drinking Water Supplies”	2011	Center for Rural Pennsylvania	Water Quality & Use	No		None found
“The Local Impact of Oil and Gas Production and Drilling in Oklahoma”	2008	Oklahoma State University	Manufacturing/Economy	No	I	Weak
“The Natural Gas Subcommittee Report on Energy and Job Creation”	2011	Michigan House of Representatives	Manufacturing/Economy	No	O	None found
“The Next Frontier in the United States Unconventional Shale Gas and Tight Oil Extraction: Strategic Reduction of Environmental Impact”	2013	Harvard	Public Health/Environment	No	I	Medium
“The Pennsylvania Marcellus Natural Gas Industry: Status, Economic Impacts and Future Potential”	2011	Penn State	Manufacturing/Economy	No	F	Strong
“The Petroleum Industry and the Monterey Shale: Current Economic Impact and the Economic Future of the San Joaquin Valley”	2013	California State University, Fresno	Manufacturing/Economy	No	F	Strong
“The Role of Oil and Gas and Amenities in County Economic Development”	2013	Liberty Source	Manufacturing/Economy	No	F, C	Strong

“The Shale Shift: Exploring the impact of shale gas on the U.S. economy”	2012	TD Economics	Manufacturing/Economy	No	A	Medium
“The technology behind natural gas supplies”	2010	American Exploration and Production Council	Manufacturing/Economy	No	F, M	Strong
“The US Energy Revolution: How Shale Energy Could Ignite the US Growth Engine”	2012	Goldman Sachs	Manufacturing/Economy	No	A	Medium
“Trace Elements and Radon in Groundwater Across the United States, 1992-2003”	2011	USGS	Water Quality & Use	Yes		None found
“U.S. LNG Exports: State-Level Impacts on Energy Markets and the Economy”	2013	ICF International	Other	No	F, C	Strong
“U.S. Supply Forecast and Potential Jobs and Economic Impacts (2012-2030)”	2011	Wood Mackenzie	Manufacturing/Economy	No	F, C	Strong
“U-M technical reports examine hydraulic fracturing in Michigan”	2013	University of Michigan	Water Quality & Use	No		None found
“Understanding the Marcellus Supply Chain”	2012	University of Pittsburgh	Manufacturing/Economy	No	O	Weak
“Water Consumption of Energy Resource Extraction, Processing, and Conversion”	2010	Harvard	Water Quality & Use	No	I	Medium
“Water Sources and Demand for the Hydraulic Fracturing of Oil and Gas Wells in Colorado from 2010 through 2015”	2012	Colorado Division of Water Resources, the Colorado Water Conservation Board, and the Colorado Oil and Gas Conservation Commission	Water Quality & Use	No	O	Weak
“Water-Quality Characteristics and Trend Analyses for the Tongue, Powder, Cheyenne, and Belle Fourche River Drainage Basins, Wyoming and Montana, for Selected Periods, Water Years 1991 through 2010	2012	USGS	Water Quality & Use	Yes		None found
“Why Every Serious Environmentalist Should Favour Fracking”	2013	Centre for Policy Studies	Public Health/Environment	No	A	Medium
“Why Rapid Approval of LNG Applications	2013	American Council for	Other	No	M, I	Strong

is Important for U.S. Prosperity"		Capital Formation				
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