

BLOWBACK FROM THE SHALE BOOM:

Fracking-based Surge in Industrial Construction Leads to Rise in Greenhouse Gas Pollution



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THE ENVIRONMENTAL INTEGRITY PROJECT

The Environmental Integrity Project (EIP) is a nonpartisan, nonprofit organization established in March of 2002 by former EPA enforcement attorneys to advocate for effective enforcement of environmental laws. EIP has three goals: 1) to provide objective analyses of how the failure to enforce or implement environmental laws increases pollution and affects public health; 2) to hold federal and state agencies, as well as individual corporations, accountable for failing to enforce or comply with environmental laws; and 3) to help local communities obtain the protection of environmental laws. Visit our website at <http://www.environmentalintegrity.org>.

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Shale Gas Fuels Growth in Petrochemical Industry...and Rise in Greenhouse Gases

The recent surge in industrial construction projects sparked by the boom in hydraulic fracturing accelerated in 2014, bringing with it increased greenhouse gas emissions. The extraction of gas and oil from shale formations through “fracking” and horizontal drilling drove down fuel prices and opened the door for investments in new fertilizer plants, chemical factories, refineries, and liquid natural gas export terminals that otherwise might not have been economically viable. Since January 1, 2014, companies in Texas, Louisiana and other states have applied for or received permits for 57 new oil, gas, or chemical projects that would produce more than 71 million tons a year of greenhouse gases (as expressed in carbon dioxide equivalent tons), according to permitting documents on file with the U.S. Environmental Protection Agency and state regulators.¹ While 11 applications are still pending, 46 draft or final permits issued since the beginning of the year authorize greenhouse gas emission increases of more than 55 million tons per year – as much as the output from 12 large (500 megawatt) new coal fired power plants.²

These projects have multiplied as industries tap into low cost supplies of shale oil and gas that provide feedstock or fuel for manufacturing or export. Over the past three years, EPA and state agencies have issued draft or final permits to build or expand 105 oil, gas, or chemical plants that authorize nearly 97 million tons of greenhouse gas emissions yearly. Counting 15 permit applications still pending, the 120 projects already in the pipeline would increase emissions by more than 130 million tons every year (as much as 28 coal plants). The boom has breathed new life into industries like fertilizer manufacturing, with 15 new construction projects in the last three years after two decades of flat or declining production. But that economic growth comes with a carbon price tag.

Natural gas is replacing coal as the fuel of choice at new electric power plants, leading to a decline in carbon dioxide emissions from electric utilities because burning natural gas produces less than half as much carbon dioxide as burning coal. But methane that escapes during the drilling and fracking process is at least 20 times more potent as a greenhouse gas than carbon dioxide.³ And the new data about emissions from the industrial construction projects being driven by lower natural gas prices suggests the decline in pollution from the electric utility sector



Because of cheaper natural gas and oil prices, U.S. companies in 2014 received Clean Air Act permits to build at least 46 new or expanded industrial facilities across the U.S. that will produce 55 million tons of greenhouse gases a year, or about as much as 12 large new coal-fired power plants.

will be partly offset by the construction of new chemical plants, fertilizer factories, LNG export terminals and other facilities.

The recent data shows that these new projects launched in the wake of the fracking boom are moving quickly through the permitting pipeline, with 46 draft or final permits issued in 2014, 46 in 2013, and 13 in 2012. The totals do not include the emissions from gas-fired power plants, or pollution from the many smaller projects at gas compressor stations, processing plants, and flares springing up in states across the U.S. that have experienced an increase in drilling into shale formations.

The analysis in this report is based on approvals or applications for federal Clean Air Act permits required for large new projects that would significantly increase emissions of carbon dioxide, methane, or other global warming gases. But after a June 23, 2014, Supreme Court ruling⁴, these requirements no longer apply to greenhouse gas emissions – no matter how large – unless the project in question would also significantly increase emissions of smog forming chemicals or other pollutants that have long been subject to the Clean Air Act.

As a result, companies have begun withdrawing permit applications for new projects that would add more than a million tons of global warming pollution to the atmosphere every year. For example, Freeport LNG Development received a draft permit from EPA in December of 2013 that would cap greenhouse gas emissions from its proposed new liquefaction project in Brazoria County, Texas, at 1.56 million tons per year. But the company withdrew its application in July of 2014, explaining that it “no longer require[d] a permit for greenhouse gases” after the Supreme Court decision.⁵

Clean Air Act permits for major construction projects establish legally enforceable emission limits and other operating requirements that reflect the best available pollution controls. For greenhouse gas emissions from petrochemical plants, that usually means operating at maximum efficiency to eliminate the waste of energy or raw materials, actions that often save money and eliminate pollution at the same time. EPA investigations and independent studies have shown repeatedly that these cost-effective opportunities are missed when companies are not required to find them. The Court’s recent ruling eliminates those regulatory incentives by allowing some large projects to proceed without reasonable limits on the amount of carbon they release.

Table A below shows a breakdown of the projects proposed or approved from 2012 through 2014, by sector. The chemical and natural gas industries had the largest number of permit applications.

TABLE A: PERMIT APPROVALS AND PENDING APPLICATIONS, 2012-2014

Sector	Number	CO2 increase (TPY)	Average Increase Per Facility
Chemical	43	39,276,599	913,409
Fertilizer	15	25,051,615	1,670,108
Refineries	15	6,592,523	439,502
Natural Gas	37	26,009,394	702,957
LNG Export	10	33,356,312	3,335,631
TOTAL	120	130,286,443	1,412,321

Location of the Projects

The largest numbers of the plant constructions and expansions related to the shale gas industry over the last three years have been in Texas (49), Louisiana (33) and Oklahoma (6). But a scattering of projects are also located in other states across the U.S., including in Alaska, Arizona, Colorado, Florida, Georgia, Iowa, Idaho, Illinois, Indiana, Kansas, Maryland, Michigan, Minnesota, Mississippi, North Dakota, New Mexico, Oregon, Pennsylvania, Tennessee, Utah, West Virginia, and Wyoming. (See the Excel Spreadsheet included with this report for a full listing of the greenhouse gas permits and permit applications from 2012 through 2014).

Not available for this report were permits that were not posted on the websites of the U.S. Environmental Protection Agency or state environmental agencies that review and approve air pollution control permits.

Table B on the next page is a listing of the most recent shale-gas related projects (not including electric power plants) that would produce the largest greenhouse gas emissions.

TABLE B: TOP 10 PROJECTED OIL, GAS, AND CHEMICAL PLANT GREENHOUSE GAS INCREASES

(2014 Permit Approvals or Pending Applications)

State and Locality	Company	Project	Sector	Greenhouse gases (tons per year)
Louisiana (Cameron Parish)	Sabine Pass	Sabine Pass LNG Terminal Johnsons Bayou, Louisiana	LNG Export	7,268,538
Louisiana (Calcasieu Parish)	Sasol North America, Inc.	Lake Charles Gas to Liquids Project	Natural Gas	6,463,719
Louisiana (Cameron Parish)	Sabine Pass	Sabine Pass, LNG, Sabine Pass LNG Terminal	LNG Export	4,656,175
Louisiana (Ascension Parish)	CF Industries Nitrogen, LLC	Donaldsonville Nitrogen Complex	Fertilizer	4,426,158
Texas (Calhoun County)	Excelerate Liquefaction	Lavaca Bay LNG Project	LNG Export	4,216,932
Louisiana (Calcasieu Parish)	Trunkline LNG Export, LLC	Lake Charles Liquefaction Export Terminal	LNG Export	4,210,862
Louisiana (Calcasieu Parish)	Sasol North America, Inc.	Lake Charles Cracker Project	Chemical	4,202,663
Louisiana (Cameron Parish)	Cameron LNG	Cameron LNG Liquefaction	Natural Gas	3,983,512
Texas (San Patricio and Nueces Counties)	Corpus Christi Liquefaction	LNG Terminal	LNG Export	3,413,185
Texas (Calhoun County)	Formosa Plastics	Olefins 3 and Propane DeHydrogenation Plant	Chemical	2,627,187

(Note: Figures above are for draft and final greenhouse gas permits, and permit applications still pending, filed with EPA and state environmental agencies in 2014. Greenhouse gas figures are for carbon dioxide equivalent tons.)

Chemical Manufacturing

The sector that may have experienced the sharpest growth because of the shale boom recently is the chemical industry, with 22 new construction or expansion projects proposed or approved in 2014. These new projects are permitted to release 27 million tons of greenhouse gases a year from plants that will produce or use petroleum-based ingredients to make plastics and other products. Much of the construction on new chemical factories is in Texas and Louisiana. But it is also happening in Beaver County, Pennsylvania, and Wood County, West Virginia, where companies are planning to build facilities that crack ethane, a component

of natural gas, and process it into ethylene, a building block for a wide range of chemicals including solvents, plastics and antifreeze solutions. (See Table A on page 3 for the emissions growth from chemical plants and other sectors over the last three years, based on draft or final permits approved and applications still pending.)

Natural Gas

The natural gas industry obtained permits or submitted new applications for 16 major projects in 2014 that would release a combined total of 17 million tons of greenhouse gases from compressor stations and other units that remove impurities, or separate gas from petroleum liquids. All but one of these projects received draft or final permits, and not surprisingly, most are in Louisiana and Texas. But a plant to process natural gas products into propane and butane is also planned in Adams County, Mississippi, for example, and a natural gas processing facility is proposed in Clare County, Michigan.

This analysis does not cover dozens of new compressors or gas plants that release just under 100,000 tons of CO₂ per year. Emissions below that level (even before the Supreme Court decision) do not trigger the Clean Air Act pollution standards that apply to larger construction projects.

The Fertilizer Industry

The fertilizer industry secured permits for eight new or expanded plants in 2014 that are authorized to emit 10.4 million tons of greenhouse gases, mostly to produce nitrogen-based fertilizers used on corn, soybeans, and other crops. The manufacture of nitrogen fertilizer releases nitrous oxide, which EPA estimates to be 310 times more potent as a greenhouse gas than carbon dioxide.⁶ In 2014, large nitrogen fertilizer factories were approved by the Midwest Fertilizer Corporation in Posey County, Indiana; the Iowa Fertilizer Company in Lee County, Iowa; Chronus Chemicals in Tuscola, Illinois; CF Industries Nitrogen in Ascension Parish, Louisiana; Koch Nitrogen in Garfield, Oklahoma; Magnolia Nitrogen in Idaho; and by US Nitrogen in Greene County, Tennessee.⁷ AM Agrigen submitted a new application in October requesting approval for a project in Louisiana that would add another 2 million tons of global warming pollution to the total.

Refineries and LNG Export Terminals

Petroleum refineries proposed five construction or expansion projects in 2014 that will emit almost three million tons of greenhouse gases. The projects are in Texas, Louisiana, Illinois, and Oklahoma. Two have final permits, one is in draft form, and two applications are still pending.

Companies also applied for or received permits for four liquid natural gas (LNG) plants to condense and export the fuel in 2014. These plants super-cool methane to its more dense liquid form, and would produce 11.6 million tons of the heat-trapping gases, according to their permit applications.⁸ Three of these projects would be on the Gulf Coast, in Texas and Louisiana. But Maryland's Public Service Commission also approved a controversial project to export liquid natural gas from a terminal on the Chesapeake Bay in Calvert County, Maryland. Dominion Energy's Cove Point LNG export terminal would produce an estimated two million tons of greenhouse gases a year.⁹

About the Data

The estimates in this report are based on the net increase in greenhouse gas emissions that have been authorized under draft or final Clean Air Act permits issued since January 1, 2012, or which have been proposed in permit applications that are still pending. Actual emissions can be lower than permit limits, which are usually based on plants operating at full capacity. On the other hand, some permits do not cover potential emissions from abnormal events like malfunctions or startups and shutdowns, and do not accurately reflect likely methane leak rates from tanks and process units. Also, as noted earlier, the analysis is limited to data that could be obtained online from either the EPA or state agency websites. Finally, the report does not include emission increases from many smaller projects that can add up quickly over time.

Methods for Industry to Limit Greenhouse Gas Emissions

The Clean Air Act requires large new greenhouse gas sources to demonstrate that they have applied the best technologies available to minimize that pollution. So far, neither EPA nor state agencies have required permit applicants to remove and inject carbon dioxide in underground formations, due to its high cost. But there are cost-effective alternatives – such as avoiding wasted energy and stopping leaks from pipes and valves -- that can cut emissions while saving money through more frugal use of energy or raw materials.

Here are three examples of improved efficiency paying off in the form of reduced greenhouse gas pollution.

- 1) A Kansas-based chemical and refinery company called Flint Hills Resources agreed in a recent permit action to take corrective action whenever exit gas temperatures from new heaters at its Pine Bend, Minnesota, refinery exceed 350 F, which will reduce fuel consumption by minimizing heat loss. Based on company estimates, these efficiency improvements should reduce greenhouse gas emissions more than 200,000 tons below permitted levels.¹⁰ An EPA study has estimated that installing or upgrading insulation to reduce heat loss could reduce boiler emissions by up to 13 percent, with the investment paying for itself in 18 months or less.¹¹
- 2) As much as one third of the natural gas recovered from the Bakken oil fields in North Dakota is burned off in flares. Flares are also routinely used to dispose of waste gas at chemical plants, refineries, gas processors, and tank batteries. According to EPA, flare gas recovery systems to be installed at the BP Whiting refinery in Indiana under a recent settlement will cut greenhouse gas emissions by nearly 100,000 tons per year.¹²
- 3) Every year, oil and gas storage tanks leak more than a million tons of methane, an especially potent global warming pollutant, along with even higher volumes of volatile compounds that cause smog. EPA's new Clean Air Act standards for the oil and gas industry require tighter seals and vapor recovery systems, which will reduce product losses while eliminating the equivalent of 19 to 33 million tons of greenhouse gas emissions every year.¹³

As explained above, the Supreme Court's decision on June 23 of this year means that greenhouse gas emission limits or pollution controls will no longer be required for many projects, including some listed in this report that received their permits before the Court's ruling.¹⁴

Conclusion and Recommendations

The shale gas boom has produced great benefits to the U.S. economy, but a full and honest accounting is needed of its environmental footprint – especially with regards to how much greenhouse gas the industry produces.

There is no question that electric utilities fueled by natural gas are cleaner than coal plants, and generate far less carbon dioxide per megawatt of power produced. But a side-effect of the manufacturing boom sparked by hydraulic fracturing – including new fertilizer plants, chemical factories, refineries, and LNG export terminals – is that tens of millions of tons of global warming gases will rise into the atmosphere. Other air pollutants will also be emitted from these new industrial plants along the Gulf Coast and elsewhere, including toxins and fine particle pollution that can trigger asthma and heart attacks.

The EPA and state agencies should take some practical steps to minimize this air pollution:

- 1) New projects and modifications at major pollution sources are already required to employ the best available technologies to eliminate greenhouse gases as well as “conventional” pollutants like nitrogen oxide, volatile organic compounds, or toxic chemicals like formaldehyde or hexane. Permit requirements should incorporate cost-effective investments that can reduce all of these pollutants through greater energy efficiency, by minimizing product losses (from leaking tanks or process units), and by reducing reliance on flaring.
- 2) These benefits can be realized through better process design, and through closer monitoring of performance, e.g., by measuring exit gas temperatures to identify and prevent heat losses. The research suggests that reducing greenhouse gases from the oil, gas, and chemical sectors may depend, at least in the short run, on establishing and maintaining protocols to help plant managers identify and eliminate waste at multiple points throughout the manufacturing process. EPA and the states should require establishing these protocols in new permits, along with monitoring and reporting requirements to track performance over time.
- 3) EPA has proposed limits for greenhouse gas pollution from the electric utility sector and coal-fired power plants. But the federal agency has yet to establish greenhouse gas limits for other

industries, although it is obligated under a Supreme Court decision. EPA has published rules that require new or modified pollution sources that will significantly increase emissions to obtain permits and meet “best available technology” requirements. But case by case permitting is not a substitute for the national greenhouse gas emission standards that EPA must establish for each of the industrial categories subject to Clean Air Act regulation in the wake of the landmark 2007 Supreme Court decision, *Massachusetts v. EPA*.

The Obama Administration has taken some notable steps forward in regulating greenhouse gas pollution – including from vehicles and coal-fired power plants. But a problem as complex and massive as climate change requires all sectors of the economy to contribute toward the solution, including the oil and gas industry and the chemical and fertilizer factories that are enjoying a renaissance because of hydraulic fracturing. The good news is that operating more efficiently is good for both the global climate and corporate profits.

END NOTES:

¹ Figures are for Clean Air Act permitting documents available online from the U.S. Environmental Protection Agency and state environmental agencies in Alaska, Arkansas, Colorado, Florida, Georgia, Illinois, Iowa, Idaho, Indiana, Kansas, Louisiana, Maryland, Michigan, Minnesota, Mississippi, North Dakota, New Mexico, Oklahoma, Oregon, Pennsylvania, Tennessee, Texas, Utah, Virginia, West Virginia and Wyoming.

² The average baseload coal plant is about 500 megawatts and emits about 520 tons of CO₂ per hour, and up to 4.55 million tons per year if operated continuously, according to emission factors developed by the Energy Information Administration and the USEPA. <http://www.eia.gov/tools/faqs/faq.cfm?id=74&t=11>.

³ Over a 100 year time frame. U.S. Environmental Protection Agency, “Overview of Greenhouse Gases,” available at: <http://epa.gov/climatechange/ghgemissions/gases/ch4.html>

⁴ Util. Air Regulatory Grp. v. E.P.A., 134 S. Ct. 2427 (2014).

⁵ EPA letter to Freeport LNG, July 30, 2014. Available at: http://www.epa.gov/earth1r6/6pd/air/pd-r/ghg/freeport_lng_withdrawal-letter080614.pdf

⁶ See note 3.

⁷ See note 1.

⁸ Ibid.

⁹ Ibid.

¹⁰ Environmental Integrity Project, Minnesota Center for Environmental Advocacy and Environmental Integrity Project Reach Innovative Settlement Agreement with Flint Hills Resources to Reduce Air Pollution Emissions at Minnesota Refinery, http://www.environmentalintegrity.org/news_reports/04_19_2013.php.

¹¹ U.S. Environmental Protection Agency (Office of Air and Radiation), “Available and Emerging Technologies for Reducing Greenhouse Gas Emissions from the Petroleum Refining Industry (October 2010),” p. 12, available online at <http://www.epa.gov/nsr/ghgdocs/refineries.pdf>

¹² BP Whiting Consent Decree, U.S. Dist. Court Northern Indiana, Civil No. 2:12 CV 207 (2012), <http://www2.epa.gov/sites/production/files/documents/whiting-cd.pdf>

¹³ U.S. Env'tl. Prot. Agency, Fact Sheet: Overview of Final Amendments to Air Regulations for the Oil and Natural Gas Industry 1-2 (2012), available at <http://www.epa.gov/airquality/oilandgas/pdfs/20120417fs.pdf>.

¹⁴ Util. Air Regulatory Grp. v. E.P.A., 134 S. Ct. 2427 (2014).



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