

ENERGY FACTS



Leaking Profits: The U.S. Oil and Gas Industry Can Reduce Pollution, Conserve Resources, and Make Money by Preventing Methane Waste

Methane makes up as much as 90 percent of natural gas, a fossil fuel used extensively in the United States to produce electricity, heat buildings, and fuel factories and vehicles. Currently, when natural gas is extracted by hydraulic fracturing or other techniques, significant amounts of methane are wasted: from wells during the extraction process, from processing equipment while compressing or drying gas, and from poorly sealed equipment while transporting and storing it. In fact, at least 2 to 3 percent of all natural gas produced by the U.S. oil and gas industry is lost to leaks or vented into the atmosphere each year. Since methane is a global warming pollutant at least 25 times more potent than carbon dioxide over a 100-year period, methane pollution accelerates and magnifies climate change. Preventing the leakage and venting of methane from natural gas facilities would reduce pollution, enhance air quality, improve human health, and conserve energy resources. The oil and gas industry can afford methane control technologies. Indeed, capturing currently wasted methane for sale could bring in more than \$2 billion of additional revenue each year. Ten technically proven, commercially available, and profitable methane emission control technologies together can capture more than 80 percent of the methane currently going to waste. The U.S. Environmental Protection Agency (EPA), other federal agencies, and the states should move forward with regulations that require use of these technologies for methane control, and industry itself should move quickly to adopt these measures.

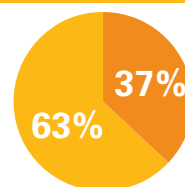
ENVIRONMENTAL AND ECONOMIC BENEFITS OF METHANE CONTROL TECHNOLOGIES

Emission control technologies for natural gas can:

- Reduce by more than 80 percent harmful methane pollution from the oil and gas industry that worsens air quality and exacerbates climate change
- Reduce emissions of volatile organic compounds (VOCs) and hazardous air pollutants (HAPs) that cause asthma attacks and other health and environmental harms
- Generate more than \$2 billion in annual revenues from the sale of recovered natural gas, or provide fuel for use on site

- Provide royalties to individuals and governments for natural gas produced on private and public lands
- Improve industrial safety, limit corporate liability from leaking gases, and reduce power and maintenance needs

Methane from the Oil and Gas Industry Contributes a Growing Proportion of Total Global Warming Pollution in the U.S.




- U.S. O&G Industry Methane Emissions
- Total U.S. Methane Emissions

Note: Methane made up 10.3 percent of U.S. greenhouse gas emissions in 2009.




For more information, please contact:

Vignesh Gowrishankar, Ph.D.
vgowrishankar@nrdc.org
(212) 727-4525

 switchboard.nrdc.org/
blogs/vgowrishankar

Thomas Singer, Ph.D.
tsinger@nrdc.org
(505) 989-7925

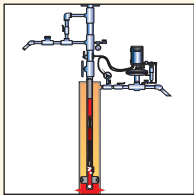
 switchboard.nrdc.org/
blogs/tsinger

TEN PROFITABLE METHANE CONTROL TECHNOLOGIES

The EPA has estimated that 42 percent of emissions from natural gas systems come from well completions and workovers (to stimulate natural gas production from wells) or well cleanups at low-pressure wells (to clean up older clogged wells). In liquid petroleum systems, nearly half of methane emissions come from undetected leaks in connectors, valves, and pumps. Together, the 10 technologies discussed below have the potential to capture more than 80 percent of methane lost to the atmosphere from the U.S. oil and gas industry each year.



- 1. Green completions** Using temporary processing equipment brought to a well site, fluids and gases can be routed to a tank for separation to enable sale of gas and condensate. This process, known as green completion or reduced emission completion, captures liquids and gases coming out of wells as they are being drilled, repaired, or stimulated during hydraulic fracturing.



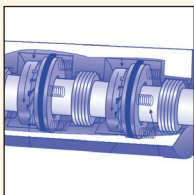
- 2. Plunger lift systems** Older gas wells stop flowing when liquids accumulate inside the wellbore; methane is emitted when operators open the wells to clean out the liquids and resume gas flow. Plunger lift systems are one way to remove liquids and keep gas flowing without venting methane, extending the productive life of the well. These systems work well in mature wells and have the added advantage of not requiring separate power.



- 3. TEG dehydrator emission controls** Tri-ethylene glycol (TEG) dehydrators, commonly used to remove moisture from natural gas, vent methane into the atmosphere. Methane venting can be minimized, though, by retrofitting TEG dehydrating systems with emission controls and optimizing dehydration processes.



- 4. Desiccant dehydrators** To remove gas moisture without venting methane, desiccant dehydrators pass the gas through a bed of water-absorbing salt (the desiccant). Only a small amount of methane is released intermittently when the salt is replaced. Desiccant dehydrators are best suited to wells with low gas flow rates and temperatures.



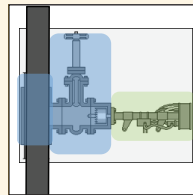
- 5. Dry seal systems** Throughout the oil and gas industry, dry seals can be used to reduce emissions from the centrifugal compressors that move gas efficiently through pipelines. Most new centrifugal compressors have dry seals, which use gas to create high-pressure barriers that prevents leaks.



- 6. Improved compressor maintenance** Replacing worn rod packing, as part of an improved compressor maintenance program, can prevent methane leaks.



- 7. Low-bleed or no-bleed pneumatic controllers** Pneumatic controllers control pressure, gas flow, and liquid levels, and automatically operate valves. Pneumatic controllers may be designed to release (bleed) methane to the atmosphere as part of normal operations. Methane emissions can be reduced by replacing high-bleed controllers with low- or no-bleed ones, retrofitting with bleed-reduction kits, or converting gas-based pneumatics to air-based pneumatics.



- 8. Pipeline maintenance and repair** When a pipeline is repaired or replaced, or cut to install a new connection point, methane is traditionally released into the atmosphere. The amount of methane vented can be reduced by connecting a new pipe to the system while it remains in operation, removing gas with compressors, or depressurizing the pipeline to flow gas to a nearby low-pressure fuel system.



- 9. Vapor recovery units (VRUs)** Crude oil containing natural gas or gas liquids (condensates) is sometimes stored in tanks. Methane can escape from the tanks during agitation of the liquids, during transportation or mixing, or even while standing. VRUs comprising scrubbers, compressors, and valves can capture up to 95 percent of the methane that would otherwise be vented.



- 10. Leak monitoring and repair** Methane leaks can occur from numerous locations at an oil and gas facility—valves, drains, pumps, connections, pressure relief devices, open-ended valves, and lines. These leaks are called fugitive emissions. Since methane is a colorless, odorless gas, methane leaks often go unnoticed. A well-implemented program of regularly monitoring and repairing leaks can significantly reduce fugitive emissions.

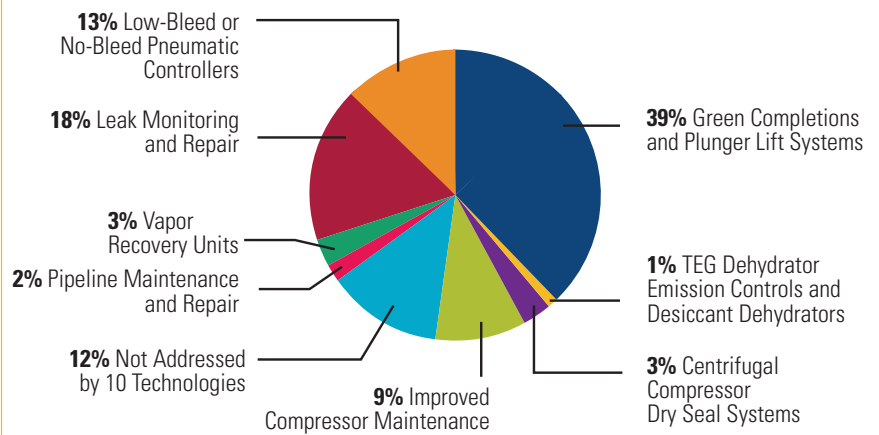
VALUE OF METHANE CONTROL TECHNOLOGIES

The 10 methane control technologies highlighted here will pay for themselves and be profitable within just a few months or years of installation, as shown in the table below. Technologies with potential to capture a large percentage of the industry's methane emissions, such as green completions and plunger lift systems, have very short payback periods and continue to generate profits for years.

The EPA's estimates of the total amount of methane wasted in the United States are quite uncertain, and other sources estimate that methane waste could be higher.¹ The EPA estimates that its proposed oil and gas New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAPs) would reduce methane by about 3.4 million tons per year (approximately 160 billion cubic feet (Bcf) or about a quarter of estimated 2009 emissions of 623 Bcf).² The proposed standards would also reduce 540,000 tons of VOCs and 30,000 tons of HAPs nearly 30 percent of the current emissions.

The EPA quantified the global social benefits of these methane reductions in mitigating climate change (agricultural, health, sea level, heating and cooling) at up to \$4.7 billion.³

O&G Industry Methane Emission Reduction Potential by Technology



Note: 2009 gross O&G industry methane emission was 791 Bcf. The 10 technologies can address all but 12 percent of these emissions.

STRONGER POLICIES AND ACTION ARE NEEDED TO MINIMIZE METHANE EMISSIONS

The EPA and a few states have already reduced the oil and gas industry's U.S. gross methane emissions by approximately 20 percent through a combination of voluntary programs, such as Natural Gas STAR and regulations. Given industry standard practice to date, however, the profits to be gained from methane control technologies may not be enough to drive further voluntary reductions. Even the American Petroleum Institute acknowledges that "companies and investors operate under capital constraints and the estimated financial returns of such GHG reduction projects may not justify diverting capital from other higher return or more strategic initiatives."⁴ Mandatory programs and improved policies are needed to get closer to the more than 80 percent methane reduction level that is within our reach.

Methane Capture Technology Costs and Benefits

Technology	Investment Cost	Methane Capture	Profit	Payout
Green Completions	\$8,700 to \$33,000 per well	7,000 to 23,000 Mcf/well	\$28,000 to \$90,000 per well	< 0.5 – 1 year
Plunger Lift Systems	\$2,600 to \$13,000 per well	600 to 18,250 Mcf/year	\$2,000 to \$103,000 per year	< 1 year
TEG Dehydrator Emission Controls	Up to \$13,000 for 4 controls	3,600 to 35,000 Mcf/year	\$14,000 to \$138,000 per year	< 0.5 years
Desiccant Dehydrators	\$16,000 per device	1,000 Mcf/year	\$6,000 per year	< 3 years
Dry Seal Systems	\$90,000 to \$324,000 per device	18,000 to 100,000 Mcf/year	\$280,000 to \$520,000 per year	0.5 – 1.5 years
Improved Compressor Maintenance	\$1,200 to \$1,600 per rod packing	850 Mcf/year per rod packing	\$3,500 per year	0.5 years
Pneumatic Controllers Low-Bleed	\$175 to \$350 per device	125 to 300 Mcf/year	\$500 to \$1,900 per year	< 0.5 – 1 year
Pneumatic Controllers No-Bleed	\$10,000 to \$60,000 per device	5,400 to 20,000 Mcf/year	\$14,000 to \$62,000 per year	< 2 years
Pipeline Maintenance and Repair	Varies widely	Varies widely but significant	Varies widely by significant	< 1 year
Vapor Recovery Units	\$36,000 to \$104,000 per device	5,000 to 91,000 Mcf/year	\$4,000 to \$348,000 per year	1 – 3 years
Leak Monitoring and Repair	\$26,000 to \$59,000 per facility	30,000 to 87,000 Mcf/year	\$117,000 to \$314,000 per facility per year	< 0.5 years

Note: Profit includes revenue from deployment of technology plus any O&M savings or costs, but excludes depreciation.

The 10 technologies discussed in this report can capture more than 80 percent of the 623 Bcf wasted by the oil and gas industry. Selling this methane at the average 2011 price of \$4 per thousand standard cubic feet (McF) would generate more than \$2 billion annually, and reduce global warming pollution equivalent to emissions from more than:

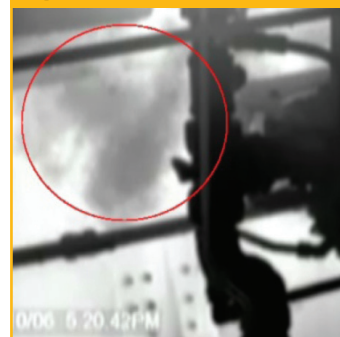
- 40,000,000 passenger vehicles
- The electric use of approximately 25,000,000 homes
- 50 coal fired power plants, or
- 500,000,000 barrels of oil⁵

Hand Held Infrared Camera



© Mine Safety Appliances Co.

Leaking Valve as shown by Infrared Camera



© FLIR Systems, Inc.

GOVERNMENT SHOULD REQUIRE PRODUCERS TO ADOPT BEST PRACTICES IN METHANE CAPTURE

- **NRDC supports the EPA's issuance of NSPS regulations to curb VOC emissions from new and modified sources in the oil and gas industry.** Controlling VOCs will achieve significant methane reduction co-benefits. For example, methane emissions during well completions and recompletions will be controlled to a much larger degree under the proposed regulations. The EPA's proposed regulations are a good starting point, but they and the NESHAPs could go much further.⁶

Currently, the EPA's proposed standards would achieve methane reductions through VOC regulation, but the EPA should also regulate methane directly, which would achieve much larger emission reductions.

- **The EPA should issue methane emissions guidelines for existing sources that generate the bulk of methane emissions.** States would then be required to adopt methane leakage control measures for existing sources through their State Implementation Plans. The EPA's guidelines and state implementing standards should also cover methane emissions from all significant sources of emissions from all segments of the natural gas supply chain, and require compliance with even stronger standards and procedures.
- **Federal land management agencies should reduce methane leakage from oil and gas lease operations on federal lands.** They should modernize oil and gas conservation policies to account for ever-improving

methane reduction technologies and practices, and control methane emissions from oil and gas development through environmental reviews, lease stipulations, and drilling permit approvals.

- **States should do more to protect environmental quality and public health.** Colorado, Wyoming, and Montana have standards covering existing methane emission sources including wells, pneumatic devices, and storage tanks. While these safeguards provide a good start, they and other states should develop even stronger standards.
- **Best practices learned from voluntary programs should be required of all producers.** Through the EPA's voluntary Natural Gas STAR program, many techniques to reduce methane emissions have been tried, yet proven and effective technologies have not been widely adopted by the industry. To achieve significant industry-wide reductions, the most successful practices documented by the Natural Gas STAR program should be made mandatory, such as through NSPS and NESHAPs programs.

NRDC supports establishing a fully effective system of safeguards to ensure that natural gas is produced, processed, stored, and distributed in a way that ensures protection of our water, air, land, climate, human health, and sensitive ecosystems. NRDC opposes expanded fracking until effective safeguards are in place. For more information on NRDC's position on natural gas and fracking, go to <http://www.nrdc.org/energy/gasdrilling/>.

1 Howarth, R. et al., Methane Emissions from Natural Gas Systems, Background Paper Prepared for the National Climate Assessment (reference number 2011-0003), February 25, 2012. Available at <http://www.eeb.cornell.edu/howarth/Howarth%20et%20al.%20-%20National%20Climate%20Assessment.pdf>.

2 U.S. EPA, Oil and Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews; Federal Register, v. 76, no. 163 (76 FR 52738); EPA Docket No. EPA-HQ-OAR-2010-0505, FRL-9448-6; August 23, 2011, available at: <http://www.epa.gov/airquality/oilandgas/index.html>.

3 U.S. EPA, Regulatory Impact Analysis, Proposed New Source Performance Standards and Amendments to the National Emissions Standards for Hazardous Air Pollutants for the Oil and Natural Gas Industry, July 2011, page 4-32. Available at <http://www.epa.gov/airquality/oilandgas/index.html>.

4 American Petroleum Institute (API) and the International Petroleum Industry Environmental Conservation Association (IPIECA), Oil and Natural Gas Industry Guidelines for Greenhouse Gas Reduction Projects, prepared by URS Corporation, March 2007, page 18.

5 U.S. EPA Greenhouse Gas Equivalencies Calculator, <http://www.epa.gov/cleanenergy/energy-resources/calculator.html#results>.

6 NRDC and other environmental organizations, Comments on New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews, Proposed Rule, November 30, 2011; EPA Docket No. EPA-HQ-OAR-2010-0505, Document ID No. EPA-HQ-OAR-2010-0505-4240. Available at www.regulations.gov.

Download the full report "Leaking Profits: How the Oil and Gas Industry Can Reduce Pollution, Conserve Resources, and Make Money by Preventing Methane Waste" at www.nrdc.org/energy/leaking-profits.asp