BLUEGREEN ALLIANCE

PLUGGING THE LEAKS

Protecting Workers, Reducing Pollution, and Creating Quality Jobs by Reducing Methane Waste in the U.S. Oil and Gas Industry

BLUEGREEN
ALLIANCE

The BlueGreen Alliance unites America's largest labor unions and its most influential environmental organizations to identify ways today's environmental challenges can create and maintain quality jobs and build a stronger, fairer economy.

BLUEGREEN ALLIANCE Partner Organizations

UNITED STEELWORKERS USW · SIERRA CLUB · CWA · NRDC · SEIU Stronger Together · National Wildlife Federation · SMART Sheet Metal, Air, Rail and Transportation

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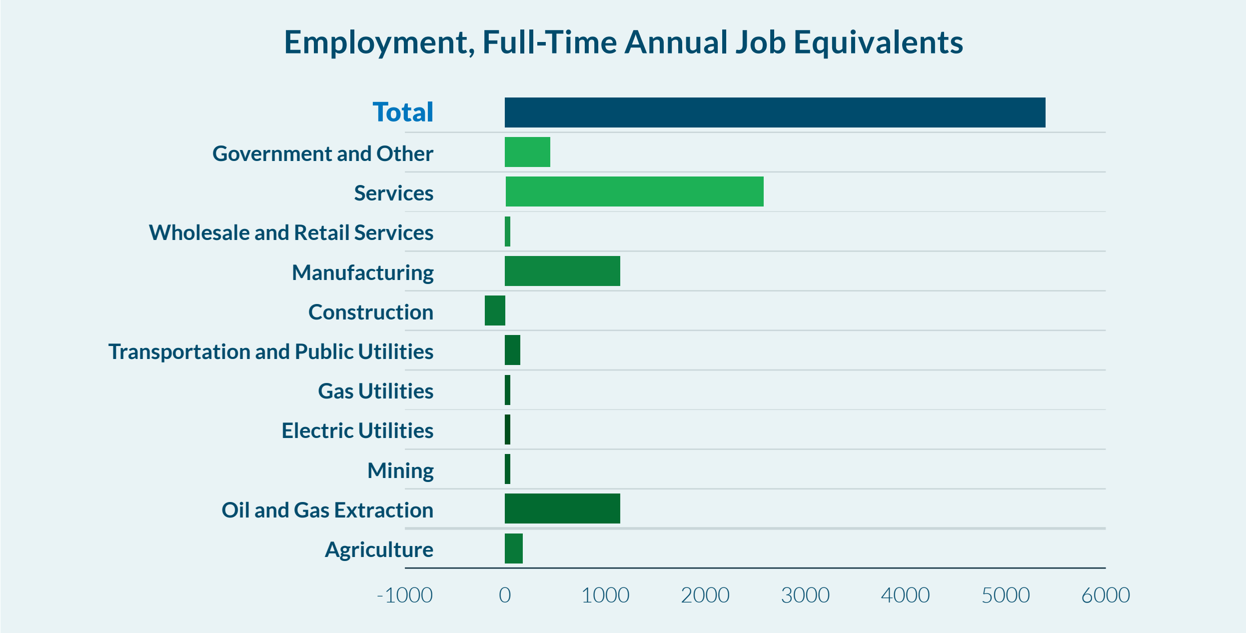
EXECUTIVE SUMMARY

Reducing methane emissions in the United States is yet another example of how America's environmental challenges can also be economic opportunities. Methane is a greenhouse gas that is many times more potent than carbon dioxide and the second largest contributor to climate change,[1] and reducing methane emissions can reap economic benefits for workers and communities across the country.

To address this problem, the U.S. Environmental Protection Agency (EPA) recently issued a final standard, the "Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources," which is intended to bring improved technologies and practices to the energy sector with the expressed purpose of reducing waste and pollution. This report examines the economic impact of these standards—both in terms of direct and indirect jobs created and the quality of jobs created as a result of anticipated investments.

The broadly positive employment results are due to the fact that the emissions reduction technologies modeled, specifically in leak detection and reduction, are more labor intensive than the oil and gas extraction industry on average.

It is estimated that nearly 5,400 direct and indirect jobs will be created annually in a variety of sectors, including manufacturing. With full and continuing adoption of leak reducing technologies and practices at new and modified oil and gas facilities, this would suggest creation of over 50,000 jobs over the first decade of full implementation of methane standards.[2]



Activities in the U.S. oil and gas industry are the largest source of methane emissions.[3] While this can be due to accidental leaks, more often these emissions are due to outmoded practices and obsolete technology utilized by the industry in the gathering, transmission, production and processing of natural gas. Lost and leaking natural gas costs billions of dollars every year—nationwide, these activities waste the amount of gas it takes to heat nearly 7 million homes.[4]

But the problem goes beyond impacts to our climate. Throughout this process, the nation's energy sector leaks dangerous and wasteful emissions like benzene—a known carcinogen—and other pollutants into the air, which endangers workers and communities surrounding these facilities.[5]

This report examines the impacts of anticipated investment in cleaner technologies incentivized by this standard by measuring the resulting employment effects. This federal standard would achieve cost-effective methane emissions reductions and provide greater certainty about Clean Air Act permitting requirements for new and modified upstream natural gas activities, such as the gathering, transmission, production, and processing of natural gas. Low-cost solutions already exist to plug industrial gas leaks, which are being deployed by many companies, however most of the industry has failed to adopt these safeguards.

The findings in this report are clear: Updating industry practices and equipment to meet the standards will not just make workers and communities around the facilities safer and healthier, but will also generate and support quality, family-sustaining jobs.

PLUGGING THE LEAKS

I. INTRODUCTION

The U.S. economy is the largest in the world, representing about a quarter of total global output.[6] Even though a highly advanced services sector represents the bulk of economic activity, the United States also has an important manufacturing base, which represents about 12 percent[7] of the nation's economy.

The U.S. economy maintains its preeminent status due to several factors. The country has access to abundant natural resources, including natural gas, as well as extensive—although deteriorating in many sectors—physical infrastructure. American workers are among the best educated and productive in the world. Physical and human capital is deployed effectively in a free-market system in a society characterized by political stability, an effective legal system, and a regulatory structure that promotes prosperity and growth.

In recent years, however, the U.S. economy is emerging from a period of great turmoil.

The economy has been recovering slowly but steadily since the depths of the Great Recession. While unemployment has recovered significantly—dropping to about 5 percent in 2016—there is widespread debate regarding the health of the U.S. economy.[8] Specifically, although profits and compensation have risen, wages for average workers have risen at a much slower place, and the wage gap has widened in our economy.[9] The struggle in our economy isn't just creating jobs; it is creating quality jobs that provide family-sustaining wages and benefits for workers. That is why it is vital to realize the potential of a clean, low-carbon economy—sectors of the economy producing goods and services with a climate benefit, which in turn would stimulate growth in the remainder of the economy—as a source of economic growth and quality job creation.

This clean economy values efficiency; a wasted resource—like natural gas released or lost from upstream activities—does not just cost us all money, it also impacts our environment, and in many cases, our climate.

The U.S. Environmental Protection Agency (EPA) in May 2016 introduced a new standard *Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources*[10]—from here referred to as methane standard for the purposes of this report—that is intended to bring improved technologies and practices to the energy sector with the expressed purpose of reducing waste and pollution. This report attempts to quantify the estimated benefits of these recent federal efforts to reduce methane leaks throughout the energy sector.

The following assessment examines the impacts of expected investment in cleaner technologies from the methane standard by measuring employment effects.

II. METHANE LEAKS AND THE OIL AND GAS SECTOR

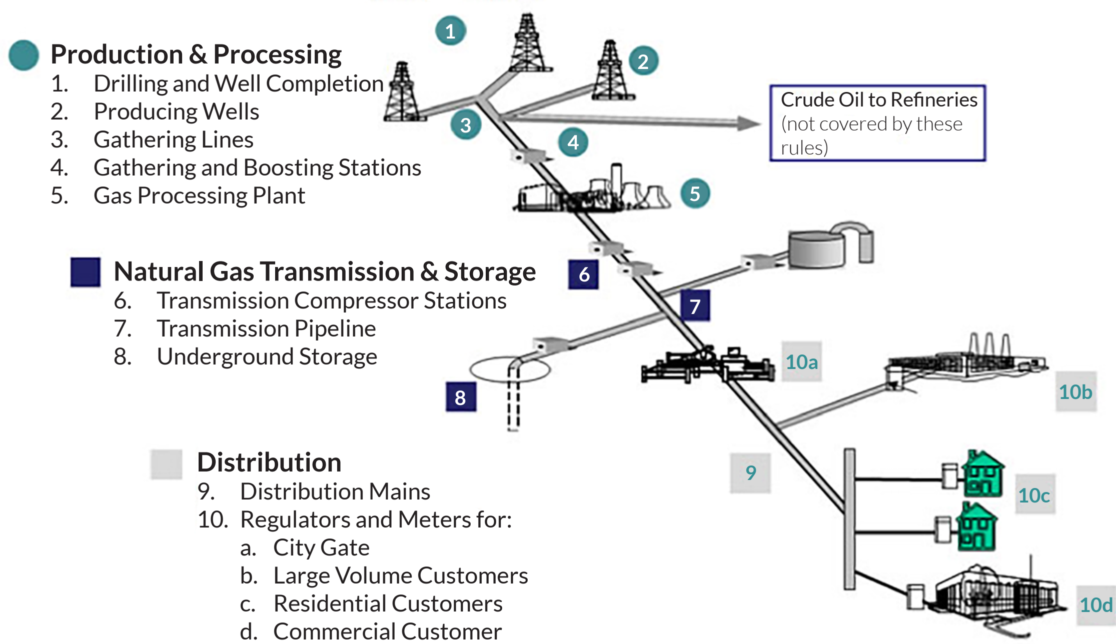
Our nation's energy sector has made significant strides to increase the efficiency of our natural gas systems in recent years. However, leaking methane continues to harm the economy and the environment. Leaking pipes and systems present a hazard for workers and communities, waste valuable resources, and worsen climate change. On a pound-for-pound basis, atmospheric methane is orders of magnitude more potent[11] than carbon dioxide as a greenhouse gas (GHG). Oil and gas activities are the largest sources[12] of methane pollution, and recent EPA inventories suggest these emissions are 34 percent higher than originally estimated.[13]

During natural gas gathering, transmission, production, and processing activities—otherwise known as upstream sources of methane emissions—the nation's energy sector leaks dangerous and wasteful industrial pollution like methane, benzene and other pollutants into our air from oil and natural gas wells, pipelines, tanks, and other equipment (for an illustration of upstream activities, see Figure A, upstream activities are above the city gate).[14] These releases can be accidental, but often are due to outmoded practices and obsolete technology.[15] This lost and leaking natural gas costs billions of dollars every year, and nationwide, these upstream activities waste the amount of gas it takes to heat nearly 7 million homes.[16] Efforts to curtail this waste are vital to strengthening the economy and protecting the environment.

Laws protecting public health and environmental protections have a successful history of pushing our nation's energy sector to evolve for the better, including policies such as the Clean Air Act, Clean Water Act, and more recently "green completions"[17]—emissions reduction standards for natural gas wells that laid the groundwork for policies such as the methane standard. Proven, low-cost technologies are already commercially available to cut methane emissions from the oil and gas sector by 50 percent in the next five years.[18] While some companies have moved to adopt these improvements voluntarily,[19] the prospects of keeping gas in the system with available and cost-effective of mitigation technology could expect to improve with a larger market and level regulatory playing field among energy companies.

FIGURE A: The Natural Gas Production Industry

Natural gas systems encompass wells, gas gathering and processing facilities, storage, and transmission and distribution pipelines.



Source: Adopted from American Gas Association and EPA Natural Gas STAR Program

III. EPA METHANE STANDARDS AND HOW THEY WILL EXPEDITE TECHNOLOGY

Low-cost solutions already exist to plug industrial methane leaks and power more homes and businesses.[20] Despite this, most of the industry has failed to adopt these safeguards. The methane standard put forward by the EPA reflects the necessity to spur the industry to reduce waste and pollution in new and modified sources coming online. Having the standard in place also provides an opportunity for companies to innovate in methane mitigation technology and strategies and provides greater regulatory certainty for the industry over the long run.

About the Rule

In 2012, the EPA the released New Source Performance Standards (NSPS), better known as the "green completions" rule, which regulated conventional pollutants—including volatile organic compounds (VOCs) and sulfur dioxide—in products and processes for drilling and extraction of oil and natural gas, as well as processing and transportation of natural gas.[21] The May 2016 methane standard builds on the success of the green completions rule to adopt emissions standards for VOCs and adds methane emissions standards for new, reconstructed, and modified sources in the oil and natural gas sector.

The 2016 rule improves industry accountability in the following ways:

- Builds on the agency's 2012 rules ("green completions") to curb methane (the primary component of natural gas) and volatile organic compound (VOC) emissions from new, reconstructed and modified sources in the oil and gas industry to cover additional equipment and activities in the production chain. Operators will be able to achieve leak reductions using technologies that are cost-effective and readily available.
  - Sources that were not covered under the green completions rule include hydraulically fractured oil well completions, emissions from well sites and compressor stations, and pneumatic pumps;
  - The rule expands limits to methane sources that previously were subject only to VOC standards including hydraulically fractured gas well completions and equipment leaks at natural gas processing plants; and
  - The methane rule also expands methane and full VOC standards to equipment that was previously only subject to partial VOC standards, including pneumatic controllers, centrifugal compressors, and reciprocating compressors, with the exception of compressors located at well sites.[22]
- Requires improvements to oil and gas industrial practices. For example, the final rule requires low production wells to monitor leaks, rather than exempting them. Also, the 2016 rule requires compressor stations to monitor leaks four times a year, rather than twice a year.

Why Do We Need This Standard?

The EPA determined that GHGs, including methane, present a threat to public health and welfare, and there are significant GHG emissions from the oil and gas sector. The natural gas and petroleum systems are the largest emitters of methane in the United States, and these emissions are expected to continue growing.[23, 24]

To address climate change, the EPA and Obama administration have undertaken a multi-pronged approach to reducing emissions. These efforts include carbon pollution limits for new and existing power plants, signing onto the Paris Agreement to limit global greenhouse gas emissions, and a goal to reduce methane emissions from the oil and gas sector by 40 to 45 percent from 2012 levels by 2025.[25] These standards are vital to achieving the methane emissions reductions goal.

Implementing the Standards

The Regulatory Impact Analysis estimates the total annualized engineering costs of implementing the rule to be between $180 million and $200 million in 2020, and $370 to $500 million in 2025.[26] This analysis found the benefits to reducing methane emissions in the oil and gas industry far outweighed the costs. The EPA estimates the final rule will generate climate benefits of $690 million in 2025, which would outweigh estimated implementation costs of $530 million—netting climate benefits estimated at $170 million in 2025.[27]

In addition, the standards will prevent significant new emissions: 170,000 to 180,000 tons of methane, 120,000 tons of VOCs, and 310 to 400 tons of hazardous air pollutants will have been prevented in 2020.[28]

Finally, the monetized climate benefit from reducing methane emissions, calculated using the social cost of methane, but not including positive health impacts from reducing air pollution, is estimated to be $200–210 million in 2020.[29]

As described later in this report, this investment in products and processes will also create jobs manufacturing the products and technologies installed; these jobs are not included in the above estimates. Upgrading industry practices and outdated technology means better working conditions—with less exposure to carcinogens like benzene—and stronger job opportunities for frontline oil and gas workers.

IV. FIXING LEAKS THROUGH BETTER TECHNOLOGY

The technology required to fix leaks in upstream natural gas activities already exists, and much of it is cost-effective to deploy. A 2014 report from ICF International, *Economic Analysis of Methane Emission Reduction Opportunities in the U.S. Onshore Oil and Natural Gas Industries*, explores what sources are responsible for a large portion of the emissions at existing facilities and what existing technologies can be used to reduce them. One key finding was that energy sector methane emissions could be cut dramatically—40 percent—at an average annual cost of less than one cent per thousand cubic feet of produced natural gas by adopting available emissions-control technologies and operating practices. These costs could be further offset by recovering the full market value of recaptured natural gas.[30]

Opportunities and Key Technologies

As the ICF International report notes, 80 percent of methane emissions are produced by 20 percent of the products and processes. The actions that we can take to reduce the largest leak areas by volume include:

- Improving leak detection and repair of fugitive emissions ("leaks") at facilities and gas compressors;
- Reducing venting of associated gas; and
- Replacing high-emitting pneumatic devices, including pumps and bleeding equipment.[31]

Focusing on the categories that create the majority of emissions, this report delves into existing technology to reduce leaks in these areas and includes several detailed case studies. ICF International found that more than half of methane reductions identified can be achieved at a negative net cost, accounting for the value of captured methane sold at $4 per thousand cubic feet (Mcf). In many cases, more than 95 percent of emissions could be reduced at zero net cost.

Job Opportunities

A 2014 report from Datu Research, *The Emerging U.S. Methane Mitigation Industry*, further explains existing technologies with a focus on identifying and exhibiting companies that produce the products and services. They found that:

- At least 76 firms manufacture methane mitigation equipment in the United States and/or offer services;
- Fifty-nine percent of methane mitigation firms qualify as small businesses;
- Methane mitigation companies provide U.S. jobs in at least 531 locations across 46 states;
- The methane mitigation industry employs at least 30 key job types; and
- The median hourly wage for the industry is $30.88, compared to $19.60 for all U.S. jobs[32]

FIGURE B: U.S. Map of Employee Locations In The Methane Mitigation Industry[2]

Total Locations: 568
Unique Locations: 531
Total Firms: 76

- U.S. Headquarters: 68
- Manufacturing/Assembly: 102
- Services: 344
- Sales: 54

Visit www.edf.org/methanejobs to explore an interactive map with the location and distribution of methane mitigation industry firms.[33]

V. FINDINGS

For this report, we used the ICF International analysis of future emissions and reduction options referenced above to identify the costs and benefits of deploying a suite of existing technologies to reduce methane emissions. The ICF analysis provides a much broader suite of options of emissions reductions throughout the energy sector than were included in the final NSPS rule for new and modified facilities handing oil and gas; however it is useful here for providing insight into the existing methane mitigation sector, how the sector operates, and how expanded use of these technologies as required by the methane standard would impact the sector and larger economy.

The ICF analysis builds out an abatement cost curve based on 18 sources of emissions and the costs of implementing reduction technologies in each. The analysis includes estimates of the capital and operating costs of each technology, the amount of recovered methane likely to be captured for resale, and the economic value of the sales. The report presents annualized costs of reductions assuming $4 per Mcf of natural gas—a reasonable long-term estimate for gas prices given historic trends and estimated future supply and production ability.[34]

We used the results of the ICF analysis to estimate the annual employment impacts of deploying the full suite of reduction technologies examined by ICF and representative of the leak detection and reduction technologies and practices outlined in the 2016 EPA methane standards. The technologies assessed include a range of capital expenditures, ongoing labor requirements, and other operating costs. It develops an annualized cost of deployment, which smooths the up-front capital costs across the expected lives of each individual installation, resulting in a steady-state net cost and benefit assessment.

Our analysis estimates the impacts on employment of this steady state. We model annualized capital investments as well as the labor and other operating requirements of the reduction technologies. We include the sales of recovered methane at $4 per Mcf and account for the reductions in gas production and sales that the recovered methane offsets to generate a net impact on the oil and gas industry as well as the industries along the both the traditional drilling and emission reduction supply chain.

For the entire suite of methane mitigation technologies, of which the methods entailed by the NSPS are a comparable subset, ICF estimates implementation costs would entail gas costs at $4.66 per Mcf. With an assumed market price of $4 per Mcf, the sale of recovered emissions is insufficient to cover the entire cost of the reductions, leaving a net cost of $0.66 per Mcf. This represents less than one cent per Mcf of total gas produced in the U.S. market. For this reason, our modeling assumes that overall end use gas consumption would not change. The gas industry reduces emissions, capturing much of the gas for resale, reducing production and sales of gas from traditional methods to offset the sales of recovered gas. We model this as a reduction in expenditures by the oil and gas sector on traditional activities and an increase in expenditures on labor and equipment purchases as detailed by ICF. Total revenues to the sector do not decline, since we assume that end use gas consumption and prices both do not change. However, net expenditures by the sector do increase, since the cost of reducing emissions is less than the value of the sale of the recovered gas.

It is estimated that nearly 5,400 direct and indirect jobs will be created annually in a variety of sectors, including manufacturing.

Figure C shows the employment impacts as measured in annual full-time job equivalents (FTE) for the economy as a whole, broken down into 11 major economic sectors. The impacts are either neutral or positive for every industry except construction, which shows a modest decline in employment.

The broadly positive employment results are due to the fact that the emissions reduction technologies modeled, specifically in leak detection and reduction, are more labor intensive than the oil and gas extraction industry on average. As a result,

> It is estimated that nearly 5,400 direct and indirect jobs will be created annually in a variety of sectors, including manufacturing.

job losses in gas extraction that result from reduction in traditional gas extraction are more than offset by increases in employment required to sustain emissions reduction efforts. This accounts for the relatively large increase in employment in the gas sector. Intuitively, it has shifted a share of its production away from traditional, less labor-intensive methods to the more labor-intensive methods required by the emissions reduction technologies.

This increase in employment results in an increase in household income, which in turn results in increases in household purchases which tend to be relatively concentrated in more labor-intensive industries—notably in services—accounting for the increase in employment in that sector as well as in other sectors, including government, transportation, utilities, and agriculture.

The manufacturing sector shows a significant increase in employment, which is due to the fact that it produces the equipment needed for the various emission reduction investments.

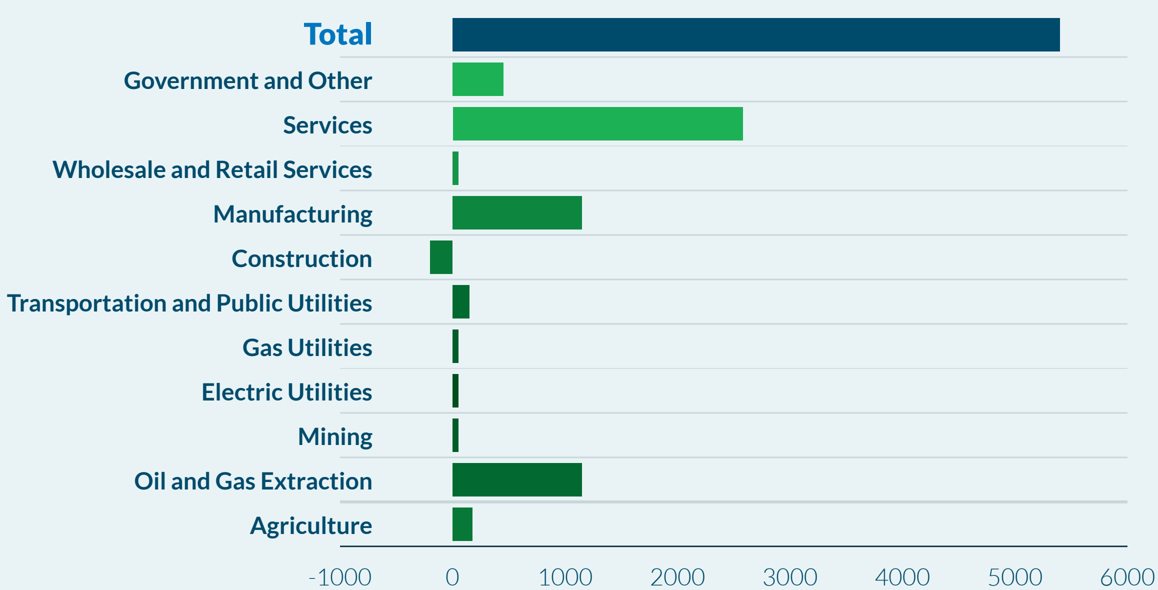
The need to implement and operate more advanced equipment and apply more comprehensive leak detection and mitigation technologies over time suggests jobs directly created in the oil and gas sector would not be temporal nor necessarily relocate. While some jobs would engage engineering and other technical professions requiring advanced degrees, they mostly also employ high skilled labor and trades professions complementing the current workforce at oil and gas operations.

The creation and sustainment of jobs is tied strongly to the investment and implementation of a rather well-defined set of cost-effective technologies and practices in the oil and gas sector, and may not totally offset job attrition resulting from "boom and bust" cycles to which the energy sector is often prone. However, the skill level needed and consistent nature of leak detection and mitigation activities entailed by the methane standard—employed industry-wide versus at a fraction of companies—offer a new avenue for steady job sustainment compared to 'business as usual' prior to the NSPS. In addition, the Datu report finds that jobs in the methane mitigation industry are good-paying jobs, with the median hourly wage for workers at $30.88, compared to $19.60 for all U.S. jobs.

The reduction in employment in the construction sector is due to the fact that traditional gas extraction employs a certain amount of resources from the construction sector in its supply chain, such as pipeline construction. In our model, the manufacture and installation of emission reduction equipment is undertaken by the manufacturing and gas extraction sectors respectively, which does not offset the reduction in construction sector employment. Further, households generally consume very little construction services, so that the increase in household income increases construction employment at a level insufficient to offset the losses resulting from decreased gas extraction.

With full and continuing adoption of leak reducing technologies and practices at new and modified oil and gas facilities, this would suggest creation of over 50,000 jobs over the first decade of full implementation of methane standards.[35]

FIGURE C: Employment, Full-Time Annual Job Equivalents



VI. METHODOLOGY

The estimates developed for this report are based on relatively straightforward input-output analysis. The model is based on core data from the IMPLAN group, utilizing their 2014 U.S. national model. Using data from ICF on the equipment, labor, and other costs of reducing methane emissions, we calculated the total final demand requirements needed to install and operate the emissions reduction technologies examined in the report.

The time profile of these investments may involve a large initial capital investment followed by relatively smaller ongoing expenditures. For this report, we analyzed the likely impacts of the emissions reductions on an annualized basis. One reason for this is to represent what the economy would look like in a steady state. The equipment required for the emission reduction has a finite lifespan—with some equipment having an expected life of three years, at which point it would be replaced. Modeling annualized costs abstracts from potential lumpiness of the investment timeline.

We allocated the required expenditures on equipment to the manufacturing sector, and the labor requirements to the household sector as income. The ICF report estimated the labor expenditures and salaries of the technical staff required to perform the work involved. We mapped the expenditures to household sector as mentioned, and calculated the FTE job impacts of the labor requirements. Using these spending patterns and overall costs, we created a vector of final demands as the input to the economic model. The model calculates employment impacts throughout the economy based on the number of jobs required to support the resulting household purchases, the equipment investments, and the ongoing operating costs, as well as supply chain requirements of all of these impacts, accounting for imports by scaling sectoral demand based on the average level of imports for the individual sectors.

As mentioned above, ICF estimated the net cost of reducing emissions to be $0.66 per Mcf. Because this would represent a small fraction of gas sales, less than one cent per Mcf (one-quarter of one percent), an amount small enough to be lost in ordinary market-driven price fluctuations, we assumed that it would not result in any net reduction in end use natural gas demand. Instead, we assumed that the cost would be borne by the gas industry, as part of the Oil and Gas Extraction sector. An alternate assumption would be to assume the costs were borne by consumers, which would result in much smaller net impacts on both the gas and the service sectors. It would also reduce or eliminate the negative impacts on the construction sector. The decision of how to allocate the costs is a necessarily arbitrary one, and it is more appropriate to focus on the overall results rather than the impacts on individual sectors.

VII. CONCLUSIONS

A significant investment in our domestic economy, specifically reducing leaks and pollution in the oil and gas sector—an investment that will help fix a critical part of our energy infrastructure while simultaneously creating jobs and cutting global warming pollution—appears to be a winning proposition for workers and communities, the environment, and the economy, and an example of way to build out a cleaner, lower carbon economy.

The EPA methane rule for new and modified facilities in the oil and gas sector would entail job creation and sustainment, in proportion to a very nominal cost for upgrades in technology, equipment, and practices for the industry. The technical and innovative nature of these jobs suggest they would be better paying and less temporal than other jobs in the general economy, and the overall economy would benefit by having well-developed energy infrastructure that delivers safe and reliable energy efficiently to end-users.

What kinds of technology?

When it comes to the energy technology driving America's 21st century economy, techniques and equipment in many cases date back to the 20th century, often several decades. **Newer, less leak-prone machinery for oil and gas operations is increasingly available—the Datu report referenced in this report identifies more than 500 facilities producing methane mitigation technologies across 46 states that could help reduce leaks and achieve the emissions reduction goals of the EPA methane standard.**

For example, compressors have long used a "wet" seal system, using high-pressure oil to keep seal moving parts. Newer "dry" seal technology, using high pressure gas, is increasingly available and substantially reduces emissions. In addition, dry seals significantly reduce operating costs and improve efficiency; some types of dry seal compressors are estimated to pay back their costs in less than a year.

Pneumatic controllers are devices that use energy from pressurized gas to create mechanical action. In oil and gas operations, devices often used natural gas as an operating element as it is readily available and flowing under pressure; newer technology uses compressed air to deliver the same mechanical effect. In addition, the need to "bleed" pneumatic devices to avoid high pressure conditions is a common element of gas transport and processing, newer, more advanced devices operate at higher tolerances and these low- or no-bleed technologies reduce the need to vent high volumes of natural gas while operating safely and effectively.

Lastly, process improvement complements the technological component. Across companies, inspection of oil and gas equipment can vary widely and can be on an "as needed" basis. **The EPA standards now require annual, semiannual, or quarterly inspections of gas handling equipment where often there were none or fewer before. This maintenance and operations aspect aims to identify leaking or faulty equipment sooner than later, averting emissions, improving operations and requiring skilled, proficient workers to ensure strong guidelines are met.**

ENDNOTES

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2 Note that the jobs estimates reported here are more appropriately called "job-year equivalents." Each "job" represents an increase in demand for employment sufficient to employ one-person full time for one year. When labor markets are tight, it is possible that a significant number of jobs created will be workers hired away from other jobs, so not all of the jobs created will be net new employment. In the current economic situation with high unemployment in construction and other key sectors, this problem is largely minimized.

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