CUTTING METHANE POLLUTION: SAFEGUARDING HEALTH, CREATING JOBS, AND PROTECTING OUR CLIMATE

HEARING

BEFORE THE

SELECT COMMITTEE ON THE CLIMATE CRISIS HOUSE OF REPRESENTATIVES

ONE HUNDRED SEVENTEENTH CONGRESS

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ONE HUNDRED SEVENTEENTH CONGRESS

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FRIDAY, JUNE 24, 2022

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE ON THE CLIMATE CRISIS,
Washington, DC.

The committee met, pursuant to call, at 9:02 a.m., in Room 210, Cannon House Office Building, Hon. Kathy Castor [Chairwoman of the committee] presiding.

Present: Representatives Castor, Bonamici, Brownley, Huffman, Levin, Graves, Palmer, Carter, Miller, Armstrong, Crenshaw, and Gonzalez.

Ms. CASTOR. The committee will come to order.

Without objection, the Chair is authorized to declare a recess of the committee at any time.

As a reminder, members participating in a hearing remotely should be visible on camera throughout the hearing. For members participating in person, masks are optional, per the Office of the Attending Physician.

As with in-person meetings, members are responsible for controlling their own microphones. Members can be muted by staff only to avoid inadvertent background noise.

As a reminder, statements, documents, or motions must be submitted to the electronic repository, to SCCC.repository@mail.house.gov.

Finally, members or witnesses experiencing any technical problems should inform the committee staff immediately.

Well, good morning. Welcome to our "Cutting Methane Pollution: Safeguarding Health, Creating Jobs, and Protecting our Climate" hearing. Today, we will review community perspectives on public health, climate, and jobs and the economic benefits of cutting methane pollution from oil and gas infrastructure.

I will now recognize myself for 5 minutes for an opening statement.

Well, welcome to part two of our hearing series on methane, the second-largest source of heat-trapping pollution and a major contributor to the climate crisis. Last week, we discussed state perspectives on cutting methane pollution and waste from the oil and gas sector. This week, we will discuss how slashing methane will help us safeguard the public health, create family-sustaining jobs, and improve lives across the nation.

It is clear that we need Federal action to reduce methane pollution from the oil and gas sector, which remains the largest indus-

trial source in the United States. According to the majority staff report from the House Science Committee, oil and gas companies are routinely failing to address super-emitting leaks.

Deployment of technologies to find and repair leaks is limited, and it is inconsistent. In order to fix this, it is crucial that the Federal Government holds producers accountable for wasteful leaks as well as harmful practices like venting and flaring. Unless we step up our work, American families will continue to face the costly harms posed by this super-pollutant.

The health risks associated with methane pollution are clear. Americans living near oil and gas production suffer more asthma attacks as well as other lung and heart problems. Living near oil and gas wells can be dangerous to pregnant women, causing lower birth weights and pre-term births. In too many cases, these harms fall on frontline communities, including communities of color and low-income neighborhoods.

But these outcomes are entirely avoidable. There are ample technologies available to help producers cut methane in cost-effective ways. These include continuous monitoring technologies, handheld optical imaging sensors that use infrared light, satellites that detect plumes from individual sites, and technologies to cleanly combust methane on site.

Deploying these technologies would allow the oil and gas sector to slash its methane emissions in half at no net cost. This is low-hanging fruit. These technologies can reduce waste and help save producers and customers money, but we need more companies to take advantage of them. Strong methane regulations from the Environmental Protection Agency to address the industry's wasteful methane leaks will help drive innovation, enhance deployment, and create jobs.

The good news: we are getting help from the Biden administration. Last week, along with the European Union and others, President Biden helped launch the Global Methane Pledge Energy Pathway, a commitment to drive down methane pollution in the oil and gas sector and to eliminate routine flaring as soon as possible.

The President is also committed to slashing methane emissions in half by 2030. And his proposed EPA rule would reduce methane emissions by roughly 41 million tons through 2035.

House Democrats have also taken action. In the Energy Act of 2020, we included improvements to natural gas pipeline safety as well as requirements for minimum performance standards, strict deadlines, and the use of advanced technologies to find and repair methane leaks.

Last year, we passed a bipartisan resolution rejecting the Trump administration's attempt to weaken methane safeguards. And through the Bipartisan Infrastructure Law, we invested $4.7 billion to help states and Tribes plug and remediate abandoned oil and gas wells.

We also increased funding for reclaiming abandoned mines, modernizing natural gas pipelines, and addressing undocumented orphan wells. The House-passed reconciliation bill also included a methane fee to address wasteful pollution. And the House-passed Bipartisan Innovation Act included provisions to help states repair and replace leaking natural gas distribution pipelines.

So cutting harmful methane pollution will protect the public health and the climate, it will catalyze growth of new small businesses, and it will create tens of thousands of new jobs. So I look forward to hearing from our witnesses today as we bring these cost-saving benefits to more American communities.

I yield back the balance of my time and recognize the Ranking Member, Mr. Graves of Louisiana, for his 5-minute opening statement.

[The statement of Ms. Castor follows:]

Opening Statement of Chair Kathy Castor

Hearing on "Cutting Methane Pollution: Safeguarding Health, Creating Jobs, and Protecting Our Climate"

June 24, 2022

As prepared for delivery

Welcome to Part 2 of our hearing series on methane, the second largest source of heat-trapping pollution and a major contributor to the climate crisis. Last week, we discussed state perspectives on cutting methane pollution and waste from the oil and gas sector. This week, we'll discuss how slashing methane will help us safeguard public health, create family-sustaining jobs, and improve lives across the nation.

It's clear that we need federal action to reduce methane pollution from the oil and gas sector, which remains the largest industrial source in the United States. According to a Majority Staff Report from the House Science Committee, oil and gas companies are routinely failing to address super-emitting leaks. Deployment of technologies to find and repair leaks is limited and inconsistent. In order to fix this, it's crucial that the federal government holds producers accountable for wasteful leaks, as well as harmful practices like venting and flaring. Unless we step up our work, American families will continue to face the costly harms posed by this super-pollutant.

The health risks associated with methane pollution are clear. Americans living near oil and natural gas production suffer more asthma attacks, as well as other lung and heart problems. Living near oil and gas wells can be dangerous to pregnant women, causing lower birth weights and preterm births. In too many cases, these harms fall on frontline communities, including communities of color and low-income neighborhoods, but these outcomes are entirely avoidable.

There are ample technologies available to help producers cut methane in cost-effective ways. These include continuous monitoring technologies; handheld optical imaging sensors that use infrared light; satellites that detect plumes from individual sites; and technologies to cleanly combust methane on site. Deploying these technologies would allow the oil and gas sector to slash its methane emissions in half at no net cost. This is low-hanging fruit. These technologies can reduce waste and help save producers and customers money. But we need more companies to take advantage of them. Strong methane regulations from the Environmental Protection Agency to address the industry's wasteful methane leaks will help drive innovation, enhance deployment, and create jobs.

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novation Act included provisions to help states repair and replace leaky natural gas distribution pipelines.

Cutting harmful methane pollution will protect public health and the climate. It will catalyze the growth of new small businesses. And it will create tens of thousands of new jobs. I look forward to hearing from our witnesses as we bring these cost-saving benefits to more American communities.

Mr. GRAVES. Thank you, Madam Chair.

I want to thank the witnesses for being here, and those that are here online.

I represent South Louisiana and, I would argue, one state that probably is more at risk from sea rise, from more intense storms, than probably anywhere else in the country.

And, Ms. Tomcik, Moms Clean Air Force—you know, I have got kids too, and I think a lot about the country that we leave them, the planet that we leave them.

You read the news and you listen to all the narratives that are out there, and you get this perspective that one side is here and then another side is over here. When you actually start digging in and looking at the data, the reality is you get a very different picture. You get a very different picture.

You know, I will remind you that the United States has led the world in reducing emissions. We have led the world. I will remind you that Russian gas, when it is delivered to Europe, has 41-percent higher lifecycle emissions, Russian gas delivered to Asia, 47-percent higher lifecycle emissions, as compared to the United States.

The Biden administration has said very clearly—the Biden administration—that there is going to be a significant increase in natural gas demand over the next 30 years. They have said that there is going to be a 50-percent increase in global energy demand over the next 28 years.

Yet what is happening in the United States? We are watching our administration carry out policies that shuts down American oil and gas production. So you can sit there and say, "Oh, this is great, because we are getting rid of oil and gas production, so that is going to reduce emissions and it is going to save our planet." What the facts show is that that results in higher global emissions.

Don't shake your head. That is the fact. It is a fact. You want to debate me? I can't wait—I can't wait to debate this.

Because the United States has some of the lowest intensity of emissions of conventional fuel production than any other country in the world. And don't take my word for it; it is the IEA's data. And it is crystal-clear. It is crystal-clear.

You want to argue with me on the other one? National Energy Technology Lab's 2019 September, October report. Would love to have that discussion.

So here is the thing: what do we do? Instead of going out there and stopping Germany from building the Nord Stream II pipeline, the President of the United States effectively lifts the remaining sanctions that were blocking that from being built. You are facilitating more Russian gas going into Germany.

Do you know, if we just took just the gas coming in from Russia into Europe in 2021, if we had just stopped it and replaced it—not stopped it—stopped it and replaced it with U.S. gas, do you know

that the lifecycle emissions reduction would have been 218 million tons of greenhouse gas reductions? 218 million tons.

According to your testimony, as I recall, you say that there are 8 million tons of methane emissions from U.S. oil, gas, and coal production. And I am not going to sit here and try and do the math between total greenhouse gas emissions and the methane, but—my gosh, 218 million tons from 1 year. And, according to your testimony, I believe it is 8 million tons for oil, gas, and coal—for all energy production in the United States.

This is baffling to me. This administration shuts down the Keystone Pipeline, whenever you have his own Press Secretary standing up there and saying, oh, no, it didn't stop the production of the areas where the Keystone was going to transport from. They are just sending it through different means. Do you know what that means? That means that you have higher emissions, and it means you have a greater chance of spilling. Wait a minute. I thought we were doing this to protect the environment?

You know, what is happening right now with this administration's policies, they have said, well, we are going to ban Russian oil, all right? We are going to ban Russian oil. We are going to stop it. And we said this was going to happen, and we said it on February 22: if you don't do this right, it is actually going to cause greater emissions, and it is going to cause greater problems.

So look at what is happening right now. Russia is actually making more money—they are making more money off of their oil today than they were before they invaded Ukraine. Look at their economy. Look at the ruble.

And you know what we have done? We are selling cheaper energy right now to India and to China, which has higher greenhouse gas emissions. So all we have done is we have incentivized the purchase of Russian oil that has greater greenhouse gas emissions. Nice job. And, hey, on top of it, there is lagniappe. We have actually incentivized a higher-emitting source and, on top of it, we have undermined the U.S. economy and lost competitiveness.

You know, I have been accused—I am from South Louisiana, where we have energy production—and, by the way, some of the lowest-intensity-of-emissions energy production in the world. And I have been accused of being a shill of the oil and gas industry.

I want you all to think about something. The policies this administration has carried out have resulted in over a 100-percent increase in gasoline prices, nearly tripling of natural gas, that have been heard as price gouging and all these massive profits from these companies. Who has caused that? They have. The policies we are advocating for? Lower emissions.

Let me ask you a question. Who is the environmentalist?

Ms. CASTOR. Now I want to welcome our witnesses.

Patrice Tomcik is the Senior National Field Manager with Moms Clean Air Force. She advocates for equitable solutions to protect children's health from air pollution and climate change. A resident of Pennsylvania, Ms. Tomcik first became involved with Moms Clean Air Force as a volunteer, joining other local parents to push for clean air safeguards after fracking was permitted at gas wells near her children's schools.

Dr. Robert Kleinberg is a Senior Research Scholar at Columbia University's Center on Global Energy Policy. His work focuses on energy technology and economics as well as environmental and regulatory issues associated with the oil and gas industry. Dr. Kleinberg earned a Doctorate in Physics from the University of California, San Diego, and is a Senior Fellow at the Boston University Institute for Sustainable Energy.

Dr. Caroline Alden is the Co-Founder and Vice President of Product and Markets at LongPath Technologies, which is a greenhouse gas emissions monitoring service based in Boulder, Colorado. Dr. Alden earned her Doctorate in Geology from the University of Colorado, Boulder, and she previously worked with the National Oceanic and Atmospheric Administration's Carbon Cycle Group on greenhouse gas flux algorithms.

Sarah Ann Smith is the Chief of Programs with the Clean Air Task Force. A member of Clean Air Task Force's senior leadership team, Ms. Smith led the growth of the organization's methane emissions reduction program, building up a small team into a substantial global operation on four continents.

Without objection, the witnesses' written statements will be made part of the record.

With that, Ms. Tomcik, you are now recognized for 5 minutes. Welcome.

STATEMENTS OF PATRICE TOMCIK, SENIOR NATIONAL FIELD MANAGER, MOMS CLEAN AIR FORCE; DR. ROBERT L. KLEINBERG, SENIOR RESEARCH SCHOLAR, COLUMBIA UNIVERSITY CENTER ON GLOBAL ENERGY POLICY; DR. CAROLINE ALDEN, CO-FOUNDER AND VICE PRESIDENT OF PRODUCT AND MARKETS, LONGPATH TECHNOLOGIES; AND SARAH ANN SMITH, CHIEF OF PROGRAMS, CLEAN AIR TASK FORCE

STATEMENT OF PATRICE TOMCIK

Ms. TOMCIK. Thank you. And hello, Chair Castor, Ranking Member Graves, and members of the Select Committee. Thank you for inviting me here today to speak about protecting our health, our climate, by cutting methane pollution.

I am Patrice Tomcik, a National Field Manager for Moms Clean Air Force, a national community of more than 1 million moms and caregivers united to protect our children's health from air pollution and climate change. We envision a safe and equitable future where all children breathe clean air and live in a stable climate.

I am a mother of two boys living in southwest Pennsylvania on top of the Marcellus Shale, where many oil and gas operations are located within communities like mine.

In the U.S., the oil and gas sector is the largest industrial source of methane pollution contributing to climate change. Methane is a potent greenhouse gas and a main component of natural gas.

Children who live, learn, and play near oil and gas operations face higher risk of exposure to oil and gas industry's harmful air pollution. Across our nation, more than 3.9 million children go to school within a half a mile of oil and gas operations.

My children attend the Mars Area School District, where there are gas wells and a spiderweb network of gathering pipelines. The

closest wells that have been fracked are approximately a half a mile away from my children's school campus, where 3,200 students' health is put at risk.

Oil and gas operations emit climate-warming methane and also harmful volatile organic compounds, otherwise known as VOCs. Both can contribute to ground-level ozone or smog. Smog is a lung irritant that triggers asthma attacks and increases lung infections.

Children have a higher respiratory rate than adults and, thus, can be exposed to higher rates of air pollution than adults. My boys play outdoor sports for school, and I am very concerned about what they are breathing into their still-developing lungs.

In addition, VOCs such as benzene are emitted by oil and gas operations. Benzene can affect lung development in children and increase the risk of immune system damage, neurological problems, and cancers such as childhood leukemia.

As a parent of a child who had leukemia, I know firsthand how critical clean air is to good health. In fact, it was my youngest son's cancer journey that motivated me to speak out about protecting children's health long before the first gas well was fracked near my school.

Every day I send my children to school, I fear for their health. This is especially true for Carson, who is at a higher risk of having cancer again. I am constantly reminded about how important my work is to protect children's health from air pollution and climate change.

The families I work with would tell you that our climate crisis is a health crisis. These families are experiencing climate change impacts when smoke from record-breaking wildfires can poison the air for millions across the West; when severe heat waves regularly threaten public health, preying on older adults, pregnant women, and low-income communities. The list goes on.

This is happening right now, and we are all impacted by it. And especially at risk are Black, indigenous, and Latino communities, who are disproportionately exposed to the effects from climate change and harmful pollution from oil and gas operations. We need environmental justice now, and we need climate justice now.

Quickly and significantly reducing methane pollution is one of the best levers we have to slow the rate of climate change now and clean up the air to protect children's health. Our families need strong Federal standards to create baseline methane protections, especially for states that have failed to enact meaningful oil and gas methane protections.

This is why it is so important that the EPA finalize a comprehensive methane rule to eliminate routine flaring and include frequent inspections for small wells with leak-prone equipment.

As parents, we can't control the air our children breathe. It is why we depend on you, our elected leaders, to do your jobs and protect our children. What we want is for our Congressmembers to urgently pass legislation than invest in a clean, healthy energy future.

Thank you.

[The statement of Ms. Tomcik follows:]

Testimony of Patrice Tomcik

Senior National Field Manager for Moms Clean Air Force

U.S. House of Representatives Select Committee on the Climate Crisis

Hearing on "Cutting Methane Pollution: Safeguarding Health, Creating Jobs, and Protecting Our Climate"

June 24, 2022

Chair Castor, Ranking Member Graves, and members of the Select Committee, thank you for inviting me here today to speak about cutting methane pollution.

I commend each of you for your commitment to protecting our health and climate while creating jobs.

I am Patrice Tomcik, a Senior National Field Manager for Moms Clean Air Force. Moms Clean Air Force is a community of more than 1 million moms and dads nationwide united to protect our children's health from air pollution and climate change. We envision a safe and equitable future where all children breathe clean air and live in a stable climate.

I am the mother of two boys living in the town of Gibsonia located in Southwest Pennsylvania on top of the Marcellus Shale where oil and gas operations are widespread with many located within communities like mine. I am here in person today to emphasize how important it is for frontline community members to literally be in the room as climate and air pollution discussions are happening with lawmakers and agencies.

Methane is a potent greenhouse gas responsible for over a quarter of current global warming, and the oil and gas sector is the nation's largest industrial source of methane pollution. In the U.S., it is estimated that the oil and gas industry emits more than 16 million metric tons of methane pollution annually—the equivalent of the climate pollution from all of the nation's passenger vehicles in a year. Methane is the principal component of natural gas.

Climate change is causing a health crisis—and it's happening right now. We see it when extreme storms cause devastating flooding; when smoke from record-breaking wildfires can poison the air for millions across the West; when severe heat waves regularly threaten public health, preying on older adults, pregnant women, and low-income communities. Especially at risk are Black, Indigenous, and Latino communities who are disproportionately exposed to the effects from climate change and harmful pollution from oil and gas operations.

We *need* environmental justice. We *need* climate justice. And we *need* it now.

In the U.S., more than 17 million people live within a half mile of an active oil and gas operations and more than 3.9 million children go to school within a half mile of oil and gas operations that puts their health at risk.

My children attend the Mars Area School District where there are unconventional gas wells and a spider web network of gathering pipelines. The closest gas wells that have been fracked are approximately a half mile away from my children's 5-school campus that puts 3,200 students' health at risk.

Oil and gas operations not only emit climate warming methane but also harmful volatile organic compounds (VOCs). Both can contribute to ground level ozone, or smog. Smog is a lung irritant that triggers asthma attacks and increases lung infections. Children have a higher respiratory rate than adults and thus can be exposed to higher rates of air pollution than adults. In our family, my boys both play outdoor sports for school. I am very concerned about what they are breathing into their still-developing lungs.

In addition, VOCs such as benzene are emitted by oil and gas operations. Benzene can affect lung development in children and increase the risk of immune system damage, neurological and developmental problems, adverse birth outcomes, and even cancer such as childhood leukemia.

As a parent of a child who had leukemia, I know first-hand how critical clean air is to good health. In fact, it was my youngest son Carson's cancer journey that motivated me to speak up about protecting children's health—and long before the first gas well was fracked near the school. Yet, every day I send my children to school, I fear for their health. This is especially true for Carson who is at a higher risk of having cancer again.

My children and children across the nation need strong federal standards to create baseline methane protections, especially for states that have failed to enact meaningful oil and gas methane protections. This is why it is so important that the EPA finalize a comprehensive methane rule to eliminate routine flaring, require the use of non-polluting equipment and include frequent inspections for smaller, leak-

prone wells. Low-producing oil and gas wells are responsible for approximately half of the methane emitted from all well sites in the United States while accounting for only 6% of the nation's oil and gas production.

It is important that Congress properly funds the EPA to carry out the enforcement of rules in order to protect the health of communities. And as regulations and policies are being considered, there needs to be frequent consulting of environmental justice communities and communities living on the frontlines near oil and gas operations to influence decisions related to the design and implementation of rules and policies. This week EDF published a new study that combines location of active oil and gas wells with census tract data showing that in dozens of counties throughout the U.S. a disproportionately large number of communities of color, people living below the poverty line, older individuals and young children live near wells.

Parents can't control the air our children breathe; we depend on our leaders to do their jobs and protect them. Moms and dads want action on climate, and we want those who represent us in Washington—our members of Congress—to pass laws, incentives and funding that builds a clean energy future.

Every child has the right to breathe clean air, and the right to a stable climate. Thank you.

Resources

(1) https://www.edf.org/media/new-epa-rules-will-cut-methane-pollution-thousands-oil-and-gas-facilities-benefit-millions#:~:text=EDF%20estimates%20the%20U.S.%20oil,and%20air%20 toxics%20like%20benzene

(2) https://oilandgasthreatmap.com/threat-map/

(3) https://www.momscleanairforce.org/resources/how-oil-and-gas-operations-impact-your-babys-health/

(4) https://www.nature.com/articles/s41467-022-29709-3

(5) https://nam11.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.edf.org%2Fmedia%2Fstudy-explores-demographics-communities-living-near-oil-and-gas-wells&data=05%7C01%7Cptomcik%40edf.org%7C19d347ee348c4ee29d1508da53da48e6%7Cfe4574edbcfd4bf0bde843713c3f434f%7C0%7C0%7C637914494243881035%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=So%2BSvTYQeC2UzwGJ%2FiTjZ9q17BBGfy6wUe39CK%2BmqX8%3D&reserved=0

Ms. CASTOR. Thank you very much.

Next, Dr. Kleinberg, you are recognized for 5 minutes to provide a summary of your testimony. Welcome.

STATEMENT OF DR. ROBERT L. KLEINBERG

Dr. KLEINBERG. Yes. Good day, Chair Castor, Ranking Member Graves, and members of the Select Committee. It is an honor to address you.

The subtitle of today's hearing is "Safeguarding Health, Creating Jobs, and Protecting Our Climate."

Methane emission mitigation is essential to reducing the rate of global warming between now and 2050. This is technically and economically feasible and has already generated a constellation of innovative U.S. small businesses exploiting American designed and built technologies.

We know we must reduce our use of fossil fuels, and we know the transition from fossil fuels to zero-carbon sources of energy will take time. One of our chief challenges will be to minimize the damage associated with fossil fuel use during this transition.

According to the International Energy Agency, the world consumed 4 trillion cubic meters of natural gas in 2020. Assuming nations adhere to their announced Paris Agreement nationally determined contributions, the world will consume almost exactly the same amount of gas in 2050.

Assuming the world can do much better than this and satisfy the IEA sustainable development scenario, consumption would still be 2.5 trillion cubic meters. No matter how optimistic you are that nations will respect their Paris Agreement commitments, you must take methane emission reduction seriously.

Moreover, even after the transition from fossil fuels is complete, the methane problem will not go away by itself. Biogas and biomethane production and transport have been found to be sources of this climate pollutant as well.

It is a time-honored truth that you cannot manage what you don't measure. EPA relies on emission factor methodology which is now, sadly, outdated. Remarkably, over the last 7 years, American industry, academia, and nongovernmental organizations have worked together to find out how much methane the oil and gas industries are actually emitting. The results show that EPA dramatically underestimates methane emissions.

Two examples of new measurement methods are aerial surveillance and continuous monitoring. The practicality of large-scale, quantitative, airborne remote sensing is now well-established. A large number of large-scale campaigns have been performed in major oil- and gas-producing regions. Costs are surprisingly modest.

Dr. Caroline Alden, who personifies the transformation of world-class academic research into successful business, will tell us about continuous monitoring in a few minutes.

You have probably heard that methane reduction can be implemented at no cost or even implemented at a profit, and I am sure this is true in some cases. But if it were generally true, industry would not be emitting as much methane as it does. I can tell you from personal experience that the petroleum industry does not leave money on the table.

As it is, oil- and gas-source methane emissions are declining at the meager rate of 0.3 percent per year. The truth is, industry needs to be nudged to do the right thing. This means smart regulation.

Oil and gas methane emissions can be remediated by known engineering solutions. In my written testimony, I review some simple measures that can reduce emissions by millions of tons per year. I compare these measures to the health and safety improvements I saw over the course of my career in the oil field. Our highly skilled and inventive workforce has made our workplaces safer while keeping American industry the most efficient and productive in the world. Given smart regulations and incentives, they will do the same with methane.

Finally, to address Ranking Member Graves's point, I would like to point out that Russia is taking advantage of inferior methane reporting methods to improve its environmental image. Like the United States, Russia uses the emission factor method when reporting its methane emissions to the UNFCCC, but, unlike the United States, Russia's self-reported methane emissions from its oil and gas sector declined by a remarkable factor of eight since 2015.

As a result, Russia's self-reported methane intensity is now less than that of the United States. If left unchallenged, the Russian re-

ports weaken the case for reduction of European dependence on Russian natural gas. Only measurements will reveal the truth.

Please see my written submission for some specific recommendations. And thank you for giving me the opportunity to share these observations with you.

[The statement of Dr. Kleinberg follows:]

Testimony of Dr. Robert L. Kleinberg—Final

Senior Research Scholar,
Columbia University Center on Global Energy Policy
Senior Fellow, Boston University Institute for Sustainable Energy
Member of the National Academy of Engineering

U.S. House of Representatives Select Committee on the Climate Crisis

Hearing on "Cutting Methane Pollution:
Safeguarding Health, Creating Jobs, and Protecting Our Climate"

June 24, 2022

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Introduction

Good day Chair Castor, Ranking Member Graves, and members of the Select Committee. My name is Robert Kleinberg. I am presently affiliated with energy policy research units of Columbia University and Boston University, which I joined after working for four decades in technology development in the oil and gas industry. I have been elected to the National Academy of Engineering in recognition of my contributions to geoscience technology.

The subtitle of today's hearing is "Safeguarding Health, Creating Jobs, and Protecting Our Climate". Some people see creating jobs and protecting our health and environment as mutually exclusive goals, particularly with respect to oil and gas development. I hope to show you today that those goals support each other. Methane emission mitigation is essential to reducing the rate of global warming between now and 2050. It is technically and economically feasible. And it has already generated a constellation of innovative U.S. small businesses exploiting a variety of American designed and built technologies. If we use the technologies we have developed, we will secure the United States' place as the world's premier supplier of fuels while minimizing climate change during the transition to zero-carbon energy.

To understand the importance of minimizing climate change during the transition to low-carbon sources of energy, we must have a clear view of the magnitude and pace of the transition. According to the International Energy Agency, the world consumed four trillion cubic meters of natural gas in 2020. Assuming nations adhere to their announced Nationally Determined Contributions, the world will consume almost exactly the same amount of gas in 2050 [IEA, 2021, Table A.12]. No matter how optimistic you are that nations will respect their Paris Agreement commitments, you must take methane emission reduction seriously.

Moreover, even after the transition from fossil fuels is complete, the methane problem will not go away by itself. Biogas and biomethane production and transport have been found to be increasingly important sources of this climate pollutant [Scheutz, 2019].

Methane as a Greenhouse Gas

We know we must reduce our use of fossil fuels, and we know the transition from fossil fuels to zero carbon sources of energy will take time. One of our chief challenges will be to minimize the damage associated with fossil fuel use during the transition. One of the big questions we face is, who can provide energy with the smallest greenhouse gas (GHG) footprint. The European Union is considering the Carbon Border Adjustment Mechanism, a market-based plan that preferences those countries best able to meet this challenge. Many of us believe the United States should be able to out-compete most everyone else.

You have already learned that control of methane emissions plays an important role in greenhouse gas reduction. Reducing methane is likely the only realistic route to mitigating global temperature increase before 2050, see Figure 1. Unlike carbon dioxide, which is an inevitable by-product of the generation of useful energy from fossil fuels, methane emissions benefit no one. No one makes money sending methane into the atmosphere, no energy is produced as a result of it, no communities are supported by it, no one's job depends on it. Venting methane into the atmosphere is like throwing garbage into the street outside your home. It is worse than that, it is like throwing good food, that could be used elsewhere, into the street outside your home.

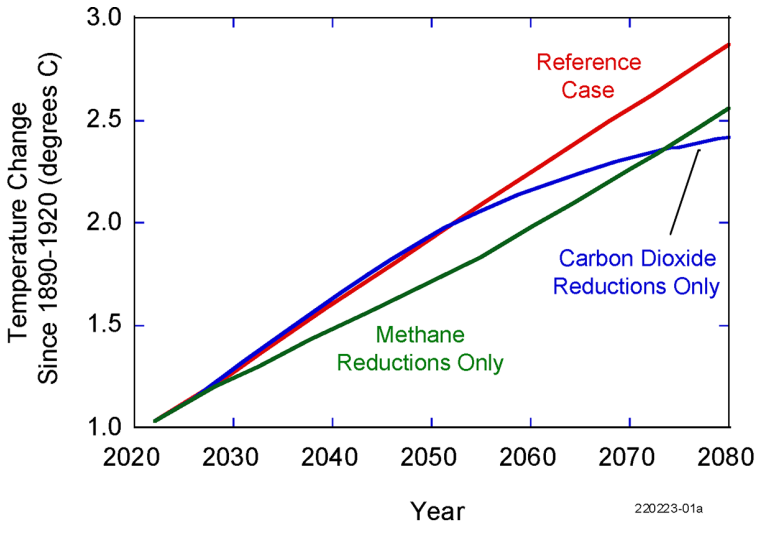

Figure 1. Scenarios for global average temperature change. Updated and redrawn from calculations by Shindell [2012].

Methods for Quantifying Methane Emissions Need to be Improved

We are rapidly refining our understanding of where methane waste is coming from, and therefore how to reduce it. Every year, Annex 1 nations report their methane emissions to the secretariat of the United Nations Framework Convention on Climate Change (UNFCCC). The United States submits the Environmental Protection Agency Inventory of U.S. Greenhouse Gas Emissions and Sinks ("GHGI") [UNFCCC, 2022a; EPA, 2022a]. The effort and care EPA invests in this report is extraordinary. EPA tracks 250 methane source types from natural gas and petroleum systems alone [EPA, 2022b].

EPA relies on emission factor methodology, which when it was introduced in the 1990s was the best method of the time, but which is now decidedly outdated. Emissions are calculated from the populations and estimated gas loss rates of each of the 250 source types found in oil and natural gas infrastructure. This is a spreadsheet exercise that requires no measurements of equipment operating in the field and therefore does not represent actual amounts of methane emitted to the atmosphere.

Due to its own extraordinarily restrictive rules on acceptance of alternative means of emission limitation, EPA has to date approved only two methods for natural gas

leak detection, neither of which are quantitative [40 CFR 60 Appendix A–7 Method 21; 73 Fed Reg 78199–78219]. Remarkably, over the last seven years, American industry, academia, and non-governmental organizations have moved beyond regulations and worked together to find out how much methane our oil and gas industries are actually emitting. The results have showed that EPA dramatically underestimates methane emissions [see e.g., Alvarez, 2018; Rutherford, 2021].

The Methane Problem is Relatively Easy to Solve

Current regulations to control oil and gas methane emissions are both inefficient and ineffective [Kleinberg, 2021b]. However, this does not imply that solving methane emission problems are economically ruinous or technically difficult. In fact, solutions are not particularly expensive and fall within the range of current engineering practice.

Realizing the limitations of current EPA regulations, the oil and gas industry, competing technology innovators, academics, and non-governmental organizations have cooperated to develop new and better methods to detect and characterize sources of methane emissions. Scientific and technical publications number well above a thousand and a thorough review of this work is beyond the scope of this testimony. I present a few examples that might serve as models for national-scale efforts in the future.

Aircraft Surveillance

The practicality of large scale, quantitative airborne remote sensing is well established. A number of basin-scale campaigns have already been performed in major oil and gas producing regions, by public and private entities using a variety of remote sensing technologies. Here are some examples:

- In the Permian Basin, aircraft-based instrumentation was used to survey areas totaling 55,000 km^2. Methane emission rates were measured at the largest emitters: more than 1000 oil and gas facilities. Updated results are published by the Environmental Defense Fund on maps showing every large emission event, tagged with emission rate and owner/operator identity; see Figure 2 [EDF, 2021b; Cusworth, 2021]. Flare malfunction is the subject of special studies [EDF, 2021a].

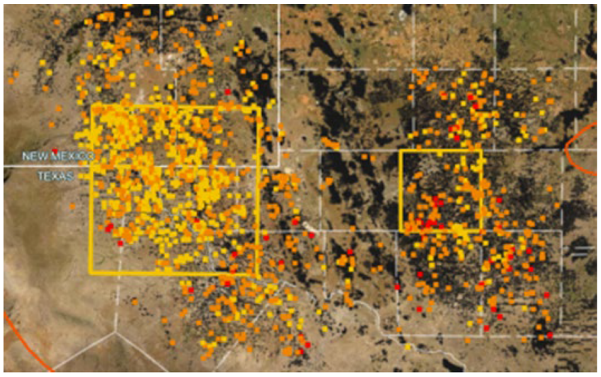

Figure 2. Survey of methane emissions in 55,000 km^2 of the Permian Basin, Fall 2019. White: < 2 kg/h; Yellow: 2-100 kg/h; Orange: 100-1000 kg/h; Red: > 1000 kg/h. Environmental Defense Fund PermianMAP/UArizona/NASA Survey 1 [EDF, 2021b; Cusworth et al., 2021].

- In the Permian Basin of New Mexico, Kairos Aerospace surveyed more than 30,000 active oil and gas wells and more than 10,000 miles of gas gathering pipeline. These comprised 93% of surface facilities and 77% of pipeline length over an area of 10,859 square miles. As a result, 1056 active methane emitters were located, identified, and quantified [Berman & Deiker, 2020; Sridharan, 2020].
- In California, 272,000 infrastructure elements were surveyed over 59,000 km^2. As a result, 564 methane point sources (including those in agricultural and waste sectors) were identified and quantified [Duren, 2019].

Consistent with a modeling study [Rashid, 2020], these surveys have shown that facility-level measurements, even when 100 to 1000 times less sensitive than current EPA mandates, are efficient and effective in finding vented and fugitive methane emissions. Moreover, these surveys are remarkably inexpensive: about $150 per well site in the Permian Basin according to one source [Johnson, 2021]. About 45,000 wells have been drilled in the Permian Basin since January 2011, arranged on a smaller number of pads [EIA, 2021]. These wells can be surveyed for about the cost of drilling and hydraulically fracturing a single well. Note however that service pricing varies with location and other factors.

Continuous Monitoring

Continuous monitoring of oil and gas infrastructure for methane emissions is not yet mature, but I believe it will become an essential element of methane surveillance in the future. The intermittency of super-emitters is a problem that is at the forefront of methane control issues [House Committee on Science, Space, and Technology, 2022]. Continuous monitoring, which is more expensive than occasional aircraft surveys, is best suited for sites with emission-prone infrastructure. These include gas processing plants, refineries, biogas and biomethane production facilities, liquefied natural gas terminals, and well sites or other facilities with storage vessels. By contrast, simple well sites with minimal ancillary hardware are unlikely to need this service. Simple wells account for most of the one million U.S. well sites that the EPA seeks to regulate in its proposed new methane control rules [EPA, 2021]; avoiding the extra expense of monitoring them continuously is desirable. General comments detailing the capabilities and deployment options of continuously monitoring sensors have been submitted to EPA [LongPath, 2022; CleanConnect.AI, 2022].

Remediation

While we have discovered we are emitting much more methane than we thought, we have also discovered that oil and gas methane emissions problems can usually be remediated by known engineering solutions. EPA has already determined that replacing natural-gas-actuated valves with electrical or compressed air systems can reduce methane emissions by a remarkable two million tons per year. Simple combustion sensors can be used to prevent unlit flares from emitting vast amounts of methane. SCADA systems that make sure pressure relief valves on tanks close properly should be universally implemented. Again, note the contrast with carbon dioxide. Reducing our carbon dioxide emissions will entail a multi-decadal, multi-trillion dollar reorganization of our economy. Reducing our oil and gas methane emissions will require some engineering fixes. I compare these to the health and safety improvements I saw over the course of my career in the oilfield. Our highly skilled and inventive workforce has made our workplaces safer while keeping American industry the most efficient and productive in the world. Given smart regulations and incentives, they will do the same with methane.

Economic Benefits of Methane Mitigation

Methane Emission Characterization is Dominated by U.S. Technology and Service Providers

A rapidly growing, highly competitive, small-business-dominated industry is developing in the absence of regulatory drivers. For example, here is a partial list (in alphabetical order) of U.S. service providers offering commercial aerial surveillance of methane emissions on a fee-for-service basis:

Aerial Production Services	https://www.flyaps.io/oil-gas
Baker Hughes	https://www.bakerhughes.com/emissions-management
Bridger Photonics	https://www.bridgerphotonics.com/
Carbon Mapper	https://carbonmapper.org/
Kairos Aerospace	https://kairosaerospace.com/
LaSen	https://www.lasen.com/
Scientific Aviation	https://www.scientificaviation.com/
SeekOps	https://seekops.com/

Here is a partial alphabetical list of mostly small companies providing continuous monitoring services for oil and gas clients:

Airdar
CleanConnect.ai
Honeywell | Rebellion
IntelliView Technologies
Kuva Systems
LongPath Technologies
Project Canary
Qube Technologies
Scientific Aviation
Sensirion Connected Solutions

These leading-edge companies are a small fraction of the total effort devoted to methane emissions mitigation today. A report written for the Environmental Defense Fund estimates that 215 U.S. companies are engaged in various phases of methane control [EDF, 2021c].

Increasing Interest in Fossil Fuels with Low Greenhouse Gas Footprints

The proposed European Union Carbon Border Adjustment Mechanism (CBAM)—which includes methane as part of the "CO_2equivalent"—is the leading example of the trend towards preferencing imports of low-GHG products. CBAM will be meaningless if it is based on spreadsheet exercises unmoored to measurement. If U.S. fossil fuels have lower GHG impact than those from other nations (as plausibly asserted by minority members in a House Committee on Science, Space and Technology hearing last week) certification based on measurement will both immediately benefit U.S. energy exporters and, in the long run, spur other nations to take verifiable actions to reduce their GHG emissions. This will help reduce the rate of climate change during the energy transition.

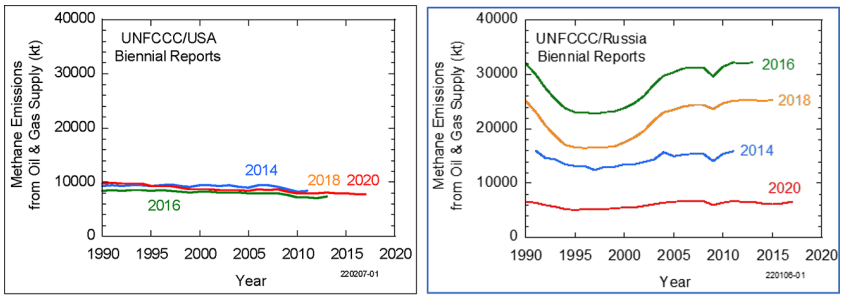

Figure 3. Methane emissions from oil and gas industries, as reported to UNFCCC. Labels are the years of biennial reports. For each report, methane emissions were recalculated from 1990 to two years prior to the date of the report using updated emission factors. Left: United States. Right: Russian Federation. [UNFCCC, 2022b].

Russia Takes Advantage of Inferior Methane Accounting Standards

Like the United States and other Annex 1 countries, Russia uses the emission factor method when reporting its methane emissions to UNFCCC. However, Russia reports on only fourteen source types in their oil and gas industry. And whereas the United States changes its emission factors cautiously, Russian emission factors vary by large amounts from year to year [Kleinberg, 2022]. Figure 3 compares U.S. and Russian reports.

With regard to methane emissions associated with natural gas exports to Europe, the U.S. would today appear to be at a competitive disadvantage relative to Russia. Since 2015, Russia's methane emissions from the oil and gas sector have declined by a factor of eight, according to its National Inventory Reports to UNFCCC. As a result, Russia's reported methane intensity is now less than that of the United States. If left unchallenged, these data weaken the case for reduction of European dependence on Russian natural gas. Although there is broad consensus in U.S. industry and policymaking circles that U.S. natural gas is the cleaner product, UNFCCC data must be challenged, and the only way to do this is with measurements such as those being developed and perfected by American industry and academic groups.

Recommendations

Launch a Methane Census

I draw the Committee's attention to the recently released majority staff report "Seeing CH4 Clearly: Science-Based Approaches to Methane Monitoring in the Oil and Gas Sector" [House Committee on Science, Space and Technology, 2022]. The Recommendations section of this report is worthy of attention. I particularly point to the idea of a Methane Census:

> The Methane Census would utilize commercially-available innovative LDAR [Leak Detection and Repair] technologies to perform large-scale methane detection surveys covering the majority of oil and gas infrastructure in each basin and to quantify the size of the detected emissions. The Methane Census would gather data to improve the characterization of oil and gas sector methane emissions in several key aspects, including by segment and by emission source, as well as data regarding the aggregate emissions for each basin. [House Committee on Science, Space and Technology, 2022, page 53]

As documented above, aerial surveys of the Permian Basin and of California have already shown the feasibility of this idea, which can be implemented at relatively low cost. Comprehensive nationwide data would establish the United States as a supplier of verifiably low-GHG fossil fuels for the rest of the world and serve as a baseline for future reduction efforts.

Support the International Methane Emissions Observatory

The International Methane Emissions Observatory (IMEO) is mentioned but not highlighted in the House Committee on Science, Space and Technology majority staff report. The IMEO is a project of the United Nations Environment Programme and supported by the European Commission [European Commission, 2021]. Its mission is to integrate multiple streams of methane emission data to better understand causes and remedies. "A technical study to inform approaches to reconciling the data from the Methane Census with existing EPA data sources" [House Committee on Science, Space and Technology, 2022, page 53] is exactly what IMEO was created to do. The United States has not yet strongly engaged with this effort, which would most certainly benefit from the energy and expertise of U.S. actors in this space. The United States, in turn, would benefit from interaction with European technical experts, particularly in the field of satellite surveillance of oil and gas infrastructure, in which Europe has taken the lead.

Reform the Alternative Means of Emission Limitation Process

Through multiple waves of Environmental Protection Agency rule-making over the last ten years, the EPA has remained an impediment to technical innovation in methane emission control, when it should be a promoter of it. American small business, academics, and NGOs, are enthusiastically innovating in this space, but inflexible EPA rules have discouraged widespread adoption of new technology by oil and gas operators. To put it bluntly, the only two EPA-approved methods, Method 21 and OGI, have been cold dead hands in this horror story.

The Clean Air Act recognizes the role of new technologies in helping to solve our environmental problems:

> If after notice and opportunity for public hearing, any person establishes to the satisfaction of the Administrator that an alternative means of emission limitation will achieve a reduction in emissions of any air pollutant at least equivalent to the reduction in emissions of such air pollutant achieved under the requirements of paragraph (1), the Administrator shall permit the use of such alternative by the source for purposes of compliance with this section with respect to such pollutant. [42 USC 7411(h)(3)]

It has been shown over and over again that basin-wide aircraft overflights have the potential to reduce methane emissions by half or more. This would be outstanding progress compared to the present rate of methane reduction, which averages 0.3% per year [Kleinberg, 2021b].

However, the Alternative Means of Emission Reduction (AMEL) process, as implemented by 40 CFR 60 Subpart OOOO in 2012 and renewed by 40 CFR 60 Subpart OOOOa [40 CFR 60.5398a, 29 August 2017], was perversely, fiendishly difficult to satisfy. From 2012 to 2020, while American innovators were developing and successfully field testing numerous ground-based, drone-based, aerial, and satellite methods for emission reduction, not a single application for AMEL was filed with EPA. The 2020 Technical Amendments (which were not withdrawn by Public Law 117–23) considerably simplified AMEL application requirements [40 CFR 60.5398a, 15 September 2020]. A single application has been filed, more than a year ago [Bridger, 2021], but to the best of my knowledge, this application has not yet been acted on. For more details on the AMEL issue see [Kleinberg, 2021a, Section 16 and Appendix IV].

Carefully Examine OGMP 2.0 Before Adopting It as U.S. Policy

OGMP 2.0 is a methane emission measurement and reporting protocol for the oil and gas industry that has been embraced by the United Nations Environment Programme, the European Commission, the Government of the United Kingdom, the Environmental Defense Fund, and eighty oil and gas companies [OGMP, 2022a]. Companies that adhere to a subset of its principles are deemed to have attained "gold standard" status. The original OGMP 2.0 Framework [OGMP, 2020] was defective in many respects, but it has recently been replaced by an improved version [OGMP, 2022b] that honors the learnings that have accumulated over the last several years. The range of sponsors has lent momentum to this protocol, and the European Commission seems predisposed to incorporating it into initiatives such as the Carbon Border Adjustment Mechanism. U.S. policymakers should be prepared to respond.

Thank you for giving me the opportunity to share these observations with you.

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Ms. CASTOR. Thank you very much.

Next, Dr. Alden, you are recognized for 5 minutes. Welcome.

STATEMENT OF DR. CAROLINE ALDEN

Dr. ALDEN. Thank you. Chairwoman Castor, Ranking Member Graves, and members of the committee, thank you for inviting LongPath to testify today.

My name is Caroline Alden. I have spent the last 15 years using greenhouse gas measurements to understand emission sources to the atmosphere. After a decade researching this topic, I helped cofound LongPath Technologies. And in my current role, I develop algorithms that convert our laser measurements to emission volumes and I work with stakeholders across industry, academia, environmental organizations, and government on how best to reduce emissions.

This morning, I look forward to discussing the technology and the benefits of measuring and mitigating methane emissions, which I believe is a win-win for the climate, for industry, and for neighboring communities.

Methane leaks from oil and gas operations are unpredictable. They can happen anywhere at any time, and they can be intermittent. Methane leak plumes are invisible and odorless. These characteristics make methane leaks very difficult to catch without advanced technologies.

There are three pillars of advanced methane detection: number one, frequency of emission readings. Total emissions are governed by how long the leak goes on, meaning the faster you catch it, the better. Number two, site coverage. It is important to see all emission points on a site. The EPA method of handheld cameras often misses unlit flares, for example, simply because they are high up off the ground. Number three, sensitivity to different leak sizes. As industry keeps reducing emissions, technologies must ultimately be able to help operators get to zero emissions.

So there are a range of new methane detection technologies. Airplanes and satellites generally perform periodic surveys. Aerial surveys only really catch larger leaks, but they do see all of the equipment on a site and they cover large areas. This informs what emissions look like as a whole, including whether policy targets are being met.

Fixed continuous monitors provide high-frequency emission readings, allowing for rapid fixing of leaks. Continuous technologies vary in terms of coverage, but most have the ability to catch small leaks, and many have the ability to quantify leak volumes.

The U.S. doesn't currently have a regulatory system established to leverage quantification data, but quantitative data provides many benefits. Quantification lets operators prioritize leaks for faster repair, prioritize what equipment to replace, tune equipment set points, and ultimately assess how well compliance measures work.

LongPath Technologies uses Nobel Prize-winning frequency comb lasers that emit hundreds of thousands of colors of infrared light to measure methane and other greenhouse gases in the atmosphere. Each laser is tower-mounted and covers 20 square miles, measuring emissions on a site-by-site basis for customers within the purview. LongPath's network-style coverage lowers the barrier to entry for monitoring all types of facilities, importantly including marginal and orphaned well sites.

So, going back to those pillars of advanced monitoring, LongPath provides continuous emissions data to customers in real-time, our readings cover all the equipment on a site, and we quantify all sizes of leaks. Importantly, the tech is proven through extensive third-party blind testing and in the field, and we have made all of that data publicly available.

In closing, I would like to offer four themes for methane detection in emerging policy, differentiated markets, and with respect to industry adoption.

Number one, methane monitoring reduces emissions, saves costs for operators, drives energy efficiencies for the market, and creates jobs. LongPath tripled in size last year, with new jobs ranging from field technicians in West Texas to software engineers working remotely across the U.S.

Number two, the U.S. is the world leader in methane monitoring technologies. If we recognize the aligned incentives of policymakers, climate advocates, and industry, then U.S. gas can also become the cleanest in the world.

To accomplish this, regulations need to encourage operators to use new technologies and plan for quantification-based metrics. EPA rules should include a matrix that allows for technology-neutral choices by operators. SEC rules should require measurements, not outdated inventories. And responsibly sourced gas standards should preclude greenwashing by driving stringency, transparency, and quality in monitoring.

Relatedly, number three, the Federal Government could invest in the creation of independent third-party bodies to certify and create standards for new technologies.

Lastly, number four, continuous monitoring is inexpensive, and it more than pays for itself through reduced costs and revenue retention for operators. We can outfit the Permian Basin, the largest gas-producing basin in the U.S., for quantitative continuous methane monitoring for less than the cost of 20 to 30 miles of interstate highway—or, as my colleague Gregory Rieker puts it, for less than the cost of the last James Bond movie.

So thank you for the opportunity to contribute to today's hearing.

[The statement of Dr. Alden follows:]

The Testimony of Caroline Alden, Ph.D.
LongPath Technologies, Inc.

"Cutting Methane Pollution:
Safeguarding Health, Creating Jobs, and Protecting Our Climate"

A Hearing of the
Select Committee on the Climate Crisis
U.S. House of Representatives

Friday, June 24, 2022

Chairwoman Castor, Ranking Member Graves, and distinguished Members of the Committee, thank you for inviting LongPath Technologies to testify today. My name is Caroline Alden. I have spent the last 15 years using greenhouse gas measurements to understand emission sources and sinks to the atmosphere. After a decade contributing to academic research on this topic, I co-founded and am now the Vice President of Product and Markets for LongPath Technologies. In this role, I not only work on the algorithms to leverage atmospheric measurements to monitor methane emissions, but I also work with experts and stakeholders across industry, academia, environmental organizations, and government.

This morning I look forward to discussing both the technology and benefits of measuring and mitigating methane emissions from oil and gas operations and other man-made sources. In the oil and gas industry, where LongPath provides methane monitoring, reducing emissions is a win-win for the climate, for industry, for neighboring communities, and for policymakers who are concerned about methane pollution.

Methane leaks from oil and gas operations are unpredictable. They can happen anywhere and at any time, and they can also be intermittent, meaning leak sizes can change over hours or days.[1] Finally, methane leak plumes are invisible and odorless. These characteristics make leaks of methane from oil and gas operations very difficult to catch without advanced technologies.

There are three pillars of advanced methane detection:

1. **Frequency of data readings.** Total emissions are the leak rate times how long the leak goes on, meaning the faster you catch it the better. And intermittent emissions are hard to catch at all without high-frequency data.
2. **Site coverage.** It's important to see all emission points on a site. The older EPA method of using handheld infrared cameras often misses unlit flares, for example, because they are high up off the ground.
3. **Sensitivity to different leak sizes.** Can a technology catch all leaks or only large leaks? As industry keeps reducing emissions, technologies must ultimately be able to help operators get to zero emissions. That means seeing both large and small leaks is important.

There is a wide range of new methane detection technologies. Airplanes and satellites generally perform periodic surveys of sites. Aerial surveys see all equipment on a site, but generally only catch larger leaks. However, by covering large areas, aerial surveys provide important information about what emissions look like as a whole, including whether policy targets are being met.

Fixed, continuous monitors provide a high frequency of readings. This characteristic allows for reliable and rapid fixing of leaks. LongPath's laser fencelines provide full site coverage, including of tall equipment like stick flares. While other continuous technologies vary in terms of site coverage, many are able to catch small leaks, and many have the ability to *quantify* leak rates.

The U.S. doesn't currently have a regulatory system established to leverage quantification data. However, quantitative data provides many benefits. Quantification lets operators prioritize leaks for repair, gauge the cost-effectiveness of equipment replacements, tune equipment set points to lower emissions, track how equipment performs in different settings, and, ultimately, assess how well compliance measures work.

The LongPath network is a little like a methane radar. We use Nobel prize-winning frequency comb lasers that emit hundreds of thousands of colors of infrared light. We measure methane and other greenhouse gasses by detecting how much of

[1] Cusworth, D.H., Duren, R.M., Thorpe, A.K., Olson-Duvall, W., Heckler, J., Chapman, J.W., Eastwood, M.L., Helmlinger, M.C., Green, R.O., Asner, G.P. and Dennison, P.E., 2021. Intermittency of large methane emitters in the Permian Basin. *Environmental Science & Technology Letters*, *8*(7), pp. 567–573.

that light is absorbed while it is traveling through the atmosphere. The laser is tower-mounted, and each tower covers 20 square miles, measuring emissions on a site-by-site basis for customers within the purview. The ability to provide broad-scale network style coverage means that there is a very low barrier to entry for monitoring all types of facilities including, importantly, marginal well sites.[2,3]

Going back to those pillars of advanced monitoring: LongPath provides continuous, quantitative emissions data to customers in real-time; our data provides full coverage of all equipment on site; and we have a very sensitive ability to see leaks—10 to 1000 times more sensitive than aerial and satellite technologies. Importantly, the tech is proven through extensive 3rd-party blind testing at test sites[4] and in the field, and we have made that data publicly available.[5,6]

I'd like to offer 4 themes for methane detection in emerging policy, differentiated markets, and industry adoption:

1. Methane monitoring reduces emissions, saves costs for operators, drives energy efficiencies for the market (extending all the way to the ratepayer), and creates jobs. LongPath has tripled in size in the last year, with new jobs ranging from field technicians in West Texas to software engineers working remotely across the U.S.
2. The U.S. is the world leader in methane monitoring technologies. If we recognize the aligned incentives of policy makers, climate advocates and industry, then U.S. gas can also become the cleanest in the world. To accomplish this, policies and regulations should encourage operators to use new technologies and also plan for quantification and performance-based metrics. EPA rules should include new technologies in a matrix that allows for technology-neutral choices by operators. SEC rules should require measurements, not outdated inventories. And responsibly sourced gas standards should preclude greenwashing by driving stringency, transparency and quality in monitoring.
3. The federal government should invest in the creation of independent third-party bodies to create standards for certifying the capabilities of new alternative technologies.
4. Finally, continuous monitoring is inexpensive and more than pays for itself through increased efficiencies for the oil and gas industry. Reduced costs and revenue retention for operators occur in two ways: by fixing leaks and equipment malfunctions, and by providing real-time feedback on operations. Not to mention the co-benefits of cleaner air, a more stable climate, jobs creation and American leadership in environmental standards and technological innovation. As my colleague Greg Rieker said two weeks ago in testimony to the House Science Committee, we can outfit the Permian Basin for continuous, quantitative methane emissions monitoring for less than the cost of 20–30 miles of interstate highway, or, as he put it, for less than the cost of the last James Bond movie.

Summary Information on LongPath Technologies

The LongPath system is a fixed-location continuous monitoring system. The LongPath monitoring system employs dual frequency comb spectrometer (DCS) technology with a detection range of up to 5 km. The LongPath system is capable of continuously monitoring multiple facilities via a single installation of a centralized tower from which the laser light source is generated. The high site coverage of a single reading, combined with high frequency of data collection and low detection threshold, classify this technology as "true continuous." The LongPath system employs a rigorous system of quality control checks to ensure incoming data is valid. With this data, the LongPath system is capable of accurately quantifying emission rates with a detection and quantification level of 0.2 kg/hr. Time-to-detect of emission from leak start to leak detection for sustained emissions ranges from several minutes to less than one day.

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[2] Bowers, Richard L. *Quantification of Methane Emissions from Marginal (Low Production Rate) Oil and Natural Gas Wells*. United States: N. p., 2022. Web. doi:10.2172/1865859.

[3] Omara, M., Zavala-Araiza, D., Lyon, D.R., Hmiel, B., Roberts, K.A. and Hamburg, S.P., 2022. Methane emissions from U.S. low production oil and natural gas well sites. *Nature communications*, *13*(1), pp. 1–10.

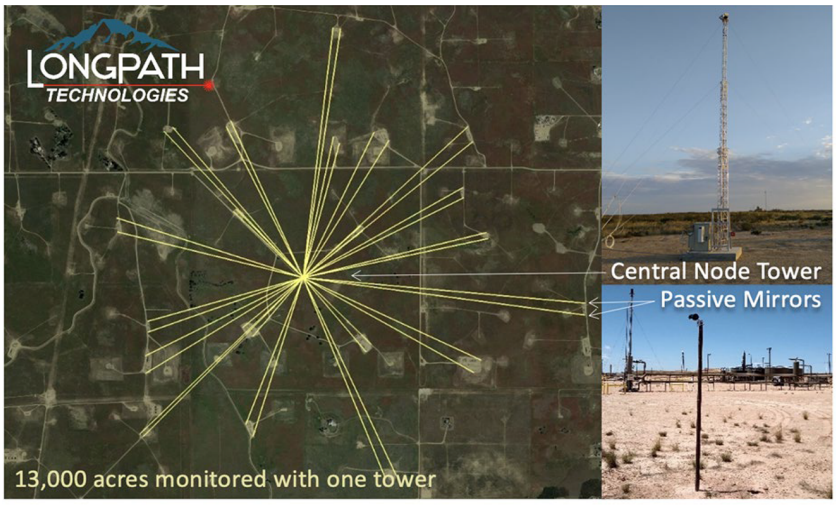
[4] Methane Emissions Technology Evaluation Center (METEC): https://energy.colostate.edu/metec/

[5] Alden, C. B., Coburn, S., Wright, R. J., et al. (2019). Single-blind quantification of natural gas leaks from 1 km distance using frequency combs. *Environmental Science & Technology*, *53*(5), 2908–2917. https://doi.org/10.1021/acs.est.8b06259

[6] Coburn, S., Alden, C. B., Wright, R., et al. (2020). Long distance continuous methane emissions monitoring with dual frequency comb spectroscopy: deployment and blind testing in complex emissions scenarios. https://arxiv.org/abs/2009.10853

LongPath's DCS technology was developed at the National Institute of Standards and Technology (NIST) and the University of Colorado Boulder and was transitioned for field use and oil and gas monitoring by LongPath's founders at the University of Colorado under the Department of Energy's ARPA–E MONITOR program. Open-path, laser-based DCS measurements rely on frequency combs, a specialized class of lasers that output hundreds of thousands of stable, discrete wavelength elements or "comb teeth"; an innovation that garnered the Nobel Prize at the University of Colorado in 2005. DCS leverages these properties to enable spectroscopic measurements at an unprecedented combination of spectral bandwidth (>100 nm), resolution (<$2x10^{-3}$ nm) and signal-to-noise ratio, providing precise and accurate absorption spectra that yield high-fidelity, multi-species measurements.[7,8]

The LongPath system is composed of a 50-foot-tall retractable tower on an approximately 8-foot square base, where a field hardened control cabinet houses LongPath's proprietary laser spectrometer and computing and control systems. A telescope, which emits the laser light and receives (detects) the reflected, return laser light, sits at the top of the tower. The control cabinet, tower, and an anemometer are all co-located at a central node. Retroreflectors are installed on and/or around each monitored area and return emitted laser light to the transceiver.



LongPath System deployment overview. A central node is shown in the center of the starburst pattern in the left-hand panel. In that panel, yellow lines indicate the geometry of eye-safe and invisible laser light that travels between the telescope (located at the central node location) and retroreflective mirrors (or "passive mirrors") located in and around monitored areas.

Measurements are coupled to an atmospheric model and methane source sizing/localization inversion framework. LongPath positions laser beams to create a fenceline around each monitored area and measures plumes as they cross the beamline. The sensor geometry for LongPath is not a single point in space, but, instead, an integrated line (pathway) through space between the telescope head and the retroreflective mirror (and back). LongPath's full fenceline attribute results in high spatial coverage of the monitored area with each reading that is taken under a wide range of wind directions.

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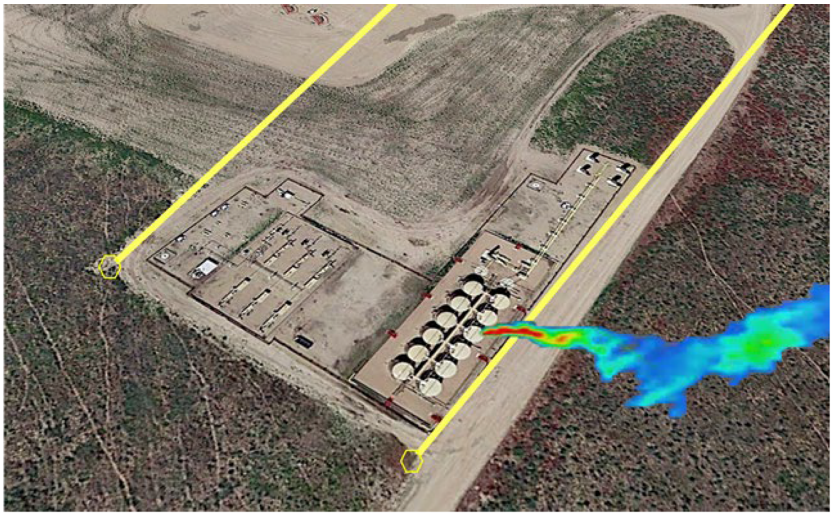
[7] Rieker, G. B., Giorgetta, F. R., Swann, W. C., Kofler, J., Zolot, A. M., Sinclair, L. C., … Newbury, N. R. (2014). Frequency-comb-based remote sensing of greenhouse gases over kilometer air paths. Optica, 1(5), 290–298. https://doi.org/10.1364/OPTICA.1.000290

[8] Coburn, S., Alden, C. B., Wright, et al., (2018). Regional trace-gas source attribution using a field-deployed dual frequency comb spectrometer. *Optica*, *5*(4), 320. https://doi.org/10.1364/OPTICA.5.000320

LongPath has demonstrated in blind testing (METEC and field) the ability to detect, locate, and quantify methane sources from individual facilities at rates of 0.2 kg/hr over large regions.[9,10,11,12]



Laser beam paths (yellow lines) extend between the telescope (outside image top) to retroreflector locations (yellow hexagons), providing a fenceline bounding the monitored area. Sites are measured during wind conditions that favor high site coverage (potential plumes would cross bounding laser beams). A theoretical plume is shown emitting from the tanks and crossing the downwind beam.

Importance of Continuous Monitoring

The benefits of continuous monitoring are many and impact many stakeholders: neighboring communities in oil and gas production areas, the environment and global communities grappling with a changing climate, and an industry that is working to reduce waste and cut emissions.

Methane emissions from oil and gas are intermittent and vary through time, at both producing and abandoned well sites,[13,14] with intermittent emissions contributing substantially to overall emissions. Continuous monitoring is therefore unparalleled in the value it provides. Snapshot monitoring approaches (OGI, aircraft, satellite surveys) can't provide adequate information for operators to mitigate, or often even detect, intermittent emissions. Continuous monitors can mitigate intermittent emissions by revealing temporal context about deviations from baseline rates, which can be linked with SCADA data for root cause analysis. Off-site diagnosis and even repair can often be accomplished. Further, continuous monitors don't mistake intermittent emissions for persistent emissions, as can be the case for snapshot-in-time surveys (resulting in wasted OGI follow-ups).

The temporal context and coverage provided by continuous monitors also means that leak repairs can be immediately verified without site visits or OGI surveys. LongPath has found linked leaks that it took more than one attempt to repair—without continuous monitoring, the first repair would not have mitigated all emis-

[9] Rieker, G., et al., (2014). Frequency Comb-Based Remote Sensing of Greenhouse Gases over Kilometer Air Paths, Optica, 1, 290–298. https://doi.org/10.1364/OPTICA.1.000290

[10] Coburn, S., Alden, C. B., Wright, et al., (2018). Regional trace-gas source attribution using a field-deployed dual frequency comb spectrometer. Optica, 5(4), 320. https://doi.org/10.1364/OPTICA.5.000320

[11] Alden, C. B., Ghosh, S., Coburn, S., et al. (2018). Bootstrap inversion technique for atmospheric trace gas source detection and quantification using long open-path laser measurements. Atmospheric Measurement Techniques, 11(3), 1565–1582. https://doi.org/10.5194/amt-11-1565-2018

[12] Alden, C. B., Coburn, S., Wright, R. J., et al. (2019). Single-blind quantification of natural gas leaks from 1 km distance using frequency combs. Environmental Science & Technology, 53(5), 2908–2917. https://doi.org/10.1021/acs.est.8b06259

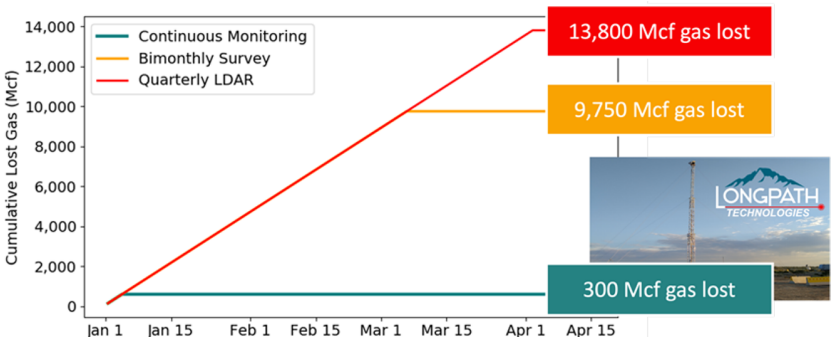
[13] Johnson and Heltzel, "On the Long-Term Temporal Variations in Methane Emissions from an Unconventional Natural Gas Well Site."

[14] Riddick et al., "Variability Observed over Time in Methane Emissions from Abandoned Oil and Gas Wells."

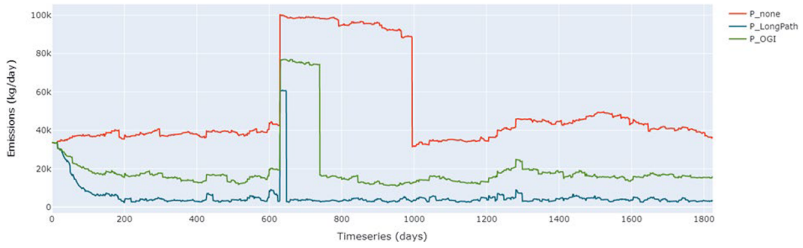
sions, and the operator wouldn't have known that other problems persisted, despite OGI follow-up.

Continuous monitoring is highly scalable. With modest capital investment, around 1000 LongPath sensors could provide cost-effective continuous monitoring for most of the Permian Basin of West Texas and Southeastern New Mexico. Already, LongPath is continuously monitoring more than 230,000 acres in the DJ, Anadarko, Delaware and Midland basins. Once LongPath's networked infrastructure is in place, any site in the area can be quickly and cost-effectively subscribed. This includes orphaned and marginal wells, which LongPath can monitor, quantify and prioritize for plugging at a very low cost compared with other methods.

Finally, and most importantly, continuous monitoring affords rapid repair, such that cumulative emissions to the atmosphere are tens to hundreds of times lower than survey approaches can provide. The figure below is based on a real leak mitigated by LongPath; a stuck dump valve that was identified and repaired in 2 days, resulting in a cumulative loss to the atmosphere of 300 Mcf. A bi-monthly or quarterly survey might not have discovered the leak for 2–3 months, which would have resulted in some 30–50 times higher cumulative emissions emitted to the atmosphere. The difference in gas lost between continuous monitoring and a theoretical quarterly survey would have been 13,500 Mcf, or roughly 10.4 t. At a (currently below-market) value of $3.25/Mcf, a loss of 13,800 Mcf is roughly $44,850 over 3 months. These losses dwarf the cost of the monitoring itself (and for many years)—a clear proof point that continuous monitoring is cost effective. The social cost of methane ($1,800/t) would equate to $18,720 saved compared with quarterly LDAR.



The below LDAR-Sim model results[15] show expected emissions given a LongPath emissions mitigation program ("P_LongPath", blue), a quarterly LDAR program ("P_OGI", green, with efficacy matching Zimmerle et al.)[16] and no LDAR program ("P_none", red). Interestingly, in this simulation, a super-emitter event occurs just following an OGI visit. While this would seem to be a rare event, LongPath has documented occurrences of this scenario in customer monitoring. In periods of both normal operations and during a fugitive event, LongPath's overall emissions reductions are substantially better than quarterly OGI.



[15] Highwood Emissions Management, January 2022.

[16] Zimmerle et al., "Detection Limits of Optical Gas Imaging for Natural Gas Leak Detection in Realistic Controlled Conditions."

EPA and Continuous Monitoring as an Alternative Means of Compliance

LongPath has provided to EPA a detailed and complete work practice and framework for the inclusion of LongPath and other forms of continuous monitoring in the EPA's rule as an alternative means of compliance.

Separately, we are providing to EPA, together with a diverse group of stakeholders, including industry, NGOs and legal experts, a matrix table for compliance under different frequencies and detection thresholds that is entirely technology-neutral, paving the way for regulations that will not hinder either current or future technological innovations.

Accompanying each method (technology) used to meet a given portion of the matrix table will be: 1) technology-specific work practices, 2) details of method certification, and 3) response requirements for when emissions exceed stated thresholds.

Elements of a Framework Provided to EPA by LongPath

LongPath provided a written response to all questions posed by EPA in the draft language published in November. These questions formed the EPA's pathway for inclusion of continuous monitoring as a compliance method in the final rule.

In addition to providing answers to the EPA's prompts, LongPath also outlined a specific framework for monitoring and response requirements that suit the LongPath technology class. No other technologies operate in the same way as LongPath, so we currently stand as the only C-Open Path (Continuous-Open Path) technology type in our class. Nonetheless, it is incumbent upon EPA to create rules open to all technology classes, regardless of how unique, and the offered matrix approach and generalized frameworks provide this ability.

Despite the work practice and response requirements being specific to the C-Open Path technology class, the bulk of the framework is generalizable to include all continuous monitoring platforms and the unique challenges posed by and solvable by continuous tech (e.g., the ability to characterize intermittent emissions and offer alternate response requirements than for persistent emissions).

Next Steps: R&D Efforts Needed To Enable the EPA's Proposed Regulations

Formation of a neutral third party organization to: 1) set standards for testing of emissions detection work practices, 2) provide auditing of and testing of technologies with stated work practices, and 3) provide a clearing house for certification and reports.

The DOE and other federal institutions will be ideal venues for these efforts to be initiated and/or carried forward. Existing and new R&D dollars should be considered for use in the development of the standards, certification practices and clearinghouse for approved technologies.

Ms. CASTOR. Thank you, Dr. Alden.

Next, Ms. Smith, you are recognized for 5 minutes to provide your testimony. Welcome.

STATEMENT OF SARAH ANN SMITH

Ms. SMITH. Chair Castor, Ranking Member Graves, members of the Select Committee, thank you so much for inviting me to testify.

My name is Sarah Smith. I am the Chief of Programs at Clean Air Task Force, a global nonprofit organization working to safeguard against the worst impacts of climate change by catalyzing the rapid development and deployment of low-carbon energy and other climate-protecting technologies.

I would like to emphasize three points.

The world is warming rapidly, and serious impacts are here today. Simple solutions like finding and fixing plumes of methane at oil and gas sites can dramatically cut U.S. emissions and represent the fastest way to slow warming while also limiting unhealthy air pollution and creating jobs. Strong EPA standards represent a key opportunity to accomplish this and should be finalized this year.

Whether it is severe storms, rising seas, deadly heat waves, or rampaging wildfires, the impacts of our warming climate are being

felt today. And recent reports from the Intergovernmental Panel on Climate Change make it very clear that, if emissions continue, these impacts will get much worse in the coming years.

Methane is a key culprit, responsible for about half a degree of the 1 degree Celsius of warming we have already experienced. But methane is also a key opportunity. Its high warming potential during its relatively short lifetime in Earth's atmosphere provides us with our biggest chance to slow warming over the next few decades.

Reducing methane is like a handbrake for our warming planet, which is currently hurdling toward a much hotter period to which humans may not be able to quickly adapt.

Pulling this handbrake while we tackle carbon dioxide, too, is essential, both to limit direct impacts on people and, importantly, to limit the acceleration of harmful feedback loops, where warming causes more warming, such as the rapidly disappearing Arctic sea ice. The darker surfaces left behind after the ice melts, they absorb more sunlight, just like removing a natural canopy that exposes a dark parking lot in the summer, creating more warming—a feedback loop.

The good news is, we can cut methane emissions very rapidly from oil and gas today just by using technologies and practices that are already included in standards on the books in leading states like New Mexico and Colorado. EPA can cut oil and gas methane emissions by 65 percent in just a few years. These solutions do not require rocket science, just simple, sound plumbing.

The standards EPA should put in place would require the oil and gas industry to regularly check their equipment for leaks using modern instruments and to replace equipment that is designed to dump methane gas into the air with modern, clean equipment that doesn't. It is that simple.

EPA's proposal last fall would go a long way to accomplish these reductions, but it needs to be strengthened. The methane emissions reductions program in the House-passed Build Back Better Act would serve as an effective and efficient complement to the EPA regulations because it would go into effect more quickly for existing sources, incentivizing the highest-emitting operators to rapidly invest in cleaner equipment.

These policies would lead to dramatic cuts in methane from U.S. oil and gas—nearly 8 million tons per year of methane. And, as Ms. Tomcik underscored, these policies would cut pollution beyond methane as well—millions of tons of other ozone smog precursors and over 100,000 tons of air toxics, like carcinogenic benzene, every year.

Finally, strong EPA standards would create more than 60,000 high-paying jobs, according to CATF estimates, in the oil and gas industry, manufacturing, and other sectors. These policies can dramatically cut U.S. methane emissions by 2030 and build on global momentum to address methane emissions, as seen by the Global Methane Pledge, led by the United States and the European Union.

The U.S. has shown great leadership on methane around the world and can back up that leadership with strong action to cut methane here at home.

Methane emissions from oil and gas are wreaking havoc on our planet and our communities, and we have the solutions in hand to rein them in. We must use them now.

Thank you.

[The statement of Ms. Smith follows:]

Testimony of Sarah Smith
Chief of Programs, Clean Air Task Force

Before the U.S. House of Representatives
Select Committee on the Climate Crisis

Hearing on "Cutting Methane Pollution:
Safeguarding Health, Creating Jobs, and Protecting Our Climate"

June 24, 2022

Madam Chair, Ranking Member, and Distinguished Members of the Committee:

My name is Sarah Smith and I am the Chief of Programs and former Director of Super Pollutants at Clean Air Task Force (CATF), an environmental organization founded in 1996. CATF is a global nonprofit organization working to safeguard against the worst impacts of climate change by catalyzing the rapid development and deployment of low-carbon energy and other climate-protecting technologies. With over 25 years of internationally recognized expertise on climate policy and a fierce commitment to exploring all potential solutions, CATF is a pragmatic, non-ideological advocacy group with the bold ideas needed to address climate change. CATF has offices in Boston, Washington D.C., and Brussels, with staff working virtually around the world. Thank you for the opportunity to be here today to testify.

Today I will share CATF's thoughts on how reducing methane emissions from the oil and gas sector can provide crucial climate benefits, as well as help communities that surround oil and gas developments by reducing harmful pollution and creating jobs using technologies that are already mature and available today.

[1] *Methane is a greenhouse gas that is much more potent that carbon dioxide, and it is a primary driver of climate change. Addressing methane emissions, particularly from the oil and gas industry, is a critical piece of the climate action puzzle here in the United States and around the world.*

The world stands on the brink of irreversible changes. As the Intergovernmental Panel on Climate Change ("IPCC") put it in its Sixth Assessment Report ("AR6"): "Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years." [1] The impacts of this warming climate are hitting the most vulnerable populations the hardest, and efforts to adapt to our new climate reality are being outpaced by those impacts.[2] As the scientific understanding of climate change impacts has evolved, it has revealed that we can pass catastrophic tipping points much more suddenly or at lower temperatures than once thought.[3] This means that the collapse of ice sheets or the loss of rainforests, and the resulting impacts on vulnerable populations, are likely much nearer than we thought.

Reducing emissions of methane, a potent greenhouse gas with a warming potential over 80 times greater than that of carbon dioxide over a twenty-year period,[4] must play a crucial role in any rapid greenhouse gas mitigation. Because of its warming potency and atmospheric lifetime—which is much shorter than that of carbon dioxide—establishing policies to quickly reduce methane emissions is the fastest way to slow the escalating rate of global warming, serving as a handbrake to slow the accelerating climate crisis. As of June 17, 2022, the U.S. has joined 119 other countries in pledging to reduce global methane emissions by 30 percent by 2030 under the Global Methane Pledge.[5]

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[1] IPCC, AR6 Working Group I ("WGI"), *Summary for Policymakers* 6 (2021), https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf.

[2] IPCC, AR6 Working Group II ("WGII"), *Summary for Policy Makers* SPM–27–28 (2022), https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf.

[3] IPCC, WGI, *Technical Summary* Box TS.9 (2021), https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_TS.pdf.

[4] IPCC, WGI, *Full Report* Table 7.15 (2021), https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf.

[5] Press Release, *U.S.-EU Joint Press Release on the Global Methane Pledge Energy Pathway*, U.S. Dep't of State (June 17, 2022), https://www.state.gov/u-s-eu-joint-press-release-on-the-global-methane-pledge-energy-pathway/.

In the U.S., the most cost-effective way to achieve this is by reducing methane emissions from the oil and natural gas sector. The oil and natural gas sector, comprised of the oil and natural gas production and natural gas processing, transmission and storage, and distribution segments, is the largest industrial source of methane emissions in the country, responsible for over 8 million tons in 2020, according to the U.S. Greenhouse Gas Inventory ("GHGI").[6] We know that this underestimates the true scale of the problem as the current version of the GHGI fails to capture the emissions from super-emitters: infrequent but large emission events that have been documented in many independent studies to arise at oil and gas sites.[7] CATF estimates the actual emissions to be approximately 12 million metric tons.[8] Fortunately, solutions to reduce methane emissions from the oil and natural gas industry which are already being used in various jurisdictions can jumpstart the curbing of these emissions.

a. *We have the solutions in hand to address the oil and natural gas methane problem.*

There are no technical barriers to rapidly reducing emissions from the oil and natural gas industry. Relying on technologies and practices that are in use *today,* CATF has laid out a pathway by which regulatory standards—all based on regulations in place today—can reduce methane emissions from the industry by 65 percent relative to 2012 levels.[9] The House-passed Build Back Better Act contains a complementary program, the Methane Emission Reduction Plan, to further reduce emissions to align with the industry's ambition by assessing a charge on the methane emissions above a specified leak rate. Together, these two approaches provide two near-term, cost-effective solutions to address the industry's methane emissions.

b. *There are Solutions Required by Leading States Today That, if Used Nationwide, Would Reduce Oil and Natural Gas Methane Emissions to 65 Percent Below 2012 Levels*

Based on CATF's calculations, the oil and natural gas industry emits 12 million metric tons (MMT) annually, which using EPA's Greenhouse Gas Equivalency Calculator warms the climate in the decades after emissions as much as the carbon dioxide emissions from 260 coal-fired power plants.[10] Within the industry, those emissions primarily originate from: fugitive emissions ("leaks") and other improper conditions; intentional venting and flaring; and outdated equipment that is designed to emit gas. Standards on the books today in leading states address each of these sources.

Fugitive Emissions

Emissions from leaks and other improper conditions occur when the mechanical processes or pieces of equipment at an oil or natural gas facility deteriorate or fail to operate in the intended manner, and these constitute the single largest source

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[6] EPA, *Greenhouse Gas Inventory Data Explorer*, https://cfpub.epa.gov/ghgdata/inventoryexplorer/#allsectors/allsectors/allgas/econsect/current (last accessed June 21, 2022).

[7] David Lyon et al., *Constructing a spatially resolved methane emission inventory for the Barnett Shale region*, 49 Env't Sci. Tech. 8147 (2015); Daniel Zavala-Araiza et al., *Reconciling divergent estimates of oil and gas methane emissions*, 112 Proc. Nat'l Acad. Sci. 15597 (2015); Daniel Zavala-Araiza et al., *Super-emitters in natural gas infrastructure are caused by abnormal process conditions*, 8 Nat. Commc'ns. 14012 (2017); Daniel Zimmerle et al., *Methane emissions from the natural gas transmission and storage system in the United States*, 49 Env't Sci. Tech. 9374 (2015); Mark Omara et al., *Methane emissions from conventional and unconventional natural gas production sites in the Marcellus Shale region*, 50 Env't Sci. Tech. 2099 (2016); Jeff Peischl. et al., *Quantifying atmospheric methane emissions from Haynesville, Fayetteville, and northeastern Marcellus shale gas production regions*, 120 J. of Geophysical Res.: Atmospheres 2119 (2015); Dana Caulton et al., *Importance of superemitter natural gas well pads in the Marcellus Shale*, 53 Env't Sci. Tech. 4747 (2019); Robertson et al., *New Mexico Permian Basin measured well pad methane emissions are a factor of 5–9 times higher than U.S. EPA estimates*, 54 Env't Sci. Tech. 13926 (2020); Yuzhong Zhang et al., *Quantifying methane emissions from the largest oil-producing basin in the United States from space*, 6 Sci. Advances 5120 (2020); David Lyon et al., *Concurrent variation in oil and gas methane emissions and oil price during the COVID–19 pandemic*, 21 Atmospheric Chemistry and Physics 6605 (2021); Ramón Alvarez, *Assessment of methane emissions from the U.S. oil and gas supply chain*, 361 Science 186 (2018).

[8] CATF, *Reducing Methane from Oil and Gas: A Path to a 65% Reduction in Sector Emissions* (Dec. 2020), https://cdn.catf.us/wp-content/uploads/2020/04/21092556/Path_to_65pc_OG_reduction-Dec2020_update.pdf ("65 Percent Memo").

[9] 65 Percent Memo at 8.

[10] EPA, *Greenhouse Gas Equivalencies Calculator* (last updated Mar. 2022), https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results.

of methane emissions within the oil and natural gas sector. Based on CATF's analysis, fugitive emissions accounted for 5.6 MMT of methane emissions in 2020. Most of these emissions arise from the abnormal process emissions and equipment failures that create super emitters.

To effectively reduce these fugitive emissions, the leak or problem must be detected as quickly as possible, and then rapidly fixed. Leak detection and repair ("LDAR") programs can be used to find and fix everything—from a simple leaking valve to super-emitters. The strength of a LDAR program, and thus its potential to reduce emissions, depends upon the capabilities of the detection technology, the frequency an operator deploys it to detect leaks, and the scope of components that are inspected.

A number of technologies to detect methane emissions are well-established, while newer powerful techniques have advanced rapidly in recent years. The rapidly growing list of LDAR technologies [11] can be divided into two groups: close-range technologies and screening technologies.

Close-range technologies are handheld instruments that can diagnose individual leaks on a component-by-component basis, such as optical gas imaging ("OGI") cameras, which produce an infrared light image in real time, making a normally invisible pollution stream visible to our eyes. Older handheld detectors are also used to detect hydrocarbon leaks. Close-range technologies are extremely useful to pinpoint exactly where individual leaks are, both big and small, so they can be fixed.

Screening technologies can quickly monitor larger areas, typically at a detection limit greater than close-range technologies. This means that screening technologies are only able to detect larger sources. Examples of screening technologies include instruments mounted on aircraft, drones, ground vehicles, and satellites, in addition to fixed monitors or measurement devices which continuously measure methane concentrations to monitor for higher levels indicating an increase in emissions.

These innovative technologies can bring the cost of monitoring sites for emissions down and offer the opportunity to find emitters faster, or perhaps much faster—especially for large super-emitters. In proposed regulations, EPA and other regulators have required operators to use close-range technologies such as OGI, which have long been proven to be cost-effective. Concurrently, EPA and other regulators are also working with operators and technology providers to evaluate approaches for innovative screening technologies to be used in alternative monitoring approaches that will further reduce emissions from leaks and improper emissions. Leading states have recognized that frequent inspection for emissions is the key to effective methane reduction. Colorado, which has years of experience in reducing emissions with LDAR inspections, requires all new and modified sites to be inspected *monthly*.[12] Some large existing sites are inspected monthly. Most operators in Colorado use optical gas imaging, but other technologies (including advanced technologies approved by the State) are allowed. New Mexico has very recently approved rules that require operators to regularly inspect *all* sites, including wellpads with very low-producing wells.[13]

Routine Flaring of Associated Gas and Intentional Venting

The oil and gas industry is currently venting and flaring huge amounts of associated natural gas from oil wells. While there are many reasons that operators flare gas, the vast majority of gas flaring occurs when operators do not have the infrastructure (such as gathering pipelines) in place to handle natural gas at oil well sites. This scenario is referred to as routine flaring. Routine venting from oil wells—simply dumping the gas produced along with the oil into the air—is even worse, because it releases all the methane and other pollutants directly into the air. But routine flaring is also extremely harmful. In the U.S., routine flaring wasted enough gas in 2019 to heat over 8.5 million homes.[14] Routine flaring is a source of huge amounts of harmful pollution, including vast amounts of carbon dioxide equivalent

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[11] According to at least one report, there are over 100 distinct methane measurement technologies. *See* Highwood Emission Management, *Technical Report: Leak detection methods for natural gas gathering, transmission, and distribution pipelines* 20 (2022), https://highwoodemissions.com/wp-content/uploads/2022/04/Highwood_Pipeline_Leak_Detection_2022.pdf.

[12] 5 Colo. Code Regs. § 1001–9 D.II.E.4.e.(ii).

[13] N.M. Code R. § 20.2.50.116 (approved May 27, 2022, publication pending).

[14] Flare volume [The World Bank, 2022 Global Gas Flaring Tracker Report (2022), https://thedocs.worldbank.org/en/doc/1692f2ba2bd6408db82db9eb3894a789-0400072022/original/2022-Global-Gas-Flaring-Tracker-Report.pdf]; Gas per household calculated from EIA data [EIA, Natural Gas Consumption by End Use, https://www.eia.gov/dnav/ng/ng_cons_sum_dcu_nus_a.htm (last accessed June 21, 2022); EIA, Number of Natural Gas Consumers, https://www.eia.gov/dnav/ng/ng_cons_num_a_EPG0_VN4_Count_a.htm (last accessed June 21, 2022)].

to driving 17 million gasoline-powered vehicles for a year.[15] Natural gas flares consistently malfunction or fail to completely burn gas (or go out entirely), leading to huge amounts of methane emissions. A recent study by Environmental Defense Fund found that in the Permian Basin region—which accounts for 46 percent of flaring in the U.S.—10 percent of flares were found to be malfunctioning and 5 percent were completely unlit.[16] Finally, flares also produce large amounts of harmful pollutants such as black carbon soot, which directly impacts the health of people in communities near oil production sites.

Routine flaring has been recognized as wasteful for many years. Many oil producers avoid routine flaring entirely by ensuring that they have adequate infrastructure in place to handle all the natural gas a well will produce before the well is completed. However, other producers have track records of continuing to flare large volumes of gas for long periods of time perpetuating the industry's flaring problems. Taking action to address this problem, leading states have now banned routine flaring entirely. New Mexico, one of the states with high levels of flaring in the Permian Basin, banned routine flaring with new rules in 2021.[17] Colorado enacted rules prohibiting routine flaring in 2020.[18] New Mexico's rules will also require operators to ramp down other types of flaring (such as that done for maintenance activities) over the next several years.[19]

In the standards EPA proposed last year, *venting* from oil wells would be prohibited (a valuable measure given the harm from venting), but routine flaring would not be prohibited if a wellsite did not have adequate pipeline capacity to take away the gas from the wells at the site. This is an enormous exception since this is the very reason most routine flaring occurs. If clear standards prohibiting routine flaring are put in place, oil producers will invest in the capacity they need to get gas from wells to market so flaring is not required. If those standards have loopholes, as is the case in EPA's proposal, operators will continue to wastefully and harmfully flare. EPA should follow the precedent set by New Mexico and Colorado and prohibit oil producers from harmful and wasteful routine venting and flaring of gas.

Outdated Equipment

Another large source of methane emissions comes from industry's reliance on outdated equipment that is designed to release gas into the air. Examples of such equipment are: tanks for storing crude oil and hydrocarbons that are designed to release vapors as they evaporate into the air, rather than control those emissions; automated equipment which uses pressurized natural gas to pump liquids or to open and shut valves, releasing natural gas into the atmosphere every single time the equipment operates (and often when not operating); and compressors with non-hermetic seals on moving parts that are designed to vent harmful gas into the air.

These types of outdated equipment emit millions of tons of methane a year. In each case, technologies exist today to greatly reduce or eliminate emissions from these types of equipment, and in fact standards on the books today in leading states require the use of lower- or non-emitting equipment. For example, both Colorado[20] and New Mexico[21] require operators to replace automated gas-driven valve controllers with non-emitting equipment, such as valve controllers powered by electricity or compressed air. Colorado,[22] Pennsylvania,[23] and New Mexico[24] all have good standards in place for storage tanks, ensuring that emissions from the tanks are controlled to a low level.

The standards proposed by EPA in 2021 address some types of outdated equipment (such as automated valve controllers) very well, while the treatment of other types (such as liquids storage tanks) is inadequate and far behind the standards in

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[15] EPA, *Greenhouse Gas Equivalencies Calculator* (last updated Mar. 2022), https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results.

[16] Permian Map, *Flaring Aerial Survey Results*, Env't Def. Fund, https://www.permianmap.org/flaring-emissions/ (last accessed June 21, 2022).

[17] N.M. Code R. § 19.15.27.8 (Lexis, 2021).

[18] Colorado Oil & Gas Conservation Commission, Rule 903 (2021) https://cogcc.state.co.us/documents/reg/Rules/LATEST/900%20Series%20-%20Environmental%20Impact%20Prevention.pdf.

[19] N.M. Code R. § 19.15.27.9 (Lexis, 2021).

[20] 5 Colo. Code Regs § 1001–9 D.III.C.4.c.

[21] N.M. Code R. § 20.2.50.122 (approved 27 May 2022, publication pending).

[22] 5 Colo. Code Regs. § 1001–9 D.II.C.1.c.

[23] Pennsylvania Dep't of Env't Protection, *Pennsylvania General Plan Approval And/Or General Operating Permit*, GP–5A, Section E, http://www.depgreenport.state.pa.us/elibrary/GetFolder?FolderID=36120.

[24] N.M. Code R. § 20.2.50.123 (approved 27 May 2022, publication pending).

place for those types of equipment in leading states. CATF has provided EPA with detailed comments about how EPA should improve those provisions.[25]

Benefits of Nationwide Standards Based on Policies in Place in Leading States

Using a model of national methane emissions from the oil and gas inventory built by CATF that uses EPA's Greenhouse Gas Inventory and adjusts for emissions from super emitters as estimated by Alvarez et al.,[26] and using projections from the U.S. Energy Information Administration (EIA) to scale "potential emissions," CATF has projected methane emissions for future years assuming that specific regulatory standards are put in place. The documented benefits of each standard are used to quantify the benefits of the standard in the model. Based on this model, we see that nationwide EPA standards for methane emissions from new, modified, and existing sources can reduce methane emissions from the industry by 65 percent.

i. *The Environmental Protection Agency Has the Ability to Regulate Methane Emissions from the Oil and Natural Gas Sector*

As Congress has recognized, the EPA has clear authority under section 111 of the Clean Air Act to regulate methane for the oil and natural gas sector.[27] EPA first promulgated methane standards for new and modified sources in 2016.[28] But there are currently no nationwide standards for most existing sources: at present, sources that will account for about 60 percent of projected emissions in 2025 are not subject to any nationwide standard.[29] Such standards are an essential component to have in place for reliable reductions, as they are federally enforceable and would protect the health of people living near oil and gas production sites.

In November 2021, EPA proposed updated standards for new and modified sources and emissions guidelines for existing sources.[30] This proposal has several strong aspects, such as requiring operators to eliminate emissions from all gas-driven automatic valve controllers. However, the standards proposed for other emissions sources are not as strong, and lag well behind the standards on the books and implemented in leading states. Deep reductions in methane pollution from this industry are needed, so EPA must strengthen the standards and guidelines it proposes in the upcoming supplemental proposal.[31]

One key improvement EPA must make is to require frequent and regular LDAR inspections for all sources, without exceptions, to reduce fugitive emissions by 80 to 90 percent. Additionally, EPA must follow in the steps of New Mexico and Colorado and ban the wasteful practice of routine flaring. As described in more detail above in section b, CATF has shown that those changes and others can reduce the sector's emissions by 65 percent in a cost-effective way.

ii. *The House Has a Plan to Address Many of the Industry's Methane Emissions.*

An important complementary tool to the EPA source-specific standards is the Build Back Better Act's Methane Emissions Reduction Program ("MERP"), which would assess a charge on methane emissions from the oil and natural gas sector.[32] In general, this program would establish a charge levied to operators that would be assessed based on the methane emissions reported to EPA's Greenhouse Gas Reporting Program (GHGRP) if they are above a threshold established by the legislation. An operator would calculate the natural gas production in each basin, the volume of methane it reported under the GHGRP for that basin, and if the methane emissions were to exceed the threshold leak rate, the operator would pay the charge on those emissions.

This program would incentivize larger operators to reduce emissions quickly and efficiently. If operators emit at levels below the threshold level, they pay no fee. For

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[25] Clean Air Task Force, et al., *Comments on Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review* (Jan. 31, 2022), https://cdn.catf.us/wp-content/uploads/2022/05/11104718/Joint-Environmental-Comments-on-Proposed-OOOOb-and-OOOOc.pdf.

[26] Ramón Alvarez, *Assessment of methane emissions from the U.S. oil and gas supply chain*, 361 Science 186 (2018).

[27] 42 USC § 7411(b); H. Rep. 117–64.

[28] 40 C.F.R. § 60.5365a *et seq*.

[29] Based on CATF model projection of oil and gas methane emissions (based on EPA's GHGI and EIA projections) and estimates of proportion of current and future equipment that will be subject to NSPS Subparts OOOO and OOOOa.

[30] 86 Fed. Reg. 63,110 (Nov. 15, 2021).

[31] *See* 86 Fed. Reg. at 63,115 (announcing plans to issue a supplemental proposal).

[32] Build Back Better Act, H.R. 5376, 117th Congress (2022).

oil and gas producers, the threshold level of emissions is a level targeted by the Oil and Gas Methane Partnership, a group of leading producers. Because there are many cost-effective ways to reduce emissions at costs below the amount of potential fees, operators with emissions above the threshold level will rapidly do so. The fee level ($1500 per metric ton of methane after full implementation of the legislation) is well below the societal damage caused by emitting a metric ton of methane.[33]

The MERP represents a valuable complement to the regulations EPA is developing. First, any reductions required by EPA's rules will reduce the fees operators will need to pay under the MERP. For some operators, especially those who start with relatively low emissions given the amount of gas they produce, the reductions required by the EPA rules will eliminate the MERP fee. But, given the long lead time required for EPA's rules to be implemented, the MERP's more immediate applicability will incentivize more rapid adoption of the established technologies available to operators.

Second, the MERP's emissions-based fee will incentivize ongoing efforts for mitigation beyond that achieved by the EPA standards. The EPA standards that we advocate for would not eliminate methane emissions from the oil and gas sector—opportunities will still exist for further reductions. The MERP will focus efforts on finding innovative ways to further reduce emissions. This will also help drive further innovation and growth in the methane emissions reduction industry.

Notably, only operators emitting above the GHGRP reporting threshold (25,000 metric tons per year of CO_2 equivalent) would need to pay any fees under the MERP; smaller operators would be entirely exempt.

[2] *Implementing these solutions will provide welcome and much-needed benefits to communities and populations around oil and natural gas development.*

Strengthening and finalizing EPA's methane standards and emission guidelines and passing the MERP provisions of the Build Back Better Act will provide important climate benefits, improve the health of communities and workers around oil and natural gas development, and add jobs. It's a win-win-win.

Climate Benefits

Beyond the impacts that rapidly reducing methane has on decelerating the warming rate, methane reductions provide significant value to society. Under the current EPA regulations and state policies in place,[34] CATF estimates that the oil and natural gas industry would emit 11.8 million metric tons of methane in 2025. Thus, by reducing methane emissions by 65 percent, after adjusting for the actual emissions from super emitters, would prevent over 7.8 million metric tons of methane emissions.[35] Using the Interagency Working Group's social cost of methane,[36] these reductions would save society over $13 billion annually by 2025.

Health Benefits

Methane emissions from oil and gas production have serious negative impacts on public health. Using publicly available data, research from Earthworks and the Fractracker Alliance indicates that over 17 million people live within a half-mile of oil and gas production, of whom nearly 6 million are people of color. Furthermore, 3.1 million children attend the more than 12,000 schools located within half a mile of oil and gas production.[37]

Methane contributes to the formation of ground-level ozone, or smog, by reacting with sunlight in a photochemical reaction in the lower atmosphere. Other air pollutants are also co-emitted when methane is leaked or vented. These co-emitted pollutants include volatile organic compounds (VOCs), which are also smog-forming, as well as a variety of toxic hazardous air pollutants (HAPs). The oil and gas industry

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[33] Drew Shindell, *The social cost of methane: theory and applications*, 200 Faraday Discuss 429 (2017).

[34] *See* 40 C.F.R. Part 60, subpart OOOOa.

[35] 65 Percent Memo at 2, Table 1.

[36] $1,700, based on a 3 percent average discount rate for the year 2025. *See* EPA, *Regulatory Impact Analysis for the Proposed Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review*, 3–11, Table 3–3 (October 2021), https://www.epa.gov/system/files/documents/2021-11/proposal-ria-oil-and-gas-nsps-eg-climate-review_0.pdf ("Proposed Rule RIA").

[37] Oil & Gas Threat Map, https://oilandgasthreatmap.com (last accessed June 21, 2022).

emitted 2,504 kt of ozone smog-forming volatile organic compounds (VOCs) in 2017.[38]

Methane, VOC, and HAP emissions from the oil and gas industry are typically emitted as a mixture. This means that technological solutions which reduce methane emissions will also significantly reduce emissions of VOCs and HAPs, providing critical public health benefits to vulnerable communities. A 65 percent reduction of methane emissions in line with what CATF has shown is possible by a nationwide implementation of solutions on the books in leading states right now would prevent 2.3 million tons of VOCs and 165,000 tons of HAPs from being emitted each year.

Reducing methane and VOC emissions will directly reduce the health risks associated with ground-level ozone. Epidemiologically derived research suggests that methane-induced changes in ground-level ozone levels can impact air quality, human health, and even agricultural productivity.[39] Reducing methane emissions can therefore change ground-level ozone levels in ways that provide significant value to society, including reduced risks of adverse health impacts.

Scientific research has firmly established that exposure to ground-level ozone smog harms human health. Such harms include asthma, decreased lung function among healthy adults, increases in respiratory-related hospital admissions and emergency room visits, and premature death.[40] Long-term exposure can be particularly severe: EPA has found that there is "likely to be a causal relationship between long-term exposure to [ozone] and respiratory effects."[41]

For vulnerable populations, exposure to ground-level ozone can be particularly harmful. Many studies have demonstrated that children with asthma lose some lung function and face worsened respiratory symptoms when exposed to ozone pollution.[42] Moreover, people with respiratory diseases or asthma, older adults, and people who are active outdoors (including outdoor workers) can face adverse respiratory effects.[43] In total, ozone smog attributable to oil and gas contributes to more than 750,000 summertime asthma attacks in children every year, children miss 500,000 days of school each year, and adults take approximately 1.5 million personal days when they are forced to rest or reduce activity due to high smog levels.[44]

Long-term exposure to HAPs can be life-altering for communities living near oil and gas operations. One such HAP emitted in large amounts, benzene, is a "known human carcinogen (causing leukemia) by all routes of exposure and ... that exposure is associated with additional health effects, including genetic changes in both humans and animals"[45] that is naturally present in underground oil and natural gas. Chronic inhalation of benzene is also associated with noncancer health effects like the arrested development of blood cells, anemia, leukopenia, thrombocytopenia, and aplastic anemia.[46] When natural gas leaks or is otherwise emitted in the production segment, benzene is often present in the emitted gas. EPA has also documented the harmful effects of other specific toxic air pollutants emitted from oil and natural gas operations, including toluene, carbonyl sulfide, ethylbenzene, mixed xylenes, n-hexane, and other air toxics.[47] In total, 234 counties in 20 states face cancer risk, due to oil and gas air pollution, that exceeds the EPA's one-in-a-million threshold, placing approximately 14 million people at risk. Some of the areas with the greatest health risk are found in New Mexico, West Virginia, Colorado, Texas, Louisiana, and North Dakota.[48]

Taking action to reduce methane emissions from the oil and natural gas industry will thus provide additional health benefits by reducing the risks of adverse health impacts associated with smog-forming pollution (VOCs and methane) as well as benzene and other toxic air pollution.

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[38] *See* 86 Fed. Reg. at 63,132, Table 11 (sum of VOC emissions from oil and natural gas production, natural gas processing, and natural gas transmission and storage).

[39] Drew Shindell, The social cost of atmospheric release, 130 Climatic Change 313 (2015).

[40] EPA, *2013 Final Report: Integrated Science Assessment of Ozone and Related Photochemical Oxidants* 1–6, EPA/600/R–10–076F ("ISA").

[41] ISA at 1–8.

[42] Kathleen Mortimer et al., *The Effect of Air Pollution on Inner-City Children with Asthma*, 19 European Respiratory J. 699 (2002); ISA at 6–120, 6–121, 6–160.

[43] ISA at 1–8.

[44] CATF, Gasping for Breath (Aug. 2016), http://www.catf.us/wp-content/uploads/2018/10/CATF_Pub_GaspingForBreath.pdf.

[45] Proposed Rule RIA at 3–22.

[46] Proposed Rule RIA at 3–23.

[47] Proposed Rule RIA at 3–23—3–26.

[48] CATF, Fossil Fumes (forthcoming report update).

Employment Benefits

Implementing strong methane standards would result in a significant number of U.S.-based manufacturing jobs from upfront capital investments, as well as ongoing maintenance, repair, and inspections jobs. According to a forthcoming report, the CATF 65 Percent Plan will result in nearly 64,000 direct jobs, compared to just over 27,000 direct jobs for the EPA proposal. In both cases, indirect and induced jobs are also significant: indirect jobs reflect inter-industry purchases and arise from firms purchasing inputs from their suppliers, while induced jobs result from wages paid to workers, who may spend these wages on consumer electronics, clothing, etc. Overall, the CATF 65 Percent Plan results in nearly 220,000 total jobs compared to 92,000 for the EPA proposal, a difference of 120,000 jobs.

There are several reasons why the jobs created by oil and gas methane standards will be good-quality jobs, which add value both for the workers themselves and for their communities.

Technologies exist which will help companies to comply with regulations, but firms will have to ramp up production of equipment in order to meet demand that will be driven by compliance with the standards. Such equipment includes optical gas imaging cameras, air compressors, electric pumps and actuators, solar panels and batteries, and vapor recovery units. In at least one important case—the manufacture of optical gas imaging cameras—CATF has information indicating that 70 percent of the manufacturing will take place domestically in the U.S.[49]

Globalization has undoubtedly had an impact on the American labor market through practices such as offshoring and outsourcing. However, the many jobs generated by standards would be inherently non-offshorable. Many of the jobs required entail the installation of equipment, ongoing maintenance, and leak inspections and repairs, all of which require U.S.-based workers.

Many of the jobs, particularly those involving installation, maintenance, and inspections at well sites and compressor stations, are likely to be filled by employees with oil and gas industry experience, using transferable skills and experience.

Some degree of upfront jobs is associated with initial capital investment in equipment. But most of the other jobs are ongoing, not time-limited jobs. These are jobs that provide stability to both the workers themselves and the communities in which they live.

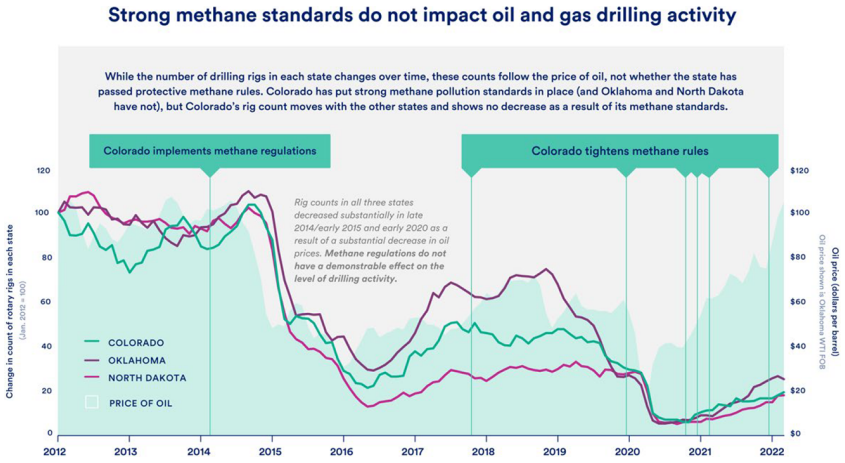
Finally, we estimate that at least 10 percent of the jobs will be union jobs. There are unionization rates well above 10 percent in many of the top job categories that we identify.

Impact of regulations on industry

Strong standards for methane emissions from the oil and gas industry will lead to climate, public health, and economic benefits, and they will achieve these benefits with minimal negative impact on the industry and its workforce.

CATF analyzed data on oil and gas well drilling in several U.S. states and conclude that strong methane standards have not impacted activity in the oil and gas industries. As shown in the figure below, while the number of drilling rigs in each state changes over time, the number of rigs follows the price of oil, not whether the state has passed protective methane rules. Colorado has strong methane pollution standards in place (while Oklahoma and North Dakota do not), but changes in Colorado's rig count are consistent with those in the other two states and shows no decrease as a result of the state's methane standards. Rig counts in all three states decreased substantially in late 2014, early 2015, and early 2020 due to a substantial decrease in oil prices. This indicates that methane regulations do not have a demonstrable effect on the level of drilling activity.

[49] Based on CATF conversations with OGI camera manufacturers.



Ms. CASTOR. Thank you, Ms. Smith.

And thanks to all of our witnesses for your insightful testimony. I like the American "can do" spirit theme that you all have.

Now we will go to member questions.

First up, Ms. Brownley. You are recognized for 5 minutes. Good morning.

Ms. BROWNLEY. Thank you, Madam Chair. And I feel like this is the first time I have ever been first on the committee to ask questions, so thank you for that.

According to the International Energy Agency, natural gas markets could have sold an addition 180 billion cubic meters of natural gas if all the leaks from fossil fuel operations in 2021 had been captured—a volume equal to the entire gas market of Europe.

Ms. Smith, you noted in your testimony that routine flaring wasted enough gas in 2019 to heat over 8.5 million homes. This seems like it should be a powerful economic incentivize for industry to stop leaks and flares from drilling.

So what do you think accounts for industry's failures to do more on their own to address the problem? Do you think industry's failure to fix the problem is yet another argument for strong EPA standards?

Ms. SMITH. Thank you so much for the question, Representative Brownley. And you are absolutely right; the amount of waste is staggering: billions of dollars' worth of natural gas being vented and flared and leaked every year.

Why hasn't the industry acted? I think we haven't had uniform standards requirements. And that is the role that EPA can play, by issuing strong safeguards this fall.

Ms. BROWNLEY. Do you see any industries beginning to regulate this on their own, just to protect their bottom line?

Ms. SMITH. Some companies have been more forward-thinking in this area. We released a benchmarking report recently that looked at the top 100 operators, and there is a big range when it comes to emissions. So, again, that underscores that the solutions do exist but are not being used uniformly.

Ms. BROWNLEY. Thank you. Thank you for that.

Ms. Tomcik, thank you for your testimony and being here.

You mentioned and talked about your children's school being a half a mile or so from fracking wells. So, with all of the new technology and satellite data that is really available now to track methane flares and emissions, has this data helped you in any way to raise awareness at the local level about these problems?

Ms. TOMCIK. I am sorry. Could you repeat the last part of that question one more time?

Ms. BROWNLEY. Yeah. I am asking if, with all of the tools and data that we have available now to track methane flares and emissions, has any of this—these tools, this data—has that been able to help you in terms of raising awareness in your own community to improve upon those leaks, et cetera, that are happening?

Ms. TOMCIK. What we do know is that there is a lot of oil and gas air pollution that is impacting communities where they live. And so the information, the technologies are making it clear that we need Federal methane rules and regulations to protect those communities who are being impacted by flaring and also the pollution that is created from the leaks from small leak prone wells.

And so it is very important that these methane rules are enacted as quickly as possible to protect the health and help protect people from climate change too.

Ms. BROWNLEY. Thank you. And, again, thanks for being here.

Ms. Smith, you noted in your testimony that there are a variety of different kinds of leak detectors, including close-range technologies and screening technologies.

Do you have an estimate of how much these various technologies would cost? For instance, the handheld device that you spoke of?

Ms. SMITH. I am sorry. Was that for me or Dr. Alden?

Ms. BROWNLEY. For Ms. Smith, yes.

Ms. SMITH. Oh, sure. Thank you. Thank you so much for that question, Representative.

Fortunately, overall, the costs are very, very low. You know, we look at leading states like Colorado, for example, which has had strong leak detection and repair standards on the books, and it hasn't had an impact on their rig count and productivity compared to other states that do not have standards.

Ms. BROWNLEY. And, Ms. Alden, can you add anything to that?

Dr. ALDEN. Sure. Yeah, I completely agree with Ms. Smith. And it is pretty amazing how implementing this kind of monitoring drives amazing efficiencies for operators. And so it really does kind of keep product in the pipeline; identifies malfunctions, which, whether it is a leak or not, I mean, that saves money; and provides this kind of instant feedback on operations to help folks really dial in their systems.

So the technologies——

Ms. BROWNLEY. Thank you.

Dr. ALDEN [continuing]. Themselves are very affordable and—sorry, yeah,—and pay for themselves.

Ms. BROWNLEY. Thank you.

I yield back, Madam Chair.

Ms. CASTOR. Next, Representative Gonzalez, you are recognized for 5 minutes.

Mr. GONZALEZ. Thank you, Chairwoman Castor and Ranking Member Graves, for holding this hearing today, and for our witnesses, for all your work and your testimony.

Dr. Alden, I am going to start with you. As you know, ARPA–E plays an invaluable role in the U.S. energy innovation ecosystem, spurring development and commercialization of transformative technologies that in some cases are too risky for the private sector to invest in. Cash flows are way out into the future. It is great to see, however, that LongPath is a two-time ARPA–E recipient, particularly a selection of the SCALEUP program.

Despite the successes of ARPA–E, many of my colleagues and I remain concerned that some companies may face bureaucratic barriers from agencies outside the DOE in the ARPA–E process that chill future private investment and slow down the path to commercialization.

So, with that as sort of the backdrop, can you provide some insight into LongPath's experience with regulatory agencies such as the EPA during the ARPA–E process?

Dr. ALDEN. Sure. And, yeah, we are a huge fan of ARPA–E. I mean, the ability for the Federal Government to invest in high-risk, high-reward ideas—and, you know, some of those won't pan out; some of those do. And that is great for the American economy when they do.

And so working with other agencies—I mean, it is tough for Federal regulations to keep pace with the kind of technological innovation that is happening right now. I think EPA has taken great first steps in their draft rules. They opened the door to new technologies, which is huge.

And we have been working directly with them and a whole bunch of other stakeholders—including Dr. Kleinberg as well—to help them get those rules across the finish line in terms of, you know, kind of planning for the future of better technologies taking hold.

So I think, yeah, to the extent that, you know, agencies can look at regulations that are potentially adaptable in the future and also setting metrics that we think we can achieve in the future, I think that is a positive step.

Mr. GONZALEZ. Thanks.

And, outside of the rulemaking process, are there any other specific recommendations that you would make to improve the process on your side, just to make sure that, you know, we don't have a bunch of great technology companies stuck in sort of a bureaucratic mess, which I know happens at times?

Dr. ALDEN. Yeah. I think the ability to have agencies create rules that are very much inviting of stakeholder feedback is very positive.

And, certainly, a great step right now, in terms of looking at agencies like ARPA–E or DOE or NETL or some of those groups, would be to now—what we really need to enable these technologies to take hold and get out there at large scale is going to be a governing body or independent group. And I think that ARPA–E, DOE, some of those agencies, could help to fund an independent group to create, as I mentioned, those standards and certifications to make sure the technologies going out in the field are really of that utmost, you know, highest quality.

Mr. GONZALEZ. Thank you.

Shifting gears a bit, I want to take a minute to focus in on how the various methane-monitoring technologies can work together to improve our detection systems.

In recent years, one of the more popular emissions-control devices has been satellites. But, while satellite observations carry many benefits, they also feature some drawbacks, such as their considerable range of uncertainty and inability to apply to smaller emitting sources.

Can you explain how monitoring systems like LongPath's can work in collaboration with today's satellites and drones to monitor and identify leaks?

Dr. ALDEN. Yes. As I mentioned, there is a real value in both those, kind of, large-scale survey technologies, as you mentioned, and in having real fixed monitors to provide that mitigation piece.

So satellites are extremely powerful, especially on the world stage. So there are a lot of places on Earth where it is too hard, you are not going to be able to get ground-based monitors or even aircraft, aerial surveys, in place. So, on the global stage, satellites are a huge key to the puzzle.

In the U.S., where we do have the ability to deploy this tech at scale, I see some value in stacked solutions in terms of, you get your continuous fixed monitors on your discrete well pads—so well pads, tank batteries, LNG terminals, you know, compressor stations. And then there is a lot of other infrastructure that is a little more diffuse, so gathering pipelines and pipelines, for example, can be a real nice place to kind of fill in that gap with some of the aerial technologies.

But there are a lot of ways to stack these technologies, and certainly redundancy can't hurt in this realm, where the stakes are so high.

Mr. GONZALEZ. Great. Well, thank you for that. Thank you for all the work that you are doing.

And, with that, I yield back.

Ms. CASTOR. Next, Representative Levin, you are recognized for 5 minutes.

Mr. LEVIN. Thank you for holding today's hearing, Chair Castor. I am glad we are continuing this conversation on the benefits of cutting methane pollution.

And I, too, think about these issues as a parent, with two young kids at home, 9 and 8 years old. And my wife and I encourage them to learn basic science, and I thought I would start with some very simple facts.

As we have heard, methane is a key greenhouse gas driving global mean temperature rise. While addressing carbon dioxide emissions gets prime focus in many conversations around climate change, a recent study by scientists at Scripps Institution of Oceanography, in my district, confirms what we already know: reducing carbon dioxide emissions alone is not enough to meet our 2050 climate targets.

In order to stay below these metrics, the study notes that we must also focus on addressing methane emissions and other non-carbon dioxide climate-warming pollutants in order to avoid triggering irreversible climate change.

Methane is particularly important because it has a warming potential nearly 80 times greater than carbon dioxide over 20 years, and human-caused emissions of methane currently represent one-third of all warming from greenhouse gases.

Given methane's intense warming potential, stopping methane pollution is one of the most impactful interventions we can take in the short term to avoid additional warming in the coming years, as we continue working to decarbonize all facets of our society.

But, as we have discussed today, stopping methane leaks doesn't just have climate benefits, but we also know that reducing methane emissions has key public health and economic benefits.

And as part of the United States' efforts to help reduce Europe's dependence on Russian fossil fuels, President Biden recently committed to provide an additional 50 billion cubic meters per year of U.S. liquified natural gas.

A recent analysis by the Environmental Defense Fund found that reasonable reductions in methane waste from leaks and flaring could meet 50 percent of President Biden's commitment of sending 50 billion cubic meters to our European allies.

It seems to me that the oil and gas industry should focus on reducing waste of our natural resources as the most tangible short-term solution to increase the domestic supply of natural gas.

Ms. Smith, do you agree that reducing methane pollution by deploying leak detection and repair technologies represents a key opportunity to increase our overall supply of natural gas and help address high energy prices, both domestically and for our European allies?

Ms. SMITH. Thank you for this question. Yes, ending wasteful venting and flaring would indeed free up additional gas for export to Europe and should absolutely be a priority. We are talking about billions of dollars' worth of gas going up in flames or going straight into the air in the U.S. every single year.

Mr. LEVIN. So my hope is that if we are really serious about maximizing the potential of our current gas, that we should be doing all we can to mitigate leaks and we should be preventing flaring.

With my time remaining, I would like to shift a bit to discuss efforts going on in my home state of California in using aerial surveys to improve the detection of methane leaks.

Dr. Kleinberg, as you know, I think between 2017 and 2021, CARB led a pilot program—California Air Resources Board led a pilot program to use airplanes to detect methane leaks from sources including oil fields. And as part of this initiative, 44 California facilities voluntarily repaired leaks after they were notified about them as part of a pilot program.

The fixes prevented the equivalent of 1.2 million metric tons of carbon dioxide from escaping into the atmosphere, which is equal to taking about a quarter of a million cars off the road for a year.

And, as a result of this success, CARB and Carbon Mapper are planning on launching two satellites in 2023 to provide regular, complete, precise, and timely measurement, not just of methane, but also of carbon dioxide emissions as well as over 25 other environmental indicators.

Dr. Kleinberg, given the success of California's pilot program, what lessons should the Federal Government take from these efforts to improve standards and methods for detecting and remediating methane leaks through aerial surveys perhaps on a national level.

Dr. KLEINBERG. Yeah. Well, the California survey was a model for the way I think we should be moving forward in terms of regulation and measurement. It was extremely comprehensive—272,000 sites. Riley Duran testified just last week at the House Science Committee on this.

This is exactly what we need to be doing. It is remarkably inexpensive to do it and, as Caroline Alden pointed out, comprehensive. So this is the way to go.

Mr. LEVIN. Well, I am very grateful to—and had the opportunity to have that pilot in California. I hope the rest of the country will take notice.

And it is also great to hear from a UCSD graduate on our panel today.

Dr. KLEINBERG. Yes, sir.

Mr. LEVIN. So I thank the witnesses, and I will yield back to the chair.

Ms. CASTOR. Next up, Representative Carter, you are recognized for 5 minutes.

Mr. CARTER. Thank you, Madam Chair.

And thanks to all of you for being here, the witnesses, for being here.

Look, as much as my colleagues on the other side of the aisle don't want to admit it or don't like it, we have to admit that fossil fuels, that natural gas and oil are going to be part of our portfolio for a long time. I mean, let's face it, we know that a great percentage of our energy portfolio today is fossil fuels. And that didn't happen overnight, and it is not going to change overnight, no matter how hard we want it to do that or how badly we want to do that.

But I have to tell you that I am encouraged by the progress that the oil and gas industry, the fossil fuel industry, if you will, has made in decreasing emissions. I had a group in my office just earlier this week, a group of six oil companies that are doing business up in Canada. And they have a desire, they have a goal of being carbon-neutral by 2050, even with the fossil fuels.

And I applaud them for that. I think that is great. And I think that we don't give enough credit to the fossil fuel and the oil and gas industry for the progress that they have made in decreasing emissions.

And a lot of that has to do with the policies. Just last week, we had the Governor of Wyoming before this committee, and he was telling us how he has directed the state to pursue a goal of net-negative carbon-dioxide emissions and continue to use fossil fuels. So, you know, it is going to be part of our future, I understand that, and technology is going to play a big part of that as well.

But I want to pivot just a little bit, because we all know that climate change and that—that this is a global problem. And we would be remiss, and we are being remiss, by not thinking about third-world countries and about up-and-coming countries, developing countries, because they are using fossil fuels, and they are going

to. Yeah, they do their best to use renewable energy and clean energy, but they are going to use whatever they have to in order to get their economies going and to have electricity, these developing and growing nations.

Just an example, the Indian Government's own future fuel mix. Their modeling shows that they will overwhelmingly depend on fossil fuels, even though they are going to have a rapid rise in renewable energy as well.

Nigeria's Vice President put it this way, and I quote: "No country in the world has been able to industrialize using renewable energy," yet developing countries are being expected to do so, "when everybody else in the world knows that we need gas-powered industries for business." So it is just part of it.

Dr. Alden, I wanted to ask you—my question for you is this. Doesn't that mean that it is extremely important to continue to invest, to explore, and to innovate in technologies, like LongPath has, so that we can reduce these emissions while still providing reliable energy?

Dr. ALDEN. Absolutely. I mean, I think that, you know, looking at the global stage, as I mentioned, there are—you know, satellites can kind of go everywhere all the time, or a lot of the time, and at least see the very, very large emissions that might be happening in other countries. But I think there is a lot of potential for exporting the technologies that have been developed here in the U.S., like LongPath or the aerial surveys, all the different—I mean, there is a whole host of new tech here that is kind of ready to go abroad as well.

So I think that there is a great opportunity for the investments that have been made in U.S. innovation to exported overseas and try to solve that problem. Yeah. And, also, I think that, yeah, the other pathway is just, we have the technology here; let's implement it and prove via measurement that U.S. gas is clean, and then, you know, we can even export that gas. So——

Mr. CARTER. Well, let me ask you this real quick. I am running out of time here. What about regulations? Wouldn't improving regulations to encourage more widespread adoption of technologies like we see at LongPath, wouldn't that contribute to the potential for job creation in these areas?

Dr. ALDEN. Absolutely. So making sure the new rules that come online here are recognizing new technologies and creating a direct on-ramp for new technologies is going to be hugely important to kind of stimulate that innovation in the technology sector and to get the folks, you know, on the ground to want to use it. So, yeah, I think——

Mr. CARTER. Well—and just let me say that I have always said, in order to address this situation, we are going to have to have adaptation, mitigation, and innovation. And I truly believe that the greatest innovators, the greatest scientists, are right here in the United States of America, and we should be encouraging that.

Thank you, Madam Chair, and I will yield back.

Ms. CASTOR. Next, Representative Bonamici, you are recognized for 5 minutes.

Ms. BONAMICI. Thank you so much, Chair Castor.

And thank you to the witnesses.

I serve on the Science, Space, and Technology Committee, as well as the Select Committee. And, earlier this month, we released a majority staff report finding that oil and gas companies are failing to address super-emitting leaks, and they are not consistently deploying the innovative leak detection and repair technologies that exist.

And, Dr. Alden, yes, your colleague Dr. Rieker was there from LongPath at the hearing where we spoke about this. And I wanted to follow up on some of the questioning that you have been responding to.

We know, as you have established, as others have established, that the technology now exists and that there are financial incentives. But, apparently, the industry is not adapting this technology. So how can Congress motivate industry to adapt this continuous monitoring technology?

And I just want to point out as well that I appreciate your comment, something that I have run across over the last decade on the Science Committee, that regulating technology is challenging because the technology changes so much more rapidly than regulations.

So can you talk a little bit about the best things that Congress can do to motivate industry to adopt continuous monitoring?

And, also, if you could mention as well—there has been a lot of talk about the oil and gas industry, but that is not the only source of methane. So could you talk a little bit about how your technology works with other methane-emitting sources?

Dr. ALDEN. Thanks, Congresswoman Bonamici. Yeah, those are great questions.

So, with the EPA rules and the SEC rules and other rules coming down the pipeline, I mean, I think just being ready, the technologies are here, and knowing that we can achieve the metrics we want—if you want quantitative metrics, like methane intensity, that effectively scale across different production zones, different basins, in a meaningful way, we can get there now with the technologies that we have.

So I think, in the more immediate term, though, the EPA rules—we have worked with a lot of stakeholders, Dr. Kleinberg has been a great leader in this process—in creating a technology-neutral matrix that EPA can directly implement into the rule so that we can have those technologies ready to go.

And the reason that is important for industry adoption is, if the EPA rules, for example, or the SEC rules don't allow a direct on-ramp for these new technologies, then industry is going to be stuck doing the old methods. So they are going to be stuck doing these old OGI surveys four times a year, and they are not going to want to spend extra money to do the monitoring that is really effective with LongPath.

So we need to make sure that we are encouraging and at least not, you know, disincentivizing operators to use these technologies. So I think those would be really important things, to just recognize the technology is here and then build rigs to meet that.

And then, to your second point, that is absolutely a huge issue, is that biogas and other incredible, incredible innovations coming online, they are going to need monitoring too. Because if you are

effectively capturing methane from various sources and moving it around, it has got the same type of leaks as you do in oil and gas infrastructure. They are equally difficult to find, if not harder to find. And so we need to be sure we are incentivizing the development and application of measurements in these realms as well.

Similarly, inventory numbers just don't cut it. You just can't predict where and when these leaks are going to happen, so you need to be using measurements.

Ms. BONAMICI. Okay. Thank you very much, Dr. Alden.

Dr. Kleinberg, in your written testimony, you cite the need to reform EPA's alternative means of emission reduction process. So would you please explain a little bit about the process and how addressing this limitation would help increase the deployment of methane emissions reduction technology?

Dr. KLEINBERG. Yes, I will be happy to.

You know, one thing that is really, really important in regulations is having them be adaptive, because this field in particular, where so much technology is being developed so fast, this begs for a regulatory scheme that takes into account new technology, which has been blossoming in the last 7 years.

And the alternative means of emission limitation is a provision of the Clean Air Act that basically anticipates that. But the way it has implemented so far by the Environmental Protection Agency, it has turned out to be more of a barrier than an enabler.

And, in fact, since 2012, when it was first implemented for methane, there was no applications between 2012 and 2020, while people like Caroline Alden and others were developing this phenomenal technology, because the process was so onerous.

Now, it approved a bit in 2020. But, still, one application, which is still sort of floating around in EPA. You know, we need to do better than that. We need to give EPA the resources to handle these applications and regulations that encourage innovation, not discourage it.

Ms. BONAMICI. I appreciate that.

And I have another question for Ms. Smith, but I am out of time, so I am going to be submitting that for the record, as well as some followup for Dr. Kleinberg.

So thank you very much, Madam Chair. I yield back.

Ms. CASTOR. Thank you.

Next, Mr. Armstrong, you are recognized for 5 minutes.

Mr. ARMSTRONG. Thank you, Madam Chair.

If we think capturing 100 percent of the natural gas would lower our energy prices in the near term, then I don't think we are really being honest about how products get to market.

In fact, one of the two biggest drivers for North Dakota not producing more oil and gas right now is human capital—we have a workforce shortage, as a lot of people do—and gas capture. And so if we would capture 100 percent of the gas in North Dakota right now, we would drop probably 250- to 300,000 barrels of oil a day, and that would happen overnight.

So you wouldn't produce more gas, you would produce less oil. And the reason for that is we are the geographic center of North America, and we don't have the capacity to get that product to market.

So when we are considering methane emissions from oil and gas industry, we continue to hear the majority paint the industry with one broad brush. I think it is important that when we talk about who these producers are, what they are, and where they do business, yes, there are large multinational companies, but the majority of the regulatory burden from broad Federal onshore policy will fall on small- and medium-size oil and gas companies.

And companies rightfully have concerns with these proposals. It is not because they want to pollute and it is not because they aren't already being regulated. It is because they don't want to be subject to duplicative regulation from wellhead to market.

And the real problem with actions by the EPA and Congress is that they stifle innovation. And even if they are intended not to, by the very nature of Federal regulation, they are burdensome.

As the majority has noted, states are already regulating and supporting innovative technology. We did this in North Dakota in the beginning of the oil boom when I served in the state legislature, talking about rewriting all our pipeline law. And at that time, we were talking about sensors, and we were really interested in how we were going to use them. It turns out they don't work when it is 25 below zero. So they didn't work, and we continued to move forward.

North Dakota does this through the DEQ through robust methane regulation that is already on the books. But the problem is, is when you revert to Obama-era EPA policies or a one-size-fits-all approach, you cut out new technology. By the very nature of Federal regulation, it is unwieldy, it is burdensome, and it's unusable by producers. We need to stop duplicative regulations that only serve to slow down market innovation that limits methane.

Dr. Alden, in your presentation, you walk through the technology developed by LongPath that support continuous monitoring of facilities that provides for leak detection and quantifiable data in real time. How do you accurately quantify emissions helps operators that use this technology work more effectively, and how can that benefit both the industry and also reduce emissions?

Dr. ALDEN. Your question is about how quantification helps?

Mr. ARMSTRONG. Yeah.

Dr. ALDEN. Yeah. So quantification drives a lot of insights. I mean, you know, we hear a lot of operators say, oh, you need just a smoke detector. You just need to know if there is a leak or not. But when folks do start to onboard, like, quantitative data that is actually accurate and reliable, we see that they find a lot of value in that.

So, for example, folks can prioritize leaks for repair. They can start to tune in when they want to get alerts, what size leaks they want to get alerts on, what type of leaks they want to get alerts on, in order to really be efficient about attacking the worst leaks first.

They can track and compare how equipment performs in different settings. They can look at, say, hey, you know, on windy days, this separator that doesn't have a burner control unit, you know, blows out and leaks gas, but this other one over here with a more advanced burner control unit doesn't.

So we see a lot of value in being able to track those emissions over time, really look at their reductions, quantify their reductions over time, and then compare site to site and equipment to equipment.

Mr. ARMSTRONG. And I appreciate that. We are always interested if it will work in February in North Dakota. That is usually a big concern for us.

So as you state in your testimony, technology-neutral regulations could allow for adoption and deployment of new technologies. How could a neutral regulatory framework help deploy these technologies, and how important is it that regulatory agencies work with the different stakeholders to adopt a framework that allows this approach?

Dr. ALDEN. Yeah, a great question. So as I mentioned, there is a group of stakeholders, so—and that is industry folks, NGOs, technologists like myself, legal experts, who are together kind of crafting what we call a matrix approach for the rule. And we are very, very hopeful, and I think expecting that the EPA will adopt this in the new rule.

And what that will do is allow for certain kind of technology-neutral metrics to be put forth, like how frequently does the technology look, and what sort of detection level does it need to have, what kind of size leaks does it need to be able to find reliably.

And so that is a great first step in terms of kind of—I think that that probably will go in the EPA rule, and I applaud the EPA for opening the door to that type of regulation.

The second thing, I want to emphasize what Dr. Kleinberg said about adaptive regulation. So if the rule right now—and this is going to be more of a struggle because this pushes the EPA rules a little further away from where they have been historically, which is difficult, but getting in place the ability to pick the metrics you want for the long term, pick quantification and build your rule around that. And then, as the years go by, in 3 years, in 5 years, in 7 years, return to the best current science on what emissions are and the best current science on what you want and tune.

Ms. CASTOR. Thank you.

Mr. ARMSTRONG. Thank you. I yield back.

Ms. CASTOR. Representative Huffman, you are recognized for 5 minutes.

Mr. HUFFMAN. Thank you, Chair Castor.

And thanks to the witnesses for their very interesting testimony.

Dr. Kleinberg, I would like to start with you. You gave us a lot to think about in terms of methane from the oil and gas sector, but we also hear a lot about methane in agriculture and other sources.

Could you just, in terms of the scale of the problem we are trying to deal with, add that into the context of the conversation?

Dr. KLEINBERG. Yeah, I will be happy to. You know, people talk about oil and gas because, basically, the people that run the oil and gas industry are very well-capitalized, very high-technology, so that looks like a good sector to work on and, indeed, it is.

Nonetheless, the agriculture sector is a bigger problem. And, in fact, in that survey of California that Representative Levin mentioned, many of the largest sites turned out to be either agricul-

tural, dairy farms, that sort of thing, or waste management landfills and so on.

Those are also very big problems that we should not ignore. In some ways, they are sort of easier to deal with because it is a less itinerant industry. You know, there are always new wells here and there and with many possibilities for leaks and high-pressure gas and so on. Agriculture might be easier in a different way or different problems, but things that we should be working on right now.

Mr. HUFFMAN. Different solutions, though.

Dr. KLEINBERG. Different solutions, yes.

Mr. HUFFMAN. Appreciate that. So if we achieved total methane control in the oil and gas sector and just did a great job with all these technologies, both detecting the methane and eliminating the leaks, if we are meeting ever-higher amounts of global energy demand with natural gas, we are still increasing CO_2 in the atmosphere, aren't we?

Dr. KLEINBERG. Yes.

Mr. HUFFMAN. So I think it is really important as we think about what do we do with this methane issue. Obviously, we have got to apply the handbrake that Ms. Smith and others have talked about, because it is a super pollutant, 84 times more potent than CO_2, and global heating is happening really fast, so we desperately need to get methane under control. But if we are not simultaneously bringing CO_2 concentrations down, we are in real trouble, aren't we?

Dr. KLEINBERG. Yeah, definitely in the long term. Methane acts fast and sort of gives you instant gratification, but in the long run, we need to deal with CO_2, absolutely.

Mr. HUFFMAN. Yeah. And so I just wonder about the moral hazard or the policy hazard of maybe assuming—sometimes I hear it suggested by colleagues across the aisle that we will tackle this methane problem, we will do that, and then we can go out with clean natural gas and everything will be just fine, that innovation will sort of figure out new ways to capture the CO_2 emissions. We will use offsets.

Any thoughts about the moral hazard of, you know, giving this clean bill of health to natural gas as we stare down a climate crisis?

Dr. KLEINBERG. No. I think your concern is well-founded. But I will say, it has been brought up this morning, that carbon capture and sequestration is another route to taking carbon dioxide out of the atmosphere.

Mr. HUFFMAN. So is time travel, but neither of them are happening at scale right now. I mean, do you disagree?

Dr. KLEINBERG. The technology exists to do it. The problem is, is that CCS costs about $60 a ton. We need a price on carbon to make it work, because nobody takes away your garbage for free.

Mr. HUFFMAN. Yeah. But you don't disagree that right now CCS is just a hypothetical. All of this additional natural gas we are trying to sell all over the world, none of it is being captured.

Dr. KLEINBERG. It is a hypothetical because there is no price on carbon. Yes.

Mr. HUFFMAN. Thank you.

You know, the other point, I think, is that methane pollution has all of these other pollution impacts, the environmental justice impacts that have been discussed.

And so, Ms. Smith, I wonder if you could just speak a little bit more about the other reasons that we ought to be very, very concerned in terms of public health and environmental justice in reducing methane pollution.

Ms. SMITH. Thank you. Yes, the long-term exposure to hazardous air pollutants from the oil and gas operations can be life-altering for communities that live near them. Benzene, a known human carcinogen, is released alongside methane in very large amounts, and then there is the estimated three-quarters of a million asthma attacks in children each year directly attributable to the smog from the oil and gas industry.

So, again, that is why we need EPA to use its well-established authority to go as far as it possibly can to reduce methane emissions and the pollution released alongside it. And in addition to the methane rules, EPA should use its well-established authority to reduce air pollution from key sources like power plants and vehicles to protect communities.

Mr. HUFFMAN. Thanks very much.

I yield back.

Ms. CASTOR. Next, Mr. Palmer, you are recognized for 5 minutes.

Mr. PALMER. Thank you, Madam Chairman.

I always appreciate the opportunity to speak about justice, especially when it comes to how people are impacted by the policies of my colleagues across the aisle. And they talk about environmental justice, but they rarely talk about energy injustice or economic injustice.

And I brought this up in this committee and other committees multiple times about this town in Illinois, Pembroke Township, a town of about 2,200 people. And I think the population is over 90 percent, 97 percent African American.

These are people who don't have access to natural gas. They are forced to heat their homes with propane or wood-burning stoves. Some of them are cooking on wood-burning stoves.

And I just wonder, Ms. Tomcik, if you would support Pembroke Township getting access to a natural gas line. It is a yes or no. It is not a speech. It is a yes or no.

Ms. TOMCIK. Thank you, Representative. I think that it is important——

Mr. PALMER. It is a yes or no. Would you support a natural gas line for these low-income families that live in Pembroke Township in Illinois? It is a yes or no.

Ms. TOMCIK. I would like to——

Mr. PALMER. I will take that as a no.

The good news is Jesse Jackson disagrees with you and others in the civil rights movement disagree with you, and they have worked tirelessly to get a natural gas pipeline and the Illinois Legislature has finally approved it.

So they will be getting access to clean-burning natural gas that they can use to heat their homes, cook their food, warm their water and, hopefully, bring some businesses into their city so that they

can have better jobs. And that is, in my opinion, environmental justice, economic justice, and energy justice.

I also want to point out some things about the research. We love to talk about technology in this committee and in some of our other committees, and we act as though methane is a problem that can't be solved, and that is just not the case.

The University of Illinois, since we were talking about the State of Illinois, has developed a process to convert methane to methanol. It is a liquid fuel. Pacific Northwest National Laboratory is converting methane to hydrogen, with zero CO_2 emissions. MIT is converting methane to fuel or a chemical feedstock on site at the wellhead. That technology is not commercially available yet, but I predict that it will be. We are doing a tremendous job in that area.

And there is also the issue of the research that shows that common clay products, such as what they use in cat litter, can be used to curb methane emissions. And I realize methane is a major greenhouse gas, but it is also one of the most—it is the most volatile greenhouse gas.

I want to ask Dr. Alden a couple questions. You mention in your testimony the development of new technology to detect methane leaks is essential for reducing methane emissions. Tell me a little bit about what LongPath is doing to reduce methane leaks without the government mandates.

Dr. ALDEN. Yeah. Well, there has been some pretty great industry adoption of trials of these types of technologies. So the industry is interested. I mean, they are testing stuff out. They are looking at the new tech. They are sometimes trialing multiple different types of technology and kind of seeing how emissions can be reduced.

And so, yeah, I think that, you know, as I mentioned, no one wants to do more—yeah, double up on what they need to do. So I think having the regulations allow that to count will be phenomenal, and I expect that to happen.

Mr. PALMER. You know, when you are talking about methane leaks, my colleagues on the other side of the aisle will often make it seem like oil and gas companies are fine with leaks, but the fact of the matter is that is just not true. You have noted that reducing these leaks is a win for industry.

What are the benefits? I think there is a financial benefit for reducing these leaks. Would that be accurate?

Dr. ALDEN. Yes, there certainly is. I mean, it is just adding a really powerful tool to the toolkit to be able to track what is going on in their operations. I mean, it is not just the leaks that are a problem. The leaks are generally a sign of a malfunction or an inefficiency in the system. And so it is a really powerful tool to add to the toolkit to just drive efficiency in operations.

Mr. PALMER. Thank you.

Ms. Tomcik, I just want you to know, I don't want you to feel bad about putting you on the spot, but I have yet to have a Democrat say they would support that.

Thank you.

Ms. CASTOR. Okay. Mr. Palmer yields back.

I recognize myself for 5 minutes for questions.

So the reason that we have devoted so much time in this committee, two hearings to methane, is because it is a super pollutant. It is super damaging to the climate, and that is driving higher cost. We talked about some of the health impacts.

Dr. Kleinberg, in your testimony, what caught my attention, you said: "Venting methane into the atmosphere is like throwing garbage into the street outside your home. It is worse than that. It is like throwing good food, that could be used elsewhere, into the street outside your home."

You know, at the last committee meeting, we had Governors who talked about what they were doing. And Governor Lujan Grisham from New Mexico worked with all stakeholders and has really developed a model. But there is a real patchwork of what is going on across the country.

Is that why it is important to have strong Federal standards here on methane? What is your view?

Dr. KLEINBERG. Well, yes, I think Federal regulations are needed. You know, states vary a lot, and I am a big believer in federalism. But there are some states that are very much advanced in adopting new technology, encouraging it. Colorado comes to mind. New Mexico is very good. Canada—actually, Canada came up earlier. Canada has some strong regulations. But other states not so much. And we need a level playing field.

And also with respect to our exports to the rest of the world, particularly Europe, Europe wants to see a low upstream greenhouse gas footprint. That is best done at national scale, especially since so much gas comes out of the Permian Basin through Corpus Christi.

Ms. CASTOR. And, Ms. Smith, do you agree? You said we have the solutions in hand to reduce methane. Then you said this is not rocket science, it is more like modern plumbing.

What is your view on the importance of Federal standards?

Ms. SMITH. Yes, I agree with Dr. Kleinberg. We have a patchwork of state rules and some large emitters like Texas that haven't acted. So we need those Federal safeguards, and they have to apply to the existing equipment too. That is responsible for about 60 percent of the pollution problem in the U.S.

Ms. CASTOR. And, Ms. Tomcik, you really spoke from the heart, your perspective as a mom, the impact of pollution on your children, and really spoke on behalf of parents everywhere for their hopes.

I mean, this is a massive public health issue. I know we get involved in a lot of the technical questions over time, but air pollution is a killer. And this is harmful, harmful stuff, and if there are ways to help reduce the health impacts and the harmful consequences to our kids, we should be doing that, right? What is your opinion?

Ms. TOMCIK. Yes, absolutely. The reality is that the oil and gas operations that are in communities today are going to be there for a long time. And the potential to pollute is going to be there for a long time. And so we need Federal rules to protect these communities who are living near them.

And so what we do know is that states like Pennsylvania, it is the second largest natural gas producer in the nation, and the oil

and gas industry in that state is responsible for emitting over 1 million metric tons of methane annually. And strong EPA methane rules could quickly and significantly lower those methane pollutants, along with the accompanying VOCs that are really impacting the communities.

The reality is, is that we don't know exactly what is in the air in communities because there is not widespread community monitoring, and so that is something that really needs to be addressed in order to protect communities. And I am hoping that the EPA will come out with some really strong solutions to help communities that are living with this oil and gas today.

Ms. CASTOR. And what do your kids say?

Ms. TOMCIK. My kids are worried about climate change. They are worried about the oil and gas wells in their communities. And when we talk about it, they are concerned about what the world will be for their children when they are old enough to have children. They are teenagers right now.

And I just want to let you know that I told my kids that I was coming here, and my son said, you know, let them know that I am the best lacrosse player in the country and that I won the state championship. And I tell you this because I want you to know that we are people. We are real families. We are individuals that are living here with oil and gas, and we need methane rules to protect our health from air pollution and climate change. Thank you.

Ms. CASTOR. Thank you very much.

Mrs. Miller, you are recognized for 5 minutes.

Mrs. MILLER. Thank you, Chair Castor and Ranking Member Graves. And thank you all for being here today.

In my home state of West Virginia, which I talk about frequently, we are abundantly rich in natural resources that power our community and our country and our world. I am a member of this committee because our energy-producing communities deserve a voice in the debate on the future of energy and climate policies.

I am deeply committed to finding the solutions to combat emissions. Although our world's climate has changed and will continue to change since God first created Earth, we have science like never before that we can depend upon to help us solve these problems, to mitigate and reduce the emissions.

I am most concerned not with our ability to find the solutions so much, but the willingness to make sure that we have the ability to do so. This administration and my colleagues across the aisle have tried to make it impossible to invest in the technologies that will reduce emissions from reliable sources of energy. Without future investment, these technologies won't even exist, and we will not be able to bring our energy-producing communities along into the next generation of prosperity.

Dr. Alden, thank you for joining us today. I was intrigued reading your testimony on the work that LongPath Technologies is doing to track methane emissions. Can you explain a bit on how methane monitoring makes the oil and gas industry more viable for a less carbon-intensive future?

Dr. ALDEN. Thank you, Congresswoman Miller. Yes. So measuring methane emissions really does contribute to reductions in emissions across the supply chain for oil and gas. So I do think it

is important for public and the private sectors to both invest heavily in technologies that can help us reduce emissions wherever possible. And, yeah, I think it is a win-win for reducing emissions.

Mrs. MILLER. Well, more generally, can you talk about the importance of continued investment in more traditional forms of energy and the new technologies that will support those types of producers?

Dr. ALDEN. Yeah. I can't speak to, you know, sort of the general investment in fuels, because that is not quite my expertise, but I can speak to, you know, helping these technologies continue to evolve and be more responsive, more sensitive, more quantitative is certainly going to help everybody.

Mrs. MILLER. That is true. LongPath currently operates in the Permian Basin, which is quite flat. Does the technology also work in more mountainous areas, like West Virginia, where we have abundant natural gas and oil reserves?

Dr. ALDEN. That is a great question. So LongPath Technologies is a very, very new technology. We are very young. And so, right now, we are at that kind of max inefficiency in terms of kind of our system being able to get to smaller and smaller sites.

So the reason that is is we use one laser to cover many, many, many oil and gas facilities. So, right now, areas like the Permian are ideal for us, because we can kind of spread the cost of the system out over many, many operators and drive the cost of monitoring to very, very low levels. Certainly, as our technology continues to evolve, we will be able to kind of shrink down and get out to areas like the Marcellus and where you guys are.

And so, yeah, again, I think just keeping these technologies rolling, keeping that American innovation pushing—pushing forward will certainly help get monitoring everywhere it needs to be.

Mrs. MILLER. That is why investing is so very important in innovation.

Thank you. I yield back my time.

Ms. CASTOR. Next up, Mr. Crenshaw, you are recognized for 5 minutes.

Mr. CRENSHAW. Thank you, Madam Chair.

Okay. I think we all agree that we should detect, we should quantify, and we should limit emissions. And we have been trying to help companies like LongPath get the EPA approval they need to do this kind of very important work.

It should also be said none of us want harmful particulates in the air, but we should also know that these are already well-regulated.

I do want to take a step back and note some inescapable facts. Number one, methane is simply a component of natural gas. Number two, natural gas has been and will be a key factor in reducing global emissions as it displaces higher emitting coal. Number three, no matter what we talk about here, the demand for natural gas and energy demand in general around the world will increase drastically. Number four, U.S. natural gas is far cleaner than our largest competitor, Russia, 41 percent cleaner by life-cycle emissions.

So now we have a cost-benefit question on our hands. Our citizens are facing higher energy prices and suffering from the associated inflation, and this administration can't stop coming up with

ways to discourage investment in our domestic oil and gas industry to increase production, which is our only hope of reducing prices anytime soon.

So if we want to tell the American people today that they should accept even higher prices, there better be quite the extraordinary benefit awaiting them. But here is the thing: oil and gas methane emissions make up about 20 percent of global methane or global emissions. The U.S. makes up about 7 percent of that global emissions. And U.S. oil and gas makes up about 2.8 percent of global methane emissions.

So in the end, we are talking about tackling 2.8 percent. So you have to ask, what will happen? What will reducing a fraction of a fraction at great cost even really accomplish?

Ms. Smith mentioned earlier that this was the fastest way to reduce global emissions, but this is clearly false, just by the numbers. If we want to be factual, we would recognize that 50 percent of the world's emissions come from foreign coal. Foreign coal is most likely to be displaced by natural gas if we can get our product there.

Our domestic gas producers tell me that they could quadruple exports in the next 10 years. If our export policy was targeted at displacing foreign coal, this would have the emissions equivalent of electrifying 100 percent of U.S. passenger cars, powering every home in America with rooftop solar and battery packs, and adding 54,000 windmills, which would mean doubling U.S. wind capacity.

That would seem like a better investment to me if reducing global emissions was, indeed, our goal, while also maintaining some kind of price stability and energy reliability. Seems like we can have it all if we want.

So my questions are for Dr. Kleinberg. You talked about Russian gas earlier and some of the problems with measuring their gas and how we can compete with that. Frankly, if a country is looking to purchase natural gas with low methane emissions, should they purchase from the U.S. or from Russia?

Dr. KLEINBERG. Well, you know, to be honest, we don't actually know the answer to that question. Now, I have studied the Russian statistics very carefully, and they just look fishy. I am not done tracking down exactly how they managed to reduce their reported emissions by a factor of eight.

Mr. CRENSHAW. Yeah, it is suspicious.

Dr. KLEINBERG. It is suspicious. But the real answer is we need to be measuring in both countries. And we have talked about aircraft. We have talked about the continuous monitoring. There are satellites. If the United States does it, other countries will start to do it as well. If the United States doesn't, I am sure they will not.

Mr. CRENSHAW. I think that is actually what I wanted to get at. I mean, why would we think that? Why would increasing our own regulations encourage the Russians, who are clearly not our friends these days?

Dr. KLEINBERG. Right.

Mr. CRENSHAW. Why would that encourage them to care about the environment all of a sudden? They are busy invading other countries.

Dr. KLEINBERG. Well, yeah. No, Russia is a tough case. But in general——

Mr. CRENSHAW. But they are the biggest one. I mean, when we are talking about gas, they are the biggest one.

Dr. KLEINBERG. That is right. So we have to, basically, show that we are doing it right, and the European Union and the other buyers are then going to have to determine, well, whose data is more credible? Is it the measurements from the United States or is it the spreadsheet exercise with strange numbers from Russia? I think the Europeans are smart enough to figure that out.

Mr. CRENSHAW. I mean, I would hope so. I mean, they recently canceled a large deal with a Texas oil and gas company for that reason, making up things that just aren't true. I mean, our national labs have done this work already, and I assume you probably agree with their work or think that that work is unbiased and very thoughtfully done.

But, with that, I am already out of time. But I think we got the point across.

Thank you, Madam Chair.

Ms. CASTOR. Next up, Ranking Member Graves, you are recognized for 5 minutes.

Mr. GRAVES. Thank you, Madam Chair.

Dr. Kleinberg, again, I appreciate you being here. And I want to follow up on Congressman Crenshaw's questioning.

Russia for weeks sat there at the border and said they weren't going into Ukraine. They said they were performing a special military operation. Later, they said they were liberating Ukrainians who wanted to be liberated. They denied any human rights violations whenever things were clearly—you know, there was clear evidence that that was not the case. And my point is here is that I am not sure that Russia has much credibility.

We can sit here all day long and talk about the lies of Vladimir Putin or methane numbers. I do want to ask you, though, you noted in your testimony that there is likely some distortion. I heard you tell Mr. Crenshaw that some of Russian numbers are fishy.

I did want to ask, what do we do to put a better system in place to actually get more accurate measurement? And can you explain the benefits of the International Methane Emissions Observatory?

Dr. KLEINBERG. Yeah, I will be happy to. You know, Russia is using the same system that was first used in the United States, pioneered by the EPA and the Gas Research Institute back in the 1990s, which was the best method at the time, which is this emission factor method, which is basically a spreadsheet that involves no measurements. And Russia copied that. Most countries do copy what we do. How they implement it, okay, that is another question.

But I think by the same token, we need to—now that we have these wonderful new instruments, such as LongPath, the aerial surveys that were mentioned and so on, we can do a lot better. And other countries will copy us.

I just want to point out—you are from Louisiana—when I have been around the world talking to petroleum engineers, they are trained at LSU. They are trained at Texas A&M. They are trained in Oklahoma.

Believe me, the American influence is very powerful in this industry. And once we do it right, other countries will. And then the

purchasing nations, the Europeans, the Japanese, Koreans, are going to say, yes, we want this, it is verifiably cleaner.

Mr. GRAVES. I just want to thank you for listing the universities in order of prominence.

Dr. Alden, when your colleague at LongPath, Dr. Rieker, testified at House Science a few weeks ago, they talked about the importance of EPA regulations and encouraging innovation to provide a path to new technologies to determine methane leaks more effectively.

Would you mind expanding on that and just talk a little bit about some of the opportunities and some of the challenges that companies are facing in deploying those technologies?

Dr. ALDEN. Yeah. So a lot of companies are trying out the new technologies right now, and they are seeing what it is all about, testing the waters. And so it is going to be really important to be able to take that next step and have policies and regulations really incentivize and encourage operators to use these new technologies.

Another piece of the puzzle is, you know, if policymakers and decisionmakers are interested in the data that comes of that, they are going to need to encourage and incentivize producing that data, and certainly not do that with a stick but, rather, do that with a carrot.

So, yeah, we see a lot of people trying stuff out. We want to see the policies encourage widespread adoption. And we find that the folks who do put the time in to integrate LongPath's data see pretty immediate gains in terms of improved efficiencies.

Mr. GRAVES. Thank you.

Ms. Tomcik, again, I want to thank you for being here. And please know that my opening statement wasn't an effort to attack you. My opening statement is that I am a parent too, and I care a lot about the environment and the planet that we leave our kids. I just think that the data shows a pretty different outcome than a lot of folks believe the narrative to be.

You know, I was curious. In your testimony, I think you said that—and I think I got this backwards earlier. You said that it is estimated the oil and gas industry emits more than 16 million metric tons of methane pollution annually. However, Ms. Smith said that the domestic oil and gas industry emits half of that, or just 8 million tons.

Did you understand what the difference is between your testimony and Ms. Smith's testimony?

Ms. TOMCIK. So the 16 million metric tons annually is based off of Environmental Defense Fund's information. And what they do is they are looking at the measurements that are taken directly from oil and gas and using estimates—mathematical estimates to calculate those.

I would be very happy to provide that information to you.

Mr. GRAVES. That would be great if you could. And I also want to ask if you could provide some information on the—you made a comment that minorities are more impacted, in your testimony, and if you could just provide some data on that, because last time someone said that their data actually showed the opposite.

Madam Chair, I want to ask unanimous consent that two letters, one June 23 from a number of energy companies and another one

from June 24 from AXPC, be included in the record of the hearing, both talking about their methane emissions and energy independence efforts.

Ms. CASTOR. Without objection, so ordered.

[The information follows:]

Submissions for the Record

Representative Garret Graves
Select Committee on the Climate Crisis

June 24, 2022

ATTACHMENT: Letter from energy companies and associations to President Biden re: methane emissions and energy independence efforts, June 23, 2022.

This letter is retained in committee files and available at:
https://www.api.org/~/media/Files/News/2022/06/23/Energy-Trades-Open-Letter-to-President-Biden

ATTACHMENT: Letter from AXPC to the Select Committee on the Climate Crisis, June 24, 2022.

June 24, 2022

The Honorable Kathy Castor
Chairwoman
Select Committee on the Climate Crisis
U.S. House of Representatives
H2–359 Ford House Office Building
Washington, DC 20515

The Honorable Garret Graves
Ranking Member
Select Committee on the Climate Crisis
U.S. House of Representatives
H2–359 Ford House Office Building
Washington, DC 20515

Dear Chairwoman Castor and Ranking Member Graves,

The American Exploration and Production Council[i] (AXPC), a national trade association representing large independent oil and natural gas exploration and production companies in the United States, would like to offer our perspective as part of the record for the House Select Committee on the Climate Crisis' hearing, "Cutting Methane Pollution: Safeguarding Public Health, Creating Jobs, and Protecting our Climate."[ii]

The member companies of AXPC are providing affordable, reliable energy to Americans and the world and are committed to environmentally responsible and safe operations. We are proud of our role in helping author the American Shale Revolution, which has unlocked vast reserves of American natural gas, helping our nation reduce carbon dioxide emissions in the power generation sector by 32 percent since 2005.[iii]

Because methane is the primary constituent of natural gas, capturing methane is important to industry from an environmental and business standpoint. AXPC was the first national trade to support the federal regulation of methane,[iv] and wants to work collaboratively with the administration and Congress to achieve meaningful action to address climate change, including on the critical issue of methane.

Due to industry leadership and investment in new technologies, methane emissions from petroleum and natural gas systems fell from 1990–2019, even as production increased dramatically.[v]

Notably, AXPC member companies are members of The Environmental Partnership (The Partnership or TEP)—a collaboration of oil and natural gas companies working to continuously improve the industry's environmental performance by "taking action, learning about best practices and technologies, and fostering collaboration to responsibly develop our nation's essential oil and natural gas resources."[vi]

Flexibility to Allow for Emerging Technologies

Consistent with our Climate Policy and Principles,[vii] AXPC believes federal methane policy should:

- Encourage innovation and flexibility, instead of overly prescriptive regulations that hinder the goal of reducing methane emissions;
- Allow and incentivize the development and deployment of technologies to monitor and mitigate methane emissions for compliance purposes;

- Appropriately quantify and assess the feasibility, costs and benefits of implementing new requirements for existing facilities;
- Avoid creating duplicative and overlapping regulatory regimes at the federal and state levels; and
- Properly interpret and follow the relevant provisions of the Clean Air Act.

Our industry necessarily prioritizes compliance first and foremost, but unfortunately regulations today do not allow for use of emerging methane detection technologies to meet compliance requirements—which impedes broad-scale deployment. Still, because of the importance of this issue, our companies have not stopped at minimum compliance, but instead invested heavily in the evaluation, testing, development, and early utilization of more advanced technologies for leak detection and leak quantification. While driving these innovations forward, industry has similarly, reasonably prioritized finding and fixing leaks over measuring them, until such time as the development of field-reliable quantification technologies could be realized.

Industry has spent nearly a decade—from an initial posture of envisioning possibilities to having realized many of them today—advocating for EPA regulations to provide greater flexibility to allow the use of emerging technologies that could find bigger leaks faster compared to the site-by-site on the ground surveys required today.

The industry has long promoted technology and innovation as the best near-term pathway for significant emission reduction and AXPC member companies have invested significant time and resources in improving capabilities and practices for leak detection, repairs, and eventual quantification. As recent as the comments submitted this year for EPA's November 2021 Methane proposal, we have pushed for the ability to use those technological advancements to meet compliance requirements and to be able to prioritize finding the larger leaks for greater efficiency in methane reduction.[viii]

Leak Detection and Repair and Emissions Measurements

Methane Leak Detection and Repair (LDAR) technologies are rapidly evolving, but there are still challenges to using current LDAR technologies to quantify methane from a particular area, especially in field applications. Though capabilities are advancing, these measurement technologies still have wide margins for error, are largely still in pilot phases.

It has only been through partnership with industry, and largely funded by industry, that these technologies have been developed and continue to improve. The industry is committed to progressing these technologies so that they can someday quantify emission leak rates in the field in a way that could be reliable enough to be used more broadly across the industry.

While our industry recognizes how useful quantification measurements might be in LDAR, the development of that technology will take time, particularly as it moves from the laboratory to field applications. The technology must also yield results that are fully auditable, adding to the complexity of field applications.

In the meantime, using all the data we have to address emissions on a daily basis we have not found the lack of precise quantification a hinderance to finding leaks of any size. Additionally, trending data provided by engineering emission-factor based inventories, such as the EPA's Greenhouse Gas Reporting Program, have been a powerful tool to understand some of the greatest emission reduction opportunities in the sector and are still the most comparable inventories available today.

Best Practices

AXPC member companies often go above and beyond what is required for regulatory compliance and are working to ensure the forthcoming EPA methane rule incentivizes and allows for new and emerging technologies to meaningfully reduce emissions.

Similarly, companies develop and share best practices and technologies to continuously reduce emissions through voluntary coalitions such as TEP. In 2020, The Partnership collaborated with technology companies to advance the development and implementation of new methane detection technologies through substantive engagement with Colorado State University, Bridger Photonics, and NASA's Jet Propulsion Laboratory Methane Source Finder team.

Even outside of TEP, companies are actively collaborating on approaches and best practices that can help reduce emissions faster. For example, AXPC has hosted its own "technology forum" to share learnings for piloted technologies that that allow us to find large leaks across a basin more efficiently. AXPC also conducts annual peer benchmarking surveys, including data such as emissions and trends, to help member companies continuously improve their operational performance.

Summary

AXPC member companies are committed to providing affordable, reliable energy to America and the world, while continuing to meaningfully reduce emissions. We want to work collaboratively with the administration and Congress to address the critical issue of methane. We believe it is important that legislative and regulatory policy embraces the domestic energy industry, providing needed flexibility to encourage innovation, and enables meaningful solutions to achieve the dual goals of climate progress and providing energy security and prosperity to the American people.

Thank you for your consideration of this important issue.

Sincerely,

Anne Bradbury
CEO
American Exploration and Production Council

References

[i] https://www.axpc.org/who-we-are/

[ii] https://climatecrisis.house.gov/committee-activity/hearings/cutting-methane-pollution-safeguarding-health-creating-jobs-and-0

[iii] https://www.eia.gov/todayinenergy/detail.php?id=48296

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[v] https://www.api.org/~/media/Files/Policy/Environment/TEP/2021/The-Environmental-Partnership-2021-Annual-Report.pdf

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[vii] https://www.axpc.org/working-responsibly/climateprinciples/

[viii] https://www.regulations.gov/comment/EPA-HQ-OAR-2021-0317-0831

Ms. CASTOR. And I want to thank the witnesses today for your very insightful testimony.

And also ask unanimous consent to admit to the record a letter from the Evangelical Environmental Network thanking the committee for our hearing; and, let's see, the Environmental Defense Fund, also a letter from them on recent scientific papers, economic reports highlighting the need for strong Federal rules that comprehensively target methane waste and pollution; and a third letter from Clarke Valve Company that is encouraging the committee to weigh in with EPA to urge the agency to consider lowering methane emissions beyond the currently proposed levels.

[The information follows:]

Submissions for the Record

Representative Kathy Castor
Select Committee on the Climate Crisis

June 24, 2022

June 22, 2022

Chair Kathy Castor
Ranking Member Garret Graves
The United States of America, House of Representatives
Select Committee on the Climate Crisis
H2–359 FHOB
Washington, DC 20515

Ref: Hearing on the Benefits of Cutting Methane Pollution
Written Testimony Submitted by The Evangelical Environmental Network

Dear Chair Castor and Ranking Member Graves,

Thank you for your service to our nation. We thank you for your leadership and common commitment to making America's energy the cleanest in the world—a goal that every American can be proud of and that is indispensable for giving our chil-

dren and grandchildren the bright and healthy future they deserve. Compared to other global energy producers, American energy has made incredible strides in this area, but when it comes to ensuring every child—including the unborn—have a chance at a thriving, fulfilling life, there is still much work to do. That is why we are grateful for the Committee's hearing on the benefits of cutting methane pollution, including sealing methane leaks that waste our nation's precious natural resources at a time when families cannot afford any wasted drop.

As pro-life evangelicals, we have a special concern for the unborn. We want children to be born healthy and unhindered by the ravages of pollution even before they take their first breath. The medical community has long known pollution and other environmental impacts harm our unborn children, and we know that fossil fuel combustion is the leading environmental threat to children's health worldwide.[1] It was once thought expectant mothers supply a shield of protection to their developing unborn child by filtering out pollutants—medical research repeatedly shows that this is untrue.

Studies show that smog, VOCs, and air toxics have a disproportionate impact upon life in the womb and that living close to oil and gas infrastructure poses a significant threat to unborn life:

- Dr. Lisa M. McKenzie with the Colorado School of Public Health published peer-reviewed research linking birth defects to methane production.[2]
- Casey J.A., et al further find that simply living within a half-mile radius of natural gas development leads to increased brain, spine, or spinal cord birth defects in children.[3]
- Research by Dr. Shaina L. Stacy and others at the University of Pittsburgh shows that in Butler County, PA babies born to families living closer to unconventional gas wells have lower birth weights.[4] Babies with low birthweight are at higher risk for breathing problems, neurologic problems, and sudden infant death syndrome (SIDS), and have harder time eating, gaining weight, and fighting infection because their tiny bodies are simply not strong enough.

This isn't a small or isolated problem: 3.2 million children attend 12,445 schools located within with 0.5 miles of an oil/gas facility and 17.32 million Americans of all ages live within that same radius.[5] Over 85% of the medical studies[6] that have studied the gas industry's impact on health find that that emissions from oil and gas facilities and infrastructure is highly detrimental to the health of both children and adults—this includes heart failure,[7] asthma,[8] and the exposure to known carcinogens.[9]

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[9] McKenzie, L.M., et al., "Ambient Nonmethane Hydrocarbon Levels Along Colorado's Northern Front Range: Acute and Chronic Health Risks," Environmental Science Technology, April 17, 2018, 52(8):4514–4525, https://pubs.acs.org/doi/10.1021/acs.est.7b05983

Not only are these leaks spewing methane, benzene, other VOC's, and toxins that threaten our children's right to an abundant life, methane is greenhouse gas 86 times more potent than CO_2 in the first twenty years—making fugitive and leaking methane as an imperative for any hope in keeping temperature below 1.5° C. by 2050 or sooner. Methane is responsible for at least one-quarter of the climate warming we are experiencing today.[10] Warmer temperatures produce more smog, increasing asthma, another serious health concern.

The level of emissions from leaks from these facilities is grossly underestimated, with research showing it is very likely to be 60% greater than current EPA estimates.[11] Reducing methane emissions by least 65% below 2012 levels—either through Congressional Legislation or regulation—is necessary to sufficiently safeguard our children's health from pollution and the growing threats of climate change. This must include addressing leaks across the complete supply chain from production to transportation and distribution for all existing wells and new production.

Reducing emissions from low producing wells represents a great opportunity for high return on investment. According to a recent report published in *Nature,* the oil and gas industry's lowest producing wells turn out to be the largest source of leaked methane. While they are only 6% of total U.S. methane and oil production, these low-producing wells release 50% of all methane emissions.[12] As an example out of a total of 81,500 total wells in all of Appalachia, there are over 70,000 low-producing wells alone in the state of Pennsylvania where EEN is based—making Pennsylvania based oil and gas companies the region's primary offenders.

Nationally these porous wells spew enough methane to supply over 3.6 million homes in the U.S. every year. That's $1.3 billion in wasted energy. Put another way, this leakage amounts to more than 10% of the gas these wells produce. And this wasted methane does not disappear harmlessly into the wind. It drifts up to our atmosphere where it worsens climate change, and it settles into the lungs, hearts, and brains of our children and grandkids. With industry representatives and politicians now demanding more drilling in the name of "energy security," it seems smarter to capture this wasted gas first before sinking fortunes into drilling new wells that will only continue to harm our children and contaminate God's amazing creation.

Here's the good news: these leaks sprout from fixable sources. With the advances of technology and new monitoring techniques, we have the tools at hand to stop methane gas leaks. Better routine maintenance, innovative new equipment, and regular site monitoring could capture this wasted methane and could even pay for the repairs since more methane will make it to market.

And we are not alone when it comes to calling for robust controls on methane gas leaks. We collected over 135,000 comments from pro-life Christians in 2022 in support of a new EPA rulemaking on methane asking for regular inspection and repair at these low-production wells.

In addition to the Evangelical community, leading oil/gas corporations and organizations like *Shell*, *Equinor*, *BP*, *EQT*, *Jonah Energy*, *Equitrans Midstream*, and the *Interstate Natural Gas Association of America* all support methane leak standards. Industry actually stands to increase their bottom lines by plugging wasteful methane leaks and recapturing fugitive methane emissions, making cutting methane pollution is a win-win-win.

Yet many in oil and gas industry has so far refused to address this critical health risk, and our children suffer the consequences.

With little or no willingness from these industry players to do the right (and economical) thing, Congress has a critical role to play in encouraging wise stewardship of the American economy, our precious natural resources, and protection of our children's health and future. Before allowing more methane drilling or further funding for methane expansion into hydrogen, plastics, or other potential uses, Congress must secure a commitment from industry reduce this leakage problem.

In addition to defending our children and their future, this is also a matter of fairness for the American People who foot the added tax burdens (not to mention the health care costs) that we already pay to clean up the messes of oil/gas industry.

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[10] lissa B Ocko *et al* 2021 *Environ. Res. Lett.* **16** 054042.

[11] Alvarez, RA *et al*. (2018), "Assessment of Methane Emissions from the U.S. Oil and Gas Supply Chain," *Science* 361, 186 (*available at* https://science.sciencemag.org/content/361/6398/186).

[12] Mark Omara, Daniel Zavala-Araiza, David R. Lyon, Benjamin Hmiel, Katherine A. Roberts, and Steven P. Hamburg https://doi.org/10.1038/s41467-022-29709-3, Nature Communications: April 19, 2022.

Today's bonding structure and royalty fees to access resources owned by the American People is unjust and needs an overhaul.

Our common book, the Bible is clear on fairness, justice, and righteous as the Hebrew Bible prophet Amos 5:24 (NIV) states,

"But let justice roll on like a river, righteousness like a never-failing stream!"

Infrastructure Investment and Jobs Act provided $4.5 for the remediation of orphaned oil/gas wells. These billions in taxpayer dollars that will only cover part of the problem of orphaned wells[13] that companies have left to the U.S. This is a problem that would not exist if proper bonding requirements were in place from the start or had been updated since the 1950's.[14] Without adequate bonding requirements, we are doomed to repeat these mistakes yet again and saddle the next generation with despoiled land, water, and air and a billion-dollar price tag for a mess they didn't make.

We urge the Committee to defend our children's health and the American Taxpayer by demanding that new bonding requirements that fully cover real remediation. This includes actual third-party bonding per permit—not self or blanket bonding. These issues are correctly and thoroughly discussed in an outstanding white paper entitled ***Broken Promises*** by *Conservatives For Responsible Stewardship*.[15]

EEN President, The Rev. Mitch Hescox, knows firsthand of our government's failure to ensure proper land restoration after energy and mineral extraction. His childhood playground was left blighted and barren by un-reclaimed strip mines less than 100 yards from his Cambria County, PA backdoor. Even today acid mine drainage erodes his family's traditional hunting area.

Another opportunity for fiscal responsibility and wise stewardship of our resources is securing fair payment for lost, leaked, or vented methane and associated gases. A methane fee guarantees that just and fair royalties are paid to mineral-rights owners—whether they be an individual landowner or the Federal Government. Putting a fiscal incentive to encourage good practices and adequate maintenance reinforces good stewardship of our precious natural resources and benefits all of us. It is simply wrong not to demand proper accounting for the all the valued product extracted.

Another failure in stewardship for the American people has been not increasing the royalty rate for commodities extracted on Federal lands. Royalty rates have not changed for Federal Leases for over 100 years, since before the Great Depression and the presidency of Harding. According to the Government Accountability Office, our failure to increase royalties adequately and properly has cost the American people up to $300 million dollars per year by 2025 with a maximum 2% decrease in Federal production.[16]

Failure to increase royalties still is just another example of putting the oil/gas industry before the health our children. This amounts to another handout to one of the most subsidized industries in the U.S.

Even with today's high energy prices, analysis shows that changing bonding, instituting a methane fee, and increasing royalties will not increase costs for Americans but is necessary to hold industry accountable.[17]

Our past and current tax system incentivizes profits for the fossil fuels industry while the costs have been borne in the hearts, lungs, minds, and even lives of our children and passed along as tax burden to the American people.

It is time to incentivize the well-being of our children and the American taxpayer instead of the fossil fuel industry. It's past time for the American People to stop paying to clean-up the fossil fuels industries' messes. Our children's health and the American economy cannot afford for us to repeat the mistakes of the past. We cannot levy the same burdens upon the next generation that earlier generations have levied upon us.

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[13] IOGCC, Idle and Orphan Oil and Gas Wells 14 (2019), available at https://iogcc.ok.gov/sites/g/files/gmc836/f/iogcc_idle_and_orphan_wells_2021_final_web.pdf.

[14] GAO, BLM Should Address Risks from Insufficient Bonds to Reclaim Wells 11 (Sept. 2019), available at https://www.gao.gov/assets/gao-19-615.pdf.

[15] https://www.conservativestewards.org/wp-content/uploads/2021/10/CRS-bonding-analysis_FINAL.pdf.

[16] Oil, Gas, and Coal Royalties: Raising Federal Rates Could Decrease Production on Federal Lands but Increase Federal Revenue, https://www.gao.gov/products/gao-17-540

[17] Oil & Gas Reform Won't Raise Prices at the Pump, https://www.taxpayer.net/wp-content/uploads/2021/10/OG-Reform-and-Gas-Prices-Primer.pdf.

Now is the time to exercise sound fiscal responsibility through good economic and environmental stewardship. It's time to defend our children's health and future by reducing methane leaks, stop wasting taxpayer money by cleaning up the fossil fuels legacy, and supply real bonding and royalty reform.

Sincerely,

Rev. Dr. Jessica Moerman
Vice President, Science and Policy
Evangelical Environmental Network

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June 22, 2022

The Honorable Kathy Castor
Chair
House Select Committee on the Climate Crisis
H2–359 Ford Building
Washington, DC 20515

Dear Chair Castor:

Please accept the three recent scientific papers and economic reports included herein for the record. These papers and reports highlight the need for strong federal rules from the U.S. Environmental Protection Agency and Bureau of Land Management that comprehensively target methane waste and pollution.

As these reports illustrate, strong action can both help protect frontline communities and create American jobs in the growing methane mitigation industry. These regulations should include important safeguards, like phasing out intentionally-polluting equipment by requiring zero emitting pneumatic controllers; address pollution and waste from unlit flares; and require frequent inspections of smaller wells with leak-prone equipment. can both help protect frontline communities and create American jobs in the growing methane mitigation industry.

EDF appreciates the opportunity to provide input into this critical issue. Thank you for your consideration.

Sincerely,

Elizabeth Gore
Senior Vice President, Political Affairs

1. SpringerLink. "The demographic characteristics of populations living near oil and gas wells in the USA," a report by Jeremy Proville, Katherine A. Roberts, Adam Peltz, Lisa Watkins, Elizabeth Trask, Dustin Wiersma. May 9, 2022.

Report available at:
https://www.edf.org/media/study-explores-demographics-communities-living-near-oil-and-gas-wells

ABSTRACT

This study documents the prevalence of historically marginalized populations (across age, income, education, race-ethnicity, and language) living near active oil and gas wells throughout the USA, at both local and aggregated scales. This is performed by way of areal apportionment using well location data and population characteristics from the American Community Survey. A clustering analysis of marginalized populations living near a high density of wells reveals four distinct regions of high prevalence: southern California, southwest Texas, Appalachia, and northwest New Mexico. At the nationwide scale, we find large absolute numbers of people living near wells, including marginalized groups: nearly 18 million people in total across the USA, many of which are Hispanic (3.3 million), Black (1.8 million), Asian (0.7 million), and Native American (0.5 million), live below the poverty line (3 million), older individuals (3 million), or young children (over 1 million). In certain states, this represents a large share of the total population—over 50% in the case of West Virginia and Oklahoma. Estimates are subsequently compared to county level control groups to assess patterns of disproportionality. Wide variations are found across regions and metrics, underscoring the locally specific nature of these data. Our research contributes to the field of environmental justice by describing the populations living near oil and gas wells.

2. Datu Research. "Find Measure Fix: Jobs in the U.S. Methane Emissions Mitigation Industry," a report by Marcy Lowe and Robin Lowe-Skillern. September 17, 2021.

Report available at:
https://www.edf.org/sites/default/files/content/FindMeasureFixReport2021.pdf

EXECUTIVE SUMMARY

The following report introduces policy makers, firms, researchers, and the general public to the growing methane emissions mitigation industry, describing its recent innovations, growth potential, and ability to provide U.S. jobs. These manufacturing and service firms offer solutions to oil and gas companies across the United States by finding, measuring, and mitigating methane emissions. Recent advances in emerging technology and advanced data analytics are making it possible to do so in ways never before possible.

Our research updates and builds upon two similar reports released in 2014 and 2017—demonstrating that this growing industry:

Creates U.S. Jobs. Firms in the industry offer well-paid employment opportunities across the country that provide upward mobility and often involve fieldwork that cannot be offshored.

Saves Operators Money. Methane emissions mitigation reduces waste by keeping otherwise lost product in the sales line.

Improves Environment and Climate. Addressing natural gas leaks across the country reduces emissions of a highly potent greenhouse gas, while contributing to cleaner air in surrounding areas.

SEVEN KEY RESEARCH FINDINGS ABOUT THE METHANE EMISSIONS MITIGATION INDUSTRY

1) The industry is growing rapidly. Today it includes at least 101 manufacturing firms (a 33-percent increase over our 2014 count) and 114 service firms (a 90-percent increase over our 2017 count). Together, these firms have at least 748 employee locations nationwide.
2) The industry comprises dozens of job types, with annual salaries ranging from $37,150 to $140,960 (as compared to the U.S. annual mean wage of $56,310 for all occupations).1 Common entry-level jobs such as assemblers and fabricators offer opportunity for upward mobility.
3) Most of the firms (70 percent) are small businesses, known to serve as an economic engine for new job growth.
4) Nearly 25 percent of the manufacturing firms and over 40 percent of the service firms were founded in the past 12 years, indicating a fast-growing industry.
5) Firms are adding new U.S. employee locations. In 2021, we identified a total of 748 employee locations for manufacturing and service firms, an increase of 26 percent over the number previously identified.
6) Firms anticipate growing jobs. Of 57 firms that responded to our survey, 75 percent of the manufacturing firms and 88 percent of the service firms reported that if future state or federal methane emission rules were put in place, they would anticipate hiring more employees.
7) These jobs appear poised to grow soon, since the current Administration and at least eight states are preparing either to introduce new methane rules or expand the scope of existing ones.

3. Nature Communications. "Methane emissions from US low production oil and natural gas well sites," a report by Mark Omara, Daniel Zavala-Araiza, David R. Lyon, Benjamin Hmiel, Katherine A. Roberts & Steven P. Hamburg. 2022.

Report available at:
https://www.nature.com/articles/s41467-022-29709-3

ABSTRACT

Eighty percent of U.S. oil and natural gas (O&G) production sites are low production well sites, with average site-level production ≤15 barrels of oil equivalent per day and producing only 6% of the nation's O&G output in 2019. Here, we integrate national site-level O&G production data and previously reported site-level CH_4 measurement data (n = 240) and find that low production well sites are a disproportionately large source of U.S. O&G well site CH_4 emissions, emitting more than 4 (95% confidence interval: 3–6) teragrams, 50% more than the total CH_4 emissions from the Permian Basin, one of the world's largest O&G producing regions. We esti-

mate low production well sites represent roughly half (37–75%) of all O&G well site CH_4 emissions, and a production-normalized CH_4 loss rate of more than 10%—a factor of 6–12 times higher than the mean CH_4 loss rate of 1.5% for all O&G well sites in the U.S. Our work suggests that achieving significant reductions in O&G CH_4 emissions will require mitigation of emissions from low production well sites.

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June 24, 2022

The Honorable Kathy Castor
Chairwoman, House Select
Committee on the Climate Crisis
H2–359 Ford House Office Building
Washington, DC 20515

The Honorable Garret Graves
Ranking Member, House Select
Committee on the Climate Crisis
H2–359 Ford House Office Building
Washington, DC 20515

Dear Chairwoman Castor and Ranking Member Graves:

Clarke Valve (Clarke) commends you for holding this hearing on "Cutting Methane Pollution: Safeguarding Health, Creating Jobs, and Protecting Our Climate" and for drawing attention to this critical issue. Clarke appreciates the opportunity to submit this letter to the Committee.

Control valves are the leading cause of methane emissions from oil and gas production sites. Clarke has invested in American jobs and manufacturing, along with its ingenuity, to eradicate 98 percent of these emissions. Headquartered in Rhode Island, Clarke is a company that manufactures an innovative and efficient control valve technology, called the Dilating Disk,[1] that can capture, or prevent the release of, methane emissions from pipelines and from every piece of equipment across all aspects of oil and gas operations for which a control valve is required. Clarke's Dilating Disk technology is certified to reduce ***virtually all*** control valve methane leaks and emissions. So, when talking about reducing methane emissions from oil and gas operations, the technology exists to achieve far greater reductions.

Such technology currently is being manufactured in the United States and being sold both domestically and abroad. Clarke also will make the case that, while the Environmental Protection Agency's (EPA) recent Proposed Rule to reduce methane emissions from new and existing oil and gas operations[2] represents progress, its proposed 500 parts per million (ppm) leak definition (or detection limit)[3] will not reduce methane emissions to a level that otherwise could be achievable and is therefore insufficient—and problematic.

Context

Control valves are essential equipment to the oil and gas industry: they regulate pressure, temperature, and flow rates of liquids and gases. Unlike the pipes that control valves are installed in, the control valve is the natural point of leakage for any pressurized pipeline carrying methane or other greenhouse gases. Individual oil and gas facilities can have hundreds or thousands of control valves, so there are millions of valves installed today. As a reference point, the global market for control valves is projected to reach $10.6 billion by 2025.[4]

Importantly, not all valves are the same. Most "typical" existing, or legacy, control valves are certified to meet an international standard, referred to as the ISO 15848[5] "Class C," or 500 parts per million (ppm), tightness rating (meaning these valves are certified to prevent emissions above, or limit emissions to, 500 ppm).

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[1] The Dilating Disk meets the category definitions of industry control valve standards but is referred to specifically as a Dilating Disk herein to prevent confusion with legacy control valve designs.

[2] *Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review* (Proposed Rule), 86 Fed. Reg. 63110 (Nov. 15, 2021).

[3] EPA's proposed performance standards for new and existing sources define 500 parts per million (ppm) as a leak.

[4] GlobeNewswire News Room, Report Linker, "The Global Control Valve Market Size Was Valued at USD 5.5 Billion in 2020 and is Projected to Reach USD 10.6 Billion by 2025," October 2, 2020, available at: www.globenewswire.com/news-release/2020/10/02/2102781/0/en/The-global-control-valve-market-size-was-valued-at-USD-5-5-billion-in-2020-and-is-projected-to-reach-USD-10-6-billion-by-2025-It-is-expected-to-grow-at-a-CAGR-of-14-2.html.

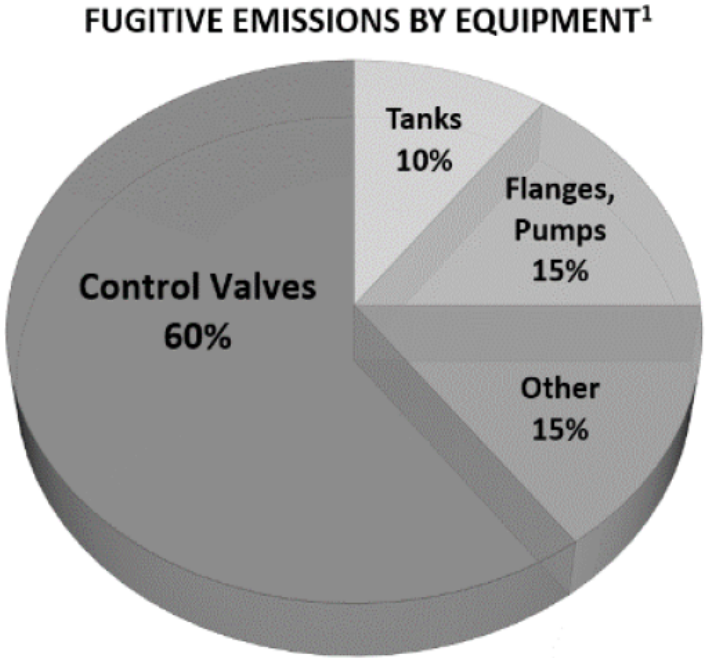
[5] International Organization for Standardization (ISO), ISO 15848–1:2015, *Industrial valves—Measurement, test and qualification procedures for fugitive emissions—Part 1: Classification system and qualification procedures for type testing of valves*, June 2015, available at: https://www.iso.org/standard/61441.html.

The ISO Standard's "Class B" tightness rating is 100 ppm, and its "Class A" tightness rating is 50 ppm.[6] Several mature valve products meet both the "Class B" and "Class A" tightness ratings. High grade seals that enable valves to achieve emissions of 50 ppm or less typically cost less than $5.00 each.

Using such widely-available seal material as a standard feature, Clarke's control valves not only meet, but exceed, the "Class A" tightness rating. More specifically, Clarke Valves reduce or **limit emissions to 2 ppm, that is, they achieve 25 times greater emissions reductions than the most stringent current international standard**.

The Problem and What is at Stake

EPA estimates that the oil and gas industry has a leak rate of 1.4 percent, which equates to an estimated 8 million metric tons of methane emissions per year.[7] The Environmental Defense Fund (EDF) estimates a leak rate of 2.4 percent, or 13 million metric tons per year of methane emissions.[8] This latter amount of gas would be enough to power up to 10 million homes for one year and would be worth approximately $2 billion.[9] Despite efforts over time by EPA and by the oil and gas industry to mitigate emissions from harmful pollutants, reducing fugitive emissions remains a major challenge. In fact, fugitive emissions—or leaks—from ***control valves*** are estimated to account for approximately **60 percent of total fugitive emissions**.[10]



Clarke has used EPA's methodology[11] to estimate methane emissions from existing—and prevalent—"Class C," or 500 ppm, control valves at well sites and compressor stations. Based on an estimate that a single company would have, on average, more than 2,300 control valves in gas lift applications for its upstream oper-

[6] Ibid.
[7] Environmental Defense Fund (EDF), "Major Studies Reveal 60% More Methane Emissions," available at: www.edf.org/climate/methane-studies.
[8] Ibid.
[9] Ibid.
[10] Mackay, James E., and Kevin J. Smith. *Monitoring and Containment of Fugitive Emissions from Valve Stems—Electrical Conductivity and Gas Adsorption Measurements on Metal Oxides*. Department of Chemical and Biological Engineering, University of British Columbia.
[11] EPA's correlational methodology.

ations, the "Class C"-rated valves would emit approximately 30 tons or 85 percent higher mass emissions (i.e., kilograms/hour (kg/hr)) over ten years than a Clarke Valve, which restricts emissions to 2 ppm. At the well pads, where at least 3 control valves are installed on more than 2,000 separators per company, emissions would exceed those of Clarke Valves by 73 tons per year.

Similarly, again using EPA's correlation method, Clarke estimates that a single site with, on average, 30 compressor stations that have 6 control valves each (i.e., 180 valves total) would emit 2 tons more methane emissions over ten years than if Clarke Valves were used. To appreciate the magnitude of the impact, these values must be multiplied by tens of thousands of sites, from which methane emissions are affecting the health of employees and those in nearby communities, many of which are underserved.

EPA's Recent Proposed Rule to Reduce Methane Emissions from Oil and Gas Operations

EPA's recent Proposed Rule seeks to reduce fugitive methane and VOC emissions from new, modified, or reconstructed (hereinafter collectively referred to as new) sources and from existing sources at specified new well sites and at specified existing well sites and compressor stations.

While commendable, Clarke encourages EPA to continue to further explore all options to reduce these emissions, with a particular emphasis on control valves, where an immediate and significant impact can be achieved in the reduction of fugitive emissions.

Moreover, EPA's proposal would only require companies to address leaks or emissions above 500 ppm.[12] This 500 ppm definitional leak limit will lead to a significant amount of methane emissions accruing over time, thereby diminishing the robustness of EPA's proposal, at least to some extent. It also would accommodate aging seal technology, while significant scientific and material advances have been available for the last few decades that easily enable manufacturers to meet a more stringent standard, as noted above. In fact, several valve manufacturers already are using widely-available, mature seal technology, such that their valves are achieving emissions below 50 ppm even after 100,000 cycles, which equates to 10 years of simulated use. On the other hand, some of the largest valve manufacturers, and oil and gas companies who use the valves, will only adhere to the minimum requirements in law, which is why the new requirements must be as stringent as possible to achieve maximum emissions reductions.

Notably, EPA has issued Consent Decrees that contain a 100 ppm leak threshold for equipment repairs or replacements.[13]

The Time is Now to Change Course

For these reasons and more, Clarke is urging the Committee and Congress to weigh in with EPA to urge the Agency to consider lowering methane emissions beyond the currently-proposed levels and especially to **change the definition of a "leak" from 500 parts per million to 50 parts per million (ppm)**. Fifty (50) ppm is consistent with the existing international ISO Standard's "Class A" tightness rating for control valves and is readily achievable.

To the extent practicable, another important step would involve you and your colleagues working to preserve the methane incentives that are contained in the House-passed Budget Reconciliation package.[14]

Clarke appreciates the opportunity to share this information and stands ready to be a resource at any time.

Sincerely,

/s/ Kyle Daniels
Founder and CEO, Clarke Valve
42 Whitecap Drive
North Kingstown, RI 02852
(401) 667–7880
Email: Kyle.Daniels@clarkevalve.com

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[12] The proposed performance standards for new and existing sources define 500 parts per million (ppm) as a leak.

[13] E.g., *United States of America v. WRB Refining LP and Phillips 66 Co.* (Consent Decree), No. 3:18-cv-01484.

[14] H.R. 5376, Rept. No. 117–130, November 19, 2021, available at: https://www.congress.gov/bill/117th-congress/house-bill/5376/text.

Ms. CASTOR. Thanks again. This is a critical topic, and we appreciate the insightful testimony, again, and the participation of members.

The committee is adjourned.

[Whereupon, at 10:38 a.m., the committee was adjourned.]

United States House of Representatives
Select Committee on the Climate Crisis

Hearing on June 24, 2022
"Cutting Methane Pollution:
Safeguarding Health, Creating Jobs, and Protecting Our Climate"

Questions for the Record

Patrice Tomcik
Senior National Field Manager
Moms Clean Air Force

THE HONORABLE KATHY CASTOR

1. Could you please tell us about why you are concerned about oil and gas operations so close to your children's schools?

Children who live, learn, or play near oil and gas operations face a higher risk of exposure to the oil and gas industry's harmful air pollution. In my children's Mars Area school district located in Mars, Pennsylvania, there are five unconventional gas well pads with multiple gas wells on them and many gathering pipelines. The closest wells that have been fracked are approximately a half mile away from the school campus that puts 3,200 students' health at risk. Across our nation, more than 3.9 million children go to school within a half mile of oil and gas operations and more than 17 million people live within a half mile of active oil and gas operations. Parents like me and community members are very concerned about the pollution that can be emitted by these oil and gas operations and what their families might be exposed to. I know wherever oil and gas is being drilled, compressed, and processed, you can find methane leaking along with harmful volatile organic compounds (VOCs). Air pollution from the oil and gas operations can cause respiratory diseases, asthma attacks, reproductive problems, blood disorders, neurological problems, cancer, and contribute to climate change, which further harms health. Children are especially vulnerable to air pollution because their lungs and brains are still developing until early adulthood. In our family, my boys both play outdoor sports for school. I am very concerned about what they are breathing into their still-developing lungs. Comprehensive EPA rules would cut methane pollution and have the benefit of reducing associated harmful VOCs, such as benzene, that can cause cancer. As a parent of a child who is a cancer survivor, I don't want any parent to have to suffer the anguish of watching a child battling through cancer.

2. How can we best protect communities from the harmful air pollution from the oil and gas industry?

Oil and gas production comes at a high cost to public health and climate stability. There is never a time when it is acceptable to knowingly compromise the health of communities living on the frontlines of oil and gas. And there is a real cost associated with climate change as communities' health and safety are impacted by wildfires, drought, flooding and extreme heat. Children across the nation need strong federal standards to create baseline methane protections, especially for states that have failed to enact meaningful oil and gas methane protections. This is why it is so important that the EPA finalize a comprehensive methane rule to eliminate routine flaring, require the use of non-polluting equipment, take into account third-party air monitoring, and include frequent inspections for smaller wells with leak-prone equipment.

Communities need protections from routine flaring. When companies rush to extract oil, some forgo investments necessary to capture and sell gas and instead burn it as a waste product through flaring, emitting a host of climate and health-harming pollutants. Many flares have been found to malfunction or fail entirely, spewing methane directly into the atmosphere. EPA must follow the lead of states like Colo-

rado and New Mexico and move to eliminate pollution from routine flaring except in emergency situations.

Communities need protections from intentionally-polluting equipment. Intentionally-polluting equipment like pneumatic controllers are a big source of methane pollution that needs to be phased out in favor of zero-emitting alternatives in the EPA methane rule.

Communities need monitoring in their neighborhoods to be acknowledged by the EPA. Having the EPA recognize third party methane emissions estimates based on data rather than relying on oil and gas operator's self reported estimated emissions would give a more accurate picture of the methane pollution problem. The use of accessible proven monitoring technologies such as frequent aerial surveys and infrared technology (FLIR) would allow the EPA to accept and prioritize monitoring results to ensure major leaks that are harming nearby communities are fixed more quickly.

Communities need protections from small wells with leak prone equipment. A new study published in the journal Nature Communications reveals that small oil and gas wells that have leak prone equipment are responsible for approximately half of the methane emitted from all well sites in the United States while accounting for only 6% of the nation's oil and gas production.(1) Pollution from small wells has a very real impact on the climate and on the health of communities who live near these facilities. Nearly 8 million people across the country live within half a mile of these well sites. Not only do these facilities emit significant volumes of the potent greenhouse gas methane, they also leak other pollution that is toxic to human health and can severely deteriorate air quality. A new mapping tool from the Environmental Defense Fund shows how a disproportionately large number of communities of color, people living below the poverty line, older individuals and young children live near small wells.(2)

3. Do you think Congress should invest to help states reduce their greenhouse gas pollution and adapt to the climate changes we can no longer avoid?

Because we know that climate impacts will continue to unfold in the coming decades, we do need Congress to invest in helping states create robust adaptation plans and infrastructure. At the same time, we need to prioritize mitigation efforts, because everything we do to limit methane pollution and other forms of greenhouse gas emissions now can help prevent future harm to our children and later generations. Investment in adaptation and mitigation are both essential in our response to the climate crisis. We need Congress, the White House, the EPA and other change agents to work together to solve our methane pollution problem.

The oil and gas industry is the largest industrial emitter of methane pollution. And the industry has readily available, cost-effective solutions for significantly cutting pollution. Industry leaders acknowledge they can do much better, but only government action can ensure that all of the industry cleans up the wide-spread methane pollution for which they are responsible. The historic Infrastructure Investment and Jobs Act passed by Congress in November 2021 provided $4.7 billion to help states and tribes plug and remediate orphaned oil and gas wells. Millions of Americans live within one mile of hundreds of thousands of orphaned oil and gas wells that jeopardize public health and safety by emitting harmful pollutants including methane and volatile organic compounds (VOCs). In addition, the Methane Emissions Reduction Program (MERP) in the Inflation Reduction Act of 2022 includes much-needed investments to curb methane pollution and puts a price on emissions to incentivize operators to deploy common sense solutions to stop them. The program would complement and reinforce the enforceable methane pollution standards currently being developed by EPA. Each tool plays an important role in tackling methane pollution. Strong and comprehensive pollution standards from EPA are essential to ensure protective, broad and equitable reductions for all communities. A charge on especially wasteful levels of methane emissions can discourage pollution and hold industry accountable for its impacts. The charge on methane pollution, working in conjunction with strong and protective EPA standards, will drive deep and equitable methane pollution reductions for all communities and to ensure that polluters—not the public—bear the costs of controlling their own pollution.

4. How would strong Federal rules on methane pollution help communities like yours in Pennsylvania?

Pennsylvania is the second largest natural gas producer in the nation. The oil and gas industry in the state is responsible for emitting over 1 million metric tons of methane annually from both unconventional and conventional wells. Wherever there are oil and gas operations you can find methane and volatile organic compounds

being emitted that are impacting public health and contributing to climate change. Over the past ten years there has been a significant increase in the scientific knowledge about the health risks from living in close proximity to oil and gas operations with many studies coming from Pennsylvania data. In Butler county where I live, a health study found that living in close proximity to natural gas wells was associated with having lower birth weight babies.[3] Low birth weight babies are at increased risk of early death, infections, and learning disabilities. Research has also found that living close to oil and gas operations is linked to other adverse birth outcomes, such as preterm birth, congenital heart defects, and neural tube defects.[4] Strong methane protections would help to protect babies from harmful oil and gas pollution. In Pennsylvania, we also have many small wells that have equipment prone to leaks. A recent study found that small wells account for only 6% of production, but half of methane emissions in the U.S. The EPA needs to require frequent inspections of these small wells that account for an outsized amount of methane emissions.

A strong EPA methane rule could quickly and significantly reduce methane pollution and other harmful air pollutants from oil and gas operations. This is one of the best levers we have to slow the rate of climate change now and help clean up the air to protect the health of children living near oil and gas operations. There are already existing technologies to find methane leaks, which can be as simple as fixing a leaking pipe or closing a tank hatch. Some states like New Mexico and Colorado have acted to put strong methane rules in place but other states have not, like Pennsylvania. This is why we need EPA to act and create a strong federal regulatory baseline for all states.

5. Why is it important for frontline and EJ communities to have an active role in decisions related to the design and implementation of regulations and legislation?

As regulations and legislation are being considered, frontline and environmental justice communities must have an active role in decisions related to the design and implementation of regulations and legislation that impact their communities throughout the entire process. This stakeholder engagement is more important than ever with EPA methane rules because—as a new mapping tool by the Environmental Defense Fund reinforces—a disproportionate number of communities of color, people living below the poverty line, older adults and young children live in counties near oil and gas wells.[5] Prioritizing protections for environmental justice and frontline communities is imperative as they have historically shouldered an outsize burden from the impacts of air pollution and the climate crisis. We cannot have a country that includes "sacrifice zones." Oil and gas air pollution adds to the burden of existing pollution problems in underserved, low-income communities, exacerbating inequities and putting families at increased risk of serious health issues. Strong and comprehensive oil and gas methane pollution standards from EPA are essential to ensure protective, broad and equitable reductions for all communities. And once methane rules are finalized, it is important that Congress properly funds the EPA to carry out the enforcement of rules in order to protect the health of communities. Enforceable pollution limits are needed to ensure pollution reductions benefit all communities.

References Page

[1] https://www.nature.com/articles/s41467-022-29709-3

[2] https://blogs.edf.org/energyexchange/2022/07/19/interactive-map-who-is-impacted-most-by-overlooked-pollution-from-americas-small-oil-and-gas-wells/#more-21927

[3] https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0126425

[4] https://www.momscleanairforce.org/resources/how-oil-and-gas-operations-impact-your-babys-health/

[5] https://blogs.edf.org/energyexchange/2022/07/19/interactive-map-who-is-impacted-most-by-overlooked-pollution-from-americas-small-oil-and-gas-wells/#more-21927

Questions for the Record

Dr. Robert L. Kleinberg
Senior Research Scholar
Columbia University Center on Global Energy Policy

THE HONORABLE KATHY CASTOR

1. Dr. Kleinberg, in your testimony, you mentioned that reducing harmful methane pollution is cost effective and you described the suite of new technologies that are available. Could you please elaborate on how new technologies enable cost-effective reduction of methane pollution?

Achieving net zero carbon dioxide emissions will require a multi-decadal, multi-trillion dollar reorganization of the ways we use energy, which will have profound economic and social consequences [IEA, 2021]. In contrast, while anthropogenic methane emissions from the oil and gas industry are responsible for a substantial part of our climate change problem, reducing that part of the greenhouse gas inventory is relatively simple and surprisingly inexpensive. In the context of the oil and gas industry, methane emission reduction consists of two distinct phases. First, emitters must be detected and quantified. Second, they must be remediated.

(a) Detection and Quantification

Detection of gas leaks from petroleum and natural gas systems is not trivial. Intermittent super-emitters are responsible for a large fraction of methane losses to the atmosphere [House Committee on Science, Space and Technology, 2022]. Repeated rounds of measurements and repairs will eventually reduce emissions, but persistence is required [Kemp, 2021].

Quantification is important because emission rates from individual sources span the range from less than 30 grams per hour to more than 100 tons per hour, more than three million times larger. It is a poor use of resources to focus attention on tiny leaks when vents thousands of times larger are allowed to persist. Yet, this is the situation today [Kleinberg, 2021].

Due to technological advances in aerial surveillance, mostly pioneered by U.S. researchers and companies, overflights of oil- and gas-productive basins are effective and inexpensive ways to detect and quantify methane emitters [Kleinberg 2022a, Section 3.1.1]. As pointed out in my written testimony to the Select Committee, a survey of 45,000 Permian Basin wells, during which methane emissions were quantified and operators were identified, cost about the same as drilling and fracking a single well [Kleinberg, 2022b].

Continuous monitoring of oil and gas infrastructure combined with prompt repair dramatically reduces the amount of methane entering the atmosphere [LongPath, 2022]. While aerial surveillance, with its considerable economies of scale, is usefully employed over all oil and gas infrastructure, continuous monitoring is best suited for sites with emission-prone equipment. These include gas processing plants, refineries, biogas and biomethane production facilities, liquefied natural gas terminals, and well sites or other facilities with storage vessels. Simple wells with minimal ancillary hardware, which constitute the majority of upstream sites, are unlikely to need this service. Therefore, continuous monitoring services can be deployed selectively, where they are most likely to be useful.

(b) Remediation

The most current and authoritative estimates of the cost of remediating methane emissions are provided by the International Energy Agency [IEA, 2022a]. These estimates are more reliable for the United States than for other nations [IEA, 2022b]. According to the IEA, 13,824 kilotons (kt) of methane was lost from U.S. oil and gas operations in 2021, of which the estimated technical abatement potential is 9,648 kt, 70% of the total. The share of emissions that could be avoided at no net cost is about 2,500 kt or 18% [IEA, 2022a].

The IEA marginal abatement cost curve is shown in Figure 1. Unlike nations such as China or Russia, most abatement measures that have not already been implemented in the U.S. impose a net cost on the industry. This is consistent with the widely held belief within the U.S. oil and gas industry that "we don't leave money on the table". According to IEA estimates, the net cost of eliminating 9,648 kt of methane would be approximately $1.7 billion, or $176/ton of methane. This is far less than the most recent estimate of the social cost of methane, $1500/ton of methane [IWG, 2021]. It is also far smaller than the LDAR-focused regulation 40 CFR

60 OOOOa of 2016, which proposed to reduce U.S. oil and gas methane emissions from regulated segments by 2% at a cost of $1340/ton of methane [Kleinberg, 2021].

At a cost of $1.7 billion, eliminating 70% of our oil and gas methane emissions would not have a material impact on our oil and gas industry, or on energy prices. U.S. oil and gas revenue in the United States averaged $157 billion per year between 2010 and 2020 [Statista, 2021] and capital expenditures are expected to exceed $100 billion in 2022 and each of the years thereafter [AOGR, 2021].

(c) Summary

The U.S. oil and gas industry has already remediated almost all the methane emitters that reduce operating efficiency and profitability. Additional incentives or regulatory measures are required to reduce emissions further. Improved methods for finding and quantifying methane emissions sources will enable operators and service providers to find emitters more efficiently, and to prioritize repairs so that the largest emitters are fixed first. Quick detection and prioritized repairs will result in less methane entering the atmosphere.

2. How could U.S. leadership on cutting methane pollution influence other countries to adopt similar technologies and strategies?

(a) American Petroleum Engineering Practice is Considered Standard Around the World.

There are a number of reasons why American engineering practice is followed widely around the world:

- The United States is the world's leading producer of both crude oil and natural gas [EIA, 2021].
- From my personal experience of forty years in the international oil and gas industry, I have found the leading schools of petroleum engineering, educating petroleum engineers from all over the world, are largely in the United States. These include Louisiana State University, the University of Texas at Austin, Texas A&M, and the University of Tulsa, among many others.
- The professional societies which set engineering standards and disseminate technical information are mostly based in the United States. These include the Society of Petroleum Engineers, the American Association of Petroleum Geologists, and the American Petroleum Institute.

This does not imply that American practice is automatically adopted everywhere, but it is the baseline against which local practices are compared. This is particularly true in the health, safety, and environment (HSE) arena. Over the course of my career, HSE standards have been globally upgraded, largely led by U.S.- and European-based international oil companies (IOCs) such as ExxonMobil, Chevron, and Shell.

(b) The United States has been the Global Leader in the Detection and Characterization of Methane Emissions in the Oil and Gas Industry.

In 1996 the U.S. Environmental Protection Agency published the monumental fifteen volume *Methane Emissions from the Natural Gas Industry* [EPA, 1996]. These documents are the foundation of the emission factor inventories universally used to report national methane emissions to the Secretariat of the United Nations Framework Convention on Climate Change [UNFCCC, 2022].

Not every nation matches the meticulous record keeping of the United States. The reports of the Russian Federation are particularly egregious examples of the inconsistent application of the emission factor method [Kleinberg, 2022a]. The advantage of a measurement-based reporting system is that nations will not be able to report superior performance by merely changing a multiplier on a spreadsheet, as permitted by the present reporting system.

(c) The United States Continues to be the Global Leader in the Detection and Characterization of Methane Emissions in the Oil and Gas Industry.

Remarkably, in the absence of government regulation or an established market, a methane emission characterization industry has sprung up, which is dominated by U.S. technology and service providers. This is detailed in my written testimony to the Select Committee [Kleinberg, 2022b].

Diffusion of these technologies to other nations is in its early stages. Measurement campaigns aligned with American principles have already been undertaken in Canada [MacKay, 2021], Mexico [Zavala-Araiza, 2021], and China [Zhang, 2021]. Technology diffusion will accelerate if markets for the new methods are encouraged

to grow. Emission reduction incentives and smart regulation encourage the dissemination of new technology, with associated start-up business formation, small business vitality, and economies of scale. As technology improves and costs decline, methane reduction methods will spread to other countries. This story is common in the petroleum industry. My own oilfield innovations have benefited from this dynamic.

The adoption of a Carbon Border Adjustment Mechanism by the European Union, if extended to fossil fuels, would also provide powerful encouragement to oil, gas, and coal exporting nations to extend and routinize the use of these technologies.

(d) Summary

There is no guarantee that other nations will follow our example should the United States adopt new technologies and strategies for finding and reducing methane emissions. However, logic and experience provide evidence that the United States can set a standard for responsible practices in the oil and gas industry. Based on my long experience in this industry, I am fairly certain that if the United States does not set a good example, most other nations will see no need to do any better.

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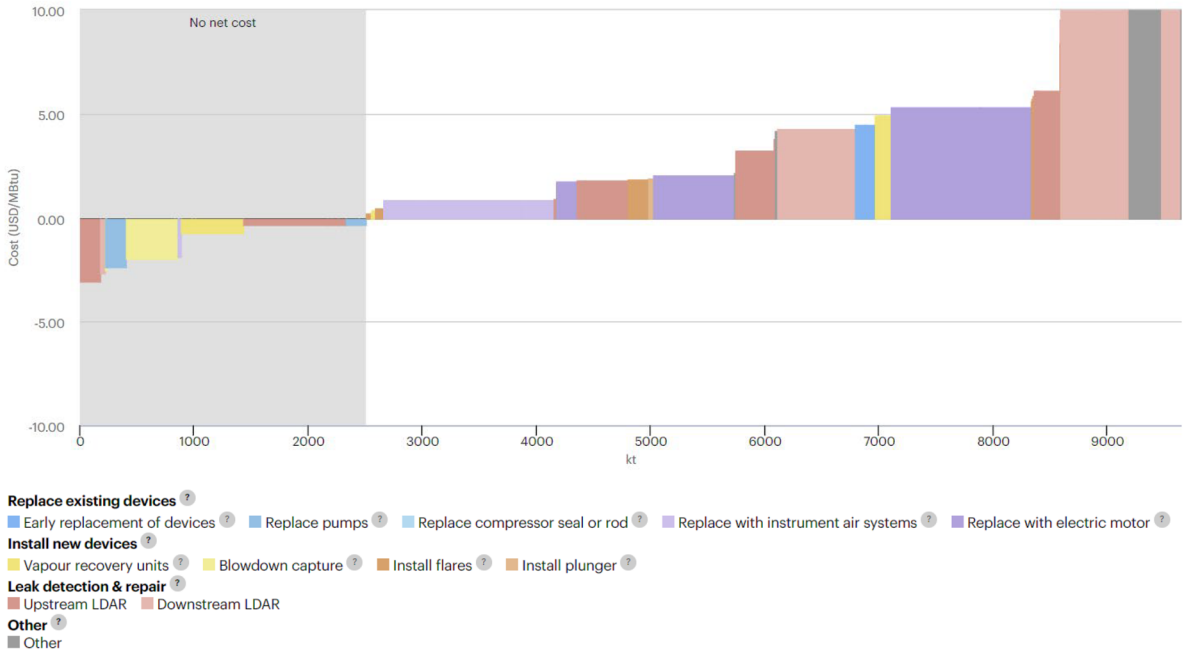
Figure 1. International Energy Agency (IEA) methane abatement cost curve for the U.S. oil and gas industry. The horizontal axis is the cumulative quantity of methane that can be prevented from escaping to the atmosphere in kilotons per year, if specific remediation measures are undertaken (colored blocks). The measures are ordered by the net cost of remediation in U.S. dollars per million British Thermal Units (MBtu) of avoided emissions, plotted on the vertical axis [IEA, 2022a]. The annualized net cost of emission reductions is based on the capital and operating costs of the emission reduction technologies and the value of recovered gas [ICF, 2016, Section 2.1]. Costs associated with the light pink (Downstream LDAR) and gray (Other) blocks at the right end of the chart exceed 10 USD/MBtu. For methane, 1 MBtu = 990 cubic feet = 27.91 cubic meters = 19 kilograms [EPA, 2022].



Questions for the Record

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THE HONORABLE KATHY CASTOR

1. How would strong Federal rules complement state regulations?

Currently, several states are leaders in regulating methane monitoring and emissions reductions. However, other states have not implemented methane rules, resulting in a hodgepodge of regulations across state lines. Operators therefore must keep track of different combinations of rules in different areas of operation.

If strong Federal rules for methane monitoring and emissions mitigation were put into place, it would create a more homogenized compliance landscape for operators. A key element of a strong Federal regulation that could encourage broad adoption (and removal of duplication) by states would be for regulations to be performance-based rather than prescriptive.

Currently, we believe that EPA can push much further in the direction of performance-based specifications, and much further away from rule language that prescribes either operation of equipment or methods for deployment. A performance-based rule would, for example, specify the frequency with which all regulated equipment must be "scanned" (whether by aircraft, OGI camera, continuous monitoring device or other technology) and the size of emission that must be "seeable" (threshold of detection). A performance-based rule would include a technology-neutral matrix of options, each with an equivalent set of specifications (frequency of scanning all equipment and threshold of detection) and each with an equivalent work practice or set of follow-up requirements. A performance-based rule would not carve out specific technologies or work practices into separate categories but would instead include all modes of monitoring under the same umbrella, with separate work practices and follow-up requirements to achieve equivalency in emissions reductions and operator obligations.

The U.S. is at a pivotal and very exciting moment, with an opportunity for meaningful regulation that can provide measurable and demonstrable emissions reductions while simultaneously offering industry and technological innovation. To achieve sustained emissions reductions, rules should use performance-based metrics and require measurements to demonstrate reductions.

Questions for the Record

Sarah Ann Smith
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Clean Air Task Force

THE HONORABLE KATHY CASTOR

1. Abandoned wells can contribute to methane pollution and plugging them has health and safety benefits as well. The Bipartisan Infrastructure Law invests $4.7 billion in helping states and tribes and our federal agencies plug abandoned wells across the country, and it will likely create thousands of jobs, especially in traditional energy producing communities. How would efforts to plug abandoned wells help create good paying jobs? More generally, how would cutting harmful methane pollution from the oil and gas industry could help create jobs?

Actions to reduce methane provide a multitude of high-quality jobs, in addition to the climate and public health benefits from such actions. In an upcoming report, Clean Air Task Force analyzed the jobs that would be created in two cases: 1) a plan to reduce methane from the oil and gas sector by 65%,[1] and 2) the Environmental Protection Agency's November 2021 proposed updated standards for new and

[1] Clean Air Task Force ("CATF"), *Oil & Gas Methane: Mapping the Path to a 65% Reduction* (June 2021), https://www.catf.us/resource/oil-gas-methane-mapping-the-path-to-a-65-reduction/.

modified sources and emissions guidelines for existing sources.[2] In each case, Clean Air Task Force (CATF) estimated the jobs that would be created by measures to address the four most important emissions sources covered by the proposed rules: leaks, pneumatic equipment, storage vessels, and compressors. Overall, CATF has found that strong actions that would reduce methane by 65% would create nearly 220,000 total jobs, including manufacturing jobs from upfront capital investment as well as continuing jobs for maintenance, repair, and inspection needs.

2. In your testimony, you described the importance of rapid action to stop climate tipping points or feedback loops. Could you please elaborate on the role of methane mitigation in avoiding climate tipping points or feedback loops?

Methane is a highly potent climate pollutant. Over the twenty years after it is emitted into the atmosphere, methane warms Earth's climate over eighty times more than an equivalent amount of carbon dioxide.[3] Fortunately, methane remains in the atmosphere for just a few decades, a relatively short period of time in the atmosphere compared to carbon dioxide. Combined, this means that aggressively cutting methane pollution can lead to significant, meaningful decreases in the warming we will experience over the next 15 to 30 years.

As a result, slowing down warming by cutting methane pollution is an essential tool to avoid crossing climate tipping points and feedback loops. Tipping points are situations when climate change causes a shift in the Earth's system that will not be reversible. The loss of ice sheets and the collapse of rainforest ecosystems and the protective weather patterns that the rainforests create are examples of tipping point changes that will increasingly threaten humanity over the next decades. Feedback loops happen when a heating climate makes heating accelerate—for example, when a warming climate increases wildfires and those wildfires produce more climate warming pollution, or when the warming climate increases methane emissions from wetlands and thawing permafrost.

Both tipping points and feedback loops get worse as the temperature rises. Since methane reductions are perhaps the most effective way to reduce climate heating over the coming decades, they are also a very good way to avoid crossing tipping points or initiating feedback loops.

3. Which specific measures do you think that the Environmental Protection Agency should include to strengthen the proposed oil and gas methane regulations?

The Environmental Protection Agency's November 15, 2021 proposal required owners and operators of facilities with a "potential to emit" ("PTE") of less than 3 tons per year to just perform a single, one-time instrumental inspection for fugitive emissions (or leaks), with no requirements for future instrumental inspections. This could allow for any leak that occurs after the required inspection to emit in perpetuity without any requirement to inspect or repair it. The EPA should strengthen the leak detection and repair provisions in the proposed regulations and require all facilities to perform regular inspections at all facilities, including smaller well sites.

Additionally, the November 2021 proposal from the Environmental Protection Agency banned the venting of associated gas—the natural gas that is released with oil production—and prohibited flaring, if a sales line is available. Leading states like New Mexico have shown that lack of pipeline capacity or availability is not a valid excuse for oil producers to flare gas: operators there are prohibited from venting or flaring gas if they lack sufficient capacity to capture it. Operators must plan development to ensure that proper gas gathering infrastructure is in place or use alternatives such as utilizing the gas onsite or trucking it offsite. EPA should strengthen its proposal by prohibiting routine flaring of associated gas, regardless of the pipeline availability.

4. Could you please elaborate on how the Environmental Protection Agency's existing methane regulations have benefitted public health and the climate?

Environmental Protection Agency regulations on methane and volatile organic compound (VOC) emissions from the oil and gas industry have provided important

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[2] Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review, 86 Fed. Reg. 63,110 (Nov. 15, 2021).

[3] Intergovernmental Panel on Climate Change ("IPCC"), AR6 Working Group I ("WGI"), *Full Report* Table 7.15 (2021),
https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf.

benefits to both the climate and public health. In the short-term, methane is more than 80 times more potent than carbon dioxide as a climate pollutant. Methane accounts for nearly 0.5 degree C of the 1 degree C warming we've experienced to date,[4] and levels in the atmosphere are surging.[5] Quickly and significantly reducing methane pollution is one of the most important opportunities we have to quickly slow the rate of, and damage from, climate change.

In addition to the harms we experience from a warming climate, pollutants from oil and gas harm our health. Methane is a precursor for ground-level ozone smog, raising concentrations of ozone around the globe—hurting people and crops, and making it tougher for communities to meet clean air standards. Moreover, other pollutants which harm public health are released alongside methane. Nationally, more than 17 million people, including nearly 3.2 million children, live within a half mile health threat radius of active oil and gas production.[6]

Toxic air pollutants that are often co-released alongside methane from oil and gas facilities have been linked to increased risk of cancer and respiratory disorders. For example, benzene, one of the constituents of raw natural gas, has been linked to cancer, anemia, brain damage, birth defects, and is associated with respiratory tract irritation. In total, 236 counties in 21 states face cancer risk that exceeds the EPA's one-in-a-million threshold due to toxic pollution from oil or gas sources, placing approximately 14 million people at risk. Some of the areas with the greatest health risk are in Texas, Louisiana, Oklahoma, North Dakota, Pennsylvania, and Colorado.[7]

Even in areas far from oil and gas production, air pollution from oil and gas facilities has a significant impact on public health. Volatile organic compounds (VOCs), methane, and nitrogen oxides all react together in the presence of sunlight to form ozone smog. When inhaled, ozone smog can impair lung function, trigger asthma attacks, aggravate diseases like bronchitis and emphysema, and even cause premature death. Children, the elderly, and people with existing respiratory conditions are the most at risk from ozone pollution. Ozone smog that results from oil and gas industry pollution has a significant and harmful impact on the lives of Americans. In total, ozone smog attributable to oil and gas contributes to more than 750,000 summertime asthma attacks in children every year, causes children to miss 500,000 days of school each year, and forces adults to take approximately 1.5 million personal days to rest or reduce activity due to high smog levels.[8]

By reducing emissions of harmful methane, toxic air pollutants, and volatile organic compounds from the new and modified sites that are covered by EPA's existing standards, EPA has reduced these harmful impacts.

5. Methane leaks are likely underestimated by as much as 50 percent and satellite data shows that certain U.S. oil and gas basins are ultra-emitters of methane, especially the Permian Basin. The oil and gas industry fails to quantify and address super-emitting methane leaks. How could the United States cost-effectively do much better in developing and deploying technologies and strategies to reduce harmful methane pollution?

While many innovative and exciting technologies have been developed to detect methane emissions, most operators are not utilizing these technologies. Standards are needed so that all operators are required to regularly inspect each one of their sites for leaks and problems that lead to harmful emissions. These standards should allow operators to use alternative technologies and methodologies to find leaks, provided that the alternative technology and methodology is proven to reduce emissions as much as traditional inspections. These standards will incentivize deployment of currently existing technologies, and development of new technologies, that can effectively and quickly find all leaks and unintended emissions.

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[4] IPCC, WGI, *Summary for Policymakers* 7 (2021), https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf.

[5] United Nations Environment Programme and Climate and Clean Air Coalition, Global Methane Assessment: Benefits and Costs of Mitigating Methane Emissions (2021), https://www.unep.org/resources/report/global-methane-assessment-benefits-and-costs-mitigating-methane-emissions.

[6] Oil & Gas Threat Map, https://oilandgasthreatmap.com (last accessed June 21, 2022).

[7] Heny Patel and Lesley Feldman, *Fossil Fumes: A Public Health Analysis of Toxic Air Pollution from the Oil and Gas Industry*, CATF (Sept. 2022), https://www.catf.us/resource/fossil-fumes-public-health-analysis/ (report update forthcoming).

[8] CATF, Gasping for Breath (Aug. 2016), http://www.catf.us/wp-content/uploads/2018/10/CATF_Pub_GaspingForBreath.pdf.

6. Could you please describe the environmental justice benefits of cutting methane pollution from U.S. oil and natural gas infrastructure?

Preventing air pollution across the natural gas supply chain has significant benefits for those communities that bear the brunt of the gas industry's localized impacts. Policy action is needed to immediately rein in these emissions across the gas supply chain, from the well head to the point of use or the export facility. The methane and VOC rules currently being promulgated by EPA will provide important health benefits to communities located near gas development as well as communities in smog-laden areas far from gas development.

Furthermore, oil and gas companies routinely site highly polluting facilities near or in communities of color. This creates an unequal distribution of health impacts, with African American communities facing particularly serious health risks as a result of disproportionate exposure to air pollution. More than 5½ million people of color live within a half mile from existing natural gas facilities.[9] More than half a million people live within 5 km (3.1 miles) of flaring sites, including a disproportionate number of black, indigenous, and other people of color.[10] Flaring from oil and gas facilities nationwide released approximately 16,000 tons of black carbon, resulting in dozens of premature deaths and other adverse health impacts.[11] Taking measures to reduce methane emissions from leaking and flaring is an important step towards redressing these harms which disproportionately impact communities of color.

7. How would developing countries benefit from deployment of renewable energy? How would developing countries benefit from oil and methane gas producers eliminating methane pollution?

Both the deployment of renewable energy and mitigation of methane pollution from the oil and gas sector will provide benefits for developing countries and particularly for frontline communities within those countries. First, the lack of access to modern electricity and energy stifles development, and the expansion of modern energy sources, including renewable energy, are critical factors for development. Second, many developing countries are at a higher risk of climate-induced harm compared to developed countries. The IPCC Sixth Assessment Report from Working Group II on Impacts, Adaptation, and Vulnerability found that hot spots of high human vulnerability to climate risk are found particularly in West-, Central-, and East Africa, South Asia, Central and South America, Small Island Developing States, and the Arctic.[12] The IPCC report indicated that between the years of 2010 and 2020, human mortality from floods, droughts, and storms was fifteen times higher in these high-vulnerability regions compared to regions with low vulnerability.[13] Reducing methane emissions can lead to significant, meaningful decreases in the rate of climate change over the next 15 to 30 years, which will reduce the climate-induced risks faced by developing countries which may not have access to the same adaptation capabilities as more developed countries.

Additionally, reducing methane emissions from the oil and gas sector often reduces other air pollution that causes adverse health effects. Reducing these air pollutants provides important benefits to the overall public health of communities near oil and gas development in developing and developed countries alike.

Finally, the mitigation of methane emissions provides more natural gas supply overall. Particularly if mitigation occurs within the borders of a developing country, this provides a near-term cleaner energy supply that can improve the quality of life for people that live there. Importantly, methane mitigation provides these benefits to developing countries in a cost-effective way, allowing these countries to accelerate development while protecting their citizens. This is particularly important considering the risk that the use of wood fuels poses to public health in many developing countries, where wood fuel combustion is a major driver of local air pollution and respiratory illness as well as deforestation and loss of carbon sinks.[14] The transition to cleaner alternatives such as gas and away from wood fuels can provide a significant benefit to indoor air quality in many developing countries. Furthermore, spe-

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[9] Oil & Gas Threat Map, https://oilandgasthreatmap.com (last accessed August 12, 2022).

[10] Lara Cushing et al., *Up in smoke: characterizing the population exposed to flaring from unconventional gas development in the contiguous US*, 16 Env't Rsch. Letters 3 (2021).

[11] Chen Chen et al., *Black carbon emissions and associated impacts of gas flaring in the United States*, 13 Atmosphere 3 (2022).

[12] IPCC, AR6 Working Group II, *Summary for Policymakers* B.2.4. (2022), https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf.

[13] *Id.*

[14] World Health Organization, Household Air Pollution and Health (July 26, 2022), https://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health.

cifically in Africa, the bulk of climate-warming emissions result from land-use change and agriculture, rather than from the energy sector. The use of wood fuel is a key driver of these land-use change emissions. Switching to cleaner alternatives for cooking and heating, such as natural gas that would otherwise have been wasted through methane leaks or flaring, presents an opportunity to limit these emissions. Eliminating methane pollution is key to enabling clean energy access in developing countries.