EDF ENVIRONMENTAL DEFENSE FUND®

Finding the ways that work

SPECIAL REPORT
SPRING 2019
Prepared for EDF Members

EDF READY TO GO INTO SPACE

By Judy Stoeven Davies

Methane is a powerful greenhouse gas that is one of the main contributors to climate change. It does not last as long in the atmosphere as carbon dioxide, but during its short life span, it is far more effective pound for pound at trapping the earth's heat than carbon dioxide. Already, methane emissions from human activities are responsible for about a quarter of today's global warming.

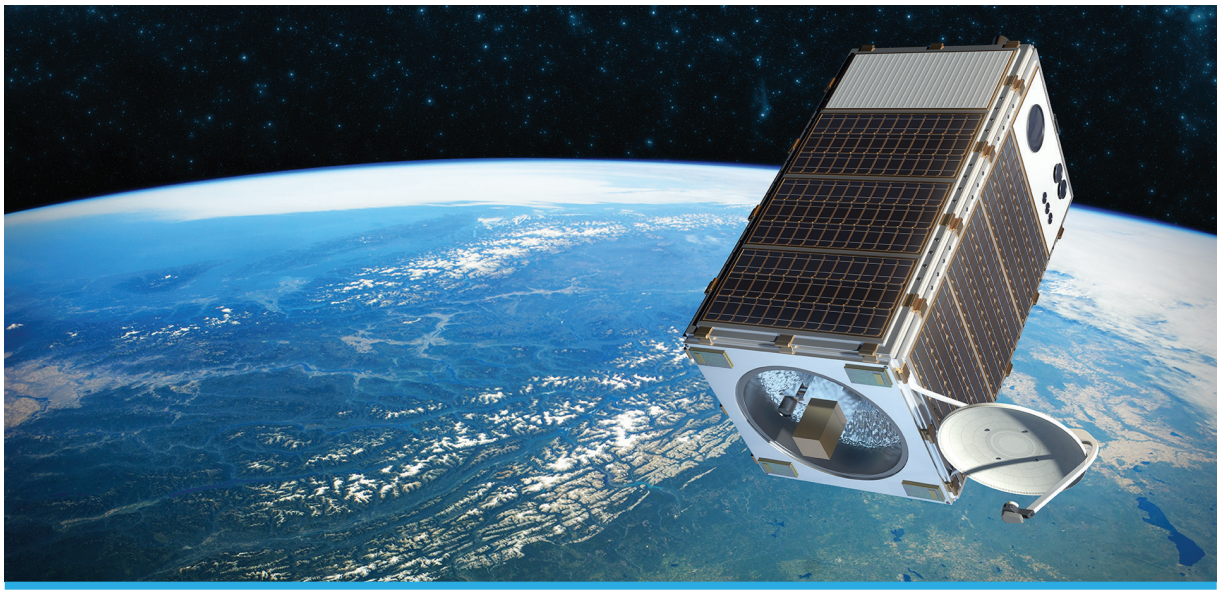
One of the world's largest sources of methane is the oil and gas industry, which releases this powerful climate pollutant into the atmosphere during the production, transportation and distribution of natural gas. This is no small problem. More than a quarter of the world's energy use is tied to natural gas, and demand for it is growing, particularly in the Middle East and Asia. Demand in North America is also rising.

But there's good news. It's cost-effective and relatively easy to prevent methane from escaping into the atmosphere. The problem is that countries and companies don't know the full extent of the problem or have a handle on where all of the emissions are coming from.

Six years ago, Environmental Defense Fund (EDF) set out to measure methane emissions from the U.S. oil-and-gas supply chain. We launched an unprecedented scientific study—with more than 140 researchers, four dozen oil and gas companies and a range of technologies—including sensors mounted on helicopters, airplanes and Google Street View Cars. The conclusion: the U.S. oil and gas industry emits nearly 60 percent more methane than current government estimates.

Now, EDF is pushing the technological envelope even further by going into space to measure and map methane emissions from global oil and gas operations and other major sources of methane emissions from human activities. MethaneSAT, which is due to launch in 2021, is critical to advancing EDF's methane strategy, which has a near term goal of reducing global oil and gas methane emissions 45 percent by 2025.

One of the people leading EDF's MethaneSAT project is Senior Vice President of Energy Mark Brownstein. With a background in the utility industry, he may seem like a bit of an odd duck in an environmental organization. Until you hear him talk about what is possible.



MethaneSAT will provide high-resolution coverage of roughly 50 major oil and gas regions around the world, collecting robust data to spot human-made methane emissions—and measure progress over time.

What can you tell us about MethaneSAT?

It is about the size of a college dorm refrigerator. It will orbit at 372 miles above sea level. MethaneSAT will enable us to monitor emissions from 80 percent of oil and gas facilities globally about every four days, so we'll be able to know when emissions are going up, and when they are going down, and where.

It will have a big field of view. Think of this like the big screen TV on your wall. The size of the rectangle determines your field of view, and then the number of pixels that you have determines how sharp that picture is. Except this isn't a photo camera. It's an infrared sensor collecting data which is run through some very sophisticated algorithms to give us the data we need to take action.

Why is it so critical to collect data on methane from space?

People are worried about the near-term consequences of a warming planet that we're already experiencing: the intensity of storms and droughts, the rapid melting of glaciers and rising seas, which are already inundating coastal communities.

The most immediate thing we can do to slow all this down is to reduce methane emissions. Pound for pound, methane is 84 times more potent as a greenhouse gas than carbon dioxide for about a decade after it is emitted.

Methane doesn't last in the atmosphere very long, but because its so effective in trapping the earth's heat, it has a profound impact on warming over its short life. The way I think about it is that methane emitted today affects the temperature of the planet during my lifetime and my children's lifetime. The carbon dioxide

Methane, the main component of natural gas, can leak from many places along the supply chain as it makes its way to your home or business.

emitted today affects the temperature of the planet during my grand children's lifetime and the generations thereafter. To effectively battle climate change, we need to reduce both methane and carbon dioxide.

Right now, our best estimate is the global oil and gas industry is responsible for somewhere around a quarter of all methane emissions caused by human activities. We know from our work in North America that reducing these emissions is relatively straightforward and can be achieved at a low cost.

What we don't know is the exact amount of global oil and gas emissions and what companies and countries are most responsible for them. If we can find out where the emissions are—and who is responsible for them—we can get about the task of fixing the problem.

How significant would that be to global climate?

Even if we only cut global oil and gas methane by half, that would have the same impact on climate in the near term as closing nearly all of China's coal-fired power plants.

Reducing methane from the oil and gas industry is the biggest low-cost opportunity our generation has to slow the rate of warming in the near term.

> "(This) is the biggest low-cost opportunity our generation has to slow the rate of warming in the near term."

When delivered as natural gas, methane is a valuable, lower-carbon energy source. But too often, it is vented, leaked or flared, wasting $30 billion of gas worldwide each year. That's enough to power Africa two times over.

How can the oil and gas industry reduce methane pollution?

Through our fieldwork in North America, we've learned that methane emissions can occur anywhere along the natural gas supply chain—starting with the oil and gas wells where methane is produced. Then giant pipelines and compressors transfer large quantities of natural gas over long distances, to the smaller pipes of the city utility systems that bring gas to your home or business.

We've also learned that much of the methane that is lost along the way is due to venting or leaks—which are preventable. Many of these problems can be fixed by a worker with a wrench. This is not rocket science. It's really auto mechanics…with a wrench. The fixes are relatively simple and straightforward, and the payoff for the environment is huge.

What led EDF to focus on methane?

In 2010, there was a crescendo of activity to get Congress to pass climate legislation. During the Waxman-Markey debate, most people assumed that we would have to continue to rely on coal in the short term because we were running out of natural gas, which burns much cleaner than coal.

The climate legislation got through the House but failed in the Senate, thanks in large part to the political pressure of the coal industry and electric utilities, which, at the time, were dependent on big old coal-fueled power plants.

Using drones to fly over oil and gas facilities to detect methane leakage and flaring in Colorado

But right at that moment, a revolution was taking place in the energy sector. New technology—hydraulic fracturing, horizontal drilling, 3D seismic and other innovations—gave the oil and gas industry access to huge amounts of natural gas they'd never been able to reach before. Natural gas burns much cleaner than coal. And it had become so much cheaper. Suddenly, utility executives were beginning to think differently about their existing coal-fired plants and their options going forward.

Because I'd worked in the utility business—and my colleague Scott Anderson had a background in the oil and gas industry—we saw that natural gas was about to give dirty coal a huge push out of the marketplace. But, we also knew that natural gas production—particularly the increased use of hydraulic fracturing—came with its own set of environmental risks.

But, if natural gas is lower in carbon than coal, isn't it good news for climate?

At the time all this was going on, EDF chief scientist Steve Hamburg raised the methane issue. He said that research clearly points to the fact that methane has a larger impact on climate in the short term than carbon dioxide. But it wasn't clear whether oil and gas methane emissions were so high that they could erase the climate benefit of using gas instead of coal—the government and industry were not taking it very seriously.

EDF teamed up with Google Earth Outreach to pinpoint methane leaks under our streets and sidewalks from natural gas pipes.

A debate was beginning to emerge between industry and academics over how much methane the oil and gas industry was emitting, but there was little or no actual field data informing the argument. It was at this point that EDF President Fred Krupp directed us to get to work on the problem.

What was the next step?

We knew that the official numbers coming from government were probably wrong. Their estimates were based on a few field measurements that were 20 years old. We decided we needed to get better information—rigorous scientific, fact-based data about the scope of the problem.

Already we were concerned natural gas production was running roughshod over the environment in local communities, and we'd begun working in several states to put new regulations and policies in place. During that early work, we had built industry relationships with forward-thinking companies and with key scientists and academics. We decided to launch a comprehensive, nationwide research project to understand the problem.

Why didn't you push the government to do the studies?

Our feeling was we needed high quality, peer reviewed research, but we needed it done quickly, faster than the government could do it. These studies could let us get a handle on the problem so we could find tangible and immediate fixes to have a big, near-term impact on climate. And collecting real data on methane emissions would mean no one could argue the problem didn't exist or the impact was minimal.

So, EDF launched a six-year scientific research effort to measure emissions at every link in the supply chain, from remote wellheads to pipes under your local street. Results of the project were published in some three dozen separate articles in peer-reviewed scientific journals. A synthesis paper published in June 2018 in *Science* concluded the U.S. oil and gas industry emits nearly 60 percent more methane than current EPA (Environmental Protection Agency) estimates.

Having strong data collected by more than 100 scientists gave us standing with government and industry. We knew as much or more about the problem than they did. We had extensive data and could talk about the nature of the problem, what needs to be done, the degree to which emission reductions can be achieved—and we were having those discussions using real numbers.

Very importantly, through our fieldwork we found many sites had virtually zero methane leakage—so we realized if sites could achieve these results, then it's surely possible that all sites could be free of methane emissions. It's technically possible to fix this problem and, in the process, save natural gas that would otherwise be wasted.

The other thing we learned is a significant portion of the emissions we did see came from equipment that was not operating properly or could be attributable to worker error—which is one reason the engineering calculations used by government and industry undercount emissions. They always assume the equipment in the field is performing as designed. In fact, as anyone who owns a car knows, sometimes stuff just "happens." And as it turns out, this is a major reason for emissions. It's something we never would've known about without going into the field and collecting the data.

What impact did these studies have on EDF's work?

Twenty years ago, the government and industry had a monopoly on information. We could use their numbers to make arguments about what they should be doing, but fundamentally, we had no choice but to rely on their data. What's new now is we're using numbers gathered in partnership with academic institutions and responsible companies. The data is completely transparent. Everyone knows what the numbers are and the methods we used to obtain them.

That has been incredibly powerful for shaping the nature of the conversation in the United States, for informing policy—and for stimulating some leading companies to take more seriously their obligation to reduce these emissions. We've seen it happen in the United States and Canada—the world's fifth largest natural gas producer. And we are seeing the same thing happening in Mexico, and starting to happen in Europe.

The new numbers are shaping the debate and framing the nature of the problem—and the solutions.

On-site testing for methane emissions at a natural gas facility.

MethaneSAT will collect an enormous amount of data. How will you make sense of all that information?

Harvard scientists are developing algorithms that will translate data collected by the satellite into something you or I could understand about methane emission rates and how they vary across the globe.

We will design a public-facing platform that serves the widest number of interests most effectively. We want the data to be used. We know how powerful it can be. If we know where and how emissions vary, we can address the problem. It could change the course of our planet in a meaningful and significant way.

Who will use MethaneSAT's data stream?

MethaneSAT will map methane pollution so people can see it. It's about turning data into action by getting that information into the right hands—oil and gas companies, government and citizens.

Our vision is governments will tighten standards. Citizens will be empowered to help make that happen. Our goal is to cut methane emissions from the coal and gas industry 45 percent by 2025. This is one of the most important and urgent things we can do now to slow climate change. It would have the same near-term climate benefit as shutting down 1300 coal-fired power plants—one-third of all the coal plants in the world.

EDF chief scientist Steven Hamburg with Tom Ingersoll, a satellite entrepreneur who's helping EDF get MethaneSAT off the ground.

Who is building MethaneSAT for EDF?

EDF hired Tom Ingersoll to lead the project. He's a satellite entrepreneur and the former CEO, Skybox Imaging and earlier at a global satellite ground-station. He started his career in the PhantomWorks of McDonnell Douglas Corporation, where he worked on advanced technology projects in satellite and rocket systems.

We're also partnering with Harvard and the Smithsonian Astrophysical Observatory to do the basic science and technical strategies for the mission. We're in the process of choosing the technical partners who will build the system. We are aiming to launch in 2021.

Is there a reason that American taxpayers should care about methane leakage?

American taxpayers should care about methane leakage because somewhere between 17 and 20 percent of all oil and gas production happens on federal and tribal lands. Our lands. We are the royalty owners. The American people should get full compensation for what our lands yield. If methane is lost into the atmosphere rather than captured and sold, we won't be compensated.

The lost gas on U.S. lands is worth an estimated $2 billion—and could fuel 10 million homes—roughly the number of homes in Ohio or Pennsylvania.

> “We are the royalty owners. The American people should get full compensation for what our lands yield.”

How do companies currently monitor methane leakage?

The standard practice for finding leaks is to send someone out to a well site or a compressor site and walk the area with a portable methane-sensing device, such as a gas analyzer or an infrared camera so the inspector can literally see the gas and then fix it. In the United States, we have more than a million wells spread over hundreds of thousands of miles. It's not very efficient to send someone out in a pickup truck with a handheld methane sniffer. And visits are sporadic, at best.

In parallel to our scientific studies, we've been working with the research community and industry to come up with more effective ways to either continuously monitor sites for emissions or to outfit mobile technologies like cars, helicopters, airplanes and drones so they can get a sense as to where the problems are.

Do you expect nations to act quickly when MethaneSAT pinpoints a problem?

Over two-thirds of the world's oil and gas reserves are held by national oil companies. No country wants to waste its oil and gas resource, so we expect at least some countries will want to step up and adopt best practices.

In January, Steve Hamburg and I flew to Beijing to finalize an agreement between EDF and the China National Petroleum Company to work together to improve the accuracy of its natural gas inventory—and ultimately, we hope, to help develop a methane reduction strategy.

China sees natural gas as one of the ways the country can transition off its dependence of coal, which it wants to do because of air quality issues. The last thing it wants to do is transition off of coal and then not achieve its international climate targets because of methane leakage.

You worked for years for PSE&G, one of the nation's largest electric and gas utilities. You don't come off as a granola-eating environmentalist.

I do like granola.

But does your background make it easier for you to work with the oil and gas folks?

Well, it's really our Senior Policy Director Scott Anderson who has experience in the oil and gas industry. But I do have a certain amount of empathy for people inside large corporations whose job it is to manage environmental policy.

I've always tried to approach the work with a certain amount of humility. I try to ask questions so I can understand where they're coming from. I try to keep a sense of humor about it. And I try to remind myself of the fact that I use oil and natural gas, as most people do.

Mark Brownstein worked for PSE&G for 10 years, first on air pollution and then on the utility's environmental strategy.

As head of EDF's energy program, I'm trying to promote policies that will accelerate the transition away from heavy dependence on oil and gas. Zero carbon electricity is essential and has a big role to play in reducing the use of oil in transportation and natural gas in heating water and buildings and cooking food.

It's essential that we move quickly to make this transition. The climate crisis is getting worse. Reducing methane is essential to slow warming now, but ultimately if we don't significantly reduce the carbon dioxide emissions driven by fossil fuel use, future generations will surely suffer.

Already there is more carbon dioxide in the atmosphere than there's been in 800,000 years! At the same time, I appreciate the fact people work really hard to produce oil and gas—and make them accessible to me and everyone else. I want them to do the best job they can to minimize the environmental impact for as long as oil and gas play a major role in the global energy economy.

You spend about half your time on the road, working with the oil and gas companies and governments around the world. Why does this mean so much to you?

As a kid I was very fortunate. Both my parents were teachers, so we got long summer vacations. We spent a lot of time in the Adirondacks. For me, the wilderness is very restorative. It's very calming. When you're sitting there on top of the mountain, when you're walking through the woods, you have a certain reverence for creation, and you feel a certain responsibility to make sure you're living up to your end of the bargain.

Are you hopeful that we can make progress?

Let me tell you a story. In March, I spoke at CERAWeek, an annual energy conference. I joke that it's like Burning Man for the oil and gas industry. I'm one of the few environmentalists there, which kind of makes me like the panda exhibit at the zoo... a rare species that many people are curious about.

I've been going now for over 10 years, and I learn a lot. I can tell you that when I talked about climate change five years ago, people looked at me with disdain—if they didn't simply try to ignore me. Five years later, the theme of the conference was the energy transition—and climate change was a central theme. Now, among oil and gas people, there is the idea that all these new technologies are going to change the way people generate and consume energy. It's a big shift.

However, it's not happening fast enough. There certainly were people at the conference who are still very much driving forward by looking in the rearview mirror. But I see change. I'm hopeful we're heading in the right direction and making progress.

We are at a critical moment. The impacts of climate change are increasing. All of us are feeling it: more powerful and destructive storms, drought and heat waves. If we can control methane and the powerful but short-term effect it has on climate, we will limit the near-term damage from climate change, while we address the larger and more complicated issue of reducing carbon dioxide. This will involve a radical shift in how we use energy. I'm optimistic we can do it. But, we have no time to waste, and we can't afford to leave any opportunity to reduce methane or any other global warming pollutant untaken.

For more information, please contact EDF Member Services at 800-684-3322 or email members@edf.org.

Environmental Defense Fund
257 Park Avenue South
New York, NY 10010

T 212 505 2100
F 212 505 2375
edf.org

New York, NY / Austin, TX / Bentonville, AR / Boston, MA / Boulder, CO / Raleigh, NC / Sacramento, CA / San Francisco, CA / Washington, DC / Beijing, China / La Paz, Mexico / London, UK