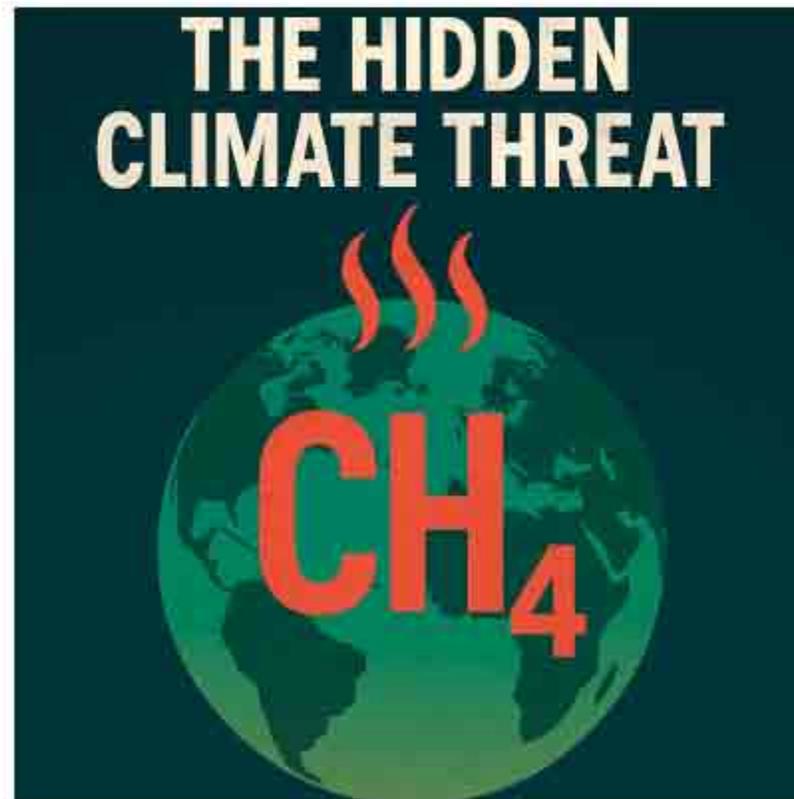




MIT Alumni for Climate Action



Introduction

💧 When we think of climate change, carbon dioxide (CO₂) usually takes center stage. But lurking in the background is another potent player—methane (CH₄). Often overlooked, methane is quietly driving global warming at an alarming rate. Over a 20-year period, it traps about **84 times more heat than CO₂**.

Methane's concentration in the atmosphere is much lower than CO₂, its heat-trapping ability makes it's a major player. Methane's **direct contribution to warming is ~30%**, and possibly **higher (35-40%)** when accounting for indirect effects like ozone formation and atmospheric aerosols

🌍 But methane's impact doesn't stop at climate. It also harms our health. Methane contributes to the formation of **ground-level ozone** and fine particulate pollution (PM_{2.5}). These pollutants can trigger or worsen breathing problems, heart disease, cancer and strokes. Methane is also often released along with other toxic air pollutants (VOCs such as benzene, toluene, xylene and more) further harming our health..

What is Methane?

🔬 Methane is a **simple but potent gas** made of one carbon atom and four hydrogen atoms (CH_4). It's **colorless and odorless**, but don't let that fool you—it's one of the most impactful greenhouse gases.

🏠 **In everyday life**, methane is the main component of **natural gas** used for heating, cooking, and generating electricity. While cleaner-burning than coal or oil, natural gas leaks—whether from **pipelines**, **storage tanks**, or **appliances**—makes it a major problem.

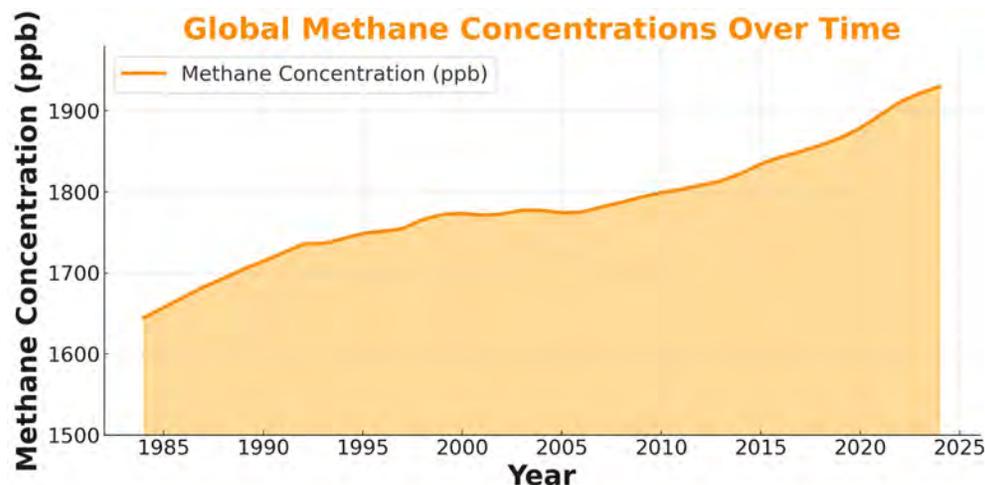
Here's a breakdown of major methane leak sources:

🏠 **Fossil Fuels (~30%)**: Leaks from oil & gas operations and coal mining.

🐄 **Livestock (~30%)**: Livestock like cows and sheep produce methane through **enteric fermentation**—a natural digestive process that releases methane as a byproduct. Manure management also contributes.

🗑️ **Landfills (~20%)**: Decomposing organic waste emits large amounts of methane.

🌾 **Rice Paddies (~10%)**: Flooded fields create conditions for methane-producing microbes.



Why is methane a bigger problem than we thought?

✧ Methane has a global warming potential **84 times greater than CO₂ over 20 years**. Recent headlines suggest the problem is **worse than we thought**:

Methane A crucial opportunity in the climate fight:

At least 25% of today's global warming is driven by methane from human actions.

Methane Emissions Rising Rapidly:

A Stanford-led study reports that global methane emissions have increased **faster over the past five years** than ever before, posing a serious threat to climate goals.

A Vicious Cycle: Warming Wetlands Intensify Emissions:

Research indicates that **Arctic warming** is accelerating methane releases from wetlands, creating a feedback loop that could **exacerbate climate change**.

Global Landfill Methane Emissions Underestimated:

A study published in *Nature* found that methane emissions from landfills worldwide may be **underestimated by up to 200%** at individual sites.

Real-world Methane Leaks?

📍 Real-World Methane Leaks:

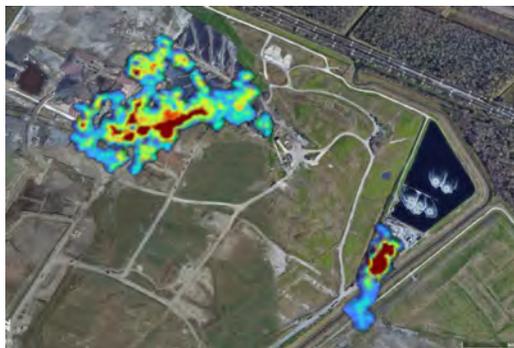
Permian Basin, Texas: Studies using state of the art technologies reveal methane leaks of 1.4 Million Tons per year – enough gas to meet the demands of 2 million homes. This is nearly 3 times more methane than EPA estimates.

Kazakhstan Well Blowout (2023):

A well blowout in remote Kazakhstan caused a fire lasting over six months, releasing an estimated **127,000 tons of methane**, as revealed by satellite analysis

Boston, Massachusetts: Aging natural gas pipes leak methane under city streets, contributing to both climate change and public safety risks.

More than Half of US Landfills maybe Methane Super-Emitters: Aerial observations of hundreds of large landfills across 18 states found they are leaking 40% more methane than is reported to the EPA. Technology exists to capture and convert the gas into energy.



Satellite image of a leak from an Oil and Gas Site



Pipeline leaks in Boston

What are the Solutions?

The good news? We can **tackle methane emissions right now!**

Human-caused methane emissions could be reduced by as much as **45% within the next decade**, potentially averting nearly **0.3 °C of global warming by 2045**.

The consequent reduction in ground level ozone could prevent 260,000 premature deaths, 775,000 asthma related hospital visits, 73 Billion hours of lost labor from extreme heat and 25 million tons of crop losses.

Key solutions include

 **Oil & Gas Leak Detection and Remediation (LDAR) Solutions:** Advanced sensors that detect leaks rapidly from pipelines and wells.

 **Livestock Solutions:** Feed additives (like seaweed) reduce methane from digestion. Better manure management helps too.

 **Landfill Solutions:** Capturing methane for energy and composting organic waste.

 **Policy:** Strong methane reduction targets, incentives for leak detection, and global commitments like the **Global Methane Pledge**.

 **Personal Actions:** Reducing food waste, eating plant-based meals, and supporting sustainable agriculture.

Personal Actions that Matter!

Food & Waste

- **Compost food waste & Yard waste** → Avoids Landfill methane, healthier soil.
Yard trimmings make up 13% of municipal solid waste.
Each ton of food waste composted avoids 0.62 metric tons of CO₂e
- **Eat less red meat** → Beef has 10x the footprint of turkey

Energy Use at Home

- **Fix leaky natural gas appliances** (lower your bill while improving your family's health)
- **Switch from natural gas to electric** (heat pumps, induction stoves) → a single gas stove (even when turned off) can emit methane. Children in homes with gas stoves have a 42% higher risk of asthma symptoms.
- Choose **Renewable energy plans** or rooftop solar if possible

Community & Advocacy

- **Support local composting + waste diversion programs**
- **Encourage utilities to fix gas leaks** (many cities have aging pipelines)
- Support **landfill gas capture** programs in your city (waste → energy)
can reduce landfill emissions by 60-90%

Why should we act now?

⚡ Cutting methane is **fast, affordable, and effective**:

🔑 **Immediate impact:** Methane breaks down in ~12 years, so action today slows warming quickly.

🌿 **Cleaner air:** Reducing methane also cuts pollutants that harm our health.

💰 **Economic gains:** Leak detection can save billions in wasted gas.

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Conclusion

Methane may be invisible, but its impact is **undeniable**. Tackling this hidden threat offers one of our **best chances to slow warming** and build a healthier, more sustainable future. Let's not wait. Let's act—because **every ton of methane cut makes a difference**.

Some useful references?

If you're curious to learn more about methane and how it affects our climate, check out these valuable resources:

[Global Methane Assessment \(UNEP\)](#) – Comprehensive analysis of methane's impact and mitigation strategies.

[IPCC Sixth Assessment Report](#) – Key insights into methane's role in climate change.

[Global Methane Pledge \(U.S. and EU Initiative\)](#) – Learn about this international commitment to cutting methane emissions.

[Environmental Defense Fund \(EDF\)](#) – Clear explanations of methane science and solutions.

[TED Talks](#): A series of engaging talks that bring to life the urgency of methane emissions and highlight actionable solutions

[MethaneSAT](#): For those curious about methane leaks, MethaneSAT offers unparalleled transparency by showing where emissions are occurring