Congressional Climate Camp: Non-CO2 Greenhouse Gases

Materials will be available at: www.eesi.org/022323camp
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Thursday, February 23, 2023
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In addition to a full portfolio of federal policy work, EESI provides direct assistance to utilities to develop “on-bill financing” programs

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We recognize that systemic barriers impede fair environmental, energy, and climate policies and limit the full participation of Black, Indigenous, people of color, and legacy and frontline communities in decision-making

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Climate Change Solutions
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Timely, objective coverage of environmental, clean energy, and climate change topics

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Active engagement on Twitter, Facebook, LinkedIn, and YouTube
Upcoming Briefings in this Series

Congressional Climate Camp

Budget and Appropriations | Thursday, January 26, 2-3:30 PM

Public Polling on Climate Change | Thursday, February 9, 2-3:30 PM

Non-CO2 Greenhouse Gases | Thursday, February 23, 2-3:30 PM

Implementing the Inflation Reduction Act and Infrastructure Investment and Jobs Act | Thursday, March 9, 2-3:30 PM

Briefing RSVP here: eesi.org/2023cc
Non-CO$_2$ – Fast Climate Solutions to Slow Warming in the Near Term

Gabrielle Dreyfus, Chief Scientist
Institute for Governance & Sustainable Development (IGSD)

EESI Congressional Climate Camp
23 February 2023
Strategies Targeting Non-CO$_2$

**Slow warming in the next 20 years**
Cutting SLCPs could avoid 4X more warming in 2050 than decarbonization alone

**Improve health**
Black carbon and ozone (including from methane) are major air pollutants; avoid millions of premature deaths

**Increase food security**
Avoid billions in dollars in crop losses from ozone and heat damage; cut N$_2$O with precision agriculture

**Avoid energy waste**
Fix leaks and capture emissions that waste 110 million metric tons of methane every year
<table>
<thead>
<tr>
<th>Super Climate Pollutants</th>
<th>Short-lived Climate Pollutants (SLCP)</th>
<th>Long-lived Greenhouse Gases (GHG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide (CO₂)</td>
<td>1 (potency over 20 years)</td>
<td>1 (potency over 100 years)</td>
</tr>
<tr>
<td>Nitrous oxide (N₂O)</td>
<td>273 (potency over 20 years)</td>
<td>273 (potency over 100 years)</td>
</tr>
<tr>
<td>Methane (CH₄)</td>
<td>81 (potency over 20 years)</td>
<td>28 (potency over 100 years)</td>
</tr>
<tr>
<td>Hydrofluorocarbons (HFCs)</td>
<td>1 – 12,400 (potency over 20 years)</td>
<td>1 – 14,600 (potency over 100 years)</td>
</tr>
<tr>
<td>Ground-level ozone (O₃)</td>
<td>Not directly emitted</td>
<td></td>
</tr>
<tr>
<td>Black carbon</td>
<td>2400* (potency over 20 years)</td>
<td>660* (potency over 100 years)</td>
</tr>
</tbody>
</table>

**IPCC AR6 WGI (2021) Table 7.SM.7; * IPCC AR5 WGI (2013) Table 8.SM.17**
Climate Change Impacts Today

- Feeling impacts of human caused climate change today — sooner and more severe
- Ex. PNW heat wave, drought, severe storms
- Every fraction of degree matters

United States Billion-Dollar Disaster Events 1980-2022 (CPI-Adjusted)

- Drought Count
- Flood Count
- Freeze Count
- Severe Storm Count
- Tropical Cyclone Count
- Wildfire Count
- Winter Storm Count
- Combined Disaster Cost
- Costs 95% CI
- 5-Year Avg Costs

NOAA (2023) [https://www.ncei.noaa.gov/access/billions/](https://www.ncei.noaa.gov/access/billions/)
Short-lived climate pollutants (methane, HFCs, black carbon, ozone) contribute half of total warming.

Cutting SLCPs could avoid 4X more warming in 2050 than decarbonization alone.

IPCC AR6 WGI Figure SPM.2
Dual strategy combine SLCP sprint with CO$_2$ marathon

SLCP Climate Benefits
Avoided global warming

Rapid implementation of SLCP mitigation measures, together with measures to reduce CO$_2$ emissions, would greatly improve the chances of keeping the Earth’s temperature increase to less than 2°C relative to pre-industrial levels.

Source: Climate and Clean Air Coalition (2014) *Time to act to reduce short-lived climate pollutants* (based on Ramathan)
Montreal Protocol – Benefits Extend Beyond Fixing the Ozone Hole

• Ozone hole is recovering thanks to compliance with 1987 Montreal Protocol on Substances that Deplete the Ozone Layer and amendments phasing out HCFCs.

• Avoided 0.5–1.0°C of warming by 2050 by stopping build-up of potent CFCs, HCFCs, Halons; protecting terrestrial plants and carbon sink from UV will avoid up to an additional 1.0°C by 2100.

• Avoided hundreds of millions of cases of skin cancer and cataracts.

• 2016 Kigali Amendment phases down production and use of HFCs; ratified by Senate in September 2022; EPA currently implementing American Innovation and Manufacturing (AIM) Act of 2020.

WMO (2022) Scientific Assessment of Ozone Depletion; Young et al. (2021)
Implementing the 2016 Kigali Amendment and aggressively phasing down HFCs will avoid 0.1 °C by 2050.

Even more with energy efficiency.

Figure ES-4. HFC emissions (left) and their impact on global average surface temperature (right). Shown is a scenario without global HFC control measures (the ‘baseline’ scenario from the 2018 Assessment, blue area) and the 2018 and 2022 scenarios assuming full compliance with the Kigali Amendment (orange and pink, respectively). Also shown is a scenario assuming that the global production of HFCs ceased in 2020 (black dashed line). For comparison, the total warming from all greenhouse gases is projected to be 1.4 °C to 4.4 °C by the end of the 21st century, relative to 1850–1900, following IPCC (2021) projections. The contribution from HFC-23 emissions is not included here.

WMO (2022) Executive Summary. Scientific Assessment of Ozone Depletion
Lifecycle Refrigerant Management

- Roughly 100 billion metric tons CO$_2$e avoidable emissions this century (*additional* to Kigali Amendment)
- Refrigerant and foam banks will continue to grow under the HFC phase-down
- Most emissions are preventable through reducing leaks and end-of-life release
- ~60% consumption for filling existing equipment

<table>
<thead>
<tr>
<th>ODS &amp; HFC Refrigerants (GtCO$_2$e)</th>
<th>Current</th>
<th>Through 2050</th>
<th>Through 2100</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>3.6</td>
<td>6.9</td>
<td>9.2</td>
</tr>
<tr>
<td>Global</td>
<td>34</td>
<td>61</td>
<td>91</td>
</tr>
</tbody>
</table>

*EIA, NRDC, IGSD (2022)*
Strategies Targeting Non-CO$_2$

Slow warming in the next 20 years
- Cutting SLCPs could avoid 4X more warming in 2050 than decarbonization alone

Improve health
- Black carbon and ozone (including from methane) are major air pollutants; avoid millions of premature deaths

Increase food security
- Avoid billions in dollars in crop losses from ozone and heat damage; cut N$_2$O with precision agriculture

Avoid energy waste
- Fix leaks and capture emissions that waste 110 million metric tons of methane every year
Resources

- Climate and Clean Air Coalition [https://www.ccacoalition.org/en](https://www.ccacoalition.org/en)
- IGSD (2022) *The Need for Fast Near-Term Climate Mitigation to Slow Feedbacks and Tipping Points*.
- IGSD (2023) *A Primer on Cutting Methane: The Best Strategy for Slowing Warming in the Decade to 2030*.
Thank you!

Gabrielle Dreyfus
gdreyfus@igsd.org
"The methane gushing out of the damaged Nord Stream pipelines is another type of climate catastrophe. It represents the amount of methane — emitted every single day — on average from oil, gas and coal energy systems, totaling about 110 million metric tons annually. Most of this wasted methane could be avoided or captured at low net cost and often at a net savings."
Non-CO$_2$ Climate Solutions to Slow Warming in the Near Term

Gabrielle Dreyfus, PhD

*Chief Scientist*

Institute for Governance & Sustainable Development

EESI Congressional Climate Camp

23 February 2023
Short-lived climate pollutants: Black carbon and methane

Susan Anenberg, PhD

February 23, 2023

Congressional Climate Camp: Non-CO2 Greenhouse Gases

Milken Institute School of Public Health

THE GEORGE WASHINGTON UNIVERSITY
Short-lived climate pollutants refer to species that are both climate-warming agents and air pollutants.

I will focus on two of many short-lived climate pollutants: black carbon (a component of PM$_{2.5}$) and methane (a precursor to ozone).
Health effects of major air pollutants

A “Pyramid of Effects” from Air Pollution

- **PM$_{2.5}$**
  - Cardiovascular effects
  - Respiratory effects
  - Nervous system effects
  - Cancer
  - Mortality

- **Ozone**
  - Respiratory effects
  - Cardiovascular effects
  - Mortality

Which path will we take?

Temperature (°C) relative to 1890-1910

- Reference
- Long-lived GHG mitigation
- CH$_4$ and BC mitigation
- Long-lived GHG, CH$_4$ and BC mitigation

*UNEP/WMO Integrated Assessment of BC and Ozone, 2011*

*Shindell et al. Science, 2012*
Particulate Matter Impacts on Climate
Black Carbon

Diesel vehicles emit black carbon (soot) into the atmosphere.

Photo: US Environmental Protection Agency
Black Carbon Sources

• Black carbon, a component of PM$_{2.5}$, is an important short-lived climate pollutant and is emitted by diesel exhaust, biomass for cookstoves, and the burning of coal and biofuels.

• Developing nations are the highest emitters of black carbon.

• Black carbon particles are strong absorbers of solar radiation, and the global warming potential of black carbon over 100 years ranges between 1,055–2,020 (relative to a global warming potential of 1 for CO$_2$).

Source: GRID-Arendal/UNEP
Black carbon, or soot, is part of fine particulate air pollution (PM₂.₅) and contributes to climate change.

**Sources**
- **Household Energy**: 51%
- **Transport**: 26%
- **Agriculture**: 8%
- **Industrial Production**: 5%
- **Waste**: 5%
- **Fossil Fuel Operations**: 3%
- **Large-scale Combustion**: 2%

**Impacts**
- **Health**:
  - Deaths from:
    - Stroke: 24%
    - Heart disease: 29%
    - Lung disease: 25%
    - Liver cancer: 43%
- **7 million pollution-related deaths every year**

**Lifetime in Atmosphere**: Up to 2 weeks

**CLIMATE**
- Absorbs sunlight and converts it to heat

**Snow & Ice**
- Accelerates the melting of snow and ice

**Weather**
- Prevents clouds from forming
- Alters regional weather patterns and rainfall

**Agriculture & Ecosystems**
- Reduces sunlight
- Affects plant health and productivity

www.ccacoalition.org/black-carbon
# Black Carbon: Mitigation Options

<table>
<thead>
<tr>
<th>Energy</th>
<th>Transport</th>
<th>Agriculture</th>
<th>Fossil Fuels</th>
<th>Waste Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replace traditional cooking to clean burning modern fuel cookstoves</td>
<td>Use diesel particular filters for road and off-road vehicles</td>
<td>Ban open-field burning of agricultural waste</td>
<td>Capture and improve oil flaring and gas production</td>
<td>Ban open burning of municipal waste</td>
</tr>
<tr>
<td>Replace traditional cooking and heating with clean-burning biomass stoves</td>
<td>Fast transition to Euro VI/6 vehicles and soot-free buses and trucks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eliminate kerosene lamps</td>
<td>Eliminate high-emitting diesel vehicles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace lump coal with coal briquettes for cooking and heating</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace wood stove and burners with pellet stoves and boilers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modernize traditional brick kilns to vertical shaft brick kilns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modernize coke ovens to recovery ovens</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ozone Precursors and Radiative Forcing

(a) Effective radiative forcing
1750 to 2019

Emitted Components
- CO₂
- CH₄
- N₂O
- CFC + HCFC + HFC
- NOₓ
- NMVOC + CO
- SO₂
- Organic carbon
- Black carbon
- Ammonia

Climate effect through:
- Carbon dioxide (CO₂)
- N₂O
- CFC + HCFC
- HFC
- Methane (CH₄)
- Ozone (O₃)
- H₂O (strat)
- Aerosol-radiation
- Aerosol-cloud
- Sum
Methane emissions caused by human activities are one of the most significant drivers of climate change. Methane is also the main precursor of tropospheric ozone, a powerful greenhouse gas and air pollutant.

**Sources**
Methane is one of the fastest growing greenhouse gases in the atmosphere. Human activity causes 2/3 of emissions.

- 42% AGRICULTURE
- 36% FOSSIL FUEL OPERATIONS
- 18% WASTE
- 3% OTHER

**Impacts**

- **Climate**
  - Responsible for 40% of warming since the industrial revolution
  - 86x more powerful than carbon dioxide over a 20-year period

- **Health**
  - Increasing emissions are driving a rise in tropospheric ozone air pollution, which causes 1.4 million premature deaths annually. Methane is responsible for roughly 1/2 of these deaths.
  - Respiratory diseases
  - Heart disease
  - Damaged airways and lung tissue

- **Agriculture & Ecosystems**
  - Up to 15% annual yield losses of soy, wheat, rice and maize

**Lifetime in Atmosphere:**
12 YEARS

Since methane does not last long in the atmosphere, efforts to reduce it will bring immediate benefits for the climate and human health.

[www.ccacoalition.org/methane](http://www.ccacoalition.org/methane)
# Methane: Mitigation Options

## Agriculture
- Improve manure management and animal feed quality
- Apply intermittent aeration of continuously flooded rice paddies
- Improve animal health and husbandry by combining herd and health management, nutrition and feeding management strategies
- Introduce selective breeding to reduce emission intensity and increase production
- Promote farm-scale anaerobic digestion to control methane emissions from livestock
- Adopt guidelines on healthy dietary choices

## Waste Management
- Separate and treat biodegradable municipal waste, and turn it into compost or bioenergy
- Upgrade wastewater treatment with gas recovery and overflow control
- Improve anaerobic digestion of solid and liquid waste by food industry
- Upgrade primary waste water treatment
- Divert organic waste
- Collect, capture and use landfill gas

## Fossil Fuels
- Carry out pre-mining degasification and recovery and oxidation of methane from ventilation air from coal mines
- Reduce leakage from long-distance gas transmission and distribution pipelines
- Extend recovery and utilization from gas and oil production
- Recover and use gas and fugitive emissions during oil and natural gas production

https://www.ccacoalition.org/en/slcps/methane
Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants

77 countries
78 non-state partners
Methane: Congressional Climate Camp on Non-\text{CO}_2\text{ Greenhouse Gases}

Deborah Gordon
Senior Principal, Climate Intelligence Program

EESI Briefing Series
February 23, 2023
THE EVIDENCE IS CLEAR: THE TIME FOR ACTION IS NOW.
—Intergovernmental Panel on Climate Change

Average annual greenhouse gas emissions were at their highest levels in human history over the past decade.

We can halve emissions by 2030.
Methane is playing a major warming role.

- Methane is >80 times more climate forcing than CO$_2$ using a 20-years global warming potential.
- But methane’s ~10-year lifetime, it is >100 times more climate forcing than CO$_2$.
- IPCC finds that climactic warming from methane rivals carbon dioxide, within error.

**Assessed contributions to observed warming in 2010–2019 relative to 1850–1900. Source: IPCC, AR6, Figure SPM.2, 2021.**
Methane emissions are concentrated in a few sectors.

28 Mt per year in US
Estimated* total human-made methane

* Carbon Mapper aerial surveys and satellites are identifying significant methane super-emitters that suggest undercounting in Current national (and global) methane inventories.

2020 US Methane Emissions, by source
## What is co-emitted with methane?

<table>
<thead>
<tr>
<th>Natural Gas Main Components</th>
<th>Volume %</th>
<th>Air Toxins in Gas Study Samples</th>
<th>Concentration (ppm_v)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>&lt;70 - &gt;90%</td>
<td>Benzene</td>
<td>165</td>
</tr>
<tr>
<td>Natural Gas Liquids</td>
<td>5-15%</td>
<td>Toluene</td>
<td>161</td>
</tr>
<tr>
<td>CO₂ &amp; H₂S</td>
<td>5-40%</td>
<td>Ethylbenzene</td>
<td>13</td>
</tr>
<tr>
<td>Oxygen, nitrogen &amp; other impurities</td>
<td>1-5%</td>
<td>Xylene(s)</td>
<td>75</td>
</tr>
</tbody>
</table>

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*Residential pipeline gas may have fewer toxin content than industrial gas*
Methane in Oil & Gas and Waste Sectors
Making emissions visible

Targeting the outsized threat and opportunity by preventing super-emitters

Climate, air quality, public health and environmental justice issues

GOM Offshore Platform: 66% methane leakage rate in state waters

New Orleans Landfill: 2,000 kg methane per hour

Methane super-emitters in disadvantaged communities
Quantify, attribute, and mitigate methane

Preventing leakage eliminates one-half of the oil and gas industry’s climate impact.


Modeling ~70% global O&G supplies.
Leverage emissions transparency for decarbonization across supply chains

- Expanded emissions visibility
  - Measure, Model & Quantify
  - Account, Digitize & Track
  - Standardize & Certify

Will drive decarbonization on several fronts

- Emissions-differentiated market activation
- Climate-aligned corporate business models
- Better investor portfolio allocations
- Informed government policy and regulation
We can manage what we can measure

It’s wasteful, harmful, and dangerous to leak gas.

The oil and gas industry is the #2 source of human-made methane.

But it's #1 for reduction potential.

Leaking over ~3% of produced gas makes it more damaging to the climate than coal.

Publicly track oil and gas asset ownership to ensure consistency between federal and state agencies.
Waste MAP (Methane Assessment Platform)

- Visualizes data for decision makers
- Combines top down and bottom up emissions
- Deep dives provide feedback loop with richer data

Proposed Concept
Two-Pronged Approach to Waste Methane Mitigation

**WASTE MAP**

- **Open-Source Platform**
  - Designed to collect and improve availability and robustness of global waste sector data and enable methane emissions transparency

- **Decision Support Tools**
  - The platform will include a heat map of methane emissions from waste, strategic playbooks for waste methane mitigation, and case studies

**COUNTRY DEEP DIVES**

- **On-the-Ground Support**
  - Subnational and national engagement to support a pathway for waste management improvements, improve public health, and reduce environmental impact

- **Information Sharing**
  - Creating and convening a network of waste experts and peer-to-peer exchange to share global waste management practices.

Prioritized methane in this decisive decade.

Increase transparency:
- Fund public methane monitoring to spot leakage in industry supply chains using satellites, aerial leak detection, and ground-based optical imaging.

Track methane:
- Track, quantify, and attribute emissions through non-proprietary reporting so that responsible parties develop mitigation plans and curtail emissions.

Establish methane markets:
- Use an independent, verifiable certification process to differentiate commodities and price them based on their emissions to incentivize rapid methane reduction.

Advance policymaking:
- Convert voluntary market standards, meet national pledges, adopt mandatory performance standards, extend methane fees, and create financial instruments.
What we’ve learned over the past 40 years shapes what we choose to work on

**Expertise**
- Energy systems
- Supply chains
- Market forces

**Influence**
- Access to key actors
- Radical collaboration
- Communication

**Impact**
- Catalytic opportunities
- Relentless monitoring + evaluation

**Inclusion**
- Deeply committed to DEIJ
- Transition benefits all

RMI is transforming global energy use to secure a clean, prosperous, zero-carbon future — for all.
In addition to preserving natural resources and mitigating climate change...

“Cutting methane emissions [is] a critical environmental justice opportunity and a critical way to save hundreds of thousands of lives.”

— Rick Duke
Senior director and White House liaison for U.S. special climate envoy John Kerry
Thank you!

Deborah Gordon
dgordon@rmi.org
@RMIllemissions
Agricultural Emissions of Nitrous Oxide and Methane

Environmental and Energy Study Institute, Briefing Series: Congressional Climate Camp
February 23, 2023

Eric A. Davidson
Professor, University of Maryland Center for Environmental Science
Principal Scientist, Spark Climate Solutions
However, when using 20-year GWPs, the calculated contribution of CH$_4$ increases from 11% to 24% and the total contribution from agriculture increases from 10% to 15%.

Agriculture sector contribution:
~40% of CH$_4$ emissions
~75% of N$_2$O emissions
~10% of total GHG emissions

N$_2$O is not only a potent GHG, but also an important reactant in destruction of the protective layer of stratospheric ozone.
Livestock emissions are the largest category without the needed suite of solutions yet.


Project 2030 Emissions (Mt/yr)

- No technical solutions yet
- Technically- (but not economically-) feasible mitigation
- Economically-feasible mitigation

Note: Portion of emissions shown as addressed using methane removal are hypothetical.
The methane produced by a cow is energy wasted; it could be used by the cow to produce more meat or milk, hence increasing profitability for the farmer.
Two-Thirds of US emissions are from grazing cattle, which are much harder to access than housed cattle.

What will happen without action and new technology

- Enteric Emissions projected to increase 30% by 2050
- Enacting proven solutions will reduce those emissions by 30%
- Therefore without innovation we will stand still

Commercial solutions can only address <10% of US livestock enteric methane emissions (less globally)
Global nitrogen fertilizer input for 2015

(Mueller et al., 2017, Global Biogeochemical Cycles)
Nitrogen: A Very Leaky Element

Historic and projected $\text{N}_2\text{O}$ emissions under the Shared Socioeconomic Pathways (SSPs) in the Coupled Model Intercomparison Project Phase 6 (CMIP6) for the sixth assessment (AR6) of the IPCC. Tian et al. 2021. Nature
The **4Rs** for incrementally improving nitrogen use efficiency in croplands:

1. **Right Source**: slow release fertilizers, balanced nutrients
2. **Right Rate**: soil testing, crop sensors, on-line tools, professional crop advisors and extension agents
3. **Right Time**: spring vs. fall; more frequent but smaller doses aligned with crop growth needs
4. **Right Place**: broadcasting vs. injection into the soil

Agronomic practices and technologies to improve nitrogen use efficiency:

- Cover crops
- Nitrification inhibitors
- Conservation tillage
- Increased crop diversity
- Re-integration of crop and livestock production
- Livestock feed management and manure management
- Precision agriculture
- Regenerative agriculture/climate smart agriculture
Non-technological needs for improving nitrogen use efficiency

• Social science investigations of farmer decision making and technology adoption
• Farmer engagement in on-farm research

Longer-term, more transformational strategies needing R&D:

• N fertilizer synthesized with renewable energy or through new catalytic pathways and possibly at the farm scale
• Crop breeding to extend growing seasons, reduced grain N, and retain N in roots
• Feeding livestock synthetic amino acids in lieu of N-rich crops

These transformative advances would begin to uncouple N₂O emissions from food production
Figure ES-1: Agricultural R&D Spending on Climate Mitigation (2017–2021 Average)

- **Enteric Methane**
- **Rice Cultivation**
- **Manure Management**
- **Soil Management (N₂O)**
- **Soil Carbon Sequestration**

**Total**

**Sponsoring Agency/Program**
- ARPA-E
- ARS Mitigation
- ARS USGCRP
- FFAR
- NIFA AFRI
- NIFA Hatch
- NIFA SARE
- NSF
- Other NIFA

LAB TO FARM

BREAKTHROUGH
INSTITUTE
The Next Decade is Critical

Minimizing peak temperatures requires livestock enteric methane research today.

**Goal:** Aggressive R+D, and capacity-building investment to develop and test solutions

2023

**Goal:** Solutions discovered, and being commercialized

2030

**Goal:** Minimize methane emissions → full global deployment of solutions that reduce methane by 90%+

2040

**Goal:** Minimize atmospheric methane levels to minimize peak warming

2050

Research timelines are uncertain, and must start now.

Solutions will take at least a decade to commercialize, scale, and be fully adopted.

Atmospheric lifetime of methane is about a decade.
What did you think of the briefing?

Please take 2 minutes to let us know at:
www.eesi.org/survey

Materials will be available at:
www.eesi.org/022323camp

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Thursday, February 23, 2023