Provisions for
Reducing and Removing
Greenhouse Gases and Black Soot
For Inclusion in the
Interior - EPA Appropriations Bill for FY22

Coordinated and Coauthored
By
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On behalf of
Methane Action
And Scientific and Public Interest Allies.[1]

June 5, 2021

(1) Reducing emissions and concentrations of greenhouse gases and black soot (climate forcing agents). In order to reduce greenhouse gases and other climate forcing agents to historically healthy levels as soon as possible the Administrator of the Environmental Protection Agency (EPA), in consultation with the Secretaries of Energy, Agriculture, the Interior, State and Treasury, the Administrator of USAID, the Chief Executive Officers of the Millennium Challenge Corporation and the U.S. International Development Finance Corporation and the Export Import Bank, shall, as directed below:

> **A)** Use his existing authorities including but not limited to the Clean Air Act, the Toxic Substances Control Act, the Comprehensive Environmental Response and Control Act, the Resource Conservation and Recovery Act, the Clean Water Act, the Independent Agencies' Appropriations Act, to propose and promulgate regulations before July 4th, 2022 expediting the limitation or elimination of emissions of, and the removal from the atmosphere of methane, carbon dioxide, and other climate forcing agents in such a manner as to require the adoption of technologies that are designated by the Administrator annually as cost-effective and report to the Committees of jurisdiction on those that could be given further development.

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[1] John M. Fitzgerald is a former House Subcommittee Counsel and Legislative Aide handling energy and environment where he helped to staff the Congressional Solar Energy Caucus. He is former chief counsel, policy director and current board member of conservation science and policy non-profit organizations. Contributing organizations include in addition to Methane Action, OceansX, Remineralize the Earth, Climate Protection and Restoration Initiative, and members of Restore Our Climate, as well as numerous individual climate, chemistry, and other experts primarily in the U.S. and Europe.

B) Review existing and pending patents and relevant scientific and other literature for methods of removing methane, carbon dioxide and other climate forcing agents from the atmosphere both near and far from their sources and review methods for reducing or eliminating emissions thereof, as well as grants and contracts for the development of such technologies made by the U.S. and other governments, including but not limited to the United Kingdom, and foundations, and ensure, in consultation and cooperation with the Special Envoy and Domestic Advisor on Climate Change and the appropriate departments and agencies, including but not limited to the Chair of the Council on Environmental Quality, and foreign and international governments, that the research, development, and deployment of such methods is completed and advanced each year to the extent practicable, and incorporated in the Administrators' proposed rules and other actions, and to the extent possible in the actions of other relevant agencies, including but not limited to their foreign assistance, intergovernmental cooperation, and international finance programs, and provisions. The Administrator shall complete the steps of paragraph, (B), and its subparagraphs below by July 1, 2022 unless otherwise noted in the schedule set forth as follows:

(i) Field test methane oxidation effects of iron in ships' fuel to assess the feasibility of removing methane from the atmosphere in order to reduce its presence as a pollutant with climate forcing and other dangerous effects by increasing the oxidative power of the atmosphere using chlorine atoms generated by iron-containing sea salt aerosols. This technique is called Enhanced Atmospheric Methane Oxidation (EAMO), employing iron salt aerosol to catalyze the oxidation. EAMO mimics the natural methane removal processes. The Administrator shall report to the Committees of jurisdiction and relevant agencies on the effectiveness of EAMO and any co-benefits of oxidizing and removing methane such as removing nitrous oxide, tropospheric ozone and soot. The Administrator shall also inform the Commandant of the Coast Guard and the International Maritime Organization for their use in assessing options for reducing pollution from ships. The Administrator, in consultation with the Secretary of State, the Secretary of the Navy, the Coast Guard, the Governments of Denmark and the Netherlands, and competent civil society, academic and scientific organizations shall contract in FY22 for EAMO Field Tests and an Environmental Impact Statement encompassing the assessment of expanded ship (i) and land-based (ii) deployment.

Field Tests from FY22-24:	$2,156,866
Environmental Impact Statement in advance of expanded EAMO deployment:	$ 348,000

(ii) Enhanced Atmospheric Methane Oxidation (EAMO) via Remote Island Tower. The Administrator is directed to contract for an initial test project to disperse Iron Salts Aerosols ("ISA" in the form of FeCl3) into the atmosphere allowing ISA to work as a photocatalyst that in the presence of sunshine accelerates methane oxidation to CO2 and water. The Administrator shall contract in FY22 with a qualified provider for a trial of EAMO via Island Tower:

$1,207,000.

(iii) Methane Oxidation Monitoring System (MOMS). The Secretary, in consultation with EPA, shall complete a two-year contract to complete a Methane Oxidation Monitoring System (MOMS) using data from multiple existing satellites and from newly installed surface detection equipment, to be deployed on at least twenty ships by July 1, 2023. Ship Deployment and operations budget to be appropriated for FY2023. For development of MOMS in FY2022:

$2,010,000

(iv) Agricultural and silvicultural methane removal. In cooperation with USDA and its agencies, such as the USDA Office of International Research, Engagement and Cooperation, by July 1, 2022, and the Administrators of EPA and USAID, the Secretary shall contract for an evaluation of GHG sequestration, uptake, oxidation and other long term removal methods in agricultural and silvicultural practice, including but not limited to the methods described in paragraphs 4)(I) and (II) below.

I) With a goal of cutting methane emissions from rice cultivation in half, in cooperation with USDA and the Administrators of EPA and USAID, the Secretary shall contract in FY 2022 for a three year test of the impact of various potential additives to rice farming, including but not limited to iron sulfates, approved for organic farming to enhance yields, fight plant chlorosis, and improve the nutritional value of rice crops by enhancing their iron levels in order to fight anemia, in conjunction with other changes in rice farming practice such as targeting the flooding of fields more efficiently:

$3,000,000.

II) In consultation with the Secretary of Agriculture and the Administrators of USAID and EPA, the Secretary shall contract with one or more qualified organizations in FY22 to complete over a period of 18 months an agricultural GHG sequestration program, with an initial focus on Haiti, that includes restoring minerals to the soil

and provides multiple development benefits: to help Haitian agronomists and smallholder farmers adopt the regenerative agriculture practice of soil remineralization, leveraging southern Haiti's enriched basalt geology to restore badly depleted soils and forest ecosystems, launching agroforestry pilot projects, producing more nutritious food, removing excess CO2 from the atmosphere and reducing methane emissions. The project shall include constructing a local supply chain that diverts waste rock dust from Haitian quarries and cement operations to school gardens, smallholder farms, and forest landscape restoration sites, to regenerate soils and restore forest ecosystems needed to replenish local food production and help create a regional Carbon Storage Network (CSN) of communities in southern Haiti working with for-profit, non-profit, and government organizations to design, test, implement and evaluate a methodological framework of Forest Landscape Restoration and Financial Inclusion that can be scaled throughout the Caribbean and globally. $300,000

(v) Achieving methane and other GHG emissions reductions, and potential sequestration and other removal via wetlands management. In cooperation with USDA and the Administrators of EPA and USAID, the Secretary, the Chief of Engineers and Commanding General of the United States Army Corps of Engineers (USACE), and the Commissioner of the Bureau of Reclamation, shall contract in FY22 for one or more investigations of relative wetland emissions of greenhouse gases, through field surveys and laboratory experiments to determine if alternative practices could reduce greenhouse gas emission, without significantly changing the ecosystem of important wetland and other land preserves, recommend such wetland management practices, and evaluate proposals for changing land status, e.g., rewetting drained wetlands. $500,000 per year for 3 years:

$1,500,000

(vi) Restoring Climate Keystone Species. The Secretary of Energy and the Chief of Engineers and Commanding General of the United States Army Corps of Engineers (USACE), and the Commissioner of the Bureau of Reclamation in carrying out their duties under Section 7(a)(1) and (2) of the Endangered Species Act shall assist the Secretaries of the Interior and Commerce, and competent non-government organizations, in establishing a program to enhance the recovery of salmon, whales, elephants and other climate keystone species in the U.S. and other including but not limited to countries in Africa, the Dominican Republic, and Canada

and in U.S. states with species whose ranges overlap with other countries and to the extent possible, measure the climate impact of that work. This shall include negotiating and restoring marine reserves and taking other steps to reduce the carbon footprint of trawling and to protect whales and other climate keystone and water cleansing species such as kelp forests and oysters.

$20,000,000

(**vii) Surface-based Photocatalytic Enhanced Methane Oxidation (SPEMO).** In cooperation with the Environmental Protection Agency and the Secretary of State and the Administrator of USAID the Secretary of Energy shall contract for three years of research and development of surface-based photocatalytic enhanced methane oxidation (SPEMO) to:

I) Lower methane emissions from coal mines, oil wells and animal farms, to ensure that the CH4 concentration from ventilated air is less than 1.7 ppm by volume; and

II) Apply photocatalytic paint to buildings, rooftops, photovoltaic panels, or in a ventilated conduit to reduce methane in the general atmosphere as a complement to commercial photocatalytic paints and coatings already being used because of their self-cleaning property and ability to reduce urban pollution such as nitrogen oxides and volatile organic compounds.

At $1,000,000 per year for a total contract in FY2022 for (I) and (II) of: $3,000,000

(viii) Accelerate the recovery of the stratospheric ozone layer. To complement the schedule for reducing HFCs already in place via the Kigali protocol and U.S. law, in consultation with the EPA, NOAA, and the Scientific Advisory Panel of the Montreal Protocol, and the Secretary of State, the Secretary of Energy shall contract in FY22 for a three year study of technologies for eliminating Ozone Depleting Substances at the source or in the general atmosphere, to promote the use of those found feasible and to develop and publish a comprehensive mitigation plan for reducing emissions and eliminating ozone depleting substances from the atmosphere.

$500K per year for 3 years: $1,500,000

(C) Ensure the environmental and biological assessment of the likely positive and negative impacts, including co-benefits, under the National Environmental Policy Act and Section 7(a)(1) and (2) of the Endangered Species Act and other relevant domestic and international impact assessment procedures, of any methods that have not been the subject of such assessments prior to the deployment of methods of reducing the impact of climate forcing agents or securing the long term removal from the atmosphere of climate forcing agents, including, among other methods, by the addition of minerals such as iron or other nutrients;

To assist in completing Environmental Impact and Biological Assessments of any action that may affect listed species overseas, including but not limited to the projects included in this title, Section 7(a) of the Endangered Species Act is hereby amended by inserting after each phrase "threatened or endangered species" the phrase "in the United States, the high seas or in foreign countries" in order to restore the original full global geographic and substantive scope of the interagency consultation to ensure that process includes biological assessments to avoid jeopardizing the continued existence or recovery of any listed species and to enhance their recovery in the design and operation of proposed actions by the action agencies, and opinions rendered on those assessments by the Secretaries of the Interior and/or Commerce as the case may be, the Secretary of the Interior is appropriated for his use and for pass through grants to the affected agencies as necessary:

$5,000,000

(D) Integrate Pollution Removal in Development Assistance and Trade.

1) The Administrator in consultation with the Administrators of USAID and of ARPA-E, the Chief Engineer of the USACE and the Commissioner of the Bureau of Reclamation, the U.S. Customs and Border Protection, and the Secretary of Commerce, shall calculate the difference between the climate forcing agents and other pollution emitted in the production of fuels, other energy sources, and other goods and services, including but not limited to air, water, toxic and hazardous materials pollution, and waste treatment and landfills or the lack thereof, in other countries and such pollutants emitted in the United States, and the costs of that pollution and of reducing, eliminating, and removing it, and inform U.S. Trade Representative and the Secretary of Commerce and the public here and abroad by publication in the Federal Register and direct notice to the affected ambassadors by June 1, 2022 of the results of those calculations and ensure to the extent practicable that those receiving assistance or permits in programs under their jurisdiction or control or exporting goods or services to the United States will limit and sequester, oxidize or otherwise remove the climate forcing agents or the carbon dioxide equivalent thereof to the extent

practicable currently and endow a fund for the future reclamation of such agents as technical or natural capacities for so doing are available; and

2) The Administrator, in consultation with the Secretary of the Treasury, shall assist the U.S. Customs and Border Protection, and the U.S. Trade Representative and the Secretary of Commerce, in calculating by June 1, 2022 tariff and trade adjustments including if necessary, embargoes, that would internalize the avoided pollution-related costs and externalities that exceed those of comparable production and transportation in the United States; so that they are in a position to impose tariffs and embargoes accordingly by September 1, 2022.

3) By September 15th 2022, the Administrators of the EPA and the U.S. Customs and Border Protection shall use their existing authorities under the Clean Air Act, the Independent Agencies' Appropriations Act and the Toxic Substances Control Act, among others, to impose fees or tariffs on the importation of goods the production and transportation of which releases CO2, methane, and other pollutants that create public or environmental health hazards including but not limited to climate change, and are emitted in excess of the levels permitted by U.S. producers and transporters of comparable goods and to the extent that they are not comparably subjected to such a climate tax in excess of other taxes by the countries of origin of those goods and the parts thereof. After covering the costs of implementing the border adjustments (tariffs or fees) and controls (embargoes or other limits) the Administrator shall create and retain a fund to cover the costs of contracts or grants for the cost-effective removal first, of methane and other short lived climate pollutants, and second, of carbon dioxide.

(E) Ensure Global Governance of GHG removal methods.

Beginning no later than one week after the date of enactment and continuing thereafter, the Administrator shall assist the Secretary of State and the US Trade Representative, in consultation with the Special Envoy for Climate Change, and the agencies participating in the affected U.S. delegations, in proposing and pursuing resolutions and agreements for supporting the proper assessment, deployment and governance of methods of reducing the atmospheric presence of climate forcing agents to historic healthy levels; of assessing the effects thereof to ensure the sufficient, safe and proper use of technologies for reducing the emissions of carbon dioxide, methane, CFCs, HFCs, black soot and other climate forcing agents or the climate forcing impact of them; and for actively removing such agents from the atmosphere, within or apart from existing international agreements in a manner that is complementary to their objectives and not preemptive of any conservation and restoration efforts. Those agreements shall include but not be limited to the UNFCCC and its protocols and accords, the London Convention on Marine

Pollution (via the International Maritime Organization), the Vienna Convention on the Protection of the Ozone Layer and its protocols, UNECE Convention on Long-range Transboundary Air Pollution, the Convention on Migratory Species, the Convention on Biological Diversity and other conservation agreements, the major international trade agreements, and the United Nations, and UNEP, FAO, UNDP and any other relevant subsidiary bodies. $3,000,000

(F) Report on Plans. The Administrator, in cooperation with the Secretary of State shall form a Committee on Climate Restoration comprised of the Secretaries and agency heads tasked under this Title to report as directed in subsections (E) and (F) to the Committees of jurisdiction within ninety days of enactment of their training programs and plans for cooperating with the United Nations, the Organization for Economic Cooperation and Development and their subsidiary bodies, other interested nation states in implementing paragraphs (a)-(d) and for incorporating these elements in their work and measuring the success of their implementation; and

G) Report on Results. Within 180 days of enactment and annually thereafter the Committee on Climate Restoration shall report to the Secretaries and Administrators listed in Section 1, and the Congressional Committees of jurisdiction, on their progress and report any requests and suggestions for expediting the deployment of methods found to be effective in light of their direct and indirect costs and co-benefits as informed in more detail every two years by the assessments produced by and in cooperation with the National Academy pursuant to subsection (G).

H) Comprehensive assessment of atmospheric methane sources, sinks and solutions, and development of a plan for atmospheric methane reduction. The Administrator of the EPA, in cooperation with the Secretary of Energy and the Secretary of State shall by December 1, 2021 commission a report from the National Academy of Sciences to be delivered in draft form by July 1, 2022, and in final form not less than 6 months later, providing (1) an assessment of the size and changes occurring in emission and sinks of methane globally; (2) an analysis of the likely impact of atmospheric methane on climate change and other problems caused by atmospheric methane; (3) a review of each major methane emission source and sink to determine what options are available to affect their impact on atmospheric methane levels; (4) a review of all possible, and all currently practicable, technologies, programs, policy and regulatory changes that could help reduce atmospheric methane levels, whether by abatement (emissions reduction) or remediation (Greenhouse Gas Removal), and for each proposed technology or policy change, consideration of their technological readiness, likelihood of success, barriers hindering implementation, cost-effectiveness and cost-benefit analysis, and likely overall impact on atmospheric methane levels; (5)

development of national and global plans for atmospheric methane reduction, that provide goals and recommendations, and discuss options for investment in new technologies, possible regulatory and land management changes, and other means for reducing atmospheric methane, and the barriers to implementing them.

The Administrator shall ensure that the report and plan are produced with the cooperation of appropriate government agencies, including but not limited to the Secretaries of Interior, Agriculture, Energy, and the Administrators of the EIA and USAID and others included elsewhere in this Section. The Secretary shall further ensure that authors include a range of conservation biology, oceanic, agronomy and atmospheric scientists, among others, as well as economists, engineers, policy makers, regulatory experts. The federal agencies should also provide a companion report discussing their efforts, progress and challenges. The Administrator is directed to commission from his regular budget an NAS report updating the initial report every 2 years.

$4,000,000

Section 2. Citizen Enforcement. Any person who can demonstrate constitutional standing may bring a lawsuit in Federal District Court to require any agency head or other person to comply with this Act or regulations promulgated hereunder. Any substantially successful plaintiff shall be awarded reasonable market rate attorneys' and expert witness' fees and costs.

Section 3. Integrating Climate Restoration across the Government. The program requirements of these Sections are to be integrated into the regular order of business and carried out within the budget authorities and amounts appropriated for each of the affected agencies independent of further appropriations, this section however, hereby also provides such authorization as may be necessary through FY2028 as well as appropriations for FY2022.

Section 4. Severability. If any provision of these sections is found to be contrary to law it may be severed from the remainder without delaying or inhibiting the completion of the rest.

(Committee Report Language Follows)

Committee Report

Provisions for
Reducing and Removing
Greenhouse Gases and Black Soot
For Inclusion in the
Interior-EPA Appropriations Bill for FY22

This report begins with material providing the context and background and ends with a section-by-section analysis of the bill language.

In light of the increased emphasis across the whole of government on reducing emissions of greenhouse gases and other climate forcing agents, and in particular the very powerful short lived climate pollutants such as methane, the Committee has included in the Interior-EPA Appropriations bill provisions for reducing and removing greenhouse gases and black carbon or soot and addressing these and other pollutants in particular in the course of international trade and aid. These are intended to ensure that the Federal Government assists and cooperates across the whole of government and with other governments and international organizations in assessing the risks and benefits of methods of reducing the climate forcing of such agents and ensures the proper development and deployment of methods to reduce both future emissions and the accumulated levels of them in the atmosphere.

The May 2021 groundbreaking report of the Energy Information Agency (https://www.iea.org/news/pathway-to-critical-and-formidable-goal-of-net-zero-emissions-by-2050-is-narrow-but-brings-huge-benefits-according-to-iea-special-report) called for not only for no new oil and gas fields but for increased research and development of new technologies including ways to remove greenhouse gases, although they referred only to carbon as that is so far the primary climate forcing agent that most people understood can be removed or captured until recently.

The doubling of historic levels of methane in recent years presents both a great challenge and an opportunity for international development and cooperation in that the majority of these emissions arise overseas from both natural and human-caused, or anthropogenic, sources. Anthropogenic sources include livestock, gas, coal and oil production, landfills, wastewater such as municipal solid waste, rice cultivation and other agricultural practices such as enteric fermentation, such as the burping of cows depending on their feed among other things, the production of nitrogen fertilizer, and biomass burning, as well as impoundments, or lakes, behind dams. Natural sources such as wetlands and forests, especially in heat stressed conditions, are also major sources. Methods of limiting emissions range from closing leaks in fossil fuel production and transmission as we transition to efficient use of renewables to improving agricultural practices. In recent years researchers in Europe have been developing methods of efficiently oxidizing potentially large

amounts of methane into water and very small amounts of carbon dioxide by providing a small addition of the same minerals such as iron that occur in dust from deserts or smoke from volcanoes.

The opportunity for multiple co-benefits that this scenario presents for foreign aid and diplomacy is also immense. Controlling methane leaks and other pollution is unlikely to be dependably done from Myanmar to Venezuela without help from and monitoring by developed nations. The lack of iron in the diets of poor populations dependent on rice is a major public health problem yet research shows that a small addition of organic iron-rich fertilizer can not only solve that problem and increase yields but is likely to reduce methane emissions when combined with other rice management techniques. The same is likely to be true for phytoplankton, fish stocks, and whale recovery in the oceans and in other ecosystems where iron is a limiting factor in the health of the food chain as iron has now been found to be at such low levels as to limit the growth in ocean plant and animal life.[2]

Likewise, the restoration of terrestrial forests, kelp forest, and marine wildlife can greatly reduce climate change and provide an economic return that is estimated at $10 trillion.[3] Studies of the role of the ocean's food chain from the great whales down to phytoplankton have shown that the loss of 70-90% of the great whales from whaling and other human activities removed not only their ability to store carbon but the iron that these whales once deposited in their waste. The loss of that iron has reduced the phytoplankton that forms the basis of almost the entire ocean food chain and its carbon sequestration services. [4]

The International Monetary Fund has calculated that taking steps to restore the great whales and forest elephants would return billions of dollars worth of climate services. For example:

> If whales were allowed to return to their pre-whaling number of 4 to 5 million—from slightly more than 1.3 million today—it could add significantly to the amount of phytoplankton in the oceans and to the carbon they capture each year. At a minimum, even a 1 percent increase in phytoplankton

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[2] Science News--Iron deficiency restrains marine microbes -- Scientists discover important process in the nutrient cycles of the tropical North Atlantic, May 19, 2017, Helmholtz Centre for Ocean Research Kiel (GEOMAR) *Summary:* Iron is a critical nutrient in the ocean. Its importance for algae and the nitrogen cycle has already been investigated in detail. Now a new discovery shows that microbes also need iron to process phosphorus. A team of researchers has completed a study showing that iron can limit phosphorus acquisition in the ocean.

[3] – See https://climategamechangers.org/game-changers/climate-restoration/marine-permaculture-arrays/

[4] "A strategy to protect whales can limit greenhouse gases and global warming" by Ralph Chami, Thomas Cosimano, Connel Fullenkamp, and Sena Oztosun

https://www.imf.org/external/pubs/ft/fandd/2019/12/index.htm

> productivity thanks to whale activity would capture hundreds of millions of tons of additional CO_2 a year, equivalent to the sudden appearance of 2 billion mature trees. Imagine the impact over the average lifespan of a whale, more than 60 years.[5]

To date most of the funding for these most promising developments has come from private investors. Government funding has always played a key role in bringing new technologies to market and that has been missing here so far. Furthermore some private investors may rush to be the first with the most and overdo the application of these methods in the wrong places at the wrong times or, on the other hand, may seek to limit the deployment of oxidation methods so as to maximize the return on their existing investments. With appropriate contributions balanced by common sense regulation on a national and global scale, investors and the public alike can benefit fully from these innovations while the risks of improper allocation of these resources is limited.

Therefore, if the United States is actively engaged in bringing all of these GHG reduction methods to bear properly, we are much more likely to be able to reduce and maintain greenhouse gases at levels that will support the full enjoyment of life, learning, liberty and community both here and abroad.

Background on Federal Efforts Regarding the Removal of Methane and other Climate Pollutants from the Atmosphere

National Academy of Science Calls for Substantial Investment for Rapid Progress on Negative Emissions Technologies

In 2019 the National Academy of Science, Engineering and Medicine developed a research agenda for six terrestrial and near shore "negative emissions technologies''(NET) to remove excess carbon dioxide from the atmosphere. Its consensus report[4] determined that those six methods appeared viable and merit further research, development and deployment. The NAS also noted the limited scope of its work and recommended launching a substantial initiative as soon as possible encompassing those and other methods:

> …The exclusive focus of this report on terrestrial and near-shore coastal NETs reflects the Statement of Task. The committee recognizes that oceanic options for CO2 removal and sequestration (e.g., iron fertilization and ocean alkalinization), which fall outside the scope of its task, could sequester an enormous amount of CO2 and that the United States needs a research

[5] Ibid. --

strategy to address them.[5]

> Recommendation: The nation should launch a substantial research initiative to advance negative emissions technologies (NETs) as soon as practicable. A substantial investment would (1) improve existing NETs (i.e., coastal blue carbon, afforestation/reforestation, changes in forest management, uptake and storage by agricultural soils, and bioenergy with carbon capture and sequestration) to increase the capacity and to reduce their negative impacts and costs; (2) make rapid progress on direct air capture and carbon mineralization technologies, which are underexplored, but would have essentially unlimited capacity if the high costs and many unknowns could be overcome; and (3) advance NET-enabling research on biofuels and carbon sequestration that should be undertaken anyway as part of an emissions mitigation research portfolio."

While this work was underway, NASA's former top climate scientist, Dr. James Hansen, and many others continued to advance our understanding of the potential climate, agricultural and ecological benefits of NETs when used in the right context. For example, combining enhanced rock weathering (EW) and remineralization with a regenerative (biological) agriculture model, including adding rock dusts and biochar as an alternative to conventional chemical fertilizer enhances carbon sequestration in soils. It also yields synergistic enhancements of soil and food security while providing the base cations (positively charged minerals) needed to mitigate climate change. Downstream, this process buffers the oceans, mitigating a significant result of excess carbon dioxide: ocean acidification and its degradation of marine life.

ARPA-E Requests Information on Methane Removal

In September 2020, the Department of Energy's Advanced Research Projects Agency (ARPA-E) issued a Request for Information on methods of reversing the rate of accumulation of methane in the atmosphere, including at least two technologies for removing methane from it.

The DOE Request for Information reflected dozens of peer-reviewed studies indicating the viability of accelerating natural processes to remove methane and other potent climate forcing agents. [6]

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[6] See, National Academies of Science, Engineering, and Medicine. "Negative Emissions Technologies and
Reliable Sequestration: A Research Agenda." The National Academic Press, 2019, 5.
https://doi.org/10.17226/25259.
National Academies of Science, Engineering, and Medicine, "Negative Emissions Technologies and Reliable Sequestration: A Research Agenda," The National Academic Press, 2019,
https://doi.org/10.17226/25259.

Experts Call for Rapid Development and Global Governance of Enhanced Atmospheric Methane Oxidation

In the days leading up to the gathering of heads of state convened on Earth Day 2021 by President Joe Biden to consider cooperative action on climate change, thirty-one of the world's leading scientists from across the United States, Europe and Japan, with expertise ranging from climate science and atmospheric chemistry to conservation biology signed the following letter led by Sir David King of Cambridge University, the former scientific advisor to the Government of the United Kingdom:

April 16, 2021

> We the undersigned scientists whose expertise includes atmospheric chemistry, climate change, and related fields, concerned by rapidly rising atmospheric methane concentrations, call on national and global leaders to take effective measures to cut methane emissions, reduce atmospheric methane concentrations, and return methane in the atmosphere to preindustrial levels.
>
> Currently, atmospheric methane concentrations are at a record high, about 2.5 times higher than the preindustrial level of ~750 parts per billion, and continue to rise rapidly. A particularly sharp rise in atmospheric methane has been underway since 2007, including the largest annual growth on observational record in 2020 despite the pandemic.[1] This may be attributable to a variety of factors, ranging from biological sources[2] to previously underestimated fugitive methane from the fossil fuel industry.[3] Whatever the causes, the Paris Climate Agreement[4] did not anticipate the sharp rise in methane. Nor do the pathways the IPCC laid out for keeping global warming to 1.5 °C[5] take it into account.[6],[7]

While any ambitious new method must first be carefully assessed for its environmental impacts, the following article reviews the risks of several geoengineering methods such as Solar Radiation Management and proposes some methods that offer few risks and more benefits – Tingzhen Ming et al., "Fighting Global Warming by Climate Engineering: Is the Earth Radiation Management and the Solar Radiation Management Any Option for Fighting Climate Change?," Renewable and Sustainable Energy Reviews 31 (March 2014):
pp. 792-834, https://doi.org/10.1016/j.rser.2013.12.032.
– https://www.sciencedirect.com/science/article/pii/S1364032113008460
Lyla L. Taylor et al., "Enhanced Weathering Strategies for Stabilizing Climate and Averting Ocean Acidification," Nature Climate Change 6, no. 4 (2015): pp. 402-406, https://doi.org/10.1038/nclimate2882.
David Lefebvre et al., "Assessing the Potential of Soil Carbonation and Enhanced Weathering through Life Cycle Assessment: A Case Study for Sao Paulo State, Brazil," Journal of Cleaner Production 233 (2019): pp. 468-481, https://doi.org/10.1016/j.jclepro.2019.06.099.

The pre-industrial level of CO_2 equivalent (CO_2e) in the atmosphere (including all greenhouse gases) was 320 parts per million (ppm); today it is over 500 ppm. Using the common convention of citing CO_2 alone, the atmospheric concentration is 415 ppm, but that ignores rising concentrations of methane and other non-CO_2 climate pollutants. We strongly urge using CO_2 equivalent as a fairer indicator of climate forcing.

Methane is a potent warming agent (84 times more powerful than CO_2 over 20 years). Atmospheric methane accounts for roughly 25% of the radiative forcing driving climate change.[9]Lowering atmospheric methane concentrations is therefore important for avoiding catastrophic climate change, and must be part of any effective strategy for meeting climate goals.

As the planet warms, scientists are seeing signs of acceleration in localized natural methane emissions in the Arctic. For example in October 2019, an international team of mainly Russian scientists observed firsthand bucket-sized methane bubbles rising through the ocean from seabed permafrost melting below the East Siberian Sea.[10] The same team had observed steadily increasing emissions of such gas plumes in annual expeditions since 2008.[11] Methane releases are also forming craters in the permafrost. Seventeen large craters from methane explosions have appeared on the Yamal Peninsula since 2014. One was observed directly by scientists in 2020.[12] While emissions from such sources are still small compared to natural methane sources globally, more monitoring is needed to know how methane emissions in the Arctic are developing regionally and over time.

Many nations including the United States are adopting strategies for reducing or mitigating anthropogenic methane emissions at their sources. These measures are critically important. They may include capping oil and gas wells and stopping other fugitive methane emissions from the fossil fuel industry, decarbonizing and managing demand for energy, addressing agricultural emissions, and managing demand for methane-intensive products.[13]

In addition to mitigating or reducing the emissions of climate pollution, we also recognize the need to reduce concentrations of climate forcing agents already in the atmosphere, including methane. Intractable methane emissions that are hard or impossible to mitigate nevertheless need to be addressed in order to bring atmospheric methane concentrations down to safe levels. Anthropogenic sources currently account for 50-60% of all methane emissions[14] and rising, not all of which are susceptible to mitigation. Methane emissions from natural sources are also accelerating as the planet warms. Anthropogenic and biogenic emissions overlap, since human-caused climate change is driving them both. To deal with methane emissions that can't otherwise be mitigated, to reduce the overall methane burden, and to get atmospheric methane levels to a range consistent with meeting climate goals, we must combine prevention and mitigation of new methane emissions with actively lowering the concentration of methane already in the atmosphere.

Research is currently underway on scalable methods that can accelerate and enhance atmospheric methane oxidation (a naturally occurring process which continuously removes methane from the atmosphere),[15],[16] such that it could become sufficient to lower atmospheric methane concentrations even as natural methane emissions and some anthropogenic emissions continue to rise. Given adequate funding for research and development and testing, it should be possible to rapidly develop safe and effective enhanced atmospheric methane oxidation technologies and infrastructure.

When combined with aggressive mitigation of methane emissions, these technologies have the potential to reduce atmospheric methane concentrations rapidly and substantially. The stakes of realizing this potential are high, and the opportunity is great. For example, cutting atmospheric methane concentrations in half would return radiative forcing from greenhouse gases to 2005 levels,[17] complementing other forms of climate action and helping significantly to put ambitious climate goals within reach.[18],[19]

At the same time, it would have significant co-benefits. The social cost of methane per ton is an order of magnitude higher than that of CO_2.[20] Methane triggers ozone (O_3) formation in the troposphere, which damages human health and agricultural harvests. Reducing atmospheric methane would also reduce these impacts.

As such, lowering atmospheric methane concentrations is an additional, reinforcing action that should be considered a necessary component of an effective climate strategy. We therefore urge national and global leaders to:

1). ensure that all countries are committed to aggressively reducing or mitigating methane emissions at their sources;

2). fund and initiate programs to monitor atmospheric methane and to research and develop technologies that reduce atmospheric methane safely and effectively; and

3). frame and implement a global agreement to return atmospheric methane concentrations to preindustrial levels.

[Signatures available at https://methaneaction.org/expert-statement-oxidation-methane/]

Citations:

[1] https://research.noaa.gov/article/ArtMID/587/ArticleID/2742/Despite-pandemic-shutdowns-carbon-dioxide-and-methane-surged-in-2020 "NOAA's preliminary analysis showed the annual increase in atmospheric methane for 2020 was 14.7 parts per billion (ppb), which is the largest annual increase recorded since systematic measurements began in 1983. The global average burden of methane for December 2020, the last month for which data has been analyzed, was 1892.3 ppb. That would represent an increase of about 119 ppb, or 6 percent, since 2000."

[2] Nisbet, E. G., et al. (2016). Rising atmospheric methane: 2007–2014 growth and isotopic shift, Global Biogeochem. Cycles, 30, 1356– 1370, doi:10.1002/2016GB005406.

[3] Schwietzke, S., Sherwood, O., Bruhwiler, L. et al. (2016). Upward revision of global fossil fuel methane emissions based on isotope database. Nature 538, 88–91. https://doi.org/10.1038/nature19797

[4] The English text of the Paris Agreement can be found here: https://unfccc.int/sites/default/files/english_paris_agreement.pdf.

[5] Hansen, J., et al. (2017). Young people's burden: requirement of negative CO2 emissions. Earth System Dynamics, 8(3), 577-616. https://doi.org/10.5194/esd-8-577-2017

[6] Nisbet, E. G., et al. (2019). Very strong atmospheric methane growth in the 4 years 2014–2017: Implications for the Paris Agreement. Global Biogeochemical Cycles, 33(3), 318-342. https://doi.org/10.1029/2018GB006009

[7] Ganesan, A. L., Schwietzke, S., Poulter, B., Arnold, T., Lan, X., Rigby, M., et al. (2019). Advancing scientific understanding of the global methane budget in support of the Paris Agreement. Global Biogeochemical Cycles, 33, 1475-1512. https://doi.org/10.1029/2018GB006065 "Since the Paris Agreement, CH_4 mole fractions in the atmosphere have, however, increased above the RCP2.6 pathway (Figure 2a). In 2018, CH_4 mole fractions were more than 100 ppb higher than in RCP2.6 and were also higher than RCP4.5 (Nisbet et al., 2019). While RCP2.6 is only intended to be indicative of scenarios that keep below 2 °C, it shows a divergence in radiative forcing that has been larger for CH_4 than for CO_2 and nitrous oxide (Figure 2b, Nisbet et al., 2019)."

[8] Intergovernmental Panel on Climate Change. (2014). Myhre, G., D. et al. (Eds). Anthropogenic and Natural Radiative Forcing. In Climate Change 2013 – The Physical Science Basis: Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 659-740). Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9781107415324.018 . Retrieved December 18, 2020.

[9] Ganesan, et al., 2019.

[10] https://www.cnn.com/2019/10/12/us/arctic-methane-gas-flare-trnd/index.html

[11] Wadhams, P. (2016). *A Farewell to Ice.* Allen Lane, Ch. 9.

[12] Bogoyavlensky, Vasily; Bogoyavlensky, Igor; Nikonov, Roman; Kargina, Tatiana; Chuvilin, Evgeny; Bukhanov, Boris; Umnikov, Andrey. (2021). "New Catastrophic Gas Blowout and Giant Crater on the Yamal Peninsula in 2020: Results of the Expedition and Data Processing" Geosciences 11, no. 2: 71. https://doi.org/10.3390/geosciences11020071

[13] Harmsen, M., van Vuuren, D.P., Bodirsky, B.L. et al. (2020). The role of methane in future climate strategies: mitigation potentials and climate impacts. Climatic Change 163, 1409–1425. https://doi.org/10.1007/s10584-019-02437-2

[14] Saunois M et al. (2020). "The Global Methane Budget" 2000-2017. Earth System Science Data 12:1561-1623. https://essd.copernicus.org/articles/12/1561/2020/

[15] Nisbet, E. G., Fisher, R. E., Lowry, D., France, J. L., Allen, G., Bakkaloglu, S., et al. (2020). Methane mitigation: methods to reduce emissions, on the path to the Paris agreement. Reviews of Geophysics, 58, e2019RG000675. https://doi.org/10.1029/2019RG000675

[16] Boucher, O., and Folberth, G.A., (2010) "New directions: atmospheric methane removal as a way to mitigate climate change?." Atmospheric environment 44(27), 3343-3345. https://doi.org/10.1016/j.atmosenv.2010.04.032

[17] For the basis of this calculation, see https://www.esrl.noaa.gov/gmd/aggi/aggi.html . Halving methane levels would reduce methane forcing by round 80%, bringing it down by 0.413. If this is subtracted from the total, the total forcing becomes 1.66, which corresponds to the year 2005.

[18] Jackson, R.B., Solomon, E.I., Canadell, J.G. et al. (2019). Methane removal and atmospheric restoration. Nat Sustain 2, 436–438. https://doi.org/10.1038/s41893-019-0299-x

[19] de Richter, R., Ming, T., Davies, P., Liu, W., & Caillol, S. (2017). Removal of non-CO2 greenhouse gases by large-scale atmospheric solar photocatalysis. Progress in Energy and Combustion Science, 60, 68-96. https://doi.org/10.1016/j.pecs.2017.01.001

[20] Interagency Working Group on Social Cost of Greenhouse Gases (IWG). (2021). Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990. February. Available at: https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf

Section-by-Section Analysis

The Provisions for Reducing and Removing Greenhouse Gases and Black Soot Are the Committee's Considered Response to Findings By the Scientific Community that More Must and Can Be Done to Affirmatively Remove Climate Forcing Agents Now In the Atmosphere.

A) This subsection ensures that the Administrator will take a comprehensive but cost effective approach to revising the existing methane rules and ensures that he will incorporate in those rules a process of requiring methods of removing methane and other climate forcing agents found annually to be cost effective. It dovetails with the provision on trade so that no domestic producer will be disadvantaged by his rules. See, e.g. "Acting rapidly to deploy readily available methane mitigation measures by sector can immediately slow global warming." Ilissa B Ocko et al 2021 Environ. Res. Lett. 16 054042

It is worded as follows:

> Use his existing authorities including but not limited to the Clean Air Act, the Toxic Substances Control Act, the Comprehensive Environmental Response and Control Act, the Resource Conservation and Recovery Act, the Clean Water Act, the Independent Agencies' Appropriations Act, to propose and promulgate regulations before July 4th, 2022 expediting the limitation or elimination of emissions of, and the removal from the atmosphere of methane, carbon dioxide, and other climate forcing agents in such a manner as to require the adoption of technologies that are designated by the Administrator annually as cost-effective and report to the Committees of jurisdiction on those that could be given further development.

B) Subsection (B) requires the Administrator to take several steps, in consultation with domestic and foreign expert agencies to complete the research, development, and global deployment of methods of limiting the emissions of climate forcing agents across the board -- from agriculture and architecture to energy, refrigeration, and transportation -- and to secure the long term removal from the atmosphere of greenhouse gases, black soot and any other climate forcing agents in order to restore those climate forcing agents to historically healthy levels as soon as

possible. These steps start with a review of existing and pending patents for methods of removing climate forcing agents and limiting the emissions thereof, and grants and contracts for the development of such technologies made by the U.S. and other governments, including but not limited to the United Kingdom, and foundations and a requirement that the Administrator ensure, in consultation and cooperation with the Special Envoy and Domestic Advisor on Climate Change and the appropriate departments and agencies, including but not limited to the Chair of the Council on Environmental Quality, and foreign and international governments, that the research, development, and deployment of such methods is completed and advanced each year to the extent practicable, so that it shall be incorporated in the actions of the Administrator and can be incorporated in the actions of others, including but not limited to their foreign assistance, intergovernmental cooperation, and international finance programs and provisions. The Administrator shall complete the steps of paragraph, (A), and its subparagraphs (i) and following, by July 1, 2022 unless otherwise noted in the schedule set forth below, after a note here on recent similar investments by the UK which is positioning itself to profit from what it expects will be a massive market for GHG removal services:

https://www.gov.uk/government/publications/direct-air-capture-and-other-greenhouse-gas-removal-technologies-competition/projects-selected-for-phase-1-of-the-direct-air-capture-and-greenhouse-gas-removal-programme

Projects selected for Phase 1 of the Direct air capture and greenhouse gas removal programme

Updated 24 May 2021

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24. 24.Modular Direct Air Capture

The specific research and development projects covered in Subsection (a) include:

(**i) A field test of the methane oxidation effects of iron in ships' fuel**. Civil society organizations, Methane Action and Oceans X and scientists at several institutions in Europe are cooperating with Danish shipping entities, the Netherlands Navy and authorities in the islands formerly known as the Netherlands' Antilles to assess the feasibility of removing methane from the atmosphere in order to reduce its presence as a pollutant with climate forcing and other dangerous effects by increasing the oxidative power of the atmosphere using chlorine atoms generated by iron-containing sea salt aerosols. This technique is called Enhanced Atmospheric Methane Oxidation (EAMO), employing iron salt aerosol to catalyze the oxidation. This mimics the natural methane removal processes. The hypothesis to be tested is that current iron emissions by ships are catalyzing the generation of chlorine radicals in the ships' plumes, and in this way enhancing the oxidative power of the atmosphere. The hypothesis will be tested experimentally by observing chlorine chemistry in the plume of ships, in which baseline emissions are measured with two different technologies, and then the iron amount is varied by adding iron particles as a scrubber into the exhaust of the ship, while using an iron-free fuel. For shipping companies and for global health in general, this project creates value, because methane removal will be expected to more than compensate for CO2 emissions, and the chlorine chemistry involved removes Nitrous Oxide, tropospheric Ozone and soot, all of which are pollutants that warm the climate and harm human health. These field tests are also intended to help inform not only the achievement and calculation of climate change benefits but also the International

Maritime Organization's analysis of options for reducing pollution from ships, which is on track for a rulemaking by the IMO to take effect in 2023. Methane Action has contracted with an independent company to conduct an Environmental Assessment prior to the field tests. Given the significant in-kind contributions expected from a Danish ferry and Dutch Navy ships the cost of the three part field test from October 2021 to October 2024 is very low and a contract for the entire amount in FY22 could guarantee timely completion:

$2,156,866

Environmental Impact Assessment for EAMO

In order to enhance the possibility that methane oxidation could successfully remove harmful methane gas from the atmosphere, the oxidation techniques should be subject to careful environmental impact assessment before they are deployed outside of the laboratory.

Following are estimates of the costs of such impact assessment work at: i) the preliminary field research phase, and ii) the subsequent Pilot Project phase, both of which are fundable now:

i) **Preliminary field research– impact assessment costs**

According to estimates from a top U.S. air emissions consulting firm, the cost of conducting an initial environmental assessment for field research for enhanced atmospheric methane oxidation would be approximately $48,000 in expert assessment costs. These are broken down as follows:

- Project Management	$7,000
- Data Processing, Regulatory Compliance	2,000
- Atmospheric Dispersion Modeling	7,000
- Atmospheric Environment Analysis	5,000
- Marine and Social Analysis	7,000
- Draft and Final Documentation	15,000
- Site visits	5,000
Total	$48,000

The Administrator of USAID is directed to contract for such impact assessment work, potentially guided by a non-profit institution with suitable expertise that is familiar with the evolution of both the technology and impact assessment and separated from the field research's Principal Investigator in order to ensure greater objectivity. $48,000

ii) **Scaled-up Pilot Project – impact assessment costs**

The Pilot Project is intended to be a scaled-up version of the field testing described above, and is designed to be the foundation of global implementation if the methane removal technology proves to be feasible and not pose significant environmental harms. Undertaking the Pilot Project is to be preceded by an environmental impact assessment commensurate with the expanded project. This would include: a) a broader scope involving assessing several alternative approaches; b) greater magnitudes of effects, c) taking public and governmental comments on a draft impact assessment, d) public outreach sessions, and e) other assessment complications compared to the initial field research environmental assessment. As such, it is estimated to be approximately three times the cost of the field research phase for each cost category. Thus, instead of in the range of $48,000 it would be estimated for a Pilot Project impact assessment to cost an additional $150,000.

To provide reliable findings it will be optimal to duplicate the Pilot Project, that is, conduct it twice using alternative approaches (e.g., one piloted approach entirely on the open ocean, with another approach on land, or a third piloted approach perhaps as a hybrid sea/land application). The Secretary is by this provision directed to contract for such an assessment for this phase at $300,000.

In sum, the costs of environmental impact assessment for both the field research and Pilot Project phases of enhanced atmospheric methane oxidation would total approximately $348,000. Such impact assessment work is expected to be commissioned by a non-profit institution with suitable expertise which institution is separated from those implementing the Pilot Project in order to ensure greater objectivity unless another government or agency with sufficient expertise and resources commits to completing the assessments in such a manner as to follow closely the guidance of both the International Maritime Organization and the Convention on Biological Diversity for assessments of actions with potential impacts on the high seas environment and biological diversity.
Environmental Impact Statement for EAMO (i) and (ii): $ 348,000

(ii) Enhanced Atmospheric Methane Oxidation via Remote Island Tower. A Swiss company, atmospheric methane removal-ag, in cooperation with scientists elsewhere in Europe is planning to conduct a test of EAMO on an island rather than from ships. The Administrator is directed by this provision to contract for an initial test project to disperse Iron Salts Aerosols ("ISA" in the form of FeCl3) into the atmosphere allowing ISA to work as a catalyst that causes methane to oxidize into CO2 and water. As noted in the text of the amendment, the goal of EAMO as tested in (i) and (ii) is to halve atmospheric methane's average lifetime and to reduce its quantity to pre-industrial levels over several years. This would slow global warming considerably. This project would be a public trial of this method on land designed as test (i) is, to this maximize methane oxidation with safety, efficiency and minimal, if any, negative environmental impact. A steel lattice tower 360 meters high will contain an Atmospheric Injection Pipe (AIP), which transports

FeCl3, embedded in warm air, to the top of the tower and then releases it into the troposphere. The tower should preferably be located on a remote Pacific island or a similar location that guarantees strong solar radiation and continuous westward trade winds. The Pacific lacks iron and is therefore well suited to take up small, well-dispersed additional amounts of it. This project would benefit from the Environmental Assessment done for project (i) above but not be covered directly by it.

Second phase implementation is planned for 2023 with a budget of 25 million USD - The 360 m tower is being built on a location 40 m above the sea or 390 meters from 10 meters above sea level. Overall height above sea-level will be 400 m. A 360 m steel tower on Nauru, for example, would require land of the size of 80 * 80 m. Until then, a sublimation or other process may be developed to produce smaller particles. The final prototype will go into production at the end of 2023. Operational cost: 50 Million USD / year. The main cost is for the material (FeCl3) and electric power, which will be provided in form of wind or solar energy. Operational cost does not include cost of measuring results. This should be born by regulating agencies.

The third phase of full rollout is planned for 2024-2028. It would have a budget 500 million USD for 20 large towers size 400 – 1000 m on 20 remote islands along the equator, most in Pacific, some Indian Ocean or in Atlantic. Operational cost of 20 towers would be one billion USD / year. Final operational cost could be paid for by fees for methane certificates or permits to be implemented by domestic and international agencies. The operational cost does not include cost of confirming results, which would be born in part by regulating public and private, independent agencies.

Phase one is included in the FY22 appropriation with any additional funding depending on progress made during that year:

$1,207,000.

(iii) Methane Oxidation Monitoring System (MOMS). Methane Oxidation Monitoring System (MOMS)

The global objective of reducing atmospheric methane concentration towards pre-industrial levels can be achieved through reducing emissions or by increasing methane oxidation. While technological emission reduction solutions have been prioritized, nature oxidizes methane in the atmosphere, and amplifying nature's approach appears efficient and considerably faster and lower cost. Any successful methane oxidation will require accurate measurement of localized atmospheric methane reduction. Developing the technology to oxidize atmospheric methane requires rapid and reliable measurement of its oxidation or removal, and such systems do not currently exist. Providing accurate and rapid-response data could transform the fields of methane and CO2 removal.

Current solutions to the methane problem lie mainly in methane abatement technologies at anthropogenic sources such as capping oil and gas wells, or reducing emissions from the agricultural sector and landfills. However, these methods have not made a considerable difference in reducing methane concentrations, and these sectors continue to grow and contribute additional emissions. In addition, natural sources such as wetlands, terrestrial vegetation, and thawing permafrost also contribute to rising atmospheric concentrations of methane. Methane abatement solutions do not address these emissions. Due to the scale and sources of methane in the atmosphere, it is imperative to implement solutions that remove methane from the atmosphere in addition to employing abatement technologies.

One unique characteristic of methane is that it has a relatively short atmospheric half-life of 8 years, as opposed to several hundred for CO_2. This is because methane can react with oxygen in the atmosphere, in a process known as oxidation. This oxidation means that methane can be removed from the atmosphere relatively quickly, forming CO_2 and water as byproducts.

Since methane is more potent than CO_2, increasing methane oxidation is a very effective solution to slow global warming, especially in the short term. Organizations are researching the potential to boost natural methane oxidation through Enhanced Atmospheric Methane Oxidation (EAMO), which provides the opportunity to remove methane at gigaton scale.

To produce the required accurate and rapid response GHG concentration data, the proposed Methane Oxidation Monitoring System technology will use satellite data, such as ESA Copernicus, and NASA Orbiting Carbon Observatory to measure large-scale (100 km granularity) methane and CO2 removal. Natural methane oxidation is expected to be measurable in this way by subtracting images separated by one week. This project will develop and test software to usefully track air masses over the ocean and detect methane oxidation and eventually CO2 removal with 1-week resolution. This should measure both natural processes and artificially accelerated processes.

Establishing an accurate and reputable source of data in this way will result in close to real time evaluations of oxidation that will provide the foundation for methane oxidation technology development and deployment. This monitoring methodology is a critical element in transforming the field of methane removal, and could similarly impact the field of CO_2 removal. Accurate measurements of methane removal could introduce high quality offsets into the multi-billion dollar carbon offset market, and displace lower quality offsets that are more difficult to measure.

MOMS will collect methane data from satellites, analyze and validate oxidation over a given area, and provide data to groups developing methane removal technologies, which could be used for carbon offset certification requirements. In the coming years, MOMS will contribute to improvements in methane oxidation monitoring technology. MOMS expects to partner with other companies focused on monitoring

methane concentration levels in the atmosphere, such as MethaneSAT.

The MOMS group that exists as of May 24, 2021 is informal and is considering incorporation as either a non-profit organization or a for-profit company. The form of organization that MOMS will take will be determined by which form is best suited to further the development of the methane oxidation monitoring technology and a business model that can sustain it. The research team is comprised of the following members:

Lauren Bosche (Team Lead) - Geographic Information Systems Technician at the U.S. Army Corps of Engineers' Cold Regions Research and Engineering Laboratory (CRREL)

Ariel Mobius (Technical Research) - Undergraduate at Massachusetts Institute of Technology, and

Martin Smit (Satellite Data Analysis) - CEO of Caeli, a Dutch company that analyzes and maps air quality and pollution using satellite data https://www.caeli.nl/welcome.html

MOMS advisors include Berend van de Kraats - co-director of the ship based EAMO trials described in subsection (A)(i) of this section, a recently retired Dutch Navy submarine captain, and Founder and President of OceansX, a Dutch organization that initiates and supports ship based projects in the public interest including reducing pollution during ship operations -- https://oceansx.nl

The Administrator is directed by November 30th of FY22 to enter into a two - year contract to complete a Methane Oxidation Monitoring System (MOMS) using data from multiple existing satellites and from newly installed surface detection equipment, to be deployed on at least twenty ships by July 1, 2023. Ship Deployment and operations budget to be appropriated for FY2023. For development of MOMS in FY2022: $2,010,000

(iv) Agricultural and silvicultural methane removal. In cooperation with USDA and its agencies such as agencies, such as the USDA Office and International Research, Engagement and Cooperation, by July 1, 2022 the Administrator is directed in this provision to contract for an evaluation of GHG sequestration, uptake, oxidation and other long term removal methods in agricultural and silvicultural practice, including but not limited to the methods described in paragraphs (iv)(I) and (II) below.

I) With a goal of cutting methane emissions from rice cultivation in half, the Administrator in cooperation with the Administrator of USAID, and the Secretary of the USDA, is directed to contract in FY 2022 for a three year test of the impact of

various potential additives to rice farming, including but not limited to iron sulfates, approved for organic farming to enhance yields, fight plant chlorosis, and improve the nutritional value of rice crops by enhancing their iron levels in order to fight anemia, in conjunction with other changes in rice farming practice such as targeting the flooding of fields more efficiently. The production of rice, a basic staple for nearly half the world population, produces about 8% of global methane emissions and 2.5% of radiative forcing, and these numbers are expected to double by 2100.

$3,000,000.

II) The Administrator, in cooperation with USAID and USDA, is directed by this provision to contract with one or more qualified organizations in FY22 to complete over a period of 18 months an agricultural GHG sequestration program, with an initial focus on Haiti, that includes restoring minerals to the soil and provides multiple development benefits.

Hope for Haiti, in partnership with Remineralize the Earth (RTE) is planning such a program to help Haitian agronomists and smallholder farmers adopt the regenerative agriculture practice of soil remineralization, leveraging southern Haiti's enriched basalt geology to restore badly depleted soils and forest ecosystems, launch agroforestry pilot projects, produce more nutritious food, and remove excess CO2 from the atmosphere.

By constructing a local supply chain that diverts waste rock dust from Haitian quarries and cement operations to school gardens, smallholder farms, and forest landscape restoration sites, Soil Solidarity for Haiti will not only regenerate soils and restore forest ecosystems needed to replenish local food production. It will also regenerate a regional agriculture of abundance and circular economic interdependence, in a region that 300,000 children, parents and grandparents call *lakay ou*, home.

Remineralization of farms and forests will be a key step in realizing Hope for Haiti's long-term vision of a regional Carbon Storage Network (CSN) of communities in southern Haiti working with for-profit, non- profit, and government organizations to design, test, implement and evaluate a methodological framework of Forest Landscape Restoration and Financial Inclusion that can be scaled throughout the Caribbean and globally. To the benefit of the poor and rural Haitians, scalable agroforestry initiatives resulting culture of rural stewardship will combine restoration of land, restoration of wealth, and restoration of national pride in the role of the Haitian farmer.

The project will conduct garden-scale soil remineralization projects at 4 Hope for Haiti partner schools, where the established School Garden program has been a successful platform for hands-on agriculture and nutrition education of children and families and for the relief of food insecurity. With content and guidance from Remineralize the Earth's Let's Remineralize! science education program translated to Haitian Creole by Hope for Haiti staff, develop primary and secondary

school curricula on soil restoration, regenerative agriculture, remineralization, and their impacts on food and nutrition, ecosystem resilience, biodiversity, enhancing the land's ability to sequester carbon, and the downstream reduction of ocean acidification and its degradation of marine life (itself a harm of excess atmospheric CO2).

Alongside all of the above activities, they will collect baseline data that will inform a Monitoring, Evaluation, Accountability and Learning (MEAL) plan for pilot projects and long-term programmatic impact. Baseline characteristics of landscapes and communities will be used to anticipate indicators of success including an increase in: restored forests, prosperous farms, agriculture jobs, biodiversity, carbon sink and store, clean water ecosystem services, financial accounts held by rural people, loans repayment in rural communities, rural student achievement, and young people who remain in the countryside; and a decrease in: malnutrition, food insecurity, burning of biomass, domestic produce prices, division and abandonment of family farms, soil erosion, and rural vulnerability to severe weather events.

$300,000

(v) Methane and Other GHG Emissions Reductions and Potential Removal via Wetlands management. Wetlands are a major source of methane emissions –31% of total methane emissions. However, drained wetlands (especially drained peatlands), despite their small size (just 10% of total peatlands), produce 2 Gt of CO2, about 5% of total Global CO2 output, as well as nitrous oxide N2O (the 3rd GHG). The literature indicates that rewetting dried wetlands may reduce global warming by significantly reducing CO2 and N2O, even if methane emissions increase. Research is needed to determine whether and which wetlands and former wetlands should be wet, and whether changes in land management practices could reduce wetland and dried wetland production of greenhouse gases without significantly damaging the current ecosystems involved.

In cooperation with USDA, the Secretary of State, the Secretary of Energy and the US Army Corps of Engineers and Bureau of Reclamation, the Administrator is directed by this provision to contract in FY22 for an investigation of relative wetland emissions of greenhouse gases, through field surveys and laboratory experiments to determine if alternative practices could reduce greenhouse gas emission, without significantly changing the ecosystems of important wetland and other land preserves, recommend such wetland management practices, and evaluate proposals for changing land status, e.g., rewetting drained wetlands.

$500,000 per year for 3 years: $1,500,000

(**vi) Restoring Climate Keystone Species.** Every agency has had a duty since the enactment of the Endangered Species Act with no opposing votes in the Senate in 1973 under Section 7(a)(1) to use its programs for the affirmative restoration of endangered and threatened wildlife. Now research is revealing the massive extent to which natural sequestration of carbon and the oxidation of

methane depends on the health of what can be known as "climate keystone species" of very different types at the top and bottom of the food chain. Many of these are listed as endangered or threatened.

While recovery of listed species that are atop their ecological or food chains, enhancing habitat for others, such as elephants and whales, and even CITES-listed tree species such as mahogany, has always been a goal of U.S. policy, these species also play important roles as both victims of climate change and potential partners in the sequestration and removal of GHGs.

The International Monetary Fund has reported over the past two years that restoring the great whales and forest elephants would have billions of dollars worth of climate change mitigation (reduction) benefits. This subsection seeks to ensure the full appreciation and use of such co-benefits that the recovery of such species and more natural climate mitigation and greenhouse gas oxidation and sequestration approaches both offer by providing funds and direction for the Secretary of State, in collaboration with the Secretaries of the Interior and Commerce, to assist in the recovery of elephants, whales and other climate keystone species in other countries. Such programs can include conservation groups such as the Environmental Investigation Agency of the U.S. and U.K., which documents and helps to stop illegal timber and ivory poaching and works to curtail domestic trade in ivory in Japan and China which provide a cover for the market in poached ivory. EIA also works to halt the trade in goods raised on illegally deforested lands.

This subsection also includes pass through funds for states with species whose ranges overlap with other countries, such as Right Whales that migrate from the waters of the Dominican Republic up the East Coast to Canada, through the funding of State recovery programs under Section 6 of the ESA. One example is the State of Maine where lobstermen and women feel overburdened by being asked to do more than their competitors in Canada to use whale-safe lobster pot lines, and to work around off shore wind farms being proposed in both state and Federal waters while also acknowledging that their diesel engines emit large amounts of black soot and carbon dioxide, both climate forcing agents and that scallop dredging that many do in the winter also causes the ocean bottom to release more GHGs.

Oregon State University and the University of Maine are already cooperating in measuring the extent to which phytoplankton are sequestering carbon taken from the air and storing it ultimately and safely on the sea floor. Incorporating the role of whales dependent on such plankton in this or a similar study would help complete the life cycle analysis and inform us of how we might enhance that process in ways that support it and do not put it at risk.

Many lobster boats convert to scallop trawling during the colder months. As reported in Nature and described in the Guardian trawling releases roughly as much carbon as air travel:

Fishing boats that trawl the ocean floor release as much carbon dioxide as the entire aviation industry, according to a groundbreaking study. Bottom trawling, a widespread practice in which heavy nets are dragged along the seabed, pumps out 1 gigaton of carbon every year, says the study written by 26 marine biologists, climate experts and economists and published in Nature on Wednesday.
https://www.theguardian.com/environment/2021/mar/17/trawling-for-fish-releases-as-much-carbon-as-air-travel-report-finds-climate-crisis

The carbon is released from the seabed sediment into the water, and can increase ocean acidification, as well as adversely affecting productivity and biodiversity, the study said. Marine sediments are the largest pool of carbon storage in the world.

The Administrator is directed, in cooperation with the Secretaries of the Interior, State and Commerce and the Administrator of US AID, and other listed in Subsection (a)(vi) of this Section, to develop and include in their work with Maine and Canada a program to help resolve these and other climate related conflicts affecting lobster and scallop fisheries and reduce the carbon footprint of the latter by helping to evaluate and implement steps, including designating marine "ocean climate restoration" reserves and whale calving grounds water quality protection programs, that are likely to help restore and protect whales in areas from the Dominican Republic to Canadian and Russian waters and other areas essential for the recovery of endangered and threatened wildlife and important in the restoration of healthy oceans and the ocean atmosphere.

$20,000,000

(vii) Surface-based photocatalytic enhanced methane oxidation (SPEMO). The photocatalytic enhanced methane oxidation (SPEMO) system will oxidize methane (CH_4) in a photocatalytic reactor (PCR) producing only water and CO_2, which will be released to the atmosphere. No transportation of solid materials or waste to or from the process is needed. No CO_2 storage is required.

The SPEMO gas-to-gas process is simple, requiring only existing methane and air flows as input, and as an output it replaces one atmospheric molecule of CH_4 with high global warming potential (GWP) by CO_2 of much lower GWP, effectively reducing GWP by at least 90%. Methane removal will have several co-benefits, as methane reduces the oxidizing capacity of the atmosphere and produces tropospheric ozone, a harmful compound for humans, livestock and plants.

The future prototype is a fixed plant using CH_4 leakage from point sources (such as abandoned coal mines; landfills; animal farms; sewage sludge and water treatment plants), and will be used for also demonstrating oxidation of CH_4 from the ambient atmosphere. The photocatalysts are readily available minerals requiring

initial standard processing, with small quantities required in comparison to global mineral extraction. The reaction rate with a catalyst such as zinc oxide has been shown to be faster at lower initial concentrations, this is optimal for the application due to the lower concentration being available when using fugitive emissions or at ambient conditions.

Air is drawn through the PCR by existing natural or mechanical ventilation or by adding fans. The PCR is a well-illuminated lattice impregnated with the photocatalyst. For daytime operation, illumination by sunlight will be favored. In case of nighttime operation, UV LED illumination will be used.

No fuel inputs are required for the SPEMO system as it uses UV light for activating the catalyst, and either ventilation systems already, new ones using fans or passive natural ventilation processes. The electricity inputs can be provided by renewable sources (PV and wind turbines). After prototype stage, the most cost-effective zero-emissions energy system will be used according to local circumstances. Solar PV is likely to be favored in many isolated locations for daytime operation.

Among the purposes of this project, there is testing the scalability of the PCR, and generating a full-scale system that can subsequently be replicated. The plant design is modular -- it can be sized up or down according to land availability and be scaled to achieve climatically significant reductions in global warming. The initial phase design study will provide for the prototype to generate empirical data for a range of variables (e.g. CH_4 concentration, temperature, flow rates, alternative catalysts, media, particle sizes, and coating technologies, and light sources) to allow for system optimization when scaling.

The Administrator of the Environmental Protection Agency, in cooperation with the Secretary of State and the Administrator of USAID and the Secretary of Energy, is by this provision directed to contract in FY22 for three years of research and development of surface-based photocatalytic enhanced methane oxidation (SPEMO) to:

A) eliminate lower methane concentration levels (below 1% = 10,000 ppm parts per million) emitted from coal mines, oil wells and animal farms via their ventilation systems; and

B) apply photocatalytic paint to buildings, rooftops, photovoltaic panels, or in a ventilated conduit to reduce methane in the general atmosphere as a complement to commercial photocatalytic paints and coatings already being used because of their self-cleaning property and ability to reduce urban pollution such as nitrogen oxides and volatile organic compounds.

At $1,000,000 per year for a total contract in FY2022 of: $3,000,000

(viii) Accelerating the recovery of the stratospheric ozone layer. To complement the schedule for reducing HFCs already in place via the Kigali protocol, in consultation with the EPA, NOAA, and the Scientific Advisory Panel of the Montreal Protocol, the Secretary is directed to contract in FY22 for a three year study of technologies for eliminating Ozone Depleting Substances at the source or in the general atmosphere, to promote the use of those found feasible and to develop and publish a comprehensive mitigation plan for reducing emissions and eliminating ODS from the atmosphere.

The upper atmosphere ozone layer is essential for blocking certain UV light, but it may be increasingly under threat from both human-made and natural ozone depleting substances (ODS). These include substances beyond the better-known hydrofluorocarbons.

Methane oxidation in the lower troposphere close to the earth can help protect the ozone layer but there may be more than can be done. Of particular concern are the chloromethane, or methyl chloride and bromomethane hydrocarbons, one form of which is known as methyl bromide. The former was once used as a refrigerant and is still used in the manufacture of other products, and the latter and is still used as an insecticide in some countries.

Further research is needed to determine which of these ODS are increasing, and how to reduce emissions or eliminate them from the atmosphere. This program is intended to help determine which ODS are increasing, and quantify the magnitude of the threat to the ozone layer and its likely impact on human life. The Administrator of the EPA, in consultation with the Administrator of NOAA, and the Scientific Advisory Panel of the Montreal Protocol, is directed to contract for a study to conduct lab experiments on technologies that may prove effective in eliminating ODS at the source or in the general atmosphere, to promote their use if found feasible and to develop and publish a comprehensive mitigation plan for reducing emissions and eliminating ODS from the atmosphere.

The Committee appropriates an amount sufficient to cover a contract for $500K per year for 3 years to cover researchers' salaries, cost of lab equipment and on-site experiments, reporting in scientific publications, and administrative overhead.

$500K per year for 3 years: $1,500,000

(C) Environmental Impact and Biological Assessments. In early June 2021 the US Fish and Wildlife Service and the National Marine Fisheries Service announced their intention to promulgate revised regulations for five aspects of the Endangered Species Act including Section 7's interagency consultation process which has been held to result in essentially mandatory precautions to avoid jeopardizing endangered and threatened species. These sections of the regulations were weakened by the previous Administration but the announcement's wording

and the process itself are not limited to correcting those weakening steps. In light of the very wide range of technologies being developed to reduce not only emissions but also the impact of emitted greenhouse gases, Subsection (b) is intended to ensure the assessment of the effectiveness and the risks and benefits of different alternatives in accordance with U.S. statutory requirements and international guidance before deploying any that are likely to have significant negative impacts on the environment, such as interfering with the sequestration of carbon dioxide by forests and perennial crops, and to take advantage of those that have low risks and considerable co-benefits such as increasing crop yields and providing more nutritious rice and other foodstuffs through the use of organic iron fertilizer that can reduce methane emissions from rice paddies while correcting the anemia that is a major health problem for the global poor.

In order to operate effectively and in good faith as the United States asks other countries to share comparably in actions to reduce and reverse climate change and its impacts, Subsection (B) restores, as follows below, the full scope of the consultation process to cover both avoiding jeopardy and assisting recovery of listed species anywhere they are likely to be affected by U.S. agency actions, while preserving the automatic exemptions available on request to the Secretary of Defense and those that can be provided by the interagency committee under subsection (h). That consultation was reduced by regulations adopted in 1986 without any statutory change to support them. That regulation was challenged in court and ruled to be illegal by the 8th Circuit Court in Defenders of Wildlife v. Lujan, leading Congress to not address the problem in the 1988 ESA reauthorization bill. That decision unfortunately was vacated by the Supreme Court in a decision announced on June 12, 1992 during the United Nations' Conference on Environment and Development or "Earth Summit" in Rio de Janeiro, Brazil, on the procedural grounds that Defenders lacked standing due to their inability to show their biologist had current plans to be present in Sri Lanka when hundreds of Asian elephants were expected to be displaced from their habitat and potentially eradicated by a U.S. AID funded dam on the Mahaweli River.

> SEC. 7. (a) FEDERAL AGENCY ACTIONS AND CONSULTATIONS. (1) The Secretary shall review other programs administered by him and utilize such programs in furtherance of the purposes of this Act. All other Federal agencies shall, in consultation with and with the assistance of the Secretary, utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species, [inserting "in the United States, the high seas, or in foreign countries"] listed pursuant to section 4 of this Act. (2) Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency (hereinafter in this section referred to as an "agency action") is not likely to jeopardize the continued existence of any endangered species or threatened species [inserting "in the United States, the high seas, or in foreign countries"].

To enhance capacity of the USFWS, with authorization to share or pass through a portion of these funds with NMFS and other partnering Federal and state agencies in implementing this restoration of consultation under Section 7(a)(1) and (2) the Committee appropriates:

$5,000,000

D) Integrate GHG removal in Development Assistance and Trade -- And restore fairness in trade and the restoration process. Subsection (c) is intended to make the polluter pay for the reduction and removal of his or her excess pollution using tariffs and performance bonds or other deposits to cover the cost of deploying removal or retrieval methods so that affected operators cannot declare bankruptcy or leave without being responsible for the best control methods that can be used to remove the CO2 equivalent level of climate pollutant for which he or she is responsible: "After covering the costs of implementing the border adjustments (tariffs or fees) and controls (embargoes or other limits) the Administrator shall create and retain a fund to cover the costs of contracts or grants for the cost-effective removal first, of methane and other short lived climate pollutants, and second, of carbon dioxide."

This comports with long established principles of common law, customary international and U.S. statutory principles found in modern law as well. Border tariffs on imports made by emitting more greenhouse gases than comparable products made in the U.S. would have been required by the House-passed Markey-Waxman climate legislation of over a decade ago. The inclusion of such tariffs is not intended to preclude the authority to ban the importation of such products or services that after a year's notice continue to cause pollution in excess of domestic levels for comparable products and services as countenanced by the WTO in the Shrimp and Sea Turtle Appellate Decisions and in Article XX (b) and (g) of the General Agreement on Tariffs and Trade. See, e.g., "The United States secured a victory Oct. 22 in defending its ... prohibition on shrimp imports from countries without adequate conservation policies for the protection of sea turtles after the World Trade Organization's Appellate Body rejected Malaysia's attempt to overturn the ban." (United States Import Prohibition of Certain Shrimp and Shrimp Products, Recourse to Article 21.5 of the DSU by Malaysia, WT/DS58/AB/R. (International Trade Daily | October 23, 2001 | By Daniel Pruzin.)

E) Ensure Global Governance of GHG removal methods. Subsection (D) ensures the U.S. will coordinate its efforts in this regard with the relevant international bodies but will develop cooperative agreements or use the existing powers of its own and its partners under international law to expedite essential action if existing bodies prove to be slow and cumbersome.

F) Reports on Implementation Plans. Subsection (e) establishes an interagency Climate Restoration Committee including the Secretaries of Energy and

State, and the Administrator of EPA among others, which will coordinate a report to the Committees of jurisdiction on plans and training for the expeditious implementation of the Title and the Reports on Effectiveness required by Subsection (F).

(G) Reports on Effectiveness. Subsection (f) requires a semi-annual report on progress and effectiveness and suggestions for improvements that shall also reflect the findings of the bi-annual reports of the National Academy of Sciences in the cooperating agencies under paragraph (H).

(H) Comprehensive assessment of atmospheric methane sources, sinks and solutions, and development of a plan for atmospheric methane reduction. This subsection directs the Administrator to commission a report from the National Academy of Sciences to be delivered in draft form by July 1, 2022, and in final form not less than 6 months later, providing (1) an assessment of the size and changes occurring in emission and sinks of methane globally; (2) an analysis of the likely impact of atmospheric methane on climate change and other problems caused by atmospheric methane; (3) a review of each major methane emission source and sink to determine what options are available to affect their impact on atmospheric methane levels; (4) a review of all possible, and all currently practicable, technologies, programs, policy and regulatory changes that could help reduce atmospheric methane levels, whether by abatement (emissions reduction) or remediation (Greenhouse Gas Removal), and for each proposed technology or policy change, consideration of their technological readiness, likelihood of success, barriers hindering implementation, cost-effectiveness and cost-benefit analysis, and likely overall impact on atmospheric methane levels; (5) development of national and global plans for atmospheric methane reduction, that provide goals and recommendations, and discuss options for investment in new technologies, possible regulatory and land management changes, and other means for reducing atmospheric methane, and the barriers to implementing them.

The Committee directs the Administrator to ensure that this report and plan are produced with the cooperation of appropriate government agencies, including but not limited to the EIA, USAID and those included elsewhere in this Section. The Administrator is directed to further ensure that authors include a range of conservation biology, oceanic, agronomy and atmospheric scientists, among others, economists, engineers, policy makers, regulatory experts. The federal agencies should also provide a companion report discussing their efforts, progress and challenges. The Secretary is directed to commission from his regular budget an NAS report updating the initial report every 2 years. $4,000,000

Section 2. Citizen Enforcement. This section provides a largely typical law enforcement provision such as found in most environmental and civil rights law. In providing that "Any person who can demonstrate constitutional standing may bring a lawsuit in Federal District Court" the provision avoids the prudential barriers to

standing raised in more recent decades by the courts but not required by the Constitution, such as finding that the plaintiff is not within the zone of interests protected by a provision of the law, like a citizen whose environment is harmed by a flagrant violation of the grants provision of the Federal Aid Highway Act. The sentence "Any substantially successful plaintiff shall be awarded reasonable market rate attorneys' and expert witness' fees and costs" reflects the fact that the general fee shifting provision for small businesses and non-wealthy citizens who prevail against the Federal Government has not been updated in many years and thus has low ceilings for the resources or assets any plaintiffs may have when filing and for the rates per hour that their attorneys can recover after enforcing Federal law that are now far below market rates in most major cities.

Section 3. Integrating Climate Restoration across the Government. The program requirements of these Sections are to be integrated into the regular order of business and carried out within the budget authorities and amounts appropriated for each of the affected agencies independent of further appropriations. Although the Committee believes that the work required in these provisions is within the budget and legal authority of the agencies so tasked, Section 3 provides authorization if necessary through FY2028 as well as appropriations for FY2022.

Section 4. Severability. This provides that if any provision of these sections is found to be contrary to law by any final court ruling or other competent authority, it may be severed from the remainder without delaying or inhibiting the completion of the rest.