# Climate Modeling Assumptions and Federal Decision Making

September 12, 2024

The Honorable Jennifer Granholm
Secretary of Energy
U.S. Department of Energy
1000 Independence Ave SW
Washington, DC 20585

The Honorable Janet Yellen
Secretary of Treasury
U.S. Department of Treasury
1500 Pennsylvania Ave NW
Washington, DC 20220

Re: Climate Modeling Assumptions

Dear Energy Secretary Granholm and Treasury Secretary Yellen:

As U.S. scientists and researchers we are closely following efforts by the U.S. Department of Energy and the U.S. Department of Treasury to develop greenhouse gas analyses of liquified natural gas (LNG) and hydrogen, and implore you to use the best available science when conducting this analysis.

The U.S. Department of Energy is currently updating its analysis of the climate impact of LNG as part of its evaluation of whether or not pending export authorizations are in the public interest. At the same time, the U.S. Department of Treasury is evaluating the climate impact of various forms of hydrogen production, including those that use natural gas as a feedstock. These models will determine the subsidies for the 45V clean hydrogen tax credits that producers will receive.

The stakes could not be higher. The choices that you make relating to modeling assumptions for the heat-trapping potential of natural gas will determine if the federal government will make decisions based on climate science or wishful thinking.

The main constituent in natural gas is methane, a powerful climate-disrupting pollutant that traps more than 80 times more heat in the atmosphere than carbon dioxide over 20 years, the relevant timeframe in which we must act. We agree with President Biden's declaration to world leaders that this is the decisive decade. As the climate crisis becomes more urgent, we are rapidly approaching planetary thresholds that, once breached, cannot be reversed.

The fossil fuel industry wants you to distort the scientific evidence and asserts, falsely, that decisions to expand natural gas production and consumption are consistent with U.S. and global climate goals. They are advocating for flawed modeling assumptions that would hide the true climate impact of gas. It is imperative that the Departments of Energy and Treasury reject these efforts.

Republican leaders in the U.S. House of Representatives Committee on Science, Space and Technology recently sent a letter to the Energy Secretary casting doubts on the research

findings of Cornell University biogeochemist Robert Howarth, a world authority on global methane cycling. Their claim that "Dr. Howarth uses incontrovertibly flawed methodology" is false. This accusation, which originated with a pro-LNG think tank, is directed at a single forthcoming paper that evaluates the greenhouse gas footprint of LNG exported from the United States. In this study, Howarth finds that LNG has 33% more heat-trapping capacity as coal over a 20 year time period.

What the Committee on Science, Space and Technology decries as "flawed methodology" is actually modeling assumptions related to the 20-year versus 100-year time frame as well as the leakage rates of methane across the LNG lifespan, from wellhead to liquefaction center and shipping to burner tip. We find Howarth's assumptions on time frames and leakage rates entirely reasonable. They are corroborated by the findings of other peer-reviewed studies and direct observations of methane leakage.

As Dr. Howarth himself notes in his concluding remarks, the 100-year time frame was an arbitrary choice, dating back to the Kyoto Protocol in the 1990s when methane's potency as a greenhouse gas was widely overlooked. Many researchers now call for a 20-year time frame in lifecycle assessments as it represents the time available to us to rapidly decarbonize and avoid catastrophic tipping points. As Howarth notes, and we agree, when using a 20-year global warming potential in modeling studies, LNG always has a larger greenhouse gas footprint than coal. In our view, insisting on an arbitrary 100-year timeframe as a modeling assumption in light of everything we have learned about methane's role in climate destabilization over the past three decades is misguided accounting and represents an attempt to skew the way we measure methane's impact on the climate in a way that masks its damage.

An abundance of scientific evidence now shows that natural gas is at least as damaging to the climate as coal and may be worse due to inevitable leaks and disproves the claim that natural gas can serve as a "bridge fuel" while renewable energy sources ramp up. For example, a July 2023 study found that a methane leakage rate of just 0.2 percent causes the warming potential of natural gas to exceed that of coal, which, when burned, forms sulfate aerosols that mask warming. Further, multiple studies, using a range of methodologies, now also show that real-world methane leakage rates from North American drilling and fracking operations greatly exceed earlier EPA estimates and are likely driving the current surge in global methane levels. As is now documented in many studies, fugitive methane emissions from U.S. drilling and fracking operations are omnipresent, much higher than previously supposed, and a main driver of rising methane emissions in the United States.

Dr. Howarth's latest findings also align with those from earlier peer-reviewed papers authored by Howarth and using other methodologies. In a 2019 analysis, for example, Howarth used isotopic analysis to distinguish shale gas from conventionally extracted gas and concluded that shale gas production in North America over the past decade may have contributed more than half of all the increased emissions from fossil fuels globally and approximately one-third of the total of increased missions from all sources globally over the past decade. In sum, with atmospheric methane levels surging, we urge you to adopt strong modeling assumptions, as does Dr. Howarth.

We also note that the harms of LNG extend beyond the climate and include severe water and air pollution. These harms adversely impact communities in the Gulf Coast, compounding public health and safety risks to communities of color already disproportionately burdened by environmental problems. These harms extend beyond the Gulf Coast throughout the entire supply chain of LNG, including extraction, transportation, liquefaction and combustion. Methane

emissions themselves contribute to ground-level ozone formation (smog), which kills 500,000 people around the world each year.

Both fossil fuel-based hydrogen and LNG companies are also promoting climate models premised on the assumption that they are better than the alternatives, comparing their product to other fossil-fuel based choices, such as coal or Russian LNG. Trying to prove whether U.S. gas is better or worse for the climate than other fossil fuels is like debating whether the water in the Titanic's swimming pool is the right temperature.  It misses the bigger point, which is that increasing supplies of fossil fuels from anywhere will undermine global progress toward science-based climate goals.

Some companies argue that by sourcing the methane used to make gas-based hydrogen from factory farms or from methane captured from coal mines qualifies their product for clean hydrogen tax credits. This is the wrong basis for comparison. Instead, we urge an alternatives analysis that compares LNG exports and hydrogen to *all* other options, including renewables. While LNG and hydrogen manufacturers contend that their product creates fewer emissions or offsets emissions, renewables create zero emissions. The models used to determine tax credits should not be based on comparing these energy sources to the worst and dirtiest option, which fails to take into account the benefits of renewable alternatives.

Importantly, gas certification programs and voluntary pledges should not alter your calculations of the likely methane emissions from gas projects. There is no scientific evidence that labeling a given supply of methane gas as having lower emissions actually reduces the damage done to climate. Earlier this year, you jointly issued "Voluntary Carbon Markets Joint Policy Statement and Principles." Those principles state that claimed reductions must "represent genuine atmospheric impact that is determined in a transparent and replicable manner using robust, credible methodologies" and "prevent emissions from occurring, being shifted, or intensifying beyond their boundaries as a result of the activity."

Those principles also state that reductions must also be permanent and independently verified. Claims to permanently avoid methane leaks in the oil and gas supply chain are not credible. They do not guarantee a genuine atmospheric impact. A large share of oil and gas methane leakage occurs when large leaks happen unexpectedly. No pledge or program can accurately guarantee that a given source of gas supply will avoid methane leaks and reduce overall global methane emissions.

Finally, we write to urge you to apply the precautionary principle when applying greenhouse gas emissions analysis to far-reaching decisions that could shape energy production and consumption for years to come. We are already at considerable risk of overshooting global and U.S. commitments to reduce greenhouse gasses and stabilize global greenhouse gas concentrations in the atmosphere. Comparative analysis of new gas supplies to other fuels are only as good as our vision of the future energy pathways that we need to achieve. International Energy Agency's World Energy Outlook 2023 envisions a 50% reduction in global gas supply for its net-zero pathway.

The science is clear, with a high degree of confidence, that the continued use of gas at current global levels will add to global warming and climate damages. Decisions that risk locking in new sources of gas for many years to come must not be minimized by highly uncertain assumptions that one fossil fuel will merely replace another.

Sincerely,

*Scientists joining this letter do so in their individual capacities and not on behalf of the institutions with which they are affiliated.*

**Initial Signatories**

Rose Z. Abramoff, PhD
*Ronin Institute*

Mark Jacobson, PhD
*Professor of Civil & Environmental Engineering &
Director of the Atmosphere/Energy Program
Stanford University*

Micheal Mann, PhD
*Presidential Distinguished Professor & Director
Penn Center for Science Sustainability & the Media*

Ted Schettler, MD/MPH
*Science Director
Science and Environmental Health Network*

Sandra Steingraber, PhD
*Senior Scientist
Science and Environmental Health Network*

**Additional 126 Signatories**

Ronnie Abolafia-Rosenzweig, PhD
Project Scientist, NCAR

Thomas E. Adams III, PhD
Senior Hydrometeorological Advisor,
USAID

Benjamin Allen, PhD
Associate Professor of Mathematics,
Emmanuel College

Cort Anastasio, PhD
Professor, University of California - Davis

Jean Andrews, MS, M.Phil and J.D.
Retired

Alli Antar, PhD
Assistant Professor, Baylor College of
Medicine

Tyler Anthony, PhD

Senior Environmental Scientist, California
Department of Water Resources

Lillian Aoki, PhD
Assistant Professor, University of Oregon

Johan Arango-Quiroga, ALM
PhD Candidate, Northeastern University
School of Public Policy and Urban Affairs

Mona Bachmann, PhD
Post- Doc

Mathew Barlow, PhD
Professor of Climate Science

William S. Beckett, MD, MPH
Emeritus Staff, Moung Auburn Hospital

Melanie Bergmann, PhD

Senior Scientist, Alfred Wegener Institute Helmholtz Centre for Polar & Marine

Neil Bernstein, PhD
Professor Emeritus, Mount Mercy University

Laura Blanco-Murcia, MS
PhD Candidate, University of Waterloo

Charles Bloch, PhD
Professor, University of Washington

Barbara W. Brandom, MD, MS
Retired, Professor of Pediatric Anesthesiology, University of Pittsburgh

Roselie Bright, ScD
Retired, Federal Epidemiologist

Claire V. Broome, MD
Adjunct faculty, Rollins School of Public Health Emory University

Clair Brown, PhD
Professor, University of California, Berkeley

Silvia Bunge, PhD
Professor

Gail Carlson, PhD
Director, Buck Lab for Climate and Environment

Robert N. Coats, PhD
Research Associate, Dept. Environ. Sci. & Policy, Univ. of Callif., Davis

John Collins, BS
Graduate Student Researcher
Adam Cooper, MS
PhD Candidate, University of California - San Diego

Aaron Cozen, PhD
Consulting Research Scientist, University of California San Francisco

Carlos Davidson, PhD
Professor Emeritus of Evironmental studies, San Francisco State University

Michael Dettinger, PhD
Visiting Researcher, Scripps institution of Oceanography

Christina DiGiulio, BS
Environmental Chemist

Christine Dolph, PhD
Research Scientist, Department of Ecology, Evolution and Behavior, Univeristy of Minnesota

Nathan Donley, PhD
Environmental Health Science Director

Catherine N. Duckett, PhD
Associate Dean School of Science, Monmouth University

Andrea Dutton, PhD
Professor, University of Wisconsin-Madison

Timothy Eaton, PhD
Associate Professor

Mary Elizabeth, MS
R.E.H.S. Science Educator Stockton Unified

Hans Engler, PhD
Professor Emeritus of Mathematics

Elvin J. Estrada Garcia, MS
Senior Educational Projects Coordinato, Ciencia Puerto Rico

Guillaume Falmagne, PhD
Postdoctoral Research Associate, Princeton University

Stanley Farkas, PhD
Leader, Staff Scientist: SecureTheFuture2100.

Gabriel Filippelli, PhD
Chancellor's Professor, Indiana University

Kevin Fistanic, MS Student
Restoration Programs Manager, Tidal
Influence LLC, Wetlands Ecology

John Fleming, PhD
Senior Scientist, Center for Biological
Diversity

Kenneth A. Gould, PhD
Professor, City Univerisyt of New York

Griffin Gowdy, BS
PhD Candidate, Columbia University

Anshul Gupta, PhD
Senior Research Scientist, IBM Research
and Senior Policy Analyst, New Yorkers
for Clean Power

William J. Gutowski Jr., PhD
Professor Emeritus of Meteorology

Ali Hadjarian, PhD
Climate Activist

Will Harlan, MS
Senior Scientist, Center for Biological
Diversity

Valerie Harrington, ScM
PhD Student, University of Maryland
Baltimore

Jacalyn Heinl, MPM
Soil & Wetland Scientist

Austin Hinkel, PhD
Assistant Professor, Thomas More
University

Harry Hochheiser, PhD
Professor, University of Pittsburgh

Mark Huising, PhD
Professor

Anthony Ingraffea, PhD
Dwight c . Baum Professor, Cornell

David W. Inouye, PhD
Professor Emeritus, University of
Maryland

Kyle Isaacson, PhD
Formulation Scientist, Phospholutions

Laura L. Jackson, PhD
Director and Professor of Biology,
University of Northern Iowa

Benjamin Johnson, PhD
Assistant Professor, Iowa State
Univesrsity

Steven L. Johnson, PhD, MBA
Associate Professor of Commerce,
University of Virginia

Steven Jorissen, PhD
Adjunct Professor of Chemistry University
of St Thomas

Larry Junck, MD
Emeritus Professor

J. Boone Kauffman, PhD
Professor, Senior Research, Oregon
State University

Sarah Kavassalis, PhD
Assistant Professor of Climate and
Chemistry, Harvey Mudd College

Fredric R. Kellogg, MD
Retired, Associate Professor, Mount Sinai
School of Medicine

Tom Kimmerer, PhD
Consulting Forest Scientist

Kevin Kircher, PhD
Assistant Professor, Purdue University

David Klein, PhD
Professor Emeritus, California State
University

Jasper Kok, PhD
Professor of Atmospheric and Oceanic
Sciences, UCLA

Samantha Leaf, MS
Senior Clinical Laboratory Scientist

Susan Lessin, MD
Retired Physician, Hematologist/Medical Oncologist)

Grace Lindsay, PhD
Assistant Professor, NYU

Philip Loring, PhD
Global Director of Human Dimensions Science, The Nature Conservancy

Edward Maibach, PhD, MPH
Distinguished University Professor and Director

Michelle Merril, PhD
Internal Coordinator, Scientist Rebellion Turtle Island

Roberta Millstein, PhD
Professor Emerit

Stephen Mulkey, PhD
Lecturer University of Florida Biology; President emeritus Unity Environmental University

Robert K. Musil, PhD, MA, MPH
Pressident & CEO, Rachel Carson Council

Steven Neshyba, PhD
Professor, University of Puget Sound

Robert Newman, PhD
Professor, University of North Dakota

Peter Nightingale, PhD
Emeritus Professor of Physics, University of Rhode Island

Philip Nyhus, PhD
Professor of Environmental Studies, Colby College

Connor O'Brien, PhD
Research Fellow, Boston University

Joseph D. Ortiz, PhD
Professor and Chair, Kent State University

Lisa Patel, MD, MESc
Executive Director, Medical Society Consortium on Climate and Health and Clinical Associate Professor of Pediatrics at Stanford

Mark Peifer, PhD
Professor of Biology, UNC-Chapel Hill

Ivette Perfecto, PhD
Bunyan Bryant Collegiate Professor of Environmental Justice

Randi J. Pokladnik, PhD
Grassroots activist, retired educator

Heather Price, PhD
Chemistry Professor

James W. Raich, PhD
Professor Emeritus

Hugo Raguet, PhD
Assistant Professor, INSA and University of Tours, France

Terry Rankin, DMin
Retired

Gareth E. Roberts, PhD
Professor of Mathematics, College of the Holy Cross

Terry L. Root, PhD
Senior Fellow, Emerita

Jerry Rosen, PhD
Professor Emeritus, California State University

Mary Rosen, PhD
Professor Emeritus, California State University

Brad Rosenheim, PhD
Professor, University of Florida

James A. Roth, PhD, MS, DVM
Distinguished Professor

Philip Russell, PhD, MS
Retired Senior Scientist, NASA

Stacia Ryder, PhD
Assistant Professor, Utah State University

Eric Schechter, PhD
Professor Emeritus, Vanderbilt University

Juliet Schor, PhD
Professor, Boston College

Joseph Schreiber, PhD
Professor

Kevin Schultz, PhD
Associate Professor, Hartwick College

Bhavna Shamasunder, PhD
Associate Professor, Occidental College,
Urban & Environmental Policy

Yvonne Sorovacu, MD
Environmental Scientist, Protect PT

Viktoria Spaiser, PhD
Associate Professor, University of Leeds

Greg J. Spooner, PhD
CEO/Principal, Gain Consulting Services

Jim R. Stewart, PhD
Retired

Joanna F. Swain, PhD
Senior VP, Repertoire Immune Medicines

Joseph Taliercio, PhD
Clinical Assistant Professor, Weill Cornell
Medical College

Varykina Thackray, PhD
Professor, UC San Diego

Antonio Tovar, PhD
Board Chair, Community-Campus
Partnership for Health

Tyler J. Tracey, BA
Chemist

Gary Trubl, PhD
Staff scientist at Lawrence Livermore
National Laboratory

Michael Tullius, PhD
Project Scientist, UCLA School of
Medicine

Jess Tyler, MS
Staff Scientist

Thomas T. Veblen, PhD
Distinguished Professor, University of
Colorado Boulder

Celine Wang, PhD
PhD Student at Boston University

Sheila Ward, PhD
Independent researcher

Paul H. Wermer, PhD
Retired

Stephen M. Wheeler, PhD
Professor, U.C. Davis Department of
Human Ecology

Michelle White, MS
PhD Student, Princeton University

Shaye Wolf, PhD
Climate Science Director, Center for
Biological Diversity

Naomi Yoder, MS
GIS Manager, Texas Southern University

Kathryn Young, MD

Lucas V. Zeppetello, PhD
Assistant Professor, UC Berkley