TESTIMONY OF DR. MICHAEL E. MANN

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BEFORE THE

COMMITTEE ON OVERSIGHT AND REFORM.

FEB 8, 2022

Chairwoman Maloney and members of the Committee. My name is Michael Mann. I am Distinguished Professor of Atmospheric Science at Penn State University, and Director of the Penn State Earth System Science Center. My research involves the use of climate models, the analysis of empirical climate data, and developing methods for comparing observations and model predictions. The primary aim of my research is understanding the long-term behavior of Earth's climate system, determining the roles of various potential agents of climate change, both natural and human, and assessing climate change impacts and climate mitigation strategies.

I have published more than 200 scientific articles, numerous commentaries and five books about the basic science, impacts and policy implications of climate change. My most recent book, *The New Climate War*, details the harmful role that has been played by fossil fuel interests and their enablers.

I have served on numerous U.S. and international scientific working groups, panels and steering committees. Among other awards and honors, I have received the Hans Oeschger Medal of the European Geophysical Union, the Award for Public Engagement with Science from the American Association for the Advancement of Science, the Tyler Prize for Environmental Achievement and the Leo Szilard award of the American Physical Society. I'm a Fellow of the American Geophysical Union, the American Meteorological Society, the Geological Society of America, and the American Association for the Advancement of Science. In 2020 I was elected to the U.S. National Academy of Sciences.

I am perhaps best known for my paleoclimate research two decades ago that produced the iconic "hockey stick" curve demonstrating the unprecedented nature of

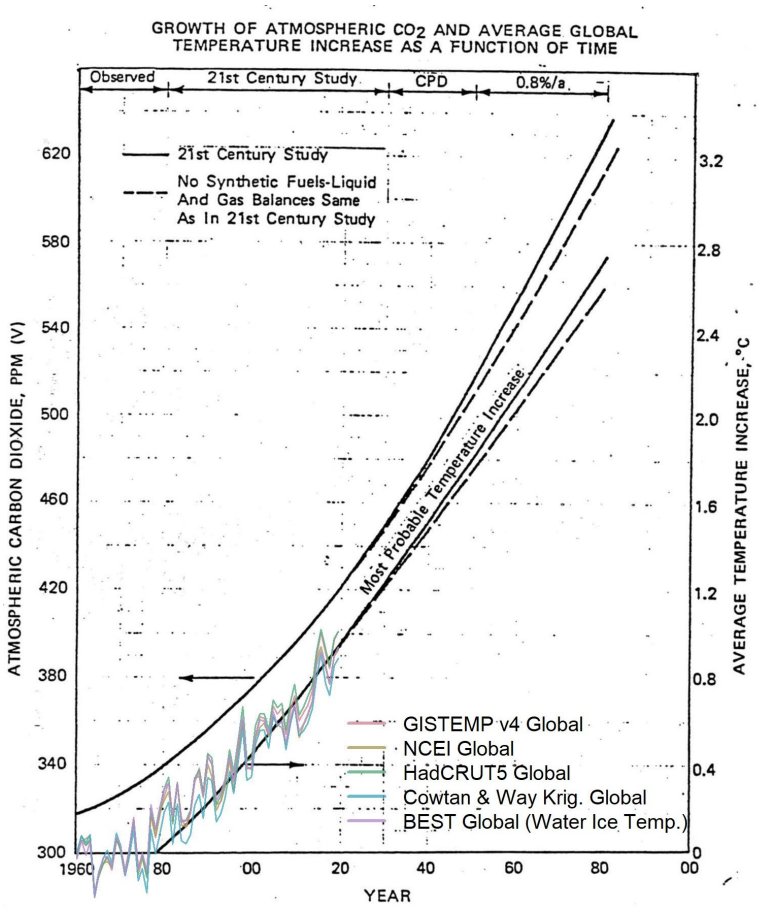
human-caused planetary warming. My research in recent years, however, has focused on other topics including the increased coastal risk from sea level rise and intensified hurricanes, and the impacts of climate change on extreme weather events.

My objective today is to review the basic scientific framework for assessing and mitigating human-caused climate change and its impacts. And I will begin by discussing climate projections that were made nearly four decades ago, not by NASA or other climate modeling groups, but by none other than ExxonMobil, the world's largest publicly-traded fossil fuel company.

ExxonMobil's own scientists, in a secret 1982 report that was never released to the public, made remarkably accurate predictions of both the rise that we would see in atmospheric carbon dioxide levels and the planetary warming that would result given business as usual extraction and burning of fossil fuels (see graphic below). They even used the word "catastrophic" to describe the potential impacts of that warming. But rather than come forward with what their own scientists had concluded, they engaged in a campaign of denial and delay which continues on today.

We are now paying the extreme opportunity cost of that delay in the form of withering heat waves, more destructive tornado outbreaks, wildfires, and floods exacerbated by climate change. Whether it's the apocalyptic wildfires that once again ravaged California and the west this summer, a heat dome over the Pacific Northwest that made parts of Canada feel like Phoenix on the 4th of July, or the devastating floods my state of Pennsylvania experienced as the remnants of climate change-fueled hurricane Ida dumped months' worth of rainfall in a few hours, it is clear that dangerous climate change is upon us. These events are costing the U.S. hundreds of billions of dollars a year

and the toll in dollars and human lives will continue to increase in the absence of concerted action.

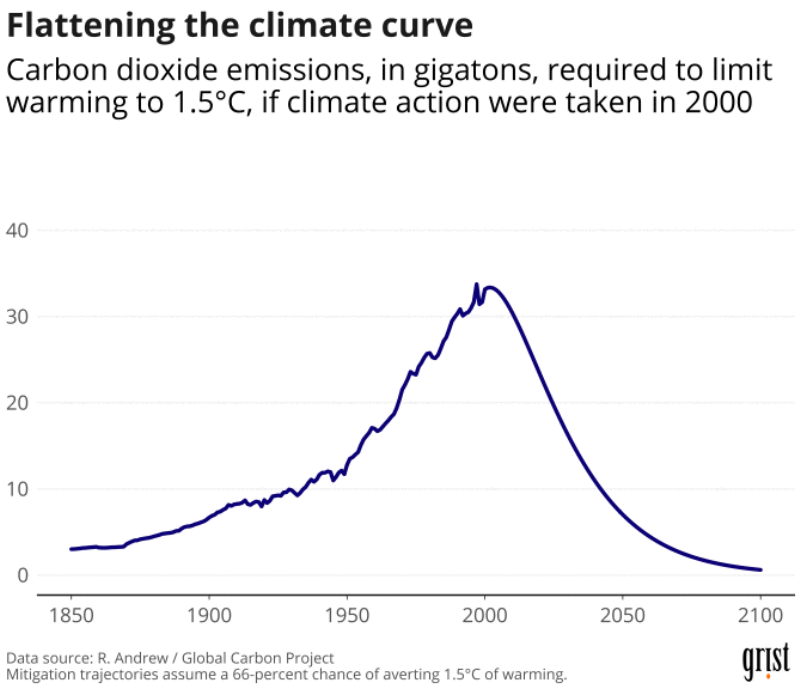


Exxon's private prediction of the future growth of carbon dioxide levels (left axis) and global temperature relative to 1982 (right axis). Elsewhere in its report, Exxon noted that the most widely accepted science at the time indicated that doubling carbon dioxide levels would cause a global warming of 3°C. Illustration: 1982 Exxon internal briefing document (modified to show actual surface temperature trends through 2020)

Much of that damage could have been avoided had we acted decades ago when the scientific community—and indeed ExxonMobil's own scientists---recognized we had a problem (see graphic below). Because of the delay that resulted from the public disinformation campaign funded by ExxonMobil and other fossil fuel interests, we now have a far greater challenge on our hands if we are to limit global warming below 1.5C

(roughly 3F), a level beyond which we will see the worst, potentially irreversible impacts of climate change.

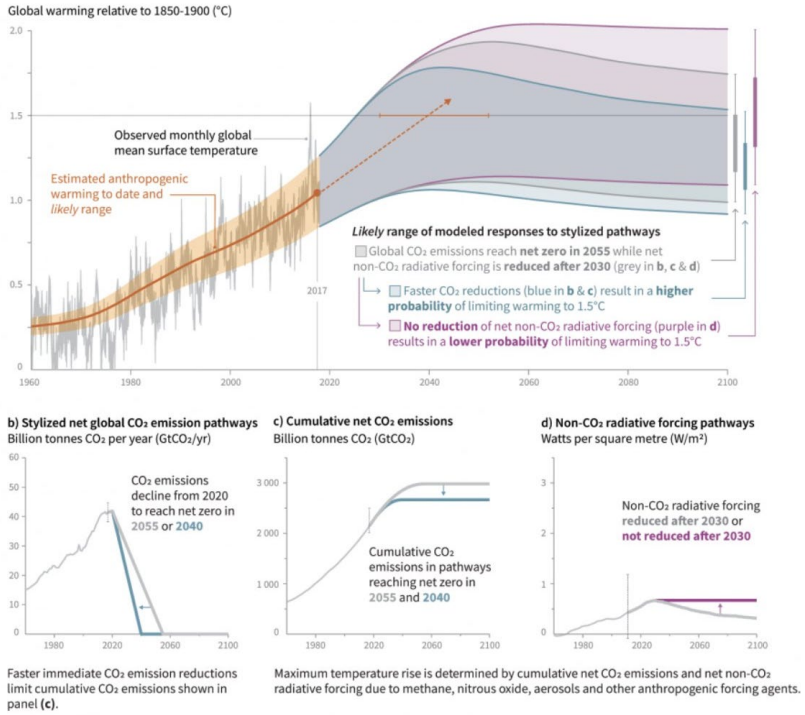
There is nonetheless some positive news when it comes to the feasibility of such efforts. The increasingly comprehensive climate modeling done over the past decade demonstrates that surface warming is likely to stabilize rather quickly, i.e. within a few years, once net carbon emissions reach zero.



This is a result of the somewhat fortuitous cancelation of two different effects, one of which is aggravating with respect to surface warming, the other of which is actually mitigating. On the one hand, the oceans continue to warm up for decades in response to the input of carbon pollution into the atmosphere owing to the large amount of thermal mass and consequent sluggishness of ocean heat absorption. On the other hand, the ocean is constantly absorbing atmospheric carbon pollution, which leads to a lowering of atmospheric carbon dioxide levels once carbon emissions stop. As a result of

these two opposite effects, surface temperatures remain roughly constant once net emissions go to zero. In other words, there is a direct and immediate response to our efforts to reduce global carbon emissions.

We can therefore prevent surface warming from crossing key thresholds such as 1.5C/3F surface warming through aggressive efforts to decarbonize the global economy. We must reduce carbon emissions by 50% this decade and bring them to net zero (zero emissions of carbon into the atmosphere allowing for offsetting natural or artificial carbon capture) by mid-century. The 2018 special report on 1.5C warming of the Intergovernmental Panel on Climate Change (see graphic below) demonstrates a pathway by which this can be accomplished.



(from *IPCC "Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways",* Masson-Delmotte, V.*et al*, Waterfield (eds.)]. *World Meteorological Organization, Geneva, Switzerland, 32 pp.* (https://www.ipcc.ch/sr15/chapter/spm/)

It is important to recognize that some impacts such as ice sheet collapse and sea level rise may continue to worsen even after carbon emissions go to zero and surface warming stops, owing to the very long timescale responses of ice sheet dynamics, as well as potential "tipping point" behavior (for example, once the ice shelves began to disintegrate, that may set in motion irreversible collapse of large parts of the west Antarctic ice sheet, eventually leading to not just feet but meters of sea level rise).

We must recognize, therefore, that in the words of former presidential science adviser John Holdren, any comprehensive plan for addressing climate change will necessarily consist of three components: mitigation, adaptation, and suffering. That is to say, we must prevent any additional warming (and associated climate change) that we can, enact policies to increase our resilience and adaptive capacity in the face of those impacts that are now locked in, and provide assistance to those individuals who have the least adaptive capacity and are facing many of the worst impacts already. This latter imperative speaks to issues of environmental and climate justice.

If we are to meet this monumental challenge, we will need all hands on deck. We cannot have industry and their PR firms working at cross purposes. That means holding fossil fuel interests accountable for the damage they've already caused and preventing them from doing more damage through delay tactics such as promises of mid-century "net zero" pledges, offsets and unproven (e.g. carbon capture) technology. It means incentivizing the energy industry to move toward clean and renewable energy today, rather than kicking the can down the road. Congress has a central role in facilitating all of these actions.