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Examining the Oil Industry's Efforts to Suppress the Truth about Climate Change

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I. Introduction

Thank you very much for the opportunity to speak with you today about the issue of man-made global warming, which affects all of our lives. My testimony today is based on 15 years of research, on the history of climate science, and on the history of attempts to undermine, distract attention from, and confuse the American people about that science.

I come to this subject not as a politician or activist, but as a scholar and teacher. That said, the issue before us—man-made climate change—is so serious—so imperative—that at this moment in history, we must all become active to fix it, before the opportunity to do so is lost. This requires us to understand the reasons that we have failed to act so far—the forces that are responsible for our inaction—in order to overcome them before it is too late.

II. The Science

Scientists have known since the late 19th century that carbon dioxide (CO_2) added to the atmosphere by burning fossil fuels has the potential to dramatically change the Earth's climate. Until the 1950s, however, the limits of both theory and measurement made it difficult to say more about the problem that that. In the late 1950s, post-war advances, along with increased funding, made it possible to address the question in a sustained and rigorous way. In 1957-58, under the auspices of the International Geophysical Year, scientists took up the two-fold question: 1) was atmospheric CO_2 increasing? And, if yes, was that increase having a discernable impact on the global climate? The systematic measurement of atmospheric CO_2 became the life work of University of California geochemist Charles David Keeling.

The issue of CO_2 and global warming was already being widely discussed by earth scientists. In 1957, for example, the director of the Woods Hole Oceanographic Institution noted that we would be wise not to make the same mistake with radioactive waste as we were making with carbon dioxide: "In the case of carbon dioxide in the atmosphere, man went ahead and began burning fossil fuels at a prodigious rate before he considered the possibility that he might be altering the climate on Earth in an unfavorable manner."[1] That same year, at the Scripps Institution of Oceanography, Roger Revelle and Hans Suess noted that by "returning to the atmosphere and

[1] Woods Hole Oceanographic Institution, Office of the Director, Record AC9 Box 24 Folder 19: Personnel, Iselin COD, 1949-1959, item: Speech to the Newcomen Society, 1957, "Matthew Fontaine Maury (1806-1873) Pathfinder of the Seas, Newcomen Society Meeting, 6 June 1957, Falmouth and Woods Hole, MA.

oceans the concentrated organic carbon stored in sedimentary rocks over hundreds of millions of years," humans were performing a great experiment on the Earth.[2] In 1961, Alvin Weinberg, the Director of the Oak Ridge National Laboratory, called carbon dioxide one of the "Big Problems," of the world, by which he meant a problem "on whose solution the entire future of the human race depends" (Appendix 1).[3] Weinberg and his colleagues did not necessarily think that all the anticipated changes would be adverse, but they thought most would be, particularly sea level rise, which could drown coastal ports and cities around the globe. So, they began to try to alert governments to the question.

One well-known early alert is the 1965 report to President Lyndon Johnson by his Science Advisory Committee, "Restoring the Quality of Our Environment." This report declared that "by the year 2000 there will be about 25% more CO_2 in our atmosphere than at present [and] this will modify the heat balance of the atmosphere to such an extent that marked changes in climate…could occur."[4] President Johnson included the topic in a special address to Congress later that year, in which he noted that "This generation has altered the composition of the atmosphere on a global scale through…a steady increase in carbon dioxide from the burning of fossil fuels."[5]

Less well known are speeches given by Russell Train, environmental advisor to President Nixon and later the head of Nixon's Council on Environmental Quality, about atmospheric degradation caused by fossil fuel combustion. In 1968, he said: "Man and his environment are in a critical and growing state of imbalance… The carbon dioxide content of the atmosphere is increasing, a portent of possible disaster to the world."[6]

Similarly, unknown is a letter that Henry M. Jackson, Democratic Senator from the state of Washington, wrote in 1969 to Lee DuBridge, the science advisor to President Richard Nixon. Reacting to a letter from a constituent, who had heard about the "greenhouse effect" on television, Jackson asked DuBridge whether pollution from automobiles could contribute to the "greenhouse effect," and whether this was something about which he should be concerned. DuBridge replied: "It is known that high concentrations of CO_2 in the atmosphere will tend to admit and retain heat

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[2] Revelle, Roger, and Hans E. Suess (1957). "Carbon Dioxide Exchange between Atmosphere and Ocean and the Question of an Increase of Atmospheric CO2 During the Past Decades." *Tellus* **9**: 18-27.

[3] Weinberg: "An even more fundamental problem is the deterioration of our atmosphere by the accumulation of CO_2. As we burn more and more coal and oil, we throw more and more CO_2 into the atmosphere. Now CO_2 effectively absorbs infra-red energy. Its presence in the atmosphere converts the earth into an enormous greenhouse; the sun's energy remains partially trapped; and the temperature of the earth increases. It is estimated that, as a result of the current burden of CO_2 in the atmosphere, the average temperature of the earth is increasing about 1° C per century. This is enough to melt the ice caps in a fairly short time with the result that the sea would rise and flood many inhabited, areas." Alvin Weinberg Papers, MPA.0332. University of Tennessee Libraries, Knoxville, Special Collections, Box 106, Folder 6, Speech: The Problem of Big Problems."

[4] *Restoring the Quality of Our Environment,* Report of the Environmental Pollution Panel, Presidents Science Advisory Committee, The White House, December 1965, on p. 9

[5] President Lyndon B. Johnson *Special Message to Congress on Natural Beauty,* 1965 http://acsc.lib.udel.edu/items/show/292

[6] Russell E. Train Papers, Manuscript Division, Library of Congress, Washington, D.C., Box 69, Folder 3, Speech, June 3, 1968. See also speeches in Box 69, Folder 5.

radiation from the sun in such a way as to warm the climate…. [T]here is little doubt that the automobile contributes a very significant fraction of this carbon dioxide" (Appendix 2).[7]

Between 1966 and 1970, when congress held hearings on air pollution in the run-up to the Air Quality Act of 1967 and the Clean Air Act of 1970, the subject of the "greenhouse effect" and its potential to cause global environment damage was a significant point of discussion. Many leading scientists testified to the potential adverse effects of increased atmospheric carbon dioxide on weather and climate. Their testimony, and legislators' detailed and sometimes lengthy discussions of the issue, help to explain why the 1970 Act explicitly states that "All language referring to effects on welfare includes, but is not limited to, effects on soils, water, crops, vegetation, manmade materials, animals, wildlife, weather… and climate…."[8] As the bill was finalized in December 1970, Jennings Randolph, Republican Senator of West Virginia—and chair of the Senate Public Works Committee, which drafted the Act—advocated for worldwide pollution monitoring, which would aid efforts to understand the worldwide increase in CO_2 and its effects on "weather and climate."[9]

These activities and concerns were not limited to the United States. In 1972, when world leaders gathered in Stockholm for the United Nations Conference on the Human Environment—the first UN conference to address what we now call sustainability—climate change was a topic of conversation and a subject in the conference report.[10] (The U.S. delegation was led by the Republican Senator from Tennessee, Howard Baker, a friend and long-time associate of Alvin Weinberg.[11])

Seven years later, in 1979, climate was the focus when 350 specialists from 53 countries and 24 international organizations, and a wide range of disciplines including agriculture, water resources, fisheries, energy, environment, ecology, biology, medicine, sociology and economics, gathered in Geneva for the world's first international conference on "climate and mankind."[12] The conference report called on the nations of the world to "foresee and prevent potential man-made changes in climate that might be adverse to the well-being of humanity." Following this meeting, the World Meteorological Organization (WMO) established the World Climate Programme, an umbrella for scientific and educational activities. In 1985, the WMO, together with the UN Environment Programme and the International Council of Scientific Unions, convened in Villoch, Austria, for what in retrospect could be considered the first international scientific assessment of the climate impact of greenhouse gases (GHG). The report of this meeting predicted that, unless steps were taken to control GHG emissions, rising global temperatures would yield a wide-range of adverse social, political and economic impacts. Three years later, in 1988, American climate modeler James

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[7] NARA II: OST Senators and Representatives Correspondence Files, 1963-1973, RG 351 UD/ Entry 1, Folder Jackson.
[8] 42 U.S.C. 7602(h).

[9] Randolph, Jennings. "A Worldwide Commitment." *Journal of the Air Pollution Control Association* 21, no. 2 (February 1971): 58.

[10] https://sustainabledevelopment.un.org/milestones/humanenvironment

[11] http://knoxblogs.com/atomiccity/2014/06/26/howard-baker-dies/
https://www.nap.edu/read/12473/chapter/56#336

[12] https://public.wmo.int/en/bulletin/history-climate-activities White, R.M., 1979: The World Climate Conference: Report by the Conference Chairman. WMO Bulletin, 28, 3, 177-178.

Hansen testified here, in the U.S. Congress, that anthropogenic climate change was no longer a prediction; it was now underway. This testimony was widely reported in the media, including on the front page of *The New York Times*.[13]

That same year, the Intergovernmental Panel on Climate Change was assembled to advise governments what to do about this existential challenge. The fact that the IPCC was created as a joint venture between a scientific organization—the World Meteorological Organization—and a political one—the United Nations—tells us that Hansen was not out on a limb; scientists had already for some time recognized the potential severity of this challenge, and political leaders were starting to respond. This was the basis for the 1992 Earth Summit in Rio de Janeiro, where U.S. President George H.W. Bush signed the United Nations Framework Convention (UNFCC), which committed its nearly 200 signatories to global action to prevent "dangerous anthropogenic interference" with the climate system. In signing this convention, President Bush promised to translate the promises made in Rio "into concrete action to protect the planet."[14] Nine years later, President George W. Bush awarded the National Medal of Science to Dave Keeling for the CO_2 measurements that by this time bore his name: The Keeling Curve.[15]

Since that time, there have been hundreds of scientific reports and assessments and tens of thousands of peer-reviewed scientific papers on the issue. There have been laws passed, statements made, resolutions galore. There have been countless conferences, reports, and opinion pieces. Universities, foundations, churches, and individuals have divested from fossil fuels, and citizens across the globe have taken to the streets. Children have refused to go to school. And in December of this year, the Conference of Parties to the UNFCCC (COP) will meet for the *25th time*.

But, despite all this work by scientists, political leaders, activists, citizens, and even children, climate change has not been stopped. It has not even been slowed. Atmospheric carbon dioxide began the industrial revolution at 280 ppm; it has now passed 400 ppm, just as scientists predicted it would. The last time CO_2 concentrations were this high more than 3 million years ago. Scientific data suggests that global temperature at that time was 3°–4°C higher than it is today. Sea level was 15–25 meters higher, meaning that *all* of today's coastal cities, had they existed then, would have been under water.[16] When we account for the other GHGs that we have also added to the atmosphere, such as methane and certain short-lived fluorinated gases, the problem is even worse.[17] No matter how you interrogate the pronoun, we have failed to stop disruptive climate change. Scientists have failed, politicians have failed, activists have failed.

Why is this? Clearly, the answer is not for lack of information. Scientists have been working steadily and sedulously on this issue for more than half a century, and the problem has been known to politicians, including this body, for nearly as long. Why didn't we take those concrete steps to

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[13] https://timesmachine.nytimes.com/timesmachine/1988/06/24/350088.html?pageNumber=1

[14] https://www.nytimes.com/1992/06/13/world/the-earth-summit-excerpts-from-speech-by-bush-on-action-plan.html

[15] https://www.nsf.gov/od/nms/recip_details.jsp?recip_id=191

[16] https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide

[17] https://www.c2es.org/content/short-lived-climate-pollutants/

protect the planet—to protect *ourselves*—that our first President Bush promised us? Why have we wasted 60 years?

A major part of the answer is the systematic, organized campaign by the fossil fuel industry and its allies to sow doubt about the science and prevent meaningful action.

III. The Disinformation

We have heard from Drs. Hoffert and Garvey how ExxonMobil, one of the world's largest corporations, not only knew about the findings of climate science, but, until the 1980s, contributed to climate science. It was not only ExxonMobil. Historical documents show that various oil and gas companies, the American Petroleum Institute, and the Electric Power Research Institute already knew in the 1950s that greenhouse gases produced by burning fossil fuels could change the global climate.[18] In 1958, Frank Capra, one of Hollywood's most celebrated film-makers, produced an episode for an American television series about how air pollution, including CO_2, could change the weather and climate.[19] Shortly after the release of the 1965 report to President Johnson report, API president Frank Ikard addressed industry leaders at the organization's annual meeting. He stated: "One of the most important predictions of the report is that carbon dioxide is being added to the Earth's atmosphere by the burning of coal, oil, and natural gas at such a rate that by the year 2000 the heat balance will be so modified as possibly to cause marked changes in climate beyond local or even national efforts." Ikard did not dispute the report's conclusions. Rather, he noted that if the scientists were right, then "there is still time to save the world's peoples from the catastrophic consequence of pollution, but time is running out"[20] (Appendix 3).

However, in the late 1980s to early 1990s, the fossil fuel industry changed course. Rather than accept the science and alter its business model accordingly, it made the fateful decision to fight the facts. For more than thirty years, the fossil fuel industry and its allies have denied the truth about anthropogenic global warming. They have systematically misled the American people, and contributed to delay in acting on the issue, by discounted and disparaging climate science, mispresenting scientific findings, and attempting to discredit climate scientists (Appendices 4-10).

They have done this in a number of ways.

One way is through misleading advertisements.

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[18] Franta, 2018. Early Oil Industry Knowledge of CO_2 and Global Warming, Nature Climate Change 8: 1024-1026. https://www.nature.com/articles/s41558-018-0349-9.epdf?shared_access_token=pjzah7DpLvTpHzKC6tJnR9RgN0jAjWel9jnR3ZoTv0P4fU1pUb7k0a5LnOE5ZS6C6a7RZ3NHKtxGsOdgHHB-ipijdyckMqNGCt7v20UfBStXn7urJhqpBnkOrEEg4cBKl28toRgrdYqY_8QwJXcMn236XXSYtNuslXyHqNb8nuU%3D

[19] https://www.youtube.com/watch?v=sqClSPWVnNE

[20] Franta, 2018. Early Oil Industry Knowledge of CO_2 and Global Warming, *Nature Climate Change* 8: 1024-1026. https://www.nature.com/articles/s41558-018-0349-9.epdf?shared_access_token=pjzah7DpLvTpHzKC6tJnR9RgN0jAjWel9jnR3ZoTv0P4fU1pUb7k0a5LnOE5ZS6C6a7RZ3NHKtxGsOdgHHB-ipijdyckMqNGCt7v20UfBStXn7urJhqpBnkOrEEg4cBKl28toRgrdYqY_8QwJXcMn236XXSYtNuslXyHqNb8nuU%3D

In our 2017 analysis of ExxonMobil's 40-year history of climate change communications, my post-doctoral research fellow, Dr. Geoffrey Supran, and I, analyzed ExxonMobil's outreach to the general public through paid advertising in leading newspapers (Appendices 11-14). From 1989 to 2004, ExxonMobil published a series of "advertorials" in *The New York Times* and other leading newspapers. These were paid advertisements, but were formatted to look like editorials, and which were not labelled as the advertisements that they in fact were.

In our study of ExxonMobil we demonstrated two things:

First, that many of their advertorials were misleading, misrepresenting the state of the science and exaggerating the degree of uncertainty. In one case, the misrepresentation was so egregious that the scientist whose work was being cited called the use of his data 'very misleading," and stated that what ExxonMobil had done was "something no responsible scientist would do."[21]

Second, that there was a systematic discrepancy between what the advertorials—designed to influence public opinion—said about climate change and what the company and its scientists said either in private, or in communications that were intended for restricted scientific or industrial audiences. Specifically, we compared their positions on climate change as real, human-caused, serious, and solvable. In all four elements, we found that as documents become more publicly accessible, they increasingly communicate doubt. This discrepancy is most pronounced between advertorials and all other documents. For example, 83% of peer-reviewed papers and 80% of internal documents acknowledge that climate change was real and human-caused, yet only 12% of advertorials do so, with 81% instead expressing doubt.

Fossil fuel disinformation goes well beyond ExxonMobil's advertorials. The fossil fuel industry has also promoted disinformation through the activities of "third-party allies": other organizations and groups, with whom they collaborated on messaging, helped to fund, or helped to create. These included the *Global Climate Coalition,* the *Cooler Heads Coalition, Informed Citizens for the Environment,* and *the Greening Earth Society*. These groups promoted messages similar to those promoted by ExxonMobil in its advertorials: that we weren't really sure if climate change was happening, that the science wasn't settled, that we could adapt to any changes that did occur, and that addressing climate change would wreck the American economy. Two of these groups—the so-called *Informed Citizens for the Environment* and the *Greening Earth Society*—were created and funded by a coal industry trade association, the Western Fuels Association, representing Powder River basin coal producers. This is a classic example of "astroturf"-ing: creating organizations that look like the grass-roots efforts of ordinary citizens, but are in fact industry creations. The use of third parties in this way has also been referred to as "information laundering," because the purpose is to make information seem clean.[22]

Similar messaging was pursued by a network of think tanks promoting free market solutions to social problems. These included, but were not limited to, the George C. Marshall Institute, the Cato Institute, the Competitive Institute, and the Heartland Institute. Often their politically motivated contrarian claims were presented in formats designed to make them look like the scientific reports that they were in fact rejecting. In 2009, the Cato Institute issued a report that precisely mimicked the format, layout and structure of the U.S. National Climate Impact Assessment, but which

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[21] Supran and Oreskes, 2017 Assessing ExxonMobil's climate change communications (1977–2014), Environmental Research Letters, 12, https://iopscience.iop.org/article/10.1088/1748-9326/aa815f
On p 9.

[22] http://climate.envsci.rutgers.edu/pdf/UCSexxon_report.pdf

presented claims deeply at odds with that report's science (Appendix 15). [23] In 2017, the Heartland Institute sent a booklet to over 200,000 school teachers, repeating the oft-cited contrarian claims that climate science is still highly unsettled, and that even if climate change is occurring, it "would probably not be harmful." The director of the National Center for Science Education has said of this this booklet, "It's not science, but it's dressed up to look like science. It's clearly intended to confuse teachers."[24] The National Science Teachers Association has called it "propaganda," and suggested that teachers placed their copies in the recycling bin.[25]

A third way the industry has promoted disinformation is through their trade associations. In the early 1990s, the Western Fuels Association ran a media campaign across the country designed to undermine public support for climate action by promoting the message that it would be wasteful to spend money solving a problem that perhaps did not actually exist (Appendix 16). Trade associations including the American Legislative Exchange Council (ALEC), the American Petroleum Institute (API), the U.S. Chamber of Commerce, and the National Association of Manufacturers (NAM) have contributed in diverse ways to efforts to deny the reality of man-made climate change, and prevent action to address it.

A fourth way the fossil fuel industry has undermined public understanding is through personal attacks on scientists. One of the earliest documented was the attack on climate scientist Benjamin Santer, the scientist at the Lawrence Livermore National Laboratory who demonstrated that the observed increase in global temperatures could not be attributed to increased solar radiation. He served as the lead author in the Second Assessment Report of the IPCC, responsible for the 1995 conclusion that "the balance of evidence suggests a discernible human impact on the climate system."[26] Santer became the target of a vicious, and arguably defamatory attack, by scientists from the George C. Marshall Institute and the Global Climate Coalition, who accused him of scientific fraud. Other climate scientists, including Michael Mann, Jonathan Overpeck, Malcolm Hughes, Ray Bradley, and Katharine Hayhoe, have been subject harassment, investigation, and politically motivated freedom-of-information attacks. Some of these attacks emanated from the U.S. Congress, led by Texas Representative Joe Barton and Oklahoma Senator James Inhofe. Texas and Oklahoma are of course, oil and gas states, and both these men have received extensive campaign contributions from the fossil fuel industry.[27]

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[23] https://www.globalchange.gov/browse/reports/global-climate-change-impacts-united-states

[24] https://www.pbs.org/wgbh/frontline/article/climate-change-skeptic-group-seeks-to-influence-200000-teachers/

[25] https://www.nsta.org/climate/hearland.aspx

[26] https://www.csldf.org/2017/12/26/perspectives-scientists-become-targets-ben-santer/ https://beta.prx.org/stories/95363

[27] https://www.opensecrets.org/members-of-congress/summary?cid=N00005656 https://www.opensecrets.org/members-of-congress/summary?cid=N00005582&cycle=2020&type=C

Finally, there is the issue of lobbying. Lobbying is of course not illegal, and when done honestly is a reasonable part of the American political system. But the fossil fuel industry has spent billions of dollars in its efforts to block climate action, far outspending, for example, environmental groups. Their disinformation campaigns are therefore best understood as an extension of their lobbying efforts: designed to undermine public support for action and sustain the status quo.

An analysis by Drexel University sociologist Robert Brulle and colleagues finds that, over the period 1986-2015, five major fossil fuel companies spent $3.6 billion on advertising, much of it motivated by Congressional attention to the issue of climate change.[28] Brulle has also shown that lobbying by sectors involved in the production and use of fossil fuels dwarfs that of the renewable energy sector and environmental groups. In the period 2000-2016, more than $2 billion dollars was spent on by these industries on Congressional lobbying. Lobbying by the renewable energy industry and environmental groups rarely accounted for more than 5% of total lobbying spending in any year. Brulle writes: "Overall, the environmental organization and the renewable energy sectors were outspent by the corporate sectors involved in the production or use of fossil fuels by a ratio of approximately 10 to 1" (Appendix 17).

Industry lobbying increased dramatically in the run-up to, and during, the 111th Congress, when members were considering the American Clean Energy and Security Act (also known as the Waxman-Markey bill), which would have established an emissions trading program to control greenhouse gases. This was a market-based mechanism—similar to that applied in the 1990s to control acid rain—an approach that many Republicans and business leaders had endorsed. But the industry launched an all-out campaign to block it. In 2005-6, lobbying by pro-fossil fuel interests was $92 million. In 2007-2008, it increased to $443 million. In 2009-2010, when a vote on Waxman-Markey was pending, it increased to $716 million. After Waxman-Markey was defeated—and the threat of serious climate change legislation at least temporarily averted—lobbying fell back to a "mere" $315 million.[29]

Brulle's analysis covers lobbying that can be identified as involving oil and gas companies, utilities, and other industries directly involved in the production and use of fossil fuels. This leaves open the question: who has funded the activities of the trade organizations and other third-party allies? In some cases, we know the answer: in 2006, The Royal Society of the United Kingdom documented the funding by ExxonMobil of 39 organizations that promoted "inaccurate and misleading" views of climate science.[30] The Society was able to identify $2.9 million spent in this manner in the year 2005. But that was just one year, and it is unlikely that this is the whole story.

In my 2010 book with Erik M. Conway, we showed that the strategies and tactics used by the fossil fuel industry to disparage climate science and sow doubt in the minds of the American people, particularly the use of third-party allies, were in many cases the same as those used by the tobacco

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[28] Brulle, Robert J., Melissa Aronczyk, and Jason Carmichael, Corporate Promotion and Climate Change: An Analysis of Key Variables Affecting Advertising Spending by Major Oil Corporations, 1986–2015, forthcoming in *Climatic Change*.

[29] Brulle, Robert J. 2018 The Climate Lobby: A Sectoral Analysis of Lobbying spending on Climate Change in the USA, 2000-2016. *Climatic Change* 145 (3-4): 289-303.
https://link.springer.com/article/10.1007/s10584-018-2241-z

[30] https://royalsociety.org/topics-policy/publications/2006/royal-society-exxonmobil/
https://royalsociety.org/-/media/Royal_Society_Content/policy/publications/2006/8257.pdf

industry. We further showed that this was no coincidence, because many of the same individuals, PR firms, advertising agencies, and institutions were involved in both (Appendix 18).

IV. The Cost in Dollars

During the period when the fossil fuel industry pursued a strategy of denial and disinformation about the matter, climate change went from being a prediction to a fact. Scientists predicted decades ago that global warming would make heat waves, floods, fires, and hurricanes worse. We now have clear and convincing evidence that this is so.

Extreme weather events are extremely costly. The National Oceanic and Atmospheric Administration (NOAA) estimates the cost of Hurricane Harvey alone (which led 780,000 Texans to evacuate their homes) at $125 billion dollars; leaders in Texas have estimated that the total cost of recovery could reach $151 billion.[31] NOAA has estimated that in 2017, the total bill for extreme weather events was $306 billion.[32] We can expect these costs continue to escalate, as climate change worsens in the coming years. Moreover, these dollar-valued costs do not include the anxiety and suffering experienced by people who have lost their homes, much less the costs to those who have lost their lives.

We can compare these costs with the profits reaped by the fossil fuel industry, the most profitable industry in the history of humanity. In 2017, ExxonMobil declared profits of just under $20 billion.[33] That year, the American people picked up a tab for 15 times that amount. The fossil fuel industry has reaped the profits of selling fossil fuels, while we, the American people, have picked up the bill, a bill for damage that could have been avoided had the truth not been obscured, and action not delayed, by the actions of this industry.

Of course, some of these events might have happened without global warming, but the available evidence suggests that many, and possibly all, of these extreme weather events have been made worse. This follows from a simple scientific fact, the fact that Svante Arrhenius pointed out more than a century ago: The heat trapping effect of greenhouse gases means that there is now more energy in the climate system than there would otherwise be. The first law of thermodynamics--the law of conservation of energy--tells us that that energy must go somewhere. And the "somewhere" that much of it goes is into driving extreme weather events. In this situation, any weather event is

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[31] https://www.fema.gov/media-library-data/1535741330175-f46e9a841bb61e25547685f69bbeccda/1_Year_Texas_Harvey_Recovery_Guide.pdf https://coast.noaa.gov/states/fast-facts/hurricane-costs.html. https://www.texastribune.org/2018/01/30/how-much-has-been-raised-harvey-relief-and-hows-it-being-spent/

[32] https://coast.noaa.gov/states/fast-facts/hurricane-costs.html

[33] https://news.exxonmobil.com/press-release/exxonmobil-earns-208-billion-2018-6-billion-fourth-quarter

likely to have been made at least worse, and some events have been made much worse, than they would otherwise have been.

We once thought of climate change as something that would mostly affect people long in the future or far away from us. We know now that that assumption was incorrect. Poor people, of course, have fewer resources at their disposal to deal with climate change impacts and this exacerbates the injustices they already face. The environmental justice issue is real, and sharp. But it is also the case that when it comes to climate change, the entire United States of America is a vulnerable community.

V. The Cost to Democracy

The costs of climate change cannot be measured only in houses damaged, people evacuated, dollars spent, or even lives lost. There has been another cost: the cost to our democracy. The long history of fossil fuel funded denial has resulted in a profound, and deliberate, distortion of our democracy. As a result of fossil fuel disinformation, our rights as citizens have been undermined.

This has occurred in two ways.

First, for three decades, the American people have been confused about a matter that affects their fundamental health, safety, and security. But democracy depends on voters making informed decisions based on accurate information. Through its disinformation campaigns, the fossil fuel industry and its allies have denied us our right to accurate information on which to make crucial decisions about our families, our homes, our communities, and our country.

Second, ordinary citizens do not have access to advertising agencies, PR firms, and lobbyists. We are not able to counter the weight of the fossil fuel industry. The so-called "free market of ideas" isn't free at all—it is very, very expensive. Ordinary people do not have the deep pockets that would be needed to make their voices hear against the din of denial. Ordinary American are not able to hire lobbyists to represent their interests. Nor do environmental and environmental justice groups have this kind of money. Even the renewable energy industry does not have this kind of money. And so the diverse voices of 300 million ordinary people are drowned out by the professional messaging of a handful of fossil fuel companies.

The result of all of this has been, in effect, to disenfranchise the American people. We know what is happening. Public opinion polls show that a large majority of the American people want meaningful action on climate change. And we want it now. But our voices are drowned out by the drumbeat of fossil fuel denial and disinformation.

Thank you for your time.

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