

**ATTACHMENT I**

**Joint Comments of Center for Biological Diversity, Earthjustice, Environmental Defense Fund, Natural Resources Defense Council, Sierra Club, and Public Citizen, Inc., Regarding the Proposed Greenhouse Gas Emissions and Fuel Efficiency Standards for Light-Duty Vehicles, Model Years 2021-2026**

**Comments Specific to Climate Change**

**Docket ID Nos. EPA-HQ-OAR-2018-0283, NHTSA-2018-0067, The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks; Proposed Rule *and***

**Docket ID No. NHTSA-2017-0069, Environmental Impact Statement for the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Year 2021-2026 Passenger Cars and Light Trucks**

## I. INTRODUCTION

These comments discuss the voluminous scientific evidence published in recent years to demonstrate the urgent threat to human health and welfare posed by climate change. This evidence further reinforces EPA's already compelling finding that greenhouse gases ("GHG") endanger public health and welfare by driving increasingly dangerous climate change,<sup>1</sup> as well as NHTSA's long-standing recognition of the threat posed by climate change, as the agencies concluded in their 2012 greenhouse gas and fuel economy standards for light-duty vehicles as well as in EPA's mid-term evaluation of the greenhouse gas standards.<sup>2</sup> In particular, we discuss the post-2015 evidence demonstrating the following climate change-driven harms, most of which are now upon us:

- An unrelenting rise in surface temperatures, rendering increasingly large geographic areas less habitable;
- The increasing frequency and severity of extreme weather events, and the scientific advances attributing shifts in extreme weather to anthropogenic GHG emissions;
- Steadily rising ocean temperatures, sea level rise and the dire effects of ocean acidification;
- Increasing harm to human health and welfare, including current and future severe illness and mortality that disproportionately affect the elderly, children and disadvantaged communities;
- Harm to biodiversity, ecosystem services, and public lands;
- Severe harm to the U.S. economy with damages exceeding hundreds of billions of dollars every year, a number that will continue to rise over time;
- The clear and present danger of climate change to our national security;
- The immense difference in climate-change related damage created by overshooting a temperature rise beyond 1.5° C by just one-half of a degree, and the critical importance of action to reduce carbon emissions *within the next decade* to avoid those damages; and
- The United States' inability to remain within its shrinking carbon budget absent immediate action to greatly reduce vehicular GHG emissions.

Climate change and the overwhelming evidence of the devastation it causes underscore that EPA must fulfill its legal mandate to address vehicular CO<sub>2</sub> emissions, and that any rollback of the existing vehicle greenhouse gas standards is an unlawful abrogation of EPA's obligation

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<sup>1</sup> Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496, 66,497 (Dec. 15, 2009); *see also* 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards; Final Rule, 77 Fed. Reg. 62,624, 66,889-98 (Oct. 15, 2012) (hereinafter "2012 Final Rule").

<sup>2</sup> 77 Fed. Reg. at 62,669-70 (discussing NHTSA's recognition of the benefits of reducing tailpipe CO<sub>2</sub> emissions in NHTSA rulemakings going back to 1988).

under the Clean Air Act. Similarly, this evidence demonstrates that NHTSA has improperly shortchanged environmental considerations in setting its fuel efficiency standards, in violation of the agency's responsibilities under the Energy Policy and Conservation Act. NHTSA has further failed to meet its obligations under the National Environmental Policy Act by failing to take a hard look at these impacts in its Draft EIS.

At the outset, it is important to emphasize that the agencies' egregious failure to address the critical threat of climate change in the Proposal reflects not merely bad public policy, but would, if the proposal were adopted, be *unlawful*. Under the Administrative Procedure Act, courts must set aside agency actions that are "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law."<sup>3</sup> The Supreme Court has explained that agency actions are arbitrary and capricious "if the agency has relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise."<sup>4</sup>

This principle holds true whenever an agency seeks to change or reverse a previous policy. The agency must "show that there are good reasons for the new policy" and provide "a reasoned explanation . . . for disregarding facts and circumstances that underlay or were engendered by the prior policy."<sup>5</sup> Where an agency action rests on factual findings (or, as here, factual assumptions and conclusory assertions) that contradict its earlier findings, the agency must provide "a more detailed justification than would suffice for a new policy."<sup>6</sup> A failure to do so renders the action arbitrary and capricious. "An agency cannot simply disregard contrary or inconvenient factual determinations that it made in the past."<sup>7</sup>

The Proposal runs directly afoul of these bedrock administrative law principles. In 2009, EPA found—based on an "ocean of evidence"<sup>8</sup>—that anthropogenic GHGs are driving climate change that endangers public health and welfare;<sup>9</sup> the D.C. Circuit upheld that finding in its entirety against industry challenges;<sup>10</sup> and the Supreme Court refused to review the holding.<sup>11</sup> In their 2012 joint rulemaking setting forth standards for MY 2017-2025, EPA and NHTSA underscored that their final rules were in response to "the country's critical need to address

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<sup>3</sup> 5 U.S.C. § 706(2)(A). Accord, Clean Air Act §307(d)(9)(A), 42 U.S.C. § 7607(d)(9)(A).

<sup>4</sup> *Motor Vehicle Mfrs. Ass'n of the United States v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983).

<sup>5</sup> *Encino Motorcars, LLC v. Navarro*, 136 S. Ct. 2117, 2126 (2016) (quoting *Fed. Commc'ns Comm'n v. Fox Television Stations, Inc.*, 556 U.S. 502, 515-16 (2009)).

<sup>6</sup> *Fox Television Stations*, 556 U.S. at 515.

<sup>7</sup> *Id.* at 537 (Kennedy, J., concurring).

<sup>8</sup> *Coal. for Responsible Regulation, Inc. v. EPA*, 684 F.3d 102, 123 (D.C. Cir. 2012), *rev'd in part on other grounds sub nom. Util. Air Regulatory Grp. v. EPA*, 134 S. Ct. 2427 (2014).

<sup>9</sup> Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496 (Dec. 15, 2009).

<sup>10</sup> *Coal. for Responsible Regulation*, 684 F.3d at 116-26.

<sup>11</sup> The Supreme Court denied the petitions for certiorari that sought to challenge the D.C. Circuit's ruling upholding the Endangerment Finding. *Virginia v. EPA*, 571 U.S. 951 (2013), and *Pac. Legal Found. v. EPA*, 571 U.S. 951 (2013).

global climate change and reduce oil consumption.”<sup>12</sup> As we discuss below, since 2009, the peer-reviewed scientific literature on climate change and evidence of both future and *current* climate impacts has become even more clear, specific and undeniable, further buttressing the rigor of the endangerment finding and the urgency of the Clean Air Act’s legal mandate that EPA address CO<sub>2</sub> emissions from vehicles and NHTSA’s obligation to consider such impacts as part of its standard setting.

Remarkably, despite the overwhelming record evidence demonstrating that climate disruption is becoming ever more severe in the United States and globally, the Proposal all but ignores the subject of climate change. It does not even attempt to explain how rolling back the existing standards could be squared with the existing record and the additional evidence discussed herein. The Proposal also ignores scores of studies and reports published since the 2009 endangerment finding and the existing standards’ promulgation. This fundamental, appalling failure renders the Proposal unlawful, arbitrary and capricious.

The Proposal’s plan to entirely forgo any fuel efficiency improvements and greenhouse gas reductions for the light duty vehicle fleet from 2021 through 2026, a span of six years, is particularly egregious in light of a special report issued by the Intergovernmental Panel on Climate Change in October 2018. That report issues a stark warning that global greenhouse gas emissions must be drastically reduced *within the next decade* to avoid what will be massive and irreversible additional damages arising from overshooting a 1.5° C temperature increase by just one-half of a degree.<sup>13</sup> The Proposal instead would utterly squander six of those critical ten remaining years by rolling back regulations the agencies reviewed and found eminently feasible and cost-effective just two years ago. The Proposal simply cannot be squared with the overwhelming scientific evidence mandating immediate and deep emission cuts.

These comments provide an overview of peer-reviewed, climate change-specific scientific studies released since 2015. The depth and breadth of their findings emphasize the legal deficiency of the Proposal’s failure to grapple with climate change and the ever increasing havoc it wreaks.

## **II. RECENT SCIENTIFIC AND ECONOMIC STUDIES MAGNIFY THE IMPORTANCE OF EPA’S LEGAL OBLIGATION TO LIMIT CO<sub>2</sub> POLLUTION FROM VEHICLES AND NHTSA’S OBLIGATION TO CONSIDER SUCH EMISSIONS IN SETTING FUEL EFFICIENCY STANDARDS**

The 2012 Final Rule and the 2016 mid-term evaluation stand in stark contrast to the Proposal’s flimsy-to- non-existent record on climate change. The 2012 rulemaking is based on a

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<sup>12</sup> 77 Fed. Reg. at 62,626-27.

<sup>13</sup> IPCC [Intergovernmental Panel on Climate Change], Global Warming of 1.5°C, an IPCC Special Report on the Impacts of Global Warming of 1.5°C Above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty (October 6, 2018), SPM-15 (“IPCC 2018 Special Report”).

comprehensive record of peer-reviewed evidence demonstrating the causes and effects of climate change and the need to promptly reduce GHGs released by cars and light duty trucks.

The 2012 Final Rule reaffirmed EPA’s 2009 endangerment finding that anthropogenic GHGs emissions jeopardize public health and public welfare.<sup>14</sup> That rulemaking discussed the key findings of major peer-reviewed studies of climate change issued after 2009 by the National Research Council (“NRC”).<sup>15</sup> The 2012 Final Rule found that “these recent NRC assessments represent another independent and critical inquiry of the state of climate change science” and they “have reached similar conclusions to those of the assessments upon which the [EPA] Administrator relied.”<sup>16</sup>

The 2016 Draft Technical Assessment Report (“Draft TAR”), developed jointly by EPA, NHTSA, and the California Air Resources Board as part of the mid-term evaluation, included additional discussion of more recent climate science findings, concluding that these studies “confirm and strengthen the science that supported the 2009 Endangerment Finding.”<sup>17</sup> The Draft TAR discussed<sup>18</sup> the key findings of major peer-reviewed studies of climate change issued after 2009 by the U.S. Global Change Research Program (“USGCRP”),<sup>19</sup> the Intergovernmental Panel on Climate Change (“IPCC”),<sup>20</sup> and the NRC.<sup>21</sup> The Draft TAR explained, for example,

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<sup>14</sup> 77 Fed. Reg. at 66,894-95.

<sup>15</sup> NRC, *Advancing the Science of Climate Change* (2010), <https://www.nap.edu/catalog/12782/advancing-the-science-of-climate-change>; NRC, *Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia*, Committee on Stabilization Targets for Atmospheric Greenhouse Gas Concentrations (2011), [www.nap.edu/catalog/12877/climate-stabilization-targets-emissions-concentrations-and-impacts-over-decades-to](http://www.nap.edu/catalog/12877/climate-stabilization-targets-emissions-concentrations-and-impacts-over-decades-to).

<sup>16</sup> 77 Fed. Reg. at 66,895.

<sup>17</sup> EPA, California Air Resources Board, NHTSA, *Draft Technical Assessment Report: Midterm Evaluation of Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards for Model Years 2022-2025* at 1-14 (July 2016), <https://nepis.epa.gov/Exe/ZyPDF.cgi/P100OXEO.PDF?Dockkey=P100OXEO.PDF>.

<sup>18</sup> *Id.* at 1-13 – 1-19.

<sup>19</sup> *See, e.g.*, USGCRP, *Climate Change Impacts in the United States: The Third National Climate Assessment*, Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe (eds.) (2014), <http://nca2014.globalchange.gov/>. Congress created the USGCRP in 1990 to serve as “a comprehensive and integrated United States research program which will assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change,” Global Change Research Act of 1990, Pub. L. No. 101-606, 15 U.S.C. § 2931(b), and urged EPA and other policymakers to use its work to formulate “a coordinated national policy on global climate change,” *id.* § 2938(b)(1)-(2). *See also* 15 U.S.C. § 2934(d)(3) (directing the USGCRP to “combine and interpret data from various sources to produce information readily usable by policymakers attempting to formulate effective strategies for preventing, mitigating, and adapting to the effects of global change”).

<sup>20</sup> IPCC, *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects, Working Group II Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.) (2014), [www.ipcc.ch/report/ar5/wg2/](http://www.ipcc.ch/report/ar5/wg2/); IPCC, *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects, Working Group II Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Barros, V.R., C.B. Field,

that since the 2009 Endangerment Finding, the USGCRP Third National Climate Assessment and multiple NRC assessments have projected future rates of sea level rise that are “40 percent larger than, and in some cases more than twice as large as, the projected rise” estimate referred to in the Endangerment Finding.<sup>22</sup> It noted a recent NRC assessment that had concluded that “[i]n the Northern Hemisphere, the last 30 years were likely the warmest 30 year period of the last 1400 years.”<sup>23</sup>

In contrast to the 2012 Final Rule and Draft TAR, the Proposal’s preamble does not mention any of the evidence supporting either the 2009 endangerment finding or the subsequent determinations on climate harm, and includes virtually *no* discussion of climate change at all apart from briefly acknowledging that climate benefits would be sacrificed by rolling back the existing standards.<sup>24</sup> The accompanying Preliminary Regulatory Impact Analysis (“PRIA”) omits nearly any discussion of climate impacts,<sup>25</sup> and the accompanying Draft EIS’s discussion is

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D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.) (2014), [www.ipcc.ch/report/ar5/wg2/](http://www.ipcc.ch/report/ar5/wg2/); IPCC, Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation, Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change, Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.) (2012), <https://wg1.ipcc.ch/srex/>.

<sup>21</sup> See, e.g., NRC, Ocean Acidification: A National Strategy to Meet the Challenges of a Changing Ocean, Committee on the Development of an Integrated Science Strategy for Ocean Acidification Monitoring, Research, and Impacts Assessment (2010), [www.nap.edu/catalog/12904/ocean-acidification-a-national-strategy-to-meet-the-challenges-of](http://www.nap.edu/catalog/12904/ocean-acidification-a-national-strategy-to-meet-the-challenges-of); NRC, Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia, Committee on Stabilization Targets for Atmospheric Greenhouse Gas Concentrations (2011), [www.nap.edu/catalog/12877/climate-stabilization-targets-emissions-concentrations-and-impacts-over-decades-to](http://www.nap.edu/catalog/12877/climate-stabilization-targets-emissions-concentrations-and-impacts-over-decades-to); NRC, National Security Implications of Climate Change for U.S. Naval Forces, Committee on National Security Implications of Climate Change for U.S. Naval Forces (2011), [www.nap.edu/catalog/12914/national-security-implications-of-climate-change-for-us-naval-forces](http://www.nap.edu/catalog/12914/national-security-implications-of-climate-change-for-us-naval-forces); NRC, Understanding Earth’s Deep Past: Lessons for Our Climate Future, Committee on the Importance of Deep-Time Geologic Records for Understanding Climate Change Impacts (2011), [www.nap.edu/catalog/13111/understanding-earths-deep-past-lessons-for-our-climate-future](http://www.nap.edu/catalog/13111/understanding-earths-deep-past-lessons-for-our-climate-future); NRC, Sea Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future, Committee on Sea Level Rise in California, Oregon, and Washington (2012), [www.nap.edu/catalog/13389/sea-level-rise-for-the-coasts-of-california-oregon-and-washington](http://www.nap.edu/catalog/13389/sea-level-rise-for-the-coasts-of-california-oregon-and-washington); NRC, Climate and Social Stress: Implications for Security Analysis, Committee on Assessing the Impacts of Climate Change on Social and Political Stresses (2013), [www.nap.edu/catalog/14682/climate-and-social-stress-implications-for-security-analysis](http://www.nap.edu/catalog/14682/climate-and-social-stress-implications-for-security-analysis); NRC, Abrupt Impacts of Climate Change: Anticipating Surprises, Committee on Understanding and Monitoring Abrupt Climate Change and Its Impacts (2013), [www.nap.edu/catalog/18373/abrupt-impacts-of-climate-change-anticipating-surprises](http://www.nap.edu/catalog/18373/abrupt-impacts-of-climate-change-anticipating-surprises).

<sup>22</sup> Draft TAR at 1-15.

<sup>23</sup> *Id.* at 1-16.

<sup>24</sup> See generally The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks, 83 Fed. Reg. 42,986, 42,996 (Aug. 24, 2018).

<sup>25</sup> See generally NHTSA and EPA, Preliminary Regulatory Impact Analysis: The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Year 2021 – 2026 Passenger Cars and Light Trucks (July 2018), <https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/ld-cafe-co2-nhtsa-2127-al76-epa-pria->

fatally flawed.<sup>26</sup> Worse still, as discussed in other comments to the docket, the proposal’s regulatory impact analysis has deeply discounted these forgone public health and environmental benefits by using faulty economics and science.<sup>27</sup> The Proposal’s failure fully to account for and properly measure the ever increasing harm necessarily resulting from increased GHG emissions is unlawful, arbitrary, and capricious.

Below, we discuss new evidence presented in scientific studies published after 2015 that demonstrates the escalating and alarming harms climate change will cause to the environment, human health and welfare, and has caused already.

**a. Scientific Studies Overwhelmingly Demonstrate that Climate Change Is Already Causing Immediate, Devastating Impacts on Communities Across the Country and Will Lead to Further Catastrophic Damages If Unmitigated.**

i. Greenhouse gas emissions are making the earth’s climate hotter and more extreme.

According to the Fourth National Climate Assessment published in November 2017 by the USGCRP — (a federal program in which the EPA is a constituent agency, along with NASA, NOAA, the National Science Foundation, and others) — “there is no convincing alternative explanation” for the observed warming of the climate over the last century other than human activities.<sup>28</sup> Global CO<sub>2</sub> emissions from fossil fuel use more than tripled from the 1960s to the period from 2007 to 2016,<sup>29</sup> and CO<sub>2</sub> accounted for approximately 82 percent of the increase in radiative forcing (i.e., “heat trapping”) over the past decade.<sup>30</sup>

2017 was the third warmest year ever recorded for the United States, with only 2012 and 2016 warmer than last year.<sup>31</sup> 2017’s extreme weather and climate disasters killed hundreds of Americans and cumulatively cost \$306 billion, making 2017 by far the costliest year on record in

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[180823.pdf](#); *see also id.* at Section 10.2 on Energy and Environmental Impacts, deferring any meaningful discussion of GHGs to the Draft EIS.

<sup>26</sup> *See, e. g.*, Joint Comments of by the Center for Biological Diversity et al. Re: The Safer Affordable Fuel-Efficient (SAFE) Vehicle Rule for Model Year 2021-2026 Passenger Cars and Light Trucks: Draft Environmental Impact Statement, submitted to Docket ID No. NHTSA-2017-0069 (“DEIS Comments”).

<sup>27</sup> *See* comments on the social cost of carbon submitted by the Institute for Policy Integrity to these dockets.

<sup>28</sup> USGCRP, Climate Science Special Report: Fourth National Climate Assessment, Vol. I, Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.) (2017), [https://science2017.globalchange.gov/downloads/CSSR2017\\_FullReport.pdf](https://science2017.globalchange.gov/downloads/CSSR2017_FullReport.pdf) at 10 [hereinafter USGCRP 2017].

<sup>29</sup> Le Quéré, C. *et al.*, Global Carbon Budget 2017, 10 EARTH SYST. SCI. DATA DISCUSS. 405, 423-24 (2018), <https://doi.org/10.5194/essd-2017-123>.

<sup>30</sup> World Meteorological Organization [“WMO”] and Global Atmosphere Watch 2017, The State of Greenhouse Gases in the Atmosphere Based on Global Observations through 2016, 13 WMO GREENHOUSE GAS BULLETIN, 3 (2017), [https://library.wmo.int/opac/doc\\_num.php?explnum\\_id=4022](https://library.wmo.int/opac/doc_num.php?explnum_id=4022).

<sup>31</sup> Climate Central, The 10 Hottest U.S. Years on Record (2018), <http://www.climatecentral.org/gallery/graphics/10-hottest-us-years-on-record>.



terms of climate harms.<sup>32</sup> According to one recent study, “*this sequence of record-breaking temperatures had a negligible (<0.03%) likelihood of occurrence in the absence of anthropogenic warming.*”<sup>33</sup> Another new study found that “the 2016 record global warmth was only possible due to substantial centennial-scale anthropogenic warming.”<sup>34</sup>

Annual average temperatures in the United States have increased by 1.8°F (1.0°C) between 1895 and 2016,<sup>35</sup> and the number of heat waves (defined as six-day periods with a maximum temperature above the 90th percentile for 1961 through 1990) has increased since the 1960s.<sup>36</sup> In the last two decades, more than two daily heat records were broken in the U.S. for every daily cold record.<sup>37</sup> By comparison, in a stable climate, the ratio of high- to low-temperature records would be approximately 1:1.<sup>38</sup>

To put their findings in context, scientific reports often express the extent of scientific understanding of key findings by means of clearly defined metrics expressing the degree of confidence in those findings.<sup>39</sup> Where the following discussion uses these metrics, it presents them in italics.

The U.S. is expected with *high confidence* to warm by an additional 2.5°F, on average, over the next few decades.<sup>40</sup> Daily highs are likewise projected with *very high confidence* to

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<sup>32</sup> NOAA National Centers for Environmental Information [NCEI], U.S. Billion-Dollar Weather and Climate Disasters (2018), <https://www.ncdc.noaa.gov/billions/>.

<sup>33</sup> Mann, M.E., *et al.*, Record Temperature Streak Bears Anthropogenic Fingerprint, 44 GEOPHYS. RES. LETT. 7936 (2017) (emphasis added), <http://onlinelibrary.wiley.com/doi/10.1002/2017GL074056/abstract>.

<sup>34</sup> Knutson, T.R., *et al.*, CMIP5 Model-based Assessment of Anthropogenic Influence on Record Global Warmth During 2016, 99 BAMS S11 (2017), <https://www.ametsoc.org/ams/index.cfm/publications/bulletin-of-the-american-meteorological-society-bams/explaining-extreme-events-from-a-climate-perspective>.

<sup>35</sup> USGCRP 2017 at 13.

<sup>36</sup> *Id.* at 191.

<sup>37</sup> *Id.* at 192.

<sup>38</sup> Meehl, G.A., *et al.*, US Daily Temperature Records Past, Present, and Future, 113 PNAS 13977 (2016), [www.pnas.org/content/113/49/13977](http://www.pnas.org/content/113/49/13977).

<sup>39</sup> The USGCRP communicates the extent of scientific understanding of its key findings with two metrics: “confidence”, and “likelihood.” Confidence is defined as “the validity of a finding based on the type, amount, quality, strength, and consistency of evidence (such as mechanistic understanding, theory, data, models, and expert judgment); the skill, range, and consistency of model projections; and the degree of agreement within the body of literature.” The scale is *very high confidence* (strong evidence and high consensus), *high confidence* (moderate evidence and medium consensus), *medium confidence* (suggestive evidence and competing schools of thought), and *low confidence* (inconclusive evidence and disagreement or lack of expert opinion). Likelihood is defined as the “probability of an effect or impact occurring,” and is “based on measures of uncertainty expressed probabilistically ... e.g., resulting from evaluating statistical analyses of observations or model results or on expert judgment.” The scale is *virtually certain* (99 to 100 percent likelihood), *extremely likely* (95 to 100 percent likelihood), *very likely* (90 to 100 percent likelihood), *likely* (66 to 100 percent likelihood), *about as likely as not* (33 to 66 percent likelihood), *unlikely* (0 to 33 percent likelihood), *very unlikely* (0 to 10 percent likelihood), *extremely unlikely* (0 to 5 percent likelihood), and *exceptionally unlikely* (0 to 1 percent likelihood). USGCRP 2017 at 6, 7.

<sup>40</sup> *Id.* at 11.



increase.<sup>41</sup> Under business as usual, the hottest days of the year could be at least 5°F (2.8°C) warmer in most areas by mid-century and 10°F (5.5°C) by late this century.<sup>42</sup> The urban heat island effect — which is expected with *high confidence* to strengthen as urban areas expand and become denser — will amplify climate-related warming even beyond those dangerous increases, which can cause heat-related illness and death, as discussed below.<sup>43</sup>

Heavy precipitation has likewise become more frequent and intense in most regions of the U.S. since 1901 (*high confidence*),<sup>44</sup> even as average annual precipitation has decreased in some regions (*medium confidence*).<sup>45</sup> This finding is consistent with the scientific understanding that more water vapor is available to fuel extreme rain and snowstorms as the world warms (*medium confidence*).<sup>46</sup> Recent studies of Hurricane Harvey<sup>47</sup> and the 2016 flood in south Louisiana<sup>48</sup> concluded that climate warming made the record rainfall totals of both disasters more likely and intense. Under continued high GHG emissions, most U.S. regions are projected to experience two to three times more extreme precipitation events by the end of the century than relative to the historic average.<sup>49</sup> Rainfall during hurricanes making landfall in the eastern U.S. could also increase by 8 to 17 percent over the next century, compared to 1980-to-2006 levels.<sup>50</sup>

Anthropogenic activities have contributed to the upward trend in North Atlantic hurricane activity since the 1970s (*medium confidence*).<sup>51</sup> Climate change is projected to increase hurricane intensity, making hurricanes more destructive by fueling higher wind speeds and more rainfall.<sup>52</sup> One recent study suggests the average intensity of Atlantic hurricanes will increase 1.8 to 4.2 percent by the 2080s, compared to a 2000 baseline.<sup>53</sup> Adding to increases in hurricane intensity, there is *very high confidence* that sea level rise will make coastal floods more frequent and

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<sup>41</sup> *Id.* at 185.

<sup>42</sup> *Id.* at 197.

<sup>43</sup> *Id.* at 17.

<sup>44</sup> *Id.* at 20.

<sup>45</sup> *Id.* at 207.

<sup>46</sup> *Id.* at 214.

<sup>47</sup> Emanuel, K., Assessing the Present and Future Probability of Hurricane Harvey's Rainfall 2017, 114 PNAS EARLY EDITION (2017), [www.pnas.org/cgi/doi/10.1073/pnas.1716222114](http://www.pnas.org/cgi/doi/10.1073/pnas.1716222114); Risser, M.D. and M.F. Wehner, Attributable Human-induced Changes in the Likelihood and Magnitude of the Observed Extreme Precipitation During Hurricane Harvey, 44 GEOPHYS. RES. LETT. 12,457 (2017), doi: 10.1002/2017GL075888; van Oldenborgh, G.J. *et al.*, Attribution of Extreme Rainfall from Hurricane Harvey, 12 ENVIRON. RES. LETT. 124009 (2017), <https://doi.org/10.1088/1748-9326/aa9ef2>.

<sup>48</sup> van der Wiel, K., *et al.*, Rapid Attribution of the August 2016 Flood-inducing Extreme Precipitation in South Louisiana to Climate Change, 21 HYDROL. EARTH SYST. SCI. 897 (2017), [www.hydrol-earth-syst-sci.net/21/897/2017/](http://www.hydrol-earth-syst-sci.net/21/897/2017/).

<sup>49</sup> USGCRP 2017 at 218.

<sup>50</sup> Wright, D.B., *et al.*, Regional climate model projections of rainfall from U.S. landfalling tropical cyclones, 45 CLIM. DYN. 3365 (2015), <https://link.springer.com/article/10.1007%2Fs00382-015-2544-y>.

<sup>51</sup> USGCRP 2017 at 257.

<sup>52</sup> *Id.*

<sup>53</sup> Balaguru, K., *et al.*, Future Hurricane Storm Surge Risk for the U.S. Gulf and Florida Coasts Based on Projections of Thermodynamic Potential Intensity, 138 CLIMATIC CHANGE 99 (2016), <https://link.springer.com/article/10.1007%2Fs10584-016-1728-8>. This study precedes the unprecedented damages caused by hurricanes in 2017 and 2018.

severe during storms.<sup>54</sup> For example, relative sea levels in New York City increased 19.7 inches (50 centimeters) between 1800 and 2000.<sup>55</sup> The rise in sea levels increased the height of flooding during Hurricane Sandy from 7.5 to 9.2 feet (2.3 to 2.8 meters).<sup>56</sup> Combined with sea level rise, more intense hurricanes could result in a median increase in storm surge from 25 to 47 percent along the U.S. Gulf and Florida coasts.<sup>57</sup>

Global average sea level rose by seven to eight inches since 1900, and the rate of sea level rise is accelerating.<sup>58</sup> Global sea level is likely to rise by 1.0 to 4.3 feet by the end of the century relative to the year 2000, with sea level rise of 8.2 feet possible.<sup>59</sup> The severity of sea level rise is dependent on the actions taken to reduce greenhouse gas pollution. By the end of the century, global mean sea level is projected to increase by 0.8 to 2.6 feet under a lower emissions scenario (the “Representative Concentration Pathway 2.6” scenario), compared with 1.6 to 6 feet under a high emissions scenario (the Representative Concentration Pathway 8.5 scenario”).<sup>60</sup> Sea level rise is already making flooding more likely. Sea level rise has contributed to a 5- to 10-fold increase in minor tidal floods along the U.S. coast since the 1960s (*very high confidence*). Those tidal floods are expected with *very high confidence* to become more frequent, deeper, and wider in extent as sea levels continue to rise.<sup>61</sup> Sea level rise and intensifying storm surge threaten coastal ecosystems and millions of Americans living along the coast. Recent research projected that 4.2 million Americans would be at risk of flooding from 3 feet of sea level rise, while 13.1 million people would be at risk from 6 feet of sea level rise, driving mass human migration and societal disruption.<sup>62</sup> Climate warming also has exacerbated recent historic droughts and western U.S. wildfires by reducing soil moisture and contributing to earlier spring melt and reduced water storage in snowpack (*high confidence*).<sup>63</sup> In the continental western U.S., human-caused climate change accounted for more than half of observed increases in forest fuel aridity from 1979 to 2015.<sup>64</sup> Drying of forest fuels has contributed to an increase the number of large fires (*high confidence*) and a doubling in fire area since the early 1980s.<sup>65</sup> The risk of severe wildfire in Alaska has likely increased by 33 to 50 percent because of climate change.<sup>66</sup> One model suggests that anthropogenic climate change may have quintupled the risk of extreme vapor

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<sup>54</sup> USGCRP 2017 at 27.

<sup>55</sup> Lin, N., *et al.*, Hurricane Sandy’s Flood Frequency Increasing from Year 1800 to 2100, 113 PNAS 12071 (2016), [www.pnas.org/content/113/43/12071](http://www.pnas.org/content/113/43/12071). We converted the return period in Lin *et al.* 2016 to probabilities with National Weather Service, Flood Return Period Calculator, [www.weather.gov/epz/wxcalc\\_floodperiod](http://www.weather.gov/epz/wxcalc_floodperiod) (accessed Nov. 28, 2017).

<sup>56</sup> Lin *et al.* 2016.

<sup>57</sup> Balaguru *et al.* 2016.

<sup>58</sup> USGCRP 2017 at 339.

<sup>59</sup> *Id.* at 25-26, 333, 343.

<sup>60</sup> *Id.* at 344.

<sup>61</sup> *Id.* at 333.

<sup>62</sup> Hauer, Matthew E. *et al.*, Millions Projected to Be at Risk From Sea-Level Rise in the Continental United States, 6 Nature Climate Change 691 (2016); Hauer, Mathew, Migration Induced by Sea-Level Rise could Reshape the US Population Landscape, 7 Nature Climate Change 321 (2017).

<sup>63</sup> *Id.* at 231.

<sup>64</sup> *Id.* at 243.

<sup>65</sup> *Id.* at 243.

<sup>66</sup> *Id.* at 244.

pressure deficit (a measure of atmospheric moisture) in the western U.S. and Canada in 2016, increasing the risk of wildfire.<sup>67</sup>

In addition to warming Earth's climate, CO<sub>2</sub> emissions have made the surface of global oceans about 30 percent more acidic over the last 150 years.<sup>68</sup> There is *medium confidence* that the current rate of acidification is higher than at any time in at least the last 66 million years.<sup>69</sup> Under continued high emissions of CO<sub>2</sub>, surface acidity is expected with *high confidence* to increase by another 100 to 150 percent by the end of the century.<sup>70</sup>

Finally, the Fourth National Climate Assessment concludes with *very high confidence* that large-scale shifts in the climate system, also known as tipping points, and the compound effects of simultaneous extreme climate events have the potential to create unanticipated, and potentially abrupt and irreversible, "surprises" that become more likely as warming increases.<sup>71</sup> The disastrous effects of compound extreme events are, in fact, already occurring, such as during Hurricane Sandy when sea level rise, abnormally high ocean temperatures, and high tides combined to intensify the storm and associated storm surge, and an atmospheric pressure field over Greenland steered the hurricane inland to an "exceptionally high-exposure location."<sup>72</sup> The crossing of tipping points could result in climate states wholly outside human experience and result in severe physical and socioeconomic impacts.<sup>73</sup> For example, increased rainfall and meltwater from Arctic glaciers have the potential to slow a major ocean current called the Atlantic meridional overturning circulation ("AMOC"). If the AMOC slows or collapses, the northeastern U.S. will see a dramatic increase in regional sea levels of as much as 1.6 feet (0.5 meters).<sup>74</sup> Another potential tipping point in the Arctic is the release of carbon (either as CO<sub>2</sub> or as methane) from thawing permafrost, which has the potential to "drive continued warming even if human-caused emissions stopped altogether."<sup>75</sup> In 2016, record high temperatures were set at most permafrost monitoring sites in the Arctic.<sup>76</sup> A recent analysis suggests that the earth is at risk of crossing a planetary threshold that could lock in a rapid pathway toward much hotter

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<sup>67</sup> Tett, S.F.B., *et al.*, Anthropogenic Forcings and Associated Changes in Fires Risk in Western North America and Australia During 2015/16, 99 BAMS S60 (2018), <https://www.ametsoc.org/ams/index.cfm/publications/bulletin-of-the-american-meteorological-society-bams/explaining-extreme-events-from-a-climate-perspective/>.

<sup>68</sup> USGCRP 2017 at 372. Acidification is causing many parts of the ocean to be undersaturated with the calcium carbonate minerals that are the building blocks for the skeletons and shells of many marine organisms, which impairs these organisms' ability to produce and maintain their skeletons and shells. *See* Pacific Marine Environmental Laboratory, National Oceanic and Atmospheric Administration, What Is Ocean Acidification, *available at*:

<https://www.pmel.noaa.gov/co2/story/What+is+Ocean+Acidification%3F>.

<sup>69</sup> USGCRP 2017 at 364.

<sup>70</sup> *Id.*

<sup>71</sup> *Id.* at 411-23.

<sup>72</sup> *Id.* at 416.

<sup>73</sup> *Id.* at 411.

<sup>74</sup> *Id.* at 418.

<sup>75</sup> *Id.* at 419.

<sup>76</sup> Romanovsky, V.E., *et al.*, Terrestrial Permafrost, in Arctic Report Card 2017, J. Richter-Menge *et al.*, eds. (2017), <http://www.arctic.noaa.gov/report-card>.

conditions—“Hothouse Earth”—propelled by self-reinforcing feedbacks, and that this risk could exist at a 2°C temperature rise and increase significantly with additional warming.<sup>77</sup>

ii. Climate change threatens human health.

Anthropogenic climate change is already affecting public health, and will pose even more severe threats without action to greatly limit GHGs.<sup>78</sup> The 2012 joint rulemaking recognized and accounted for these threats. For instance, the 2012 preamble explained that climate change-induced “extreme weather events, changes in air quality, increases in food- and water-borne pathogens, and increases in temperatures are likely to have adverse health effects.”<sup>79</sup> Evidence gathered since the 2012 Final Rule shows the threats to human health have only multiplied and become more severe. The current proposal, however, does not discuss any specific health-related impacts from climate change anywhere in the preamble or its RIA, in contravention of the agencies’ duty to “examine all relevant factors and record evidence, and to articulate a reasoned explanation for [their] decision.”<sup>80</sup> Further, the Draft EIS also improperly shortchanges the discussion of climate change impacts on human health.<sup>81</sup>

Heat is the most direct health threat from climate change,<sup>82</sup> particularly for older adults and young children, outdoor workers, low-income communities, communities of color, and people with chronic illnesses (*very high confidence*).<sup>83</sup> A recent review found evidence for 27 different ways in which extreme heat leads to deadly organ failure, including (but not limited to) such pathologies as ischemia (inadequate blood supply), heat cytotoxicity, and inflammatory response—conditions that can affect the brain, heart, intestines, kidneys, and liver.<sup>84</sup> It is very likely that the United States will see thousands to tens of thousands more premature heat-related deaths in the summer under business as usual. The increase in heat deaths will likely be larger than a concomitant decrease in cold-related deaths.<sup>85</sup>

Extreme heat can exacerbate or cause a range of illnesses such as respiratory diseases or pre-term births that often require expensive emergency treatment.<sup>86</sup> More than 73,000 U.S. patients hospitalized for heat-related illnesses in the U.S. from 2001 to 2010 had a median stay of

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<sup>77</sup> Steffen, Will et al., Trajectories of the Earth System in the Anthropocene, PNAS (2018), <https://doi.org/10.1073/pnas.1810141115>.

<sup>78</sup> USGCRP, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment, Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtnanj, and L. Ziska (eds.) (2016), <https://health2016.globalchange.gov/> at 26 [hereinafter USGCRP 2016].

<sup>79</sup> 77 Fed. Reg. at 62,895.

<sup>80</sup> *Am. Wild Horse Pres. Campaign v. Perdue*, 873 F.3d 914, 923 (D.C. Cir. 2017) (citing *State Farm*, 463 U.S. at 52).

<sup>81</sup> See DEIS Comments.

<sup>82</sup> USGCRP 2016 at 30.

<sup>83</sup> *Id.* at 44.

<sup>84</sup> Mora, C., et al., Twenty-Seven Ways a Heat Wave Can Kill You: Deadly Heat in the Era of Climate Change, 10 CIRC. CARDIOVASC. QUAL. OUTCOME e004233 (2017), <http://circoutcomes.ahajournals.org/content/10/11/e004233> [hereinafter Mora et al. Circ. Cardiovasc. Qual. Outcome].

<sup>85</sup> USGCRP 2016 at 44.

<sup>86</sup> *Id.* at 50.

two days, at a median cost of nearly \$9,000 per stay. Costs were highest among adults over 65 years, African-Americans, Asians/Pacific Islanders, and women.<sup>87</sup>

By one estimate, nearly one-third of the world's population is currently exposed to a deadly combination of heat and humidity for at least 20 days a year; without deep cuts in global GHG emissions, that percentage is projected to rise to nearly three-quarters of the world's population by the end of the century, with particular harms to the southeastern United States.<sup>88</sup> Although air conditioning and other response measures can help limit heat-related deaths and illnesses, future increases in heat could "recurrently 'imprison people' indoors and may turn infrastructure failures (e.g., power outages) into catastrophic events."<sup>89</sup> Florida suffered such harms after Hurricane Irma knocked out electricity at a nursing home and at least 14 residents tragically lost their lives due to heat.<sup>90</sup>

Climate change also is likely to worsen air quality by accelerating the formation of ground-level ozone pollution (*high confidence*), increasing fine particle pollution and ozone pollution from wildfires (*high confidence*), and making pollen and mold allergy seasons longer and more severe (*high confidence*).<sup>91</sup>

Research indicates that faster reductions in carbon pollution will prevent millions of premature deaths. Compared with a 2°C pathway, a 1.5°C pathway is projected to result in 153 ± 43 million fewer premature deaths worldwide (with ~40% of those deaths avoided during the next 40 years) due to reduced PM 2.5 stemming from fossil fuel combustion and ozone exposure, including 130,000 fewer premature deaths in Los Angeles and 120,000 in the New York metropolitan area.<sup>92</sup> For example, there is consistent evidence that wildfire smoke exacerbates existing respiratory health problems, including asthma and chronic obstructive pulmonary disease. Growing evidence also suggests that wildfire smoke exposure is associated with increased risk of respiratory infections.<sup>93</sup> The severe wildfires in summer and fall of 2017 sent people across Washington and California to triage centers, hospitals, and doctors' offices with breathing problems.<sup>94</sup> Communities already suffer a considerable economic burden from the illnesses and deaths related to wildfire smoke. A study that modeled wildfire smoke exposures over the continental U.S. from 2008 to 2012 found that health costs from short-term smoke

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<sup>87</sup> Schmeltz, M.T., *et al.*, Economic Burden of Hospitalizations for Heat-Related Illnesses in the United States, 2001–2010, 13 INT. J. ENVIRON. RES. PUBLIC HEALTH 894 (2016), [www.mdpi.com/1660-4601/13/9/894](http://www.mdpi.com/1660-4601/13/9/894).

<sup>88</sup> Mora, C. *et al.*, Global Risk of Deadly Heat, 7 NATURE CLIMATE CHANGE 501 (2017), [www.nature.com/articles/nclimate3322](http://www.nature.com/articles/nclimate3322).

<sup>89</sup> Mora *et al.*, Circ. Cardiovasc. Qual. Outcome.

<sup>90</sup> Nedelman, M., *Husband and Wife Among 14 Dead After Florida Nursing Home Lost A/C*, CNN (Oct. 9, 2017), [www.cnn.com/2017/10/09/health/florida-irma-nursing-home-deaths-wife/index.html](http://www.cnn.com/2017/10/09/health/florida-irma-nursing-home-deaths-wife/index.html).

<sup>91</sup> USGCRP 2016 at 70.

<sup>92</sup> Shindell, Drew *et al.*, Quantified, Localized Health Benefits of Accelerated Carbon Dioxide Emissions Reductions, 8 Nature Climate Change 291 (2018).

<sup>93</sup> Reid, C.E., *et al.*, Critical Review of Health Impacts of Wildfire Smoke Exposure, 124 ENVIRON. HEALTH PERSPECT. 1334 (2016), <http://dx.doi.org/10.1289/ehp.1409277>.

<sup>94</sup> Upton, J., Breathing Fire, Climate Central (Nov. 7, 2017), [www.climatecentral.org/news/breathing-fire-california-air-quality-smoke-waves-21754](http://www.climatecentral.org/news/breathing-fire-california-air-quality-smoke-waves-21754).



exposures totaled \$63 billion in net present value over the study period, and \$450 billion for long-term exposure effects.<sup>95</sup>

Young children, older adults, those active outdoors, and people with asthma are among the populations most vulnerable to climate-related increases in air pollution.<sup>96</sup> Estimates show that the annual costs that asthma imposes on U.S. states range from \$60.7 million (Wyoming) to \$3.4 billion (California) due to medical expenditures, and \$4.4 million (Wyoming) to \$345 million (California) from missed work and school days.<sup>97</sup>

The USGCRP has also determined with *high confidence* that climate change will alter the geographical extent and seasonal timing of tick- and mosquito-borne diseases like Lyme disease and West Nile Virus.<sup>98</sup> The two species of ticks capable of spreading Lyme disease — the most common vector-borne illness in the U.S.<sup>99</sup> — have already expanded to new regions of the U.S. partly because of rising temperatures.<sup>100</sup> In 2015, *Ixodes scapularis* and *I. pacificus* were found in more than 49 percent of counties in the continental U.S., a nearly 45 percent increase since 1998.<sup>101</sup> Globally, climate change has also increased the capacity of mosquitoes to generate new infections of dengue fever, and the number of dengue cases each year has doubled every decade since 1990.<sup>102</sup>

Rising temperatures, more extreme rainfall, and coastal storm surges are expected with *medium confidence* to increase the risk of water-<sup>103</sup> and food-borne illnesses.<sup>104</sup> For example, vibriosis is an infection contracted through contaminated shellfish or seawater that can lead to diarrhea, skin infections, or even death.<sup>105</sup> The bacteria that cause vibriosis grow more quickly in

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<sup>95</sup> Fann N., *et al.*, The Health Impacts and Economic Value of Wildland Fire Episodes in the U.S.: 2008–2012, 610-611 SCI. TOTAL ENVIRON. 802 (2018),

[www.sciencedirect.com/science/article/pii/S0048969717320223?via%3Dihub](http://www.sciencedirect.com/science/article/pii/S0048969717320223?via%3Dihub).

<sup>96</sup> USGCRP 2016 at 70; *see also* EPA, Health Effects of Ozone Pollution, <https://www.epa.gov/ozone-pollution/health-effects-ozone-pollution> (last visited Apr. 20, 2018).

<sup>97</sup> Nurmagambetov, T., *et al.*, State-level Medical and Absenteeism Cost of Asthma in the United States, 54 J. ASTHMA 357 (2017), [www.tandfonline.com/doi/full/10.1080/02770903.2016.1218013](http://www.tandfonline.com/doi/full/10.1080/02770903.2016.1218013).

<sup>98</sup> USGCRP 2016 at 130.

<sup>99</sup> Schwartz, A.M., *et al.*, Surveillance for Lyme Disease — United States, 2008-2015, 66 MMWR 1 (2017), [www.cdc.gov/mmwr/volumes/66/ss/ss6622a1.htm](http://www.cdc.gov/mmwr/volumes/66/ss/ss6622a1.htm).

<sup>100</sup> Eisen, R.J., *et al.*, Tick-Borne Zoonoses in the United States: Persistent and Emerging Threats to Human Health, ILAR Journal (2017), <https://academic.oup.com/ilarjournal/advance-article/doi/10.1093/ilar/ilx005/3078806>.

<sup>101</sup> Eisen, R.J., County-Scale Distribution of *Ixodes scapularis* and *Ixodes pacificus* (Acari: Ixodidae) in the Continental United States, 53 J. MED. ENTOMOL. 349 (2016), <https://academic.oup.com/jme/article/53/2/349/2459744>.

<sup>102</sup> Watts, N., *et al.*, The *Lancet* Countdown on Health and Climate Change: From 25 Years of Inaction to a Global Transformation for Public Health, *Lancet Online First* (2017) (Watts *et al.*, 2017), [www.thelancet.com/journals/lancet/article/PIIS0140-6736\(17\)32464-9/fulltext](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(17)32464-9/fulltext).

<sup>103</sup> USGCRP 2016 at 158.

<sup>104</sup> *Id.* at 190.

<sup>105</sup> Centers for Disease Control and Prevention, *Vibrio* Species Causing Vibriosis, [www.cdc.gov/vibrio/index.html](http://www.cdc.gov/vibrio/index.html) (accessed Nov. 28, 2017).

warmer waters and are restricted to warmer months of the year along much of the eastern U.S. coast.<sup>106</sup> Reported cases of vibriosis have tripled in the U.S. since 1996.<sup>107</sup>

In addition, climate-related disasters like inland flooding, wildfires, and hurricanes are associated with myriad health threats including injuries, skin infections, mental health conditions, and deaths (*high confidence*).<sup>108</sup>

iii. Climate change and ocean acidification harm biodiversity, ecosystem services, and public lands.

Species can respond to climate change in three ways: they can cope through temporary changes or evolutionary adaptation, relocate to new habitats, or go extinct.<sup>109</sup> Both geographic shifts and extinctions will have dramatic consequences for biodiversity and the ecosystem functions on which humans depend.<sup>110</sup> EPA and NHTSA recognized these threats in the joint 2012 Final Rule and mid-term evaluation. Among many examples, in the 2012 Final Rule preamble, the agencies discussed the NRC's *Advancing the Science of Climate Change* report, which noted the potential for "broad, catastrophic impacts on marine ecosystems."<sup>111</sup> The agencies' Draft TAR reviewed the NRC's *Abrupt Impacts* report, which found "similarities between the projections for future acidification and warming and the extinction at the end of the Permian[,] which resulted in the loss of an estimated 90 percent of known species."<sup>112</sup> In the current Proposal, on the other hand, the agencies include no discussion or analysis of such impacts, even though the evidence of these harms has become even more alarming.

Because attempting to shift its range is often a species' first response to new environmental pressures, climate change is already "impelling a universal redistribution of life on Earth."<sup>113</sup> In fact, many species have experienced local extinctions at the warm edge of their range as they have shifted to cooler latitudes or elevations. A recent review of 976 plant and animal species around the world found that 47 percent have experienced climate-related local extinctions, with the highest extinction rates occurring in tropical species, animals, and freshwater habitats.<sup>114</sup> The redistribution of species has been linked to reduced terrestrial productivity, alterations in ecological networks in marine habitats, and the development of toxic algal blooms.<sup>115</sup>

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<sup>106</sup> Muhling, B.A., *et al.*, Projections of the Future Occurrence, Distribution, and Seasonality of Three *Vibrio* Species in the Chesapeake Bay Under a High-Emission Climate Change Scenario, 1 GEOHEALTH 278 (2017), doi:10.1002/2017GH000089.

<sup>107</sup> USGCRP 2016 at 164.

<sup>108</sup> USGCRP 2016 at 100.

<sup>109</sup> Wiens, J.J., Climate-Related Local Extinctions are Already Widespread Among Plant and Animal Species, 14 PLOS Biology e2001104 (2016), <http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.2001104> [hereinafter Wiens 2016].

<sup>110</sup> Pecl, G.T., *et al.*, Biodiversity Redistribution Under Climate Change: Impacts on Ecosystems and Human Well-Being, 355 SCIENCE eaai9214 (2017) [hereinafter Pecl *et al.* 2017]. Wiens 2016.

<sup>111</sup> 77 Fed. Reg. at 62,895.

<sup>112</sup> Draft TAR at 1-16.

<sup>113</sup> Pecl *et al.* 2017.

<sup>114</sup> Wiens 2016.

<sup>115</sup> Pecl *et al.* 2017.



Many species will be unable to move quickly enough—or to move at all—due to geographical barriers such as oceans or mountains, characteristics of their life histories, a lack of suitable new habitat, or the rapid pace of local changes in climate.<sup>116</sup> For instance, high temperatures, ocean acidification, and non-climate stressors are already causing significant losses of shallow coral reefs in the U.S.<sup>117</sup> Under continued high emissions of GHGs, shallow coral cover in Hawaii is expected to decline from 38 percent in 2010 to 11 percent in 2050.<sup>118</sup> Shallow corals are projected to nearly disappear from south Florida by the late 2030s and from Puerto Rico by the 2070s.<sup>119</sup> In the Arctic's Eastern Bering Sea, reduced ocean productivity linked to higher temperatures is expected to reduce catches of walleye pollock, one of the largest fisheries in the world. At the same time, however, continuing winter sea ice cover may limit the ability of pollock to shift northward to cooler, more productive waters.<sup>120</sup> By one estimate, 4.3°C of additional global warming caused by continued high levels of GHGs could lead to the extinction of 1 in 6 of the world's species, while a temperature rise of 3°C could lead to the extinction of 1 in 12 species.<sup>121</sup>

Both population declines and species extinctions can disrupt the structure and function of ecological networks, which in turn can harm or eliminate ecosystem functions such as pollination.<sup>122</sup> Oyster reefs, for example, provide a wide array of ecosystem services including food production, water filtration, shoreline stabilization, and cultural heritage. Ocean acidification threatens those services by stunting oyster growth, causing developmental abnormalities in larval oysters, and increasing mortality.<sup>123</sup> One recent review of nearly 120 scientific studies found negative effects of climate change on ecosystem services in 59 percent of the analyses. Regulating services (e.g., biological control of pests) and cultural services (e.g., tourism) were strongly harmed by climate change.<sup>124</sup> Another meta-analysis reported that climate

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<sup>116</sup> Wiens 2016. Vázquez, D.P., *et al.*, Ecological and Evolutionary Impacts of Changing Climatic Variability, 92 BIOL. REV. 22 (2017), <http://onlinelibrary.wiley.com/doi/10.1111/brv.12216/abstract>.

<sup>117</sup> USEPA, Multi-Model Framework for Quantitative Sectoral Impacts Analysis: A Technical Report for the Fourth National Climate Assessment, EPA 430-R-17-001, at 171 (2017), [https://cfpub.epa.gov/si/si\\_public\\_record\\_Report.cfm?dirEntryId=335095](https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=335095).

<sup>118</sup> *Id.* at 172.

<sup>119</sup> *Id.* at 173.

<sup>120</sup> Zador, S., *et al.*, Groundfish Fisheries in the Eastern Bering Sea, in Arctic Report Card 2017, J. Richter-Menge, *et al.*, eds., 2017, <http://www.arctic.noaa.gov/report-card>.

<sup>121</sup> Urban, M.C., Accelerating Extinction Risk from Climate Change, 348 SCIENCE 571 (2015), <http://science.sciencemag.org/content/sci/348/6234/571.full.pdf>.

<sup>122</sup> Young, H.S., *et al.*, Patterns, Causes, and Consequences of Anthropocene Defaunation, 47 ANNU. REV. ECOL. EVOL. SYS. 333 (2016), [www.annualreviews.org/doi/10.1146/annurev-ecolsys-112414-054142](http://www.annualreviews.org/doi/10.1146/annurev-ecolsys-112414-054142).

<sup>123</sup> Lemasson, A.J., *et al.*, Linking the Biological Impacts of Ocean Acidification on Oysters to Changes in Ecosystem Services: A Review, 492 J. EXP. MAR. BIOL. ECOL. 49 (2017), [www.sciencedirect.com/science/article/pii/S002209811730059X?via%3Dihub](http://www.sciencedirect.com/science/article/pii/S002209811730059X?via%3Dihub).

<sup>124</sup> Runting, R.K., *et al.*, Incorporating climate change into ecosystem service assessments and decisions: a review, 23 Glob. Change Biol. 28 (2016), doi: 10.1111/gcb.13457.

change is already adversely affecting 82 percent of 94 key ecological processes that form the foundation of healthy ecosystems.<sup>125</sup>

America's national parks are bellwethers for many of these changes. In 2014, the National Park Service published a study that examined the extent to which 289 parks are experiencing extreme climate changes when compared to the historical records from 1901 to 2012.<sup>126</sup> Results show that our national parks are overwhelmingly at the extreme warm end of the historical temperatures. For example, rising sea levels in Florida's Everglades National Park threaten the mangrove ecosystem that filters saltwater, thereby preserving freshwater wetlands.<sup>127</sup> Rising temperatures and drought in New Mexico's Bandelier National Monument have driven bark beetles to higher elevations, causing high mortality rates to the Piñon pines. Rising temperatures in Yellowstone National Park are also killing whitebark pine trees; loss of whitebark pine translates to reduced grizzly bear survival in Yellowstone because grizzlies rely heavily on whitebark pine seeds as a critical source of nutrition.<sup>128</sup> Warmer temperatures in Great Smoky Mountains National Park could increase ozone levels, further damaging critical tree and plant species.<sup>129</sup> Our national parks are living emblems of our nation's heritage, and they warrant regulations and policies that promote ecosystem resilience, enhance restoration and conservation of the system's essential resources, and preserve America's natural and cultural legacy.

iv. Climate change hurts the U.S. economy.

Climate- and weather-related disasters are already harming the U.S. economy. There have been 219 such disasters since 1980 that cost the country at least \$1 billion each, for a total cost of more than \$1.5 trillion.<sup>130</sup> One recent study estimated that the increased cost of U.S. hurricane damage due to human-caused climate change added between \$2 and \$14 billion of losses in 2005.<sup>131</sup> In 2017, there were 16 separate weather and climate disaster events in the U.S. with damages exceeding \$1 billion each, *totaling \$306 billion in just one year*—a new U.S. record.<sup>132</sup>

In the 2012 Final Rule, EPA and NHTSA provided both a macro-level discussion of the economic consequences of climate change and also noted the many specific phenomena that will

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<sup>125</sup> Scheffers, B.R., *et al.*, The broad footprint of climate change from genes to biomes to people, 354 *SCIENCE* 719 (2016), <http://science.sciencemag.org/content/354/6313/aaf7671>.

<sup>126</sup> Monahan WB and NA Fisichelli, Climate Exposure of US National Parks in a New Era of Change, 9 *PLoS ONE* 7: e101302. doi:10.1371/journal.pone.0101302 (2014).

<sup>127</sup> National Park Service, Climate Change – Everglades National Park, <https://www.nps.gov/ever/learn/nature/cceffectssalineglades.htm> (accessed Dec. 29, 2017).

<sup>128</sup> National Park Service, Climate Change in National Parks, <https://www.nature.nps.gov/climatechange/docs/NPSClimateChangeBrochure.pdf> (accessed Dec. 29, 2017).

<sup>129</sup> Andrew Bingham and Ellen Porter, Ozone effects on two ecosystem services at Great Smoky Mountains National Park, National Parks Service (2015),

[https://www.nps.gov/articles/parkscience\\_32\\_1\\_71-79\\_bingham\\_porter\\_3825.htm](https://www.nps.gov/articles/parkscience_32_1_71-79_bingham_porter_3825.htm).

<sup>130</sup> NOAA National Centers for Environmental Information (NCEI), U.S. Billion-Dollar Weather and Climate Disasters (2018), <https://www.ncdc.noaa.gov/billions/>.

<sup>131</sup> Estrada, Francisco *et al.*, Economic Losses from US Hurricanes Consistent with an Influence from Climate Change, 8 *Nature Geoscience* 880 (2015).

<sup>132</sup> *Id.* The devastating destruction caused by hurricanes in 2018, including Florence and Michael, has yet to be assessed.

have negative economic repercussions. With regard to the former, the agencies discussed in detail their use of the Interagency Working Group’s social cost of carbon metric to quantify the negative economic impacts resulting from each marginal ton of CO<sub>2</sub> pollution and the corresponding economic benefits resulting from each marginal ton of emission *reduction*.<sup>133</sup> With regard to the latter, the agency noted many specific impacts from climate change that will have economic consequences, such as changes in “net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services.”<sup>134</sup>

In stark contrast, the Proposal and PRIA discuss *no* specific economic impacts from climate change, nor do they assess how the proposed repeal may exacerbate these impacts. The Draft EIS’ discussion of climate change’s economic impacts is similarly inadequate. This is a basic violation of the agencies’ duties to “consider [the] important aspect[s] of the problem”<sup>135</sup> in front of it and to “examine all relevant factors and record evidence.”<sup>136</sup> The Proposal and PRIA’s only discussion of climate change’s economic consequences is an unlawfully skewed and fundamentally erroneous assessment that drastically undervalues the estimated net climate benefits that would be lost if the repeal were finalized.<sup>137</sup> As discussed in detail in other comments submitted by the Organizations and others to the docket, the Proposal applies a deeply flawed social cost of carbon metric to quantify these net climate benefits.<sup>138</sup> Recent data, however, demonstrate that the economic harm attributable to climate change is *at least* as devastating as the estimate reflected in the 2012 Final Rule. According to a 2017 technical assessment by EPA’s Climate Change Impacts and Risk Analysis (“CIRA”) project, climate change will cost the U.S. economy *hundreds of billions of dollars each year under conservative estimates*.<sup>139</sup> Projected damages are significantly larger under a high-emissions scenario. Damages also increase over time, but not necessarily gradually; abrupt changes in climate may lead to abrupt increases in economic harm.<sup>140</sup> Some of the major climate-related economic impacts examined include:

- **Labor losses (\$160 billion per year).** Changes in extreme temperature, particularly heat, are expected to reduce the number of suitable working hours in the contiguous U.S. by 1.9 billion hours in 2090.<sup>141</sup> Globally, heat has already reduced outdoor labor capacity in

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<sup>133</sup> 77 Fed. Reg. at 62,718, 62,927-30, 63,004-06.

<sup>134</sup> 77 Fed. Reg. at 62,718.

<sup>135</sup> *State Farm*, 463 U.S. at 43.

<sup>136</sup> *Perdue*, 873 F.3d at 923.

<sup>137</sup> PRIA at 1061-65.

<sup>138</sup> See comments on the social cost of carbon submitted by the Institute for Policy Integrity to these dockets.

<sup>139</sup> USEPA, Multi-Model Framework for Quantitative Sectoral Impacts Analysis: A Technical Report for the Fourth National Climate Assessment, 209-10 (2017), *available at* [https://cfpub.epa.gov/si/si\\_public\\_record\\_Report.cfm?dirEntryId=335095](https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=335095) [hereinafter USEPA 2017].

<sup>140</sup> *Id.* at 3, 4.

<sup>141</sup> *Id.* at 54.

rural areas by approximately 5.3 percent from 2000 to 2016.<sup>142</sup> In 2013, 16,320 U.S. workers missed work because of heat-related illnesses.<sup>143</sup>

- **Heat-related deaths (\$140 billion per year).** By 2090, 49 U.S. cities will see an estimated 9,300 additional premature deaths due to heat.<sup>144</sup>
- **Damage to coastal property (\$120 billion per year).** The combination of sea level rise and storm surge will put energy infrastructure and residential, commercial, industrial, and government properties at significant risk by 2090. This damage estimate is extremely conservative, as it does not include transportation or telecommunication infrastructure or ecological resources.<sup>145</sup> The credit-rating agency Moody's already incorporates the severe financial risks of sea level rise and hurricane damage in its assessment of state and local credit-worthiness.<sup>146</sup>
- **Damage to roads (\$20 billion per year).** Extreme heat, heavy rain and flooding, and changes in freeze-thaw cycles are expected to significantly increase costs for road maintenance, repair, and replacement by 2090.<sup>147</sup> A more recent analysis suggests that costs associated with heat alone could exceed \$35 billion per year in 2070.<sup>148</sup>
- **Need for increased electricity generation (\$9.2 billion per year).** Electricity demand is expected to increase in every region of the U.S. as temperatures rise, increasing the costs of power generation in 2090.<sup>149</sup>

Other national-scale studies have confirmed the CIRA report's finding that unmitigated climate change will have extremely damaging economic impacts on the United States. For example, a September 2017 report by the Government Accountability Office highlighted a 2014 study by the Rhodium Group, entitled the "American Climate Prospectus," that assessed the impacts of climate change on coastal property, health, agriculture, the energy sector, labor productivity, and crime.<sup>150</sup> According to the Rhodium study, the likely combined impacts of climate change would reduce United States gross domestic product by 1 to 3 percent each year by the end of this century. According to this study, the *annual* health-related impacts alone could reach as high as \$161 billion over the 2040-2059 period and surpass \$500 billion by the 2080-2099 period. Losses in labor productivity could be as high as \$150 billion per year by 2080-

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<sup>142</sup> Watts *et al.*, 2017 at 581.

<sup>143</sup> Office of Compliance, Fast Facts — Heat Stress: Don't Let the Heat Get You Down, [www.compliance.gov/sites/default/files/Heat%20Stress%202016%20Fast%20Fact\\_1.pdf](http://www.compliance.gov/sites/default/files/Heat%20Stress%202016%20Fast%20Fact_1.pdf) (accessed Nov. 29, 2017).

<sup>144</sup> USEPA 2017 at 48.

<sup>145</sup> *Id.* at 113.

<sup>146</sup> Moody's Investors Services, Evaluating the Impact of Climate Change on US State and Local Issuers (2017).

<sup>147</sup> USEPA 2017 at 86.

<sup>148</sup> Underwood, S.B., *et al.*, Increased Costs to US Pavement Infrastructure from Future Temperature Rise, 7 NATURE CLIMATE CHANGE 704 (2017), [www.nature.com/articles/nclimate3390](http://www.nature.com/articles/nclimate3390).

<sup>149</sup> USEPA 2017 at 120.

<sup>150</sup> See U.S. Government Accountability Office, Climate Change: Information on Potential Economic Effects Could Help Guide Federal Efforts to Reduce Fiscal Exposure (Sept. 2017), <https://www.gao.gov/assets/690/687466.pdf> [hereinafter USGAO 2017].

2099, and storm-related losses and sea level rise could cause an additional \$190 billion per year in property damage from 2080-2099.<sup>151</sup>

v. Climate change threatens national security.

Military and intelligence leaders have long recognized the national security threats of climate change.<sup>152</sup> As the Department of Defense concluded in a 2015 report to Congress,<sup>153</sup> “[g]lobal climate change will have wide-ranging implications for U.S. national security interests over the foreseeable future because it will aggravate existing problems—such as poverty, social tensions, environmental degradation, ineffectual leadership, and weak political institutions—that threaten domestic stability in a number of countries.”

In fact, the Department of Defense “sees climate change as a present security threat, not strictly a long-term risk. [The Department is] already observing the impacts of climate change in shocks and stressors to vulnerable nations and communities, including in the United States, and in the Arctic, Middle East, Africa, Asia, and South America.”<sup>154</sup> For instance, the number of dangerously hot days – known as “black flag days” – has increased at a Department facility in the Middle East, requiring the suspension of “non-mission essential physical training and strenuous exercise.”<sup>155</sup> Flooding associated with high tides has also damaged national security infrastructure at multiple locations, including antenna facilities at a missile testing range in the Pacific.<sup>156</sup>

Extreme heat, storms and floods, sea level rise, and loss of natural resources will damage military installations, disrupt supply chains, imperil the safety of personnel, hamper training and readiness, increase the need for deployments in high risk areas of the world, and dramatically increase operating costs—exposing America’s service personnel and citizens at home and abroad to needless risks and preventable harms.<sup>157</sup>

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<sup>151</sup> *Id.* at 20 (citing Rhodium Group LLC, *American Climate Prospectus: Economic Risks in the United States* (Oct. 2014)).

<sup>152</sup> The Climate and Security Advisory Group, *A Responsibility to Prepare* (2018), [https://climateandsecurity.files.wordpress.com/2018/02/climate-and-security-advisory-group\\_a-responsibility-to-prepare\\_2018\\_02.pdf](https://climateandsecurity.files.wordpress.com/2018/02/climate-and-security-advisory-group_a-responsibility-to-prepare_2018_02.pdf).

<sup>153</sup> U.S. Department of Defense, *National Security Implications of Climate-Related Risks and a Changing Climate*, 3 (2015), <http://archive.defense.gov/pubs/150724-congressional-report-on-national-implications-of-climate-change.pdf?source=govdelivery> [hereinafter USDOD 2015].

<sup>154</sup> *Id.* at 14.

<sup>155</sup> U.S. Government Accountability Office, *Climate Change Adaptation: DOD Needs to Better Incorporate Adaptation into Planning and Collaboration at Overseas Installations*, 19 (2017), <https://www.gao.gov/assets/690/688323.pdf>.

<sup>156</sup> *Id.*

<sup>157</sup> National Intelligence Council, *Implications for US National Security of Anticipated Climate Change* (2016), <https://www.dni.gov/index.php/newsroom/reports-publications/reports-publications-2016/item/1629-implications-for-us-national-security-of-anticipated-climate-change>; Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, *Climate-Related Risk to DoD Infrastructure Initial Vulnerability Assessment Survey (SLVAS) Report* (2018), <https://reliefweb.int/report/world/departement-defense-climate-related-risk-dod-infrastructure-initial-vulnerability>; Gregg Garfin, *Climate Change Impacts and Adaptation on Southwestern DoD Facilities*



In sum, the record at the time the 2012 Final Rule was promulgated and studies and reports issued thereafter present overwhelming evidence that climate change is already wreaking havoc on public health and the environment, that the American economy is suffering damages measured in hundreds of billions of dollars annually, and that these trends are accelerating and could lead to catastrophic effects unless action is taken *now* to reverse course. EPA's and NHTSA's failure to engage with these facts in the Proposal is arbitrary and capricious. The agencies must withdraw that document and implement and strengthen the existing standards.

**b. To Avoid the Most Devastating Impacts of Climate Change, the United States Must Act *Now* to Reduce Greenhouse Gas Emissions from Cars and Light Duty Trucks.**

The hazards posed by GHG emissions for health and welfare are inherently time-sensitive. Because CO<sub>2</sub> is long-lived in the atmosphere, each year's emissions add to the accumulated total of CO<sub>2</sub> already in the atmosphere, building year after year to ever higher concentrations.<sup>158</sup> The longer we wait to reduce emissions, the greater the risks will be, and the greater the cost of reducing those risks in the future. Action too long delayed may put a sustainable climate out of reach altogether.

In 2014, the White House issued a report demonstrating that the cost of delay is not only extremely steep but also potentially irreversible, and rises exponentially as delay continues.<sup>159</sup> As the report notes, the costs of delay are “driven by fundamental elements of climate science and economics”<sup>160</sup> because CO<sub>2</sub> remains in the atmosphere for hundreds of years after it is emitted. Any mitigation policy that is delayed must therefore “take as its starting point a higher atmospheric concentration of CO<sub>2</sub>.”<sup>161</sup> Based on conservative assumptions (omitting, for example, the effects of crucial tipping points such as methane releases from melting permafrost), the report values the cost of *delay alone*—i.e., excluding the damages that occur absent delay—at no less than \$150 billion (or 0.9 percent of global output) for every year that action is delayed, if that delay causes global temperatures to overshoot a threshold increase of two degrees Celsius by just one additional degree (relative to pre-industrial levels).<sup>162</sup> Every additional degree of warming thereafter will sharply raise the annual damage above this increment (for example, an

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(2017), <https://www.serdp-estcp.org/Program-Areas/Resource-Conservation-and-Resiliency/Infrastructure-Resiliency/Vulnerability-and-Impact-Assessment/RC-2232>; USDOD 2015.

<sup>158</sup> 77 Fed. Reg. at 62,895 (citing NRC, *Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia* (2011) (“Emissions of carbon dioxide from the burning of fossil fuels have ushered in a new epoch where human activities will largely determine the evolution of Earth’s climate. Because carbon dioxide in the atmosphere is long lived, it can effectively lock Earth and future generations into a range of impacts, some of which could become very severe. Emission reduction choices made today matter in determining impacts experienced not just over the next few decades, but in the coming centuries and millennia.”)).

<sup>159</sup> The White House, *The Cost of Delaying Action to Stem Climate Change*, at 2 (July 29, 2014), <https://obamawhitehouse.archives.gov/the-press-office/2014/07/29/white-house-report-cost-delaying-action-stem-climate-change>.

<sup>160</sup> *Id.* at 4.

<sup>161</sup> *Id.*

<sup>162</sup> *Id.* at 4-5 (citing the DICE model (Nordhaus (2013))).

*additional* 1.2 percent of global output for a rise in temperatures to the next degree Celsius).<sup>163</sup> These costs are not one-time, but are incurred permanently and cumulatively, year after year.<sup>164</sup> Conversely, a delayed policy to mitigate climate change, once implemented, “must be more stringent and thus more costly in subsequent years.”<sup>165</sup> Summarizing numerous peer-reviewed scientific and economic studies, the report concluded that “delay substantially decreases the chances that even concerted efforts in the future will hit” aggressive climate targets.<sup>166</sup>

A 2018 special report from the Intergovernmental Panel on Climate Change (“IPCC”) on *Global Warming of 1.5°C* demonstrates the need for immediate, far-reaching action to reduce greenhouse gas emissions to limit warming to 1.5°C to avoid devastating harms to people and life on earth, and emphasizes the high costs of delayed action in making emissions cuts.<sup>167</sup>

The report quantifies the harms that would occur at 2°C warming compared with 1.5°C, and the differences are stark. According to the IPCC’s analysis, the damages that would occur at 2°C warming compared with 1.5°C include more deadly heat waves, drought and flooding; 10 centimeters of additional sea level rise within this century, exposing 10 million more people to flooding; a greater risk of triggering the collapse of the Greenland and Antarctic ice sheets with resulting multi-meter sea level rise; dramatically increased species extinction risk, including a doubling of the number of vertebrate and plant species losing more than half their range, and the virtual elimination of coral reefs; 1.5 to 2.5 million more square kilometers of thawing permafrost area with the associated release of methane, a potent greenhouse gas; a tenfold increase in the probability of ice-free Arctic summers; a higher risk of heat-related and ozone-related deaths and the increased spread of mosquito-borne diseases such as malaria and dengue fever; reduced yields and lower nutritional value of staple crops like corn, rice, and wheat; a doubling of the number of people exposed to climate-change induced increases in water stress; and up to several hundred million more people exposed to climate-related risks and susceptible to poverty by 2050.<sup>168</sup>

The IPCC report concludes that pathways to limit warming to 1.5°C with little or no overshoot require “a rapid phase out of CO<sub>2</sub> emissions and deep emissions reductions in other GHGs and climate forcers.”<sup>169</sup> In pathways consistent with a 1.5°C temperature increase, global net anthropogenic CO<sub>2</sub> emissions must decline *by about 45% from 2010 levels by 2030*, reaching net zero around 2050 (*high confidence*).<sup>170</sup> For a two-thirds chance for limiting warming to 1.5°C, CO<sub>2</sub> emissions must reach carbon neutrality in 25 years (*high confidence*).<sup>171</sup> The special

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<sup>163</sup> *Id.*

<sup>164</sup> *Id.* at 2.

<sup>165</sup> *Id.* at 1.

<sup>166</sup> *Id.* at 5.

<sup>167</sup> IPCC [Intergovernmental Panel on Climate Change], *Global Warming of 1.5°C*, an IPCC Special Report on the Impacts of Global Warming of 1.5°C Above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty (October 6, 2018) (“IPCC 2018 Special Report”), <http://www.ipcc.ch/report/sr15/>.

<sup>168</sup> *Id.* at Summary for Policymakers, SPM-8 to SPM-14.

<sup>169</sup> *Id.* at Chapter 2, 2-28.

<sup>170</sup> *Id.* at Summary for Policymakers, SPM-15.

<sup>171</sup> *Id.* at Summary for Policymakers, SPM-15.



report lays out in stark terms that a mere one-half of a degree Celsius of additional warming makes a vast difference in avoiding immense damage in food and water security, loss of coastal properties, extreme heat waves, droughts and flooding, migration, poverty, devastating health outcomes and lives lost. And it leaves no doubt that emission reductions within *just the next decade* will make that difference.

In regard to the transportation sector, the report finds that the needed deep emissions reductions would be achieved by technology-focused measures that include energy efficiency and fuel-switching.<sup>172</sup> In 1.5°C-consistent pathways, renewables would supply 70% to 85% of power by 2050.<sup>173</sup> Transport would need to shift heavily towards green electricity, which “would [have to] rise from less than 5% in 2020 to about 35-65% in 2050.”<sup>174</sup>

In short, the IPCC report provides overwhelming scientific evidence for the necessity of immediate, deep greenhouse gas reductions across all sectors to avoid devastating climate change-driven damages, and underscores the high costs of inaction or delays, *particularly* in the next crucial decade—which spans the six years of inexcusable inaction the agencies propose—in making these cuts.

The current proposal to drastically weaken existing vehicle GHG standards flouts these fundamental and well-understood principles. The mere act of delaying further reductions in vehicle GHG emissions itself exacerbates the harm they cause, an effect completely ignored in the Proposal. It is arbitrary, capricious, and unlawful for this reason alone.

Until this administration’s announcement of its intention to reverse U.S. policy committing to the Paris Agreement,<sup>175</sup> every country in the world endorsed the effort to act now in order to keep temperature increases and their enormous costs at a minimum. As part of its efforts under the Paris Agreement to combat climate change, the United States committed to the target of holding the long-term global average temperature “to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels”.<sup>176</sup> The Paris Agreement codifies the international consensus that climate change is an “urgent threat” of global concern.<sup>177</sup> The Agreement also requires a “well below 2°C” climate target because 2°C of warming is no longer considered a safe guardrail for avoiding catastrophic climate impacts and runaway climate change.<sup>178</sup> EPA and NHTSA considered the

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<sup>172</sup> *Id.* at Chapter 2, 2-66.

<sup>173</sup> *Id.* at Summary for Policymakers, SPM-21.

<sup>174</sup> *Id.* at Summary for Policymakers, SPM-22.

<sup>175</sup> On December 12, 2015, the United States and 194 other nation-states meeting in Paris at the 2015 United Nations Framework Convention on Climate Change Conference of the Parties consented to the Paris Agreement, committing its parties to take action to tackle dangerous climate change. Although the Trump administration has announced its intent to leave the Paris Agreement, the U.S. remains a party to it until it formally withdraws pursuant to Article 28 of the Paris Agreement. Paris Agreement Art. 28.

<sup>176</sup> Paris Agreement Art. 2(1)(a).

<sup>177</sup> See Paris Agreement Recitals.

<sup>178</sup> Hansen, James *et al.*, Target atmospheric CO<sub>2</sub>: Where should humanity aim?, 2 THE OPEN ATMOSPHERIC SCI. J. 217 (2008); Anderson, Kevin and Alice Bows, Beyond ‘dangerous’ climate change: emission scenarios for a new world, 369 PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOC’Y 20 (2011); Hansen, James *et al.*, Assessing “dangerous climate change”: Required reduction of carbon

impact of the existing standards in the context of this international effort to combat global climate change during the course of the mid-term evaluation;<sup>179</sup> the current Proposal, on the other hand, does not mention the global effects of that action, let alone explain why EPA and NHTSA's earlier conclusions were incorrect.

Instead of delay, immediate and aggressive GHG emissions reductions are necessary to keep warming well below a 2°C rise above pre-industrial levels. The U.S. is the world's second-largest emitter of CO<sub>2</sub> from fossil fuels,<sup>180</sup> and in 2017, transportation sector emissions contributed about 37 percent of U.S. energy-related CO<sub>2</sub>.<sup>181</sup> As discussed below, aggressive climate action requires a steep reduction in emissions from the transportation sector, which recently overtook power plants as the largest U.S. source of GHG emissions. Without major reductions in U.S. transportation sector emissions, success in keeping temperatures below a 2°C rise above pre-industrial levels is extremely unlikely.

The IPCC's Fifth Assessment Report and other expert assessments have established global carbon budgets, which correspond to the total amount of CO<sub>2</sub> (and CO<sub>2</sub>-equivalent emissions of other GHGs) that can be released into the atmosphere while maintaining some probability of staying below a given temperature target. According to the IPCC, the total cumulative anthropogenic emissions of CO<sub>2</sub> from 2011 onward must remain below about 1,000 gigatonnes (GtCO<sub>2</sub>) for a 66 percent probability of limiting warming to 2°C above pre-industrial levels, and to 400 GtCO<sub>2</sub> from 2011 onward for a 66 percent probability of limiting warming to 1.5°C.<sup>182</sup> The 2018 IPCC special report on *Global Warming of 1.5°C* provides a revised carbon budget for a 66 percent probability of limiting warming to 1.5°C, estimated between 420 GtCO<sub>2</sub> and 570 GtCO<sub>2</sub>, from January 2018 onwards.<sup>183</sup> At the current emissions rate of 42 GtCO<sub>2</sub> per

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emissions to protect young people, future, generations and nature, 8 PLOS ONE e81648 (2013); IPCC [Intergovernmental Panel on Climate Change], *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, [Core Writing Team, R.K. Pachauri & L.A. Meyer (eds.)], at 72-73, IPCC, Geneva, Switzerland (2014), [http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR\\_AR5\\_FINAL\\_full\\_wcover.pdf](http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf); U.N. Subsidiary Body for Scientific and Technological Advice, *Report on the Structured Expert Dialogue on the 2013-2015 review*, FCCC/SB/2015/INF.1 (2015), <http://unfccc.int/resource/docs/2015/sb/eng/inf01.pdf>; Hansen, James *et al.*, Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observation that 2°C global warming could be dangerous, 16 *ATMOS. CHEM. & PHYSICS* 3761 (2016); Schleussner, Carl-Friedrich *et al.*, Differential climate impacts for policy-relevant limits to global warming: the case of 1.5C and 2C, 7 *EARTH SYSTEMS DYNAMICS* 327 (2016).

<sup>179</sup> Draft TAR at 1-19 – 1-20.

<sup>180</sup> International Energy Agency, *CO<sub>2</sub> Emissions from Fuel Combustion: Overview* at 6 (2017), [www.iea.org/publications/freepublications/publication/CO2EmissionsFromFuelCombustion2017Overview.pdf](http://www.iea.org/publications/freepublications/publication/CO2EmissionsFromFuelCombustion2017Overview.pdf).

<sup>181</sup> In 2017, carbon dioxide emissions from the U.S. transportation sector were 1,902 million metric tons. U.S. Energy Information Administration, *Frequently Asked Questions*, [www.eia.gov/tools/faqs/faq.php?id=77&t=11](http://www.eia.gov/tools/faqs/faq.php?id=77&t=11) (accessed Oct. 7, 2018).

<sup>182</sup> IPCC, *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)], at 63-64 & tbl. 2.2, IPCC, Geneva, Switzerland (2014).

<sup>183</sup> IPCC 2018 Special Report, <http://www.ipcc.ch/report/SPM-16>.

year, this carbon budget will be spent in just the next 10 to 14 years, underscoring the urgent need for transformative global action to reduce carbon emissions to net zero within the next three decades.<sup>184</sup>

Published scientific studies have estimated the United States' portion of the global carbon budget by allocating the remaining budget across countries based on equity, economics, and other factors. Estimates of the U.S. carbon budget vary depending on the temperature target used by the study (1.5°C versus 2°C), the likelihood of meeting the temperature target (50 percent versus 66 percent probability), the equity principles used to apportion the global budget among countries, and whether a cost-optimal model was employed. As detailed below, the U.S. carbon budget for limiting temperature rise to well below 2°C has been estimated at 25 GtCO<sub>2</sub>eq to 57 GtCO<sub>2</sub>eq on average,<sup>185</sup> while the budget for limiting temperature rise to 2°C ranges from 34 GtCO<sub>2</sub> to 123 GtCO<sub>2</sub>.

To estimate the remaining U.S. carbon budget from 2010 to 2100 for a 50 percent chance of keeping the global average temperature rise to 1.5°C by 2100, researchers used averages across IPCC-AR5 equity-based sharing principles under a cost-optimal model.<sup>186</sup> Using this methodology, these researchers estimated the U.S. carbon budget at 25 GtCO<sub>2</sub>eq for six well-mixed GHGs (which corresponds to CO<sub>2</sub>-specific emissions of ~17 GtCO<sub>2</sub>) by averaging across four equity principles: capability, equal per capita emissions, greenhouse development rights, and equal cumulative per capita emissions.<sup>187</sup> The study estimated the U.S. budget at 57 GtCO<sub>2</sub>eq (which corresponds to CO<sub>2</sub>-specific emissions of ~38 GtCO<sub>2</sub>)<sup>188</sup> when averaging across five sharing principles by adding the constant emissions ratio to the four above-mentioned principles.<sup>189</sup> The U.S. carbon budget for a 66 percent probability of keeping warming below 2°C was estimated at 60 GtCO<sub>2</sub>eq based on four equity principles (capability, equal per capita, greenhouse development rights, equal cumulative per capita), and at 104 GtCO<sub>2</sub>eq for six well-

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<sup>184</sup> *Id.*

<sup>185</sup> *Id.* Quantities measured in GtCO<sub>2</sub>eq refers to the mass emissions of six well-mixed GHGs converted into CO<sub>2</sub>-equivalent values, while quantities measured in GtCO<sub>2</sub> refer to mass emissions of just CO<sub>2</sub> itself. See Meinshausen, Malte *et al.*, Greenhouse Gas Emission Targets for Limiting Global Warming to 2 Degrees Celsius, 458 NATURE 1158 (2009) [hereinafter Meinshausen *et al.* 2009]. We used a conversion factor of 1 GtCO<sub>2</sub> = 1.5 GtCO<sub>2</sub>eq based on Table 1 in Meinshausen *et al.* (2009).

<sup>186</sup> Robiou du Pont, Yann *et al.*, Equitable Mitigation to Achieve the Paris Agreement Goals, 7 NATURE CLIMATE CHANGE 38 (2017).

<sup>187</sup> Robiou du Pont, Yann *et al.*, Equitable Mitigation to Achieve the Paris Agreement Goals, 7 NATURE CLIMATE CHANGE 38 (2017), at Supplemental Table 1.

<sup>188</sup> *Id.* Quantities measured in GtCO<sub>2</sub>eq refers to the mass emissions of six well-mixed GHGs converted into CO<sub>2</sub>-equivalent values, while quantities measured in GtCO<sub>2</sub> refer to mass emissions of just CO<sub>2</sub> itself. See Meinshausen, Malte *et al.*, Greenhouse Gas Emission Targets for Limiting Global Warming to 2 Degrees Celsius, 458 NATURE 1158 (2009) [hereinafter Meinshausen *et al.* 2009]. We used a conversion factor of 1 GtCO<sub>2</sub> = 1.5 GtCO<sub>2</sub>eq based on Table 1 in Meinshausen *et al.* (2009).

<sup>189</sup> Robiou du Pont, Yann *et al.*, Equitable Mitigation to Achieve the Paris Agreement Goals, 7 NATURE CLIMATE CHANGE 38 (2017), at Supplemental Table 1. We note, however, that the constant emissions ratio, which maintains current emissions ratios, is not considered to be an equitable sharing principle because it is a grandfathering approach that “privileges today’s high-emitting countries when allocating future emission entitlements.” Kartha, S. et al., Cascading Biases Against Poorer Countries, 8 NATURE CLIMATE CHANGE 348 (2018).

mixed GHGs based on five principles (adding in the constant emissions ratio, but see footnote above).<sup>190</sup> For a 66 percent probability of keeping warming below 2°C, another study estimated the U.S. carbon budget at 34 GtCO<sub>2</sub> based on an “equity approach” for allocating the global carbon budget, and 123 GtCO<sub>2</sub> under an “inertia approach.”<sup>191</sup> The equity approach allocates national carbon budgets based on population size and provides for equal per capita emissions across countries, whereas the inertia approach bases sharing on countries’ current emissions. Also using a 66 percent probability of keeping warming below 2°C, a third study estimated the U.S. carbon budget at 78 to 97 GtCO<sub>2</sub> based on a contraction and convergence framework, in which all countries adjust their emissions over time to achieve equal per capita emissions.<sup>192</sup> Although the contraction and convergence framework corrects current emissions inequities among countries over a specified time frame, it does not account for inequities stemming from differences in historical emissions. When accounting for historical responsibility, the study estimated that the United States has an additional cumulative carbon debt of 100 GtCO<sub>2</sub> as of 2013.<sup>193</sup> Using a non-precautionary 50 percent probability of limiting global warming to 2°C, an additional study estimated the U.S. carbon budget at 158 GtCO<sub>2</sub> based on a “blended” approach of sharing principles that averages the “inertia” and “equity” approaches.<sup>194</sup> Of that 158 GtCO<sub>2</sub> budget, 91 GtCO<sub>2</sub> was categorized as “committed” emissions through the lifetimes of existing CO<sub>2</sub>-emitting infrastructure (unless they are retired early).<sup>195</sup>

Although the cited studies differ in terms of certain assumptions and normative emphases, they all tell the same fundamental story: under *any* conceivable scenario, the remaining U.S. carbon budget for limiting global average temperature rise to 1.5°C or 2°C is extremely small and is rapidly being consumed. In 2017, the U.S. transportation sector emitted 1.9 GtCO<sub>2</sub>.<sup>196</sup> Regardless of whether the total remaining U.S. carbon budget is 38 GtCO<sub>2</sub> (to limit temperature rise to well below 2°C) or in the range of 34 GtCO<sub>2</sub> to 158 GtCO<sub>2</sub> (to hold the rise to 2°C), the country must rapidly reduce and then eliminate its vehicular emissions. By delaying critical emission reductions from cars and trucks, the Proposal could seriously imperil the United States’ ability to avoid the most harmful impacts of climate change. Yet it has given no consideration to this key consequence of its proposed action.

**c. The Transportation Sector Has Become the Largest Source of Climate-Destabilizing Emissions; No Strategy for Curbing Climate Change Can**

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<sup>190</sup> Robiou du Pont, Yann *et al.*, Equitable Mitigation to Achieve the Paris Agreement Goals, 7 NATURE CLIMATE CHANGE 38 (2017), at Supplemental Table 2.

<sup>191</sup> Peters, Glen P. *et al.*, Measuring a fair and ambitious climate agreement using cumulative emissions, 10 ENVTL. RES. LETT. 105004 (2015).

<sup>192</sup> Gignac, Renaud and H. Damon Matthews, Allocating a 2C cumulative carbon budget to countries, 10 ENVTL. RES. LETT. 075004 (2015). In a contraction and convergence approach, national emissions are allowed to increase or decrease for some period of time until they converge to a point of equal per capita emissions across all regions at a given year, at which point all countries are entitled to the same annual per capita emissions.

<sup>193</sup> *Id.*

<sup>194</sup> Raupach, Michael *et al.*, Sharing a quota on cumulative carbon emissions, 4 NATURE CLIMATE CHANGE 873, at supp. fig. 7 (2014).

<sup>195</sup> *Id.*

<sup>196</sup> U.S. Energy Information Administration, Frequently Asked Questions, [www.eia.gov/tools/faqs/faq.php?id=77&t=11](http://www.eia.gov/tools/faqs/faq.php?id=77&t=11) (accessed Oct. 7, 2018).

### **Succeed Without Substantial and Rapid Reductions of Emissions from this Sector.**

In 2016, the U.S. transportation sector surpassed the electric sector for the first time as the nation's largest emitter of GHGs.<sup>197</sup> In 2017, the transportation sector emitted 1,902 MMT CO<sub>2</sub>—37 percent of the national total CO<sub>2</sub> emissions—compared to 1,744 MMT CO<sub>2</sub> in the electric power sector, 34 percent of the national total.<sup>198</sup> Moreover, transportation sector emissions have increased every year since 2012.<sup>199</sup> U.S. transportation-related emissions vastly outstrip those of any other country; in 2015, for instance, U.S. CO<sub>2</sub> emissions from the transportation sector were more than double those of China and were more than 83 percent greater than those of all 26 of Europe's OECD countries combined.<sup>200</sup> Meanwhile, light-duty cars and trucks are responsible for nearly 60% of transportation sector GHG emissions.<sup>201</sup> Emissions from the transportation sector continue to rise dramatically—increasing by 22% between 1990 and 2016, due in substantial part to light-duty vehicles.<sup>202</sup> It is clear that without rapid and substantial progress in reducing U.S. transportation sector emissions in the coming years and decades—particularly those from light-duty cars and trucks—the U.S. will be unable to stay within the confines of its carbon budget.

Maintaining the existing standards is critical to ensure that emissions reductions from the transportation sector are locked in, and that the U.S. continues to innovate and transitions towards clean transportation technologies. Indeed, because of the extreme urgency of the climate threat, the vehicle standards should be significantly strengthened in the upcoming, crucial decade. The Proposal's plan to instead freeze vehicle standards for six of those crucial years would vastly increase transportation sector emissions, and is unlawful, arbitrary and capricious.

### **III. CONCLUSION**

The evidence of the tremendous harm posed by climate change, and the need for deep and immediate CO<sub>2</sub> emission reductions from vehicles, is stronger now than it has ever been. EPA's and NHTSA's Proposal and its accompanying Draft EIS ignore this critical evidence, flouting the requirements of the Administrative Procedure Act and the governing case law interpreting it. The facts in the record leave no doubt that the existing vehicle GHG standards must be implemented and made more protective, not rolled back. The agencies must, therefore, withdraw the Proposal and instead enforce and strengthen the existing standards.

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<sup>197</sup> USEIA, *Power sector carbon dioxide emissions fall below transportation sector emissions*, Today in Energy (Jan. 19, 2017), [www.eia.gov/todayinenergy/detail.php?id=29612](http://www.eia.gov/todayinenergy/detail.php?id=29612).

<sup>198</sup> U.S. Energy Information Administration, *Frequently Asked Questions*, [www.eia.gov/tools/faqs/faq.php?id=77&t=11](http://www.eia.gov/tools/faqs/faq.php?id=77&t=11) (accessed Oct. 7, 2018).

<sup>199</sup> *Id.*

<sup>200</sup> International Energy Agency, *CO<sub>2</sub> Emissions from Fuel Combustion: Highlights* at 112–114 (2017), [www.iea.org/publications/freepublications/publication/CO2EmissionsfromFuelCombustionHighlights2017.pdf](http://www.iea.org/publications/freepublications/publication/CO2EmissionsfromFuelCombustionHighlights2017.pdf).

<sup>201</sup> *Id.* at 2-30.

<sup>202</sup> *Id.* at 2-31.