

## **“CLIMATE EFFECTS” OF CARBON REGULATIONS FOR THE U.S. ELECTRIC SECTOR**

In June 2013, the President directed EPA to regulate carbon dioxide (CO<sub>2</sub>) emissions from U.S. fossil fuel-fired power plants as part of his Climate Action Plan. The purpose of this paper is to assess certain “climate effects” that would result from reducing CO<sub>2</sub> emissions from the U.S. electric sector. *Our assessment, which is based on EPA analysis, shows that future climate effects are negligible no matter what level of CO<sub>2</sub> emission reduction is required for the electric sector.*

**METHODOLOGY** EPA’s Regulatory Impact Assessment (RIA) for its 2012 light-duty vehicle standards includes annual projections of greenhouse gas (GHG) emission reductions resulting from the standards and estimates the effect of those emission reductions on global average CO<sub>2</sub> concentrations, global average temperature, and sea level rise (“climate effects”).<sup>1</sup> According to EPA’s analysis, the cumulative CO<sub>2</sub>-equivalent<sup>2</sup> (CO<sub>2</sub>-eq) reductions for its light-duty standards total 10.61 billion metric tons (tonnes) over the period 2017 to 2050. For 2050, the RIA projects that the EPA standards will reduce the Intergovernmental Panel on Climate Change’s (IPCC’s) projected atmospheric CO<sub>2</sub> concentration by 1 part per million (ppm), reduce projected global mean temperature by a maximum of 0.006 degree Celsius (°C), and reduce global mean sea level rise by as much as 0.02 centimeter (cm). EPA acknowledged in its RIA that “... modeling results of the impacts of this [light-duty vehicle] rule alone show small differences in climate effects.”<sup>3</sup>

**STEP 1 (CUMULATIVE REDUCTIONS)** In 2013, CO<sub>2</sub> emissions from the U.S. coal fleet totaled 1.575 billion tonnes. This total represents approximately 3 percent of global GHG emissions (approximately 49 billion tonnes).<sup>4</sup> In 2013, CO<sub>2</sub> emissions from the U.S. electric sector totaled 2.05 billion tonnes, or approximately 4 percent of global GHG

emissions.<sup>5</sup> We use the Energy Information Administration's projected CO<sub>2</sub> emissions<sup>6</sup> to calculate cumulative CO<sub>2</sub> reductions through 2050 from the U.S. electric sector under four scenarios: two proposals for regulating CO<sub>2</sub> emissions from the electric sector; a rumor as to what EPA's carbon regulations might require; and elimination of the entire U.S. coal fleet.

- **NRDC Scenario:** In March 2014, the Natural Resources Defense Council (NRDC) issued an updated analysis of its December 2012 proposal for regulating CO<sub>2</sub> emissions from the electric sector under section 111(d) of the Clean Air Act.<sup>7</sup> We use the reported electric sector CO<sub>2</sub> emissions from spreadsheets NRDC provided that show emissions through the year 2025.<sup>8</sup> We extrapolate linearly between reported years, convert short tons NRDC provided to metric tons, and assume that electric sector emissions are capped at 2025 levels through 2050. This methodology produces a cumulative reduction of 24.86 billion tonnes of CO<sub>2</sub> from the electric sector over the period 2016 to 2050.
- **CATF Scenario:** In February 2014, the Clean Air Task Force (CATF) issued a proposal for regulating CO<sub>2</sub> emissions from the electric sector under section 111(d).<sup>9</sup> CATF provided emission projections only for a single year, 2020. For purposes of our analysis, we assume that electric sector emissions are capped at 2020 levels through 2050. This methodology produces a cumulative reduction of 14.60 billion tonnes of CO<sub>2</sub> over the period 2020 to 2050.
- **Rumor Scenario:** EPA is expected to propose emission guidelines on June 2 for regulating CO<sub>2</sub> emissions from the electric sector. One rumor suggests that EPA will propose a 6 percent reduction in CO<sub>2</sub> emissions by 2020 and a 25 percent reduction by 2030. For purposes of our analysis, we assume that electric sector emissions would be capped at 6 percent below 2013 levels during the period 2020 to 2029 (0.94 × 2.053 billion tonnes in 2013, or 1.93 billion tonnes) and 25 percent below 2013 emissions in 2030 (0.75 × 2.053 billion tonnes in 2013, or 1.54 billion tonnes) and thereafter. These assumptions result

in a cumulative CO<sub>2</sub> reduction of 17.56 billion tonnes over the period 2020 to 2050.

- **Zero Coal Scenario:** Hypothetically, we assume the entire U.S. coal fleet is eliminated in 2017. This assumption would reduce cumulative CO<sub>2</sub> emissions from coal by 55.65 billion tonnes over the period 2017 to 2050.<sup>10</sup>

**STEP 2 (CLIMATE RATIOS)** For each of the four scenarios, we calculate the ratio of cumulative reductions from the U.S. electric sector to cumulative reductions from EPA's light-duty vehicle rule. For example, the climate ratio for the NRDC Scenario is 2.34 (24.86 billion tonnes reduced from the electric sector/10.61 billion tonnes reduced from light duty vehicles). For the CATF Scenario, the ratio is 1.38 (14.6 billion tonnes reduced/10.61 billion tonnes reduced). For the Rumor Scenario, the ratio is 1.66 (17.56 billion tonnes reduced/10.61 billion tonnes reduced). And if the entire domestic coal fleet is eliminated (Zero Coal Scenario), the ratio is 5.25 (55.65 billion tonnes reduced/10.61 billion tonnes reduced).

**STEP 3 (CLIMATE EFFECTS)** We calculate climate effects for the four emission reduction scenarios as the product of each climate ratio and the climate effects from EPA's light-duty vehicle rule. For example, atmospheric CO<sub>2</sub> concentrations under the NRDC Scenario are calculated as 2.34 multiplied by a reduction in CO<sub>2</sub> of 1 ppm from EPA's light-duty vehicle rule. Therefore, the atmospheric CO<sub>2</sub> concentration would be reduced by 2.34 ppm by 2050 if NRDC's proposal were adopted. Applying the four ratios (2.34, 1.38, 1.66, and 5.25) to the change in atmospheric CO<sub>2</sub> concentration, change in average global temperature, and change in sea level rise that EPA projected for its light-duty vehicle rule, we estimate the following climate effects for 2050:

- If the entire coal fleet was eliminated, the global atmospheric **CO<sub>2</sub> concentration** would be reduced by, at most, 5.25 ppm, or approximately 1 percent. The current atmospheric CO<sub>2</sub> concentration is within the range of 400 ppm, and the IPCC projects CO<sub>2</sub>

concentrations to be 450 ppm to 600 ppm by 2050.<sup>11</sup> *The three regulatory scenarios produce even smaller effects on atmospheric concentration.*

- If the entire coal fleet was eliminated, global average temperature would be reduced by, at most, 0.03°C (or 0.05°F). For perspective, the IPCC projects a global temperature increase of 1.0° C to 2.0° C (1.8° F to 3.6° F) in 2050.<sup>12</sup> *The three regulatory scenarios produce even smaller effects on temperature.*
- If the entire coal fleet was eliminated, sea level rise would be reduced by, at most, 1.1 millimeters (approximately 1/25<sup>th</sup> of an inch). This reduction is less than the thickness of a dime.<sup>13</sup> *The three regulatory scenarios produce even smaller effects on sea level rise.*

The table on the next page shows climate effects for each of the four scenarios.

**CAVEATS** Our use of EPA's analysis to estimate climate effects does not imply an endorsement of its assumptions or conclusions. Also, our analysis does not contrast the negative economic impacts of carbon regulations with the negligible climate effects from reducing CO<sub>2</sub> emissions from the U.S. electric sector. However, as one point of reference, NRDC's proposal is projected by National Economic Research Associates to cost \$13 billion to \$17 billion per year.<sup>14</sup>

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## CLIMATE EFFECTS

CLIMATE EFFECT	NRDC	CATF	RUMOR	ZERO COAL	PROJECTION FOR 2050 <sup>15</sup>
<b>CO<sub>2</sub> Concentration</b>	2.34 ppm lower	1.38 ppm lower	1.66 ppm lower	5.25 ppm lower	450 ppm – 600 ppm
<b>Temperature</b>	0.014°C (0.025°F) lower	0.008°C (0.014°F) lower	0.01°C (0.018°F) lower	0.03°C (0.05°F) lower	1.0°C - 2.0°C (1.8°F – 3.6°F) increase
<b>Sea Level Rise</b>	0.047 cm (0.019 inch) lower	0.028 cm (0.01 inch) lower	0.033 cm (0.013 inch) lower	0.11 cm (0.04 inch) lower	5.9 inches – 11.8 inches increase

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<sup>1</sup> U.S. EPA, *Regulatory Impact Analysis: Final Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards*, August 2012.

<sup>2</sup> CO<sub>2</sub>-equivalent (CO<sub>2</sub>-eq) represents the climate impact of non-CO<sub>2</sub> greenhouse gases converted to CO<sub>2</sub>-equivalent emissions using their relative global warming potential (GWP).

<sup>3</sup> U.S. EPA, *Regulatory Impact Analysis: Final Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards*, August 2012, page 6-115.

<sup>4</sup> IPCC, *Climate Change 2014: Mitigation of Climate Change: Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Summary for Policymakers, page 6; U.S. EPA, *Inventory of Greenhouse Gas Emissions and Sinks 1990-2011*, April, 2013; EIA, *Monthly Energy Review*, February 2014; Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, <http://cdiac.ornl.gov/mission.html>.

<sup>5</sup> *Ibid.*

<sup>6</sup> U.S. EIA, *Annual Energy Outlook 2014*, Reference Case.

<sup>7</sup> NRDC, *Cleaner and Cheaper: Using the Clean Air Act to Sharply Reduce Carbon Pollution from Existing Power Plants, Delivering Health, Environmental, and Economic Benefits*, March, 2014; updating *Closing the Power Plant Carbon Pollution Loophole: Smart Ways the Clean Air Act Can Clean Up America's Biggest Climate Polluters*, December, 2012.

<sup>8</sup> See Technical Appendices at <http://www.nrdc.org/air/pollution-standards/>. We use the "Moderate Case with Full Energy Efficiency," which corresponds to the original December 2012 proposal.

<sup>9</sup> Clean Air Task Force, *Power Switch; An Effective, Affordable Approach to Reducing Carbon Pollution from Existing Fossil-Fueled Power Plants*, February, 2014.

<sup>10</sup> The meaningless climate effects we estimate from the Zero Coal scenario are maximum effects because we assume, for sake of simplicity, that coal is not replaced with CO<sub>2</sub>-emitting sources of electricity. To the extent coal is replaced with natural gas, cumulative CO<sub>2</sub> reductions would be less than we estimate and the climate effects would likewise be less than we have estimated.

<sup>11</sup> National Oceanic and Atmospheric Administration, Earth System Research Laboratory, "Recent Monthly Average Mauna Loa CO<sub>2</sub>." The April 2014 value was 401.3 ppm CO<sub>2</sub>. IPCC, *Climate Change 2013: The Physical Science Basis: Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Chapter 1, page 148.

<sup>12</sup> IPCC, *Climate Change 2013: The Physical Science Basis: Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Chapter 12, pages 1054-1055.

<sup>13</sup> According to the U.S. Mint, the thickness of a dime is 1.35 millimeters.

<sup>14</sup> NERA Economic Consulting, *A Carbon Dioxide Standard for Existing Power Plants: Impacts of the NRDC Proposal*, released March 2014.

<sup>15</sup> IPCC, *Climate Change 2013: The Physical Science Basis: Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Chapters 1, 12, and 13; pages 148, 1054-1055, and 1181.