COMMITTEE ON
ENERGY & COMMERCE
CHAIRMAN FRANK PALLONE, JR.

MEMORANDUM

July 22, 2019

To: Subcommittee on Environment and Climate Change Members and Staff

Fr: Committee on Energy and Commerce Staff

Re: Hearing on "Building America's Clean Future: Pathways to Decarbonize the Economy"

On **Wednesday, July 24, 2019, at 10 a.m. in the John D. Dingell Room, 2123 of the Rayburn House Office Building**, the Subcommittee on Environment and Climate Change will hold a hearing entitled, "Building America's Clean Future: Pathways to Decarbonize the Economy." The hearing will examine the challenges and opportunities associated with deep decarbonization of the United States economy.

I. BACKGROUND

In October 2018, the Intergovernmental Panel on Climate Change (IPCC) released its *Special Report on Global Warming of 1.5°C*, which examined the impacts of limiting global temperature rise to 1.5°C versus 2°C above preindustrial levels. The report concluded that avoiding the worst effects of climate change – including more frequent extreme weather events, food and water insecurity, increases in vector-borne diseases, and other public health problems – will require limiting warming to 1.5°C.[1] It further warned that countries have until 2030 to make "rapid, far-reaching and unprecedented changes in all aspects of society" to avoid exceeding that threshold.[2]

Despite this urgency, emissions continue to rise. In 2018, global carbon dioxide (CO_2) emissions increased 2.7 percent over the previous year – a rate scientists have compared to a "speeding freight train."[3] In the United States, economy-wide emissions increased between 1.5 and 2.5 percent in 2018, ending a three-year decline and marking the second largest emissions

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[1] Intergovernmental Panel on Climate Change, *Special Report on Global Warming of 1.5°C* (Oct. 2018).

[2] Intergovernmental Panel on Climate Change, Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C approved by governments (www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments) (Oct. 8, 2018).

[3] Corinne Le Quéré et al., *Global Carbon Budget 2018*, Earth System Science Data (Dec. 5, 2018); *Greenhouse Gas Emissions Accelerate Like a 'Speeding Freight Train' in 2018*, The New York Times (Dec. 5, 2018).

increase since 2000.[4] This contrasts sharply with the goal of reducing U.S. emissions 1.2 percent annually through 2020, as described in the first Nationally Determined Contribution submitted under the Paris Agreement.[5] The United States is now projected to reduce emissions just 12 to 19 percent below 2005 levels by 2025, falling far short of its initial 26 to 28 percent target.[6]

II. DEEP DECARBONIZATION OF THE U.S. ECONOMY

These trends run counter to the scientific consensus that deep, sustained decarbonization is needed to avoid the worst effects of climate change.[7] According to the IPCC, global CO_2 emissions must peak by 2030 and reach "net-zero" by 2050 to limit warming to 1.5°C by the end of the century (or by 2070 to limit warming to 2°C by the end of the century).[8] The concept of net-zero emissions refers to balancing the amount of greenhouse gases emitted and the amount removed from the atmosphere through natural or technological means, commonly referred to as "negative emissions" measures. The IPCC warned that, in the absence of near-term climate action, "net negative" emissions will eventually be required to limit warming to 1.5°C.[9]

In 2016, two years before the IPCC identified the need to achieve net-zero emissions by 2050, the Obama Administration released its *Mid-Century Strategy for Deep Decarbonization*. That comprehensive plan aimed to reduce emissions 80 percent below 2005 levels by 2050, putting the U.S. on a path to reach net-zero emissions soon thereafter.[10] The IPCC report has since made clear that countries must achieve net-zero emissions by 2050 – a more aggressive schedule than originally outlined in the *Mid-Century Strategy*.

III. PATHWAYS TO DEEP DECARBONIZATION

Research suggests that deep decarbonization of the U.S. economy will require a multipronged approach, including: (1) transitioning to a low-carbon electricity system; (2) reducing emissions from the transportation, buildings, and industrial sectors; (3) deploying negative emissions measures; and (4) reducing non-CO_2 greenhouse gas emissions.[11] The United States already has a number of tools at its disposal to chart a path towards net-zero emissions.

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[4] Rhodium Group, *Final US Emissions Estimates for 2018* (May 31, 2019).

[5] The White House Archives, FACT SHEET: U.S. Reports its 2025 Emissions Target to the UNFCCC (obamawhitehouse.archives.gov/the-press-office/2015/03/31/fact-sheet-us-reports-its-2025-emissions-target-unfccc) (Mar. 31, 2015).

[6] Rhodium Group, *Taking Stock 2019* (Jul. 8, 2019).

[7] Deep Decarbonization Pathways Project, *Pathways to Deep Decarbonization* (Dec. 2015).

[8] *See* note 1, at 95.

[9] *See* note 1, at 96 and 116.

[10] The White House, *United States Mid-Century Strategy for Deep Decarbonization* (Nov. 16, 2016).

[11] Center for Climate and Energy Solutions (C2ES), *Pathways to 2050: Alternative Scenarios for Decarbonizing the U.S. Economy* (May 2019).

Yet, policy action and aggressive investment in low-carbon technologies will be needed to increase the pace and decrease the cost of that process.[12]

A. Reducing Emissions from the Power Sector

The power sector is both simpler and less expensive to decarbonize than other sectors,[13] securing its reputation as "the linchpin of efforts to reduce greenhouse gas (GHG) emissions."[14] Over the coming decades, however, the U.S. electricity system will confront the dual challenges of meeting rising electricity demand while rapidly shifting to low- and zero-carbon generation. The U.S. Energy Information Administration projects that energy-related CO_2 emissions will decrease just 16.2 percent below 2005 levels by 2050.[15] Reducing energy-related CO_2 emissions will be more challenging and elusive in some sectors and processes than others. Policy support will be needed to reduce barriers to decarbonization.[16]

As electrification spreads across sectors and end-uses, overall electricity supply may need to double by 2050.[17] At the same time, the carbon intensity of electricity generation would have to drop to at least 90 percent of its current level to enable deep decarbonization.[18]

Decarbonizing the power sector, therefore, will require a suite of measures, including significant expansion of renewable energy capacity, deployment of other low-carbon energy technologies, and improved energy efficiency. According to the IPCC, renewables could provide 63 to 81 percent of global electricity generation by 2100 without causing grid reliability issues or major cost increases.[19] Analyses by the Natural Resources Defense Council,[20] Union of Concerned Scientists,[21] and the National Renewable Energy Laboratory (NREL)[22] have

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[12] *See* note 10, at 30.

[13] Steven J. Davis, et al., *Net-Zero Emissions Energy Systems*, Science (Jun. 29, 2018).

[14] Jesse Jenkins, Max Luke, and Samuel Thernstrom, *Getting to Zero: Carbon Emissions in the Electric Power Sector*, Joule (Dec. 19, 2018).

[15] U.S. Energy Information Administration, *Annual Energy Outlook 2019* (Jan. 24, 2019).

[16] *See* note 13.

[17] E3, Lawrence Berkeley National Laboratory, and Pacific Northwest National Laboratory, *Pathways to Deep Decarbonization in the United States* (Nov. 2015), at 70.

[18] *Id*.

[19] Intergovernmental Panel on Climate Change, *Special Report on Global Warming of 1.5°C: Summary for Policymakers* (Oct. 2018), at 14.

[20] Natural Resources Defense Council, *America's Clean Energy Frontier: The Pathway to a Safer Climate Future* (Sept. 2017), at 6.

[21] Union of Concerned Scientists, *The US Power Sector in a Net Zero World* (Nov. 2016), at 7.

[22] National Renewable Energy Laboratory (NREL), *Renewable Electricity Futures Study: Volume 1* (2012), at ES-23.

similarly concluded that renewables can provide nearly 80 percent of U.S. electricity generation by 2050. According to NREL, today's commercially available renewable technologies are "more than adequate" to meet that target.[23] Deep decarbonization of the electricity system will also require some combination of other low- or zero-carbon technologies, such as nuclear power or carbon capture.

B. Reducing Emissions from Transportation, Buildings, and Industry

Direct emissions from transportation, commercial and residential buildings, and industry together account for nearly two-thirds of U.S. carbon pollution. Emissions from buildings and industry have remained relatively flat since the mid-2000s, while emissions from transportation have steadily increased since 2012 after several years of decline.[24] Deep decarbonization of these sectors will depend on large-scale electrification, dramatic improvements in energy efficiency, and development of new materials and processes.

In 2016, transportation surpassed the power sector as the leading source of carbon pollution in the United States.[25] Decarbonizing this sector will involve steep emissions reductions across end-uses, including on-road vehicles, shipping, aviation, and rail. Achieving those reductions will require a variety of measures, such as increasing fuel efficiency, shifting toward low-carbon fuels and vehicles, increasing public transit, and reducing overall vehicle miles traveled.[26]

In the buildings sector, electrification (i.e., switching from oil and natural gas to electricity) and greater efficiency can dramatically reduce emissions. By one estimate, efficiency improvements could reduce U.S. electricity demand 16 percent by 2035, with savings largely driven by reduced energy consumption in residential and commercial buildings.[27] Other estimates suggest that energy efficiency could reduce U.S. energy consumption by as much as 30 percent by 2050.[28]

Despite the potential for energy efficiency to reduce emissions across sectors, the industrial sector remains very challenging to decarbonize. This highly diverse sector – which includes chemicals, iron and steel, cement production, and other energy-intensive industries – will require industry- and process-specific measures to reduce emissions. These measures may

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[23] *Id.*, at iii.

[24] U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks* (Apr. 11, 2019), at xviii.

[25] *Id.*

[26] *See* note 10, at 53.

[27] Electric Power Research Institute, *State Level Electric Energy Efficiency Potential Estimates* (May 2017), at 3-3.

[28] *See* note 10, at 30.

include, but are not limited to, efficiency improvements, the use of new materials and processes, and switching to low-carbon fuels and feedstocks.[29]

C. Negative Emissions

Limiting warming to 1.5°C by the end of the century will require some combination of nature-based (or "natural") and technology-based carbon sequestration and removal.[30] Natural approaches include measures in the agriculture, forestry, and other land use sectors to improve CO_2 capture and storage. For decades, U.S. forests, grasslands, peat bogs and other lands have served as "carbon sinks," absorbing more CO_2 than they emit. Continued maintenance of these lands and management practices of agricultural lands could offset up to 45 percent of U.S. emissions by 2050.[31]

Technology-based approaches using carbon capture and storage (CCS) involve sequestration and either storage or utilization of emissions. The most mature of these approaches is bioenergy with CSS, or BECCS, in which CO_2 is captured from facilities that either combust biomass for electricity or convert biomass to fuels. Other nascent approaches include direct air capture, in which CO_2 is captured from ambient air, and installation of CCS technology at coal- and gas-fired power plants and some industrial facilities.[32]

D. Reducing Non-CO_2 Emissions

Deep decarbonization of the U.S. economy will also require mitigation of non-CO_2 emissions, which account for nearly one-fifth of U.S. emissions. These highly potent greenhouse gases (including methane, nitrous oxide, hydrofluorocarbons, and other fluorinated gases) are associated with a diverse range of end-uses, from air conditioning to agriculture. Reducing non-CO_2 emissions will require improving monitoring, developing cost-effective substitutes, furthering technological advances in industrial processes, and other measures.[33]

[29] *See* note 10, at 63.

[30] *See* note 1, at 118.

[31] *See* note 10, at 69.

[32] *Id*.

[33] *See* note 10, at 87.

IV. WITNESSES

The following witnesses have been invited to testify:

Karl Hausker
Senior Fellow, Climate Program
World Resources Institute

Rachel Cleetus
Policy Director, Climate and Energy Program
Union of Concerned Scientists

Armond Cohen
Executive Director
Clean Air Task Force

Shannon Angielski
Executive Director
Carbon Utilization Research Council